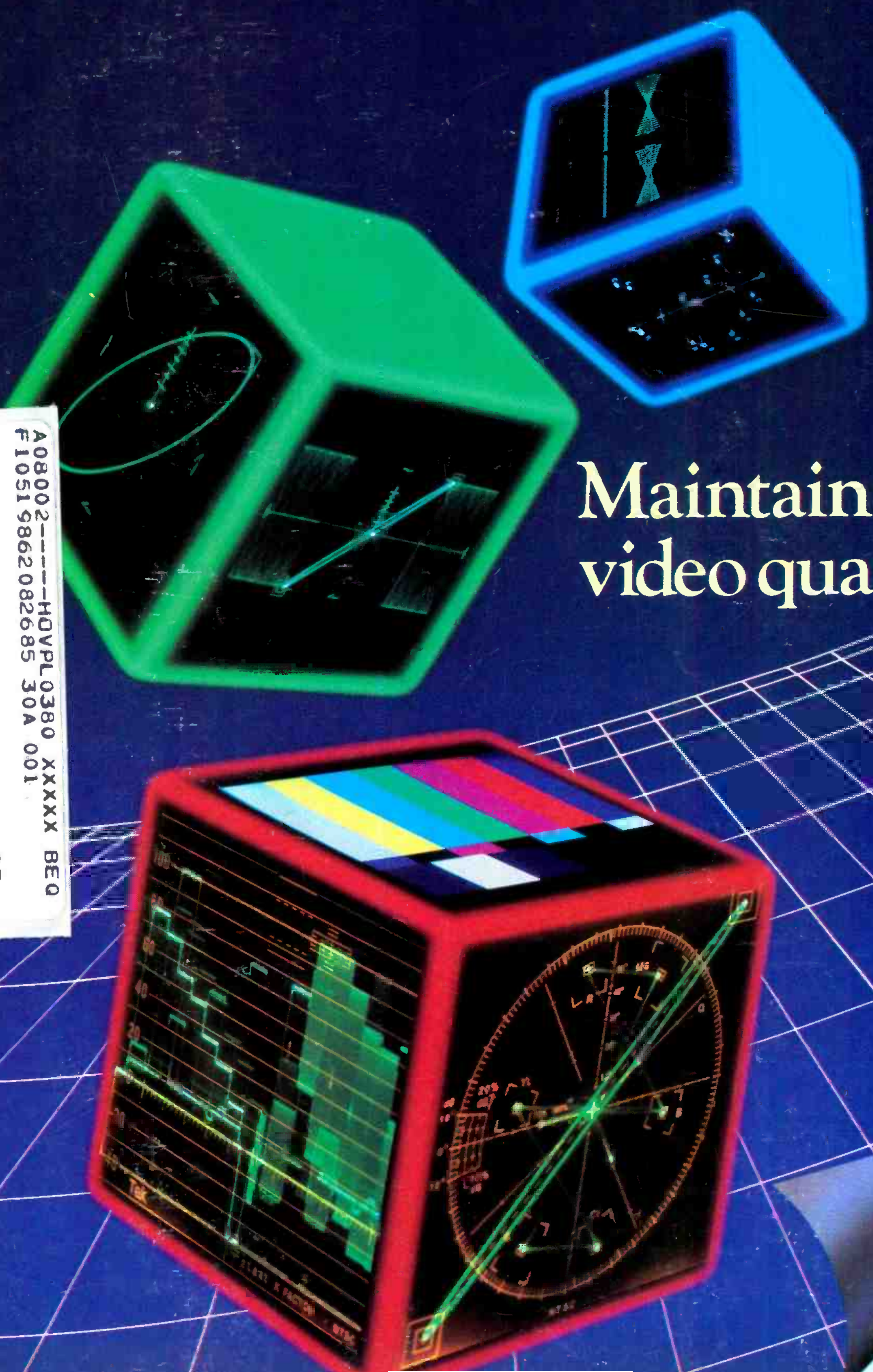
BROADCAST ENGINEERING®

July 1986/$3



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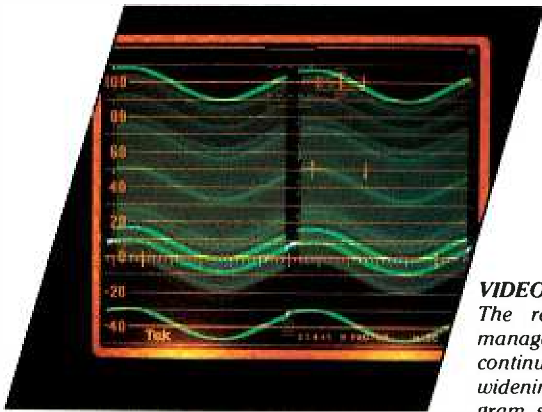

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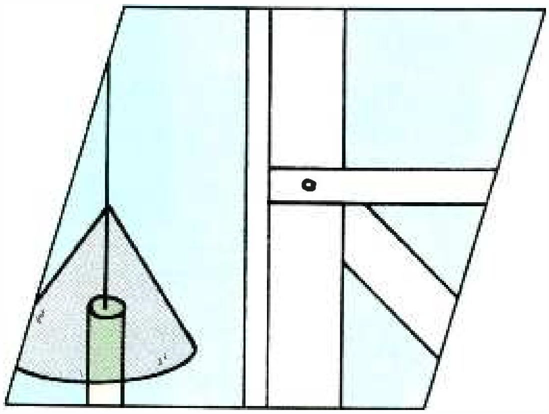
BROADCAST ENGINEERING

VIDEO EMPHASIS ISSUE:
The requirements placed upon engineers and technical managers at video production and TV broadcast facilities are continually increasing. Tough competition and an ever-widening choice of program sources mandate that every program segment—down to 10-second promos—must be of top technical quality. This month, we discuss how to do just that.



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ON THE COVER
Building toward improved video signal quality requires a knowledge of the waveforms and test instruments of television. Our cover illustrates waveform and vector displays of the SMPTE color-bar test pattern, in addition to SMPTE bars as a video component signal. The use of video test instruments to monitor and measure stereo audio also is illustrated. (Photo courtesy of Tektronix.)

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News

Legal group studies standards procedures

The SMPTE Presidential Advisory Council, established in 1985 under the auspices of Harold J. Eady, SMPTE president, has cited the efforts of a task force formed to study and analyze the society's standards procedures.

The task force is an initial step in achieving more timely domestic and international industry standards. It is composed of legal representatives from the manufacturing and broadcasting companies that comprise the council. The force's prime purpose is to determine if there are more expedient methods available to SMPTE engineering technology committees for developing standards. It will also discuss how SMPTE could enhance its role in the motion picture and TV industries.

The first meeting was held in New York on March 18. It was held at the offices of Wencer, Murase and White, the legal counsel for SMPTE, and acquainted council legal representatives with the standards procedures of the society's engineering technology committees.

At an April 12 meeting in Dallas, issues discussed included the society's responsibility to the CCIR; the need for a composite digital video standard; and forming groups to study digital small-format recording and cart machines.

SMPTE conference sessions in the making

Jack Spring of Eastman Kodak has been appointed program chairman for the 128th technical conference and equipment exhibit of the Society of Motion Picture and Television Engineers (SMPTE). The conference and exhibit will be held Oct. 24-29, at the Jacob K. Javits Convention Center in New York.

Francis J. Haney of ABC-TV is program vice chairman. Grant P. Ireland, Allied Film & Video, and Michael T. Fisher, ABC-TV, are the topic chairmen. Ireland and Fisher will be responsible for the solicitation of technical papers within the categories of film and television, respectively.

The theme for the conference is *Today's Technology—Tomorrow's Reality?* Topic sessions are being formed and the committee is arranging a session on high-definition television. A session devoted to archiving also is planned. This session would consider some of the restoration work undertaken by individuals, institutions and corporations.

CCIR postpones HDTV standard action

At its 16th plenary assembly in Dubrovnik, Yugoslavia, the International Radio Consultative Committee (CCIR) postponed action on a proposed 1,125 line/60Hz single worldwide HDTV studio standard. The proposal was supported by the United States, Canada and Japan. The 1,125/60 standard has, however, been incorporated into CCIR's report on HDTV, making it the only recognized parameter.

The CCIR is a body of the International Telecommunications Union (ITU), an organization affiliated with the United Nations. During its second session on HDTV, the CCIR approved the report of an ad hoc HDTV group. This approval included three significant steps toward HDTV standardization.

First, the 1,125/60 proposal was confirmed, making it an annex to report 801, the CCIR's only report on HDTV.

Second, the marketplace acceptance of HDTV systems based on the 1,125/60

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BROADCAST ENGINEERING

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Editorial

Politics 1, Technology 0

Ask a given number of people for a solution to a problem and you will probably get as many different answers, ranging from the practical to pie-in-the-sky schemes. That's what happened when the question of quadraphonic FM was posed, and the HDTV question seems to have met the same fate.

Thirteen years worth of research and discussion evolved into the proposed HDTV *production* system that went to the CCIR plenary session in May. Smooth sailing had been predicted for the plan as late as October 1985.

Then suddenly, in 11th-hour dissension, yea votes became nays, as talks moved from engineering circles to economically and politically oriented meetings. Even before HDTV was tabled at the CCIR session, a new study group was organized for further investigation of HDTV as a system from production to reception. A new timetable notes 1988 as the tentative deadline for new or revised proposals for improved TV imaging for the world.

Will the 1,125/60 HDTV system remain tabled until 1988? Or will predictions made by speakers at the 1985 international conference in Montreux, Switzerland, come true? Those predictions were that various systems of limited or no compatibility would be developed and used. The overall result would be a situation that might be even more complex than our tripartite world of NTSC, PAL and SECAM.

Can politics and economics control what is touted as the biggest thing in television since color? Apparently yes, but there are several other factors that require consideration.

The desire for a worldwide system of improved imaging has been stated as a major goal in picking an HDTV standard. Indeed, the CCIR study group is mandated to find solutions to concerns about the 1,125/60 NHK system. Even the Japanese have agreed to reconsider that system in light of European objections to the 60Hz-based approach. Nonetheless, the possibility of one standard diminishes as time passes.

Such analysis is no doubt a good idea. But what of those companies that have made sizable investments in research? With a marketable product now in existence, can those companies afford to sit back and wait? From that premise, the need for compatibility rests not with today's TV systems, but with the existing 1,125/60 equipment that will be in use in two years.

National economies must be protected. If a new technology should come from another country, then either licensing fees must be paid to the originating country (or its companies) or the equipment must be imported. If consumers consider the new technology as *must-have*, one method of import control is through high duties. That will mean consumers will pay exorbitant prices to purchase an HDTV receiver.

National pride also must be considered. How can a country be proud if the research and design teams of its TV equipment manufacturers succumb to designs from another country? Political ideology is inextricably linked to the outcome of this international quandary.

With these factors established at the start, the new study group can expect a difficult task in finding a universal HDTV format. It must satisfy users of both 50-field and 60-field systems and ideally offer some compatibility with current NTSC, PAL and SECAM equipment. The format should meet certain requirements desired by the film community, particularly in the area of gamma transfer characteristics.

Frequency allocations for eventual transmission of HDTV programming present additional problems. In the United States, a move is afoot to reassign some unused UHF TV channels to 2-way land mobile and cellular radio communications. Those channels could conceivably provide a terrestrial wideband transmission channel for HDTV. Satellite channels are no less in demand and may become even more sought after because of failures in the U.S. and European space agencies' programs.

In light of all the problems facing HDTV standards work, do we really need it? There is no general public outcry for the service. In fact, it would appear that only a limited portion of the broadcast industry is deeply concerned. Perhaps the best idea is, for now, to simply write off over-the-air HDTV as a clever, but impractical concept. Let it join quadraphonic sound, which died from indecision, and AM and TV stereo, now both shrouded in legal controversy.

Let's work instead to glean the maximum quality from current TV broadcast signals. Then, someday, it just may be possible to find a system that will be acceptable to the world. Then again, maybe not. But meanwhile, we will have enjoyed the fruits of our efforts with today's working systems.

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FCC modifies quarterly list requirements

By Harry C. Martin

The FCC has changed its record-keeping requirements regarding issue-responsive programming.

Under the revised rule, licensees are required to list, on a quarterly basis, the programs that have provided the station's most significant treatment of community issues in the preceding three months. Previously, quarterly program listings had to include five to 10 of the most significant community problems and a listing of illustrative responsive programming.

The basic differences between the old and the new standards are that a list of issue-oriented programs that are illustrative, without regard to significance, will no longer suffice; and that the requirement that a minimum of five to 10 issues be listed has been eliminated.

However, the commission noted that licensees whose quarterly listings of issue-responsive programming include significant programming directed to five to 10 community issues would likely be able to demonstrate compliance with FCC public service standards.

This rule change was made in response to a directive from the U.S. Court of Appeals for the District of Columbia Circuit in connection with the court's review of radio deregulation. The rule was made applicable to television for consistency. The first listing subject to the new standard was due to be placed in the public file on or before July 10.

Review of FM technical rules terminated

The FCC has terminated its review of FM technical and operational rules by eliminating the following rules that it considered unduly burdensome or inhibiting:

- FM stereophonic sound transmission quality standards;
- standards that limit development of new methods of FM stereophonic transmission;
- standards regarding FM main-channel signal degradation caused by SCAs;
- FM transmission system safety requirements and electrical properties requirements; and
- non-commercial educational FM regulations that were duplicated elsewhere in the rules.

This deregulation became effective June 9.

First come, first served

The commission has changed its processing standards for commercial FM applications in one important respect. This change, made effective in late May, applies to situations in which all of the applications filed within a window filing period are rejected for technical defects.

Under the previous procedure, the first acceptable application filed after a mass rejection would receive the grant. Under the new procedure, the commission will specify a future date—seven days from the release of a public notice—on which new applications may be filed on a first come, first served basis. No new applications will be accepted for tender before the release of this public notice. Applications received between the date of release of the public notice and the seventh day thereafter will be treated as if received on the seventh day.

This procedural change was made to ensure fairness to all potential applicants. Previously, applicants had to be prepared to refile on a moment's notice in order to have a chance to compete.

EEO rules not applicable to broadcast networks

The commission has refused to extend its Equal Employment Opportunity rules to broadcast networks and multiple-owner headquarters.

The ruling arose in connection with denial of a petition for reconsideration filed by the National Black Media Coalition. In November, when the commission decided to open a rulemaking for revision of its EEO rules, it denied the NBMC's original request to extend the reach of the EEO rules to networks and headquarters.

At that time, the agency said it would consider NBMC's proposal in the context of its broader rulemaking. In seeking reconsideration, NBMC argued that the issues being studied by the FCC in the rulemaking do not relate to networks and headquarters operations. The commission disagreed, saying it would take up the matter once the nature and scope of broadcast licensees' basic EEO obligations have been determined.

Recent forfeiture actions

The commission has issued a notice of apparent liability for a forfeiture of $10,000 to an Oregon FM station for violation of the main studio rule and another rule that requires local program originations.

In another forfeiture action, a Colorado station faces a $3,100 fine for failing to fence in its antenna tower, install an operable EBS receiver and generator, conduct weekly EBS tests, cease using remote control within three hours after a malfunction, have a licensed operator on duty, and have an issues-programs list in its public inspection file.

In spite of ongoing deregulation, the FCC continues to vigorously enforce rules that still are on the books.

Clarification of report on remote control

In April's "FCC Update" it was reported that remote-control operations using a telephone-controlled ATS system would violate FCC rules if the system lacks a fail-safe mechanism that can detect the failure of the telephone line to the transmitter necessary to terminate operations. This statement may be misleading. The FCC does not require that ATS systems have such a fail-safe mechanism in situations in which the licensee maintains a separate, redundant circuit by which transmitter operations can be terminated.

Duplication deleted

In late March, the FCC deleted section 73.242 of the rules limiting duplication of programming on AM and FM stations that are co-owned in the same market.

The rule provided that for either station of an AM/FM combination licensed to a community of more than 25,000, the FM could not devote more than 25% of the average program week to duplicate programming. The commission's deregulation in this area is designed to foster expanded hours of operation and to give full discretion to AM/FM owners with regard to program duplication.

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

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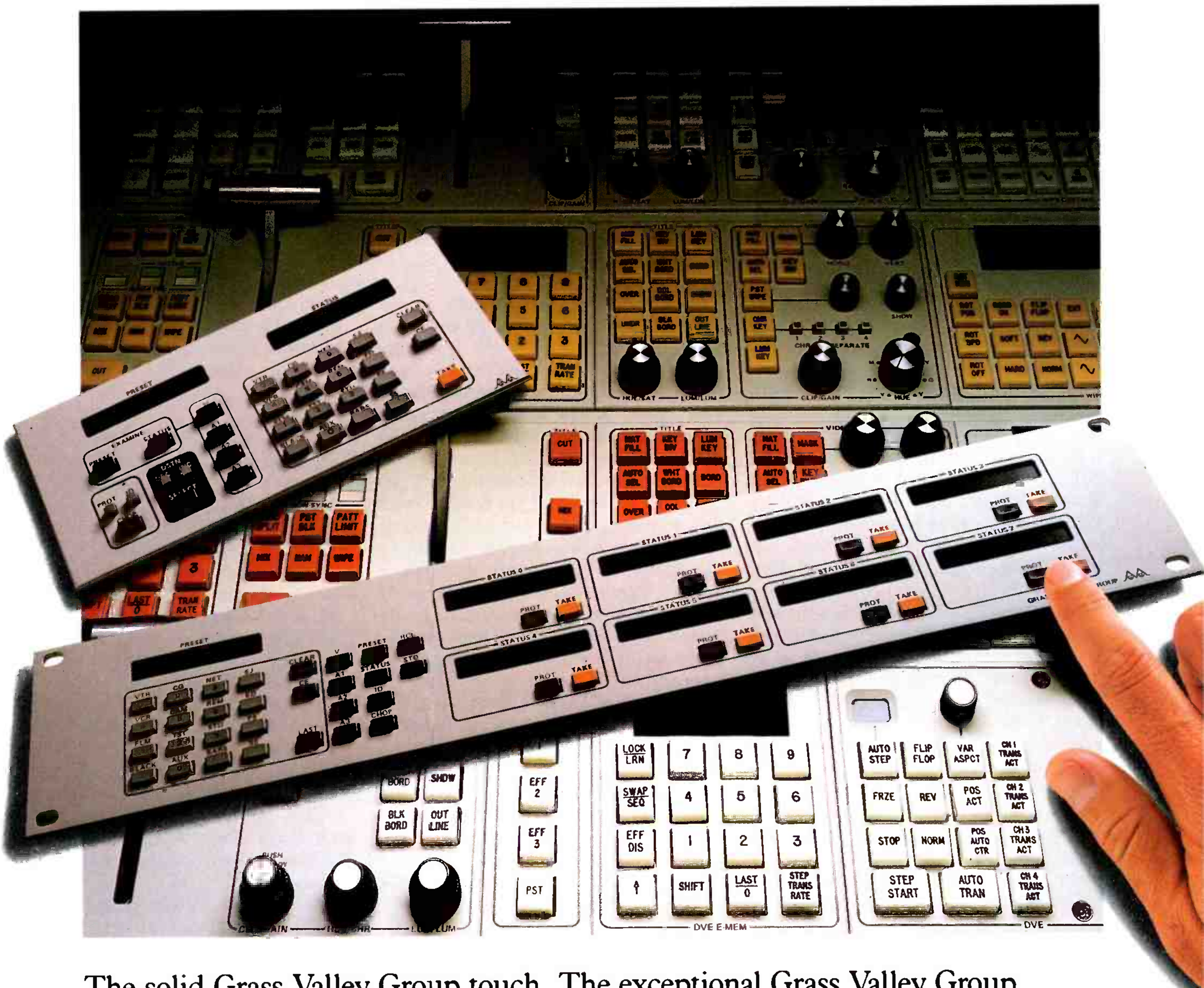

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HDTV: what it means

By Ben Crutchfield

An interesting question faces the TV broadcast industry today. What, if anything, should be done about high-definition television? We have lived with the NTSC color system for 30 years, and it almost seems to be a law of nature. We have improved the system from camera to receiver gradually over the years, so that the pictures we deliver today are vastly better than those of 20 or even 10 years ago.

Critics, particularly European critics, used to refer to NTSC as *never twice the same color.* Now they are trying to defend systems that have no significant advantages as well as the disadvantage of 50Hz flicker.

New TV system considerations

Meanwhile, improvements to NTSC continue. Sophisticated filters and digital processing at both the transmitting and receiving ends improve the quality of the pictures. Add multichannel sound and it is hard to imagine how things could be any better, until you see HDTV.

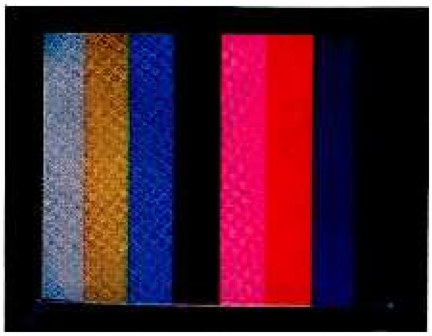
A design objective for the 1,125-line HDTV system was to be as good as high-quality 35mm film. There may be technical debates as to whether that objective has been met or exceeded, but subjectively, most people, including video engineers, agree that HDTV looks better. HDTV has the 3-dimensional quality of 35mm film without grain.

Of several systems in various stages of development, the most highly developed is the product of 15 years of work in the laboratories of the Japanese Broadcasting Network (NHK). The system uses 1,125 scanning lines, with a 60Hz field rate and 2:1 interlace. The picture has a 3x5.3 (or 9x16) aspect ratio. Luminance bandwidth is 20MHz, while two color component signals use another 10MHz. Color information, kept separate from luminance, avoids the NTSC crosstalk.

New TV studio concept

This system has been proposed as a world standard for video production. Note that this is proposed as a *production standard.* So far no one has suggested distributing 30MHz signals by any current means.

Interest in HDTV is growing among production people as a possible alternative to film as the production medium. There is no processing, allowing viewing



and editing of the tape to proceed almost as soon as a scene is shot. A wide range of special effects can be set up quickly, because there is no need to print and process film, including intermediate stages such as the *traveling matte.* When completed, the program would, for the foreseeable future, be converted to film or NTSC tape for distribution.

Exploring definition

In broadcast, however, what can we do with a program source for which the video alone takes up five times the bandwidth of our current channel allocations? The answer lies in bandwidth compression techniques. It seems that although the wide bandwidth of information is needed to produce a finished HDTV program, the viewer does not need as much data to see an HDTV picture.

The human eye and brain constitute a sophisticated system for processing information. Various subsystems process different stimuli in different ways and at different rates. Researchers have studied reactions to motion, color, brightness, lines and edges.

How the eye reacts to motion is one of the easier concepts to understand. Basically, the eye is less sensitive to the detail of a moving object. The immediate implication of this is that we do not need to transmit as much information about a part of a picture that is moving, relative to the rest of the picture. In a shot of a person running, with the camera head locked, the eye would be satisfied with less detail of the person than of the scenery. Because the scenery would change little, we do not need to retransmit all of the background information in every frame.

In fact, most information in television or motion pictures changes very little from frame to frame. Exceptions are *cut* transitions, but the eye takes longer than one frame to adjust to the new picture, reducing the need to transmit a full high-definition first frame after the cut. In experiments with transmissions of *changing information only*, pictures have been produced with some motion using the bandwidth of an audio signal.

On a practical level, several systems offer the possibility of broadcasting HDTV. At present none are completely compatible with NTSC and none are within 6MHz, nor does it appear likely that a means exists to transmit HDTV quality within the NTSC 6MHz boundaries. One culprit is the method in which color was added in the 1950s. We are, it seems, approaching the limits of improvements to the existing system.

Impressive evidence shows that an HDTV signal can be transmitted within as little as 8MHz to 12MHz, by taking advantage of what is known about eye and brain information-processing methods. Development and implementation of such a system would mean that our existing, terrestrial broadcast system could take advantage of the major improvement offered by HDTV and maintain technical competitiveness with the other mediums that are not bandwidth restricted.

Demos verify theories

Demonstrating the feasibility of such systems is a top priority of the NAB and the Association of Maximum Service Telecasters (MST). This demonstration is important for two reasons.

First, for many broadcasters, advanced TV systems are still laboratory curiosities. People need to know more about these systems, particularly regarding their potential use by broadcasters and by competing media.

Second, it is essential that Congress and the FCC be persuaded not to preclude, through changes in UHF spectrum allocations, the broadcast delivery of advanced television. This is an urgent matter, because the FCC is currently considering a major proposal to allow land mobile services to share parts of the UHF TV spectrum.

NAB and MST are preparing a series of demonstration broadcasts for the Washington, DC, area and, possibly, for other cities. The first system to be demonstrated will be MUSE, developed by NHK. NHK has conducted a broadcast test of this system in Japan using FM, but the test being planned will use vestigial sideband AM to conserve spectrum. NHK is supporting the project with equipment and engineering expertise. In addition, other manufacturers have offered cameras and recorders.

What is MUSE? The acronym stands for multiple sub-Nyquist sampling encoding. The system transmits 1,125-line HDTV in only 8.1MHz.

Crutchfield is project director for Advanced TV Terrestrial Broadcast Products, a joint project of the NAB and Association of Maximum Service Telecasters.

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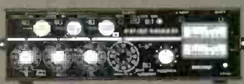

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The FMX system

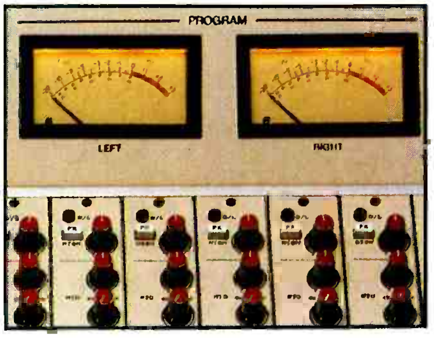
By Emil Torick

During the past three months, we have looked at the theory behind FMX. We found that FMX appears to resolve the reduced signal-to-noise ratio problem encountered by stations broadcasting in stereo through the addition of a second subchannel (S′). This signal is transmitted in quadrature with the standard stereo subchannel (S). As we finish our discussion of FMX, let's see how effective the system can be on a practical basis.

Because the system relies on companding for its operation, there is the possibility of errors developing in the receiver. As discussed last month, crosstalk is the major concern. Because crosstalk is program-related, it can add to or subtract from the conventional signal components.

A negative phase error greater than 10° may cause the apparent stage width to be narrowed. In effect, this tends to reduce the audio's stereophonic image. If the phase error is positive, the crosstalk will be out of phase and may contribute to an apparent widening of the stage width, an effect sought by some broadcasters who use additional gain in the S channel of their transmissions. In actual practice, neither effect is likely to be noticed. Because the re-entrant compression characteristic effectively limits program peaks in the S′ channel, the crosstalk from significant program transients that dominate the psychoacoustic localization process is minimized.

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



The audio effect is a function both of the amount of compression (gain) of the S′ channel and the misalignment of the receiver with respect to proper 38kHz phase.

System effectiveness

One benefit of the FMX system is improved S/N, but the main benefit to broadcasters may be the extended range of a station's signal. In strong signal areas, the monophonic and stereophonic S/N in most receivers is greater than 70dB and little improvement can be expected. For stereo reception with less than 60dB S/N, the service offers improvement to the full capability of the system.

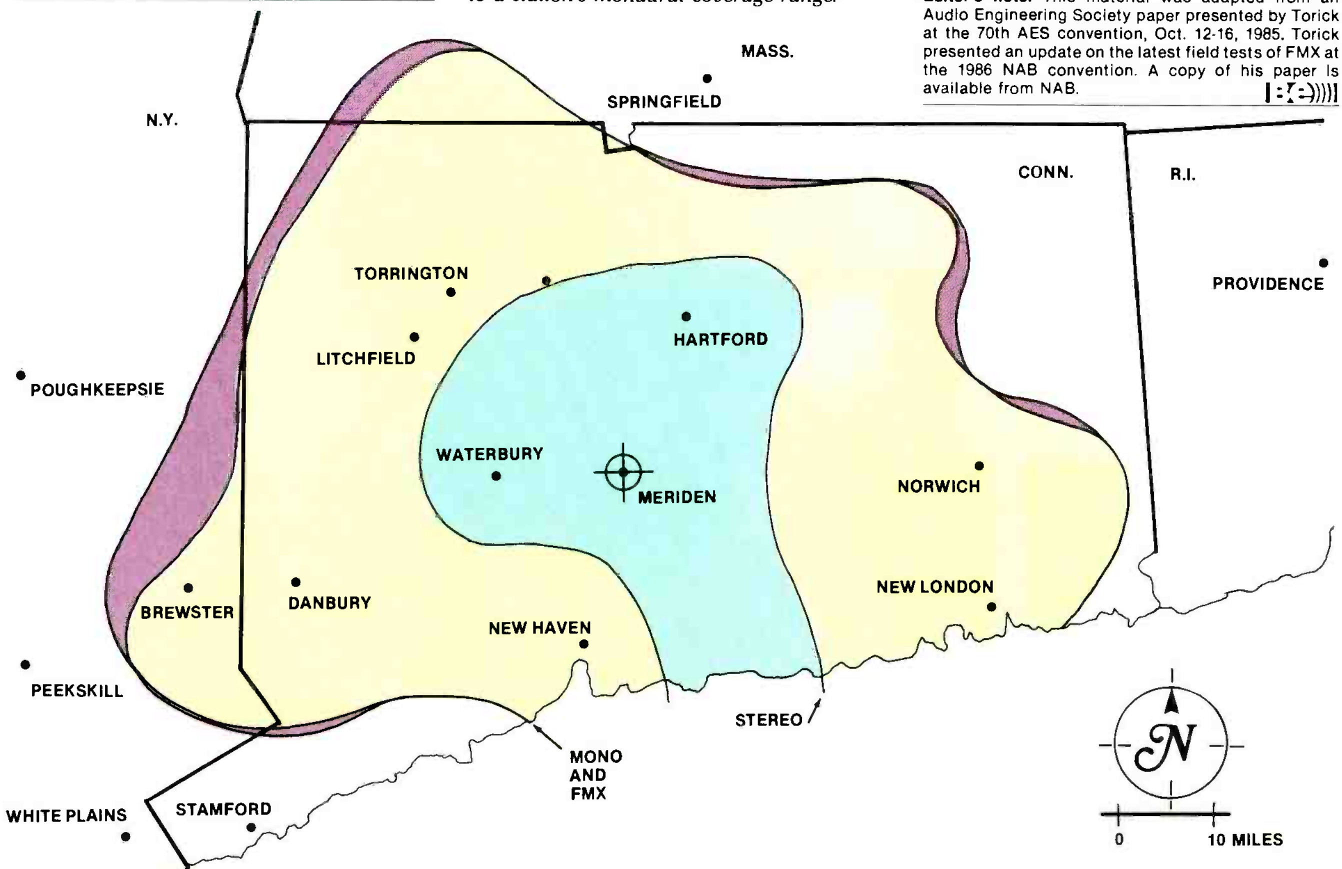
Initial tests were conducted in cooperation with Connecticut public radio station WPKT. The station transmits with an ERP of 19kW and features both music and talk programming. Figure 1 compares the station's reception contours for a received S/N of 60dB for conventional stereo, mono and FMX.

Except for a small area in a mountainous area of the western sector, the stereophonic service extends all the way out to the monophonic contour. Although theory predicts an approximate tripling in the coverage area for non-directional transmissions, the WPKT tests showed an even greater improvement. In this case, the extended 60dB stereo service area quadrupled from approximately 1,200 square miles to 4,800 square miles.

With the emphasis on AM stereo, improvements in the FM broadcast service seem to have taken a back seat. However, the FMX system may now provide additional help to the FM broadcaster attempting to meet the challenge being mounted by AM stereo. In any case, the potential for expanding the useful coverage area of a station's stereo signal through the FMX system is worth investigating.

Editor's note: This material was adapted from an Audio Engineering Society paper presented by Torick 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 is available from NAB.

Figure 1. *As the map shows, the coverage with FMX-equipped receivers is almost equal to a station's monaural coverage range.*



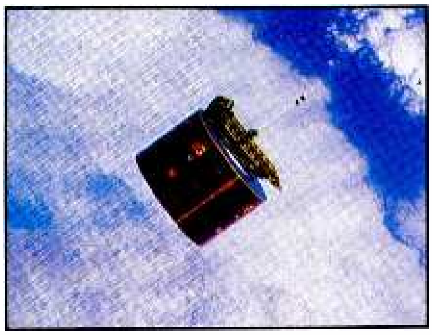
Analyzing antenna types

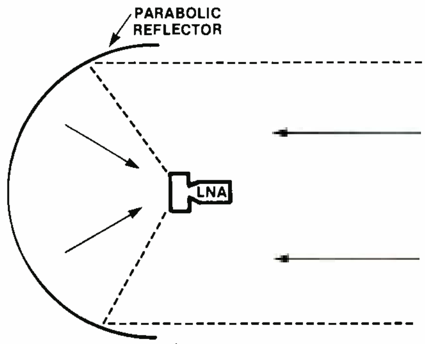
By Elmer Smalling III

The antenna system is one of the most important components of an earth station or SNG van. Although these antennas may look similar at first glance, there are three different types of *dishes*, each with its own peculiar characteristics. In order of popularity, they are:

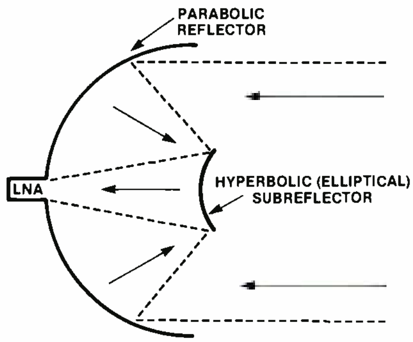
- prime focus reflector antenna;
- Cassegrain reflector antenna; and
- offset feed reflector antenna.

Many people refer to the large reflector of an earth-station system as the antenna. This is not correct. The antenna itself is a small element or portion of waveguide located within the feed assembly. The more visible reflector may be 400 to 1,000 times larger than the actual antenna element.

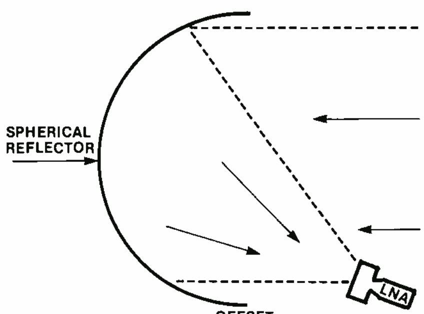




PRIME FOCUS



CASSEGRAIN (GREGORIAN)



OFFSET

Prime focus

The prime focus antenna system is the most common type of satellite earth-station antenna system. It consists of a large surface reflector with a parabolic shape. The antenna, which may be less than an inch long, and the associated low-noise amplifier (LNA) are located at the focal or prime focus point of the reflector. The two items may be supported in front of the reflector on a large *buttonhook* or at the apex of a support tripod.

The parabolic reflector shape ensures that all portions of the impinging signal wavefront reach the apex or antenna at the same time. Furthermore, all parallel rays that strike the inside face of the parabolic curve will be directed toward the focal point to achieve the most signal gain.

There are two general drawbacks to the prime focus system. First, the antenna support structures, either the buttonhook or the LNA/feed support tripod, cause some signal blockage. Second, the LNA and other feed equipment are not easily accessible.

Cassegrain

The Cassegrain antenna derives its name from an optical telescope design that uses primary and secondary mirrors. The Cassegrain reflector goes a step further than the prime focus type. Instead of a tiny microwave antenna at the focal point, a small convex reflector focuses the incoming signal energy from the main reflector back down to the antenna and LNA located at the hub or apex of the parabola.

The secondary subreflector has a hyperbolic shape that, along with the parabolic shape of the large reflector surface, causes all reflected signals to have identical length paths to or from the antenna. It is important that all signal paths to or from the antenna be the same length so that they will arrive at the antenna at the same time *in phase*.

The Cassegrain style has advantages over the prime focus type. First, the antenna and LNA are mounted at the hub of the large reflector, making them more accessible. Second, any spillover signal that reaches the large reflector comes from the area of the small subreflector and the sky. While a prime focus system allows reflections from the ground to reach the antenna, the Cassegrain system avoids these sources of possible interference. The spillover generated noise of the Cassegrain system is, therefore, much lower. The presence of the subreflector structure does create more signal blockage than with the prime focus design.

The equivalent focal length of the Cassegrain antenna system is longer than for an equivalent diameter prime focus. As a result, the cross polarization is less. Cross polarization occurs when signals, which are purposely transmitted in the vertical or horizontal planes, cross back and interfere with each other.

The subreflector may be elliptical in shape, in which case the system is called a *Gregorian* reflector. The Gregorian system allows a system design with a smaller focal length and may be used when system package size is critical.

Offset

Offset antennas are popular in SNG applications. These systems may have a single or double reflector design. In some cases, the antennas do not incorporate parabolic reflectors, which would ensure that all impinging waves are in perfect phase. As a result, the shape of the reflector for offset antennas must be carefully designed to achieve a constant phase condition across the reflector.

Spherical reflector surfaces are a popular alternative for offset systems, because the spherical shape allows for multiple focus points or feeds without astigmatism. As such, spherical reflector systems are used when antenna systems must communicate with multiple satellites over the geostationary arc.

Offset reflector designs do not have to suffer from blockage by subreflector and/or LNA support spars, because the support arms are not in line with incoming signals. These systems are easily folded and stored, making them more applicable to portable operations. In addition, the feed point and LNA are located near the base of the antenna and are easily accessible.

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

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Synchronous AM in FM systems

By Jerry Whitaker, editor

The output spectrum of an FM radio transmitter or TV aural transmitter contains many sideband frequency components, theoretically an infinite number. Pairs of sideband components are spaced from the carrier by multiples of the modulating frequency. The total RF power output of the transmitter remains constant with modulation, but the distribution of power into the sideband elements changes with the modulating waveform. Power at the carrier frequency is reduced by the amount of power shifted to the sidebands.

The practical considerations of transmitter design and frequency allocation make it necessary to restrict the bandwidth of all FM broadcast signals. Bandwidth restriction brings with it the undesirable side effects of distortion in the demodulated output of a receiver, phase shifts through the transmission chain and the generation of synchronous AM components. In actual practice, a signal of acceptable quality can be transmitted through the bandwidth allocated to an FM broadcast station or TV aural channel. This process, however, requires tradeoffs in performance. The key to this effort is the design of a system that takes advantage of all available bandwidth, while preserving the maximum spectral purity possible.

Bandwidth limiting

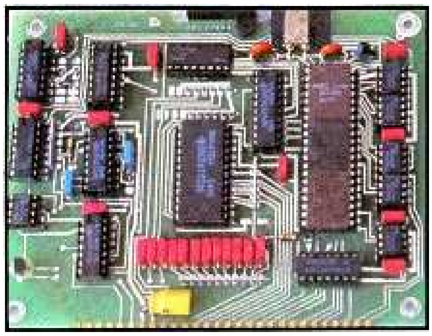
In most medium- and high-power FM and TV aural transmitters, the primary out-of-band filtering is performed in the output cavity of the final stage. Previous stages in the transmitter (the exciter and IPA) are designed to be broadband, or at least more broadband than the PA output. The goal is to limit the bandwidth of the transmitter RF signal at one stage only. In this way, control over system bandwidth can be tightly maintained, and the tradeoffs required in any practical FM system can be optimized. If, on the other hand, more than one narrowband stage exists within the transmitter, adjustment for peak efficiency and performance can be a difficult proposition.

The following factors can affect the bandwidth of an FM or TV aural transmitter:

•the total number of tuned circuits in the system;

•the amplitude and phase response of the total combination of all tuned circuits in the RF path;

•the amount of drive to each RF stage (saturation effects); and



•the non-linear transfer function within each RF stage.

Although generally the domain of the transmitter design engineer, the following techniques can be used to improve the bandwidth of a given system:

•Maintain wide bandwidth until the final RF stage. This can be accomplished through the use of a broadband exciter and broadband (usually solid-state) IPA.

•Minimize the number of interactive tuned networks within the system. Through proper matching network design, greater bandwidth and simplified tuning can be accomplished.

•Use a single-tube design (for medium- and high-power transmitters) or a broadband, complete solid-state design (where practical). The objective here is to maintain wide bandwidth until the last possible point in the RF chain.

Bandwidth affects the gain and efficiency of any FM RF amplifier stage. The bandwidth is determined by the load resistance across the tuned circuit and the output or input capacitance of the RF stage. Because grid driven PA tubes typically exhibit high input capacitance, the PA input circuit generally has the greatest effect on bandwidth limiting in an FM transmitter.

The grid circuit can be broadened through resistive swamping in the input circuit, or through the use of a broadband input impedance matching network. One approach involves a combination of series inductor and shunt capacitor circuit elements implemented on a printed circuit board. (See Figure 1.) In this design, the inductors and capacitors are etched into the copper-clad laminate of the PC. This approach provides the necessary impedance transformation from a 50Ω solid-state driver to a high-impedance PA grid in a series of small steps, rather than more conventional L, pi or tee matching networks.

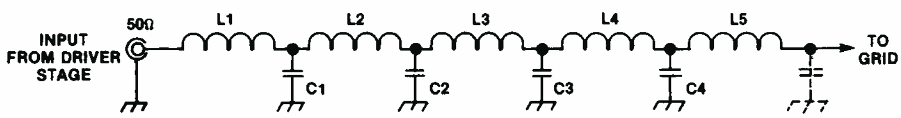


Figure 1. *A broadband impedance matching network designed to couple the 50Ω output of a solid-state driver to a high-impedance PA tube grid.*

Synchronous AM

As the bandwidth of an FM transmission system is reduced, synchronous amplitude modulation increases for a given carrier deviation (modulation). Synchronous AM is generated as tuned circuits with finite bandwidth are swept by the frequency of modulation. The amount of synchronous AM generated is dependent on tuning, which determines (to a large extent) bandwidth, and deviation from the carrier frequency. Figure 2 illustrates how synchronous AM is generated through modulation of the FM carrier.

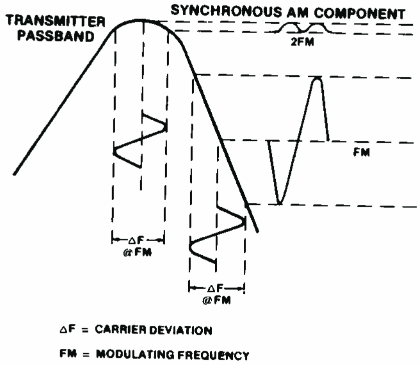


Figure 2. *The generation of synchronous AM in a bandwidth-limited FM system. Note that minimum synchronous AM occurs when the system operates in the center of its passband.*

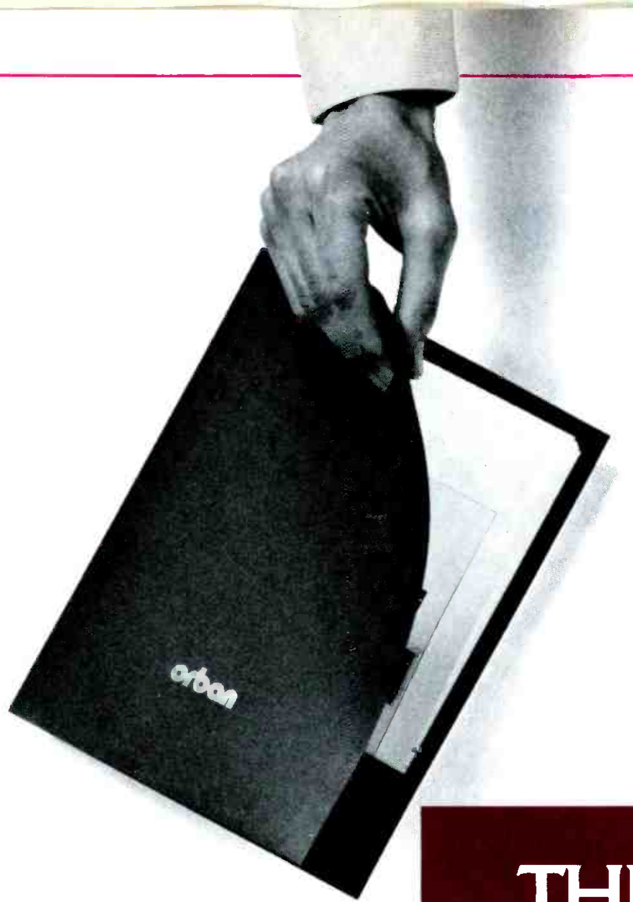
Next month, look for more on the synchronous AM problem and how it can be minimized.

Bibliography

Mendenhall, Geoffrey N. "Testing Television Transmission Systems for Multichannel Sound Compatibility." Broadcast Electronics, Quincy, IL, 1985.

Hershberger, David, and Robert Weirather. "Amplitude Bandwidth, Phase Bandwidth, Incidental AM, and Saturation Characteristics of Power Tube Cavity Amplifiers for FM." Harris Corporation, Quincy, IL, 1982.

Mendenhall, Geoffrey N. "A Systems Approach to Improving Subcarrier Performance." 1986 NAB Engineering Conference Proceedings.



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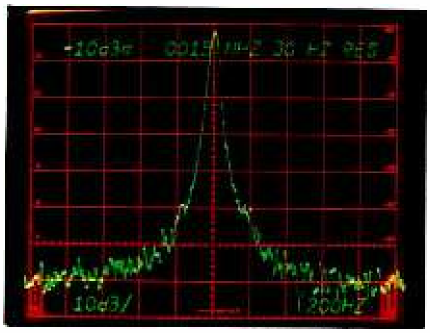
Using power tubes

By Jerry Whitaker, editor



Maintenance of the air-handling system for the PA stages of a broadcast transmitter is a relatively simple but extremely important part of routine plant maintenance. Regularly check the condition of all ducts, boots and blower cages inside the transmitter. A unit that has been in operation for a number of years can suffer from reduced air-system efficiency because of the collection of *microdust* on the blades and cage of a blower or along the sides of a discharge duct or boot.

A convenient method for checking the efficiency of a transmitter cooling system over a period of time involves documenting the back pressure that exists within the PA cavity. This measurement should be made with a *manometer*, a simple device that is available from most HVAC suppliers. The connection of a simplified manometer to a transmitter PA input compartment is illustrated in Figure 1.

Be extremely careful when using the manometer to ensure that the water in the device is not allowed to backflow into the PA compartment. Do not leave the manometer connected to the PA compartment when the transmitter is on the air. Make the necessary measurement of PA compartment back pressure and disconnect the device. Seal the connection point with a subminiature plumbing cap or other hardware.

By charting the manometer readings, it is possible to accurately measure the performance of the transmitter cooling system over time. Changes resulting from the buildup of microdust may be too gradual to be detected except through back pressure charting. Be certain to take the manometer readings during periods of calm weather. Strong winds can result in erroneous readings because of pressure or vacuum conditions at the transmitter air intake or exhaust ports.

Deviations from the typical back pressure value, either higher or lower, could signal a problem with the air-handling system. Decreased PA input compartment back pressure could indicate a problem with the blower motor or a buildup of dust and dirt on the blades of the blower assembly. Increased back pressure, on the other hand, could indicate dirty PA tube anode cooling fins or a buildup of dirt on the PA exhaust ducting to the outside. Either condition is cause for concern.

Blower maintenance

A transmitter suffering from reduced air pressure into the PA compartment should be serviced as soon as possible. Failure to restore the cooling system to proper operation could lead to premature failure of the PA tube or other components in the input or output compartments. Blower problems in a transmitter do not improve with time. They always get worse.

Failure of the PA compartment air-interlock switch to close reliably may be an early indication of impending cooling-system trouble. Such failures could be caused by normal mechanical wear or vibration on the switch assembly. Or, they may signal that the PA compartment air pressure is dropping. In such instances, documentation of manometer readings will show whether the trouble is caused by the failure of the air-pressure switch or a decrease in the output of the air-handling system.

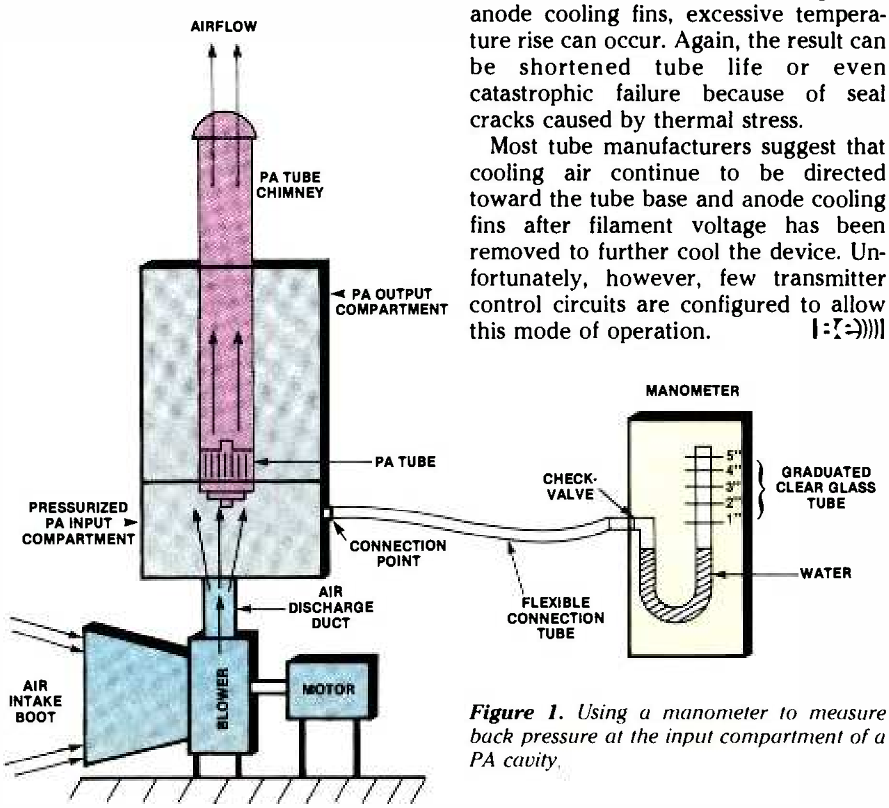


Figure 1. *Using a manometer to measure back pressure at the input compartment of a PA cavity.*

Warm-up/cool-down

The recommended warm-up period between application of *filament-on* and *plate-on* commands should be followed closely. Most transmitter manufacturers specify a warm-up period of about five minutes. The minimum warm-up time should be two minutes. Some units include a time delay relay to prevent the application of a plate-on command until a predetermined warm-up cycle. Do not defeat these protective circuits. They are designed to extend PA tube life.

Most transmitter manufacturers also specify a recommended cool-down period between the application of *plate-off* and *filament-off* commands. This cool-down, generally about 10 minutes, is designed to prevent excessive temperatures on the PA tube surfaces when the cooling air is shut down. Large vacuum tubes contain a significant mass of metal, which stores heat quite effectively. Unless cooling air is maintained at the base of the tube and through the anode cooling fins, excessive temperature rise can occur. Again, the result can be shortened tube life or even catastrophic failure because of seal cracks caused by thermal stress.

Most tube manufacturers suggest that cooling air continue to be directed toward the tube base and anode cooling fins after filament voltage has been removed to further cool the device. Unfortunately, however, few transmitter control circuits are configured to allow this mode of operation.

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Managing the management transition

By T. Lowell Landrum, Ph.D.

As you look over your career, you probably can point to events that strongly influenced it and perhaps even changed the direction you originally intended to go. If you're a broadcast engineer who unexpectedly became a manager, you would probably point to whatever it was that catapulted you into management.

A love of electronics is usually the reason engineers enter the radio or TV field. Yet, as they demonstrate their electronics skills, many of them are rewarded with promotions that take them out of electronics and place them into supervisory or management positions.

The transition from electronics specialist to people manager is often accompanied by a sense of awe, and perhaps, fear. After all, you've spent years developing electronics-related skills, not managerial techniques. The thought of having to begin developing supervisory skills—interacting with people instead of tending to equipment on a full-time basis—is more than just a little frightening.

For a large number of broadcast engineers, chances are that they have never received any kind of managerial training. Knowing how to manage others effectively comes naturally for some, but for many, a sudden promotion to management takes them from a position in which they were comfortable and knowledgeable to one in which they are unprepared to handle the tasks ahead. They lack the tools to get the job done.

Jigsaw puzzle management

Let's assume that you have been recently promoted to a supervisory position. Furthermore, let's assume that you are one of the lucky ones because your company decides to send you to school to learn some management techniques. What will you encounter as you return to the classroom?

The first thing you might learn is that there are different management philosophies. One of them is called *jigsaw puzzle management.* Under this philosophy, you compare the functions and skills of management to the pieces of a puzzle. Each piece of the puzzle

represents a particular skill that will be necessary for you to master in order to perform your job.

Like the pieces of a jigsaw puzzle, every skill is locked into several others, and when certain skills fall into place, others will follow. When you are able to put all the pieces together, you become a complete picture of a manager. This is the picture you will portray to your subordinates, peers and supervisors on a day-to-day basis. The managerial jigsaw puzzle includes these pieces, or skills:

•*Planning.* You must be able to plan not only daily activities, but also short- and long-range projects. The effective manager knows the importance of developing work plans. These plans must be flexible so that they can be reshaped as situations change.

•*Organizing.* This means more than simply having the right material at the right time. Effective organization includes assigning people to positions of responsibility for which they are suited. You should not grab the first available person for a task. It may be that a particular person is inappropriate or untrained for the project. Good managers organize the work so that people are used to their best advantage.

•*Motivating.* This is an often misunderstood term because, in reality, people motivate themselves. A manager must learn what will make staff members motivate themselves. Understanding that different things motivate different people and tailoring the incentive to the individual are the keys to successful motivation.

•*Communicating.* More complex than you might think, communication is more than talking or writing to each other; it is developing an *understanding* of what is needed to accomplish a job *before* it is started. As a manager, you cannot solve problems, train people or delegate tasks without effective communication.

Leadership styles

There are many leadership styles and just as many names for them, such as: deserter, missionary, autocrat, bureaucrat, developer and executive. More important than the names of the modes of leadership, however, is that a manager is able to borrow something from each style. Leaders who cannot shift from one leadership style to another, depending on the situation at work, will face difficulties on the job.

A manager must be sensitive to the particular needs of employees. If an individual's job-related needs go unfulfilled, that person's frustration can lead to poor performance, ineffectiveness and a vast range of problems that can also affect the rest of the staff. The style of leadership plays a role in how managers meet, or fail to meet, the needs of a staff.

Group behavior is perhaps one of the more important areas about which managers need to know. People play many different roles in an attempt to be recognized or accepted by a group. Such roles as informal leader, enforcer, clown, guard or house lawyer are often taken on by employees within a staff. Understanding how these roles are typically acted out can help managers deal with them.

Other skills

There are a myriad of other managerial skills that you must develop and constantly improve in order to be an effective supervisor. These include delegating, managing time, training personnel, handling conflicts and coping with job stress.

Developing the skills to be a good manager takes both time and effort. If you work for a company that recognizes the value of training and is willing to send you to seminars to improve your management skills, take advantage of this opportunity. On the other hand, it may be that you will have to read and study on your own to learn about becoming an effective manager. Although it is usually not as enlightening as a classroom experience, it can help you to broaden your perspective and lead you to some solutions.

Supervising others might seem a little like hocus pocus, especially at first, when a broadcast engineer goes from the absolute science of electronics to the not-so-absolute area of management. Just remember, you didn't learn all you know about electronics all at once.

[:{:-))))]

Landrum is executive vice president for the Center for Management Institutes, Lafayette, IN.

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Video waveform monitoring

By Margaret Feisel

Waveform and vector monitors tell a story about video signal quality that a picture monitor can't.

Someday, you may be able to walk into a TV studio, flip a single switch and instantly send perfect TV signals throughout the facility. Today's studios, however, simply don't work that way. Equipment malfunctions, signals become distorted and a good deal of adjustment is required. Because of these problems, the waveform monitor and vectorscope are necessities at every video facility. Both instruments have existed for more than 20 years, but new models with new features are still being introduced. They continue to provide the best method of getting the necessary information to you. They let you *see* the signals.

Waveform and vector monitors are specialized oscilloscopes adapted for the video environment. The waveform monitor is much like a traditional oscilloscope, operating in a voltage vs. time mode. Its time base triggers automatically on sync pulses in the TV signal, producing line- and field-rate sweeps. Filters, clamps and other circuits process the video signal for specific monitoring needs.

The vectorscope operates in an X–Y voltage vs. voltage mode to display chrominance information. It decodes the signal in much the same way as a TV monitor or receiver to extract color information.

The two instruments serve separate, distinct purposes as they sit side by side in a rack, monitoring the same signal. Some newer models combine functions, packaging both monitor types on one chassis with a single CRT. Others have a communications link between two separate instruments.

Beyond basic signal monitoring, the instruments provide a means to identify and analyze signal aberrations. If the signal is distorted, these instruments allow a technician to learn the extent of the problem and to locate the offending equipment.

Basic waveform measurements

Waveform monitors are used to evaluate the amplitude and timing of video signals and to show timing relationships between two or more signals. The familiar color-bar pattern is the only signal required for these basic tests.

A word of caution about the color-bar signals is necessary to avoid confusion and possible inaccurate measurements. *All color bars are not created equal.* Some generators offer a choice of 75% or 100% amplitude bars. Although sync, burst and setup amplitudes remain the same for the two color-bar signals, peak-to-peak amplitudes of high-frequency chrominance information and low-frequency luminance levels change. The saturation of color, a function of chrominance and luminance amplitudes, remains constant at 100% in both modes. The 75% bar signal has 75% amplitude with 100% saturation. In 100% bars, amplitude and saturation are both 100%.

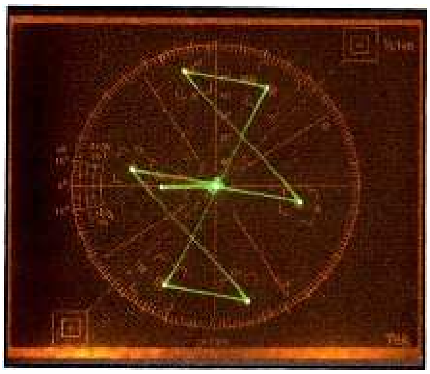

Figure 1. *Color bars on a waveform monitor, 75% amplitude, 100IRE white, 2H sweep.*

Chrominance amplitudes for 100% bars exceed the maximum amplitude that should be transmitted. Therefore, 75% amplitude color bars, with no chrominance information exceeding 100IRE, are the standard amplitude bars for NTSC. In the 75% mode, a choice of 100IRE or 75IRE white reference level may be offered. Figure 1 shows 75% amplitude bars with a 100IRE white level. Either white level can be used to set levels, but operators must be aware of which signal has been selected. SMPTE bars have a white level of 75IRE as well as a 100IRE white flag.

For a waveform monitor to make precise evaluations of signals, the monitor itself must be functioning properly. It should be periodically taken to a service center for calibration. The internal calibration signal for precise gain and sweep adjustments should be used regularly.

Select the calibration signal on the front panel and, if necessary, adjust the vertical gain calibration control until the square wave signal is exactly 140IRE units in amplitude. (Some instruments may require settings of 100IRE units. Consult the manual.)

If the signal is also a sweep calibrator, adjust the horizontal calibration control so that the square wave crosses the graticule base line at the major division marks. Figure 2 shows a typical calibrator signal. The adjustments are generally done with a screwdriver; don't confuse calibration controls with variable gain knobs.

Another preliminary consideration is the dc restorer setting. The dc restorer normally should be *on*, to stabilize the display from variations in average picture level (APL). Some instruments offer slow or fast dc restorer speeds. The slow speed maintains an average dc level, but permits the observation of low-frequency abnormalities, such as 60Hz hum. The fast speed removes most of the hum.

Most waveform monitors have filters that process the signal in order to display certain components. The *flat* response is best for basic monitor functions, because it displays the entire signal. In Figure 1, a flat response has been selected. The

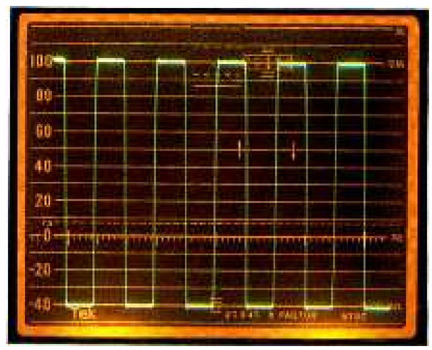

Figure 2. *A waveform monitor calibrator signal.*

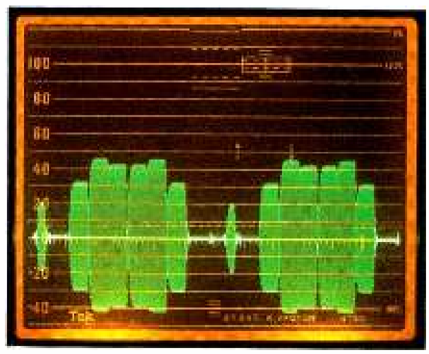

Figure 3. *Chroma filter response with color bars, 2H sweep.*

Feisel is a design engineer for Tektronix, Beaverton, OR.

chroma response filter removes luminance and displays only chrominance, as shown in Figure 3. The *low-pass* filter removes chrominance, leaving only low-frequency luminance levels in the display. (See Figure 4.)

The IRE filter was originally designed to average out high-level, fine-detail peaks on a monochrome TV signal, aiding the operator in setting brightness levels. The IRE response removes most, but not all, of the chrominance. Even so, the IRE mode can be useful for observing luminance levels, as shown in Figure 5.

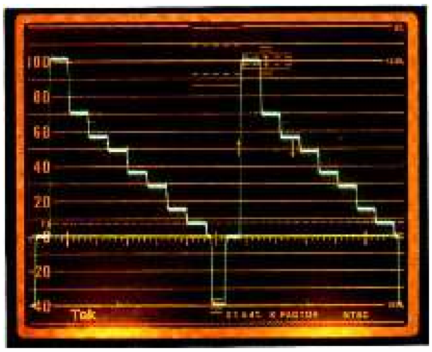

Figure 4. *Low-pass filter response with color bars, 2H sweep.*

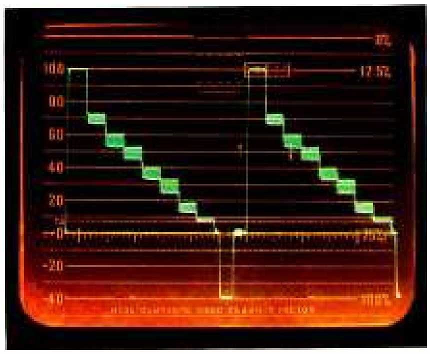

Figure 5. *IRE filter response with color bars, 2H sweep.*

Video amplitudes

The overall amplitude of the video signal is an important parameter to monitor. Deviations from the nominal 1V signal, expressed in IRE units or as percentages, are referred to as *insertion gain* or *loss*. Any equipment in the video path may change the gain, with the errors cascading to result in severe picture impairments. Even small changes in brightness can be perceived by the human eye.

The insertion gain errors, whether too large or too small a signal amplitude, may eventually manifest themselves as signal distortions. It is, therefore, important for each piece of equipment to accurately transfer a 1V signal at its input to a 1V signal at the output. Insertion gain is measured at the output of every active device in the signal path.

To check overall amplitude, position the displayed waveform vertically, until the blanking (back porch) level overlays the 0IRE graticule line. A vertical scale on the graticule divides the standard 1V video signal display into 140IRE units—100IRE above the base line and 40IRE below. The white level should come just to the 100IRE or 75IRE mark, depending on the color bars used.

Sync should extend to −40IRE, while setup (the black part of the color bars) should be at 7.5IRE. Setup and peak white are generally the only luminance levels checked with the color-bar signal. A linearity signal can be used to check intermediate luminance levels, but linearity is usually not considered necessary for basic insertion gain evaluation.

Some chrominance checks should be part of an insertion gain measurement procedure. Check (and adjust) the burst amplitude, making certain that it is 40IRE peak to peak, centered on the 0IRE mark. Verify that peaks of chrominance on the first and second 75% signal bars reach the 100IRE line. A vectorscope is better suited to precisely evaluate chrominance amplitudes and will be discussed later in this article.

Sync pulses

The duration and frequency of the TV system sync pulses also must be monitored. Horizontal sync width should be watched closely. Most waveform monitors have 0.5μs or 1μs per division magnification (MAG) modes, which help to verify that H-sync width is between 4.4μs and 5.1μs, when measured at the −4IRE point. On waveform monitors with good MAG registration, sync appearing in the middle of the screen in the 2-line mode remains centered when the sweep is magnified.

It is a good idea to check the rise and fall times of sync and the widths of the front porch and entire blanking intervals. Examine burst and count the cycles. There should be between eight and 11 cycles of subcarrier.

Check the vertical interval for correct format and measure the timing of the equalizing pulses and vertical sync pulses. The acceptable limits for these parameters are shown in the most recent FCC pulse width specification, reproduced in Figure 6.

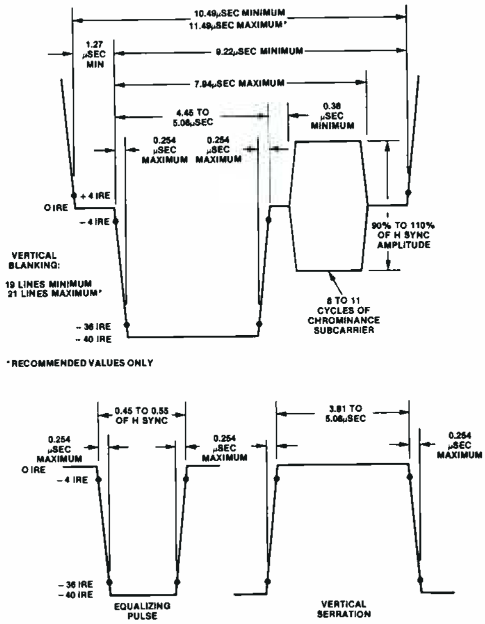

Figure 6. *FCC pulse-width requirements as of March 14, 1985.*

System timing

The sync pulses of all signals must be in the same phase at the point in the studio at which they are combined. If they are not properly timed, the viewer will see a horizontal shift when the program switches from one source to another. Even though all signals are locked to the house reference, timing errors arise as signals travel through different cable lengths, delaying one with respect to the other. Therefore, timing delay for each piece of equipment must be adjusted to bring all signals into coincidence at the switcher.

To compare signal timing adjustments, connect a waveform monitor at the output of the switcher. Select the external reference with the house reference (probably blackburst) signal connected to the external reference input. First, select this reference signal on the switcher and display it on the waveform monitor in the *2H MAG* sweep mode. Adjust the horizontal position control on the waveform monitor to place the 50% amplitude point of the leading edge of sync on one of the horizontal axis graticule marks. *(Do not change this horizontal position knob setting until system timing is finished.)* Now, switch through the video sources one by one, adjusting each source so that the leading edge of sync falls on the same graticule mark as the reference signal.

Why time to the blackburst house reference? The truth is that black really does not need to be phased, if it is never to be a program input. Any signal could be brought up first and other signals matched to it. However, something has to be the reference and blackburst is a handy place to start.

Monitoring

The procedures described thus far are performed with test signals before anything goes on-air. During editing or broadcasting, set the waveform monitor in the 2H sweep mode. Keep an eye on it in case levels need adjustment. If something goes drastically wrong with the picture, check the waveform monitor first. Has sync or burst disappeared? Are the amplitudes correct? The waveform monitor will provide clues to the nature of the problem.

Some waveform monitors have a dual filter mode, enabling the video operator to observe luminance levels and overall amplitudes at the same time. In this mode, the instrument switches between the flat and low-pass filters. With a 2H sweep selected, the display on the left is low-pass filtered, while information to the right is unfiltered. The *line select*

Continued on page 26

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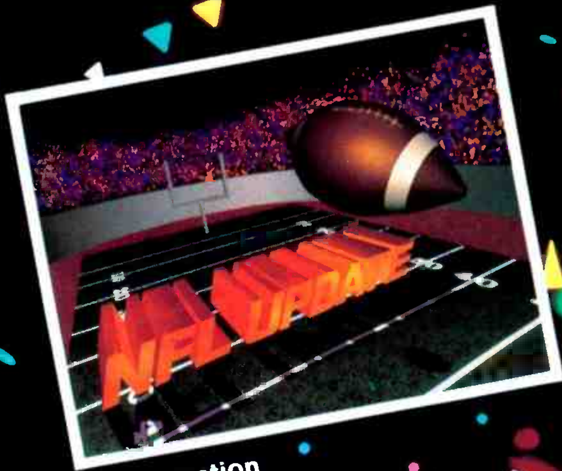

3D illustration

Video enhancement and paint

Continued from page 23
mode (which will be discussed in more detail) is another useful feature for monitoring live signals.

Basic vectorscope measurements

The vectorscope displays chrominance amplitudes, aids hue adjustments and simplifies matching relative burst phases of multiple signals. These functions require only the color-bar test signal.

To evaluate and adjust the chrominance in the TV signal, observe color bars on the vectorscope. The vectorscope should be in its calibrated gain position. Adjust the vectorscope phase control to place the burst vector at the 9 o'clock position, and note the vector dot positions with respect to the six boxes marked on the graticule. If everything is well adjusted, each dot will fall on the crosshairs of its corresponding box, as shown in Figure 7.

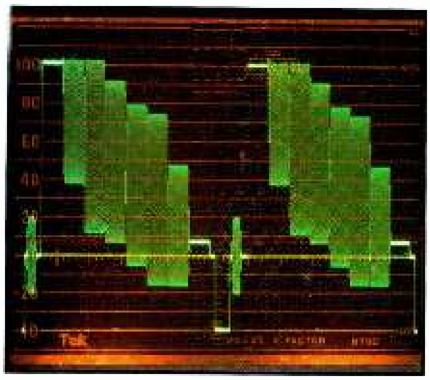

Figure 7. *Color bars on a vectorscope.*

Chrominance amplitudes

The chrominance amplitude of a video signal determines the correct intensity or brightness of color. If the amplitudes are correct, each color dot falls on the crosshairs in the corresponding graticule box. If vectors overshoot the boxes, chrominance amplitude is too large; if they undershoot, it is too small.

The boxes at each color location can be used to quantify the error. In the radial direction, the small boxes indicate a ±2.5IRE deviation from the standard amplitude. The large boxes indicate a ±20% error. Adjust chrominance amplitude on the signal source to get as close to zero error as possible.

Hue control

The hue control on TV equipment changes the phase of the color burst with respect to the rest of the signal. If it is improperly adjusted, viewers will not see true colors. Even small hue errors are undesirable, because very slight skin tone variations are noticeable. When the hue control is adjusted, the burst will remain in the 9 o'clock position as the other dots rotate around it, falling into their boxes. Again, the graticule boxes indicate the extent of the error in the circumferential direction. The small boxes represent ±2.5° error, while the large boxes indicate ±10°.

Burst phasing

A vectorscope can be used to make sure that signals from various sources have the same phase of burst. If all burst signals are not properly phased, color shifts will occur when switching between sources. This adjustment is related to sync timing with a waveform monitor and is done in much the same way.

Connect the test instrument at the output of the switcher and select the external reference on the vectorscope. Switch up the reference signal first and use the vectorscope phase control to set the burst at 9 o'clock. (Do not move the phase control until burst phasing is finished.) Then, switch up each source, adjusting the phase control on the source until its burst vector is also at 9 o'clock.

Monitoring

Vectorscopes are primarily setup tools and are less useful than waveform monitors for watching live video. Burst can be distinguished, but the picture information is usually a blur. An exception to this is the use of a vectorscope to match the tints in backgrounds.

Other capabilities

The functions discussed thus far are

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ARRAKIS SYSTEMS INC. 2609 RIVERBEND COURT FORT COLLINS, CO 80525 the common uses for vector and waveform monitors and are routinely performed in most studios. There are additional uses, however, that require an instrument with a more advanced feature set, a more skilled operator or both. Some of these involve identifying problems, while others are precise measurements to quantify equipment aberrations.

Other test signals, including modulated staircase or multiburst, are required for many of these tests. It is important to take a good look at how these signals appear immediately after they come out of the generator. Knowing what the undistorted waveform looks like simplifies the identification of distortions.

Line select

Some models of waveform monitors and vectorscopes have line select capability. They can display only one or two lines out of the entire video frame of 525 lines. (In the normal display all of the lines are overlaid on top of one another.) The principal use of this single line feature is to monitor VITS signals. VITS allows in-service testing of the transmission system, because precise evaluation of signal quality is possible with test signals.

A full-field line selector generally drives a picture monitor output with an intensifying pulse. The pulse causes a single horizontal line on a picture monitor to be highlighted. This indicates where the line selector is within the frame and correlates the waveform monitor display with the picture.

Linear distortion: frequency response

Frequency response refers to the TV system's capability to respond uniformly to signal components of different frequencies and is generally evaluated with a waveform monitor. Different signals are required to check the various parts of the frequency spectrum. If the signals are all faithfully reproduced on the waveform monitor after passing through the video system, it is safe to assume that there are no serious frequency response problems.

At very low frequencies, look for externally introduced distortions, such as

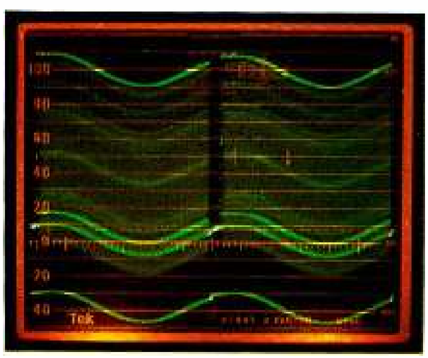

Figure 8. *A 2-field sweep on a waveform monitor, showing ac mains hum distortion.*

power-line hum or power-supply ripple, and distortions resulting from inadequacies in the video equipment itself. Low-frequency distortions will probably appear on the TV screen as flickering or slowly varying brightness. Low-frequency interference can be seen on a waveform monitor if the dc restorer is operating in the slow mode and a 2-field sweep is selected. Sine wave distortion from ac power-line hum is quite evident in Figure 8.

A bouncing APL signal can be used to detect distortion in the system itself. Vertical shifts of the blanking and sync levels indicate the possibility of low-frequency distortion.

Field-rate distortions appear as a difference in shading from the top to the bottom of the picture. A field-rate 60Hz square wave is best for measuring field-rate distortions. Distortion occurs as tilt in the waveform in 2-field mode with the dc restorer off. If a 60Hz square wave is not available, a window signal can also be used.

Line-rate distortions manifest themselves as streaking, shading or poor picture stability. To detect errors of this nature, look for tilt in the bar portion of a pulse-and-bar signal. The waveform monitor should be in the 1H or 2H mode with the fast dc restorer selected for the measurement.

The multiburst signal is used to test the high-frequency response of a system. The multiburst, shown in Figure 9, includes packets of discrete frequencies within the TV passband, with the higher frequencies toward the right of each line. The highest frequency packet is at about 4.2MHz, which is the upper frequency limit of the system. The next packet to the left is near the color subcarrier frequency (3.58MHz) and is used to check the chrominance transfer characteristics.

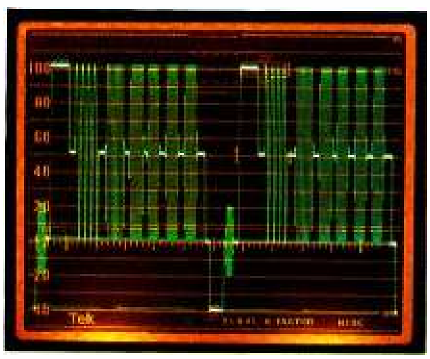

Figure 9. *Undistorted multiburst, 2H sweep.*

The remaining packets are distributed down to 500kHz. The most common distortion is high-frequency rolloff, seen on the waveform monitor as reduced amplitude packets for the higher frequencies (see Figure 10). The TV picture exhibits loss of fine detail and color intensity when this type of distortion is present. High-frequency peaking, appearing on the waveform as higher amplitude packets at the higher frequencies, causes

Figure 10. *Multiburst signal exhibiting high-frequency rolloff.*

ghosting on the picture.

Non-linear distortion: differential phase

Non-linear, or level-dependent, distortions are another type of picture impairment. One non-linear distortion is differential phase (dΘ), which is present if a change in luminance level produces a change in the chrominance phase. If the distortion is severe enough, TV viewers will note that the hue of an object changes as its brightness changes. A modulated staircase or ramp is used to measure this. Either signal places chrominance of uniform amplitude and phase at different luminance levels. Figure 11 shows a 100IRE modulated ramp. Because dΘ may change with changes in APL, several measurements of this distortion are necessary to fully evaluate system response. Measure dΘ at the center and at the two extremes of the APL range available on the test signal generator.

Figure 11. *A 100IRE modulated ramp, 2H sweep.*

Figure 12. *Differential phase of 5° on vectorscope.*

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To measure dΘ on a vectorscope, increase the gain control until the vector dot is on the edge of the graticule circle. Use the phase shifter to set the vector to the 9 o'clock position. Phase error will appear as circumferential elongation of the dot. The vectorscope graticule has a scale marked with degrees of dΘ error. Figure 12 shows a dΘ error of 5°.

More information can be obtained from a swept R−Y display, which is a feature of waveform monitor and vectorscope systems. If one or two lines of demodulated video from the vectorscope are displayed on a waveform monitor, differential phase appears as tilt across the line. In this mode, the phase control should be adjusted to place the demodulated video on the base line, which is equivalent in phase to the 9 o'clock position on the vectorscope. Figure 13 shows a dΘ error of 5°; the amount of tilt is measured against a vertical scale.

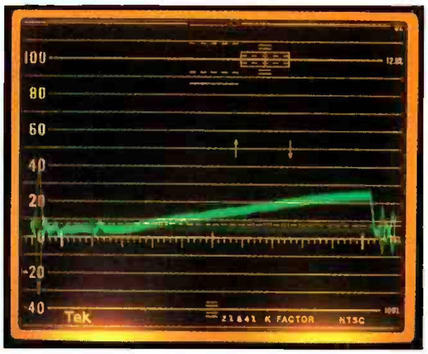

Figure 13. Differential phase of 5° on waveform monitor.

This mode is useful in troubleshooting. By noting where along the line the tilt begins, it is possible to figure out at what dc level the problem starts to manifest itself. In addition, field-rate sweeps enable the operator to look at dΘ over the field.

A variation of the swept R−Y display may be available in some instruments for precise measurement of differential phase. Highly accurate measurements can be made with a vectorscope that has a precision phase shifter and a double-trace mode. This method involves nulling the lowest part of the waveform with the phase shifter, then using a separate calibrated phase control to null the high end of the waveform. A readout in tenths of a degree is possible.

Non-linear distortion: differential gain

Differential gain (dG), another non-linear distortion, refers to a change in chrominance amplitude with changes in luminance level. That is, the vividness of a colored object will change when the brightness of the scene changes. The modulated ramp or modulated staircase is also used to evaluate this impairment. Again, make the measurement on signals with different APL levels.

To measure differential gain with a vectorscope, set the vector to the 9 o'clock position and use the variable gain to bring it to the edge of the graticule circle. Differential gain error appears as a lengthening of the vector dot in the radial direction. The dG scale at the left side of the graticule can be used to quantify the error. Figure 14 shows a dG error of 10%.

Differential gain can also be evaluated on a waveform monitor by using the chroma filter and examining the amplitude of the chrominance from a modulated staircase or ramp. Put the waveform monitor in 1H sweep and use the variable gain to set the amplitude of the chrominance to 100IRE. If the

Figure 14. Differential gain of 10% on a vectorscope.

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chrominance amplitude is not uniform across the line, there is a dG error. The reduced chrominance amplitude at the right side of Figure 15 is an example of dG distortion. With the gain normalized

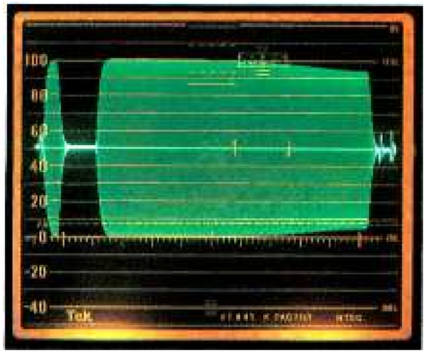

***Figure 15.** Differential gain of 10% on waveform monitor.*

to 100IRE, the error can be expressed as a percentage.

Finally, dG can be precisely evaluated with a swept display of demodulated video. This is similar to the single trace R – Y methods for differential phase. The B – Y signal is examined for tilt when the phase is set so that the B – Y signal is at its maximum amplitude. The tilt can be quantified against a vertical scale.

K-factor

The lines and small boxes near the top of the waveform monitor graticule are K-factor or quality constant scales. The K-factor system is another means to quantify signal degradation. A series of subjective viewer reaction tests generated data that correlated the relative degradation of the picture to a measured amount of all the distortions observed on a sine² pulse-bar signal. From the results of those tests, the K-factor established quality standards for TV signals from slight to severe picture degradation.

The K-factor markings line up horizontally with the pulse-bar portion of the FCC composite signal when the waveform monitor is set for a 1H sweep. The dashes and solid lines on the graticule represent ±2% and ±4% K-factor, respectively. A 5% K-factor distortion is said to be detectable by skilled observers, while 3% is not noticeable.

ICPM

Modern TV receivers use a method known as intercarrier sound to reproduce audio information. Sound is recovered by beating the audio carrier against the video carrier, producing a 4.5MHz IF signal, which is, in turn, demodulated to produce the sound. From the interaction between the audio and video portions of the signal, certain distortions in the video at the transmitter can produce audio buzz at the receiver. Distortions of this type are referred to as *incidental carrier phase modulation* or *ICPM.*

The advent of stereo audio for television has increased the importance of measuring this parameter at the transmitter, because the buzz is more objectionable in stereo broadcasts. It is generally suggested that less than 3° of ICPM be present.

ICPM is measured with a high-quality demodulator with a synchronous detection mode and an oscilloscope, operated in a high-gain X – Y mode. Some waveform and vector monitors have such a mode. Video from the demodulator is fed into the Y input of the scope and quadrature out is fed to the X input terminal. Low-pass filters make the display easier to resolve.

An unmodulated 5-step staircase signal produces a polar display, which is shown in Figure 16, on a special graticule developed for this purpose. Note that the bumps all rest in a straight vertical line, if there is no ICPM in the system. Tilt indicates an error, as shown in Figure 17. The graticule is calibrated in degrees per radial division for differential gain settings. Adjustment, although not measurement for the error, can be done without a graticule.

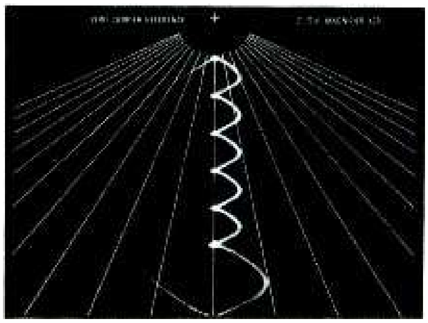

***Figure 16.** A waveform display showing no ICPM distortion.*

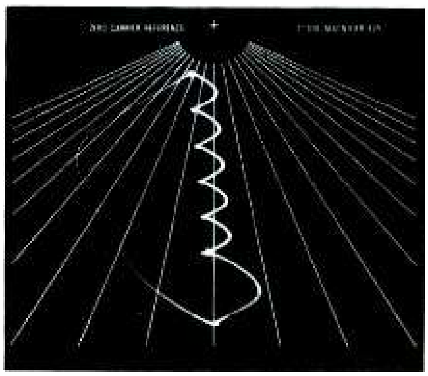

***Figure 17.** A waveform display showing 5° ICPM distortion.*

And so on...

This discussion of capabilities of waveform and vector monitors is by no means all-inclusive. Special test signals and measurement techniques have been developed to evaluate chrominance-to-luminance delay, group delay and many other parameters. Some instruments have the capability to look at SC/H phase. Instructions for performing these measurements and more detailed information on techniques already discussed can usually be found in your monitoring equipment manuals.

An effective test plan

Waveform and vector monitors are useful instruments, but the effectiveness of test and measurement procedures depends heavily upon the people who operate them. Someone must decide which parameters need to be evaluated and what the acceptable limits are for each one. Someone must select the test equipment initially. And finally, someone must be responsible for making those measurements on a routine basis.

Whether these functions are performed by one person or by members of a large staff, their judgment is important. There are no hard and fast rules, no pat answers. Technical people involved in television are always trying to get the best picture for the viewer while staying within a budget and meeting FCC requirements. In spite of this common goal, each facility will have different test and measurement requirements.

The first concern, and probably the most difficult one, is deciding what to measure and how much error to tolerate. Most facilities will want to make the checks discussed in this article, but it is impossible to generalize much further. Deciding on acceptable limits is not easy. Is 5° of dG too much? It may be perfectly acceptable for a transmitter site, while a dG of 1° may be objectionable in the studio. The operators of each facility must decide for themselves and it is, therefore, a good idea to learn how various impairments affect the picture.

The choice of test and measurement equipment is usually based on the feature set required, the cost, and personal preferences of the operators. When only a few models were available, a clear line could be drawn between monitoring equipment and measurement equipment. Although some instruments are still clearly one or the other, that line has blurred considerably in recent years. Many newer models fall in between, making it necessary to analyze the instruments feature by feature to find the best fit. Keep in mind the experience and technical skills of those who will operate the equipment most frequently, and try to find an appropriate user interface.

Finally, make sure that all of the checks and setup procedures are performed regularly by a competent operator. Good equipment and a well-defined system checkout procedure will be effective only if they are used. The person performing the check must be able to recognize when something is wrong, even if someone else must be called to fix the problem. A good waveform monitor and vectorscope, when combined with some basic skills on the part of the operator, can help achieve the goal of delivering consistently high-quality video.

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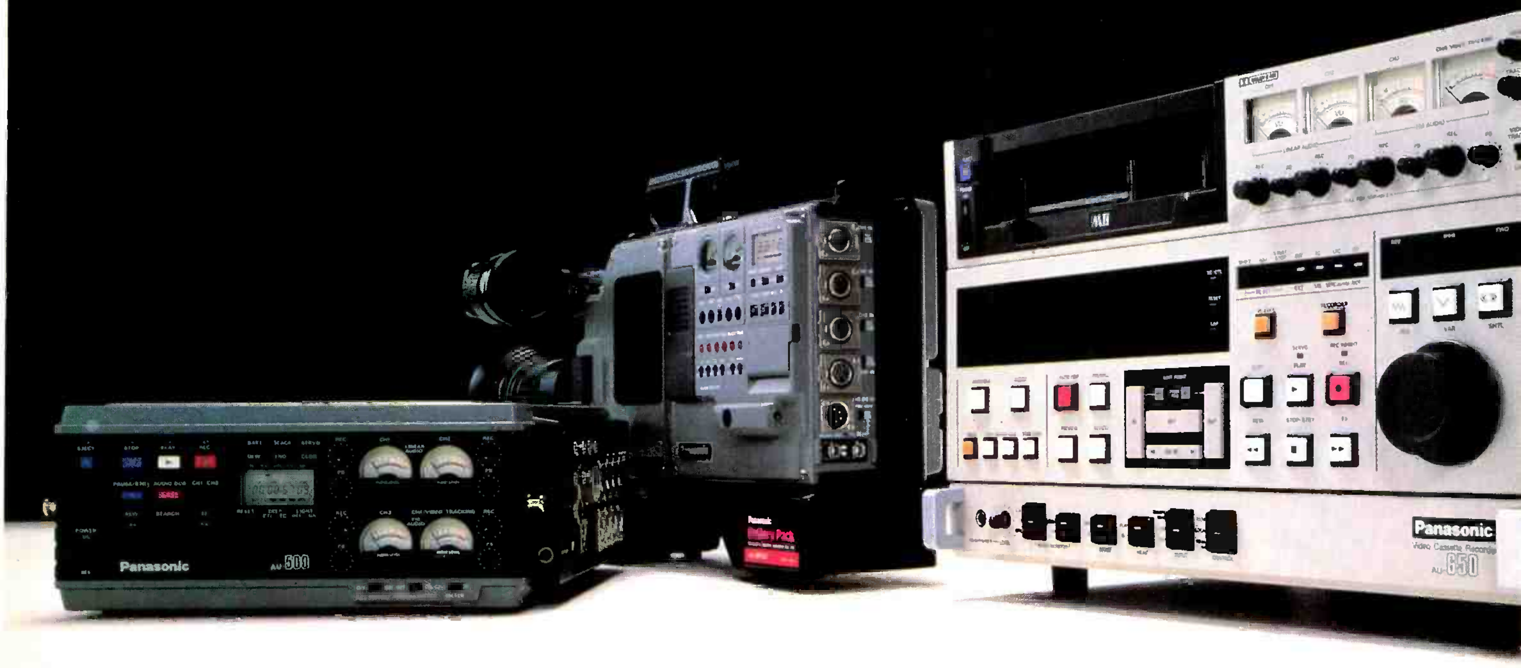

Circle (20) on Reply Card

Sync processing and distribution

By Michael Guess

The most critical aspect of teleproduction facility design is system timing.

Without sync and timing information, a video signal will produce nothing but gibberish on the CRT. Even with scrambled signals, the remnants of normal timing information are present, although they may be encoded as data. As long as a means to reconstitute sync at the display exists, television works.

Video basics

Light passing through the optical system creates a pattern of electrical charges on the target of the camera pickup tube. Inside the tube, an electron beam scans the target to complete an electrical circuit through the charges on the target. A varying density of electrons, which represents the light and dark pattern, flows from the target to form the video signal.

To accurately reproduce the scene, scanning must occur in an organized way. In the camera and TV receiver, an electron beam scans across the target and CRT screen, moving horizontally. At the same time, the electron beam gradually moves downward. Once it reaches the bottom, the beam returns to the top of the screen.

A complete picture contains 525 lines, scanned alternately or *interlaced*. During the first pass, the beam scans odd-numbered lines; during the second pass, even lines are traced. Each scan or pass of the scene is a field of 262.5 lines; two fields form a frame. Because fields are scanned in a rapid sequence of 60 per second, the viewer perceives the illusion as a completed picture.

Sync basics

To create a picture, the camera and receiver must be synchronized, scanning the same part of the scene at the same time. As the beam reaches the right end of a horizontal line, it returns to the left side of the screen. Called *horizontal retrace*, the return is coordinated with the horizontal sync pulse. Similarly, after 262.5 lines are traced, the beam returns to the top, signaled by the *vertical* sync pulse. During retrace times, *blanking* turns the beam off, so that nothing is picked up by the camera tube or written on the TV CRT screen.

Each line of video contains a *horizontal blanking period*, which includes the sync pulse and reference color burst. In the vertical sync interval, however, normal horizontal information is deleted. *Equalizing pulses* are used instead to cause video fields to begin at the proper points for interlace. *Vertical serrations* keep the horizontal sync circuitry from drifting away from the correct horizontal frequency.

System basics

To mix video signals, all signals must arrive at the video mixer, or central combining point, synchronously. That is, the scanning sequence of every source must start, and stay, in time. Otherwise, the picture will roll, jump, tear and/or have

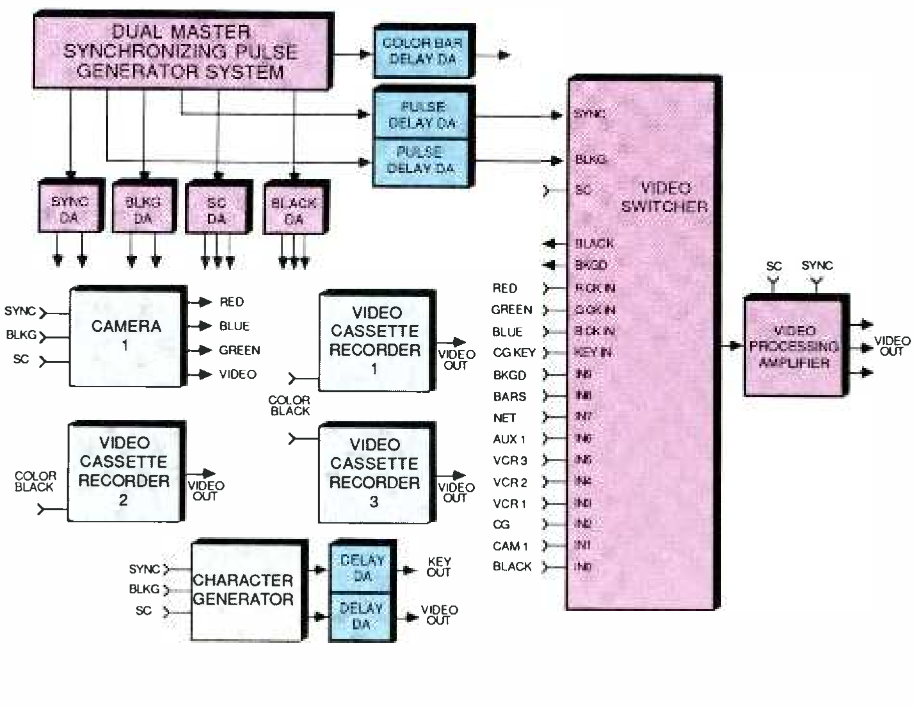

Figure 1. A small video production system using cumulative delay to achieve system timing.

Guess is a marketing specialist for Grass Valley Group, Grass Valley, CA. This article was adapted from the GVG publication, *NTSC Studio Timing: Principles and Applications*.

incorrect colors as the signals are combined. Careful system timing assures that all video signals at the input of the video switcher are synchronous.

The *sync generator* provides a reference by which all events and/or signals are timed. Establishing and maintaining precise timing involves a number of variables.

Defining advance or delay between video signals requires that one signal be defined as a reference. Advance (or negative time delay) is not possible, but with video frame synchronizers, video advance appears possible. In reality, the synchronizer introduces a delay to achieve an apparent advance.

Planning basics

In facility design, timing requirements must be defined according to information on equipment specification sheets. Most modern source equipment locks to *color black* with an integral sync generator. Timing adjustments in the local generator must have sufficient range to meet system requirements.

Not all equipment can lock to color black. Some older video devices require separate horizontal and vertical drive pulses to synchronize scanning circuits. Sync, blanking and subcarrier are normally necessary. All of these drive pulses must be timed according to the path length of the reference video device. Normally the device with the longest path length is taken as the reference device. Delays are then introduced in all other devices through coaxial cable or equivalent lumped delay lines.

Two approaches prevent excessive lengths of delay cabling. Delay lines may be used, either as variable or fixed delay amounts. A more flexible method is to use a *source synchronizing generator* to drive a video source. This secondary generator locks to color black from the master sync generator. Adjustments to the secondary unit allow the source to be properly timed.

Most production switchers require sync, blanking and subcarrier. Some have a limited adjustment range of horizontal delay, but require advanced pulse drives. Subcarrier phasing is typically an integral adjustment for color timing of the switcher.

Delay basics

Video, pulse and subcarrier distribution occurs through coaxial cable. Coax has an inherent delay of approximately 1.5ns per foot, depending upon the type of cable used. The amount of delay must be considered in the system design. Although the amount of coaxial delay may be desired, coax introduces frequency response losses that increase with cable length and signal frequencies.

Distribution amplifiers introduce inherent delays that vary with the model and range from 25ns to 70ns. Cable equalization adjustments will also affect delay, suggesting that equalization must be set prior to system timing. DA delay adjustments often include bandwidth compensation and are superior to coax or passive delay lines. Some pulse DAs allow adjustment of up to 4μs and include pulse regeneration circuits to eliminate distortion.

Processing amplifiers have a fixed electrical length, even when regenerated sync and color burst are adjustable. Switchers also introduce a path length delay. Particularly in multiple control facilities, these delays must be considered when the system is designed.

If a device feeds two or more switchers, lines going directly to the final switcher must include an additional delay equal to the electrical length of switchers or other devices that also feed the final switcher. The length of switcher systems may vary from 50ns for small routers to 700ns for large production systems. Rather than cable delays, automatic delay DAs or isophasing amplifiers can correct errors of up to ±15ns. Multiple channels, each with several outputs, will maintain a subcarrier phase accuracy to within 1°.

Example one

There are two methods by which timing can be achieved. One accumulates delay. The second uses secondary sync generators to achieve time coincidence.

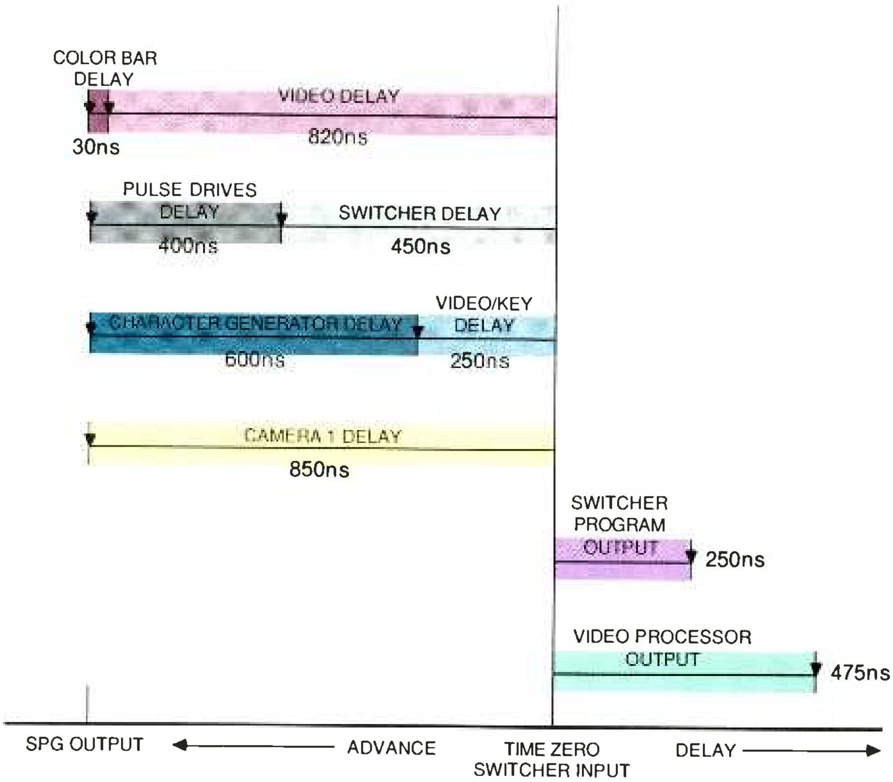

Figure 2. *Timing requirements of equipment in Figure 1, plotted relative to time zero at the switcher input.*

Consider a small system with cumulative delay. (See Figure 1.) One camera, one character generator and three VCRs—each with a TBC—make up the system. Each TBC is synchronized with color black from the master sync generator and includes timing adjustments for the VCRs.

Video sources to be mixed, keyed or used in multiple source effects must be exactly in time at the switcher input. In this example, the switcher input is designated as the *zero timing point.* (See Figure 2.) Now assume the camera to have 850ns delay from its composite sync input to its composite video output, representing the longest signal path in the system. Signals from the sync generator will drive the camera directly.

To sync the camera with switcher black or a color background generator, sync and blanking drives to the switcher must be delayed by 400ns with adjustable delay DAs. The switcher subcarrier control handles subcarrier phasing.

Bringing the character generator into time may be accomplished through delayed drive pulses or in the video and key outputs of the character generator. The system shown in Figure 1 uses video delay DAs for the video and key outputs. This arrangement provides both timing and multiple outputs.

The color-bar source is integral to the sync generator. Because the delay

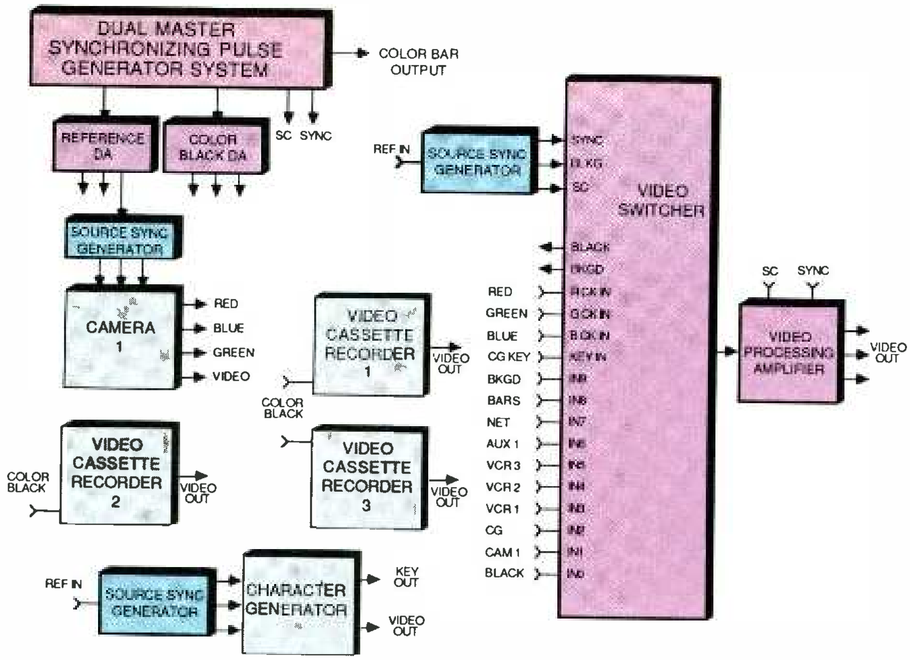

Figure 3. *A small video production system using source synchronizing generators to achieve system timing.*

through the bar generator is only 30ns, 820ns delay must be introduced in the bar signal between the generator and switcher input.

Drives for the video processing system come from DAs feeding the switcher. Integral adjustments in the proc-amp have sufficient timing range for both sync and subcarrier.

Correcting color phase

If the master sync generator is SC/H phased, a specific relationship exists between the leading edge of the horizontal sync pulse and the zero crossing of subcarrier. Ideally, an SC/H phase meter is available to adjust the camera encoder. Phasing can be done without a meter, however.

First, the leading edge of the color bar and camera sync pulses are adjusted for coincidence with the color-bar delay DA. Then the camera subcarrier phase is adjusted to match that of the color bar.

The switcher color background and camera sync and blanking are timed, followed by a subcarrier adjustment with the switcher phasing control. The character generator and titling key outputs are also set with reference to the camera sync and subcarrier, followed by adjustment of TBC controls for the VCRs.

Example two

In the simple system described previously, master and source sync generators are replaced by delay units to simplify SC/H phasing (see Figure 3). Color black drives each TBC/VTR. A reference DA provides sync information to the source sync systems for the camera, titler and switcher. The master generator also provides a color-bar signal.

Each device is SC/H phased to its source sync generator. Then, only adjustments to the secondary generators are needed to achieve total system timing. The camera is advanced by 850ns.

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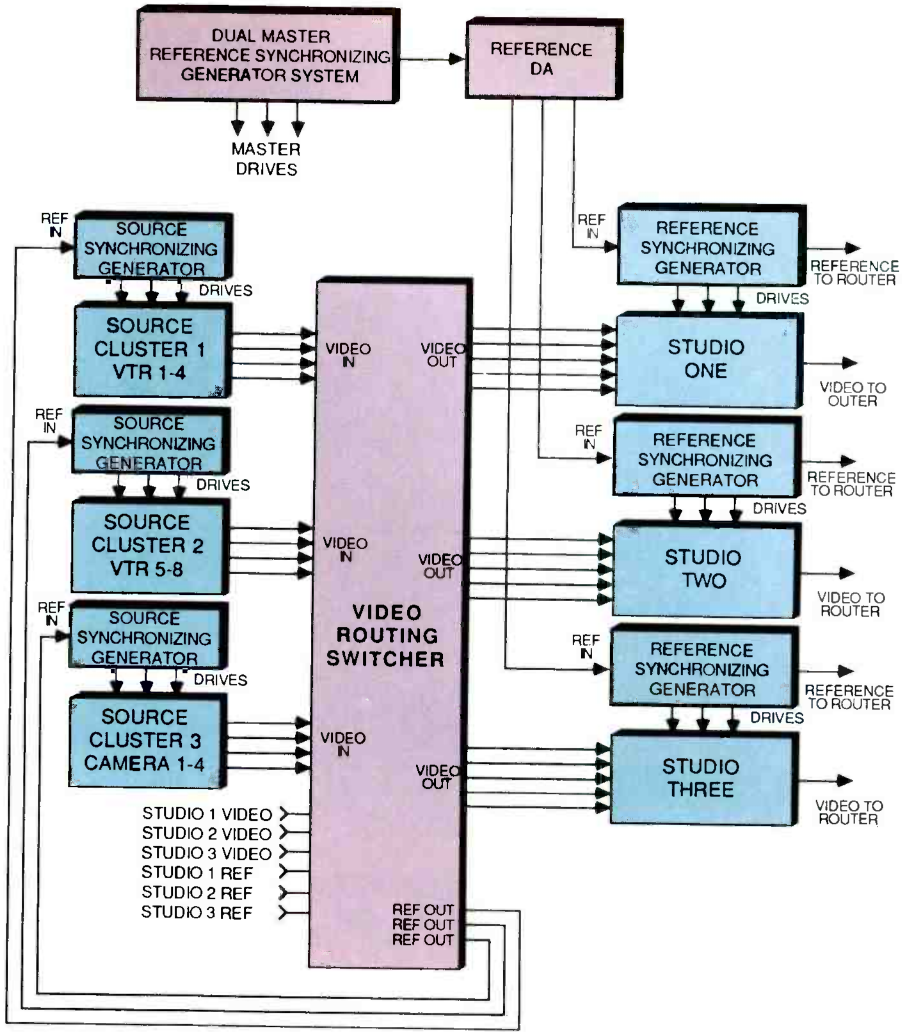

Figure 4. *Application of source synchronizing generators allows flexible source-cluster and studio timing for any interlinking of facilities.*

Appropriate sync advance times for the titler and switcher are made with separate secondary sync units.

The reference signal can be color black or encoded subcarrier. By using encoded subcarrier, a continuous sine wave of 3.579545MHz avoids jitter that might result if the reference were always regenerated from the short burst signal. *Group delay,* which results when several frequencies pass through coax cable, does not occur with the single frequency. Inverting two cycles of subcarrier during field one of color frame one provides positive color frame identification for the source generators.

Complex systems

Several systems, such as that of example two, can be combined into a multiple studio complex. In this case, a master reference sync generator drives reference sync generators, which in turn control source sync units. Each studio has access to a cluster of video sources as well as other router-assignable sources. All clustered sources are timed together. (See Figure 4.)

An output reference signal from each studio provides a key to time any cluster of equipment assigned to that studio. At the same time, a studio and its cluster of sources may become a source for another studio. Through a *phase preset* system, an assortment of equipment configurations may be stored and recalled.

Designing a complex studio facility in this manner has advantages. First, sync system redundancy avoids total system failure, which can occur even with dual generators and auto-changeover. Each level of the sync hierarchy is protected, because loss of a reference drive causes individual generators to go to a free-running mode. The second advantage is that additional sources may be integrated into the system without requiring a major redesign.

Planned success

As the complexity of TV production increases, the combining of local and remote sources with effects, stills and tape becomes more prevalent. In order to create effective video without chroma phase and horizontal luminance shifts, proper timing is essential. Only with careful planning of the timing network can complex systems be made workable.

Understanding SC/H phase

By David Jurgensen

When sync and subcarrier are properly adjusted, quality live and edited video productions become a matter of course.

Controversy surrounds SC/H phase, but until someone finds another method to determine color frame, the confusion probably will continue. Just what is SC/H phasing? Why is it necessary? How does it relate to color framing? This article looks at the subject of SC/H (subcarrier to horizontal) phase in terms of three areas of interest: the SC/H phase and color frame of the signal, the monitoring equipment and the input detection of color frame by gen-locked equipment.

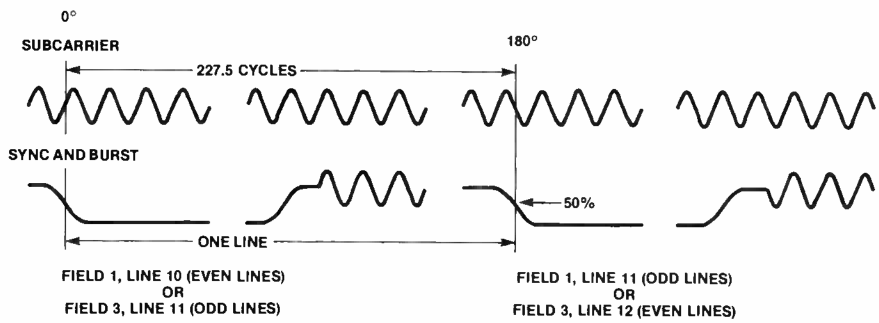

Figure 1. *Determining SC/H phase through subcarrier countdown to sync.*

Color framing

The sync-to-subcarrier relationship, vertical sync and the number of lines per field determine a 4-field sequence for the NTSC system. (In PAL the SC/H relationship defines an 8-field sequence.) The horizontal sync in NTSC is related to the color subcarrier by a factor of 455/2. This gives 227.5 subcarrier cycles between horizontal sync pulses. The same phase of subcarrier, or burst, with respect to sync repeats every other line.

Because there are an odd number of lines (525) in two fields, and the subcarrier-to-sync phase is a 2-line sequence, the first two fields are different from the second two fields. That is, the phase of burst with respect to sync will be different on a particular line of the first two fields relative to the same line of the next two fields. This results in the 4-field sequence. When combining signals, the appropriate fields (one of four) must be identified and matched. Matching of color fields between two signals is called *color framing.*

Field one of the 4-field sequence can be identified by measuring the phase of burst relative to the leading edge of sync (SC/H phase) on a selected line or lines. The proposed RS-170A standard (1977) specifies the relationship on line 10, field one to be 0° phase. Figure 1 shows the relationship between sync and subcarrier and indicates the correct phasing for field one vs. three on selected lines.

Field one or three vs. two or four is determined by the vertical sync. (In PAL, the 2-field sequence can be identified by the vertical sync; the 4-field sequence by the V-axis switching of burst; and the 8-field sequence by the SC/H phase relationship.)

There are several difficulties in determining color frame without SC/H phase and color frame monitoring equipment. Some of these are that:

•Sync and burst do not occur on the

Jurgensen is director of engineering for Magni Systems, Beaverton, OR.

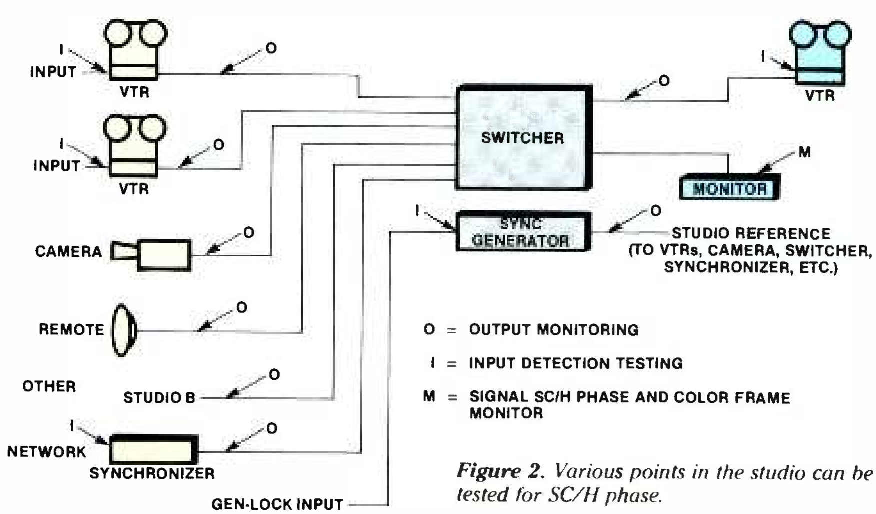

Figure 2. *Various points in the studio can be tested for SC/H phase.*

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signal at the same time.
•The phase of sync with respect to burst may not be exactly 0° or 180° (SC/H phase error).
•Correctly identifying field one of the 4-field sequence on each of two different signals doesn't ensure that the relative color framing is correct. These field identifications are relative to themselves. Because there may be delay differences between signals, correct color framing can be determined only when comparing one signal to another or to a reference. It should be possible to make this comparison with up to ½-field delay difference between signals.
•Timing jitter may not allow phase lock or trigger circuits to follow SC/H phase. Color frame cannot be identified without accurately determined SC/H phase.

Studios and SC/H phasing

There are a number of areas in the studio where SC/H phase and color frame monitoring are important. Some of these are shown in Figure 2. Other points are shown that may require testing for correct color frame input detection.

It is important that the SC/H phasing of the studio reference signal is correct. An offset of the studio reference SC/H phase may cause offsets in other equipment locked to that reference.

Color framing becomes critical when signals are to be edited. If a signal is not color framed, the VTR may not accept the edit or there may be a disruption in the signal if the edit is accepted.

Color framing is also important in switchers. Burst phases have to be matched to avoid color shifts during a switch. If burst phase is matched but color frame is not, sync will be off by ½-subcarrier cycle (140ns). This offset will cause a horizontal jump in the picture as the signals are switched.

VTRs and SC/H phasing

Two of the more commonly used videotape recorders in the studio today are the type C reel and the U-matic cassette formats. Among many other differences, these VTRs also process the signal differently.

Type C machines process color and luminance together, so that color framing and SC/H phase can be measured throughout the VTR video path. Editing will be inconsistent if SC/H phasing is incorrect, or edits may be locked out if color framing is in error.

There are three points to check: the input, the demod output and the TBC output. Even though the demod output is an important point to check phasing, be aware that many SC/H monitors will not work on this signal because of the inherent VTR time base jitter.

The U-matic videotape recorders separate chrominance from luminance so the two are no longer locked together. The SC/H phase relationship is continually varying. As a result, signals from these VTRs cannot be broadcast directly because the FCC requires chrominance to be coherent to sync (or luminance). A TBC is needed to re-establish or relock chrominance and sync. The SC/H and color framing then becomes important at the TBC output.

Defining SC/H phasing

It is important to define and measure SC/H phase, because color framing cannot be determined if the SC/H phase of a signal is too far from 0°. The proposed RS-170A standard specifies that the limits

Continued on page 52

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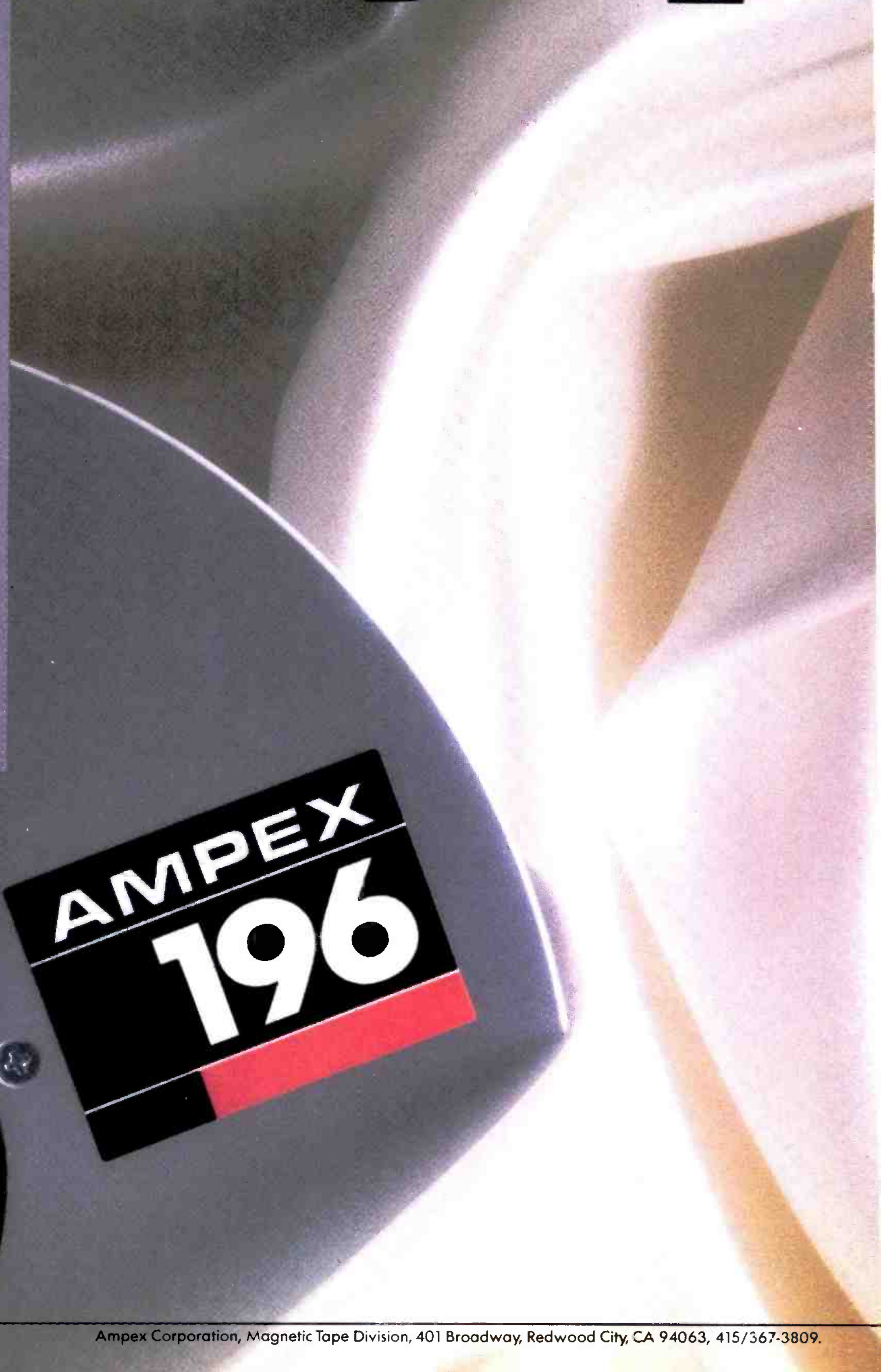

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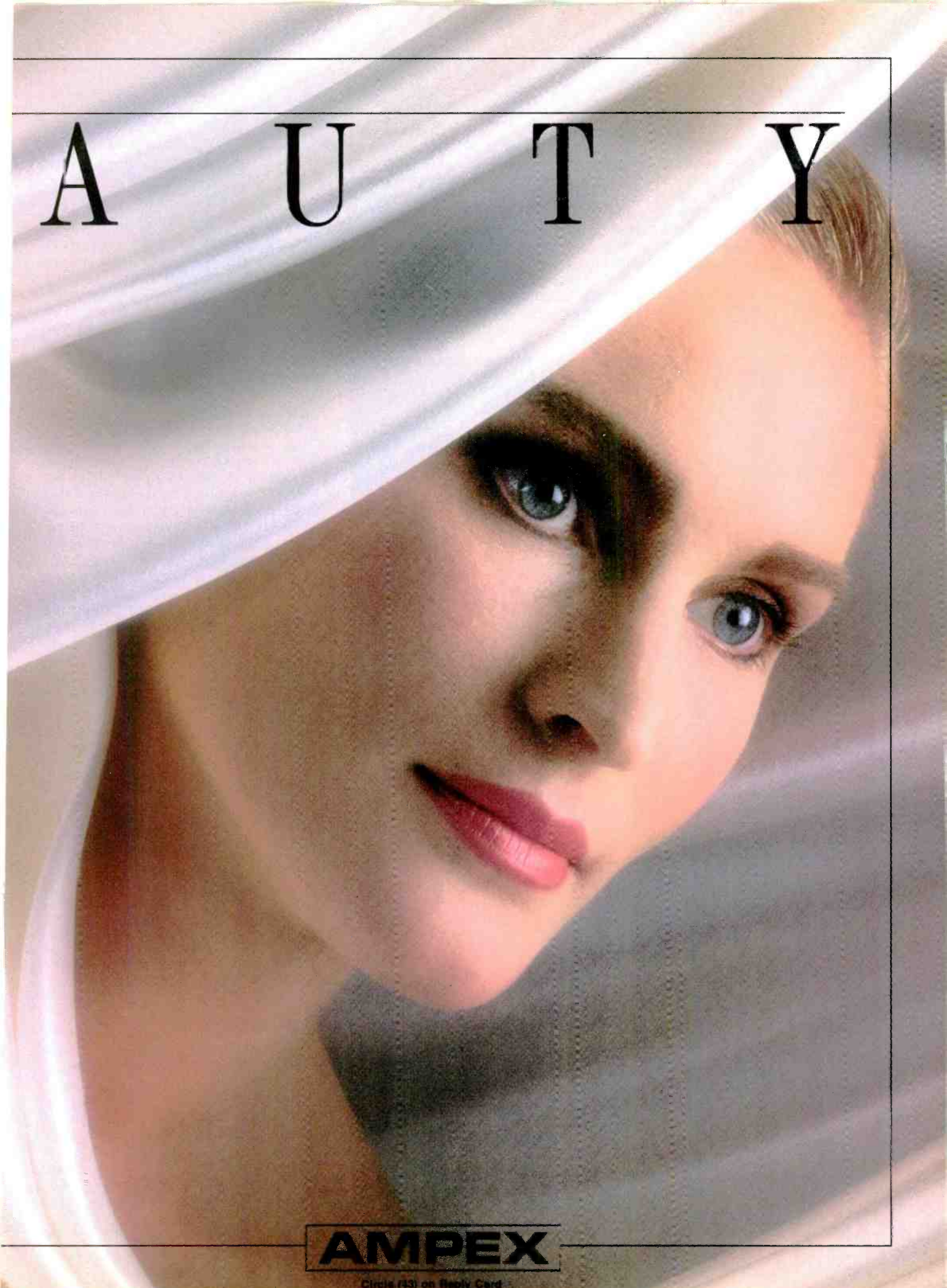
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on signal SC/H phase should be held to within ±40°. This means that the signal sync-to-subcarrier phase should be 0° ±40° on one line and 180° ±40° on the next. Line 10, field one, for example, should have a subcarrier-to-sync phase of 0° ±40° to make frame detection reliable.

The 40° limit on signals allows equipment input detection to be off SC/H phase by up to 50° before the indeterminate state is reached at a total of 90°. If the signal SC/H phase were allowed to go to 90°, it would be impossible to determine color frame because 90° is halfway between the two color frames. See Figure 3.

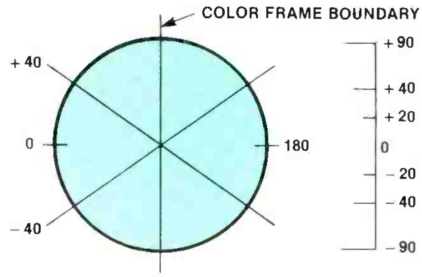

Figure 3. *Recommended SC/H phasing of signals falls into the ±40° sector to the left of the diagram.*

Signals with SC/H phase problems

When the SC/H phase of signals is not close to 0° or 180°, color frame detection circuits in TV processing equipment sometimes give unexpected color framing results. These detection circuits should be able to make the correct determination of color frame as long as the SC/H phase of the input signal is within the recommended ±40°. (See Figure 3.)

For a better understanding, consider four examples of different SC/H phase errors that may result in random color frame detection:

Example 1:

One input signal is at 0° SC/H phase and the second signal is at 100°. The second signal is in opposite color frame and 80° off from its correct SC/H phase. Figure 4 shows a vector representation of the SC/H phase of the two signals along with an SC/H phase scale.

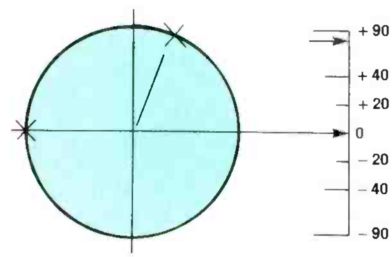

Figure 4. *Frame offset is shown. One signal with correct SC/H falls to the left, while the improperly phased signal appears to the right side of the circle.*

An SC/H phase monitor should indicate a framing error with the equivalent SC/H vectors on opposite sides of the vertical axis. Gen-lock detection circuitry should determine that the signals are in different color frames. A frame error may not be indicated, however, if the detection circuitry is in error by only 10° (only 7.5ns timing error on sync or approximately 10mV offset in 50% point of sync detection).

Example 2:

One signal is at +80° SC/H phase and

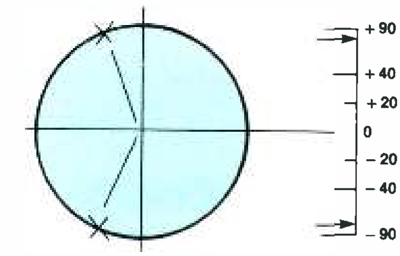

Figure 5. SC/H offset is shown. Both signals have the same color frame, but there is a 160° difference in SC/H phase.

a second signal is at −80° (see Figure 5). Even though these signals are 160° apart in phase, they are theoretically in the same color frame (that is, on the same side of the vertical axis). Gen-locked equipment may exhibit the same problems as if the two signals were not color framed, however, because there is a sync timing difference of approximately 125ns between the two signals.

Switching between these signals may cause a horizontal jump in the output signal, the typical result when signals are incorrectly color framed. Switching from a 0° SC/H phased signal to either of these signals should not cause the color frame to switch.

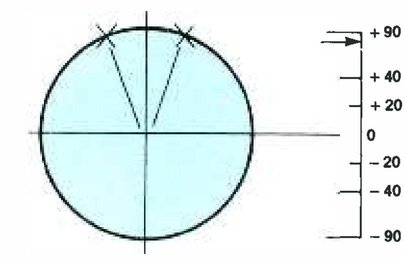

Figure 6. Frame offset is shown, but with only a 20° difference in SC/H phase.

Example 3:

One signal is at 80° SC/H phase and the second signal is at 100° (see Figure 6). The signals are not color framed even though there is only 20° SC/H phase difference between them. An SC/H monitor should indicate a color frame error and an SC/H error of 80°. Gen-locked equipment will give random results in framing, depending on the accuracy of detection. Again, 10° is approximately 7.5ns sync time error or about 10mV error in detecting the center of sync. Switching to either of these signals from a correctly phased signal may cause a frame switch.

Some SC/H phase monitoring equipment indicates only the difference in SC/H phase between two signals. The resultant display would be at 20° for the signals in Figure 6. This display doesn't indicate that both signals are off SC/H phase and improperly color framed. Switching between these two signals may cause a frame jump.

Example 4:

The signal is varying in SC/H phase field to field or over the field. Such an SC/H variation may cause signal jitter or inconsistent color framing results in some equipment.

Causes for SC/H errors

One major cause of SC/H errors is the incorrect setting of video outputs. A maladjustment of the studio reference output may add to any error on the outputs of equipment, such as a TBC that is locked to the reference. There are a number of other causes and also some indications on the signal that there may be a problem. (See Figure 7.) Several examples follow:

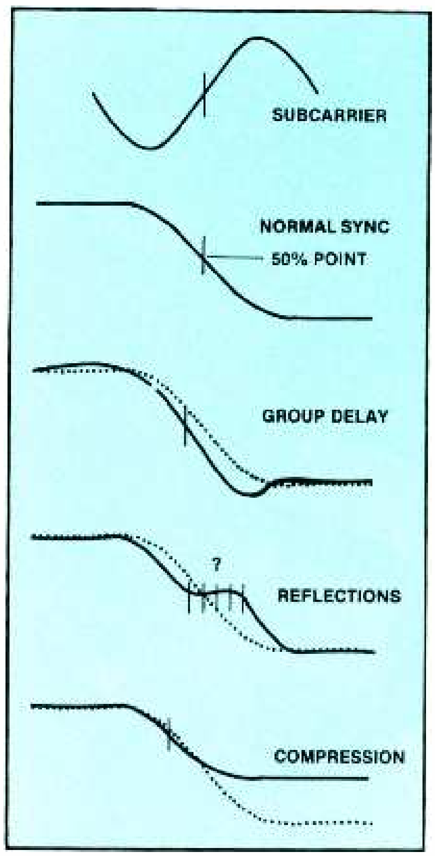

Figure 7. Signal distortions may result in SC/H phase errors.

•A video signal passing through a low-pass filter or video delay line with excessive group delay will result in an SC/H error. This group delay will show on the 2T pulse signal as an apparent asymmetrical preshoot and overshoot. Figure 8 shows the results of an improperly adjusted filter, as displayed on a monitor in the *waveform-SC/H* mode.

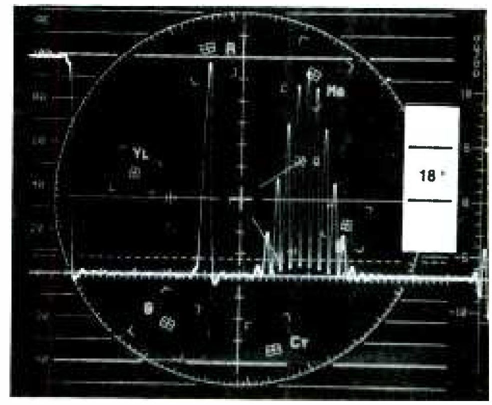

Figure 8. This display of 2T pulse shows the effect of group delay error from an improperly adjusted filter with a resulting SC/H phase offset of 18° (displayed on a Magni Systems 1527 monitor in the waveform and SC/H display mode).

•A mismatch in a termination in the system will create reflections and cause a step in the sync waveform. The change in shape of the sync will produce an SC/H error. The step can be seen on a bar test signal. A 25mV step can cause a 10° to 30° offset in SC/H phase, depending on sync rise time and the duration of the step.

•Sync compression can offset SC/H phasing. Sync compression often changes with the average picture level (APL), causing a variation in SC/H phase. Depending on the response time to APL, this phase variation may occur during a field or over many fields. Sync variations caused by compression can be measured by changing the APL of a test signal.

Crosstalk between signals into sync can cause the sync shape to change in a number of ways that may affect SC/H phase. As a rule, the closer the distortion is to the center of sync and the higher the amplitude, the more likely that SC/H phase monitoring equipment will not give the same results as actual equipment in operation.

Monitoring equipment

There are several types of monitoring equipment that measure and display the SC/H and color frame in different ways. The display may be a bar graph, a degree readout, a picture monitor display, a vector dot or other CRT scales.

When deciding on the equipment needed for a facility, consider the following questions: Does it have the accuracy needed? Will it make the measurements where they are needed? Is it self-checking? Is it easy to use? Does the dis-

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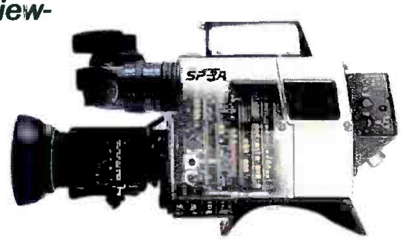

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play interfere with other measurements? Will it solve color framing problems throughout the studio?

Features of the SC/H and color frame monitoring equipment must be determined to match the monitoring equipment to its application in the studio. Most SC/H monitors will not work on the VTR demod output because of time base jitter. Some monitors require accurate matching of timing between signals to correctly indicate color framing. Some will not display sync to show possible distortions. These are only a few examples of possible limitations in monitoring equipment now available.

Input SC/H phase detection

Up to this point, only the signal SC/H phase and its measurement have been considered. Another cause of color framing errors is the input color frame detection of processing equipment such as VTRs, synchronizers, TBCs and genlocked sync generators. The detection may not be centered at 0° SC/H phase or the equipment may not recognize that the color frame has changed.

As stated in the definition of SC/H phase, 40° error in the signal allows up to 50° error in input detection before reaching the 90° undefined point of ambiguity. Some hysteresis at about 90° must be designed into the input lock of equipment so that changes in input SC/H phase will not cause frame hopping.

These offsets will add together. For example, a wrong color frame determination is initially made, the input signal SC/H phase is off by 40°, the input detection is off by 35° and the hysteresis is ±20°. The detection of the wrong color frame will not be corrected because these offsets add to more than 90°.

The fact that the input detection may drift more than the output SC/H phasing indicates the importance of testing the input SC/H phase centering. If there are intermittent framing errors, drift may be a source of the problem. The equipment should switch to the correct color frame any time the input signal is within 40° of correct SC/H phase.

Problems in detection

Adding to other errors in detection,

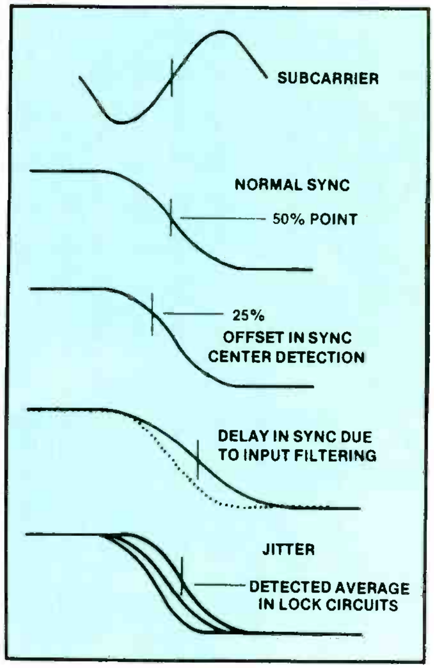
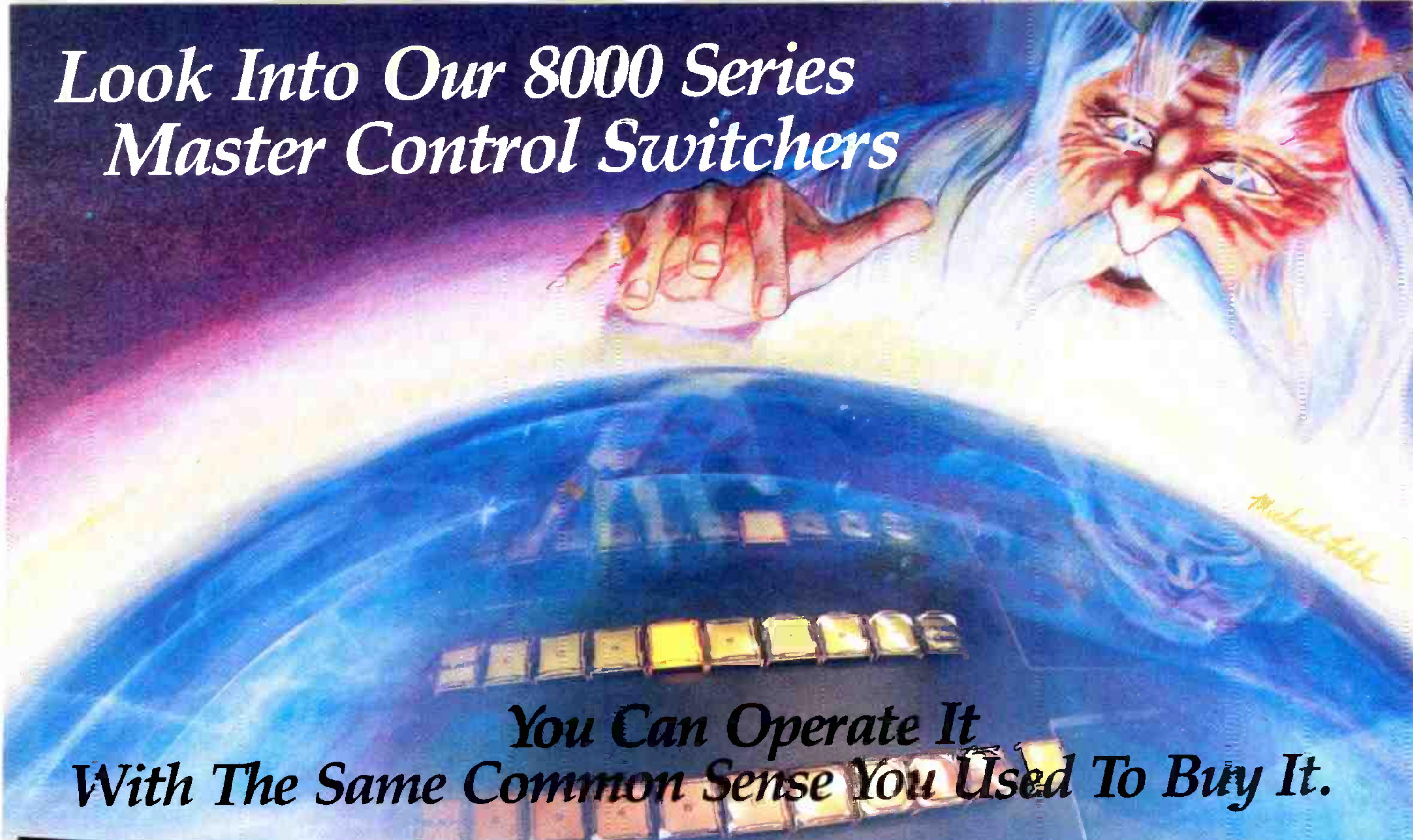


Figure 9. *Detection errors result from improperly adjusted equipment or from time base instabilities caused by VTRs.*



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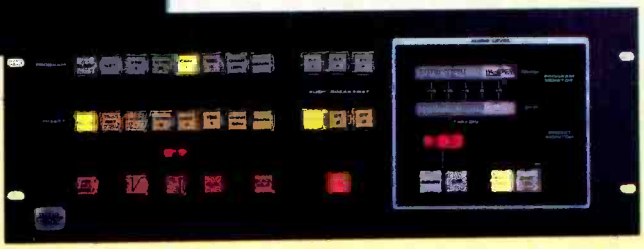

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there are some signal differences that may contribute to the problem, but will not show on an SC/H phase monitor. See Figure 9.

If the equipment is not detecting the center of sync properly, sync amplitude and rise time changes will affect the SC/H phase centering (or color frame detection). An offset error of 30mV in determining center of sync (approximately 10% of sync) will give approximately 30° change in SC/H phase detection centering as the rise time changes between 100ns and 250ns. A change in sync amplitude will produce similar results depending on sync rise time and the amount of amplitude change.

If incorrect filtering is used in the input circuits, the phase centering will change with rise time of sync.

Timing jitter in the signal may cause an offset because of loop responses in genlock circuits.

When a smooth or gradual change in SC/H phase occurs, some equipment will not change color framing, even though there is an offset of hundreds of degrees. If there is a noise burst, color framing may not recover until an abrupt change in sync occurs.

Testing input detection

There are few instruments for testing input detection of color frame. Some tests can be done by offsetting the SC/H phase or color frame of several different signal outputs and patching these signals together through a switcher to simulate switched offsets.

A programmable generator is a convenient method to check such circuits because all parameters can be varied easily. A change in sync amplitude will test sync center detection. Sync rise time variations will test input filtering. Jitter will test lock circuits.

To check SC/H detection centering, vary the SC/H phase until the equipment switches color frame. Then, change the SC/H phase back until the color frame switches back. The offset in detection centered at 0° is equal to the offset of the switching angles from symmetrical around 90°. This test may be repeated for each of the sync variations mentioned here.

To adjust centering, set the signal to switch between 40° and 140° and back. Adjust the equipment under test so that it reliably switches color frame as the signal is switched. Fine-adjust to a center of range that will switch reliably. The 100° shift (80ns) in sync should cause a 180° (140ns) shift in the output.

In some equipment, the phases are additive so that the 80ns less the 140ns leaves a net shift of 60ns in sync when the color frame is switched. If the signal SC/H phase is switched between 0° and

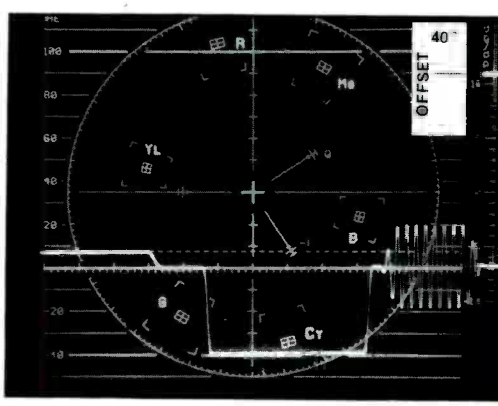

Figure 10. Display of a video signal with a programmed 40° SC/H error.

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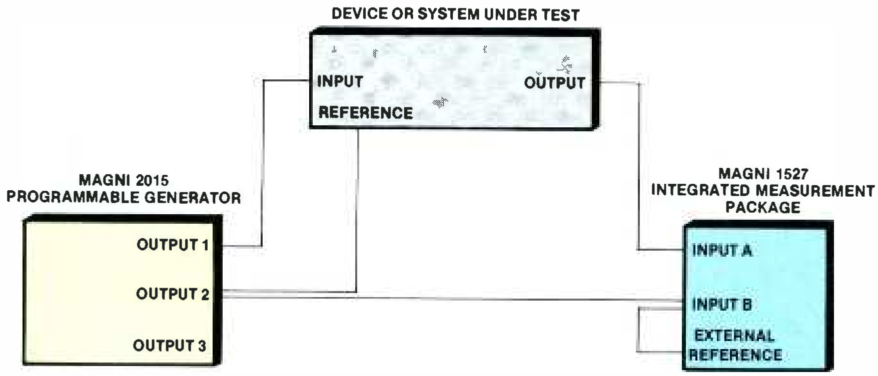

Figure 11. *A test system configuration using a programmable signal generator and SC/H phase measurement package.*

180°, there would be no residual offset in sync when the color frames switch.

Test the system response time by switching color frame and checking the time required for the system to recover. Some equipment will switch within one field and others will take several fields.

Figure 10 shows a programmed offset at the output of a programmable generator when displayed on an SC/H phase monitor. Figure 11 shows an SC/H phase and color frame test setup to check both outputs and inputs.

Example:

When the signal output is set to +40° SC/H phase, the equipment being tested should remain in the same color frame. Change the output SC/H phase to +140° and check that the gen-locked equipment changes color frame. The output sync shifts by 80ns and the equipment output sync should shift by 140ns (½-cycle of subcarrier) or recognize a color frame error.

Now change the generator back to +40° and check that the equipment changes back to the original color frame. A second output from the generator can be set to provide a continuous 0° SC/H phase for a reference.

Steps to success

In order to produce consistently high-quality video, it is advantageous to make sure that the production facility equipment is all SC/H phased. In checking the phase condition of the facility, there are four steps to SC/H and color frame testing:

- •Determine the signal SC/H phase.
- •Compare signals to determine color framing.
- •Acquire the SC/H phase and color frame monitoring equipment.
- •Check equipment input detection circuitry.

The correct SC/H and color frame monitoring equipment, along with equipment to test color frame detection, can improve the productivity of any studio.

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The folded unipole antenna

By John H. Mullaney, P.E.

The folded unipole antenna offers several advantages for stations with inefficient arrays or deteriorating ground systems.

The folded unipole antenna has been around for a long time. Yet many engineers are not familiar with its design. Even so, the unipole AM antenna offers a number of advantages, making it worth consideration by stations that have old and inefficient arrays, deteriorating grounding systems or that simply would prefer to have a grounded tower. These advantages are especially important when the station wants to add an FM antenna or reduce the problems associated with lightning and ungrounded towers.

Compared to both series-fed vertical and toploaded antennas, the unipole offers several specific benefits. The unipole has greater radiation resistance. For those stations concerned about AM improvement, the folded unipole antenna provides greater system bandwidth than does a series-fed antenna. The folded unipole antenna's base impedance can be varied, making coupling and bandwidth easy to control. Conversely, the base impedance for a series-fed antenna cannot be easily changed.

For those installations that suffer from instability in inclement weather, the folded unipole can be a real blessing. The antenna maintains its operating characteristics in most types of weather with few of the problems found in some series-fed installations.

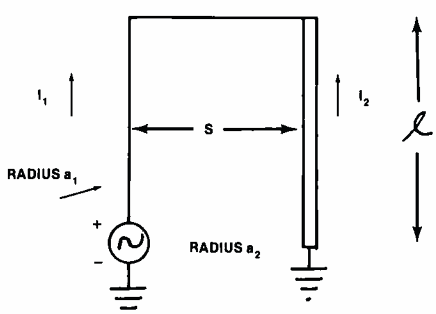

Figure 1. The folded unipole antenna can be thought of as a ½-wave folded dipole antenna perpendicular to the ground and cut in half.

Mullaney is a consulting engineer and president of Mullaney Engineering, Gaithersburg, MD.

Unipole theory

The folded unipole antenna is really a grounded vertical structure with one or more conductors folded back parallel to the side of the structure. It can be visualized as a half-wave folded dipole perpendicular to the ground and cut in half. (See Figure 1.) This design makes it possible to provide a wide range of resonant radiation resistances by varying the ratio of the diameter of the folded-back conductor in relation to the tower. Toploading can also be used to widen the antenna bandwidth.

The folded unipole antenna could be called a modification of the standard shunt-fed system. Instead of a slant wire that leaves the tower at an approximate 45° angle (as used for shunt-fed systems), the folded unipole antenna has one or more wires attached to the tower at a predetermined height. The wires are supported by standoff insulators and run parallel to the sides of the tower down to the base.

The tower is grounded at the base. The folds, or wires, are joined together at the base and driven at this point through an impedance matching network. Depending upon the type of folded unipole antenna used, the wires may be connected to the tower at the top and/or at predetermined levels along the tower with shorting stubs.

The folded unipole can be used on tall (130°) towers. However, if the unipole is not divided into two parts, the overall efficiency or unattenuated field intensity will be considerably lower than the normally expected field for the electrical height of the tower. (See related article, "Tall Towers," page 68.) For shorter towers, however, the folded unipole design is less involved.

Calculating the impedance and operating characteristics of a folded unipole antenna is quite complex and will not be covered here. Instead, this article will examine some of the other important aspects of the system.

Most broadcast folded unipole antennas use three folds on tower widths from 15 inches to 48 inches. The folds are arranged either near the apexes of the triangle of the tower or near the sides of the tower, as shown in Figure 2.

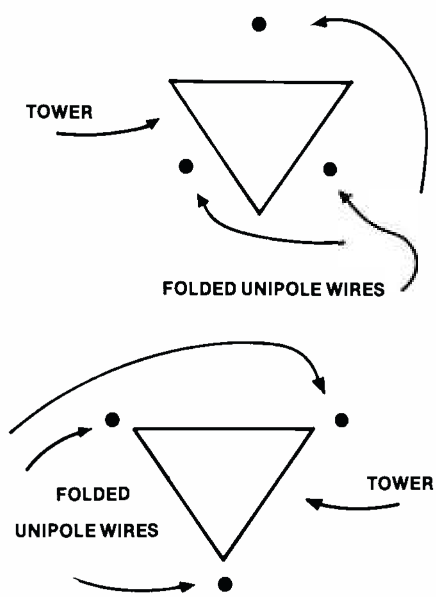

Figure 2. The folds of the antenna are arranged either near the legs of the tower or near the faces of the tower.

The various equations related to folded unipole antennas reflect the number of factors that affect the antenna's impedance. Not apparent from the equations, however, are the structural and environmental problems that can be encountered. For instance, the spacing of the folds from the tower can cause a windloading problem. Furthermore, the accumulation of ice on the bottom of the fold wires and in the strain insulators can cause the VSWR to increase, detuning the transmitter as the base impedance changes.

These problems can be addressed by a triangular brace on the top of the tower cross-arm at the termination of the folds. (See Figure 3.) The arm's spacing should not exceed four times the tower's width or side dimension. The best way to keep ice from building up around the base insulator termination is through the use of a shield-shaped funnel made from copper or sheet metal. This can be used to cover

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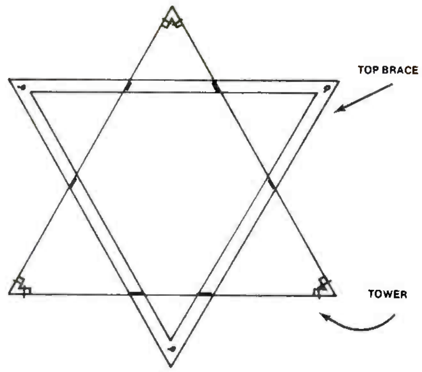

Figure 3. The top brace supports the entire weight of the folds, which are anchored near the base.

the top of the strain insulator.

The funnel not only protects the strain insulators from ice accumulation, but also acts as a corona shield. These funnels should be approximately four to eight inches in diameter.

Ground system losses

If you compare a series-fed antenna with a folded unipole antenna of the same height and similar ground system, you'll find that the unattenuated field efficiency is identical. However, if a series-fed system is many years old and suffering from a deteriorated ground system, the results may be quite different.

In cases in which the ground system has deteriorated from weather, chemical action or vehicle traffic, the folded unipole antenna can provide an increase in unattenuated field intensity. This occurs because the antenna currents divide in accordance with the impedance of the line portion and the tower. Therefore, less current flows in the ground resistance portion of the system, resulting in higher efficiency.

The folded unipole antenna is not a panacea to eliminate ground systems, but it does have the capability to work with a deteriorated ground system. The overall tower height determines the maximum efficiency you can expect from an antenna system and the folded unipole antenna can only work within these limits.

Bandwidth and coupling

Bandwidth and RF coupling to an antenna go hand in hand regardless of the method used to excite the system. All elements between the transmitter output circuit and the antenna must be analyzed, first by themselves, then as part of the system bandwidth. In any transmission system, the total *system bandwidth*, not only the bandwidths of individual components, is of primary concern.

The antenna's bandwidth depends upon its base impedance and the rate at which its reactance changes with frequency. The antenna bandwidth is considered to be the frequency band within which the power is equal to or greater than one-half the power at resonance. It is expressed in equation form as follows:

$$\Delta f = \frac{2Ra}{\frac{dx}{df}}$$

Where: f = bandwidth in kilohertz between half-power points
Ra = measured antenna resistance in ohms
$\frac{dx}{df}$ = slope of reactance curve at the resonant frequency

The effective bandwidth doubles when the generator is matched to the antenna circuit. The Q of a folded unipole antenna can be determined from the equation:

$$Q = \frac{f_o}{\Delta f}$$

Where: f_o = operating frequency in kilohertz
Δf = bandwidth of antenna in kilohertz

Antenna bandwidth is the difference in frequency between two points at which the power output of the transmitter drops to one-half the midrange value. The points are called half-power points. A half-power point is equal to a VSWR of 5.83:1, or the point at which the voltage

Continued on page 68


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Continued from page 64
response drops to 0.7071 of the midrange value.

In broadcasting, equal power in the sidebands is desirable. Because power is proportional to the square of the amplitude of modulation, power is equal to one-fourth that of the unmodulated carrier. In actual practice, a sideband VSWR of less than 1.2:1 within the bandwidth of the program content would be preferable.

A typical situation

The following example should provide a better idea of how a folded unipole antenna design can be used to improve a station's signal. The information was obtained from an actual operating station, so the problems and solutions represent real-life situations.

The station was operating with 1kW at 730kHz with a non-directional antenna system. The 300-foot series-fed tower was unstable, especially during inclement weather. The antenna system was more than 18 years old and the ground system was in questionable condition.

Over the years, several buildings had been built on top of the ground system, causing it to further deteriorate. A side-mounted FM antenna had been installed near the top of the AM tower, thereby requiring the use of a coaxial isolation transformer. A preliminary study indicated that it was not possible to replace the ground system. The station wanted to know if a folded unipole antenna might help solve the coverage problem.

The first step in any redesign is to fully

Tall towers

The fact that 50Ω or some other usable drive point can be obtained on a tall tower does not necessarily make the tower an efficient radiator. For this discussion, consider anything over 130° a tall tower.

Generally, an AM station that increases its tower height by locating on an FM tower is not allowed to operate with the efficiency that would be expected from the taller tower. The FCC requires that the station reduce the input power to the antenna so that it will produce the same unattenuated field efficiency for which it is presently licensed. This requirement is based on a mutual assumption that the station's efficiency has not changed.

Unfortunately, in a majority of the cases in which an AM station has moved to a tall FM tower, the station finds that it has increased its bandwidth, but with a noticeable reduction in signal level. The move often causes instability too. Some stations even find that the AM signal appears on the FM carrier at plus or minus the AM frequency.

The installation of a folded unipole antenna is a complex process, especially on a tall tower. Although the math indicates that a series-fed tower can usually be modified, there are a few tricks of the trade that must be followed.

Often, the folds on tall tower installations have been run either to the top of the tower or just below the FM antenna. This may not be the best solution. Sometimes, it's better to use an upper and lower set of folded unipole antennas. In these cases, the bottom section would start at the base, going up approximately 90° where the folds are bonded to the tower.

On some tall towers a second set of folds would start at the top and go down the tower to approximately the 90° point. Here, the top three folds would be connected and tuned through a variable vacuum capacitor connected to the tower. The upper section tends to couple into the lower folded unipole, so some adjustment may be required. This capacitor would then be tuned by remote control to obtain maximum field strength. After the maximum field intensity is obtained through this adjustment, the station power can be adjusted to the licensed unattenuated field intensity.

Folded unipoles can also be used to detune tall towers if reradiation is a problem. Detailed information on this process is available from the author. Write John H. Mullaney, P.E., 9049 Shady Grove Court, Gaithersburg, MD 20877.

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understand the characteristics of the current system. The base impedance was measured and carefully documented. A series of four radials, every 90° from the tower, were marked out and field-strength measurements were taken at 10 locations along each radial.

Modifying the tower

Based on the results of the measurements, the station's antenna system was found to have a low unattenuated field efficiency. The station decided to use a 3-wire folded unipole antenna to improve the efficiency.

The first step was to reduce the transmitter power to 500W so the riggers could install the three folds on the tower. The tower had a 36-inch face, making the installation fairly straightforward. The riggers were warned to be careful and to not allow the folds to come into contact with the tower during the installation process. The folds were spaced 24

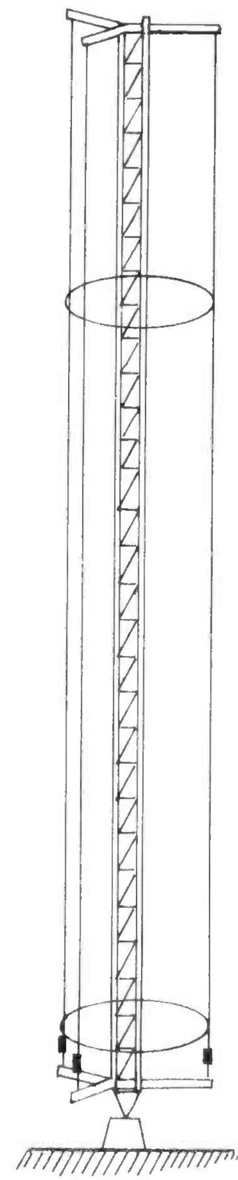


Figure 4. *A 3-wire folded unipole installation.*

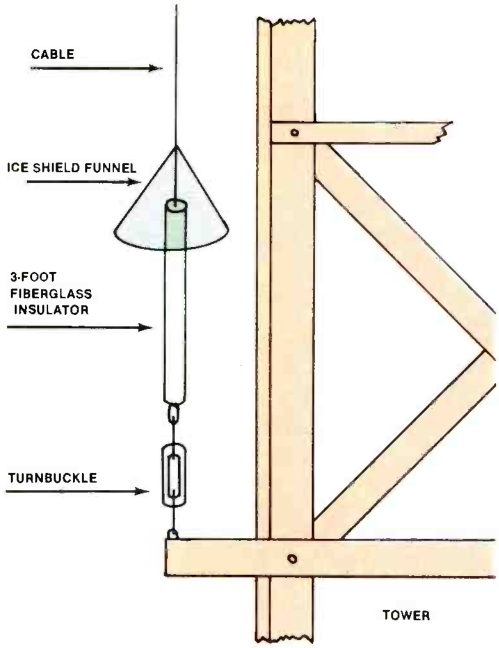


***Figure 5.** The lower ends of each fold are insulated with a fiberglass rod and protected with a funnel-shaped ice shield.*

inches out from the tower face and run from the 300-foot level to the tower base. (See Figure 4.)

After sign-off, three pieces of 4-inch copper strap were installed across the base insulator and soldered to the ground system and tower. The lighting chokes and FM isolation transformer were removed and the FM transmission line was bonded to the tower every 20 feet. The lighting system neutral wire also was bonded to the base of the tower and again at the obstruction lamp level. The three folds were then bonded to the top of the tower.

At the base, the folds were terminated with 3-foot fiberglass strain insulators, as shown in Figure 5. Because the station is located in snow country, funnels were placed on top of the insulators to prevent ice from detuning the system. The three fold wires were then bonded together and a single wire was run from the tower to the coupling house.

The folded unipole antenna design had a characteristic impedance of 50Ω, so the folds were shorted to the tower at 160 feet from the top of the tower. The design stage predicted an impedance of $50+j122\Omega$. The actual measured impedance was $50+j135\Omega$. The distance between the coupling house and the tower accounted for the additional inductive reactance.

After modifications were completed, it was time to again measure the field intensity. The same 10 points along all four radials were checked, and the results were encouraging, showing an increase of approximately 11% in field intensity. The station sounded louder, had better frequency response, and to the listener, seemed to have broader tuning. The change from a series-fed to folded unipole antenna was a success for this station.

The folded unipole antenna is a useful device for many stations. It can solve problems in a relatively inexpensive manner, often making construction work unnecessary. The grounded nature of the folded unipole tower is a real advantage to stations that are plagued by lightning or that plan to install an FM antenna. For many installations, the folded unipole antenna is equivalent to or better than an identical height series-fed antenna.

Bibliography

Mullaney, John H., P.E. "The Folded Unipole Antenna for AM Broadcast." *Broadcast Engineering*, January 1960.

Raines, J.K., P.E. "Folded Unipole Studies." *Think Book Series*, Multronics, 1968-1969.

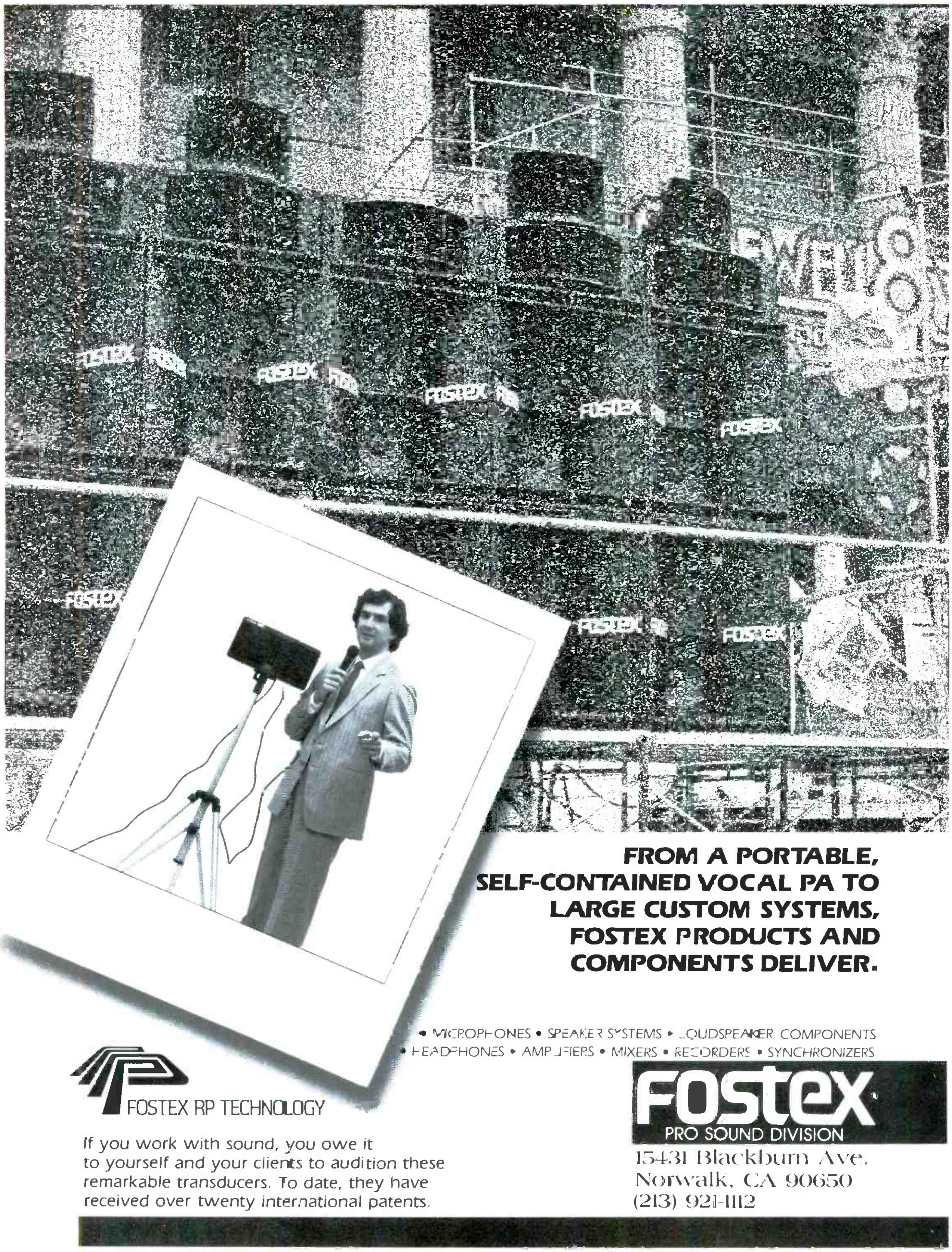
Howard, George P. "The Howard AM Sideband Response Method." *Radio World*, August 1979.

Raines, J.K., P.E. "Unipol," a Fortran program for designing folded unipole antennas. Gaithersburg, MD: Mullaney Engineering, 1970.

Mullaney, John J., and George P. Howard. "SBNET," a Fortran program for analyzing sideband response and design of matching networks.

Westberg, J.M. "Effect of 90° Stub on Medium Wave Antennas." *NAB Engineering Handbook*, 1985.

Mullaney, John H., P.E. "The Consulting Radio Engineer's Notebook." Gaithersburg, MD: Mullaney Engineering, 1985.



Circle (53) on Reply Card

Integrating AM and FM antenna systems

By Lewis M. Owens

A tall tower can be incorporated into an AM directional array to provide better coverage for your FM station. However, you must plan carefully.

The top section of the 660-foot tower after the FM antenna was mounted.

With the rise in FM station popularity, the second-cousin relationship between AM and FM installations is changing. In the early days of FM, stations typically stressed the coverage of the AM facility over the FM. Today, however, stations are interested in maximizing FM coverage. This process often requires replacing typically short AM towers with much taller towers to provide the needed height for the FM signal. Incorporating these tall towers into an AM directional array requires planning and construction because such tall towers are often electrically far too long for efficient AM radiation.

There are various methods available to electrically *shorten* an AM/FM tower. One key lies in being able to use a physically long (tall) structure and, in some installations, detune the upper portion so the AM signal "thinks" the tower is really much shorter than it is.

Field efficiency

The FCC rules provide a convenient chart that allows you to determine the approximate effective field at one mile based on antenna height. The chart, shown in Figure 1, is predicated upon a power of 1kW. The field intensity is the inverse distance value measured at one mile.

From the chart, you can see that maximum field intensity is achieved when a tower has a height equal to 0.625 wavelength, (or, as it is more commonly expressed, 5/8-wavelength.) It would appear, according to the chart, that optimum efficiency would be obtained from a tower exactly 5/8-wavelength tall. Unfortunately, towers are affected by a number of factors and the predicted dimension is usually somewhat different than the actual physical structure.

Influencing factors

Some of the factors that can influence the electrical length of a tower are more obvious than others. Side-mounted or top-mounted FM antennas and tower lighting chokes are obvious influencing factors.

Another factor involves the physical width of the tower. For example, a tower having a face width of 48 inches and height of 400 feet would have a 1% W/H ratio. That is, the width is 1% of the electrical height. Don't confuse this factor with the effective tower diameter. The effective diameter can be precisely determined only for a solid pole antenna. A

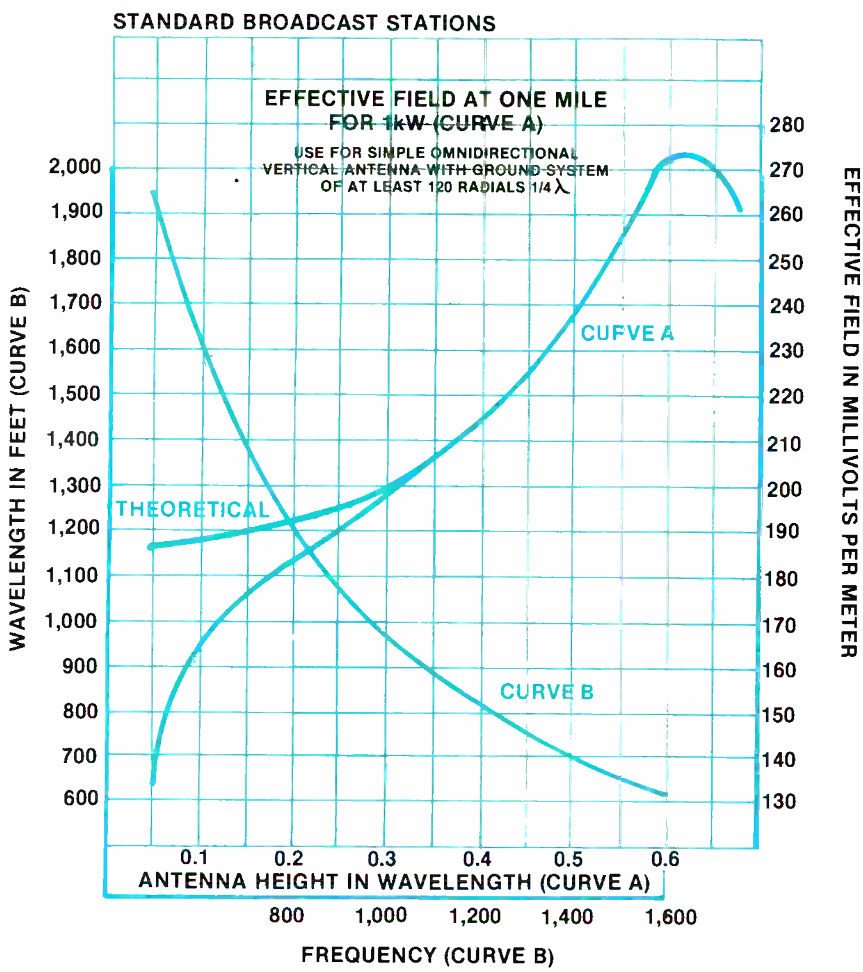
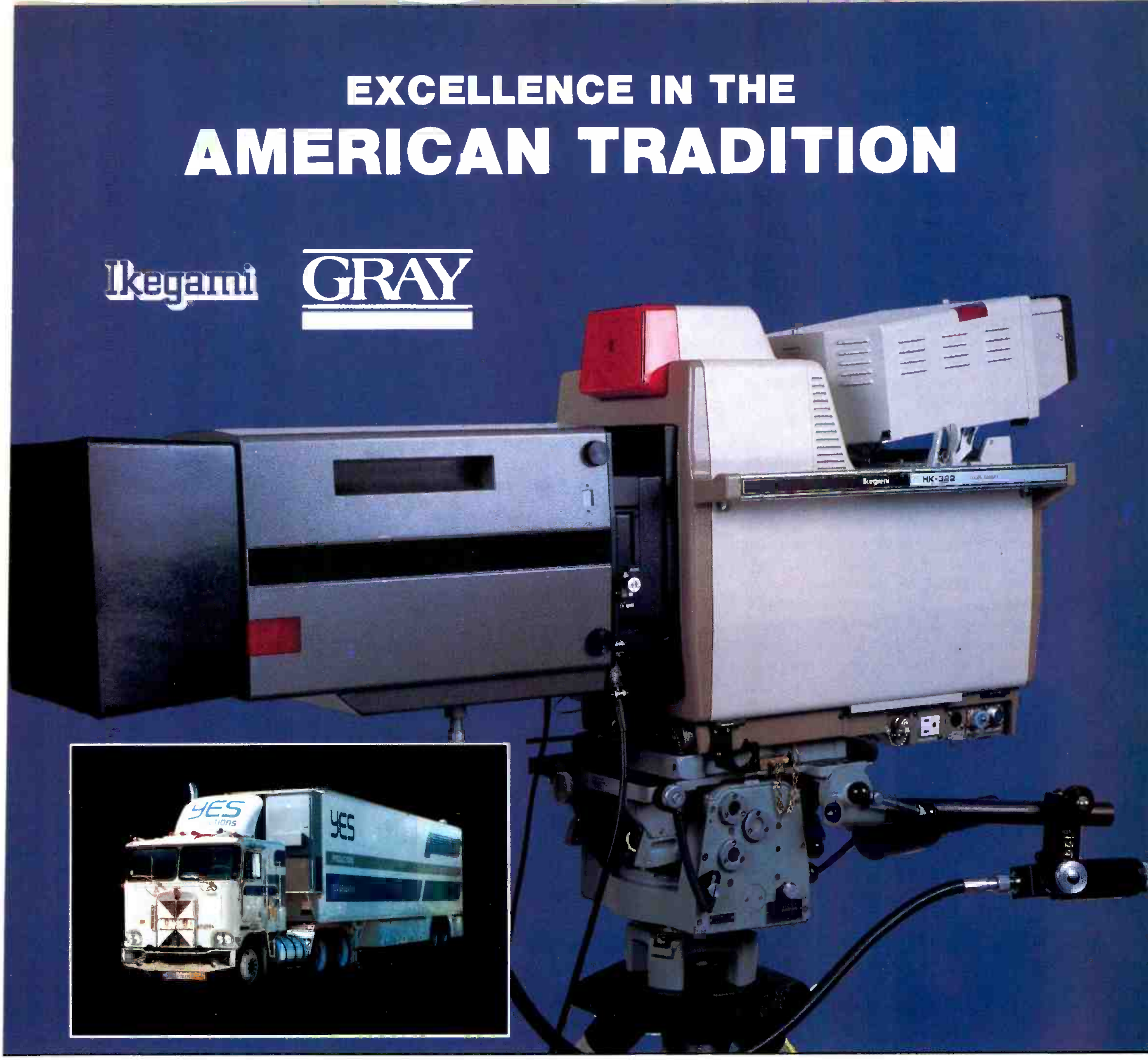


Figure 1. *Effective field intensity at one mile (FCC Figure 8).*

Owens is an engineering consultant and owner of Radio Engineering Services, Lexington, KY.



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self-supporting tower would create a worst-case situation.

A less obvious factor would be the height of the top beacon or lightning rod. Using the previous example, a 48-inch lightning rod would add 1% to the electrical height. Another common factor is the influence of FM or TV transmission lines mounted on the AM tower. These lines are often mounted on standoff insulators for the first ¼-wavelength of the tower. Isocouplers and communications antennas also can affect the electrical length of the tower.

You know that many factors can affect the operating height of an AM tower, but how do these elements come into play in real-life situations?

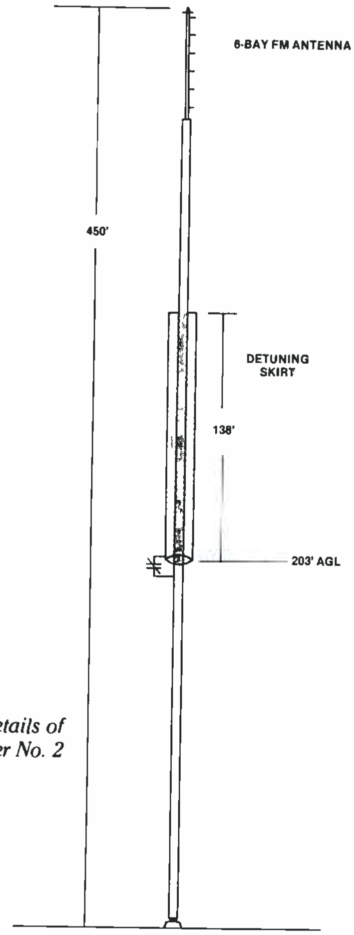
Tall tower No. 1

An FM station was operating from its AM tower site by using one of the directional antenna towers. The 6-bay antenna was side-mounted on a 300-foot (69°) tower that was part of a parallelogram array. The center of radiation was only 279 feet. Even worse, the 36-inch face of the AM tower caused severe distortion in FM coverage. Errors of ±6dB in the horizontal and ±8.5dB in the vertical patterns were leaving large coverage holes in the market the station was attempting to serve.

In order to improve the coverage without relocating the FM tower, it was decided to increase the height of one of the AM-DA towers from 69° to 152°. This was the maximum height practical guying would permit. The final design mounted the FM antenna on a 60-foot pole located on top of a new guyed tower. The unguyed pole allowed us to optimize the FM antenna, providing ±2.25dB horizontal and ±1.46dB vertical circularity.

First results

After the new tower was completed, the FM antenna, transmission line and isocoupler were installed. As adjustments began on the new antenna system, a problem was noted. The new 150° tower self-impedance was 710+j238Ω, much higher than expected. It seemed that the tower wanted to operate at more than 152°. After a close inspection of the self-impedance curve, it was discovered that



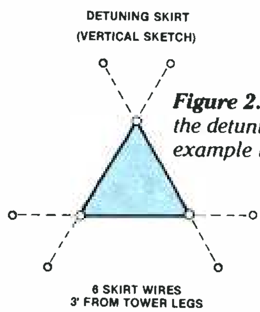
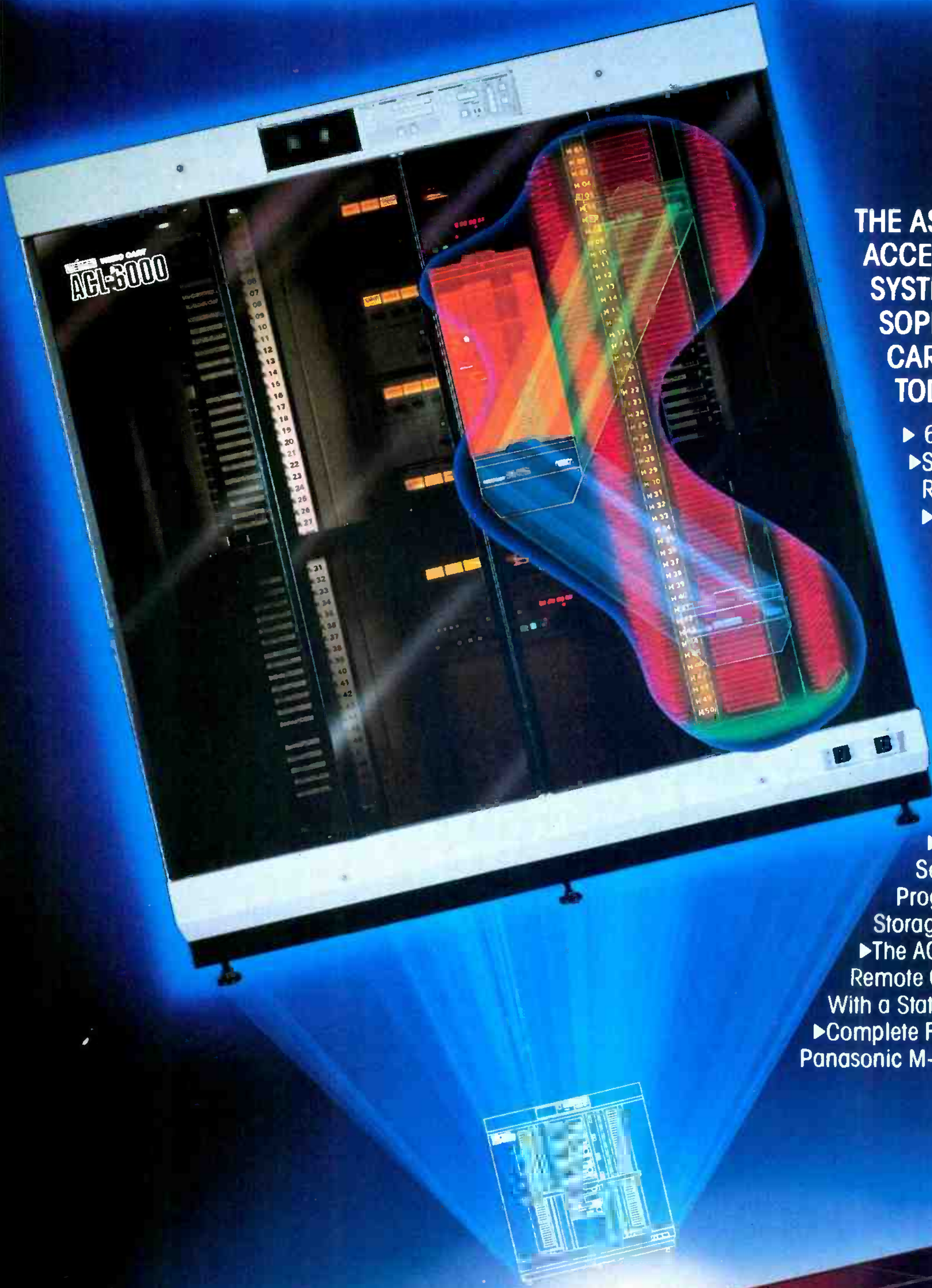


Figure 2. A vertical sketch showing details of the detuning skirt described in the tower No. 2 example in the text.

EVERY SECOND COUNTS!!



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the tower indicated operation near 180°.

A number of 1kW NDA measurements revealed that the tower's radiation was approximately 215mV/m at one mile. The antenna coupling units (ATU) were adjusted to the theoretical antenna base operating impedances and desired phase shifts and installed. To speed up the DA tuning process, the plate-modulated transmitter was used instead of the pulse-modulated unit. The older plate-modulated transmitter was less sensitive to common point impedance changes.

The tall tower continued to be a problem with the daytime pattern tune-up. The tower base operating impedance was more than 1,000+j200Ω, instead of the anticipated 250−j200Ω. A base operating impedance of 1,700+j400Ω was selected. After field-modification of the tower's ACU, the entire array responded properly to final adjustments.

The final array adjustments showed the ACU input impedance well within 10% of the desired 65Ω, with a maximum of ±j8Ω reactance for both daytime and nighttime patterns. Just as important, VSWR remained within 1.15:1 over ±10kHz, relieving our concern about system bandwidth with the higher-than-desired impedance transformation ratio of the ACU at the 152° tower.

Tower No. 2

A second installation provided a different set of problems. The AM station operated on 1,570kHz with 5kW daytime using two wide-spaced 115° towers. One of these towers had a side-mounted FM antenna with a *bazooka* FM transmission line arrangement. The other tower was 86° tall, top-loaded to 115°.

Because of the need to increase the height of the FM antenna, the decision was to replace the 115° tower with a 255° tower. The installation, therefore, required that the structure (tower height) above 115° be detuned from the lower section of the tower. This process would permit the use of the extra height of the tall tower for maximum FM coverage and still maintain the 115° height needed by the AM array.

The detuning skirt shown in Figure 2 was designed to be just under ¼-wavelength long. The advantage of this approach was that a variable capacitor could be used to make final tuning adjustments. The detuning skirt consisted of six cables running parallel to the tower legs.

In order to prevent any possible resonance from the base of the detuning skirt to the top of the tower, a simple 1-conductor detuning arrangement was also installed from the top of the tower to the main detuning skirt.

The self-impedance measurements turned out to be close to the predicted values for the 115° antenna and the non-directional field-intensity readings were correct. The current distribution for the 115° tower is shown in Figure 3.

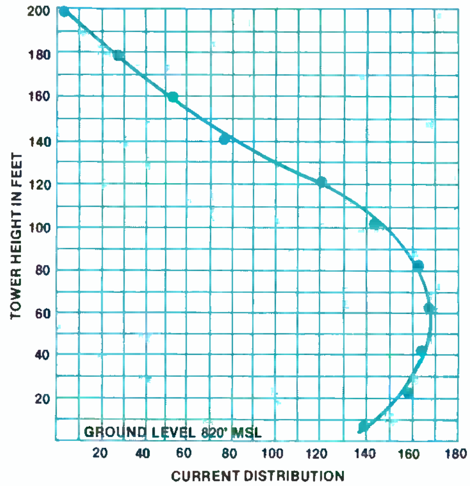

Figure 3. *Current distribution curve for the 115° section of the tower.*

The system has been in operation for several years now without problems. One of the major benefits of the installation is its stable operation. As these two examples show, tall towers can be incorporated into a directional antenna array. The process requires careful planning and usually a lot of field-intensity measurements. However, given the advantages of locating the FM antenna at an existing AM site, it's worth it.

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Circle (59) on Reply Card

Directions in video editing

By Steve Smith

The technology and applications for random access editing exist. Now, the education starts.

The editor of a half-hour videotaped sitcom is in a quandary. Which version of a scene will produce the biggest laugh? After viewing three edits of the scene, there's no question as to which one delivers the right timing.

In the post-production suite, a client is undecided how his $125,000, 30-second spot should *feel*. If he could just *see* three or four different versions back to back, he could make a decision.

The director of a major motion picture doesn't have time to wait for rushes before doing a rough edit of a critical scene. An off-line, real-time edit of the videotaped footage can resolve critical scene construction issues—now.

Why random access?

These scenarios exemplify the power and freedom of true *what if?* editing. Such capabilities have become real with emerging random access editing system technologies. As the name implies, random access editing gives TV post-production producers and film editors the capability to select segments of video and to orchestrate them into a play list. The editor can view the sequence in real time as tentatively constructed.

Changes in order, length and segment selection can be made at will without committing a single edit to tape or film. The time-consuming task of re-editing a sequence to make the slightest change is avoided. Once all permutations of a sequence have been explored, a computerized edit decision list (EDL) is created. Then, using the studio's on-line editing system, a conforming edit is performed from the master video reels or negative film, exactly as specified by the random access system EDL.

The speed of random access, combined with a freedom to explore creative possibilities, could revolutionize film and videotape editing and should improve the creative caliber of the final product.

An idea revisited

As avant-garde as it may seem in 1986, the concept of random access editing predates the 1972 introduction of the CMX model 600 disk editing system. Analog technology gave the system a 20-minute capacity of monochrome video. A light pen on a monitor identified segments for storage on 16 large magnetic disk drives. The CBS-Memorex joint venture was commercially unsuccessful for a variety of reasons. Interest in random access editing waned in favor of the linear systems prevalent today.

Smith is senior product manager of editing systems for Ampex Corporation, Redwood City, CA.

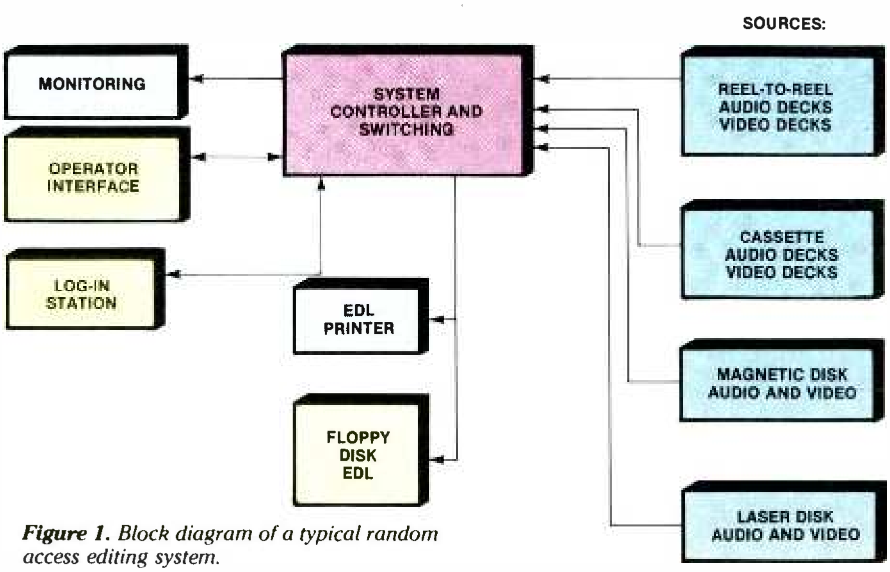

***Figure 1.** Block diagram of a typical random access editing system.*

With the advances in recording technology, however, interest in random access systems has been renewed. Three approaches showing promise are:

- laser/optical disk-based systems,
- multiple tape deck/controller systems, and
- laser or computer disk-based audio systems.

There are three primary applications for random access editing:

- *Tape to tape:* programs shot on tape and released on tape, such as sitcoms and ENG. Random access would be used for off-line editing. The tape is first transferred to a disk or tape system, edit decisions are made and an edit list is created. Finally, the program is edited in the suite with the on-line system.
- *Film to tape:* This use is best illustrated by commercials. Typically, commercials are shot on film for optical quality and released on tape. The random access editor for this application would emulate a film flat-bed. Manipulation is done in the video mode, allowing the editor to perform dissolves and to see the tentative edits being performed. When an edit list is finalized, on-line editing of the piece is set to tape.
- *Film-tape-film:* Motion pictures are shot on film and released on film. The editing process may be enhanced with a random access disk or tape-based system. Real-time preview of scenes enables filmmakers to make specific choices on how the different takes fit together.

In addition, a number of filmmakers use *video assist*. A video camera is tied beside the film camera to provide instant recorded images of the scene as it was captured on film. The video scenes can be edited on location with a random access system, providing an instant feel for how the scene will appear. By the time the film is processed and the rushes reviewed, many scene and take decisions can already be made.

Stumbling blocks

The creative potential of random access editing systems would seem to make them the method of choice over today's off-line linear systems. Yet, the industry

Continued on page 83

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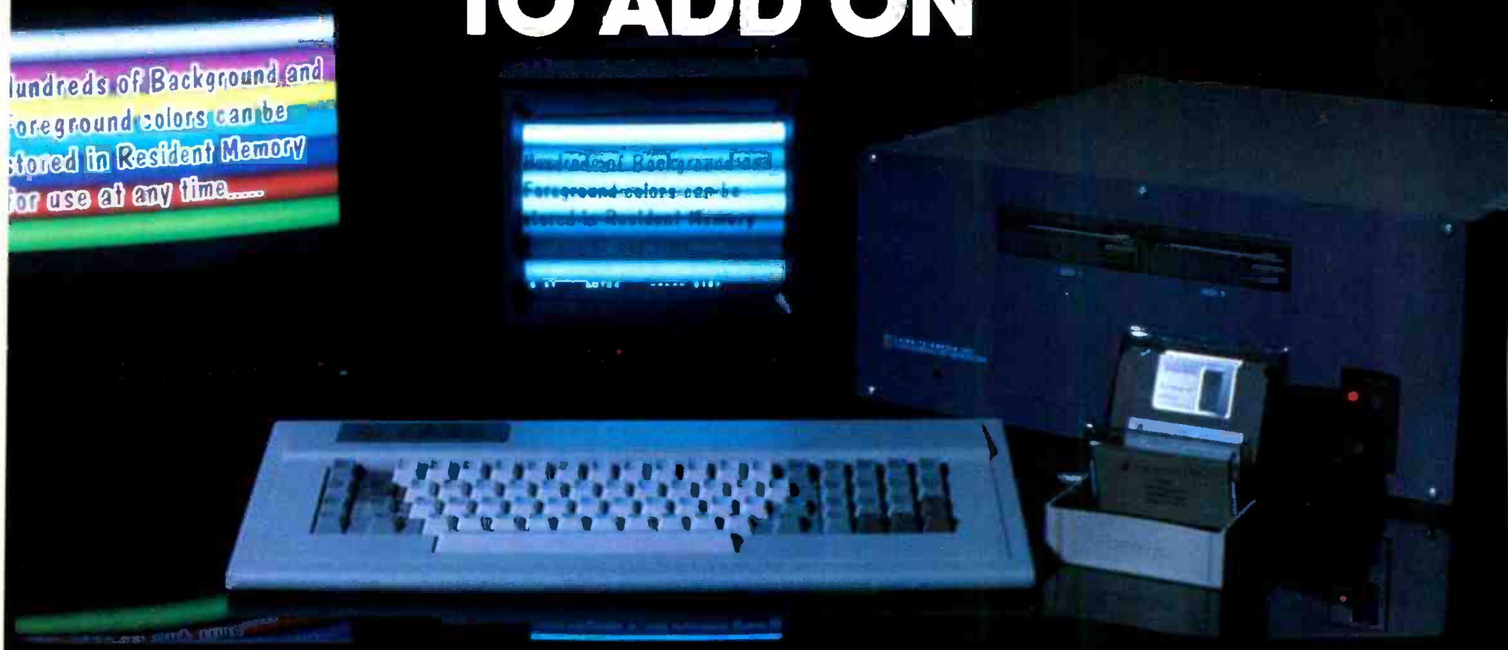

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Continued from page 80
has not taken serious notice. The reasons fall into three familiar areas: price, functionality and integration.

Of the few existing commercial systems, all are expensive and are designed for specific applications. To bring these systems to a broader market would require that they successfully compete as replacements for flat-beds and off-line studio systems. Significant price reductions also would be required for any notable market penetration.

Still in their infancy, these systems have deficiencies that limit their appeal. The lack of ISO or multicamera editing capabilities make these systems inappropriate for TV program editing, in which multiple cameras record the scene and the tapes are synchronized during the editing process. In multiple tape deck systems, machine control is limited to consumer format VCRs that are not compatible with studio recorders. This makes on-line editing impossible.

The capacity of laser disk recorders limits their application primarily to commercials unless multiple recorders are linked. A multihead laser disk unit with *A/B roll* preview capability from a single disk can lessen this drawback. As with consumer tape formats, laser disk video quality is unsuitable for on-line editing. Like tape-based systems, the laser disk approach currently cannot control graphics or effects that must be added during on-line editing.

In short, various pieces of the random access editing puzzle exist, but they have not formed a completely integrated system. Ideally, such a system would consist of a laser disk recorder, tape-based system and random access audio system. It must be capable of providing on-line and off-line editing and integrate easily into an existing facility.

When further developed, both laser disk and tape technologies will have a place in the market and will coexist with linear editors. Laser disk recorders now store a 30-minute segment of information on a single disk and are ideal for commercial production. Tape-based systems, especially when made compatible with existing studio machines, have much greater versatility.

To market

A major barrier to market acceptance of random access editing is that the industry is unaware of its tangible economic and creative benefits. To compound matters, the competitive industry environment plays a major role in the adoption of new technology. Customer demand and the pressures of competition have a direct impact on the equipment purchased. Existing editing tools in film and video are effectively meeting today's daily requirements. The opportunity for market growth will come as facilities replace aging off-line editors and flat-bed film systems.

Over the next five years, random access systems will improve and the number of manufacturers will increase. We can expect significant random access inroads into the market. Ultimately, however, the development of the random access editor market will be dictated by the industry. As with any revolution, it's a matter of time.

Hardware for random access

Laser disk technology is currently the medium of choice for long-play random access. Thirty minutes of video can be recorded on a single laser disk. Equipment is somewhat limited because ODC Corporation, Cerritos, CA, is currently the only company to manufacture a LaserVision-compatible, real-time laser disk recorder. However, several companies do provide tape-to-disk transfers.

Spectra Image, of Hollywood, CA, has the largest disk-based off-line random access editing facility using the ODC unit. This one-of-a-kind facility was designed and built by Spectra Image for sitcom and episodic use.

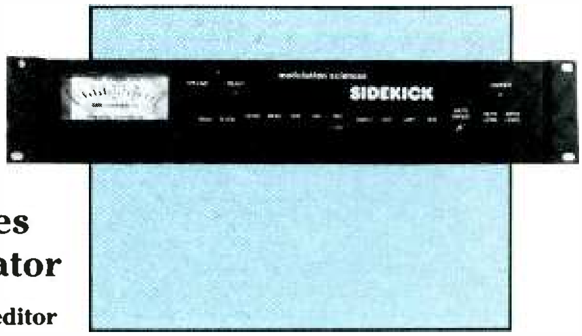
EditDroid, from the Droid Works, uses optical disks as a source medium. Designed for the feature film editor, this system concentrates more on the front end of the post-production process by using an electronic log-in station. The editor chooses up front which variation of the scene and take to edit. With editing choices completed, an industry standard EDL is produced.

The videotape concept, introduced by Montage Computer, was a multimachine controller for up to 17 consumer Beta format VCRs and borrowed greatly from film-style editing to emulate a flat-bed film editor. The system gave access to any portion of four and one-half hours of film or tape information with little or no delay. Primarily used for commercials and feature films, the system received high marks from film notables such as Sidney Lumet and Alan Alda. Montage, unfortunately, recently ceased operations.

A new tape-based entry in random access editing has been reported at work in Hollywood for episodic material. A light pen and touch-screen system controls consumer VHS VCRs as a source medium. The system has a 1-hour capacity and is easy to use, because its script-based process is familiar to film editors.

There is also a need to integrate random access audio systems with video. There are several such audio systems now available, storing audio data on Winchester-type computer disk drives or laser disks. These systems allow access to, and editing of, individual tracks of digitized audio. With them, audio may be placed in any relationship with video. In conjunction with a random access video system, the editor builds an edit using virtually any audio or video material on the system.

Field report



Modulation Sciences Sidekick SCA generator

By Brad Dick, radio technical editor

A current topic of interest among FM broadcasters is the implementation and use of subcarriers for various purposes. New FCC rules allow a station to use additional subcarrier services while increasing modulation to as much as 110%. With this rule change, broadcasters can now operate in stereo with two separate subcarrier services and not sacrifice significant loudness in the main channel. Even with these technical changes, however, there still remains one major stumbling block in adding new services to an FM channel: the quality of subcarrier equipment.

To accommodate the potentially numerous subcarrier services, Modulation Sciences has introduced the Sidekick, an integrated generator and audio processor. The Sidekick contains all of the necessary hardware to allow stations to begin transmitting aural subcarrier services on any desired frequency. The unit is an integrated assembly, including a crystal-controlled generator, modulation monitor, audio processor and transmitter tuning aid. With this equipment, installing a subcarrier service is straightforward and easy.

General description

The unit is contained in a small rack-sized cabinet 3½ inches high. The front panel contains a meter for reading AM synchronous noise, broadband audio gain reduction, high-frequency gain reduction and peak subcarrier deviation (modulation). Front-panel user controls include input level adjust, injection and mute level controls, high-frequency limiting, limiting/compression balance, noise output level and sensitivity adjustments. No back-panel controls or adjustments are necessary, which simplifies installation and operation.

One thing that has stood in the way of quality subcarrier transmission has been the lack of quality audio processing. In order to provide the necessary peak control for program audio and to maintain high-average modulation, the audio processing must be designed specifically for subcarrier signals and conditions. The audio frequency response must be limited to avoid crosstalk into the main-channel audio. The audio level in the subcarrier channel must also be kept as high as practical to mask crosstalk from the main channel into the subcarrier.

Most stations, when faced with adding a subcarrier, simply use an old main-channel FM limiter tied to the generator input. These limiters are usually several years old and designed for 75µs operation.

Performance at a glance

- *±1dB 70Hz to 4kHz*
- *Noise level 65dB below 5kHz deviation with 150µs pre- and de-emphasis*
- *Accepts input signals from −30dBm to +10dBm*
- *Flexible user controls for audio processing*
- *Optional 0µs, 75µs or 150µs pre-emphasis*
- *Operating frequency changeable through internal strapping*
- *Built-in transmitter tuning aid*

The unit solves these problems with a well-thought-out approach. The block diagram in Figure 1 illustrates the major elements of the generator. The input circuits contain both low- and high-pass filters to prevent out-of-band energy from upsetting the compressor and limiter circuits. After filtering, the signal is fed to a compressor for general level control. Audio then passes to the high-frequency limiter circuits. As in the compressor, front-panel adjustments allow the operator to tailor the sound of the signal as needed. Finally, the audio signal is safety-controlled by a broadband limiter that sets an instantaneous deviation limit by removing peaks exceeding a preset threshold.

The generator carrier frequency is crystal-controlled and adjustable by changing straps on an internal circuit card. The unit is capable of operating on any authorized subcarrier frequency. Even if a change in frequency is needed later, new crystals are not required.

The Sidekick provides inputs for telemetry as well as companding or encryption boards. The mother board is

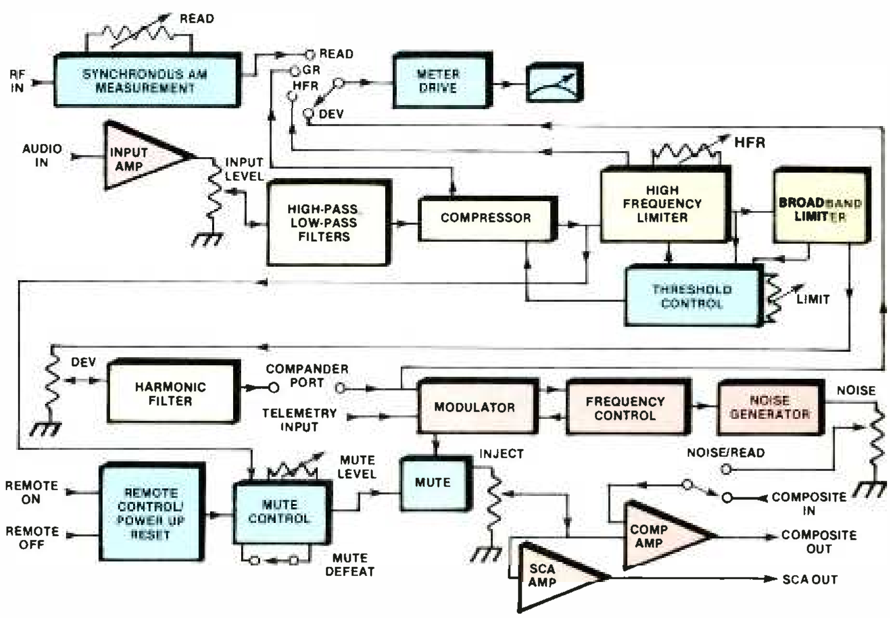


Figure 1. *Block diagram of the Sidekick subcarrier generator.*

Dick was director of engineering at KANU/KFKU, Lawrence, KS, when he prepared this report.

The modular system for a transitional world . . .

BC1115 Mono Mic-Line Input Module.

MTS, SAP, AFV, S-buss are now standard terms in today's audio world. Broadcasting techniques and systems are changing daily. Not since the introduction of color have the production, post-production and broadcast facilities faced such rapid changes in technology, and in day-to-day operational methods. Each facility and operator has a different requirement for systems and hardware.

Audio consoles for broadcast from other manufacturers have just been adaptations of their On-air or record consoles, or maybe they offered some custom modules to try to match a specific need. Obviously, this is not the best way — especially in a dynamically changing environment.

AMEK has applied their years of experience as console system builders to the problem.

The result is the BCII, AMEK's response to the needs of the contemporary broadcaster. The BCII is modular, both inside and out, with 3 different frame sizes offering up to 32 modules in any combination (16 positions in a 19" rack), offering almost limitless configurations. Stereo and mono inputs, electronically balanced in and out, and standard features such as AFV, 6 busses and the famous AMEK EQ sound set the AMEK BCII apart.

Keeping with AMEK's open-ended systems approach, the BCII is factory or field fittable with VCAs (mono or stereo), and all of the logic and control functions appear on "D" connectors with full CMX® and S-buss support available. The BCII gives you AMEK quality in a user customizable system at an affordable price. The BCII is truly the modular system for our transitional world.

AMEK
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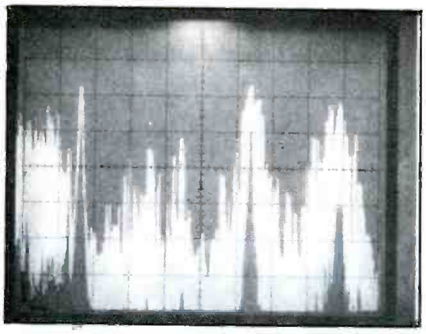


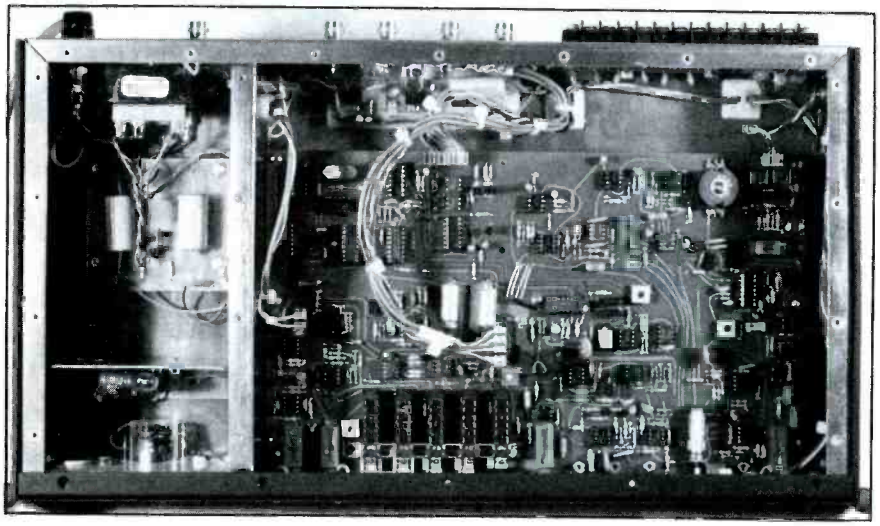
Actual demodulated composite baseband showing two subcarriers at 67kHz and 92kHz.

wired for the companding feature and merely requires the addition of the card and changing a few circuit board straps. The *message card*, as the company calls it, allows a user to easily adapt to any type of service that may come along.

From a maintenance standpoint, it would have been helpful if the printed circuit boards had the component numbers silk-screened onto the board. The circuit is fairly complex and a screened board with component numbers would assist troubleshooting.

One point of caution: The manual indicates the unit should be returned to the factory for service; for many stations this might be difficult. In our tests, we did have one need to call the factory for assistance. Our request for help was treated promptly and the unit was returned to service that day. The unit is complex and modern test equipment will be needed if the station plans on performing its own maintenance.

Interior view of the Sidekick generator.



Tuning for performance

A unique method is used to adjust the transmitter for best subcarrier performance. Those engineers familiar with subcarrier transmission may remember the disappointment felt when first tuning on a new generator only to hear severe crosstalk from the main channel. The problem usually was because of improper transmitter tuning. Some transmitter manuals tell you to peak each stage of the transmitter. Although this may result in maximum efficiency, it also can spell disaster for subcarrier signals by narrowing the transmitter bandwidth.

One measure of how well a transmitter

Continued on page 90

"NOT MANY CAMERA COMPANIES MAKE CIRCUITS THIS TOUGH."

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Before Pat Thatcher chose the Sharp XC-A1 to carry on a 21-day hike through the Himalayas, he tried out cameras from five of our competitors.

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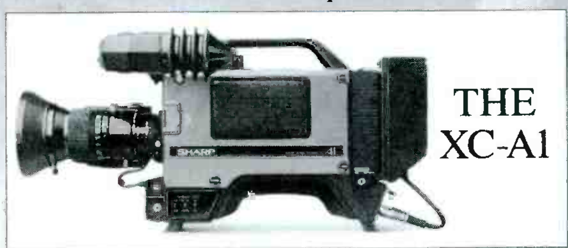

THE XC-A1

Pat was amazed by the quality of the Sharp video. And impressed by its performance in low light.

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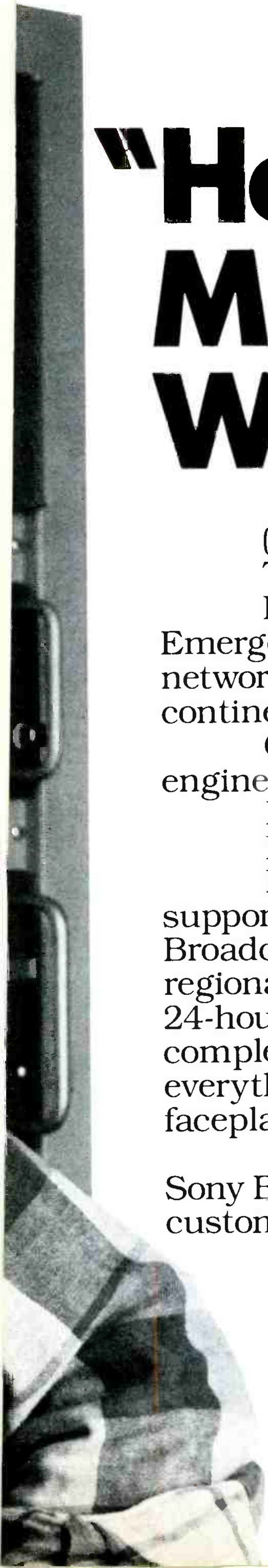

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They know that the Sony Standard works.

Nights, weekends and holidays, too.

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Continued from page 86

will pass subcarrier signals is the synchronous AM noise reading. This measurement should not be confused with the typical *AM noise measurement* made with the modulation monitor. The AM noise measurement required by the FCC uses a 75µs de-emphasis circuit and effectively filters out the high-frequency components of synchronous AM noise.

To tune the transmitter, simply depress the *noise* button on the front panel and adjust the wideband-noise generator output level for 100% modulation. This noise signal is generated internally and substituted for the normal stereo generator signal when in this test mode. Then, press the *read* button and adjust the transmitter for a minimum noise reading. The intent of this procedure is to broaden transmitter bandwidth. By slightly offsetting the resonant frequencies of successive stages (stagger tuning), transmitter bandwidth is broadened. The manual warns that some transmitters may not operate at rated efficiency when tuned in this manner. In such cases it will be necessary to properly determine the new efficiency factor after completing the tuning procedure.

A point of caution is in order. As we found out by accident, be sure your operators don't press the noise button during normal operations. Wideband noise at 100% modulation is not something an audience appreciates.

On-air tests

The unit arrived at KANU tuned to 92kHz. After obtaining a temporary test authorization from the FCC, we demonstrated the unit's capabilities at the spring meeting of the Kansas Association of Broadcasters. Using our standard setup for 67kHz plus the Sidekick, we were able to demonstrate dual subcarrier operation at the meeting.

The audio processing used in the KANU 67kHz radio reading service is quite sophisticated. Audio is passed through a 3-band AGC processor, a fast 150µs limiter and finally a safety clipper circuit and low-pass filter. The average modulation is high, but provides excellent quality. The audio quality comparison between the Sidekick and our 67kHz system was different, but not greatly so.

The average increase in loudness was approximately 3dB to 4dB. According to the manufacturer, most operators can expect to see 10dB or more increase in loudness. To get an idea of how much improvement most stations would notice, we substituted an older main-channel limiter for the 67kHz processor and compared it to the unit operating at 92kHz. Not only was the loudness difference quite apparent, but the difference in the sound *quality* was tremendous. A station using any old type of audio processing should expect to notice a real improvement in its subcarrier operations by simply replacing the generator and processor with the Sidekick.

During the test, two different programs were transmitted to the audience of station managers and engineers. Many remarked on how clean the 92kHz signal sounded. Turning the 67kHz carrier on and off produced no difference in the sound of the 92kHz signal and a similar check on the 92kHz signal did not affect the sound of the 67kHz program.

Measured performance

Several tests were conducted on the test bench in an attempt to measure the performance. The frequency response of three different subcarrier generators is shown in Figure 2. The upper trace is the frequency response of an older generator. The middle is the measured response of a current subcarrier generator. The lower is the Sidekick's frequency response. Notice how the unit's frequency response runs right out to 10kHz and the other generators fall off at various lower frequencies.

As shown in the top photo on page 86, a composite-baseband signal shows all components for monaural, stereo, 67kHz and 92kHz signals. The 92kHz signal skirts drop off nicely and do not interfere with the 67kHz signals. No noticeable crosstalk was detected in the 67kHz

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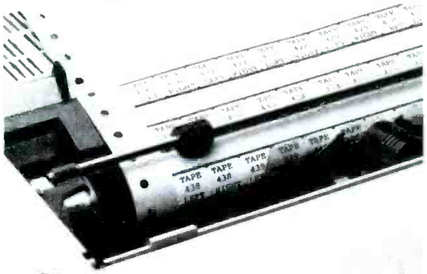

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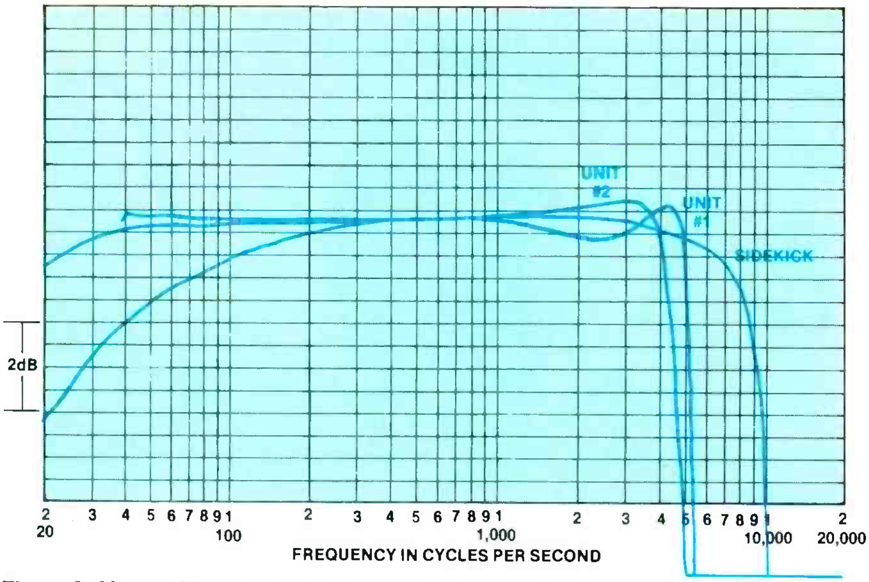

Figure 2. Measured frequency response of three representative subcarrier generators.

audio passband when the 92kHz signal was operating.

Modulation levels

Some stations express concern about the loss of main-channel audio with the addition of subcarriers. Under the FCC rules, a station can add two subcarriers, each operating at 10% injection, and modulate up to 110%. With this arrangement, the experts predict about a 1dB loss in main-channel loudness. With only one SCA and the appropriate increase in total modulation, the loss is only about 0.5dB. It's doubtful this small difference would be critical, even in a competitive situation. If the station management expresses concern about this loss, tests can be performed with a simple audio pad switched in and out of the main audio channels to stimulate the loss in main-channel loudness.

Other concerns about subcarrier signals affecting main-channel audio are really moot points. With the advent of PLL receivers and better designs, receiver whistle problems have almost been eliminated. Stations that have been using subcarriers for many years can document the reduction in the number of complaints as listeners replace obsolete equipment with modern components.

Some operators may want to consider using their subcarrier channels for digital purposes. This particular version of the Sidekick is not designed for data use. The audio-processing section is not needed, and other parameters become important when data are transmitted. Stations interested in data transmission may want to look at generators specifically assigned for data transmission.

The Sidekick is an effective device. The integrated generator and audio processor provide the means for a quality subcarrier service.

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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Gentner SPH-4 telephone interface

By Michael A. Golchert

The use of telephones in radio broadcasts is not new. For years, radio stations have used telephones for everything from news reports and talk shows to sports broadcasts. One would think that because the telephone is so important to many stations, everyone would know how to obtain the best audio from the telephone. That is not the case.

Last year, our station added a talk show to the format. Because the engineering department was concerned about carrying a call-in show with adequate voice quality, we suggested the station purchase a telephone interface unit. At first, there was objection to purchasing new equipment. After all, *can't you just hook the telephone to the console?* When the news department also expressed an interest in improving the quality of its recordings, station management decided to seriously consider solutions to the telephone interface problem.

Options

Fortunately, we had sufficient time to conduct a thorough investigation of the available products that would meet our needs. Basically, we needed an interface that would allow us to route a single caller to the air for discussions with the air talent. We did not need conferencing options or other complex functions, but we did need an interface with a shout-down function so the host could control the program. Because we act as the heart of the Hilltopper Sports Network serving Western Kentucky University, we wanted an interface that would also allow us to clean up the sound of the network's sports broadcasts.

We soon discovered that most of the interface equipment fell into three price ranges: $140-350, $450-750 and more than $1,000. Based on our needs, we decided to purchase the Gentner SPH-4 telephone interface. We felt that it offered all the features we wanted, without extra cost options that we didn't need.

Golchert is assistant chief engineer for WDNS-FM and WKCT-AM, Bowling Green, KY.

Installation

The connections to the telephone interface, as shown in Figure 1, are all straightforward, with one exception. For those stations without multichannel consoles, the creation of a *mix-minus* feed may pose a problem. The mix-minus feed is the audio that is fed back to the caller. This feed contains all of the broadcast audio *except* the caller's voice.

Although there are a number of ways to create the mix-minus audio, most of them require an additional audio channel in the console or an outboard amplifier. To keep the installation as easy and inexpensive as possible, we decided to use an old Collins tube-type remote amplifier. I'll admit it looks strange to see the old mixer placed next to modern broadcast equipment. For our purposes, however, it works nicely. The amplifier provides the line-level mix-minus audio needed to drive the interface for coupling back to the caller. This configuration allows us to premix all of the audio except the spots before transmission to the main console on a remote input.

> ***Performance at a glance***
> - *Frequency response: send input to mix output ±0.2dB 20Hz-20kHz; telephone input to system output ±2dB 300Hz-3,200Hz*
> - *System hum and noise: −60dB or lower*
> - *Distortion: 1% THD maximum*
> - *Caller-control range: 0dB to −50dB maximum override, internally expandable*
> - *Squelch sensitivity: adjustable to 30dB below normal send level*
> - *Squelch release time: 100ms-400ms, adjustable*
> - *Speaker dimming: 0dB-22dB, internally adjustable*

Connecting the phone

The most time-consuming part of the installation process centered on connecting the interface to the telephone system. The process involved disassembling the telephone to find the *call director output.* This is the output from the telephone push-button assembly. We also had to locate the *A-lead* contact on the call director output. The manual suggests that you simply look around inside the telephone for these connections. However, do you have any idea of how many combinations of connections are possible on a standard 5-line key telephone? After many wrong guesses, the correct connection points were located inside our phone. (For more infor-

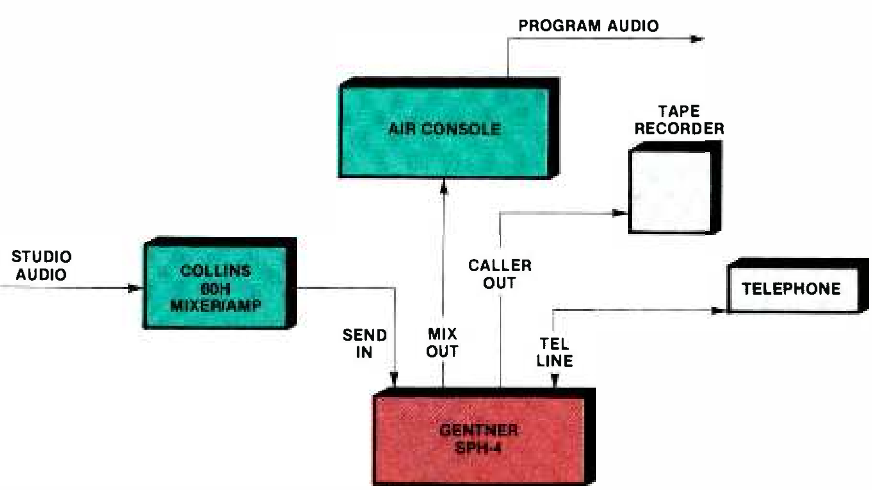
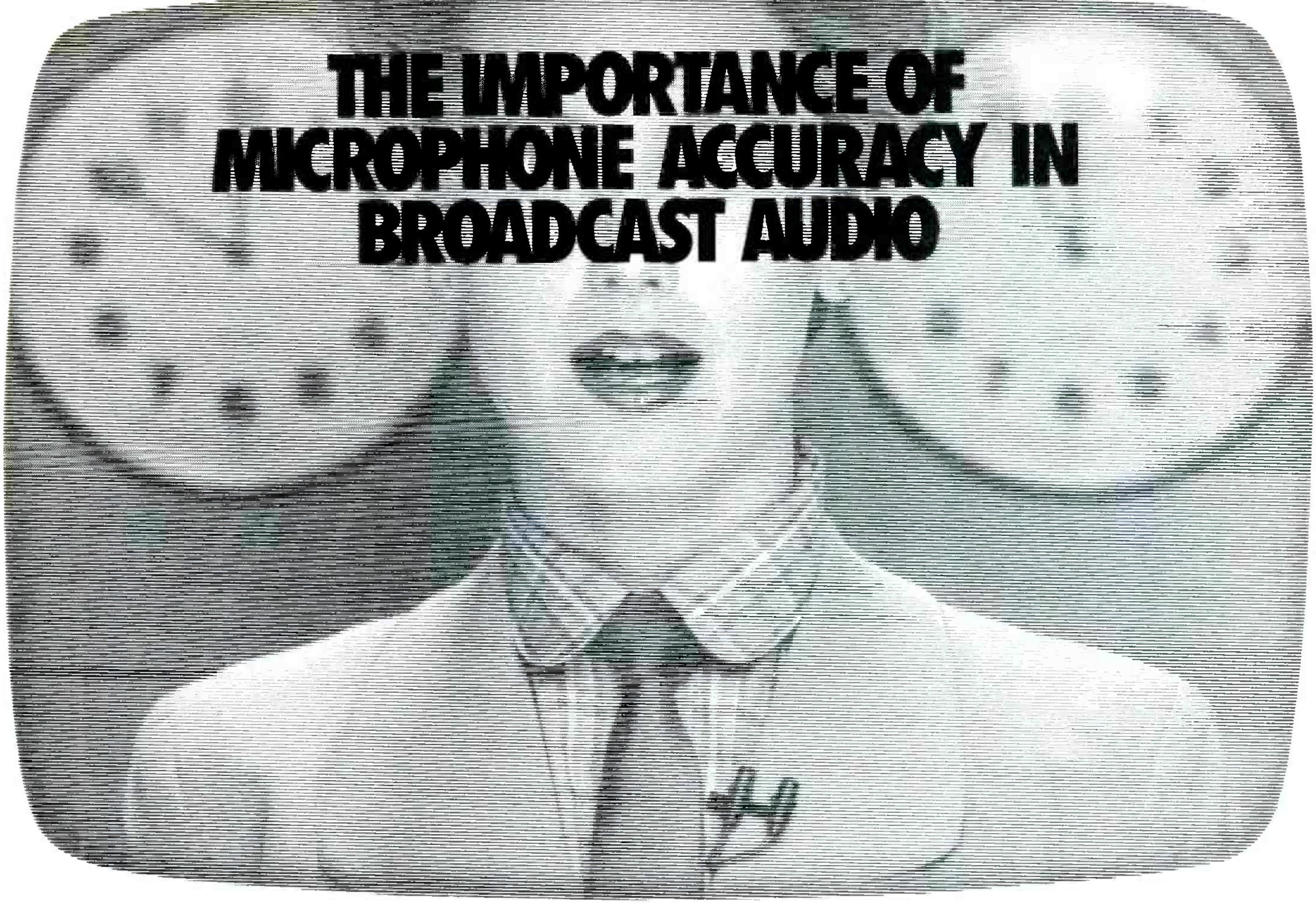


Figure 1. *Interconnecting the SPH-4 is easy and straightforward.*



A distinctive voice remains as important to a successful broadcast announcer as a recognizable visual presence. *Microphones are the critical first step in the broadcast audio chain. Acting as a highly accurate sound "lens," they must be sensitive enough to faithfully transmit all of the subtle personal nuances and inflections that distinguish one announcer's voice from another.*

Today's sophisticated broadcast productions demand more from microphones. Differences in relative mic performance are more readily apparent, and an inferior microphone stands out like the proverbial sore thumb.

In the most basic sense, any microphone need only capture the sound source exactly and convert it to electrical energy — no more, no less. *Obviously, microphones necessarily have different characteristics based on differing transduction technologies and designs. But at Beyer, we believe that the superiority of a microphone is in large part based on how accurately it transduces the source material — with no excuses based on size or applications.*

In broadcast, Beyer's concept of "accuracy" means the difference between a microphone that can focus in on a specific voice and produce a totally realistic, professionally acceptable performance, and a mic that simulates a performance by only capturing the bare outline or "silhouette" of an announcer's voice. We've dedicated the most complex and sophisticated technology in existence to reinforce the truth of this basic premise.

Sensitive and natural-sounding, the MCE5 picks up the "whole truth" of audio broadcast sound because of an unusually wide frequency range (20Hz to 20kHz) and exceptionally fast transient response for any mic, let alone one that is virtually invisible on camera. Because the MCE5 has a uniform omnidirectional pickup pattern, mic placement is not critical and the announcer's head can move without going "off mic." Handling noise is kept to an absolute minimum so the MCE5 picks up the voice, not the rustling sounds of the announcer's expensive silk tie.

The MCE5 is available in various terminations for the widest range of broadcast applications including wireless. Underscoring our longterm commitment to the broadcast industry, the MCE5 is one of a family of reliable Beyer broadcast products designed for ENG, EFP and Film/Radio/Video studio production. It has been widely adopted by discerning broadcast engineers in the U.S. and Europe.

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ACCURACY IN AUDIO

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mation on telephones, see the related article, "How the Phone Works," page 99.)

We use only two of the SPH-4 outputs. The balanced 600Ω output feeds the main console. The unbalanced output, which contains only the caller's audio, feeds a tape recorder in the newsroom. This feature allows the news department to record actualities with ease and provides a real improvement in audio quality. A balanced caller audio output and a high-level speaker feed also are available.

Adjustment

The initial setup and adjustment posed a few problems for us. It took some time to properly adjust the null control. We were finally able to obtain a trans-hybrid of approximately 22dB. The interface contains a test generator for use in the nulling process. However, using the generator only caused some problems later on.

Setting the send level was difficult. After a lot of experimentation, we discovered that the proper level for the send input was −17dBm. The squelch control also was difficult to adjust. The control is a multiturn pot and sets the level where the speaker squelch circuit takes effect. The exact level needed is more a matter of trial and error, rather than any exact scientific setting. Because several departments wanted to use the interface, a compromise had to be struck in all of the settings. Finally, after a lot of test calls and different adjustments, we decided on the proper settings for these controls in our environment. Once everything was set up, the system performed beautifully.

Advantages

The improvements in the sound quality provided by the telephone interface are immediately obvious to even the untrained listener. The typical telephone line background noise is eliminated, providing a clean audio signal. The device couples the full spectrum studio audio and the filtered caller audio onto the output bus. Although the difference between studio and caller audio is noticeable, there is no longer the drastic quality difference typical of many stations.

The caller's audio level is adjustable on the front panel. This feature ensures that every caller is mixed with studio audio at the proper level. The interface also incorporates a *shout-down* feature. When activated, the caller's audio is ducked under the studio audio. This makes it easy for a host to control any conversation, no matter how long-winded or boisterous the caller may be.

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For CATV and SMATV applications, severe microwave terrestrial interference is minimized by optional internal SAW notch filters, automatically programmed to switch in. A 30 MHz low DG/DP LC bandwidth filter is standard, and a second internally installed optional filter of 18, 22, 26, or 36 MHz bandwidth can be controlled by the microprocessor, or manually switched.

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Format control enables selections of desired satellite system. Direct-reading channel selector displays transponder-assigned channel. Second selectable, subcarrier and space for optional third subcarrier or descrambler modules.

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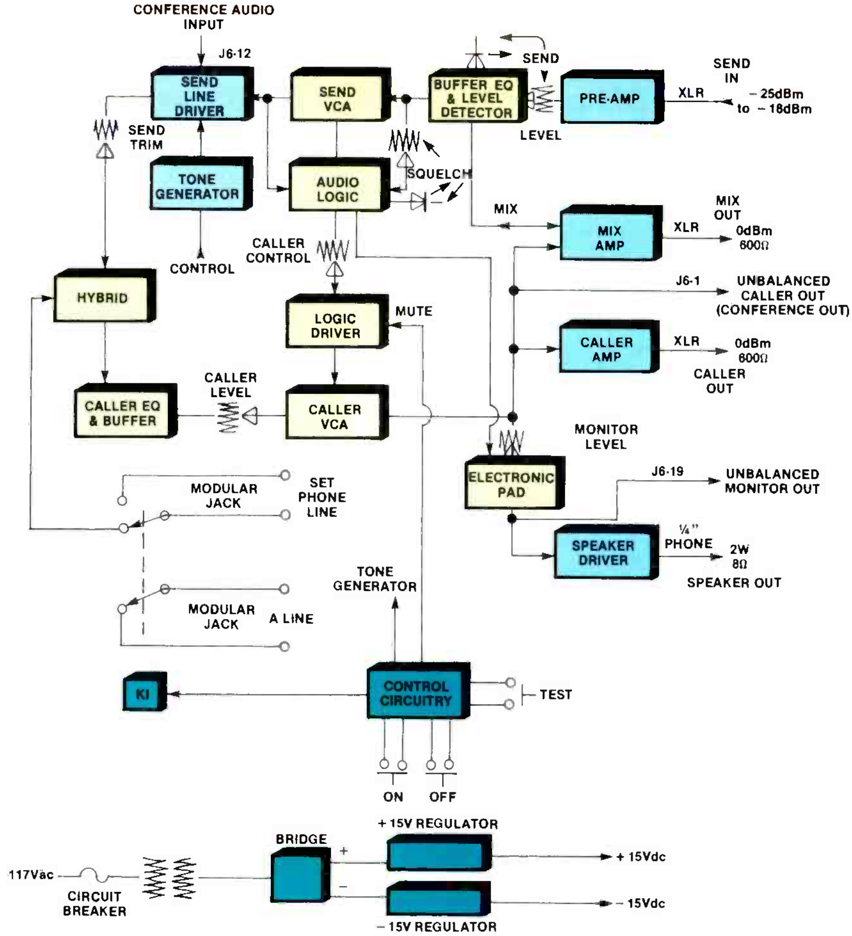

Performance

The unit's distortion is specified to be 0.1%. Because of the phase shifting network used in the hybrid, I was unable to verify this figure. The frequency response did meet the manufacturer's specifications. However, it appears that the frequency response is dependent on the incoming level. With the send level we use, −17dBm, the unit's frequency response does not meet the specifications. It is, however, acceptable for our application. The main reason we are not using a higher send level is that it would require external padding before the input to our main console and the newsroom recorder.

The telephone interface has been in service for almost a year with no problems. All of the ICs used in the device are socket-mounted, so if they fail, replacement will be easy. The back panel contains a multiple connector for those installations that require remote-control operation. The audio inputs and outputs are available on the connector.

Although the unit is exceptionally easy

Figure 2. *Block diagram of the Gentner SPH-4.*

to use, I believe there is one minor design flaw that could be easily corrected. The caller control that is used to shout down callers also contains a test generator. If the control is rotated completely counterclockwise into the detent position, a 1,200Hz sine wave is placed on the output bus. The tone is normally used for alignment purposes. On several occasions, this tone has been inadvertently activated during a recording or live program. I believe this function would be better served by a toggle switch on the back panel.

Our staff is happy with the SPH-4 telephone interface. Once users are properly trained to use the device, few operational problems occur. The improvement in our telephone recordings and talk programming has been noticed by listeners. Given the price/performance ratio of the interface, we made a good choice.

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How the phone works

Although every engineer uses the telephone, few really understand how it works. A simple way to define the telephone line is to refer to it as a 2-way, 2-wire transmission line. These two wires act as both transmission and reception paths.

The two wires used in the telephone path are called the tip *and* ring, *abbreviated T and R. These names originated in the early days of telephone technology when operators used patch cords to tie calls together. Tip and ring referred to the physical position on the patch plug of the two signals. Because the tip was the part most likely to be touched by the operator, it was made the grounded part of the plug. The term ring, in this usage, has nothing to do with the ringing mechanism of the telephone.*

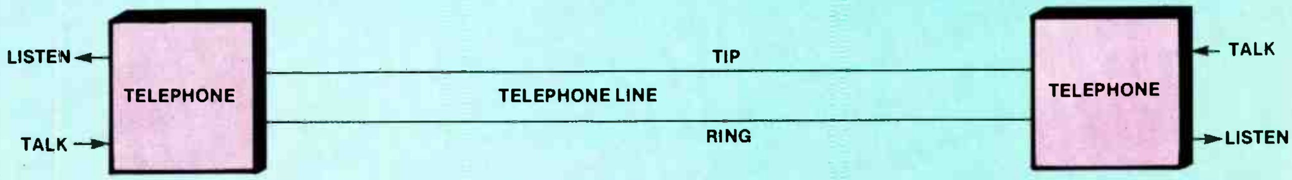
When the customer's telephone line (tip and ring) finally connects at the central office (C.O.), the 2-wire system is converted to a 4-wire system. Although they are thought of as a single path, in reality, two separate 2-way links are involved in each call. After passing through a hybrid, the two separate audio signals are connected to either a transmitter or receiver, as appropriate. The process is repeated at each end of the telephone calling locations.

Control voltages

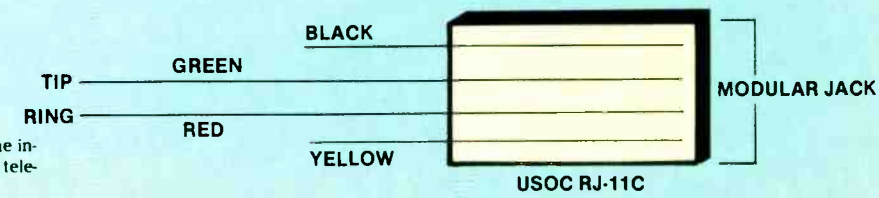
The C.O. places a dc voltage on the tip and ring leads of each telephone. This dc voltage is usually provided by a trickle-charged battery. The battery keeps the telephone system working during power outages. The battery voltage varies from 20Vdc to approximately 48Vdc with the tip and ring in an on-hook (no load) condition. This voltage provides the required dc for the carbon mics. Some modern electronic phones also use this dc voltage to power their internal circuitry.

When someone calls, a ring voltage of 105Vac is coupled to the two wires leading to your phone and in turn, the ringer in the telephone. When you pick up the handset, the switch-hook disconnects the ringer and connects the telephone network to the telephone line. This process is known as terminating the line. *Anytime a dc path of 600Ω or less is connected across the tip and ring, the line will be terminated and the call will be answered.*

When the call is completed, the reverse sequence occurs. After the C.O. senses a disconnect (a change in the load on the tip and ring) it usually reverses the dc voltage on the line. Some systems simply provide a dial tone without dc reversal. This change stops the long distance billing and gives the caller a dial tone.

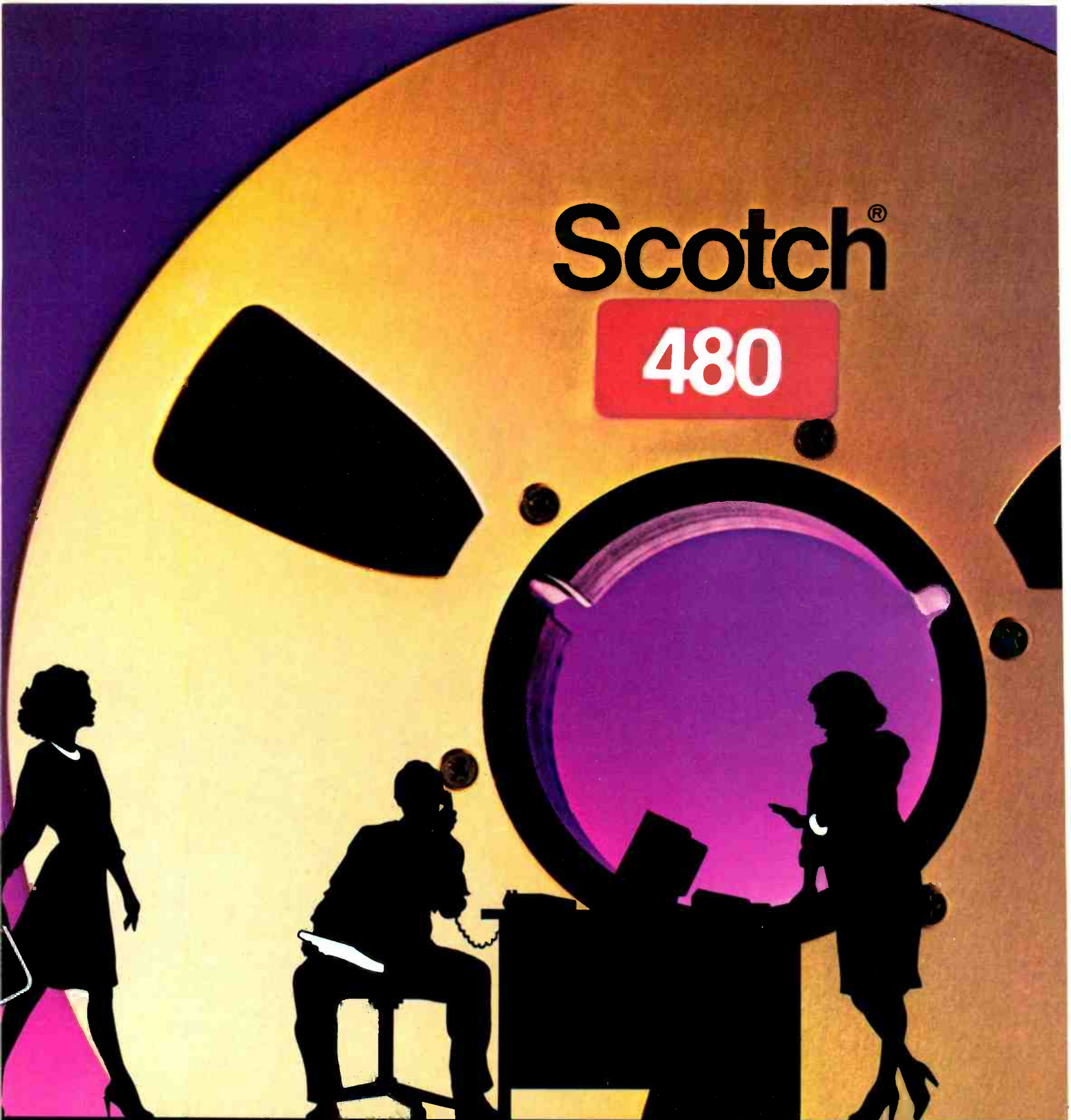


A standard telephone circuit requires two wires, referred to as the *tip* and *ring*.



A standard modular jack provides all the interconnections needed to connect most telephones to broadcast equipment.

Continued on page 102



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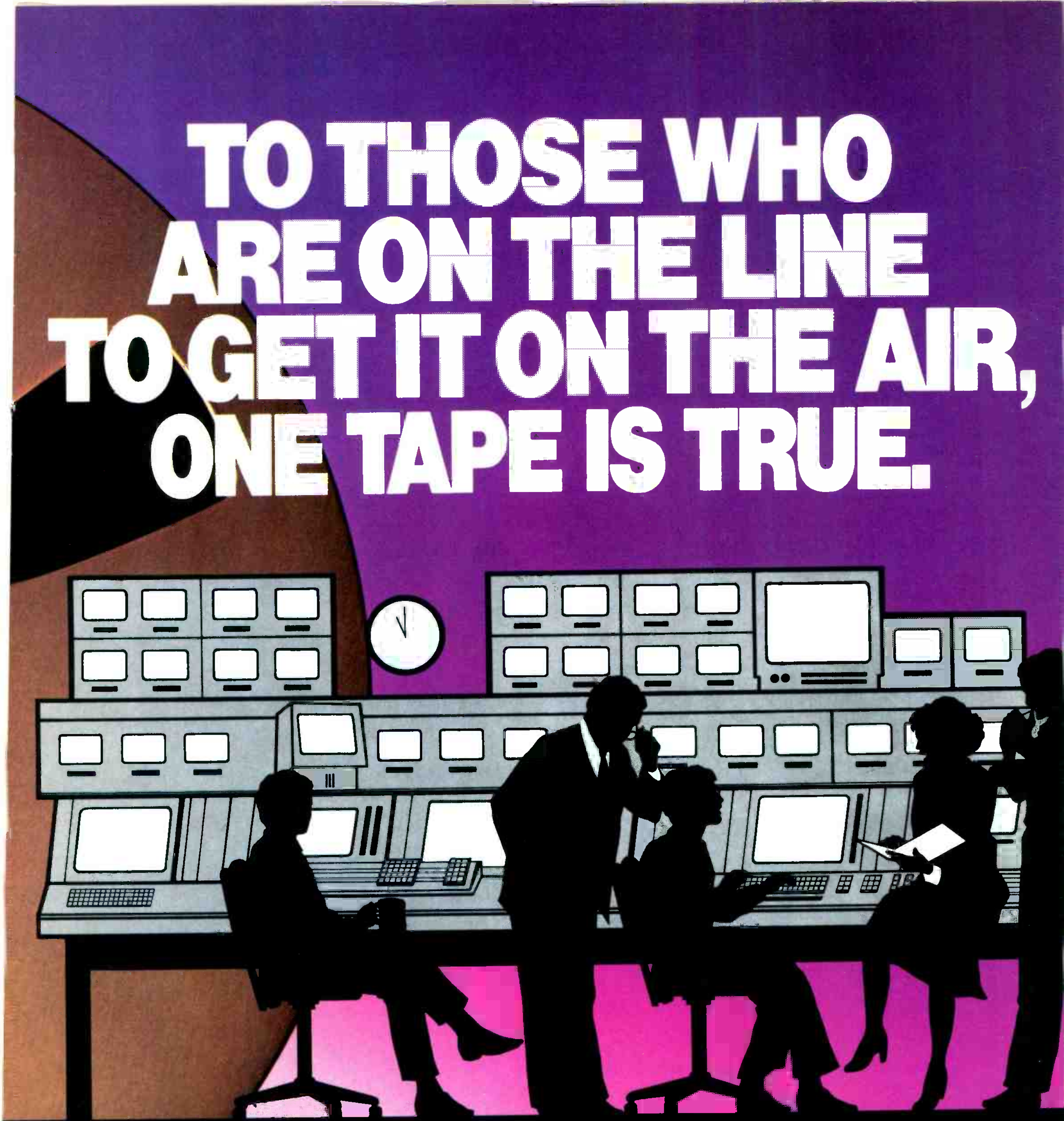
To all those who have to get it on the air without fail, you need a tape you can turn to without fear. 3M 480 1" Videotape. Designed to deliver exceedingly low video dropout levels–and extremely high audio ficelity. To give you a true picture–and true sound.



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Getting you on the air without fail...that's what we've been doing since we invented videotape 30 years ago.

That's why we stand by you–with the largest support force in the field.

And we stand behind you–with some of the most advanced research in the industry. All to keep our standing–as number one in the world of the pro.

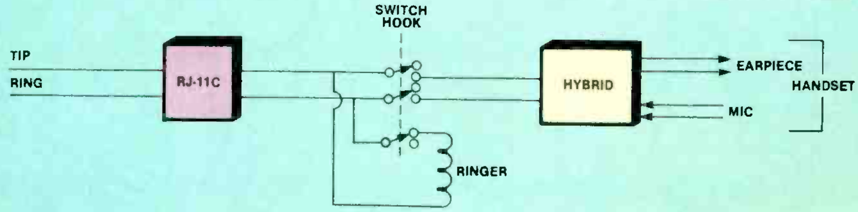
Scotch™ MAGNETIC MEDIA

NUMBER ONE IN THE WORLD OF THE PRO

3M

Circle (77) on Reply Card

Continued from page 99



Simplified block diagram of a telephone set. The hybrid converts the 2-wire system into a 4-wire system, required for normal use.

Interval wiring

The standard wiring configuration for a modular (USOC RJ-11C) plug is illustrated at right. The green and red leads are the tip and ring. A simplified diagram of a single-line telephone with the switch-hook connection is shown.

In multiple-line systems, the various telephone lines first enter the customer's key service unit (KSU). This device provides the necessary routing and control functions for the customer's telephones. There are two types of KSUs: fat wire and slim wire.

The fat-wire phone system uses at least one 25-pair cable going to each telephone. The telephones act like a rotary switch. When a line button is depressed, the appropriate tip and ring are routed to the telephone network and the button light is illuminated. This rotary switch is commonly referred to as the call director.

Continued on page 106

The ITC "Component System"

Listeners Will Love It!

Provide impressive on-air sound for even the most discriminating listener at an unbelievable price/performance relationship.

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The ITC "Component System" combines the quality of digital source material with *all* the operational flexibilities of an all-cart format. Simply record from a compact disc onto a ScotchCart®II broadcast cartridge using a 99B master recorder with ELSA, then play back on a DELTA reproducer!

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Allow ITC's "Component System" to provide your facility with the operational flexibilities of an all-cart format while you offer your listeners impressive on-air sound they are sure to love.

When newer technology emerges, it will come from International Tapetronics Corporation/3M, "The Leader in Reliability and Service."

Call today to discuss financial options and the unbelievable price/performance benefits of the ITC "Component System." In the U.S., call toll-free **800-447-0414,** or collect from Alaska or Illinois **309-828-1381.** In Canada, call Maruno Electronics, Ltd. **416-255-9108.** In most countries outside the U.S. and Canada, information on ITC equipment can be obtained through local distributors.

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P.O. Box 241
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3M

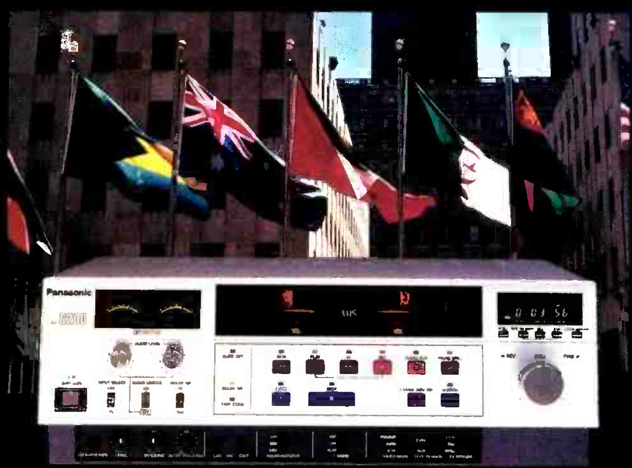
Circle (110) on Reply Card

AG-6810 VHS Hi-Fi video recorder. Perfect for entertainment or hi-fi dubbing. Dynamic range is greater than 80dB.

AG-6300 High performance VHS recorder and editing source deck. Two-frame editing accuracy. Inputs for time base corrector.

AG-6300MD Designed for medical applications. VHS recorder conforms to UL-544 standards. Ext. sync in. Time code connectors.

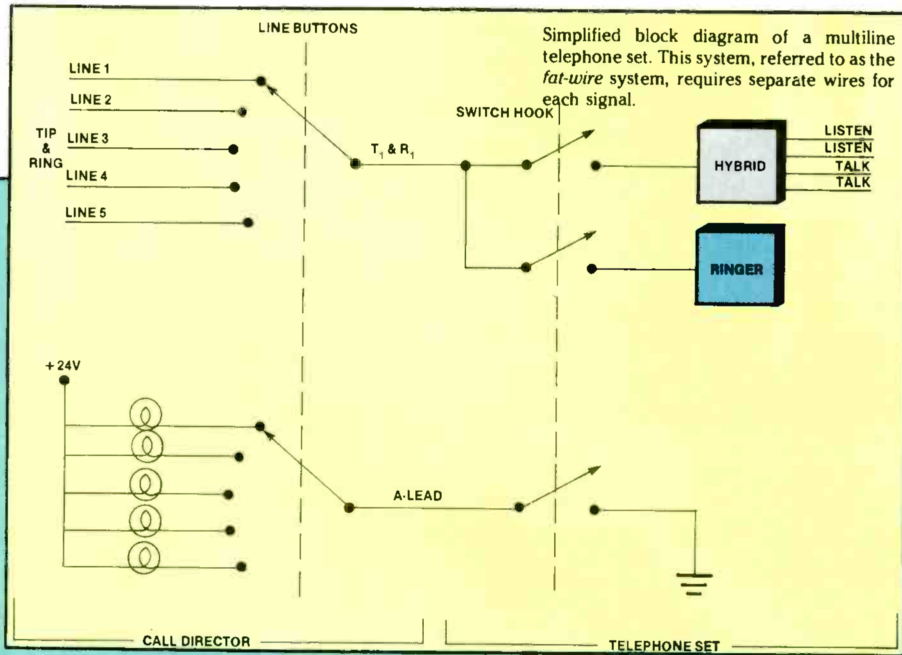
AG-6200 High performance, general purpose VHS recorder. 34-pin parallel remote interface.



AG-6200E Multi-format VHS recorder for worldwide use: PAL, CCIR and 4.43 MHz, NTSC. 14-step dial search.

AG-6100 VHS playback deck. 14-step dial search. Frame advance. Auto-repeat.

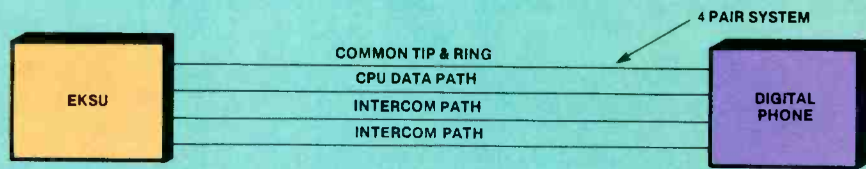
Continued from page 102



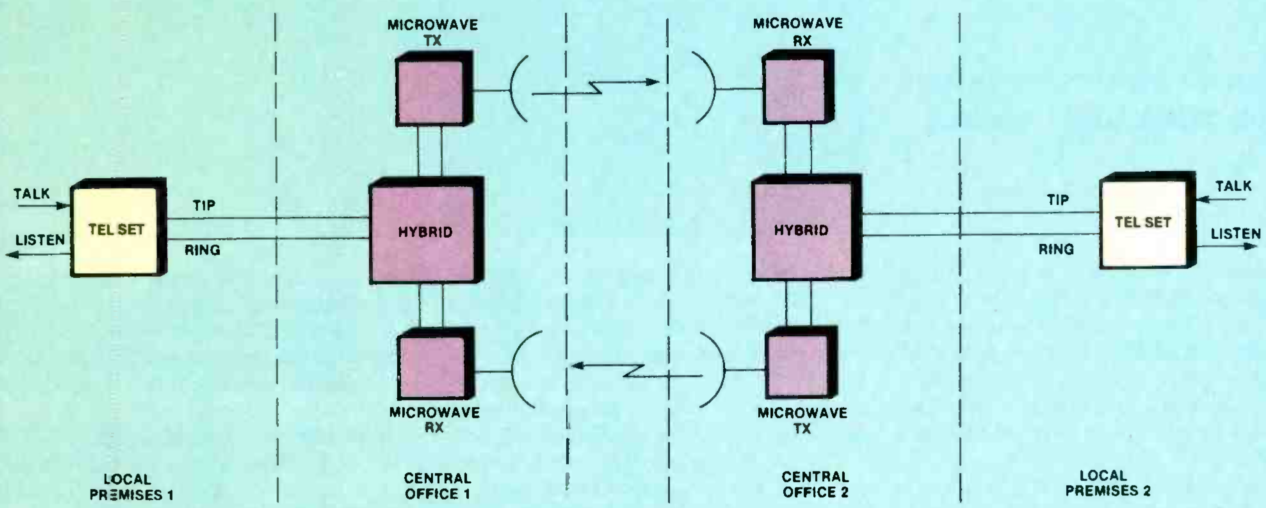
Simplified block diagram of a multiline telephone set. This system, referred to as the *fat-wire* system, requires separate wires for each signal.

A slim-wire phone system (usually referred to as a digital system) accomplishes the same task with four or fewer pairs of wires. A microprocessor in the electronic key service unit (EKSU) electronically provides the same functions described previously. When a line is requested by the telephone, the telephone sends a digital signal to the microprocessor telling it what line to route to the phone. If the line is available, the EKSU switches the tip and ring to the phone.

Most telephone interface devices can be interconnected to either type of telephone system. Before you purchase a system, contact the manufacturer to find out if optional interfaces or couplers may be required. Some telephone interface units are universal and may not require any additional couplers, but check to be sure.



A digital *slim-wire* telephone system usually accomplishes the same task with four or fewer pairs of wire.

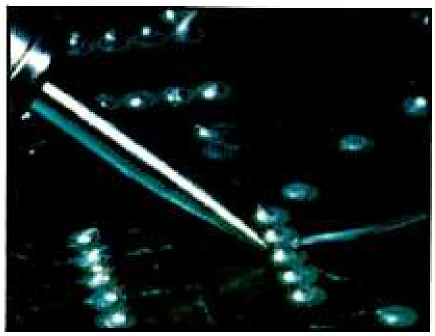


Although there are only two wires connecting your phone to the C.O., these offices must rely on duplex microwave or cable systems for interconnection.

Acknowledgment: "How the Phone Works" was adapted from the Gentner SPH-4 telephone interface user's manual. For further information on connecting telephone interfaces, contact Gentner Engineering.

Remote control system operates unattended

By P. Michael Zeimann



Recent FCC rule changes have drastically altered the way broadcast engineers look at remote control. In the past, most stations relied on dedicated hardwired loops between the transmitter and studio sites. Transmitters even had (and still have) failsafe interlocks to turn the carrier off if the loop failed.

Today, deregulation is the key word. Stations have more freedom to develop remote-control systems that meet their particular needs. Stations are still required to monitor the transmitter and be able to turn it off if something goes wrong, but it isn't always necessary to pay the telephone company for a dedicated loop to the transmitter site.

Alternative solution

Our station, WKDN-FM, needed to modernize its remote-control system. We also wanted to incorporate some computerlike features. Although there are systems available that provide computer features such as automatic logging and alarm indications, they were too expensive for us.

Personal computers are now common equipment in broadcast stations. They are no longer the mystery device they used to be. Many engineers know how to program them, and even more importantly, interface them to the real world.

We decided to use this technology and develop our own computer-based remote-control system. The system is designed around a Commodore 64 computer and its related equipment. Almost any computer can be used as long as you understand the principles of interfacing.

In addition to the computer, we needed an interface device. The Innovative Technology 1020 interface board provided the missing link for our system.

Features

The remote-control system performs many functions. It monitors and controls our station's transmitter and provides a printed log of transmitter readings and alarm conditions. It also monitors various functions such as overmodulation, tower lights, building security and the EBS receiver. The system provides both audible and visual indications when any monitored function is out of tolerance. And, more importantly, it allows WKDN off-premises unattended studio operation from midnight to 6 a.m.

The computer remote-control system meets all of the requirements of the FCC. By using a dial-up telephone line and a modem, the off-premises terminal can access the transmitter (by way of the TFT remote control) at any time.

It's important to note that this system is not an automation system. It functions only as a real-time remote-control system. All programming is controlled by another device at the studio.

System function

The host computer (studio) calls the off-premises control point (terminal) every two hours. After the call is completed, the host computer reports on readings and status conditions at the transmitter. This sequence takes place automatically. The off-premises terminal operator does not need to take any action if no alarms occur at the transmitter.

If an alarm occurs, however, the host computer immediately calls the terminal computer and reports it. The terminal operator is immediately notified by an audible warning and display on the computer screen. The operator can reset the alarm or take other precautionary or corrective action.

The computer system automatically performs many scanning functions each minute, thereby ensuring timely transmission of important information back to the studio. The host computer continually monitors and controls the transmitter and prints a record of readings and alarm conditions. Any reading exceeding a preset limit, either high or low, activates

Ziemann is station manager for WKDN-FM, Camden, NJ.

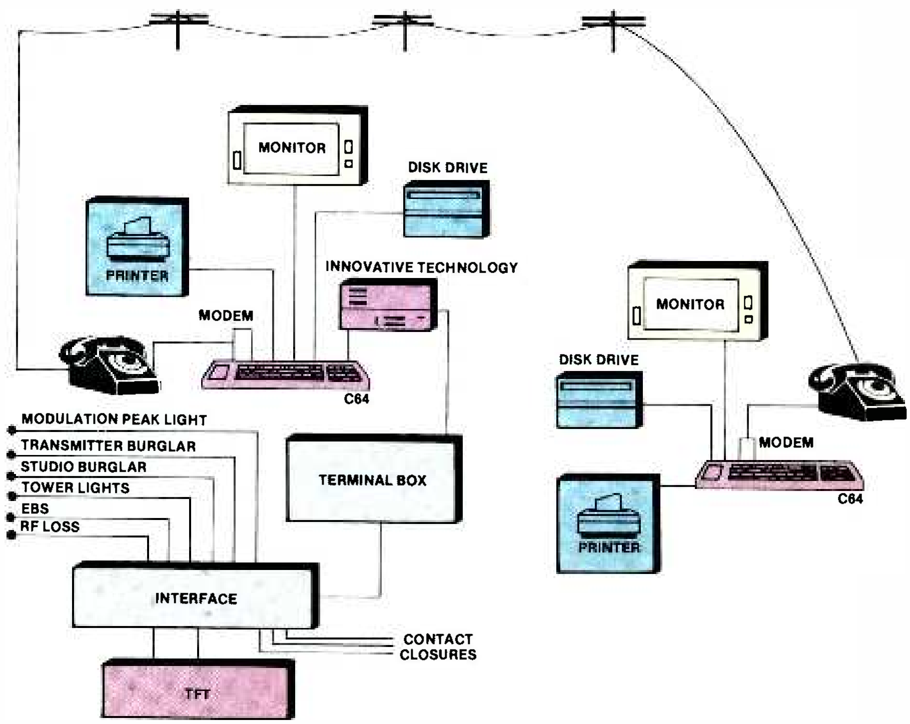


Figure 1. The WKDN transmitter can be controlled from an off-premises location through the use of an inexpensive computer.

Figure 2. *Block diagram of the control system. The only complex device is the Innovative Technology interface board.*

an alarm and is printed on the log.

All important readings and alarms are displayed in color on the host CRT for easy viewing. The log is automatically printed at regular intervals and a self-correcting clock permits programmable events.

As a final backup, during hours of unattended operation, the host computer continually resets a watchdog timer connected to a Sensaphone. If the computer crashes for any reason, or is unable to access the off-premises terminal, the Sensaphone first calls the off-premises remote-control location and then local station personnel.

Design

In order to implement this project, the station's normal remote-control system must be capable of external control. In other words, the computer system actually *controls* the remote control. If your remote control cannot provide this feature, alternatives must be investigated.

The basic system diagram is shown in Figure 1. Wiring is not critical, but observe good grounding practice. You will need to construct a rack-mounted interface box. Mount this as close to the remote control as possible to avoid lightning-induced transients. If the computer is located more than five feet away, you should use another terminal box and shielded cable. (See Figure 2.)

Because of the product-specific nature of the interface, no schematic drawing is shown. However, armed with information from your remote-control manufacturer and the Innovative Technology schematic, you should be able to interface the system to your remote control.

How it works

The key to the system is the capability of the regular remote-control system to be controlled by another device. In our case, the TFT 7610 remote control provides both BCD latched outputs and TTL level inputs. This permits the computer to control the remote-control unit. The Innovative Technology board converts the control signals from the Commodore to standard TTL level signals for the 7610.

Information from the transmitter site is communicated back to the studio over telephone lines. The remote control outputs the readings on the back panel for connection to the IT board and the computer. This connection allows the computer to read all of the necessary transmitter readings through the 7610.

When the computer needs to control the transmitter, it does so by outputting a signal to the IT board. The IT board converts these signals into standard TTL levels, which are communicated to the remote control for implementation.

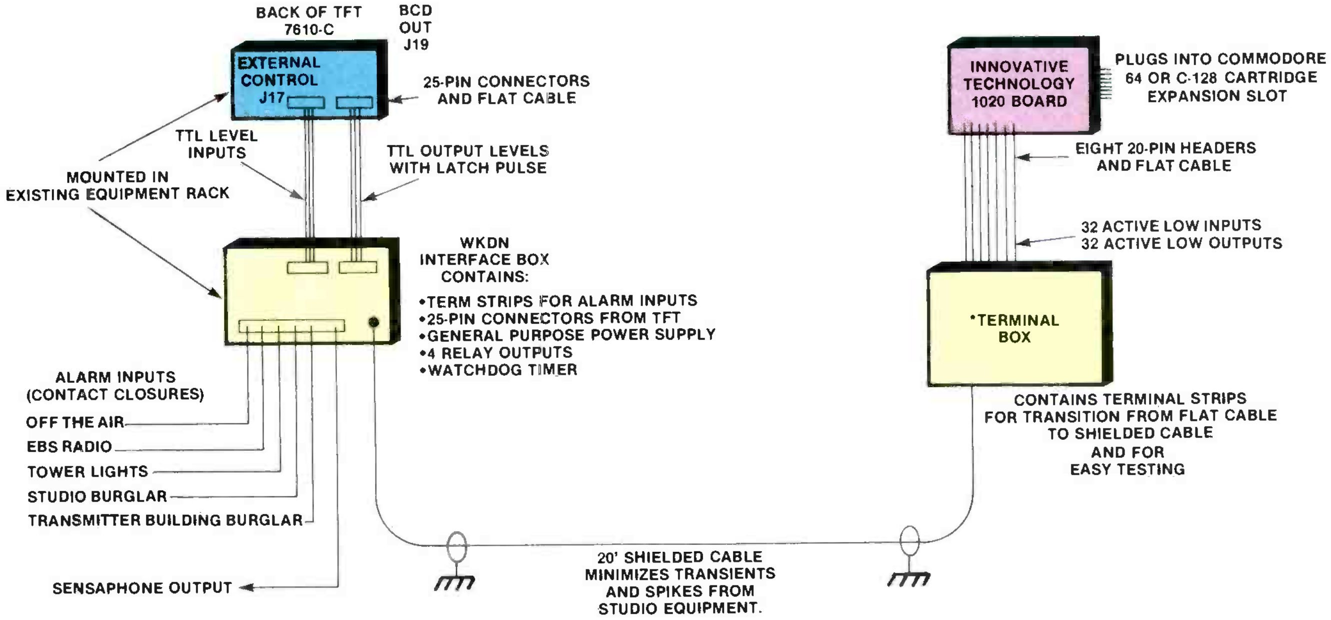
After the hardware is assembled, you will need to tackle the software problem. The BASIC program is several hundred lines long. A simplified flow chart is shown in Figure 3. For a requested Ennis Foundation donation of $5, a complete hard copy of the program is available from the Society of Broadcast Engineers, 7002 Graham Road, Suite 118, Indianapolis, IN 46220.

The program also is available as an

(TFT INTERNAL)

*J19 BCD OUT-GOES TO J3 ON DISPLAY BOARD

J17 EXTERNAL CONTROL-GOES TO J11 ON MOTHER BOARD



*CAN BE FACTORY OPTION OR YOU CAN INSTALL YOURSELF.

*NOTE:
SHIELDED CABLE AND TERMINAL BOX IS NOT NECESSARY IF COMPUTER IS LOCATED WITHIN APPROXIMATELY 5 FEET OF TFT REMOTE UNIT. FLAT CABLE FROM INNOVATIVE TECHNOLOGY BOARD COULD GO DIRECTLY TO THE INTERFACE BOX.

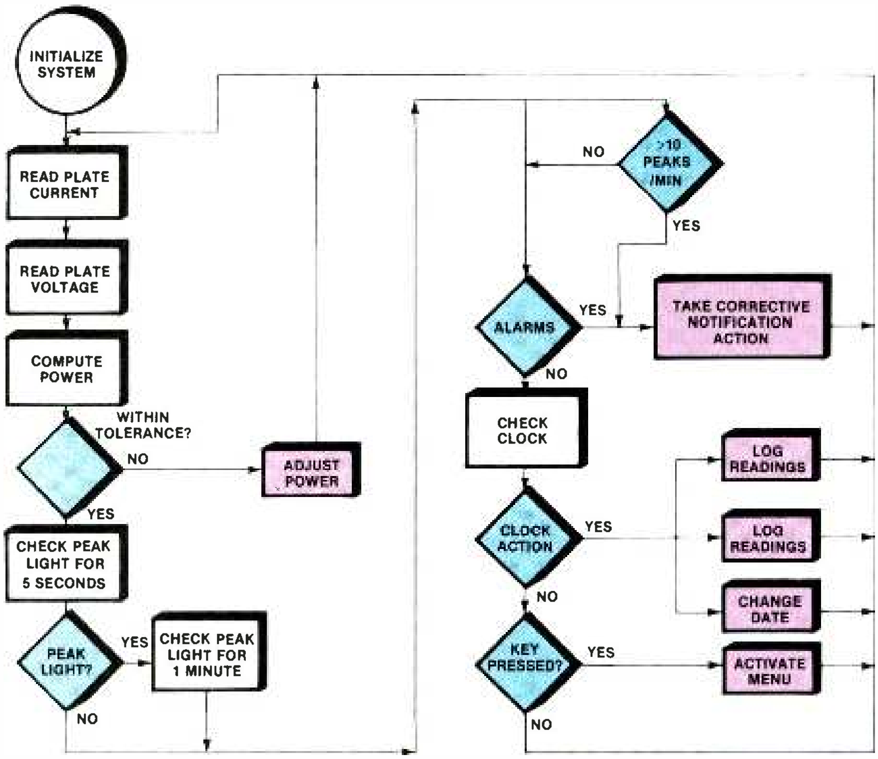


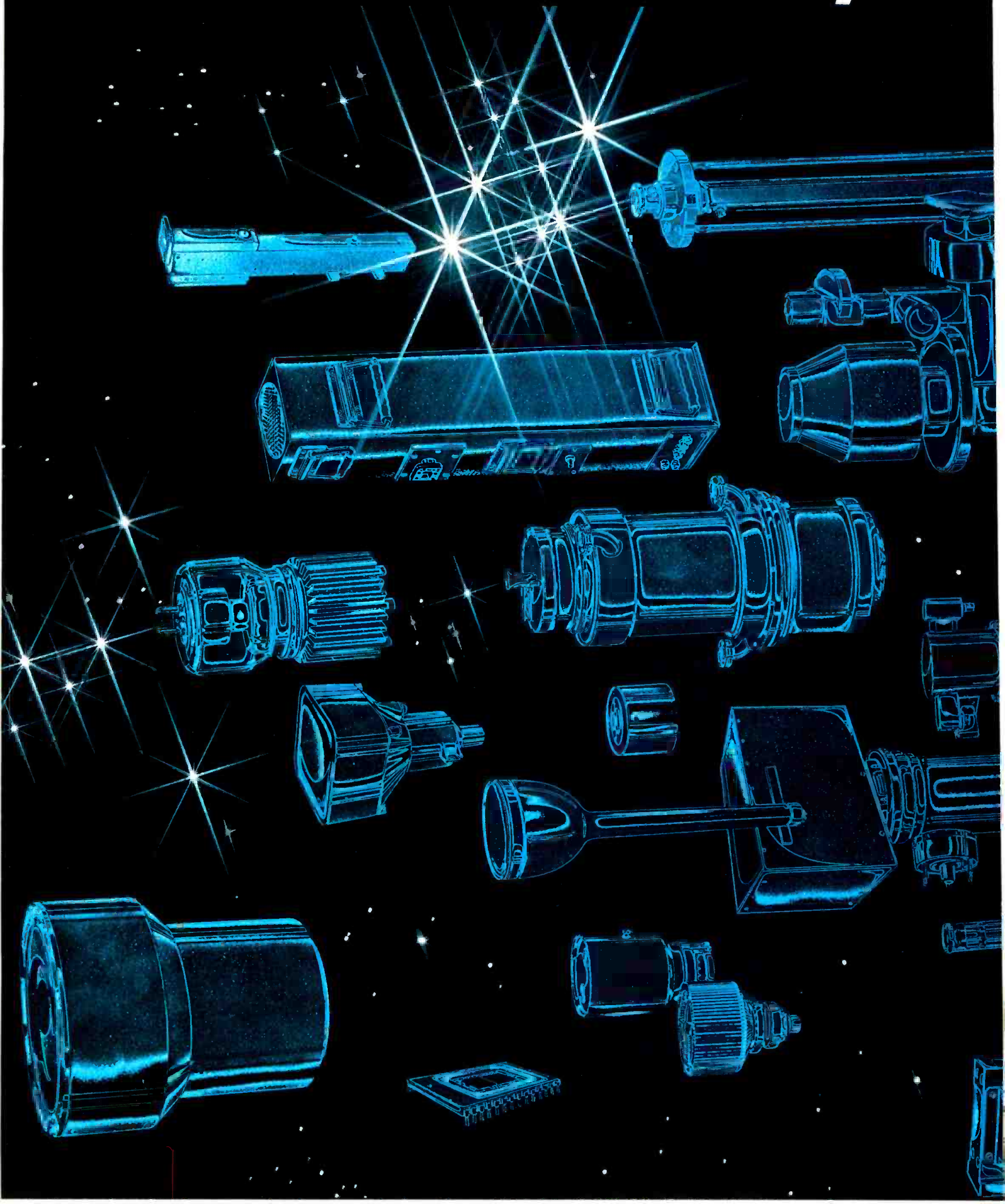
Figure 3. The computer program flow chart is simple. However, the actual control sequence and error checking routines require detailed programming.

ASCII file from the Broadcasters Database (BDB). If you have a membership in BDB, the file can be downloaded directly into your computer. You can contact BDB at 3935 Westheimer, Suite 305, Houston, TX 77027; 713-623-4011. If you download the program from BDB, it will in turn notify SBE for donation purposes. Your support of these programs helps ensure that they will continue to be made available to **BE** readers.

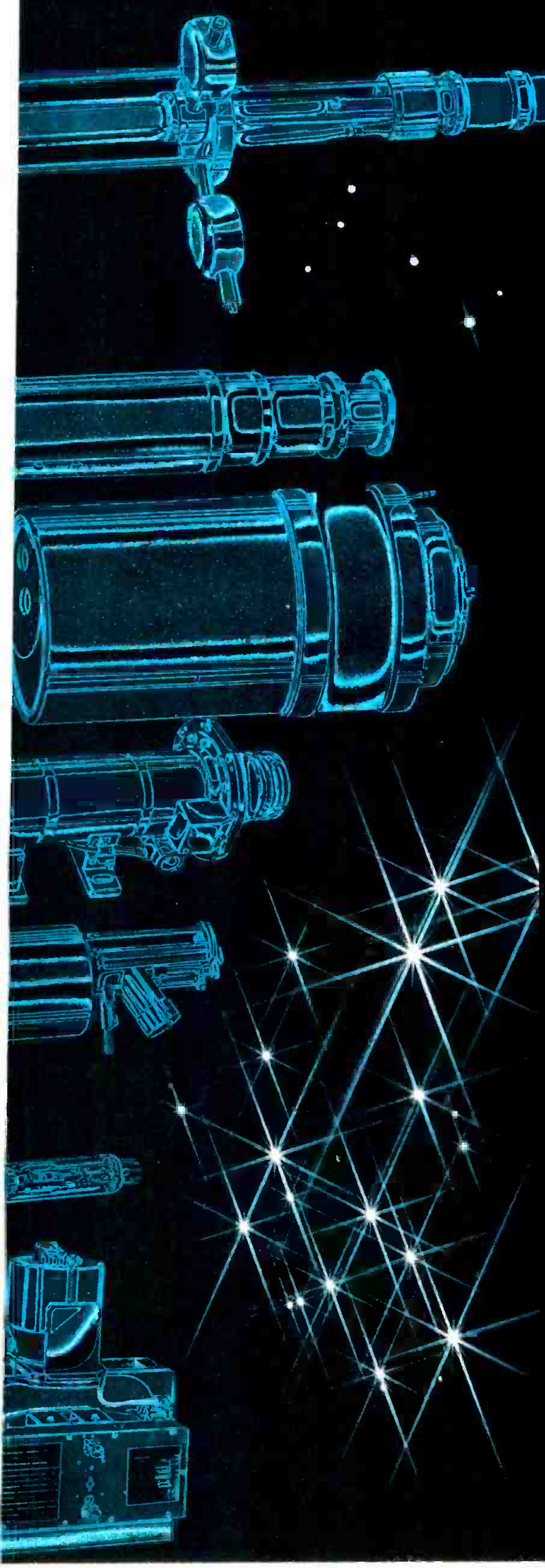
The system works effectively for our station. It permits us to provide our audience with 24-hour operation without the expense of hiring full-time personnel just to monitor the transmitter. In our case, sister station WFME, Newark, NJ, is the off-premises terminal location and monitors our air signal and computer alarms with another C64 computer and modem. You may wish to make similar arrangements when implementing this type of system.

Editor's note: Zeimann presented a paper on the implementation of this remote-control system at the 1986 NAB engineering conference. Copies of the *Proceedings* are available from the NAB Science and Technology Office, 1771 N Street NW., Washington, DC 20036.

THE FURTHER WE GO, THE



FURTHER YOU GO.



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The NFCC shapes up

By Bob Van Buhler

The National Frequency Coordination Committee (NFCC), referred to in last month's "SBE Update," is taking shape. Elections were held at the group's first meeting. The following persons were elected to key positions: Jerry Plemmons (Outlet Communications), chairman; Bob Van Buhler (WBAL, Baltimore), vice chairman; Ed Williams (NAB department of science and technology), secretary; and George Thomas (Mutual Broadcasting System), treasurer.

The council adopted an organizing structure and appointed subcommittees including one on databases and one on procedures and policy. Another committee will develop a nationwide calling frequency and a video source identification signal to assist in local coordination. The officers also formed a charter and bylaws committee, which will develop the procedural aspects of the new council.

Timing of the next meeting depends on the progress made by the subcommittees. A meeting may be held this month. Representatives of all major networks, Radio and Television News Directors Association (RTNDA), NAB and the National Cable Television Association attended the first meeting.

SBE on-line

SBE has been working at the national level to improve communications with its membership. One part of this improvement includes a cooperative arrangement with CompuServe to include SBE in the Broadcast Professional's Forum (BPFORUM).

Gerry Dalton of the Dallas chapter and SBE's National Frequency Coordination chairman has been named as chairman of the electronic communications committee. A portion of his duties includes acting as SBE system operator (Sysop) for liaison with CompuServe.

SBE has an area within the BPFORUM to upload meeting information, newsletters, private conferences and communications exchanges with members. The system allows members to leave specific messages and questions for individual board members.

The current SBE filings with the FCC will be included in the on-line information. The SBE area also will include a list of Part 74 frequency coordinators.

Most SBE members will be able to sign on through a local access number, thereby avoiding long distance charges. If you haven't subscribed to CompuServe, consider doing so. You can subscribe by checking the appropriate box on the back of your SBE membership renewal card. If you have already renewed your SBE membership, or need additional information, call the national office at 317-842-0836.

Membership growth

Many chapters have already realized the importance of the personal touch in membership stability and growth. There will always be those in the chapter who will forget to pay their annual dues and gradually they become ashamed and neglect to show up at the meetings. The chapter chairman can help prevent this from happening.

An essential element in keeping current members in the fold is accurate information. The chapter's chairmen and secretaries have an obligation to know the renewal status of each of its members. They also need to let members know when their memberships have lapsed. Sometimes, it is necessary for the chairman to call the members and let them know that participation is important. The personal touch usually suffices in drawing people back to the meetings.

Chapters may find it effective to appoint a membership and fellowship chairman. This person can be responsible for new members and help them feel at ease at their first meeting. Membership and fellowship chairmen also are the ones who make a telephone call to the members who have not paid their dues. These chairmen also can obtain feedback from the members on meeting plans and national SBE issues. Often a phone call is all that is necessary to keep a member active.

The most successful chapter in obtaining new members last year was chapter 47 in Los Angeles. This chapter enjoyed a growth of 19 new members during the year. Other chapters with 15 or more new members for 1985 include chapter 46 in Baltimore, chapter 16 in Seattle, chapter 15 in New York and chapter 9 in Phoenix.

1987 SBE national convention

With the 1986 national convention in St. Louis already well planned and successfully booked, the SBE national office is soliciting proposals for hosting the 1987 and later conventions.

Other chapters and chapter groups are invited to make their proposals as soon as possible. The prospective host must have the ability to contract a 250-booth area for exhibits and demonstrate the organizational structure to properly execute the convention. The financial resources to secure reservations and accomplish advance printing also are necessary. These costs are estimated at about $10,000.

SBE tape library

The SBE offers individual chapters several tutorial videotapes that make good monthly programs. The tapes include programs on signal-to-noise ratio measurements, linear and non-linear distortion and field time VIRS. These particular tapes were produced by Tektronix. Other tapes include a lighting seminar by Colortran and line measurements and IM distortion from Hewlett-Packard.

There is no fee for the use of these tapes, but the chapter must pay postage both ways. If needed, the tapes can even be duplicated for delayed use by your chapter. If you are interested in using any of these materials, contact the national office. If you have similar training materials, please let us know. Offers and suggestions can be directed to Bob Van Buhler at 301-338-6567.

Sustaining membership

Local chapters have been given an opportunity to participate in the SBE sustaining membership project. A mailing has gone out to each of the SBE chapter chairmen with a list of sustaining membership candidates. The chapter chairman is requested to make the personal contact needed to help secure the new SBE sustaining member.

As of April, a total of 84 manufacturers, distributors and consultants were supporting SBE through sustaining membership.

An additional 194 group broadcasters and 1,537 manufacturers and distributors were requested to support SBE last month. Because of the size of our membership, we are an important element to each of these groups of companies. If you are willing to help with this project, contact Joe Manning at KAET-TV, 602-965-3506.

Van Buhler is chief engineer for WBAL-AM and WIYY-FM, Baltimore.

News

Continued from page 4

parameter was noted by adding the following to the report: "Progress in HDTV technology and component design has resulted in HDTV production equipment now being available from sources in several countries. Also, a number of HDTV production facilities using certain parameter values given in the annex are in operation in various parts of the world."

Third, technical experts were urged to complete HDTV studies before the CCIR's final meeting in 1989. To achieve this, the expert study group will schedule a meeting on HDTV in 1988.

Finally, noting the views of several countries using the 625 line/50Hz broadcast systems, the CCIR added: "There is also a need for the HDTV studio standard to accommodate future broadcasting systems compatible with existing scanning standards."

Delegates from 75 nations attended the plenary. Leading the opposition to the 1,125/60 parameter were France, the Netherlands, West Germany and Great Britain. Some European receiver manufacturers were concerned about the potential impact of the proposed standard. They intend to study and possibly develop alternative systems to compete with the 1,125/60 standard developed by NHK, the national Japanese broadcasting service.

People

Richard Abbenante has joined Broadcast Systems, Austin, TX, as Western regional sales manager. He previously spent 26 years with RCA Broadcast Systems.

Benton Everett and **Brent Bullock** have been assigned positions with Quanta, Salt Lake City. Everett is Midwest regional sales manager. He is responsible for promoting character generators, the Quantapaint electronic video paint series and Dimension, a 3-D modeling and animation system. Bullock has been reassigned to the Western region as regional sales manager. He joined Quanta in January of 1984 as sales manager for the Midwest region.

Dot Warshawsky has been named Mid-Atlantic sales manager for Richardson Electronics, Franklin Park, IL. She is responsible for design and implementation of a marketing program targeted at current and potential accounts from Delaware to Virginia, as well as assisting the other district sales managers on distributor accounts.

Daniel P. Marchetto has been promoted to OEM sales engineer for Shure Brothers, Evanston, IL. He is responsible for OEM customers, as well as developing new accounts and opportunities in the various OEM markets.

Mark Terry has been named director of marketing for New England Digital, White River Junction, VT. He is responsible for the supervision and coordination of advertising and marketing.

Michael A. Pirrone has joined COMSAT International's marketing and sales division, Washington, DC. He is responsible for sales of international broadcast services. Pirrone will operate out of the company's New York City office.

Photo credit

We mistakenly left off the photo credit for our May *Transmission Systems Special Issue* cover. The cover photograph, a dramatic view of a Klystrode, was taken by Pete Nuding of Pete Nuding Photography, Mountain View, CA.

Business

Fuji Photo Film opens new headquarters

Fuji Photo Film USA, New York, has opened its corporate headquarters in Elmsford, NY. The address is Taxter Corporate Park, 555 Taxter Road, Elmsford, NY 10523. The telephone number is 914-789-8100.

BAF purchases Scientific-Atlanta components

Scientific-Atlanta, Atlanta, has received an order from BAF Communications for broadcast quality video components. The purchase included model 7555 video exciters, model 9630 receivers, model 418A protection switches and dehydrators. BAF will use the equipment to outfit transportable uplinks for satellite news gathering applications. The components will be integrated into mobile uplinks.

Grass Valley receives Andrew order

The Grass Valley Group, Grass Valley, CA, has received the largest single order for its Ten-X 10x1 routing switcher from the Andrew Corporation. The routing switcher will be used to switch video and stereo audio via an RS-232 serial interface from satellite downlinks to major TV networks.

Bayly makes name change

Bayly Engineering Limited, Ajax, Ontario, has changed its name to AEG Bayly. The address remains the same.

Shintron and Chroma Digital reach agreement

Shintron, Cambridge, MA, and Chroma Digital Systems, Santa Clara, CA, have reached an agreement whereby Shintron has acquired Chroma Digital's assets, including inventories, know-how and technology under development.The products will be manufactured at Shintron's Cambridge plant. Shintron will honor the remainder of Chroma Digital's existing warranty policies and obligations.

Gentner makes delivery to Conus Communications

Gentner Engineering Company, Salt Lake City, has announced the delivery of a second communications system to Conus Communications, Minneapolis.

Studer and Philips form venture

Willi Studer A.G. and N.V. Philips Gloeilampenfabrieken have formed a joint venture for the research and development of compact disc-related professional studio systems. The venture is intended to exploit the synergism attained by cooperation of the two companies in R&D resources, as well as expertise in product engineering. The venture will not affect independent developments by both companies in the magnetic tape recording and optical disc mastering systems.

Sony receives orders, delivers equipment

Sony Broadcast has received orders from TVi, London, for five Betacart machines. TVi is the first company in the United Kingdom to use the machines for on-air transmission.

RTP, the Portuguese radio and TV network, has ordered 13 BVW-3AP Betacam cameras, 15 BVW-40P recorders, 12 BVW-10P players, seven BVW-20P portable players, seven CCU-300PL camera remote-control units, a range of monitors and more than 25 sets of wireless microphones.

Sony Professional Products is producing its PCM-3000 series DASH ¼-inch format digital audio recorders at its Ft. Lauderdale, FL, facility. The first 15 units were delivered to the NHK broadcast network in Japan last September. The shipment was part of an order for more than 25 recorders.

A.F. Associates holds rep position

A.F. Associates, Northvale, NJ, has been reappointed the exclusive North American representative for the British-made AVS 6500 standards converter.

Transtar chooses Wegener SCPC

The Transtar radio network has chosen the series 1600 SCPC system from *Wegener Communications,* Norcross, GA, to transmit network programming to its format 41 and oldies channel affiliates. The system will be used for stereo audio, cuing signals, addressing and distributing network information to radio stations from the Transtar radio uplink.

Kahn and Totsu sign marketing agreement

Kahn Communications, New York, and Totsu Company, Tokyo, have signed a marketing agreement whereby Totsu will exclusively market KCI broadcast products to Japanese government and commercial broadcast stations.

Networks approve Dalsat systems

Dalsat, Plano, TX, has announced network approval of its satellite news gathering vehicles for use by network affiliates. ABC and CNN have already approved the satellite news gathering systems.

Enterprise Systems acquires Kaman Broadcasting

Enterprise Systems Group, Dallas, has signed an agreement to purchase the assets of Kaman Broadcasting Systems, Colorado Springs, CO. Kaman Broadcasting specializes in computer services for the broadcast industry with a customer base of more than 50 TV and radio stations in the United States, Canada and Mexico. The company will continue to be based in Colorado Springs.

AKG acquires Ursa Major

AKG Acoustics, Stamford, CT, has announced the acquisition of Ursa Major, Boston. AKG acquired all assets and trademarks, establishing a new digital products division. In addition to the R&D activities undertaken by the parent company in Vienna, Austria, the Boston-based facility will become AKG's second R&D center for digital product development.

Delta Electronics installs system

Delta Electronics, Alexandria, VA, has announced that Radio Mundial, Rio de Janiero, Brazil, has installed a Delta C-Quam AM stereo system. This installation follows the Brazilian government's decision to make the C-Quam system the AM stereo standard. Radio Mundial, the first station to install the system, is part of the Globo Network.

Radio Systems becomes distributor

Radio Systems, Edgemont, PA, has been appointed the exclusive distributor of two subcarrier FM radio receivers, imported by Uni-Band, a group of SCA station operators. Model RF-42 is a portable, battery operated radio, and model RF-92 is a tabletop receiver with a pre-amp output.

New products

Broadcast systems

Panasonic Broadcast Systems has introduced the following products:

- The AK-3090/AK-3091 coax or triax cable adapter for the AK-30 handheld camera with separation distances of up to 6,600 feet between the camera and the remote base station.
- The AG-6400 VHS hi-fi portable recorder/player is designed for field recording. The unit has dual VU meters, a dynamic range of greater than 80dB, less than 0.005% wow and flutter and an audio response of 20Hz to 20kHz.
- The AG-155 professional VHS CCD camcorder features color pictures produced by a ½-inch CCD pickup element and a piezo auto focusing system, which consists of a microprocessor and a special controlled lens.
- The VP-7722P audio analyzer has a 0.0001% distortion factor, with a 10Hz to 110kHz frequency range and 20 channel inputs. The analyzer measures distortion factor, signal-to-noise ratio, ac level and intermodulation distortion.

Circle (350) on Reply Card

Presentation system

A.F. Associates has unveiled the Pegasus 5150 commercial presentation system, which allows playback of prerecorded composite reels and/or individual spot material. It also allows the user to make late changes in running order and supports multiple playback sources.

Circle (351) on Reply Card

Power amps, communications link

Raycom Group has introduced the following products:

- Microwave power amplifiers which couple broadbandedness with high-power output. One model covers both the 2GHz and 2.5GHz auxiliary broadcast bands in a single broadband unit while another covers both the 6.5GHz and 7GHz bands in a single unit. A third model covers the 13GHz band and features output power options of 2.5W or 5W.
- Sky-Link, a satellite communications link that provides mobile uplink vehicles with four independent audio channels.

Circle (352) on Reply Card

Tripod, fluid head, microphone fishpole

Gitzo has announced the following products:

- The 563LM Reporter Fisher is a 5-section fishpole, with an outside diameter of five inches and two soft handgrips, and has a range from 2½ feet to 10½ feet.
- The 480 fluid head offers an adjustable counterbalance for cameras up to 30 pounds, as well as 100% fluid tilt, the fluid having a silicone base for operating under extreme temperatures.
- The Mini Tele Studex is a 4-section tripod with a leg diameter of 1½ inches, extending from zero inches to 63 inches and supporting cameras up to 100 pounds.

Circle (353) on Reply Card

TV program delay system

Hubbard Communications has announced the HCD-500 TV program delay system, which will delay any incoming program from three minutes to two hours. The system incorporates the field-tested electronics of the HCC-55 cart system.

Circle (354) on Reply Card

Video, audio switchers

HEDCO has introduced the Hedline series of self-powered 4-input, 1-output video and audio switchers which offer remote control and AFV operation. The video unit features looping inputs, vertical interval switching and full broadcast specifications with 30MHz bandwidth. The audio switcher has two balanced outputs plus a monitoring phone jack on the front panel. Signal-to-noise ratio is greater than 100dB with response at ±0.1dB 20Hz to 20kHz.

Circle (355) on Reply Card

Wireless receiver, 2-way radio

Nady Systems has introduced these products:

- The EasyTalk PRC-4H is a handheld 2-way radio using the 49MHz band. The radio has FM operation and a dual conversion superheterodyne receiver and provides communication for a range of up to one-fourth to one-half mile. It is housed in a light case with belt clip and a 9V battery provides power.
- The 501 VR is a portable wireless receiver on the VHF highband for use with the 501 or 701 VHF wireless transmitter. The mini-receiver is for video production or stage monitor use.

Circle (356) on Reply Card

Time compressor/expander

Lexicon has introduced the 2400, a stereo audio time compressor/expander incorporating a time-code reader and reference output. The unit is designed for use on both polyphonic music and voice, and employs digital signal processing algorithms to provide mono compatibility and stereo imaging. It is designed to change the running time of video, film or audio program material while maintaining the original audio pitch.

Circle (357) on Reply Card

PC compatible ENR system

Comprompter has introduced the ENR-PC, an IBM-PC compatible news production and prompting system. It features the same functions available in its Apple-based systems in a PC version. The system features menu-selected functions, on-screen prompts, split-screen scriptwriter/word processor, automatic word wrap and line endings, catalogue displays, electronic prompting, computerized archiving and a built-in modem/terminal script transfer program.

Circle (358) on Reply Card

Component downstream keyer/RGB chromakeyer

Shintron has introduced the DK3/CK3 component downstream keyer/RGB chromakeyer combination. The keyers use a super-linear extra wideband to perform key and program-preset fades; generates independent video keys and performs drop shadows in eight directions.

Circle (359) on Reply Card

Clipping protection devices

MCG Electronics has introduced the following products:

- The Surge-Master Avalanche 2100A series prevents damage to extra-sensitive equipment by clamping ac line transients directly at the equipment input. The unit consists of matched diodes to directly shunt transients around the sensitive load in less than 1ns.
- Mini Surge-Master 600 series ac power line protector provides 2,250 joules/phase absorption capability for 120Vac to 480Vac single phase or wye service panels. It features a triple redundant, modular approach.

Circle (360) on Reply Card

Satellite data decoder

The Chesapeake Group has introduced the SDD-10 station data decoder. It permits identifying individual stations and groups of stations with a unique code so that messages can be sent to them. The unit accepts FSK data from many sources.

Circle (361) on Reply Card

Multi-element antenna

Spatial Communications has announced the Microtenna-ME, a multi-element antenna for reception of multichannel television at distances greater than 10 miles from the transmitting antenna site. It features a 4-element antenna with integrated block downconverter. The array provides an additional 6dB of antenna gain.

Circle (362) on Reply Card

Edit suite audio mixer

Graham-Patten Systems has developed model 608, an 8-input, edit suite audio mixer. It offers edit system control of source selection, preview functions and transitions. It also may be operated manually as a conventional audio mixer or with a combination of manual and edit system control.

Circle (363) on Reply Card

Audio correction device

Titus Technological Laboratories has introduced The Last Word, a microprocessor-based stereo audio correction device to correct audio problems. It is a unity gain in-line device that monitors any stereo source and will correct automatically or manually. The unit provides metering of the inputs monitoring the left and right input channels on 20dB VU meters, and monitoring the L+R and the L−R on 40dB VU meters.

Circle (364) on Reply Card

Steadi-film system

The Steadi-Film Corporation has introduced the Steadi-film system, which eliminates film weave in film-to-tape transfer. The system is a pin-registered telecine gate that retrofits to a Rank Cintel Mark III and operates under its own microprocessor-control unit.

Circle (365) on Reply Card

Digital multimeter

John Fluke Manufacturing has announced the 8060A digital multimeter, a handheld, microcomputer-controlled 4½-digit test instrument. It measures frequency to 200kHz and relative and decibel measurements with almost any impedance. Dc voltage is measured in ranges from 200mV to 1kV full scale at an input impedance of 10mΩ. Ac voltage is measured in ranges from 200mV to 750V true rms.

Circle (366) on Reply Card

Stabilizing lens accessories

Schwem Technology has announced three Gyrozoom 60/300 image stabilizer lens accessories. The wide-angle attachment reduces focal length by 5X. It's rated at f/6.2 with a 3-inch minimum operating distance. The remote-control system provides remote control of focus, stabilization, iris and zoom. The travel bag has separate compartments to hold the wide-angle attachment and lens cables.

Circle (367) on Reply Card

Switcher with editor control

Crosspoint Latch has introduced the 6119 production switcher with editor control. It features five inputs, three buses, full colorizer, fade to black, soft, hard or bordered edges, 12 wipes, joystick, two keying levels, test mode and a blanking processor.

Circle (368) on Reply Card

Filter, cover, discharger and multicharger

Perrott Engineering Labs has introduced these products:

- A dichroic filter designed in Pyrex for daylight color correction from a tungsten Halogen source is mounted in a metal holder for use on the Perrott minilight on-camera portable light.
- Cozies are quilted, thermally insulated, battery operated warming covers for cameras and VTRs.
- The PE 138 NP Betacam battery discharger is designed to discharge and exercise Betacam batteries.
- The PE 868 multicharger is capable of overnight charges of up to eight Perrott PE-90s or equivalents, simultaneously and independently.

Circle (369) on Reply Card

Wireless microphone system

Telex Communications has announced its wireless microphone system, designed for ENG broadcast and remote video production markets. The system consists of the ENG-4 4-channel receiver and WT-400 2-channel transmitter. The ENG-4 has a small monitor earphone and 1-wave antenna. The WT-400 is a 2-channel selectable transmitter to be used with a Telex WLM-200 miniature lapel microphone.

Circle (370) on Reply Card

Audio and video products

Ampex has introduced the following products:

- Ampex 198 and 199 ½-inch VHS and Beta videocassettes for the M format feature high-energy, cobalt-modified gamma ferric oxide and an antistatic agent.
- 467 professional U-matic digital audio cassettes for PCM converters feature a cross-linked copolymer oxide binder and can be used in all digital U-matic systems with standard factory adjustment.
- ATX-100 digital repositioner with zoom consists of control keyboard, computer system and a signal system.
- Ampex ADO component input/output kit adds capabilities to standard composite ADO systems. It consists of three boards and allows user to choose between composite and component input and outputs.

Circle (371) on Reply Card

Videotape editor, automation system and optimizer

CMX has introduced the following products:

- The CMX 3100 computer-assisted videotape editor features multiple EDL files, expanded EDL memory, autoclean, match-cut calculate, learn keys, short-cut wipe and dissolve, and an enhanced, easy-to-use switcher memory.
- The CASS 1 computer-aided sound sweetener is an integrated time code-based audio editing and audio console automation system that controls up to six audiotape recorders and 15 additional sources. The system features a fader memory system and the CRT graphics show fader levels.
- The EDL Optimizer provides list cleaning, sorting, text editing and look back through multiple generations of EDL and auto assembly.

Circle (372) on Reply Card

Semi-automatic distortion meter

Leader Instruments has introduced the LDM-171 semi-automatic distortion meter. It features automatic nulling that eliminates manual tuning; S/N measurement; ac signal level measurement; high-pass filter; and monitor output terminals.

Circle (373) on Reply Card

Oscilloscopes and spectrum analyzers

Hewlett-Packard has introduced the following products:
•The HP8570A benchtop analyzer covers RF signals from 10MHz to 22GHz. It features built-in peak-search, and resolution bandwidth, video bandwidth and sweep time are adjusted automatically.
•The 8567A RF analyzer has a 10kHz to 1.5GHz range. An FFT function for close-in amplitude modulation and Gaussian noise power density are measured with built-in functions.
•The HP5180T/U and HP5183T/U digitizing oscilloscopes feature automatic test routines and provide digital waveform storage from which they can process waveform data to supply frequency, rms, volts, peak-to-peak, pulse and frequency spectra. They feature a 2,048 x 2,048 vector display.

Circle (374) on Reply Card

Studio monitors and amplifier

JBL has introduced the following products:
• A line of studio monitors deliver frequency response beyond 27kHz. The 2-way 4406 features a 170mm polypropylene woofer; the 2-way 4408 has a 200mm fiber cone woofer; the 3-way 4410 has a 125mm midrange transducer and a 250mm laminate construction woofer; the 3-way 4412 has a 300mm woofer and a 75mm diameter ribbon wire copper voice coil.
• The 6215 power amplifier features 35W into 8Ω, 45W into 4Ω and 90W into 8Ω, mono-bridge mode. It uses a low transient intermodulation design, is housed in a heavy-gauge steel chassis, and features complementary devices in all predriver, driver and output stages.

Circle (375) on Reply Card

Frame synchronizer, changeover system and test generator

Leitch Video has introduced the following products:
• The DFS-3000N is a compact NTSC digital frame synchronizer with noise immunity, RS-170A zero SCH output, RS-232C remote control ports, field or frame freeze, three switching modes, VIR corrector, auxiliary video input and four output system phase presets.
• The CDA-5500 automatic changeover system for the CSD-5300N master lock system driver monitors time code, impulse drive RS-232C outputs, and audible and visual alarm indicators.
• The TTG-2500N stand-alone digital test set generator contains an NTSC sync generator, produces 22 test signals, has sync, blanking, subcarrier and trigger outputs and an internal temperature-compensated crystal oscillator.

Circle (376) on Reply Card

Video triax connector

Lemo has introduced the 75Ω video triax connectors, which accommodate cable diameters from 8mm to 15mm. The connectors are self-latching with quick connect/disconnect gold-plated contact connectors.

Circle (377) on Reply Card

Color pattern generators

Video Aids of Colorado has announced the PG-2PC color pattern generator. It features full-field and split-field color bars, full-field blue gun, cross-hatch and blackburst.

Circle (378) on Reply Card

SCPC receiver and IF processor

AVCOM has introduced two products:
• The SCPC-2000 receiver with phase-locked microwave oscillator and multiplier system receives signals from satellites operating in the 3.7GHz to 4.2GHz band.
• The SCPC-500 IF processor block converts signals on

transponders 1-24 to an intermediate frequency of 50MHz to 550MHz. A microwave oscillator allows unattended reception over long periods of time without significant drift.

Circle (379) on Reply Card

Computer graphics system and paint package

Cubicomp has introduced enhancements for its PictureMaker system:

- Video image capture, video control and digital matting allow the system to act as a turnkey unit with live-action video and 3-D computer graphics.
- The PictureMaker/20 is designed for off-line video production and graphics. Enhancements include user interface features, cross-sectional modeling, curve smoothing and 20 new fonts.
- True Color Paint, a 16-bit true-color paint package, enables users to display 65,000 colors in a single image and uses a pop-up palette. Colors can be blended and images can be tinted and shaded.

Circle (380) on Reply Card

Noise reduction unit

Dolby Laboratories has introduced the model 390 C-type noise reduction unit, which provides noise reduction for the two tracks of ¾-inch videotape recorders. Features include electronically balanced concentric input/output level controls, S/N reduction of 20dB, and spectral skewing and anti-saturation techniques. Noise reduction identification has been added to the model 350 noise reduction unit. It responds to subaudio frequency carrier and an NRI tone is generated along with the program.

Circle (381) on Reply Card

Camera cover and battery pack

CVR Products has introduced two broadcast products:

- The Rain CVR video camera cover is made of lightweight, waterproof nylon. It is adjustable and provides access to camera controls.
- The BP90-type battery pack for the Sony BVW-3 Betacam works with 3.5Ah to 4Ah BP90-type batteries instead of the 1.5Ah NP1 batteries. It mounts in place of the tripod mount and mates to the tripod plate-locking system.

Circle (382) on Reply Card

Broadcast color monitor

Barco Industries has introduced the CVS, a professional broadcast color monitor that uses a microprocessor-based design and plug-in modularity. The monitor has a digital and an analog bus and four open slots for plug-in modules. Functions are controlled by touch-activated membrane switches on the front of the monitor. Any and/or all functions can be made available at a remote keyboard.

Circle (383) on Reply Card

Communication towers

Aluma Tower Company has introduced trailer-mounted communication towers. They are available with up to 100 feet height and can be provided with a manual crank mechanism or 12V winch operation. They come complete with 2-inch ball hitch, spring suspension and taillights.

Circle (384) on Reply Card

Automatic synthesizer

Orban has introduced the 275A automatic stereo synthesizer. The synthesizer is a stereo in/stereo out device, incorporating two methods of automatic recognition. Single-channel recognition looks for the absence of audio on one channel and will crossfade to synthesize stereo from the remaining channel. Mono-stereo recognition analyzes certain correlation characteristics of a 2-channel input to decide when to synthesize and automatically crossfades between synthesis or bypass.

Circle (385) on Reply Card

Telephone line enhancement

Gentner Engineering Company has introduced the Teleprocessor, which uses Aphex enhancing along with upper and lower band equalization adjustments to maximize telephone line quality. The unit works in conjunction with a telephone hybrid or frequency extension equipment. It also maintains average send audio down the telephone line.

Circle (386) on Reply Card

Zero loss video delay fills

Matthey has introduced its PC card that can be equipped with any amount of delay in the 10ns through 1,830ns range. A thick film video amplifier compensates for flat loss and provides 1Vp/p output signal. Five nanoseconds trim is front-panel adjustable.

Circle (387) on Reply Card

Stereo field-production mixer

Shure Brothers has announced the FP42 stereo mixer, designed for professional stereo remote broadcast and field production applications. The mixer provides users with two outputs and four inputs, all switchable for mic- or line-level operation. Each input channel includes a level control, center detented stereo pan-pot, and a pull-pot cuing feature.

Circle (388) on Reply Card

Wireless mic system

Cetec Vega has introduced the following products:

- The Pro 1-B professional wireless microphone that includes the T-37 bodypack transmitter and R-31A receiver.
- The Pro 1-H professional wireless microphone that features the T-36 handheld transmitter and the R-31A receiver.

Circle (389) on Reply Card

Ku-band satellite antenna

Nurad has developed a Ku-band satellite antenna for SNG operations. It is six feet wide and features an offset feed for low sidelobes and high directivity. The fiberglass reflector is honeycomb-reinforced to be lightweight and is painted with a silver coating for reflectivity.

Circle (390) on Reply Card

Phone remote audio mixer

Telfax Communications has introduced the TFX-131B phone remote unit, a miniature 4-channel audio mixer. It features built-in 2-way telephone circuitry and up to four mics, two high-level feeds and four headphones can be connected. Features include push-button dialing, built-in rechargeable Ni-cad battery pack, 1kHz test-tone oscillator and 6-pin accessory interface jack for external processors.

Circle (391) on Reply Card

Camcorder aluminum cases

RMS Electronics has introduced the VCM-1838 and VCM-1627 Camcorder aluminum cases. They will protect Camcorders, VHS and Beta video cameras and accessories. Each case comes with a padded handle and shoulder strap.

Circle (392) on Reply Card

Video interface and audio recorder

Mitsubishi has introduced the following products:

- An interface that allows communications to the intelligent digital faders from video editing systems. It contains protocol information that allows real time automation control of fader level and mute commands.
- The X-86 2-channel digital audio recorder comes in three versions. Features include 14-inch reels, razor blade and electronic editing, punch-in/out, 9.6kHz sync input, auto locator, RS-232C/422 communications port, and EBU interface.

Circle (393) on Reply Card

Video cart machine

BSI has announced its second generation DC-80 automatic video cart machine with software-based control, up to 24 transports, stereo audio, automatic cue recording, Q-Mod anti-head clogging system, 2-second preroll, CRT display, auto cue, hard-copy logging and auto eject. It provides CRT displays at the machine and at remote-control points.

Circle (394) on Reply Card

Heads and tripods

Innovative Television Equipment has introduced four fluid-type pan-and-tilt heads with companion tripods and accessories. The Cartoni-manufactured camera support equipment features lightweight and compact counter-balanced fluid-type heads with multistop drag controls.

Circle (395) on Reply Card

Portable distribution center

Union Connector has introduced the portable distribution center. The 100A single phase input supplies six 20A and one 60A breaker-protected circuits with indicator lights.

Circle (396) on Reply Card

Compact editing console

The Winsted Corporation has introduced a compact editing console for ½-inch and ¾-inch frontloading VCRs. The console is 28 inches deep and shelves adjust vertically.

Circle (397) on Reply Card

Delay systems

ART has introduced its PD3 professional delay system, a 16-bit linear device. It features 64kHz sampling rate; 20kHz bandwidth; 1 input, 3 outputs; barrier strip terminal and ¼-inch phone jacks; and separate recessed front-panel controls. Output delays are adjustable in 1ms to 225ms steps.

Circle (398) on Reply Card

B/W CCD camera

VSP Labs has announced the SC series solid-state cameras. The series uses a frame transfer CCD with 610x485 array size, has 500 TV line resolution and H and V drive sync.

Circle (399) on Reply Card

Remote automated machine network

Avtec Industries has introduced Ramnet, a remote automated machine network for video communications companies and multi-user training facilities which controls routing switchers and VCR functions through IBM PC computers and compatibles. The system automatically schedules and programs up to 255 VCR/VTR and routing switcher events for a full year from remote locations.

Circle (400) on Reply Card

Betacam videocassettes

Fuji Magnetic Products Division has announced the H321B Beta format ½-inch videocassette. Improvements include an increase of +1.0dB in the audio output and audio S/N, high video S/N, and an ABS-resin shell. Features include duroback coating and an anti-static leader.

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KUHT-TV MASTER CONTROL SWITCHER: KUHT-TV, Channel 8, a major market public television station and licensee of the UNIVERSITY OF HOUSTON, needs two master control switcher/tape/transmitter operators. Applicants should have appropriate FCC license and at least two years experience in a similar position. KUHT is equipped with state-of-the-art equipment and broadcasts a full daily schedule at maximum power with many programs in MTS stereo. A degree or associate degree in electronics a plus. Please send resume to: KUHT-T, 4513 Cullen Boulevard, Houston, Tx. 77004. Attention: Mr. Al Leverick, Chief Engineer. E.O.E. 7-86-1t

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Please send a copy of your resume to:

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J. Hodge, Personnel Manager
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645 Bryant Street
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(415) 957-1063

TELEVISION/ SATELLITE ENGINEER

Voluntary Hospitals of America, Inc. (VHA), a progressive national health care service organization, is rapidly expanding. We are seeking a Television/Satellite Engineer to assist the Manager of Technical Operations in the operation of the VHA Satellite Network, which will include the planning, operation and maintenance of all reception and broadcast equipment for the Corporate organization and member organizations.

Qualified candidates will possess the following:

- Minimum of 2 years of college education or equivalent technical education
- First Class or General FCC license preferred
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- Satellite systems experience preferred
- Excellent communication and interpersonal skills required
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WPAT JOB OPPORTUNITY—WPAT HAS AN OPENING FOR THE FOLLOWING POSITION: Technical Supervisor. New York station has opening for highly qualified technical supervisor. Maintenance experience required for all phases of broadcasting. Contact Kenneth Stout, WPAT AM/FM, 1396 Broad Street, Clifton, New Jersey, 07013. 201-345-9300. **AN EQUAL OPPORTUNITY EMPLOYER.** 7-86-1t

KOVR-TV, SACRAMENTO, is looking for a dynamic self-starter to act as our primary ENG Maintenance Engineer. Must be familiar with ENG cameras and Sony ¾" VTRS and be able to work well with a competitive news department in the 20th market. SBE certification a plus. Contact Bob Hess, 916-927-1313 or direct correspondence to C/E, KOVR-TV, 1216 Arden Way, Sacramento, CA 95815. EEO M/F. 6-86-2t

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. 6-86-2t

TV MAINTENANCE ENGINEER: The Christian Broadcasting Network, Inc. has an immediate opening for a TV Maintenance Engineer for their Middle East TV Station. The qualified candidate should have 3-5 years solid TV engineering experience using studio and field transmitter equipment, FCC commercial radio/telephone license or Certified Electronic Technician Certificate required. Must have demonstrated problem-solving skills in electronic field engineering. If you feel this opportunity is part of God's plan for you, forward your letter of introduction, resume and salary history, in confidence, to: The Christian Broadcasting Network, Inc., Employment Department—Box ME, CBN Center, Virginia Beach, VA 23463. 7-86-1t

MAINTENANCE ENGINEEER: Leading television production/post production facility in San Francisco seeks experienced maintenance engineer with strong Broadcast maintenance background. Experience on GVG 300, Quantel paintbox, Quantel Encore, Ampex ADO, Sony BVE 5000 preferred. Good starting salary, medical, dental. Resumes only to Ed Granlund, C.E., Varitel Video, 350 Townsend St., #250, San Francisco, CA 94107. 7-86-1t

REMOTE ENGINEER—Opening for highly motivated individual with desire to travel. Six years experience in television engineering capable of making component level repairs. Client relations very important. Systems designs helpful. State of the art equipment used on entertainment and sporting events, coast to coast. Grass Valley, Ampex, Sony, Ikegami, Chyron, Abekas and Quantel. Competitive salary and benefits. Relocation required. Serious applicants only. Dept. 668, Broadcast Engineering, P.O. Box 12901, Overland Park, KS 66212. 7-86-1t

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