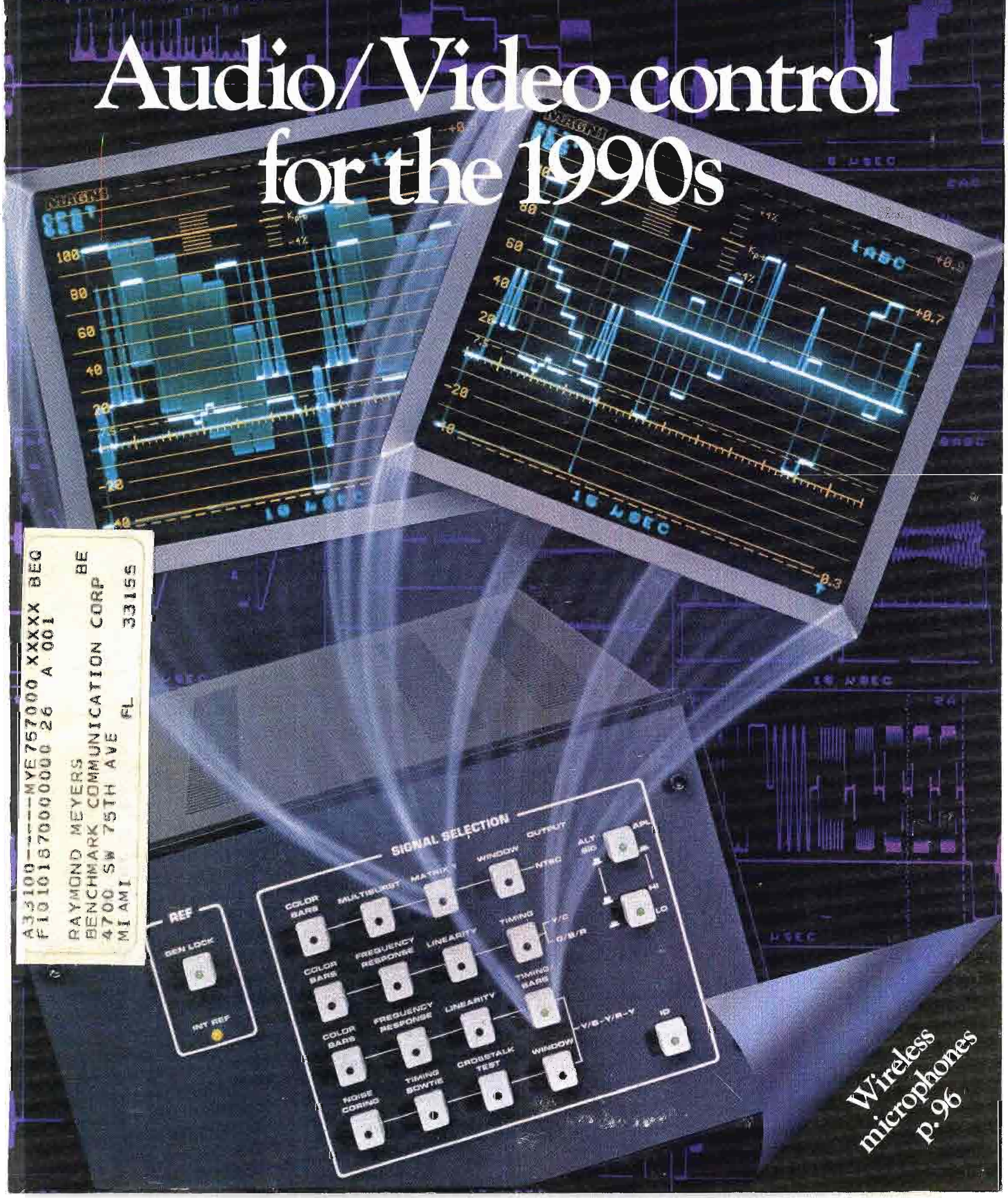
BROADCAST engineering

AN INTERTEC PUBLICATION
September 1987/$3.00

Audio/Video control for the 1990s



Wireless microphones p.96

ADM . . .
THE STANDARD FOR QUALITY

ADM S/TV . . .
THE STANDARD FOR VALUE

New features make the S/TV even more flexible

Flexibility is the key word in the S/TV. Flexibility in design, flexibility in features, flexibility in operation. The S/TV can be built to match your needs and your budget. You can have a desk top or floor stand mainframe. 16 to 32 inputs, any combination of mono mic or stereo line modules, in-line equalization or preselection, 2 simultaneous telephone callers on air with mix-minus functions, two studio operation, and in addition, the S/TV is interfaceable to many of today's most popular editors.

The S/TV now gives the smaller TV station the opportunity to acquire ADM quality, reliability and performance at a price that is gentle on your budget.

For full details, call or write your ADM representative or call ADM direct at 313-524-2100

Circle (1) on Reply Card

ADM® *The Audio Company*

ADM Technology, Inc.
1626 E. Big Beaver Road, Troy, Michigan 48084
Phone: (313) 524-2100 • TLX 23-1114

Performance and Portability

The S-1 Flyaway – Another Midwest Innovation

It's the world's first hi-performance, truly portable Ku-band satellite uplink. Each of the 13 A.T.A. approved cases weighs less than 100 pounds, and the complete system conforms to international baggage regulations. Checked as excess baggage, the S-1 arrives when you arrive. Economically.

The system utilizes a Vertex 1.8M offset-fed antenna with a transmit gain of 46.6 dbi. This precision, aluminum surfaced reflector antenna meets the $29\text{-}25 \log \Theta$ FCC 2° spacing curves.

Two STS phase combined power amplifiers provide fail-safe redundancy and plenty of reserve power. And an Intelsat-approved exciter with half and full transponder transmit capabilities allows you to operate on any available satellite system. The S-1 can be set up fast, on-line in less than 30 minutes. And the S-1's modular electronics make system repair or replacement in the field easy.

Video and audio control and monitoring equipment are included in the standard S-1 package. Options include a 2-way communications channel, and an international receive configuration is available. The S-1 is also easily adaptable for data transmission. Contact Midwest for complete information.

The S-1 Flyaway from Midwest.

Built to perform. Packaged to go . . . anywhere.

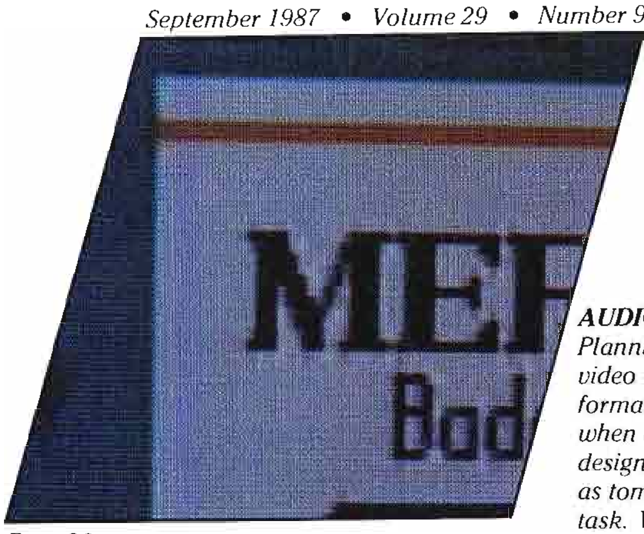
MIDWEST
Communications Corp.

One Sperti Drive
Edgewood, KY 41017
606-331-8990

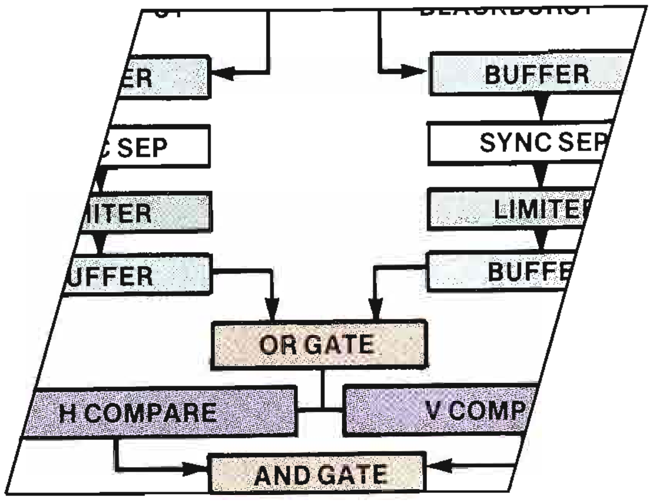
Circle (4) on Reply Card

Contents

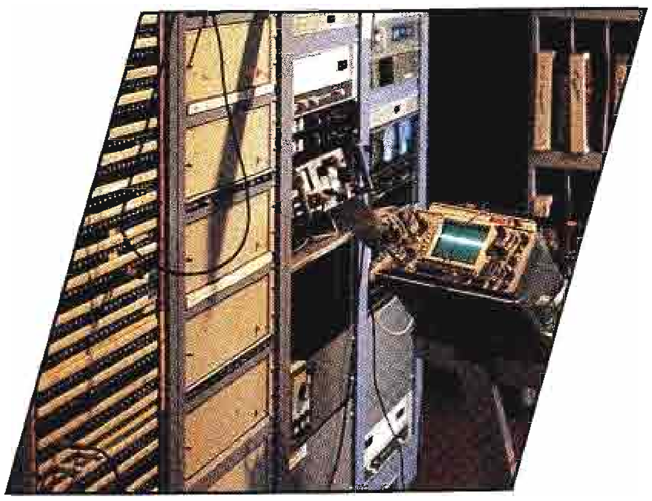
September 1987 • Volume 29 • Number 9



Page 26



Page 52



Page 73

BROADCAST engineering

AUDIO-VIDEO UPDATE:

Planning for the future has never been more difficult. The audio-video equipment used today is capable of not only high performance, but also long life. This is one of the problems faced when designing new facilities. When planning for the 1990s, the design engineer must accommodate today's standards as well as tomorrow's possibilities. The planning process is not an easy task. What can an engineer do to help ensure that new facility designs provide room for growth and advancing technology? A return to the basics is a good first step. Careful attention to seemingly minor details can often make the difference. In this issue, we will examine some of the details that are important to a successful facility design.

OTHER FEATURES:

ON THE COVER

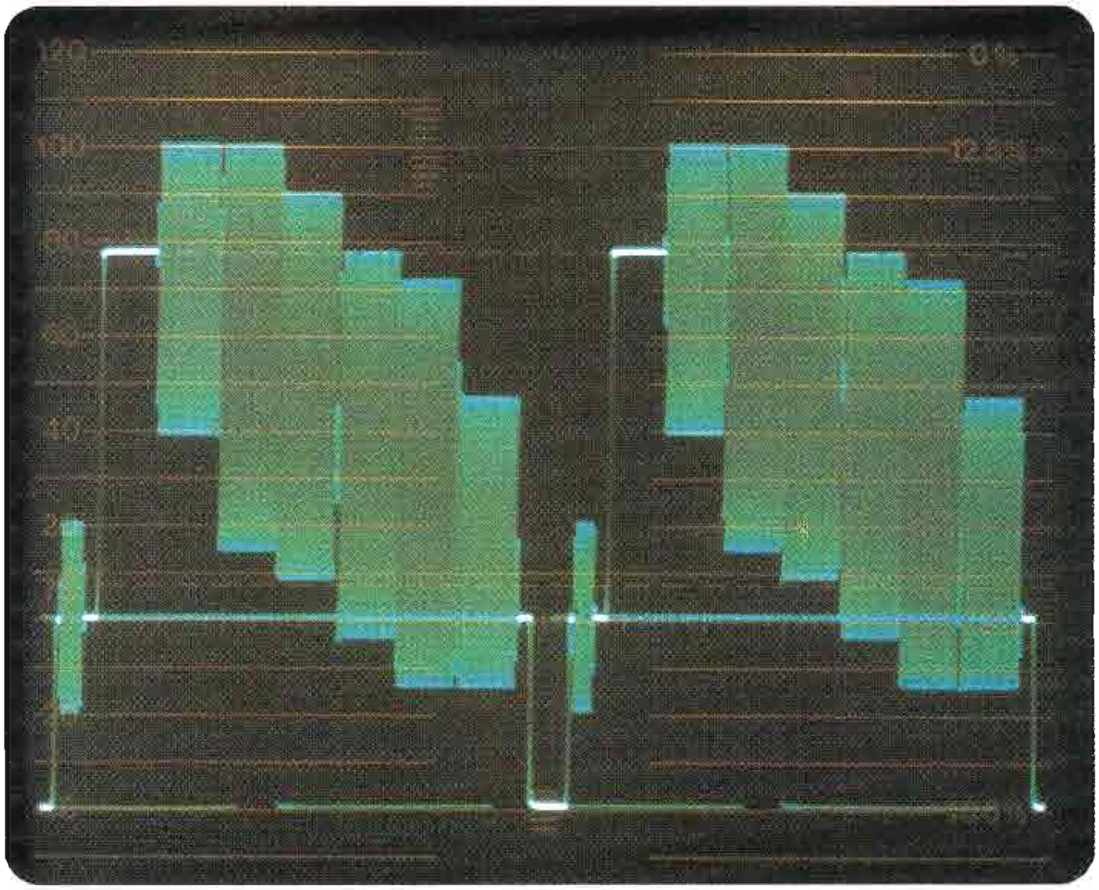
Today's audio and video control equipment offers more operational flexibility and better performance than ever before. Using the many available features effectively, however, requires careful planning by the design engineer. This month, our cover illustrates typical waveforms that might be measured when documenting the performance of a new installation. (Cover photo courtesy of Magni Systems.)

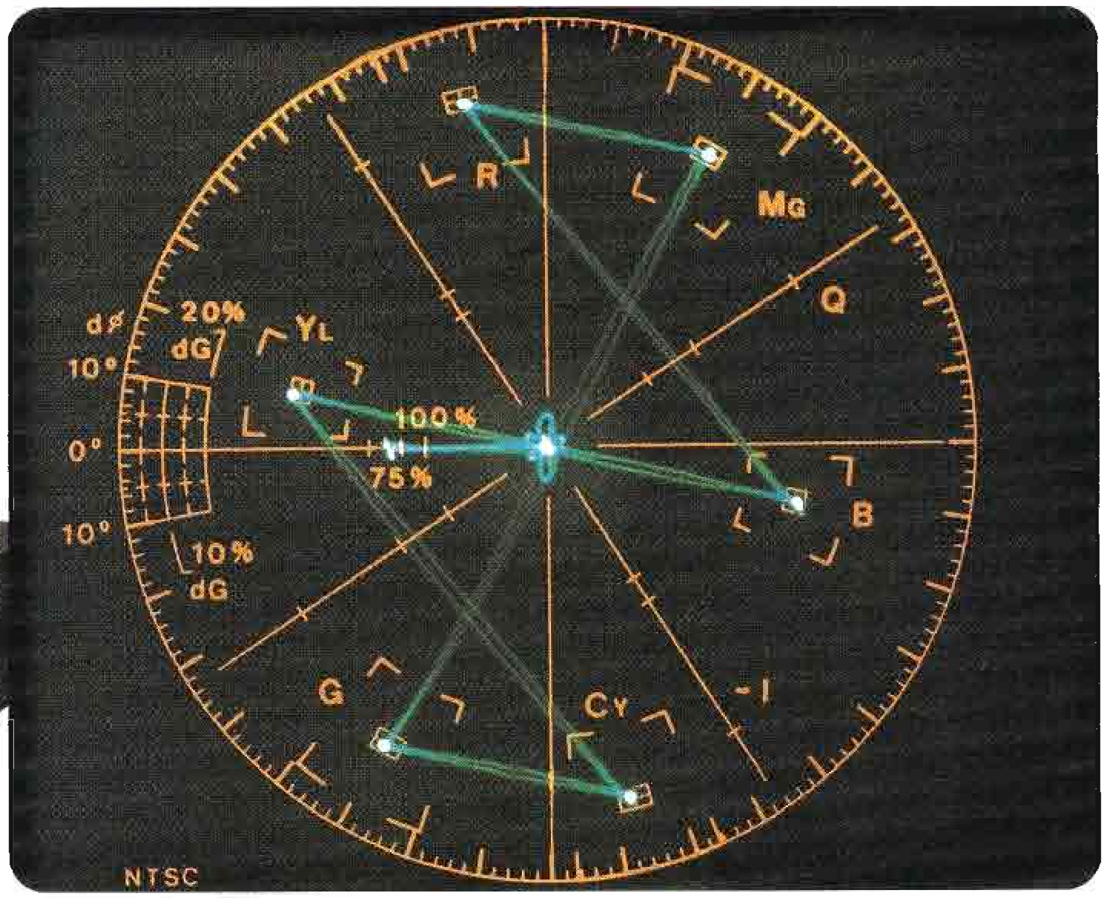
DEPARTMENTS

ONLY HITACHI

Hitachi waveform monitors and vectorscopes get a great reception from broadcast professionals.

Both screens
shown actual size.





Because *they* get...
...6″ rectangular CRTs with internal graticule in both Waveform Monitor V-079 and Vectorscope V-069.

With our Waveform Monitor *they* get...
...lines 9 through 22 of field 1 or 2, for observation of VIR, VIT and Teletext signals...guaranteed flat response: ±1% over 25Hz-3.6MHz range, and +1%/−2% over the 3.6-6MHz range ...frequency response selection: FLAT, IRE, CHROMA, DIFF GAIN... horizontal axis sweep selection: 2V, 2V MAG, 2H, or 1μsec/div...RGB display, YRGB optional...DC restore ...fine adjustment of horizontal-axis position.

And with our Vectorscope *they* get...
...±1° vector phase accuracy...two loop-thru inputs and a loop-thru external sync input...independent selection of chrominance and sync signals...vector measurement of input A sub-carrier...calibration of input sensitivity to 1V full scale or 75% or 100% saturation, variably controllable 0.5-5 times...non-synced circle, for self-check of gain balance and quadrature phase...differential gain and phase measurements.

For more information call 516-921-7200. Or write Hitachi Denshi America, Ltd., 175 Crossways Park West, Woodbury, NY 11797.

In Canada: Hitachi Denshi, Ltd., 65 Melford Dr., Scarborough, Ontario M1B2G6. Tel: 416-299-5900.

HITACHI

Hitachi Waveform Monitor V-079 & Vectorscope V-069
(Also available: Models V-099 & V-089)

Circle (5) on Reply Card

Euro-MAC completes satellite TV design

A European consortium formed by Logica, Fuba, ITT Intermetall, Salora-Luxor, Philips and Thomson has completed its specification for Euro-MAC, a pan-European satellite broadcast TV system.

The consortium was formed last year with the intention of developing a system that would resolve the current debate over variants of the MAC TV standard, which has threatened the success of satellite broadcasting.

Key aspects of the design include the fast delivery of descrambling messages to pay-TV receivers, and the provision of high-quality multilingual broadcasting, which allows the viewer to select the appropriate language. The system could be used for satellite broadcasting with or without controlled access to pay TV, and in the future, could be implemented in home video recorders. The design also makes allowances for future applications such as wide-screen displays and high-definition television.

The system will be able to provide individually controlled access to the 150 million potential viewers of European television. It will exploit the new MAC technology for television using Euro-MAC, a derivative of the European Broadcasting Union's MAC/Packet family of systems.

The role of the London-leased Logica company will be to supply audience management systems, while Fuba will supply the encoders. These elements will make up the complete transmission system. ITT Intermetall will supply integrated circuits for decoders. Philips, Thomson and Salora will manufacture set-top decoders and fully integrated satellite TV receivers. The system will be marketed jointly by all the members of the consortium, but its specification will be made public so that all manufacturers can participate.

The aim of the Euro-MAC consortium is to create a unified European satellite TV transmission and scrambling system so that consumers need to purchase only one receiver and access system in order to view the satellite program of their choice. Program providers will, therefore, share the cost of the development of a single system that will give access to all of their programs.

AES announces session titles

Schedule and session titles for the technical papers sessions have been announced for the 83rd Audio Engineering Society Convention scheduled for Oct. 16-19 at the New York Hilton Hotel and the New York Sheraton Centre. The technical papers sessions will include nine sessions plus four special papers sessions. The technical papers will be presented in two evening sessions (Friday, Oct. 16 and Saturday, Oct. 17). Morning

Continued on page 134

BROADCAST engineering

Editorial and advertising correspondence should be addressed to: P.O. Box 12901, Overland Park, KS 66212-9981 (a suburb of Kansas City, MO); (913) 888-4664. Telex: 42-4156 Intertec OLPK. Circulation correspondence should be sent to the above address, under P.O. Box 12937. RAPIDFAX: 913-888-7243.

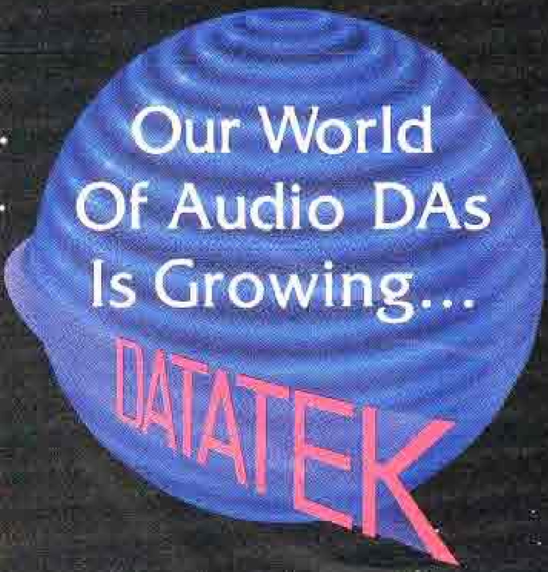
SUBSCRIPTIONS: BROADCAST ENGINEERING is mailed free to qualified persons within the United States and Canada in occupations described here. Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $25.00. Qualified and non-qualified persons in all other countries; one year, $30.00 (surface mail); $108.00 (air mail). Back issue rates, $5, except for the Buyers' Guide/Spec. Book, which is $20. Rates include postage. Adjustments necessitated by subscription termination at single copy rate. Allow 6-8 weeks for new subscriptions or for change of address. Second class postage paid at Shawnee Mission, KS.

BROADCAST ENGINEERING Volume 29, No. 8 (USPS 338-130) is published monthly (except in the fall, when two issues are published) by Intertec Publishing Corporation, 9221 Quivira Road, P.O. Box 12901, Overland Park, KS 66212. Second class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to BROADCAST ENGINEERING, P.O. Box 12983, Overland Park, KS 66212.

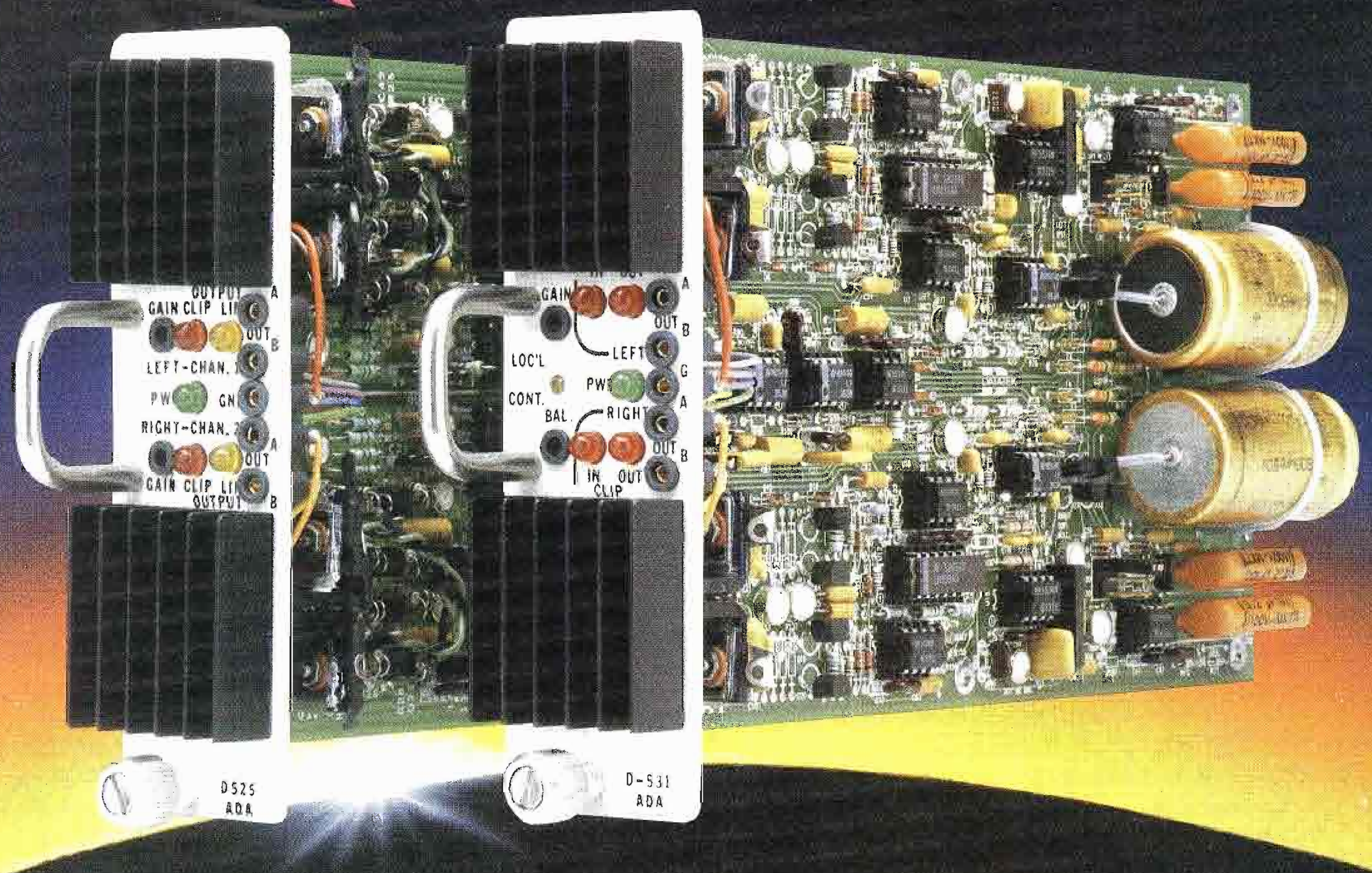
ISSN 0007 1794 $2.00 + $0.00.

Advertising offices listed on page 147.

INTERTEC PUBLISHING CORPORATION



Now TWO Stereo Audio DAs Available From Datatek!



D-525 DUAL CHANNEL/STEREO AUDIO DA

- Two isolated channels for use in stereo or dual distribution amplifier applications
- Used for one stereo input and 6 balanced stereo outputs, one monaural input with 12 outputs, or 2 monaural inputs with 6 balanced outputs each
- 0.05% max. distortion at +27 dBm

D-531 STEREO AUDIO DA WITH REMOTE GAIN

- Local and/or remote control of gain and balance, with accurate tracking over the gain range
- Six balanced stereo outputs with 0.05% max. distortion at +27 dBm
- Two balanced mono sum (L+R) outputs at up to +28BV available simultaneously with stereo outputs

For a descriptive brochure and further information call or write:

DATATEK CORP.

1121 Bristol Road, Mountainside, N.J. 07092 • 1-800-882-9100 • 201-654-8100 • TELEX 833-541

Circle (6) on Reply Card

Catch 22

If you were going to expand a shopping mall, you would first have to plan carefully so that new merchants and more cars and customers could be accommodated. You would also have to meet other basic requirements before you could even break ground. You might think the same principles of advance planning would hold true for the FCC when it expanded the uses for a section of spectrum. Not so.

When the commission spawned low-power television, AM stereo, C-band and Ku-band satellite services, and made other Part 73 broadcast industry changes, it greatly underestimated the need for Part 74 support frequencies.

It's almost as if there is a Part 74 Catch-22 of the commission's rules that works counter to reason, common sense and the laws of physics.

It isn't difficult to identify some of the problems in the Part 74 service. You need only to look at the congestion being faced by TV ENG dispatch and aural programming services. Broadcasters often face receiver desensitization and spurious products generated by land-mobile transmitters operating in the 451MHz to 455MHz band. Even the best receivers have a difficult time providing defenses against harmonics and broadband noise generated by these multiple dispatch and paging transmitters, which may be operating less than 1MHz away. This is another example of the Catch-22 principle.

Users of Part 74's visual services also are not without their Catch-22 frustrations. TV ENG has only seven principle channels. The other three are shared with oil companies, public safety organizations, common carriers and microwave ovens. To make things worse, half of channel A9 and all of channel A10 will be taken away once the new satellite system for terrestrial navigation (Geostar) is launched. In most cases, congestion and interference are a matter of course. It doesn't take a genius to understand that TV ENG frequency congestion has reached critical mass. Catch-22 rides again.

Radio stations face similar problems. Many AM stations are looking for STL links, which provide stereo capability and reduce the dependence (and cost) of using telephone lines. The commission did increase the number of usable 950MHz channels. However, at the same time, the commission required many long-time holders of STL frequencies to vacate certain STL frequencies, which were then allocated to other uses—Catch-22.

The SBE has been attempting patiently to point out some of the logical and technical flaws in the spectrum allocation procedures being carried out by the commission. It also has proposed some viable solutions.

The society also is cooperating with the NAB and other industry entities to make it easier for licensees to work with local coordinating committees. Some way must be found for the commission to recognize the volunteer coordination effort, which the commission says cannot be recognized formally.

If all else fails, maybe a formula can be developed that will redistribute the spectral wealth more fairly. Consider the following formula:

$$N/F = NWV$$

Let N equal the number of end-users of the spectrum in question per week. Let F equal the bandwidth in MHz. *NWV* is the net weekly value of the spectrum in question. For broadcasters, we will use the yardstick of CUME numbers for N. For a land-mobile user with one 25kHz channel and 100 trucks in a dispatch system, the formula yields an NWV of 100 / 0.025, or 4,000.

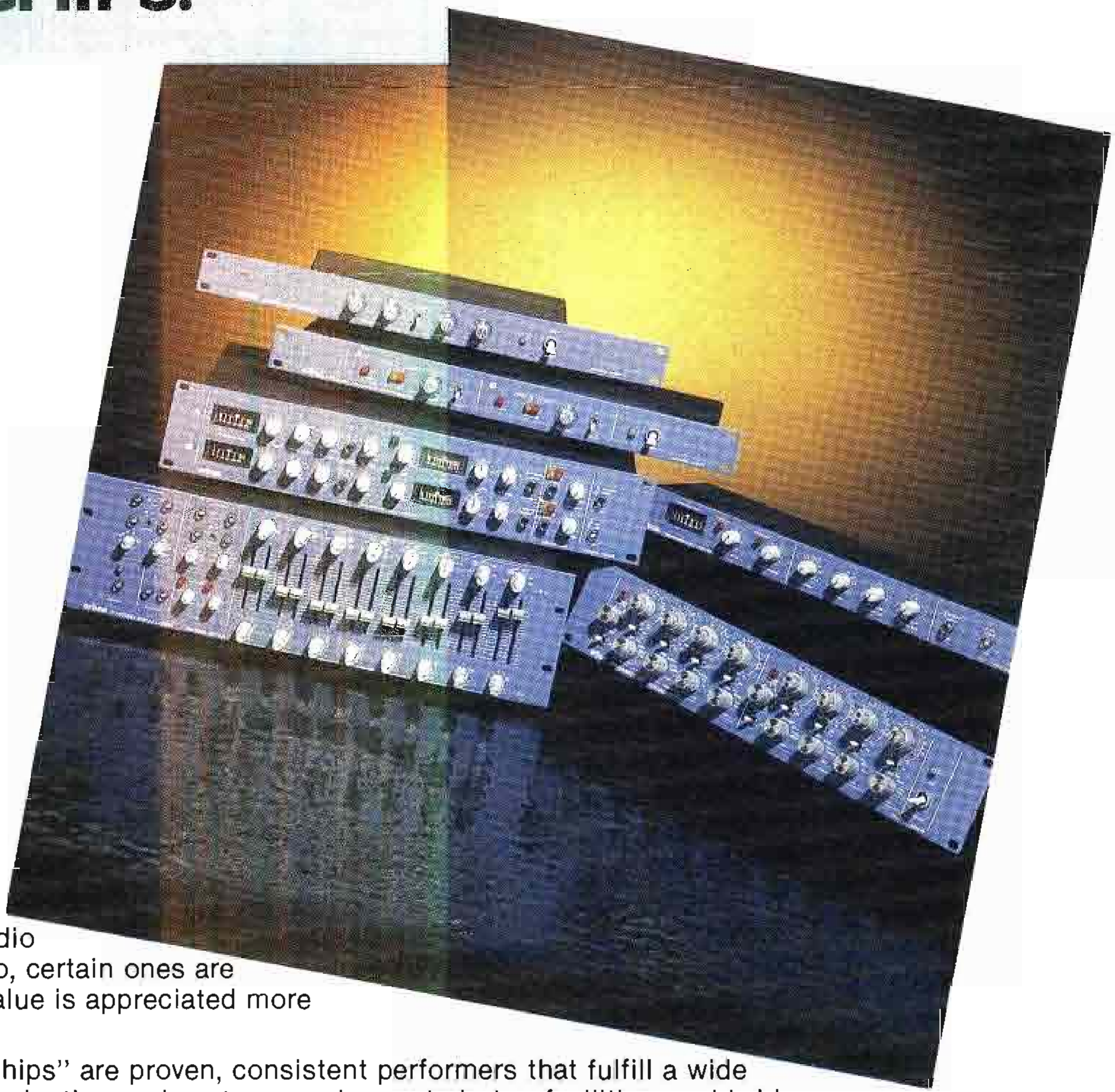
A broadcaster with a 100,000 CUME using a 375kHz channel for high-quality remote pickup would have an NWV of 100,000 / 0.375, or 26,666—a 6.66:1 ratio in the broadcaster's favor.

The land mobile industry may not take kindly to my solution, but the formula does point out how the use of just one criterion can swing an argument away from reason and physics into the land of Catch-22.

Oh, yes. Reread Joseph Heller's classic, *Catch-22*, and the FCC's Part 74. See if you can find a similarity in themes.

This editorial was prepared by Richard Rudman, chief engineer for KFWB-AM, Los Angeles, and president of the Society of Broadcast Engineers.

THE BLUE CHIPS.



While trendy audio products come and go, certain ones are timeless. Their true value is appreciated more year after year.

Orban's "Blue Chips" are proven, consistent performers that fulfill a wide variety of essential production and system requirements in top facilities worldwide .

622B Parametric Equalizer: The standard by which all others are judged. Sonically and musically pleasing. Can be used as combination 4-band EQ and notch filter. A real job saver.

672A/674A Graphic Parametric Equalizers "The Paracrossalizer": Combines eight bands of parametric EQ with tunable high and lowpass filters. A uniquely versatile production tool. Also quickly becoming the smart choice for room and system tuning because it eliminates ringing and phase shift problems. Can be used as full electronic crossover plus EQ in one cost-effective package.

536A Dynamic Sibilance Controller: Around the world, Orban de-essers are the salvation of vocal sessions. Quick set up and easy operation.

422A/424A Gated Compressor/Limiter/De-Esser "The Studio Optimod": The most flexible, cost-effective level control system available. Orban compressors are known and appreciated for their smoothness. No pumping, no breathing; they work for you, not against you in tough applications.

412A/414A Compressor/Limiter: Transparent level control delivers the punch without the bruise. Very cost-effective. Ideal for installations and reinforcement work.

245F Stereo Synthesizer: Magical stereo effects from mono synths, drum machines, or any mono source. Perfect for extending capability of smaller format multi-track systems—the 5th, 9th, 17th, or 25th track. Inexpensive.

Orban also manufactures the reliable 111B Dual Spring Reverb as well as attractive acrylic security covers which fit all standard 19" rack mount products.

Orban Associates Inc.
645 Bryant St. San Francisco, CA 94107
(415) 957-1067 Telex: 17-1480

Circle (7) on Reply Card

Status of ATV systems is reviewed

By Harry C. Martin

The FCC has issued a Notice of Inquiry to determine the status of advanced TV systems (ATV), which include high-definition television, and the role the commission should take in their growth. The key issues to be addressed include: whether ATV systems will require additional spectrum; where the spectrum will come from; and whether current technical standards for television should be revised or replaced.

At the outset, the commission noted that the new technologies involved are in various stages of planning and development. They differ in the amount of spectrum they require and in their transmission and reception methods. Therefore, the commission wants to develop a broad, detailed record concerning the emergence and current status of ATV systems.

The commission predicted that the additional spectrum necessary for ATV systems would come from vacant UHF or VHF TV allotments or from microwave allotments. The commission also suggested that "UHF taboos," restrictions that require large separations between UHF channel assignments, be relaxed in order to free bandwidths for ATV use.

A further concern of the commission is the potential conflict in the compatibility of any new ATV system with the existing TV technical standard developed by the National Television Systems Committee (NTSC color TV standard). The commission asked for comments in two related areas: the transition from NTSC to ATV transmission standards, specifically regarding the costs and availability of converters capable of decoding and displaying an ATV signal on NTSC receivers; and the feasibility of making the NTSC standard voluntary in order to remove constraints on the development and implementation of ATV systems.

The commission also asked for comments and suggestions on other ATV-related topics, including: off-air terrestrial advanced television; the extent to which new technologies can be used by other media; allocation and technical issues; economic, legal and regulatory issues; a general timetable for implementation; and the public interest implications.

In connection with this inquiry, the commission has placed a temporary freeze on new TV allotments and applications in the top 30 markets. The freeze does not affect existing applications, however.

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

Review of AM assignment criteria

As an outgrowth of the FCC Mass Media Bureau's 1986 report on the status of its AM broadcasting rules, the commission is initiating a comprehensive review of its technical principles related to AM broadcast assignment criteria. The 1986 report recommended the elimination of outdated licensing and regulatory constraints, thereby giving AM broadcasters greater ability to respond to market demands.

The current technical assignment rules prescribe the degree of interference protection provided to AM stations; establish the service areas that AM stations are entitled to under their particular circumstances; and establish the standards and procedures for applying the technical assignment principles. In its new proceeding, the commission will review several areas relating to the rules, primarily: 1) the field strength values of station contours; 2) the radiated emissions of AM stations; 3) skywave propagation curves; 4) groundwave propagation; 5) interference calculation methodologies; and 6) development and identification of antenna systems, which could provide greater flexibility to overcome antenna-site restrictions, skywave interference and other problems.

According to the commission, AM service to the public could be enhanced in several respects. However, many of the necessary changes would result in trade-offs between signal quality and extent of service. The commission warned that, in view of the current congestion in the AM band, AM stations will remain locked into their current quality of service if such trade-offs are not accepted.

Further areas of exploration by the commission include possible exceptions to the rigid application of technical assignment principles to provide greater flexibility in making new or modified assignments. Among the issues to be resolved is whether to remove the restriction that bans applications for facilities that would receive interference, thereby permitting many stations to improve service while protecting other stations. The commission also plans to decide whether to allow AM broadcasters to accept prohibited interference through private agreements.

FM and TV booster use expanded

In mid-July, the commission adopted new rules, expanding the authority of FM and TV broadcasters to use "booster" stations. Boosters are on-frequency auxiliaries used to reach shadowed portions of a station's predicted service area.

Under the new rules, FM boosters can operate with an ERP of up to 20% of the maximum ERP permitted for the class of primary station they rebroadcast. However, FM booster stations are still prohibited from extending their service contours beyond the predicted contours of their primary stations. In addition, the technical standards included in the new rules ensure that high-powered boosters will not interfere with co-channel or adjacent channel stations.

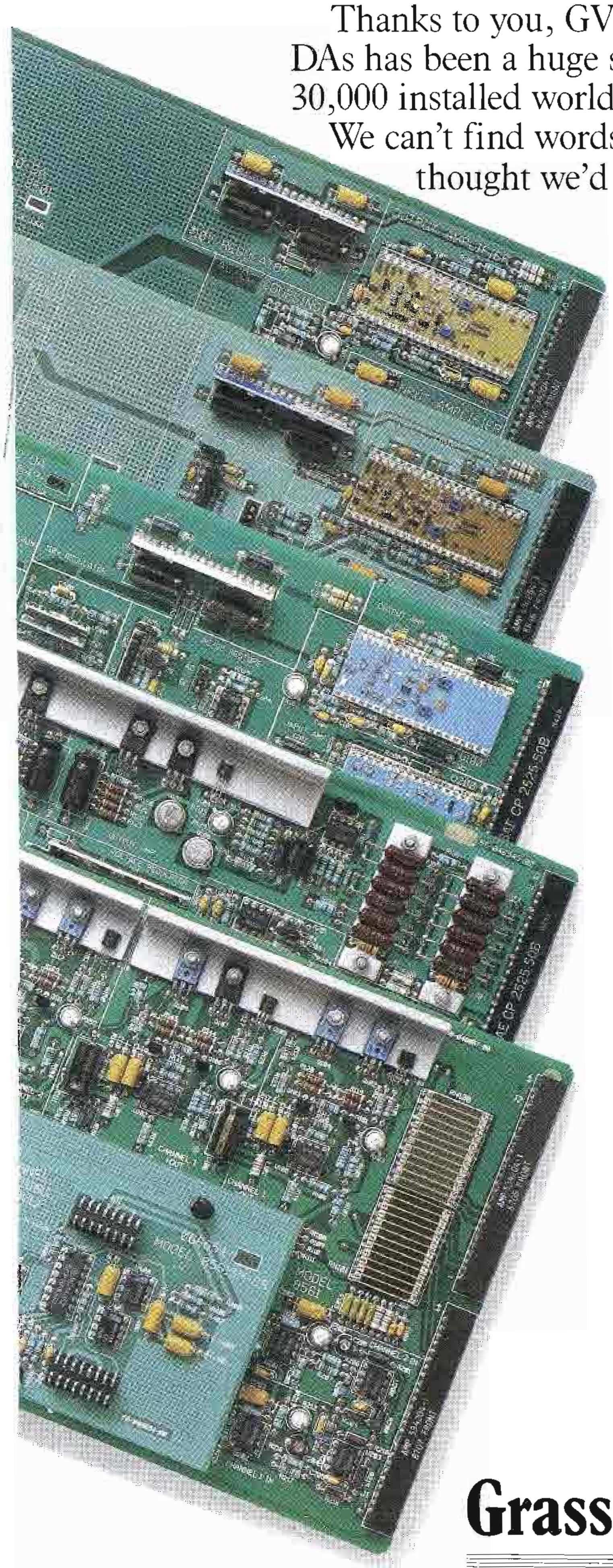
The commission also has authorized FM licensees to feed their primary stations' signals to boosters by any technical means they choose, including aural auxiliary channels (intercity relay stations) or through other microwave or common-carrier services.

Finally, the new rules establish a TV booster service to allow full-service stations to fill in shadowed areas within their Grade B contours. TV booster facilities will be subject to the same technical regulations as are TV translators and low-power TV stations, but will be authorized only to licensees of the primary stations being rebroadcast. Although authorizations generally will be issued on a noncompetitive basis, if a TV booster application is found to be mutually exclusive with a low-power TV or TV translator application, the booster application will be included in the relevant LPTV lottery.

Now you'll pay even less for a GVG DA.

Thanks to you, GVG's family of high performance DAs has been a huge success. So far, there are over 30,000 installed world-wide.

We can't find words to express our gratitude, so we thought we'd use numbers, instead:



8501 Video DA
~~$175~~ old price — $160 new price

8502 Equalizing DA
~~$285~~ old price — $260 new price

8503 Precision DA
~~$395~~ old price — $375 new price

8551 Audio DA
~~$275~~ old price — $250 new price

8561 Stereo DA
~~$525~~ old price — $495 new price

Grass Valley Group DAs make extensive use of advanced hybrid circuit technology. And now, feature an all-time high performance-to-price ratio.

Grass Valley Group®

STRENGTH YOU CAN RELY ON

THE GRASS VALLEY GROUP, INC.® — P.O. Box 1114 — Grass Valley, CA 95945 USA — Telephone (916) 478-3000 — TRT: 160432
OFFICES: New York (201) 845-7988; District of Columbia (301) 622-6313; Atlanta (404) 493-1255; Chicago (219) 264-0931;
Minneapolis (612) 483-2594; Dallas/Fort Worth (817) 483-7447; Los Angeles (818) 999-2303; San Francisco (415) 968-6680 *A TEKTRONIX COMPANY*

Circle (8) on Reply Card

Adding local color

By Carl Bentz, technical and special projects editor

No matter how exciting the host and the guests might be, a studio-based variety or talk show needs visually attractive elements. If properly chosen, the elements can be restful to studio and home viewers, because they offer a break from the monotony of the studio walls. Visual elements may play a part in the show as well, either by adding a different color to the setting or by bringing into the studio something that coincides with the program.

In news presentations, chroma-key screens are used to bring action into a "talking heads" situation. It would be possible just to go to tape, but not every taped segment is self-explanatory. Chroma-key screens often work better if the news talent appears in the picture with the action as a backdrop.

Although chroma-key is an effective short-term technique, it needs some special considerations in order to work well. For a long-term presentation, chroma-key screens might be nice for home viewers, but for those people in the studio, the blank blue walls quickly could become tedious and nerve-wracking.

Variety or talk shows, such as "The Tonight Show" or "Donahue," can be moved out of the studio, but it takes a good deal of effort, and the result is often unsatisfactory. Too many production factors must be considered in order for a show to go remote. Program sound, correct lighting for the video, extraneous noise and many other elements will offset whatever advantages might be gained by having a local landmark for the background.

A possible solution for backdrops is a simple technique called backlighting. Several methods can be used for this approach. A back-screen projection can provide an effective backdrop, but the lighting should be planned carefully to avoid flooding the screen from the front and to avoid silhouettes on the backlit screen.

Another method would be to have large transparencies made of appropriate scenery or subjects. Lighting a transparency from close range requires a flat field of light with the source effectively shielded. Otherwise, hot spots may ruin the effect.

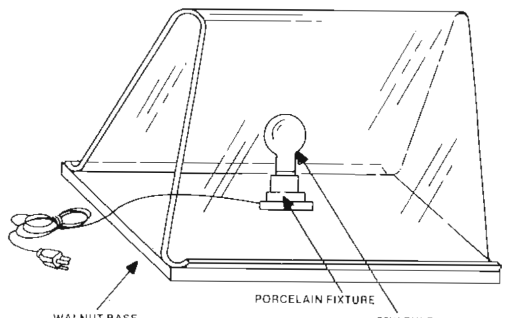


Figure 1. *In its simplest form, backlighting requires an image wrapped around a light source. Here, the image would be attached to the outside of the plexiglass angle.*

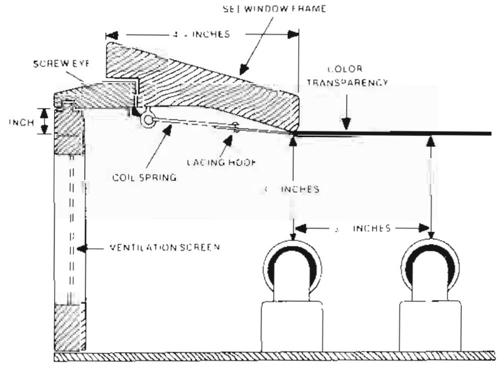


Figure 2. *For large expanses of backlit translucent material, tension should be placed around the edges of the material. Fluorescent tubes can provide an effective light source.*

When KGO-TV had a set designed for the AM San Francisco show, the slide concept came into play. The station created three 6′ x9′ translucencies from original 2¼"x2¼" slides of San Francisco Bay. The translucencies are placed in the set windows in front of relatively shallow light boxes, which produce a life-like view for the audience.

One slight problem still remains. The angle of the lighting in the image remains fixed. Even to the casual viewer, it is obvious that the windows contain only pictures, but the view is nice.

The set window backgrounds for the KGO-TV program use Kodak Duratrans material, which was prepared by Color 2000, a commercial photo lab in San Francisco.

Acknowledgment: Photos and drawings are courtesy of KGO-TV, San Francisco and Eastman Kodak.

The mic mixer you would have designed yourself–The Shure M267.

In the space of just two years, the Shure M267 has become one of the most well-known and widely used mixers in the broadcast industry. One look at it will tell you why.

The M267 gives you the improvements you've told us were most important. Every channel has a mic line level switch for maximum flexibility. There's also a built-in limiter to keep the M267 from overloading at critical moments. The unit contains a built-in battery pack that utilizes three standard 9-volt batteries. Simplex (phantom) power and a peak LED are standard, too.

The M267 oscillator provides a clean 1 kHz tone, and is located on the front of the unit for simple access. The headphone output is also on the front and includes a level control. IC design, along with active gain controls, provides greater headroom and quieter operation.

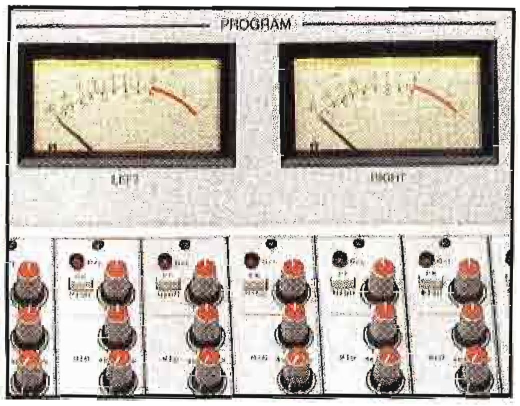
For location work or even studio post-production, the M267 carries on Shure's reputation for reliability and ruggedness.

For more information on Shure's complete line of mixers, call or write Shure Brothers, Inc., 222 Hartrey Avenue, Evanston, IL 60202, (312) 866-2553.

SHURE®

BREAKING SOUND BARRIERS

Circle (9) on Reply Card



Prewinter antenna maintenance

By John Battison, P.E.

Last month's column began a discussion on basic AM antenna maintenance. To continue on this theme, we will look at the above ground items of an AM antenna that need to be checked before winter.

Maintaining proper records

Engineers often make the mistake of not realizing the importance of good record keeping until after something breaks. When a coil or capacitor fails in an antenna-tuning unit (ATU) is not the time to find that you don't know its value. The best time to document a system's performance is when everything is properly working.

Begin by looking at the schematic drawing of the antenna system. Is it still correct? Or, as is sometimes the case, have undocumented changes been made? You may know your system like the back of your hand. But, what if you go on vacation or are sick and someone else has to perform emergency maintenance on your system? Will that 20-year-old drawing be available—and up to date?

If necessary, make a new schematic, and label all important components. It may not be necessary to draw a schematic for factory-assembled units, such as the phaser, but it often helps. Drawings for these devices are usually correct, unless major system changes were made after installation.

Tower-base matching units (ATUs) may not be properly documented. It is easy to make little changes in components over the years without keeping track of the work that has been done. If this happens, a newcomer may be faced with extra work and possible lost airtime. For your benefit and the benefit of someone who may fill in for you, keep good records of the changes you have made to your system.

Battison, BE's consultant on antennas and radiation, owns John H. Battison & Associates, a consulting engineering company in Columbus, OH.

Measure performance

Accurate measurements of a properly operating system are critical to proper maintenance. The old saying, *"How are you going to adjust it if you don't know what it's supposed to be?"* certainly is applicable to AM antenna systems.

Using an operating impedance bridge (OIB), measure the operating values of each ATU arm and base impedance. Take measurements both with and without any lightning chokes that may be in the lines. Make the tests under each mode of operation. Check the base currents and verify the ratios against the antenna monitor and the station license.

In non-directional antenna systems, the transmission-line operating impedance should be a close, if not an exact match to the input to the ATU. But, it is not unusual to find directional antenna systems with mismatched line impedances, which vary from tower to tower. If this is the case, the need for correction is obvious.

In general, if your transmitter can stand the power, and the lines don't overheat, a small mismatch need not be an earth-shaking event. However, mismatched lines can affect AM stereo separation. Other problems, such as sideband mismatch and high-frequency modulation also can result.

Measure the transmission-line input impedance to the ATUs and to the output line from the transmitter or phaser. Measure the antenna-monitor line impedances. Properly record all of these values for later reference.

Using a field-intensity meter, measure the RF level from each tower that arrives at the antenna monitor. If possible, record the dc resistance of every transmission line, including the monitor lines. Knowing the dc resistance of each line provides a quick and easy way to check the line if something fails.

A transmitter dummy load is a valuable test device. If you have one, be sure that its impedance exactly matches that of your antenna. Although it's wonderful to have a dummy load in which to couple your transmitter on a cold winter night, it won't do you much good if dummy load and antenna impedances aren't the same. If they don't match, the transmitter may trip an overload protector when you switch to the antenna.

Meter accuracy

Calibrate your meters. Rent or borrow a secondary standard ammeter and a variable-voltage transformer. Connect the meters in series with the transformer output and the standard meter. Remember, it is easy to burn out low-amperage meters. If necessary, make a voltage divider, which will prevent overdriving the meters. (See Figure 1.)

While slowly increasing the current, verify that each of your meters agrees with the standard meter. If not, develop an appropriate calibration chart.

It's a good idea to perform a power analysis. Measure the base operating current and resistance. Then, using the I^2R formula, calculate the power in each tower. The sum of these powers should be close to the power calculated at the common point. Be sure to include in your calculations, any permitted loss factor for directional antenna systems. Even for non-directional systems, power discrepancies can surprise engineers.

A little preventive maintenance can save many hours of work. Use the late summer and early fall weather to perform some of these tests—and remember to document the results.

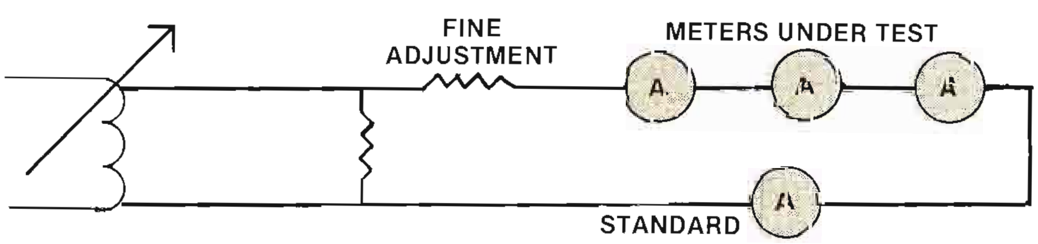
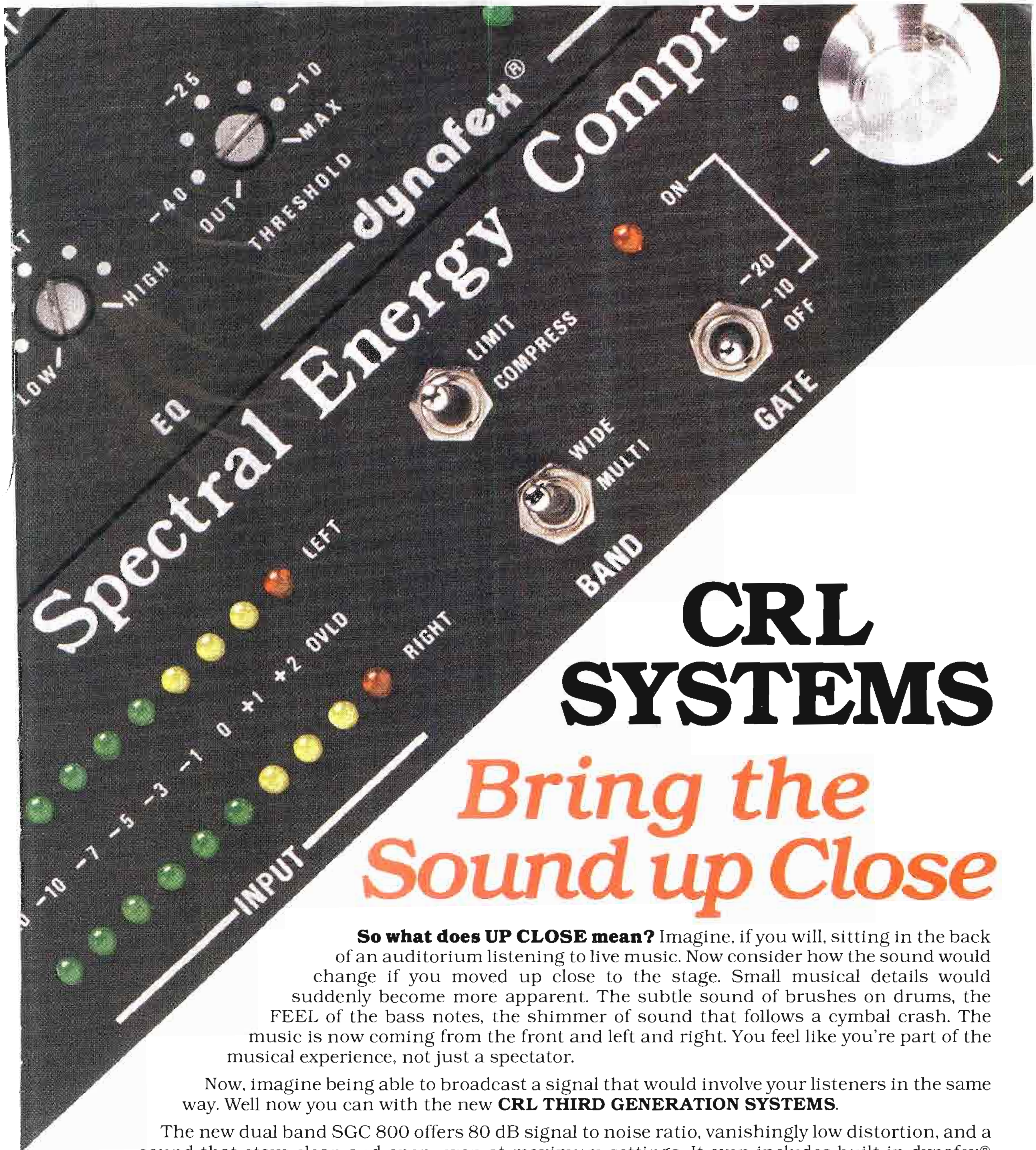


Figure 1. *Meter calibration circuit.*



CRL SYSTEMS

Bring the Sound up Close

So what does UP CLOSE mean? Imagine, if you will, sitting in the back of an auditorium listening to live music. Now consider how the sound would change if you moved up close to the stage. Small musical details would suddenly become more apparent. The subtle sound of brushes on drums, the FEEL of the bass notes, the shimmer of sound that follows a cymbal crash. The music is now coming from the front and left and right. You feel like you're part of the musical experience, not just a spectator.

Now, imagine being able to broadcast a signal that would involve your listeners in the same way. Well now you can with the new **CRL THIRD GENERATION SYSTEMS**.

The new dual band SGC 800 offers 80 dB signal to noise ratio, vanishingly low distortion, and a sound that stays clean and open, even at maximum settings. It even includes built in dynafex® noise reduction circuits. The all new **STEREO MODULATION PROCESSOR, SMP 850**, with our new transfer function limiting circuit and soundfield enhance will let you broadcast a signal superior to anything else on the dial. It provides that UP CLOSE sound that will make you the winner in the button pushing contest.

If you think this sounds too good to be true call now for complete information. Be sure to ask about our FREE trial plan. If you don't, your competition will.

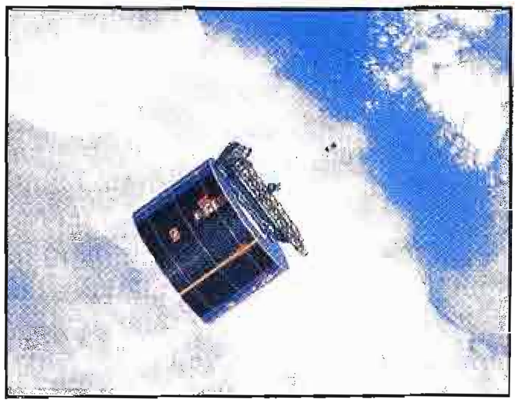
THE PROFESSIONAL'S CHOICE

CRL SYSTEMS

CRL Systems
2522 West Geneva Drive
Tempe, Arizona 85282
(800) 535-7648 (602) 438-0888
TELEX: 350464 CRL TMPE. UD.

Circle (101) on Reply Card

Basic operations of a spectrum analyzer



By Elmer Smalling III

The spectrum analyzer is one of the most important pieces of test equipment a satellite user can own. These devices are used primarily to check for a clear transponder prior to transmitting to a satellite. They also may be used to analyze downlink signals or to check for spurious or out-of-band transmissions generated by the earth station or SNV unit. With the increasing number of uplinks and the growing problem of interference between satellite users, spectrum analyzers provide a simple method for checking traffic on any transponder.

Spectrum analyzers are tunable receivers with a CRT display of the demodulated signal output. They will tune a selected portion of any frequency band (depending on their frequency range) and display the signal as a function of frequency on a CRT screen in the same form as you would draw it. The X (horizontal) axis displays frequency and the Y (vertical) axis displays signal amplitude. The center frequency of the signal being analyzed may be set to the center of the CRT display screen by the operator, and the bandwidth may be adjusted so that the entire carrier signal and sidebands are displayed for analysis.

Although some spectrum analyzers look complicated and difficult to operate because of their many knobs and switches, they can be quite simple to master. Some of the adjustments, such as special filtering and scan rates, may be required only for laboratory routines and special test situations not normally encountered by the average satellite user. The most often-used controls will be frequency, bandwidth, attenuator and resolution. A sample setup procedure for examining a typical transponder on a given satellite might run as follows:

- Point the antenna toward the satellite with the transponder to be examined. This may be done by using a setup chart that details azimuth and elevation given geographic coordinates or by using known signals on adjacent transponders as guides.
- Turn on the spectrum analyzer and select the proper frequency band (C-band or Ku-band receive frequency) with the coarse-frequency control and the transponder frequency with the fine-frequency control.
- Set the frequency span per screen division to 5MHz. At this setting, the 36MHz transponder width will fill the screen on most units. Spreading the signal in this manner allows for a more detailed examination than a 10MHz (or more) per division display, which would crowd the whole transponder bandpass into a knot at the center of the screen.
- Set the resolution to 5kHz. This setting will display small signal differences and will allow close examination of sidebands or subcarriers. Most spectrum analyzers have a wide resolution range so that many aspects of a given signal may be examined as closely as the operator wishes. For instance, it is easy to check the deviation of a carrier by expanding the display and noting the amount the carrier has shifted.
- Adjust the input attenuator so that the noise floor is visible on the bottom of the screen and so the maximum signal level is set to the reference or 0dB calibrated setting. The range of this level will depend on where the analyzer is placed in the incoming signal path.

With the analyzer properly set up and adjusted, the level and frequency of the video carrier and audio subcarrier may be measured accurately. It is wise to use a picture monitor on the video output of the receiver at all times during testing and transmission (uplinking) so that signal discontinuities that might go unnoticed on the spectrum analyzer may be easily seen.

Transmitting a color-bar video signal and test tones on the subcarrier(s) will make measurement easy. It is good practice to check the transponders on each side of the one being measured, to monitor the accuracy of the frequency readings of the spectrum analyzer. The identity of the adjacent transponders can be gotten from the video information or the satellite owner/broker. Once it is determined that the transponder to be used is idle and ready for uplinking, and after permission has been granted for use, begin with a test transmission while observing the downlink. At this time, the uplinked signal should be visible. If not, terminate the uplinking immediately and investigate the transmitter. (Make certain it is tuned to the correct frequency and that it is in the transmit mode.)

Once the frequency, bandwidth and level of the round-robin, downlinked signal have been determined to be within proper limits, all other video and audio parameters can be measured using a high-quality satellite receiver/demodulator and standard TV-test gear such as waveform monitor and oscilloscope.

Always coordinate transmissions with the receiving site, using an on-board telephone frequency or ground line (telephone). The spectrum analyzer may be used for any purpose throughout the broadcast plant where it is important to determine signal level, frequency and possible spurious radiations. A single analyzer that tunes the range of 100kHz to 20GHz can be used for rapid evaluation of problems with AM, FM, TV, STL, ENG and satellite transmitters. If a spectrum analyzer is chosen that has a maximum sensitivity of −115dBm, it may be used as a test receiver for path studies or TV/radio interference complaints.

In summary, spectrum analyzers are not cheap, but they can be the handiest tool at a communications facility.

BE))))

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

SURVIVAL RADIO

It really *is* a jungle out there. And in that jungle, Otari's MTR-10 audio machine gives you the ammunition you need to stay alive—like three speeds, microprocessor control, a built-in cue speaker, and an optional ten-memory autolocator.

The MTR-10's "creative arsenal" helps you keep pace in the tough, competitive world of broadcast. Whether you're doing spots, editing, or working "live", this rugged machine provides the features you'll need for the recording tasks of tomorrow. As one of our customer's put it, "Everything I even *think* I want to do, I *can* do on this machine."

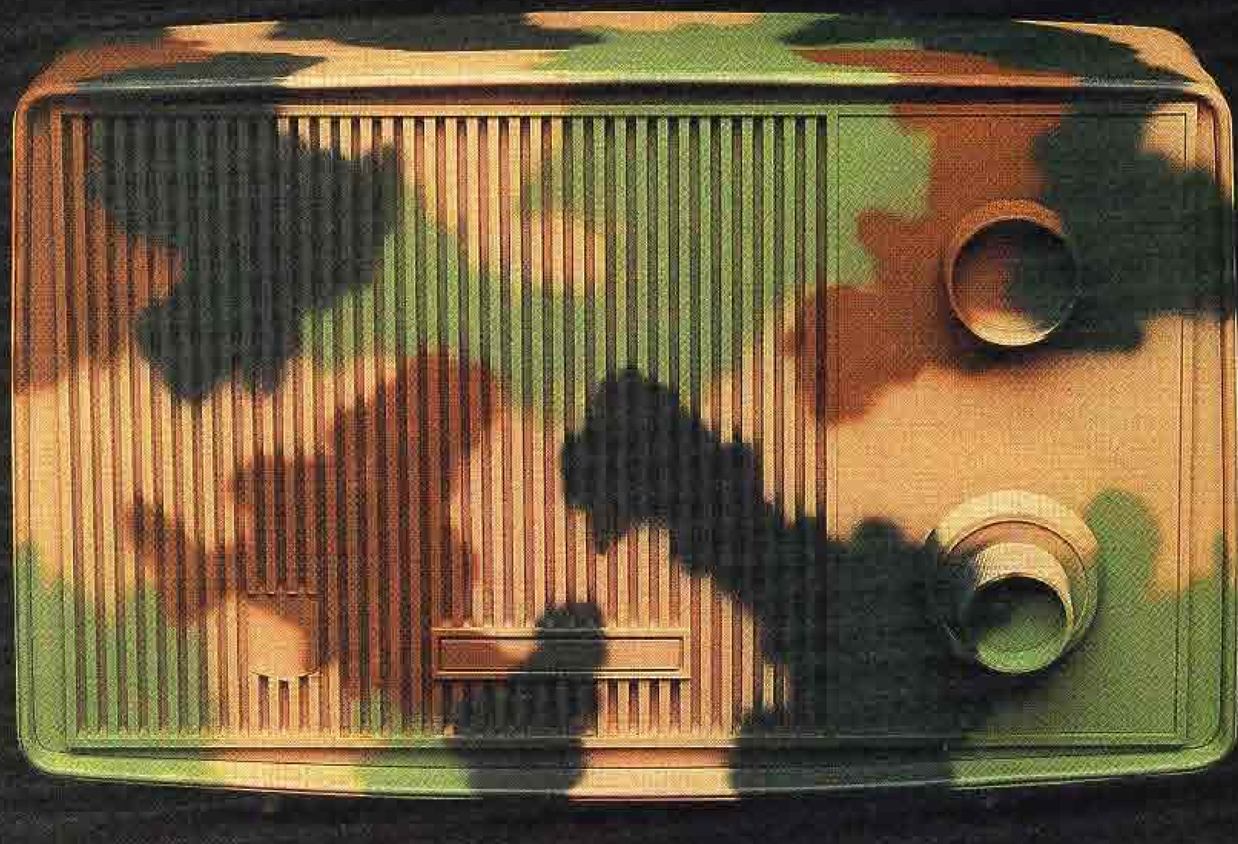
Now add Otari's legendary reliability and customer support, and your chances of survival become even more certain.

Has a good business decision ever been easier to make? From Otari: The Technology You Can Trust.

Contact your nearest Otari dealer for a demonstration, or call Otari Corporation, 2 Davis Drive, Belmont, CA 94002 (415) 592-8311 Telex: 9103764890

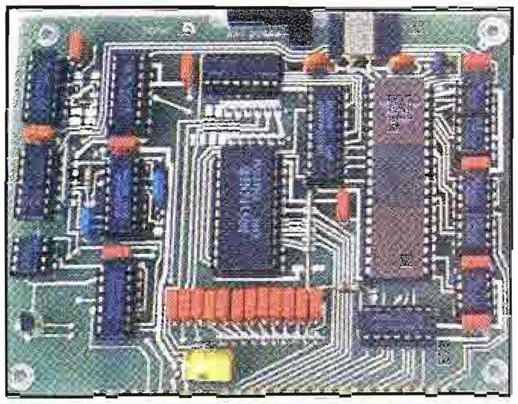
Circle (11) on Reply Card

OTARI®



Part 12

Circuits



Inside digital technology

By Gerry Kaufhold II

During the first year of this series on digital electronics, background material has been presented, and a comparison between analog circuits and digital circuits introduced the series. Basic gates were explained with truth tables, and decoder circuits were developed using the basic gates. Counters and microcontrollers have been introduced.

Before the operation of a microprocessor can be looked into, one final documentation convention will be discussed.

Because microprocessors operate as electronic computers, a quick tour of the computer world will introduce the idea of a *state machine.*

Types of computers

Five types of digital electronic computers have evolved, each in response to specific needs.

Data-processing machines handle information. They sort, file, collate and store almost any kind of fact. In addition, data-processing machines regurgitate facts in the form of reports. The reports can be individualized, such as utility bills sent to broadcast stations, or can be summaries of activities, such as a company's annual report. Many bookkeeping, accounting, financial management, inventory control and payroll departments make good use of data-processing machines. Data-processing machines manage facts.

Research computers are found at most colleges and research centers. Research computers are capable of manipulating mathematic expressions with incredible speed and usually are accessible only for long-term scientific research.

Computer-aided drafting, computer-aided manufacturing, computer-aided engineering and video animation all use high-speed graphics computers. A spin-off from the large research computers, *graphics computers* usually contain several microprocessors and connect to a minicomputer. Graphics computers manage video displays.

Each of these types of computers can be classified as a computing machine. The main purpose of the computer is to accomplish a predetermined repetitious task with high speed. Each time one of these computers begins work on a problem, it follows a sequence of steps that is defined solely by the instructions of the program. All decisions are predefined by the programmer.

Computers linked together by a network are *telecommunications systems.* Managing the paths of flow of information is similar to managing long-distance calls on the switched-telephone network. Each moment in time presents a new problem to the network management computer. The present state of connections made on the network define what links will be available for the next user who wishes to use the network. Telecommunications systems are state machines.

The defining characteristic of a state machine is the way that each decision limits the available choices for the next decision.

The best example of a state machine is a microprocessor that is handling the automation equipment of a broadcast station. Due to the randomness of sources and destinations, designing a state machine to operate master control requires a great deal of organization, because each event limits the possible choices for the next event.

Real-time process control

The type of state machine that handles automation events according to the real-time clock in master control is called a *real-time process controller.*

The Z-80 microprocessor manufactured by Zilog has become popular for doing work with real-time process control. The reason for this hinges on the capability of the Z-80 to change states quickly and in an organized manner.

The first state of a Z-80 is *reset.* The Z-80 is a *static* microprocessor, because it can be given clock pulses one "tick" at a time. The address, data and control lines can be single-stepped through the reset state and observed.

Upon first power-up, or immediately following a low-going reset signal, all of the Z-80 address lines go LO to zero. The data lines are read as inputs, and the control lines reflect a data read from address 0000 (hex).

Normally, the instruction stored at address 0000 is a *jump* instruction that goes to the beginning of the program. In addition to reading the first instruction at address 0000, the Z-80 interrupts are disabled. This means that for the beginning sequence, the Z-80 will step sequentially through the program just like a data-processing machine.

At the beginning of the program, the *initialization* state preloads all the applicable output ports and preprograms any peripheral control devices like counter/timers, disk controllers or input/output latches. Usually, a sign-on message is sent to the video display terminal of the real-time control operator's station.

So far, the microprocessor has been stepping sequentially through a predetermined program. At the end of the initialization state, the processor reads the existing states of all its inputs: which tape machines are already running, which ones are cued-up and which device will come up next according to the real-time clock.

The processor has a beginning state for this time of day and this day of week. A program that primarily watches the real-time clock and is usually called a *dispatcher* monitors all the inputs and decides what task to dispatch next. Sometimes, several events occur simultaneously—like prerolling a video cart, mixing audio under a slide or switching to network by time.

Next month we will begin an in-depth look at the Z-80 microprocessor.

Kaufhold is an independent consultant located in Tempe, AZ.

"We wanted the best sound in town—I think we were successful."
Martin Brandl, Chief Engineer
CJMF-FM, Quebec City, Canada
(Soft Rock)

"The automatic equalization and gently gain riding were just what we were looking for. And thank you for making your updates retrofittable."
Don Hobson, Engineering Manager
KJQY, San Diego, CA
(Light and Easy Music)

"I would highly recommend it to anyone—except my competitors!"
Ray Fisher, Program Director
WZIX, Columbus, MS
(Contemporary Hit Radio)

"Increased our punch and gave us a fuller sound. It's ultimately clean. In a competitive market, regardless of format, the cleaner sound gets (and keeps) the long-term listener. The added controls give us the advantage of tailoring our sound to the listener."
John Bortowski, Chief Engineer
WBMX, Chicago, IL
(Urban Contemporary)

"It's scary! Loud and dense, but not fatiguing. And it's consistent whether we're playing old LPs or a new Huey Lewis CD."
Duffy Egan, Chief Engineer
WPRO-FM, Providence, RI
(Contemporary Hit Radio)

"Clean and loud."
Barry Mishkind, Chief Engineer
KFXX, Tucson, AZ
(Contemporary Hit Radio)

"Clean and natural without being strident. It gives you lots of adjustment capabilities, and will fit almost any format. The manuals are very good as usual."
David Ficker, Chief Engineer
KHOO, Waco, TX
(Adult Contemporary)

"Voices sound clean and open, and the music sounds great."
John Buckham, Chief Engineer
KITS, San Francisco, CA
(Modern Rock)

"Super! The most cost-effective change we've ever made."
Randy Wells, Chief Engineer
KREO, Santa Rosa, CA
(Adult Contemporary)

"It's the biggest bang for the buck—lets us customize our sound for our listeners."
Matt Conner, Chief Engineer
WASH, Washington, D.C.
(Adult Contemporary)

"Lethal."
Terry Carpenter, Chief Engineer
KJYY, Houston, TX
(Vocal Soft Rock)

"Gave us more punch and clarity without any increase in distortion."
Michael Fast, Chief Engineer
WPOC, Baltimore, MD
(Modern Country)

The OPTIMOD-FM XT2 Processor: Everything they say is true.

Orban's XT2 Six-Band Limiter is an accessory chassis that works with any 8100-series OPTIMOD-FM. It gives you bass and high frequency equalizers, plus CLIPPING and DENSITY controls that let you customize the sound for your format and target audience. At $2075*, it's probably the most cost-effective upgrade you can make to your audio.

For the details, see your Orban dealer, or contact us direct.

Orban Associates Inc.
645 Bryant St, San Francisco, CA 94107 USA
Phone (415) 957-1067 or (800) 227-4498
Telex 17-1480 FAX (415) 957-1070

*(suggested list)

orban

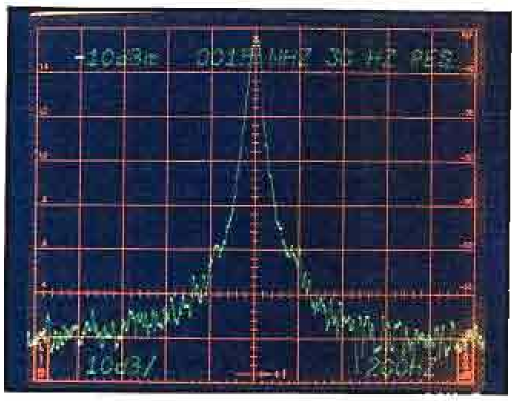
Circle (12) on Reply Card

Part 2

Troubleshooting

Maintaining switching-voltage regulators

By Gerry Kaufhold II



Switching regulators work by switching pulses of current through an inductive element onto a filtering capacitor. The inductance and capacitance are chosen for their characteristics at the nominal operating frequency. In many ways, the operation of a switching regulator is similar to driving a tuned LC circuit at its resonant frequency. As the width of the driving pulse changes in response to the load, the LC circuit acts like a tuned circuit being fed by a modulated carrier.

Like any other radio-frequency circuit, the final LC power circuit must have high Q for efficiency, and must be broadband enough to adequately pass the upper and lower sidebands of the driving energy.

Three topologies commonly are used for switching-voltage regulators. Each type has advantages for its application.

Buck regulator

In a *buck* regulator, the switching transistor feeds current into an inductor. Peak current in the inductor is 1.4 times the current delivered into the load. A diode protects the transistor from the negative-going pulse caused when current flow in the inductor is interrupted, and also permits current to flow in the inductor while the transistor is OFF.

The regulated voltage is always less than the voltage on the power-supply filter capacitors. The duty cycle for the pulse-width modulator under normal loading is approximately equal to the ratio of the regulated voltage divided by the voltage of the power-supply filter capacitors.

One advantage of the buck regulator is its capability of stepping a fairly high-input voltage down to a much lower regulated voltage without dissipating much heat. If a series-pass device is used for the same application, it must continuously drop all of the voltage across the collector-emitter junction of the series-pass element, which generates a lot of heat and places the series-pass transistor under extreme stress. By using a buck-type switching regulator, a regulated low-voltage can be obtained from the medium-to-high voltage output of a supply, saving windings on a transformer or eliminating the need for a low-voltage transformer.

Kaufhold is an independent consultant located in Tempe, AZ.

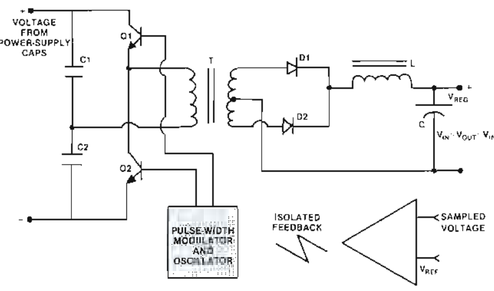


Figure 1. *The forward converter uses a transformer and an inductor to generate voltage.*

Because the voltage drop across the collector-emitter junction of the switching transistor is small, the buck regulator also performs as a low-dropout voltage regulator.

Recall that most 3-terminal series-pass regulator chips require 2½V minimum between the input voltage and the regulated output voltage. The buck regulator is found in many applications where minimum dropout between the input and the output is required.

Boost regulator

The *boost* regulator takes a low-input voltage and steps it up to a higher regulated voltage. ENG equipment, photoflash units and other battery-operated systems use the boost regulator circuit.

With the switching transistor OFF, the dc voltage on the output-filter capacitor is the same as the voltage on the rectifier-filter capacitors, minus the diode voltage drop.

When the switching transistor is turned ON, current flows through the inductor and through the transistor to ground. The diode blocks the voltage on the output-filter capacitor, keeping it charged while the transistor is ON. When the transistor turns back OFF again, the magnetic field in the inductor collapses, sending current through the diode, and the voltage on the output capacitor increases to the regulated value. Like the buck regulator, peak inductor current is about 1.4 times the expected load current.

Forward converter

Figure 1 illustrates one example of the forward converter. The forward converter uses a transformer as well as an inductor, so that almost any voltage can be generated. The transformer used in forward converters is designed for operation at the oscillator frequency, so it can be much smaller and less expensive than a transformer designed for use at the 50Hz or 60Hz ac line frequency.

The forward converter provides excellent isolation between the regulated voltage outputs and the rectified dc from the power-supply transformer. The forward converter is found in computer power supplies to derive +12V and −12V from the 5V supply.

When transistor Q1 is ON, current flows through the transformer primary onto the capacitor C1 and through the transformer secondary. The diodes rectify the voltage from the transformer secondary, and the inductor stores energy from the current pulses in its magnetic field.

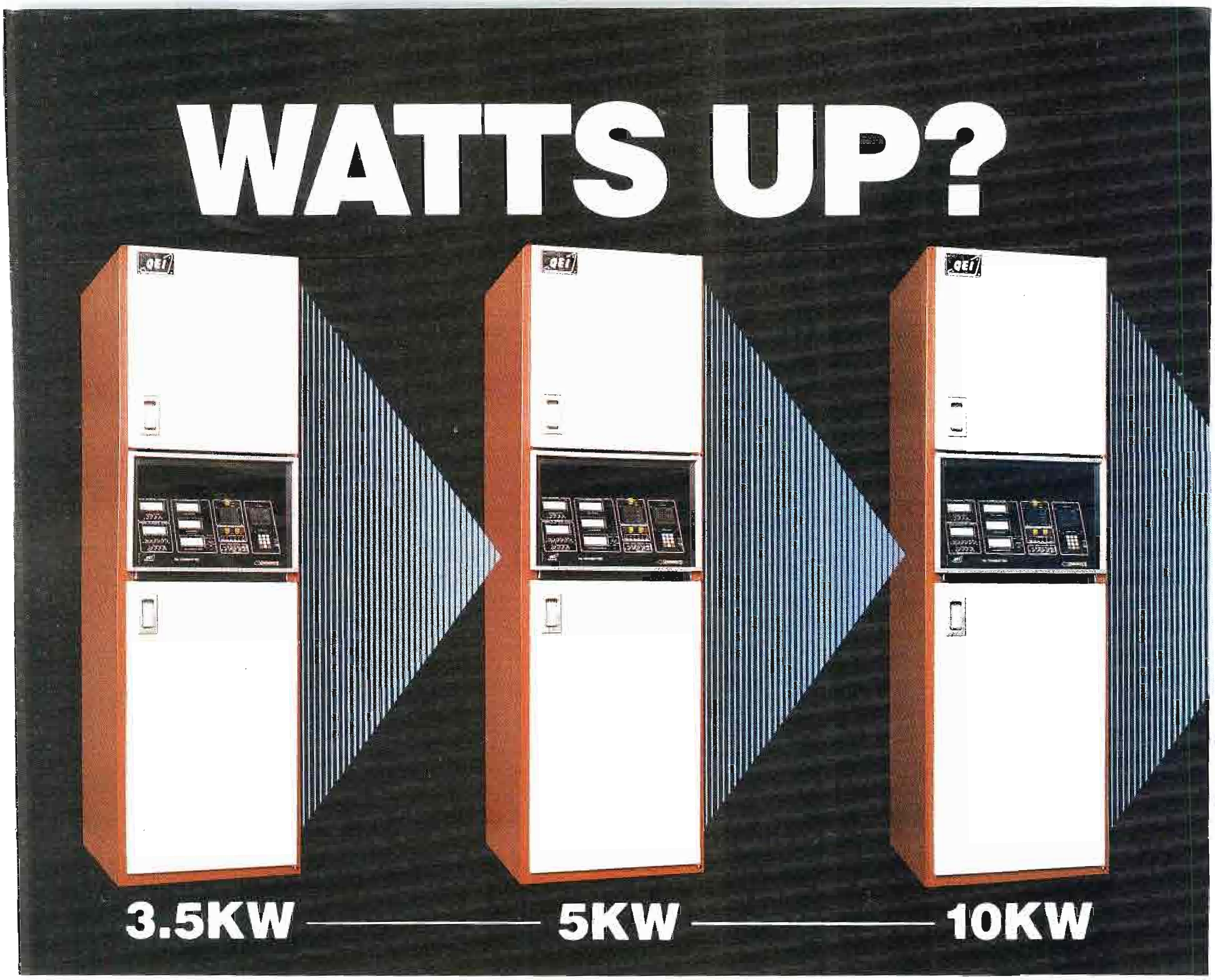
When transistor Q1 is OFF, Q2 turns ON, discharging C1 and driving a second pulse of current through the transformer primary. The diodes D1 and D2 conduct during alternating half cycles of current in the transformer secondary.

During the zero-crossings of the secondary voltage, current continues flowing into the load from the collapsing magnetic field of the inductor.

The forward converter topology costs quite a bit more than the buck and the boost regulators, because of the transformer, and the need for isolating the feedback elements between the regulated voltage output and the switching-transistor-driver circuits.

Forward converters use many of the same design principles that are used in switching-power regulators, which operate directly from the ac power line. These line-operated regulators will be featured next month.

BE



When-and-if you're ready to UP your transmitting power, will your FM transmitter be ready too? If it's one of the QEI "New Reliables" FMQ series, the answer is YES!

Our new 3.5KW, 5KW and 10KW transmitters were designed to give you a clear upgrade path to higher power. In just a few hours, your 3.5KW or 5KW QEI FM transmitter can be upgraded to a factory-equivalent 5KW or 10KW unit, right in the field. QEI's unique modular solid state drivers and interchangeable P.A. assembly make these power upgrades easy...and very economical.

If you're shopping for a 10KW unit in the first place, the QEI FMQ-10000 has lots to recommend it. No other FM transmitter packs this much power, reliability and performance into a single 24" wide rack cabinet. And the FMQ-10000 is designed to operate on single-phase power, so there's no need to pay for installing new three-phase electric service.

What's more, for upgrades to power levels beyond 10KW, each of these FMQ series transmitters can serve as the driver section for QEI's 20, 30 or 60KW transmitters, again resulting in major cost savings.

Every QEI "New Reliables" FM transmitter is built to deliver ultra-dependability and performance. So—whether your station is thinking of upping its power down the road, or if the power you start with is the power you stay with—you'll be glad you chose QEI. Call us toll-free at (800) 334-9154 for the full story.

QEI CORPORATION

The New Reliables

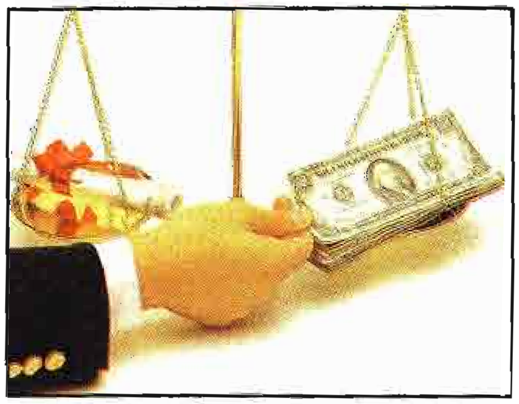
One Airport Drive, P.O. Box D
Williamstown, NJ, 08094 (609) 728-2020

SEE US AT SBE, ST. LOUIS - BOOTH 628

Circle (13) on Reply Card

Part 3

Management for engineers



Managing upward

By Brad Dick, radio technical editor

For the past two months, we've discussed how you can adapt your managing techniques to maximize your relationship with your supervisor. The key is to first recognize differences and similarities and then to act upon them. This month we will illustrate how using these techniques can achieve a specific goal—a raise.

How many times have you thought about asking for a raise? Most of us have wanted, and perhaps have even given serious thought to, asking for a salary increase. However, few people work up enough courage to do so and even fewer are successful in their attempts. Despite these factors, you can do several things to improve your chances for receiving that much-deserved raise.

Know thyself

One overriding factor has to be present before you ask for a raise—you must deserve it. It doesn't matter whether you think you deserve the raise. What counts are the facts. Be honest with yourself—do you really deserve that raise?

If, after careful and honest self-evaluation, you decide that you don't really deserve a raise, then at least you know where you stand. Change your habits. Work harder. Although you may not want to pursue the pay-raise issue now, the following steps may prove helpful as you attempt to mend your ways.

BEFORE YOU ASK FOR A RAISE

- BE SURE YOU DESERVE THE RAISE
- MONITOR YOUR OWN PERFORMANCE
- RECORD YOUR ACHIEVEMENTS
- KNOW THE SYSTEM, LOOK FOR LOOPHOLES
- KNOW WHAT THE INDUSTRY IS PAYING
- DON'T THREATEN
- LEAVE THE DOOR OPEN FOR A YES RESPONSE

Table 1. *Consider carefully the above steps before you ask for a salary increase. If you've already completed them, you may not even have to ask for the raise.*

Measure your performance

It is important that you measure your own performance. This is often difficult to assess in the technical and operational areas. Even so, there are measurement tools that might be appropriate to your job.

Does your department remain within its budget? Have you completed any projects since your last salary increase? Have you received any special recognition for your skills or your work? SBE certification is a good example of industry recognition that may prove to be monetarily advantageous. Holding an office in a local SBE chapter also may help. Even if your manager does not recognize the value of this work, you can still benefit.

Keep track of your achievements. If you don't keep track of the important things you do in your job, no one else will. For instance, how many hours did you extend the life of the transmitter tube by careful adjustments? Did you build a nifty interface that saved the station money? Has that new preventive maintenance program resulted in more reliable operation?

Report the results

Many things you do as a regular part of your job provide unmeasured, and perhaps, unnoticed, benefits to the station. Once you have identified these duties, report them.

Many stations have some type of formal reporting system for departments. Reporting systems are relatively easy to identify for the sales, operations and traffic areas. Sometimes, the engineering department is left out of such communication lines, until something happens.

If you don't have a formal reporting system, develop an informal one. At least once per quarter, summarize your accomplishments and place the memo in your files. Send a copy to your supervisor so your work will be noticed. The information also may be useful as you prepare budgets or attempt to justify new equipment purchases.

If you've completed a special task for someone else, ask that person to let your boss know. Asking that person to pass on a good word for work you did is not the same thing as fishing for compliments.

You should try to meet with your supervisor several times a year. The meetings need not be formal. Rather, you can make a simple statement that you think you are doing a good job and then ask for your boss's opinion. An open-ended question is a good way to obtain feedback on how someone else views your performance. Don't assume you are doing a good job—find out for sure.

Know the system

Know the pay-scale system. How are raises handled? Who decides who gets raises and how much raises will be? Find out if there is a formal procedure that must be followed. Even more important, find out where the loopholes are. Just because you have not reached the official salary review point doesn't mean that a raise isn't possible. Close examination of the company policy may indicate that raises can be given at non-standard intervals. And, just as important, the amount of raises is often negotiable.

It also is important to know how much to ask for. If the industry is paying a similar position $30,000, it might be foolish to ask for $50,000. Special circumstances could justify such a differential, but you need to be able to justify the request. You may want to ask for something other than an increase in salary. Perhaps special club memberships, a company car, gasoline allowance or even extra vacation time would be preferable (or more likely to be granted) than money.

Find out what others in similar positions are paid. The October issue of **Broadcast Engineering** is a good source for salary information. Using unbiased authoritative sources may add weight to your request for a raise.

NEW FROM ARRAKIS SYSTEMS
5000 SERIES

The First No-Compromise Modular Radio Console...

...At A Down-To-Earth Price: 16 Channels, Under $10,000.

THE FEATURES YOU WANT—

- 16 Modular Stereo Channels.
- Program, Audition and Mono Mixdown Balanced Outputs.
- Telephone Mix-Minus Buss.
- Full Monitoring Facilities.
- Remote Equipment Start/Stop.
- Remote Module Control.
- Standard Digital Clock and Timer.
- Optional EQ and Effects Modules.

THE DEPENDABILITY YOU NEED—

- DC Controlled – No Audio On Pots.
- Rugged Modular Construction.
- Penny & Giles Slide Faders.
- ITT Schadow Switches.
- NE5532 IC Module Design.
- External Regulated Power Supply.
- Superb Audio Performance Specs.
- Most Important, Arrakis Systems Designed-in Ultra Reliability!

For features, performance, price and reliability,

NOBODY BUILDS CONSOLES LIKE ARRAKIS.

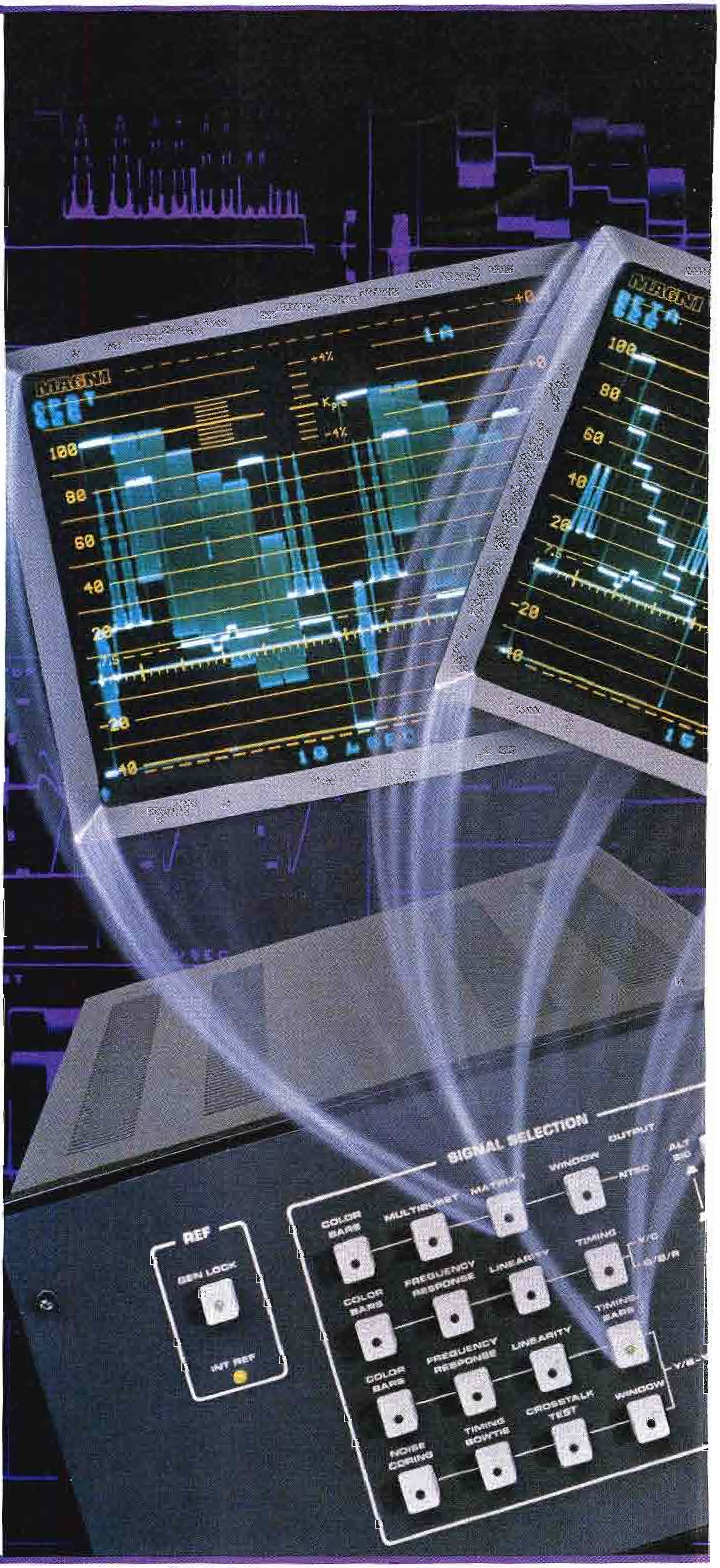
Call (303) 224-2248

Circle (14) on Reply Card

arrakis SYSTEMS, INC.

ARRAKIS SYSTEMS INC. 2609 RIVERBEND COURT FORT COLLINS, CO 80525

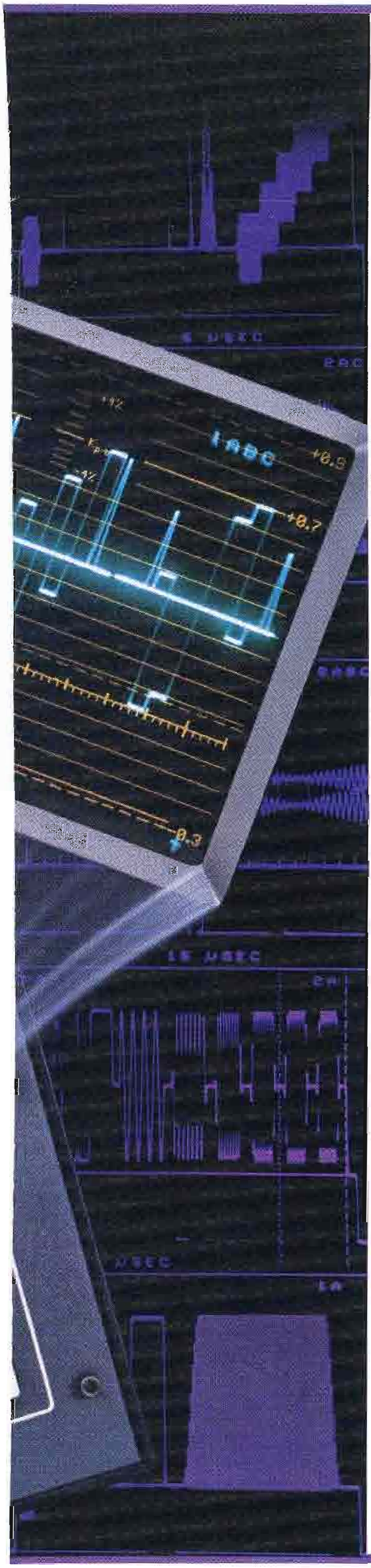
Audio/ Video control for the 1990s



Planning a new broadcast or production facility is both a pain and a pleasure. Engineers usually relish the thought of dumping old equipment and installing the latest in technology. However, as any engineer who has been through such an experience can tell you, it's a lot more work than expected.

Today's choices in equipment, formats and designs are more extensive than ever before. To the design engineer, these choices represent great opportunity. The wide selection of equipment means operational flexibility and cost-effective designs. Unfortunately, however, even the best equipment cannot perform optimally if it is not interfaced correctly with other devices. So, what's the solution?

Planning is the obvious answer, but because of the complexities of current technology, it almost requires a crystal ball. What will tomorrow's formats require? Will the switching and control equipment in-



stalled today be compatible with tomorrow's broadcast equipment? What can you do to ensure that the decisions made today won't limit the opportunity for growth in the future?

No one can tell you what the technical requirements will be five or 10 years from now. There are no easy answers. The best approach is simply to rely on the basics of good engineering design and practice.

This issue covers several areas within the broadcast plant that significantly affect the overall quality of the final product. The overview provided by the following articles may help you direct your thinking if you are preparing to modernize or to install new facilities:

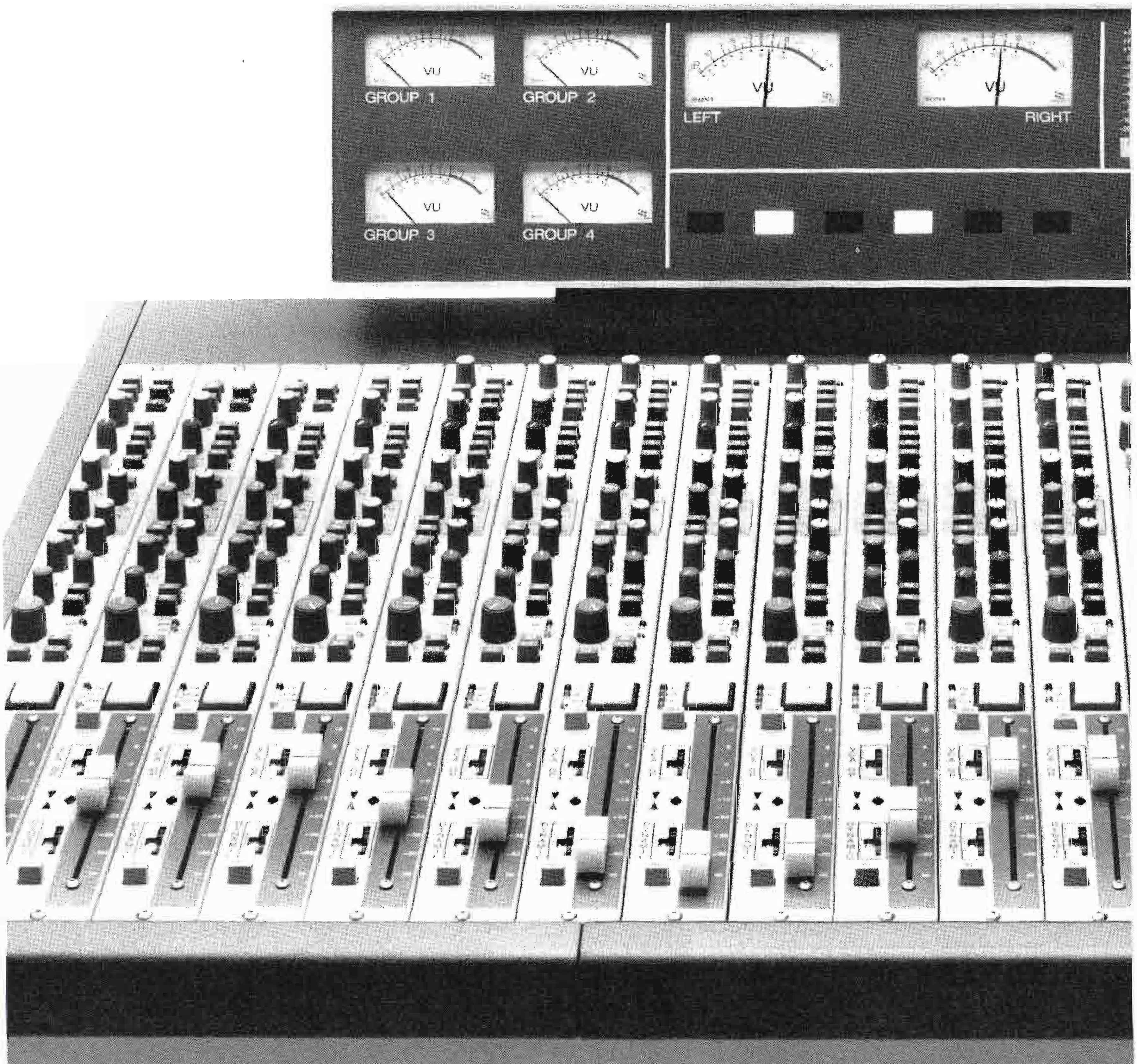
These days, designs, formats and operational procedures can change quickly, and modern broadcast plants must be able to adapt. This doesn't mean you should build everything on rollers so it can be moved in and out as needed. But it does mean that you have to consider your future equipment—now.

Brad Dick

Brad Dick,
issue editor

The questions surrounding the move from composite to component video are among the most difficult for engineers planning new facilities. This photograph illustrates the transition that is taking place. (Photo courtesy of Magni Systems.)

Sony presents hund
Here they are.



reds of new mixers.

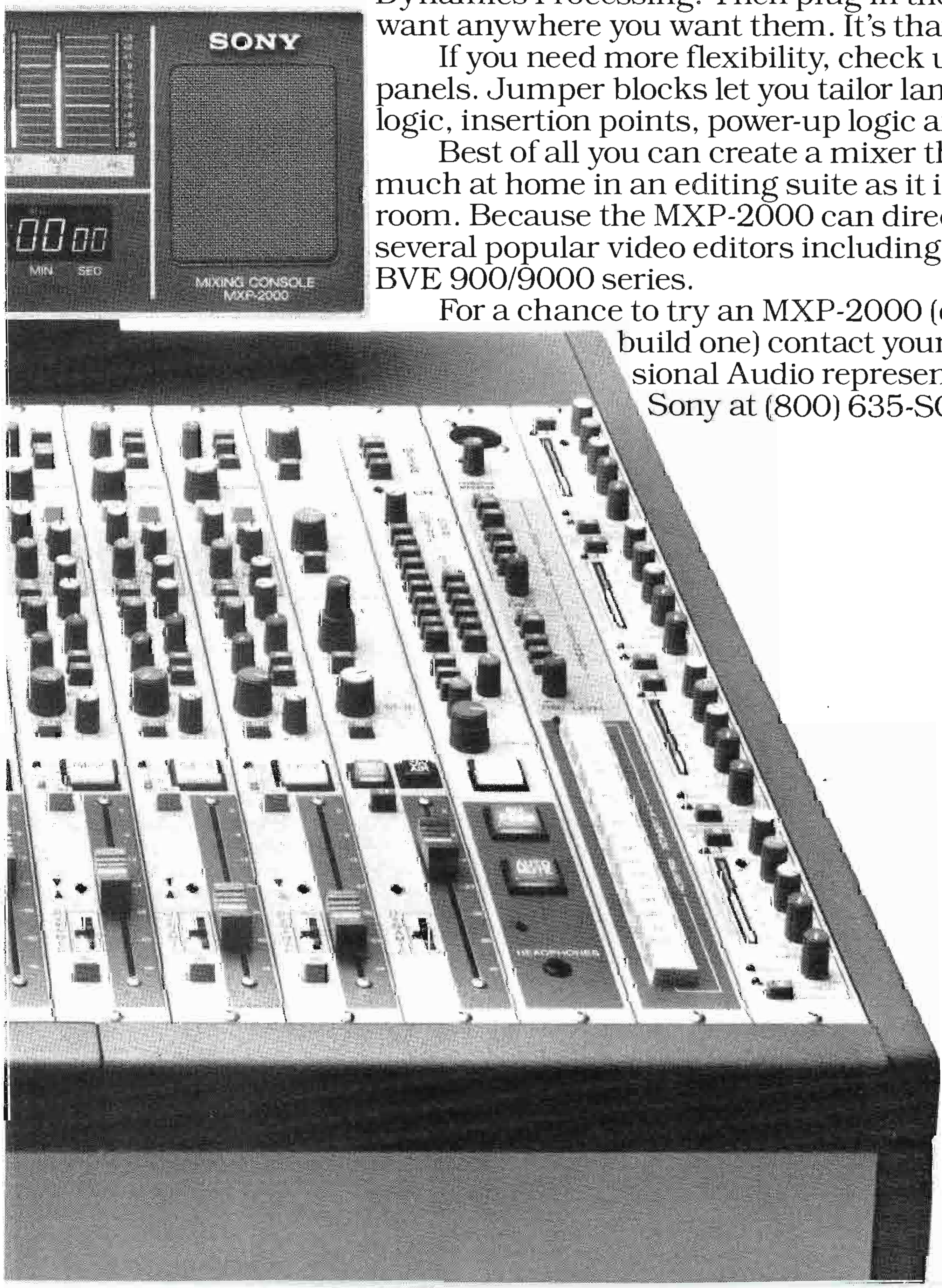
Now if you want a custom-built teleproduction mixer with the great sound of a Sony you can build one yourself. All you need is imagination and a Sony MXP-2000.

First choose from a 20 or 36 module frame. Next pick from 7 different modules including Stereo Input, Mono Input, VCA Group, and Dynamics Processing. Then plug in the modules you want anywhere you want them. It's that easy.

If you need more flexibility, check under the top panels. Jumper blocks let you tailor lamp indication logic, insertion points, power-up logic and more.

Best of all you can create a mixer that's just as much at home in an editing suite as it is in a control room. Because the MXP-2000 can directly interface to several popular video editors including the new Sony BVE 900/9000 series.

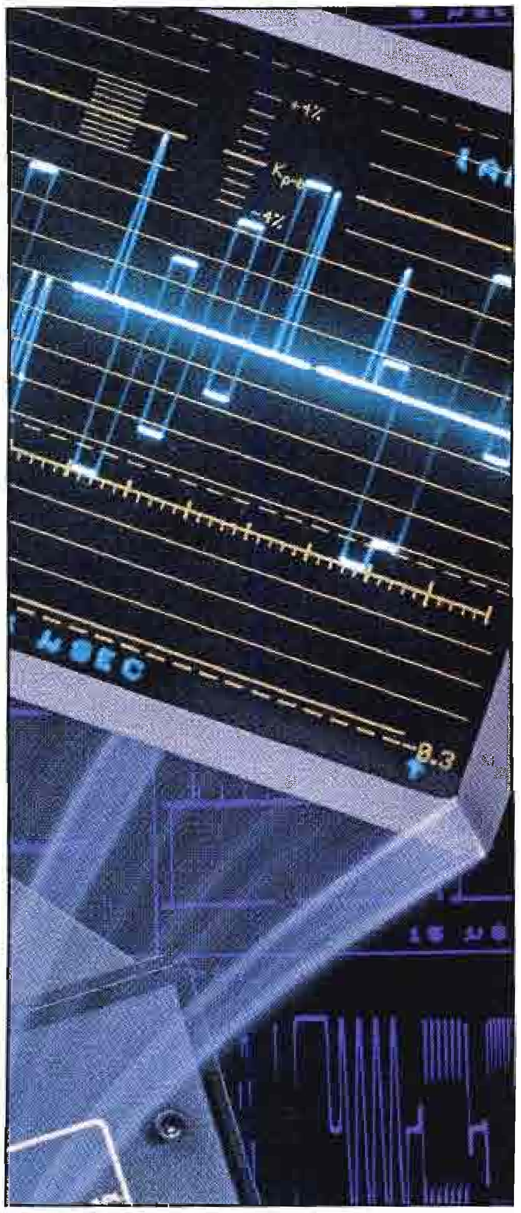
For a chance to try an MXP-2000 (or better yet build one) contact your Sony Professional Audio representative. Or call Sony at (800) 635-SONY.



SONY

Professional Audio

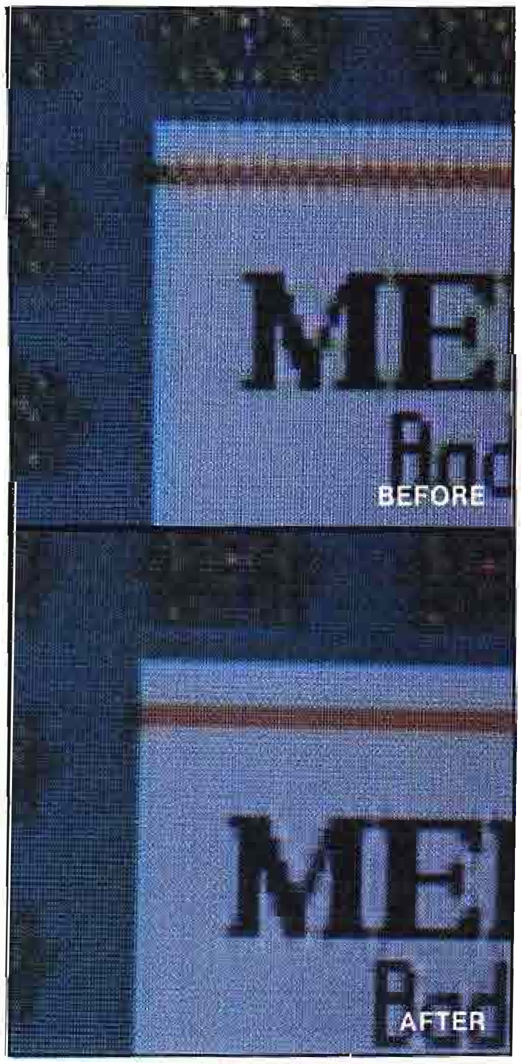
Circle (15) on Reply Card



Getting more from NTSC

By Carl Bentz,
technical and special projects editor

Can NTSC survive 3.57945MHz, or $F_{SC}=(455/2)(525/2)fv$?



Television has never been good enough. In fact, ways to improve TV images have been sought every since the first monochrome signal was transmitted. Equipment designs of origination, transmission and reception products have changed significantly, with brightness, contrast and resolution—display attributes—undergoing the greatest improvements.

The advent of color marked a new era. The CBS-vs.-RCA battle in the race to broadcast color was decided in favor of RCA's NTSC, primarily because compatibility with the existing monochrome receivers was designed into the system. The CBS approach differed vastly from the EIA monochrome system. Later, PAL, similar to NTSC, appeared as a second incompatible standard. A third incompatible standard was SECAM. Most of the following comments are applicable to PAL, SECAM and NTSC, however.

A variety of NTSC image degradations, some of which are visible at left (top photo), are related to interleaving of the monochrome and color signals. Lettering that is not specifically designed for TV presents special problems, not all of which are solved easily. Careful design of processing systems can prevent most of the degradations.

Editor's note: This article is based on papers presented at NAB, SMPTE and other technical symposia by Yves Faroudja (Faroudja Labs), William Glenn (NYIT), William Schreiber (MIT) and E. Benjamin Crutchfield, Special Engineering Projects (NAB).

Improvements to color over the past 30 years have been the result of automatic circuitry to control color levels and phase. Special test signals from network or local sources serve as references for some receivers. Improved linearity and more stable video amplifiers, sweep systems and phase-sensitive stages from solid-state devices are among the achievements, but the search for enhancement goes on.

Questions of definition

High-definition TV demonstrations first captured industry attention in the '70s. More than 10 years later, HDTV technology continues to develop with a foreseeable goal of pictures equal to or better than 35mm film. The current technology, however, exists as several mutually incompatible systems capable of more-than-doubled picture resolution.

HDTV presents economic and technical questions. It is predicted that the cost of receivers will be significantly higher than today's designs when the technology comes to consumers. Another drawback is that several systems under consideration are mutually incompatible with current television and with one an-

WE PUT SOMETHING VERY SPECIAL INTO OUR NEW TV-80 ZOOM....

A LOT OF THOUGHT.

We got inside the heads of professionals like you before we designed a single component inside the new Schneider TV-80.

The result is a 17X studio zoom that's picture perfect. One that's easy to use. Easy to service. And one that delivers uncompromising image quality. Truly, the ideal mate for the new generation of 2/3-inch studio/OB cameras.

Our advanced servo module with digital feedback and built-in microprocessor typifies the innovative thinking that's gone into this lens. The servos align themselves automatically whenever you power up, and the easily removable module is interchangeable with flexible cable drives for control flexibility.

The built-in pattern projector employs a unique color mixing system that insures correct color temperature and illumination. Full servo zoom is under one second, and when used with its built-in 2X range extender, the servo iris automatically compensates for light loss, producing constant video level at all times.

The TV-80 is rugged and compact. All adjustment points are grouped together for easy access. An optional diagnostic digital test unit is available for quick analysis of all electronic functions via one simple connector. And plug-in electronic components make service a snap.

The new Schneider TV-80 Zoom. We put a lot of thought into it, so you'll never think twice before buying it. For more information or a demo, contact: Schneider Corporation of America, 400 Crossways Park Drive, Woodbury, NY 11797, (516) 496-8500.

Western U.S.A. Service: 861 Production Place, Newport Beach, CA 92663, (714) 631-7430.

Schneider
KREUZNACH
SHOOT FOR THE BEST.

Circle (16) on Reply Card

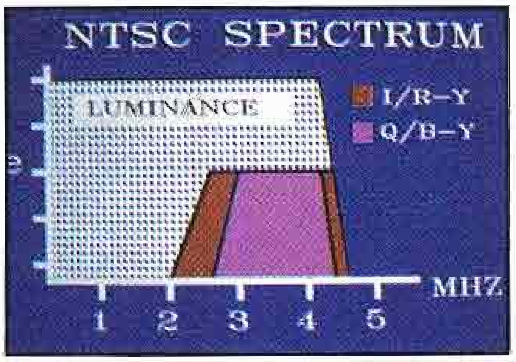


Figure 1. *An NTSC signal in the frequency domain illustrates the unequal, bandlimited color-difference signals I/Q or R−Y and B−Y.*

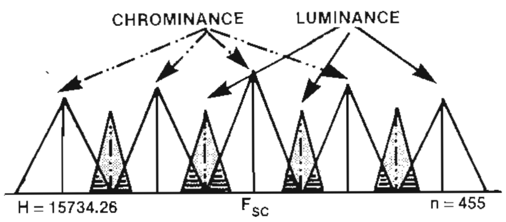


Figure 2. *Interleaving of luminance and chrominance sideband energies near the subcarrier frequency, $F_{SC} = (2n+1)\ F_H/2$. The shaded areas indicate where luminance and chrominance overlap, generating mutual interference.*

other. Finally, wideband video and RF signals require new means for display and new assignments for transmission.

To many who endorse HDTV, NTSC represents an outmoded standard—one, they say, that has reached a plateau as far as improvements are concerned. They fault the method of encoding color into the signal, blaming the 3.58MHz subcarrier as the source of image degradation. An 8MHz video bandwidth, reduced to fit a 6MHz RF bandwidth specification, limits the resolution that can be achieved.

One of the primary objectives of the Advanced Television Systems Committee (ATSC) of the NAB is to consider possible improvements to today's television. Technical groups within the ATSC have approached the problem in three tiers. First, the T1 group studies methods to improve NTSC and maintain compatibility. The T2 study involves non-compatible, enhanced television with higher resolution and larger screens. Finally, T3 focuses on HDTV and a doubling of resolution.

But is the NTSC picture really as bleak as it seems? The search for a 1,125-line TV image has resulted in some worthwhile HDTV fallout. A different approach to signal processing can bring definite improvement to NTSC.

Analyzing NTSC

Some faults of NTSC are stepchildren of the color-transmission system design. The first circuits for color had to cope with vacuum-tube instabilities. Component values drifted with ambient temperatures inside equipment chassis. Interference problems demanded bandwidth limitations. Intercircuit coupling played havoc with signals. Phase errors in the equipment and the transmission path caused hue variations from minute to minute.

However, NTSC is an ingenious plan and, with stabilized component circuits and attention to detail, has the potential to bring about improvements throughout production, transmission and receiver stages that promise much better pictures for viewers. The system is spectrally efficient through the interleaving of luminance and chrominance difference signals. More telling, however, is visual proof that 525-line images, when handled differently, rival higher line-rate images on existing color receivers.

Minding the I's and Q's

Three steps can extend NTSC. First, rules of the standard must be strictly observed throughout the signal chain. Second, certain rules implied by the nature of NTSC need attention. Third, some compatible, beneficial changes must be made to the rules.

In a correctly operating TV transmitter, adherence to NTSC specifications is almost automatic. The equipment has built-in limitations to meet the acceptable engineering practices of the FCC Rules and Regulations, Vol. III, Part 73. (See Figure 1.) Minimal complex processing occurs between the STL receiver and the radiating antenna. As a result, the radiated signal quality is a function of the elements that modify it at the transmitter site, such as the final encoder, exciter or modulator and sideband filters (presumably, precision devices) that shape a channel response curve.

The path through the studio is more convoluted, with routing, switching, recording and processing in a succession of analog and digital devices. Each signal manipulation increases the probability of deterioration in the overall signal. Signal processing that calls for fast rise times, as with titlers, effects systems, computer graphics and color keyers, generates illegal sidebands as the chroma is processed. (See the related story, "Keys to Better Understanding: Illegal Sidebands," page 34.)

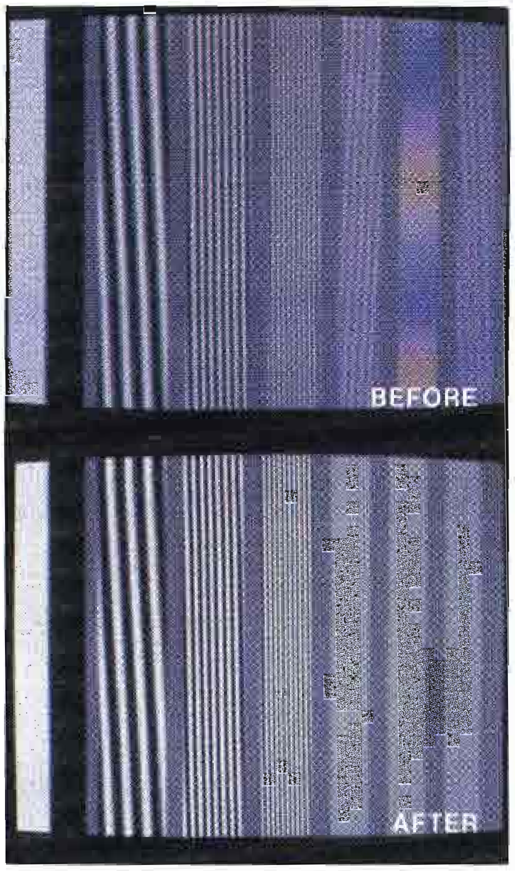
A spectrum analyzer would quickly show I and Q (or R – Y and B – Y) chroma bandwidth bounds often exceeded in titler video. The signal contains intermodulation overlaps that cannot be decoded correctly by any decoder in a monitor or receiver. (See Figure 2.) Control of these factors at the outset would contribute to improved images in the studio or the home.

Video signals are submitted to various sampling mechanisms, starting with scanning. Ideally, signals rebuilt from sampled information are indistinguishable from the original. Reality indicates otherwise.

Prescreening artifacts

One solution to digitizing degradation is the use of multidimensional Nyquist filters, applied both before and after the sampling process. Such filters would eliminate or reduce 60Hz and 15,750Hz harmonic aliasing caused by 2:1 interlace scanning. Filters also would reduce artifacts of motion and chroma/luminance spectral overlap that create visual disturbances in fine-detail areas.

In the beginning, cameras seldom produced useful MTFs (modulation transfer functions) at luminance frequencies above 4MHz. A 3.58MHz notch filter in



The multiburst test simulates degradation of spatial frequencies near the 3.58MHz subcarrier. Comb filters in encoding and decoding produce remarkable results.

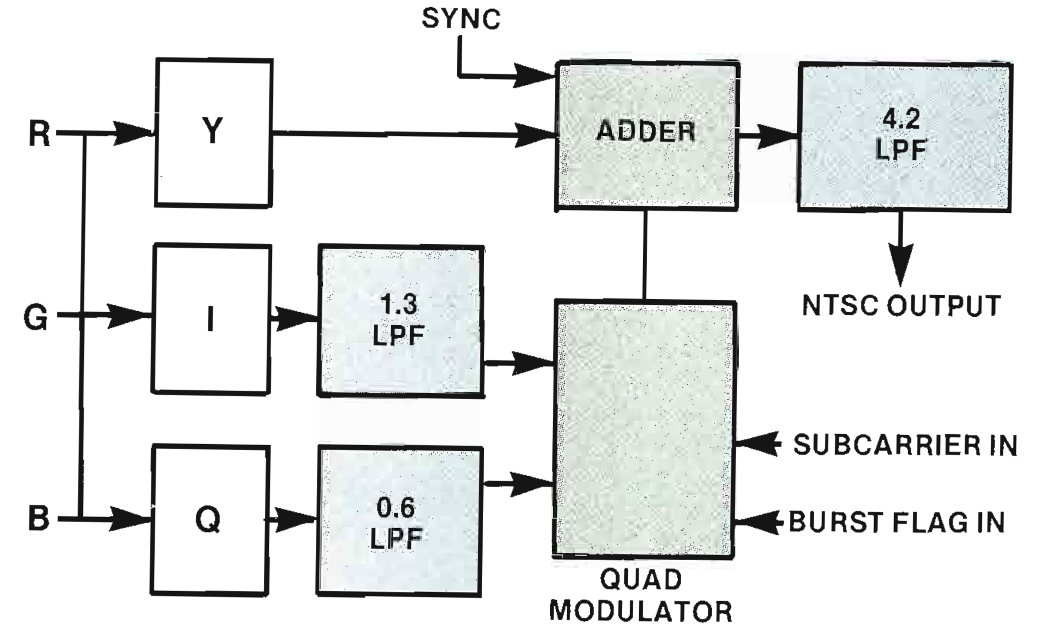


Figure 3. *The essential blocks of a typical NTSC encoder.*

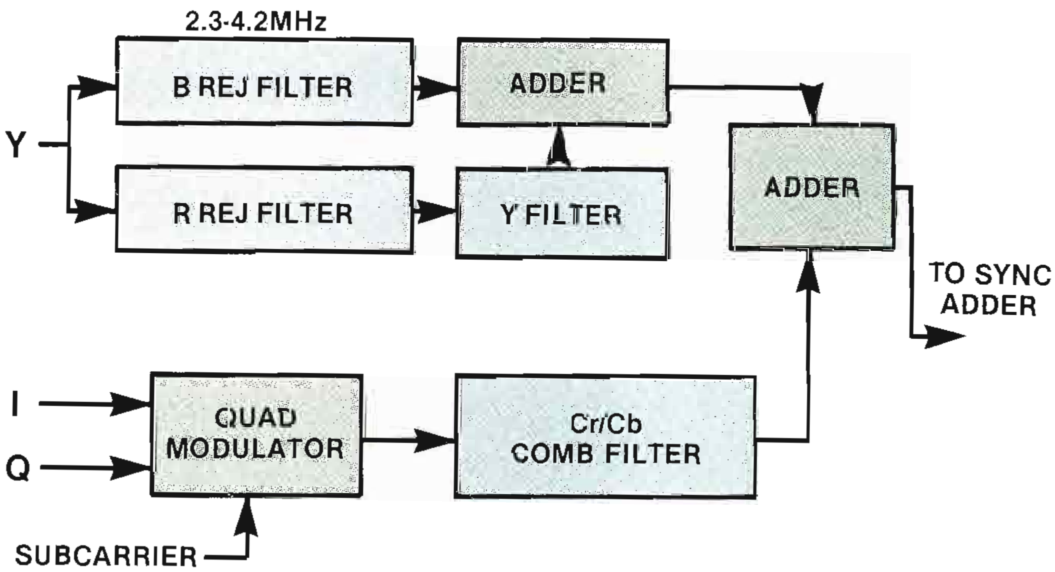
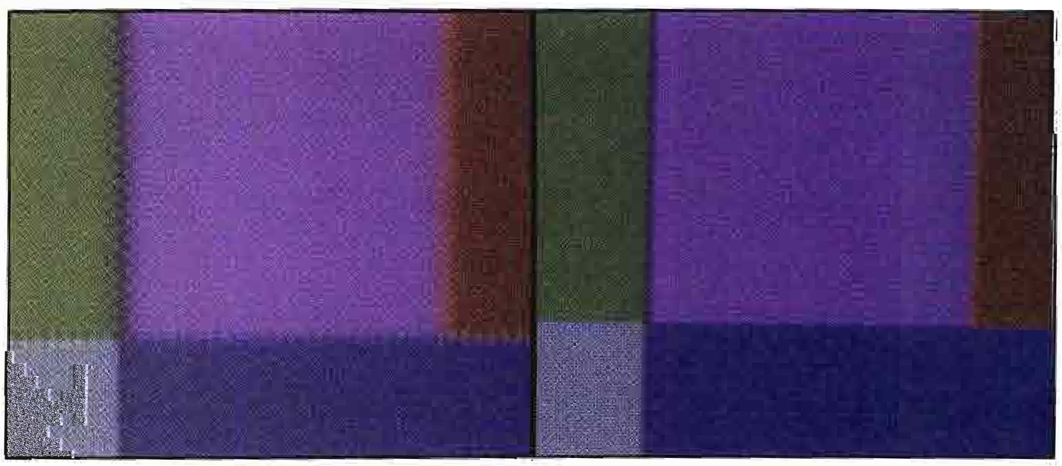


Figure 4. *A block diagram showing the encoder using equal-bandwidth I and Q.*



Not all problems of the green-to-magenta syndrome are avoided, but comb filtering in encoding and decoding of NTSC signals alleviates most of them.

the display unit easily removed subcarrier without harmful effects to image resolution. However, today's cameras produce signals extending beyond 6MHz. Some method to recover the higher-luminance components after comb-filter chroma separation would allow the detail they provide (above 3.2MHz).

One way to recover the extended frequency range is through 2H (2-line) comb filtering in encoding and decoding. With adaptive logic, such manipulation can produce near-RGB picture quality even on home receivers. The addition of complexity beyond 2H brings even greater improvement.

Changing NTSC rules to replace the differing I and Q bandwidths with equal 1MHz baseband channels would make some difference. (See Figures 3 and 4.) Sharper rolloff characteristics in these channels would effectively reduce, if not eliminate, cross-luminance in the decoder. In addition, more strictly defined transitional characteristics of the chroma channel would make significant reductions in the NTSC deficiencies of chroma ringing, C/L delay and fast rise time pulse-handling. Stricter filter requirements in transmitters would, logically, avoid negation of any improvements achieved prior to the transmitter.

RGB vs. Y/Cr/Cb vs. NTSC

Passive mixing of RGB signals into luminance and difference components does not, in itself, cause serious intercontamination of either of the channels. Y/Cr/Cb component systems show that dematrixing to components produces images nearly identical to the original RGB signals. (See the related story, "Keys to Better Understanding: Y/Cr/Cb," page 34.) Rather, it is encoding or actively mixing the three components into a single transmission channel, where NTSC experiences difficulty. In fact, after frequency interleaving in the encoder, three distinct problems exist: cross-color, cross-luminance and limited chroma bandwidth.

If all signal transitions within an image fell along the horizontal or vertical axes, interleaving would not produce interference between luminance and chrominance. Vertical domain transitions (once each 1/60-second at most) contain no high-frequency luminance information and cause no interference in the chrominance spectrum. Likewise, horizontal domain transitions (about once each 1/15,750-second) are separable by comb filtering, because luminance data exists at even multiples of one-half the line frequency. Meanwhile, chrominance lies at odd multiples. Diagonal transitions, on the other hand, produce chroma and luminance signals that must share spectrum. In the sharing, unwanted artifacts result.

Overlapping chroma and luminance (refer to Figure 2) produce cross-color, the most blatant degradation of NTSC signals. Visually, cross-color appears as the disturbing rainbow pattern that occurs in a picture when diagonal high-frequency luminance information exists. Patterns in clothing are common causes, particularly at certain zoom lens focal lengths, when a spatial frequency near 3.58MHz is created, in effect, by luminance transitions.

Cross-color has subliminal psychophys-


Perfect Control
Perfection in Master Control switching and Station Automation systems—that's Utah Scientific's goal. To reach it, we've redesigned our MC-500 Series switchers around a new high-speed, 16-bit processor and added SAP channel control and metering, plus many other new features.
We've also upgraded our Station Automation—the SAS-2 System features color screens and a host of new features to provide enhanced reliability and on-air flexibility.
Call or write today for more information.
SONY
UTAH SCIENTIFIC, INC.
DYNATECH Broadcast Group
1685 West 2200 South, Salt Lake City, Utah 84119
(801) 973-6840 • Toll Free 1-800-453-8782 • TLX: 269-916 • FAX: 801-973-0255
Circle (18) on Reply Card

ical effects as well. NTSC is a 4-field sequence; the phase of cross-color interference switches 180° every other frame. Four fields are needed to return all component phases to a starting condition. Stationary objects in the image flicker at one-half the frame rate, that is, 15Hz. Although that rate is below the comfort threshold of the human eye, for large image areas, it contributes to long-term viewing fatigue.

Cross-luminance, the hanging-dot pattern, is visible only with a comb-filter decoder. It appears when the decoder mistakes chroma at vertical-domain transmissions to be luminance information. Visually, cross-luminance displays as one or two lines of dots at 3.58MHz that appear to crawl upward along luminance transitions or, more apparently, along diagonals. Although not objectionable to an untrained observer, the phenomenon indicates that an image is not RGB. It should be reduced or eliminated.

Limited and unequal chroma bandwidths (refer to Figure 1) are the least objectionable of the three problems. Purposely limited, the chroma channels (I = 1.3MHz, Q = 0.6MHz) cause a visible loss of resolution for highly saturated chroma transitions. The effect appears at sharp vertical junctures between highly saturated, dissimilar colors. For example, a transition from green to magenta in the standard color-bar pattern vividly shows a slow decay of green and an even slower rise of magenta. In the transition, the subcarrier modulation dot pattern becomes quite noticeable.

Bandwidth limitations originally were instituted for practical reasons. The eye's ability to resolve blue detail fails before its ability to resolve red. Red detail is less critical than green. Also, more red and green occurs in our visual environment than saturated blue. Therefore, Q (B–Y) theoretically needs to carry only gross blue detail. I (R–Y) must support finer detail, and accordingly, requires more spectrum. The lesser need for blue also is indicated in NTSC matrix equations.

Most viewers tolerate these degradations, partly because the brain adapts to them as normal occurrences. Over repeated long-term exposures, the effects are psychologically suppressed, but the brain must work subconsciously to do this. In subjective comparisons for watching NTSC and RGB images, fatigue factors are far greater for NTSC.

Squelching artifacts

No matter how complex the decoder might become, complete separation of two superimposed spectra currently is not possible. For better pictures, then, the first step is to eliminate those encoding artifacts that can subsequently appear in the decoded image. NTSC rules do not preclude signal processing of encoder inputs that could lead to more efficient decoding.

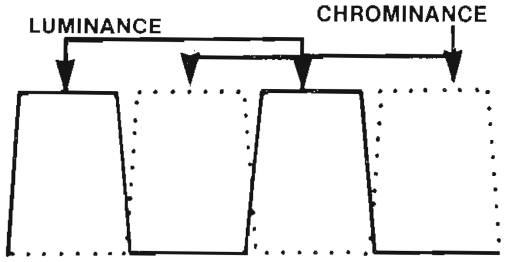


Figure 5. The ideal separation of Y and CrCb components is possible with a multiple delay line encoder and decoder system, according to the results of simulation tests.

Prevention of encoder spectral overlap is possible by prefiltering luminance and chrominance with comb filters. Bidimensional manipulation in the horizontal and vertical domains does reduce the overlap area between the interlaced signals. Luminance can be precombed between 2.3MHz and 4.2MHz to alleviate interaction with chrominance energy normally resident in that spectrum. Combing and averaging chrominance over several lines effectively reduces the hanging-dot pattern.

Comb filters for this use vary in complexity, beginning with 2H structures and increasing the number of delay paths to achieve higher intermodulation rejection. The 2H value usually is chosen as a matter of cost. Still, more complex, multiline filters, such as 2H+6H, define nearly square-wave luminance and chrominance spectral responses, removing overlaps where intermodulation originates. Experiments with simulated 11- and 13-line delays totally separates luminance and chroma signals entering the encoder adder and quadrature-modulation circuits. (See Figure 5.)

An encoder with a 2H comb filter and precise passband control of luminance and chrominance information produces an output NTSC signal with limited cross-color and cross-luminance artifacts. To what extent does this affect viewing? If decoded with a 2H comb filter for display, the result is quite close to the original RGB input. However, even receivers without special decoders show some improvement from this type of encoding. Specifically, cross-color artifacts, although still visible along vertical luminance transitions, are virtually eliminated at 45° angles. The 15Hz flicker phenomenon is reduced, and a significant improvement to picture quietness is visible.

In a system using 2H encoding and 1H decoding, a cross-color reduction factor of 2.7 can be calculated. With a 6H encoder, the factor increases to 3.8. Increasing the number of delay lines causes the reduction factor to approach 10. Changing from a 1H comb filter decoder to use 2H filters in both encoder and decoder increases the factor from 2.7 to 6. Additional encoder filtering boosts the reduction factor even more.

To this point, filtering processes do not include adaptive filters. Note that adaptive techniques will compensate for residual artifacts and produce more improvements, particularly when image motion is considered.

Noise

Typical pictures appear to have a great deal of apparent color noise, particularly in low-luminance-level scenes. Without prefiltering, what appears as chroma noise is actually high-frequency luminance noise injected into the chrominance channel. A triangular noise spectrum, shown in Figure 6, illustrates a rising noise characteristic in cameras that create a matrixed luminance signal. The noise figure is substantial around the subcarrier frequency, but actual color noise is inherently limited by the narrow bandwidth of the chrominance channels.

The degree of chrominance noise is related to the luminance noise level and may range from a high 40dB in poorly lit images to only a little with a clean luminance signal from a high-brightness scene. With a 2H encoder and decoder system, the improvement in the chrominance signal-to-noise ratio for a dark scene may be as much as 12dB. The effective increase in the S/N occurs because the modulation of chrominace has been prevented by luminance noise through filtering.

Less than perfection

A 2H encoder/decoder scenario has notable limitations. One is a small loss of diagonal resolution in the luminance path, primarily in detail above 2.3MHz, where signals are averaged over three lines. Notch decoders leave little useful information above 2.3MHz, so the loss produces no visible effect. In a 2H decoder, the rise time of diagonal transitions is degraded by 16%, dropping the modulation depth at 45°, a spatial equivalent of a 3.5MHz bandwidth (recall the reversing polarity of the subcarrier), rather than the normal 4.2MHz one. A higher number of delay lines could reduce this limitation, but the economic trade-off is not adequate to offset the small loss of resolution.

Other methods

Other means to enhance television have been discussed. Recommendations include tossing NTSC out and replacing it with HDTV with 1,125-line resolution. The proponents of this suggest that NTSC and HDTV would necessarily be transmitted simultaneously for a time, but at

Main story continues on page 36

Solid as a Sony.

Sony videotape has a rock-solid reputation as the toughest you can buy.

One word sums up everything we tried to achieve with V1-K videotape: durability.

From its cross-linked binder system to its adhesive base film, it was perfected for the real world of constant jogging, still frame editing, shuttling... and deadlines.

And its ultrafine Vivax™ magnetic particle formulation was made to deliver astonishing picture quality, higher stability and optimum S/N ratio with the lowest headwear rate of any major one-inch videotape.

What we did for V1-K benefitted BCT Betacam® too, resulting in trouble-free still frame editing, totally reliable repeated playback and worry-free long-term storage.

And new Sony BRS and XBR U-matic® cassettes have all of the above plus the new Sony Carbonmirror™ back coating, as well as Sony's anti-static shell, which we introduced in BCT Betacam. They deliver a new level of durability, runability and especially fewer dropouts.

So, after all, Sony professional videotape is just like any other Sony: standard-setting video and audio with a "solid as a rock" reputation. That's why it's the only videotape you can treat like a Sony.

SONY®
THE ONE AND ONLY.®

Circle (19) on Reply Card

Keys to better understanding

Nyquist criteria:

A common statement of the Nyquist sampling theorem is that the sampling frequency must be at least twice that of the highest frequency to be sampled with subsequent reconversion to analog form and without sampling degradation.

A raster of scan lines spaced V apart can represent vertical sinusoidal components with frequencies that are no higher than V/2. Apparent resolution of a TV scene is somewhat less, because of the quantization of scan lines. That loss is expressed numerically by the Kell factor K, where $0<K<1$.

Kell factor:

The Kell factor is involved in predicting the video bandwidth needed to provide the same resolution in the horizontal direction as produced by the scan-line structure in the vertical direction.

There is a number K, such that an image transmitted with scan lines V apart is equal in vertical resolution to the original, spatially continuous image that has been vertically filtered to K/2V, but not sampled by scan lines. K is the loss of vertical resolution in a scanned picture, relative to the original picture that has been filtered to ½V.

If a raster of a scan lines yields a resolution of aK/2 cycles/picture height, and if the horizontal-to-vertical aspect ratio is R:1, then for equal orthogonal (H and V) resolution, no horizontal components higher than RaK/2 cycles/picture width need to be reproduced. Therefore, there must be, at most, Ra2K/2 cycles/frame or with n frames/second, the video bandwidth (without retrace) is f = ½nRa2K.

Lines of resolution:

Theoretically, image resolution is the number of samples distinguishable in the horizontal or vertical direction of the TV image. In the vertical direction, the number is technically limited by the line structure of the picture. Because video is continuous across the TV line, the horizontal measurement is taken as the number of cycles of a sinusoidal signal occurring during a single visible line time.

In the camera and the display, resolution is subject to error because the scanning beam is circular rather than square. (We would like to believe a pixel is square.) The response resulting from illumination of the camera tube and CRT by the electron beam is more accurately described as Gaussian, or bell-shaped, adding more confusion to the resolution question.

Cross-color:

This degradation is the appearance of spurious color in regions of high detail where luminance information becomes inadvertently interpreted as chrominance information.

Cross-luminance:

This degradation is a moving crosshatch pattern that develops at the boundaries of brightly colored areas where color information is erroneously interpreted as luminance. This becomes particularly obvious along vertical and diagonal lines and is most striking on monochrome displays.

Y/Cr/Cb:

An abbreviation to state luminance and color difference signals based upon red and blue. It is equal to NTSC's Y/R−Y/B−Y or Y/I/Q and Y/U/V in PAL.

Illegal sidebands:

The time duration of a signal transition from "0" to "1" is its rise time. The shorter the period of time, the more vertical the edge of the pulse becomes. As a pulse edge becomes more vertical, the spectrum of frequencies contained in it (or necessary to recreate it) becomes wider. A rise time of zero would require an infinite band of frequency components. Fast transitions in video, either from titling or various manipulations, result in chroma sidebands that extend downward into luminance.

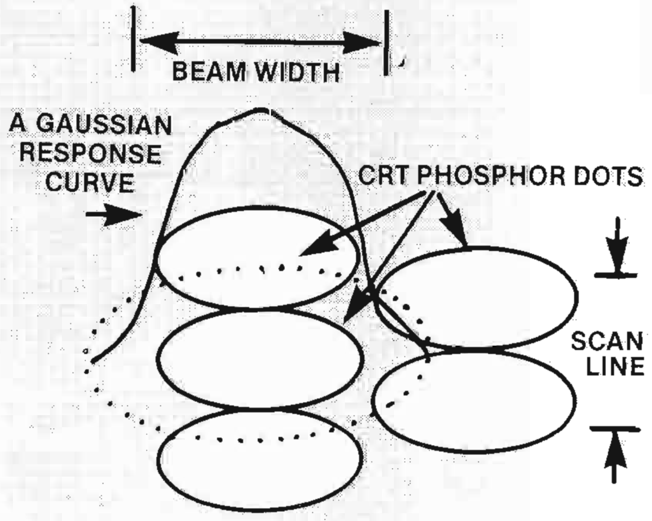
Comb filters:

Two methods are typically used to separate luminance and chroma. One, the 3.58MHz notch filter, uses high Q tuned bandpass and bandstop circuits to perform the separation. Unfortunately, the 3.58MHz filter to remove color information also removes luminance detail. An LC filter at 3.58MHz to recover color also records some luminance. These remnants of signals produce some of the age-old NTSC undesirables.

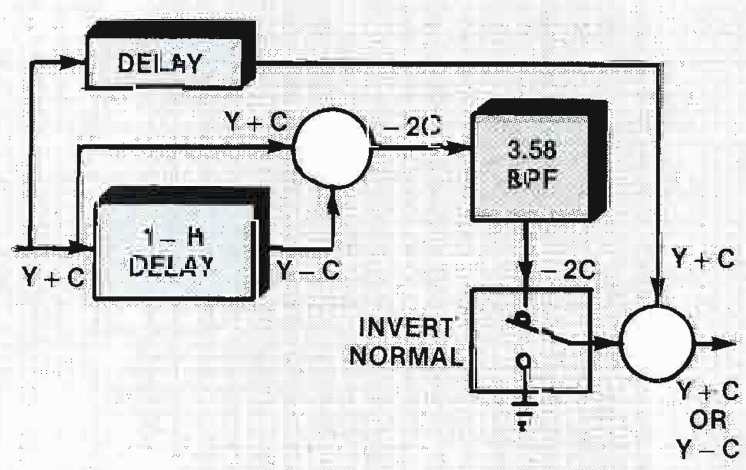
The second method is the comb filter. Although comb filtering creates additional harmonics in some situations, when coupled with bandpass filtering after separation, a comb filter produces images that are better than those produced by notch filters.

In operation, the comb filter depends upon the 180° inversion of the 3.58MHz color subcarrier on each TV line. You might say that for one horizontal line named Y+C, the previous or following line will be Y−C. If a Y+C line is applied to a 1H delay line, the output of the delay coincides in time with the next line (Y−C). If the two are summed algebraically in an op-amp, the result is Y−C − (Y+C) = −2C. The same approach may be used to remove chroma by reversing the connections on the op-amp, providing a 2Y result.

Resolution is degraded by the scanning beam because the response to the beam is greater than one phosphor dot in width.



A 2-H comb-filter color processor separates Y and C (inside the dotted line), allowing bandpass filtering of chroma without degrading luminance resolution.



Tired of excuses from "third party" synchronizer companies? Studer, the world's premier tape transport maker, now offers two new intelligent SMPTE/EBU bus controllers.

SC 4008: Dedicated and Expandable – The basic SC 4008 system controls four audio, video or film machine transports via Studer TLS 4000 synchronizers. For more sophisticated applications, an optional expansion board extends SC 4008 control to as many as eight machines. The operating panel has a full array of dedicated keys logically grouped according to function.

Optional features include take count-down unit, VITC reader/translator, video character inserter, and event controller with outputs to trigger up to 10 additional non-synchronous sources.

SC 4016: Soft Alternative to Hard Production Tasks– The SC 4016 top panel shows a radical departure from the SC 4008 concept. Instead of dedicated keys, the SC 4016 employs eight "soft keys" with internal alphanumeric LED displays. The software menu assigns functions to the keys according to selected system mode, and keys are automatically re-labelled to indicate currently assigned function.

The SC 4016 controls up to 16 synchronous transports, providing complete control (including shuttle and cue functions where applicable) as well as comprehensive machine status displays. Master and slave machine designations may be re-programmed at any time. And, for advance EDL preparation, the SC 4016 provides floppy disc data exchange with personal computers.

In Sync with Swiss Timing – Studer system controllers are made in Switzerland, the country famous for being in control and precisely on time. Every time. For more information on Studer system controllers, please contact your nearest Studer office.

STUDER REVOX

STUDER REVOX AMERICA, INC.
1425 Elm Hill Pike, Nashville, TN 37210, (615) 254-5651

Offices: Los Angeles (818) 780-4234/New York (212) 244-4462/
Chicago (312) 526-1660/Dallas (214) 943-2239
San Francisco (415) 930-9866

Machine Control from a Machine Maker

SC 4008

SC 4016

STUDER SMPTE BUS CONTROLLERS

Synchronizing complex, Austrian Broadcasting Center, Vienna. Studer SC 4016 system controller, Studer mixing console, Studer tape machines.

Circle (20) on Reply Card

Continued from page 32

some point, NTSC would cease.

Perhaps more politically acceptable would be the transmission of the TV signals in two parts. A primary channel would carry a standard 6MHz NTSC signal. A second transmission path would contain additional data for HDTV receivers to develop a 1,125-line image. The second channel would contain detail to enhance definition and would provide a 5:3 aspect ratio, all within a bandwidth of 3MHz to 6MHz. To appreciate the augmentation-channel enhancements, a new receiver design would be required, including progressive scanning. Typical NTSC receivers would be complemented by the encoding methods already discussed.

This approach to enhanced television brings up the question of spectrum efficiency. The argument against the second channel is defused by the narrowband channel for added definition. Another aspect of the argument is that of the spectral characteristics for the secondary channel. Is it adjacent to NTSC bands? Is it shared with UHF? If it is removed from standard TV frequencies, what RF characteristics must be considered to maintain timing, phase and related parameters based upon environmental effects to the spectra involved? Transmission-path delays would not necessarily be a problem if manipulation of data in receiver memories offered buffering capabilities to retime the dual-display information. A factor that would reduce protection for the augmentation channel is that sync could be included without the large opposite polarity pulse that exists in NTSC.

HDTV, as introduced, required a 30MHz channel to carry the necessary data. That drops in the single-channel MUSE system, demonstrated at NAB and in on-air tests sponsored by NAB and others in Washington, DC, earlier this year. The baseband signal of 8.1MHz does require at least an additional 1MHz of RF bandwidth for vestigial sideband transmissions. Bandwidth-reduction schemes, such as MUSE and the William Glenn 2-channel compatible HDTV system under study by New York Institute of Technology, are possible because our perception of moving detail does not require a continuous transmission of all image-detail information, as was previously thought.

Because the 3.58MHz subcarrier seems central to much of the image degradation, suggestions have entertained

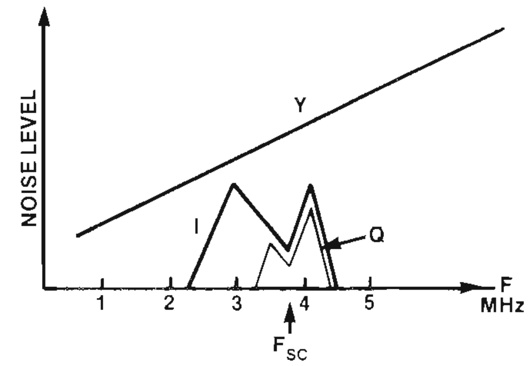


Figure 6. *Contribution of luminance and chroma channels to the overall noise level of an NTSC video signal.*

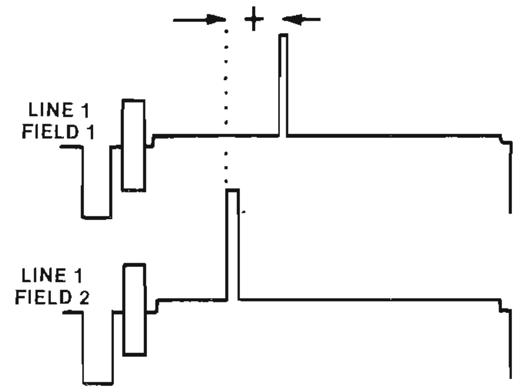


Figure 7. *A moving object changes its position in the time between two video fields, causing aliasing from scanning.*

Extraordinary situations demand an extraordinary camera

The new LDK 90 from BTS brings you a new dimension in CCD camera technology. It's the first frame transfer CCD camera designed for cameramen — by cameramen, and it defies all comparison with portable tube and first generation CCD cameras.

Cameramen want comfort with easy operation. So we made the LDK 90 light, easy to handle and we gave it a flat bottom.

They wanted an unobstructed view over the camera. So we designed the LDK 90 with the lowest possible profile, and we equipped it with a universally adjustable viewfinder.

They wanted a camera built to take the knocks and bumps of everyday camera work. So we made the LDK 90 extra rugged.

They wanted a versatile multi-role camera. That's why the LDK 90 system includes quick-fit ENG, EFP and on-camera recording modules for Betacam, Betacam SP and MII, as well as system remote controls.

The picture quality of our LDK 90 is outstanding. Three maintenance-free sensors team up with an optical shutter to totally eliminate smear. Pin-sharp picture quality is ensured by no less than 604 pixels per line (604 PAL, 610 NTSC). There's no lag, no risk of burn-in and no blooming. Dramatic low light level performance is combined with automatic dynamic contrast control, (500% signal level over peak white without loss of detail) and provides a contrast range never seen before in a video camera.

For more information contact

USA Corporate Headquarters,
P.O. Box 30816
Salt Lake City, Utah 84130-0816
Phone: (801) 972-8000.

Sales and Service Headquarters
900 Corporate Drive
Mahwah, New Jersey 07430
Phone: (201) 529-1550.

Regional Sales Offices

New York City (201) 529-1550	Mid-Atlantic (703) 461-0188	Northern California (818) 766-8184
Midwest (312) 803-8060	Southeast (904) 492-1600	Southern California (818) 766-8184
Northeast (207) 283-0777	Southwest (512) 335-1481	Intermountain (801) 972-8000
Allegheny (201) 529-1550	Great Plains (507) 334-1891	

Circle (22) on Reply Card

"Customer Satisfaction Is Our Satisfaction"

BTS Broadcast Television Systems

A joint company of Bosch and Philips

changing the color-subcarrier frequency. Immediate incompatibility with NTSC is obvious.

Modified compatibility

Ironically, NTSC picture quality suffers from the method by which it achieves its current resolution. The 2:1 interlace is used to raise large-area flicker phenomena to a rate that is relatively unobjectionable. In reality, 30 pictures per second are viewed, but through interlace, 60 half-pictures appear per second. The persistence of vision and of CRT phosphors combine to integrate the 60 events per second into a smoothly flowing sequence.

Anyone seeing a PAL signal for the first time may initially sense a visual flicker, particularly in large surface areas, from the 25-frame rate of that standard. The effect subsides after a few minutes, because of the mental integration of the two 50-per-second half-pictures. The higher 625-line images of PAL may play two roles in this integration. More lines mean more resolution from the start and more for the eye to comprehend overall.

In still images, interlace works well, but few TV programs consist entirely of stills. With motion, new problems develop. In the time interval between two fields, the position of an object may change significantly, producing blur. (See Figure 7.)

Suggested solutions to motion degradation include cameras operating at twice the standard scan rates, followed by adaptive processing to merge the additional data into a standard NTSC signal for home receivers. How successfully this could be displayed is uncertain. The Sony supermotion system took this approach with a 3X scan rate and subsequent processing in the VTR to a special-purpose slow-motion display.

With a sequentially scanned camera, less interfield movement would exist, leaving only the interline-position discrepancies to be resolved. Such a sequential scan also might be processed adaptively to an NTSC output, but the ideal solution for both approaches is a receiver following the design of the camera. Incompatibility with NTSC in both cases is immediately apparent.

Shutters in TV cameras reduce interfield effects and produce exceptionally high-quality images of fast motion without blur. In normal image-rate reproduction, perception integrates the positions from one field to another with no problem. If used for slow-motion reproduction, pictures from shuttered cameras exhibit spatial aliasing from image to image, simply because the interim motion data between normal field scans no longer exists. Perhaps a higher scan rate in the camera with appropriate processing would adaptively generate the missing information, but would there be a problem in displaying such signals successfully with NTSC?

No immediate solution

Millions of TV sets in operation worldwide meet current NTSC, PAL or SECAM specifications. Many homes have multiple receivers. Broadcasters must serve those viewers by providing signals that can be received by those sets. The pictures may not be perfect, but a majority of viewers are not terribly concerned or are unaware of the improvements that could be made to them.

An immediate switch to HDTV, rendering all current products useless, obviously would be economic suicide by the industry. However, procedures to improve what now exists might offer desirable interim solutions and buy time until something better comes along. Perhaps by that time, the industry will have defined exactly what it expects of HDTV.

Direct-to-Disk™

DIGITAL MULTITRACK RECORDER

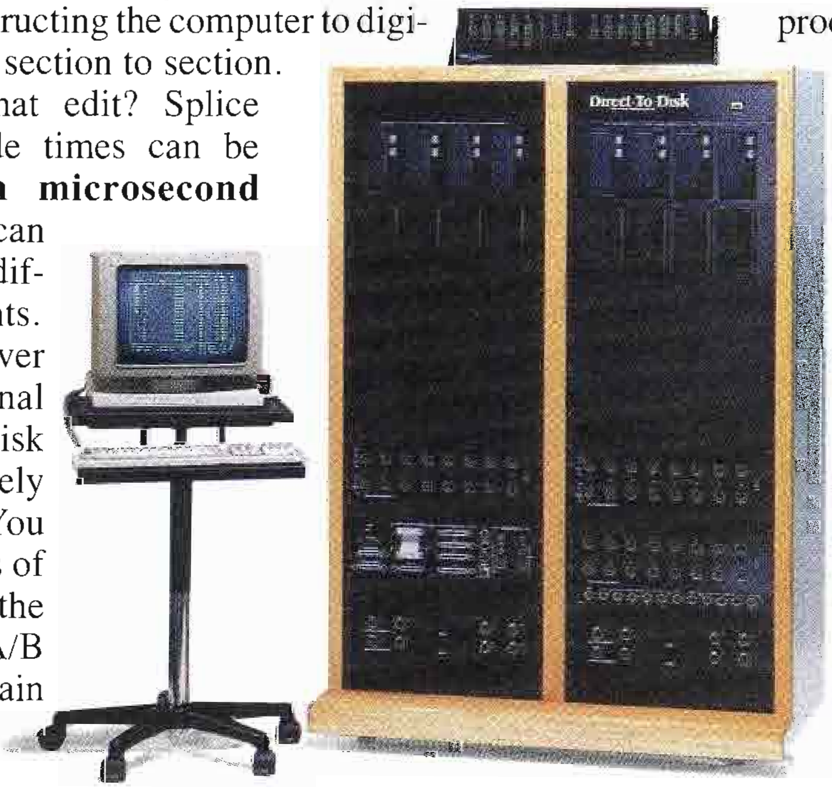
Already proven in leading studios throughout the world, the Direct-to-Disk Multitrack Recorder is now available in stand-alone, remote operated 4, 8, and 16-track units.

Powerful new software provides fast, flexible **automated editing** features unavailable with conventional tape-based multitracks, such as individual track offsets, auto fly-ins, and multiple loops on every track.

The terminal screen gives a complete, easy-to-read visual display of all track information.

Using a mouse you identify splice points with microsecond precision on the display, instructing the computer to digitally crossfade from section to section.

Unhappy with that edit? Splice points and crossfade times can be adjusted with **ten microsecond accuracy**. Or you can define a completely different set of edit points.



Because you never disturb your original tracks, Direct-to-Disk editing is completely **non-destructive**. You can construct dozens of different edits from the same material and A/B each one. Bounce again and again with no loss of fidelity. Even punch-in without erasing. The computer records and logs each move, and can instantly retrieve any pass for comparison.

With Direct-to-Disk, audio information is recorded and stored on a network of reliable, high-speed winchester hard disk drives, which offer not only **superior audio fidelity** and data integrity compared to tape, but superior performance. And because winchester disks are a **random access medium**, rewind, fast-forward, autolocate and SMPTE lock are instantaneous.

With variable digital sampling rates of up to **100 kHz, 16-bit resolution**, 0.04% distortion and 96 dB signal-to-noise ratio, Direct-to-Disk offers by far the best fidelity of any multitrack on the market today.

The stand-alone Direct-to-Disk is based on the same hard disk storage and proprietary processing technology that has made the Synclavier® the industry standard for reliable performance in the studio and on the road. And like the Synclavier, the Direct-to-Disk system is modular and **software updateable**.

As new features become available, you upgrade simply by loading in a floppy disk.

There is only one totally integrated disk-based digital audio recording and editing system for today's music production and audio post-production requirements—the Direct-to-Disk Multitrack Recorder.

New England Digital™

White River Jct., Vermont 05001
(802)295-5800

NEW ENGLAND DIGITAL OFFICES **New York** (212) 977-4510 **Los Angeles** (213) 651-4016 **Chicago** (312) 266-0266

AUTHORIZED DISTRIBUTORS **Nashville** (615) 327-4343 **Toronto** (416) 868-0528 **England** 44-1-202-4366 **France** 33-1-48-76-1144 **Japan** 03-354-3317 **West Germany** 49-7131-4801

Synclavier, Direct-to-Disk and The Tapeless Studio are trademarks of New England Digital. Product specifications are subject to change without notice. Copyright 1987 New England Digital.

Circle (24) on Reply Card

Video in transition, Part 2

By Paul McGoldrick

Integrating new formats requires new monitoring techniques.

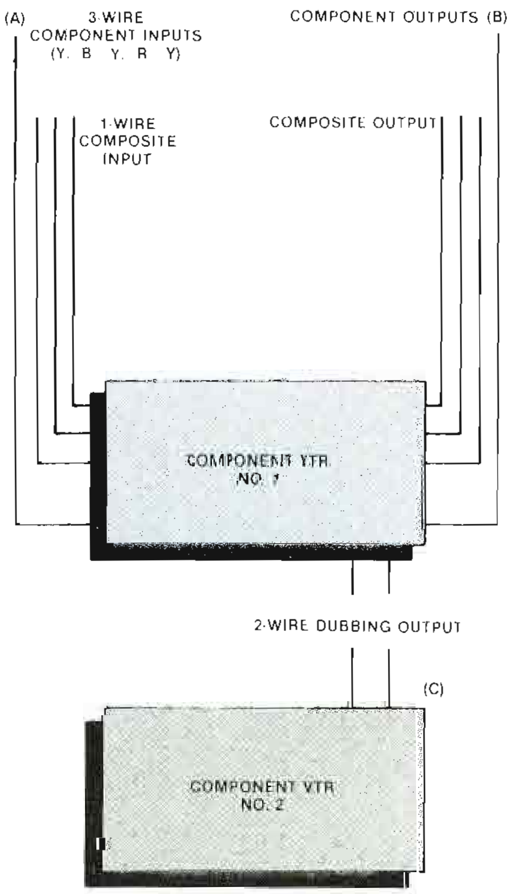


Figure 1. *A number of signals are required for complete CAV testing of a professional component VTR.*

Testing component video equipment requires signals capable not only of translating from component to composite, but also of providing information (in the composite form) about what is happening between channels. The translation makes it possible to use conventional display devices. This was the logic that led to the development of the *dual timing pulses* waveform (see "Video in Transition, Part 1," page 50 in the August 1987 issue of **BE**). This waveform does not replace other waveforms required for component testing, but can be used effectively in conjunction with them, particularly in the mixed environment created by the coexistence of component and composite hardware.

Expanding formats

The use of component analog video has been (and will continue to be) determined by the available VTRs, the standards they employ and their reliability and performance. Two major ½-inch standards—Betacam from Sony (and other manufacturers) and M-II from Panasonic/JVC—have been the subjects of much discussion. Betacam SP, Beta ED and Super VHS also have generated a good deal of interest among professional and industrial users.

The profusion of formats is the result of the quest for fulfillment of user needs, including the requirement for continued profitability in TV operations. Tight budgets in the broadcast industry have encouraged the development of recording systems that offer lower-cost operation and enhanced performance.

The popular machines available today are color-difference component (Y, B – Y, R – Y) with different signal levels, according to the manufacturers' standards. It is likely, however, that with the improving quality of recorders with separate channels for luminance and chroma signals (not just Y/C dubbing between machines), a number of products that offer high-quality signals will find applications within various areas of the broadcast environment.

That being the case, engineers, managers and operators will be faced with a barrage of component standards, in addition to the component/composite dilemma. Broadcasters must maintain flexibility in the way equipment is chosen and employed, and take great care to ensure that the various equipment "islands" are compatible with one another.

If you can satisfy the diverse requirements for testing component VTRs, you can meet virtually all other component testing requirements in studio equipment.

Test signals

Testing can be separated into two dis-

McGoldrick is vice president of sales and marketing, Magni Systems, Beaverton, OR.

The Abekas A42 Video Slide Projector

With the introduction of the A-42 Video Slide Projector, we revolutionized the still store business. Now, three years and 300 units later, we let our customers tell the success story of the A-42. The widespread use of the A-42 by networks and TV stations across the country has set a new standard for the still store in the television industry.

The overwhelming acceptance of the A-42 was no accident. It was a pioneering effort from Abekas that did the job—for the right price.

This small but powerful system is the answer for those seeking upward mobility. The A42 comes in single- or dual-channel configuration. Winchester-style hard disks provide an on-line storage capacity of up to 1050 frames/2100 fields. A digital ¼″ cartridge tape provides easy-to-handle, cost-effective, off-line storage. An optional library system gives the user simple yet sophisticated file management for up to 10,000 on-line slides.

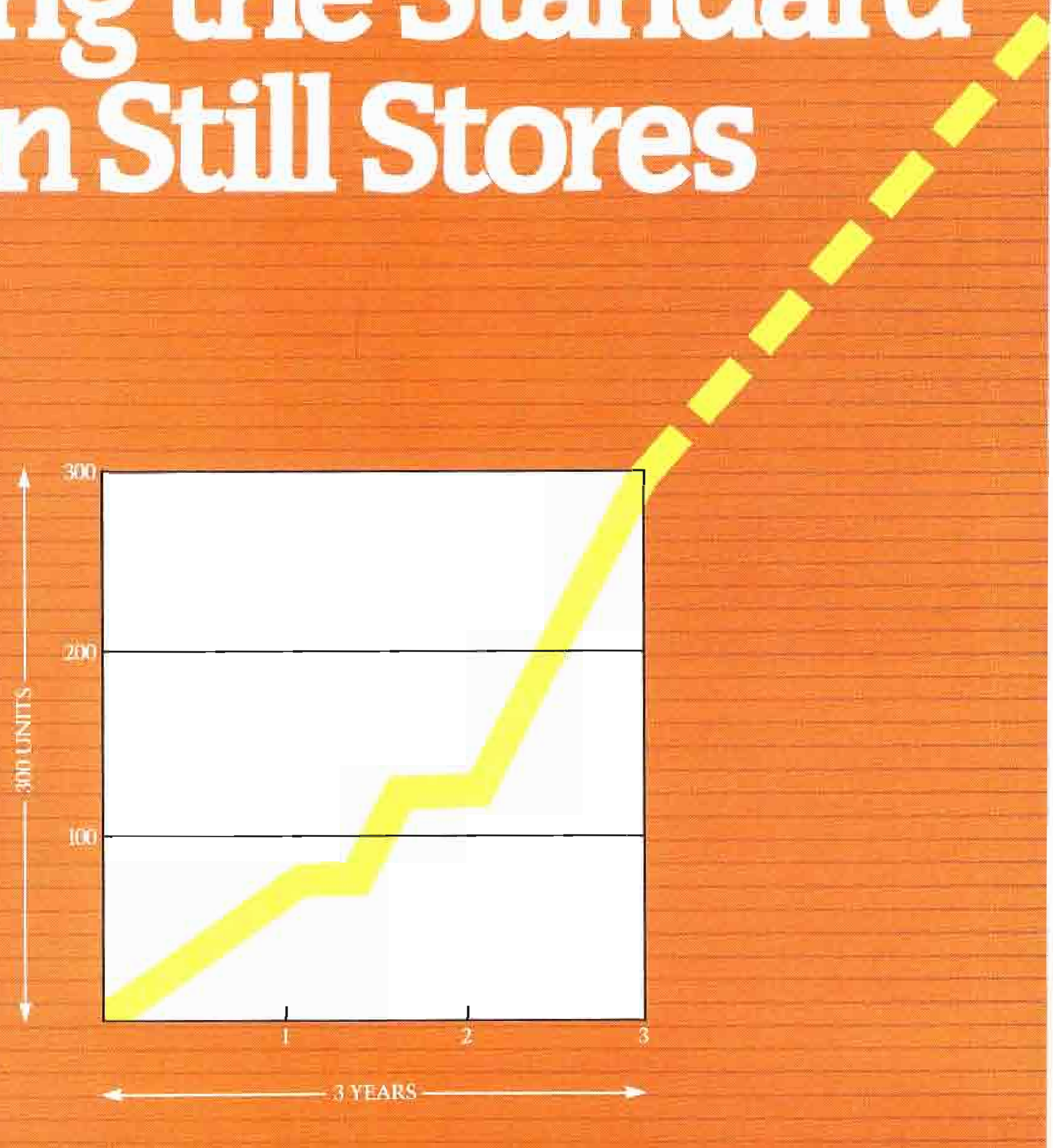
Discover the reasons behind the ever-growing list of our customers. Find out from them why the A42 can't be topped when it comes to outstanding reliability and price/performance. For details and a complete A42 customer list, contact us at: Abekas Video Systems, Inc., 101 Galveston Drive, Redwood City, CA 94063. (415) 369-5111.

Abekas
Video Systems, Inc

Now Anything is Possible

Circle (25) on Reply Card

Setting the Standard in Still Stores



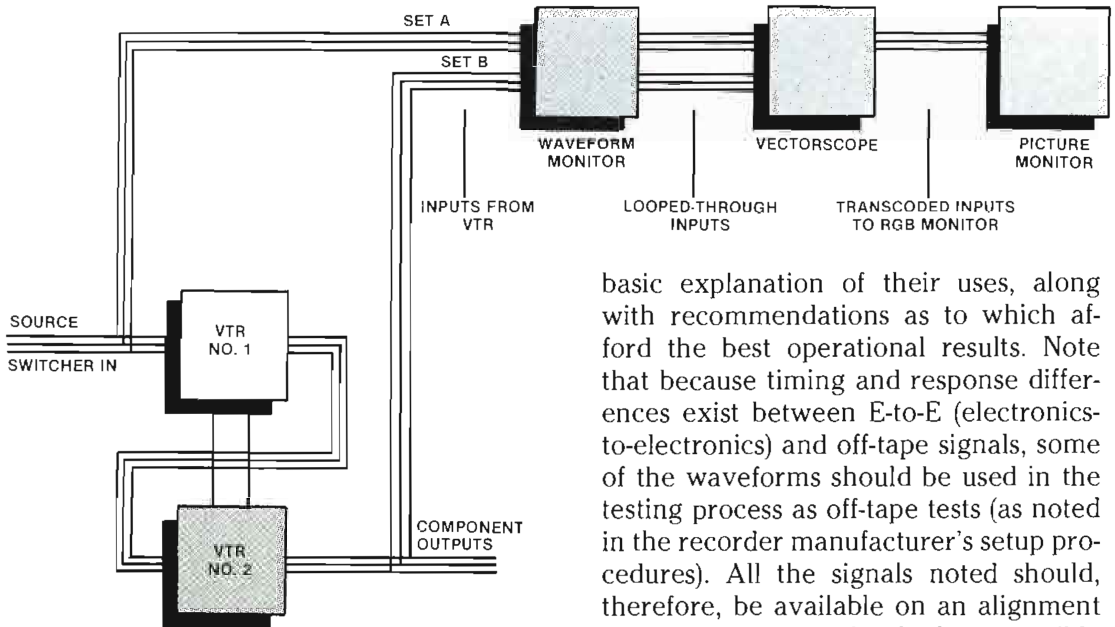


Figure 2. *Block diagram of a basic component editing suite showing interconnections to the required monitoring equipment.*

tinct divisions: special and general. The special category includes some signals discussed in the first part of this series last month, such as the dual timing pulses signal. Within the general category are waveforms more familiar to TV engineers and operators.

Table 1 lists the primary composite and component test signals and offers a basic explanation of their uses, along with recommendations as to which afford the best operational results. Note that because timing and response differences exist between E-to-E (electronics-to-electronics) and off-tape signals, some of the waveforms should be used in the testing process as off-tape tests (as noted in the recorder manufacturer's setup procedures). All the signals noted should, therefore, be available on an alignment tape recorded to the highest possible standard of accuracy.

The testing and monitoring of component VTRs, in whatever format, require test generators that will supply NTSC waveforms, 2-wire and 3-wire signals (see Figures 1 and 2). On the monitoring side, the waveform display and/or vectorscope should be capable of examining existing signals without requiring external patch panels and the like. The monitoring equipment also should be capable of transcoding the composite or color-difference signals to RGB to feed standard monitors without complex switching. Carefully chosen equipment will reduce the overall cost and complexity of testing and monitoring.

It must be emphasized that not all the test signals that are suggested or used in the component environment are suitable for transmission purposes. In fact, in some cases, if the luminance and color-difference signals were applied simultaneously to an NTSC encoder, illegal waveforms would result. It is, therefore, extremely important for the monitoring system in a component environment to have some kind of color-gamut warning with an indication of which channels are causing, or could cause, an illegal signal problem.

The table lists a range of typical signals for component testing and explains the applications they satisfy. Other signals are, on occasion, called for by either the equipment manufacturers or by acceptance engineering groups who want to evaluate equipment to the limits of its performance rather than simply "to specification." The table also notes whether the signal set is considered purely for operations, for maintenance or both.

Figures 3, 4 and 5 show three selected waveforms from the list in Table 1. Dis-

Main story continues on page 46

"And now, live from the scene..."

It's happening now, and it's news. Though it may not be a catastrophe to some, for you it's a disaster of unbelievable proportions. While your tape is trapped in traffic, in a helicopter on its way in, or racing to get into microwave range, your competition is on the air live. And, it hurts.

There's a simple solution and it's not as expensive as you think it is. The NETWORKER from Centro, or its 4x4 cousin the NEWSBREAKER, may just be the piece of production equipment you need to get the job done. And, to take back a few critical rating points.

The new 4x4 Newsbreaker.

Ku-band satellites, like electronic news gathering and microwave transmission, is helping redefine "local news." Whether you're looking for no-frills basic uplinking, a middle of the road truck with a little production gear or a full blown SNV, Centro has just the truck you're looking for.

You know Centro, the systems people who've been building top-notch mobile broadcast and production vehicles since the industry first discovered wheels. Everything from compact ENG vans to the big 48 footers.

So it should come as no surprise to find out that the most rugged, most versatile, most valued SNV on the market comes from Centro. Why not take a minute right now, while you're thinking about it, and give us a call. Before the next big story breaks and they're on the air again, first.

Centro is a subsidiary of Skaggs Telecommunications Service, an American Stores Company

Centro

Centro Corporation
369 Billy Mitchell Road
Salt Lake City, Utah 84116
1-800-654-4870

Circle (27) on Reply Card

SIGNAL		AVAILABILITY	SIGNAL COMPONENTS	APPLICATIONS	OPERATIONS/ MAINTENANCE
1	**SMPTE color bars**	C	75% color bars with 75% white and 7.5% setup; reverse blue bars; IWQ with PLUGE at setup level	Picture monitor brightness, hue and saturation adjustment	O
2	**Multiburst**	C	Pedestal; 0.5, 1.25, 2.0, 3.0, 3.58 and 4.1MHz sine-wave packets	Frequency response	O/M
			12.5T mod pulse	Chrom/lum delay and gain inequality	
			2T pulse	Pulse response	
3	**Matrix (split field)**	C/G/2/3	Convergence	Picture monitor linearity and convergence	O/M
			75% color bars	(see No. 1)	
			Reverse blue bars	Picture monitor hue and chrom setup	
			Dual timing pulses	Component signal delays and amplitude	
			PLUGE at setup level	Picture monitor black setup	
			5% safe action area marks; 10% safe title area marks	Production video limits	
4	**Window**	C/3	3-wire window: purple on green background	Clamp circuits, gain-matching on color-difference channels	O/M
			NTSC window: 100% white with inverted 2T pulse, after	Field time errors	
			modulated 12.5T and 2T pulses	Group delay and frequency/pulse response	
5	**Color bars (100%)**	C/G	Six 100% bars with 100% white bar and 0% setup	Encoder headroom evaluation	M
6	**Chroma sweep**	C	Sweep 1.579-5.579MHz, 75IRE markers every 0.5MHz, 100IRE marker at 3.579MHz	Chrom bandpass, chrom rejection by lum circuits in decoders, comb-filter adjustment	M
7	**Mod pulses**	C	White reference bar; pairs of mod chrom pulses: 20T, 12.5T, 10T, 5T and 3T, one each in B – Y and R – Y	Similar to dual timing pulses in function, but checks over a wider bandpass	M
8	**Frequency response (split field)**	G/2/3	Field split alternating multiburst: sector 1 = Y, sector 2 = B, sector 3 = R; multiburst; Y:0.5; 1, 1.5, 2.5, 3.58 and 5MHz packets; R and B: 0.5, 1, 1.5, and 3.0MHz packets	System frequency and transient response Interchannel crosstalk	M
9	**Linearity (split field)**	G/2/3	Sector 1: Y = 4.5MHz 3-level packet and 100IRE linear ramp, B = 3-level 1.5MHz packet and ramp, R = 3-level 1.5MHz packet and ramp	High- and low-frequency linearity; tests encoders over a wide range of input and output amplitudes	M
10	**Noise coring**	3	Y = 10IRE Bow-Tie signals of 0.5, 1, 2, 3 and 4MHz; field split at different pedestals	Tests high-frequency noise coring circuits	M
			Color difference: Bow-Tie, 0.5, 1, 1.5 and 2.5MHz		
11	**Timing Bow-Tie**	G/3	Sine-wave packets: 500kHz, lum; 502kHz, color difference; 20ns markers	Determining timing and amplitude errors between lum and color difference	O/M
12	**Crosstalk (split field)**	3	Y: sweep, 0.5 to 6MHz, with markers; color difference: 0.5 to 2.5MHz sweep, with markers; time-coincident 300ns component 3T pulses all channels	Frequency response and crosstalk	M

C = Composite
G = GBR
3 = 3-wire
2 = 2-wire

Table 1. *The primary composite and component test signals and their applications.*

Continued from page 42
plays such as these can tell an operator or maintenance engineer a great deal about the performance of the equipment under test, provided the person knows what to look for.

Jitter in the CAV recorder

Engineers using composite video equipment are probably familiar with *jitter*, which consists of timing perturbations about the correct mean value. This may sound like a mouthful, but in real terms, it is the lengthening or shortening of the TV line time on a rapid variation basis (certainly at a rate less than 10kHz) or the rapid movement of subcarrier frequency or SC/H phase. It is the video equivalent of flutter in an audio recorder.

Luminance jitter in a component recorder causes basically the same visual appearance as jitter in a composite recorder. Jitter in the color-difference signals that differs from that in the luminance channel causes an apparent variation in RGB registration. Excessive differential jitter appears as a variable vertical color fringing, and it may result in some loss of color detail.

Because the channels in a CAV machine are recorded by separate heads and are separated mechanically on the drum, there is always a difference in jitter between the channels. In addition, the horizontal tape separation between channels means that the channels are not recorded in the same place and, therefore, are subject to short-term variations between adjacent, but different, places on the tape. Also, because of multiplexing techniques, the signals are not recorded simultaneously in time.

Experience shows that even after time base correction, some differential jitter is visible between channels from the current range of component recorders. However, it is an exceedingly small amount, and it does not seem to be a problem that needs to be addressed with separate, highly refined test signals. Jitter can be seen and, to a large extent, minimized by adjustment with 10ns *Bow-Tie* signals. Jitter "targets" from CAV recorder time base correctors seem to be about 5ns. This compares favorably with earlier recording techniques.

Definite subjective differences in differential jitter exist in machines in which time multiplex, rather than frequency multiplex, is used. One does not appear objectionably worse than the other, however, in a well-adjusted machine.

Moire noise or patterns

Moire in recording is produced by the interference of coherent frequencies, usually of high amplitude as well as high frequency. In composite recordings, such moire production was reduced significantly by the movement to highband systems. CAV recorders started as lowband systems, but the nature of separate channel recordings, in which the collision of high-frequency luminance information and chroma can no longer occur, means that moire production is really limited to coherent collisions within the individual channels. This is far less likely, and is limited to rather unusual signals.

Separate moire measurements for CAV machines do not seem to be considered necessary. However, if long-term operational experience by users indicates that it would be advisable, it would be a straightforward matter to generate a new test signal. The presence of the relevant interfering frequencies for spectrum-analyzer measurements of the moire component levels, compared to the signals that produced them, would be a duplication of current techniques for composite machines.

Chrominance noise

A number of organizations and manu-

This is what makes the new Sony editing VTR so good.

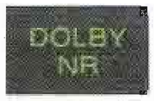
This is what makes it great.

U-matic

Plug-in Time Base Corrector

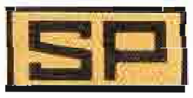
TBC Remote Control

Expanded Dial Operation

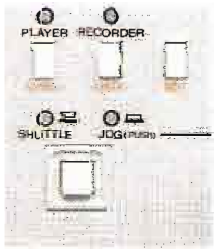


Dolby C
Noise Reduction

Status Display



SP Technology



Front-panel Presets

Built-in Character Generator

Plug-in Time Code

Self-Diagnostics

It's rare to find an editing VTR that comes with everything you want yet still goes with everything you have.

Enter the BVU-950.

It has the resolution, the sound quality, and the advanced editing features you've been wanting, yet it's still compatible with the entire U-matic line of players and recorders. You can even hook it up to other broadcast equipment using an RS-422 interface.

To learn more about this remarkable addition to the U-matic line, please write to Sony, P.O. Box 6185, Department BVU-1, Union, NJ 07083.

Introducing the BVU-950.

SONY
Professional Video

Circle (31) on Reply Card

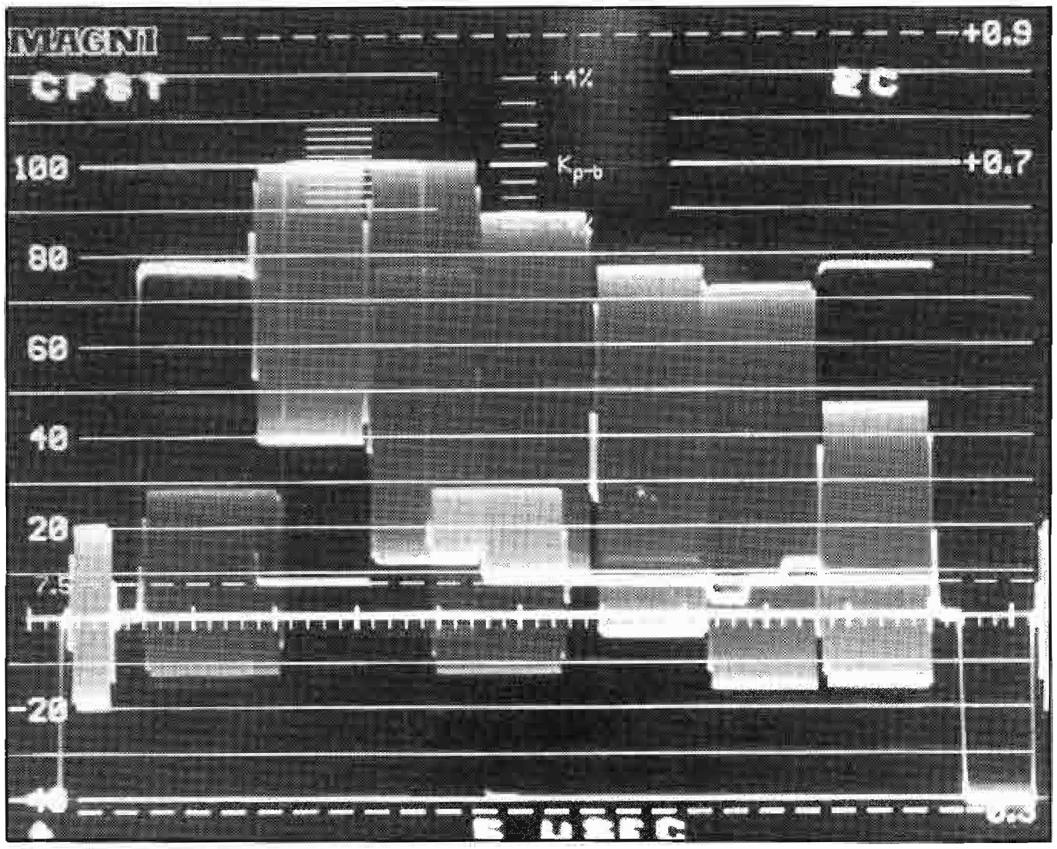


Figure 3. *Test signal of SMPTE color bars in composite format: 75% bars, reverse blue bars, IWQ plus PLUGE. This signal is used primarily for picture-monitor brightness, hue and saturation adjustment. (Refer to signal No. 1 of Table 1.)*

facturers have studied the relative effects of color-difference noise and differential-channel jitter on the resultant noise in the chrominance channel of a composite, encoded signal. None have suggested that measurement of color-difference signal-to-noise ratio, using luminance techniques, is an insufficient test. However, with the relatively lower bandwidth of the color-difference components compared with luminance, chrominance noise is lower than that produced in a composite recording environment.

Testing for tomorrow

Dramatic changes have come about since the days of 2-inch (quad) recorders. The cost, lack of mobility and relative complexity of the format meant that most machines were restricted to areas where front-line maintenance was available on short notice. With the introduction of the 1-inch formats (type B and type C), lower-cost machines suddenly became available, less "magic" was involved, and the same apparent technical quality could be more easily achieved.

The introduction of ¾-inch U-Matic systems permitted true portable video recording and ushered in the era of ENG. The U-Matic format, in fact, almost sin-

The SL 5000 M Series

The World's Most Advanced Stereo Broadcast Consoles

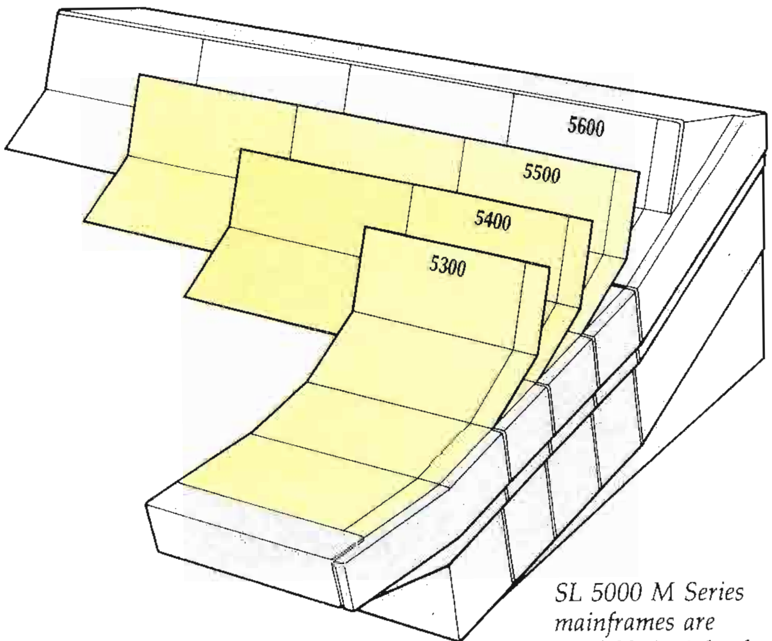
The SL 5000 M Series is designed to meet the demands of today's broadcasters – offering a new level of operational and creative flexibility in a practical format.

Built from a wide range of audio and control cassettes housed in a variety of mainframe sizes, the SL 5000 M Series offers all the advantages of customised functions and layouts, even for the smallest consoles. Larger organisations will also benefit from common operating procedures, parts stock and maintenance routines.

The SL 5000 M Series is designed for a wide diversity of applications – live radio, continuity, outside broadcasts, film and video post. It will satisfy your requirements for many years to come.

HTV – Bristol △

Film Australia – New South Wales ▽



SL 5000 M Series mainframes are available in 4 depths and from 8 to 72 channels wide, allowing consoles of almost any size and capacity.

Whether you are looking for an eight input on-air console, or a 72 input multitrack desk, call us now and join the growing number of broadcasters equipped for the 1990s.

Solid State Logic

Oxford • Paris • New York • Los Angeles

Begbroke, Oxford, England OX5 1RU • (08675) 4353
1 rue Michael Faraday, 78180 Montigny le Bretonneux, France • (1) 34 60 46 66
101 Park Avenue, Suite 2506 • New York, NY 10178 • (212) 315-1111
6255 Sunset Boulevard • Los Angeles, California 90028 • (213) 463-4444

Circle (33) on Reply Card

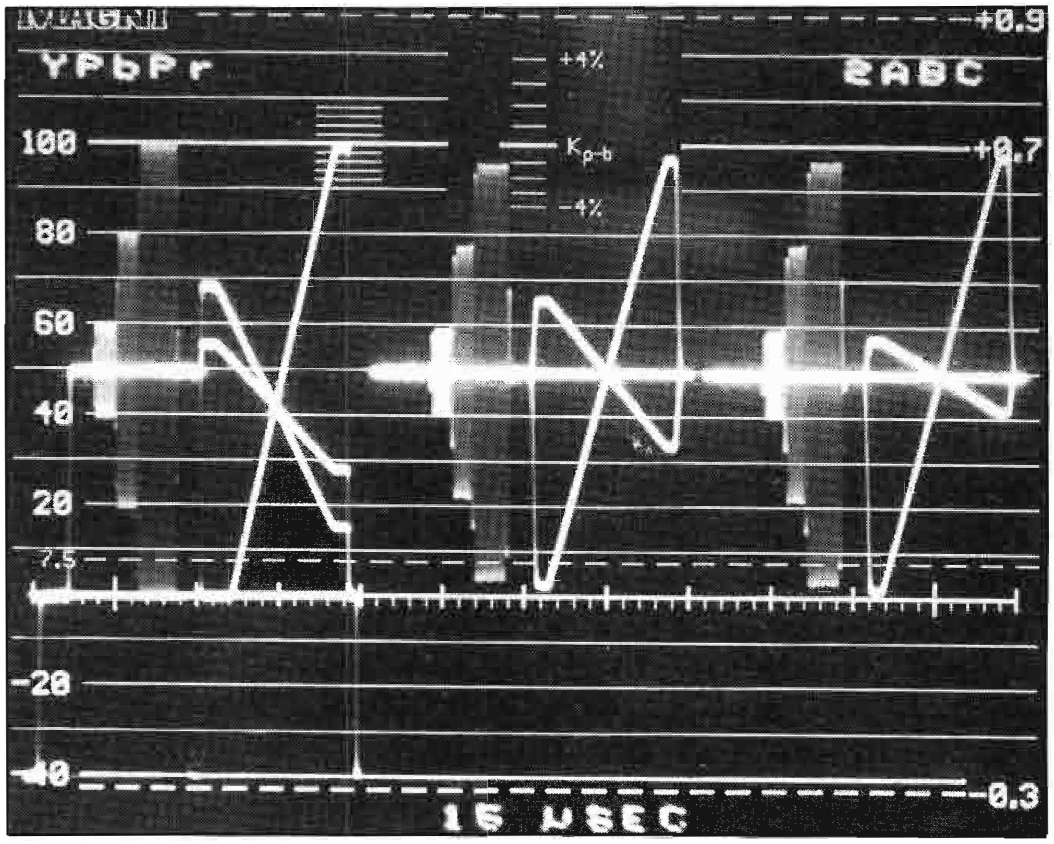


Figure 4. Test signal for high- and low-frequency linearity. This waveform checks encoders over a wide range of input and output amplitudes. Parameters are: linearity at 4.5MHz at three levels in Y; and at 1.5MHz at three levels in B – Y, R – Y plus ramps. (Refer to signal No. 9 of Table 1.)

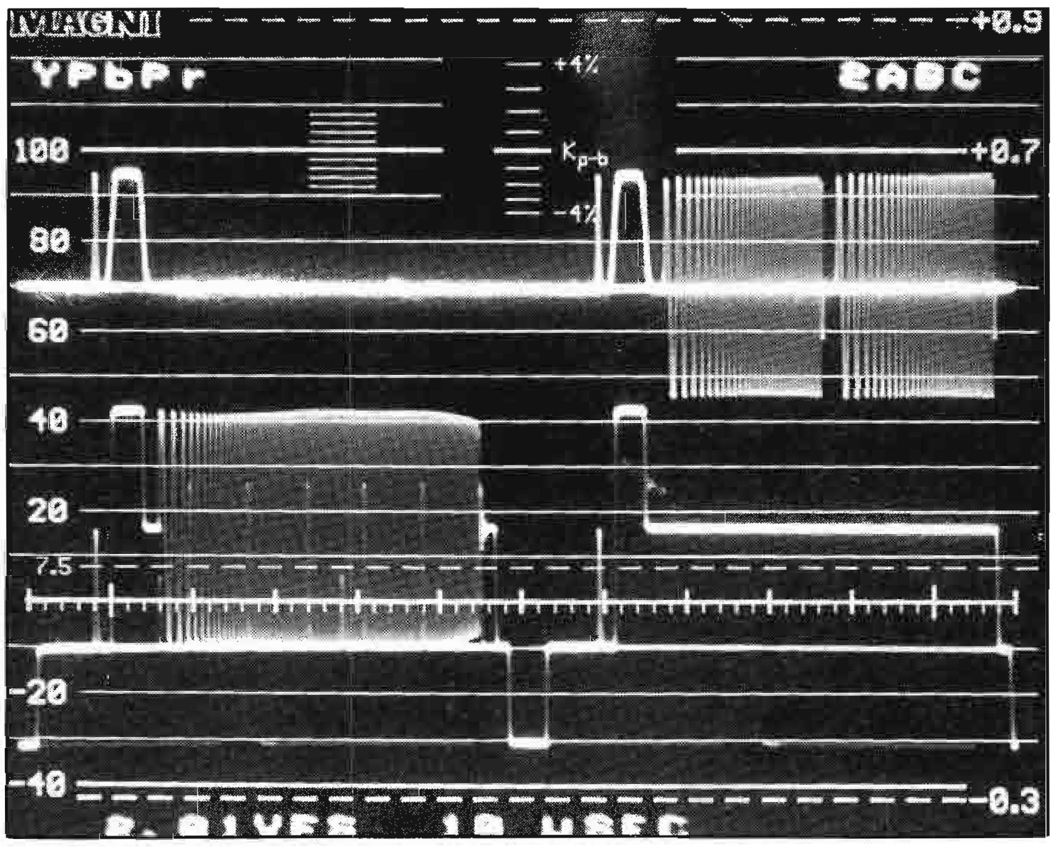
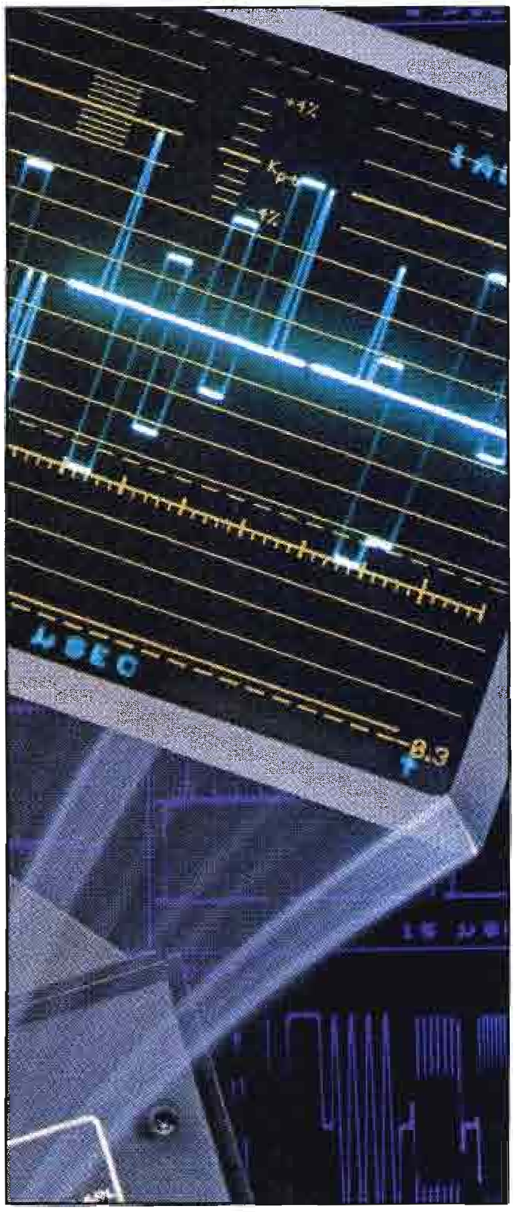


Figure 5. Test signal for frequency response and crosstalk. Crosstalk signals are in color-difference component format. Sweeps are 0.5-6MHz on Y and 0.5-2.5MHz on B – Y and R – Y.

gle-handedly changed the face of TV news.

Today, the new ½-inch videotape formats offer the user the ultimate in flexibility and portability, along with excellent technical quality. The fight to maintain that quality rests with engineers and maintenance personnel. And that work can be accomplished only with the proper tools.

Editor's note: The *Bow-Tie* signal is an invention of Tektronix and is used with permission. [BE]



The ins & outs of video switching

By Carl Bentz,
technical and special projects editor

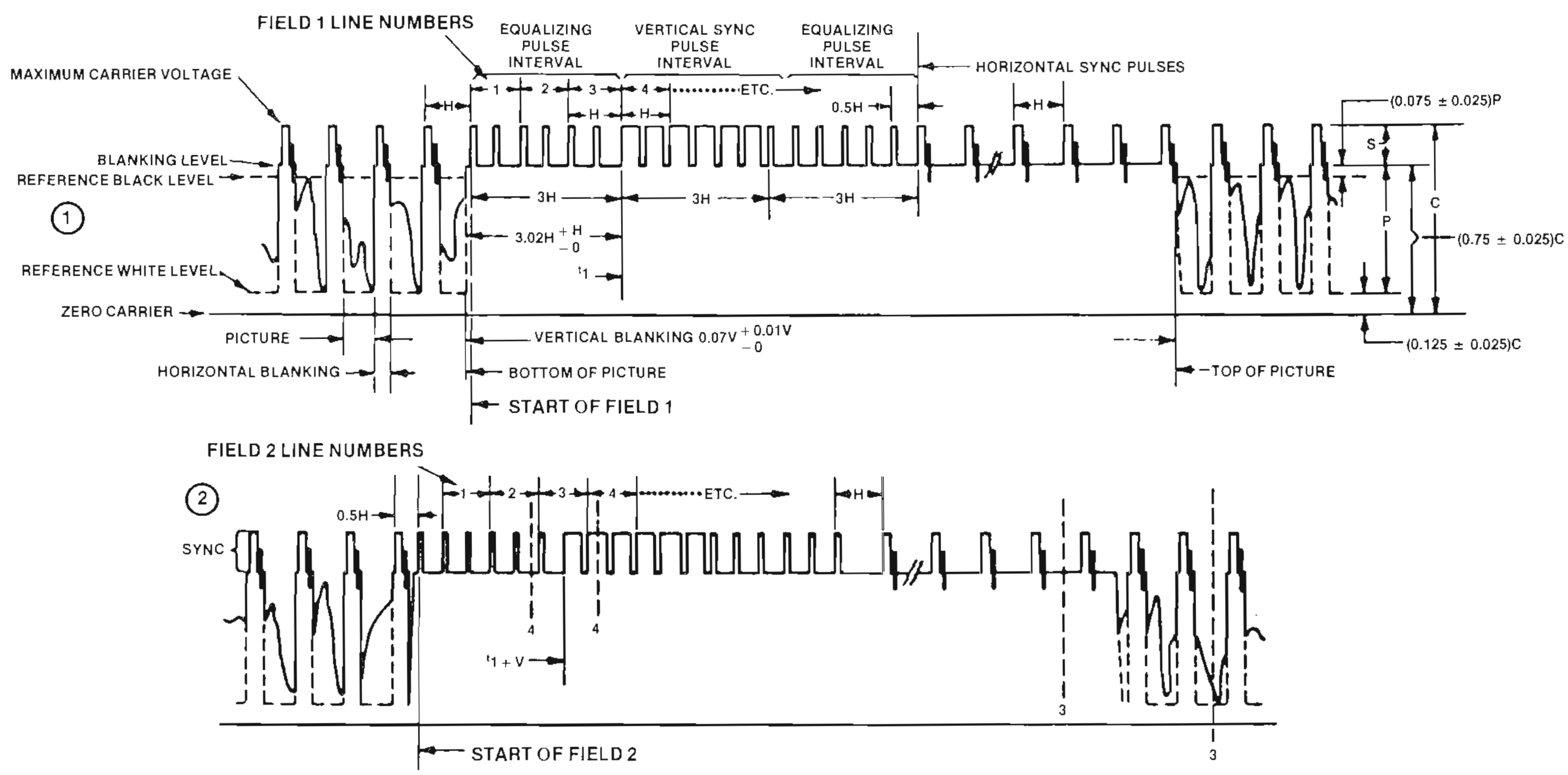
Chroma-key and other TV magic result from ultralinear analog and high-speed digital concepts.

The primary goal of any signal-switching system is to simplify the control and flexibility of signal source-destination interconnections. The sophistication of a switching system in broadcasting depends upon several factors:

- The function of the system—master control, production or utility-routing switching;
- The type of source;
- The destination;
- How clean the switching must be; and
- The type of switching mechanism used.

Consider these factors relative to vid-

Figure 1. The vertical interval includes continuous horizontal sync information as well as a method for triggering vertical sync. Tolerance of pulse widths is critical for image stability on the monitor or receiver.

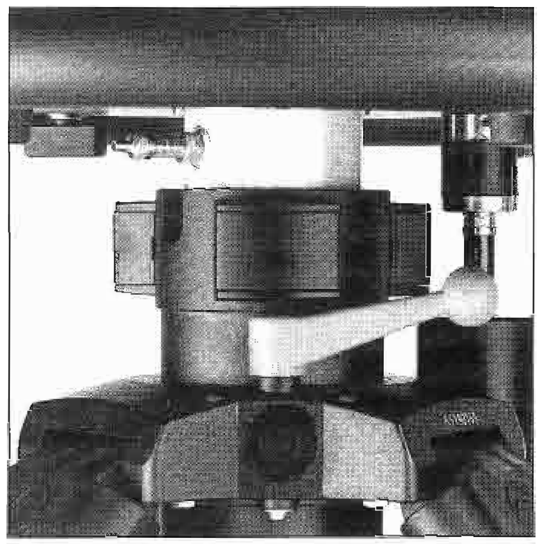


Hello world.
We can put you on a pedestal.

Sachtler has uniquely combined a pneumatic center column with a double-wheeled, steerable combi-dolly that utilizes modular construction and lightweight materials. The dial-in steps of drag and built-in counterbalancing let you pan and tilt smoothly and precisely, fast or slow, in any direction. It's as close as you can get to taking your studio with you on location. Anywhere. Anytime.

Sachtler is so confident of the performance of the Combi-Ped system that it has extended its normal usage warranty from **1** to **3** years and guarantees its leak-proof fluid modules for **5** years. It's the best warranty in the business and comes only with the best camera support systems in the world.

Call or write today for more information and the location of your nearest Sachtler dealer for a hands-on demonstration.



sachtler®
corporation of america

55 North Main Street
Freeport, NY 11520
Phone: (516) 867-4900

West coast:

3316 West Victory Blvd.
Burbank, CA 91595
Phone: (818) 845-4446

Circle (35) on Reply Card

eo-signal control in the production studio, in master control or through large-scale matrix routing.

Why clean switching?

Various contact forms may be used to switch video. The simplest form is the utility switcher, used to select a signal to the monitor. If the cleanliness of the switch is relatively unimportant, an interlocked mechanical device may suffice. When the button is pressed to initiate a new connection, the break-then-make switcher releases the existing set of contacts before completing the newly selected circuit. Another type is the make-before-break type, which maintains the original connection until the second is made.

A total break in signal continuity is likely with both forms, causing a massive disturbance on the monitor. For utility monitoring, this probably causes no great harm, but for the on-air signal, neither approach works.

For production and on-air video switching, both of which also may include a large matrix-routing system, signal continuity must be maintained. There can be no dropout to, or double illumination of, the destination during signal transitions. Also, no major timing or level changes should occur in the stream of synchronizing information being fed to subsequent equipment. Such changes may cause undesirable results. This requirement also precludes the use of simple relays in the switching system, because of the possibilities of contact bounce and multiple contact closures within a few milliseconds.

Video recorders normally require a continuous stream of sync to generate correct control-track information during a recording. No matter how fast a break in signal, any change in sync timing causes the recorder to reorganize its servo systems to the conditions posed by the new sync signal. If that happens, picture breakup will occur on subsequent playbacks of the recording. For an instantaneous drop in signal, time base correction of the VTR playback may solve the problem. If you are recording from a satellite or remote signal source, you can use frame synchronizers to maintain a continuous signal source.

Some transmitter designs require video-signal continuity to operate. The logic tree of such transmitter diagnostics designates a drop or discontinuity in sync as an alarm condition and forces the transmitter off the air. A frame synchronizer on the STL feed to the transmitter would keep the station on the air in the event of momentary STL outages or failures in equipment prior to the STL. The operator would be expected to keep an eye on the transmitted signal, however, because FCC rules and good engineering practices consider extended periods of transmitted black video, with or without audio, to be undesirable.

In the VBI

The solution to switching video signals without losing sync stream continuity is *vertical interval* switching. If all changes in full-screen images are made during the *vertical blanking interval* (VBI), vertical rolling in the resulting picture usually is avoided. However, a VBI switch is somewhat critical because other factors also are involved.

First, the number of horizontal lines within a field (and frame) structure must remain respectively constant at 262.5 or 525 for NTSC (312.5 or 625 for PAL). Second, the switch must always occur at the same point in time within the frame. That is, it cannot be during field 1 for the signal being released and during field 2 in the signal being taken. In fact, the switch must occur consistently on the same line within the frame. Third, the

Continued on page 58

"Here's why Blane Webster bought Auditronics for WLAK–FM"

Blane Webster.
Chief Engineer. WLAK–FM

"When I prepared the budget for our new facilities on Chicago's Michigan Avenue, I could have included any console I wanted, be it Ward-Beck, Neve, you name it. So I looked at and listened to everything the industry had to offer, from the Harrison to the Harris Medalist, and I bought Auditronics.

I bought the Auditronics 200 primarily for its audio quality, by which I mean its waveform integrity, freedom from distortion and low noise floor. The quality of its sound is remarkably transparent. I think Auditronics' VCA technology is really good too, maybe the best on the market.

I also looked for reliability. The console's the most important link in the studio chain because it's on the air all the time. We just can't afford a failure, and I recalled that our old Auditronics console at Sears Tower never had an on-air failure.

Features were important too, like the modular concept that lets me pull a module out and pop another one in almost as fast as making an Indianapolis pit stop. If I need another mike channel or cart machine channel, I've got it right here on the shelf for immediate use. The layout of the Auditronics 200 is almost self-explanatory so our on-air people can use it without making mistakes, and the 200 is rugged enough to withstand the jocks' abuse and coffee spills.

One of the things that sets WLAK apart is that we're the number 1 adult contemporary station in the Chicago market, and to us being number 1 means more than just winning in the ratings. It means being the best both on and off-the-air. This includes the kind of equipment we buy and the way we use it. We're a winner and we're proud of it."

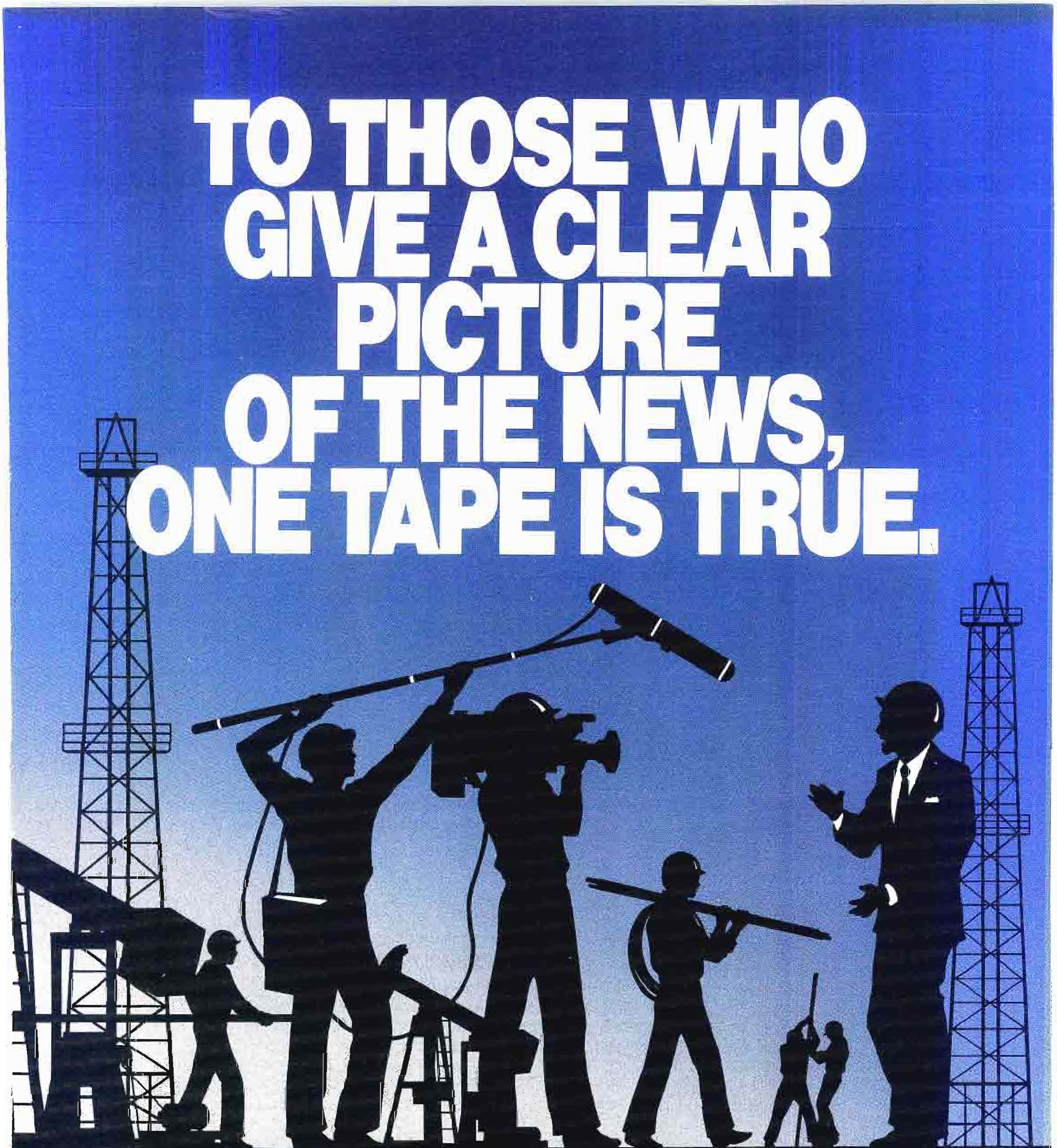
If you'd like to know more about why Viacom's Blane Webster specifies Auditronics consoles for *both* on-air and production, call 800-638-0977 toll free, for complete information and a demonstration near you.

auditronics, inc.
3750 Old Getwell Road,
Memphis, TN 38118 • 901-362-1350

Circle (38) on Reply Card

One Tape for a True Picture.

If digging for oil is the story, digging for news will take you there. And the tape you take is the 3M ¾" MBR™ Videocassette–created to exceed even our widely acclaimed MBU Videocassette. Designed with our exclusive Anti-Stat™ System–to reduce its static charge and help prevent the dust buildup that causes dropouts. To give you a true picture.


TO THOSE WHO GIVE A CLEAR PICTURE OF THE NEWS, ONE TAPE IS TRUE.

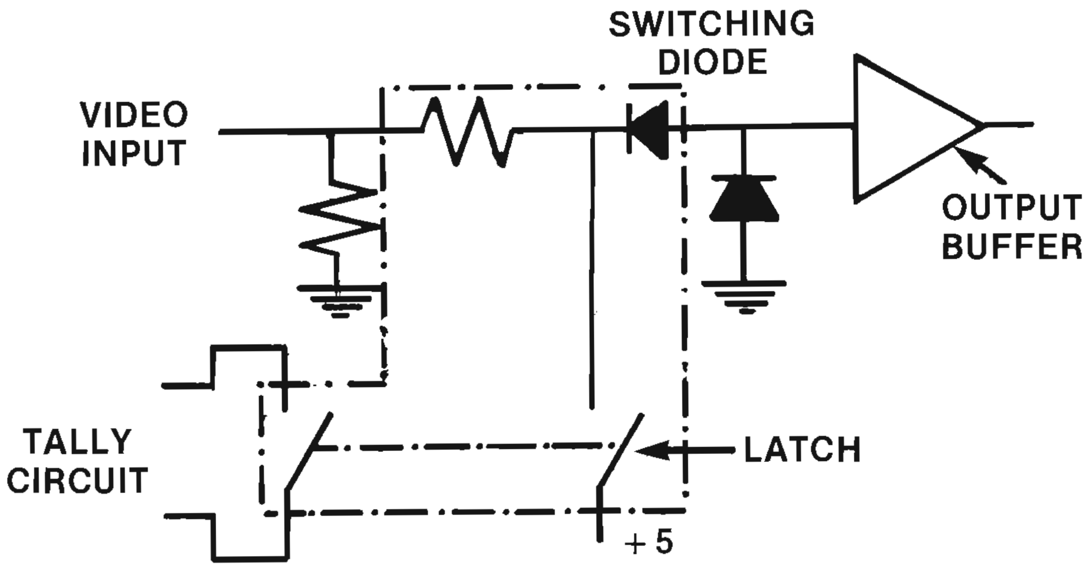


Figure 2. A block diagram of a video switcher crosspoint.

Continued from page 54

phase of the subcarrier relative to sync (SC/H phasing) should remain as constant as possible.

The easiest method to avoid timing discrepancies among different signals is to keep all sources *in time.*[1,2] A thorough understanding of timing is essential for engineers and technicians assigned to the task of setting up and maintaining a TV studio facility. Although most discussions of SC/H phase and sync timing have been directed toward editing facilities for creating taped presentations with zero defects, live signals should be handled with equal care.

It is worth looking at the vertical interval to understand how its components relate to stable pictures. (See Figure 1.) Two similar forms of the VBI structure exist, depending upon the preceding field. Active video may or may not conclude with a half-line.

Generally, four sectors of time between active video fields must be considered. The first, an *equalizing pulse interval*, is equal to three horizontal lines, with each 63.5μs interval being broken at midpoint by pulses at a 2xH rate. The presence of the 2xH pulses aids in maintaining CRT display horizontal sync during the lengthy vertical blanking interval. The 2xH pulse rate alleviates the problems that would result from the half-line differences between fields 1 and 2.

Next is the *vertical sync pulse interval* with vertical serrations, characterized again by the 2xH pulse train. The polarity, however, has been inverted. The vertical sync pulses are integrated through an RC until sufficient level is achieved to trigger vertical retrace. Alternatively, a solid-state network can be used to determine the presence of the interval and trigger retrace. Again, the duration is equal to three horizontal-line periods.

The third section of the VBI is another equalizing interval with 2xH interruptions to retain or restore normal sweeps in the display device. This section is perhaps even more valuable than the first interval in maintaining monitor sync after the vertical sync interruption.

The last section, lines 10 to 20, contains a variety of video black or data signals with normal sync and color burst information. The first half of line 21 may contain data used to include closed captioning for the hearing impaired, although some stations may use the period for other purposes. The second half of the line will either contain data or be blank, if the subsequent video is a field 1. If the interval begins field 2, the first half-line contains a pseudo data block to aid in keeping data receivers synchronized. The second half of the line begins the active picture area for the field.

Lines 10 to 20 may serve a variety of purposes, including vertical interval test signals (VITS), vertical interval reference signals (VIRS), teletext data transmissions, selectively decodable program-captioning signals or other analog and digital services. Restrictions upon signals inserted on these lines are that no interference in the active image area or sound channel results and that any additional video-signal bandwidth incurred because of these signals must remain within the standard 6MHz video channel.

Crosspoints

The actual mechanics of the switch take advantage of solid-state switching devices. Figure 2 illustrates the concept of a crosspoint. In essence, switching occurs with bias voltages on diodes. When a small signal diode is reverse-biased, video cannot pass through the resulting high impedance of the diode PN junction depletion area. If a forward bias is applied, the depletion zone is reduced, and the diode becomes a low resistance to the signal.

When the switcher operator makes a selection on the control panel, a pulse is sent immediately to the input gate of a latch circuit. A second input on the prelatch gate circuit enables latch operation only at a specific time within the VBI. The latch is a type of set-reset multivibrator circuit that is triggered into its on position, then remains in the on state until an unlatch trigger (and enable pulse) is generated at the press of another button. The on or off output from the latch circuit is routed to the bias-control network for the crosspoint.

Non-synchronicity

Vertical interval switching solves most problems if all video inputs are synchronous. However, signals not locked to local studio sync present new hurdles. For many years, standard practice for network affiliates was to gen-lock to the network signal at some point prior to a program feed, during which local supers, fades or effects might occur.

Because a switch to gen-lock normally caused a momentary disruption of all local sync-driven equipment, it was done during video black between programs or spots. (Dropping gen-lock causes no problem, because the local sync source merely continues in its present state. However, re-entry to gen-lock, even immediately, probably will cause another disturbance.) This plan works fine until, for some reason, the network loses its sync. And when the network loses sync, so do its affiliates.

Stations can circumvent momentary sync loss by using frame synchronizers for all incoming remote feeds, such as network, satellite or ENG vehicle return signals. The VTR playbacks are locked to house sync through their TBC units. As a result, all remote and tape signals can be used in fades and effects with studio cameras, the telecine and character generator.

Unsynchronized signals cannot be used with effects and fades, because the timing discrepancies cause picture breakup or unstable color. A *cut switch* to and from the non-sync source is possible. Current (house) sync is maintained on the output of the switcher until the transition to the untimed source occurs. The instant of switching is usually during the 14th line of the current picture signal; that is, the switch to the new source occurs at a point after the second set of equalizing pulses and before most of the commonly used vertical interval test or data signals.

Although the duration of the switch is almost instantaneous (the time it takes to change the depletion zone of the diode PN junction), entry into the new signal falls at random into the field or frame structure. A glitch in the output is inevitable.

To deal with the possibility of an untimed video source, the switcher design

may include a monitor for each input signal (see Figure 3). Horizontal and vertical timing are monitored to determine synchronicity of the two signals. If a request is made to fade or to initiate effects between sync and non-sync signals, the control logic may refuse to do anything if the second source is non-synchronous. Another possibility is that a cut switch occurs instead of the fade or effect.

Simple effects

This discussion has centered on the problem of cuts between two sources. Having considered the problems of non-synchronous signals, assume, for simplicity, that there are no untimed occurrences. What about a fade from camera 1 to camera 2? Logic says that if the two signals are applied to fader potentiometers in such a way that the attenuation seen by the wipers is in opposite directions (one increases attenuation, while the second decreases it), then a crossfade between the two is possible. However, a better solution is needed, because between the two endpoints of the fade, the syncs and videos are adding, producing an output signal of more than 1Vp–p.

In switcher designs that allow intersignal mixing, sync is separated from the video, and the blanking (black) levels of the signals are clamped to a common value before the mix is allowed. Now in a non-composite form, the video signals are applied to a multiplier circuit in which circuit gain is controlled by dc voltages (or digital words in a digital switcher) taken from the fader potentiometer wipers. A complementary control voltage may be required to produce a linear function from the multiplier circuit, because many multiplier devices operate logarithmically, rather than linearly, without the appropriate correction.

Switchers with automation features or options may use a form of digital fader control. A ramp generator consists of an up/down counter driven by the system clock. Fader movement determines the direction of counting, and, through digital-to-analog conversion, the output of the circuit creates an ascending or descending ramp to apply to the multiplier. In an automation application, software in the master computer, instead of physical fader movement, controls the counting direction.

The operator of the switcher can release the pin between the two fader bar levers to create a superimposed image. The resulting signal can exceed a 1Vp–p composite or 0.707V non-composite signal that would overload subsequent cir-

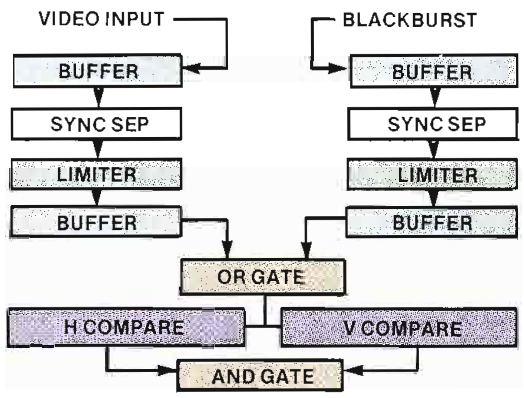


Figure 3. *A monitor checks each video input for the presence of a synchronous signal, referenced to switcher black.*

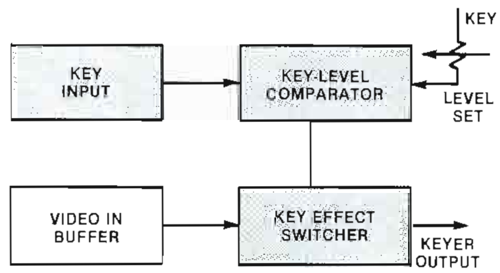
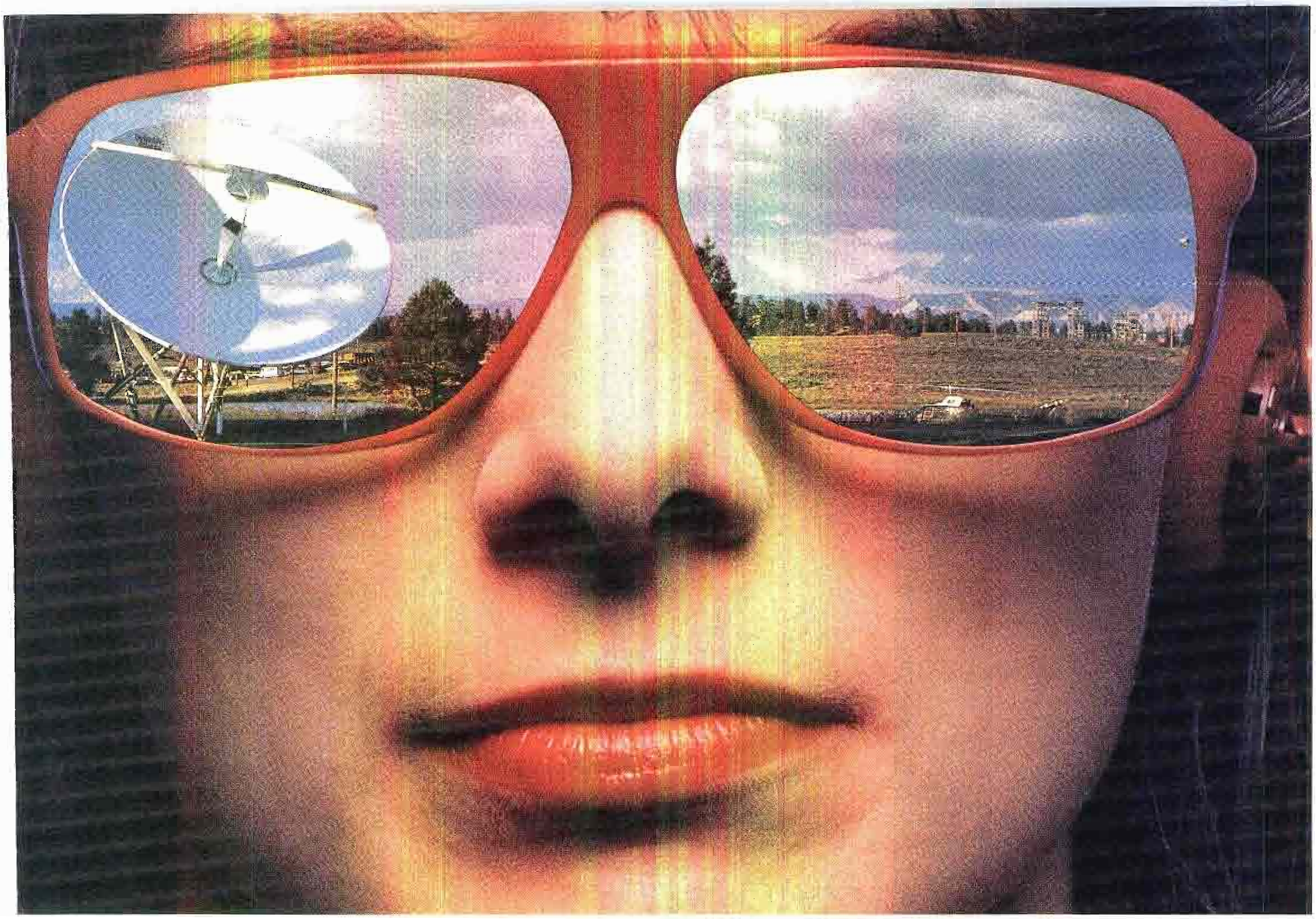


Figure 4. *A block diagram of a keying system.*



LET'S PAUSE FOR STATION IDENTIFICATION

Stations identify with us. Not only at "break" time, but from sign-on until sign-off. Because they can't afford dead air and inferior performance, broadcast engineers go with audio components they know and trust. Result: Switchcraft parts are part and parcel of hundreds of AM, FM, Shortwave and TV stations worldwide.

Because we identify with stations we're well aware of your industry and its exacting requirements. Our 40 year commitment to excellence comes through loud and clear. The superior reproduction quality, flexibility and durability of our thousands of electrically and mechanically verified standard and miniature products includes unique technological advances such as the innovative "QG" Quick Ground connectors. And, our support **engineers are constantly available to** answer your probing questions.

So - pause for a minute - and identify your own audio component needs - from jacks, plugs and jackpanels to connectors and adapters. Then send for our literature and see how easily your station can identify with us.

Circle (43) on Reply Card

Send me information on your quality components:

- ☐ Please have a representative contact me.
- ☐ Please send me your General Line Catalog covering the complete Switchcraft line.

My area(s) of interest is:

☐ Switches ☐ Connectors ☐ Power Cords
☐ EAC Receptacles ☐ Jacks Plugs
☐ Molded Cable Assemblies ☐ Patch Panels

My appication is ☐ Current
☐ Future ☐ (date)________

Name________

Company________ Title________

Address________

City________ State________ Zip________

Telephone (   )________

Mail To: Marketing Communications Dept., Switchcraft, Inc. 5555 N. Elston Ave., Chicago, IL 60630 B9-87

Switchcraft

A **Raytheon** Company

5555 N. Elston Ave.
Chicago, IL 60630
(312) 792-2700

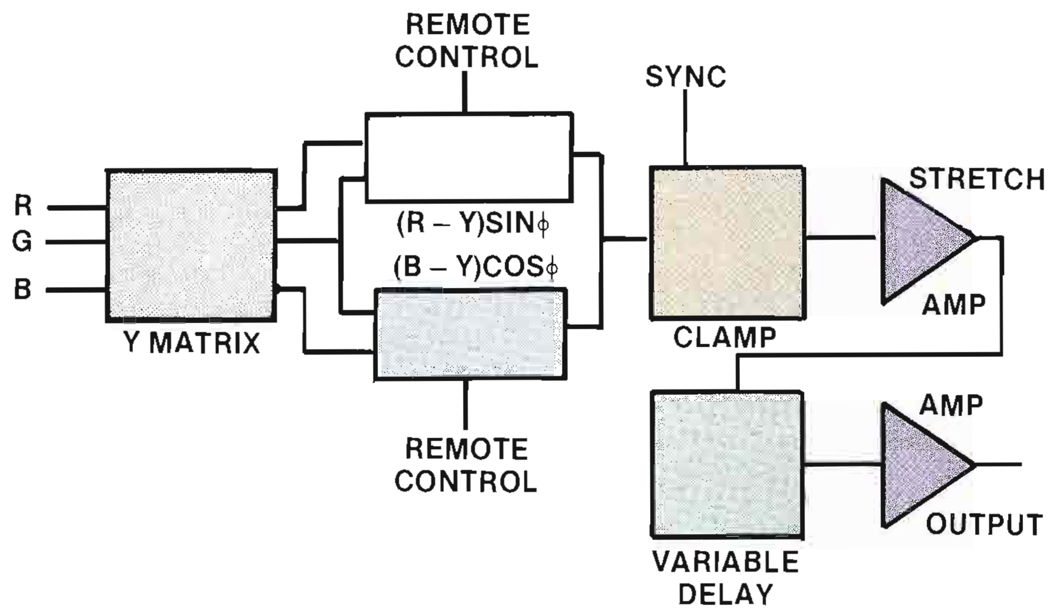


Figure 5. *A block diagram of a chroma-keyer.*

cuitry. A limiting stage controls the gains of the mixing circuit to hold the signal to proper levels.

Keys

Although splitting the fader bar offers a method for inserting video titles, *keying* is preferred. Keying serves numerous purposes beyond titling. However, all keying follows a general pattern, with the various forms depending upon the source of information used to create a keyhole or pattern in the main video signal.

A luminance key is most straightforward. Consider a white square on a black background as the pattern to insert a secondary image into the primary picture. Figure 4 shows the parts of the system that are essential in achieving the result. The key camera, used to develop the keying input signal, can be a relatively inexpensive monochrome camera.

Inside the keyer, a comparator monitors the signal level produced by the white square. If the video voltage is above a predetermined level that has been set by the operator, video 2 is inserted into the video 1 image, while the output level remains within the prescribed 1Vp–p limitations. If the level is below the preset point, the comparator causes no action, and video 1 remains continuous.

Key shapes may be generated by a variety of devices external to the switcher system. Electronic titlers commonly have a key output connected to the switcher external key input. Many digital effects systems produce key signals that may be used as external key patterns. In addition, most production switchers allow any video input to the switcher to be used as the key pattern source, including the image currently selected as the main picture. (This condition provides some intriguing effects, such as fading from a sepia-tone image into a full-color image.) The keyer simply compares signals at a preset level and initiates action at that point.

Keys by color

A useful application of keying is to create images that do not really exist. Let's say the script for a TV production calls for the Parisian skyline and Eiffel Tower to be in the background of the picture for a short scene. Moving the entire production to Paris to create the segment would be out of the question financially. A rear screen projection could be used, but that approach often leads to a washed-out appearance. Chroma-keying, however, provides an opportunity to introduce any secondary image where the primary image is a specific color. In the newsroom, the event being described by the commentator becomes the background, replacing a section of the studio backdrop. The application adds interest to the news.

A chroma-keyer is essentially a narrowband chromatic filter with a passband that can be positioned anywhere within the color spectrum. The portion of a TV signal corresponding to a particular color can be selected and used to trigger effects keying, based upon color rather than luminance.

Two types of chroma-keyers are common. One type, illustrated in Figure 5, processes RGB components to produce a Y luminance component. The R, B and Y signals are applied to differential- and voltage-controlled amplifiers to create the color-difference components, R–Y and B–Y, and the products (R–Y)sin ϕ and (B–Y)cos ϕ. ϕ refers to a phase angle determined by the hue-control setting. The two signals are summed, then clamped to a reference level during the breezeway period (between sync and burst).

The result, applied to an exponential amplifier, is increased for greater selectivity to the key-level control. Through adjustment of the key level, objects that are of the selected keying color, but at a different luminance level, may be retained in the primary image or deleted from it.

The second type begins with encoded video, from which it decodes Y, R–Y and B–Y components, similar to most video monitors. These components are then applied to the differential and VCA blocks as before. The overall product from encoded signals is normally indistinguishable from that of RGB signals. Although some argue that decoding of encoded signals introduces more noise than would be present from the encoding of RGB, improved decoding circuitry produces little, if any, residual noise from the processing.

The latest generation of switchers for analog component systems may contain a third type of chroma-keyer circuit. Because Y, R–Y and B–Y are provided originally by the sources, neither encoding nor decoding are required. Just as production with component video often exhibits marked improvement compared with encoded video, keys from component sources tend to show greater detail and definition.

Keeping it linear

Keying *linearity* has become an important buzzword in video production because of the added capabilities it provides.[3] Although many keyers are triggered by somewhat gross changes in video level, the more linear the keyer system, the more minute the change in signal level for the keying pattern can be. At the same time, a range of levels can be set to produce a key that includes soft-edge transitions from the main image to the inserted picture.

To keep the edges of a key insert as sharp as possible, transitions used to create the key pattern must be fast, and the circuitry must include filtering to avoid ringing and aliasing effects. On the other hand, a soft edge can produce a pleasing, dramatic dissolve between two images. In this case, the key source pattern is derived from a much slower rise time and may need to be expanded through linear amplification.

Through cascading of several keying circuits, multiplanar effects are possible, including the passing of one plane through another. Linearity is critical for applications in which multiple planes fade into one another. Sharp transitions between the planes, on the other hand, require more clearly defined, faster rise times.

Keying may allow effective use of borders between images. With a signal similar to that for color backgrounds or mattes,

When You Have to Get it Right the First Time—Reach for HME.

There are very sound reasons why professionals reach for HME when the show goes on.

Dependability. HME knows the vital need in your business for reliable equipment. We think we build the best wireless microphones, as well as the best wireless intercoms and cabled intercoms available anywhere. They're rugged, built from top quality components, and assembled with HME's Pride in Excellence.

Performance. You'll please the most demanding performers with an audio quality that's second to none. Dynamic range and immunity to interference are unsurpassed.

Service after the sale. No one reacts like HME in the event you need assistance. Now we have direct telephone lines to Customer Service—the people with the answers. Should your system ever require repair we'll turn it around faster than anyone in the business.

Call us today for all the details. See why more professional sound engineers rely on HME when performance is on the line.

HME manufactures:
Wireless microphones
Wireless Intercoms
Cabled Intercoms

hme

HM ELECTRONICS, INC.

9675 Business Park Avenue, San Diego, CA 92131, U.S.A.
Phone (619) 578-8300 Telex: 350-771

Circle (44) on Reply Card

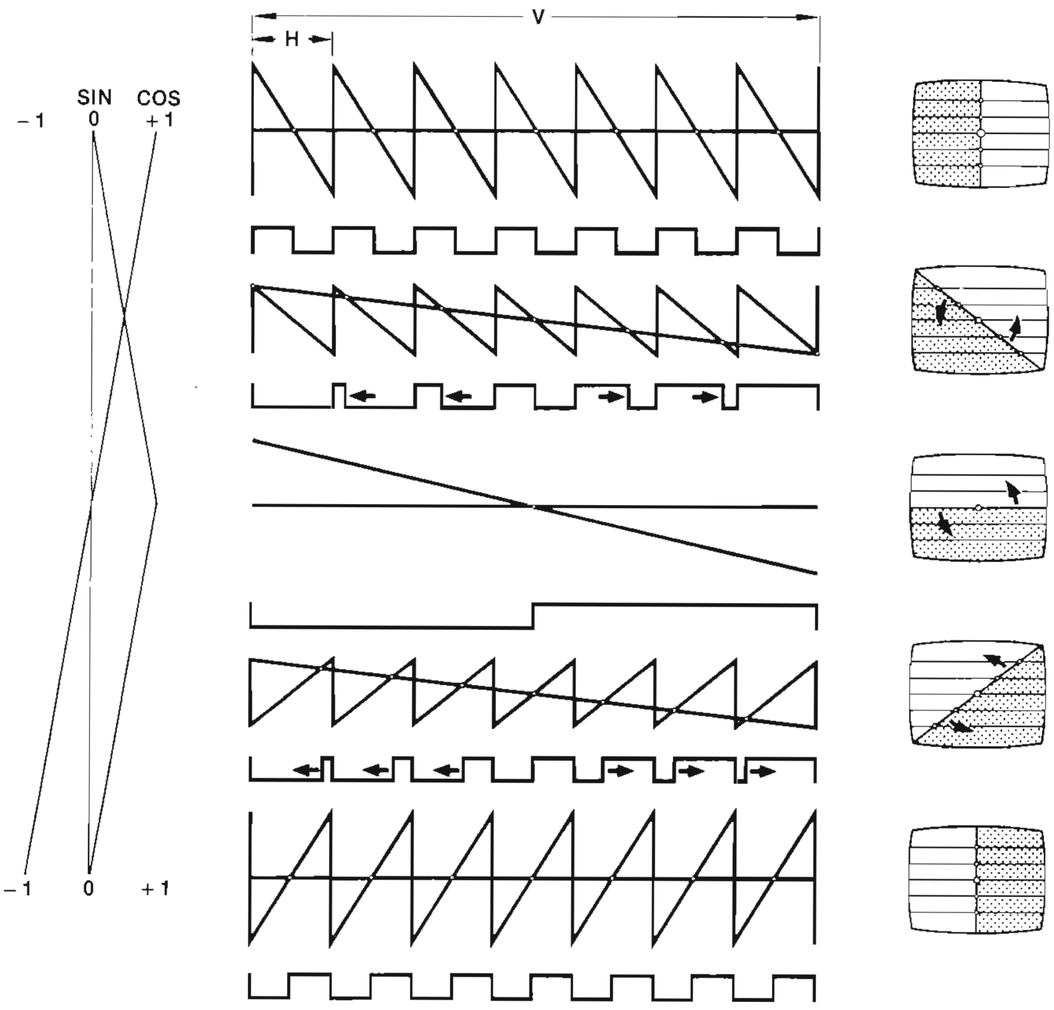


Figure 6. The waveforms involved in generating a rotating wipe effect.

borders can be set to any color and saturation or can even be animated by cycling through 360° of phase, all colors. To accomplish this function, a border or edge must have a defined width or time duration, in addition to start and stop signals. Luminance, saturation and hue controls are provided for the signal being placed in the border area.

The addition of slope to the keying waveform allows shadowing in the key to create the illusion of depth. By introducing an offset into parameters for shadow effects with an external digital effects system, it is possible to track an object that flies through the picture. This is achieved by creating a second key pattern from video 2 with a shape adjusted for the point of view and passed over the video 1 image as a self key with a reduced luminance-level parameter. One application is a shadow that moves across a graphically created landscape as a graphically created airplane flies overhead.

Splits and wipes

What are commonly called effects on switchers follow the same idea of keying. Instead of a comparison between two signal levels, a time duration determines the point at which image switching is accomplished. What also makes switcher effects different is the method by which patterns are achieved. Simple split screens seem fairly logical. For a vertically split screen with video 1 to the left, and video 2 to the right, a control setting causes the switch to occur with respect to time. Prior to time T, video 1 is routed to the output of the mix/effects amplifier. After time T, video 2 is the output.

The switching circuitry requires some special design considerations as the complexity of the split/wipe patterns become more involved. An H or V split is mere child's play compared with a rotating 5-point star that has a color-animated border and horizontally and vertically modulated star edges. Faster switching rates obviously are needed, along with relatively fast calculations of where the next switch between signals must occur.

Effects using linear lines that are static or that move at fixed angles to image-scan lines are fairly straightforward, but those involving curvilinear lines become heavily involved with sine and cosine functions. If rotation is added to a linear shape or to a curvilinear shape, an additional layer of trigonometric functions must be calculated. Keep in mind that these calculations must be accomplished on a line-by-line basis. Figure 6 illustrates the principle involved in generating a rotational wipe.

Moving ahead

In an industry that is now feeling the digital explosion, the application of computer technology to video switching already has begun. Some of the special effects that have been available on production switchers for some years are based upon rudimentary digital methods. Digital, however, dealt only with the timing and creation of the switching information between signals. Video signals have remained analog in nature. Now, composite and component digital signals have taken video production to the brink of a new era.

Several digital video switchers have been introduced in the past seven years, but for various reasons, they did not immediately catch on. More recently, interest in the concept of an entirely digital studio has grown and flowered in HDTV production facilities developed in France, Canada and New York. Once inside the switcher electronics, analog video is sampled into digital words, with which any conceivable manipulations may be performed. It may no longer be jokingly said that once video is in a digital form, there is no limit to image manipulation, even to a pixel level. Today it's no joke—it is fact.

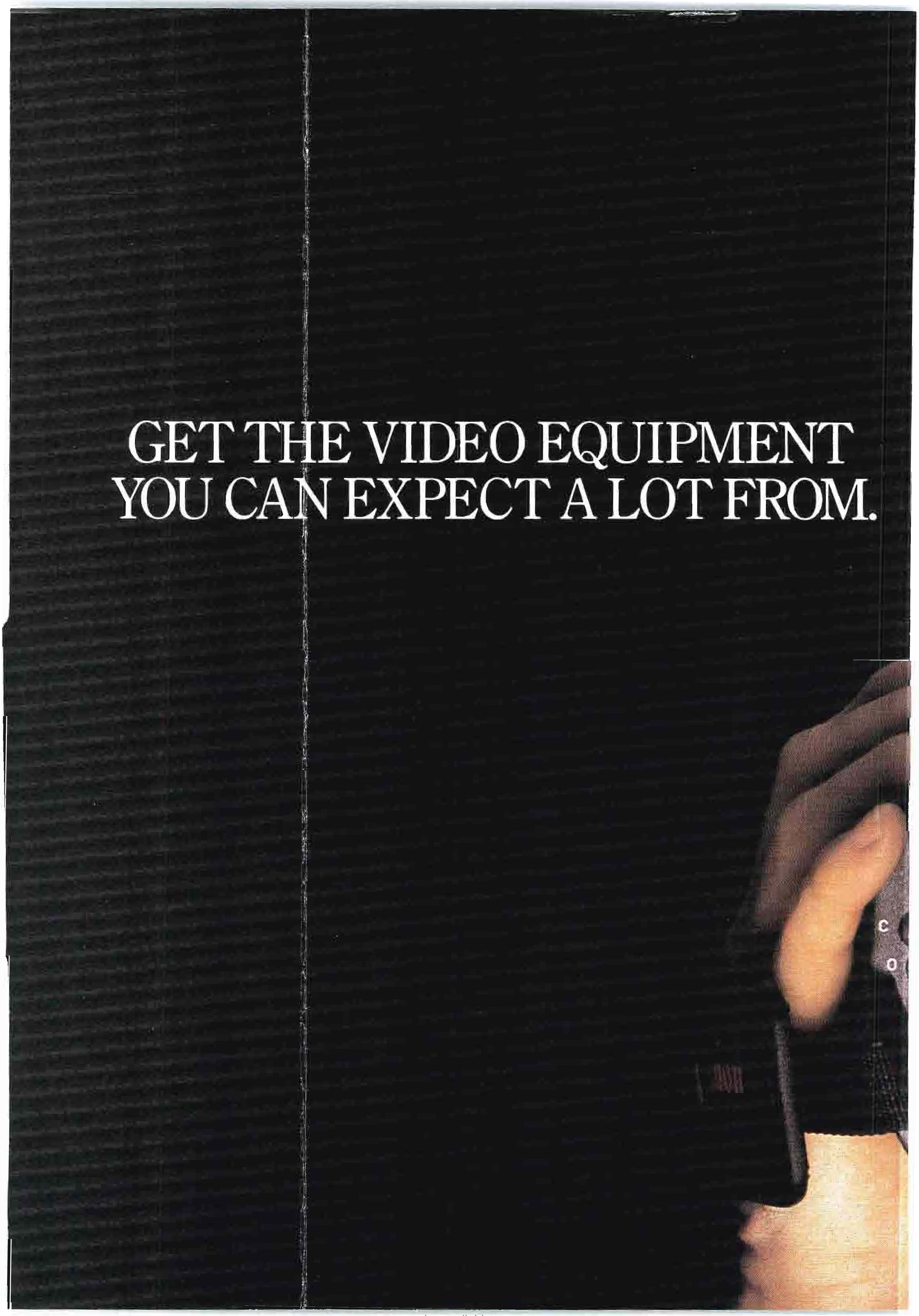
Most of the digital switching exhibited at NAB '87 involved an all-digital studio approach, but more isolated or standalone products will appear within the year. It is likely that these products will be associated with existing digital effects equipment, taking advantage of the A/D and D/A conversion circuitry that already exists. (Why reinvent the wheel?) Faders, or perhaps push buttons, will create control signals for the attenuators consisting of 8-bit words handled in parallel. By manipulation or rearrangement of the bits in the control word prior to the fading device, bizarre new styles of visual presentation may be possible.

It is difficult to predict exactly how video will look within the next few years. Just as there are few limits to the capabilities of a microprocessor (depending on the cleverness of the programmer), the possibilities for video depend upon the software created for the switcher-control system. After all, in terms of hardware, what's another tap off the bus?

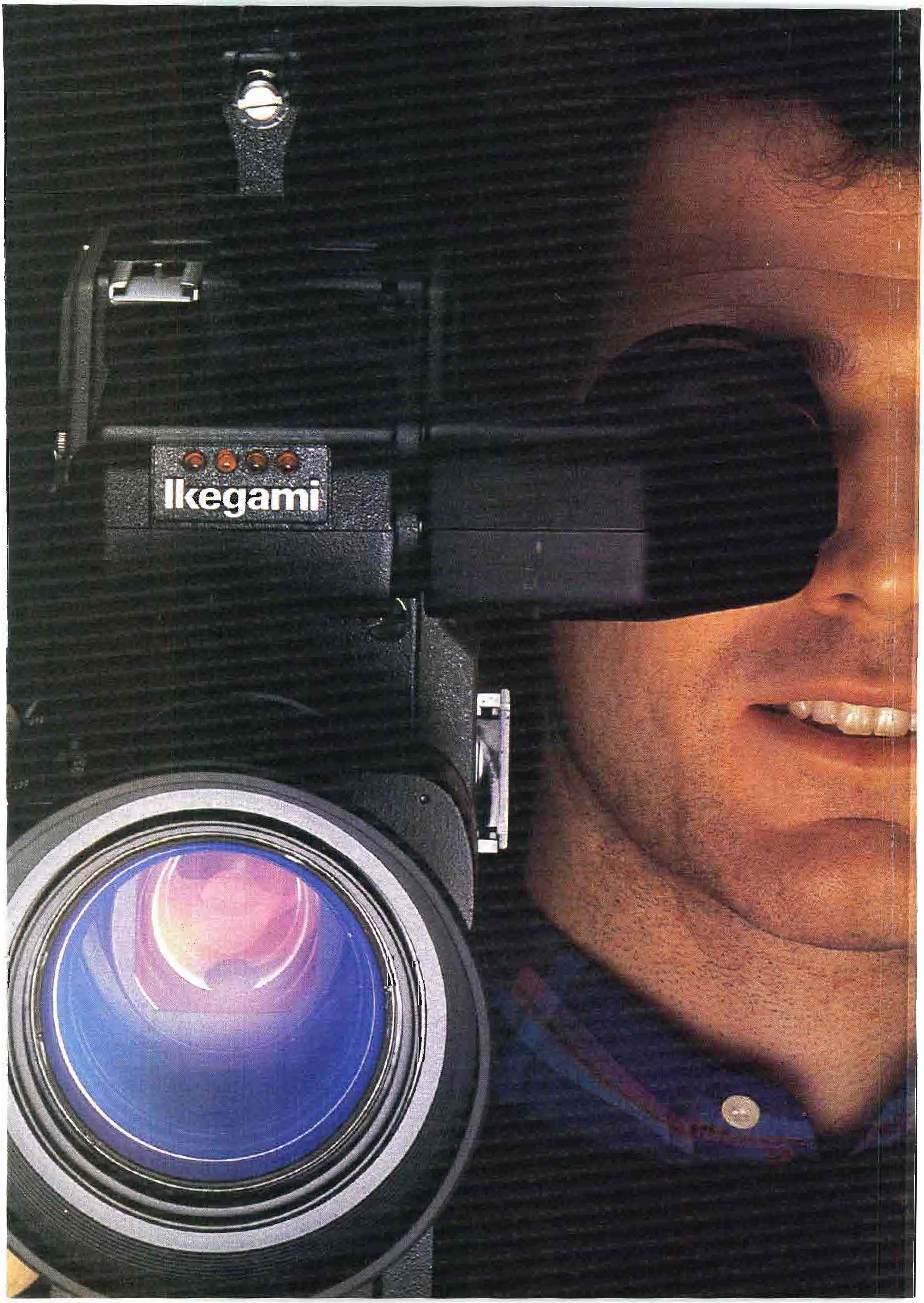
Editor's note: Ampex AVSD, BTS Broadcast Television Systems and Grass Valley Group provided assistance in the preparation of this article.

Bibliography

1. Guess, Michael. "Sync Processing and Distribution." **Broadcast Engineering**, July 1986, p. 36.
2. Jurgensen, David. "Understanding SC/H Phase." **Broadcast Engineering**, July 1986, p. 46.
3. Goldberg, Tom. "Linear Keying in Video Production." **Broadcast Engineering**, September 1986, p. 62.


GET THE VIDEO EQUIPMENT
YOU CAN EXPECT A LOT FROM.

IF YOU EXPECT A LOT FROM YOUR VIDEO EQUIPMENT...


Ikegami

CHOOSING THE BEST

Whether your particular interest is in network TV, production, ENG, corporate training or educational broadcasting, you can select from amongst the finest video cameras without turning the page. Presenting the full line of Ikegami video cameras, the ideal answers to your particular need.

For budget minded users, our new CCD-770 chip, priced around $5000 is a significant improvement over conventional CCD cameras due to the latest in MOS image-sensor technology which virtually eliminates smear and panning distortion. An electronic shutter captures motion within a fraction of a second and a highlight compression circuit, lets you shoot scenes of wide contrast range.

Broadcasters who want great performance and value will find the HL-379A, 3-chip

camera, delivers outstanding picture quality with 650 lines resolution and–60dB S/N, yet is priced within easy reach. The HL-379A is compatible with either a Beta or MII on-board VCR and features low power consumption, dynamic detail correction, white shading correction, auto highlight compression, knee aperture correction, SMPTE color bar and more including several digitally-controlled remote functions.

Want a terrific low cost 3-tube camera? Our new ITC-735 (with a 4-camera CCU ideal for teleconferencing), is another product destined to earn its place of distinction with budget conscious professionals who demand a high performance ENG/EFP camera. Saticon® IV tubes and newly designed low-noise preamplifiers offer excellent picture quality, while a high speed f/1.4 prism pro-

duces quality color reproduction, high sensitivity and excellent resolution. Other features include a 2H detail corrector, several automatic functions and a compact, lightweight design

For the very finest one-piece ENG camera, priced around $25,000, the Ikegami HL-95B tube camera/recorder ENG sys-

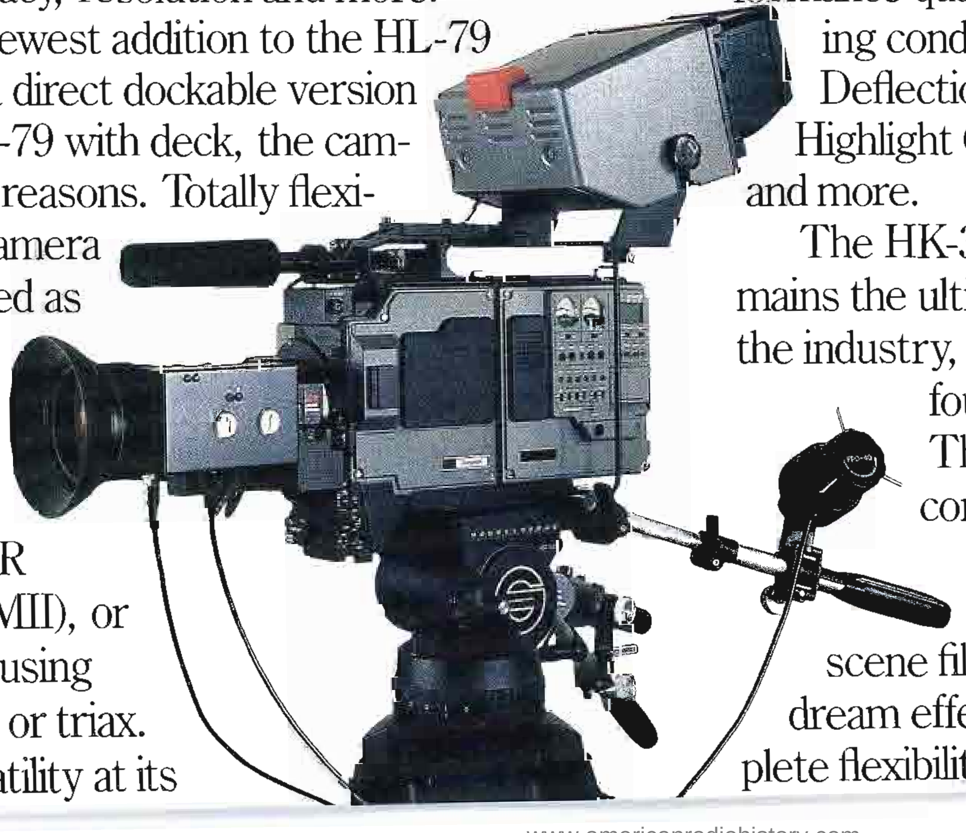
tem is the camera of choice. Operational in both Beta and MII formats, the HL-95B maintains total flexibility without compromising strictest standards of

VIDEO CAMERA HAS

performance, sensitivity, resolution and registration. With proven registration stability (without adjustment over many weeks); excellent shoulder balance; superb low light level sensitivity; better S/N for low light levels; the HL-95B is today's best performance/price quality camera.

Ikegami's HL-79E with component output for Beta or MII stand-alone VCRs is not only a great broadcast ENG camera, but a camera whose legendary performance and capabilities have been embraced by over 10,000 users worldwide. The HL-79E features Dynamic Detail Correction, Chroma Aperture Correction, Highlight Aperture Correction and Auto Contrast Compression. Plus the legendary HL-79E offers superior contrast range, S/N ratio, registration accuracy, resolution and more.

The newest addition to the HL-79 series is a direct dockable version of the HL-79 with deck, the camera for all reasons. Totally flexible, the camera can be used as a stand-alone, one-piece with on-board VCR (Beta or MII), or remote using wire or triax. ...satility at its



best. Features include selectable gain, SMPTE color bar generator; high S/N ratio, and much more.

If you're a corporate or industrial user, or a local TV or cable operator, you'll be very impressed with the "no-nonsense" performance of the SC-500 studio camera. With ⅔″ tubes, the camera offers superb clarity and color fidelity. All this in an economical camera that is easy to operate and proven to maintain its reliability and per-

formance quality under the most demanding conditions. The SC-500 features Deflection Distortion Correction, Highlight Compression, Dynamic Focus and more.

The HK-322 with 1″ or 1¼″ tubes remains the ultimate production camera in the industry, with specialized functions not found on any other camera. These include 6 vector color corrector, scan reversal with memory, negative video, horizontal aperture correction, scene files with extensive memories, dream effect and much more. For complete flexibility, the hand-held HL-79EP is

R MONITOR LINE
ED YOUR CHOICE.

the 9-Series and 10-Series continue to enjoy enormous popularity.

The 9-Series Broadcast Color Monitors incorporate In-line Gun technology, High Resolution Shadow Mask CRTs and American Standard Matched Phosphors. In a word, the 9-Series provides superb resolution (700 TV Lines), excellent stability, easy maintenance and low power consumption. Standard features include pulse cross; keyed back porch clamp; video amplifier; preset contrast, hue, chroma, and brightness controls; on-demand degaussing; aperture correction; remote control capability and more. A 14″, 20″ and a 10″ portable model is available.

The 10-Series Broadcast Color Monitors feature a high resolution (800 TV Lines) Delta Gun CRT, specifically developed for image quality, with nine-sector convergence controls and Feedback System (BFS) that detects and greatly reduces brightness changes due to current deviation in CRT emission. Available in 14″ and 20″ models, the 10-Series is remarkable for its picture quality. And this quality is equally evident in our 3H-Series Monochrome Monitors.

The 3H-Series of Professional Monochrome Monitors provides the high performance necessary for technical evaluations. 9-inch configurations are available as: bare chassis, cabinet with handle; and for 19-inch rack mounting in an 8¾-inch height for single, single with WFM, single with Vectorscope space, and dual unit uses. 14-inch configurations are for cabinet use or for 19-inch rack mounting in a 10½-inch height.

Sliding panels are featured on all color monitors.

Our monochrome monitor, the PM 9-5, is a low cost product that combines high reliability and superior picture quality. Features include: dual video inputs, pulse cross, keyed back porch clamp amplifier, and tally light. It's available for various rack-mount configurations.

Ikegami monitors fullfill your most demanding expectations, while narrowing your choice for the very best. For further information, call your Regional Ikegami Office for the dealer near you.

Ikegami

Ikegami Electronics (USA), Inc. 37 Brook Avenue, Maywood, NJ 07607
East Coast: (201) 368-9171 West Coast: (213) 534-0050 Southeast: (813) 884-2046
Southwest: (214) 869-2363 Midwest: (312) 834-9774 Hawaii: (808) 946-5955

BY EXPANDING OU
WE'VE NARROW

Whether you're choosing a monitor for its technological advantage, unique features or low price, you can own the monitor of choice: an Ikegami.

Now Ikegami has expanded its monitor line to include a state-of-the-art Auto Setup Color Monitor.

ASP-15 Auto Setup Probe

Ikegami monitors are available in 3-Series Monochrome, 5-Series Low Cost Monochrome, 9-Series Color (In-line Gun), 10-Series Color (Delta Gun), 15-Series Color (Auto Setup) and 16-Series Color (Low Cost Professional) Models. What distinguishes Ikegami monitors from others is a commitment to research and development, and continued market analysis to meet the broadcasters' needs. The results speak for themselves. Today, Ikegami is proud of its reputation not only for the finest cameras, but the finest monitors. It's a reputation that we strive to maintain.

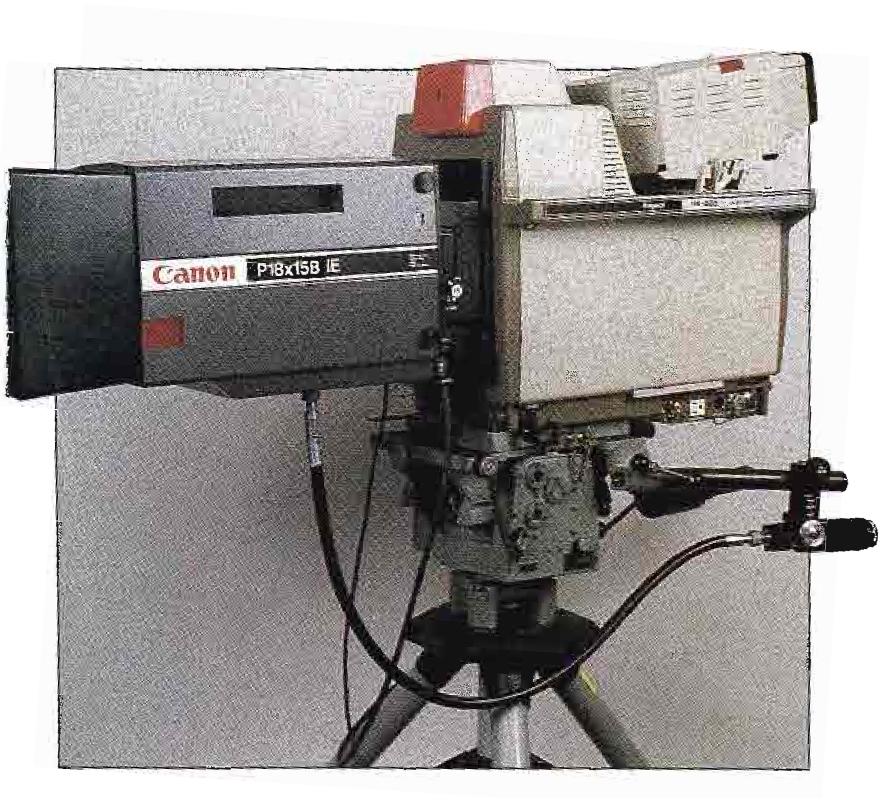
Consider the latest advancement in monitor technology: Auto Setup. Originally pioneered for Ikegami cameras and now available in the Ikegami 15-Series Broadcast Color Monitors.

With an optional Auto Setup Probe, the 15-Series is menu driven with data shown on the CRT. An optional Remocon Box provides for remote control operation. The CRT features a Fine Dot Pitch Shadow Mask for superior resolution, an In-line Self Converging Electron Gun, Controlled hosphors and a Black Matrix. The 15-Series is available in 14″ and 20″ and uses a Digital Control System (DCS) to simplify monitor set up. When using the Auto Setup Probe, the following functions can be automatically set, at a reference level, and stored in less than 50 seconds: contrast, brightness, chrome, hue, RGB background and GB gain. Auto Setup is another Ikegami breakthrough.

TM 20-15RH Auto Setup Monitor with Probe.

The Ikegami 16-Series Low Cost Monitors feature an In-line Self Converging Electron Gun, a Black Matrix CRT, a Comb Filter/Trap, and front panel selectable A/B Video and RGB video outputs. Specifically designed for a wide range of production and broadcast applications, the 16-Series is available in 14″ and 20″ at surprisingly low costs, making the series extremely competitive. The introduction of the 15-Series and 16-Series monitor comes as

NEVER BEEN EASIER.

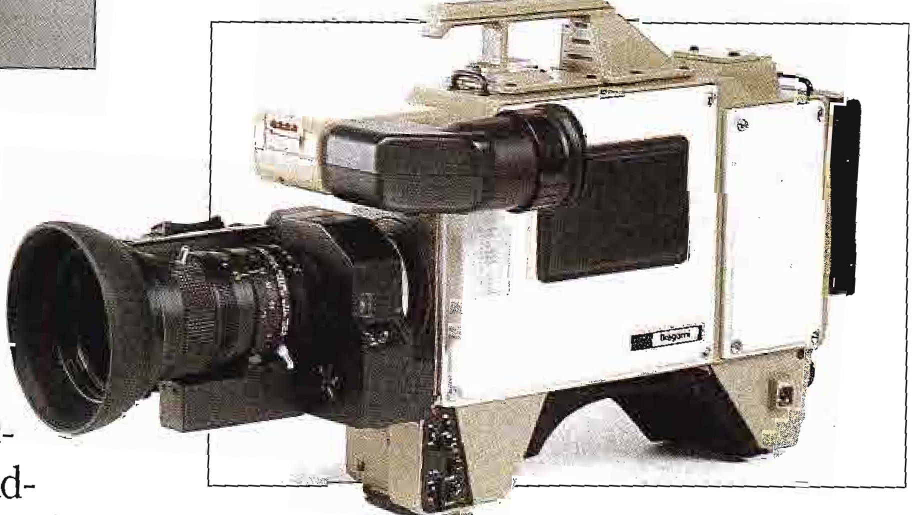


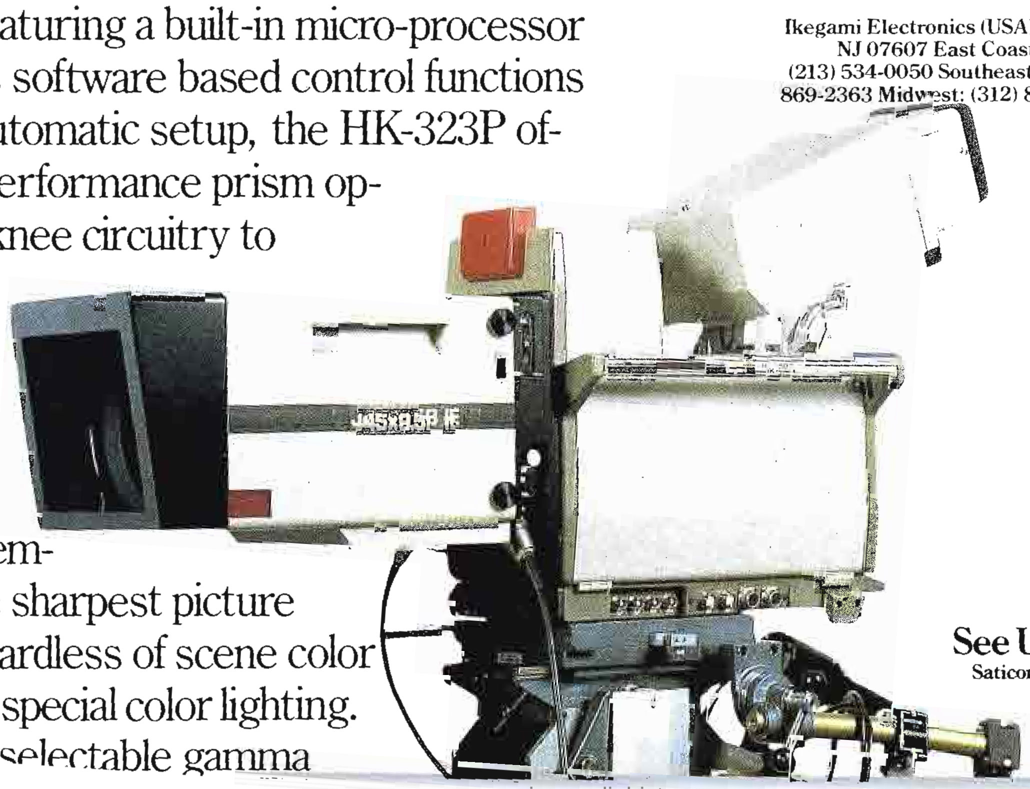
available as the companion camera.

For field/studio operation, the HK-323 with 1″ or ⅔″ tubes, recently introduced by Ikegami, have quickly gained acceptance with the networks as the market leaders in this segment of fully automatic micro-processor controlled, lighter weight broadcast cameras. The HK-323 is available with the optional hand-held companion, the HK-323P, which operates off the same base station. Featuring a built-in micro-processor for various software based control functions and fully automatic setup, the HK-323P offers high performance prism optics, auto-knee circuitry to handle high contrast, and scene files with extensive memory for the sharpest picture quality regardless of scene color content or special color lighting. This plus selectable gamma values; 0.45, 0.4, 0.35, two motorized servo filter wheels each with four positions and a back-up memory system for total system flexibility. The HK-323P is now available with dockable Beta and MII VCRs.

What distinguishes Ikegami cameras from the competition, aside from its full line, is its total commitment to design and manufacture the very best cameras possible. It's what makes an Ikegami camera the absolute leader in its class.

For further information contact your Regional Ikegami Office for a dealer near you.



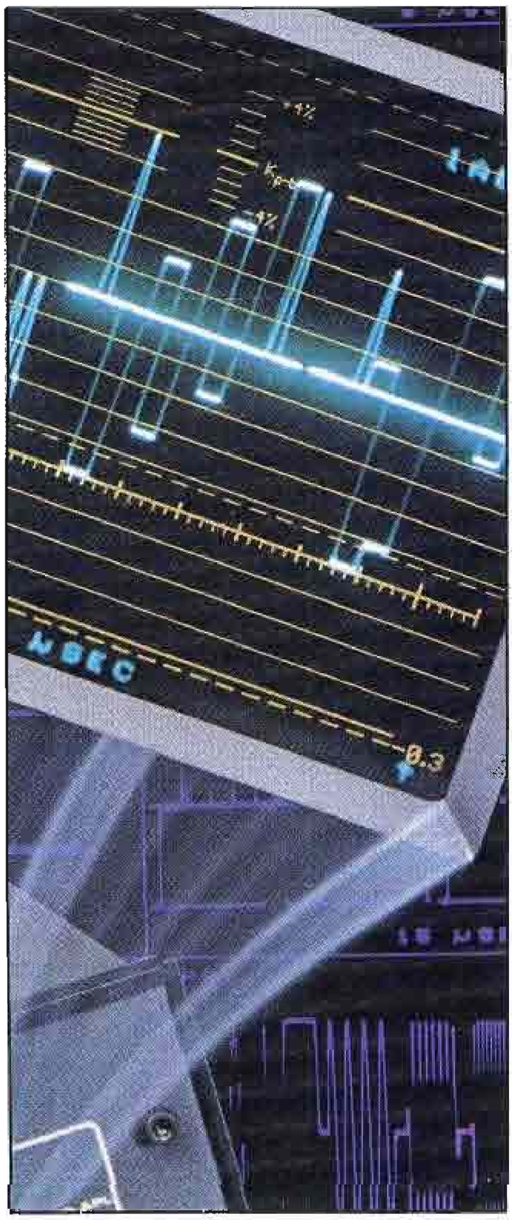


Ikegami®

Ikegami Electronics (USA), Inc. 37 Brook Avenue, Maywood, NJ 07607 East Coast: (201) 368-9171 West Coast: (213) 534-0050 Southeast: (813) 884-2046 Southwest: (214) 869-2363 Midwest: (312) 834-9774 Hawaii: (808) 946-5955

See Us At SMPTE Booth #518

Saticon® is a registered trademark of Hitachi Denshi



Wiring an audio-video facility

By Ned Soseman,
TV technical editor

Wiring a system is an investment in the future.

What is it that makes broadcast and production system design and engineering so doggone interesting? Because no two people seem to agree on the "right" way to interface, wire and dress a system. Almost every facility adheres to a technical philosophy that is as unique to that facility as the mnemonics it has used to name its equipment. Yet, all of these facilities are successful, more or less.

The personality, experience and craftsmanship of the installer is built into every system, along with the plans and the budget. Each system is a legacy, one that will affect the facility and staff for years to come. It will either do the job satisfactorily or be torn out and rebuilt. The other option, of course, is that the staff can simply "learn to live with it."

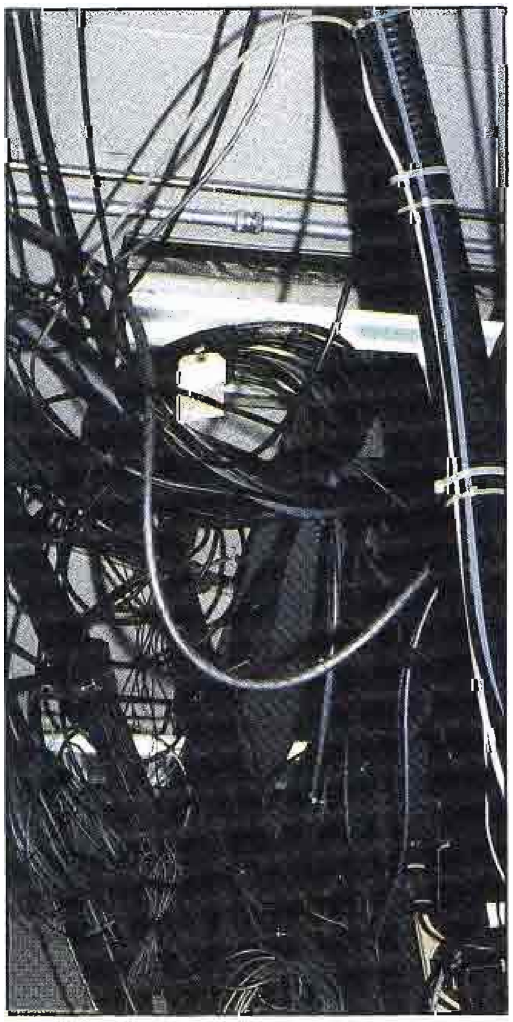
Project management

Construction and wiring projects require time-consuming, detailed supervision and full-time leadership. Leadership via remote control or committee will not do. The scope of such an undertaking calls for an on-site individual who will devote the necessary time and energy to the design, management and success of the project.

Informed decisions must be made. Architectural, mechanical and electrical drawings must be thoroughly reviewed. Changes must be initiated. Battles must be fought. Equipment must be selected, ordered and inventoried. The system must be designed and documented. Rooms and racks must be laid out. More battles must be fought. Detailed drawings must be generated. Lists must be managed. Timetables must be developed and met.

Attention to every detail and complete, orderly documentation of every wiring project is as important as the actual wiring. Inadequate management and supervision can result in problems nested within a system. These hidden problems can plague a facility for years.

The first step in any project is to determine who is going to be in charge. At a facility that is already on the air, the chief engineer or maintenance supervisor would seem, to many managers, to be the logical choice. However, the chief engineer and maintenance supervisor probably already have plenty of respon-



"The active transmitter input is the one with the blue file-folder label wrapped around it." This functional installation may have been conceived to provide job security for the in-house installer, but there are certainly more orderly methods of wiring a system.

Ergonomics play an important role in the operational success of a facility. Note the easy access to audio source equipment from the audio console operator position.

sibilities to fill each day without the additional duties of managing and supervising a construction and wiring project. Thus, the difficulty of the decision will vary with the scale of the project. Those who take on two full-time jobs, attempting to simultaneously manage maintenance or engineering departments and a major construction/wiring project risk potential career problems and a significant increase in stress.

Should authority and responsibility be delegated to a supervisor or engineer or should an outside project manager be brought in? Ultimately, this question can be answered only by those who control the money. Regardless of which route management decides to take, any successful project requires a knowledgeable leader with the time to do the job right.

Taking control

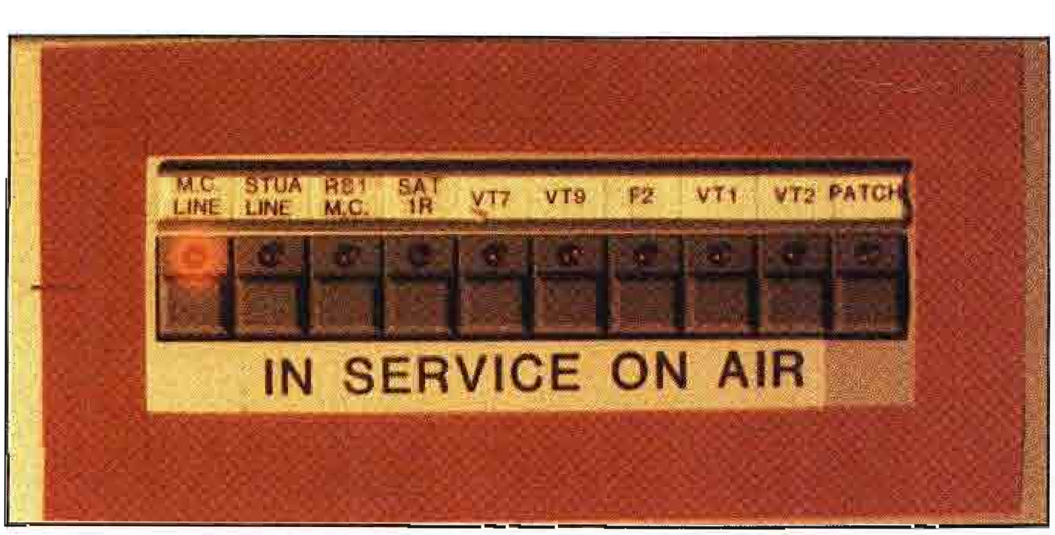
Broadcast stations and production facilities are unique environments. They don't fall into the molds to which architects and construction companies are accustomed. They're not office buildings, computer centers, factories or hospitals, but they contain certain elements of each. Only a seasoned broadcast engineer can understand fully the unique requirements of successful facility design and construction. The overall technical success of any installation project is measured by two criteria: the wiring (electrical design, neatness, performance and reliability) and its human interface.

Whether you're wiring a new room or a new facility, the decision-making process is the same. The installation leader who does not participate in or question design and construction decisions usually is blamed for many problems that actually were created during the initial decision making. Consider the following scenario:

All equipment and racks have been purchased, but wire and connectors have not. The racks are in place and numbered. The rack elevations have not yet been determined. You have been charged with the responsibility of wiring the facility. What do you do? The situation, however typical, is unfortunate because decisions concerning equipment models, room size, window and door placement, power requirements, rack placement and layout, cable runs, air-conditioning, lighting and console design all affect the success of an installation. The choices can make or break its subsequent operation, efficiency and ultimate profitability.

Seemingly insignificant architectural, construction and engineering details often are viewed as indisputable or they are ignored or brushed over by management during the planning stage. Some decisions, of which management may

Continued on page 78



Plan for contingencies by incorporating methods to feed the transmitter directly from several sources in case of switcher failure.

IT ONLY TOOK TEN YEARS TO GET TO

After ten years of research, design, and field experience, Sharp has developed two new video cameras to meet the demands of the broadcast and professional users: the XC-B10 with Saticon® tubes and the XC-B20P with Plumbicons.®

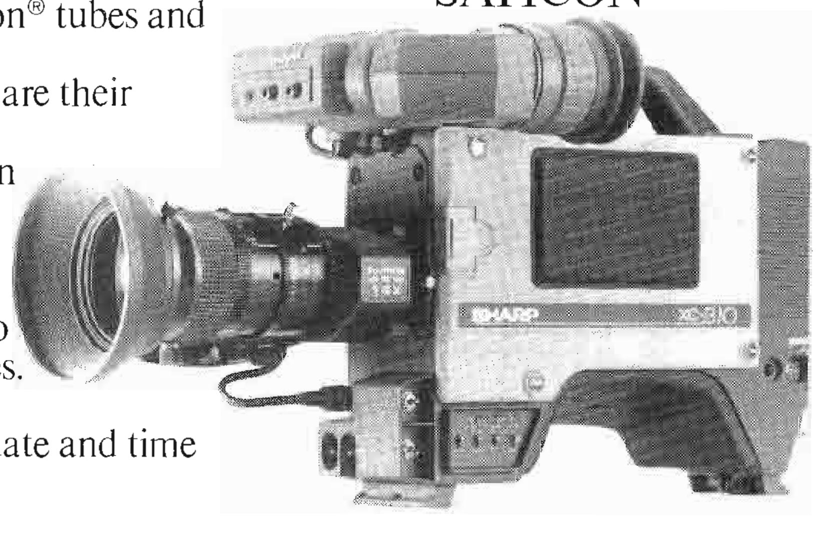
What make both of these cameras so remarkable are their features.

Like Beta and MII component output. So you can connect directly into component recorders without adapters.

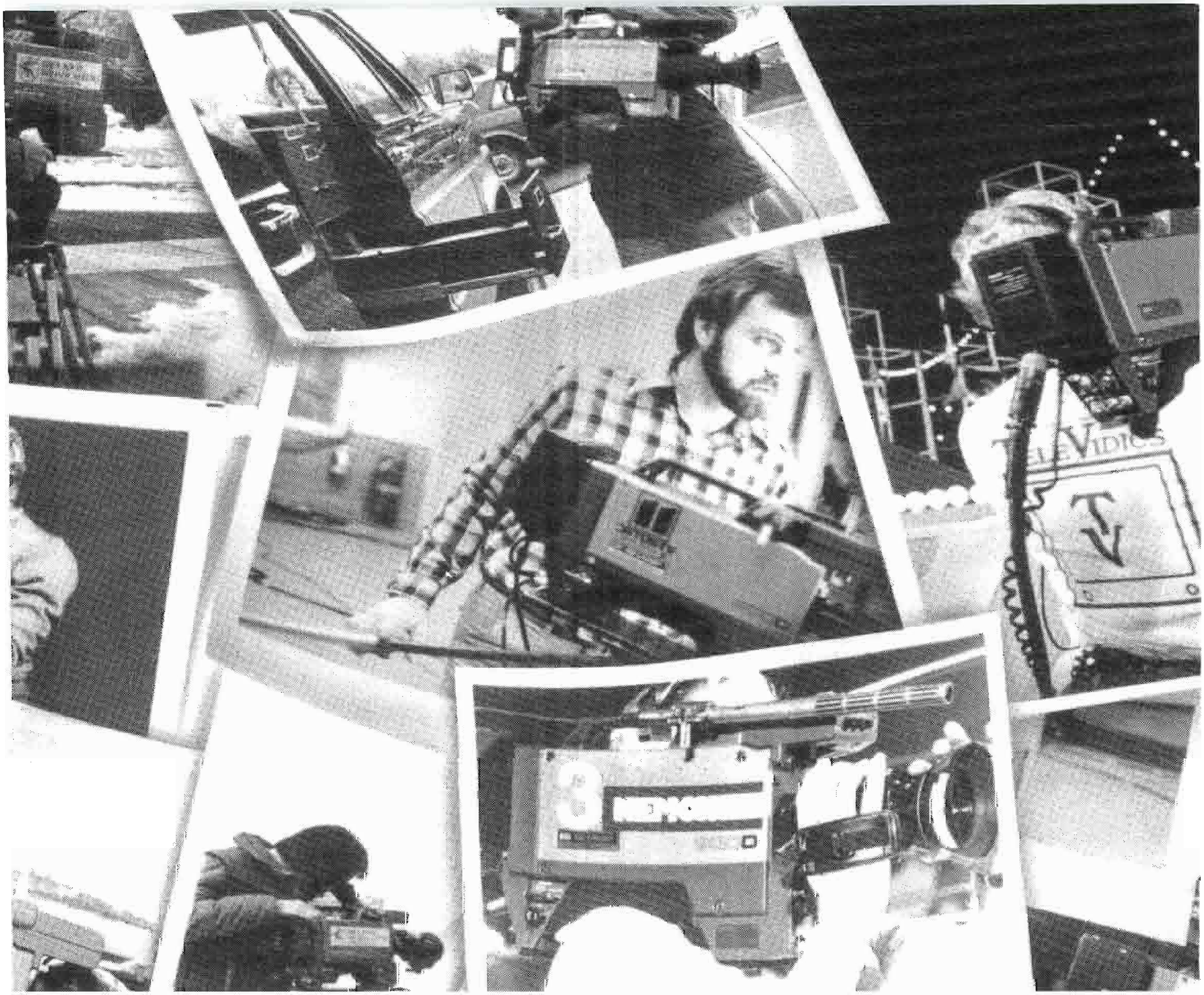
And a unique auto contrast circuit to change washed out video into crisp, clean information. Plus auto knee that prevents losing your video in ultra-bright scenes.

We've even put in a unique computer-controlled clock/calendar that gives you the option of burning the date and time into your recordings for editing and archival use.

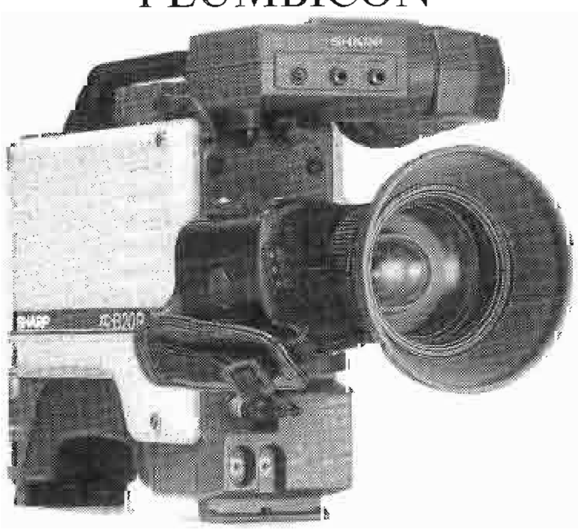
THE NEW XC-B10 SATICON®



For more information or the name of your local Sharp broadcast dealer, call (201) 529-8731 or write Sharp Electronics Cor



AND THOUSANDS OF CAMERAS THESE TWO.



THE NEW XC-B20P PLUMBICON®

The tubes themselves deliver exceptional pictures, thanks to their state-of-the-art low capacitance mixed-field diode gun technology.

And both cameras have information-packed viewfinders, multicore and triax remote units with full system capability, and prism temperature sensing. Not to mention selectable 6-12 or 9-18dB gain and rugged diecast construction with extensive EMI protection.

All in all, the XC-B10 and XC-B20P are truly remarkable cameras. But don't just take our word for it. Contact your local Sharp broadcast dealer and ask for a demonstration.

Then you can see for yourself the kind of technology that's made Sharp one of the fastest growing camera companies in America.

SHARP®
FROM SHARP MINDS COME SHARP PRODUCTS™

adcast Group, Sharp Plaza, Mahwah, NJ 07430-2135. © 1986 Sharp Electronics Corporation

Circle (47) on Reply Card

Continued from page 74
not even be aware, will have a pivotal influence on the capability of the system to perform as expected, and are expensive, or impossible, to change once they have been executed.

Leading management

Some engineers, when charged with the task of installation, treat audio-video as if it were something special, beyond the realm of dollars-and-cents business decisions. This just isn't so. In fact, a well-prepared and coordinated study of short-term and 5-year operational and business goals for the facility could reveal many areas in which money would be more wisely spent up front. If you take a methodical, businesslike approach to the task and back yourself up with strong data, management is much more apt to be led to the same conclusion.

Broadcasting and teleproduction are businesses. The product is uninterrupted generation of video and audio, either for recording or transmission. Interruption, or the inefficient flow of video and/or audio, means lost revenue or decreased profitability.

Any construction and wiring project represents a financial investment toward future profitability. It's that simple. Broken wires and malfunctioning equipment are common sources of abrupt interruption. Management rightfully expects a new system to be void of these interruptions. But what about the gradual erosion of profitability caused by make-goods, inefficiency, absenteeism and low morale? The human element must be carefully analyzed and integrated into system design and construction to optimize management's return on investment.

For example, operator fatigue due to poor ergonomics results in errors. So does inadequate training and unfamiliarity with new equipment. Overcomplication lowers efficiency, thus increasing costs. HVAC not only influences equipment failures, but also affects operator health, employee absenteeism and morale.

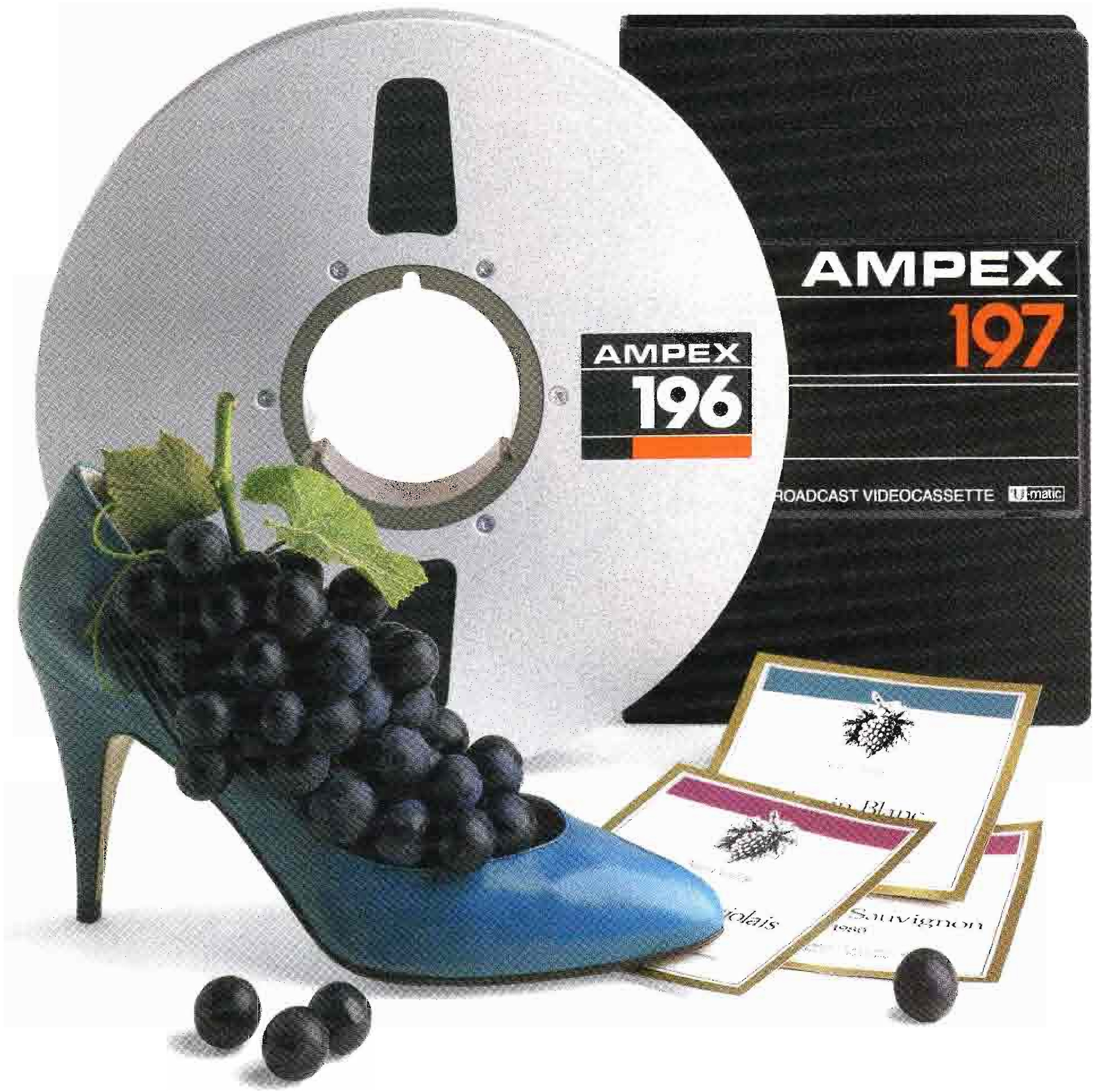
It used to be that equipment, at least in terms of sensitivity to operating temperature, was fairly forgiving. The mean time between failure of today's modern microelectronics is inversely proportional to the cumulative effects of heat. If, over a period of months, one of two identical, continuously operated electronics systems is subjected to an increase of just a few degrees Fahrenheit, it will fail first. Air-conditioning is now more important than ever.

It is beyond the scope of this article to detail completely the extent to which installation leaders should be involved with management, architects and construction crews. However, these leaders would be remiss in their responsibilities if they did not thoroughly review preconstruction drawings and plans and question any decisions that they do not believe to be in the station's best interest.

A written, detailed explanation as to why specific details should be changed is the preferred method of communication. First, define the scope of the wiring project. List the operational goals and discuss the anticipated future expansion of the system. What is it *not* expected to do? Which units are most likely to be replaced first? What other items might be added later, without major reconstruction? What types and brands of equipment are familiar to the operators?

How many rooms will be wired? Will the system include an in-house RF system? Will wiring of offices and conference rooms be included? What's the budget? Who will perform the work? What is the timetable? Will the equipment interface properly? Will interface adapters need to be built?

Continued on page 82



The Flavor of "Falcon Crest" is Preserved on Ampex Video Tape

When you have a hit show like "Falcon Crest," you want to keep it a hit. That's why Lorimar specifies Ampex 196 and 197 Professional Video Tape for film-to-tape transfer and distribution.

Ampex 196 and 197 Video Tape lets Lorimar maintain all the subtlety of emotion that was originally captured on film. The kind of emotion you can appreciate only through superb video clarity and quality.

Plus the kind of exceptional audio performance that has made Ampex studio mastering tape number one in the music industry.

Find out more about Ampex 196 and 197 Broadcast Quality Video Tape by calling (415) 367-3809, or by writing Ampex Corporation, Magnetic Tape Division, 401 Broadway, Redwood City, CA 94063-3199.

AMPEX

Circle (49) on Reply Card

Relax! We didn't meddle with a great format. But now that Ampex is delivering Betacam,™ you get a lot of things that make this great format even better, and your job a lot easier.

Our field service people will solve your problems *fast* wherever you are in the world. Reach us in the U.S. via our technical support hotline.

Our spare parts operation makes sure you get the right parts for your needs, and will advise you of any upgrades available.

Besides parts and fast service, Ampex offers pre-packaged repair kits. These simplify maintenance, insure peak performance, and reduce down-time. You can get kits and parts from 14 regional warehouses designed as a worldwide network, close to you wherever you are.

And if you need help in the training department, classes are taught by experienced Ampex instructors at reasonable rates.

It also is comforting to

Ampex gives you

Continued from page 78

Immediately take steps necessary to amass a complete set of service manuals for each item of equipment to be installed. They'll be necessary for interface, installation, connector wiring and setup.

Tuning for minimum downtime

Designing the electrical interconnection of a system means determining how to go about connecting the "gozintas" and the "gozouttas" for maximum efficiency and reliability. In most cases, selecting an operational philosophy, adding distribution amplifiers (DAs) to make the system follow the design philosophy, and documenting the results sums up system design.

The use of DAs requires a judicious approach. System design work offers a wide choice of input, output and DA combinations that bring varying degrees of success. Minimize susceptibility to DA failure by looping critical feeds through DA inputs and terminating at switcher inputs wherever possible. The fewer monitor and/or DA loops included in any feed from source equipment to the primary switcher, the better. Do not terminate feeds at monitors or DAs. Include the capability for by-passing switchers in the event of a switcher failure. Use audio and video patch panels to provide a manual method of by-passing switchers for direct-line input from sources.

Use equalized DAs for any cable longer than 250 feet. Some longer cables, particularly transmitter or STL inputs, may be a source of ground loops and hum. Therefore, an adequate stock of video isolation transformers should be on hand during the installation.

Use common sense when designing patch panels. As you face the front of the panel, label the top row "A," the next row down "B," and so on. Number jacks from left, with the first jack in each row as No. 1. Always keep input/output pairs together. On normaled patch panels, the output jacks are directly above inputs. On panels that are not normaled, the inputs are on top, and the outputs are below.

Lay out the panel so that signals flow from the left. Incorporate at least two 2-way circuits on each patch panel between areas where patch panels are installed. Include all input and output source equipment in control rooms on patch panels. Do not wire DA inputs and outputs to patch panels, except where necessary.

Use only one output per device, unless the manufacturer suggests otherwise or unless only two sources are needed. Do not loop a pulse DA (except via delay lines) to another pulse DA that is terminated. Terminate all unused audio, video and pulse DA outputs. Do not attempt to

save the company money by building terminators. Factory-built terminators use precision resistors, and are designed with requisite attention to stray capacitance.

Audio interconnection requires close attention these days. The proliferating consumer and industrial players with unbalanced outputs typically require the use of an active device for interface to a balanced 600Ω system. Review the specs of all audio sources to determine how many unbalanced outputs will require interfacing, and determine how many "black boxes" will be needed.

Another new set of audio dilemmas was introduced with dual-channel videotape formats, and a further complication was the introduction of VTR formats that provide four audio channels. Judging from the track record of dual-channel formats, tapes will undoubtedly be encountered where program, and perhaps unwanted audio, may be recorded on any channel(s). Thus, summing amps and selection of source by channel(s) will be needed.

Prewiring

Complete the following documentation before wiring begins: all rack positions, elevations and console layouts; architectural, mechanical and electrical building drawings; a "from/to" signal-analysis matrix; and a wire list.

Before a from/to matrix can be generated, most engineering decisions already must be made. Sync system design, signal distribution, sync timing, system timing and other philosophical decisions will determine how the matrix lays out. The from/to matrix will serve as the shopping list for cables, connectors, adapters and distribution amplifiers, and will serve as a final checklist of missing equipment or accessories.

To develop the matrix, simply list all sources and all destinations, including monitors. Add at least the room and rack number for each piece of equipment. Then determine how each signal is going to get from point A to point B. Use the matrix to show how many DAs will be needed when program and air feeds are looped. Apply the results of the matrix to generate a preliminary system-wiring drawing.

Athough a from/to matrix can be compiled manually, several commercially available computer programs can add to the from/to list's usefulness and efficiency. A computerized list can be easily sorted by equipment, room, rack, facility or any other parameters that were entered with each piece of equipment. Use the completed list as a database to identify and number each cable that will be needed. At least one program even prints cable labels. By comparing the cable list to the facility layout drawings, you can measure the length of each cable and identify the appropriate connectors.

Drawings

The preliminary drawing is a conceptual tool for planning and revision. The final drawing reflects the approved system, as designed. An "as built" drawing reflects installation changes to the final drawing.

Begin by developing separate functional block diagrams for video (including tally), sync, audio (including muting), control and intercom. Drawings may be broken down to defined areas such as "studio control B." Illustrate all equipment as rectangular blocks. Label each block with the functional name of the item, manufacturer and model and rack number.

Indicate looping with a half circle, and show termination with a straight line into the box. Indicate external termination with a standard resistor symbol. Label signal connectors on equipment by signal. Label signals on all cables.

Organize drawings to suggest left-to-right signal flow. Reserve the topmost portion of the drawing for monitoring equipment. Use the center and bottom for sources, processing, distribution, switching and destination equipment. Reserve the leftmost area for a column format list of points of origin for signals not originating on the drawing. Similarly, reserve the rightmost side for a column format listing of exit points for signals not terminating on the drawing.

Mark each wire on drawings by using a flag above and attached to horizontal lines, and a flag attached and to the right of vertical lines. Label longer lines on both ends. Indicate direction of signal flow with arrowheads. Mark cables of equal lengths (system timing) with an "E." Show patch-panel detail on separate drawings.

Installing the racks

Rack installation can be treacherous. First, critical decisions must be reached as to how the racks will be laid out in a particular room. Second, racks must be ordered in kit form; that is, doors, tops, side panels, sliding shelves, separators and ac-power strips must be ordered separately. Ordering lead time on racks varies, but deliveries are seldom as fast as most purchasers would like.

When racks are installed, closely check the squareness and level of each one. Confirm adequate door clearances from the floor, walls, hanging light fixtures, speakers and other obstructions.

Wiring ac power into racks is also a challenge. Typically, an electrician requires several hours—or even a day—per rack, depending on power loads and other factors. Be realistic when predicting the amount of time in the project schedule for completion of ac wiring.

When it comes to lighting the insides of racks for installation and maintenance, few systems are similar. Some use off-the-shelf lights that mount inside the racks. Others use desk lamps with goosenecks mounted on top of or inside the racks. Still others prefer to use mechanic troublelights with hangers and cord reel mounted to walls behind the racks. And, of course, architects like to use track lights. Although few installers agree on the superiority of any one approach, all agree that standard fluorescent ceiling lighting is inadequate, and that it must be supplemented with dedicated rack lighting.

Preparing the cable

Develop a wire list using the system drawing. Two versions will be needed, one sorted by wire number, the other sorted by mnemonic signal designations. Include the wire number; wire type; signal-destination mnemonic; wire length (where critical); wire origin, including area, rack number and equipment name; wire destination, including area, rack number and equipment name; and any remarks.

Most installations use five types of cable: microphone cable, line-level audio cable, control cable, utility video cable and program video cable. Most modern video equipment uses BNC connectors. Therefore, audio and control circuits require special attention to which connector is appropriate on which end.

Determine a cable-numbering system. Reserve sets of numbers for predictable cable functions. For example, label cables for in-house RF distribution using numbers 0 to 100. Use 200 to 500 for reference (sync, blanking), 600 to 900 for control, 1,000 to 3,000 for video, 5,000 to 7,000 for line-level audio, and 8,000 to 9,000 for mic-level audio.

Once you have determined all cable lengths by comparing the matrix and system drawings to the building drawings, add approximately 10 feet to each end, tally the total, and order the bulk ca-

HHSmith. Your exclusive connection for Neutrik® precision connectors.

Today's sophisticated audio and industrial componentry is only as good as what links it all together. And it never gets as good as Neutrik brand precision engineered connectors, only from HHSmith. Advanced interconnects that receive a level of design attention usually reserved for the finest electronic circuitry.

Take our XLR straight and right angle connectors for example. Alloy gold and silver plated contacts for ease of signal flow. Hard polyester inserts, fiberglass reinforced for extra strength. A chuck type clamp for secure strain relief without damage to insulation. And a high reliability die-cast zinc shell, finished in satin nickel or black chrome.

Or our XLR receptacles with gold or silver plated brass pins, beryllium copper contacts and easy 2-screw mounting.

There's even an X series 3 pin male/female connection system that saves you up to 50% in assembly time. Or our same-size male/female "D" series receptacles with PC board or solder spring selection, and receptacle inserts that lock in and out for repair without shell removal.

All examples of truly precision engineering and craftmanship. The kind that makes itself evident in every Neutrik product, including AC connectors and receptacles, phone jacks, plugs, goosenecks and transformers.

To find out more about the full line of Neutrik products, hook up with a free HHSmith catalog. Write HHSmith, 1913 Atlantic Ave., Manasquan, NJ 08736 or call (201) 223-9400 today.

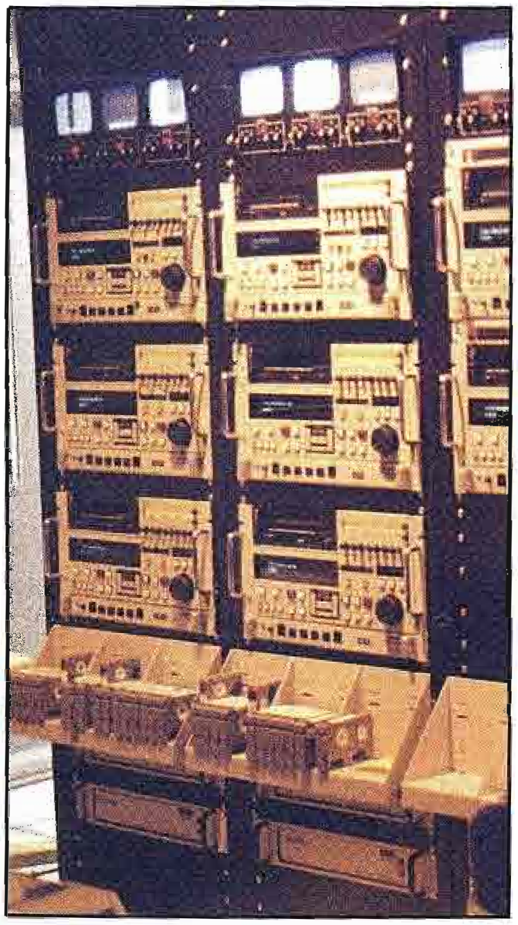
DIALIGHT CORPORATION

DIALIGHT • KULKA • HHSMITH

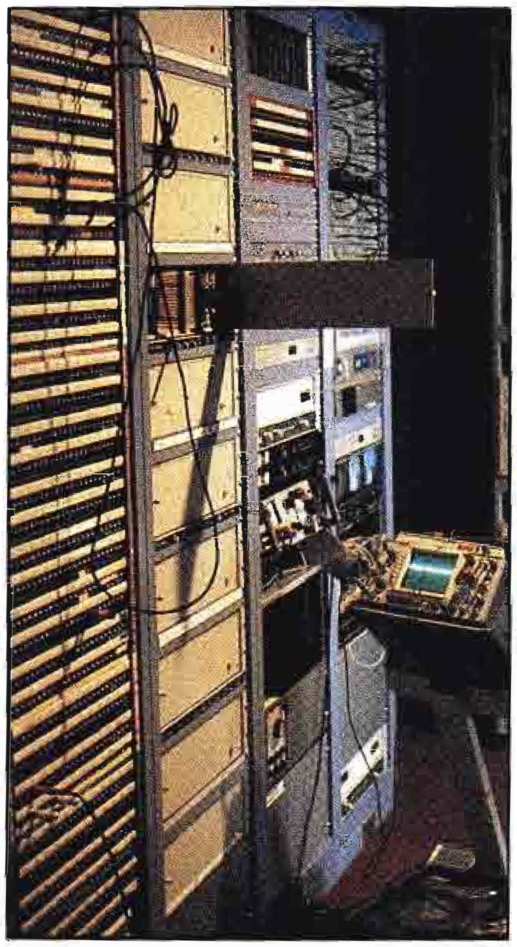
A North American Philips Company

® Registered Trademark of Neutrik AG

Circle (56) on Reply Card



Laying out automated master-control racks provides an opportunity to create a logical and efficient work space.



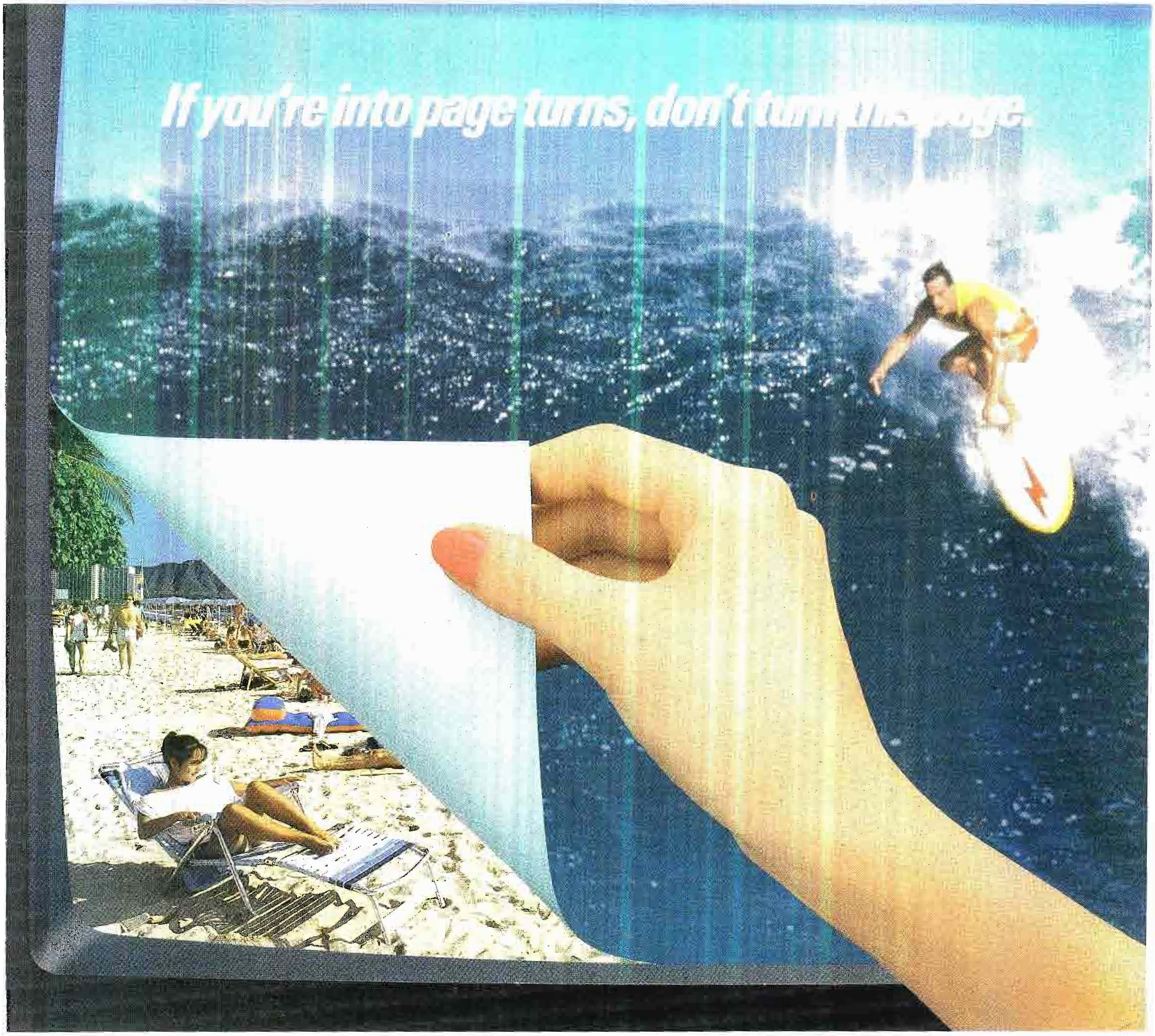
Placement of these audio racks allows easy access for maintenance.

ble and connectors. Learn from connector manufacturers which specialty tools they recommend to install specific connectors. Buy the recommended tools and an ample supply of cutting blades. When the cables arrive, begin measuring, labeling with cable numbers and cutting the cables to length.

Affix wire number labels to cables using the *left-hand rule*. Hold the cable in your left hand, palm down, and orient the cable so your thumb points in the direction of signal flow. Apply the label right side up, so that when the label is read, signal flow will always be from left to right. Label any cable longer than one foot at both ends. When labeling a cable at both ends, place the labels no less than 3 inches and no more than 6 inches from each end of the wire.

Mark the functional name of the point of connection with equipment, such as "video in" or "chroma-key out," on the end of each cable. Use either a separate label or combine this information with the wire number label.

Cables should be bundled and pulled by the rack. Various methods have been employed successfully to bring the cables into racks. One approach is to separate each rack with a metal spacer, and bring in the vertical runs between racks. This

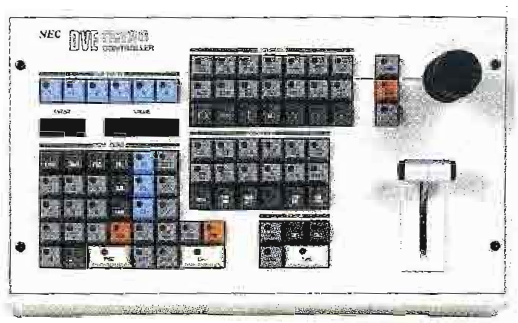


Curl it, roll it, fold it or peel it. With NEC's DVE® System 10, video images are as flexible as a page in this magazine. Just push a button, flick the joystick and System 10 performs your page turns freely and smoothly. The system also offers wave, 3-D rotation, infinite perspective, cube-making and more.

THE FUTURE IS BUILT-IN

DVE System 10 not only puts you on the leading edge of video today. It gives you a secure spot in the future. The system is continuously software-upgradable and will run new effects developed by NEC.

By combining the System 10 with our VSR-10 video recorder, you enter a new realm of freedom in the production of complex special effects. The all-solid-state VSR-10 uses VLSI chips to give you 34 seconds of memory and maintain original image quality.



Turn over a new page in your video productions by calling NEC today. Ask about our DVE System 10, the component version System 10C, and the powerful VSR-10 recorder.

DVE®: registered trademark of NEC Corporation.

For further information, please contact:

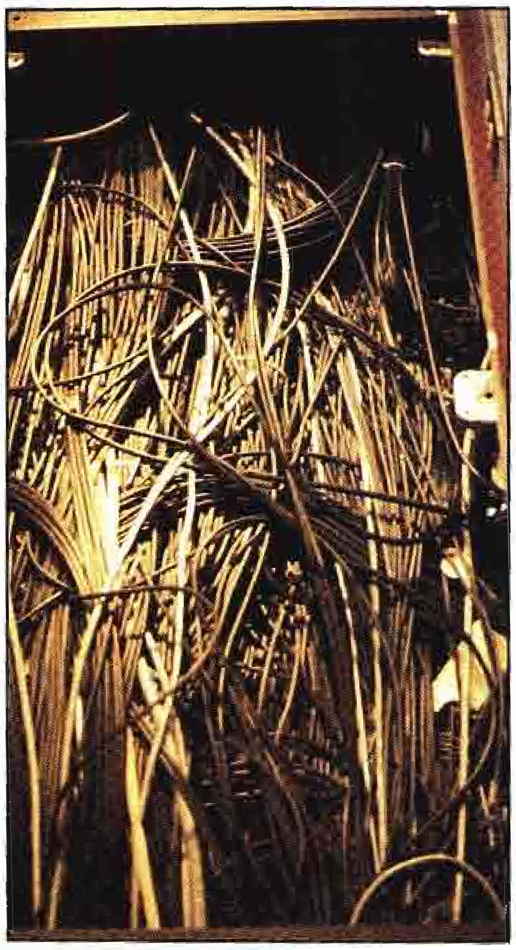
NEC America, Inc.
Broadcast Equipment Division,
1255 Michael Drive, Wood Dale, Illinois 60191
Tel: 1-800-323-6656. In Illinois: 312-860-7600

C&C
Computers and Communications

NEC

Circle (58) on Reply Card

Delay lines are mounted on the rails of this production switcher rack.



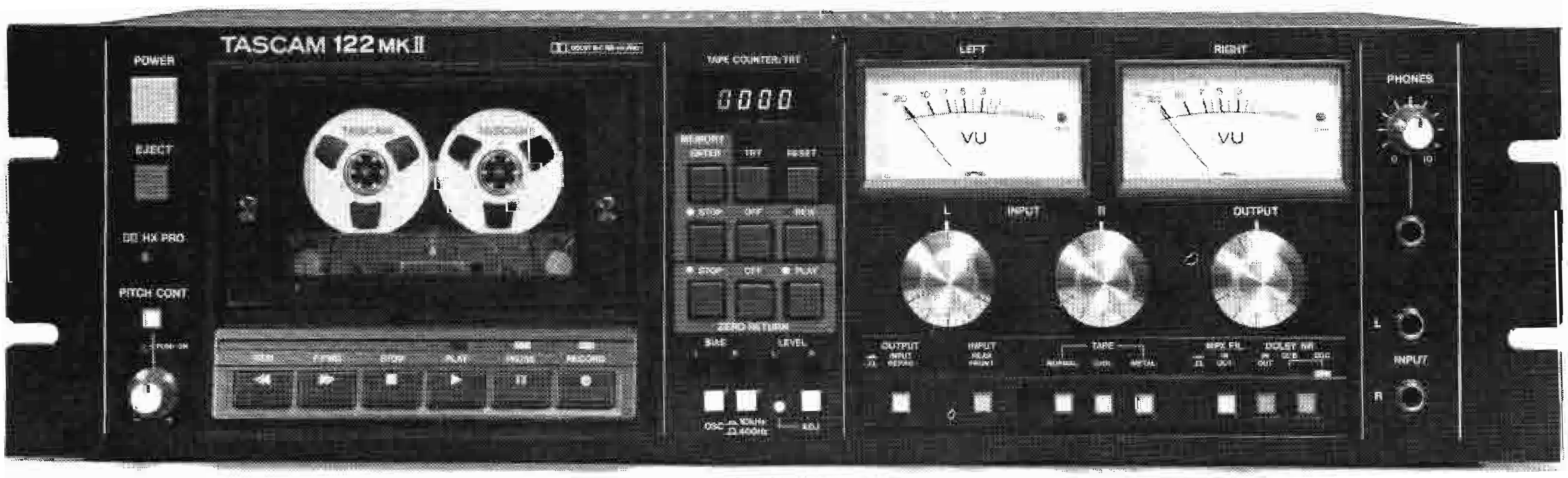
When determining raised-floor height, allow for extra-thick cable bundles around racks.

method clearly reduces the behind-the-equipment congestion typical to rack installations, but eats up space and may be difficult to change later.

If vertical runs are inside racks, some installers prefer to run audio cables on one side of a rack and video cables on the other. This philosophy should remain flexible, because many racks these days are dedicated for audio or video, and both sides should be used for either, if necessary. Do not attach connectors until after wires and bundles have been pulled.

Plan to leave enough cable at the end of vertical runs so that equipment on rack slides can be pulled out easily without stressing cables or bundles. Using the service manuals, check for any equipment that may have adjustments or circuit boards that are accessed at either side of the unit. Do not mount these items in racks that are next to a wall or near other obstructions that might interfere with extender boards.

Some engineers like plastic cable ties, and some don't. Cable ties work well for service loops, but may be difficult to handle when you're securing large bundles on vertical runs. Cradle clips spaced at 12- to 18-inch intervals for final dressing provide an easily modifiable method of



securing cables to surfaces and racks. In any event, confirm that cable dressing does not cover wire marking.

Grounding

A 4-inch, 16-gauge copper strap grounded to earth usually provides an adequate facility ground. Ground all metal equipment racks to the facility ground. In theory, each rack should be grounded individually, using a No. 10 or larger solid conductor, silver-soldered to the facility ground strap. At minimum, ground every third rack in this manner, and ground adjoining racks by attaching them to the grounded racks using several toothed washer/bolt/nut combinations, after paint removal, at connection points.

Ground audio cables only at the next point of signal amplification. Do not use patch panels as a ground bus. Bus and connect the shields of all jacks in a jackfield separately, directly to the facility ground.

Fan outs

A fan-out interface is necessary for all equipment that uses multiple connectors. A fan out provides access for testing, emergencies, modifications and growth. Typically, fan outs are used for audio, tally, control and intercom systems. Many installers prefer Jones No. 6 barrier strips or punchdown blocks. Christmas-tree fan outs are easy to install, but do not lend themselves to maintenance or changes.

Fan outs require extra attention to serviceability. When designing the fan out, the wires that may require changes should be connected last, so the fan out does not have to be completely disassembled when changes and updates are made.

Sync systems

A variety of sync-distribution methods have been successfully employed in system design. The time-tested rule of thumb is to use a master sync generator and sync everything to it. Determine the longest sync cable, and cut all other sync cables to that length to achieve SC/H phasing. This usually requires leaving coils of cables under the floor or in the trenches, or using delay lines.

Some newer stand-alone products that recently have appeared on the market provide multiple, individually timed blackburst outputs. This concept eliminates much of the cable pruning and tuning normally required for system timing.

Some systems use a decentralized approach. Separate "sync islands" use sync generators, gen-locked to the master sync generator at various locations throughout a facility. This idea provides backup systems in case the master sync generator fails, eases system-timing difficulties and allows subsystems to gen-lock to remote feeds, sometimes eliminating the need for a frame synchronizer.

Finishing the job

No system is complete until the work is fully documented "as built," cables are properly dressed, blank rack spaces are filled and each piece of equipment and wire is labeled permanently. Support documentation with photographs and/or videotape, depicting various stages of progress and construction.

Permanently label all racks and hardware. Label racks at a consistent location on the front and back. To label equipment, establish a consistent location (such as the upper left-hand corner), and affix a permanent label on that same spot for each piece of equipment. The label identifies the mnemonic name of the item (film chain 7, camera 3, etc.), or the name of the feed that it monitors.

Develop operations training documentation for each subsystem, such as electronic slide storage, automation systems, film chain operations and character generators. Base the training documents on

AMEK

BCII

AMEK BCII – Compact Audio Engineering for Broadcast Production

Preferred for Film and Video Post · Audio Post for Radio · Stereo Television · Foley · ADR · Transfer · ENG · On-Location Recording · Corporate Video Production.

AMEK's BCII System responds to the needs of the contemporary Broadcast Production environment for a higher standard of performance and flexibility in compact audio production consoles.

Our in-depth understanding of operational and creative requirements has lead to the inclusion of many new and valid design ideas. Our innovative approach has created an audio mixing system which is truly compatible with almost any operating environment; whilst its competitive pricing makes the BCII extremely budget-efficient.

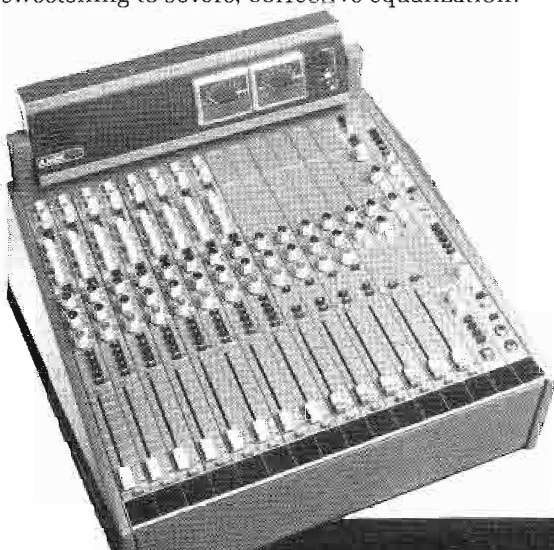
A range of interchangeable modules in both Mono and Stereo formats utilising plug-in subassemblies, combined with comprehensive control facilities, allow many tasks to be accomplished in a number of ways. Customization of signal flow paths using internal links, optional Dynamics modules and several chassis variations, further serve to increase the capabilities of the system.

The robust, all-metal chassis design fully screens the electronics from stray electromagnetic fields; ultra-low-noise circuitry, balanced outputs, and the use of balanced bussing provide exceptional performance characteristics. The AMEK equalizer has a very wide operating range, suited to any application from delicate track sweetening sweetening to severe, corrective equalization.

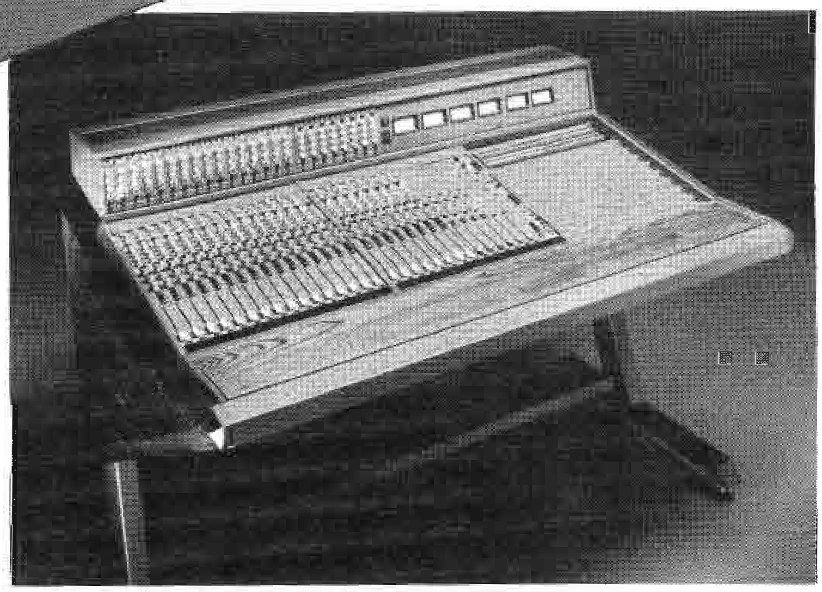
The monitoring system allows comprehensive handling of gallery/control room requirements. Various metering arrangements are available.

Furthermore, the BCII has ports for AFV (Audio Follows Video) which can be configured for either Remote Muting in the standard version or for remote DC control of fader levels in the VCA version.

In essence, an outstanding product specified worldwide by a diverse range of clients, from owner-operators to major, multi-installation broadcasters such as the BBC and NBC.



AMEK BCII IN 8/4/2 VERSION



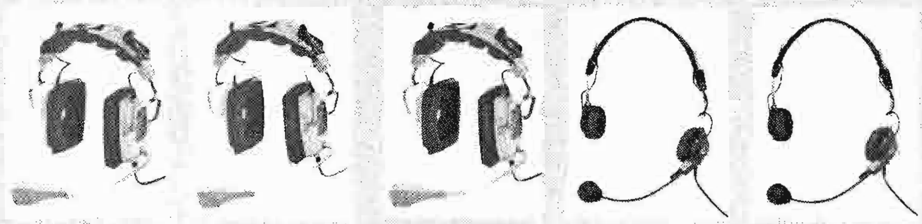
AMEK BCII IN 24/4/2 STUDIO CHASSIS VERSION

Head Office, Factory and Sales: AMEK Systems and Controls Ltd, Islington Mill, James Street, Salford M3 5HW, England. Tel: 061-834 6747. Telex: 668127 AMEK G E-MAIL: AMEK-UK. Fax: 061-834 0593.

In the USA: AMEK Controls Inc. 10815 Burbank Blvd, North Hollywood, CA 91601. Tel: 818/508 9788. Telex: 662526 AMEK USA E-MAIL: AMEK US. Fax: 818/508 8619.

1985 AMEK 1986

Circle (68) on Reply Card



operator manuals. Edit by condensing and personalizing the text so that it is applicable to your particular facility and to the knowledge level of operators. Include by-pass instructions, alternate plans and fuse locations in case of failure. Several outside companies offer operational documentation service.

System checkout

When temporary wiring has been completed (before final cable dressing), check it out thoroughly. Confirm the proper operation of each unit and all remote controls. Verify the operation of all LEDs, lamps and other indicators. Check the operation of all signal-level controls. At normal operating levels, controls should be set between 50% and 75% of maximum travel.

Check the operation of speakers at maximum gain. Listen for absence of hum and noise. Check video monitors for crosstalk, RFI, purity, convergence and color balance. Check calibration and operation of waveform monitors.

Verify proper operation of all signal sources, processors, DAs and switchers. Adjust sync timing and check special effects on switchers. If any adjustments in timing exceed 175ns, install a delay line or recut the cables. Confirm all SC/H phasing at switcher inputs before dressing cables.

Simulate DA and switcher failures to verify the by-pass capabilities of the system. Failures should not affect on-the-air operations.

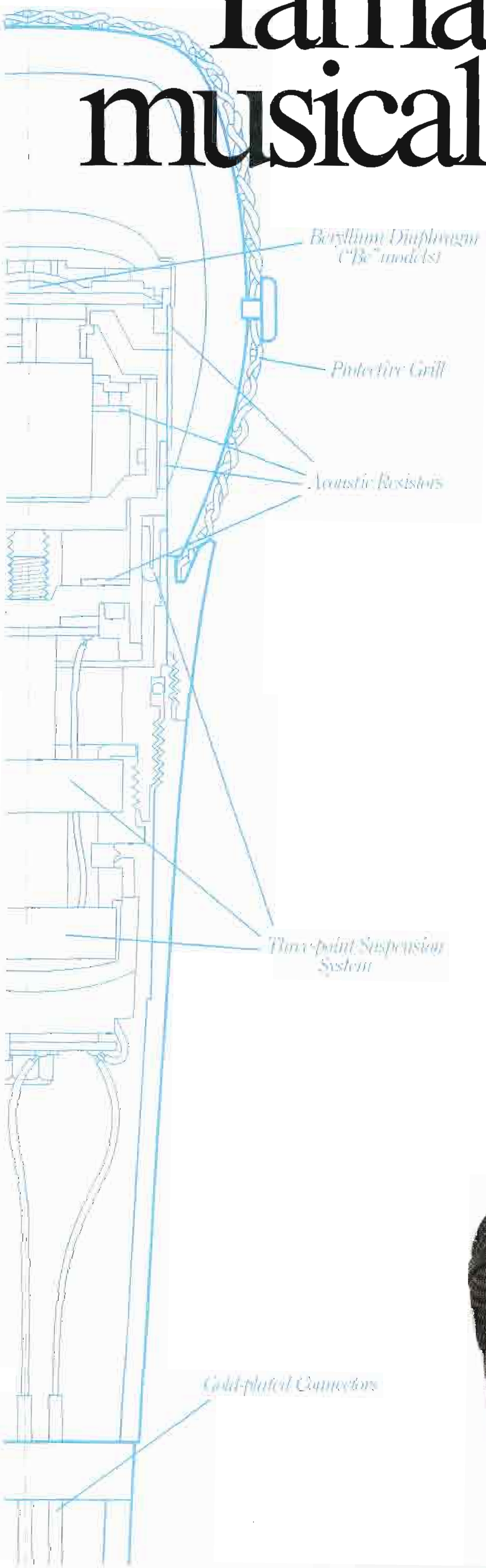
Generate a discrepancy list, and repair those items that do not function as expected. When system operation is satisfactory, remove temporary cable ties and dress the wiring permanently. Complete a final system checkout after all temporary cable ties have been removed, blank panels and rack doors have been installed and the cables have been permanently dressed.

Stocking the shop

Keep a healthy stock of unused connectors, terminators, wire markers, specialty tools and other supplies. Organize all manuals, extenders, unused accessories, power supplies and warranty cards. Bind completed "as built" drawings, as well as final drawings. Bind documentation of all custom construction, such as fan-out interfaces, interface adapters, control panels, patch-panel layouts and facility timing charts.

Taking a formal approach to familiarizing operators and managers with the working system gives them an opportunity to ask questions about methods, philosophy and operation. A thorough orientation will leave the operators trained, prepared and smiling.

Yamaha's newest musical instruments.



For years, Yamaha has been making musical instruments that allow performers to express what they feel. Our new line of MZ Series professional dynamic microphones continues this tradition.

The three-layer laminated beryllium film used in the diaphragms of the MZ102Be, MZ103Be and MZ105Be offers greater control over piston movement for heightened presence and accuracy throughout the entire frequency range.

Throughout the entire line, a superior acoustic damping system makes use of a mesh screen and photo-silkscreen technology. The benefits are extraordinary long-term stability and absolute uniformity. This uniformity can be especially important when matching pairs of mics for stereo.

A tight cardioid pattern provides excellent off-axis rejection for superior feedback suppression.

To reduce handling noise, all MZ mics have a unique three-point floating suspension system. And a special windscreen with three times the impact resistance of conventional types. So you know it can take a pounding.

We even use gold-plated audio connectors.

But when you listen to Yamaha MZ mics, you hear more than the result of advanced technology. You hear a one-hundred-year tradition of making music.

For complete information, write Yamaha International Corporation, Professional Audio Division, P. O. Box 6600, Buena Park, CA 90622.

YAMAHA®
Engineering Imagination

Circle (65) on Reply Card

Wireless microphone frequency compatibility

By Ken Fasen

Proper frequency selection is the key to successfully using multiple wireless microphones.

The advantages provided by wireless microphones make them popular, and occasionally mandatory, for many broadcast and recording applications. The freedom of movement and benefit of concealment allow production options that would be impossible with wired microphones. Perhaps the most notable advantage is that talent is no longer restricted to a stage, creating many opportunities for flexibility and creative production.

Wireless microphones are radios and, therefore, are subject to the laws of radio-frequency physics. These laws of physics and the regulations of the FCC put practical limitations on the selection of operating frequencies. In addition, when two or more wireless microphone systems are operated simultaneously, a complex set of restrictions applies to the equipment design and selection of operating frequencies. The following is a description of these restrictions, what causes them and how they can be overcome.

Fasen is engineering manager for HM Electronics, San Diego, CA.

Definition

Multiple-system frequency compatibility is defined as the condition of two or more wireless microphone systems operating simultaneously, with no degradation in the performance of one due to the presence of the other systems. A *system* is defined as a transmitter and a companion receiver.

Suppose five wireless microphone systems are operating simultaneously. If each system functions equally well with the other four systems turned on, as well as with them turned off, the five systems are said to be compatible. If, however, the presence of any of the other four systems degrades the performance of the fifth, they are said to be incompatible. Only one of the other systems may be responsible for the interference. On the other hand, a combination of the other systems could be responsible.

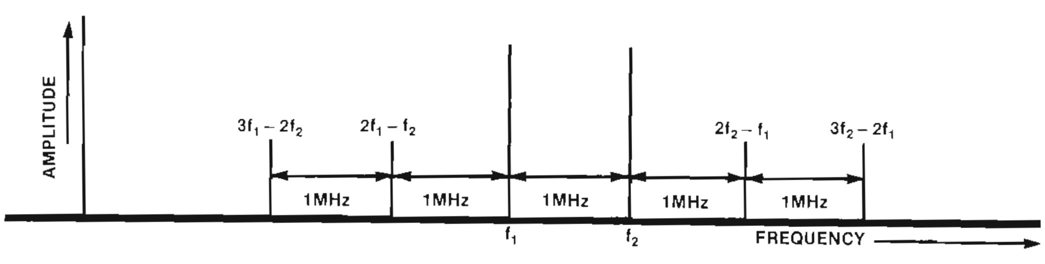


Figure 1. *Two-signal IM does not produce interference when only two systems are used.*

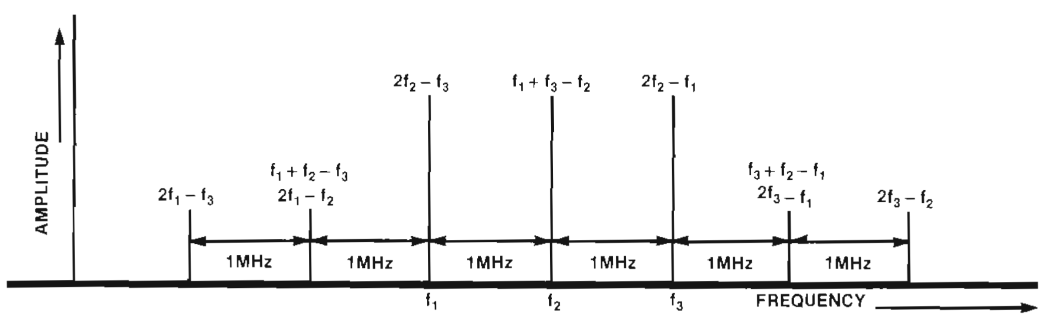


Figure 2. *Three-signal IM can produce interference at a large number of frequencies.*

Causes of frequency incompatibility

The restrictions on the selection of operating frequencies are imposed both by the FCC and by the limitations of the transmitter and receiver circuits. The FCC reserves specific frequencies and bands of frequencies for wireless microphone operation. Eight specific frequencies are reserved under FCC Part 90.265(b) for wireless microphone use. Because of the channel spacing chosen, however, only combinations of two of these frequencies are truly compatible in spite of the eight available frequencies. Selecting frequencies in the TV-channel spectrum allows larger compatible systems to be built.

RF physics and the limitations of the equipment circuitry impose restrictions that fall into the following six categories:

- separation between operating frequencies,

Broadcasting and Telecommunications industries throughout the world use and recommend the Mosses & Mitchell range of Jacks and Jack Panels.

These products have gained a well earned reputation for engineering excellence and are now available in the U.S.A through sole distributors Penny & Giles Inc.

Manufactured from the highest quality materials using the latest engineering techniques Mosses & Mitchell Jacks and Jack Panels meet the most exacting specifications.

For full details of how Mosses & Mitchell Jacks and Jack Panels will help maintain the quality and reliability of your products contact:

Penny and Giles Inc.
2716 Ocean Park Boulevard, Suite 1005, Santa Monica 90405, California
Telephone: 2133 930014

Circle (66) on Reply Card

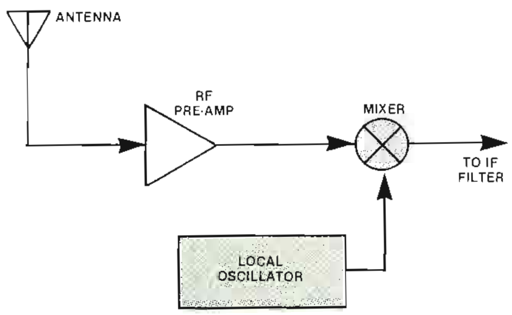


Figure 3. *Basic superheterodyne receiver block diagram.*

- transmitter spurious signals,
- two-signal intermodulation,
- three-signal intermodulation,
- receiver local oscillator radiation and
- receiver image-frequency sensitivity.

Each category is distinct and requires its own explanation. All six restrictions concerning system frequencies must be satisfied simultaneously to achieve complete compatibility.

Separation between operating frequencies

The separation between operating frequencies is simply how close together in frequency the systems are spaced. The limiting factor in the receiver design is the selectivity of the intermediate frequency (IF) filter and the dynamic range of the RF pre-amplifier and mixer circuits. The more selective the filter and the higher the dynamic range, the closer the operating frequencies can be. A basic guideline is that all operating frequencies should be separated from one another by at least 400kHz.

A selectivity problem can be identified by turning on all receivers, then turning on only one transmitter at a time. If any receiver other than the companion receiver unsquelches, the operating frequencies may be too close together. Calculating differences in operating frequencies can confirm this possibility.

The best solution to this problem is to change system frequencies. To do this, calculate the differences between system frequencies. If any of them are less than 400kHz apart, they must be changed. Suppose the following system frequencies are being used:

F1 = 174.8MHz
F2 = 175.4MHz
F3 = 175.7MHz

You find F2 and F3 less than 400kHz apart. Therefore, either F2 or F3 must be changed. An acceptable frequency for F3 would be 178MHz. Now all system frequencies are separated by more than 400kHz.

One alternative is to turn on the transmitter companion to the affected receiver in an attempt to *capture* the receiver and reject the interfering signal. Capture is a phenomenon in FM receivers whereby the stronger of two co-channel signals suppresses the weaker one. This alternative may or may not be successful, depending on conditions.

Transmitter spurious signals

In addition to the desired signal, transmitters emit energy on other frequencies as well. Most wireless microphone transmitters use a quartz crystal as a frequency-determining element and multiply it up to the operating frequency. A multiplier circuit is one in which the output frequency is a multiple of the input frequency.

Consider a transmitter operating on 160MHz. Starting with a 20MHz crystal and multiplying by 2 yields 40MHz. Multiplying by 2 again yields 80MHz, and once again yields the desired 160MHz. This is a "times eight" (2 x 2 x 2 = 8) transmitter. However, it also radiates energy at frequencies other than 160MHz. Signals also are present at 80MHz (x4), 140MHz (x7), 180MHz (x9), 200MHz (x10) and so on. Granted, they are significantly weaker than the desired 160MHz signal, but they exist. A receiver operating on one of these undesired output frequencies may receive the transmitter's spurious signal, possibly causing audio degradation.

Assume that a spurious signal is transmitted at a level 70dB less than the desired signal. Its transmitted power might then be −53dBm. This is 57dB above the threshold sensitivity of the receiver and will unsquelch it.

The solution is to select frequencies so these spurious signals do not fall on or near the other operating frequencies. Such undesired signals should be at least 250kHz from any operating frequency. Multiples of 1 through 16 times the crystal frequency should be computed and compared with all the other operating frequencies.

To check for spurious signals, turn on all the receivers, then turn on only one transmitter at a time. If any transmitter unsquelches a receiver other than its companion receiver, you may have a transmitter spurious problem. Calculating the transmitter's undesired crystal harmonics will tell you if this is the case.

Again, the best solution is to change system frequencies. First, calculate the offending crystal harmonic, then change the offending transmitter or the offended receiver. Suppose you are using the following system frequencies:

F1 = 190.8MHz
F2 = 214.8MHz

The ninth harmonic of the crystal for system No. 1 occurs on 214.65MHz, which is within 150kHz of F2. The calculations follow.

1. 190.8MHz ÷ 8 = 23.85MHz (crystal frequency).
2. 23.85MHz x 9 = 214.65MHz (ninth crystal harmonic).

The World's First 4:2:2 Telecine

The no hassle . . . . . broadcast telecine

ADS 1
Advanced Digital Scanner

With ADS 1, Rank Cintel has applied its unique film-scanning experience to the specific needs of the broadcaster.

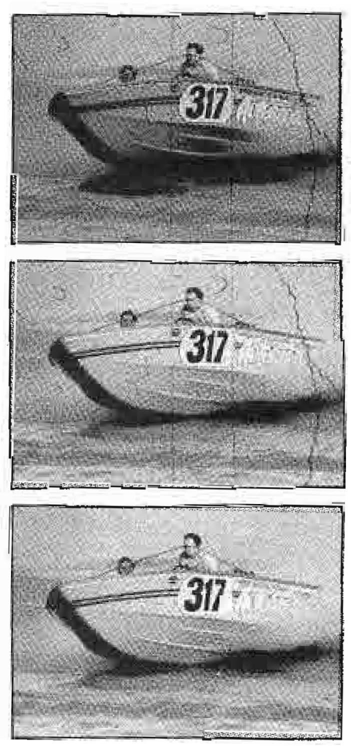
Developed in close co-operation with the British Broadcasting Corporation (BBC), this CCD multiplexed broadcast-telecine is designed for easy 'on-air' operation and transfer of film to tape prior to transmission.

The incorporation of solid-state imaging technology is an example of Cintel's continuing development philosophy.

Latest component technology, cost-conscious design and modern manufacturing techniques have been exploited, without compromising performance and reliability. The result is a telecine system which is technically advanced while at the same time being economical to operate.

That is not all, ADS 1 also features a unique electronic dirt and scratch concealment system. Add all this together . . . . and you have the ideal broadcast-telecine package.

Take the hassle out of film broadcasting — call us at 914-353-1914.



Rank Cintel Inc. East Coast
New York 10994, U.S.A.
260 North Route 303, West Nyack,
Tel: 914-353 1914 Telex: 726441

Rank Cintel

West Coast
13340 Saticoy Street, North Hollywood,
California 91605, U.S.A.
Tel: 818-765 7265 Telex: 182694 RPI LSA
Fax: 818-765 3315

Rank Precision Industries Inc. 411 East Jarvis Avenue, Des Plaines, Chicago, Illinois 60018, U.S.A. Tel: 312-297 7720 Telex: 646998 Fax: 312-6990581

Circle (63) on Reply Card

3. 214.8MHz − 214.65MHz = 150kHz (less than 250kHz apart).

An acceptable frequency for F2 would be 214MHz because it is 650kHz away from the ninth crystal harmonic of system No. 1 (214.65MHz − 214MHz = 650kHz). Alternatively, you can keep the F2 transmitter turned on in an attempt to mask the undesired signal from transmitter F1. Results of this approach will vary.

Two-signal intermodulation

Two signals applied to any non-linear circuit create additional signals, or intermodulation (IM). These signals include the sum-and-difference products of each of the fundamental input signals and their associated harmonics. The following components are produced:

- fundamental: F1, F2
- second order: 2F1, 2F2, F1 ± F2, F2 − F1
- third order: 3F1, 3F2, 2F1 ± F2, 2F2 ± F1
- fourth order: 4F1, 4F2, 2F1 ± 2F2, 2F2 ± 2F1
- fifth order: 5F1, 5F2, 3F1 ± 2F2, 3F2 ± 2F1
- higher-order products

Order is defined as the sum of the numerical coefficients that multiply the F1 or F2 terms. Note that the even-order products usually occur far removed in frequency from F1 and F2 and, therefore, are omitted here for simplicity.

If F1 and F2 are close to each other in frequency, the 2F1 − F2 and 2F2 − F1 terms also fall close together. If F1 and F2 are separated by 1MHz, those products also will be separated from F1 and F2 by 1MHz. For example, if F1 = 160MHz and F2 = 161MHz, the following intermodulation signals will occur:

- third order: 159MHz (2F1 − F2) and 162MHz (2F2 − F1)
- fifth order: 158MHz (3F1 − 2F2) and 163MHz (3F2 − 2F1)
- higher-order products

An RF spectrum analyzer display depicting these relationships is shown in Figure 1.

If any of these products fall on or near any system frequency, interference and incompatibility will result. The guideline is that these IM products should be at least 250kHz away. Note that 2-signal IM will occur when two systems are operated simultaneously. However, if the two transmitters are separated by the required minimum of 400kHz, the interference is not a problem when only two systems are operating. This is because the close-in IM products (2F2 − F1 and 2F1 − F2) will be at least 400kHz away from either system frequency. Two-signal IM, however, also can cause interference when three or more systems are used.

IM can occur in the output stages of two closely held transmitters. If this happens, it actually will be retransmitted by both transmitters. The IM also might occur in the receiver RF circuitry due to close proximity of the transmitters to the receiver antenna. In any case, a signal produced on or near a system frequency may unsquelch an undesired receiver.

The problem can be identified in two ways. First, the interference occurs only when two transmitters are turned on. Turning either one of the transmitters off removes the interference. Second, the interference is more severe when the two transmitters are in close proximity to one another or are close to the receiver antenna. The interference may disappear completely when the transmitters and receiver antenna are separated from each other.

Again, the best solution is to change system frequencies. Calculate the IM products to see if any fall within 250kHz of any system frequency. For example, suppose the following system frequencies are being used:

F1 = 174.8MHz
F2 = 175.4MHz
F3 = 176.6MHz

When tested, with F1 and F2 transmitters both turned on and in close proximity to one another, the receiver on F3 not only unsquelches, but also receives the audio from F1 and F2. Use the following formulas to identify the cause:

1. 2F1 - F2
2. 2F2 - F1
3. 3F1 - 2F2
4. 3F2 - 2F1

The calculations show that 3F2−2F1 = 176.6MHz, which is F3. You must, therefore, select a new F3. Recalculate the IM products using the new F3 to be sure no IM products fall within 250kHz of the new F3 frequency. In addition, you must take into account all of the combinations of any two of the three system frequencies. In this case, an acceptable frequency for F3 would be 178MHz.

One option is to keep the transmitters separated from each other and from the receiving antenna by at least 10 feet. Also, turning on the transmitter for the offended receiver may help to mask the problem.

Three-signal intermodulation

Just as two signals combined in a nonlinear circuit can cause sum-and-difference products to be created, the same happens with more than two signals. Although not as severe, 3-signal IM also can be a problem. The following signals are produced by 3-signal IM.

- fundamental: F1, F2, F3
- third order: 2F1 ± F2 and F1 ± F2 ± F3

Again, the even-order and higher-order products usually are far removed in frequency and are seldom of interest. For the sake of simplicity, the higher-order products will not be discussed here.

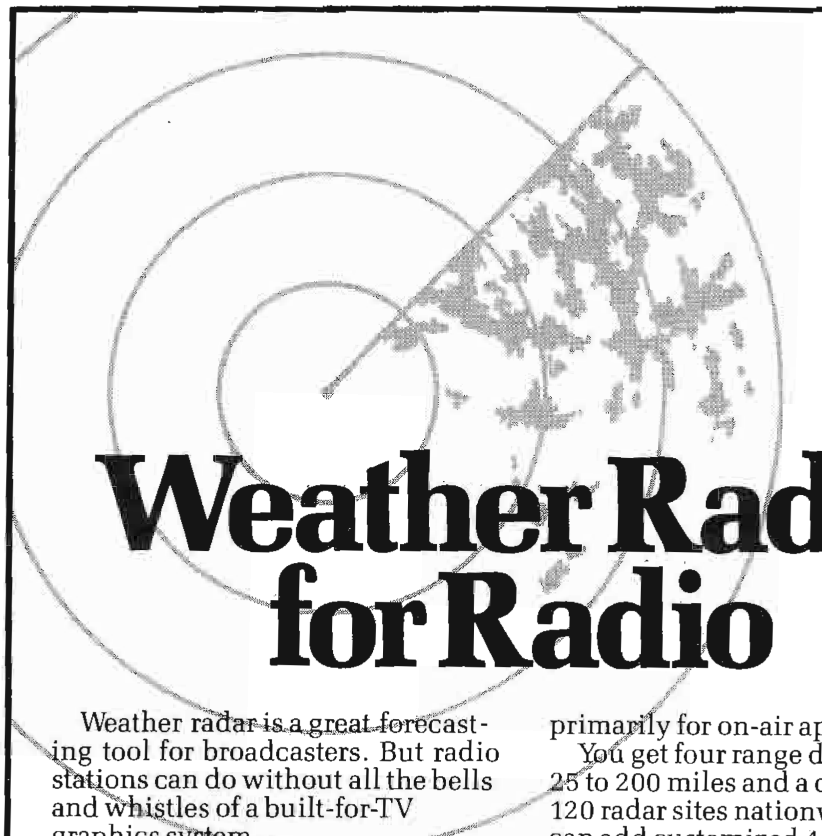
Consider a system with microphones operating on the following frequencies:

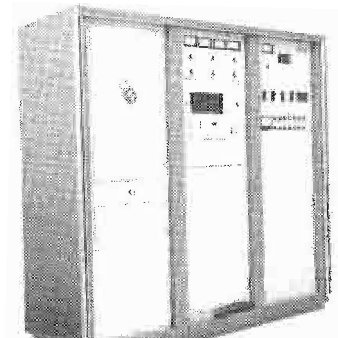
F1 = 159MHz
F2 = 160MHz
F3 = 161MHz

Third-order IM products will occur as follows:

Frequency	IM Product Formula
157MHz	2F1−F3
158MHz	F1 + F2−F3 and 2F1−F2
F1 = 159MHz	2F2−F3
F2 = 160MHz	F1 + F3−F2
F3 = 161MHz	2F2−F1
162MHz	F3 + F2−F1 and 2F3−F2
163MHz	2F3−F1

Note that in the example given, third-order IM products fall exactly on the system frequencies themselves. For example, F1 + F3 − F2 = 160MHz, which





is F2. Hence, equal spacing of system frequencies results in 2-signal IM interference (2F2 – F1) as well as 3-signal IM interference. These relationships are shown in the RF spectrum analyzer display in Figure 2. The guideline, again, is to keep these IM products at least 250kHz away from any system frequency.

The characteristics of 3-signal IM are identical to those of 2-signal IM. Three-signal IM can occur in the output circuits of transmitters or in the input circuits of receivers. The problem can be identified in two ways. First, turning off any one of the three offending transmitters will eliminate the interference. Second, the interference is more severe when the three transmitters are in close proximity to one another or to the receiver antenna.

As with 2-transmitter IM, the best solution to 3-transmitter IM is to change frequencies. When you add a fourth transmitter, the calculations take on even more importance, because you must consider all combinations of three of the four frequencies. Consider the following example:

F1 = 181.4MHz
F2 = 183.4MHz
F3 = 184.8MHz
F4 = 186.8MHz

When transmitters on F1, F2 and F3 are turned on and in close proximity to one another, the receiver on F4 not only unsquelches, but also receives the audio from transmitters F1, F2 and F3. The following formulas are, therefore, applicable:

1. 2F1 – F3
2. F1 + F2 – F3
3. 2F1 – F2
4. F3 + F2 – F1
5. 2F3 – F2
6. 2F3 – F1

Note that only third-order product formulas are listed here. Fifth-order formulas (3F1 – F2 – F3 and 3F3 – 2F1) also may be significant, but are omitted here for simplicity.

Calculations show that F3 + F2 – F1 = 186.8MHz, which is F4. You must, therefore, select a different frequency for F4. In addition, you must consider all combinations of three of the four system frequencies, and you must be sure the six formulas don't indicate an IM product within 250kHz of the new fourth-system frequency. In this case, an acceptable frequency for F4 would be 204.8MHz. Alternatively, keeping the offending equipment physically separated and turning on the offended receiver's transmitter may help minimize the problem.

Receiver local oscillator radiation

A basic superheterodyne receiver block diagram is shown in Figure 3. The local oscillator (LO) generates a carrier, which is mixed with the signal received at the antenna. This process generates a new signal at the intermediate frequency (IF). The local oscillator is actually a low-powered transmitter-type circuit, with an output wired to the mixer circuit. If the LO signal is coupled to and radiated by the receiver antenna, interference may be produced.

Consider a receiver operating on 160MHz. If the receiver has an IF of 10.7MHz and low side injection, the LO will operate on 149.3MHz. This frequency can be radiated by the receiver antenna and detected by any receiver operating on or near 149.3MHz.

If a receiver LO signal falls on or near any system frequency, interference (and incompatibility) may result. The guideline is that no receiver LO should be closer than 250kHz to any system frequency. LO radiation can be identified by turning off the offending receiver and noting whether the interference disappears. Of course, this effect is most obvious with all the transmitters turned off.

Assume you have a system operating on the following frequencies:

F1 = 203.3MHz
F2 = 211.4MHz
F3 = 214.0MHz

When the receiver on F3 is turned on, the receiver on F1 unsquelches. You determine that the LO frequency of receiver F3 = 203.3MHz (214MHz – 10.7MHz), which is F1. The solution is to select a new F1 or F3, being sure it is at least 250kHz away from the LO of the other receivers. An acceptable frequency for F1 would be 210.8MHz.

Again, physically separating the offending receiver and its antenna from the offended one and turning on the offended receiver's transmitter should help reduce the problem.

Receiver image-frequency sensitivity

Receiver image frequencies also can produce interference problems. An image frequency is equal to the LO frequency minus the IF frequency. For example, if a receiver operates on 160MHz with an IF of 10.7MHz and an LO of 149.3MHz, then the image frequency is 138.6MHz (149.3MHz – 10.7MHz).

The typical receiver is 70dB less sensitive at its image frequency than at its operating frequency. This provides an image-frequency threshold sensitivity of approximately –40dBm. A transmitter with an output level of +17dBm will generate a signal 57dB above the receiver's image-frequency sensitivity threshold. Interference can result easily. The same basic guidelines apply. Separate all image frequencies from operating frequencies by at least 250kHz.

You can identify the problem by noting whether the offending transmitter is 21.4MHz lower than the offended receiver's operating frequency. Although these calculations are based on low side injection and an IF of 10.7MHz, the principle is valid regardless of the LO frequency.

Degrees of compatibility

As with other forms of interference, the amount of compatibility varies. In some cases, the problem may be mild and, in others, severe. The stronger the interference signal and the closer it is to a system frequency, the more serious the problem. For example, if a system operates on 160MHz, and an IM product is generated on 160.05MHz (50kHz away), the problem is likely to be severe because the frequencies are close together. If, however, the IM product occurs at 160.24MHz (240kHz away), the problem may be mild or even non-existent.

Mild compatibility problems often can be masked by keeping all the transmitters turned on. The transmitter's signal strength usually will be sufficient to capture its companion receiver. If a transmitter is turned off, any signal stronger than 1μV may be heard in its companion receiver. If, however, the transmitter is turned on, an interfering signal may have to be as strong as 1,000μV (60dB stronger) to be heard in the receiver.

Misdiagnosis

Other problems may appear to be caused by incompatible frequencies. Outside RF interference or dropouts are sometimes responsible for poor microphone performance. It is important to be aware of this possibility so you don't waste time looking for a cause in the wrong place.

First be sure that the entire wireless microphone system is operating on compatible frequencies. In the case of a 4-microphone system, this involves more than 14,500 calculations.

To complete such an analysis requires a sophisticated computer program. Fortunately, programs can be written to automatically search for a desired number of compatible frequencies when given lower- and upper-frequency bounds. Such programs may be available through software companies, public databases or computer bulletin boards. When purchasing wireless microphone systems, ask the manufacturer to perform an analysis for you. The company may be able to suggest alternative frequencies if compatibility problems seem likely.

Well-designed, state-of-the-art equipment can maximize wireless mic performance. However, even with the best equipment, there is always the potential for problems. The first step to minimizing frequency incompatibility is to judiciously choose system frequencies.

DAMS Digital Audio Mass Storage System.

Audio Switching Systems.

Stereo Audio Distribution Amplifiers.

In Australia, we see things differently…

Not necessarily upside down. But, if that helps our team of talented designers to get a new slant on an innovative product, then upside down is fine with us.

Whichever way you look at it, Alldesign has produced a range of broadcast audio equipment in a class of its own.

By giving our team the creative freedom to take a fresh approach to old problems, we have made a world of difference to the way radio stations sound and operate.

And that gives you more creative freedom.

But you don't need to travel to Australia to find our equipment. It's now manufactured and serviced in the U.S.

Control Room Monitor System.

Alldesign. We sound as good as we look.

Stereo Line E.Q. Amplifiers.

On-air Broadcast Presentation Consoles.

Southern Broadcasting Systems Limited
Unit 1/375, 11 Brodie Hall Drive
Bentley 6102, Western Australia
Telephone: (09) 470 2343
Telex: AA96824 WATDA
Fax: (09) 470 2624

ALLDESIGN

Circle (72) on Reply Card

Transformers in audio design

By Bruce E. Hofer

Properly used, transformers can deliver sonically superior results.

In 1831, Faraday observed that a changing voltage applied to a coil wound on an iron core induced a related voltage across a second coil. This experiment led to the development of what is now called the transformer. Transformers couple power from one circuit to another through a common magnetic field. They offer the fundamental advantages of isolation and common-mode rejection between two circuits, and they can find application at almost every interface in an audio system.

$$\frac{V_2}{V_1} = \frac{I_1}{I_2} = \frac{N_2}{N_1}$$

$$Z_1 = Z_2\left(\frac{N_1}{N_2}\right)^2$$

Figure 1. *The basic relationships among voltage, impedance and turns ratios.*

Figure 1 shows the basic relationships among voltage ratio, impedance ratio and turns ratio. Transformers possess the unique property of impedance conversion, because the input and output powers must be approximately equal. For example, a 1kΩ resistor connected to the primary of an ideal 1:2 turns ratio (step-up) transformer electrically looks and behaves like a 4kΩ resistor at the secondary connections. Transformers are, therefore, attractive devices for coupling signals between circuits with significantly different impedance levels, such as a microphone and a low-noise pre-amplifier.

The impedance ratio is a common specification of many audio transformers and is equivalent to the square of the turns ratio. For example, a 600/10kΩ transformer would have a 1:4.08 turns ratio and a 12.2dB voltage gain. The impedance ratio generally suggests the nominal values for source and load resistances to obtain the best frequency response. Achieving an optimum signal-to-noise ratio depends upon maximizing signal power transmission, which occurs only when source and load impedances are matched.

Hofer is vice president and principal engineer at Audio Precision, Beaverton, OR.

Transformers have their share of imperfections with inherent bandpass limitations and non-zero distortion. It is not too surprising that their popularity has declined in the age of transistors and integrated circuits. However, as many engineers have learned from experience, there are far more audible problems in the real world than failing to achieve a 0.001% residual distortion level or dc-to-light frequency response.

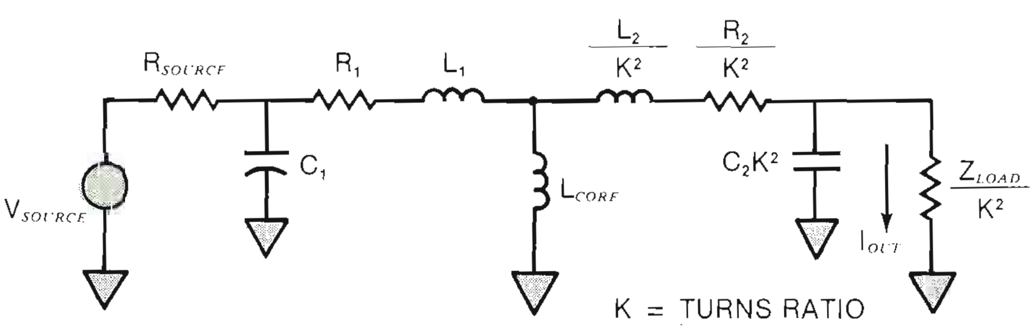


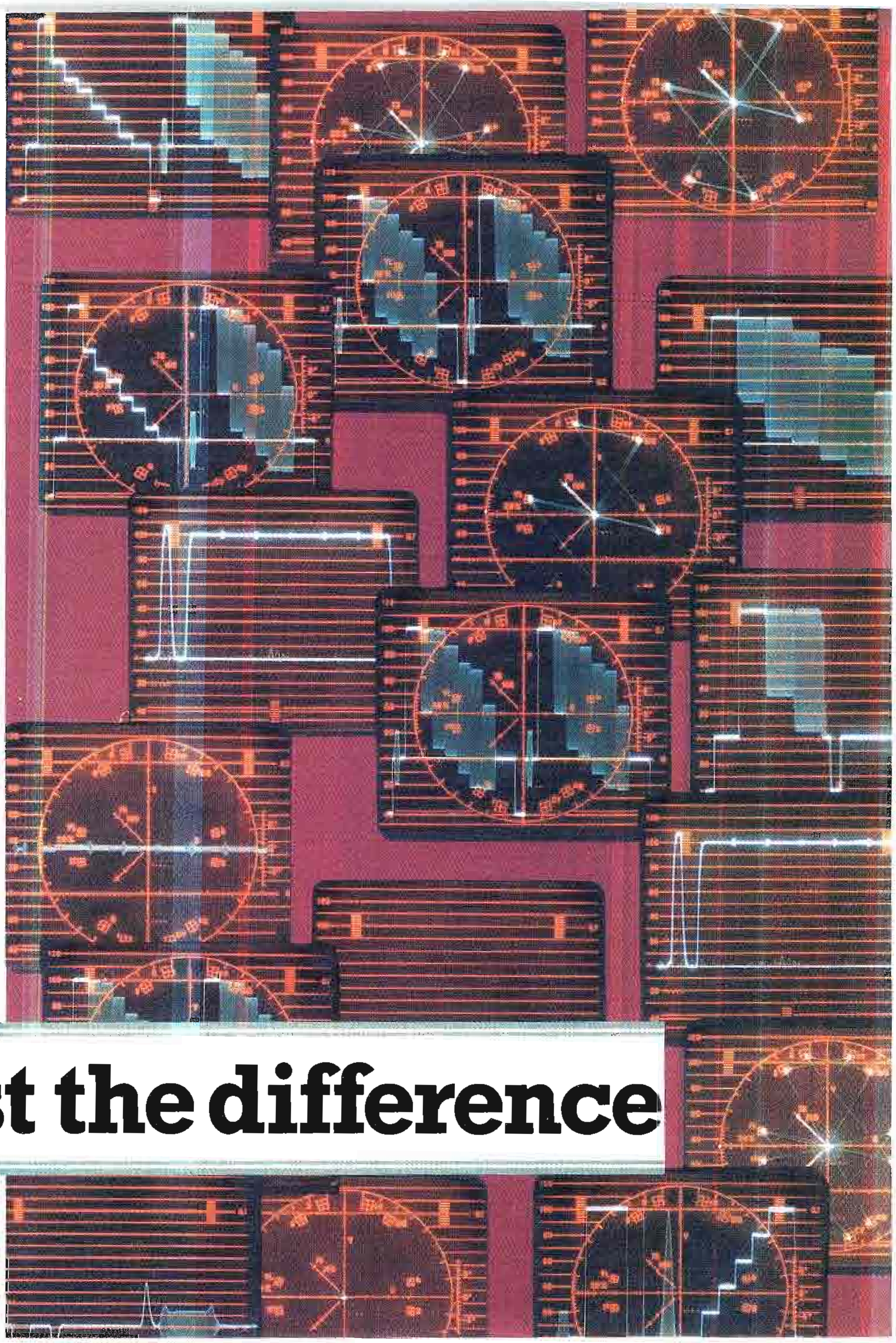
Figure 2. *A simplified model of a typical transformer-coupled circuit. The ac equivalent circuit is seen by the source. R_1, L_1, C_1 and R_2, L_2, C_2 model the primary and secondary windings, respectively. Note the secondary impedance scaling due to the turns ratio. L_{core} limits low-frequency response and typically is 1H to 1,000H.*

Transformer-equivalent circuit

Figure 2 shows a simplified model of a typical transformer-coupled circuit. Note how the secondary elements, including the load impedance, are transformed or reflected back into the primary as a function of the turns ratio. Winding resistance is due to the finite conductivity of copper wire. The leakage inductance of a winding is due to the small percentage of flux that is not linked by the other windings. Capacitance exists between the turns of each winding.

A transformer's high-frequency response is limited by the complex interaction of leakage inductance, winding capacitance, and the source and load impedances. Computer circuit-analysis techniques generally are required to predict the exact response. Also, a potential high-frequency resonance between the inductance and capacitance elements can cause audible ringing or smearing. Leakage inductance is particularly sensitive to the winding-assembly process

Switch to the brightest displays for every TV signal!



No matter what TV signal you have to analyze, the new Philips Waveform Monitors and Vectorscopes give you a new standard for bright, crisp displays. And now they can even be combined into one efficient, high performance unit to lead the industry.

- **PM 5665 Waveform Monitor and PM 5667/68 Vectorscopes** The ultimate in measuring and monitoring. Even VITS appear sharp and easy to see. And the PM 5668 also features Sc-H phase.
- **PM 5661 Waveform Monitor/Vector scope.** Two instruments combined into one lower-priced unit. Compact size is ideal when space and power are limited, without sacrificing performance.
- **PM 5662 Waveform Monitor/Vector scope.** Also a combined configuration for greater efficiency, with Sc-H display for even higher performance.

A whole new range of Philips Waveform Monitors & Vectorscopes are now ready to fill all your TV-signal monitoring and measuring needs, no matter where you have to work. With, of course, worldwide Philips service guaranteed for a unit's entire product lifetime.

Test the difference

All over the world, in broadcasting, program production and set manufacturing, Philips Professional Television instruments are used when state-of- the-art technology is needed to ensure the highest test and measuring standards. That's why we say with pride...

Every day, over a billion people watch us work.

Test the difference and you''ll also agree that Philips wins on price and performance every time.

Call or write:
Philips Test & Measuring Instruments, INC. 85 McKee Drive, Mahwah, New Yersey 07430.
Phone: 800-631-7172
201-529-3800

PHILIPS Test & Measurement

PHILIPS

Circle (73) on Reply Card

and can vary significantly among low-quality units. Manufacturing a consistently high-quality audio transformer is similar to making a fine wine—both involve the careful blending of effects and attention to detail.

Small-signal low-frequency response is limited by the core inductance seen by the input (see Figure 2). This inductance results from the magnetic field established by the source winding and is roughly proportional to the square of the number of turns (N^2) and the core material's *relative permeability*, a measure of the material's flux concentration property. Most ferromagnetic alloys exhibit values from 1,000 to 100,000, meaning they can pass that much more flux than empty space with the same cross-sectional area. Without a core, a transformer would be useless for audio applications. All core materials, however, *saturate*, or exhibit a sharp drop in relative permeability above some critical flux density.

One basic audio transformer rating is the maximum signal level it can pass without gross distortion. Typically, this is specified at 20Hz with 1% to 3% THD. Figure 3 shows how the flux generated in a core is phase-shifted with respect to the applied voltage and its relationship to

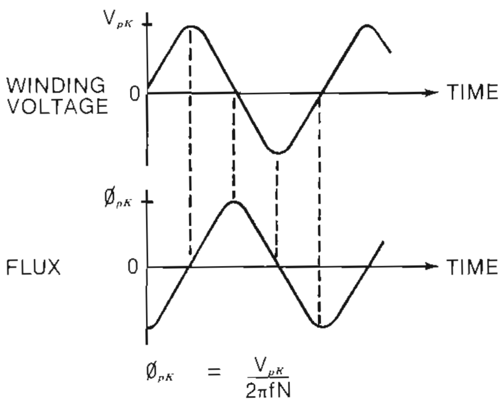


Figure 3. *The winding voltage is proportional to the flux rate of change. Peak flux is inversely proportional to signal frequency and number of turns in the winding. Note the 90° phase shift between flux and voltage.*

signal frequency. Because the peak flux level is inversely proportional to signal frequency, the maximum allowable signal level decreases to zero at 0Hz. When saturation occurs, the large shunting inductance and the reflected secondary elements in the equivalent circuit shown in Figure 2 almost disappear. The transformer input impedance drops, limited only by the resistance and leakage inductance of the primary winding. This can potentially provoke current limiting or other disastrous effects in the source.

Input transformers

Input transformers are optimized for isolation and common-mode rejection. They come in two basic designs, depending upon signal level. Low-level versions are intended for coupling a microphone or other low-impedance, low-output transducer to a pre-amplifier, and for providing voltage step-up ratios of 1:2 to 1:10 (+6dB to +20dB). Maximum input signal ratings are typically −10dBu to +8dBu (0dBu = 0.776Vrms). High-level versions can take up to +30dBu, and are intended for coupling line sources with unity gain or even modest attenuation factors such as 2:1.

Input transformers usually contain one or more *Faraday shields* to improve isolation and common-mode rejection. A Faraday shield is a grounded conductor placed between primary and secondary windings to break up the capacitance often present between them. It can be made of fine wire mesh, metal foil or a single-layer winding. Figure 4 shows how such a shield splits the capacitance between the input and output windings, preventing common-mode signals from coupling into the source of the load.

Two Faraday shields give the best performance, with each connected to their respective input and output circuit commons. As a bonus, the grounded capacitance of the shields interact with the transformer's leakage inductance to form an effective RFI filter.

A well-designed input transformer with Faraday shielding is tough to beat for rejection of common-mode interference. Typical rejections of 130dB at 60Hz, to 80dB at 20kHz, exceed the maximum performance of many practical transformerless input circuits. A transformer-coupled input also does not have the common-mode range limitations characteristic of transformerless designs.

The high-frequency response of low-level input transformers is particularly sensitive to source and load impedances. The source resistance and load capacitance are especially critical because of the transformer's step-up ratio. Some manufacturers also may recommend a secondary RC compensation network to obtain the best response. Cabling adds significant amounts of capacitance and always should be connected to the low-impedance side of an input transformer to avoid excessive high-frequency loss or signal attenuation.

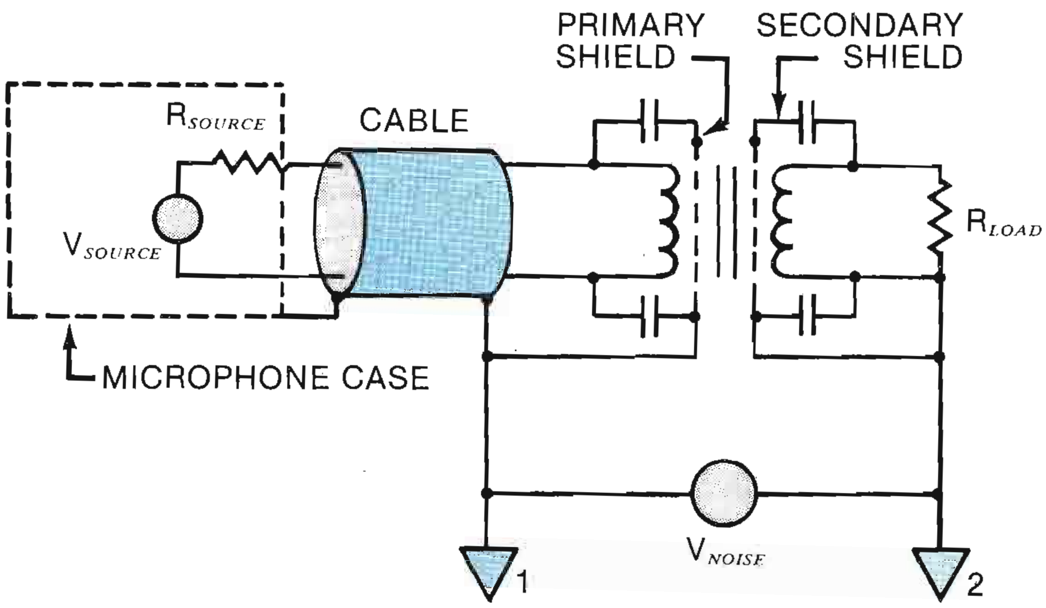


Figure 4. *Faraday shields break up the winding-to-winding capacitances and substantially improve isolation from V_{noise}. A 130dB common-mode rejection at 60Hz is possible. Without shields, a fraction of V_{noise} would couple into R_{load} or access the input due to a slight mismatch in cable capacitance.*

Input transformers are packaged inside magnetically shielded enclosures to prevent interference from stray fields. The shielding material typically is a nickel-iron alloy that has undergone a special heat treatment to enhance its shielding properties. Soldering to the case, tapping mounting screw holes or causing other physical stressing should be avoided to prevent a loss in its shielding effectiveness.

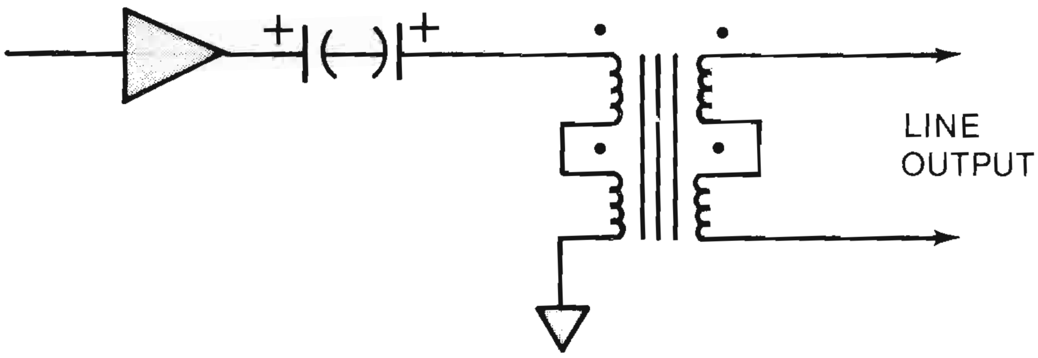


Figure 5. *A typical 1:1 unbalanced-to-balanced output. Note the polarity of series windings for correct operation. A non-polar or equivalent coupling capacitor is recommended to avoid applying dc offsets to the transformer.*

Output transformers

Modern output transformers—not the old power amp variety—are optimized for line-driving applications. The most important rating of an output transformer is its maximum output level. A maximum output rating usually will specify the source and load impedances because they influence low-frequency distortion. (See the related article, "Transformer Distortion," page 112.)

Output transformers differ significantly from input transformers, both in construction and performance. To preserve high-frequency bandwidth with both low-impedance sources and loads, it is necessary to minimize leakage inductance. To obtain low inductance, output transformers commonly are wound in a *multifilar* fashion. This gives near-perfect magnetic coupling between windings at the expense of a much higher winding-to-winding capacitance. The resultant compromise in high-frequency isolation usually is acceptable because of the relatively high-output line levels.

Bifilar, trifilar and *quadfilar* are terms describing the number of wires wound simultaneously. Step-up or step-down applications require series or parallel connection of multiple windings because all the windings have the same number of turns. Quadfilar output transformers are among the most popular because of their flexibility permitting 3:1, 2:1, 1:1, 1:2 or 1:3 turns ratio configurations.

Figure 5 shows a typical 1:1 application for a quadfilar output transformer interfacing a low-impedance unbalanced amplifier to a balanced load or line. The schematic also shows the recommended capacitive coupling between the amplifier and the transformer primary. Even small input offset voltages can cause problems because of the relatively low winding resistances of output transformers. The flux in the core is magnetically offset by dc winding currents, resulting in a reduction of signal-handling capability and an increase in low-frequency distortion.

Figure 6 shows how a combination of output and input transformers can solve a tough real-world interface problem. In this example, the output from a portable mixing console is cabled to the input of another system 1,000 feet away. The ac power sources are on different circuits with as much as 10V of common-mode ground noise between them. It is hard to

Main story continues on page 113

The image makers

Whatever your imaging application – medical or industrial diagnostics, machine vision, broadcasting or CCTV, surveillance or robotics – Amperex is eager to work with you.

The resources available to you at our Slatersville, Rhode Island facility include our Research and Development and Applications Engineering Departments. Both are integrated with a "super clean" Class 100 manufacturing plant. In addition to offering a broad range of imaging devices including the newest solid state image sensors, Amperex is continuously developing new technologies and adapting existing products to the specific needs of our customers.

The Amperex reputation as an image maker is based on supplying the right products for your imaging needs. For more information call or write Imaging Products Group, Amperex Electronic Corporation, Slatersville, Rhode Island 02876. (401) 762-3800. A North American Philips Company. Outside the U.S.A. contact: Philips Electronic Components and Materials Division, 5600 MD Eindhoven, The Netherlands.

Amperex®

Amperex Imaging Products
. . . we see things your way.

High Resolution Diode Gun™ Plumbicon® TV Camera Tubes for diagnostic imaging.

Pyroelectric DTGFB vidicon tube with 8-14 micron sensitivity for thermal imaging and 24-hour surveillance.

Electro-magnetic coil assemblies.

Vidicon tubes – low cost general purpose to fiber optic special window types.

Image intensifier tubes including microchannel plate and proximity focused types.

Solid state thermal imaging devices for 3-5 micron and 8-13 micron applications.

Newvicon® high-sensitivity camera tubes for low light and 1 micron IR imaging.

High resolution frame transfer CCD image sensors for color and black and white applications.

Diode Gun and Triode Gun Plumbicon camera tubes for color or general purpose imaging.

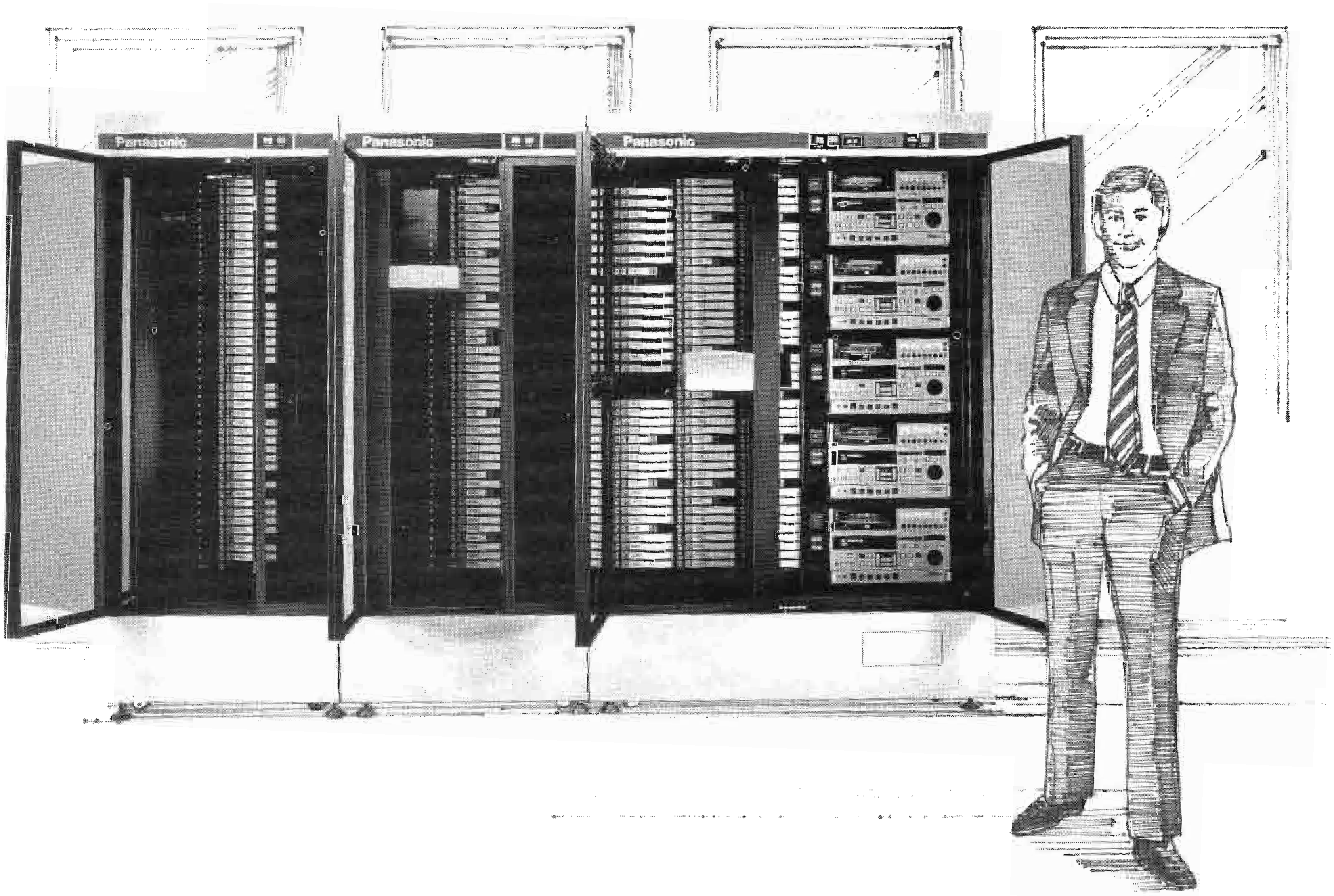
Circle (78) on Reply Card

WHAT HAS 5 VTR'S,
2 ROBOTS,
3 ROTARY LIBRARIES,
1,184 CASSETTES,
A COMPUTER,
THE ABILITY TO PLAY
15-SECOND SPOTS
BACK TO BACK
CONTINUOUSLY,
IS AVAILABLE NOW,

AND IS SURE TO TURN
THE BROADCAST INDUSTRY
UPSIDE DOWN?

ANSWER:

THE MII M.A.R.C. SYSTEM CART MACHINE.



It's probably the most technologically advanced cart machine ever created. So advanced, we doubt the competition will have anything like it for a long while to come.

But the really impressive thing is: **it's available now.**

So give us a call if you'd like a demonstration, or to be put on our priority delivery program.

Remember, if you're looking for high broadcast quality, overall cost reductions and the finest support programs in the industry, look into MII from Panasonic.

The broadcast system that makes business sense.

MII Panasonic
Broadcast Systems Company

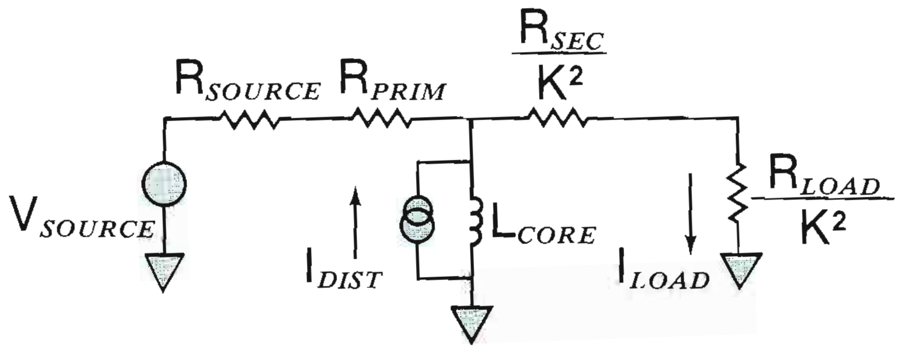
For more information, call 1-201-348-7671.

Circle (79) on Reply Card

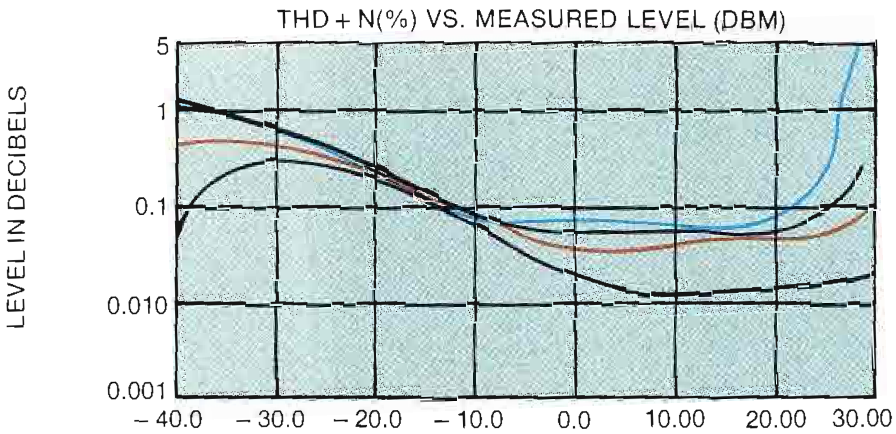
Transformer distortion

Transformer distortion is caused by the non-linear magnetic properties (hysteresis) of the core material. This can be modeled by connecting a distortion current source in parallel with the winding inductance. In reality, the inductance is non-linear. However, it is convenient to separate linear and non-linear effects in a model. The distortion current splits between input and output circuits and develops distortion voltages across the various source, load and winding resistances. Note that minimizing source resistance will minimize distortion.

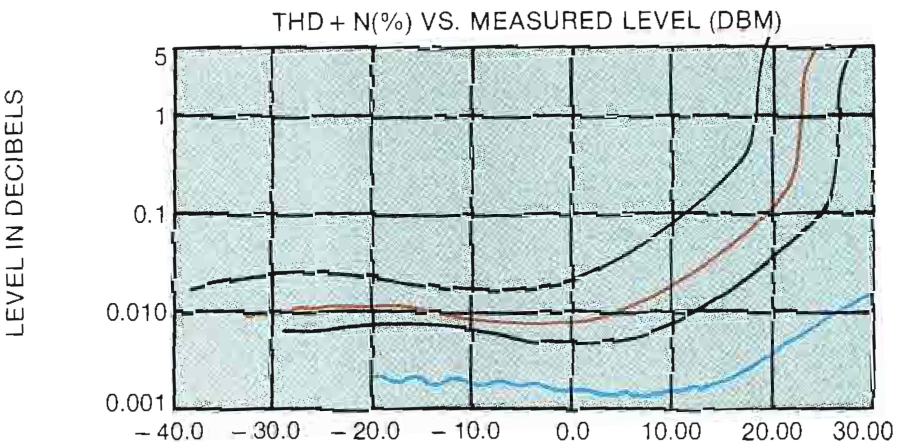
The selection of core material can have a profound effect on low-frequency distortion characteristics. The measured THD of an output transformer with different cores varies with output level and frequency. Commonly available silicon-steel (M6) offers a high output level before saturation, but exhibits bizarre distortion behavior at low levels. An 80% nickel alloy saturates approximately 8dB lower than silicon-steel, but shows little rise in THD at lower signal levels. In all cases, the distortion is dominantly third-harmonic. Other materials, such as 40% nickel alloys, cobalt alloys and ferrites, have different characteristics, but find limited applications in audio design.



The I_{dist} models transformer distortion due to non-linear magnetic property of core material. K = turns ratio. I_{dist} causes distortion voltages across R_{source} and R_{prim} even when R_{load} is infinite.

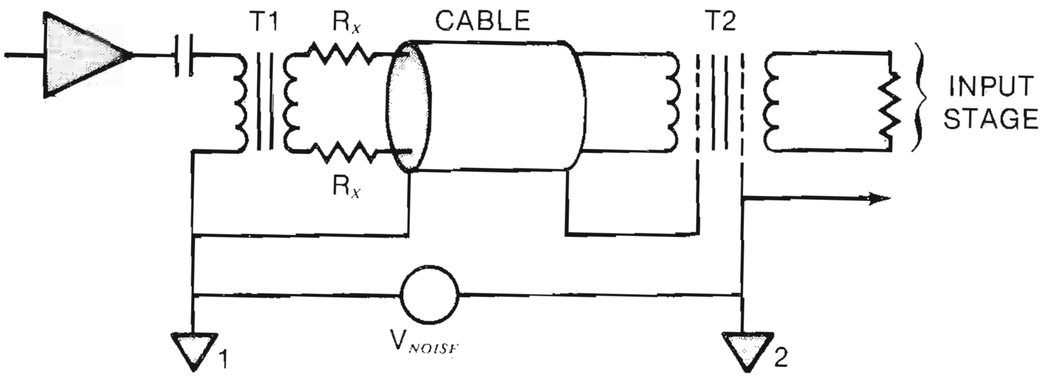


The measured THD of an output transformer with M6 silicon-steel core material. Frequency sweeps are 20Hz, 30Hz, 50Hz and 100Hz, top to bottom. $R_{source} = 50\Omega$ and $R_{load} = 600\Omega$.



The measured THD of an output transformer with 80% nickel alloy core material. Frequency sweeps are the same as shown in the figure above. $R_{source} = 50\Omega$ and $R_{load} = 600\Omega$.

Figure 6. Two transformers can solve tough interface problems where V_{noise} can be many volts. T1 is an output type, and T2 is a line-level input type. Note the recommended grounding of the cable shield. Typical values for R_x are 10Ω to 47Ω depending upon cable length and capacitance.



Continued from page 108

imagine a workable solution without the use of transformers.

Other audio transformers

Microphone-bridging transformers are used to couple a microphone into several inputs simultaneously. These transformers come in 1:1, 1:1:1 and 1:1:1:1 turns ratio configurations and have Faraday shields for each winding to provide complete isolation of circuits. For best performance, it is essential that the shields be connected to their respective circuit commons.

Direct-box transformers are used to couple musical instruments and other high-level sources directly into microphone-level inputs. They typically have turns ratios of 10:1 with at least 20dB of attenuation to provide the correct matching between the relative high-output impedance and level of such devices and the low impedance and level of a microphone input. Long cables have a negative effect on high-frequency response because the cable capacitance shunts the high-impedance side of the transformer.

Line-matching transformers are used to interface remotely located speakers to a constant-voltage (70.7V) distribution line driven by a centralized power amplifier. This technique keeps the size of the distribution wire and system power losses at a minimum. It is identical in concept to electrical power transmission systems. Line-matching transformers often provide primary taps because different speakers may have different efficiencies or may need to be balanced to provide even sound coverage. The most important specification of this type of transformer is its power-handling rating and frequency range.

Transformers provide the broadcast engineer with the inherent advantages of both isolation and common-mode rejection. Transformers do not have the common-mode range limitations of transformerless circuits, and may be the only practical solution to many interface problems. The principal disadvantages of transformers are their cost, size and weight. Inherent bandpass response and low-frequency distortion are other drawbacks. However, the hums and buzzes resulting from inadequate common-mode rejection usually are far more audible than any 50kHz bandwidth limitation or 1% THD at 20Hz.

On the receiving end

By Michael Heiss, contributing editor

This article is the beginning of a series that will focus on video products from the consumer world. We will also touch on professional gear and situations from time to time.

Why write about consumer electronics in a magazine devoted to professional broadcast technology? The answer is simpler than you might think. First, the increased sophistication and quality of consumer video and audio hardware will mean that the viewing and listening public will be better able to judge the quality of your broadcast productions or the quality of your station's signal. Technical faults that once would have gone unnoticed will now show as glaring errors. By keeping up-to-date on the equipment available to the average consumer, you will be able to keep your production hardware one step ahead of the quality of the gear consumers use to consume your product.

The sophistication of consumer equipment is the second reason why the professional should be aware of the latest equipment trends and features. The quality and flexibility of consumer equipment will lead to its increasing use in professional applications. The trend of consumer and industrial hardware crossing over into the professional world began with U-matic, and it hasn't stopped. We'll make sure you know what consumer equipment has professional possibilities.

Finally, even though you may be an expert on professional equipment, you may not have the time to keep up with the latest in consumer gear. That shortage of time, however, does not serve as a good excuse when everyone wants your expert opinion. If it isn't the station manager asking you for suggestions on which type of VCR to buy for an uncle's birthday, it's a neighbor wanting to know which camcorder to buy. You no longer will be without this vital information. We'll bring it to you right here.

For those wanting to see all of the latest in consumer electronics hardware, the place to be is the semiannual Consumer Electronics Show, held each January in Las Vegas, and each June in Chicago. The past few CES events have been concerned more with industry profits than products. For the approximately 100,000 attendees at the June show, however, concern over the dollar/yen situation was overshadowed by a number of new products that should be of interest to the video professional.

Heiss is director, market development, for Bell & Howell/Columbia Paramount.

S-VHS

Receiving the most publicity at the show was Super VHS, or S-VHS, as it will be known. This is not really a new format, but an "upward compatible" extension of the existing VHS format. It is the one about which you will probably get the most, "should I buy one?" questions from co-workers and neighbors; it is the one that will put the most pressure on you to produce and transmit or distribute quality signals; and it is the one with the most crossover potential for use in non-consumer venues.

S-VHS's main selling point is greatly increased horizontal resolution, up from the 240 lines common in standard VHS gear to more than 400 lines. To augment this higher resolution, the new system offers Y/C component outputs to minimize moire and dot crawl. On the audio side, it improves some of the defects in earlier VHS hi-fi audio systems, with decreased switching noise and a 10db increase in dynamic range.

These wonders are accomplished through a number of technical tricks, centering on the use of a highband recording system. The higher-frequency recordings allow for an increase in the luminance-frequency deviation to 1.6MHz, the root for the 440-line resolution figure. Narrower gap heads and tape with slightly higher coerciveness and finer particles help make this all work.

Although the basic recording method has not changed, the signal inputs and outputs have. A new "S" connector offers a Y/C component signal thats exact derivation had not been disclosed at press time.

ED Beta

Those who have lived through the ½-inch wars in either the consumer or pro-component arenas would expect an announcement such as S-VHS from JVC and Matsushita to be countered by Sony. In this case, the response was the disclosure of ED Beta. Many skeptics see it as a technical exercise on behalf of a format on its last legs—a face-saving gesture that will never reach the marketplace. If ED Beta becomes a production product, however, it will have serious implications for the low-end video user.

Through the use of 1,450Oe metal particle tape and a frequency deviation of 1.8MHz, this system claims horizontal resolution of figures more than 500 lines, with Y/C available for use on new high-definition monitors. The pictures were impressive, but you wonder if this ultra-highband Beta will ever be something you can buy off the shelf.

Regardless of your format loyalty, it is undeniable that these higher-resolution systems are a major turning point in the video world. They will place increased quality demands on broadcast and prerecorded programs; defects that once would be invisible will now be evident. Their higher quality makes them prime candidates for crossover as production tools. Finally, they are such a quantum leap in consumer video that anyone considering a new high-end consumer VCR or TV set would be wise to give them a look before buying.

S-VHS decks for the home were scheduled to be in the stores by Labor Day. S-VHS camcorders should arrive by the end of the year. To help you understand what the new ½-inch consumer formats are all about, we will devote space to them next month.

CD-V

The excitement over new tape systems was not the only video-related development at the CES, however. Video excitement was shared by a disc format, the new CD-V system.

The selling point of CD-V is its capability to present five minutes of full-motion video on a standard size 5-inch CD along with up to 20 minutes of digital audio. In most applications, this will mean four or five album cuts and a standard length music video will be able to share the same real estate at a cost that will probably run under $10.

A wide variety of hardware was shown to accommodate the system. Some were "combi" players capable of working with standard audio-only CDs, the new CD-V discs as well as current 8-inch and 12-inch optical videodiscs. Others, aiming at a different market, will cost less but play only audio CDs and new CD-Vs.

For the professional, this format probably will not have much impact. The short playing time and lack of indexing within a program will limit the use of this medium for training applications. Furthermore, keep in mind that, in the initial stage of a CD-V's product life, there will be a limited number of titles available to play on the new gear. It will, however, receive a great deal of consumer press attention, so it is important that you be aware of its existence.

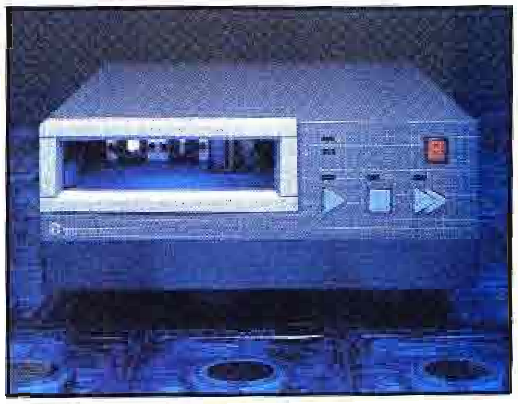
The availability of another optical disc format may increase the consumers' use of this medium, but it also confuses things. To date, we have a vast lexicon of optical formats. In addition to CD and CD-V, there is CD-1, CD-ROM, LV and DVI. When you add *DRAW* and *WORM* discs to this babble, confusion is inevitable. We'll explain it all to you in a future column.

R-DAT

The third part of the new product trilogy at the summer CES was the R-DAT digital audiotape format. Unlike the prototype models shown by a few brands at the winter show in January, all of the major brands had full-production models on display this time. This is due, in part, to the fact that R-DAT is a commercially available product in Japan, but it also indicates that, while the date of R-DAT's introduction to the U.S. market is up in the air, its inevitability is almost without question.

R-DAT's implications for the professional are numerous. Once prerecorded software is available in the R-DAT configuration, it will certainly find a home in radio and TV applications.

Editor's note: Michael Heiss joins **BE** on a regular basis starting this month. He has been writing about consumer and professional video hardware for more than 10 years.



Pacific Recorders Micromax reproducer

By Chriss Scherer

Cartridge machines are so commonplace in broadcast facilities that they sometimes are overlooked. Furthermore, because of the many types of machines available, selecting a new one for your station can be confusing. When Pacific Recorders & Engineering introduced Micromax to its line of cartridge machines, WVUM-FM decided to give the reproduce deck a try.

Performance at a glance

- *Tape format: NAB size AA cartridge*
- *Tape speed: 7.5ips play, 22.5ips fast wind*
- *Start time: <60ms*
- *Stop time: <40ms*
- *Reproduce amplifier: THD <0.01%*
- *Frequency response: 40Hz to 16kHz ±0.5dB*
- *Noise: −58dB unweighted*

Construction

The deck's lineage can be traced back to the Tomcat series. It is sleek in appearance, measuring 8.5″ x 3.5″ x 13.75″. The audio and control connectors add another half inch to the overall depth.

The front panel is quite different from those seen on other broadcast equipment. The transport function buttons—play, stop and fwd—are easy to use, and visually identify their respective functions. Small LEDs, located above the function buttons, indicate machine status. Similar LEDs are used to display the detection of secondary and tertiary tones.

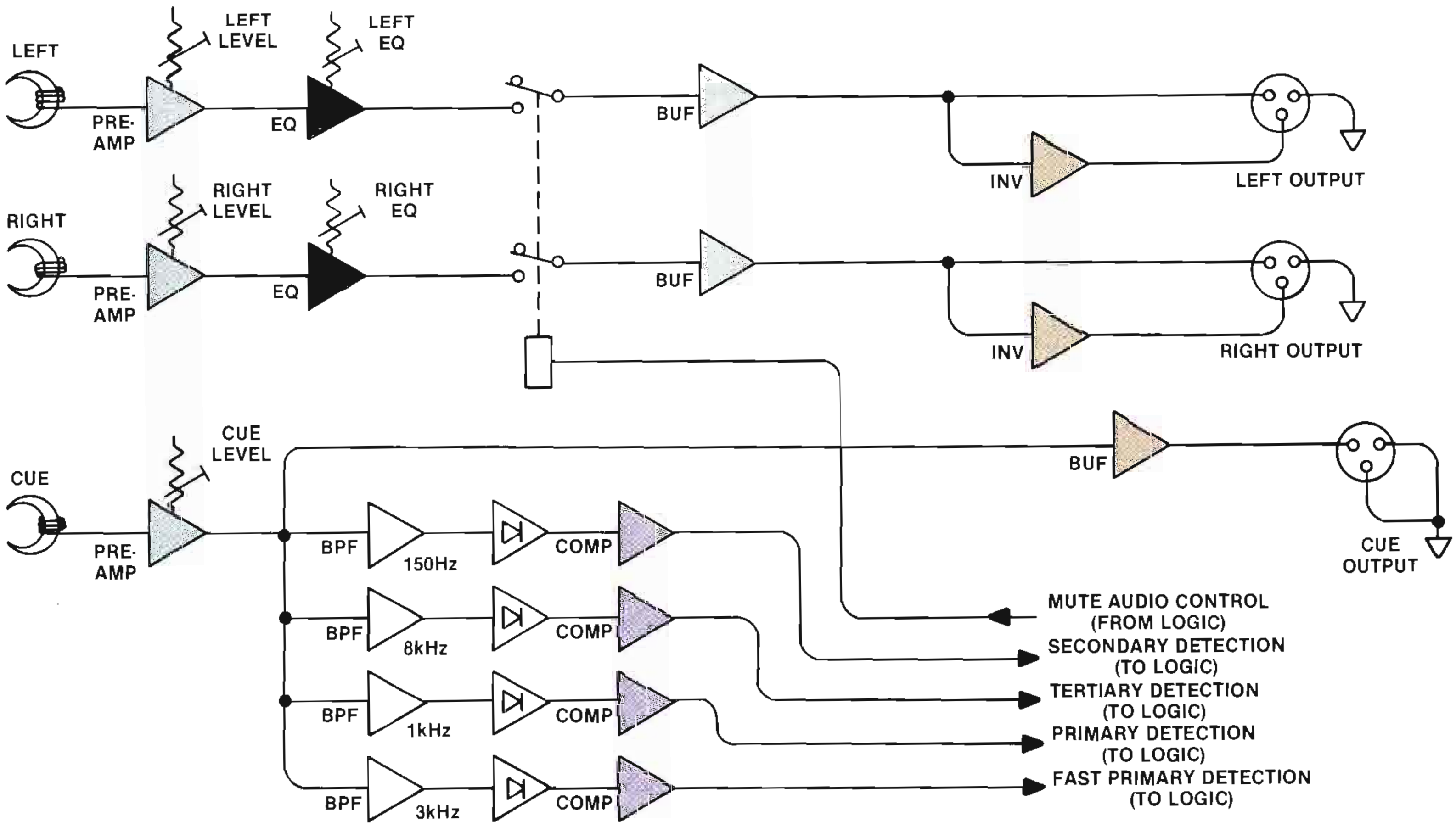
A user-settable LED deck number is displayed on the face of the unit. Any number from zero to nine can be displayed by setting a small thumbwheel switch located inside the unit. This number is then displayed on the LED/power indicator. Although it may be a simple feature, it looks better than embossed tape or cardboard labels. The deck is housed in a rugged steel case that can be left freestanding on a desk or grouped as a pair and rack-mounted.

The back panel also is well thought out. Standard XLR connectors are used for the audio connections. A 4-pin Amphenol-style locking-ring connector is used to couple the cue tones to other equipment. Additional items on the back panel include the fuse and power-cord connector plus a logic connector for various remote-control functions. The power cord and the audio connectors are located on opposite sides of the machine, which helps reduce the likelihood of coupling ac hum into the audio channels.

The deck's block diagram, shown in Figure 1, indicates the simplicity, yet sophistication of the circuits. Active audio and bias summing record-head drivers help eliminate tedious record-bias trap adjustments. A special high-frequency

Scherer is general manager for WVUM-FM, Miami.

Figure 1. The Micromax relies on CMOS devices for control logic and the latest in high-performance ICs for the audio circuits.



equalization circuit is used in the reproduce pre-amplifiers. The circuit allows trimming the pre-amplifier band-edge response to compensate for head-gap loss. This circuit is independent of the standard reproduce equalization circuit.

Track format

One of the most unique features of the deck is the track format. This Maxtrax-head format, shown in Figure 2, relies on wider tracks for the audio, where higher fidelity is desired, and a slightly narrower cue track where the response is less critical. The design increases the audio-track width from 0.43 inches to 0.80 inches, providing approximately 100% more signal path than the NAB format.

Many broadcast stations rely on cart libraries based on the standard NAB-format track configuration. Although the Micromax comes equipped with the Maxtrax heads, it is also available with NAB-format heads.

Interior view

Access to the interior of the desk-mount unit is made by a spring-release top. This feature makes servicing much easier. Head and pressure-roller cleaning are no longer the chores they once were. The deck also is available in a rack-mount design. In this case, the lift-top feature is not available, but the machine slides out from the rack.

All of the audio and logic circuit boards are accessible from the top. The boards are plug-in assemblies, with the audio board located immediately behind the heads. The power-supply circuit board is mounted flat to the deck plate with quick-release connectors for the electronics. The ICs are socket-mounted for simplified servicing.

The logic board contains a 4-position DIP switch, which customizes the machine to the operator's needs. These switches can be set according to how a station likes to handle carts.

The first switch controls the capstan motor. When the switch is in the off position, the capstan will run only when a cartridge is inserted into the machine. When the switch is turned on, the capstan runs continuously.

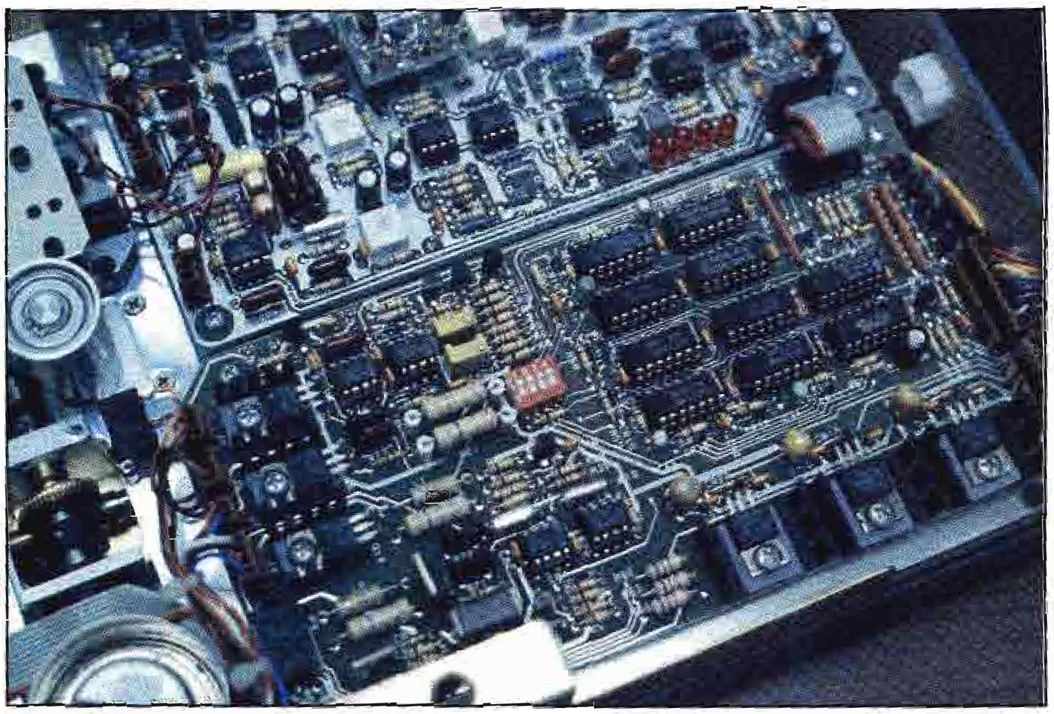
The second switch enables the replay inhibit circuit. When turned off, the same cartridge may be played again simply by pressing play. If the switch is left in the on position, a cartridge may only be replayed by removing it and then reinserting it or pressing the stop button. This is a useful feature and can help prevent the embarrassing situation of accidentally playing a song or commercial twice in a row.

The third and fourth switches control the sensing of the primary and secondary tones. When these switches are set to on, the machine will sense these tones and react appropriately. When the switches are set to off, the machine will ignore the tones. Disabling these tones is helpful in some maintenance situations. Because test cartridges cause a cart deck to stop as soon as the 1kHz stop tone arrives, it is difficult to make any adjustments. By turning off the tones, you can make adjustments without interruptions.

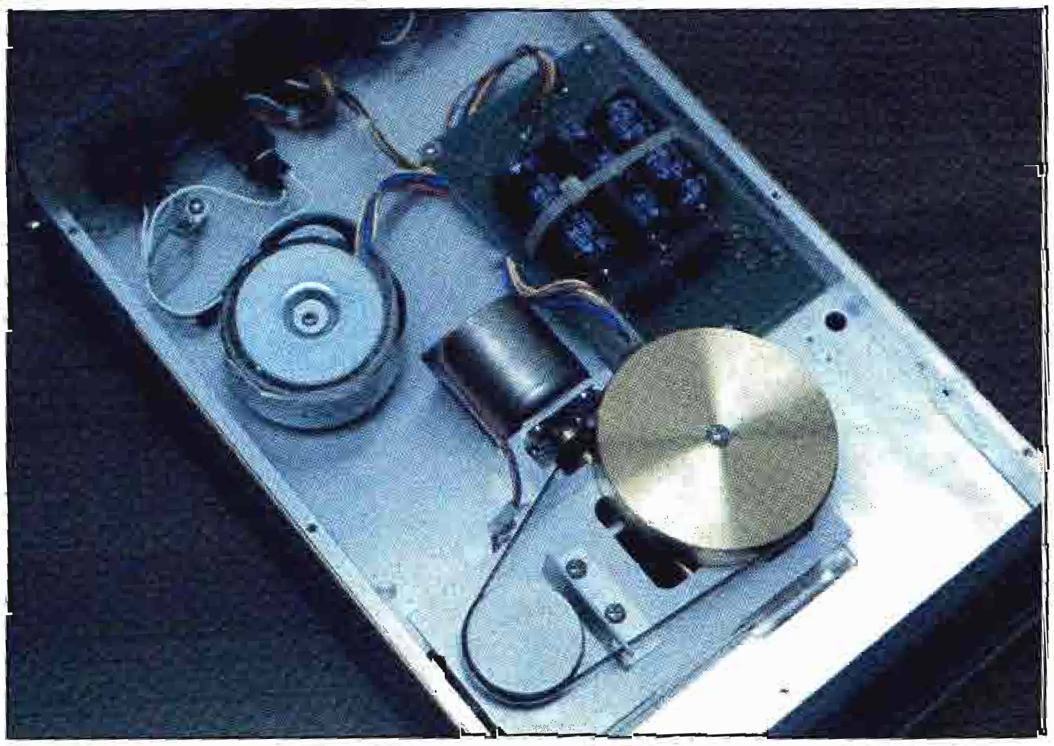
All tones on the cue track are sent to the *cue-track output* on the back panel. The output voltage is dependent on the cue-detector sensitivity control and ranges from −4dBu to +4dBu.

The deck does not use audio transformers. Many engineers will find this a worthwhile feature. The audio card contains four LEDs for maintenance purposes. Although it may seem strange to have LEDs on an audio card, once their functions are understood, their value becomes obvious.

The four LEDs are labeled *run, pri, sec* and *ter*. When the machine is in the play mode, the run LED is illuminated. The other three LEDs light up upon the detec-



All user-electronic adjustments can be accessed by removing the top cover. Note the four LEDs and DIP switch, which are described in the text.



A dc motor and belt drive provide a reliable tape-drive system. The pinch wheel is controlled by the small motor, shown in the center of the photograph.

tion of the primary, secondary and tertiary cue tones. The LEDs make it possible to see when the tones occur on the tape.

Tape transport

When you look at the tape transport, it is apparent that a lot of consideration was given to tape handling. The lack of a pinch-roller solenoid is one example of this. The second example is the use of a reliable belt/flywheel tape-drive system. All tape motion is controlled by two independent dc-servo motors. One motor drives the capstan and the other drives the pinch roller.

Using one motor to control the capstan is a common function in other decks. The difference with this deck, however, is that it relies on a belt-drive system. For those engineers familiar with other designs, the capstan motor in the deck will appear quite small. However, the motor size actually results in performance advantages.

The capstan motor drives a small shaft, which is coupled to the flywheel/capstan assembly. Benefits of this design include:

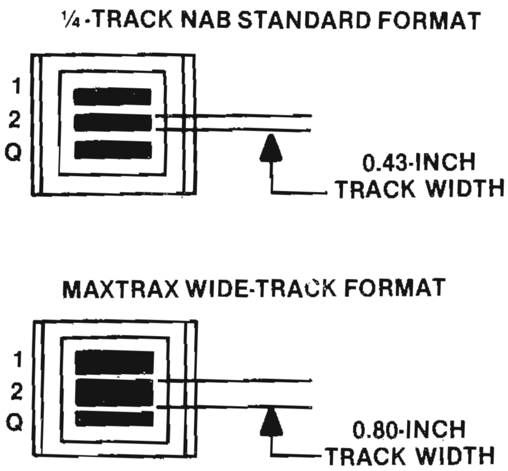


Figure 2. *The Maxtrax heads provide almost twice as much audio-track width as the more common NAB-format heads.*

reduced space requirements, increased torque and lower wow and flutter components. The system also is simple to maintain and inexpensive to replace, because the component motor does not rely on a microprocessor for control.

Using a small motor to control the pinch roller is unique to the Micromax design. The pinch-roller motor drives a worm gear, which turns another gear that moves the pinch roller into place. The pinch roller's servo motor engages quietly, without a clunk. Once a cartridge is inserted, the pinch roller automatically moves up to its ready position. When the play button is pressed, the roller must only move a fraction of an inch to reach the capstan and start the tape.

Because the tape-drive system relies on motors, few mechanical adjustments are necessary. Most tape-drive adjustments are accomplished through trim pots located on the logic board.

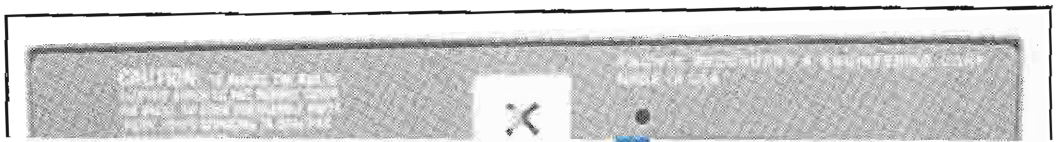
Although having the pinch roller in the ready position just after a cartridge is inserted offers the advantage of a rapid start, there may be a small drawback. You must be careful when removing the cart. If the cart is pulled out too quickly, it may catch on the roller. However, during the tests performed here, this situation occurred only once.

Both the capstan and pinch-roller assemblies are mounted to a thick, machined-aluminum deck plate. The pinch roller is self-aligning to the capstan, which helps eliminate tape skew.

Maintenance from below

The bottom cover is attached by four screws, two on either side of the unit. Because most adjustments are performed from the top, removing the screws to access the bottom should pose no problem.

Housed underneath the deck plate are the toroidal power transformer with the regulator circuit board, the capstan



mount, which we tested, or dual units ready for rack-mounting. Kits are available to convert between either styles. Although the standard configuration uses the Maxtrax format heads, the deck

SBE Update

NFCC meets FCC

By Bob Van Buhler

Richard Rudman, SBE president and chairman of the all-industry National Frequency Coordinating Council (NFCC), Jerry Plemmons and his SBE counterpart, Gerry Dalton, SBE national frequency coordination chairman, presented FCC officials and interested members of the public a tutorial on frequency coordination at the commission's Washington offices on July 14.

Rudman led the discussion with a summary of the history of Part 74 coordination in the United States, explaining that many of the problems that were experienced were the result of sharing the bands with non-broadcast entities.

Rudman also explained the background and workings of home channel plans and the distinctions between point-to-point and mobile coordination needs.

Plemmons addressed the work of the all-industry NFCC. The council currently is involved in writing a national policy and procedures manual. The manual is expected to become the uniform guideline for coordination in the freewheeling world of blanket-band licensing of mobile links and band sharing of fixed-link channels.

Dalton explained in a computer-video-integrated presentation the new coordination computer database system, which will allow uniform coordination record keeping in most major U.S. markets in the near future.

Coordination goes international

Dalton has been invited by the commission and NTIA to present a demonstration of the national database program this month in Geneva, Switzerland. The SBE/NFCC-developed program is viewed by NTIA as having international interest, because it represents an easy way to get developing countries involved in the process of spectrum management at a low cost.

The 1987 convention

This year's SBE convention promises to be interesting and informative, with working engineer. The convention is scheduled to run from Tuesday, Nov. 10 through Thursday, Nov. 12. The Tuesday morning sessions are designed to appeal to both radio and TV engineers, with papers on master-clock systems, improved methods of grounding and digital audio. Tom Keller of the National Association of Broadcasters (NAB) will provide industry insights on the direction broadcasting will take in the coming years.

The Tuesday afternoon sessions will be devoted to a maintenance seminar and will feature papers by a number of experienced presenters on RF, studio and cartridge machine maintenance. A late afternoon session will follow on audio processing. Bill Ammons of CRL, session chairman, will focus on the practical aspects of processing and how variation of each processing parameter can change the perceived sound in objective and subjective ways. The session is titled *The Nuts and Bolts of Audio Processing*.

Wednesday's conference will feature separate sessions for radio and TV engineers. Radio papers will cover such topics as surge protection and grounding, telephone hybrids, AM pre-emphasis and automated programming of CD devices. A report on reduced skywave-antenna-design tests by Ogden Prestholdt, consultant for A.D. Ring Associates, will highlight the afternoon sessions. Michael Rau of the NAB will update the attendees on NRSC standards. Other sessions will include papers on electronic-antenna broadbanding and cartridge machine automatic phase-correction systems.

TV topics for Wednesday will include issues that have developed only in the last couple of years. Sessions on measuring MTS modulation and mobile-mast safety concerns will be included in the program. The TV audience also will look at the workings of the 15kW Klystrode with experts from Varian. How engineers interface with computer graphics artists will be examined by Richard Lehtinen of KSL-TV.

Other TV sessions to be covered will

are running way ahead of the 1986 convention, with more and better known manufacturers participating. More exhibitors also are taking multiple booth spaces, indicating plans to show a larger assortment of equipment.

Exhibitor reactions to last year's SBE convention were extremely favorable, and many manufacturers are holding the opinion that the national convention will develop into their most fruitful exhibition with regard to quality engineering traffic.

Convention attendees will find quality technical sessions and a dazzling array of new technology in the exhibit hall. Plan now to attend. A registration form is included at the back of this issue.

1988 convention location selected

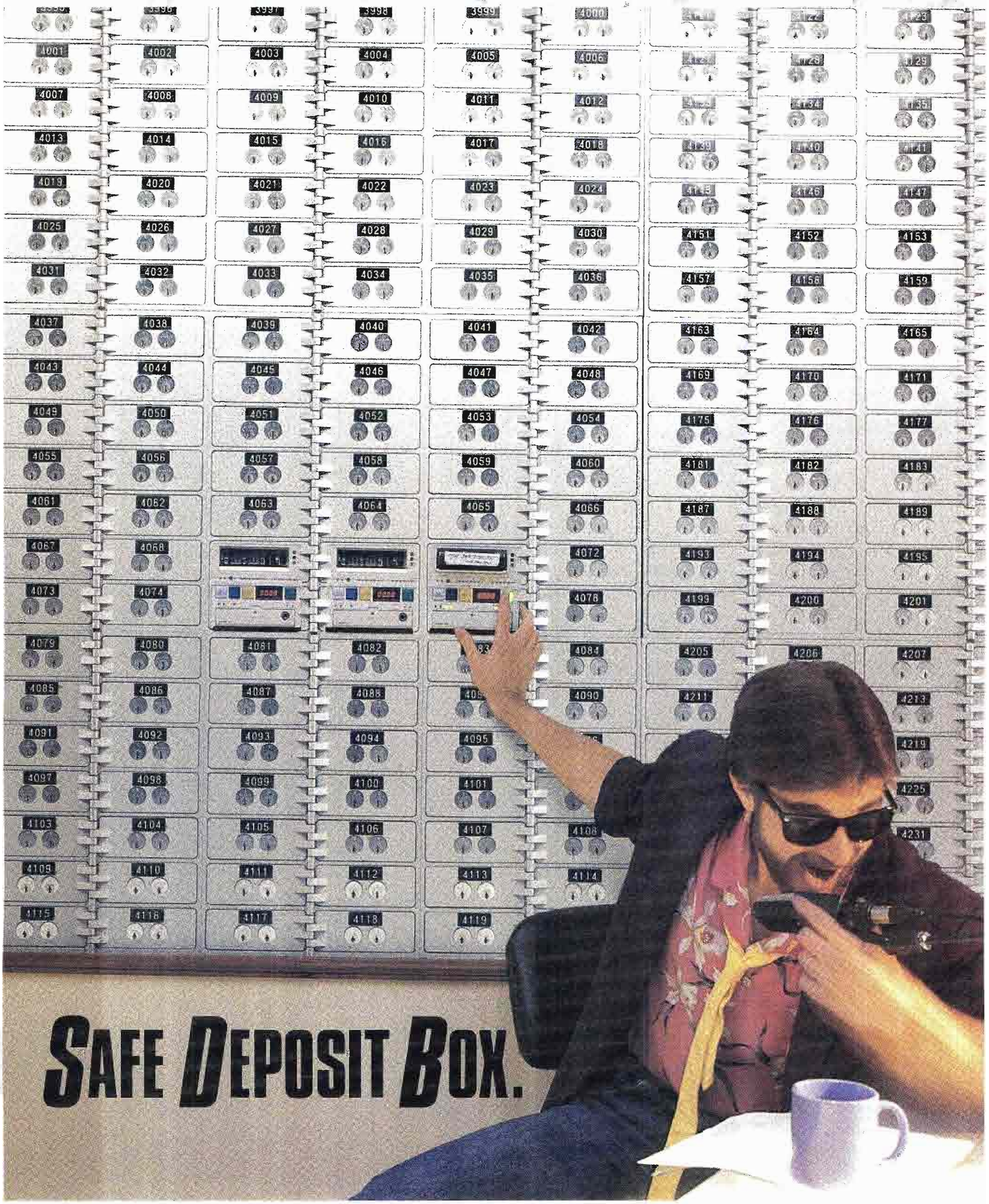
The SBE executive board selected Denver, CO, as the preliminary site for the 1988 SBE National Convention and **Broadcast Engineering** Conference. Denver was selected because of its central location, easy airline access and the hotels situated within several blocks of the convention center.

September 20-22, 1988, were the dates chosen in order to avoid conflict with other technical conventions. The 1988 convention will run Tuesday through Thursday just like previous SBE shows. This schedule is designed to accommodate the needs of both attendees and exhibitors. The Tuesday opening of the exhibits will allow exhibitor travel on the first and last days of the week, making it a more attractive schedule to manufacturers, who may enjoy spending the weekends with their families.

New SBE chapters

New SBE chapters have been charted in Toledo, OH; Tallahassee, FL; and Houston, TX. Houston is the 105th chapter to officially form, and Tallahassee is the 106th. Of the 106 historical chapters that have been formed, 89 are fully active, and membership is about 5,800.

CTM-10 CARTRIDGE RECORDER



©Otari Corporation, 1986

Finally, a cart machine you can bank on. No jams, no repeats and no make goods. Our new CTM-10 cart machine has the same famous reliability that is built into our 5050 BII, plus many new features like Hx-Pro,* so 7.5 ips sounds like 15 ips and your listeners don't tune-out when you shift from CD to cart.

So call us for Technology You Can Trust. Otari Corporation, 2 Davis Drive, Belmont, CA 94002 (415) 592-8311 TWX 9103764890.

OTARI®

*Trademark Dolby Laboratories Licensing Corporation

Circle (88) on Reply Card

Postcard from Montreux

By Jerry Whitaker, editorial director, and Howard Head, BE European correspondent

The weather was lousy. The convention floors were either too hot or too cold. Parking was practically impossible. Good hotel rooms in the city were difficult to find at a reasonable price. The food—by and large—was OK, but nothing to write home about. Making an international phone call was often a major project.

But all of that didn't matter. It was still a great show. No one can deny that the International Television Symposium and Technical Exhibition at Montreux was the world's premiere international convention for 1987.

The venue was not the best from an exhibitor's standpoint. Montreux, Switzerland is a beautiful town. It is the stuff that summer vacations are made of. It is not, however, the easiest place to hold an equipment exhibition. The convention-center layout was more than a little bewildering to even seasoned showgoers. The arrangement of floors and walkways (at least five different levels), was confusing and many of the ceilings were low (bad news for exhibitors).

And then there was the air conditioning, or lack thereof. Some floors were too hot. Other floors were too cold. The top floor wasn't even a real floor. Well, the floor was real, but the roof wasn't. The top level of the convention center was constructed of a canvas-type covering over scaffolds and support posts. It was an unusual arrangement, but it worked all right. At least it didn't leak when the rainstorms hit.

Oh yes, the rain. Most attendees packed shorts, T-shirts and swimming suits for the off-time at the convention. (This assumes that off-time could be found.) Well, after the first day of the exhibition the rains started and didn't stop until sometime after the show had ended. Many attendees grumbled about the stroke of bad luck, but they made the best of it.

There were rumblings among exhibitors that maybe the time had come for the convention and technical conference to move out of Montreux and into the convention center in Geneva, a few miles down the freeway. Show organizers, however, did their best to squelch any talk of moving the International TV Symposium out of Montreux. After all, the Montreux show just wouldn't be the same if it wasn't held in Montreux. Besides, the city of Montreux organizes the convention.

In an attempt to answer the complaints of exhibitors—and attendees, for that matter—city leaders promised to add space to the convention center (about 12,000 square feet by 1989), improve the air-conditioning system and build more parking lots. The city showed genuine interest in the problems experienced by attendees and exhibitors and gave every indication that the problems experienced this year wouldn't be repeated.

But enough of the complaints. Exhibitors were pleased with the high quality of attendees. And attendees were treated to an impressive showing of broadcast products. Much of the hardware exhibited at the convention had already been unveiled at NAB in Dallas, which preceded the Montreux show by about 2½ months. There were, however, several significant new product introductions for the PAL world by U.S., Japanese and other manufacturers.

Just the facts, Ma'am

Convention organizers reported a record turnout for this year's symposium. Paid registration was approximately 2,300, with 300 journalists in attendance. Total attendance, including paid registrants, the press, visitors and exhibitors, was estimated at 35,000. That number—frankly—sounds a little inflated. It places Montreux at about the size of an NAB show. But whatever, we'll give them the benefit of the doubt.

The broadcast industry's return engagement to Montreux is set for June 17-23, 1989. The 16th International Television Symposium is scheduled to run several days later than usual because of the NAB show. The 1989 NAB convention in Las Vegas ends in early May and Montreux organizers wanted to give exhibitors as much time as possible between the two events. Organizers for the '89 gathering report that 80% of the companies exhibiting this year at Montreux had booked space for the 1989 show by the end of the convention.

Format news

No broadcast industry trade show would be complete without some type of announcement regarding the marketing battle between the Betacam (and Beta SP) and M-II camps. This fight for the hearts and minds—and most importantly, dollars—of video professionals tends to overshadow other news at most trade shows. This one was no exception.

Panasonic gave its M-II efforts a big boost with an announcement on the first day of the exhibition that Thames Television, the largest independent TV station in the United Kingdom, will adopt the M-II ½-inch format. Initial deliveries of production-line equipment will start next spring. The order will include studio VTRs, camera-recorders and accessories. An exact dollar amount was not given. However, the agreement was expected to total $8 million to $10 million over 10 years.

Panasonic officials cited the agreement as a significant breakthrough into the PAL European market for its M-II product. The company said it will establish a separate organization within the United Kingdom to handle PAL users.

Richard Dunn, managing director of Thames Television, said the decision to go with M-II was made after "several months of careful and considered investigation into the technical and operational aspects of the available formats." Thames initially will use the new equipment for ENG and other mobile operations. Dunn also said he considers M-II as a future replacement for 1-inch type C machines.

Thames Television produces approximately 850 hours of news and entertainment programming a year.

Not to be left out, the Betacam camp also had a significant announcement to make at the convention. Ampex reported it had won a major order from Viewplan, a broadcast hire company in the United Kingdom, for $600,000 worth of Betacam SP hardware. The units will be among the first to be supplied to the United Kingdom. The order includes 75 studio recorders and 35 portable VTRs.

Ampex also announced that it had completed development of a PAL version of its 4fsc (composite digital) recording format. The announcement followed submission of the NTSC version of the 4fsc format to SMPTE's video-recording technology committee for consideration as a SMPTE/ANSI standard. Submission of the format was made jointly by Ampex and Sony. Both companies support its adoption as a world standard.

Technical sessions

The cornerstone of the Montreux convention was the technical symposium. Two keynote addresses opened this year's event. The first, delivered by Richard Kirby, director of CCIR (the International Radio Consultative Committee), dealt with present and future problems in international TV standards. The second, delivered by M. Morizono, director of research and development for Sony, dealt with present and future technological trends in TV equipment.

Kirby reviewed existing standards relating to television and pointed out the areas where new or revised standards are urgently needed. He told the session the most pressing need is in the area of HDTV production. In an attempt at CCIR standardization last year at Dubrovnik, Yugoslavia that failed, and in the absence of an extraordinary procedure, it will not be considered again until 1990.

In the meantime, Japan and the United States are moving ahead with what amounts to a de facto 60Hz standard, but the 50Hz countries also are pursuing their work actively, and failure to reach a common agreed standard will, according to Kirby, impede the development of hardware and the international exchange of programs.

Kirby also told the gathering that standards are needed for studio and post-production digital television. Digital audio and video system development are moving forward rapidly, and some experts believe that within a few years this field will be all-digital, including video recording. Color encoding is becoming component (RGB or equivalent) and, according to Kirby, compatible (subcarrier-modulated) encoding is on the way out.

Kirby observed that true direct satellite broadcasting to homes employing small receiving antennas is moving slowly, although frequency and orbit assignments for DBS in the Ku-band near 12GHz have existed for 10 years. The only country with regularly operating DBS is Japan, although lower-power and lower-frequency satellites are widely used for program relay. Kirby remarked that recent U.S. attempts to "leave standardization to the marketplace" had not brought about satisfactory results.

Morizono's address focused on the changing trends in technology that have an effect on broadcasting. He identified eight areas in which he saw principle technical emphasis placed at the symposium: telecommunications; transmission and reception, including earth satellites; signal-processing; optoelectronics; recording technology, including media and devices; computer systems; display and sensor technology; and solid-state devices.

Morizono cited continued advancements in large-scale device integration as being essential to support the rapid change from analog to digital. This progression requires considerable increases in processor speed, storage capacity and access time to make the new technology possible. For example, to increase video and audio quality beyond the present levels of performance would require increasing video quantization from the present 8-bit sample to perhaps 10 or 12 bits and audio samples from the present 16 bits to 20 bits or more. Such improvements demand much higher sampling frequencies and, therefore, faster devices.

These increases foresee advances in *submicron technology,* in which the closest chip dimensions that can be exploited will be reduced from 1μm to 0.1μm. Given such advances, the storage capacity of a DRAM (dynamic RAM) device could be increased to perhaps 128Mbytes. At these storage levels, solid-state devices such as an audio recorder "are sure to become a reality," according to Morizono. By extending these techniques to three dimensions, even higher capacities can be obtained. Faster speeds can be realized by substituting materials such as gallium arsenide for silicon. This may provide operating speeds of as much as 20 times that of silicon.

Advances are expected in signal-processing, both for the transmission of signals (to make optimum use of available bandwidths) and in applications relating to recording, computer graphics and picture manipulation (especially in real time). This will require not only the use of algorithms already available, but also the development of new algorithms for specific applications.

New techniques now being explored in memory devices, such as laser-beam spot recording, may have a (future) capacity of as much as 1,000 gigabits (1 terabit) in an area of only one square centimeter. This could accommodate more than one hour of video storage using the 4:2:2 format. Morizono characterized this as "amazing." Some observers thought it was Buck Rogers. But, then look at today's computer hardware against the

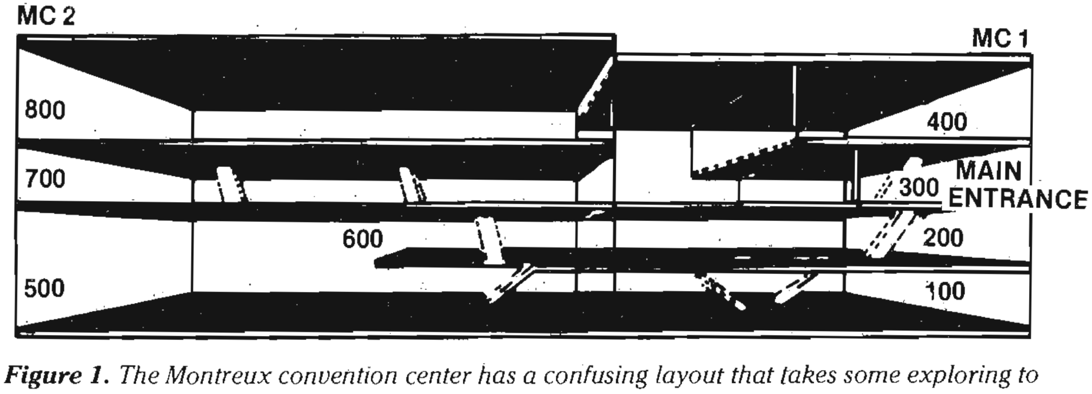


Figure 1. *The Montreux convention center has a confusing layout that takes some exploring to conquer.*

backdrop of just 20 years ago.

Morizono also foresees in the more distant future—the 21st century—the possible use of living protein molecules as storage media. Now that's really Buck Rogers.

High-definition television

In the international technical community there is agreement on the new HDTV-picture aspect ratio (16:9), but little else. The two camps are divided into field rates of 50Hz and 60Hz. Both systems offer line definition at approximately 1,100 lines, the exact number depending on various factors including the field rate.

Ulrich Messerschmid (Institut fur Rundfunktechnik, Munich) provided an overview of the capabilities and shortcomings of HDTV. In production, HDTV is seen both as a means for providing improved pictures for television and as a new way of producing motion pictures. According to Messerschmid, present production parameters for HDTV cannot match the performance of direct 35mm film; this would require 2,000 lines, 80-frames per second and progressive scanning.

Transmission standards are even more bothersome than production standards. The multiplexed analog component (MAC) packet series is not particularly well-suited to HDTV. Other systems of modulation might incorporate FM analog or digital, 50Hz or 60Hz, and might use the 12GHz or 22GHz satellite broadcast bands. Only time will tell whether development will be evolutionary or revolutionary.

Erasmo Lionetti (RAI—Radiotelevisione Italiana) reviewed the two principle aspects of the relationship between HDTV and movie production. These are the twin conversion problems of HDTV to film and vice versa. The two media were demonstrated in a screening of two productions, one by RAI of a movie produced almost entirely by HDTV techniques and then transferred to film, and the other produced by Canadian Broadcasting Corporation (CBC) using HDTV techniques both for production and screening.

HDTV production requires HDTV equipment, which is more complicated and expensive than standard NTSC or PAL hardware. Engineering representatives of various equipment manufacturers briefed session attendees on developments relating to the technology. It was clear from the presentations that HDTV hardware is here and—in many cases—ready to go. Products discussed ranged from graphics systems to telecines to cameras. Most of the major equipment manufacturers offered some type of HDTV hardware, at least in a prototype form.

Taij Nishizawa (NHK, Japan) described a new standards converter to change from 60Hz HDTV to 50Hz PAL. The new converter pays particular attention to picture motion, which can be a problem in standards conversion. A choice of motion-smoothing algorithms, made automatically by the converter, is applied depending on the location and amount of motion in the picture.

Videotape recording systems

Two technological newcomers whose meeting was foreordained are HDTV and digital-video recording. The difficulty of the problems facing designers can be appreciated when it is understood that bit rates may exceed 1 gigabit per second for a digital-video recorder. H. Tanimura (Sony) described an experimental digital-video recorder built for HDTV that meets the required specifications. The system uses eight sets of rapidly rotating recording heads and 1-inch tape traveling at 30 inches per second.

M. Umemoto (Hitachi) described a prototype HDTV component digital VTR that has been built and is being tested. The tape is one inch and tape speed is 20 inches per second. Ninety minutes of playing time can be contained on a 14-inch reel. The total bit rate is 648Mb/s and frequency bandwidths are 21MHz for luminance and 9MHz for chrominance.

Discussion of tape-recording technology for more conventional applications included a wide variety of formats, applications and hardware implementations. Equipment discussed included component, composite and digital-recording systems.

Fraser Morrison (Ampex) described the development and testing of a high-performance PAL DVTR format using 19mm (¾-inch) tape, and incorporating a number of novel features. Rolf Hedtke (BTS—Broadcast Television Systems) discussed the capabilities provided by its D-1 DTVR. Y. Fujiwara (Sony) described its recorder models intended for production and post-production use. Richard Petit (Odetics) advanced a concept of *margin* testing of the overall performance of tape-recording equipment. All of the systems described employ similar codes for error correction and error concealment. Reed-Solomon and Miller codes were most frequently mentioned.

TV production systems

The great bulk of today's production, post-production and editing facilities are composite analog, but the trend is toward component digital. Although, in a few instances, there may be a revolutionary change from one format to the other, the usual experience has been a gradual introduction of component operation into the present composite environment and digital operation into the analog environment.

Denis Belanger (of the Quebec French language network, Television Quatre Saisons) described an exception to the rule with the construction of new all-component (color unencoded) TV studios in Montreal. He believes the facility to be the first entirely component-type TV plant in the world. (The operation uses Sony Betacam hardware.) NTSC encoding is delayed until the transmitter input.

Encoded material received from outside sources and remote pickups that must be encoded for microwave relay is decoded to the component format upon receipt. Some modification of switching, effects and other production equipment was necessary, but these changes were not extensive and the results have proved satisfactory, according to Belanger.

M. Croll (BBC) reported on his experience in the digital video area, which dates back to 1983. Additionally, Croll reported on a production mixer that has been designed and built to interconnect with a digital slide file. The slide file may be replaced by a DVTR in the near future.

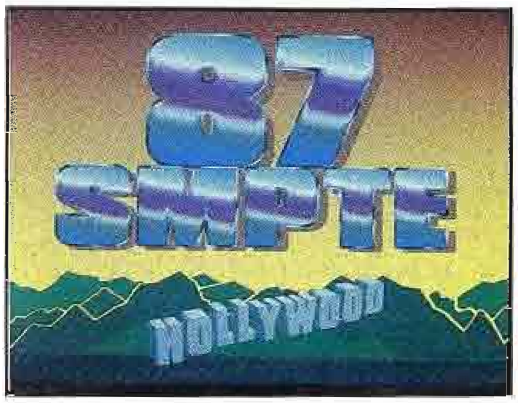
The cold winds of change

There is general agreement that TV broadcasting in Europe will change. It is, in fact, now changing. But the direction of change is unclear. Speakers at this international TV conference reviewed in varying detail the technical, social and political climate in the west European countries, and explored possible future courses. Individual governments for political, commercial and cultural reasons, are staunchly independent—and proud of it.

So-called *private television* is being introduced, and state television is being expanded, not only by planned satellite transmissions, but also by an increase in the number of terrestrial transmitters. At the same time, Europe is committed to high-power DBS. Twin, almost identical, French and German satellites, developed to common standards, are ready and will be launched when Ariane flights resume. Launches of high-power British, Scandinavian and Italian satellites will follow.

So the signals will be there, but what will be the public reaction? Viewers may opt for their own dishes, if they live in houses; SMATV in apartments; or a "collective" of apartments; or connection to a cable network, often controlled by the government.

Unless the government shuts off over-the-air TV transmissions, the viewer must *want* to see the satellite programming. In spite of efforts to expand and improve European program production, the only source of program supply that can accommodate a heavy increase in demand is the United States. One speaker put it bluntly, "American television has never needed Europe, but Europe has always needed America."



SMPTE goes Hollywood

By Jerry Whitaker, editorial director

The Society of Motion Picture and Television Engineers (SMPTE) is getting ready to present its 129th technical conference and exposition. The gathering is set for Oct. 31 through Nov. 4 at the Los Angeles Convention Center. The L.A. site offers excellent facilities for a large convention, and will be a welcome relief from New York's Javits Center (the site of last year's event) to convention attendees and exhibitors. To put it mildly, the Javits venue left something to be desired.

A total of 215 companies had reserved approximately 750 booths as of press time. The exhibit area will occupy 75,000-square-feet of floor space. Show organizers predict that between 15,000 and 18,000 people from around the world will attend the event.

You can expect to see new developments in most product categories on the show floor including: recording equipment, special-effects systems, cameras and lenses, film and videotape. The equipment exhibit will run for four days, opening on Saturday, Oct. 31 and concluding on Tuesday, Nov. 3.

Technical sessions

The SMPTE is best known for its excellent technical sessions, and the offerings at this fall's conference are no exception. Organizers have planned five days of engineering presentations on audio, video and film topics. The well-chosen theme for this year's conference is, *Imaging and Sound—Today and Tomorrow.* Some of the key technical topics planned for examination will include the following:

- *High-definition television*

HDTV is one of the areas expected to generate a great deal of interest among attendees. Following a precedence set in 1981, the conference will feature a variety of presentations on HDTV technology and—perhaps more importantly—possible implementation of the hardware.

This year, papers will address various technical aspects of HDTV and some of the key political and economic issues surrounding the widely debated 1,125-line, 60-field system advanced by NHK (Japan) and first demonstrated in the United States in 1981. Reports are scheduled on the application of HDTV to film production, TV entertainment programming and commercials. (See Table 1.)

- *Improved NTSC*

The conference also will provide a forum for the proponents of improved NTSC. Refining our existing video-transmission standard is a topic that is gaining added importance in view of the HDTV bandwagon, which appears to be looming on the horizon. The conference will examine work currently under way to improve the TV transmission system now used in North America, Japan and parts of Asia and South America. The focus of the presentations will be on methods to improve NTSC sufficiently so that it can rival HDTV in pictorial quality, but still remain compatible with the millions of TV sets currently in homes around the world. (See Table 2.)

- **HDTV: An Historical Perspective**—Corey Carbonara, Baylor University
- **The First High-Definition Production in the U.S.**—Barry Rebo, Rebo High-Definition Studio
- **Film-Style Drama Production Using High-Definition Video**—John Galt and Charles Pantuso, Northernlight & Picture Corporation
- **HDTV Requirements for Motion Picture Film**—James A. Mendrala, NBC
- **"Julia and Julia": The First Movie Made by HDTV Electronic Means**—E. Lionetti, RAI (Rome, Italy)
- **Practice of HDTV to Film Conversion by Means of Laser Film Recorder**—N. Yura, Imagica Corporation and H. Kumata, NAC
- **Recent Developments of Laser Telecine and Laser Beam Recorder for HDTV**—Y. Sugiura, Y. Nojiri, H. Hirabayashi and T. Motoki, NHK, Japan

Table 1. *Technical session papers scheduled for the SMPTE fall conference relating to HDTV.*

Photo credit: The '87 SMPTE illustration was produced by Colleen Smith (a graphic designer at Chyron Telesystems) on the Chyron Scribe. The photo is used courtesy of Chyron.

- *ES-bus communications standard*

The ES-bus has stimulated a good deal of discussion and some debate among potential users of the communications-protocol system and manufacturers that are now (or may in the future) build hardware to meet the requirements of the format. The conference will devote an entire technical session to discussions and lectures on the ES-bus, a serial-communications standard jointly developed by the SMPTE and the European Broadcasting Union (EBU). The goal of the ES-bus is to provide for the control of the wide variety of equipment currently found at a TV facility.

Presentations on the subject will be given by representatives of companies that have developed hardware conforming to the standard, and engineers at TV facilities that have incorporated ES-bus-supported systems. Among the companies planning to participate in the session are Broadcast Television Systems, 3M and Alamar Electronics. On the user side, the Institut fuer Rundfunktechnik, Munich, Germany, will report on an editing system currently in use, which incorporates the ES-bus. An engineering representative from the BBC (United Kingdom) will deliver a paper on its experiences with ES-bus technology. The goal of the session is to bring additional light to current applications of the ES-bus standard.

The SMPTE and the EBU have been working together on a basic architecture for a control network since 1979. The ES-bus network is based on the concept of distributed processing, with each item of controlled equipment connected to the network through a tributary. The ES-bus standard defines both control messages and characteristics of the electrical/mechanical interface.

- *Fiber-optic applications*

Rounding out the conference will be an examination of the application of fiber-optic technology in the broadcast environment. A technical session is scheduled on the topic, with the aim of creating an awareness in the industry of the feasibility of fiber-optic transmission systems for program distribution. This will be the first full session at a SMPTE conference devoted exclusively to the dis-

- **Enhancing Television – An Evolving Scene** – J. L. E. Baldwin, Independent Broadcasting Authority (United Kingdom)
- **Experiment with Enhanced-Quality TV System Compatible with NTSC** – Yoski Anaki, Hitachi Denshi America
- **Compatible Enhancements to NTSC – Which Way to Go?** – Kerns Powers, RCA Labs
- **System Concepts for NTSC-Compatible HDTV** – C. A. A. J. Greebe, Philips Labs
- **1,125-Line HDTV Can Be Compatible with NTSC** – W.E. Glenn and K. G. Glenn, New York Institute of Technology
- **Transmission of High-Definition TV Pictures Compatible with the X-Mac/Packet Family: The 3-D Filtering Approach** – Frederic Fonsales, Laboratories of Science and Applied Physics, France
- **Exploring and Exploiting Subchannels in the NTSC Spectrum** – M. A. Isnardi, David Sarnoff Research Center
- **Recent Advances in NTSC Signal Processing** – Yves Faroudja, Faroudja Labs; Joe Roizen, Telegen
- **Optimizing the Encoding Process to Overcome the Major Defects of NTSC** – John Rossi, Intelvideo

Table 2. *SMPTE technical papers that will focus on ways to improve the NTSC transmission system now in use.*

cussion of fiber-optic technology.

Session organizers feel that many engineers and technical directors in the broadcast industry may have insufficient information on how fiber optics can be used to transmit video and audio programming. The papers planned for the session are designed to help close the information gap and raise some questions and issues of importance to broadcasters.

Capital Cities/ABC will report on its experience with an experimental intercity fiber-optic transmission line between New York City and Washington, DC, over which broadcast-quality programs are being transmitted. Papers also will address the cost-effectiveness of program distribution via fiber optics.

SMPTE presents honor awards

The society will honor 19 individuals with service and achievement awards, and name 15 new Fellows. The late George W. Colburn will be placed on the SMPTE honor roll in a ceremony at the convention, a distinction given to motion picture and TV pioneers. He will be recognized for his technical contributions to the design and construction of 8mm film printing and processing equipment.

The Progress Medal, the premier award of the society, will be presented to Irwin Young "in recognition of his devoted energies and commitment...to both the motion picture and television industries." Young is chairman of the board of Du Art Film Laboratories and sections vice president of the SMPTE.

The awards will be presented at the society's honors and awards luncheon on Saturday, Oct. 31.

Trick or treat

If you take a close look at your calendar, you will notice that Saturday, Oct. 31 is Halloween. Well, the big day for spooks falls right in the middle of the SMPTE convention. To get into the spirit of the day, we might suggest an optional event for convention attendees—like a costume trick-or-treat walk down Hollywood Boulevard. That should be fun.

As a veteran of many conventions, this observer looks forward to the experience. I only hope I can tell the difference between those dressed up in costumes and the people that normally walk around Hollywood Boulevard at night.

See you at Hollywood and Vine.

The 1987 SBE National Convention and **Broadcast Engineering** Conference will be even better than last year!

- More seminars
- More exhibits
- More manufacturers

Plan now to attend the convention directed toward the hands-on needs of radio and TV engineers. The '87 SBE National Convention and **Broadcast Engineering** Conference—the *must attend* event this fall.

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

PREREGISTRATION FORM:

Complete form, enclose check or money order (or Visa/MasterCard information), place in envelope and mail to the address shown on the opposite side of this card.

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

NAME: ____________________

COMPANY: ____________________

ADDRESS: ____________________

CITY:__________ STATE:__________ ZIP CODE:__________

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

Registration fee of **$45.50** includes entrance to all technical seminars, a copy of the *Proceedings* of the conference, a ticket to the engineering luncheon and entrance to the convention show floor.

TOTAL AMOUNT ENCLOSED (do not mail cash) ....$__________

I will be paying by: ____Visa ____MasterCard CARD NUMBER: __________

SIGNATURE: ____________________ EXPIRATION DATE:______

The 1987 SBE National Convention and **Broadcast Engineering** Conference will be even better than last year!

- More seminars
- More exhibits
- More manufacturers

Plan now to attend the convention directed toward the hands-on needs of radio and TV engineers. The '87 SBE National Convention and **Broadcast Engineering** Conference—the *must attend* event this fall.

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

PREREGISTRATION FORM:

Complete form, enclose check or money order (or Visa/MasterCard information), place in envelope and mail to the address shown on the opposite side of this card.

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

NAME: ____________________

COMPANY: ____________________

ADDRESS: ____________________

CITY:__________ STATE:__________ ZIP CODE:__________

SBE NATIONAL CONVENTION
BROADCAST ENGINEERING CONFERENCE

Registration fee of **$45.50** includes entrance to all technical seminars, a copy of the *Proceedings* of the conference, a ticket to the engineering luncheon and entrance to the convention show floor.

TOTAL AMOUNT ENCLOSED (do not mail cash) ....$__________

I will be paying by: ____Visa ____MasterCard CARD NUMBER: __________

SIGNATURE: ____________________ EXPIRATION DATE:______

FILL OUT OPPOSITE SIDE OF CARD, ENCLOSE CHECK OR MONEY ORDER (OR VISA/MASTERCARD INFORMATION), PLACE IN ENVELOPE AND MAIL TO:

SBE National Convention
P.O. Box 16861
St. Louis, MO 63105

FILL OUT OPPOSITE SIDE OF CARD, ENCLOSE CHECK OR MONEY ORDER (OR VISA/MASTERCARD INFORMATION), PLACE IN ENVELOPE AND MAIL TO:

SBE National Convention
P.O. Box 16861
St. Louis, MO 63105

READER SERVICE CARD For issue of September 1987 – Use until January 1, 1988

After that date, please contact manufacturer directly.

BROADCAST engineering®

1. **IMPORTANT: Do you wish to receive/continue to receive BROADCAST ENGINEERING FREE?**
☐ Yes ☐ No

____
Your signature is required *Date*

Please print or type:

Name ____________________

Title ____________________

Organization or firm ____________________

Street or box ____________________

City ____________ State ________ Zip ______

Phone ( ) ____________________

SAVE TIME: Use peel-off address label for faster service.

2. **Please check the ONE type of facility or operation that best describes your business classification:**
19 ☐ Low Power TV Station
20 ☐ TV Station
21 ☐ AM Station
22 ☐ FM Station
23 ☐ AM & FM Station
24 ☐ TV & AM Station
25 ☐ TV & FM Station
26 ☐ TV, AM & FM Station
27 ☐ CATV Facility
28 ☐ Non-Broadcast TV including Closed Circuit TV (CCTV)
29 ☐ Recording Studio
30 ☐ Teleproduction Facility
31 ☐ Microwave, Relay Station or Satellite Company
32 ☐ Government
33 ☐ Consultant (Engineering or Management)
34 ☐ Dealer, Distributor or Manufacturer
☐ Other ____________ *(Please specify)*

3. **If you checked 20 through 26 above, which of the following best describes your over-the-air station: (Check only one.)**
A ☐ Commercial
B ☐ Educational
C ☐ Religious
D ☐ Campus Low Frequency
E ☐ Community
F ☐ Municipally Owned

4. **Check the category that best describes your title: (Check only one.)**
A ☐ **Company Management**–Chairman of the Board, President, Owner, Partner, Director, Vice President, General Manager (other than in charge of Engineering or Station Operations Management) and other Corporate and Financial Officials
B ☐ **Technical Management & Engineering**–Technical Director or Manager, Chief Engineer, Other Engineering or Technical Titles
C ☐ **Operations & Station Management/Production & Programming**–VP Operations, Operation Manager/Director, Station Manager, Production Manager, Program Manager, News Director and other Operations Titles
D ☐ **Other: Specify** ____________

5. **IMPORTANT: Check the statement that best describes your role in the purchase of major communication equipment components and accessories.**
☐ Make final decision to buy a specific make or model
☐ Recommend make or model to be purchased
☐ Have no part in specifying or buying

SEND ME MORE INFORMATION about products or services I have circled.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256
257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352
353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384
385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416
417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448
449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512
513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544
545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576
577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608

RS7

FOR FASTER ACTION!!!

I have an immediate interest in the items I've indicated here. Please have a sales person call me.

READER SERVICE CARD For issue of September 1987 – Use until January 1, 1988

After that date, please contact manufacturer directly.

BROADCAST engineering®

1. **IMPORTANT: Do you wish to receive/continue to receive BROADCAST ENGINEERING FREE?**
☐ Yes ☐ No

____
Your signature is required *Date*

Please print or type:

Name ____________________

Title ____________________

Organization or firm ____________________

Street or box ____________________

City ____________ State ________ Zip ______

Phone ( ) ____________________

SAVE TIME: Use peel-off address label for faster service.

2. **Please check the ONE type of facility or operation that best describes your business classification:**
19 ☐ Low Power TV Station
20 ☐ TV Station
21 ☐ AM Station
22 ☐ FM Station
23 ☐ AM & FM Station
24 ☐ TV & AM Station
25 ☐ TV & FM Station
26 ☐ TV, AM & FM Station
27 ☐ CATV Facility
28 ☐ Non-Broadcast TV including Closed Circuit TV (CCTV)
29 ☐ Recording Studio
30 ☐ Teleproduction Facility
31 ☐ Microwave, Relay Station or Satellite Company
32 ☐ Government
33 ☐ Consultant (Engineering or Management)
34 ☐ Dealer, Distributor or Manufacturer
☐ Other ____________ *(Please specify)*

3. **If you checked 20 through 26 above, which of the following best describes your over-the-air station: (Check only one.)**
A ☐ Commercial
B ☐ Educational
C ☐ Religious
D ☐ Campus Low Frequency
E ☐ Community
F ☐ Municipally Owned

4. **Check the category that best describes your title: (Check only one.)**
A ☐ **Company Management**–Chairman of the Board, President, Owner, Partner, Director, Vice President, General Manager (other than in charge of Engineering or Station Operations Management) and other Corporate and Financial Officials
B ☐ **Technical Management & Engineering**–Technical Director or Manager, Chief Engineer, Other Engineering or Technical Titles
C ☐ **Operations & Station Management/Production & Programming**–VP Operations, Operation Manager/Director, Station Manager, Production Manager, Program Manager, News Director and other Operations Titles
D ☐ **Other: Specify** ____________

5. **IMPORTANT: Check the statement that best describes your role in the purchase of major communication equipment components and accessories.**
☐ Make final decision to buy a specific make or model
☐ Recommend make or model to be purchased
☐ Have no part in specifying or buying

SEND ME MORE INFORMATION about products or services I have circled.

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64
65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96
97	98	99	100	101	102	103	104	105	106	107	108	109	110	111	112	113	114	115	116	117	118	119	120	121	122	123	124	125	126	127	128
129	130	131	132	133	134	135	136	137	138	139	140	141	142	143	144	145	146	147	148	149	150	151	152	153	154	155	156	157	158	159	160
161	162	163	164	165	166	167	168	169	170	171	172	173	174	175	176	177	178	179	180	181	182	183	184	185	186	187	188	189	190	191	192
193	194	195	196	197	198	199	200	201	202	203	204	205	206	207	208	209	210	211	212	213	214	215	216	217	218	219	220	221	222	223	224
225	226	227	228	229	230	231	232	233	234	235	236	237	238	239	240	241	242	243	244	245	246	247	248	249	250	251	252	253	254	255	256
257	258	259	260	261	262	263	264	265	266	267	268	269	270	271	272	273	274	275	276	277	278	279	280	281	282	283	284	285	286	287	288
289	290	291	292	293	294	295	296	297	298	299	300	301	302	303	304	305	306	307	308	309	310	311	312	313	314	315	316	317	318	319	320
321	322	323	324	325	326	327	328	329	330	331	332	333	334	335	336	337	338	339	340	341	342	343	344	345	346	347	348	349	350	351	352
353	354	355	356	357	358	359	360	361	362	363	364	365	366	367	368	369	370	371	372	373	374	375	376	377	378	379	380	381	382	383	384
385	386	387	388	389	390	391	392	393	394	395	396	397	398	399	400	401	402	403	404	405	406	407	408	409	410	411	412	413	414	415	416
417	418	419	420	421	422	423	424	425	426	427	428	429	430	431	432	433	434	435	436	437	438	439	440	441	442	443	444	445	446	447	448
449	450	451	452	453	454	455	456	457	458	459	460	461	462	463	464	465	466	467	468	469	470	471	472	473	474	475	476	477	478	479	480
481	482	483	484	485	486	487	488	489	490	491	492	493	494	495	496	497	498	499	500	501	502	503	504	505	506	507	508	509	510	511	512
513	514	515	516	517	518	519	520	521	522	523	524	525	526	527	528	529	530	531	532	533	534	535	536	537	538	539	540	541	542	543	544
545	546	547	548	549	550	551	552	553	554	555	556	557	558	559	560	561	562	563	564	565	566	567	568	569	570	571	572	573	574	575	576
577	578	579	580	581	582	583	584	585	586	587	588	589	590	591	592	593	594	595	596	597	598	599	600	601	602	603	604	605	606	607	608

RS7

FOR FASTER ACTION!!!

I have an immediate interest in the items I've indicated here. Please have a sales person call me.

Which one advertisement in this issue was of most interest to you?

Advertiser's Name ________________ Circle No. ______

Comments on this issue:

PLACE FIRST CLASS POSTAGE HERE

BROADCAST engineering®

P.O. Box 12902
Overland Park, KS 66212-0902

Which one advertisement in this issue was of most interest to you?

Advertiser's Name ________________ Circle No. ______

Comments on this issue:

PLACE FIRST CLASS POSTAGE HERE

BROADCAST engineering®

P.O. Box 12902
Overland Park, KS 66212-0902

News
Continued from page 4

and afternoon sessions on Friday, Saturday, Sunday and Monday also are scheduled.

The session titles and chairpeople will include:

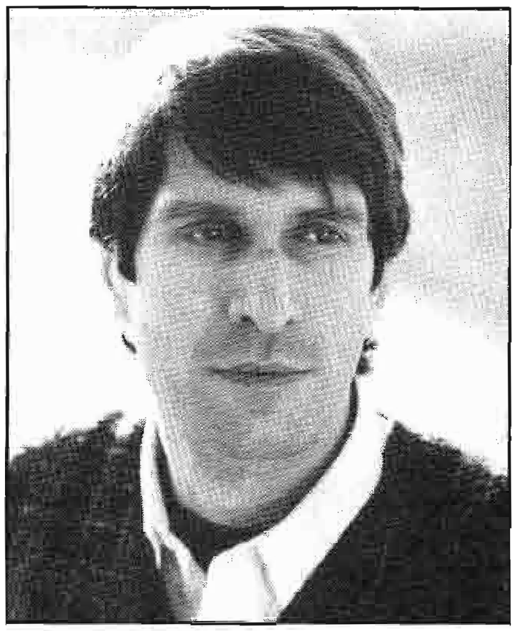
- *Advances in Digital Audio-Video*—Ken Pohlmann, University of Miami
- *Psychoacoustics and Listening Tests*—Diana Deutsch, University of California, San Diego
- *Architecturalacoustics and Sound Reinforcement*—Don Keele, Crown International
- *Recording, Mixing and Editing*—Larry Boden, JVC
- *Transducers*—John Vanderkooy, University of Waterloo, Ontario
- *Signal Processing*—Robert Adams, dbx
- *Broadcast Audio Systems*—Steve Lyman, Canadian Broadcasting
- *DSP Chips for Music Synthesis, Recording and Processing*—John Strawn, S Systems
- *Audio Measurements and Evaluation*—Richard Cabot, Audio Precision

The special papers sessions will include:

- *Transmission*—Daniel Gravereaux, consultant
- *Acoustics and Sound Reinforcement*—Ken Jacobs, Bose Corporation
- *Signal Processing*—Don Eger, Crown International
- *Transducers*—John Bullock, Shure Brothers
- *Audio Measurements and Evaluation*—John Prohs has prepared a paper on the work of the late Richard Heyser.

SSL executive dies

Douglas Finch Dickey, a key figure in the professional audio industry and senior executive at Solid State Logic, died on Aug. 8 after a long illness. For more than 10 years, Dickey played a major role in SSL's development and success, first as head of SSL's professional audio team in the United States and subsequently became increasingly involved in product specification and design. He was part of the team responsible for the SSL stereo video system, which has become an influence in the production of audio for stereo television. More recently, he helped guide SSL's move into the motion picture industry, and was involved in panel design and software interfaces for SSL's first digital system. He became vice president for Design Communications in 1983, and moved from Washington, DC to SSL's headquarters in Oxford, England in May 1986.



NPR holds Music Recording Workshops

More than 60 public broadcasting engineers and producers from around the country attended the 15th and 16th Music Recording Workshops in Fredonia, NY, in late July. The workshops were comprised of two sections: jazz/folk and classical recording.

The workshops were conducted by National Public Radio. Nationally recognized experts from NPR and independent recording engineers provided instruction in the skills needed to produce high-quality recordings. The sessions are well-known throughout the public broadcasting arena. The workshops provide training in music recording. Many of the participants used their expertise to produce programming for both local stations and national distribution through NPR and other networks.

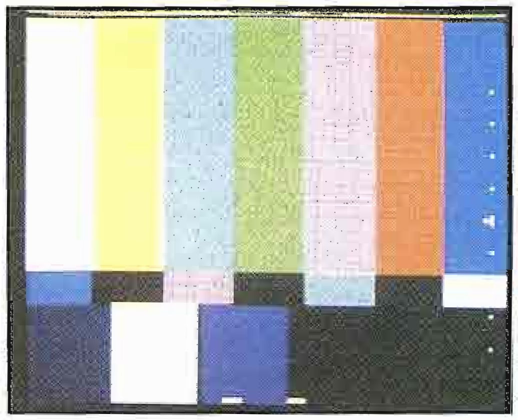
Topics covered in the workshops included console operation, mixing, microphone selection and placement, monitoring, troubleshooting, acoustics and digital-recording techniques.

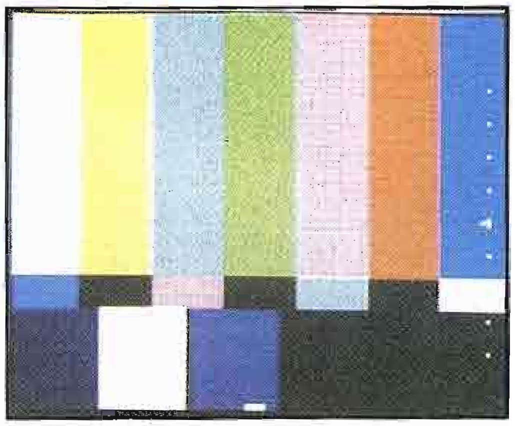
The classical workshop provided participants the opportunity to record the nationally celebrated Chautauqua Orchestra live on the Fredonia campus. The jazz/folk sessions also recorded groups in live settings to make the training as realistic as possible.

More than 1,200 public broadcasters have attended the training sessions during the past six years. Additional information on the next set of workshops can be obtained from NPR, 202-822-2000.

Correction

Due to a production error on page 67 of last month's issue, the differences between two photos of color bars on the Time Code Sync Monitor could not be seen. The photos are shown here as they were originally intended to appear. The cursors shown in the top photo indicate 0° SC/H phase error. The bottom photo shows a 20° SC/H phase error.





Update information

In the August **BE** issue, a comment was printed in the "Modifying Time—System Considerations" article by Lawrence Rich, Lexicon, that the ½-inch VCR systems, (Betacam and M-II) were not appropriate equipment for time-compression applications.

After the issue had been published, it was learned that equipment for both formats now does, or soon will, support time compression.

Faroudja, Ikegami announce agreement

Ikegami, Tokyo, and *Faroudja Laboratories,* Sunnyvale, CA, have announced a comprehensive licensing agreement in which the image-processing technology developed by Faroudja Laboratories will be used by Ikegami to improve the NTSC images made by its cameras. Ikegami has purchased the rights to Faroudja's patent portfolio, which contains more than 20 patents relative to the encoding and decoding process of NTSC video signals.

Faroudja also has offered an NTSC encoder and decoder to the Broadcast Technology Association of Japan for its evaluation. Hiroaki Danjo, manager of audio-video equipment sales for Hoei Sangyo Company, Faroudja's Japanese rep, will coordinate the provision of Faroudja encoders and decoders and will provide technical assistance for the EDTV committee when it conducts its evaluations.

Soundtracs PLC expands manufacturing facility

Soundtracs PLC has expanded its manufacturing facility in Surbiton, Surrey, England. The increased capacity is due to the demand for new products. The additional third unit will produce the CP6800 series and FM/FMX/FME series of consoles providing additional capacity in Unit 2 for the PC MIDI Series.

Soundtracs also has expanded its research and development department. The facility includes additional CAD design and plotting stations, ATE stations for the evaluation of new circuit designs and computer hardware for the development of digital control systems.

Lenco receives International Trade Award

Mark A. Hill, international sales manager, and Donald K. Ford, director of marketing, both from *Lenco,* Jackson, MO, have received the International Trade Award for Outstanding Manufacturer New to Market, presented by John Ashcroft, governor of Missouri. The marketers were presented the award at the 29th annual Governor's Economic Development Conference held at the Hyatt-Regency in Kansas City. The New to Market International Trade Award recognizes Lenco for its success in selling its product line to targeted countries abroad to which Lenco had not previously exported products.

NBC makes arrangements for Summer Olympics

NBC has signed a contract with the Grass Valley Group, Grass Valley, CA, for the purchase of production switchers for use in the coverage of the 1988 Summer Olympics in Seoul, Korea. GVG will supply six 24-input 3-mix-effects production switchers for the control rooms and edit suites in NBC's international broadcast center. In addition, NBC is negotiating with GVG to provide 12 type-100 component switchers to be used with M-II video recorders. Deliveries are expected to take place over a 6- to 8-month period. GVG will furnish technical support at the Olympic games as well.

NBC also signed a contract with 3M for the purchase of the routing switcher and machine-control system to be used at the Summer Olympics. Installation of the equipment in NBC's international broadcast center is expected to begin in January, and 3M will test the system before turning it over to NBC at the beginning of July 1988.

Along with these arrangements, NBC made an agreement with Dynamic Technology, London, for the development and construction of NBC's international broadcast center for the Summer Olympics. The center will be composed of two TV studios with associated control rooms, four edit suites, 11 small edit suites and transmission facility. The broadcast center will be at the Olympic site and operational by July 1, 1988.

Ampex and Cubicomp expand marketing agreement

Ampex, Redwood City, CA and *Cubicomp,* Haywood, CA, have agreed to broaden their partnership by expanding their marketing efforts for the PictureMaker 3-D animation computer graphics system. Cubicomp's sales force and designated dealers will join Ampex in selling the full range of PictureMaker graphics systems to all U.S. and overseas markets, including TV broadcast and post-production. Previously, Ampex was the chief supplier of PictureMaker systems to the broadcast and post-production markets, while Cubicomp focused its sales efforts on the corporate/industrial and other non-broadcast areas. Cubicomp is the developer of PictureMaker, and manufactures software and hardware for both companies.

Crow Broadcast Holdings is formed

Crow Broadcast Holdings Limited, a new broadcast engineering group, has been formed from the acquisition of the Crow Group and Seltech International. Members of the management board are: Corney Webster, group managing director and chief executive; Chandu Luhar, group financial director; and Sam Husain, chairman.

The Crow Group—acquired from Hudsons Offshore Holdings Limited—includes five separately registered subsidiaries: Crow Broadcast Systems, Crow Computer Graphics, Turnbull & Crow, MVC and Crow Broadcast Equipment, Singapore. These companies were derived from the Crow of Reading Group, which was taken over by Hudsons in 1984. The organization will be restructured to form a unified profit center at the Reading premises.

Seltech International, however, was formerly an autonomous subsidiary of Chalford Communications and is financially self-supporting. It will, therefore, continue to function under the administration of its existing management. Seltech is the sole UK distributor of broadcast engineering products from Canadian and other North American manufacturers.

Freeze. Frame.

Introducing the fastest, easiest way to get quality prints and slides from video.

Now you can capture the moment, freeze it, and frame it. All with the touch of a button. With the new FreezeFrame Video Image Recorder from Polaroid.

FreezeFrame produces sharp, instant color prints and color or black and white 35mm slides from virtually any video source. And it delivers a finished picture that is far superior in quality and resolution to direct screen photography or thermal video image recorders.

System includes Video Image Recorder, control console, and print film camera/adapter. 35mm camera/adapter optional.

FreezeFrame can be used in broadcast, production and advertising to proof, edit, storyboard, or reference.

It can also be used to pull a print off a just-breaking news story.

The FreezeFrame system includes a Video Image Recorder, control console, and print film camera/adapter. And the system connects easily to video cameras, professional VCR's, laser disc players and computer graphics systems.

New FreezeFrame from Polaroid. It's fast, easy and at $1,899,* very affordable.

To find out how FreezeFrame can help you, call toll-free **800-343-5000** 8 a.m. to 8 p.m. Eastern Time.

Or fill out and return the coupon. We'll give you the full picture and show you just how easy it can be to capture the moment on FreezeFrame.

For more information, mail this coupon to Polaroid Corporation, Dept. 678, P.O. Box 5011, Clifton, NJ 07015.

☐ Please send more information.
☐ I'd like a demonstration. BE9/1

Name ____________
Title ____________
Company/Institution ____________
____
Address ____________
City ______ State ______ Zip ______
Telephone ____________
Video Source ____________
Application ____________

Polaroid

Image Source: The PHOTO STORE™

Circle (151) on Reply Card

New products

Camera automation systems

The HS-110P

TSM has introduced the following products:

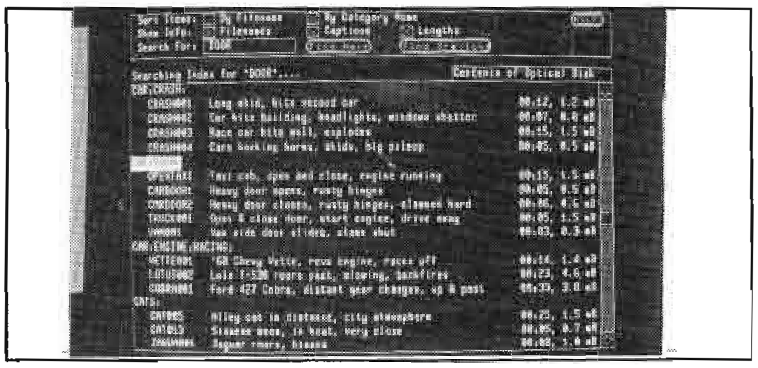
• The HS-110P studio-camera automation system operates with the MultiController and is designed to control studio-size cameras. It is a high-precision electromechanical system that provides broadcast-quality motion control with cameras and accessories weighing up to 250 pounds.

The pan/tilt head features: mechanical, electromechanical and electronic systems designed for zero maintenance and maximum reliability; non-lubricated, self-aligning gear-train technology and electromechanical controls; mechanical design using sound and vibration-dampening material provides a virtually noise and vibration-free operation under all operating conditions; the head supports up to 250 pounds; the camera cradle is adjustable; high-torque servo systems use digital/analog servos; can be`pedestal- or ceiling-mounted; electronic design uses multifunction ICs and components, keeping PCB size to a minimum; and head electronics are contained on two PCBs that are 100% interchangeable.

• The SportsFocuser features quick set ups; holds focus while live, even with tight shots, and no focus overshoots; stays with the play while live. The focusing system tracks precisely to within one foot in 100 yards, and within 1/10 of one second.

Circle (350) on Reply Card

Optical disk storage and retrieval system



New England Digital has introduced an optical disk-based digital audio storage and retrieval system for its Synclavier digital audio work station. The product is designed to augment the video/film/post-production and music professional's existing Winchester hard disk or tape-storage system, allowing a user to store more than 5½ hours of high-fidelity digital audio material on each optical disk.

As many as 20,000 1-second sound effects or 1,300 15-second effects can be stored, archived and accessed with a single keystroke from the Synclavier keyboard. The optical disk system is supported by its own screen at the terminal. This allows a user to name and classify individual sounds into an organized on-line library that can be cross-referenced. The system also performs global find searches for individual sound files.

Circle (351) on Reply Card

Modulator power supply

Varian Associates has introduced the model VPW-6892 MRU-II, a compact, lightweight modular replaceable unit power supply. It is capable of driving a wide range of traveling-wave tubes in satellite communication applications. It occupies 0.71 cubic feet of volume and weighs less than 40 pounds. Designed to operate in small aperture earth stations, the power supply can be located in the hub of an antenna, in a small equipment rack, in a satellite news-gathering van or shelter. The power supply can be separated from the associated TWT by up to 12 feet, giving earth-station designers leeway in positioning the power amplifier to minimize losses in long waveguide runs. The power supply supplies 1,800W of output power with an 80% efficiency.

Circle (349) on Reply Card

Audio level controller

Valley has announced the LEVELLER audio level controller. With its linear integration detection, the controller is capable of comprehending the intent of the performer in terms of output loudness for each note, syllable or accent. Once the input level is set and the output gain determined, the operator of the controller decides whether more or less leveling action is required and operates the unit's threshold control. There are no attack time or release time controls, because these functions are program dependent and correspond to one of the two switch-selectable intervention times chosen. Automated program dependency circuitry optimizes the attack and release times as the program content changes. Continual monitoring and recalibration of the attack and release times by the circuitry ensures that no dynamic distortion is added to the signal.

Circle (352) on Reply Card

Tower strobes

Broadcast Communications Systems has introduced the RTF-2001 tower strobe that meets all FAA requirements for medium and low intensity strobes. It is a retrofit that replaces the upper incandescent lamp in a standard 300mm code beacon. The strobe can plug into the upper light socket or it can be wired directly into the connector strip in the base of the code beacon. The strobe features lamp redundancy with a ring of six lamps; solid-state components, no relays; and no special wiring is required.

Circle (353) on Reply Card

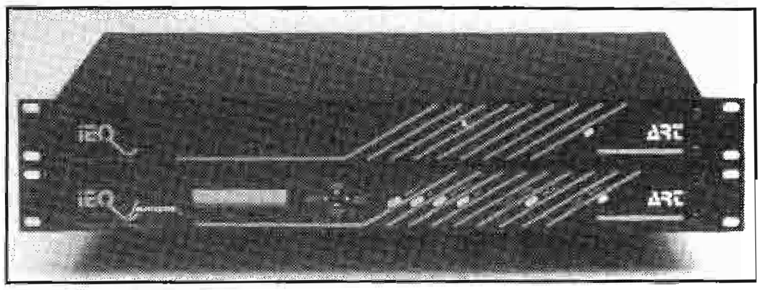
Self-supporting tower member

Central Tower has introduced a self-supporting solid-round steel member, all welded section tower. The tower height is 160 feet with a face width of 60 inches at the base.

The company also is producing an all welded guyed tower at 1,000-inch heights. This design offers an increase in leg-member weld area. Other self-supporting and guyed towers are available.

Circle (354) on Reply Card

Equalizer system



ART has announced the Smart Curve intelligent EQualizer system. It is a microprocessor-controlled, 15-band, ⅔-octave graphic equalizer that uses digital control of analog circuitry. The user-friendly front-panel controls allow increment and decrement of all parameters, while the current mode and parameter setting is displayed on the front-panel liquid crystal display. Because a composite video output is provided, the actual frequency response as well as slider positions and system status may be displayed on a video monitor connected directly to the equalizer.

Circle (355) on Reply Card

ADO communications protocol

Ampex has introduced the serial protocol of its ADO family of digital effects systems. The serial protocol provides all the necessary information to control an ADO system from an external device. The ADO family is compatible with all major manufacturer's systems.

The serial protocol document describes the series of commands that an external device can send to the ADO control panel to recall and play back ADO effects sequences. Other items include status message information and performance data of the ADO system.

Circle (356) on Reply Card

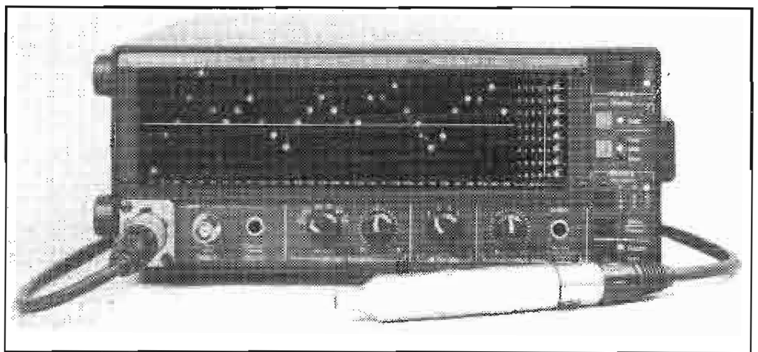
Circular connectors

Alpha Products has announced its series of circular connectors designed to several European DIN and IEC specifications, including the DIN 41524, 45322, 43321, 45326, 41524, 45327 and 15931. The circular connectors range in size from two to 19 contacts, with current-carrying capacity up to 16A per contact. The connectors are intended for panel and cable-mount with male or female contacts available on either side of the interface. Most designs have a choice of soldercup or crimp contacts with splash-proofing boots in the strain relief.

Circle (357) on Reply Card

Real-time analyzer

Audio Control Industrial has announced it is shipping the model SA-3050 third-octave spectrum analyzer, real-time program monitor with memory. It features a calibrated microphone; a 30-band display; SPL on-off and fast, medium and slow decay integration. The total display range is 44dBA to 136dBA or −56dBm to +36dBm. Other features include six memories with read, write, freeze and RTA-memory comparison functions; three signal inputs; a phantom-powered-balanced XLR input; an FET instrumentation BNC input; and a balanced bridging ¼-inch line-level input. The analyzer includes a precision digital pink-noise generator with adjustable output that can drive a speaker directly.



Circle (358) on Reply Card

3-D modeling/animation package and paint product

Artronics has introduced the following products:

- A 3-D modeling and animation system. The 3-D package consists of the Model Shop and Animator. It runs on the Video Graphics System/VGS as well as on the Presentation Graphics Producer/PGP. The images can be output to video, and can be merged with painted or high-resolution vector graphics for output-to-digital film recorders at 2,000 lines of resolution.
- The Paint24, 24-bit paint product, offers a new airbrush. It features fully antialiased user-definable brushes, 16 levels of frisket, and 14 different ways to paint. The system includes 16 levels of transparent wash alone.
- The SlideMaker is a turnkey business and presentation graphics system. It includes a 4,000-line-resolution digital film recorder.

Circle (359) on Reply Card

Exciter

BEXT has introduced the 80W exciter. It requires no tuning. The operating frequency, adjustable power and deviation level are all externally programmable from the front panel. It also has a built-in low-pass filter. It is designed to serve as an emergency transmitter, a stand-alone low-power station or a backup unit.

Circle (360) on Reply Card

Stereo signal monitoring system

B & B Systems has announced its AM-3B Phase Monitor stereo signal monitoring system. The system features real-time visual and audible monitoring of stereo audio phase, program VU levels, peak threshold levels, including left plus right sum or aux, in a 3½-inch-high, rack-mount system. Audio level monitoring, the CRT display, dual-selectable input sources and a speaker/headphone output with level control allow an operator to avoid out-of-phase stereo, peak audio distortion and loss of mono compatibility.

The system is self-contained in two EIA rack units and includes dual sets of channel inputs, which are front-panel se-

Circle (103) on Reply Card

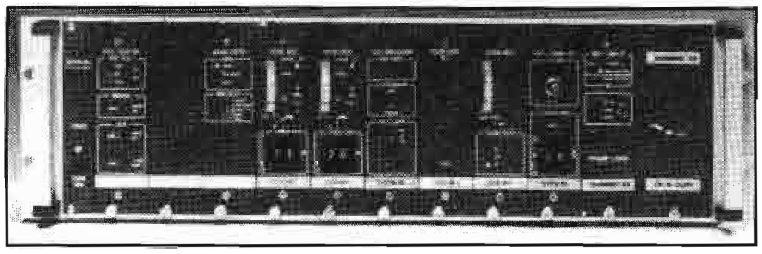
Circle (104) on Reply Card

lectable A/B, and a separate level control for a built-in power amplifier with both headphone and speaker outputs selectable for stereo, L+R mono sum or aux listening.

The units have three VU meters with peak overload LED indicators for each channel, selectable between two 3-channel input sources.

Circle (361) on Reply Card

TV modulators and demodulators



Barco Industries has introduced the VSD series of modular precision TV demodulators and TV modulators for broadcast and CATV. The line includes the VSD 1000 stereo/dual-sound demodulator and the VSBM 1000 precision TV modulator. All units are rack-mountable and feature modular, front-panel plug-ins. The demodulator series includes the VSD1 multichannel, multistandard; the VSD2 multichannel, single standard; and the VSD2/X single-channel, single standard. The VSD1 and VSD2 have five presettable channels. All units have automatic gain control that is independent of picture content; a meter for both visual and sound levels; and 2T and 20T response.

The VSD 1000 stereo/dual-sound demodulator is available for B, G, I or L transmission standards. Features include envelope and synchronous detection; stereo or dual-sound operation; and surface acoustic wave IF filter circuitry.

The VSBM 1000 precision fV modulator is available for B, G, I, Mw or DK transmission standards. Applications include transmitter excitation; CATV modulation; and production-line testing of TV equipment. SAW filtering for adjacent channel operation is standard.

Circle (362) on Reply Card

Answering device

Colonial Data Technologies has increased the message capacity of the VP-701 Voice Messenger II answering device from 16 to 45 seconds. The device is compact and adds advanced auto-answer capabilities to any phone. This technology is solid-state and maintenance-free, with no cassettes, cartridges or moving parts of any kind.

Circle (363) on Reply Card

3-D graphics system

Chromatics has introduced the CX-II 2-D and 3-D high-speed, high-resolution color graphic systems. Both the 2-D and 3-D models offer 1,536 x 1,152 display resolution on a 60Hz, non-interlaced monitor, driven by a 13-board, high-performance graphics engine. The 2-D configuration includes 4Mbytes of display-list memory, eight planes of double-buffered memory and text overlay, and a Sun- and Unix-based GKS software library. The 3-D system provides a shading processor and CX3D microcode and firmware with a 2Mbyte display-list memory, an 8-plane, double-buffer memory and text overlay. It runs VAX/VMS-based CX3D, C and FORTRAN. Both configurations also include 15-foot VAX cables and a choice of trackball, digitizer tablet or joystick.

Circle (364) on Reply Card

Isolation transformer

Cetec Raymer has introduced the TL-600, a 600Ω to 600Ω audio isolation transformer that can be used in 1-way or 2-way audio circuits because either winding can be used as primary or secondary. One winding is split to allow an alternate impedance match of 600Ω to two 300Ω circuits; or 600Ω to a single 150Ω circuit. Screw terminals are used.

Circle (365) on Reply Card

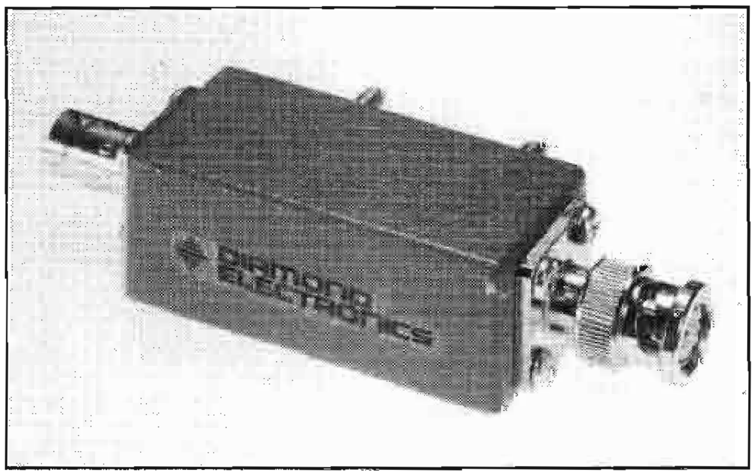
Mixing consoles

The *Creative Marketing Group* has introduced the 10x4x8, a 10-input, 4-bus, 8-monitor, rack-mount or desktop console. Features include: selectable mic and line input, 48V phantom power, 3-band equalization with switchable high and low frequency and sweepable midrange control. A post EQ, prefade insert point, mute, PFL switches and overload indicators complement the input module. Four auxilliary sends per channel switchable prepost in pairs are standard and eight monitor/FX returns are provided with equalization.

Circle (366) on Reply Card

Lightning surge protector

Diamond Electronics has announced the DE-LSP video surge protector that protects video equipment against induced transients from lightning. This in-line device is designed with extremely low capacitance circuitry. The protector comes with external ground connections for extra protection against high-potential surges from chassis ground to earth ground. The device is designed for a surge discharge current rating of 5kA.



Circle (367) on Reply Card

Multi-image display system

Delcom has introduced the Delcom Video Wall, a video-based multi-image display system using frame-store technology. It is capable of incorporating up to 768 monitors in an individual display. The video wall can be programmed in MS DOS in a wide variety of computers, including IBM, Apple and Hewlett-Packard. It also is available in PAL, SECAM and NTSC configurations. The unit can accept live, computer, tape or disc feeds, and uses frame-store technology to distribute the digitized signal to monitors.

Circle (368) on Reply Card

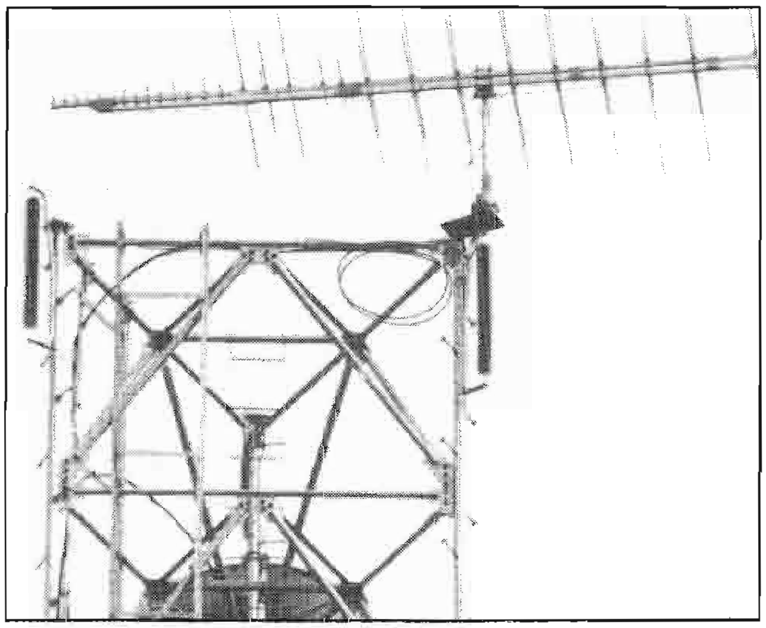
FM deviation meter

FM Systems has announced the ADM-1 FM deviation meter. It measures the peak deviation of actual program audio as well as test tones and holds the highest peak deviation reading until reset. The digital meter can read up to 199.9kHz deviation in positive peak, negative peak and peak-to-peak deviation. Measurement accuracy is ±0.5% when measuring TV audio at ±25kHz. The meter also can detect distortion in the TV channel modulator by measuring the difference between positive and negative deviation when modulating with a sine wave.

Circle (369) on Reply Card

Lightning prevention system

Lightning Prevention Systems has introduced the ALS-3000 lightning prevention system. It removes the lightning-attractive charge from the protected structure, rendering that structure virtually invisible to lightning. It is a flexible system that can be adapted to any type of tall structure where lightning protection is desired. All arrays, related parts and mounting hardware are made of high-grade stainless steel and anodized aluminum.



Circle (370) on Reply Card

Uninterruptible power systems

RTE Deltec has announced the addition of 8kVA and 10kVA models to complement its 7000 series uninterruptible power system product line. The systems assure on-line, regulated, continuous single-phase ac power for computers and other critical equipment. The models share the same streamline cabinet as the 3kVA and 5kVA models. Batteries are available in battery enclosures. LED status indicators, digital readout, a static transfer switch and a manual bypass switch are standard features. In addition, the 8kVA and 10kVA models have multiple-tapped inputs and outputs.

Circle (371) on Reply Card

Sound effects package

Pristine Systems has announced its Sound Effects Manager package. It interfaces an IBM PC/XT/AT or compatible computer with the Sony 60 disc CD changer. The package features the capability to retrieve and trigger sound effects from CDs and other sources listed in the database. It can create and execute edit decision lists. It also has the capability to generate a listing of what effects were used for what program, the source they came from and what track they were assigned to.

Circle (372) on Reply Card

Character generator

Sigma Consultants has introduced the Videoscribe 600, a combination slate, countdown and character generator. The unit has an internal sync generator, gen-lock, flashing characters, automatic word wrap, plus a 99-page memory with full random access and battery backup, a 10 to two countdown with automatic switch to external video at zero, a built-in clock that runs in either a 12-hour or a 24-hour mode, and a prompter roll at 99 different speeds.

Circle (373) on Reply Card

Wireless headset interconnect

Swintek has introduced the MARK 200D/C series of wireless interconnect to be used with 2-channel hardwired intercoms. The series uses the high VHF FM band between 150MHz to 240MHz to eliminate hum bars being introduced into video recorders. The series also incorporates db-s, audio scaling and a signal-processing technique.

Circle (374) on Reply Card

Digital effects software

Quantel has introduced V3 software for the Encore digital effects system.

Circle (375) on Reply Card

Professional services

VIR JAMES P.C.
CONSULTING ENGINEERS
Applications and Field Engineering
Computerized Frequency Surveys
3137 W. Kentucky Ave. – 80219
(303) 937-1900
DENVER, COLORADO
Member AFCCE & NAB

Alpha Tower Design, Inc.
901 Waterfall Way, Richardson, Texas 75080
214-783-2578
STRUCTURAL ENGINEERS SPECIALIZING IN TOWER DESIGN REGISTERED TO PRACTICE IN 49 STATES ... THREE DIMENSIONAL COMPUTER ANALYSIS WITH LATEST DESIGN TECHNOLOGY ... INSPECTION & REVIEW TOWER MODIFICATIONS

EVANS ASSOCIATES
CONSULTING TELECOMMUNICATIONS ENGINEERS
AM-FM-TV-CATV-ITFS-LPTV SATELLITE
216 N. Green Bay Road
Thiensville, Wisconsin 53092
Phone: (414) 242-6000 Member AFCCE

FCC ON-LINE DATABASE
dataworld®
Allocation/Terrain Studies
AM • FM • TV • LPTV • ITFS
P.O. Box 30730
Bethesda, MD 20814
(301) 652-8822 1-800—368-5754

D. L. MARKLEY
& Associates, Inc.
CONSULTING ENGINEERS
2401 West Moss Ave.
Peoria, Illinois 61604
(309) 673-7511
Member AFCCE

CHIPS DAVIS
LEDE DESIGNS, INC.
Acoustics for Stereo
Facility Design
Consultation
(415) 459-2888

TEKNIMAX
TELECOMMUNICATIONS
DENNIS R. CIAPURA
PRESIDENT
11385 FORESTVIEW LN.
SAN DIEGO, CA 92131 (619) 695-2429

SMITH and POWSTENKO
Broadcasting and Telecommunications
Consultants
2033 M Street N.W., Suite 600
Washington, D. C. 20036
(202) 293-7742

BLAIR BENSON
Engineering Consultant
TV Systems Design and Operation
23 Park Lane
Norwalk, CT 06854
203-838-9049

R.J. GRANDMAISON, P.E.
CONSULTING ENGINEER
Applications and Rulemakings
11213 Split Rail Lane
Fairfax Station, VA 22039
(703) 764-0513
Member AFCCE

JOHN H. BATTISON PE.
CONSULTING BROADCAST ENGINEER,
FCC APPLICATIONS AM, FM, TV, LPTV
Antenna Design, Proofs, Fieldwork
890 Clubview Blvd. North
Columbus, Ohio 43085
614/888-3364

Robert J. Nissen
THE NISSEN GROUP, INC.
Communications Technology Consultants
32 Ridge Drive • Port Washington, New York 11050
(516) 944-5477

BROADCASTING CONSULTANTS
AND ENGINEERS
- FCC Applications and Field Engineering
- Frequency Searches and Coordination
- Tower Erection and Maintenance
- Facility Design and Construction

Contact:
KENNETH W. HOEHN
23400 Michigan Avenue
Dearborn, MI 48124
Teletech, Inc.
Communications Engineering Specialists
(313) 562-6873

SELLMEYER & KRAMER, INC.
CONSULTING ENGINEERS
Steve Kramer, P.E. (214) 548-8244
Jack Sellmeyer, P.E. (214) 542-2056
AM FM TV MDS ITFS LPTV CATV
APPLICATIONS • FIELD ENGINEERING
P.O. Box 841 McKinney, TX 75069

ERIC NEIL ANGEVINE, P.E.
consultant in acoustics
specializing in broadcast studio acoustics
910 Lakeridge Drive Stillwater, OK 74075
405-624-6043 405-372-3949

ATT: CHIEF ENGINEERS
broadcast video maintenance
LUNAR VIDEO LTD.
FAST TURNAROUND ON ENG, EFP, EDIT SYSTEMS, MONITORS, TEST EQUIP. SONY, JVC, PANASONIC, TEKTRONIX – UPS & AIR FREIGHT. PU/DEL DAILY.
CALL COLLECT
138 E. 26th St, NYC (212) 686-4802

Consultation Services
Lightning · Power Conditioning · Grounding
Over 40 years experience, work guaranteed
Roy Carpenter
President
Lightning Eliminators and Consultants
13007 Lakeland Rd., Santa Fe Springs, CA 90670
(213) 946-6886 TWX 910-586-1381

PATCHPRINTS Video Tie Lines In 1 2 Aux 1 2 Mon A B
Custom Patch Bay Labeling for the Audio/Video Industries
By
PATCH BAY DESIGNATION COMPANY
Div. of Glendale Rubber Stamp & Printing Co., Inc.
CHARLIE SCHUFER
P.O. Box 6278, Glendale, CA 91205
4742 San Fernando Road
Glendale, CA 91204
Telephone
(818) 241-5585

ENG SERVICE
Bill Nelson
Chief Engineer
V T R Associates, Inc.
Prompt TURNAROUND on
¾" editors, color ENG cameras.
3023 Holiday Drive, S.W.
Huntsville, AL 35805
Phone
(205) 533-0571

UNUSED
CALL LETTERS
CALL
dataworld®
1-800—368-5754

TOWER DESIGN AND
FABRICATION, INC.
TOWERS, ANTENNAS, STRUCTURES
New Tall Towers, Existing Towers
Studies, Analysis, Design Modifications,
Inspections, Erection, Etc.
Rt. 1, Box 33AA,
Sturgeon, MO 65284 (314) 687-3932

Run your business card here.
Only $65 per insertion.
Frequency discounts available.
Call (913) 888-4664.

Engineering Consultant
- Video Systems Design
- Computer Graphics
- Automation
- Editing
- Production

Gene De Santis
181 Long Hill Rd.
Little Falls, NJ 07424
201-256-8141

MAILING LABELS AM, FM & TV
- Personalized to Manager, Engineer or Program Director.
- Pre-sorted by Zip Code.
- Market selection.
- Accurate.
- $40.00 per 1,000

StationBase
P.O. Box 24092
Phoenix, AZ 85282
(206) 385-3029 or (602) 899-8916

Classified

Advertising rates in Classified Section are $1.50 per word, each insertion, and must be accompanied by payment to insure publication.

Each initial or abbreviation counts a full word. Minimum classified charge, $35.00.

For ads on which replies are sent to us for forwarding (blind ads), there is an additional charge of $35.00 per insertion, to cover department number, processing of replies, and mailing costs.

Classified columns are not open to advertising of any products regularly produced by manufacturers unless used and no longer owned by the manufacturer or distributor.

TRAINING

ELECTRONICS DEGREE by correspondence. Earn Associate, then Bachelor's. NHSC accredited. Free catalog. Write Grantham College of Engineering, Dept. EE-5, 10570 Humbolt St., Los Alamitos, CA 90720. 8-82-tfn

FCC GENERAL RADIOTELEPHONE operators license through cassette recorded lessons at home plus one week seminar in Boston, Washington, Detroit or Philadelphia. Our twentieth year teaching FCC license courses. Bob Johnson Radio License Preparation, 1201 Ninth, Manhattan Beach, Calif. 90266, Telephone (213) 379-4461. 8-81-tfn

SERVICES

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

TRANSMITTER TUBE REBUILDING SINCE 1941: 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS INC., Rt. 7, Box 628, Covington, LA 70433. (504) 893-1243 or (800) 624-7626. 6-79-tfn

FOR SALE

RCA COLOR TELECINE SYSTEM, New/unused. To include: TK-66, color camera, TP-66, 16mm telecine projector, TP-7, 35mm slide projector, TP-55B, camera multiplexer. Write to: P.O. Box 23555-273, San Diego, CA 92123. 1-86-tfn

TRANSMITTERS. Need a standby transmitter? M/W? Want to get on the air but can't afford state-of-the-art equipment? Have a look at these tried-and-true oldies, then give us a call. Most are still in service and scheduled to be replaced by the end of 1987 or early 1988. As is, where is: TV/CBE/25KW/4TTC90D1S, C/W RCA/CTM-10 EXCITER; 5TX'S/TV/RCA/2KW/TT-2BH; TV/RCA/250W/TTL-200H; TENS IN PARALLEL/FM/RCA/BTF-20D; AM/10KW/GATES/BC-10P; AM/40W/MCCURDY/RRT-3; 3 UNITS/M/W/RATHEON/KTR2/7GHZ. Canadian Broadcasting Corporation, 7925 Cote St., Luc Road, Montreal, Quebec, H4W 1R5, Canada, Tel. 514-495-5583, Attn: D. Uttaro. 8-87-3t

DYNAIR SYSTEM 21 ROUTING SWITCHER. Frames, Modules, Power Supplies, Controllers, Cables. Wired 100 by 90 Video, stuffed 50 by 60, wired 200 by 50 Audio, stuffed 70 by 50. Will piece out or divide. Call for complete list and details. Steve McNeal, 817-267-4211 or 267-4717. 8-87-3t

TWO – QUAD VIDEOTAPE RECORDERS (TR70C and TR600A) VTR's are used, but in excellent condition. Complete with tech manuals and spare heads. Write or call In Touch Ministries, 796 W. Peachtree St., NW, Atlanta, GA 30308, (404) 347-8270. 9-87-1t

CMX EDGE A/B roll editor. Interfaces for Betacam and BVU-800 2½ years old. $5750. Call David 202-722-6101. 9-87-1t

TEKTRONIX 1410R NTSC Sync & Test Generator. With SPG2, TSG3, TSG5, TSG6 & TSG7. Like new $6950. T. Hopkins, Cape Fear Enterprises, Rt. 1, Box 269-A, Faison, NC 28341. (919) 594-0172. 9-87-1t

R.C.A. brand new from factory, 16 mm Telecine Projectors, TP-66 with R/C and lens. Call Mr. Frank N. Bovino, S.B. Video, 210-489-6358. 9-87-1t

WANTED TO BUY

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

WANTED: WW-II German and Japanese radio equipment. Unused US Navy and Signal Corps radio equipment before 1943. Pre-1923 radio equipment and tubes. August J. Link, Surcom Associates Inc., 305 Wisconsin Ave., Oceanside, CA 92054, (619) 722-6162. 7-86-tf

HELP WANTED

CHIEF ENGINEER for AM DA-2 and Class B FM. Variety of equipment including remote studio unit. Job requires electronic maintenance, orderly record keeping, and ability to instruct personnel on proper use of equipment. Beginners okay if able to learn quickly, EOE. Reply to: Engineer, WFMD/WFRE, Box 151, Frederick, Md. 21701. 9-87-1t

CHIEF ENGINEER: Rare opportunity for experienced person with extensive audio and FM/AM transmitter background to take charge of the technical operations of our Louisville, Kentucky CHR giant. Must have DA experience. Good salary and benefits. Send resume, references, and salary history to: Great Trails Broadcasting, Corporate Director of Engineering, 717 East David Road, Dayton, Ohio 45428. EOE. 9-87-1t

TELEVISION HELP WANTED TECHNICAL: Wanted, T.V. Maintenance Technician. CBS, Greenville, MS. Good company and benefits. Need technician with heavy experience with TCR-100's, AVR-2 and other quad VTR's. Send resume to WXVT, 3015 E. Reed Rd., Greenville, MS 38703 or call (601) 334-1500. Reply to Joe Macione, Gen. Mgr. EOE. 9-87-1t

ENGINEER. NEW YORK METRO AREA: Mobile TV Production Company has opening for person experienced in mobile operations and maintenance. Send resume or call: V.P. Sales, MHS Video Services, 240 South Dean St., Englewood, N.J. 07631, (201) 569-9567 or (212) 753-6027. 9-87-1t

ENGINEER WANTED – WYNR/WPIQ (Class 3 & C), Brunswick, Ga. Coastal Georgia. Main base Brunswick w/occasional travel among 3 other group properties (all AM/FM). Salary based on your ability and ours. Contact: Dick Boekeloo (912) 264-6251. 9-87-1

MAINTENANCE ENGINEER. Major Los Angeles area Production/Post-Production facility seeks person with strong background in repair and maintenance of post-production equipment and systems, including: Ampex VPRs, ADO, CMX 3400, Chyron, and Bosch telecine. Salary commensurate with experience. Call Albert Cerone, 213-823-8622. 9-87-1t

VIDEOTAPE EDITOR: Full service post-production company seeks full time post editor for CMX 3600, ADO, A-62, VPR-3, on-line and off-line. Computer graphics experience helpful. Resume to: Scene Three, 1813 Eighth Avenue South, Nashville, TN 37203. Attn: Joe Askins, (615) 385-2820. 9-87-1t

NEEDED IMMEDIATELY – Television Broadcast Engineer to assist in the design and construction of television facilities in the southeast. Prefer young, talented individual willing to travel without family responsibility. Must be highly motivated, have FCC license and capable of RF and studio installations. Will train on CAD. Salary negotiable. Send complete resume with references to: Chamberlain-Koch, Box 556, Lexington, NC 27293. 8-87-2t

MAINTENANCE ENGINEER: Come work in a fast growing Central Florida market. We're looking for a self-starter who can approach problems with a professional engineering attitude. Applicant should have prior experience in all areas of studio maintenance. Expert knowledge is needed in all tape machine formats as well as state of the art microprocessor based equipment. Salary commensurate with experience. E.O.E. Send resume to: Barry Edwards, WESH-TV, P.O. Box 7697, Orlando, FL 32854. 8-87-2t

TV PRODUCER/DIRECTOR/STATION MANAGER. Requires: BA degree in Communications and Broadcasting with experience in education video production. Must be familiar with supporting areas of production and low power transmissions; be able to work with clients and supervise personnel. Salary $17,000-$21,000. Liberal benefits. Submit: resume, three letters of reference and video of production samples, ¾" U or VHS (to be returned) to: Dr. Jerrilee Mosier, Division Chair, Instructional Support, Butler County Community College, 901 S. Haverhill Road, El Dorado, Kansas 67042. Applications **must** be received by October 15, 1987. An equal access/equal opportunity community college. 9-87-1t

MAINTENANCE ENGINEER: Position available immediately for FCC licensed engineer. Must be experienced in troubleshooting digital and analog circuitry to the component level. VTR/VCR maintenance experience desireable. Contact: Chief engineer, KDRV-TV, 1090 Knutson Ave., Medford, Oregon, 97504. EOE. 9-87-1t

ELECTRICAL ENGINEER specializing in high speed digital storage, A/D conversion, and digital processing. Area of application will be in video standards conversion and sync generation. Successful candidate will have excellent references and educational background. Send resume to Attn: B-2, P.O. Box 93176, Los Angeles, CA 90093. 9-87-1t

ELECTRICAL ENGINEER specializing in RF and video analog applications. Experience required in circuit design, equipment modification, and applications engineering. Knowledge of television, computers, and CRTs required. Successful candidate will have excellent references and educational background. Send resume to P.O. Box 93176, Attn: B-1, Los Angeles, CA 90093. 9-87-1t

POSITION WANTED

DIRECTOR OF ENGINEERING/CHIEF: Energetic, dedicated engineering leader with BSEE, 20 years experience. Background includes hands-on maintenance to administration. Seeks management position with group or progressive broadcaster. Broadcast Engineering, P.O. Box 12901, Dept. 684, Overland Park, KS 66212. 9-87-1t

Advertising sales offices

CHICAGO, ILLINOIS
Tom Nilsen
Telephone: (312) 435-2361
Telefax: (312) 922-1408
55 East Jackson
Ste. 1100
Chicago, IL 60604

NEW YORK, NEW YORK
Diane Gottlieb-Klusner
Telephone: (212) 702-3404
Telefax: (212) 702-7802
Josh Gordon
Telephone: (212) 702-3405
Telefax: (212) 702-7802
866 Third Ave.
New York, NY 10022

SANTA MONICA, CALIFORNIA
Herbert A. Schiff
Telephone (213) 393-9285
Jason Perlman
Telephone (213) 458-9987
Chris Woodbury-Leonard
Telephone (213) 451-8695
Schiff & Associates
501 Santa Monica Blvd., Ste. 504
Santa Monica, CA 90401

NORWOOD, AUSTRALIA
Hastwell, Williamson, Rouse Pty. Ltd.
P.O. Box 419
Norwood 5067, Australia
Telephone: 332-3322
Telex: AA87113

LONDON, ENGLAND
Nicholas McGeachin
Intertec Publishing Corp.
Roseleigh House
New Street
Deddington
Oxford OX5 4SP
England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex: 837469 BES G

TOKYO, JAPAN
Haruki Hirayama
EMS, Inc.
Sagami Bldg., 4-2-21, Shinjuku
Shinjuku-ku, Tokyo 160, Japan
Telephone: (03) 350-5666
Cable: EMSINCPERIOD
Telex: 2322520 EMSINCJ

Ad index

	Page Number	Reader Service Number	Advertiser Hotline
Abekas Video Systems	41	25	415/571-1711
ADM Technology, Inc.	IFC	1	313/524-2100
Adrienne Electronics Corp.	140	102	800/782-2321
AEG Corp. Aktiengesellschaft	85	54	416/683-8200
Alden Electronics	101	70	617/366-8851
Alpha Audio	117	75	804/358-3852
Amber Electro Design Inc.	75	46	514/735-4105
Amek Systems and Controls Ltd.	93	68	
Amperex Electronic Corp.	109	78	800/227-1613
Ampex Corp. (AVSD)	80-81	50	415/367-2911
Ampex Corp. (MTD)	79	49	415/367-2911
Arrakis Systems, Inc.	21	14	303/224-2248
Audio Technologies Inc.	60	42	215/443-0330
Audio-Technica U.S., Inc.	136-137	92	215/443-0330
Auditronics, Inc.	55	38	901/362-1350
Belar Electronics Laboratory Inc.	142	106	215/687-5550
Benchmark Media Systems	141	104	315/452-0400
Broadcast Video Systems Ltd.	142	105	416/764-1584
BSM Broadcast Systems, Inc.	107	76	509/838-0110
BTS Broadcast Television Systems	37	22	801/972-8000
Canare Cable, Inc.	74	45	818/840-0993
Centro Corp.	43	27	619/560-1578
Cetec Vega	128	87	818/442-0782
Cipher Digital, Inc.	38	23	301/695-0200
Circuit Research Labs, Inc.	13	10	800/535-7648
Clear-Com Intercom Systems	54	36	415/861-6666
Comrex Corp.	135	89	617/443-8811
Continental Electronics, Div. of Varian	101	71	214/381-7161
Datatek, Inc.	5	6	201/654-8100
DBX	45	29	800/525-7000
Dialight Corporation	87	56	201/223-9400
Dictaphone Corp.	98	67	800/431-1708
Digital Video Systems	106	93	416/299-6888
Dyer Electronics, Inc.	144	108	313/349-7910
ESE	143	107	914/592-6050
Express Tower Co.	118	40	918/479-6484
Garner Industries	112	85	800/228-0275
Gentner	42	26	408/926-3400
Graham-Patten Systems Inc.	78	48	800/547-2489
Grass Valley Group, Inc.	9	8	916/273-8421
Gray Engineering Laboratories	134	96	912/883-2121
Hitachi Denshi America Ltd.	3	5	800/645-7510
HM Electronics	63	44	619/578-8300
Howe Audio	51	34	800/525-7520
Ikegami Electronics Inc.	65-72, 72A-72B	150	201/368-9171
Image Video Ltd.	133	91	416/438-3940
Intergroup Video Systems, Inc.	121	86	800/874-7590
JamPro Antennas Inc.	50	28	916/383-1177
Jensen Transformers Inc.	140	100	213/876-0059
Leitch Video of America	59	41	804/424-7290
3M Magnetic Tape	56-57	39	800/328-1684
Magna-Tech Electronics Co., Inc.	91	60	212/586-7240
Matthews Studio Equipment	106	94	818/843-6715
McCurdy Radio Industries	36	21	416/751-6262
MCL, Inc.	119	84	312/759-9500
Microdyne Corp.	83	52	904/687-4633
Micron Audio Products Ltd.	100	69	914/761-6520
Midwest Communications Corp.	1	4	800/543-1584
Monroe Electronics, Inc.	92	61	312/358-3330
Moseley Associates Inc.	46	30	806/968-9621
Mosses and Mitchell Ltd.	97	66	
NEC Corp.	89	58	800/323-6656
New England Digital	39	24	212/977-4510
Opamp Labs Inc.	140	98	213/934-3566
Orban Associates Inc.	7	7	800/227-4498
Orban Associates Inc.	17	12	800/227-4498
Otari Corp.	15	11	415/592-8311
Otari Corp.	123	88	415/592-8311
Panasonic Broadcast Systems Co.	110-111	79	201/348-7336
Philips Test and Measuring Instruments	105	73	201/529-3800
Potomac Instruments	48	32	301/589-2662
QEI	19	13	800/334-9154
Rank Cintel	99	63	312/297-7720
ROH	134	95	800/262-4671
RTS Systems, Inc.	82	51	818/843-7022
Sachtler Corp. of America	53	35	516/867-4900
Schneider Corporation	27	16	714/631-7430
Sharp Electronics Corp.	76-77	47	201/529-8731
Shure Brothers Inc	11	9	312/866-2553
Shure Brothers Inc.	113	80	312/866-2553
Sierra Video Systems	117	74	916/273-9331
Sitler's Inc.	140	99	800/426-3938
Solid State Logic Ltd.	49	33	212/315-1111
Sony Corp. of America (A/V & Pro Aud)	24-25	15	800/662-SONY
Sony Corp. of America (A/V & Pro Video)	47	31	800/662-SONY
Sony Mag. Tape Div.	33	19	800/662-SONY
Southern Broadcasting Systems Ltd.	103	72	
Standard Tape Laboratory, Inc.	140	97	415/786-3546
Stanton Magnetics	120	90	212/445-0063
Studer Revox America Inc.	35	20	615/254-5651
Surcom Associates Inc.	92	62	619/722-6162
Swintek Telecommunications Div.	54	37	408/378-8091
Switchcraft Inc.	61	43	312/792-2700
TASCAM Dic. Teac Corp. of America	84	53	213/727-0303
TASCAM Div. Teac Corp. of America	86	55	213/726-0303
TASCAM Div. Teac Corp. of America	88	57	213/726-0303
TASCAM Div. Teac Corp. of America	90	59	213/726-0303
Tektronix Inc.	28-29	17	800/452-1877
Telex Communications, Inc.	94	64	612/887-5550
Trimm Inc.	108	77	312/362-3700
Ultimatte Corp.	115	82	818/345-5525
Utah Scientific Inc.	31	18	800/453-8782
Videotek, Inc.	115	81	602/997-7523
Ward-Beck Systems Ltd.	BC		416/438-6550
Wheatstone Corporation	IBC	2	203/393-0887
Winsted Corp.	141	103	800/328-2962
Yamaha International Corp.	95	65	

Nobody does it better!

Ward-Beck's all-new D8212 Audio Distribution System is totally transparent! Absolutely nothing else on the market today can compare for precision, performance, packaging or price!

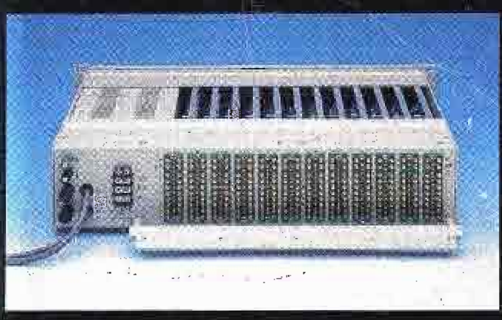
Check these features:

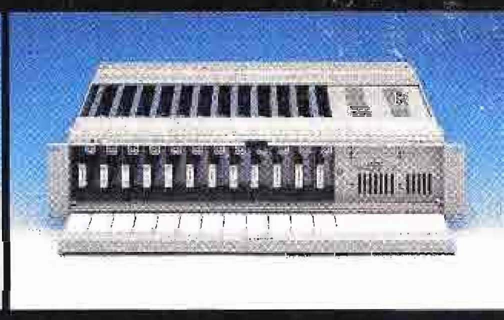
- Twelve high-performance modular DAs each with 8 outputs.
- Dual switch-mode power supplies.
- $3^{1}/_{2}$" rack mounting frame.
- Unique hinged/quick-release front panel.
- Gold-plated terminals throughout.
- Integral typewriter designation strip.
- Unmatched overall performance specifications.
- Renowned Ward-Beck Reliability and Quality.
- Priced right.

WBS

First by Design.

The Ward-Beck D8212 System – An Investment in Quality!





Ward-Beck Systems Ltd., 841 Progress Avenue, Scarborough, Ontario, Canada M1H 2X4. Tel: (416)438-6550 Tlx: 065-25399.