

# BROADCAST<sup>®</sup> engineering

November 1986/\$3

Maintenance  
special  
issue

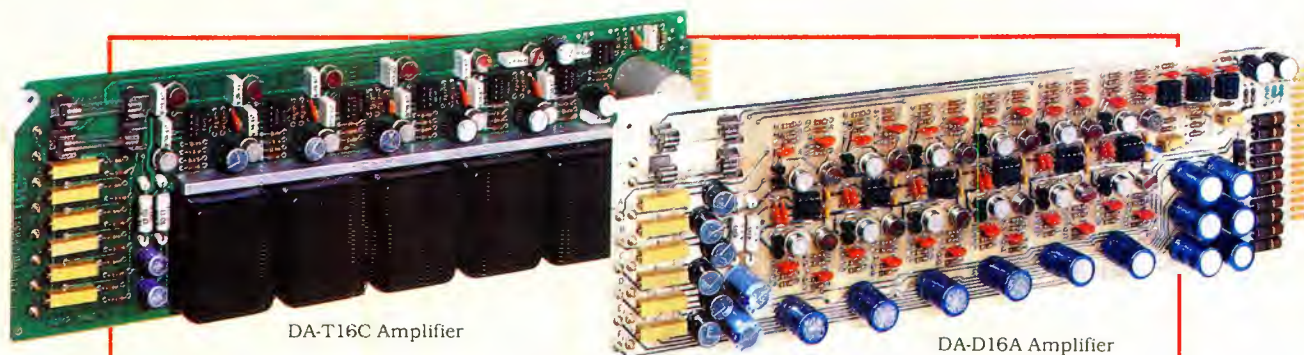


Selecting  
digital  
multimeters



# With ADM<sup>®</sup>, You Get Audio Distribution Your Way.

Transformer...or...Differential



DA-T16C Amplifier

DA-D16A Amplifier

...and One Great Frame Houses Both.



CH-20C Frame

Whichever you prefer — transformer or differential — you get a superb Audio Distribution system with ADM.

Both amplifiers are one-input, six-output cards. Each has an ultra low noise level with distortion less than .1% at +24dBm. Each has 6 individual front panel gain adjustments and 6 individual test points for audio outputs.

Up to six of either amplifier can be interchangeably housed in our CH20C rack frame,

which includes a redundant power supply with automatic changeover.

Both have exceptionally high reliability backed by ADM's five-year unconditional warranty. So take your choice. You get a great system either way.

For more information, contact:  
ADM Technology, Inc., — *The Audio Company*  
— 1626 E. Big Beaver Road, Troy, MI 48084.  
Phone (313) 524-2100. TLX23-1114.

**ADM<sup>®</sup>**  
*The Audio Company*

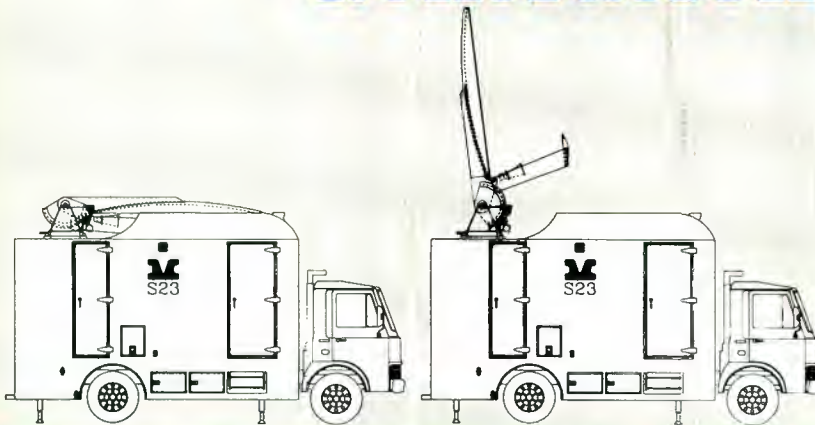
Circle (1) on Reply Card



# Mobile Satellite News Systems



## — The Second Generation



At the 1986 NAB Show in Dallas, Midwest ushered in the **SECOND GENERATION** of Mobile Satellite News Systems, the S-18... featuring the new Vertex 1.8M, Dual Reflector, Off-set Ku Antenna, specifically designed for this new service.

At the 1986 RTNDA Show in Salt Lake City, yet another Midwest innovation, the S-23, was introduced, featuring a 2.6M version of the Vertex Antenna, with 50 dbi Gain and 35db of Cross Polar Isolation.

For more information on this remarkable new antenna technology, Midwest's modular TWT Power Amplifier Systems, and other **SECOND GENERATION** innovations, call us at 800-543-1584.

|                                |                                  |                                  |                               |                                 |                                  |                                  |                                 |
|--------------------------------|----------------------------------|----------------------------------|-------------------------------|---------------------------------|----------------------------------|----------------------------------|---------------------------------|
| Cincinnati, OH<br>606-331-8990 | Toledo, OH<br>419-382-6860       | Grand Rapids, MI<br>616-796-5238 | Nashville, TN<br>615-255-2801 | Kansas City, KS<br>913-469-6810 | Roanoke, VA<br>703-980-2584      | Washington, D.C.<br>301-577-4903 | Tampa, FL<br>813-885-9308       |
| Columbus, OH<br>614-846-5552   | Pittsburgh, PA<br>412-364-6780   | Louisville, KY<br>502-491-2888   | Knoxville, TN<br>615-687-9515 | Atlanta, GA<br>404-875-3753     | Charlotte, NC<br>704-399-6336    | Baltimore, MD<br>301-665-9323    | Orlando, FL<br>305-898-1885     |
| Dayton, OH<br>513-435-3246     | Indianapolis, IN<br>317-872-2327 | Lexington, KY<br>606-277-4994    | Bristol, TN<br>615-968-2289   | Norfolk, VA<br>804-853-2600     | Raleigh, N.C.<br>919-850-9811    | Miami, FL<br>305-592-5355        | New Orleans, LA<br>504-542-5040 |
| Cleveland, OH<br>216-447-9745  | Detroit, MI<br>313-689-9730      | Charleston, WV<br>304-768-1252   | St. Louis, MO<br>314-569-2240 | Richmond, VA<br>804-262-5788    | Greenville, S.C.<br>803-226-9259 | Jacksonville, FL<br>904-642-8368 | Seattle, WA<br>206-232-3550     |



**MIDWEST**  
Communications Corp.

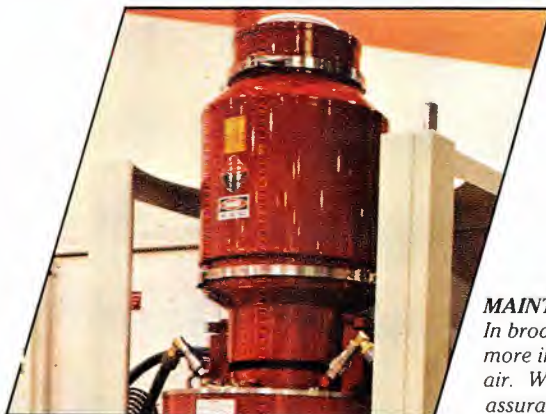
One Sperti Drive  
Edgewood, KY 41017

Circle (3) on Reply Card

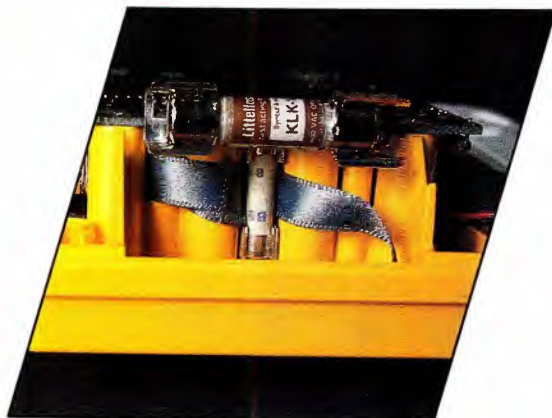


# Contents

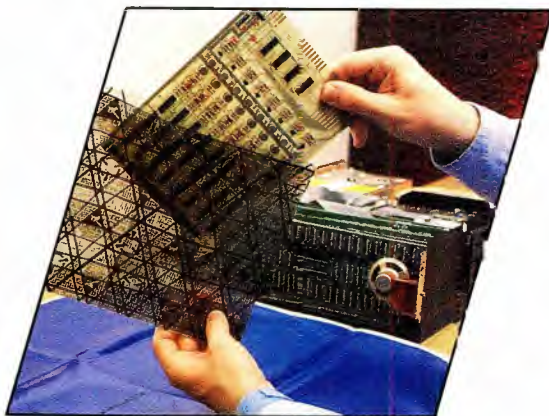
November 1985 • Volume 28 • Number 11



Page 24



Page 104



Page 120

## ON THE COVER

Station maintenance is an ongoing commitment that every engineer faces on a daily basis. It is a requirement that is as old as broadcasting itself. This issue—our third annual *Station Maintenance Special Issue*—examines how to keep the equipment at radio and TV stations operating properly. Shown on the cover is a portion of a high-voltage rectifier stack from a 30kW FM transmitter. (Equipment courtesy of Broadcast Electronics.)

# BROADCAST engineering

## MAINTENANCE SPECIAL ISSUE:

*In broadcasting, maintenance is job 1. There is no responsibility more important than keeping the equipment on-line and on the air. We examine critical areas of maintenance and quality assurance in our third annual Maintenance Special Issue.*

## 24 Preventing Transmitter Failures

By Jerry Whitaker, editorial director

The only thing that broadcasters have to sell is air time. And when you're off the air, you're dead in the water. This comprehensive report examines how to maintain transmission equipment to prevent—or at least minimize—downtime. The report is the product of years of hands-on experience by the author and consultation with respected RF experts. It is the most detailed analysis of transmitter maintenance ever published for the broadcast industry. The report examines the following specialized areas of concern:

- Routine Maintenance pg. 26
- Power Tubes pg. 46
- Preventing Failures pg. 64
- Temperature Control pg. 76
- Safety First pg. 88
- Comprehensive Preventive Maintenance pg. 94

## 96 Video Monitor Setup

By Joseph J. Kane Jr., Philips Professional Television

The video picture monitor is the primary means of confirming proper operation of the video system on a day-to-day basis. Setup of the monitor is, therefore, of critical importance.

## 104 Choosing a Digital Multimeter

By Patrick Chu, Beckman Industrial

The digital multimeter, once considered a luxury, is now standard equipment at most radio and TV stations. The selection of a new DMM requires a clear understanding of how the unit works and what it can do.

## 120 Getting a Handle on ESD

By Jess Kanarek, Wescorp

The threat to broadcast equipment posed by electrostatic discharge is increasing as the complexity and density of electronic systems increases. When repairing high-tech equipment, follow proper procedures to prevent ESD damage.

## DEPARTMENTS

- |                         |                                       |
|-------------------------|---------------------------------------|
| 4 News                  | 20 Management for Engineers           |
| 6 Editorial             | 22 SBE Update                         |
| 8 FCC Update            | 130 Field Report: Omni Logic analyzer |
| 10 Strictly TV          | 146 Applied Technology: Ampex Zeus    |
| 12 re: Radio            | 150 Station-to-Station                |
| 14 Satellite Technology | 154 1986 Technical Emmy Awards        |
| 16 Circuits             | 158 People                            |
| 18 Troubleshooting      | 160 Business                          |
|                         | 172 New Products                      |



# HITACHI INVENTS THE FIRST 1" VTR THAT WATCHES ITSELF SO YOU DON'T HAVE TO.

The revolutionary Hitachi HR-230 1" VTR has the most advanced real-time, self-diagnostic capabilities ever perfected.

In either the record or playback mode, a computer inside the HR-230 monitors 49 different performance parameters second by second. And then stores this information within the memory for recall at a later time—not just with numbers and symbols, but in words.

This means no more errors slip by when your operator is not there. And there's no more need for hit-or-miss spot checking.

The Hitachi HR-230 has a unique quick-threading tape path, incorporating retracting entrance and exit guides, main erase head, as well as a scanner air system that protects tapes.

It recues a 30-second segment in 3.5 seconds. It has a



fast/slow motion range that provides real-time reverse and field/frame still motion. Plus programmable time compression up to 20% with 0.1% accuracy.

A unique, concealed fold-out control panel groups editing functions and separates edit controls from the main control panel.

In short, it's the ultimate 1" for networks, affiliates or teleproduction companies. Don't consider your next 1" purchase without looking into it. Contact Hitachi Denshi America, Ltd., Broadcast and Professional Division, 175 Crossways Park West, Woodbury, NY 11797. (516) 921-7200 or (800) 645-7510. Hitachi Denshi Ltd. (Canada), 65 Melford Drive, Scarborough, Ontario M1B 2G6. (416) 299-5900.



Circle (4) on Reply Card



## SMPTE and SBE to form liaison

The Society of Motion Picture and Television Engineers and the Society of Broadcast Engineers have appointed liaison committees in an effort to establish a more formal and meaningful exchange of ideas.

Plans call for SMPTE and SBE to hold regular meetings, to exchange society literature and to promote the advantages of cross-membership.

M. Carlos Kennedy, SMPTE executive vice president, is chairman of the SMPTE liaison committee. Tom Weems, SBE director, will chair the SBE liaison committee.

The purposes of SMPTE and SBE are similar and parallel in their definitions and practices. The purpose of SMPTE, according to an excerpt from Article II of the society's constitution, is to "advance the engineering and technical aspects of the motion picture, television and the allied arts and sciences, and to gather, receive, prepare and disseminate scientific information concerning the motion picture, television and the allied arts and sciences." The purpose of SBE is "to dif-

fuse and increase operational and scientific knowledge in broadcast engineering, and to promote and advance the science of broadcast engineering and its allied arts, in both theoretical and practical applications."

Although SMPTE has many members in the film industry, the society has become involved in TV-related engineering activities over the past several years. The SBE serves the whole broadcast industry. Broadcast television is the primary crossover discipline between the two organizations. Other common areas include video and audio, as well as new and developing technologies.

## FCC receives request to review downgrade

The National Association of Broadcasters has asked the FCC to reassess its decision to reclassify or downgrade existing Class B and C FM stations that do not meet, or have not filed applications to meet, certain power and antenna height requirements by March 1, 1987.

In its filing, NAB said that without a rule change, these stations will be reclassified to achieve station diversity

goals that are already being met and, in the process, the commission will have abandoned several of its own fundamental communications policies.

The NAB pointed out that the commission's goal of diversity and increased service can be met, without delay, even if stations are not reclassified. It said implementation of Docket 80-90 (which created more than 600 new allotments and adopted new allocations rules that have allowed the filing of petitions to create hundreds of additional FM stations) plus plans to improve and expand the AM band, will provide additional radio service without requiring FM station downgrading.

NAB also said the commission's reclassification rule will destroy service currently enjoyed by many listeners and ignores the fact that many stations face significant obstacles in their attempts to upgrade their facilities.

It recommended that the commission begin an expedited review of the matter and issue temporary waivers to those stations making a good faith effort to upgrade, which would give the FCC additional time to revisit the rule and assess the need for reclassification.

*Continued on page 156*

## BROADCAST engineering

### EDITORIAL

Jerry Whitaker, *Editorial Director*  
Brad Dick, *Radio Technical Editor*  
Ned Soseman, *TV Technical Editor*  
Carl Bentz, *Special Projects Editor*  
Dan Torchia, *Group Managing Editor*  
Paula Janicke, *Associate Editor*  
Dawn Hightower, *Associate Editor*  
Pat Blanton, *Directory Editor*

### ART

Kristi Younger, *Graphic Designer*

### EDITORIAL CONSULTANTS

Fred Ampel, *Audio*  
Miguel Chivite, *International*  
Nils Conrad Persson, *Electronics*  
Tom Cook, *Video*  
Mel Lambert, *Professional Audio*

### BUSINESS

Cameron Bishop, *Group Vice President*  
Duane N. Hefner, *Publisher*  
Stephanie Fagan, *Promotions Manager*  
Cynthia Sedler, *Promotions Coordinator*  
Dee Unger, *Advertising Supervisor*  
Mary Birnbaum, *Advertising Coordinator*

Advertising sales offices listed in classified section.

### ADMINISTRATION

R. J. Hancock, *President*  
John C. Arnst, *Circulation Director*  
JoAnn DeSmet, *Circulation Manager*  
Kevin Callahan, *Art Director*  
Dee Manies, *Reader Correspondent*

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.

### TECHNICAL CONSULTANTS

Eric Neil Angevine, *Broadcast Acoustics*  
John H. Battison, *Antennas/Radiation*  
Blair Benson, *TV Technology*  
Dennis Ciapura, *Radio Technology*  
Dane E. Ericksen, *Systems Design*  
Howard T. Head, *FCC Rules*  
Wallace Johnson, *FCC/Bdct. Engineering*  
John Kean, *Subcarrier Technology*  
Donald L. Markley, *Transmission Facilities*  
Harry C. Martin, *Legal*  
Robert J. Nissen, *Studio/Communications*  
Hugh R. Paul, *International Engineering*  
Art Schneider, *A.C.E., Post-production*  
Elmer Smalling III, *Cable/Satellite Systems*  
Vincent Wasilewski, *Communications Law*

### MEMBER ORGANIZATIONS

Acoustical Society of America  
Society of Broadcast Engineers

Member,  
Association of Business Publishers  
Member,  
Business Publications  
Audit of Circulation



**SUBSCRIPTIONS: BROADCAST ENGINEERING** is mailed free to qualified persons within the United States and Canada in occupations described above. 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 28, No. 11 (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.

Photocopy rights: Permission to photocopy for internal or personal use is granted by Intertec Publishing Corporation for libraries and others registered with Copyright Clearance Center (CCC), provided the base fee of \$2.00 per copy of article is paid directly to CCC, 21 Congress St., Salem, MA 01970. Special requests should be addressed to Cameron Bishop, group vice president. ISSN 0007 1794 \$2.00 + \$0.00.

©1986. All rights reserved.

Advertising offices on page 196.





# LEADER



## Goodbye old standard!

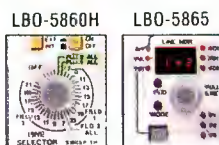
Leader's new LBO-5860B Half-Rack Waveform Monitor delivers all its features for \$590\* less!

As good as you were, old standard, your time has passed—The Leader LBO-5860B is better because it's easier to use and delivers all your features for only \$1,740 list. In fact, among the top-quality units available today, it has the lowest cost.

### The LBO-5860B sets new standards.

Compare the LBO-5860B to any other half-rack unit—be it the Tek<sup>1</sup> 1730 which lists for \$2250\*, or even the old standard, Tek<sup>1</sup> 528A, at \$2,330\*. You'll agree the high-performance LBO-5860B has no equal in ease of use and value:

- RGB at no extra cost; optional YRGB • Rack-mounts alongside LVS-5850B or any other half-



LBO-5860H allows selection of lines 7 to 21. LBO 5865, designed for camera and pickup device testing offers full 525-line selection with memory preset/recall of any three lines.

- rack vectorscope • Bright, PDA CRT with internal, etched graticule
- 4 sweep speeds (2-line and 2-field displays, regular and expanded) • Flat response, IEEE and chroma filters
- Switchable dc restorer clamps blanking at zero IRE • Switchable internal/ext. sync • Excellent stability and reliability • PAL, SECAM and line selector (5860H) models available
- 2-year warranty.

### Raise your vectorscope standards.

LVS-5850B reduced \$200 to only \$1,995.



- Easy to use
- Rack-mountable with LBO-5860B or any other half-rack waveform monitor
- Electronically generated CRT targets, and error limits • Electronic targets eliminate parallax and readout is independent of centering controls.



Buy both for \$3,735. Less than any other high-quality, half-rack pair.

Call toll-free  
**(800) 645-5104**  
In NY State  
**(516) 231-6900**

Ask for an evaluation unit, our latest Catalog, more information, or your nearest "Select" Leader Distributor.

For professionals who know the difference.

**LEADER**  
Instruments Corporation

380 Oser Avenue, Hauppauge, New York 11788  
Regional Offices:  
Chicago, Dallas, Los Angeles, Boston, Atlanta  
In Canada call Omnitronix Ltd. (514) 337-9500

\*All prices are manufacturer's suggested list prices as of 9/3/86. Actual savings may vary since prices are set by the retailer.

For Product Demonstration Circle (5) on Reply Card  
For Product Information Circle (6) on Reply Card

†Trademark of Tektronix



## The fun is gone?

I see an era passing that I feel should not go unnoted. Others could chronicle the event better than I, because they stood nearer the head of the line. They were the ones who taught me this business, and who have told me of those earlier days of broadcasting. This is in celebration of them.

A number of engineers across the United States charted the course of TV broadcasting. They ushered color, ENG, mobile units and studio automation to television as we know it today. They withstood the agonies of a fledgling industry, often keeping pictures on the air by sheer guts and ingenuity. Sometimes it was hair raising; at other times, gut wrenching; but it was fun.

These men arrived at work each morning, plagued with worries about cameras not firing up after the night's sojourn, about transmitters mysteriously failing, and about a million other major and minor catastrophes. These station basement inventors designed their own systems, with basic parts, often on shoestring budgets. These pioneers, with a drawing of the system burned into their minds, were on intimate terms with every piece of gear in the plant, having designed, modified, and/or installed it. They shared a common creed: *If it worked once, I'll make it work again.*

Dispatched to repair a unit with cryptic instructions to *make it work*, these jerry riggers found unparalleled satisfaction when the picture finally appeared. Each success was a chapter, and each chapter closed with the solving of the problem. Each day, challenging but hectic, was fun.

Perhaps the pioneering is done and the time has come for an MBA mentality to take over, to use the bottom line as its reference. Perhaps it's time to consider *will we still go on the air if we forego this?* Perhaps adequacy in a marketplace satisfied with the present product should supersede technical excellence. Perhaps television has progressed far enough and the harvest should begin.

Each industry undergoes a pioneering age when great strides are made by unlikely heroes. Chuck Yeager enveloped himself in the evolution of jet airplanes, finding his fun in breaking new ground and in the journey through the maze, but not in the final dissertation. He felt no yearning for automated space ships escorting him through the heavens, but rather, delighted in mastering his own fate.

Such were the TV titans, who designed and built the marvelous monstrosities that gave us pictures where none had been before. But could these creative minds elicit joy from pressing buttons or replacing chips? If they can't get their hands on it anymore, are they inclined to trace through a system mined with software and PROMs that render their tools ineffective? They begrudged few hardships and shrank from few challenges for the industry was tempered with their ideas of fun.

Times have changed the focus of their original commitment. Each day across this land a microprocessor will record one or more of these pioneers as they leave their stations. Some will be festooned with retirement gifts and gags; others will slip away silently, unceremoniously.

As the age of broadcast pioneers draws to a close, we must bid farewell to those who opened the Pandora's box of broadcast and set sail on a sea of microwaves. They leave behind mere specialists who know but parts of the system. (The early concepts have expanded beyond only the most imaginative of minds.) They (willingly?) bequeath the system to the minders of the money who feel secure that a picture will always arrive. After all, it was guaranteed by the signatures clearing the way to corporate possibilities, wasn't it?

Behind them, a redundancy of manufactured systems replaces one-of-a-kind fabrications. The evolutionary steps to modern television and the accompanying legacy of terrors (tales told by fireside) encountered, in blazing a trail through an electronic wilderness of valves and condensers, has given way to an advanced state-of-the-art (so they call it) industry. Hey, wait, you guys, don't take away all the fun!

!:->))))



## The Abekas A53-D Digital Special Effects System

The innovative tradition of Abekas continues with the A53-D—the most cost-effective, high-quality three-dimensional effects system available today.

In single or dual channel configuration, the A53-D gives you a full array of three-dimensional features. These include: perspective and 3D rotation, variable rotation axes and 3D locate, field/frame freeze and full manipulation of frozen pictures, variable border and background, crop and aspect change, A/B switch-

ing and GPI control, and smooth linear motion and trajectory with variable tension.

The A53-D makes good sense for both live broadcast and post-production applications. For broadcasting, the A53-D offers a simple-to-use control panel with fast access to 24 on-line effects. For post-production, the system's extensive programming features and precise control let you create intricate effects limited only by your imagination.

You can digitally interface the A53-D to the highly acclaimed Abekas A62 digital disk recorder.

This unique duo gives you the ability to composite unlimited layers of manipulated video without generation loss.

Let the A53-D add a whole new dimension to your bottom line, with unmatched price and performance. For details, contact: Abekas Video Systems, Inc., 353A Vintage Park Drive, Foster City, CA 94404 (415) 571-1711.

# Abekas

Video Systems, Inc.

Now Anything is Possible

Circle (7) on Reply Card

# ADD NEW DIMENSION TO YOUR BOTTOM LINE





## U.S./Mexican pact implemented

By Harry C. Martin



**A** new AM broadcasting agreement between the United States and Mexico was signed on Aug. 28, implementing the following long-awaited changes for daytimers:

- **Post-sunset authority:** All U.S. daytime-only AM stations that received post-sunset authority from the FCC last year now may operate for up to two hours past sunset with the power levels indicated in the FCC authorizations. No additional application or notification to the commission is necessary.
- **Use of Mexican clears:** The 300 stations that operated daytime-only on the Mexican clear channels now are authorized to operate on an unlimited time basis at the power levels indicated in show-cause orders sent to them by the commission last spring. Affected stations were required only to advise the commission in writing as to when nighttime operations would begin and to provide a brief technical description of how such operations would be conducted.

Use of the Mexican clears for new or improved facilities will be phased in over the next five years. For the next two years, until Aug. 27, 1988, the commission will accept applications for new full-time stations on the Mexican clear channels and for power increases by stations already operating on the Mexican clears. However, such applications filed prior to Aug. 27, 1991, may not specify nighttime power in excess of 500W and will not be afforded interference protection.

Beginning Aug. 28, 1988, the commission will accept applications by existing stations wishing to move to a Mexican clear if the applicant can show compliance with FCC interference standards. Therefore, stations operating on a Mexican clear channel that want to increase nighttime power should prepare and file their applications (for up to 500W) as soon as possible. Stations wishing to move to a Mexican clear will have to wait until August 1988 to apply.

Former daytime stations operating on the foreign clears, or stations seeking to

move to a foreign clear after the conclusion of the 2-year moratorium, will not be afforded nighttime protection during the 5-year phase-in period.

After Aug. 27, 1991, increased nighttime power on the Mexican clears of up to 1kW will be available, provided protection is given to all stations, including former daytime-only stations operating with a power of 250W or more at night.

### Fairness Doctrine scrutinized

In a decision involving the applicability of the Fairness Doctrine to teletext transmissions, the U.S. Court of Appeals for the District of Columbia Circuit ruled that the Fairness Doctrine is not mandated by Section 315 of the Communications Act (the "equal time" provision). This interpretation of Section 315 has long been advocated by broadcasters because of the authority it confers on the commission to exempt new technologies from the reach of the doctrine, or to repeal it altogether.

The Fairness Doctrine places an affirmative obligation on broadcasters to cover controversial issues of public importance in their communities and requires them to provide balanced treatment of such issues. Members of the commission, including Mark Fowler, chairman, have criticized the Fairness Doctrine on constitutional grounds. But the commission has stopped short of repealing the doctrine, in part because of the argument—now rejected by the court—that its enforcement is mandated by Congress.

In another case, the Court of Appeals heard arguments on Sept. 30 on the constitutionality of the Fairness Doctrine. The case involves appeals by broadcast news organizations of the commission's 1985 "Fairness Report," through which the commission announced it would continue to enforce the doctrine in spite of the agency's constitutional misgivings.

A court test of the constitutionality of the Fairness Doctrine may be delayed by Congress, however. An amendment to the commission's appropriations bill mandating reconsideration of the Fairness Doctrine came under Senate consideration in late September. Had the

bill been passed with the reconsideration language included, the commission again would have had to deliberate before the fate of the Fairness Doctrine would be ready for court review.

In any event, it appears the Fairness Doctrine's days are numbered. The scarcity argument, which long has provided the underpinning for the distinction justifying different treatment of broadcast and print media under the First Amendment, has been eroded by the development of program delivery technologies.

### VBI timetable eliminated

In early September, the commission eliminated its timetable for use of lines 10-14 for the transmission of teletext information using the TV vertical blanking interval (VBI).

The timetable was enacted in 1983 when there was concern that teletext signals could cause interference on some older TV receivers and was intended to allow for gradual replacement of such receivers. Having found that this purpose has been served, the commission eliminated its phasing-in procedure in order to satisfy the need for new and enhanced teletext services. This accelerates the time frame for full use of VBI by two years, and affords broadcasters greater flexibility in the use and development of teletext services.

The relaxation also applies to non-teletext uses of lines 10-14.

### Compelling need relaxed

In addressing petitions for reconsideration in its "omnibus" FM-channel allocation proceeding, the commission has ruled that petitions for new or changed FM allocations may propose substitutions in the Docket 80-90 table as long as such substitutions involve allotments for which the application filing window already has closed.

Previously, substitutions for Docket 80-90 assignments were permitted only upon a showing of compelling need. Under the new procedure, rulemaking petitions involving substitutions will be accepted provided the channel being proposed as a substitute meets the spacing requirements for all applied-for sites at the time the petition is filed.

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



# THE DUBNER FAMILY

**YOUR CHOICE FOR COMPATIBLE VIDEO GRAPHICS**

**CBG-2**

**TEXTA**

**20-K**

**10-K**

**DPS-1**

**CBG-2:** The head of the family. This Emmy award-winning graphics system combines the power of 3-D modeling with real-time animation playback, NTSC video painting and two channels of multi-feature character generation. A breakthrough product which has spawned a full spectrum of compatible products to meet the needs of every video user.

**TEXTA:** Bridges the gap between character generators and expensive animation systems. High quality graphics in medium priced single and dual channel configurations. Compatible with the CBG for exchanging advanced animations, graphics, and fonts.

**20-K and 10-K:** Low cost, full-function, real-time character generators featuring 16 million colors, linear keying, anti-aliased fonts, multiple effects and much, much more. And... animations or graphics created on a CBG or Texta can be played back.

**DPS-1:** A true NTSC video frame grabber/painting system. Incredibly advanced features for an unbelievably low price. Compatible with the "3rd plane" of the CBG-2LX.

Watch for new additions to the Dubner family: Multi-channel still store, more in the low price "K" series, dual channel options and exciting new products.

The Dubner Family of products. Compatible. Affordable. The Best.



**DUBNER**

DUBNER COMPUTER SYSTEMS, INC., 6 Forest Avenue, Paramus, N.Y. 07652 (201) 845-8900

A Grass Valley Group Company

Circle 61 on Reply Card

[www.americananimationhistory.com](http://www.americananimationhistory.com)

To find out more, contact your local Grass Valley Group representative or call Dubner at our spacious new facility.



## How to measure bandwidth

By Carl Bentz, special projects editor

**W**hy was the bandwidth of U.S. TV channels limited to 6MHz? Several factors were involved. Sufficient information for a reasonably good image can be contained within 6MHz. More channels were possible by limiting the bandwidth rather than allotting a larger spectrum per channel. At the time NTSC was being defined, simultaneously controlling the gain over a 6MHz band, although not exact, was possible at a reasonable cost.

Investigations into higher-definition TV systems have shown the bandwidth of the NTSC channel to be a stumbling block. Image definition is directly related to the frequency spectrum of the signal. Large areas result from luminance components of less than 1kHz, but fine detail could extend beyond 4MHz. In NTSC, detail greater than 4.2MHz is lost in bandwidth restriction. Typical home receivers cut the frequency down even more with designs for mass production of televisions at an economical price.

Because you can never recover more than you start with, the transmitter, the final limiting factor of the TV station, must be adjusted for the maximum permissible frequency response. Response monitoring usually depends upon visual displays, such as waveform monitors, to observe how multiburst, color bars and swept-frequency test signals are handled.

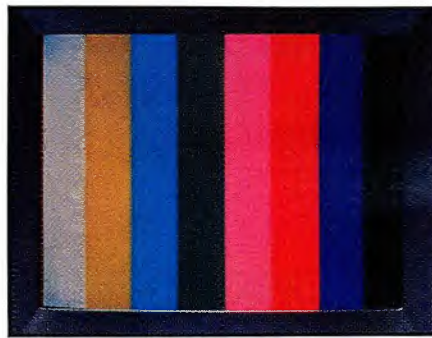
The time-domain display of a waveform monitor allows observation of the signals on single or composite line or field basis. Response translates to variations of levels between the input signal that is applied to the transmitter and the relative reduction of any component through modulation, amplification and demodulation.

Pushing NTSC for increased detail requires a means to more accurately monitor response. Viewing the transmission channel with a spectrum analyzer is one popular method. The display is based upon the frequency domain, rather than a translation to time domain.

Traditionally a video-sweep generator provides the input test for performance assessment with a spectrum analyzer. A special signal, based upon mathematical functions, offers advantages over swept-frequency methods.

### (Sin X)/X

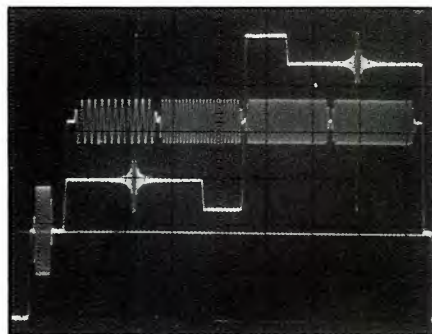
Pulses and square wave signals with fast rise times are rich in harmonics. The horizontal sync pulse provides an excellent example. With a fundamental fre-



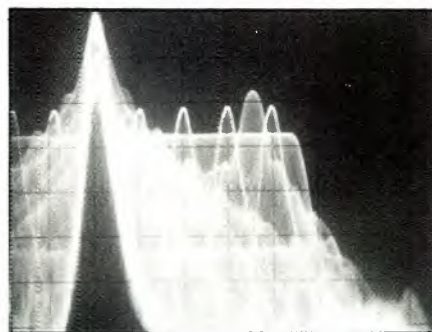
quency of 15.734kHz, sync produces harmonics that extend upward from the visual carrier. Designed attenuation reduces harmonic interference with the aural carrier. Particular concern is necessary with stereo television, where harmonics can have a detrimental effect.

A new test for transmitter response uses the (Sin X)/X relationship. (See Figure 1.) The spectrum contains all harmonics of 15.734kHz sync to 4.75MHz. All harmonics are generated with the same amplitude and energy content. The pulse is presented as both positive- and negative-going. Beyond the 4.75MHz upper cutoff frequency, attenuation removes all significant energy.

Second, the test signal uses 1MHz markers in much the same format as a multiburst signal. Viewed on the spectrum analyzer, the markers quickly veri-



**Figure 1.** The (Sin X)/X pulse and marker waveform, as produced by the Leitch XTG-2500N transmitter test generator.



**Figure 2.** The spectrum analyzer display produced by the (Sin X)/X test signal.

fy calibration of the display. Viewed on a waveform monitor, the markers produce a cursory display of system response.

The (Sin X)/X and 1MHz marker signal, connected directly to a spectrum analyzer, produces the display in Figure 2. Analyzer control settings of 1MHz/division and 300kHz resolution were used. A continuous coverage of the video band, a sharp rolloff above 4.75MHz and the visual carrier are clearly visible. The trace markers fall on each graticule marking, assuring the 1MHz/division setting.

Energy around the 3.58MHz color subcarrier is apparent, resulting from the presence of burst on the input waveform. More spillover from the subcarrier toward the aural carrier is apparent than from the luminance.

Figure 2 is a direct display. It is not obvious that the spectra produced by the positive- and negative-going (Sin X)/X pulses are shown. Under ideal conditions, both overlap perfectly. In real systems, gain-related non-linearity of the transmission system will cause the two spectra to diverge.

### Using the signal

When out-of-service testing is possible, the equipment setup and procedure is simple. A full-field test signal is applied to the video signal input of the visual modulator. An output signal taken from a sampling point after the final amplifier is applied to the spectrum analyzer.

In-service testing can be achieved through the use of VITS. The test signal is inserted onto a VBI line of the program video. To view the signal, a sample is applied to a waveform monitor with line-select or line-strobe. The strobe output is used to unblank the spectrum analyzer during the desired line. RF from the transmitter sampling point is fed to the input of the analyzer.

Although the video sweep signal can be generated with marker birdsies, it is not a continuous signal. However, the sweep rate can be set high enough that visually it appears continuous. The new form of test maintains a constant load on the transmitting system, because the fundamental and harmonics are constantly present.

Why spectrum analyzers? We'll answer that question next month as we look closer at the frequency domain.

**Editor's note:** Appreciation is expressed to Leitch Video for assistance in preparing this article.

! : T : )))



# FIELD PRODUCTION

*A special job demanding specialized products.*



## For your audio needs: a growing line of compact, easy-to-use FP amps and mixers.

Shure FP products are built specifically for ENG, EFP, film, and video work. They're not general audio products that "might" work on remotes. And no one offers as wide a selection with this kind of built-in ruggedness and reliability.

**FP32**



**FP42**



**For Stereo Remotes.** The FP32 Stereo Mixer is comparable in size and features to our famous FP31. Its stereo capability, light weight, easy-to-use controls and convenient shoulder harness make it the first choice of field crews. Our FP42 Stereo Mixer simplifies mic cueing, so important in situations like sports remotes. Plus it enables

you to easily mix down stereo in your post production booth. It offers all the features of the popular M267 plus stereo capability and a stereo headphone amp.

**FP31**



**FP16**



**The Industry Standards.** The FP31 is Shure's original field production mixer. Thousands bet their audio on it worldwide. The FP16, a one-by-six distribution amp with transformer balancing and link jacks, outperforms all competition. It's also ideal as a portable press bridge.

**FP11**



**FP12**



**For Long Yardage Situations.** The FP11 Mic-to-Line Amp provides freedom from noise in long line situations, with up to 84 dB of gain in 15 6-dB steps. It converts any mic to line level and includes an invaluable limiter circuit. The FP12 Headphone Bridging Amp is a must for shotgun and boom operators. It keeps them on target without need for a return line. It's ideal for multiple headphone feeds, troubleshooting, and as an intercom.

For more information on the entire FP line, call or write Shure Brothers Inc., 222 Hartrey Avenue, Evanston, IL 60202-3696, (312) 866-2553.

**SHURE®**

*Breaking Sound Barriers*

See us at AES Booth #s  
107-108, 213, 215

Circle (9) on Reply Card

11/86-BE-FP



## Learning the basics

By John Battison, P. E.

**M**any engineers know that an AM station with a directional antenna (DA) is required by the FCC to perform a complete proof-of-performance test after construction and before the license is issued. However, a non-directional (non-DA) station is under no FCC mandate to complete a set of field-strength tests. This is unfortunate because there are so many occasions when the information provided by a short proof completed after construction would be quite helpful.

There is no better example of when this information is needed than several years later, after the system begins to deteriorate. Typically, complaints (usually from the station manager) about poor signal coverage initiate an investigation by the engineer. If no records on the performance of the original antenna exist, it's difficult to establish whether the system is operating properly.

### Defining the problem

The problem of assessing performance is particularly difficult for stations built before 1960. Their ground systems are probably deteriorating and the antennas and insulators may be rusting and cracking and covered with soot and other conductive substances. The transmission lines may be showing signs of age also, with loose fittings or physical damage. The old adage, "out of sight, out of mind," is an appropriate description of ground systems at many pre-1960 facilities. If you've ever worked for a small station, you may have had first-hand experience with this kind of situation.

Environmental elements also can affect a station's field strength. Construction near the tower can cause problems. There may now be houses and buildings where there used to be fields. This type of construction can alter the ground's conductivity.

Trees may be growing around the antenna. Many stations were built on scrub and forest lands. The bushes and trees that were originally cleared to make room for the ground system may have grown back around the antenna.

Ground systems can be damaged by



root growth and flooding or heaving from yearly freeze/thaw cycles. Further deterioration is caused by unauthorized vehicular traffic across the site or by vandalism.

No matter what the cause of deterioration, you need a reference point. If field-strength measurements had been made when the station signed on, it would be relatively easy to make a comparison set of readings. If, on the other hand, you are not so lucky to have such a reference point, what can you do?

### Check the impedance

After sign-off, measure the base operating impedance. If an in-line operating impedance bridge (OIB) is available, you can make the test while the station is on the air.

Connect the bridge across the jack on the antenna side of the network. Ensure that the bridge is properly set up and remove the jack plug. The impedance can now be read while the station is operating. If the base impedance has changed, it is possible to correct the network setting while still on the air.

If adjustments are necessary, it may be possible to reduce the power to 500W or 1,000W and make small adjustments while wearing a linesman glove. The shunt leg determines network input resistance. The series leg determines the reactance. An OIB eliminates the need for a signal generator and speeds the work.

### Field-strength measurements

Assuming that the base resistance and current are correct, it will appear that the station is radiating its licensed power. At least it will appear that the transmitted power is going into the antenna. If the field strength is still not correct and the ground system is functioning properly, then the power is getting into the antenna system but not being radiated properly.

Using a field-strength meter, plot a radial through the areas where the signal strength is low and another where the signal strength is still good. Plot as many radials as necessary and use radials that

cover similar ground. Measure the actual field strength along these radials and plot the results on groundwave paper.

Locate the 0.5mV/m point on each radial and plot each of these points on a suitable map. Connect the points, fairing or smoothing the curve to form the half-mile contour map.

Plot the radials showing low field strength on a topographic map. Examine the area between the transmitter and the 0.5mV/m points for new construction, buildings, concrete expanses, large power lines or tall towers built with continuously poured concrete and long reinforcing bars.

Also check for proper detuning on nearby FM or TV towers. There is at least one case in which the consulting engineer specified a detuning skirt for a new FM tower, but in the haste to complete construction, the skirt was not added.

The problem was discovered when the station owner complained that the signal strength became worse after the FM tower was built. Because no measurements were made on the AM station prior to constructing the FM tower, there was no way to be sure the new tower had not caused the problem. This example points to the need to make and record measurements whenever major changes are made to any antenna system.

This example was an easy case. Far too often, the causes are not obvious. If there is any kind of tall construction in the path of signal problems, take a field-strength meter and hold it near the object. If the object is affecting the AM signal, a strong reradiated signal will be observed. The problem then becomes how to detune it.

If the tower was built by an FCC-licensed organization, redress can usually be obtained by working with the FCC and having the offending tower detuned. This illustrates the importance of watching for proposed radio/TV construction near your tower site. The best information sources are FCC applications and proposals. If you don't have access to them, consider hiring a consulting engineer or attorney to perform this work.

Next month we'll take a look at tower detuning.

! : { ~ } |||

Battison, BE's consultant on antennas and radiation, owns a radio engineering consulting company in Columbus, OH.



# SEE HOW WE STACK UP.



CRL offers much more than just another limiter for your AM or FM station.

We provide you with any combination of multiband AGC's, four channel processors, and pre-emphasizing limiter/clippers for your stereo or mono needs.

Because of this, it's no wonder we have been stacked up against the best known audio processors in the industry...and won!

All of our AGC's use multiband, patented circuitry, which avoid noise pull-up during pauses, and automatically correct errors in levels and tonal balance.

Using 6db/octave filters for precision shaping and altering of program material, our 4 channel processors will give you a powerful increase in loudness and still retain musical quality.

Our multiband limiter/clippers use patented low pass clipping filters to provide the final absolute peak and band width control. Our adjustable pre-emphasis circuits allow you to achieve the maximum in fidelity on typical receivers.

Hear for yourself why CRL has become a leader in audio processing. Call us now, toll free, at 800-535-7648, and we'll arrange for your CRL

dealer to give you a free trial so you can see for yourself how we stack up.



THE PROCESSING SPECIALISTS

**Circuit Research Labs, Inc.**

2522 West Geneva Drive, Tempe, Arizona 85282

(602) 894-0077

(800) 535-7648

Circle (10) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



## Teleport—an earth station for all reasons

By Elmer Smalling III

A teleport is an earth station that is leased for public use as a common carrier. It is a multi-access transmit-and-receive facility for domestic and international applications. It also includes support hardware to facilitate communications of voice, data and video information. Depending on the number of customers it serves, a teleport may have from one to six or more 9.2m steerable C-band or Ku-band antennas. Each antenna must be capable of covering the full arc of U.S. communications satellites, from 60° to 143° west longitude.

At this time, there are approximately 45 teleports in operation in the United States, with 200 to 300 predicted by the end of the decade. The emergence of the teleport as a new, independent entity is the result of a number of factors.

Expense is one factor. Less obvious but important reasons range from local zoning restrictions regarding satellite dishes, space requirements and the necessity of locating dishes to access the full arc without obstructions (or future obstructions), or terrestrial RF interference.

Although the number of satellite communications users is growing, private ownership of earth stations may be restricted by many factors beyond the users' control, regardless of budget. This creates the need for teleports.

### Interconnection

Typical interconnection between the teleport and its customers may be by way of microwave, fiber optics or coaxial cable, which may be provided by the local phone company or the teleport. For some customers, the interconnection may be as simple as videotape. Most teleports have standard format VTRs on-line for such feeds. Some teleports may provide accommodations for a customer's antenna and support equipment.

Hard connections such as cable or fiber optics rate high in reliability, but are expensive. These costs will be intensified if trenches need to be dug or if special cable has to be pulled into buildings. The provider of hard connection services may also specify minimum use of the service to justify the cost of installation. Typically, the customer is charged for installation, but that charge may not preclude minimum use requirements.

Microwave interconnection can be



simple and relatively inexpensive compared to hard connections. In large metropolitan areas, however, multihop links between the customer and the teleport's microwave system may be required due to line-of-sight blockage caused by buildings or terrain. Multihopping multiplies the costs of microwave interconnection, and should be compared to hard connection for overall costs of installation, operation and maintenance.

are imported via microwave.

Because the teleport is located in a new, planned business development away from downtown areas, its microwave system and microwave antenna are centrally located atop the Texas Commerce Bank building, and the InterFirst Plaza building. Interconnection between the microwave system and the teleport is accomplished using fiber optics.

### Other support services

In addition to the hardware and engineering services found at any uplink facility, a teleport requires a support staff to handle the logistics and traffic scheduling required for successful satellite communications. The support staff can lease

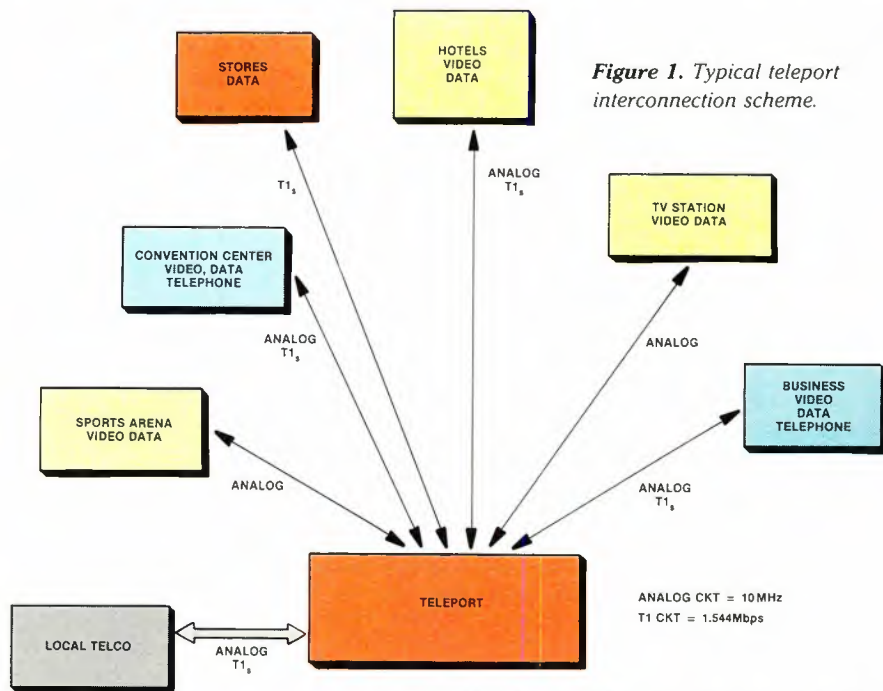


Figure 1. Typical teleport interconnection scheme.

### The Dallas-Fort Worth Teleport

The Dallas-Fort Worth Teleport is a working example of a typical teleport that serves a large metropolitan area. It provides services for TV and cable networks, single-event TV feeds, and teleconferencing. The teleport has wide-band communications with the local phone company via full duplex 6GHz microwave, with cable and fiber redundancy. The teleport also is interconnected with both major sports stadiums, the Dallas Communications Complex (a large, multifacility TV and film center), and several private businesses. Signals

transponder time for customers, as well as arrange remote services for special applications. For example, to organize a teleconference, the support staff can make all the necessary arrangements not only for a studio, uplink and transponder, but also for facilities at the receiving end of the transmission. This includes contracting satellite reception, meeting rooms, display devices, seating arrangements and coffee and doughnuts if the customer requests.

The teleport has evolved into the "one-stop shop" for users of satellite communications in a broad spectrum of applications and services.

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



© Otari Corporation, 1986

Professional Digital standard recording format ■ 32 tracks ■ Peak-reading LED meter bridge ■ The incomparable ballistics of Otari's renowned pinchrollerless transport ■ SMPTE-EBU time-code synchronization.

When you are ready to create the ultimate recording studio, the Otari DTR-900 awaits.

■ Otari, Technology You Can Trust ■ Otari Corporation, 2 Davis Drive, Belmont, California 94002 ■ (415) 592-8311 TWX 9103764890.

**OTARI**

Circle (11) on Reply Card



## Examining logic gates

By Gerry Kaufhold II

**H**ave you ever been working in the wee hours of the morning on routine transmitter maintenance, only to discover that when you think you're finished and ready to go home the transmitter won't come up? So you recheck the work you performed, since the transmitter was working before you started, and it still won't come up. Then it hits you. Check the safety interlocks. You check all the door switches and just about the time you thought you'd be crawling into bed, you find a bent lever on an interlock switch that just robbed you of a couple of hours of sleep. You may have just learned your first lesson in digital logic.

### Digital AND gates

That sequence of switches that prevented high-voltage to be applied to the plates of your transmitter formed a basic circuit analogous to the digital AND gate. In a digital AND gate, all of the inputs must be HI before the output of the AND gate goes HI. If any single input is LO, the output of the AND gate will remain LO.

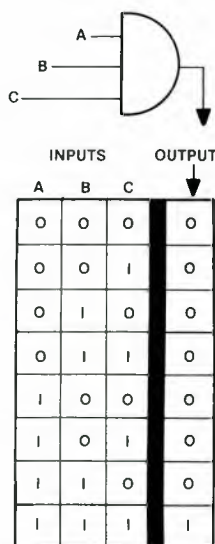
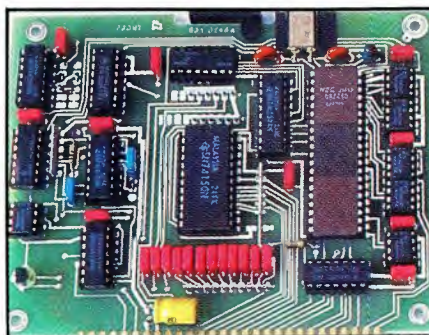


Figure 1. Truth table and logic symbol for tri-input AND gate.

### Truth tables

A truth table is one method used by designers of digital circuits to express the various input and output possibilities of a digital circuit. This term is derived from the ancient study of philosophy where Plato used truth tables to analyze con-



cepts. The states of the inputs are tabularized, and the outputs that result can be easily seen.

The truth table for a tri-input AND gate is shown in Figure 1. Note that only when all inputs are HI does the output go HI. A typical method used to implement such a gate is the multiple-emitter transistor shown in Figure 2.

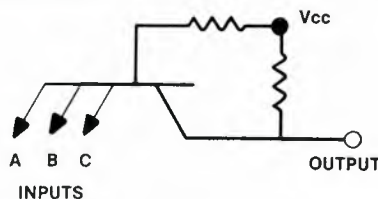


Figure 2. Multiple-emitter transistor used as a simplified AND gate.

### OR gates

An OR gate has the truth table shown in Figure 3. In an OR gate, the output goes HI when a HI is applied to any input. This might be considered similar to a parallel analog circuit except with an OR gate, the signal that gets there first is passed to the output, and all other HI signals have no effect until the first HI signal goes away.

AND or OR gates are used to pass

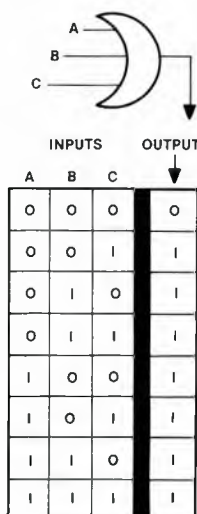


Figure 3. Truth table of a tri-input OR gate and logic symbol.

signals that go HI when they carry significant information. Such signals are called *active HI*.

### Inverters

The truth table for an inverter circuit is shown in Figure 4, and is considered a special case and has a special notation. Whenever a signal is normally HI and is significant only when it goes LO, the signal name is specified with a horizontal bar over it, and is said to be *active LO*.

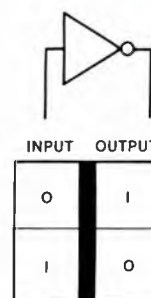


Figure 4. Inverter truth table and logic symbol. The bubble on the output signifies the inverter portion of the circuit.

Attaching an inverter to the output of an AND gate creates the NAND gate (not, AND). Similarly, using an inverter on the output of an OR gate creates a NOR gate (not, OR), as in Figure 5.

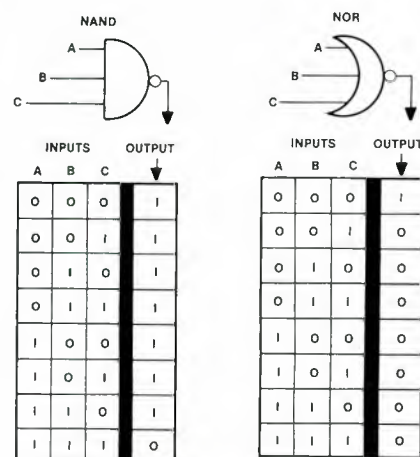


Figure 5. Logic symbols and truth tables for NAND and NOR gates.

Connecting several AND, OR, NAND, NOR and inverters together and trying to trace through the truth tables is complicated. Boolean Algebra is a form of designers' language used for testing the interconnection of gates. It was invented in the 1850s by George Boole as part of the mathematics of symbolic logic.

Kaufhold is staff engineer for KAET-TV, Tempe, AZ.





## THE MOST IMPORTANT PART OF A TV STEREO GENERATOR ISN'T THE STEREO GENERATOR.

Several manufacturers make a stereo generator for television, Orban among them. How do you choose the best one?

Stereo generator design, while difficult, is a task whose goals are objectively defined by BTSC specifications and the EIA Recommended Practices. Such design is well within the grasp of competent engineers, and the success or failure of the design is readily measureable by instrument.

In contrast, a TV stereo audio processor must be evaluated by *subjective listening tests*. Measured performance tells you almost nothing about the sound of a given design. This point is crucial because the audio processor, more than any other element in the system, dictates the air-sound you get.

Orban spent four years fine-tuning and perfecting OPTIMOD-TV Model 8182A until it could gracefully handle even the most difficult and diverse program material. During the development cycle, sophisticated mathematical design techniques were always complemented by exhaustive listening tests.

Part of OPTIMOD-TV's superiority stems from its architecture: its patented multiband compressor usually acts like a wideband compressor to preserve frequency balances. But unlike the oversimplified wideband compressors found in some other TV audio processors, it also prevents the pumping of midrange sounds (like dialogue) by low-frequency sounds (like sound-effects with lots of bass energy). It also has a CBS Loudness Controller

to prevent viewer complaints due to loud commercials.

Best of all, OPTIMOD-TV's adjustability makes it a processor that will serve you well now and in the future. Comprehensive setup controls determine the amount of dynamic range reduction that occurs, so you can operate OPTIMOD-TV to produce a consistent, uniform sound that is comfortably listenable on small sets, use it as a safety limiter, or split the difference. The choice is yours!

Orban's 8182A/SG stereo generator plugs into the 8182A, interleaving the stereo generator's low-pass filters with the audio processor circuitry. This *system approach* yields a brighter sound with lower distortion than would be achieved if our 8182A were merely cascaded with a non-Orban stereo generator.

When you add it all up, it becomes clear why there are more Orban OPTIMOD-TV audio processors and stereo generators in service than all other makes *combined*. To learn more, contact your favorite Orban Broadcast Products dealer. Or call us direct in San Francisco.

### Orban Associates Inc.

645 Bryant Street, San Francisco, CA 94107  
(800) 227-4498 or (415) 957-1067 Telex 17-1480

**orban**

Circle (12) on Reply Card



## Repairing digital systems

By Ned A. Soseman,  
TV technical editor

In many applications, the digital storage oscilloscope (DSO) performs as well as its analog counterpart and offers several features that can be highly useful to today's broadcast maintenance engineer. The DSO is not without its limitations, however, which you should consider before trading or retiring your "old faithful" analog scope for a new DSO.

### DSO sampling rate

Probably the weakest area of current DSO technology is the sampling rate. Top-of-the-line DSOs may be capable of 200 megasample/second rates, but many DSOs sample only every 20ns to perhaps 1 $\mu$ s. At a maximum speed of 200 megasamples/second, the input is sampled at intervals of 5ns. Without further processing, it will provide a resolution of  $\pm 5$ ns. Given this fact, the analog oscilloscope retains the unique capability to measure rise and fall times in the sub-nanosecond range. Until digital sampling rates can be increased economically to several gigasamples/second, DSOs must rely on other methods to accurately interpolate timing points between samples.

### The Nyquist theory

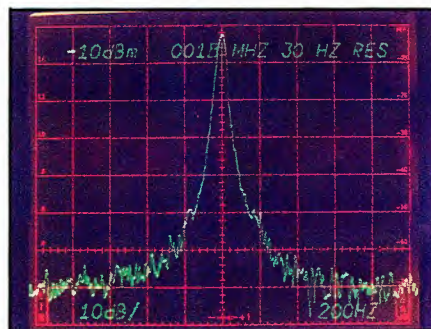
The Nyquist theory states that when a signal to be sampled is band-limited to one-half the sampling rate (the Nyquist frequency), the original sampled signal can be reconstructed completely and accurately. In fact, perfect bandpass cannot be achieved, and some high-frequency components of the signal leak through. These components are aliased, or transformed into low frequencies, similar to heterodyning. This limits the accuracy and repeatability of measurements taken by a digital sampling system.

### Digital filtering

To improve accuracy beyond the  $\pm 5$ ns resolution available from a 200 megasample/second rate, some DSOs use digital filtering that may offer a resolution with repeatability approaching 2ns for interpolation of timing points between samples. Before purchasing a DSO, find out the minimum resolution that can be observed with repeatability, and learn how the DSO resolves signals faster than one-half the sampling rate.

### Random repetitive sampling

This technique, common to some



DSOs, makes a number of enhanced DSO features possible, and it also tends to eliminate aliasing. Random repetitive sampling occurs independently of the phase or frequency of the input signal. The sampling timing is controlled by an internal crystal-referenced clock, and samples are taken at about every 25ns over many input cycles.

base stability, with a short-term phase noise (jitter) of less than one-half part per million.

To illustrate the benefit of this degree of stability, consider jitter measurement of NTSC video. Not only can the jitter of any NTSC pixel be measured accurately, but the stability offers accuracy that can resolve the instability of any one pixel of a 1,000x1,000 line high-resolution graphics display in which one pixel represents only 1/1,000,000th of the total frame. This is several orders of magnitude greater than the time-base stability of typical analog oscilloscopes.

### Some relevant DSO terms

**Analog-to-digital (A/D) converter**—A device (usually an IC) that converts an analog level into a digital word. It is the speed of this conversion that limits the effective bandwidth of the DSO.

**Battery backup**—A battery is used to retain the content of the DSO memory when ac power is removed from the scope.

**Bubble memory**—A type of non-volatile memory, also allowing the DSO to be transported without the loss of memory content.

**Digital-to-analog (D/A) converter**—A device that converts a digital word into an analog level.

**Digital sampling rate**—The rate at which the A/D conversion takes place. It is automatically determined by the sweep speed selector switch.

**Memory size**—The number of bytes that the memory of the DSO can hold. Memory size is related to the horizontal resolution of the display.

**One-shot sampling**—The process of capturing a 1-time, non-recurring event. The maximum digital sampling rate of a DSO is related to the amount of detail that can be obtained for a 1-shot signal.

**Pre-trigger view**—This feature makes it possible to view the events that occur prior to the triggering point.

**Repetitive sampling**—A technique that takes successive samples of recurring waveform, giving the DSO a higher effective bandwidth on repetitive signals only.

**Roll mode**—In this mode, the sampling rate of the DSO is slowed down so that long-term variations of a signal may be observed. When in the roll mode, the display on the CRT looks like that of a strip chart recorder.

**Word size**—This is the size, in bits, of the words in the digital memory. A typical size would be eight or 12 bits. This specification relates to the vertical resolution. An 8-bit word means the signal is broken up into 256 levels ( $2^8 = 256$ ).

The technique is called *random*, but the samples aren't truly random in nature. The description comes from the fact that there is no correlation between the time the sample is taken and the input or trigger frequency or phase. The method is called repetitive because the process is used to build a waveform display from many randomly spaced samples that are repeated and superimposed on a single sweep.

Random repetitive sampling will not increase the resolution for 1-shot applications, but it does provide a distinct advantage. The crystal-referenced clock in the DSO is capable of an excellent time-

### Negative time

Another advantage of the DSO is that it allows the user to look back in negative time, before a trigger pulse occurs. Random repetitive sampling may allow you to look back through thousands of screen diameters (one screen diameter represents the time/division times the number of divisions on the graticule). Other sampling methods may be limited to just one or two screen diameters. When you're troubleshooting an intermittent problem on a data bus or power supply, this feature can save you hours or days of watching and waiting for something to happen.

! : I : ~ ) ) ) )



# WHETHER IT'S NEW CONSTRUCTION OR RENOVATION . . .



Your goal is to be the best in your market by building a facility that will produce operating efficiencies and a superior on-air look. Lerro Corporation can help you bring together all the pieces of the technology puzzle to create the most cost-effective physical plant you need to sell your services.

Lerro uses the interactive team approach, with you providing inputs on your marketing strategy, both short and long range sales goals and cost constraints. We offer technological solutions using our broad equipment lines, product knowledge, and advanced engineering tools.

A Lerro designed and constructed facility along with our follow-up training, maintenance program and warranties will create an environment for you to market your product with quality, efficiency, comfort, and profitability.

Call the Lerro half of your design team today!

THE  
**LERRO**  
CORPORATION

3125 N. Broad St., Philadelphia, Pa. 19132  
215 - 223-8200



# Management for engineers

## Look before you leap into a new job

By Brad Dick, radio technical editor

**A**thletes and actors are not the only ones who sometimes find themselves in a position to negotiate a higher salary and better working conditions. Someday, you might find yourself in the driver's seat for negotiating a "sweet deal" with a new employer.

Not all of you have, or will, experience the exhilaration of receiving a call or letter from a company that wants to hire you away from your present employer. If it comes, however, don't accept the offer without careful thought. If you want to make the best of what might be a good situation, consider all of the aspects.

### The drawbacks

Suppose you get a call from a network or a large corporation across the country and they want you, right now. It would be a feather in your cap to step into that new position, wouldn't it? Maybe not.

Your salary is only one element of a job's total benefit package. What about your spouse's job? Will your spouse be able to find immediate and satisfactory employment? If your husband or wife works in a job that requires state licensing or credentials, he or she might have to go back to school to qualify for a similar position in another state.

What effect will the new job have on your current pension and retirement benefit programs? Consider the company's proposed hospital and sick leave benefits. All of these factors are important, especially if you are the head of a family.

Perhaps one of the most important considerations is the cost of living (COL) in the new location. For example, the COL in Buffalo, NY, is 97.3, and in South Bend, IN, it's 91.0. It would cost less to live in either of those cities than it would in a town with a COL of 100.0 (the average base cost of living in those cities reporting). If you receive an offer to work in New York, however, the salary had better be a big increase, because the COL there is 137.3, more than 37% higher than the national average.

Sometimes the COL can be misleading, because it refers to an *average* cost. If you own your home, for example, and you want to buy a house in the new location, consider the difference in house payments, including real estate prices,

interest rates and taxes. Auto insurance rates also fluctuate markedly from area to area, and could be different by a factor of two or three compared with what you're used to paying.

Before you make a decision based solely on the virtues of a larger paycheck, try to develop an accurate budget for living in the new area and compare the difference in the amount of potential expendable income. Armed with COL information, you can calculate the real gain (or loss) in your purchasing power.

### Call the shots

If a company comes to you, it's because someone recommended you. When you are the pursued, rather than the pursuer, you stand a far better chance of sitting in the driver's seat.

Suppose you have completed the initial interviews and both you and the company like what each sees. The salary would be a big increase for you, and perhaps the new duties are just what you've always wanted. Now, do you take the company's first offer?

Some experts say that if a company or headhunter contacts you for possible employment, you can use that aspect as leverage. Although you certainly can use this leverage to obtain the best possible salary, you might be able to negotiate more than that. In the long run, some *perks* may be more rewarding than a few more dollars in the paycheck.

One of those benefits worth negotiating for is a front-end bonus. In other words, the company may pay you a bonus to place your career on the line for its future. This is most likely to occur in new companies or in those with high-risk factors.

Some companies provide low-cost loans. These can be used to finance a new home, or even a car if it's required for the job. Also, there are certain tax advantages for both parties.

If your spouse is employed and you've been offered a position with a company in another city or state, it will mean your spouse must find a new job (unless one of you is willing to commute a long distance). The company may offer job



counseling for your spouse or even guarantee that a position within the company will be available within a certain period of time. Large companies may be able to place both of you in the company right away. Smaller companies may limit their efforts to providing employment information and guidance.

Relocation costs are often covered, but suppose you can't find the kind of home you want in the new town? Don't just settle for moving costs. You might want to ask for a housing allowance to help offset the cost of an apartment until you can build a new home. After all, if you are living in an apartment, paying rent and not making mortgage payments, you can be losing equity and tax deductions.

### More than one fish

Before you settle for one offer, consider that others may exist. After all, if one company has heard of you, it's possible that others have, too. Look around and see what else is out there. In many cases, job offers such as these come through professional search firms. If so, the firm may be able to help convince a prospective employer of your value. Because it's in the search firm's best interest to complete a deal, it may help put together an agreement.

Even if you can't come to terms with the first offer, don't give up. The fact that one company contacted you means that your services are valuable and recognized. If you haven't been actively looking for a job, maybe you should consider doing so. After all, the time to move on may be when things are running smoothly. In this case, you'll leave on a positive note.

### Career planning

Whether you're looking for a new job or planning to stay where you are for a while, you should have a career plan. If you haven't developed a plan or considered where you'd like to be in five or ten years, give it some thought. You can't move forward if you don't know where you're going. Having a career plan will make it easier to decide whether to accept that wonderful offer that might arrive today. When it does arrive, consider all the possibilities.

! : ? ( : )))



# ***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 Shadow 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 (13) on Reply Card

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





**By Bob Van Buhler**



# professionals need professionals

and a 30 minute BetaCam<sup>®</sup> video cassette tape  
that is virtually indestructible!

When your reputation is on the line  
you want the BEST equipment available!

You want a tape engineered with  
uncompromising quality control in the  
most modern, hi-tech manufacturing  
facility in the world.

You want a tape with a specially  
formulated, virtually indestructible  
backing to withstand the stresses

of editing pass after pass after pass.

You want a super-smooth tape  
surface with ultra-fine cobalt treated  
oxides for high recording density and  
low chroma noise levels.

You want a tape that virtually eliminates  
dropouts in a precision engineered case  
with a special anti-static resin for extra  
toughness and heat resistance.

You want the BEST...

You want RAKS...

## RAKS<sup>®</sup>

ENGINEERED FIRST TO LAST!

231 RT. 17 - SUITE 300  
RUTHERFORD, NJ 07070  
(201) 438-0119

RAKS/CHICAGO, IL.  
312/888-4075

RAKS/LOS ANGELES, CA.  
714/891-6830

RAKS/HOUSTON, TX  
713/376-4543



TV is a registered trademark of New York Television, Inc.  
BetaCam is a registered trademark of the Sony Corp.

Circle (1) on Reply Card







# Preventing transmitter failures

**There is no job more important to a broadcast engineer than maintenance of transmission equipment.**

**By Jerry Whitaker, editorial director**

Without a doubt, the most frightening event at a radio or TV station is a transmitter failure that takes you off the air. You know the feeling. That sudden burst of noise on the air monitor speakers and/or a splash of snow on the video monitors. It's something you feel as an ache inside. The reasoning mind then takes over and brings forth a long list of possible causes for the problem that place blame squarely on somebody else. Do these sound familiar?

- "It's probably just a power failure at the transmitter site. Damn the utility company anyway!"
- "Maybe it's only a problem with the air monitor here at the studio. I bet we're *really* still on the air." (The eternal optimist.)
- "No cause for alarm. We just had a power surge. It'll be back up in a second or two." (If you say that confidently enough, people will believe you.)
- "Who's on duty at master control? I bet it's operator error."
- "Telco must have lost our line to the transmitter. It's not our problem. Damn the phone company anyway!"

The list can go on and on, particularly if it's the middle of the night. At 3 a.m. you can come up with a whole laundry list of system anomalies that can be corrected from your bed. And while we're on the topic, have you noticed that nobody ever calls an engineer at home with good news? When was the last time an operator called at 10:30 p.m. to say that everything was working just fine?

Anyway, if you're lucky, one of the easy solutions that every engineer prays for will be at the root of the failure. Many times, however, the problem is not so easy to solve. Such is life.

## **Back to reality**

An equipment failure at a radio or TV station causes an instant crisis. All gear in the transmission system, from the cameras, cart machines and microphones to the antenna, must work 24 hours a day, seven days a week, without fail. Every link in the broadcast chain is important, but the transmitter itself is most important. Studio equipment may occasionally fail—and the operators will complain loudly about it—but you can usually circumvent the problem with backup gear. The greatest concern on the part of most engineering personnel is keeping the transmission system, particularly the transmitter, in good working order.

Unfortunately, the heart of the broadcast station's technical plant is often located apart from the studio, on some out-of-the-way tract of land or on a mountain top that takes half a day to reach. It becomes too easy to ignore the transmission gear until a problem occurs. The weekly transmitter inspection visits allow the engineer to give the system a quick *once-over* look, but there's no substitute for walking past *the box* every day, if possible.

Engineers who have worked on a particular piece of transmission equipment for any length of time acquire a feeling for how well the unit is working. They know what the blowers should sound like and what meter readings are normal—not by reading the meters individually, but glancing at the front panel. They know when the PA tube needs replacement, and when there's still some life left in it. They know when the transmitter needs retuning, and when to leave well enough alone. They know the unit's strong and weak points.

The only way to gain this knowledge is to know the transmitter and instruction manual forward and backward, and to work with the equipment on a regular basis. This translates into a thorough

maintenance program. Such an effort can be expensive and time-consuming, but the rewards outweigh the cost.

## **The importance of maintenance**

The transmitter is usually the most expensive single piece of equipment at a broadcast station, and one of the most vulnerable to damage, as well. Whether or not a station has a standby transmitter, the importance of regular, proper maintenance cannot be emphasized too strongly. Many stations unwisely skimp on transmitter maintenance efforts, reasoning, "If it breaks, we can always use the standby." But will the standby work? Moreover, how much extra downtime and expense will the minimum-maintenance policy cause?

Maintaining a broadcast transmitter is a predictable, necessary expense that all stations must include in their operating budgets. Tubes have to be replaced no matter what the engineer does; components fail every now and then; and time must be allocated for cleaning and adjustments. By planning for these expenses each month, many unpleasant surprises can be avoided.

Although the reason generally given for minimum transmitter maintenance is a lack of money, the cost of such a policy can be deceptively high. Problems that could be solved for a few dollars may, if left unattended, result in considerable damage to the transmitter and a large repair bill. A standby transmitter in the back room often can be a lifesaver. However, its usefulness sometimes is overrated. The best standby transmitter in the world is a *main transmitter* in good working order.

Contrary to popular belief, equipment failures are not solely dependent on the power company and divine providence. Many failures are preventable. Through accurate observation of the transmission system, degradation of the air product can be avoided.

**Editor's note:** Information on UHF TV transmitter maintenance provided by Andrew Whiteside, engineering manager at Comark Communications, Southwick, MA. Information on first aid treatment provided by Harris Corporation, Quincy, IL.



## Preventing transmitter failures



# Routine maintenance

**If you look for problems, you can find them...and prevent them.**

**M**ost failures in a transmitter can be prevented through regular cleaning and inspection, and close observation. The history of the unit also is important in a thorough maintenance program so that trends can be identified and analyzed.

### Logging practices

The front panel can tell a great deal about what is going on inside of a transmitter. Record all front-panel meter readings, as well as the positions of critical tuning controls, on a regular basis in the station maintenance log. (See Figure 1.) This information provides a history of the transmitter and can be a valuable tool in noting problems at an early stage. The most obvious application of this logging is to spot failing tubes, but any changes occurring in components can be found as well.

For example, consider the case of an IPA and PA stage in an AM transmitter that has lost neutralization. (See Figure 2.) Neutralization adjustment is made by moving taps on a coil, and none have been changed. The history of the transmitter (as it is recorded in the maintenance record) reveals, however, that the PA grid tuning adjustment has, over the past two years, been moving slowly into the higher readings. An examination of Figure 2 leads to the conclusion that C-601 is the problem.

The tuning change of the stage was so gradual that it was not thought significant until an examination of the transmitter's history revealed that continual retuning in one direction only was necessary to achieve maximum PA grid drive. Without a record of the history of



*Clean and inspect the transmitter as often as required. A comprehensive maintenance program will result in a reliable system and keep the unit looking brand new for years.*

the unit, time could have been wasted in substituting capacitors in the circuit, one at a time (each costing a couple hundred dollars). Worse yet, the engineer might have changed the tap on coil L-601 to achieve neutralization, further hiding the real cause of the problem.

An example of the importance of accurately logging meter information for a UHF transmitter involves the body-current monitoring system. A typical reading with average picture content is 50mA. Suppose that over a 4-week period the reading dropped gradually to 30mA. No other parameters showed any deviation from normal. Yet, the decrease in the reading indicated an alternate path (besides the normal body-current circuitry) by which electrons were returning to the beam power supply. (See Figure 3.) Several factors could cause the body-current variation. Eventually, each could have disastrous consequences, if allowed to run their course.

Water leaking into the body-to-collector insulation of the klystron causes partial bypassing of the body-current circuitry. In time, this water can corrode the klystron envelope. Such corrosion may lead to a loss of vacuum and obvious klystron failure.

The body-current circuit is one of the more important protection systems in the transmitter. It is essential that the circuit functions normally at all times and at full sensitivity in order to detect change when a fault condition occurs. Regular logging of important transmitter parameters will ensure that any developing problems are caught early.

Creating a history of the line and tank



# Only Canon Gives You

this...



and this...

and this!

## J8 x 6 BIE: 6mm Wide, 96mm Telephoto, 11" M.O.D.!

Once again, superior Canon optical technology gives you greater flexibility and capability than ever before. The incredible Canon J8 x 6 BIE lens provides the wide-angle coverage you need in tight situations and its built-in 2X extender gives you 96mm—when you need to get closer.

Better still, even with the 2X extender, you can get as close as you want, since your M.O.D. is an amazing eleven inches, even at 96mm! The Canon J8 x 6 BIE, it gives you more.



### Specifications:

Focal length: 6-48mm, (12-96 w/ extender)  
 Max. Relative Aperture: f1.7 (6-33mm), f1.9 at 48mm  
 f3.4 (12-66mm), f3.8 at 96mm  
 Angular Field of View: 72.5° at 6mm, 10.5° at 48mm  
 36° at 12mm, 5.2° at 96mm  
 Minimum Object Distance: 11"

# Canon

Optics Division  
 Canon U.S.A., Inc., Head Office: One Canon Plaza, Lake Success, NY 11042 (516) 486-6700  
 Dallas Office: 3200 Regent Blvd., Irving, TX 75063 (214) 830-9600  
 Chicago Office: 100 Park Blvd., Itasca, IL 60143 (312) 250-6200  
 West Coast Office: 123 Paulmar Avenue East, Costa Mesa, CA 92626 (714) 979-6000  
 Canon Canada, Inc., 6390 Dixie Road, Mississauga, Ontario L5T1P7, Canada (416) 678-2730  
 © 1986 Canon U.S.A., Inc.



Enjoy easy extended payments with the Canon Credit Card. Ask for details at participating Canon dealers and retailers.

Circle (15) on Reply Card



pressure for pressurized transmission lines helps identify line or antenna problems. After the regulator is set for the desired line pressure, record the tank and line readings each week and chart the data. If possible, make the observations at the same time of day each week.

Ambient temperature can have a significant effect on line pressure, so note any temperature extremes in the transmission line log when the pressure is recorded. The transmission line pressure usually will change slightly between carrier-on and carrier-off (depending on the power level). The presence of RF can heat the inner conductor of the line, causing the pressure to increase.

After a few months of charting the gradual loss of tank pressure, a pattern should become obvious. Investigate any deviation from the normal amount of tank pressure loss over a given period.

Whenever a problem occurs with the transmitter, make a complete entry describing the failure in the station maintenance log. Include in the log a description of all maintenance activities required to keep the transmitter operational. Make all entries complete and clear. Include the following information for each entry:

- A description of the nature of the malfunction, including all observable symptoms as well as performance characteristics.
- A description of the actions taken to

| PARAMETER                    | TYPICAL VALUE | MEASURED VALUE |
|------------------------------|---------------|----------------|
| RF power output              | 18.3kW        |                |
| Plate current                | 2.8A          |                |
| Plate voltage                | 7.55kV        |                |
| Screen current               | 380mA         |                |
| Screen voltage               | 650V          |                |
| PA grid current              | 110mA         |                |
| PA bias voltage              | 490V          |                |
| PA filament voltage          | 6V            |                |
| Left driver cathode current  | 142mA         |                |
| Right driver cathode current | 142mA         |                |
| Driver screen voltage        | 275V          |                |
| Driver screen current        | 35mA          |                |
| Driver grid current          | 1mA           |                |
| Driver plate voltage         | 1.85kV        |                |
| 28V power supply             | 27V           |                |
| Reflected power              | 15W           |                |
| Transmission line pressure   | 3.9psi        |                |
| Tank pressure                | 1500psi       |                |
| Transmitter hours            | 5412          |                |
| Exciter AFC                  | Center scale  |                |

**Figure 1.** Complete and accurate logging of important transmitter parameters is essential to preventive maintenance and troubleshooting. A complete history of the transmitter allows the engineer to spot trends in operation of the equipment. Shown is an example of a transmitter parameter form that should be filled out regularly by the station engineer.

return the transmitter to a serviceable condition.

- A complete list of the components replaced or repaired, including the device schematic number and part number.
- The total system downtime due to the failure.
- The name of the engineer who made the repairs.

#### Visual inspection

A complete visual inspection of the transmitter on a regular basis is an important part of any preventive maintenance program. Component problems often can be spotted at an early stage by regular inspection of the equipment.

- Carefully inspect all resistors for signs of overheating, check electrolytic or oil-filled capacitors for signs of leakage and

## Easier, better-sounding telephone remotes - Gentner makes it happen!

Our Extended Frequency Transceivers - EFT-900™ and EFT-1000™ - give you the high quality telephone audio you need for your remotes. We start with frequency extension - a process that recovers 2½ octaves of low frequencies, boosting the power of your announcer's voice. Then we add sharp filtering, noise reduction and Aphex® enhancing to further improve the sound.

The real beauty of an EFT, though, is its easy set-up and operation. Your mic, headset, phone line and telephone set connect directly to the unit. And because the EFT can operate full duplex, the studio and remote site can easily communicate with each other.

With the EFT advantage, your station can gain the competitive edge in all types of remotes - games, advertising, news interviews and more!



**EFT-900™**

**Low-cost, high-quality  
telephone audio!**



**EFT-1000™**

**Advanced features for  
the demanding P.D.I.**

**Teleprocessor™ -  
the perfect  
companion to your EFT units!**

- High and low band EQ, Aphex Aural Exciter® maximize your telephone audio.
- Built-in cue switch/mic allows you to send instant cues down the phone line.



**The Clear Choice.™**

**GENTNER™**  
ENGINEERING COMPANY, INC.

540 West 3560 South · Salt Lake City, Utah 84115  
(801) 268-1117

"Aphex Aural Exciter" is a registered trademark of Aphex Systems, Ltd.





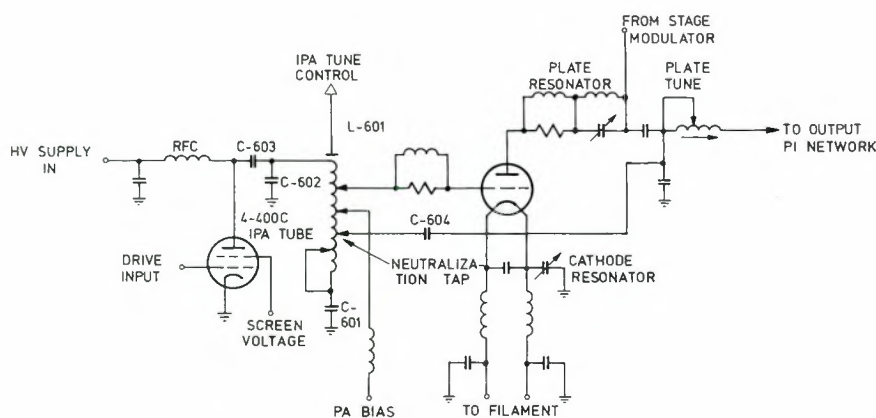
## INNOVATIVE & AFFORDABLE SYSTEMS ENGINEERING

- Production Facilities
- Broadcast Facilities
- Mobile Systems

CENTRO CORPORATION, (619) 560-1578, 9516 CHESAPEAKE DRIVE, SAN DIEGO, CALIFORNIA 92123

Circle (17) on Reply Card





**Figure 2.** An example of how detailed logging of transmitter readings and tuning control positions can aid in troubleshooting work. The example shown involves an IPA and PA neutralization problem in an AM transmitter. A history of IPA retuning (through adjustment of L-601) helped determine that loss of neutralization was caused by C-601 changing in value.

observe feedthrough capacitors and other high-voltage components for signs of arcing. Also check all high-voltage RF capacitors right after sign-off for excessive heating.

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

Vacuum capacitors present special requirements for the maintenance technician. Care in handling is a prime requisite for maximum service life. Because

the vacuum capacitor is evacuated to a higher degree than most vacuum tubes, it is particularly susceptible to shock and rough handling. Provide adequate protection to vacuum capacitors whenever you are performing maintenance procedures. The weakest parts of the capacitor are the glass-to-metal seals on each end of the unit. Exercise particular care during removal or installation.

The current ratings of vacuum capacitors are limited by the glass-to-metal seal temperature and the temperature of the solder used to secure the capacitor plates. Seal temperature is increased by poor connecting clip pressure, excessive ambient temperatures, corrosion of the end caps and/or

connecting clip, excessive dust and dirt accumulation or excessive currents.

Dust accumulation or sharp points in high-voltage circuitry near the vacuum capacitor can cause arcs or corona that may actually burn a hole through the glass envelope.

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

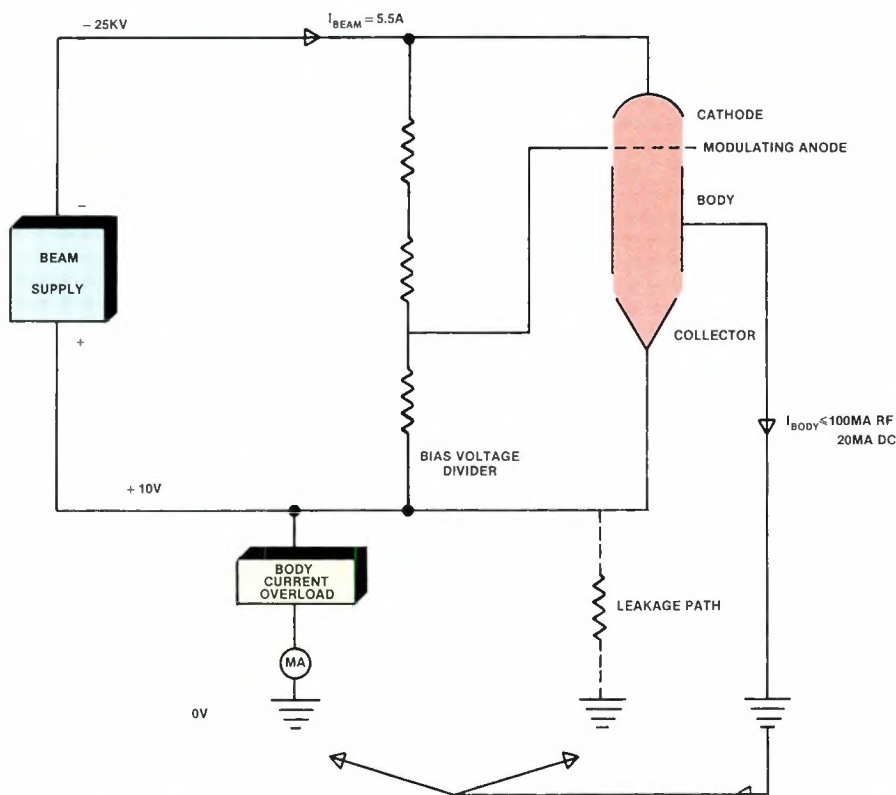
Special precautions must be taken with transmitters that receive ac power from two independent feeds. Typically, one ac line provides 208V 3-phase service for the high-voltage section of the system and a separate ac line provides 120Vac power for low-voltage circuits. Older transmitters or high-power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

Power transformers and reactors normally run hot to the touch. Check both the transformer frame and the individual windings. On a 3-phase transformer, each winding should produce about the same amount of heat. If one winding is found to run hotter than the other two, further investigation is warranted. Be careful when checking for transformer heating. Some units can run quite hot.

Check modulation transformers and reactors, if used, for excessive heating, and inspect oil-filled transformers for signs of leakage. Check transformers for dirt build-up, loose mounting brackets and rivets and loose terminal connections. Dust, dirt or moisture between terminals of a high-voltage transformer may cause flashover failures. Insulating compound or oil around the base of a transformer indicates overheating or leakage.

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

- Thoroughly clean the transmitter. Cleaning is a large part of a proper maintenance routine. A shop vacuum and clean brush are generally all you need. Use isopropyl alcohol and a soft, clean cloth for maintaining high-voltage insulators. Cleaning serves a greater purpose than just keeping the transmitter looking nice. Inspect each component as you clean and observe any changes.



**Figure 3.** Simplified HV schematic of a klystron amplifier showing the parallel leakage path that can cause a reduction in protection sensitivity of the body-current circuit. This problem may result from high coolant conductivity or coolant leakage onto the collector insulation or RF radiation shielding.



# Born To Broadcast.

## Introducing Ampex 198 and 199 1/2" Professional Broadcast Videocassettes.

Our 198 and 199 are everything you asked for in 1/2" broadcast videocassettes. Because we listened to you before we created them.

You told us you wanted bright, sharp color and clean, crisp pictures. Pictures with fewer dropouts. So we created an advanced high energy formulation and manufactured the tapes in a state-of-the-art cleanroom environment using anti-static materials.

You told us they had to be rugged and durable. So we created a tough tape binder system and a precision-molded, high-impact

AES plastic cassette mechanism.

But we didn't stop there. We also created a user-friendly labeling system that helps you find material fast. Because you don't have time for delays in the editing suite.

The result is everything you asked for in the newsroom, on location and for automatic edit playback systems.

Ampex 198 and 199 1/2" videocassettes in Betacam® or M-format. Great color. Great pictures.

# AMPEX



Ampex Corporation • One of The Signal Companies

Ampex Corporation, Magnetic Tape Division  
401 Broadway, Redwood City, CA 94063, 415/357-3809

Circle #8 on Reply Card



# Television Engineers ... How Many Channels Can You Afford NOT To Monitor?

**Let Data Check's cost effective waveform  
monitors provide the answer.**

In the high-priced field of Cable and Broadcast Television, loss of control for only a few seconds may be quite costly.

With Data Check's Series 1200 NTSC waveform monitors it's easy to maintain control. At a glance, you can monitor and compare activity for up to seven channels and quickly react to any abnormality.

All seven of Data Check's two-inch-high, precision oscilloscopes plug into a single row of a standard 3 1/2" RETMA rack. Basic controls are easy to reach on the front panel. Each channel offers selectable dual inputs (X-Y operation is also available), as well as individual attenuator and sweep rate controls.

## Proven technology for the television industry.

Since 1968, Data Check has specialized in manufacturing precision test instruments for electronics, video, audio and instrumentation fields.

The Series 1200 monitor oscilloscopes are government

and military proven instruments now available for the television industry.

## Select from a variety of six models.

The Series 1200 monitor oscilloscopes are available in the following models:

- Standard
- Recorder
- Slow sweep
- Very slow sweep
- X-Y
- Master X-Y
- NTSC

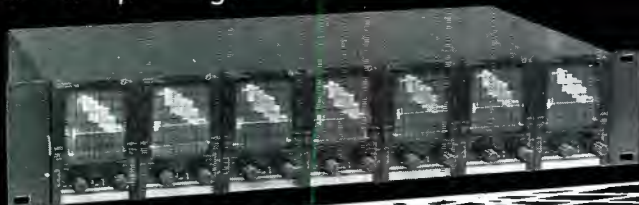
## You'll like the LOW price.

Perhaps the best feature of all is the price—less than \$800.00 per channel.

Now! Can you afford NOT to monitor your channels? Let Data Check know ... we'll provide you with solid support and more. Call or write today:

## Data Check Corporation

9918 Via Pasar  
San Diego, CA 92126 USA  
(619) 578-0101  
TWX: (910) 335-1596  
Cable: DATA CHECK



**DATA  
CHECK**  
CORPORATION



*The front panel of the transmitter can tell a great deal about what is going on inside. Make a complete check of all operating parameters on a regular basis.*

Regular maintenance of insulators is important to the proper operation of the final amplifier stage because of the high voltages present. Pay particular attention to the insulators used in the PA tube socket. Because the supply of cooling air is passed through the socket, airborne contaminants can be deposited on various sections of the assembly. These can create a high-voltage arc path across the socket insulators.

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

In your effort to keep the power tube and its socket clean, don't go overboard. If the system is working well and the compartment is clean, leave it alone.

Cleaning is also important to proper



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

*Continued on page 36*

Circle (19) on Reply Card



# EIMAC Tubes Provide Superior Reliability at radio station KWAV — over 112,000 hours of service!



**KWAV**

MONTEREY, CALIFORNIA

Ken Warren, Chief Engineer at KWAV reports that their 10 kW FM transmitter went on the air in November, 1972, equipped with EIMAC power tubes. The original tubes are still in operation after over 13 years of continuous duty!

Ken says, "In spite of terrible power line regulation, we've had no problems with EIMAC tubes. In fact, in the last two years, our standby transmitter has operated less than two hours!"

Transmitter downtime means less revenue. EIMAC tube reliability gives you *more* of what you need and *less* of what you don't want. More operating time and less downtime!

EIMAC backs their proven tube

reliability with the longest and best warranty program in the business. Up to 10,000 hours for selected types.



Quality is a top priority at EIMAC, where our 50-year charter is to produce long-life products.

Send for our free Extended Warranty Brochure which covers this program in detail.

Write to:

Varian EIMAC  
301 Industrial Way  
San Carlos, CA 94070  
Telephone: (415) 592-1221





# **Sony Betacam Betacam vs. Bo vs. Thomson-C Who will win?**

*You will.*

Because Betacam® is now a multi-source format.

That means you'll have an even wider choice of products and features to meet your specific needs. You can expect innovative future products such as high-performance Betacam SP. And you'll have the security of knowing that the premier manufacturers of broadcast VTRs are committed to a 1/2" standard.



# vs. Ampex sch Betacam SF Betacam.

Best of all, it means a major battle by each of us to become your Betacam supplier. So when the dust settles, who will come out ahead?

You guessed it.

For more information on Sony Betacam and future developments in the Betacam format, call Sony Broadcast at (201) 833-5231.

**SONY**  
**BROADCAST**







# For Excellence In Antennas

- A complete line of TV and FM Broadcast Antennas
- Modern 7,000 ft. test range facilities
- Innovative Engineering Careful construction
- Two Year Warranty on Product and Workmanship



With over 1500 delivered, we've helped more stations penetrate their market.

FCC Directionals  
Pattern Studies  
Multi-Station Arrays  
Full Scale Measurement

**JAMPRO ANTENNAS, Inc.**  
6939 Power Inn Road  
Sacramento, CA 95828  
(916) 383-1177 TELEX 377321

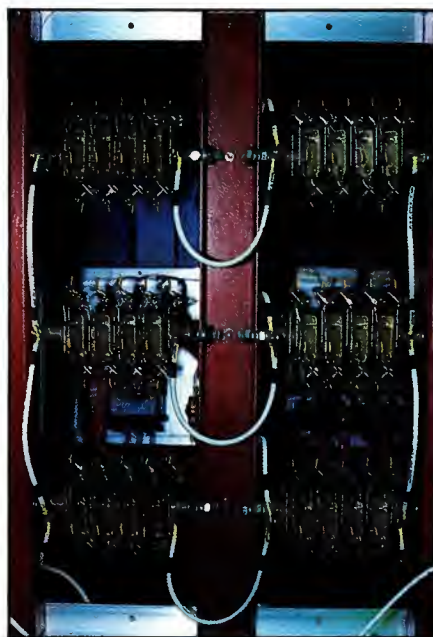
Circle (21) on Reply Card

*Continued from page 32*

cooling of solid-state components in the transmitter. A layer of dust and dirt can become thick enough to create a thermal insulator effect that prevents proper heat exchange from a device into the cabinet.

- Clean relay contacts, including high-voltage or high-power RF relays, as often as needed to keep the current-carrying points free of pitting or discoloration.

Inspecting certain relays will also show if operators are using the proper procedures to change transmitter power or antenna patterns. For example, a high-voltage relay that should never be changed in the *hot* condition should not show signs of arcing between contact points. Evidence of such arcing would indicate that operators were violating



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

established procedures by making *hot* changes from one mode to another.

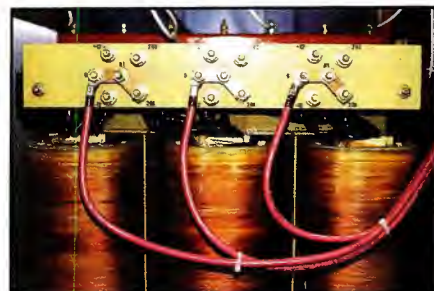
Unless problems are experienced with an enclosed relay, do not attempt to clean it. More harm than good can be done by disassembling properly working components for detailed inspection.

- Inspect all power contactors for signs of wear. Check the mechanical linkage to confirm proper operations. The contactor arm should move freely, without undue mechanical resistance.
- Inspect vacuum contactors for free operation of the mechanical linkage and for indication of excessive dissipation at the contact points and metal-to-glass (or metal-to-ceramic) seals. Contactors, vacuum or conventional, should never run hot.
- Check the mechanical operation of circuit breakers. Confirm that they provide a definite *snap* to the off position (remove all ac power for this test) and that they firmly reset when reset. Replace any circuit breaker that is dif-

ficult to reset.

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

There is no section of the transmitter where it is more important to keep connections tight than in the PA stage. Loose connections can result in arcing



*Inspect power transformers just after sign-off for indications of overheating or leakage (in the case of oil-filled transformers).*



*Check the heating of individual rectifiers in a stack assembly. All devices should generate approximately the same amount of heat.*

between components and conductors that will not only put you off the air, but also will destroy an expensive component. It might appear to the casual observer that the PA cavity is mechanically "overbuilt," that individual sections or components are secured with an unusually large number of screws and nuts. However, the manufacturer included each component—even down to the smallest screw—for a reason. It is not enough for *most* of the hardware to be tight. *Everything* must be tight.

The cavity access door is a part of the outer conductor of the coaxial transmission line circuit in FM and TV transmitters. High-RF circulating currents flow along the inner surface of the door, and it must be fastened securely to prevent arcing.

A word of caution is in order. Although it is important to keep all components in the PA circuit tight, do not overdo it. An engineer who goes overboard on



# IT'S AN ITC



## *Low Cost Performance*

**O**MEGA cartridge machines embody ITC quality at an affordable price with features to delight everyone ... *including low-cost stereo performance.*

OMEGA cartridge machines have simple, clean electronics for clear, accurate audio reproduction with the features you need. Microprocessor technology brings you many operational flexibilities with easy, economical maintainability. A crystal referenced DC servo motor provides audibly less wow and flutter, reduced heat and selectable speed operation.

OMEGA mono reproducers are field upgradeable to stereo while OMEGA mono recorders

have a selectable 1 kHz cue tone defeat and include a built-in microphone preamp. With direct microphone input and ITC's "FB-1" telephone answering interface, your facility can offer automatic dial-in information or perform a wide variety of newsroom and research functions.

CALL US TODAY to discuss financial options on ITC's complete line of cartridge machines.

99B Cartridge Machines,  
"The Best"

DELTA Cartridge Machines,  
"Today's Most Popular Cartridge Machines"

OMEGA Cartridge Machines,

"Affordable Performance You Can Trust"

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

In the U.S., call toll-free **800-447-0414**, or collect from Alaska or Illinois **309-828-1381**. In Canada, call Maruno Electronics, Ltd. **416-255-9108**. In most countries outside the United States and Canada, information on ITC equipment can be obtained through local distributors.

**International Tapetronics Corporation/3M**  
2425 South Main Street  
P.O. Box 241  
Bloomington, Illinois 61702-0241

Circle (22) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)

# 3M





Inspect high-voltage capacitors for signs of leakage around the case feedthrough terminals.

preventive maintenance can wind up causing problems.

- Paint transmitter surfaces with the original type of paint when inspection shows rust or worn paint. Use a primer coat if necessary.

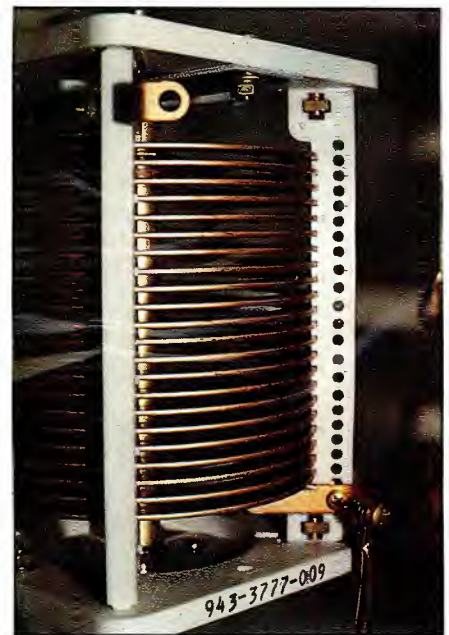
### Klystrons

Klystrons are expensive to buy and to



During each maintenance session, check transient suppression devices (shown mounted on the green glass-epoxy cards) for indications of overheating or package rupture. Be sure to discharge the circuit, using the grounding stick provided by the transmitter manufacturer, before checking the components.

operate. Compared to tetrodes, they require larger auxiliary components (such as power supplies and heat exchangers), and are physically larger. Yet, they are quite stable with high gain and may be



Clean RF coils and inductors as often as needed to keep contaminants from building up on the device loops.

easily driven by solid-state circuitry. They are simple to cool and are capable of long life with a minimum of maintenance.

Two different types of klystrons are in use today: the *integral cavity* klystron, in which the resonant cavities are built into the body; and the *external cavity* klystron. *Continued on page 42*

## We Guarantee...

We guarantee that our camera tripod plates and VTR/Camera Cables will last longer than other manufacturers'... or we will replace them at No Charge.

ENG crews and maintenance supervisors report that TSM camera tripod plates and VTR/Camera Cables last 2 to 4 times longer than other makes.

**Quick Release Tripod Mounts.** Rugged, air forced construction with positive locking... plus extra holes for optimum balance. Models shown are for Ikegami and Sharp cameras. Models for other cameras available soon.

**VTR/Camera Cables.** Heavy duty pull twist and bend strain relief design at connectors. Crews like cable flexibility and long life. Available for Ikegami, RCA, Sharp, Hitachi

and Sony cameras and popular portable VTRS. **Mono-Brace** increases stability when using long focal length or heavy lenses. Perfect prescription for back pain.

**Mic and Light Adapters** for Ikegami cameras. The TSM-MLA is a simple solution for combo mounting of shotgun mic and light.

**BCTV Zoom and Focus Controls.** Smooth 2 speed Zoom control clutch prevents end stop damage. Focus control has drag adjustment. Drive cables have dust seals.

Call or write for complete details and inquire about our Warranted Lens Repair service



**TSM**

**TOTAL SPECTRUM MANUFACTURING INC.**

20 Virginia Avenue, West Nyack, NY 10994  
(914) 358-8820

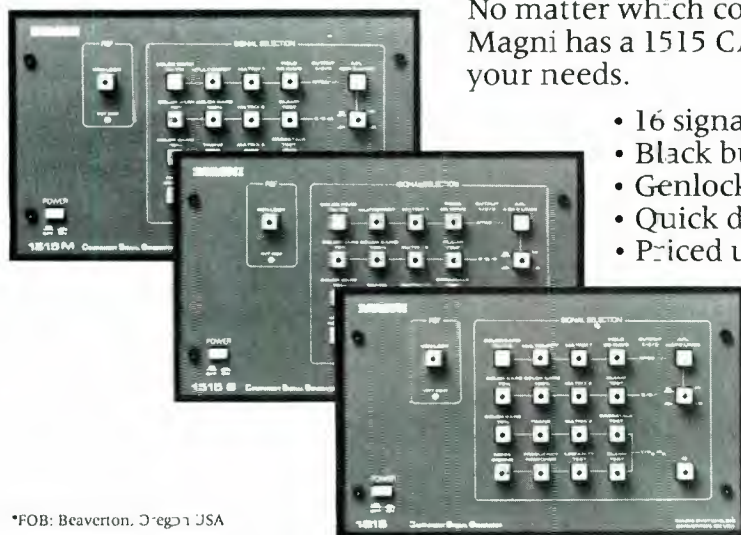


Circle (23) on Reply Card





# WE'VE GOT YOU COVERED ALL ACROSS THE BOARD.



No matter which component analog video system you choose, Magni has a 1515 CAV/composite signal generator that meets your needs.

- 16 signals
- Black burst output option
- Genlock standard
- Quick delivery
- Priced under \$5500\*

Consider your options, then call us.  
We're covering all the squares.

**MAGNI**  
*Video Measurement*

Magni Systems, Inc.  
9500 S.W. Gemini Drive  
Beaverton, OR 97005 U.S.A.  
503/626-8400  
Telex: 650-2769743 MCI

\*FOB: Beaverton, OR, USA

Betacam is a trademark of Sony Corp.,

M II is a registered trademark of Matsushita Industrial Electric LTD., Osaka, Japan.

Circle (24) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



# Music



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

# BROADCASTING



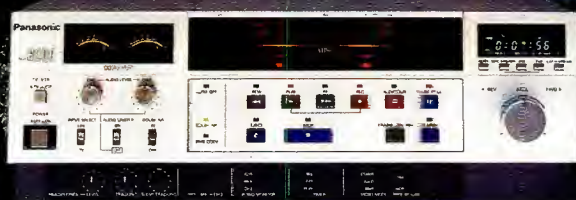
**AG-6300** High performance VHS recorder and editing source deck. Two-frame editing accuracy. Inputs for time base corrector.

# HOSPITAL



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

# UNIVERSITY



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



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



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



---

# PANASONIC HAS A PROFESSIONAL VIDEO DECK FOR EVERY PROFESSION.

From medicine to music. From New York to London. Whether it's industrial training, hi-fi stereo duplicating or international business communications, there's a Panasonic® 6000 Series VHS deck designed to meet your specific professional needs.

For long-term stability, all 6000 Series professional decks have a sturdy aluminum die-cast chassis. And a heavy-duty head structure to deliver virtually noiseless video images for special effects.

The 6000 Series also includes all the inputs and outputs professionals demand. Like 8-pin video connectors for direct single connection to a monitor. BNC connectors

for easy interface with other video components. And time code connectors for advanced editing applications. Plus versatile remote control capabilities for a host of applications.

Still, with all the 6000 Series has going for it, Panasonic knows a professional deck is only as good as the professional support behind it. That's why you'll find regional offices each with a staff of engineers to assist you with matching components for your specific system. And technical service for installation and instruction. So whatever profession you're in, take a look at the video decks designed for your profession. The Panasonic 6000 Series.

For more information, call your nearest Panasonic regional office. Northeast: (201) 348-7620. Midwest: (312) 981-4826. Southeast: (404) 925-6835. Southwest: (214) 257-0763. West: (714) 895-7200. Northwest: (206) 251-5209.

**Panasonic**  
**Industrial Company**

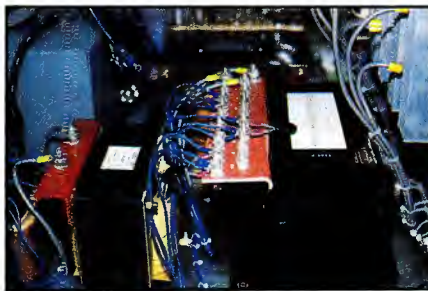
---

Circle (25) on Reply Card





Carefully inspect the PA tube socket assembly. Do not remove the PA tube unless necessary.



Check the tightness of connectors on an occasional basis, but do not stress the connection points.

Continued from page 38

klystron, in which the cavities are mechanically clamped onto the body and are outside the vacuum envelope of the device. This difference in construction requires different maintenance procedures.

The klystron body, or the RF *interaction region* of the integral cavity klystron, is cooled by the same liquid that is fed to the collector. The required maintenance involves checking for leaks and adequate coolant flow.

Although the cavities of the external cavity unit are air-cooled, the body may



Clean the PA cavity assembly to prevent an accumulation of dust and dirt. Check hardware for tightness.

# FLEXIBLE

System One offers FLEXIBLE audio test capability. Broadband and selective level and noise, thd + n, intermodulation distortion by SMPTE/DIN, CCIF, and DIM/TIM methods, quantization noise and distortion, frequency, and phase; wow and flutter soon. Measures common-mode rejection ratio without changing cable connections.

Four detectors, four high and four low frequency band limits, four sockets for optional filters.

## Audio precision

P.O. Box 2209, Beaverton, Oregon 97075  
503/297-4837, 1-800/231-7350  
TELEX: 283957 AUDIO UR

Now, that's the way to test audio!





# The Ones to Watch!

## IKEGAMI'S BROADCAST & INDUSTRIAL MONITORS: WE HAVE WHAT YOU'RE LOOKING FOR.

Whether you're looking for broadcast or industrial color or B&W monitors, one look at an Ikegami 9, 10, or 3H series monitor and you'll look no more.

And now everyone can afford to own an Ikegami monitor with prices starting at under \$400 for our new PM9-5, 9" monochrome model.

Ikegami's 9 series high resolution broadcast television monitors utilize In-Line Gun self converging cathode ray tubes with American Standard matched phosphors and are available in a 20, 14 and 10 inch models.

The 10 series resolution broadcast television monitors utilize Delta-Gun tubes to achieve maximum brightness and exceptional convergence and are available in 20 and 14 inch versions.

The 3H series high resolution broadcast television monitors feature high quality monochrome displays suitable for sophisticated broadcast studio applications. Available in 9, 14, single and dual 9 inch monitors.

For a complete demonstration of Ikegami monitors and cameras, contact us or visit your local Ikegami dealer.



**Prices Start At Under \$400**

# Ikegami®

Circle (27) on Reply Card

Ikegami Electronics (USA), Inc. 37 Brook Avenue Maywood, NJ 07607

[www.americanradiohistory.com](http://www.americanradiohistory.com)



**R**elax! We didn't meddle with a great format. But now that Ampex is delivering Beta-cam,<sup>™</sup> 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





know that when one of those real tough problems that crop up now and then comes along, you can reach right into the heart of Ampex and talk to our product specialists and product managers.

So look into *our* line of CCD and tube-type camcorders, portable recorders/players, and studio editing

VTRs. Because now you've got the best of both worlds—a reliable format that makes quality pictures, and a supplier who has a reputation for customer service and product support second-to-none. And while you're looking, you'll want to check on our complete line of NEWS-oriented products, like graphics systems, editors, ADO opti-

cal effects, "C" format recorders, and a full line of production switchers.

Atlanta (404) 491-7112 Chicago (312) 593-6000  
Dallas (214) 960-1162 Los Angeles (818) 365-8627  
New Jersey (201) 825-9600 (In New York (212) 947-8633)  
San Francisco (415) 367-2296  
Washington, DC (301) 530-8800  
Canada (416) 821-8840

# AMPEX

# more Betacam.



© Ampex Corporation 1986  
Betacam is a registered trademark of Sony Corporation

Circle (28) on Reply Card

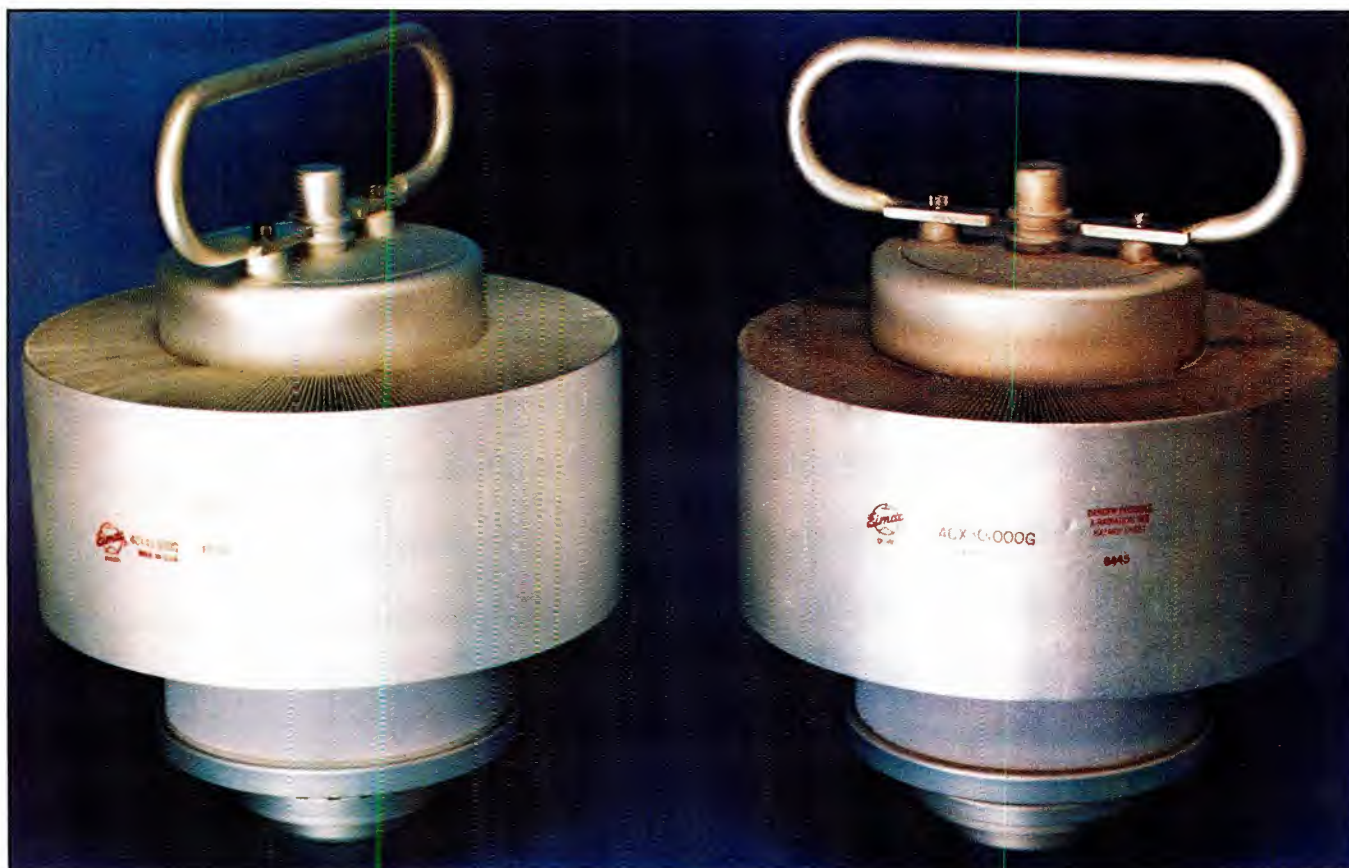


Preventing  
transmitter  
failures



# Power tubes

The heart of a transmitter is its power tube.



Two high-power tetrodes used for FM and VHF TV applications. On the left side is a 4CX40,000G and on the right, a 4CX30,000G. These tubes use pyrolytic graphite grid structures.

The power tubes used in a broadcast transmitter are perhaps the most important, and least understood, components in the system. The best way to gain an understanding of the capabilities of the PA tubes used in your transmitter is to secure copies of the tube manufacturer's

data sheet for each type of device. These are available either from the tube or transmitter manufacturer. The primary value of the data sheets to the end-user is the listing of maximum permissible values. These give the transmitter engineer a clear rundown of the max-

imum voltages and currents that the tube can withstand under normal operation. Note these values and avoid them.

An examination of the data sheet will show that a number of operating conditions are possible, depending upon the class of service required by the applica-



# The best of both worlds:



## THE SOUND TECH 1510A AUDIO TEST SYSTEM

Until recently, most Audio Test Systems have been either manual stand-alone systems or external-computer driven automated systems.

Engineers have long enjoyed the portability, ease of operation and cost effectiveness associated with manual stand-alone systems. Unfortunately, these systems have always lacked speed and documentation capabilities.

On the other hand, the ideally configured external-computer driven test system can provide speed, data analysis, documentation, graphics and integration with other GPIB test systems. Unfortunately external-computer driven systems are designed for production testing and are not suitable for troubleshooting or field work.

However, Sound Technology has combined the Best of Both Worlds into a portable, intelligent stand-alone system with complete PC compatibility: the Model 1510A! The Model 1510A can be used as an intelligent stand-alone system, and when connected to an external computer it becomes the ideal Automated Test System.

### The ST1510A as a Stand-alone System

- Built-in Intelligence
- Portable
- Semi-automatic and Manual Test modes for fast troubleshooting
- Built-in CRT/Graphics

### The ST1510A as an Automated Test System

- Graphics
- Test Chaining/limit testing
- Industry-standard Computer Interface (GPIB)
- User Choice of PC
- Bundled software for IBM, HP
- Compatible with Automated Switchers
- Production Testing

Contact us now for full technical and applications information. Learn firsthand why the ST1510A is the only test system that combines the best of both worlds!

## SOUND TECHNOLOGY

1400 Dell Avenue  
Campbell, California 95008  
(408) 378-6540 Telex: 357445



**Put The Best  
To Test!**



tion. As long as the maximum ratings of the tube are not exceeded, a wide choice of operating parameters, including plate voltage and current, screen voltage and RF grid drive, are possible.

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

### Tube dissipation

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

PA tubes used in radio and TV applications can be cooled using one of three methods: forced-air cooling, liquid cooling and vapor-phase cooling. In radio and VHF TV transmitters, forced-air cooling is by far the most common

method used. Forced-air systems are simple to construct and easy to maintain.

The critical points of almost every PA tube type are the metal-to-ceramic junctions or seals. At temperatures below 250°C these seals remain secure, but above that temperature, the bonding in the seal may begin to disintegrate. Warping of grid structures also may occur at temperatures above the maximum operating level of the tube. The result of prolonged overheating is shortened tube life or catastrophic failure.

Several precautions are usually taken to prevent damage to tube seals under normal operating conditions. A look through your transmitter may reveal air directors or sections of tubing that provide spot-cooling to critical surface areas of the PA tube. Close observation may also show airflow sensors, specially designed actuators for microswitches, associated with the directors.

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

and plate in high-frequency applications. Greater cooling is required at higher frequencies.

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

### The air-handling system

All modern PA tubes use an air-system socket and matching chimney for cooling. Never operate a PA stage unless the air-handling system provided by the transmitter manufacturer is complete and in place. For example, the chimney for a PA tube in AM applications often can be removed for inspection of other components in the circuit. Operation without the chimney, however, may significantly reduce airflow through the tube and result in overdissipation of the device. It also is possible that operation without the proper chimney could damage other components in the circuit because of excessive radiated heat.

Normally the tube socket is mounted in a pressurized compartment so that cooling air passes through the socket and then is guided to the anode cooling fins. (See Figure 4.) Do not defeat any portion of the air-handling system provided by the transmitter manufacturer.

Cooling of the socket assembly is important for proper cooling of the tube base and for cooling of the contact rings of the tube itself. The contact fingers used in the collect assembly of a socket typically are made of beryllium copper. If subjected to temperatures above 150°C for an extended length of time, the beryllium copper will lose its temper (or springy characteristic) and will no longer make good contact with the base rings of the tube. In extreme cases, this socket problem can lead to arcing, which can burn through the metal portion of the tube base ring. Such an occurrence can ultimately lead to catastrophic failure of the device because of a loss of the vacuum envelope.

Other failure modes for tube sockets include arcing between the collect and tube ring that can actually weld a part of the socket and tube together. The end result is failure of both the tube and the socket.

### Ambient temperature

A parameter that is directly under the control of the broadcast engineer is the supply air temperature. The preferred cooling air temperature is no higher than 75°F and no lower than the room dew point. The air temperature should not be modulated by oversized air-conditioning systems or by the operation of other pieces of equipment at the transmission facility.

Monitoring the PA exhaust stack  
*Continued on page 57*



A wide variety of power tubes are used in broadcast transmitters. Shown here are some common triodes ranging from 400W to 15,000W dissipation.



## ARIZONA

AUDIO VIDEO RECORDERS  
3830 North 7th Street  
Phoenix, AZ 85014  
(602) 277-4723

## CALIFORNIA

IMAGE ELECTRONICS  
18437-C Mt. Langley  
Fountain Valley, CA 92708  
(714) 964-0145  
Serving Orange County  
WALT DAVIS ENTERPRISES  
3439 Cahuenga Blvd.  
Hollywood, CA 90068  
(213) 876-6400  
Serving Los Angeles  
& Hollywood

AUDIO VIDEO SUPPLY, INC.  
5563 Kearny Villa Road  
San Diego, CA 92123-1162  
(619) 565-1101  
Serving the San Diego area.

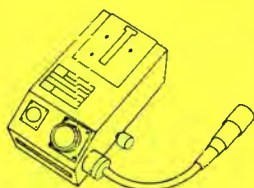
## COLORADO

DAVIS AUDIO VISUAL  
1801 Federa. Blvd.  
Denver, CO 80204  
(303) 455-1122

## FLORIDA

MIDWEST COMMUNICATIONS  
CORP  
8875 N.W. 23rd Street  
Miami, FL 33172  
(305) 592-5355

## KA-3 COMPONENT VCR ADAPTOR



Equips PROCAMS for  
all component formats,  
including the increas-  
ingly popular M-II.  
Attaches to rear of cam-  
era head. Comes with  
mount shoe, 4-pin con-  
nector, and output  
selector switch.

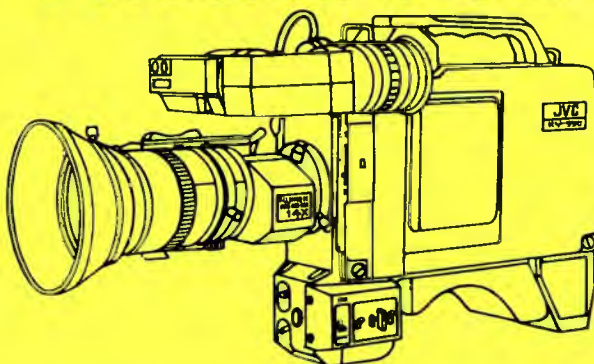
## GEORGIA

MIDWEST COMMUNICATIONS  
CORP  
522 Armour Circle NE  
Atlanta, GA 30324  
(404) 875-3753  
Serving GA & AL.

## ILLINOIS

SWIDERSKI ELECTRONICS, INC.  
1200 Greenleaf Ave.  
Elk Grove, IL 60007  
(312) 364-1900  
Serving the Chicago area.

## PROCAM® 950 B



3 L.O.C. Diode Gun Plumbicon tubes • prism optics  
59 dB S/N • 700 lines resolution at center  
compact, rugged, lightweight • broadcast quality

## KANSAS

MISSION ELECTRONICS, INC.  
3897 W. 95th Street  
Overland Park, KS 66206  
(913) 341-8370  
Serving KS & western MO.

## KENTUCKY

MIDWEST COMMUNICATIONS  
CORP  
One Sperti Drive  
Edgewood, KY 41017  
(606) 331-8990  
Serving KY, PA, OH, IN & MI.

## MASSACHUSETTS

CRIMSON TECH  
325 Vassar Street  
Cambridge, MA 02139  
(617) 868-5150  
Serving MA, NH, ME & VT.

## MINNESOTA

BLUMBERG  
COMMUNICATIONS, INC.  
525 N. Washington Avenue  
Minneapolis, MN 55401  
(612) 333-1271

## MISSOURI

LINES VIDEO SYSTEMS  
219 South Jefferson  
Springfield, MO 65805  
(417) 862-5533  
Serving southwestern MO,  
OK & AR.

VMI COMPANY OF ST. LOUIS  
2368 Schuetz Road  
St. Louis, MO 63146  
(314) 569-1334  
Serving eastern MO  
& southern IL.

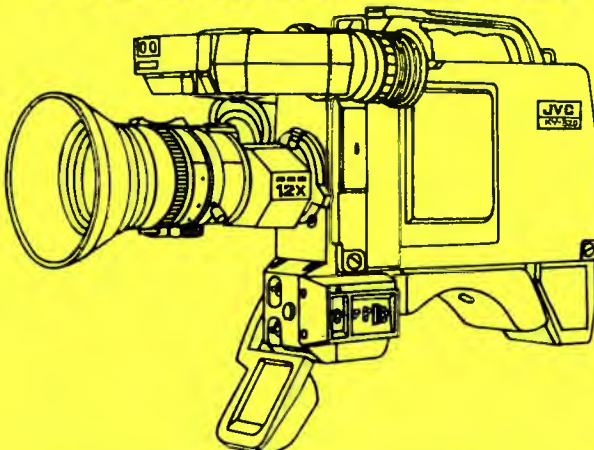
## NEW JERSEY

VIDEO CORPORATION OF  
AMERICA  
7 Veronica Ave.  
Somerset, NJ 08873  
(201) 545-8000

## NEW MEXICO

G.C. VIDEO, INC.  
Box 178, Erickson Road  
Sandia Park, NM 37047  
(505) 281-1303

## PROCAM® 320 B



3 Plumbicon S-M tubes • prism optics • 58 dB  
Signal-to-noise ratio • 650 lines resolution at center  
compact, rugged, lightweight  
superb studio and location camera

## NEW YORK

L. MATTHEW MILLER  
ASSOCIATES  
48 W. 21st Street  
New York, NY 10010  
(212) 741-8011  
Serving New York City.

## UNIVISIONS

2011 Teall Avenue  
Syracuse, NY 13206  
(315) 437-0301  
Serving New York State.

## NORTH DAKOTA

AUDIOVISUAL, INC.  
1818 Broadway  
Bismarck, ND 58501  
(701) 258-6360  
Serving ND, SD, IA, NE,  
MT & WY.

## TEXAS

MAGNETIC MEDIA  
3440 Sojourn Drive  
Suite 200  
Carrollton, TX 75006  
(214) 931-0404

## TRIAxIAL CAMERA CONTROL



PROCAMS can be  
equipped for operation  
via triaxial cable for  
long-distance remote  
work. Cables can be as  
long as 4,920 feet. Only  
system with chroma key.

## VIRGINIA

MIDWEST COMMUNICATIONS  
CORP  
1395 Air Rail Ave.  
Virginia Beach, VA 23455  
(804) 464-6256  
Serving VA, WV, NC, SC & DC.

## WASHINGTON

LINES & ASSOCIATES  
14801 119th Ave. NE  
Kirkland, WA 98034  
(206) 488-3653  
Serving WA, OR, ID,  
& northern CA.

## WISCONSIN

AVONIX VIDEO SYSTEMS, INC.  
3495 North 124th St.  
Brookfield, WI 53005  
(414) 783-6050





1. John Miller — Midwest Communications
2. Bob Romano — Central New York Univisions
3. Terry Moore — Audio Video Supply
4. Chuck Taylor — Mission Electronics
5. John Leveck — Image Electronics
6. Jay Adrick — Midwest Communications

7. Fred Wood — Midwest Communications
8. Ron Bradley — Midwest Communications
9. John Fode — Walt Davis Enterprises
10. Bruce Michael — Davis Audio Visual
11. Gene Tollini — Magnetic Media
12. Mark Swiderski — Swiderski Electronics

# JVC® PROFES



# GO TO PRO PR







Baptist  
Medical System  
Little Rock, AR



Boeing Aircraft  
Company  
Wichita, KS



Dyna-Mark  
Oklahoma City, OK



University  
of Arkansas  
Fayetteville, AR



Monroe  
Community College  
Rochester, NY



Syracuse  
Fire Department  
Syracuse, NY



BF Goodrich  
Cleveland, OH

# PROCAM: The choice of hund



Mark III  
Miami, FL



WNSC-TV  
Rock Hill, SC



Miami Lakes  
Tech. High School  
Miami, FL



Harris Corporation  
Palm Bay, FL



Prime Computer, Inc.  
Framingham, MA



University of Texas  
(Health Service-Center)  
Dallas, TX



University of  
New Mexico  
Albuquerque, NM



First Baptist Church  
Fort Smith, AR



E.R. Squibb & Sons  
Princeton, NJ



KF3B-TV  
Great Falls, MT



ARCO Oil & Gas  
Company  
Dallas, TX



Dallas Power & Light  
Dallas, TX



Harley Davidson  
Motor Company  
Milwaukee, WI



General Electric  
Binghamton, N



Video Comm.  
Montgomery, AL



WDSI-TV  
Chattanooga, TN



WPGH Television  
Pittsburgh, PA



McDonnell Douglas  
Aircraft  
St. Louis, MO



University of Georgia  
Athens, GA



George A. Hormel  
Company  
Austin, MN



Videomaster  
of New England  
Portsmouth, NH



University of Texas  
Austin, TX



WMDT Television  
Salisbury, MD



CNA Insurance  
Company  
Chicago, IL



Beard  
Publishing Company  
Arlington, TX



Tampa  
General Hospital  
Tampa, FL



WIPR-TV  
Hato Rey, PR



E.R. Squibb & S  
Princeton, NJ



Video Consultants  
Overland Park, KS



Puerto Rican Senate  
San Juan, PR



Media Artists, Inc.  
Manlius, NY



St. Joseph Hospital  
Kansas City, MO



NASA  
Palo Alto, CA



PSE&G  
Newark, NJ



WDAZ-TV  
Grand Forks, N



Living Faith  
World Outreach  
Myrtle Beach, SC



Paradise Video  
Miami, FL



Group W Cable  
Chicago, IL



Applied Media Group  
Providence, RI



Houston Independent  
School District  
Houston, TX



LSW Systems  
El Paso, TX



Gator Production  
Hialeah, FL





Join the hundreds of professionals who are closing ranks behind the JVC PROCAMS so solidly and so fast that the PROCAMS are assuming an almost generic identity as *the* high-end teleproduction cameras.

**KY-950B. KY-320B. The PROCAMS.** JVC's crowning achievements in packaging ultra-reliable performance in compact, affordable, professional, 3-tube color cameras.

**PLUMBICON\* TUBES**, of course, whose built-in bias light practically eliminates lag differential; and whose high beam current stabilizes highlights. The "comet tailing" and loss of detail that can mar shiny or glittery subjects is virtually eliminated.

Other common video problems are dispatched, too, like image retention—even with brilliant reds. And your Plumbicon-equipped PROCAM does all these things automatically, while never compromising the highest possible resolution. Plumbicons prevent the build-up of microphonic vibrations, too, helping maintain a high S/N.

**PROCAMS.** Superlative professional cameras whose performance

meets the most sophisticated requirements of broadcast, ENG, EFP, and, indeed, any high-end teleproduction.

But what about special situations that arise from day to day? Is your PROCAM adaptable? And how about emerging technologies? Is your PROCAM—or will it be—compatible with TRIAX CABLE, for example; or COMPONENT VIDEO.

**TRIAX CABLE** is a boon to video production in its ability to retain signal strength despite increasing distance from the source. Triax is indispensable to much EFP and ENG work, and in sporting and other public events where cameras are necessarily positioned some distance from the action.

Don't worry. JVC's Triaxial Adaptor mounts easily on your PROCAM. The cable permits extension to almost a full mile. And JVC's is the *only* Triaxial system in its price range offering chroma key capability.

**COMPONENT VIDEO.** By far the brightest technological star on the video horizon, component video handles signals individually instead of

combining them. Component color signals are measurably brighter, sharper, and truer than composite signals. With the handy JVC KA-3 Component Adaptor, any PROCAM can record video signals in component, and is fully compatible with the M-II tape format which is coming on strong, as well as all other 1/2" component formats. And you can keep your signals in component form right on through editing and other processing, retaining component clarity and color fidelity right up to delivery.

Component video starts with the recording—the camera—and you're ready for it. Because your PROCAM is ready for it.

And we haven't even mentioned PROCAM performance and convenience features, many of them automated to simplify portability, set-up, and operation. A partial list includes: Better than 650 Lines Resolution... Signal-to-Noise ratio of 58dB... Auto-Shift Registration... Automatic White and Black Balance... Automatic Level Depend... Automatic Highlight Compression... Auto Black Level Stabilization

... Corner Registration Correction... Matrix Masking... Flare Compensation... Focus Wobble... Zebra Stripe Video Level Indicators in Viewfinder... 2H Vertical Contour Correction... RS-189 Split Field Color Bar Generator... f/1.4 Prism Optics With Built-In Quartz Filter... Stable RS-170A Sync Output with Color Frame Pulse... Light Weight... Pickup Tube Protection Circuit... Compact, Solid Aluminum-Diecast Body... Long-term Memory Back-Up for automatic functions... Preheating Circuit... Video Recorder Power Save Circuit... LED Viewfinder Indicators... Digital H/V Variable Blanking... and more.

**The PROCAMS. The KY-950B. The KY-320B.** Penetrating dozens of new markets. Outperforming the competition in scores of imaginative applications in the hands of demanding professional users.

See for yourself.

For a demo, call us toll-free for the name of *your* PROCAM Representative.

**1-800-JVC-5825**

\*Plumbicon is a registered trademark of N.V. Philips

JVC COMPANY OF AMERICA, PROFESSIONAL VIDEO COMMUNICATIONS DIVISION, 41 SLATER DRIVE, ELMWOOD PARK, NJ 07407 JVC CANADA, SCARBOROUGH, ONTARIO

**JVC®**





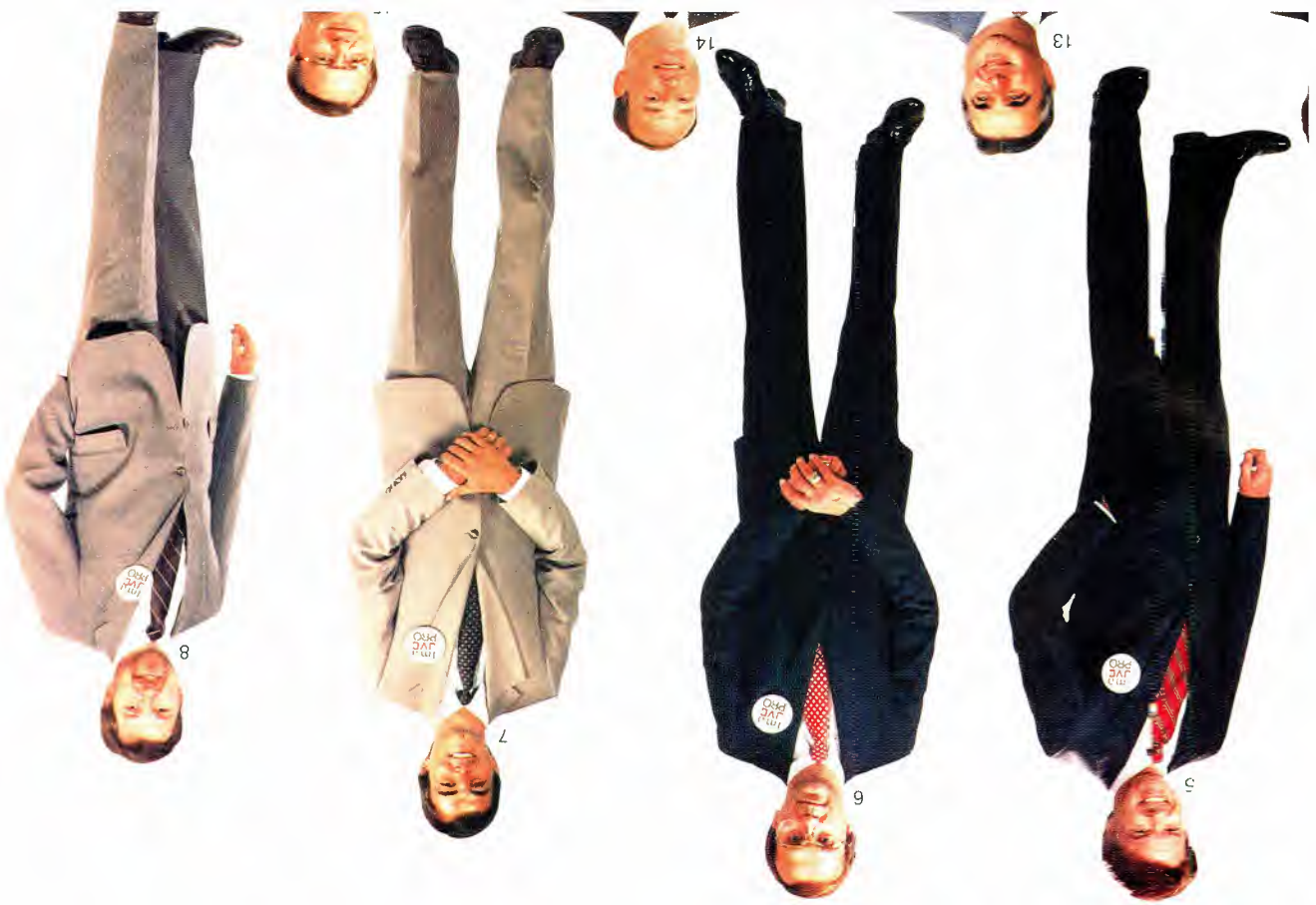
13. Al Berlin — Video Corporation of America  
 14. Phil Dalen — Blumberg Communications  
 15. Joe Stoebner — Audiovisual  
 16. Bernie Palmer — L. Matthew Miller Associates  
 17. Dave Rauth — VMI Company of St. Louis  
 18. Helene Anderson — Crimson Tech

19. Lloyd Hicks — Midwest Communications  
 20. Bud Lines — Lines Video Systems  
 21. Ken Muehnbauer — Avonix Video Systems  
 22. George Crowder — G.C. Video  
 23. Paul Lines — Lines & Associates

# SIONAL VIDEO



# THE CAM SO







WXEL-TV Boynton Beach, FL    Rochester Institute of Technology Rochester, NY    Video Genesis, Inc. Beachwood, OH    Reliance Electric Visual Systems Eastlake, OH    Searle's Video News Service Richmond, MA    Coastal Video Productions Norfolk, VA    Laird Telemedia Salt Lake City, UT

# eds in high-end teleproduction.



Valcas Video Production, Inc. River Edge, NJ    VideoAds Kennebunkport, ME    Mitre Bedford, MA    Sandia Laboratories Albuquerque, NM    KAIT-TV Jonesboro, AR    USAA Insurance Company San Antonio, TX    I Shoot Video Tulsa, OK



Main Stream Communications Minneapolis, MN    Bloomington Assembly of God Church Bloomington, MN    Boston College Chestnut Hill, MA    United Telecom Inc. Shawnee Mission, KS    Mountain Video Productions St. Thomas, US Virgin Islands    Square Wheel Productions Hollywood, CA    Priority One Plano, TX



North American Coal Company Bismarck, ND    S.C. Johnson & Son Racine, WI    Jet Propulsion Laboratory Pasadena, CA    Sheridan Hills Baptist Church Hollywood, FL    WINK-TV Ft. Myers, FL    Doerr Electric Company Cedar Berg, WI    MCNC Research Triangle Park, NC



WBNG-TV Binghamton, NY    WTVT-TV Tampa, FL    WDAY-TV Fargo, ND    Hartwick Przyborski Pittsburgh, PA    Newman Communications, Inc Grand Rapids, MI    Bureau of Jewish Education Newton, MA    Southeastern Bar Miami, FL



American Video Cinemas Lake City, FL    WKOW-TV Madison, WI    Cleveland State University Cleveland, OH    On Q Video Productions West Allis, WI    D-L Images Indianapolis, IN    Independent News Service Ambridge, PA    University of Florida Gainesville, FL



TAVPRO Omaha, NE    Comm. Energy Cambridge, MA    David Hetlend LTD. Fargo, ND    Carlson Video Billings, MT    Tecumseh Grafton, WI





# JOHN MILLER



Midwest Communications Corp.  
8875 N.W. 23rd St.  
Miami, FL 33172  
(305) 592-5355  
Serving Florida.

**John's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

*Continued from page 48*

temperature is an effective method of evaluating transmitter performance as a system. This can be easily accomplished and provides valuable data on the cooling system and stage tuning.

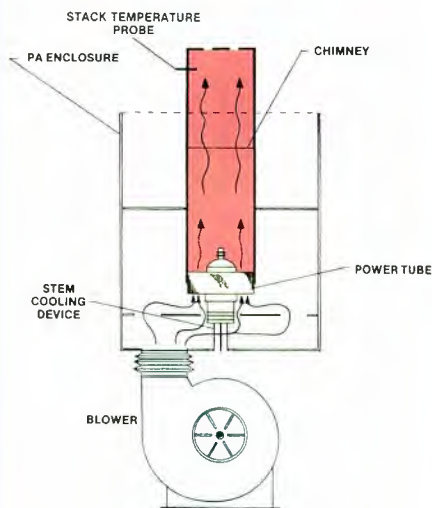
Purchase an accurately calibrated thermometer that will measure up to 100°C and locate it directly above the PA stack exhaust within the airflow from the tube. This is a simple procedure, but it must be done with great care.

The thermometer can be a standard laboratory unit or it can be a solid-state temperature-sensing module. A temperature-sensing device offers the capability of tying into your remote-control system and providing feedback on the PA stack temperature from the studio control point. Be careful when selecting a solid-state device for such applications, however, because of the effects that high levels of RF energy may have on the accuracy of the unit.

Another convenient method for checking the efficiency of a transmitter cooling system over a period of time involves documenting the back pressure that exists within the PA cavity. This measurement is made with a *manometer*, a simple device that is available from most heating, ventilation and air-conditioning (HVAC) suppliers. The connection of a simplified manometer to a transmitter PA input compartment is illustrated in Figure 5.

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

By charting the manometer readings, it is possible to accurately measure the



**Figure 4.** Typical transmitter PA stage cooling system.

# BOB ROMANO



Central New York Univisions  
2011 Teall Avenue  
Syracuse, NY 13206  
(315) 437-0301  
Serving New York State.

**Bob's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

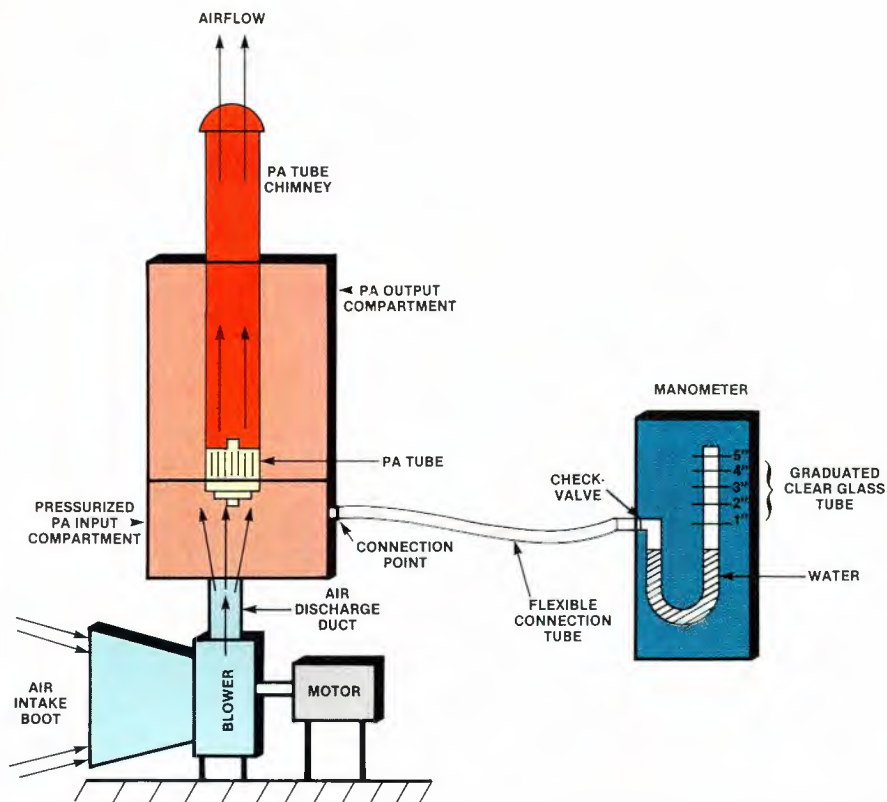


# TERRY MOORE



Audio Video Supply, Inc.  
5563 Kearny Villa Road  
San Diego, CA 92123-1162  
(619) 565-1101  
Serving the San Diego area.  
**Terry's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



**Figure 5.** A manometer device used for measuring back pressure in the PA compartment of a transmitter.

performance of the transmitter cooling system over time. Changes resulting from the build-up of small dust particles (*microdust*) may be too gradual to be detected except through back-pressure charting. Be certain to take the manometer readings during periods of calm weather. Strong winds can result in erroneous readings because of pressure or vacuum conditions at the transmitter air intake or exhaust ports.

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

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

Failure of the PA compartment air-interlock switch to close reliably may be an early indication of impending cooling-system trouble. This could be caused by normal mechanical wear or vibration on the switch assembly, or it may signal that the PA compartment air pressure is dropping. In such instances, documenta-

tion of manometer readings will show whether the trouble is caused by a failure of the air-pressure switch or a decrease in the output of the air-handling system.

## Warm-up/cool-down

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

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

Most tube manufacturers suggest that cooling air continue to be directed toward the tube base and anode cooling fins after filament voltage has been removed to further cool the device. Un-



# CHUCK TAYLOR



*An internal cavity klystron mounted in its magnet frame.*

fortunately, however, not all transmitter control circuits are configured to allow this mode of operation.

## Changing tubes

Plug-in power tubes must be seated firmly in their sockets and the connections to the anodes of the tubes must be tight. Once it is in place, do not remove a tube assembly for routine inspection unless it is malfunctioning.

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

In many cases, the specific fingerstock ring can be ordered and replaced. In other cases, however, the entire socket must be replaced. This type of work is a major undertaking, and an inexperienced engineer should consider calling in a consultant to help on the project.

## Extending tube life

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

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

Tubes must be seated firmly in their sockets to allow a good, low-resistance contact between the fingerstock and contact rings. After a new tube—or one that has been on the shelf for some time—is

# JOHN LEVECK



Mission Electronics, Inc.  
3897 W. 95th Street  
Overland Park, KS 66206  
(913) 341-8370  
Serving western Missouri and  
Kansas.

## Chuck's a PROCAM® PRO.

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

Image Electronics  
18437-C Mt. Langley  
Fountain Valley, CA 92708  
(213) 641-7733  
Serving Orange County.

## John's a PROCAM® PRO.

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC**  
**PROFESSIONAL**  
**VIDEO**

**JVC**  
**PROFESSIONAL**  
**VIDEO**



# JAY ADRICK

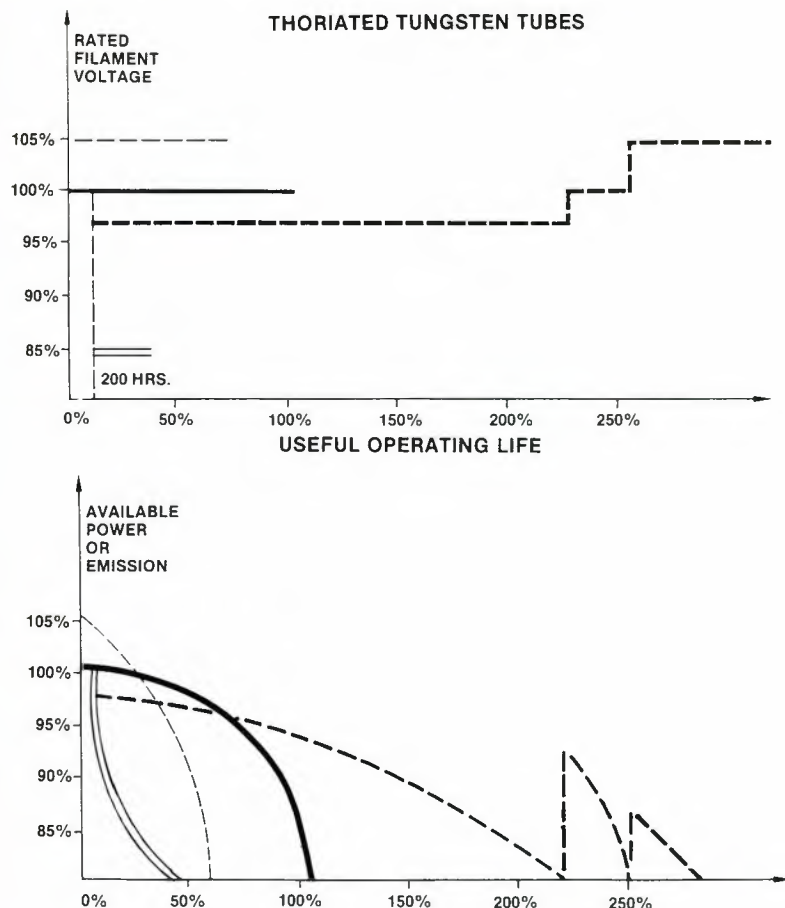


Midwest Communications Corp.  
One Sperti Drive  
Edgewood, KY 41017  
(606) 331-8990  
Serving Pennsylvania, Ohio,  
Kentucky, Indiana and Michigan.

**Jay's a PROCAM® PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

## JVC® PROFESSIONAL VIDEO



**Figure 6.** The effects of filament voltage management on the useful life of a thoriated tungsten filament power tube. Note the dramatic increase in emission hours when filament voltage management is practiced.

installed in the transmitter, run it with *filaments only* for at least 30 minutes, after which plate voltage may be applied. Next, slowly bring up the drive (modulation), in the case of an AM or TV visual transmitter. Residual gas inside the tube may cause an interelectrode arc (usually indicated by the transmitter as a plate overload) unless it is burned off in such a warm-up procedure.

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

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

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

To accurately adjust the filament voltage, a *true-reading* rms voltmeter is required. Make the measurement directly from the tube socket connections. Secure the voltmeter test leads to the socket connections and carefully route the cables outside the transmitter cabinet. Switch off the plate power supply circuit breaker. Close all interlocks and apply a *filament on* command. Do not apply the high voltage during filament voltage tests. Serious equipment damage and/or injury to the engineer may result.

Use a true-reading rms meter instead of the more common *average responding* rms meter because the true-reading meter can accurately measure a voltage despite an input waveform that is not a pure sine wave (as would be the case in an SCR-regulated filament supply). The front-panel filament voltage meter is seldom a true-reading rms device. (Most are average-responding meters.)

Long tube life requires filament voltage regulation. Many transmitters have regulators built into the filament supply. Older units without such circuits often can be modified to provide a well-regulated supply by adding a ferroresonant transformer or motor-driven autotransformer. A tube whose filament volt-



# FRED WOOD



age is allowed to vary along with the primary line voltage will not achieve the life expectancy possible with a tightly regulated supply. This problem is particularly acute at mountain-top installations, where utility regulation is generally poor.

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

Do not leave voltage on the filaments of a klystron for periods of more than two hours if no beam voltage is applied. The net rate of evaporation of emissive material from the cathode surface of a klystron is greater without beam voltage. Subsequent condensation of the material on gun components may lead to voltage holdoff problems and an increased body current.

## Filament voltage management

By accurately managing the filament voltage of a thoriated tungsten power tube, you can considerably extend its useful life, sometimes to twice the normal life expectancy. For maximum tube life, operate the filament at its full-rated voltage for the first 200 hours following installation. After this burn-in period, reduce the filament voltage by about one-tenth of a volt per step until power output begins to fall (for FM and TV transmitters) or until distortion begins to increase (for AM transmitters).

When the emissions floor has been reached, raise the filament voltage about two-tenths of a volt. Long-term operation at this voltage can result in a substantial extension in the usable life of the tube. (See Figure 6.) In any event, do not operate the tube with a filament voltage that is at or below 90% of normal. Some tube manufacturers put the minimum level at 95%. At regular intervals, about every three months, check the filament voltage and increase it if power output begins to fall or distortion begins to rise. The filament voltage should never be increased to more than 105% of normal.

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

Check the filament current when the tube is first installed, and at annual intervals thereafter, to assure that the filament draws the desired current. Tubes have failed early because of an open filament bar that would have been discovered in warranty if a current check had been made on installation.

For one week of each year of tube operation, run the filament at full-rated

# RON BRADLEY



Midwest Communications Corp.  
1395 Air Rail Ave.  
Virginia Beach, VA 23455  
(804) 464-6256  
Serving Virginia, West Virginia,  
D.C., North & South Carolina.

**Fred's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

Midwest Communications Corp.  
522 Armour Circle NE  
Atlanta, GA 30324  
(404) 875-3753  
Serving Georgia and Alabama.  
**Ron's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



# JOHN FODE



Walt Davis Enterprises  
3439 Cahuenga Blvd.  
Hollywood, CA 90068  
(213) 876-6400  
Serving Los Angeles and  
Hollywood.

**John's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

## PA TUNING ADJUSTMENT

- Unload the transmitter (switch the loading control to *lower*) to produce a PA screen current of 400mA to 600mA.
- Peak the PA screen current with the plate-tuning control.
- Maintain screen current at or below 600mA by adjusting the loading control (switch it to *raise*).
- Position the plate-tuning control in the center of travel by moving the coarse-tune shorting plane up or down as needed. If the screen current peak is reached near the *raise end* of plate tune travel, raise the shorting plane slightly. If the peak is reached near the *lower end* of travel, lower the plane slightly.
- After the screen current has peaked, adjust the loading control for maximum power output and minimum synchronous AM.
- Peak the driver screen current with C37.
- The driver screen peak should coincide with PA screen peak and PA grid peak. Driver screen peak should also coincide with a dip in the left and right driver cathode currents.

**Table 1.** A sample documented transmitter tuning procedure. Note in your listing of tuning steps the side effects of various actions.

voltage. This will operate the *getter* and clean the tube of gas.

Filament voltage supplies should be *soft*. Make sure that inrush current to the filament is limited by some means.

Filament voltage is an equally important factor in achieving long life in a klystron. The recommended voltages must be followed and checked on a regular basis. Measure the voltage at the filament terminals and calibrate the front-panel meter as needed.

Unless specifically recommended in the klystron data sheet, do not reduce filament voltage below the knee of the emission curve. Such a setting may cause uneven emission from the surface of the cathode with little or no improvement in cathode life.

### Why tubes wear out

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

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

The residual vacuum level affects tube life because the *decarburization rate* (the rate at which carbon is burned out of the filament assembly) is a function of the partial pressures of the active gases inside the envelope, primarily oxygen compounds, reacting with the carbon.

Good vacuum processing and proper *gettering* in the tube results in the lowest residual gas levels.

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

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

### Tuning up for efficiency

There are probably as many ways to tune the PA stage of a transmitter as there are types of transmitters. Experience is the best teacher when it comes to adjusting a transmitter for peak efficiency and performance. Compromises often must be made among various operating parameters. Some engineers follow the tuning procedures contained in the transmitter instruction manual to the letter. Others never open the manual, preferring to tune according to their own methods.

Whatever procedure you use, document the operating parameters and steps for future reference—yours and your successor's. Do not rely on memory for a listing of the typical operating limits and tuning procedures for the system. Write down the information and post it at the transmitter building. If you are out of town one day and someone else has to service the transmitter, the list will be invaluable.

The factory service department can be an excellent source for information about tuning your particular transmitter. Many times the factory can give you pointers on how to simplify the tuning



# BRUCE MICHAEL



Davis Audio Visual  
1801 Federal Blvd.  
Denver, CO 80204  
(303) 455-1122  
Serving Colorado.

**Bruce is a PROCAM® PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

process, or what interaction of adjustments may be expected. Whatever you learn from conversations with the factory, write it down. Again, a written record will help you and your successor.

Table 1 shows a typical tuning procedure for an FM transmitter. The actual procedures vary, of course, from transmitter to transmitter. However, if the particular tuning characteristics of the unit are documented in a detailed manner, future repair work can be simplified. This record can be of great value to an engineer who is fortunate enough to have a reliable transmitter that does not require regular service. Many of the tuning tips learned during the last service session may be forgotten by the time transmitter work must be performed again.

## When to tune

Tuning can be affected by any number of changes in the PA stage. Replacing the final tube in an AM transmitter usually does not significantly change the stage tuning, but run through a touch-up tuning procedure just to be sure. Replacing a tube in an FM or TV transmitter, on the other hand, can significantly alter stage tuning. At higher frequencies, normal tolerances and variations in tube construction result in changes in element capacitance and inductance. Likewise, replacing a component in the PA stage may cause tuning changes because of normal device tolerances. Whenever you replace a component in a transmitter RF stage, run through the complete tuning procedure.

One of the primary objectives of transmitter tuning is stability. Avoid tuning positions that do not provide stable operation. Adjust for broad peaks or dips, as required. Tune so that the transmitter is stable from a cold startup to normal operating temperature. Readings should not vary measurably after the first minute of operation.

Adjust tuning not only for peak efficiency, but also for peak performance. These two elements of transmitter operation, unfortunately, do not always coincide. Trade-offs must sometimes be made in order to ensure proper operation of the system. For example, FM or TV aural transmitter loading can be critical to wide system bandwidth and low synchronous AM. Loading beyond the point required for peak efficiency must often be used to broaden cavity bandwidth. Heavy loading lowers the PA plate impedance and cavity Q. A low Q also reduces RF circulating currents in the cavity.

Because of the interdependence of transmitter tuning and system performance, carefully consider the tuning procedures outlined in the instruction manual. There's nothing wrong with improving on the factory's recommended procedures, just as long as you don't create any new problems in the process.

# GENE TOLLINI



Magnetic Media  
3440 Sojourn Drive—Suite 200  
Carrollton, TX 75006  
(214) 931-0404  
Serving Texas.

**Gene's a PROCAM® PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



## Preventing transmitter failures



# Preventing failures

**Don't wait for a failure. Prevent one from occurring.**



*Check transmission line hardware for overheating and mechanical tightness.*

**T**he sections of a transmitter most vulnerable to failure are those exposed to the outside world: the ac-to-dc power supplies and RF output stage. These circuits are subject to high-energy surges from lightning and other sources. For this reason, particular attention must be given to the dc power supplies—especially the high-voltage plate supply—and the PA output stage.

### VSWR

The voltage standing wave ratio (VSWR) of an antenna and its transmission line is a vital parameter that has a considerable effect on the performance and reliability of a transmission system. VSWR is a measure of the amount of power reflected back to the transmitter because of an antenna and/or transmission line mismatch. (See Figure 7 for calculation data.) A mismatched or defective transmission system will result in a high degree of reflected power, or a higher VSWR.

Common practice in FM applications

calls for a VSWR of 1.1:1 as the maximum level within the transmission channel that can be tolerated without degrading the quality of the on-air signal. For TV systems, a VSWR into the antenna feeder of more than 1.04:1 will start to degrade picture quality, particularly with a long line. The reflection down the line from a mismatch at the antenna, in addition to disrupting the performance of the transmitter output stage, causes multipath distortion *within* the transmission line itself. When power is reflected back to the transmitter, it causes the RF

output stage to look into a mismatched load with unpredictable phase and impedance characteristics.

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

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

Always maintain positive pressure on the transmission line and antenna (if



# MARK SWIDERSKI



Swiderski Electronics, Inc.  
1200 Greenleaf Ave.  
Elk Grove, IL 60007  
(312) 364-1900  
Serving the Chicago area.  
**Mark's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

pressurized). Feedline pressurization keeps moisture out of the system and subsequently prevents oxidation. Disastrous burnups may occur when water collects on an insulator, causing oxidation and resulting increased attenuation.

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

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

## The effects of modulation

The VSWR of a transmission system is a function of frequency and changes with carrier modulation. This change may be large or small, but it will occur to some extent. The cause can be traced to the frequency dependence of the VSWR of the antenna (and to a much lesser extent, the transmission line). See Figure 8.

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

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

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

## Maintenance

In order to maintain low VSWR, service the transmission line and antenna system regularly.

- Inspect the antenna elements, interconnecting cables, impedance transformers and support braces at least once

# AL BERLIN



Video Corporation of America  
7 Veronica Ave.  
Somerset, NJ 08873  
(201) 545-8000  
Serving New Jersey.  
**Al's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



# PHIL DALEN



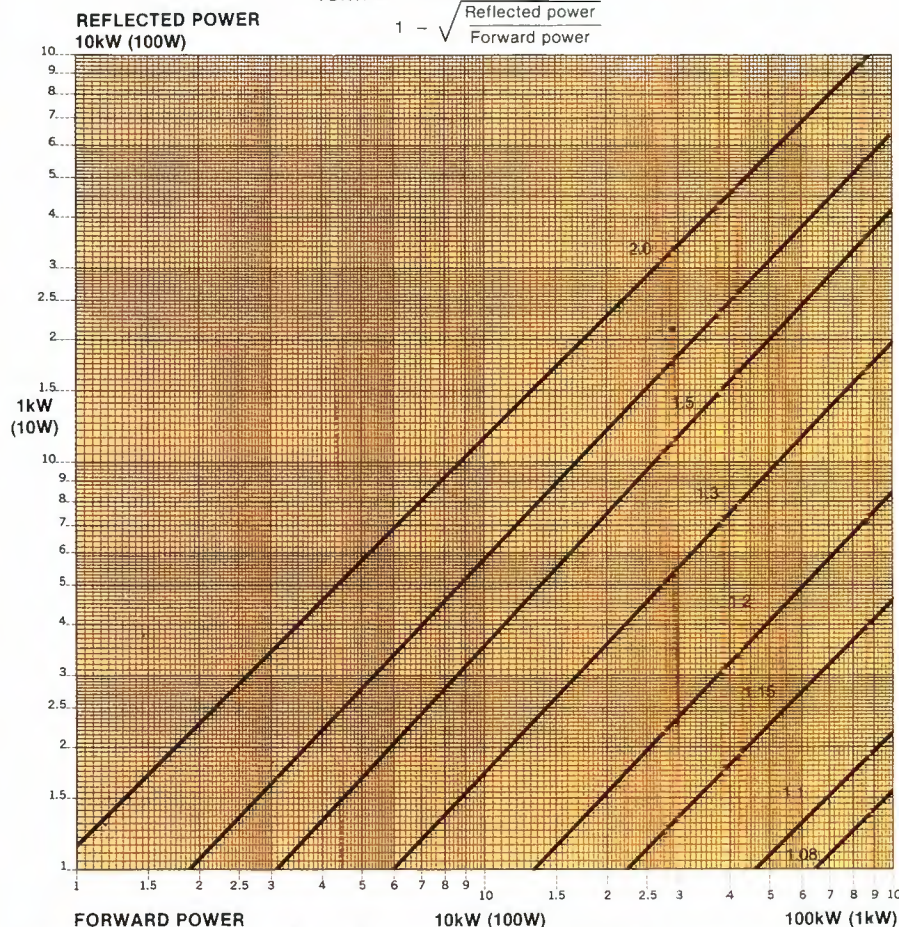
Blumberg Communications, Inc.  
525 N. Washington Ave.  
Minneapolis, MN 55401  
(612) 333-1271  
Serving Minnesota.

**Phil's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

# JVC®

## PROFESSIONAL VIDEO

$$VSWR = \frac{1 + \sqrt{\frac{\text{Reflected power}}{\text{Forward power}}}}{1 - \sqrt{\frac{\text{Reflected power}}{\text{Forward power}}}}$$



**Figure 7.** A graph that can be used for determining the VSWR of a transmission system. For low-power operation, use the values shown in parentheses.

each year. Falling ice can damage FM and TV antenna elements if proper precautions are not taken.

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

- Check AM antennas regularly for structural integrity. Because the tower itself is the radiator, bond together each section of the structure for good electrical contact.
- Clean base insulators and guy insulators (if used) as often as required. Obviously, it is only practical to clean the guy insulators near the tower and near the ground.
- Keep lightning ball gaps or other protective devices clean and properly adjusted.
- Inspect the transmission line for signs of damage. Check supporting hardware and investigate any indication of abnormal heating of the line immediately.
- Keep a detailed record of VSWR in the station's maintenance log and investigate any increase above the norm.
- Regularly check the RF system test load. Although it probably isn't used

often, be sure you can use it when it's needed. Inspect the coolant filters and flow rate, as well as the resistance of the load element. It might have been damaged the last time you used it.

### UHF systems

The RF transmission system of virtually any high-power UHF station is externally diplexed after the final RF amplifiers with either coaxial or waveguide-type diplexers. Maintenance of combining sections is largely a matter of observation and record keeping.

- Monitor the reject loads on diplexers and power combiners regularly to ensure adequate cooling.
- Check the temperature of the transmission line and components, particularly coaxial elements. Don't be surprised to find that coax of the same size, carrying the same RF power, runs warmer in UHF than in VHF systems. This phenomenon is caused by the reduced *skin effect* (or penetration depth) of UHF signal currents.

Hot spots in the transmission line can be caused by poor contact areas or by high VSWR. If they are the result of a VSWR condition, the hot spots will be repeated every ½-wavelength toward the transmitter.



# JOE STOEBNER



Audiovisual, Inc.  
1818 Broadway  
Bismarck, ND 58501  
(701) 258-6360  
Serving North & South Dakota,  
Iowa, Nebraska, Montana and  
Wyoming.

**Joe's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

- Monitor the reverse power/VSWR meters closely. Some daily variation is not unusual, in small amounts. Greater variations that are cyclical in nature are an indication of a long-line problem, most likely at the antenna. Transmission lines are usually long at UHF (a taller tower allows greater coverage) and the wavelength is small, which leads to large phase changes of a mismatch at the antenna.

Mismatches inside the building do not cause the same cyclical variation. If the reverse power begins varying significantly, immediately arrange for an RF sweep of the line. You may be able to avoid major failure. Before you consider a sweep procedure, however, run the system with the test load to see whether the problem disappears.

Another effect of VSWR variation on a UHF transmitter is change in klystron output power. The output coupler transforms the line characteristic impedance upward to approximately match the beam impedance, for a maximum power transfer from the cavity. Large VSWR phase variations associated with long lines change the impedance that the output coupler sees. This causes the output power to vary, sometimes more significantly than the reverse power metering indicates.

A common indication of antenna VSWR problems in long-line TV systems is ghosting on the output waveform. If the input signal is clean and the output has a ghost, call for an RF sweep.

## High-voltage power supply

The second section of a transmitter most vulnerable to damage because of outside influences is the high-voltage plate power supply.

Figure 9 shows a high-reliability power supply of the type common in broadcast transmission equipment. Many transmitters use simpler designs, without some of the protection devices shown, but the principles of preventive maintenance are the same.

- Thoroughly examine every component in the high-voltage power supply. Look for signs of leakage on the main filter capacitors (C1 and C2).
- Check all current-carrying meter/overload shunt resistors (R1 to R3) for signs of overheating.
- Carefully examine the wiring throughout the power supply for loose connections.
- Examine the condition of the filter capacitor series resistors (R4 and R5), if used, for indications of overheating. Excessive current through these resistors could spell a pending failure in the associated filter capacitor.
- Examine the condition of the bleeder resistors (R6 to R8). A failure in one of the bleeder resistors could result in a potentially dangerous situation for maintenance personnel by leaving the main power-supply capacitor (C2) charged

# BERNIE PALMER



L. Matthew Miller Associates  
48 West 21st Street  
New York, NY 10010  
(212) 741-8011  
Serving New York City.

**Bernie's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



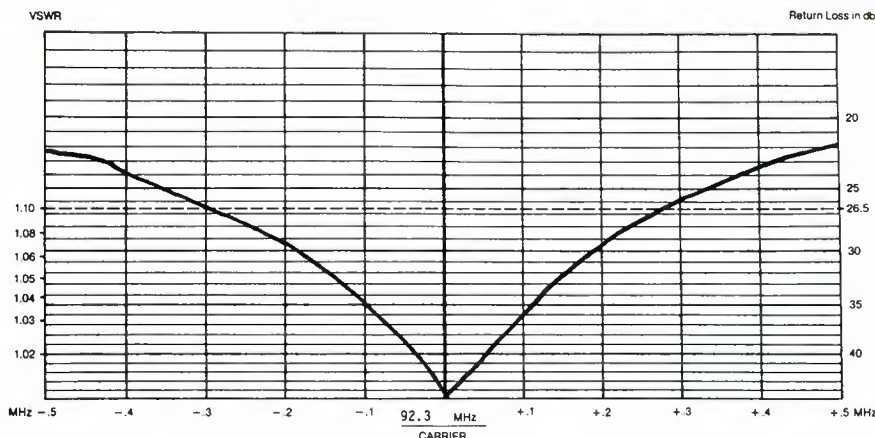
# DAVE RAUTH



VMI Company of St. Louis  
2368 Schuetz Road  
St. Louis, MO 63146  
(314) 569-1334  
Serving eastern Missouri and  
southern Illinois.

**Dave's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



**Figure 8.** The measured performance of a single-channel FM antenna (tuned to 92.3MHz). This antenna—a 10-bay circularly polarized unit—provides a VSWR of below 1.1:1 over a frequency range of nearly  $\pm 300\text{kHz}$ .

after the removal of ac input power.

- Examine the plate voltage meter multiplier assembly (A1) for signs of resistor overheating. Replace any resistors that are discolored.

When changing components in the transmitter high-voltage power supply, be certain to use parts that meet with the approval of the manufacturer. Do not settle for a close match of a replacement part. Use the *exact* replacement part. This ensures that the component will work as intended and will fit in the space provided.

## Metering

Proper metering is one of the best ways to prevent failures in broadcast transmission equipment. Accurate readings of plate voltage and current are fundamental to transmitter maintenance. Check each meter for proper mechanical and electrical operation. Replace any meter that sticks or will not zero.

With most transmitter plate current meters, accuracy of the reading can be verified by measuring the voltage drop across the shunt element (R2 of Figure 9) and using Ohm's law to determine the actual current in the circuit. Be certain to take into consideration the effects of the meter coil itself. Contact the transmitter manufacturer for suggestions on how best to confirm the accuracy of the plate current meter.

The plate voltage meter can be checked for accuracy by using a high-voltage probe and a high-accuracy external voltmeter. Be extremely careful when making such a measurement. Follow to the letter instructions for use of the high-voltage probe. Do not defeat transmitter interlocks to make this measurement. Instead, fashion a secure connection to the point of measurement and route the meter cables carefully out of the transmitter. Never use common test leads to measure a voltage of more than 600V. Standard test lead insulation for most meters is not rated for use above 600V.

## Overload sensor

The plate supply overload sensor in most transmitters is arranged as shown in Figure 9. An adjustable resistor—either a fixed resistor with a movable tap or a potentiometer—is used to set the sensitivity of the plate overload relay. Check potentiometer-type adjustments periodically. Fixed-resistor-type adjustments rarely require additional attention. Most manufacturers have a chart or mathematical formula that may be used to determine the proper setting of the adjustment resistor (R9) by measuring the voltage across the overload relay coil (K1) and observing the operating plate current value.

Clean the overload relay contacts periodically to ensure proper operation. If you encounter mechanical problems with a relay, replace it.

Transmitter control logic for UHF systems will almost certainly be configured for two states. An *operational level* requires all the *life-support* systems to be present before the HV command is enabled. An *overload level* removes HV when one or more fault conditions occur. Inspect the logic ladder for correct operation at least once a month.

At longer intervals, perhaps annually, check the speed of the trip circuits. (A storage oscilloscope is useful for this measurement.) Most klystrons require an HV removal time of less than 100ms from the occurrence of an overload. If the trip time is longer, you may be ordering another klystron sooner than you expected.

Pay particular attention to the body-current overload circuits. Occasionally check the body current without applied drive to ensure that the dc value is stable. Relatively small increases in dc body current can lead to overheating problems.

Other UHF transmitter overload circuits requiring periodic monitoring include the RF arc detectors. External cavity klystrons generally have one detector in each of the third and fourth cavities.



# HELENE ANDERSON

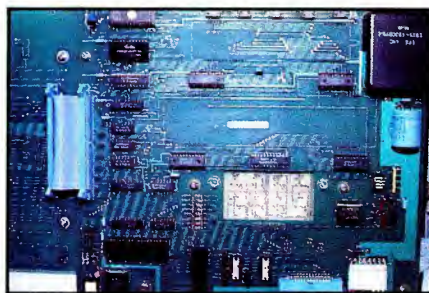


Crimson Tech  
325 Vassar Street  
Cambridge, MA 02139  
(617) 868-5150  
Serving New England.

**Helene's a PROCAM® PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



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

Integral devices use one detector at the output window.

A number of factors cause RF arcing: overdrive, mistuning, poor cavity fit (external type only), undercoupling of the output and high VSWR. Regardless of the cause, arcing can destroy the vacuum seal, if drive and/or HV are not removed quickly.

A lamp is included with each arc detector photocell for test purposes. If the lamp fails, a flashlight can provide sufficient light to trigger the cell until a replacement can be obtained.

#### Transient disturbances

Every electronic installation requires a steady supply of clean power in order to function properly. Recent advances in technology have made the question of ac-power quality even more important, as microcomputers are integrated into radio and TV transmitters.

The threat of damaging transient over-voltages from the utility company power system is a very real problem for broadcasters. Transients have been recorded on typical primary power drops ranging from harmless values just above normal, to dangerous spikes measuring several kilovolts. Experience in the computer industry has shown that equipment not protected against the possibility of power-supply disturbances will have a poor mean-time-between-failures record. The degree of protection needed at a facility depends on the type of service used, the utility company system layout and the frequency of lightning and other natural occurrences in the area.

Different types and makes of transmitters have varying degrees of transient overvoltage protection. Given the experience of the computer industry, it is hard to overprotect electronic equipment from ac line disturbances.

Figure 9 (page 70) shows surge suppression at two points in the power supply circuit. C1 and R4 make up an R/C snubber network that is effective in shunting high-energy, fast-rise time spikes that may appear at the output of the rectifier assembly (CR1 to CR6). Similar R/C snubber networks (R10 to

# LLOYD HICKS



Midwest Communications Corp.  
8875 N.W. 23rd St.  
Miami, FL 33172  
(305) 592-5355  
Serving Florida.

**Lloyd is a PROCAM® PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



# BUD LINES

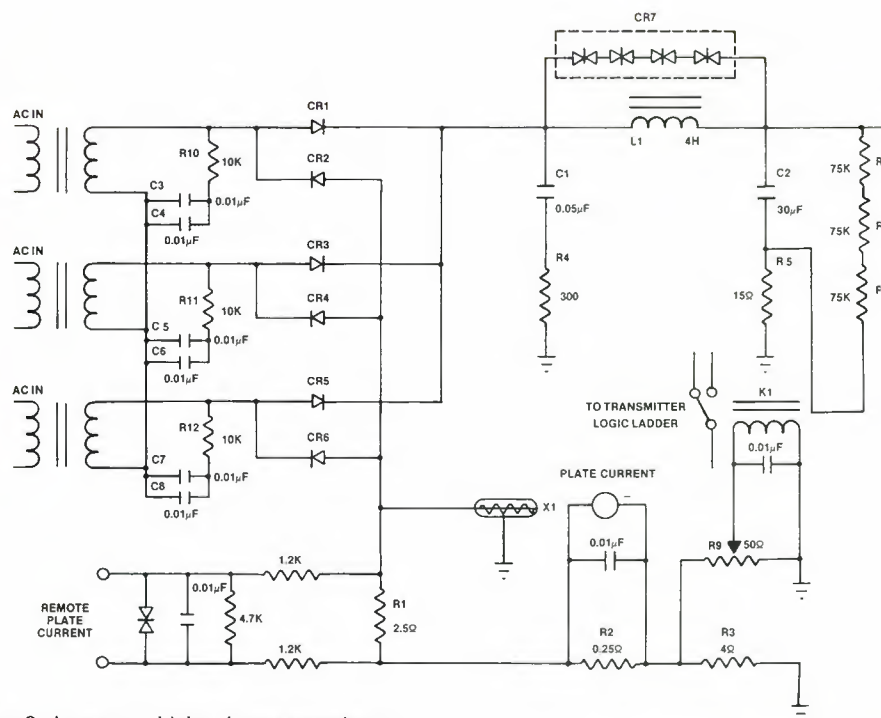


Lines Video Systems  
219 South Jefferson  
Springfield, MO 65805  
(417) 862-5533  
Serving southwestern Missouri,  
Oklahoma and Arkansas.

**Bud's a PROCAM PRO.**

When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC**  
**PROFESSIONAL**  
**VIDEO**



**Figure 9.** A common high-voltage transmitter power-supply circuit design.

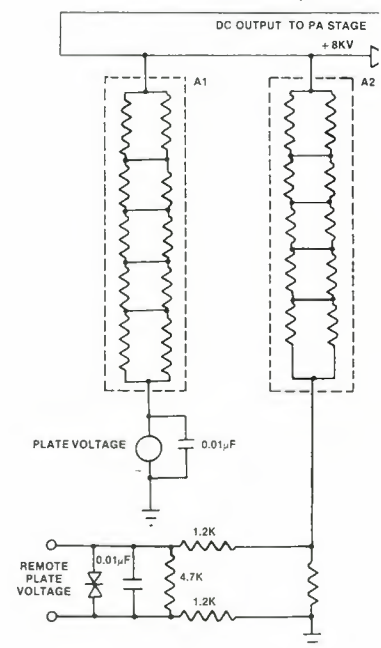
R12 and C3 to C8) are placed across the secondary windings of each section of the 3-phase power transformer. Any signs of resistor overheating or capacitor failure are an indication of excessive transient activity on the ac power line. Transient disturbances should be suppressed before the ac input point of the transmitter.

Assembly CR7 is a surge-suppression device that should be given careful attention during each maintenance session. CR7 is typically a selenium thyrector assembly that is essentially inactive until the voltage across the device exceeds a predetermined level. At the trip point, the device will break over into a conducting state, shunting the transient overvoltage.

CR7 is placed in parallel with L1 to prevent damage to other components in the transmitter in the event of a loss of RF excitation to the final stage. A sudden drop in excitation will cause the stored energy of L1 to be discharged into the power supply and PA circuits in the form of a high-potential pulse. The results of this transient can be damaged or destroyed filter, feedthrough or bypass capacitors; damaged wiring or PA tube arcing. CR7 prevents this problem by dissipating the stored energy in L1 as heat.

Investigate discoloration or other outward signs of damage to CR7. Such an occurrence could indicate a problem in the exciter or IPA stage of the transmitter. Immediately replace CR7 if it appears to have been stressed.

Check spark-gap surge-suppressor X1 periodically for signs of overheating. X1 is designed to prevent damage to circuit



wiring in the event that one of the meter/overload shunt resistors (R1 to R3) opens. Because the spark-gap device is nearly impossible to accurately test in the field and is relatively inexpensive, it is an advisable precautionary measure to replace the component every few years.

## Single phasing

Any transmitter using a 3-phase ac power supply is subject to the problem of *single-phasing*, the loss of one of the three legs from the primary ac power distribution source. Single phasing is usually a utility company problem, caused by a downed line or a blown pole-



# KEN MUEHLBAUER



Avonix Video Systems, Inc.  
3495 North 124th St.  
Brookfield, WI 53005  
(414) 783-6050  
Serving Wisconsin.

**Ken's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**

mounted fuse.

The loss of one leg of a 3-phase line results in a particularly dangerous situation for 3-phase motors, which will overheat and sometimes fail. AM transmitters using *pulse width modulation* (PWM) systems also are vulnerable to single-phasing faults. AM transmitters using PWM schemes can suffer catastrophic failure of the plate power-supply transformer as a result of the voltage regulation characteristics of the modulation system. The PWM circuit will attempt to maintain carrier and sideband power through the remaining leg of the 3-phase supply. This forces the active transformer section and its associated rectifier stack to carry as much as three times the normal load.

Figure 10 shows a simple protection scheme that has been used to protect transmission equipment from damage caused by single phasing. Although at first glance the system looks as if it would easily handle the job, operational problems can result.

The loss of one leg of a 3-phase line rarely results in zero (or near-zero) voltages in the legs associated with the problem line. Instead, a combination of leakage currents caused by regeneration of the missing legs in inductive loads and the system load distribution usually results in voltages of some sort on the fault legs of the 3-phase line.

It is possible, for example, to have phase-to-phase voltages of 220V, 185V and 95V on the legs of a 3-phase, 208Vac line experiencing a single-phasing problem. These voltages often change, depending upon the equipment turned on at the transmitter site.

Integrated circuit technology has provided a cost-effective solution to this common design problem in medium- and high-power transmitting equipment. Phase-loss protection modules are available from several manufacturers that provide a contact closure when voltages of proper magnitude and phase are present on the monitored line. The relay contacts can be wired into the logic control ladder of the transmitter to prevent the application of primary ac power during a single-phasing condition.

Figure 11 shows the recommended connection method. Note that the input to the phase monitor module is taken from the final set of 3-phase blower motor fuses. In this way, any failure inside the transmitter that might result in a single-phasing condition is taken into account. Because 3-phase motors are particularly sensitive to single-phasing faults, the relay interlock is tied into the filament circuit logic ladder. For AM transmitters using PWM schemes, connect the input of the phase loss protector to the load side of the plate circuit breaker.

The phase-loss protector shown in Figure 11 includes a sensitivity adjustment for various nominal line voltages.

# GEORGE CROWDER



G.C. Video, Inc.  
Box 178, Erickson Road  
Sandia Park, NM 37407  
(505) 281-1301  
Serving New Mexico.

**George is a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

**JVC®**  
**PROFESSIONAL**  
**VIDEO**



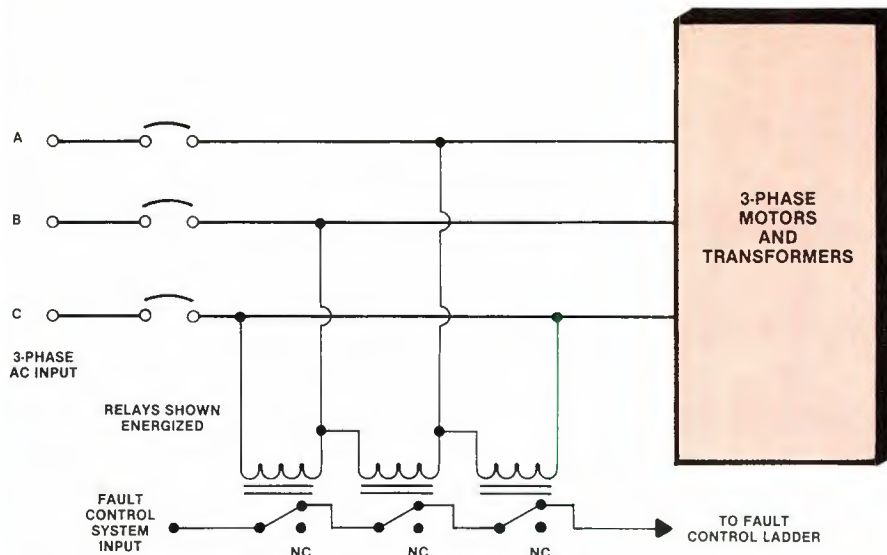
# PAUL LINES



Lines & Associates  
14801 119th Ave. NE  
Kirkland, WA 98034  
(206) 488-3653  
Serving Washington, Oregon,  
Idaho, and northern California.  
**Paul's a PROCAM® PRO.**  
When you decide to go PRO,  
go to the PRO. Your JVC  
PROCAM rep.

# JVC®

## PROFESSIONAL VIDEO



**Figure 10.** Using relays for utility company ac phase-loss protection.

The unit is small and relatively inexpensive (about \$55). If your transmitter does not have such a protection device, consider installing one. Contact the factory service department for recommendations on the connection methods that should be used.

### Modifications and updates

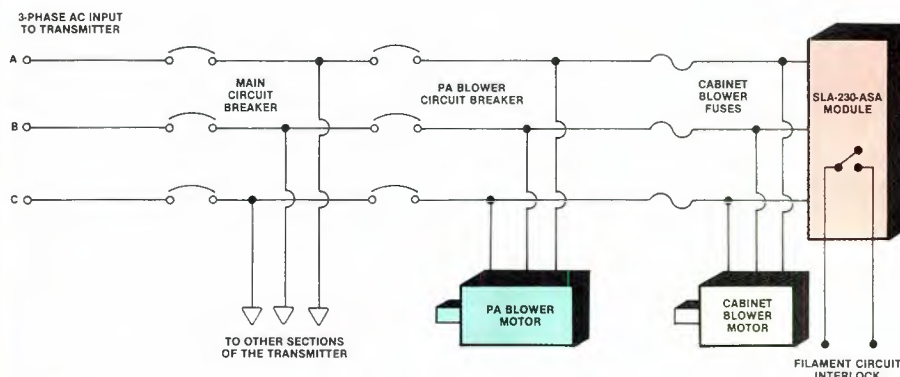
If you experience a problem, examine what can be done to prevent the failure from recurring. You might avoid a repeat by installing various protection devices or consulting the factory for updates to your equipment. If the transmitter is several years old, the factory service department can detail any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

Modifications could include changing a variable capacitor in a critical tuning stage to a vacuum variable for more stability; installing additional filtering in the high-voltage power supply; replacing

older technology transistorized circuit boards with newer IC and power semiconductor PCBs; improving the overload protection circuitry; or adding protection against transient overvoltages in various stages of the transmitter.

### Spare parts

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



**Figure 11.** A high-performance single-phasing protection circuit using a phase-loss module as the sensor. (Note: The device shown in this diagram is a model SLA-230-ASA phase-loss protector module manufactured by Diversified Electronics of Evansville, IN. Units performing comparable functions are also available from other manufacturers.)



# SURGE PROTECTORS



## Widest Range of Protectors Available Anywhere!

### Data Line Protection

MCG provides a sophisticated blend of high speed (less than 5ns) and brute force protection for the sensitive equipment on your data lines. Guards computers and terminals, video cameras and cable, video wideband equipment, modems, and more, against induced transient voltage surges. Available in multiple configurations, they are designed to be used with coaxial cable, single or twisted pairs, RS-232, -422 and -423, 20 ma loops, etc.

*MCG is your one complete source for cost-effective protection against voltage surges and transients.*  
**SEND COUPON FOR FREE CATALOG.**



### AC Power Line Protection

MCG Surge-Master™ protectors are heavy-duty, bi-polar clamping devices that limit AC overvoltage spikes to safe levels. Available as service panel protectors, plug-in devices and power strips, they guard everything from individual pieces of equipment to complete buildings. A variety of models handle the full range of AC voltage and current levels.

#### MCG Electronics Inc.

12 Burt Drive, Deer Park, NY 11729

- ☐ I have an immediate need, please contact me.  
☐ Yes, send me your free full-line catalog on:  
☐ AC Power Line Protection    ☐ Data Line Protection

Name \_\_\_\_\_ Title \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

City/State/Zip \_\_\_\_\_

Telephone \_\_\_\_\_

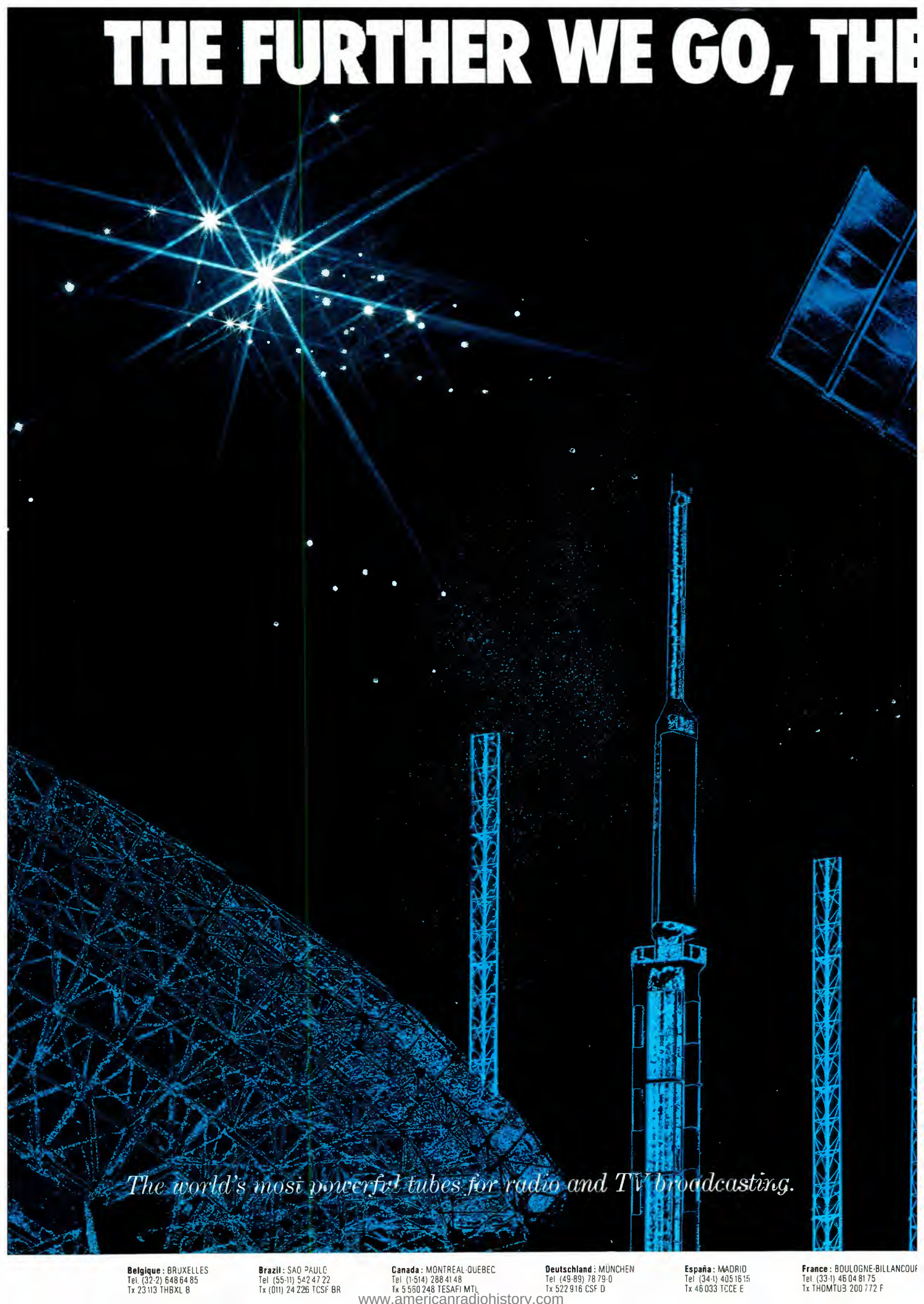
**MCG**  
 ELECTRONICS INC.

*Specialists in Circuit Protectors,  
 Transients, Lightning & Surges.*

12 Burt Drive, Deer Park, NY 11729  
 Nationwide (800) 851-1508  
 In N.Y.: 516-586-5125 Telex: 645518



# THE FURTHER WE GO, THE



*The world's most powerful tubes for radio and TV broadcasting.*

**Belgique :** BRUXELLES  
Tel. (32-2) 648 64 85  
Tx 23 113 THBXL B

**Brazil :** SAO PAULO  
Tel. (55-11) 542 47 22  
Tx (011) 24 226 TCSF BR

**Canada :** MONTREAL-QUEBEC  
Tel. (1-514) 288 41 48  
Tx 5 560 248 TESAFI MTL

**Deutschland :** MÜNCHEN  
Tel. (49-89) 78 79-0  
Tx 522 916 CSF D

**España :** MADRID  
Tel. (34-1) 405 16 15  
Tx 46 033 TCCE E

**France :** BOULOGNE-BILLANCOUF  
Tel. (33-1) 46 04 81 75  
Tx THOMTU3 200 772 F

[www.americanradiohistory.com](http://www.americanradiohistory.com)



# FURTHER YOU GO.

At Thomson-CSF we've been pioneers in developing the use of high-power tetrodes in transmitters for more than 70 years.

Over the years we've stayed ahead with such developments as Pyrobloc® grids and the Hypervapotron® cooling system.

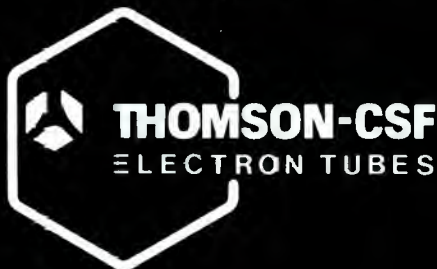
We offer: a complete line of tubes for radio broadcasting applications from FM to the most powerful SW and LW transmitters - the quality of our 500-600 kW tubes has been amply demonstrated in 15 years of service in over forty transmitters worldwide.

A complete line of power grid tubes and their associated cavities for UHF/VHF TV transmitters. Thanks to their efficiency, reliability and tight tolerances, systems makers can offer their customers substantially more cost-effective products.

A complete line of klystrons and TWTs for ground stations and space TWTs for direct broadcasting satellites (DBS) designed to last for at least a decade.

And we also produce high-resolution image pick-up tubes and devices (CCDs), and high-luminosity CRTs for top range professional applications.

In radio and television, telecommunications, military and civil aviation, as well as in a wide range of scientific and medical applications, Thomson-CSF know-how gets your systems moving. Fast.



THOMSON ELECTRON TUBES AND DEVICES CORPORATION  
550 Mount Pleasant Avenue  
DOVER, NEW JERSEY 07801.  
Tel.: (201) 328-1400. TWX: 710387 7901.

UHF and VHF tetrodes up to 50 kW.



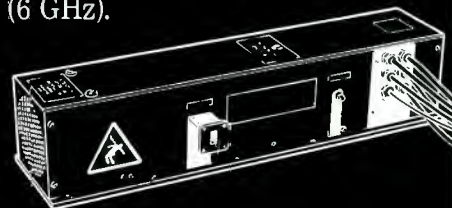
Matched cavities for best results.



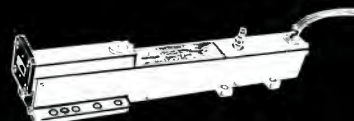
High power radio broadcasting tetrodes up to 1.2 MW (including the famous SW/LW tetrode delivering 500 kW/600 kW).



Earth station tubes up to 18 GHz (1.5 kW) or to 3.35 kW (6 GHz).



High efficiency space TWTs (including 40 W/50 W Ku-band for next generation DBS Satellites).



Primicon high-resolution, no-lag TV camera pick-up tube.



Circle (32) on Reply Card



## Preventing transmitter failures



# Temperature control

**A controlled environment is critical to reliability.**

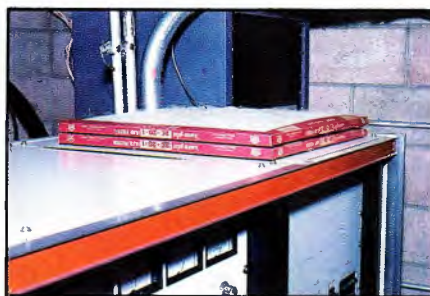
The environment in which the transmitter is operated is a key factor in determining system reliability. Proper temperature control must be provided for the transmitter to prevent thermal fatigue in semiconductor components and shortened life in vacuum tubes. Thermal fatigue occurs in semiconductor power devices because of differential expansion and contraction of the individual parts of the device itself (the silicon pellet, solder and case). Some semiconductor manufacturers have been able to predict the approximate number of thermal cycles that their devices are capable of withstanding without failure.

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

### Keeping cool

Airflow system problems can be avoided if preventive maintenance work is performed on a regular basis.

- Keep all fans and blowers clear of dirt,



*An example of how additional filtering can be added to the air-intake port of a transmitter. Standard furnace filter panels can be used and held in position by adhesive tape squares. Alternatively, special computer room filtering material can be cut to size and placed over air-intake ports. Confirm that no loss of air pressure inside the equipment results from the additional filters.*

dust and other foreign material that might restrict airflow. Check the fan blades and blower impellers for any imbalance conditions that could result in undue bearing wear or damage. Inspect belts for proper tension and alignment.

Regular cleaning of a blower motor is important because motors are cooled by the passage of air over the component. If the ambient air temperature is excessive or the airflow is restricted, the lubricant gradually will be vaporized from the motor bearings and bearing failure will occur. If dirty air passes over the motor, the accumulation of dust and dirt must be blown out of the device before the debris impairs cooling.

- Follow the manufacturer's specifications for suggested frequency and type of lubrication. Bearings and other moving

parts normally require some lubrication. Carefully follow any special instructions on operation or maintenance of the cooling equipment.

- Inspect motor-mounting bolts periodically. Even well-balanced equipment experiences some vibration, which can cause bolts to loosen over time.
- Inspect air filters weekly and replace or clean them as necessary. Replacement filters should meet original specs.
- Clean dampers and all ducting to avoid airflow restrictions. Lubricate movable and mechanical linkages in dampers and other devices as recommended. Check actuating solenoids and electromechanical components for proper operation.

Movement of air throughout the transmitter causes static electrical charges to develop. Static charges can result in a build-up of dust and dirt in ductwork, dampers and other components of the system. Filters should remove the dust before it gets into the system, but no filter traps every particle.

- Check thermal sensors and temperature system-control devices for proper operation.

### Words on water

The cooling system is vital to any transmitter. In a UHF unit, the cooling system must dissipate an average of 70%





## Are you serious about CD programming?

If you understand the full potential of the Compact Disc in broadcasting, then Philips has the player you need. The LHH 2000 is solidly built for non-stop pro use. It's modular to expand with your needs. And, although packed with features for the most sophisticated uses, the LHH 2000 is surprisingly "deejay friendly."

**The LHH 2000 provides features and capabilities** you'll never find in a consumer player, including:

- Balanced outputs
- Precise cueing
- Access time under 2 seconds with accuracy of 13.3 milliseconds.
- Search wheel with 3 time/turn ratios
- Indication of real music time remaining
- Fader start
- Status indication for each player (edit, ready, on line, on-air)
- Solid, professional-grade construction

**In the two and three player configurations** the LHH 2000 may be set to play one pre-programmed disc after another automatically. Segues between discs may be programmed while another disc is playing.

**Perhaps most important,** the LHH 2000 is easy to use. Basic on-air operation can be learned in a matter of minutes. Large LED displays are programmed to lead the operator through the sequence, step by step. Also, the control buttons are widely spread and clearly labelled to prevent errors, miscues, and dead air.

**Finally, with the LHH 2000** you can be assured of quality and knowledgeable service support. Philips is the acknowledged pioneer in CD technology. And, in the USA, Philips professional CD systems are sold and serviced by authorized Studer Revox Professional Products dealers.



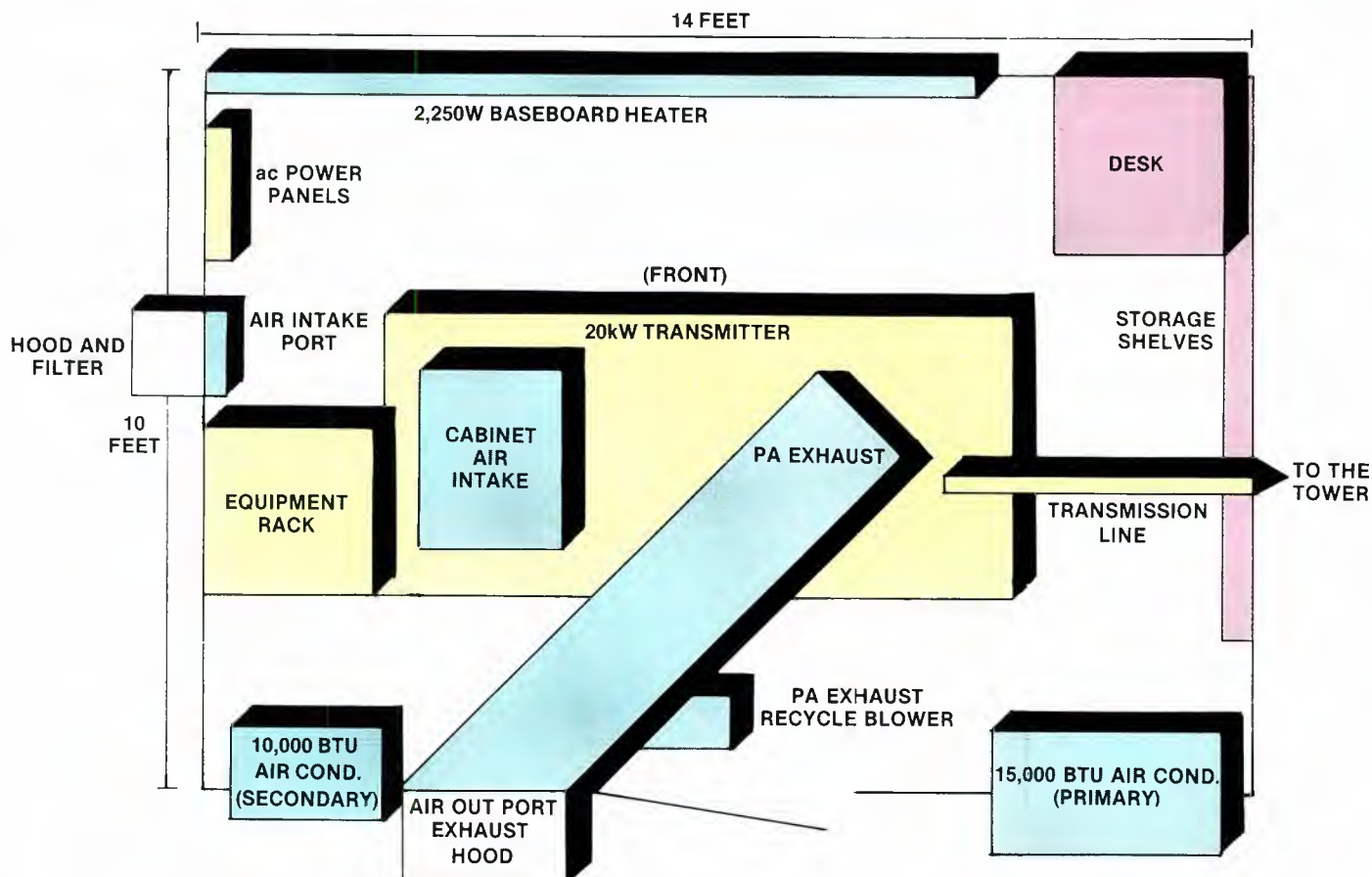
**If you're serious about the CD,** please call or write for more information plus the location of your nearest Studer dealer: Studer Revox America, 1425 Elm Hill Pike, Nashville, TN 37210; (615) 254-5651.

**STUDER REVOX**

Circle (34) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)





**Figure 12.** A typical heating and cooling arrangement for a 20kW FM transmitter installation. Ducting of PA exhaust air should be arranged so that it offers minimum resistance to airflow. Ideally, the transmitter PA exhaust would go straight up through the roof of the building.

# MAKE YOUR MOBILE 1 NUMBER ONE IN MOBILITY.

## Hannay Reels Get You In And Out Fast.

Save precious seconds in set-up, tear-down time. Just pick up the durable, lightweight Hannay portable cable storage reel, and go. When the story's in the can, direct rewind makes pick-up easy. And the portable cable storage reel is compact to take up minimal storage space.

It's just one in the full line of Hannay cable reels, available in a wide selection of sizes, shapes and capacities.

When it comes to getting in and out fast, no other reel is "remotely" as efficient as a Hannay Reel!



Send Today For  
Free Literature Packet.



# HANNAY REELS

CLIFFORD B. HANNAY & SON, INC., 600 EAST MAIN STREET  
WESTERLO, NEW YORK 12193 • TELEPHONE (518) 797-3791

Circle (33) on Reply Card



# The Graduate

The new Studer A812 has an internal "education." It knows how to get your production done with speed, precision and quality results.



People make decisions. Machines carry them out.

The Studer A812 has been "educated" to execute your decisions more efficiently. It cuts time lost in winding and cueing while eliminating many repetitive operator commands.

**First, the A812 is programmable** to meet your specific needs. Choosing from a menu of over 40 functions, you simply assign the features you need to top panel buttons. Your choices include tape dump, zero locate, rollback and start locate with 3 different sequences, up to 5 autolocate points, plus 4 different fader start and dump edit modes. Fast wind speeds (including library wind) are programmable, and variable speed operation may be specified in ips or percent deviation from nominal. The list goes on...

**For fast editing**, the A812 provides a thumbwheel shuttle control with user programmable shuttle speeds. An aluminum splicing block is standard.

**All transport functions are microprocessor controlled.**

The A812 moves tape quickly, precisely, and with uncanny smoothness. Microprocessors also take care of audio alignment parameters, with memory storage for two tape formulations.

**Other features of note:** phase compensated audio electronics, 12½" reel capacity, and choice of transformer or transformerless in/out. Available options include serial remote connector and center track time code with high-speed reading.

**Will the A812 pass your exam?** We invite you to put one to the test. Call your nearest Studer representative for all the details.

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

Offices: Los Angeles (818) 780-4234/New York (212) 255-4462/Chicago (312) 526-1660  
Dallas (214) 943-2239/San Francisco (415) 930-9866

**STUDER REVOX**

Circle (35) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



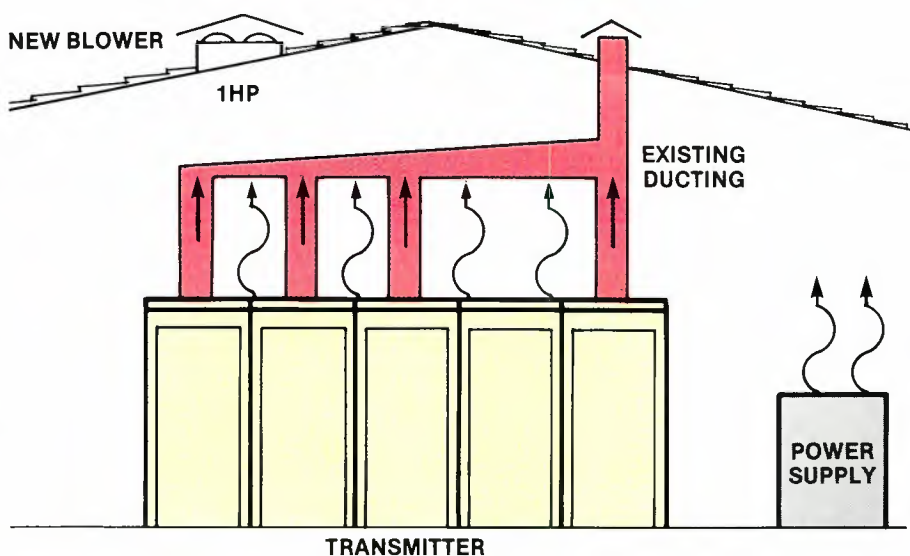
of the input ac power in the form of waste heat in the klystron collector. For vapor phase-cooled klystrons, pure (distilled or demineralized) water must be used. Because the collector is only several volts above ground potential, it is not necessary to use de-ionized water.

The collector and its water jacket act like a distillery. Any impurities in the water will eventually find their way into the water jacket and cause corrosion of the collector. It is essential to use high-purity water with low conductivity, less than 10mS/cm (millisiemens per centimeter), and to replace the water in the cooling jacket as needed.

Efficient heat transfer from the collector surface into the water is essential for long klystron life. Oil, grease, soldering flux residue and pipe sealant containing silicone compounds must be excluded from the cooling system. This applies to both vapor- and liquid-conduction cooling systems, although it is usually more critical in the vapor-phase type.

The sight glass in a vapor-phase water jacket provides a convenient checkpoint for coolant condition. Look for unusual residues, oil on the surface, foaming and discoloration. If any of these appear, contact the manufacturer for advice on how to flush the system.

Water quality is important to proper operation of a liquid-cooled klystron. In general, greater flows and greater



**Figure 13.** A case study in which excessive summertime heating was eliminated through the addition of a 1hp exhaust blower to the building.

pressures are inherent in liquid-cooled vs. vapor-phase systems, and when a leak occurs, large quantities of coolant can be lost before the problem is discovered. Inspect the condition of gaskets, seals and fittings regularly.

Most liquid-cooled klystrons use a distilled water and ethylene glycol mixture. Do not exceed a 50:50 mix by volume. The heat transfer of the mixture is lower than that of pure water, requir-

ing the flow to be increased, typically by 20% to 25%. Greater coolant flow means higher pressure and warrants close observation of the cooling system after adding the glycol. Allow the system to heat and cool several times. Then check all plumbing fittings for tightness.

The action of heat and air on ethylene glycol causes the formation of acidic products. The acidity of the coolant can be checked with litmus paper. Buffers

## This new portable UHF Field Strength Meter gives you accurate readings across the entire band.

Someone once said that "Certainty is Security." That is the main idea behind field strength measurements. They verify the signal level and rf environment at the point of reception. You know for certain what's out there.

It is now easy for UHF stations to achieve this certainty. With the new FIM-72 from Potomac Instruments.

### Tune the entire UHF band

From 470 to 960 MHz. The received signal strength is shown in volts and dB, with a 140 dB measurement range. Select peak or averaging detection; wide or narrow IF bandwidth. Seven 20dB logarithmic ranges assures precise readings. Internal demodulators (AM and FM) provide audio monitoring of the selected signal.

### It is easy to use

Find the desired signal on the spiral dial. Calibrate the meter using the internal generator, then read the signal strength from the mirrored meter. The field strength is easily determined from the supplied calibration data.

### Laboratory applications

The FIM-72 includes a precision rf generator that tracks the tuned frequency. Typical measurements include insertion loss, VSWR, and filter response.

### Call Potomac Today

Place your order for this new UHF field intensity meter. Put it to work. And then you will know for certain.



**POTOMAC INSTRUMENTS**  
932 PHILADELPHIA AVE. SILVER SPRING, MD 20910  
(301) 589-2662

Circle (36) on Reply Card



# IT'S HERE! THE FIRST GRAPHICS GENERATOR

with

# MOTION!

**CHYRON** with **MOTION**  
MODEL 4200

for only

# \$54,400

**Introducing CHYRON 4200, the first graphics generator with MOTION.**

Create and display multiple effects and text instantly—flip, spin, zoom, split images and more. CHYRON 4200 does it all, while maintaining ultra-high resolution. At a price this low, it's sure to be the FASTEST MOVING graphics generator. Find out about it—call CHYRON today.

**CHYRON** TELESYSTEMS / A MEMBER OF THE CHYRON GROUP

265 Spagnoli Road, Melville, NY 11747 • 516-249-3296 • Telex: 144522 Chyron Melv  
West Coast Office: 221 W. Alameda Avenue, Suite 103, Burbank CA 91502 • 818-842-3244

Circle (37) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



can and should be added with the glycol mixture. Buffers are alkaline salts that neutralize acid forms and prevent corrosion. Because they are ionizable chemical salts, the buffers cause conductivity of the coolant to increase. Measure the collector-to-ground resistance periodically. Coolant conductivity is acceptable if the resistance caused by the coolant is greater than 20 times the resistance of the body-metering circuitry.

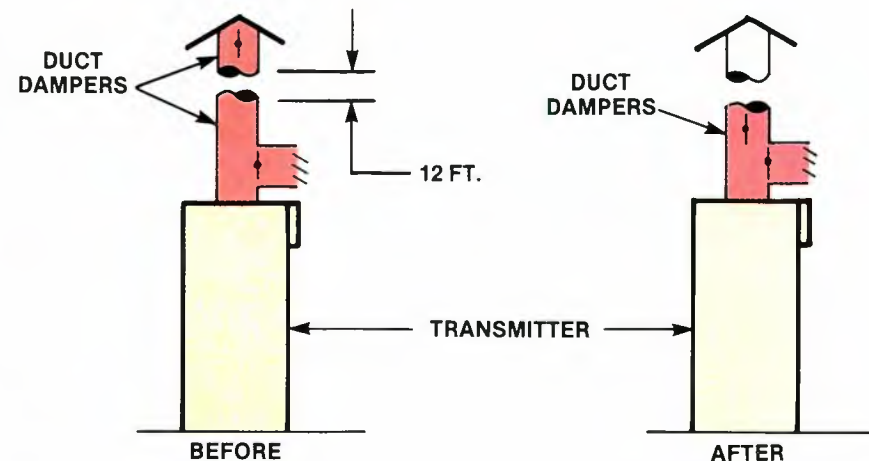
Experience has shown that the only practical way to ensure good coolant condition is to drain, flush and recharge the system every spring. The equipment manufacturer can provide advice on how this procedure should be carried out and can recommend types of glycol to use.

Maintain unrestricted airflow over the heat exchanger coils and follow the manufacturer's instructions on pump and motor maintenance.

### Cooling system design

Transmitter room cooling requirements vary considerably from one location to another, but some general statements on cooling apply to all installations.

A transmitter greater than 1kW must have its exhaust ducted to the outside whenever the outside temperature is greater than 50°F. Transmitter buildings must be equipped with refrigerated air-conditioning units when the outside



**Figure 14.** A case study in which excessive back pressure to the PA cavity during winter periods (when the rooftop damper was closed) was eliminated by repositioning the damper as shown.

temperature is greater than 80°F. The exact amount of cooling capacity needed is subject to a variety of factors, such as actual transmitter efficiency, thermal insulation of the building itself and size of the transmitter room.

Here again, though, some generalizations can be made. Radio transmitters up to and including 5kW usually can be cooled (if the exhaust is efficiently ducted outside) by a 10,000BTU air conditioner. Installations of 10kW will require a minimum of 17,500BTU of air conditioning and 20kW plants need at least 25,000BTU of air conditioning. For

larger radio installations or TV systems, consult an air-conditioning expert.

Figure 12 shows a typical 20kW FM transmitter plant installation. The building is oriented so that the cooling activity of the blowers is aided by normal wind currents during the summer months. Air brought in from the outside for cooling is well filtered in a hooded air-intake assembly that holds several filter panels.

This layout includes two air conditioners, one 15,000BTU and the other 10,000BTU. The thermostat for the smaller unit is set for slightly greater sensitivity than the larger air conditioner,

## IT'S IN THERE SOMEWHERE... you just need time to find it.

Time code. As a video professional, you know the vital role it plays in the editing and tape management process.

### DATUM's 5300 ITP

Our Intelligent Time Processor (ITP) can give you all the time code capability you'll ever want. It's available in four models, ranging from a basic SMPTE/EBU time code reader/generator to a comprehensive processor, complete with character generation and VITC code capability. And it's expandable. You can choose the basic unit now and upgrade later. Let us show you what our 5300 ITP can do for you.

Call or write for complete information.

**datum inc** TIMING DIVISION

1363 S. State College Blvd. • Anaheim, CA 92806 • (714) 533-6333



Circle (38) on Reply Card





# THE PERFORMER

The DVE® System 10 from NEC is one of the hottest selling digital video effects systems on the market today. For good reason: it performs. To find out for yourself, just spend a little time behind the controls. Get a feel for 3-D rotation, infinite perspective, cube making, tearing, A/B switching, key masking an ease of use that will make you feel like an expert in no time.

The word is that the DVE System 10 is quickly becoming the choice for TV stations, production, and post-production facilities throughout the country.

So take yourself on an adventure in creativity with the system backed up by one of the biggest names in the industry. The DVE System 10 from NEC.



## NEC

IMAGINE WHAT WE'LL DO FOR YOU

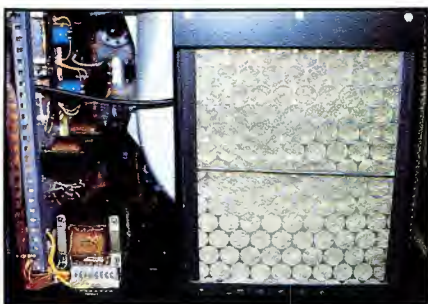


COMPUTERS AND COMMUNICATIONS • DVE® is a registered trademark of NEC Corporation.

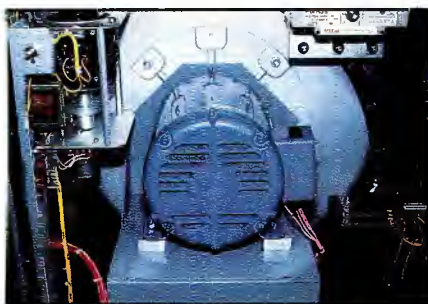
NEC America, Inc., Broadcast Equipment Division • 1255 Michael Drive, Wood Dale, IL 60191 • Toll free 1-800-323-6656 • In Illinois phone 312-860-7600

Circle (39) on Reply Card





Replace transmitter filters as often as necessary. Use only the type of filter recommended by the manufacturer.



Consult the transmitter instruction manual for the recommended blower motor maintenance schedule.

allowing small temperature increases to be handled more economically.

It is important to keep the transmitter room warm during the winter, as well as cool during the summer. Install heaters and PA exhaust recycling blowers as needed. A transmitter that runs 24 hours a day normally will not need additional heating equipment, but stations that sign off for several hours during the night should be equipped with electric room heaters (baseboard types, for example) to keep the room temperature above 50°.

PA exhaust recycling can be accomplished by using a thermostat, relay logic circuit and solenoid-operated register or electric blower. By controlling the room temperature to between 60°F and 70°F, tube and component life will be extended substantially.

#### Layout considerations

The layout of a transmitter room HVAC (heating, ventilation and air conditioning) system can have a significant impact on the life of the PA tube(s) and the ultimate reliability of the transmitter.

Air intake and output ports must be designed with care to avoid airflow restrictions and back-pressure problems. This process, however, is not as easy as it may seem. The science of airflow is complex and generally requires the advice of a qualified HVAC consultant.

To help illustrate the importance of proper cooling system design and the real-world problems that some stations have experienced, consider the following examples taken from actual case histories:

#### Case 1:

A fully automatic building ventilation system (Figure 13) was installed to maintain room temperature at 20°C during the fall, winter and spring. During the summer, however, ambient room temperature would increase to as much as 60°C.

A field survey showed that the only room exhaust for the system was through the transmitter. Therefore, air entering the room was heated by test equipment, people, solar radiation on the building and radiation from the transmitter itself before entering the transmitter.

The problem was resolved through the addition of an exhaust fan (3,000cfm). The 1hp fan lowered room temperature by 20°C.

#### Case 2:

A simple remote installation was constructed with a heat-recirculating feature for the winter (see Figure 14). Outside supply air was drawn by the transmitter cooling system blowers through a bank of air filters and hot air was exhausted through the roof. A small blower and a damper were installed near the roof exit point. The damper allowed hot exhaust air to blow back into the room through a tee duct during winter months.

For summer operation, the roof

# Spark Gaps!

## For Overvoltage Protection and High Energy Switching

You'll see EG&G spark gaps working wherever there's a need for overvoltage protection of critical system components.

For high energy protection where a very wide range of operating voltages is required—up to 50:1

Gaps designed specifically for military CO<sub>2</sub> lasers

Gaps designed for series switching in medical and pulsed laser applications.

Two element (overvoltage) and three element (triggered) devices, gas-filled and vacuum, all hermetically sealed units—all EG&G gaps are rugged, reliable, and readily available.



**EG&G ELECTRONIC COMPONENTS**

For further information, contact EG&G Electronic Components  
35 Congress Street, Salem, MA 01970 (617) 745-3200.  
On the West Coast call (818) 344-3896. Central States call (312) 640-8233.

Circle (40) on Reply Card

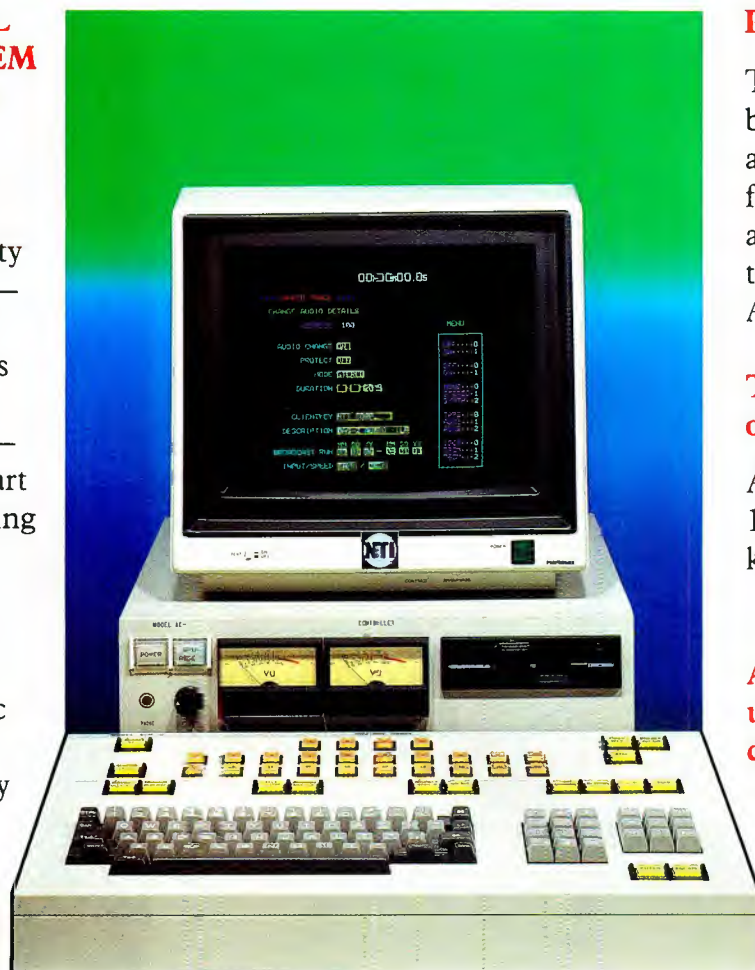


# Say goodbye to mechanical tape failures — with the DAS-2 digital audio system

No more jammed tapes, broken cartridges, wow and flutter, phase problems, loss of high frequency response, tape breakage, machine malfunctions, airplay of outdated spots, and errors caused by manual logging . . .

## The DAS-2 DIGITAL AUDIO FILE SYSTEM solves these problems **PLUS:**

- You can store up to 28 hours of high quality digital programming — spot announcements, sales promotions, news actualities as well as full length programs — using the state-of-the-art DPCM-AQ-AS recording method.
- The DAS-2 can be interfaced with your station's EDP or traffic computer via a serial port or MS DOS floppy disk providing positive verification of airplay.
- Special 20 button, 4 page access feature offers you the choice of up to 80 events for instant playback.
- Choice of either automatic or manual mode.



- User friendly operation.
- Easy to expand for your station's future growth.

## Proven track record.

The DAS-2 system has been operating flawlessly at major overseas stations for more than 5 years, and has been redesigned to meet the needs of the American broadcaster.

## Three systems are offered:

AM @ 10 kHz, FM @  
15 kHz and FM @ 20  
kHz response.

• • •

## Are you ready to upgrade to the DAS-2 digital audio system?

For further informa-  
tion or to arrange for  
a hands-on  
demonstration,  
contact:

Broadcast Engineering  
Mitsubishi International Corp.  
46305 Landing Parkway  
Fremont, California 94538

(415) 651-9931. Call collect.



Designed and built by the innovators of  
digital storage for broadcasting:  
**Nippon Television Industry Corporation**



Sold and supported in the U.S.A. by:  
**Mitsubishi International Corporation**  
Electronic Equipment Division: Fremont, CA

Circle (41) on Reply Card



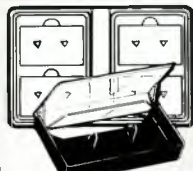
Ask for our  
**FREE CATALOG**  
OF PROFESSIONAL  
*Sound* RECORDING  
& DUPLICATING SUPPLIES



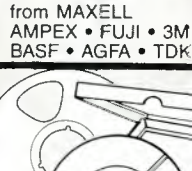
**Polysette**  
Blank-Loaded  
AUDIO CASSETTES



**TAPES • CASSETTES**  
from MAXELL  
AMPEX • FUJI • 3M  
BASF • AGFA • TDK



**CASSETTE BOXES  
LABELS • ALBUMS**



**ACCESSORIES**  
from NORTRONICS  
3M • BASF • EDITALL



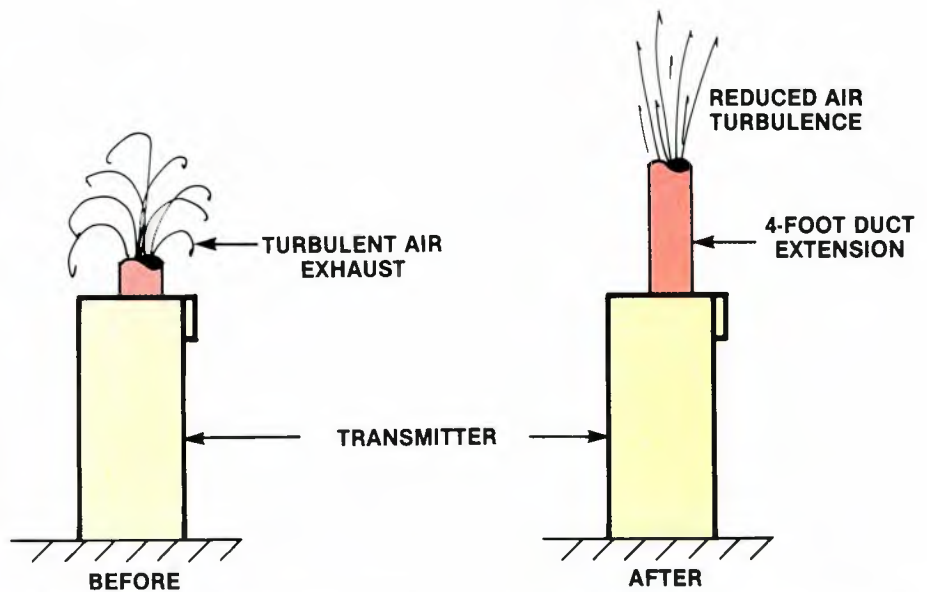
**Polyline Empty  
REELS & BOXES**



**NAB BROADCAST  
CARTRIDGES**

Switchcraft Connectors  
Canare Microphone Cable  
Connectronics Cable  
Telex Cassette Copiers  
Signature Prod. Music Library

**Polyline Corp.**  
1233 Rand Rd. • Des Plaines, IL 60016  
**(312) 298-5300**  
Circle (42) on Reply Card



**Figure 15.** A case study in which air turbulence at the exhaust duct resulted in reduced airflow through the PA compartment. The problem was eliminated by adding a 4-foot extension to the output duct.

damper was switched open and the damper closed. For winter operation, the arrangement was reversed. The station, however, experienced short tube life during winter operation, even though the ambient room temperature during the winter was not excessive.

The solution involved moving the roof damper 12 feet down to just above the tee. This eliminated the stagnant air cushion above the bottom heating duct damper and significantly improved airflow in the region. Cavity back pressure was, therefore, reduced. With this relatively simple modification, the problem of short tube life disappeared.

#### Case 3:

An inconsistency regarding test data was discovered within a transmitter manufacturer's plant. Units tested in the engineering lab typically ran cooler than those at the manufacturing test facility. Figure 15 shows the test station difference, a 4-foot exhaust stack that was used in the engineering lab. The addition of the stack increased airflow by up to 20% because of reduced air turbulence at the output port, resulting in a 20°C decrease in tube temperature.

These examples point out how easily a cooling problem can be caused during HVAC system design. All power delivered to the transmitter is either converted to RF energy and sent to the antenna or becomes heated air. Proper design of a cooling system, therefore, is a part of transmitter installation that should not be taken lightly.

Transmitter cooling system performance is not necessarily related to airflow volume. The cooling capability of air is a function of its mass, not its volume. The designer must determine an appropriate airflow rate within the equipment and establish the resulting resistance to air movement. A specified static pressure that should be present within the ducting

of the transmitter can be a measure of airflow.

For any given combination of ducting, filters, heat sinks, RFI honeycomb shielding, tubes, tube sockets and other elements in the transmitter, a specified system resistance to airflow can be determined. It is important to realize that any changes in the position or number of restricting elements within the system will change the resistance and, therefore, the effectiveness of the cooling.

The altitude of operation is also a consideration in cooling system design. As altitude increases, the density (and cooling capability) of the air decreases. A calculated increase in airflow can maintain the cooling effectiveness the system was designed to achieve.

#### Air filters

Once the transmitter is clean, keeping it that way for long periods of time may require improving the air-filtering system. Most filters are inadequate to keep out small dirt particles (microdust), which can become a serious problem in an unusually dirty environment. Microdust also can become a problem in a relatively clean environment after a number of years of operation.

In addition to providing a well-filtered air-intake port for the transmitter building, an additional air filter can be placed in front of the normal transmitter filter assembly. A computer system filter panel can be secured to the air-intake port to provide additional protection. With the extra filter in place, it generally is necessary only to replace or clean the outer filter panel. The transmitter's integral filter assembly will stay clean, eliminating the work and problems associated with pulling out the filter assembly while the transmitter is operating. Be certain that the addition of supplemental filtering does not restrict airflow into the transmitter.

**SAVE UP TO 40% ON 3/4" U-MATICS**

**3/4" U-Matic**  
NVS now offers you great savings on first quality remanufactured broadcast cassettes loaded with new 3M Color Plus, 3M MBU, Sony K or Agfa B.P. Call for a complete price list or free sample.

**TCR-100**  
New TCR-100 Cartridge Sales and Reloading with 3M Scotch 400.

**VHS**  
New VHS cassettes (T-3 to T-120)

**NATIONAL VIDEO SERVICE**  
2150 Rheem Drive, Bldg. G  
Pleasanton, California 94566  
(415) 846-1500

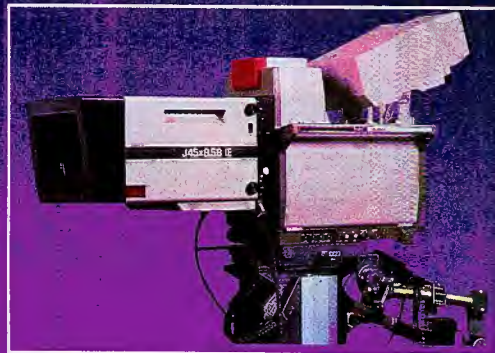
**NVS**

Circle (43) on Reply Card



# Limitless!

IKEGAMI'S NEW HK-323P IS THE IDEAL PORTABLE COMPANION FOR YOUR HK-323 FIELD/STUDIO CAMERA.



The HK-323 Field/Studio Camera

Ikegami's HK-323 1" and  $\frac{2}{3}$ " field/studio cameras are big news... so is the smaller HK-323P companion camera. This lightweight hand-held model provides the user with limitless potential, flexibility and performance that meets and exceeds industry standards for excellence.

Featuring a built-in micro-processor for various software based control functions and fully automatic setup, the HK-323P operates from the same base station as the HK-323 and offers high performance prism optics, auto-knee circuitry to handle high contrast, 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 memorized servo filter wheels each with four positions, a back-up memory system and various adaptors for total system flexibility.

Go the limit with the HK-323 and HK-323P companion camera system.

For a complete demonstration of the Ikegami HK-323 and HK-323P, contact us or visit your local Ikegami dealer.



## Ikegami

Circle (44) on Reply Card

Ikegami Electronics (U.S.A.), Inc. 37 Brook Avenue. Maywood, NJ 07607

East Coast: (201) 368-9171; West Coast: (213) 534-0050; Southeast: (813) 884-2046 Southwest: (214) 233-2844;  
Midwest: (312) 834-9774; Hawaii: (808) 946-5955



## Preventing transmitter failures



# Safety first

**Don't take chances with high voltages. They can kill.**

**A**pproach any work on a transmitter with extreme caution. The high voltages that exist in a transmitter can be lethal. Perform such work only when a second engineer is in the room.

Work inside the transmitter only after all ac power has been removed and after all capacitors have been discharged using the grounding stick provided with the transmitter. Remove primary power from the unit by tripping the appropriate power-distribution circuit breakers at the transmitter building. Do not rely on internal contactors or SCRs to remove all dangerous ac.

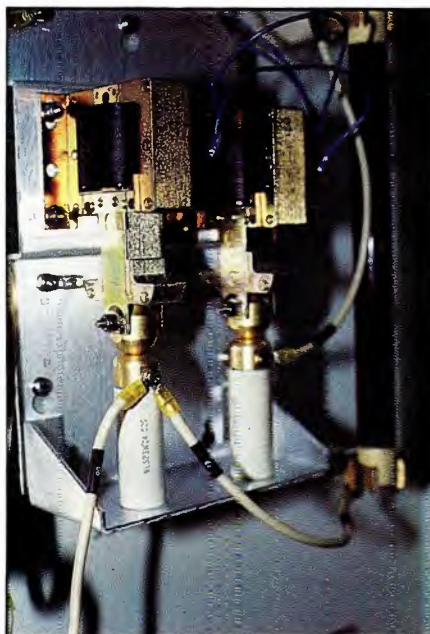
Do not remove, short-circuit or tamper with interlock switches on access covers, doors, enclosures, gates, panels or shields. Keep away from live circuits. Know your equipment and don't take chances. Although defeating an access panel or interlock switch may save work time, the consequences can be tragic.

Allow any apparently defective component to completely cool down before attempting to replace it. If a leak or bulge is found on the case of an oil-filled or electrolytic capacitor, do not attempt to service the part until it has completely cooled. Servicing the component while it is hot can cause case rupture and subsequent injury.

### Operating hazards

Hazards exist in the operation of radio and TV transmitters. Maintenance personnel must exercise extreme care near such equipment.

- Use caution around the high-voltage stages of the transmitter. Many power tubes operate at voltages high enough to kill by electrocution. Always break the primary ac circuit of the power supply



*Verify that the high-voltage protection circuits included with the transmitter operate properly and short any residual dc to ground when the interlocks are open.*

and discharge all high-voltage capacitors,

- Minimize exposure to RF radiation. Do not permit personnel to be in the vicinity of open energized RF-generating circuits, RF transmission systems (waveguides, cables or connectors) or energized antennas. High levels of radiation can result in severe bodily injury, including blindness. Cardiac pacemakers may also be affected by radiation.

The effects of prolonged exposure to low level RF radiation continues to be a subject of investigation and controversy.

It is generally agreed that exposure of personnel to radiation should be limited to an absolute minimum. It is also generally agreed that exposure should be reduced in working areas where the personnel *heat load* is above normal. A  $10\text{mW}/\text{cm}^2$  per one-tenth-hour average level has been adopted by several U.S. government agencies, including the Occupational Safety and Health Administration (OSHA), as the standard protection guide for employee work environments. An even stricter standard is recommended by the American National Standards Institute (ANSI), which advises a  $1.0\text{mW}/\text{cm}^2$  per one-tenth-hour average level exposure between 30Hz and 300MHz as the standard employee protection guide (ANSI C95.1-1982).

RF energy must be contained properly by shielding and transmission lines. All input and output RF connections, cables, flanges and gaskets must be RF-leakproof. Never operate a power tube without a properly matched RF energy absorbing load attached. Never look into or expose any part of the body to an antenna or open RF-generating tube, circuit or RF transmission system while it is energized. At regular intervals and after servicing, monitor the RF system for radiation leakage.

- Avoid contact with beryllium oxide (BeO) ceramic dust or fumes. BeO ceramic material is often used as a thermal link to carry heat from a tube or transistor to the heat sink. Do not perform any operation on any BeO ceramic that might produce dust or fumes, such as grinding, grit blasting or acid cleaning. Beryllium oxide dust and fumes are highly toxic, and breathing them can result in serious injury or death. BeO





# YOU TALKED AND WE LISTENED

The **Centro** NETWORKER is the result of extensive research into your network news requirements.

- ☒ Vehicle chassis and suspension engineered to carry heavy components.
- ☒ 2.3 meter dish with 49.5 Dbi gain and selectable-adjustable vertical and horizontal polarization from inside the vehicle.
- ☒ Unparalleled **Centro** quality in an attractive affordable package.
- ☒ Three year unlimited mileage, limited chassis warranty and serviceable in over 4,500 locations throughout the United States.
- ☒ Available in a rugged standard package with many options for your specific requirements.
- ☒ Engineered, designed and constructed to meet your most demanding Satellite News Gathering requirements.



**CENTRO CORPORATION**  
9516 CHESAPEAKE DRIVE  
SAN DIEGO, CALIFORNIA 92123

(619) 560-1578

Circle (45) on Reply Card



## TREATMENT OF ELECTRICAL SHOCK

1. IF VICTIM IS NOT RESPONSIVE, FOLLOW THE A-B-Cs OF BASIC LIFE SUPPORT.

### A AIRWAY

IF UNCONSCIOUS  
OPEN AIRWAY



- LIFT UP NECK
- PUSH FOREHEAD BACK
- CLEAR OUT MOUTH IF NECESSARY
- OBSERVE FOR BREATHING

### B BREATHING

IF NOT BREATHING  
BEGIN ARTIFICIAL BREATHING



- TILT HEAD
- PINCH NOSTRILS
- MAKE AIRTIGHT SEAL
- 4 QUICK FULL BREATHS

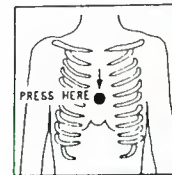


- CHECK CAROTID PULSE
- IF PULSE ABSENT, BEGIN ARTIFICIAL CIRCULATION

REMEMBER MOUTH TO MOUTH RESUSCITATION MUST BE COMMENCED AS SOON AS POSSIBLE

### C CIRCULATION

DEPRESS STERNUM  
1 1/2 TO 2 INCHES



- ONE RESCUER  
15 COMPRESSIONS.  
2 QUICK BREATHS  
APPROX. RATE  
OF COMPRESSIONS  
- 80 PER MINUTE

- TWO RESCUERS  
5 COMPRESSIONS.  
1 BREATH  
APPROX. RATE  
OF COMPRESSIONS  
- 80 PER MINUTE

DO NOT INTERRUPT THE RHYTHM OF COMPRESSIONS WHEN A SECOND PERSON IS GIVING BREATH

2. IF VICTIM IS RESPONSIVE, KEEP HIM WARM AND QUIET, LOOSEN CLOTHING AND PLACE IN RECLINING POSITION.

PLACE VICTIM FLAT ON HIS BACK ON A HARD SURFACE  
CALL FOR MEDICAL ASSISTANCE AS SOON AS POSSIBLE

Figure 16. Basic first aid treatment for electrical shock.

ceramics must be disposed of only in a manner prescribed by the device manufacturer.

- Avoid contact with hot surfaces within the transmitter. The anode portion of most power tubes is air-cooled. The external surface normally operates at a high temperature (up to 250°C). Other portions of the tube, especially the cathode insulator and the cathode/heater surfaces, also may reach high temperatures. All hot surfaces may remain hot for an extended time after the tube is shut off. To prevent serious burns, avoid bodily contact with these surfaces

both during tube operation and for a reasonable cool-down period afterward.

### First aid

Be familiar with first-aid treatment for electrical shock and burns. Always keep a first-aid kit on hand at the transmitter site. Figure 16 illustrates the basic treatment for electrical shock victims. Copy the information and post it at the transmitter site. Or, better yet, obtain more detailed information from your local American Heart Association or Red Cross chapter. Personalized instruction on first aid is usually available locally.

### Treatment of burns

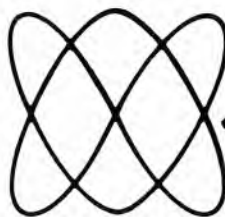
*Extensively burned and broken skin:*

- Cover affected area with a clean sheet or cloth.
- Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
- Treat victim for shock as required.
- Arrange for transportation to a hospital as quickly as possible.
- If arms or legs are affected, keep them elevated.

If medical help will not be available within an hour and the victim is conscious and not vomiting, make a weak

# PHASE CHASER

From



*Howe  
audio*

... a Sound investment

## The Smart Audio Time Base Corrector . . . Definitely Discriminating!



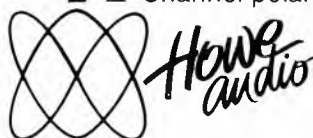
Full **THREE YEAR WARRANTY**

Stereo is everywhere . . . except in the listener's ears. Less than 50% of all radio receivers are stereo; most televisions are mono. So mono compatibility along with high quality stereo is extremely important to your success in the marketplace.

The **Howe 2300 Phase Chaser** **GUARANTEES MONO COMPATIBILITY AND STEREO INTEGRITY** everywhere in your audio chain, simply \*.

### FEATURES:

- Corrects time delay errors up to  $\pm 150$  microseconds
- Original stereo information remains unchanged
- Active balanced I/O; XLR connectors
- Programmable missing channel sensing and correction
- Channel polarity error detection and correction



2300 Central Ave., Suite E  
Boulder, Colorado 80301  
Call Bill Laletin at 1-800-525-7520  
to place your order.

\*No pilot tone or prior encoding required.

Circle (46) on Reply Card





Truly great amplifiers are measured by two standards. Sonic quality and reliability. Our new RAMSA 9055, 9110 and 9220 power amplifiers achieve excellence on both counts. And their superb, well-balanced design, combined with Matsushita's manufacturing processes and rigid quality control, gives us the confidence to back them with a 5-year limited warranty.\* This RAMSA warranty and UL listing assures you that we stand behind the 9000 series with everything we've got. And that's saying something. We challenge you to compare these new amps for yourself. But you better be prepared to re-evaluate your standards.

**RAMSA**

Panasonic  
Industrial Company

\*See terms of warranty for details © 1986 Panasonic

Circle (47) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



Apirollo  
Abestol  
Askarel  
Aroclor B  
Chlorextol  
Chlophen  
Chlorinol  
Clorphon  
Diaclor  
DK

Dykanol  
EEC-18  
Elemex  
Eucarel  
Fenclor  
Hyvol  
Inclor  
Inerteen  
Kanechlor  
No-Flamol

**Non-Flammable Liquid**  
Phenoclor  
Pydraul  
Pyralene  
Pyranol  
Pyroclor  
Sal-T-Kuhl  
Santothern FR  
Santovac 1 & 2  
Solvol  
Thermal

**Table 2.** Some of the trade names under which PCBs were marketed.

solution of salt and soda. Use one level teaspoon of salt and one-half level teaspoon of baking soda to each quart of water (neither hot or cold). Allow the victim to sip about four ounces (one-half glass) over a period of 15 minutes. Discontinue intake of fluid if vomiting occurs. Do not allow alcohol consumption. *Less severe burns (first- and second-degree):*

- Apply cool (not ice-cold) compress, using the cleanest available cloth article.
- Do not break blisters, remove tissue, remove adhered particles of clothing, or apply salve or ointment.
- Apply clean dry dressing if necessary.
- Treat victim for shock as required.
- Arrange for transportation to a hospital as quickly as possible.
- If arms or legs are affected, keep them elevated.

### PCB dangers

*Polychlorinated biphenyls* (PCBs) were used as a dielectric fluid in most pre-1980 radio and TV transmitter oil-filled power transformers and high-voltage capacitors. The health dangers associated with PCBs led to a ban on the production and use of the chemical. The Environmental Protection Agency (EPA) has established strict regulations regarding the use and disposal (if necessary) of electrical components containing PCBs.

Many products containing PCBs were marketed under various trade names, as detailed in Table 2. A large number of PCB power transformers and capacitors are still in use, and the safe operation and disposal of such components is the sole responsibility of the owner. Failure to follow applicable rules is unlawful and leaves the owner subject to criminal

prosecution. The owner of equipment containing PCBs is responsible for adherence to the EPA rules regardless of whether the owner is familiar with the regulations. A PCB cleanup could cost hundreds of thousands of dollars.

The EPA regulations are outlined in a government publication titled *40 CFR Part 761*. If your transmitter contains components that use PCBs, contact the government printing office and order a copy of the rules. The regulations cover four major areas of concern:

- **Marking of PCB components:** Each PCB transformer and capacitor must be labeled with a warning sticker that complies with EPA rules.
- **Inspection and documentation:** Logs must be kept to identify all devices that contain PCBs (including spare parts) and the condition of those parts.
- **Disposal of PCB components:** Disposal must be done only through a disposal company that is licensed to handle PCBs. A transmitter cannot be disposed of with its associated PCB capacitors and transformers still inside. They must be removed and disposed of by an authorized agent. General Electric Company is licensed in many cities to take title and remove PCBs, as well as to clean up spills.
- **Reporting requirements:** The owners of PCB transformers are required to register the components with their local fire departments.

# angénieux

## THE DAWN OF A NEW GENERATION IN VIDEO

By replacing conventional gears which control the zoom and focus servos with modern nylon belts, Angénieux has made yet another breakthrough in the design and construction of its broadcast lenses.

Substantially lighter, mechanically quicker, and dramatically quieter, with sophisticated internal hood soundproofing, recessed hood handles, an internal heater, digital readouts for iris position, extender position, and a three lamp diascope all standard, Angénieux's New Generation of broadcast lenses are at the crest of the industry's future wave.

Among Angénieux's New Generation of ENG zoom lenses are the 14x7 ultra wide angle, the 14x8 with a non-rotating front focusing element, and the 14x9, all with a maximum relative aperture of f/1.6—the fastest in the industry.

For studio and outside broadcast use Angénieux's New Generation includes the new 15x HP series—15x13 HP 1" format and 15x17 HP 1 1/4" format—and the high quality studio/O.B. 18x12.5 1" format and 18x16.5 1 1/4" format lenses.

And that's not all. Angénieux's highly skilled engineers are working harder than ever before to meet the industry's demand for more and better broadcast lenses.

# angénieux

ANGENIEUX. The New Generation. The Heritage Of Excellence.

Corp. of America 7700 No. Kendall Dr., Miami, FL 33156 • Tel: (305) 595-1144 • Telex: 80-8425 • FAX: 305-595-4636  
Opticam SA, 4, Rue Pedro Meylan, Case postale 91, 1211-Geneva-17, Switzerland • Tel: 22-36-22-66 • Telex: 27670 Optic CH • FAX: 22-86-12-49

Circle (48) on Reply Card



# LEITCH LISTENS



It's the reason why  
these three new Leitch test generators  
are tailored to your needs.

These three new test generators may look alike. But the software inside tells another story. Before they were designed, we sat down with transmitter, studio and transmission people to find out what they needed and wanted.

With these new Leitch 2500 NTSC test generators, you get digital generation for accuracy and stability. The Transmitter and

Transmission generators deliver up to 60 signals while the Studio generator provides 56 different signals. All with 10 bit precision.

Upgradeable EPROMs allow you to have the unit adapted to meet new signal requirements. And you get Leitch ease of operation.

If you want further information, just write or call. You'll find we're not only good listeners, we're good providers.

## LEITCH

Leitch Video International Inc., 10 Dyas Road, Don Mills, Ontario, Canada M3B 1V5, Tel.: (416) 445-9640 or 1-800-387-0233, Telex: 06 986 241  
Leitch Video of America, Inc., 825K Greenbrier Circle, Chesapeake, VA, U.S.A. 23320, Tel.: (804) 424-7920 or 1-800-231-9673, Telex: 710 882 4342

Circle (49) on Reply Card



## Preventing transmitter failures



# Comprehensive preventive maintenance

**Don't just react to problems. Anticipate them.**

The operating costs over the lifetime of a transmission installation can be significantly impacted by the effectiveness of the preventive maintenance program designed and implemented by the engineering staff. When dealing with a *critical-system unit* such as a broadcast transmitter, maintenance can have a major impact—either positive or negative—on downtime and bottom-line profitability of the facility.

Because of the requirement for maximum uptime and top performance, establish a *comprehensive preventive maintenance* (CPM) program that includes a systematic consideration of transmission system functions and the failure modes possible for each piece of equipment in the RF chain. Apply priority-based consideration of reliability and economics to identify the applicable and appropriate preventive maintenance tasks to be performed.

Put simply and into everyday language, CPM involves a realistic assessment of the vulnerable sections or components within the system, and a cause-and-effect analysis of the consequences of component failure. Basic to this analysis is the importance of keeping the system up and running at all times. In the most critical application of CPM—a station with no standby transmitter—anticipation of future problems and the establishment of contingency plans to deal with them is a necessity.

Obvious applications of CPM analysis include the stocking of critical spare parts used in stages of the transmitter exposed to high temperatures and/or

voltages, or the installation of transient protection equipment at the ac input point of the transmitter. Remember, as identified previously, the sections of a transmitter most vulnerable to failure are those exposed to the outside world.

The primary goals of any CPM program are to prevent equipment deterioration and/or failure and to detect impending failures. There are, logically, three broad categories into which preventive maintenance work can be classified:

- *Time-directed*, in which tasks are performed based upon a timetable established by the system manufacturer or user.
- *Condition-directed*, in which a maintenance function is undertaken because of feedback from the equipment itself (such as declining power output from a PA tube).
- *Failure-directed*, in which maintenance is performed first, to return the system to operation and second, to prevent future failures through the addition of protection devices or component upgrades recommended by the maker.

Regardless of whether you describe such work as CPM or just plain common sense, the result is the same. Preventive maintenance is a requirement for reliability. In broadcasting, you have nothing else to sell but your air signal. And when you're off the air, you're dead in the water.

### Training for personnel

Major broadcast equipment manufacturers this author has talked with over

the years have expressed concern at the lack of technical expertise (or even good common sense) of an alarming number of engineers in the field. Too many radio and TV station managers—in an effort to protect their bottom-line incomes—have skimped on equipment maintenance salaries, supplies and test equipment. The laws of physics eventually catch up with everyone, however, and stations that have not paid their maintenance dues will reap an expensive harvest.

The complexity of the equipment in the industry is continually increasing, and this hardware requires competent technical personnel to keep it running. The need for well-trained engineers has never been greater.

Proper maintenance procedures are vital to the top performance required of broadcast stations in today's marketplace. A comprehensive maintenance program can prevent transmission equipment failures that impact productivity, station image and advertising revenue. In broadcasting, good maintenance is good business.

**Acknowledgments:** The author wishes to thank the following individuals who helped in the preparation of this report:

- Gil Housewright, Mark Fryer and Jeffrey Steinkamp of Broadcast Electronics, Quincy, IL.
- Dave May, Terry Bonkowski and Joe DeAngelo of Harris Broadcast, Quincy, IL.
- Dave Chenoweth, Ken Branton and Steve Clatterbaugh of Continental Electronics, Dallas.
- Andrew Whiteside of Comark Communications, Southwick, MA.
- William Orr, Eimac/Varian, San Carlos, CA.
- Information on the dangers of PCBs courtesy of the NAB, Washington, DC.

! :~:)))



# PERFORMANCE AND ECONOMY. SIDE BY SIDE!

Now get more performance for the money in two new additions to Tek's 1700 Series family: the 1720 Vectorscope and 1730 Waveform Monitor.

For years television facilities have looked to the Tek 528A and 1420 for reliable, consistent signal monitoring. Our two new monitors do the job faster, better—and at a substantial reduction in cost.

**Even easier to use.** Now four front panel setups can be stored—from the front panel—and recalled at the touch of a button. You get complete line select capabilities including field selection,

15-line display and CRT read-out of field and line number. You can display Channel A and Channel B inputs simultaneously. The information you need is there at a glance.

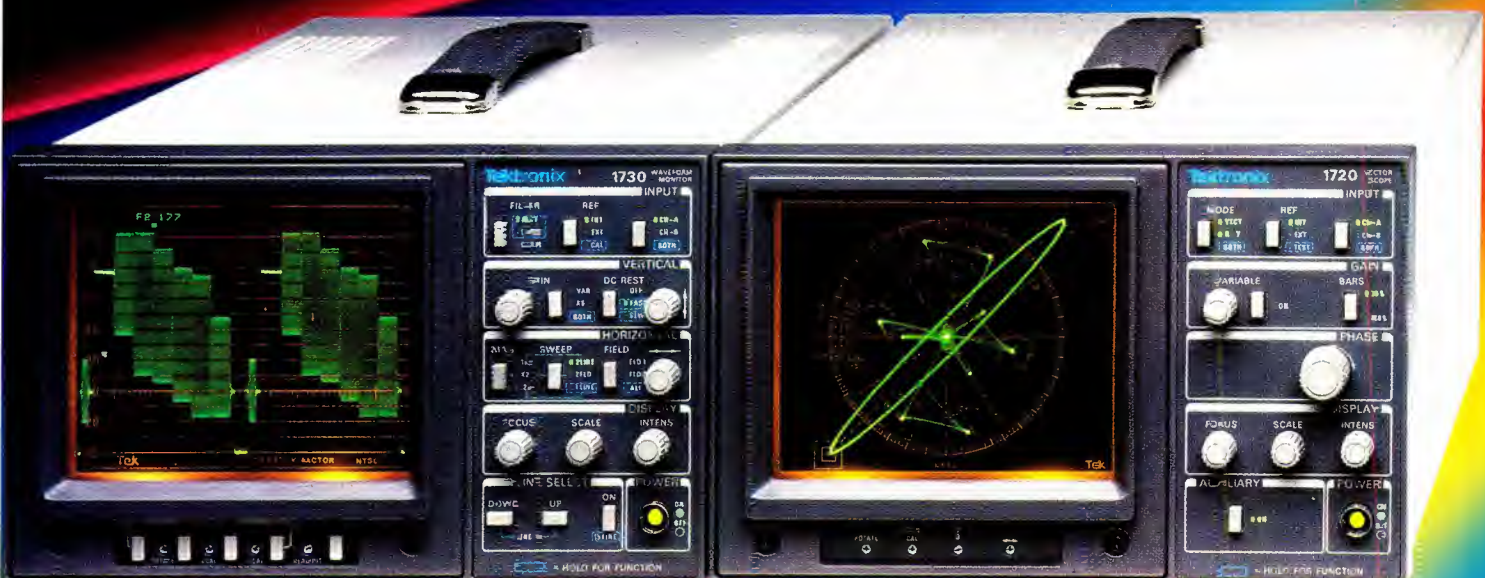
Each monitor includes its own advanced feature set. There's an X-Y input for stereo audio monitoring in the 1720. Dual filter operation in the 1730. Plus proven 1700 Series family advantages. Excellent viewability. Low power consumption. All in a compact package suited for stand alone use or rack-

mounting and available in NTSC and PAL versions.

The new 1720 Vectorscope can also be combined with a 1710B Waveform Monitor—for even greater side-by-side economy!

**Get the full story from your Tektronix representative.** Ask for a demo and see what makes the 1720 and 1730 the leading price/performance values on the market today!

**Behind the Scenes in Quality Television.**



**Tektronix**  
COMMITTED TO EXCELLENCE

Circle (50) on Reply Card

Copyright © 1986, Tektronix, Inc. All rights reserved. • TVG-051

www.americanradiohistory.com



# Video monitor setup

By Joseph J. Kane Jr.

**If the monitor settings and levels aren't quite right, the perfect color picture will probably elude you. Capture it through analysis.**

The NTSC TV system moniker of *never twice the same color* can be traced, to a great extent, to the lack of properly calibrated color picture monitors. It is impossible to have good color without first being able to display a good black-and-white picture on a color monitor. The difficulty of setting gray scale and proper levels for black and white has caused many inconsistencies in video displays. Still, for many years, picture quality judgments have been made by people who are looking at improperly calibrated monitors.

The first major solution to this problem was an optical comparator, used in con-

junction with a light meter. Color temperature was set by matching the white to the reference in the optical comparator, then using the light meter to set the final white or contrast level. Such a time-consuming operation was rarely used for daily monitor calibration.

Professional, broadcast-quality monitors are not perfect devices. Minor variations exist in electronics driving the picture tube and in the picture tube (CRT) itself, variations that won't be corrected in the near future. In the electronics, for example, the composite signal decoders do not always produce the same red, green and blue signals from a given input

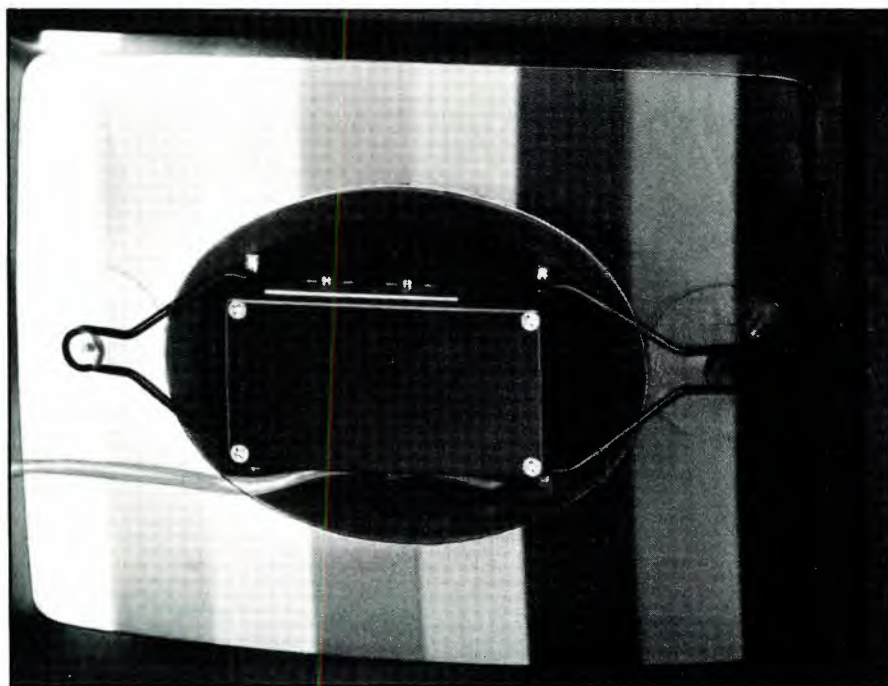
signal. In the CRT, the light output is not always consistent in color or intensity over the entire tube display surface. These differences make absolute matching of monitors difficult.

Although the perfect broadcast monitor is a long way off, manufacturers have been successful in reducing the variations, and are standardizing some of the specifications. In addition, test instruments are now available to make monitor setup easier. One such device is the color analyzer.

The color analyzer is used to measure light—red, green and blue—in units of NITs (candela/m<sup>2</sup>). (The NIT is the metric equivalent of the English footlambert, where 1fL = 3.42NIT and is the luminance in terms of 1/π candelas per square foot.) The instrument provides a means for the operator to know precisely how much red, green and blue light is emitted from the CRT for a given input signal. The part that an analyzer can play in monitor calibration prompts this discussion.

## Preconditions

The monitor must be operating for at least half an hour before any calibration adjustments are made. A test pattern of color black or another low-luminance level video signal should be applied to the video input. Video information that is constantly changing, such as typical program material, is the best source. (It is unwise to leave a high-intensity video signal, such as color bars, on a monitor for a prolonged period of time. The image may eventually burn the phosphor.)



*The sensor head attaches to the CRT faceplate with suction cups.*

Kane is Western region sales manager for Philips Test and Measuring Instruments.



# A LITTLE MIXED UP.



M-106 Mixer



**T**ASCAM's M-106 thinks it's an expensive mixer. It's a little mixed up. But the confusion is understandable.

You see, the M-106 has big-buck features like four program busses plus master controls for Aux and Effects to give you true 6-buss monitoring. So you can take any input to any buss and do full-on 4-track recording without repatching.

And with its convenient Monitor Select, you can access each buss individually.

On the road, the M-106 gives you the rock-solid construction of individual circuit cards, mic and line inputs on all channels, and four phono inputs capable of taking two stereo turntables. So it's a great choice for the deejay on the move.

TASCAM's M-106 is a versatile,

reliable performer with a great feel, a terrific body and a price tag under \$600. It just acts more expensive than it is.

Get one quick. Before it comes to its senses.

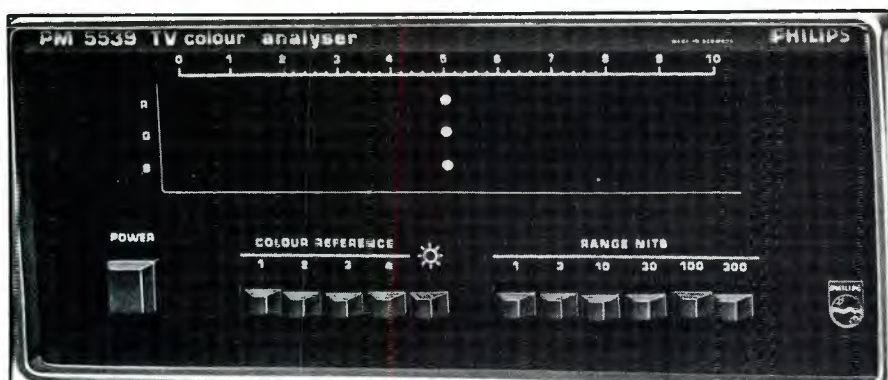
**TASCAM**  
TEAC Professional Division

7733 Telegraph Rd. • Montebello, CA 90640  
Telephone: (213) 726-0303

Circle (51) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)





An LED display indicates RGB illumination levels detected by the sensor.



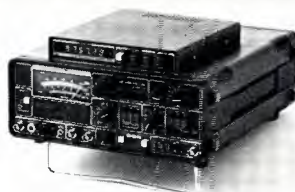
No one need be reminded of the importance of speed in today's world. New audio test requirements, now more than ever, are tuning up the demand for speed with more tests, more often and more devices to test.

The Amber 5500 Programmable Audio Measurement System offers a 3 to 10 time speed improvement over other programmable audio analyzers and perhaps 100 times that of older semi-automatic instruments. And if you really want blinding speed, our high speed plotting system captures over 500 readings per second!

The 5500 will meet the challenge of today's high-performance measurement requirements as well with distortion below 0.001%/-100dB, noise below 1uV/-120dBm and balanced generator levels above 30V/+30dBm. It measures signal level, gain, three kinds of distortion, weighted and unweighted noise, crosstalk and frequency to virtually all world standards. Balanced stereo inputs and outputs allow interface to professional, commercial and consumer devices. And if you need more measurement capability in the future, the unique Amber modular system architecture allows upward growth and system modification.

Ask for our comprehensive technical brochure.

Amber also makes one of the most popular portable high performance audio measurement systems - the 3501. Half the weight and size of comparable instruments, the 3501 has one of the best reliability records in the industry.



**Amber Electro Design Inc.**  
4810 Jean Talon West  
Montreal Canada H4P 2N5  
Telephone (514) 735 4105  
Telex 05-827598  
US Toll free 800-361 3697

**amber**

Circle (52) on Reply Card

A number of initial conditions must be met before routine monitor calibration can be started. These include checking and adjusting purity, initial setup of the screen controls for CRT cutoff, convergence, vertical and horizontal linearity, picture size and centering. With those adjustments set, the monitor should be ready for an initial or periodic setup.

The first parameter to be set on a regular basis is the gray scale, a consistent color temperature from black to white. Most TV systems throughout the world have now standardized 6,500° Kelvin as the color temperature. After a 6,500° gray scale is established, other parameters that must be set are black level, white level, color and phase. A color analyzer can assist in black level and white level adjustments, but not necessarily with color or phase.

The color analyzer is a standards-transfer device. Different design concepts have resulted in one type with factory-preset values for one or more selectable color temperatures. The second type can learn what standard is displayed by a given CRT or set of similar CRTs. The units typically have working ranges from less than 3,000°K to more than 9,000°K to accommodate most CRTs and different setup requirements. Consider a monitor for a critical viewing room environment. The analyzer will need to be taught where 6,500°K is on the CRT.

#### Establishing white D

Apply a 70IRE to 100IRE window test pattern to the monitor video input and bring a reference white D comparator to the center of the window pattern. The aim is to get a single point in the brightness scale of the CRT at white D (6,500°K). From this, the analyzer will know how much red, green and blue is needed for the CRT to produce the proper color temperature.

Using the monitor contrast control, match the intensity of the window pattern to the brightness level of the reference source. Change the CRT gain controls (also called white or drive level) and the contrast to match both the intensity and color of the CRT white to the white D reference. Your monitor may have only two of the three color controls available.

When the two match, white D has been established for a single point in the gray scale. This information can teach the color analyzer how much red, green and blue are necessary to repeat a particular color temperature setting. Do not make any additional changes to the monitor controls until the analyzer has been calibrated for the current monitor setting.

#### Teaching the analyzer

With a point on the gray scale established, place the sensor head of the color analyzer on the CRT. Adjust the





**Hector Munoz,  
Distribution Services  
Manager**

# ***"Our purpose is to keep you on the air."***

***Our extensive inventory of broadcast tubes, RF transistors and related components ensures delivery of the product to you on time—even if I have to run the package to the airport myself. Last year our company made over 7500 overnight deliveries, so we take emergencies seriously!"***



***\$30 Million Inventory—  
98% Same Day Shipment***



***Technical knowledge to  
help you save time and  
money by choosing the  
right component.***



**PRODUCTS:** Cathode Ray Tubes ■ Diodes ■ Klystrons ■ Monitor Tubes ■ Plumbicon® Tubes ■ Receiving Tubes ■ RF Ceramic Capacitors ■ RF Transistors ■ Saticons ■ Solid State Replacements ■ Transmitter/Power Tubes ■ Tube Sockets ■ Accessories ■ TV Linear Devices ■ Vacuum Capacitors ■ Vidicons ■ Vistacons  
**MANUFACTURERS:** Acrian ■ Amperex ■ Cetron ■ EEV ■ Eimac ■ GE ■ Hitachi ■ ITT ■ Jennings ■ Machlett ■ National ■ Philips ■ RCA ■ Raytheon ■ Thomson CSF ■ Varian ■ Westinghouse



***800-323-1770***

Circle (53) on Reply Card

## **Richardson Electronics, Ltd.**

**Broadcast Division — Calvert Electronics, Inc**

**Convenient Sales Offices:** Franklin Park, IL ■ Woodland Hills, CA ■ Belmont, CA ■ Dallas, TX ■ Norwell, MA ■ Rockville Centre, NY ■ East Rutherford, NJ ■ Winter Park, FL ■ Brampton, Ontario,

[www.americanradiohistory.com](http://www.americanradiohistory.com)



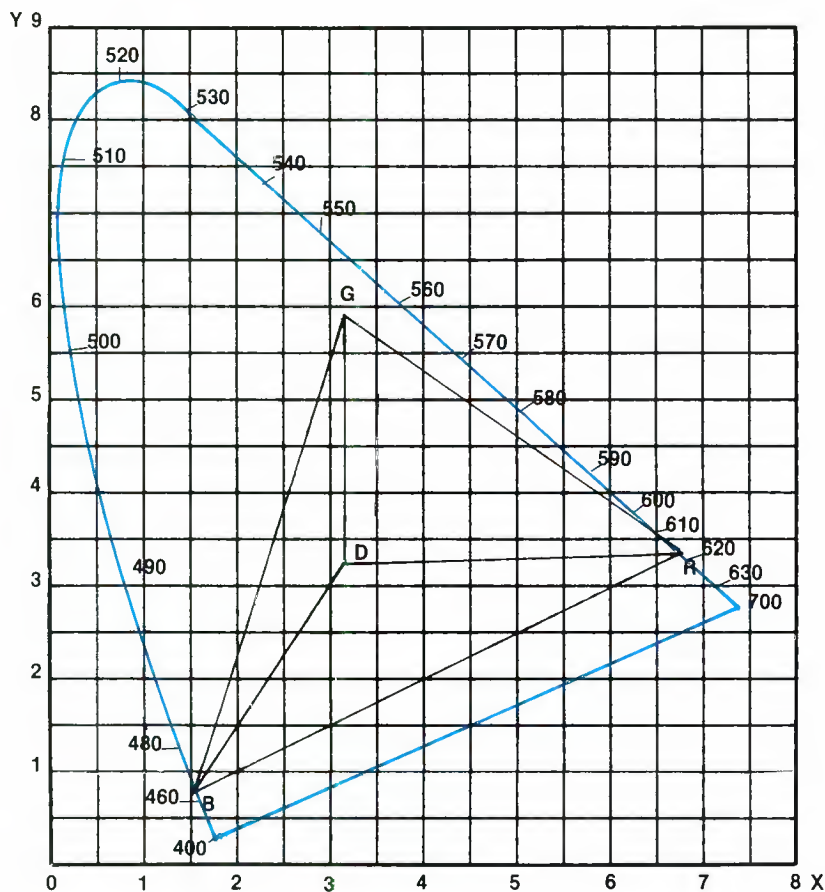


Figure 1. On a CIE X-Y color diagram, points R, G and B represent the saturation and wavelength of the three primary colors. D is the standard illuminant reference white 6,500 K.

analyzer range or sensitivity controls—first the green channel, then red and blue—to bring the LED front-panel meters on scale. For analyzers with a memory capability, select one of the reference memories for this and other monitors with the same phosphor to be set to the same color temperature.

Adjust the analyzer red and blue gain for the selected reference memory until the LEDs for red and blue on the front panel match the green LED position. The dots should line up vertically.

If you vary the contrast control on the monitor, the dots should move. You may need to readjust the red and blue gain controls slightly to make the dots exactly track the green for a jump in one LED space. When tracking is established, you know proper color temperature for the specific phosphor has been achieved whenever the three LED dots line up.

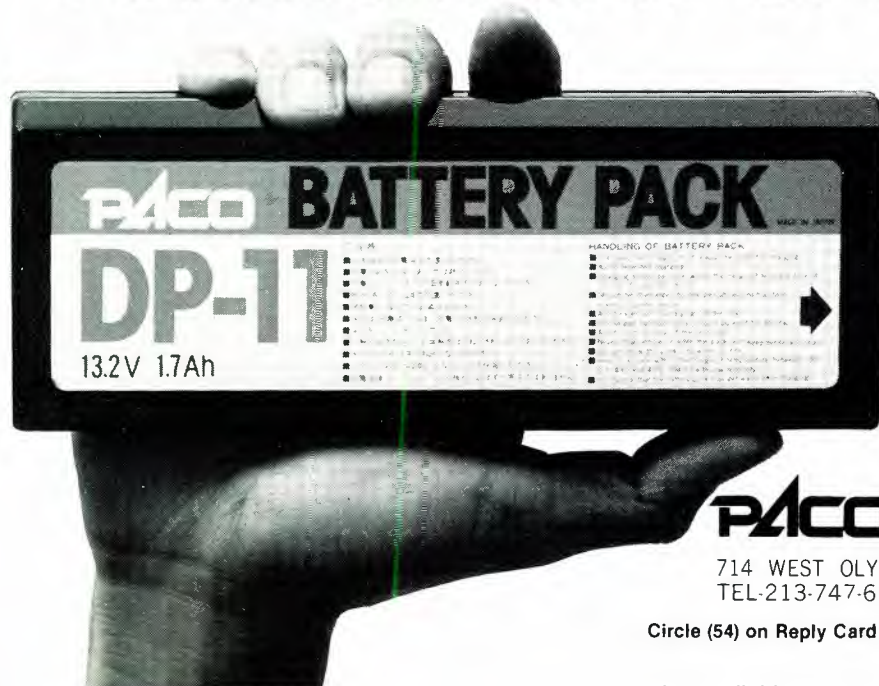
#### Setting gray scale

The dark end of the gray scale is set with the red, green and blue screen (bias) monitor controls. For the brighter high end, the gain or drive controls are used. Ideally, the high end of the scale will be set at a light intensity of about 30fL or 100NIT (a reading of 0.32 on the 300NIT scale).

A video signal level just above black is needed to set the low end. You can use a 10IRE or 20IRE window or color black

## PACO Ni-Cad BATTERY PACK

### POWER UP! NEW PACO DP-11 (13.2V 1.7Ah)



- NEW HIGH POWER CELLS ENABLE 1.7AH(0.2C Discharge Rate)
- THE MAINTENANCE FREE THERMAL PROTECTOR IS BUILT-IN, AS OTHER PACO BATTERY PACKS.
- THIS IS THE DIRECT REPLACEMENT FOR SONY NP-1.

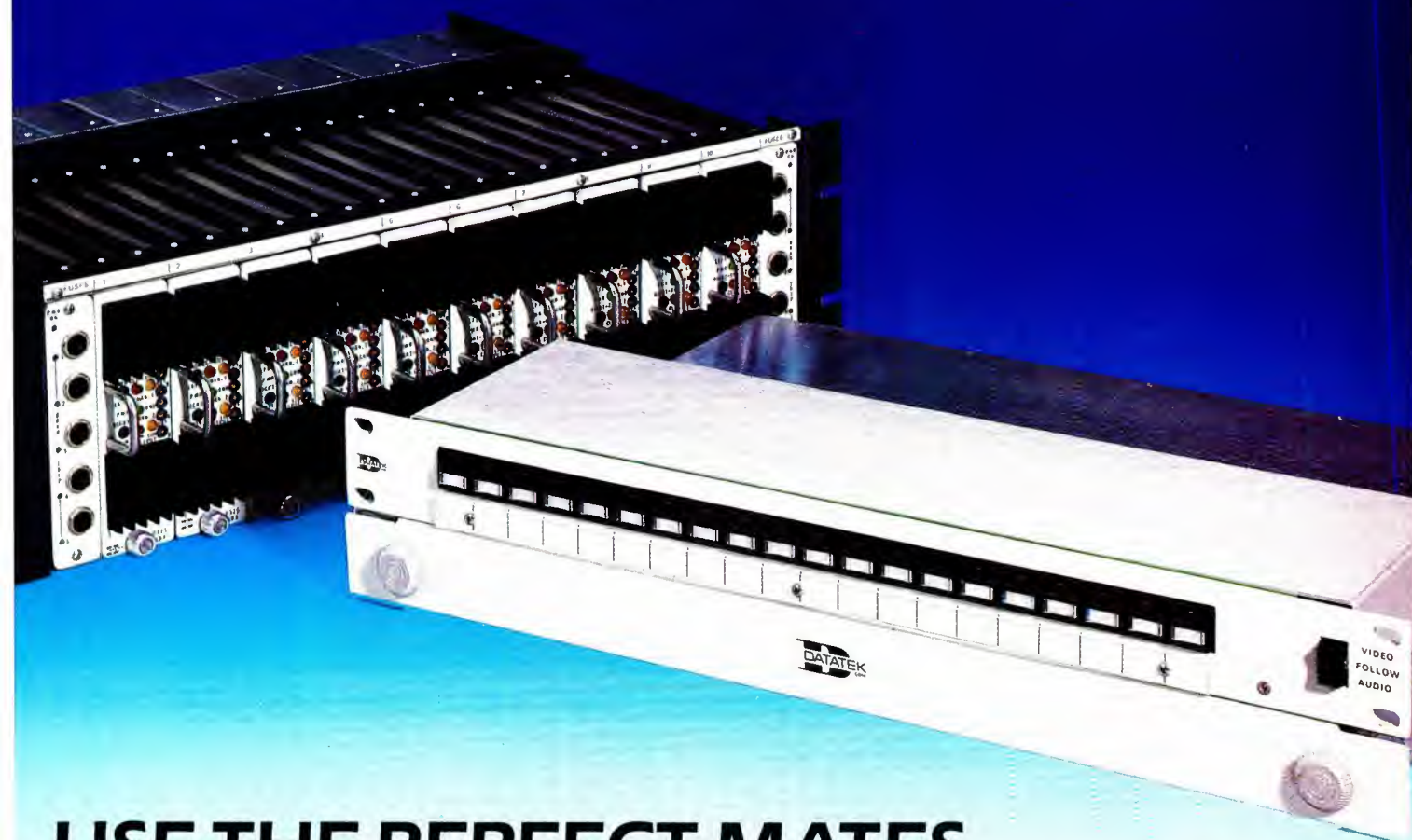
**PACO ELECTRONICS U.S.A., INC.**

714 WEST OLYMPIC BLVD., SUITE 706, LOS ANGELES, CA 90015  
TEL-213-747-6540 / TLX-756923 / FAX-213-747-3731

Circle (54) on Reply Card



**YOU KNOW DATATEK'S REPUTATION FOR QUALITY.  
NOW COMPARE US FOR VALUE.**



## **USE THE PERFECT MATES FOR YOUR STEREO SWITCHING AND DISTRIBUTION NEEDS.**

- The D-525 is a 2-channel Audio D.A. with 6 balanced outputs per channel. It can be used for one monaural input with 12 outputs, two monaural inputs with six outputs each, or one stereo input with 6 stereo outputs.
- Ten D-525 amplifiers fit in one DF-609 5¼" Rack Frame, providing 120 balanced monaural or 60 balanced stereo outputs in only 3 rack units.
- Front panel gain controls and clip level indicators.
- Individual power supply.
- The D-4317A is a 20x2 Monaural or 20x1 Stereo Audio Switcher, self contained in a 1¾" Rack Frame. It can be used with a D-4304A 20x1 Video Switcher, for 20x1 video/stereo audio switching.
- Maximum audio output is +30dBm balanced for excellent "headroom" and audio dynamic range is in excess of 100dB.
- Remote control panels operate over a single coax line.

We will be happy to assist in the selection of Datatek products to meet your exact needs.  
**Call toll free: 1-800-882-9100.**



1121 BRISTOL ROAD • MOUNTAINSIDE, N.J. 07092  
(201) • 654-8100 • TELEX 833 541

Circle (55) on Reply Card



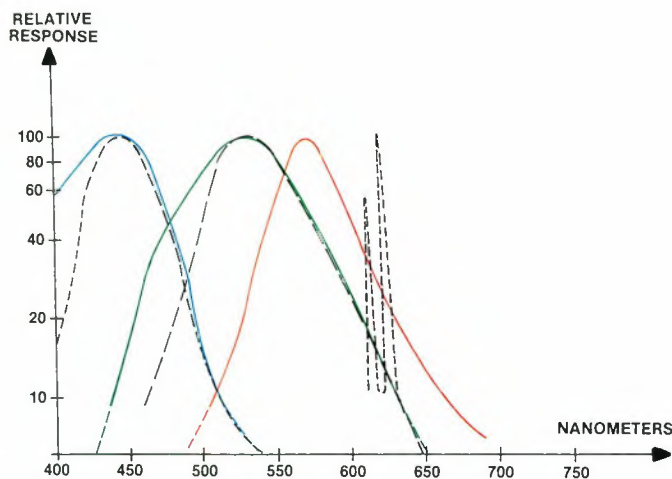


Figure 2. Emission spectra of the three primary CRT phosphors are compared with corresponding filter characteristics.

input signal with the brightness control (black level) advanced slightly. The brightness control will affect the white level as well as the black. Both levels are properly set once a satisfactory gray scale is established.

It is necessary to use a 100IRE window pattern at the high end (not a 100IRE flat field) to be sure the high-voltage power supply is operating in a linear area of its power output capability. A 100IRE flat field may cause the picture to bloom (non-linear operation of high voltage) or clip (protective clamping mode). Even when using a window pattern, it is wise to keep peak white-intensity levels at 100NIT or just slightly above. Remaining within that range will ensure that the gray scale is set within the linear operating characteristics of most monitors.

Attach the color analyzer sensor head to the center of the monitor screen with the suction cups provided. (If the suction cups fail to adhere, it is time to clean both the CRT faceplate and the cups.)

Set the analyzer to a 1NIT sensitivity level and connect a 10IRE window or color black signal. Advance the brightness slightly to bring the analyzer meter dots on scale. Now adjust the red, blue and green screens (for low lights) to make the dots line up vertically. If the dots are initially far apart, try to average the distance as you line them up.

With a 100IRE window pattern applied to the monitor, change the intensity of the CRT to about 100NIT with the contrast control. Then use the CRT gain controls to bring the dots into alignment around the 0.32 position of the 300NIT scale.

It may be necessary to alternate between the 10IRE and 100IRE signals several times to arrive at an acceptable gray scale because of the interaction be-

tween screen and gain controls. For those monitors that have only the blue and green gain controls, the indicating positions of the three colors can be shifted on the instrument intensity scale by adjusting the monitor contrast.

### Establishing levels

Set the black level with the brightness control, using a full-field PLUGE (picture line-up generating equipment) pattern or the PLUGE in the lower right-hand portion of SMPTE color bars. The PLUGE is a video pattern containing an area just slightly blacker than black by 4%, or 7.5IRE units; and just slightly above black by 4%.

Adjust the brightness until the blacker-than-black and standard black areas appear at the same level. The 4% higher area will still appear lighter than black.

Set the peak white level with the monitor contrast control to 100NIT (0.32 on the 300NIT scale) while displaying a 100IRE window pattern. This establishes peak white at about 30fL.

If you want to take the subjectivity out of adjusting black once it is established, measure and record the value of a 10IRE to 20IRE window or flat field pattern with the color analyzer after the initial setting of the brightness and contrast controls. The light level measured is where the brightness control should be set when the same 10IRE to 20IRE pattern is applied.

Accurate repeatability of the test patterns is critical to monitor setup. This modification to positioning of the black level gives you metered settings for both black and white levels. Accurate measurement of the incoming video signal levels can be made with a video-level meter.

Set the chroma gain (color) and phase (hue) monitor controls with the SMPTE

color-bar pattern and the monitor's blue-only feature. When the two controls are properly adjusted, the four blue bars display equal intensity. The two outside bars are most affected by the chroma gain, while the two inside bars are most affected by the phase control. There is interaction between the two controls, so it will probably be necessary to adjust each more than once.

Check the results of these adjustments by using a 5- or 10-step gray-scale pattern for color temperature tracking. Connect a good video source for luminance level and color adjustments.

### Potential problem areas

Monitors should always be adjusted for the display mode in which they are most often used. In other words, adjust the black-to-white gray scale with the monitor in the color mode. The monochrome mode may give a slightly different color temperature, because the decoder used in the color mode has been bypassed. Test patterns should have burst on them to make sure the color decoder is not being bypassed. If the monitor is a combination composite and component monitor, set the gray scale in the mode most often used.

The 100NIT peak white setting used in this procedure is for a low ambient light environment. If room lighting around the monitor is bright, higher black and white levels will be necessary.

If the purity of the monitor is less than perfect, the gray scale will appear to be inconsistent over the screen. Gray-scale tracking, in absolute terms, should be measured at one point in the screen, preferably at the center. It is measured by changing the intensity of the window pattern and watching the levels of the R, G and B channels of the color analyzer. The three channels should always equal one another with the dots lined up vertically for each level of the window pattern.

### Additional equipment

Proper monitor setup requires a source of accurate test patterns. The video input facilities of the monitors to be tested must determine whether composite or component pattern-generator equipment is required. A video-level meter is desirable as well, to achieve accuracy when a variable uncalibrated signal source, such as the output of a video production switcher, is used.

Although the procedure that has been outlined may seem a bit complicated at first, it becomes easy with practice. After the analyzer has been taught the gray scale for each type of CRT in use, the adjustment time is greatly reduced. It will be time well spent, however, because the resulting improvement in the color pictures displayed in the studio (and at home) will be noticed by your directors and your commercial clients.

1:7:)))



# Now the CHYRON® RGU-2



for  
\$15,990.

**Now price includes the CHYRON COLOR ENCODER/KEYER. Superb graphics and titling at a price that's too good to resist.**

The high-quality RGU-2 provides many of the most-wanted features of the industry-standard CHYRON IV: unsurpassed character resolution of 27 nanoseconds...programmed graphics animation...color for background and text on a character-by-character message basis...a versatile multi-font library...automatic color/font change... and much more.

With the optional Channel Control

Module, mixes, wipes and fades are available at the touch of a key.

Operation is flexible and uncomplicated. Just load a software program and automatic instruction displays appear on the monitor to provide an interactive communications channel between operator and RGU-2.

So, don't delay. There may never be a better time to buy the character

generator that offers most of the features found in units costing twice as much—the CHYRON RGU-2.

**CHYRON**  
TELESYSTEMS

CHYRON TELESYSTEMS/A MEMBER OF THE  
CHYRON GROUP 265 Spagnoli Road, Melville, NY  
11747 • 516-249-3296 • Telex 144522 Chyro- Melv  
West Coast Office: 221 W. Alameda Avenue, Suite  
103, Burbank, CA 91502 • 818-842-3244

Circle (56) on Reply Card

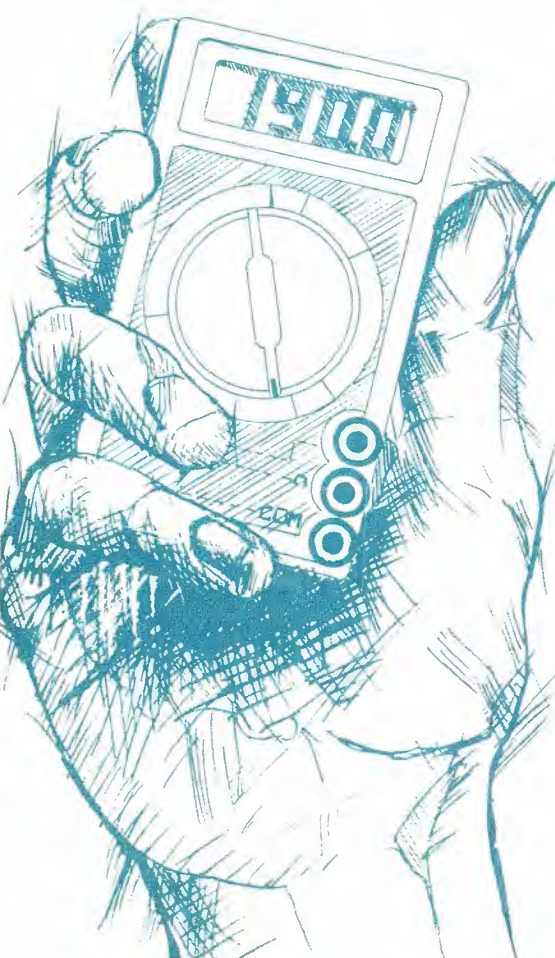
www.americanradiohistory.com



# Choosing a digital multimeter

By Patrick Chu

**If you're buying a DMM—or any other general-purpose test equipment—approach it by applying a tried-and-true decision-making method.**



Specifying and buying diagnostic tools such as digital multimeters (DMMs) are major concerns for the broadcast engineer. You need to know that you've picked the right tool for the job—at a cost that is justified by your station's specific service needs.

When you make these buying decisions, apply a formal decision process to develop buying strategies for DMMs and other general-purpose measuring instruments.

## Decision strategy

Among the various DMMs, broad categories include: low-cost (mostly imports, \$40 to \$100); professional (\$100 to \$300); and heavy-duty or *ruggedized* (\$150 to \$300). Within these categories, and even among a single manufacturer's offerings, there can be a wide variety of features and performance specifications.

A main goal, of course, is to find the product that does the job at the lowest cost. If you consider price alone, you might end up with a DMM that's low cost, but it might be useless in some applications. Avoid the pitfall of considering this essential service tool only in terms of

purchase price. If you don't match your choice carefully to your requirements, the meter might not perform needed functions, might not give accurate readings, might not operate under conditions that you consider normal and could even be a safety hazard in some uses.

In such situations, the unexpected costs could far outweigh the initial higher cost of a better product. If a DMM doesn't do the job or fails in the field, you could waste time and then have to repair or replace the meter.

On the other hand, however, there's no point in spending extra money for features that are not essential for your specific applications.

You can minimize these risks by analyzing your needs and making a thorough evaluation of the alternatives. The following decision model will help you look at the situation objectively.

## Decision model

The process or model for decision-making is shown in Figure 1. The core of the model is a sequence of seven steps:

1. State your need as a desired outcome.
2. Define the application and scope.
3. Identify requirements and write specifications.

Chu is product manager for Beckman Industrial Corporation, Brea, CA.



# EEV KLYSTRONS



**have so much more to offer  
at 60kW**

## EEV Klystrons

*Dependable  
EEV Technology*

**EEV klystrons and circuit assemblies  
are continuously tunable  
throughout their frequency range.**

The frequency setting of the cavity is uniquely identified by the numerical indication. Once the settings corresponding to vision and sound tuning on any channel are known the klystrons can be retuned within seconds. All tuning adjustments on the EEV klystrons can be carried out from the front of the circuit, enabling the transmitter to be tested on any channel without having to withdraw them from the cabinet.



*Get all the facts and figures on compact  
high efficiency wideband klystrons from  
10 to 60 kW by contacting us TODAY.*

### USA:

EEV Inc, 7 Westchester Plaza, Elmsford,  
NY 10523, USA  
Telephone: 914 592 6050  
Telex: 6818096 Fax: 914 592 8342

### CANADA:

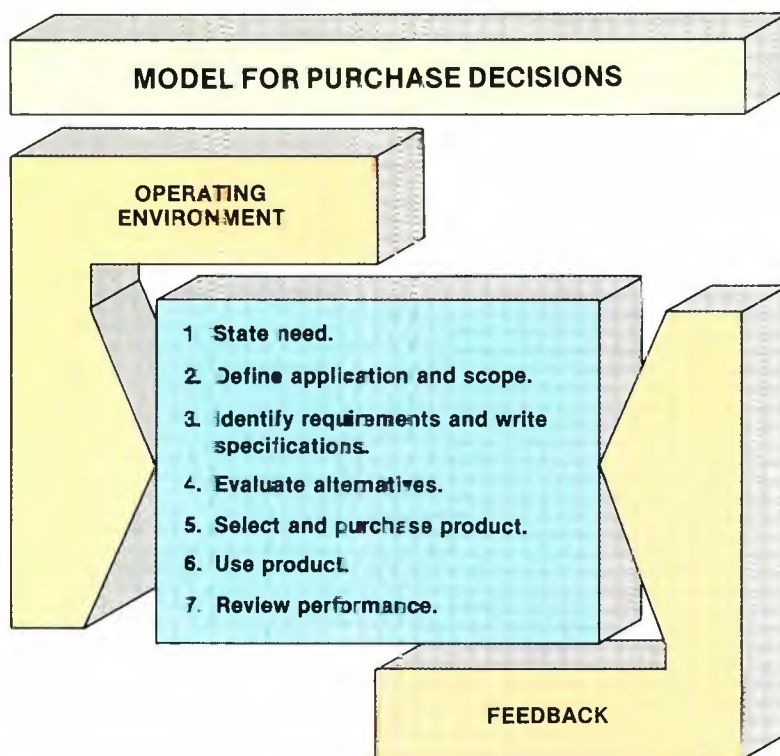
EEV Canada Ltd, 67 Westmore Drive, Rexdale,  
Ontario M9V 3Y6  
Telephone: 416 745 9494  
Telex: 06 989363 Fax: 416 745 0618

### UK:

EEV, Waterhouse Lane, Chelmsford,  
Essex CM1 2QU, England  
Telephone: (0245) 261777  
Telex: 99103 Fax: (0245) 50424

Circle (57) on Reply Card





**Figure 1.** The basic model for purchase decisions can be used for almost any general-purpose test equipment. The iterative process permits an effective selection of the appropriate test instrument for a particular task.

4. Identify and evaluate alternatives.
5. Make a purchase decision and procure the product.
6. Put it to use.
7. Review the results.

Note that two arrows feed into the set of steps in the decision process. These arrows represent factors that can influence your decision:

- feedback and
- operating environment.

Feedback loops are caused by intermediate results that trigger re-evaluation of a prior step and another cycle of the decision process. Also, your own situation will affect the process at each step. Examples of how these factors might affect your decision are included in the following description.

#### Need statement

In the first step, you state your needs in terms of a desired outcome, or intended result, such as:

*The station will be equipped for preliminary troubleshooting of electrical and electronic component failures in microcomputers, video monitors, VTRs, printers, modems and transmitters.*

This concise statement will shape your thinking from the outset. Your evaluation decision might be completely different if you state your needs some other way, emphasizing another aspect.

Even though you want to be as precise as possible, being able to state your needs doesn't mean that you must have all the answers before you start. The process model helps you derive the answers because it is iterative, or can be performed repeatedly until satisfactory results are achieved. That's the function of the feedback arrow on the right of the model diagram. At any point, if you reach a conclusion that doesn't fit your



(Photo above, left) Note the difference in size and mechanical ruggedness of the heavy-duty DMM (left), the professional DMM (center) and the low-cost DMM at the right.

(Photo at left) The major factor in mechanical protection is case design, including the number of internal ribs, the thickness of the material and the number of screws holding the case together. For protection from contaminants such as water, a gasket is needed, as shown in white on the yellow heavy-duty meter.



# Canon Quality. Canon Value.

Now available in a full line of camera support products.

## MC-200/MC-300 PEDESTALS



Featuring Canon's sophisticated Modular Cassette Counterbalance (MCC) system that makes them far lighter and more mobile, Canon pedestals also feature a very short mounting height, making them ideal for low-angle shooting.

**MC-200**  
Maximum Mounting Weight: 286 lbs.  
Elevation: 24-49 inches  
**MC-300**  
Maximum Mounting Weight: 242 lbs.  
Elevation: 23-60 inches

## TR-60/TR-90 TRIPODS



Featuring collapsible tubular leg construction, integral spreaders, flip-tip legs with spikes and rubber padding.

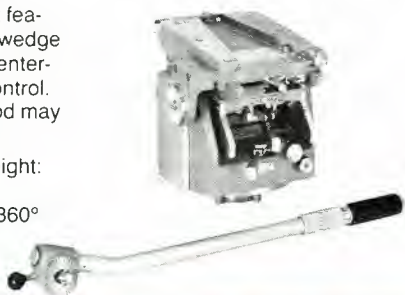
**TR-60**  
Maximum Mounting Weight: 132 lbs.  
Elevation: 20-45 inches

**TR-90**  
Maximum Mounting Weight: 198 lbs.  
Elevation: 26-48 inches

## SC-15 CAM HEAD

Designed for use with all pedestals and tripods, it features a convenient "V" wedge mounting system and center-of-gravity adjustment control. The modular panning rod may be used on both sides.

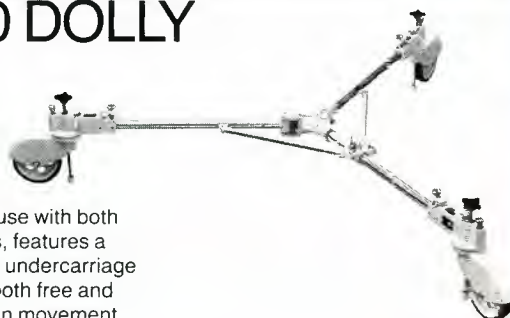
Maximum Mounting Weight: 330 lbs.  
Tilting:  $\pm 50^\circ$ , Panning:  $360^\circ$



## CD-10 DOLLY

Designed for use with both Canon tripods, features a tricycle caster undercarriage that enables both free and single-direction movement.

Maximum Mounting Weight: 198 lbs.



For years, broadcasters have made Canon lenses a top choice for studio, field and news production because they know and trust Canon's proven commitment to quality and value.

Now Canon is proud to introduce a complete, full-featured, high-quality camera support system, built to the same high standards and backed by the Canon service network.

# Canon®

Optics Division

Canon USA, Inc., Head Office: One Canon Plaza, Lake Success, NY 11042 (516) 488-6700  
Dallas Office: 3200 Regent Blvd., Irving, TX 75063 (214) 830-9600. Chicago Office: 100 Park Blvd., Itasca, IL 60143 (312) 290-6200  
West Coast Office: 123 Paulina Avenue East, Costa Mesa, CA 92626 (714) 979-6000  
Canon Canada, Inc., 6390 Dixie Road, Mississauga, Ontario L5T1P7, Canada (416) 678-2730

© 1985 Canon U.S.A., Inc.

Circle (58) on Reply Card



requirements, you can back up, change your assumptions and repeat the process.

The first time through, for example, you can identify your *ideal* requirements and extend them to actual costs. If the results exceed your budget, you can make a second pass, focusing on requirements that are essential, such as safety in measuring high-voltage power circuits or exceptional accuracy.

The arrow on the left side of the diagram shows that conclusions at each step will be affected by the way your station does business. If you don't take this into consideration, your decision might be fine—for someone else.

#### Application and scope

Based on your need statement, this step involves identifying the service procedures in the application. You also will want to think about the scope of your decision, including short- or long-term goals and purchase quantities.

Let's continue with the example of needing to troubleshoot microcomputer-based equipment in the field. A review of the troubleshooting procedures might produce the following list:

- test power supply for function and output;
- measure surface temperature of boards and IC;
- look for shorts and leaks;
- check for presence of digital signals at

outputs or on the data bus; and

- test control circuit signals.

For each of these tests, you should be able to identify specific measurements. For each type of measurement, you can determine the range and accuracy required. This information is fed to the next step, in which you develop a set of requirements and specifications for your purchase.

#### Requirements and specifications

For DMMs, your application requirements can be defined in terms of measurement functions and desired test capabilities. (See Figure 2, page 112.)

In this step, the specific types of tests that you've identified are matched with specific DMM functions. Most DMMs, for example, measure Vac, Vdc, Aac, Adc and ohms. Many of these meters also will perform continuity and diode tests. These basic functions will be found on DMMs in all price ranges, although some models might not include all of them.

Specific functions, which might be found on a few DMM models, include true rms, temperature, frequency, capacitance, conductance, transistor gain (hFE), decibels (dB) and logic.

DMM options and individual cost items correspond to some of these functions. For temperature measurements, special thermocouple test probes must be used. Some high-voltage measurements re-

quire special probes. Logic probes are special-purpose devices, and should be considered separately from the DMM. Frequency functions on hand-held DMMs are needed mainly in the field for preliminary requirements, because a bench-located frequency counter is typically used to perform more detailed tests in the shop.

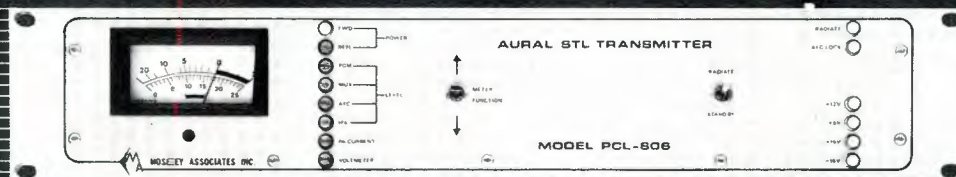
Surveys of DMM users indicate that the following factors are among the most important:

- **Size.** Each engineer has an opinion on DMM size. Some low-cost DMMs are exceptionally compact, about the size of small calculators, and are well suited for shirt pockets or briefcases. Professional and heavy-duty DMMs, on the other hand, tend to be larger because of the thicker plastic materials and case designs needed to protect internal electronics.

Some of the larger units have two parts: the meter itself and a protective plastic holder. This holder adds to the physical bulk of the meter. Some of the heavy-duty DMMs, however, are relatively compact.

- **Ease of use.** Both reliability and convenience may be enhanced if the DMM has a single rotary switch for selecting functions and ranges. The rotary switch makes it possible to turn the meter on and to select the desired function and range in a single action. By contrast, DMMs that use push-button selectors

# When Quality is Everything.



## PCL-606

It's no secret that Moseley Aural STLs have set the quality standards by which all others are measured. Stations using the PCL 606 and PCL 606/C know they count on Moseley quality, performance and technical support.

Your radio audience demands quality sound. In today's market, can you afford to compromise?

Contact Moseley Marketing or your authorized Moseley distributor.

**Moseley**



**NORTHEAST BROADCAST LAB, INC.**

10373 Saratoga Road, South Glens Falls, NY 12801  
518-793-2181 300-227-1093

Circle (113) on Reply Card



THE CHYRON GROUP  
Chyron, CMX, Digital Services Corporation  
PRESENTS CHYRON'S

# EARN-ITS OWN-PAYMENTS PLAN

Buy the Chyron Group equipment listed in this advertisement before December 31, 1986, and we'll make a deal that lets your new equipment make its own payments.

**10% DOWN.**  
**55 MONTHS TO PAY.**  
**MONTHLY PAYMENTS AS LOW AS \$299.**

If you use your new equipment only two, three or four times each month it will pay for itself. In production time saved. And with quality presentations that can increase your profits.

Think about it—55 months is over 4½ years. You're getting Chyron Group equipment almost cost free.

#### From CMX

##### CMX 3400

The industry standard

##### CMX 336XL

6 port total video editing

##### CMX 3100

Unlimited creativity for the editor

#### From Chyron

##### Scribe

The ultimate text generator

##### Chyron IV

• 4200/Motion  
• 4100 EXB

##### RGU-2

Chyron IV resolution for less

#### From DSC

##### Illusion

Full live video digital effects

##### Eclipse

Revolutionary sophisticated video effects

##### SX-2000D

Digital effects with switching capabilities

**Hurry...**

OFFER EXPIRES DECEMBER 31, 1986. SEND THE COUPON RIGHT NOW AND YOU'VE GOT THE BEST DEAL WE'VE EVER OFFERED

**CHYRON**™ CORPORATION

265 Spagnoli Road, Melville,  
New York 11747  
Telephone 516-249-3018

Circle (59) on Reply Card

I want to buy a: (Please check to indicate equipment you want).  
☐ Scribe; ☐ Chyron IV; ☐ RGU-2; ☐ Illusion; ☐ Eclipse; ☐ SX-2000D; ☐ CMX 3400;  
☐ CMX 336XL; ☐ CMX 3100  
☐ Check here if you're interested, but want more information on the equipment before you buy.

Name \_\_\_\_\_

Company \_\_\_\_\_

Address \_\_\_\_\_

Zip \_\_\_\_\_

Phone \_\_\_\_\_

Send to: \_\_\_\_\_

**CHYRON** Corporation  
545 Washington Avenue,  
Brentwood, NY 11717

BE 11/86



may require three steps: Turn the meter on, select ac or dc measurement and select function and range.

Another consideration is the readability of the meter's display. Two important factors are the size of the digits and how well they contrast with the background of the LCD. Large digits against a contrasted background make it possible to read the display from different angles. This is especially important when you're working in cramped spaces or under adverse lighting conditions.

You should determine whether the meter comes with convenience features such as tilt bail, anti-skid pads on the back of the case, or a spare fuse inside.

• **Protection.** Types of protection needed in some DMM applications include mechanical, environmental and electrical.

**Mechanical protection.** This requirement relates to the meter's impact resistance, or its capability to withstand dropping or vibrating. Some ruggedized DMMs are guaranteed to withstand a 10-foot drop to a concrete surface.

Mechanical protection is largely a matter of case design and the thickness of the plastic housing. The thickness and the degree of protection provided varies even within the offerings of a single manufacturer. Other factors that determine the degree of mechanical protection provided are the number of internal

ribs that support the various parts of the case and the number of screws that are used to hold together the case and the internal modules. The greater the number of rib supports and screws, the more durable, or rugged, the meter will be.

A stringent guideline in this area is MIL-T-28800 for Style A, Class 2 instruments. This military specification sets standards for resistance of test instruments to mechanical shock and vibration. Some heavy-duty DMMs meet this specification.

Other mechanical protection features include shock-mounting of the LCD and recessing the glass faceplate of the display below the surface of the meter's face. To prevent damage, the rotary function switch also should be recessed.

**Environmental protection.** Meters that must hold up under routine field use should be sealed against external contaminants such as dirt and dust and also should resist penetration by moisture, flammable gases and liquids. This protection can be provided by using gaskets at case seals and O-rings at case openings, such as input jacks. Also, fewer case openings minimize the number of places where contaminants might get inside.

Another environmental hazard that can affect a DMM's accuracy is radio frequency interference (RFI). Any engineer who has tried to use an inexpensive DMM at a transmitter site knows how

serious this problem can be. Inside the case, RFI shielding for meter electronics may be necessary, both to shield the DMM from interference from high-RF levels and to prevent RFI generated by the DMM from causing disturbances in external circuits.

If you plan on using the DMM at your transmitter site, try to obtain a demo unit and see if it works in high-RF fields. This test might save you a lot of grief later when you discover that your new meter is producing inaccurate results because of RFI. In general, demanding requirements for environmental protection point to the need for a heavy-duty DMM.

**Electrical protection.** Protection against electrical overload is important for the safety of the operator, as well as to prevent damage to the DMM itself. This is a point for careful consideration, because such protection often is sacrificed in low-cost models.

Professional and heavy-duty DMMs often use metal oxide varistors (MOVs) as protection devices against static discharge. An MOV goes into low-impedance conducting state if the voltage exceeds a certain value. In a DMM, the MOV is put directly across the input leads, usually in a series with a resistor. The MOV typically conducts at about 1,700V, clamping the voltage transient and protecting the meter, as well as the user.

# Remote Control is just a phone call away

## VRC-1000 Remote Control Unit

- Using inexpensive dial telephone line
- Automatic dialing to report alarms
- Automatic answer - with Full Security
- 16 Metering/16 Status/32 Commands
- Full Automatic Commands
- Video Display/Printer Optional



... for less than \$3,000

**GENTNER**  
RF PRODUCTS DIVISION

P.O. Box 32550, San Jose, California 95152  
(408) 926-3400 Telex II: 510-600-1445

Circle (60) on Reply Card



# Look Into Our 8000 Series Master Control Switchers

*You Can Operate It  
With The Same Common Sense You Used To Buy It.*

Model 8020

(also available in 12 input rack mount version)

## FIVE YEAR WARRANTY

We back our reputation for standout customer service with toll free technical assistance lines and one of the strongest warranties in the industry. Our dealers are worldwide, call for the one nearest you.

## 8000 Series Features

### EASY TO OPERATE

Logical control layout minimizes potential for operator error.

### FIELD UPGRADEABLE TO STEREO

Stereo is coming on strong. We keep you prepared so you can easily upgrade.

### EXTERNAL SERIAL CONTROL

You can save now but still be prepared for the future.

### MACHINE CONTROL

Intergroup's reliable machine control system interfaces with VTR's and film islands and features sophisticated time display.

It's also field upgradeable.



Model 8001

# INTERGROUP

"Creativity You Can Depend On"



INTERGROUP VIDEO SYSTEMS, INC.

P.O. Box 1495 / Gainesville, FL 32602-9990

(800) 874-7590 / In Florida (904) 335-0901 / TWX 810-825-2307

Circle (61) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



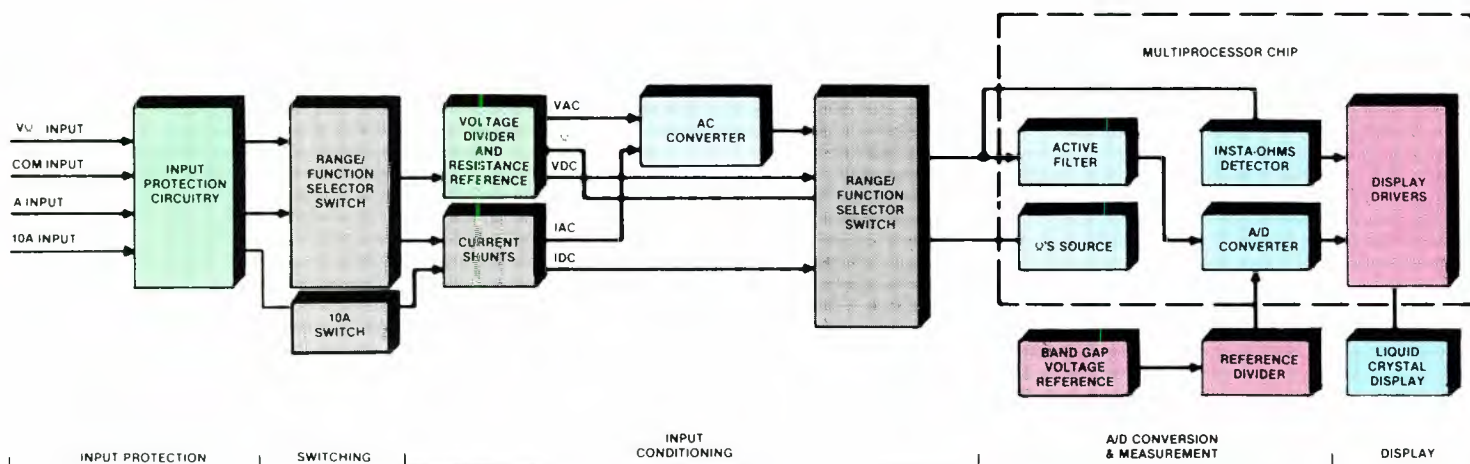
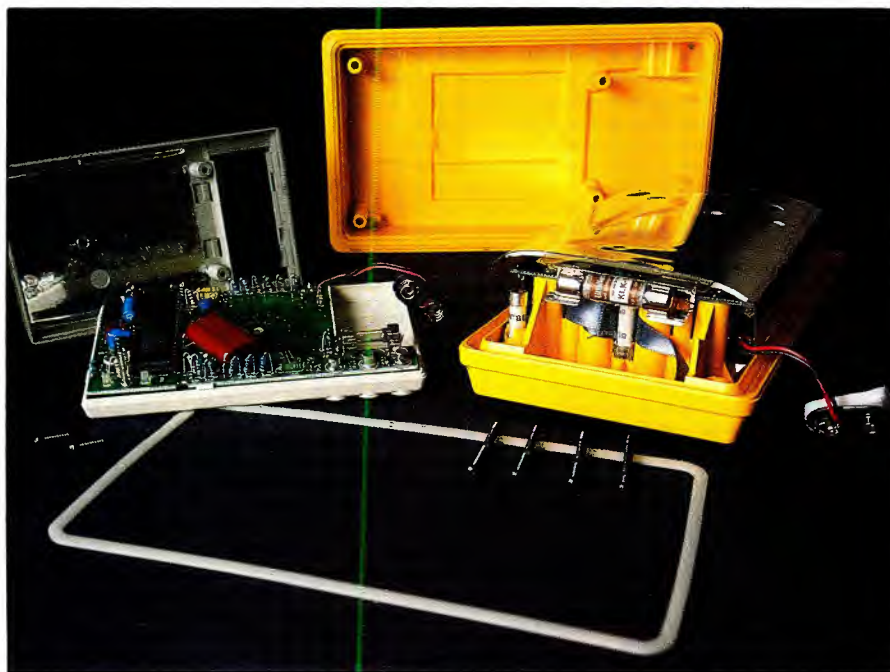


Figure 2. A simplified block diagram of a typical DMM.



The heavy-duty meter, shown on the right, provides both RFI shielding and padding for the meter's circuit board.

Most DMMs have a fuse to protect the meter's current ranges. The fuse is placed in series with the probes. The higher its current rating, the higher the fused rating of the meter. Fuses should also be capable of withstanding high voltages when blown, so the protection is provided throughout any overload.

Most DMMs have fused 2A ranges. Some heavy-duty DMMs are fused even in the 10A range. Meters without a fused 10A range rely on the current ratings of their electronic components, which might help to protect the operator but won't prevent damage to the meter itself. A stringent specification for a ruggedized DMM would be a fused rating of 15A/600V in the 10A range.

Higher-quality DMMs have cases that are made of self-extinguishing plastic. A

relevant spec for fire-retardant plastic is UL 94V.

Other electrical protection considerations include the maximum allowable voltage in resistance mode and maximum overvoltage protection. Probes should have recesses and sleeves to prevent fingers from slipping and accidentally touching any conductors. For the same reason, input jacks should be recessed into the case.

- **Performance.** Factors that affect DMM performance in specific applications include resolution, accuracy and bandwidth.

**Resolution.** The resolution of the DMM is determined by the number of digits in the display and the number of ranges available within each function. DMMs that display four digits are said to have

3½-digit displays, because the first (left-most) digit is either 0 or 1. Similarly, higher-priced DMMs that show five digits have 4½-digit displays.

DMM measurement functions are subdivided into ranges. The range selected determines the position of the decimal point in the display and the interpretation of the reading. The more ranges that are provided for each function, the more precise the measurement.

**Accuracy.** Closely related to resolution is the DMM's overall accuracy. Specifications for accuracy usually are expressed as a percentage of the reading, plus or minus a number of digits.

Another factor that affects the DMM's accuracy is the sampling method used for measuring ac voltage. Low-cost models typically use an averaging method, which is less accurate than a true root-mean-square (rms) formula. True rms measurements are needed when working with switching power supplies, SCR- or TRIAC-controlled power supplies or distorted signals.

**Bandwidth.** Another DMM performance specification is bandwidth, or the frequency range within which readings can be sensed. Costlier DMMs have bandwidths of 10kHz, perhaps even 40kHz. Low-cost models generally have bandwidths of 500Hz to 1kHz. Responsiveness to high-frequency signals often is needed in microprocessor-based and video applications.

Once you've identified all requirements and specifications, you're ready to look at specific DMM models.

### Identify and evaluate alternatives

You are now ready to begin the *shopping* phase of the process. As you gather data on different products, you might compile the specifications in a comparison chart.

You can evaluate the choices by comparing their costs and benefits. Tech-



# PAY LESS ATTENTION TO YOUR VIDEO CART MACHINE

Now Available in  
BetaCam Format



Great idea! Now you can do just that with the TCS2000.

The Cart Machine automatically manages, records and plays-to-air all forms of spots and programs, giving you much more uninterrupted time away from programming concerns.

The Cart Machine holds up to 280 carts on-line. Tracks 65,000 carts in the database. With its 1,000 event look ahead feature, you receive a printed list of needed carts and your saturation spot carts never have to leave the machine.

The Cart Machine's comprehensive software system interacts with your traffic system to download your logs and automatically preplans the spot play lists days in advance.

Now other station operations get your undivided attention—with The Cart Machine.

## Odetics

**We put *smarts* in The Cart Machine.**

Odetics, Inc. 1515 S. Manchester Ave., Anaheim, CA 92802-2907.  
Call toll free 1-800-243-2001. In California call 800-238-4422 or 714-774-5000.

Circle (62) on Reply Card





Note the difference in meter protection. The heavy-duty meter has both a 10A and 2A fuse, while the smaller meter has only a 0.8A fuse.

## Don't settle for a shotgun mic that colors off-axis sound.



**The new lightweight Shure SM89 eliminates coloration up to 30° off-axis.** Thanks to its new Accu-Port™ design, the off-axis response of the SM89 is smooth and natural, free of the peaks and dips caused by the comb-filter characteristic of most shotgun mics. So off-axis sound is much easier to control and equalize.

The SM89 also features a newly designed condenser cartridge for improved sensitivity. Plus a built-in rolloff filter that eliminates low frequency noise problems, and controls proximity effect in close-up work.

The durable aluminium design is 30-40% lighter than other models. The low noise amp also can be powered from 11 to 52 VDC phantom power and separates from the capsule for field repair.

For more information, write or call Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL. 60202-3696 (312) 866-2553. G.S.A. Approved.



**SHURE®**

*Breaking Sound Barriers for over 60 years™*

See us at AES  
Booth #s 107-108, 213, 215.

Circle (63) on Reply Card

niques for performing such evaluations include rating each alternative against a checklist of ideal requirements, assigning and tabulating point scores for requirements met by each product, or actually testing product samples in the lab or in the field.

Another advantage of actually obtaining a sample of the product is to get a feel for its quality and reliability. Look closely at the graphics. Are they well protected, or might they be rubbed away or scratched off easily? Open the case. Is the PCB paper-based and/or phenolic or glass-based? Are switch contacts gold? Is the PCB soldering clean?

It is not uncommon to find that no single product meets all your requirements. It's also not unusual to discover that a product that meets all stated requirements will strain your equipment budget. Feedback loops from this evaluation step carry results back to your definition of requirements, causing another cycle of decision steps.

### Purchase decision

In making your selection, remember that the alternative with the highest rating or lowest cost isn't necessarily the most favorable. If an alternative has a high overall rating but does not meet a critical requirement, such as overload protection or durability, it's probably a poor choice. That's why it's important to make a distinction between *ideal* and *must-have* requirements. For example, the extra cost of a 4½-digit display might not be justified unless you require up to four decimal places in the reading. (In the 2V range, the least significant digit would represent tenths of a millivolt, or 1/10,000V.)

### Use the product

Use the meter on the job to determine whether your selection meets the needs that you outlined in the first step and the requirements that you have identified for the application.

### Review the results

Evaluation of results comes after the equipment has been in use for at least one year. Your ideas about basic trade-offs will be confirmed or disproved in practice. For example, your decision might have been to buy a low-cost DMM on the assumption that it would be less costly over the long term to replace a broken unit than to repair it. In practice, there is a precise breakeven point at which higher-priced, repairable units become more economical.

The DMM is becoming a common instrument both for field and station maintenance. Modern DMMs are capable of many advanced functions including analog-type displays. With the wide range of options available, the DMM can probably handle your most demanding troubleshooting tasks—at a cost that fits into the engineering department budget.



# More power for the voice of freedom.

## High Power SW Transmitters



The Marconi Advanced PULSAM p.w.m. system makes our latest high-power short-wave transmitters over 10% more energy-efficient than any previous design. And when you're producing 1 megawatt of power continuously, that's a very substantial saving.

Naturally, these transmitters provide superb performance (with very low levels of spurious radiation).

They offer low maintenance costs thanks to outstanding reliability and dual source components.

They provide fail-safe protection for equipment and personnel.

And they share with their predecessors a unique degree of designed-in reliability to ensure that the

message from the free world comes through loud and clear.

For more details contact, Marketing Dept., Space & Broadcasting Division, Marconi Communication Systems Ltd., New Street, Chelmsford, Eng and CM1 1PL. National 0245 353221. International 44 245 353221. Telex 59201. Facsimile (Gp 2/3) 0245 87215.

Circle (64) on Reply Card

**Marconi**  
Communication Systems





## Future features

In today's test-equipment market, hand-held DMMs have largely replaced conventional volt-ohm meters (VOMs) as general-purpose measurement devices. Reasons include increased performance, convenience and reliability at modest cost, the benefits of all-solid-state microprocessor technology and digital sampling techniques.

Remarkable enhancements may be seen in the following areas:

### Input protection

Fuses probably will become physically smaller, with higher voltage ratings, providing increased safety and meter reliability. Fuses will increasingly be incorporated on all current ranges, especially in heavy-duty industrial models.

A valuable feature that is found in some of today's more sophisticated DMMs is the metal oxide varistor (MOV), which protects against high-voltage electrostatic transients, often up to 6,000V. Formerly, this protection was provided by a spark gap, which can be a hazard, especially if the meter contains a low-cost exposed-type spark gap and the meter is used in the presence of explosive gas or dust. The trend in MOVs will be to still-higher voltage protection.

### Switching

The trend is likely to be toward elec-

tronic switching, thereby reducing mechanical switch movements and the number of contacts. Microprocessor-controlled switching will permit autoranging, in which the user selects a function and the meter selects the appropriate range upon sensing the input. Elimination of mechanical switch contacts also designs out some of the potential sources of DMM failure, such as corrosion, dirt and wear of contacts. Where it is impractical to eliminate mechanical switching, contacts will be gold-plated and will have a wiping action to minimize impurities.

Also, watch for DMM switches to be replaced with a keypad-style switch similar to that used on pocket calculators. Switch types include conductive rubber pads and bubble-type switches sealed in vinyl.

### A/D conversion and measurement

CMOS chip technology has produced microprocessors with low current drain, greatly improving battery life. In 1979, custom LSI microprocessor chips were first introduced into professional and heavy-duty DMMs. This technology extended battery life to 2,000 hours.

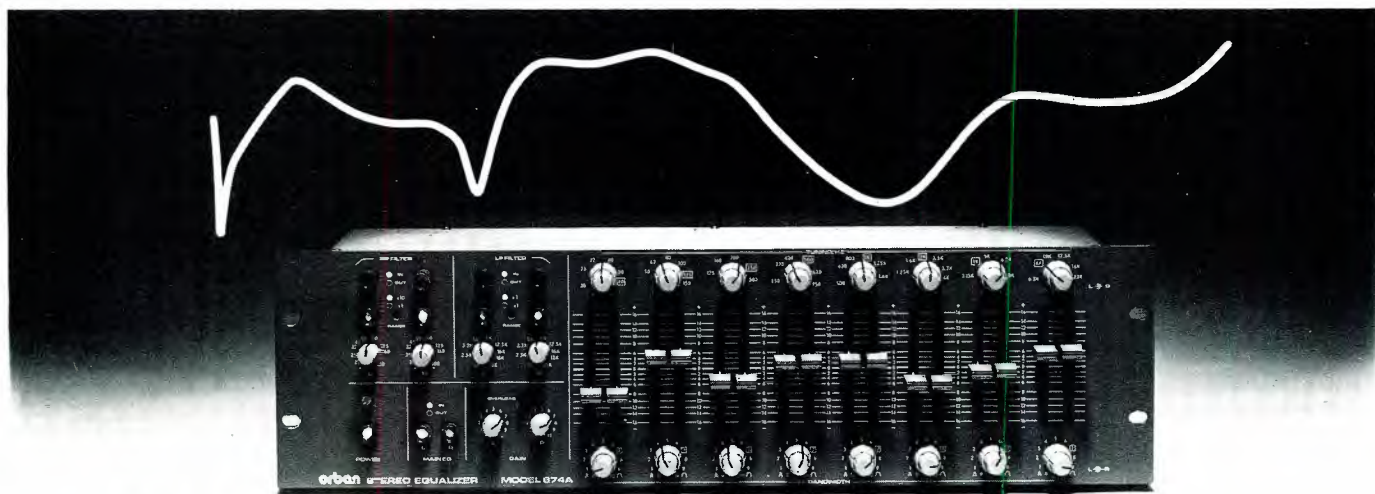
DMM designers predict a trend toward more custom chips. Silicon-factory technology will make relatively low production runs feasible. The result will be more proprietary designs

to suit specific needs. Product differentiation is likely to increase, as will the diversity of offerings. In short, users will have more choices.

### Display

The changes in chip technology also will increase the flexibility of display formats. Some existing DMM designs handle analog-to-digital (A/D) conversion, measurement and display control all within the same chip. Future DMM designs may separate these functions between at least two chips, one for A/D conversion and one for meter operation and display control. Having a separate chip for display control means that meters can be customized further. The number of available display formats may increase, with features tailored more closely to specific applications. Users may be able to control output formats through soft-touch buttons.

An extra display feature on some DMMs is a bar graph that supplements the numeric reading. This simulates d'Arsonval needle (analog) movement and provides for quick visual checks. With new display-controller chips, bargraph graduations will become finer, permitting more accurate representation. Other features may include user-selectable temperature readings in degrees Fahrenheit or Celsius; decibel measurement; relative readings and



## The indispensable curvebender.

"A one-of-a-kind problem solver"—that's what critics and users have said about Orban's 672A (Mono)/ 674A (Stereo) Graphic Parametric Equalizers.

The equalizer's continuously variable center frequency, bandwidth, and boost/cut and tunable high- and lowpass filters make the 672A/674A a superior replacement for conventional graphic equalizers, notch filters, and high- and lowpass filter sets. And this versatility is delivered with pure musicality that's easy on the ears—and at a price that, by comparison to the units it replaces, is easy on the budget.

The 672A/674A will quickly become the centerpiece of your production room. Contact your local dealer for a demo of Orban's indispensable curvebender.

**orban**

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

Circle (65) on Reply Card



**MONDAY**  
**DECEMBER**  
**1995**

---

**25**

*The HP Audio Analyzer  
might take its first day off.*

With 20,000 hours MTBF, it could be ten years before the HP Audio Analyzer takes a break. So you won't lose patience with down time or money on repairs. And at \$5800\* (or \$3900\* without a source), you can easily afford the most reliable audio distortion analyzer on the market.

For details about the HP8903B/E, call your local HP office listed in the white pages, or use our toll free number. 1-800-556-1234, ext.515. In California, 1-800-441-2345, ext.515.

\*U.S. list price



**HEWLETT  
PACKARD**

Circle (66) on Reply Card



# \$2900

## How can Grass Valley Group sync so low?

By building application-specific models centered around the revolutionary SPG Gate Array integrated circuit, that's how.

The 9510 Reference Synchronizing Generator is a compact master featuring protected video genlock. With the

phase preset option, it can even store genlock phase settings. Add an optional test signal generator and source ID, and you've got a full-featured master or source sync generator.

The 9510 is only one of our landmark 9500 Series Sync Generators.

### Grass Valley Group®

A TEKTRONIX COMPANY

STRENGTH YOU CAN RELY ON

The Grass Valley Group, Inc., P.O. Box 1114, Grass Valley, CA 95945 (916) 273-8421 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.

Circle (67) on Reply Card

## SMPTE/EBU TIME CODE READER AND CHARACTER GENERATOR



### THE STANDARD OF THE INDUSTRY MODEL DR-107B

- Provides for unsurpassed code reading using "The McFadin Window"® decoding time code from a VTR at speeds of 1/100 to 100 times. (machine dependent)
- Very useful for window dubs for off-line editing and video monitor viewing. Highly legible and unique 'Font'.
- All front panel controls for easy positioning of character display including vertical interval insertion.
- Drop frame indication, choice of Time Code or User-Bit display, restored Time Code output for dubbing, 1 1/4" rack mounting and parallel BCD output.
- A five year warranty including parts & labor, included.

**GRAY ENGINEERING LABORATORIES**  
504-P West Chapman Avenue  
Orange, CA 92668 • 714/997-4151

Circle (68) on Reply Card

minimum/maximum memory.

LCD (liquid-crystal display) technology also is changing. The use of LCD devices in DMM displays was a major advance that replaced light-emitting diodes (LEDs). LCDs using CMOS technology require less current and promote longer battery life, but there is room for improvement. Display formation depends on the liquid-crystal flow, which becomes impaired at temperature extremes. Cold-weather exposure causes extremely slow display performance. At temperatures below freezing, the liquid ceases to flow and produces no reading. Hot environments also must be avoided. Tomorrow's DMMs should be capable of producing readings even after being subjected to freezing weather or to the heat of the sun for extended periods.

Flexible materials may replace the glass that is currently used for the face of the display. These materials have already appeared on some pocket calculators. On a DMM, this will mean enhanced durability, greater safety and reduced size. DMMs also will have luminescent displays. Illuminated displays today depend on lighting or backlighting with conventional bulbs that can rapidly drain the battery. In the future, the displays will glow.

Display readouts today are available in 3 1/2 digits (1 to 1,999 counts) or 4 1/2 digits (1 to 19,999 counts). Providing the extra counts requires more expensive electronics. Low-cost alternatives in the future will increase the range of the first count to 3 1/2-digit displays. Options should include 1 to 2,499, -2,999 or -3,999 counts.

### Batteries to casings

New lithium batteries will soon be introduced. The toxicity of lithium has been a barrier to this technology, but recent advances protect the user against exposure to the chemical if the battery becomes damaged. Lithium batteries could power DMMs for more than twice the life of conventional alkaline batteries.

Some DMMs, especially the auto-range types, put out 3V to 4V in resistance mode. This voltage is sufficient to switch on diodes in the circuit under test, perhaps causing malfunction or accidental system activation. Future DMM circuits will overcome this problem by incorporating more complex processing logic.

New plastics promise to enhance the durability of DMM casing materials. These plastics offer better resistance to solvents and physical impact. Cases made of these materials should hold their shape even at relatively high temperatures—if a DMM were set on the dashboard of a car on a hot summer day, for example.

The prospects for the future of DMMs include enhanced convenience, durability and reliability. Users will have a greater number of product choices, including many models that are tailored to specific applications.

1:2=|||



# The ITC "Component System" Listeners Will Love It!



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

## The Best of Both Worlds

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

## Separately, These ITC Components are Impressive, Together They're Awesome!

Cartridge, tape and machines have been designed by a single manufacturer to compliment each other like never before and produce uncompromising audio quality.

1. 99B Master Recorder—Loaded with features
2. ELSA—A patented automatic cartridge preparation system
3. DELTA Reproducer—Outstanding audio performance in a reliable, mid-priced cartridge machine

4. ScotchCart®II Broadcast Cartridge—Capable of frequency response equalling professional reel-to-reel performance

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

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

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

**International Tapetronics Corporation/3M**

2425 South Main Street  
P.O. Box 241  
Bloomington, Illinois 61702-0241

# 3M

Circle (69) on Reply Card



# Getting a handle on ESD

By Jess Kanarek

**Electrostatic discharge is a problem technicians face every day.**

**S**top! Don't touch that chip.

Integrated circuits are incredible devices that perform wonders. They are also, however, highly sensitive to damage from electrostatic discharge (ESD) overvoltages. This problem is becoming a serious concern to broadcast engineers as the complexity of the equipment used in radio and TV stations steadily increases. ESD is a problem that will not go away.

## Scope of the problem

Engineers have known for a long time that static electricity poses a threat to microprocessors. Those who service products using microprocessors have learned basic procedures for protecting against damage caused by electrostatic discharge (ESD).

However, through the years more functions have been compressed into small microprocessor chips. This increase in efficiency has come at the cost of two trade-offs:

- The built-in switches that equalize static electricity potentials have been reduced in relation to the total size of the circuit, while the speeds of the circuits have increased. As a result, the *protective* switches are no longer able to provide adequate protection.
- In order to access all the added functions, lead diameters and spacing between leads have been reduced. These circuits cannot handle static transients as high as before.

Leads have been reduced from  $5\mu$  of a few years ago to today's  $1.5\mu$  and less. Spacing between leads has been reduced by a factor of three or four. In the past the ESD peril was to semiconductor

*Repair of the sophisticated microprocessor-based equipment in use at broadcast stations today requires careful control of ESD potentials.*

Kanarek is president of Wescorp, Mountain View, 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 craftsmanship. 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

Circle (70) on Reply Card

® Registered Trademark of Neutrik AG



# MCL

## THE SOURCE

### 21st CENTURY TWTA SATCOM TECHNOLOGY TWTA C-BAND 3KW

TWTA C-Band Satellite Transmitter System-Model 10717, delivers 2.8KW of usable power throughout the C-Band frequency range (5.85-6.45GHz). Innovative design and engineering techniques provide extended reliable commercial service in the satellite communications earth terminals.

Quality features include Thomson #3640 traveling wave tube, protective

circuitry, solid state IPA, RF input and output impedance matching, necessary power supplies, controls and monitor circuits as required.

This advanced system includes many advantageous features (including a Linearizer to give system performance equal to a 6KW system) to users throughout the world.

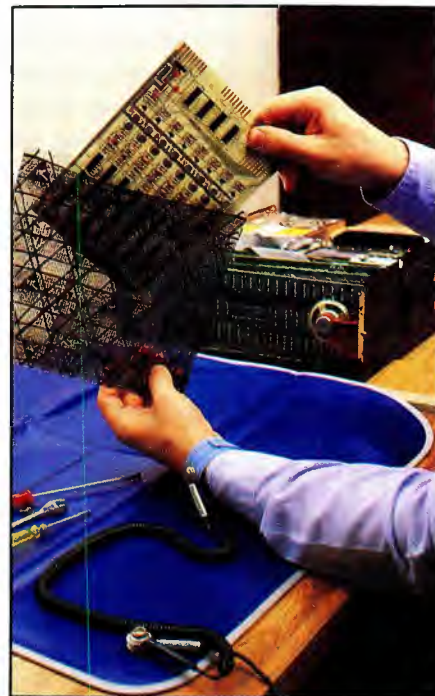
MCL assures you of 24 hour maximum parts replacement; provides 24 hour — 7 day access to MCL personnel for assistance in installation or servicing.

WRITE for your complimentary copy of Reference booklet #2002 TODAY.



**MCL**  
INC

MCL, INC. Ten North Beach  
La Grange, Illinois 60525  
(312) 354-4350 TWX 910-683-1899



*This technician's work station is equipped with a field service kit, grounding mat and grid bag. The technician wears a grounded wrist strap when working with static-sensitive devices.*

substrates, but in today's devices the metallization itself is subject to damage.

The coming 1-megabit chips are called *submicron devices* because the conductor widths will be only 0.9μ in diameter, in order to provide access to all functions, with a similar reduction in spacing between leads.

These circuits will be more than five times as sensitive to static-electricity damage as the devices in use today.

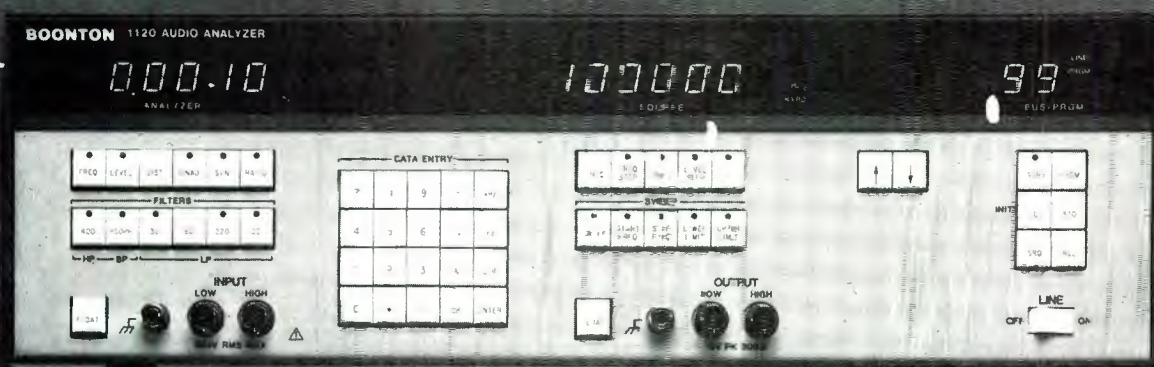
#### Minimizing ESD damage

Easy-to-use, relatively low-cost anti-static materials and products are being developed to meet the needs of this new generation of devices. If ESD damage is to be avoided, however, engineers must upgrade their anti-static procedures. To establish a starting point, refer to the following list of basic anti-static precautions commonly used:

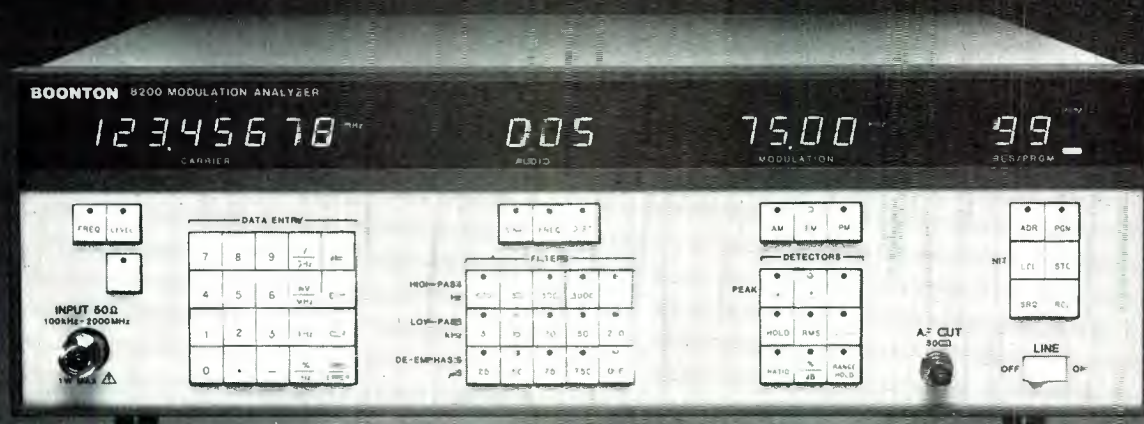
- Don't touch an individual lead, pin or trace while handling a static-sensitive semiconductor device. Hold the chips only by the plastic body.
- Keep static-sensitive parts in their original containers until ready for use. Bags, tubes or boxes provide anti-static protection.
- Drain static electricity from your body by touching a conductive, grounded surface such as a metal rack before handling or working on a chip.
- Do not slide static-sensitive devices over any surface.
- Practice good housekeeping in the work area. Remove all non-conductors such as cardboard boxes, paper work orders, blueprints and cigarette and candy packages.

Circle (71) on Reply Card





Two analyzers  
with one standard...  
**EXCELLENCE!**



### 1120 AUDIO ANALYZER

Characterize audio signals with ease from 5 Hz to 200 kHz, or audio devices using the built-in, low distortion source.

#### Measure:

- ☐ Frequency to 0.0001%
- ☐ SINAD and signal-to-noise
- ☐ Distortion in dB or %
- ☐ AC/DC voltage

### 8200 MODULATION ANALYZER

Both baseband and modulated carrier signals can be accurately analyzed with the versatile 8200.

#### Measure:

- ☐ Carriers from 100 kHz to 2 GHz, both frequency and level
- ☐ Baseband frequencies to 200 kHz
- ☐ FM/AM/ΦM
- ☐ Audio distortion in % THD or SINAD

Both the 1120 Audio Analyzer and the 8200 Modulation Analyzer are equally at home on the bench or over the bus. Both can store up to 99 complete panel setups for easy repetitive bench testing. Both feature a IEEE-488 interface as standard equipment for sophisticated system application. And, best of all, both offer superior performance at a price below the competition. Call your local representative or Boonton directly for a convincing demonstration.

### Boonton Electronics Corp.

791 Route 10, Randolph, NJ 07869

Telephone (201) 584-1077

Signal Generators ■ Modulation Analyzers ■ RF Power Meters ■ RF Millivoltmeters  
Capacitance Meters and Bridges ■ Audio Test Instruments

**SEE US AT WESCON, BOOTH 3239-3241**

**BOONTON**

Circle (72) on Reply Card



| ELECTROSTATIC VOLTAGES                   |                                 |                                 |
|------------------------------------------|---------------------------------|---------------------------------|
| MEANS OF STATIC GENERATION               | 10% TO 20%<br>RELATIVE HUMIDITY | 65% TO 90%<br>RELATIVE HUMIDITY |
| WALKING ACROSS CARPET                    | 35,000                          | 1,500                           |
| WALKING OVER VINYL FLOOR                 | 12,000                          | 250                             |
| WORKER AT BENCH                          | 6,000                           | 100                             |
| VINYL ENVELOPES FOR WORK INSTRUCTIONS    | 7,000                           | 600                             |
| COMMON POLY BAG PICKED UP FROM BENCH     | 20,000                          | 1,200                           |
| WORK CHAIR PADDED WITH POLYURETHANE FOAM | 18,000                          | 1,500                           |

**Table 1.** The magnitude of electrostatic voltages that can be generated by everyday activities. The higher the relative humidity, the lower the voltage generated.

- Wear a smock made of cotton, which generates considerably less static electricity than manmade fabrics. Gloves, if used, should also be cotton. Anti-static smocks are now available.
- Keep visitors away from static-sensitive devices.
- Have a portable conductive surface on

the work area, which is grounded. Never use carpeting.

Basic improvements are necessary on four levels to meet the static-electricity challenges of the *submicron* era.

#### ESD and the engineer

Normal movements can generate up to 50,000V, and less than 100V can ruin some devices. A conductive wrist strap is a standard anti-static device. It drains electricity from the wrist—the last feasible point between the body and the work where harmful potentials can build up.

One new wrist strap, designed to meet the needs of the submicron era, is made of conductive elastic polyester fabric with an adjustable buckle to assure a snug fit even after extended use. Stainless steel threads woven into the elastic fabric assure positive, low-resistance conductivity, provide resistance to corrosion and foster cleanliness.

A 10-foot conductive cord links the wearer's wrist to a grounded surface. Any static electricity is conducted to ground before it can accumulate to harmful levels.

To meet OSHA and other requirements for safety, the outside of the wrist attachment is insulated and a 1MΩ resistor is molded into the cord at the wrist end (in case the cord crosses an open electrical line).

Other personal items are static-safe

## Winsted® System/85 Double Bay Console



MODEL NO. G8513

Designed to hold large special-effects generators and edit controllers. Modular console system provides custom flexibility to fit your requirements. Double bay shelf provides adjustable rack space up to 40 $\frac{1}{8}$ " x 15 $\frac{3}{4}$ ". Designed for hours of comfortable editing and production work.

**For catalog of the most complete line of customized video support systems, write or call:**

PHONE  
TOLL FREE **800-447-2257**

**THE WINSTED CORPORATION**

\*\*\* GSA APPROVED \*\*\*

9801 James Circle • Minneapolis, MN 55431

**TELEX: 510-601-0887**

Circle (73) on Reply Card

## A SIGHT FOR SORE EARS.



If ears could talk, they'd scream for SONEX.

The only patented acoustic foam with a specially sculptured anechoic design can replace traditional studio materials for a fraction of the cost. SONEX absorbs sound, controls reverb, eliminates stray reflections, and kills standing waves. What's left is true sound. Your ears know. Listen to them. Simple to apply and economical to buy, SONEX blends with almost any decor and looks clean, sharp, professional. Call or write us for all the facts and prices.

SONEX is manufactured by Illbruck and distributed exclusively to the pro sound industry by Alpha Audio.

**Alpha Audio®**

2049 West Broad Street  
Richmond, Virginia 23220 (804) 358-3852

**Acoustic Products for the Audio Industry**

Circle (74) on Reply Card



When you'd give  
an arm and a leg  
for an extra foot...

A-T  
gives you  
a hand!

## The new AT835.

Now there's a new way to reach out and hear. The Audio-Technica AT835 Condenser Line + Gradient Microphone. It's barely longer than a legal pad, but it zeroes in on the sound you want to hear, while blocking out noise from the sides and rear.

### Baby Brother

The new AT835 is 4 inches shorter than our famed AT815a and its remote-powered brother, the AT815R. Yet its performance in the field is remarkably close. The major difference is a slightly wider (60°) acceptance angle at higher frequencies. Credit a sophisticated "Fixed-Charge" element for the truly impressive sound and excellent directional control. The AT835 short "shotgun" fits in whether you are recording "actualities" for the evening news, picking up dialogue for film, or A/V, or eavesdropping from the sidelines.

### With Guts

Our FET impedance converter is super quiet, and runs for months on a single "AA" flashlight cell. The balanced, phased output matches any remote or studio input from 150 to 1000 Ohms without problems. And the AT835, like all A-T condensers, is built to take real punishment. Even so, it weighs just 7½ ounces for easy fishpoking or extended hand-held use.

If your goal is better control of your sound at moderate cost, your Audio-Technica sound specialist has a brand new answer. The AT835.

audio-technica®



AUDIO-TECHNICA U.S., INC., 1221 Commerce Dr., Stow, OH 44224 • 216/686-2600

Circle 75 on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



| OBJECT OR PROCESS                         |                                                                                                                                                                                                                                                                                                                                                                                       | MATERIAL OR ACTIVITY                                          |
|-------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------|
| WORK SURFACES                             | <ul style="list-style-type: none"> <li>• WAXED, PAINTED OR VARNISHED SURFACES</li> <li>• COMMON VINYL OR PLASTICS</li> </ul>                                                                                                                                                                                                                                                          |                                                               |
| FLOORS                                    | <ul style="list-style-type: none"> <li>• SEALED CONCRETE</li> <li>• WAXED, FINISHED WOOD</li> </ul>                                                                                                                                                                                                                                                                                   | • COMMON VINYL TILE OR SHEETING                               |
| CLOTHES                                   | <ul style="list-style-type: none"> <li>• COMMON CLEAN ROOM SMOCKS</li> <li>• COMMON SYNTHETIC PERSONNEL GARMENTS</li> <li>• VIRGIN COTTON<sup>1</sup></li> </ul>                                                                                                                                                                                                                      | • NON-CONDUCTIVE SHOES                                        |
| CHAIRS                                    | <ul style="list-style-type: none"> <li>• FINISHED WOOD</li> <li>• VINYL</li> </ul>                                                                                                                                                                                                                                                                                                    | • FIBERGLASS                                                  |
| PACKAGING AND HANDLING                    | <ul style="list-style-type: none"> <li>• COMMON PLASTIC BAGS, WRAPS, ENVELOPES</li> <li>• COMMON BUBBLE PACK, FOAM</li> </ul>                                                                                                                                                                                                                                                         | • COMMON PLASTIC TRAYS, PLASTIC TOTE BOXES, VIALS, PARTS BINS |
| ASSEMBLY, CLEANING, TEST AND REPAIR AREAS | <ul style="list-style-type: none"> <li>• SPRAY CLEANERS</li> <li>• COMMON PLASTIC SOLDER SUCKERS</li> <li>• SOLDER IRONS WITH UNDERGROUNDED TIPS</li> <li>• SOLVENT BRUSHES (SYNTHETIC BRISTLES)</li> <li>• CLEANING OR DRYING FLUID OR EVAPORATION</li> <li>• CRYOGENIC SPRAYS</li> <li>• HEAT GUNS AND BLOWERS</li> <li>• SAND BLASTING</li> <li>• ELECTROSTATIC COPIERS</li> </ul> | • TEMPERATURE CHAMBERS                                        |

<sup>1</sup>Virgin cotton can be a static source at low relative humidities such as below 30%.

**Table 2.** These materials, commonly found in a maintenance area, are considered to be prime sources of static electricity.

smocks and conductive shoe grounders to drain static electricity generated from walking on floors.

#### ESD in the work area

The most common anti-static safeguard in the work area is the covering for the workbench and floor. Other items include non-nuclear ionizing air guns and fans.

Since the 1970s, suppliers have been able to extrude polyethylene compounded with approximately 30% carbon granules to obtain a rigid conductive material that could be used on tables and floors. The material had great strength and abrasion resistance and eliminated the need for conductive surfaces.

Some manufacturers claimed that this conducted too fast, so they introduced *anti-static* materials that were conductive on the surface. They followed by introducing *static-dissipative* materials, which dispersed the same conductive surface throughout, making them faster than anti-static but slower than *conductive* materials.

Subsequently, suppliers introduced rigid anti-static materials that could be permanently laminated onto bench and table tops. They came in decorator colors, which greatly improved the decor compared with the proliferation of black conductive, blue dissipative and pink anti-static materials.

Problems began to arise, however, when faster microcircuits were developed. First, the effectiveness of these bench tops was difficult to confirm. A test probe five pounds in weight and three inches in diameter is used for the standard test of surface conductivity. The devices that actually will come in contact with the surface, however, weigh only a

few milligrams. The material could pass the test and might blow out the next microcircuit it contacted.

In addition, faster switching speeds of newer microcircuits left doubt that these materials dissipated ESD fast enough.

Surface covering materials of the future should be:

- Conductive throughout, rather than on the surface. This would eliminate degradation of anti-static performance from abrasions, and shorten the path to the grounded table top for faster EDS decay.
- Non-sloughing, for use in clean rooms.
- Testable with standard ohmmeters.
- Impossible to puncture with hot soldering irons. (This rules out the 3-layer and homogeneous soft mats introduced in the early 1980s.)
- Fireproof.
- Capable of lying flat on the surface without curling.
- Resistant in the range from 500,000 $\Omega$  to 10M $\Omega$  per square, which is the optimum range needed by users.
- Capable of retaining their anti-static qualities for long periods without deteriorating.

Non-nuclear *de-ionizers*, which generate alternate flows of positively and negatively charged ions to keep them in balance, can reduce the static-electricity build-up in all work areas.

#### Protection during transportation

Clearly, a tote tray sliding across the bed of a pickup truck when it goes around corners will generate enough static electricity to undo careful shop work. In fact, friction of conveyor rollers or dollies in the shop is enough to ruin microprocessors in electronic subassemblies.

Static-safe shipping boxes and trays are now available. Some manufacturers encourage the return of these containers, which cost much more than ordinary corrugated boxes, and others write them off as the cost of assuring that the product is delivered safely without static-electricity damage.

Anti-static cushioning also is available to protect products from shock when they are traveling in static-safe containers, and to protect against static electricity damage when they are not. The most common packaging material is coated polyurethane foam made conductive by formulating carbon granules or other conductive additives to the plastic. The material is soft enough to be cut with scissors.

#### Board removal procedure

Probably the most commonly encountered type of work at a radio or TV station that poses a significant ESD hazard involves removal of a printed circuit board from a defective system. Precautions must be taken to assure that the area in and on which the service technician works is grounded, so that any static electricity that exists or is generated during board removal is drained away.

Use the following procedures when removing a circuit board:

- Unplug the system to be serviced.
- Place an ESD protective mat near the system and connect it using a ground cord terminated in an alligator clip to the system chassis.
- Wear a wrist strap that is connected to the mat. Placing the mat in series avoids the possibility of a floating ground. (Keep in mind the necessity for retaining an equal potential between the engineer



# Would you like . . . the assurance of your top maintenance engineer wherever your camera goes?

With COACH you can have it. COACH – the new Philips remote control and monitoring system for the LDK 6 family of automatic cameras. A system devised to give double assurance of the perfect performance provided by total computer control . . . in the studio or field . . . with your top engineer on-line supporting your production staff.

LDK 6A and LDK 26A television cameras already have the industry's most extensive diagnostics.

The new Philips COACH is a tool for centralised maintenance and monitoring of the LDK 6 family of cameras. It consists of 2 components – an interface and an IBM compatible personal computer. Simple to use, COACH provides –

- remote control and monitoring of LDK 6 family camera systems



COACH display

- flexible retrieval, storage and control of camera data with greatly expanded and highly protected memories to warn of approaching end of range and unusual changes in camera set-up
- in depth diagnostics monitoring including surveillance
- remote access via standard modems over telephone lines.

COACH, therefore, helps make more efficient and cost effective use of high grade engineering staff. It also allows them to give on-line technical support and advice whenever and wherever it is needed.

COACH is just another example of the developments that ensure Philips LDK 6A and LDK 26A cameras remain the fastest selling cameras in their class with over 400 sold worldwide.

Users from networks, stations, production facilities and institutions are discovering for themselves the benefits that come from *total* computer control. It is available from Philips in all tube formats . . . the 2/3" (18mm) LDK 26A and the choice of 1" (25mm) or 1 1/4" (30mm) LDK 6A.

Prove the total computer difference for yourself.

A demonstration will prove why these cameras are years ahead in design, performance and cost effectiveness. Call or write for demonstration or request the descriptive LDK 6A, LDK 26A and COACH technical brochures.

**BTS** Broadcast  
Television  
Systems GmbH  
A joint company of Bosch and Philips

LD15

## LDK 6 – the total computer control camera.

Sales and Service Headquarters  
900 Corporate Drive, PO Box 618  
Mahwah, New Jersey 07430, USA  
Tel: 201-529-1550. Telex: 37-62558

Circle (76) on Reply Card

www.americanradiohistory.com



## Handling tips

Years of experience in designing and implementing ESD control programs have resulted in the following list of dos and don'ts for use by any maintenance engineer:

- Minimize handling.
- Keep parts in original containers until ready for use.
- Use ESD protective containers to handle and transport small components.
- Discharge static electricity before handling devices by touching a

grounded metallic surface such as a rack or cabinet.

- Handle ICs by the body, not leads.
- Do not slide static-sensitive devices over any surface.
- Eliminate static generators (plastics, vinyl, styrofoam, etc.) in the area where you are working.
- When handling parts in an office, stockroom, training class or repair shop, use a static-free work station.
- Always touch the anti-static or ESD protective package before touching the device inside.

and the system.) Both the mat and the wrist strap should be equipped with 1MΩ resistors to protect the technician.

• Assemble a similar static-free work station (as described previously) for inspecting and testing the circuit boards. Again, it is vitally important that the proper ESD protective packaging materials be used whenever components are in transit, so that the chain of ESD control is never broken.

### Static-electric potential

High static-electric voltages can be caused by many common activities, as illustrated in Table 1. Note the effects that

relative humidity has on the generation of electrostatic voltages.

The static-electric potential that exists in a shop area or machine room can be determined with a static-electricity meter. Such devices are more economical and easier to use than they were a few years ago. You can quantify the static-electricity potential of every operation and location—work station, storage shelves, service counter and shipping area—by isolating them from ground one at a time. See Table 2.

Balance this information with the static sensitivity of the chips being used. The Department of Defense has classified

devices into three ranges of sensitivity and an appropriate grade of conductivity for each class. The most sensitive devices, such as metal oxide silicone (MOS) without protective circuitry, have a sensitivity range of 0V to 1,000V. These require conductive materials.

Class 2 devices have a sensitivity range of 1,000V to 4,000V, such as MOS devices with protective circuitry. Static-dissipative materials can be used for protection.

Class 3 products, such as resistor chips, have a sensitivity of 4,000V to 15,000V. Anti-static products are suitable for these devices.

The sensitivity level of a given device is available from the manufacturer. In addition, the level of conductivity selected by the chip manufacturer for shipping is generally a guide to the sensitivity of the contents: black indicates the addition of carbon, meaning it is most conductive; blue generally indicates it is static-dissipative; and pink, or anti-static, is least protective, because it offers less Faraday shielding.

The key to preventing ESD damage involves protecting sensitive devices at every step in the maintenance chain. Failure to adhere to proper rules for device handling will expose you and the station to serious failures that are difficult to troubleshoot, and even more difficult to explain.



**Digital Dynamics**

## DPS-175 TBC/Framestore

Crystal vision framestore and full-featured TBC... all in a single rack unit. The DPS-175's 525-line buffered memory freezes frames or fields of incoming monochrome, heterodyne or direct color with a 3.58 MHz feedback to tape source. And you get TBC with wide dynamic tracking range of -1 to +3 and clear viewing up to ±30X play speed.

Synchronous and non-synchronous tape source switching means flexibility and compatibility of tape source, with a 525-line

buffered correction window and RF/TTL selectable drop out compensator.

- Heterodyne or Direct Colour
- Auto memory diagnostic
- Frame hysteresis
- Digital Dropout Compensator
- Synchronous switching of tape source
- Dynamic Tracking® capability

**Scientific  
Atlanta**

Digital Video Systems Division

120 Middlefield Road, Scarborough, Ontario  
Canada M1S 4M6 (416) 299-6888 Telex 065-25344

Circle (78) on Reply Card

© Trade mark of Sony Corp.

## Are You Ready For An



## AIRCHECK?

AIRCHECK is an informative Radio broadcaster's technology and facilities Newsletter published regularly by Pacific Recorders & Engineering.

To receive your FREE copy, just circle the Reader's Service number or contact us direct.



**Pacific Recorders & Engineering Corporation**  
2070 Las Palmas Drive  
Carlsbad, California 92008  
Tel: (619) 438-3911 Telex: 181777  
MCI Telex: 650 285 0999 MCI UW

Circle (79) on Reply Card





# PESA

## Monitors As good as being there live.

9 and 14 inch high resolution CRT with 0.31 pitch \* picture tubes computer selected \* three phosphor tube selections (C, EBU and Standard) \* A/B encoded inputs \* internal/external sync \* modular design \* preset controls for all functions \* tally light \* selectable AFC TBC \* manual/automatic degaussing \* normal/underscan functions \* cab net/rackmount versions \* optional remote control of all functions \* pulse cross H, V and H+V \* high quality optional comb filter (NTSC) \* switching power supply \* PAL/NTSC standards \* color/mono auto/manual \*



Circle (118) on Reply Card



Pesa Electrónica, S.A.

Albalá, 12 - 28037 Madrid (Spain) - Telex: 48449 PESAE E - Tel: 754 00 78  
Pesa America Inc. 6073 NW 167th St. - Miami, FL 33015 (USA) - Telex: 6712435 PESAM - Tel: 305-556-9638 - Toll Free: 1-800-USA-PESA

 INISEL Group

The affordable hi-tech.



## Omni 4 logic analyzer

By Gerry Kaufhold II

Look inside a typical modern videotape recorder and you'll find five functional circuit groups: power supply, mechanical subassemblies, audio circuits, video circuits and the digital control circuits. Although each section can be repaired with common test equipment, there are occasions when specialized test equipment is required.

### Common circuits

The power supply can usually be analyzed adequately with a general-purpose oscilloscope, volt-ohm-meter and a capacitance checker. The mechanical subassemblies, such as motors, pulleys, gear linkages and rotating heads, can generally be checked for proper operation by visual inspection. The servo motors may require an oscilloscope, a

Kaufhold is an engineer at KAET-TV, Tempe, AZ.



torque meter or a wow-and-flutter meter. Quad tape machines also may require

### Performance at a glance

- Self-contained, portable logic analyzer
- Full-function personal computer
- 50ns data collection capability
- Stores 1,024 bus cycles, 16 bits per cycle, per test
- Upgradable to monitor 36 simultaneous signals
- Signature analysis and instruction disassembly
- Disk storage of setups and test data
- Optional pattern generator and EPROM programmer

pressure gauges.

The audio circuits can be checked with an oscilloscope. However, there is often the need for more specialized test equipment such as frequency counters, signal generators and distortion meters.

Although a technician may be able to repair video circuits using a general-purpose scope, four pieces of specialized video test gear usually come into play: a color monitor, color-bar test pattern generator, vectorscope and a waveform monitor. Sometimes a sync generator or proc-amp also may be necessary.

Although most of the circuits mentioned can be repaired with the listed equipment, there is one class of circuits that may require specialized test equipment—digital circuits. Unlike audio and video signals, digital signals are both fast and slow. It's also necessary to view more than one signal at a time, and this

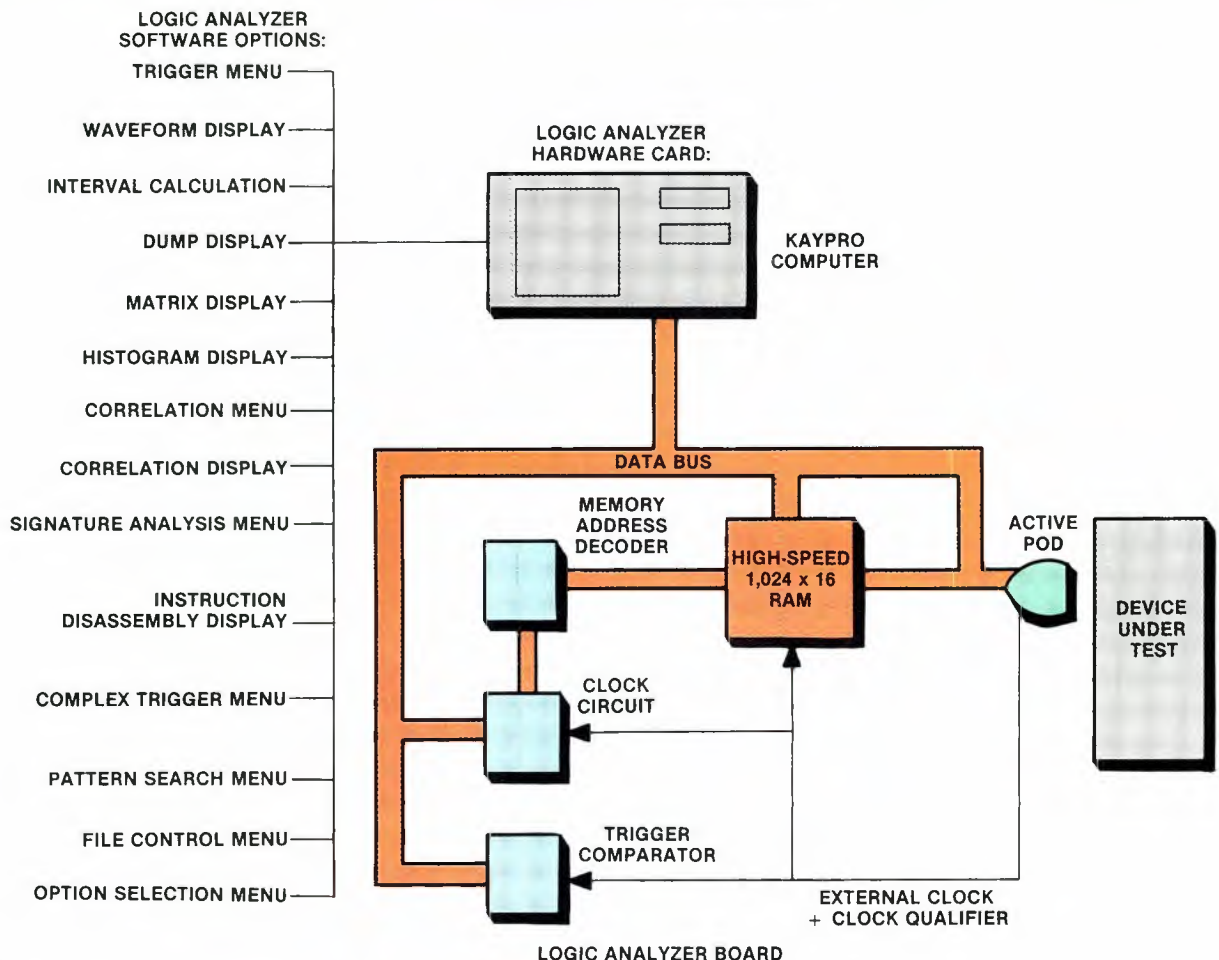


Figure 1. Block diagram showing available menus and display options.



# antonbauer Lifesaver®



**Ready  
when you are.  
*Always.***

Lifesaver 8 Hour Quad (above)  
charging a Pro Pac® 13 and 14,  
and two Pro Pac 90s. Also accepts  
Pro Pac 60 and Super D batteries.

Lifesaver  
8 Hour Single.

Lifesaver Fast Charger.  
One hour charge for  
Pro Pac 13, 14, Pro Pac 90  
or 30/13 Battery Belt.

- Lifesaver logic circuit\* safely maintains fully charged NiCad batteries until you are ready to use them...batteries are kept on Lifesaver chargers for weeks or even months with no self-discharge or damaging heat build-up.
- Lifesaver increases battery life...only Lifesaver with its unique third stage pulse process maintains a fully charged battery without the destructive effects of a conventional maintenance trickle charge.
- Lifesaver chargers automatically cycle through **three charge routines**...quick or fast, equalizing and Lifesaver Maintenance modes.
- Lifesaver 8 Hour Quad is **four chargers in one**... up to four batteries can be charged simultaneously and independently in any combination... LED charge display at each position. \* Patent Pending

Call or write for our illustrated Lifesaver brochure and the name of your local dealer.

*The quality standard  
of the video industry.*

**antonbauer**



sometimes makes digital control circuits difficult to troubleshoot.

For years, the computer industry has realized the need to view multiple signals at once. It is only recently that broadcast engineers, faced with the need to repair complex equipment, have looked beyond the standard list of test equipment. One of the devices making its way into broadcast stations is the Omni 4 logic analyzer, made by OmniLogic.

The analyzer allows monitoring of numerous signal or data lines at one time. In one regard, it is much like a multi-channel oscilloscope. However, the device goes far beyond what a scope could do for effective troubleshooting.

The analyzer is composed of a computer and sophisticated software that allows you to examine the internal workings of microprocessor-based equipment. Through the use of test probes, called *pods*, the device can monitor data lines to help isolate defective components.

### Construction

The logic analyzer comes completely contained within a Kaypro brand 2-X portable computer. The computer contains the standard package of hardware: processor, detachable keyboard, high-resolution video display, two floppy disk drives, parallel printer interface and an internal 300-baud modem. A special logic analyzer also is added. Additional stor-

age is provided under the disk drives for the diskettes, logic analyzer connectors and interconnecting cables. The complete assembly makes the logic analyzer portable, and it's only slightly more bulky than most portable scopes.

### Software

The analyzer comes with all of the standard Kaypro software: operating system, word processor, spreadsheet, database manager and modem controller. Software manuals also are provided. Special proprietary programs are supplied to execute the analysis functions. This software is the heart of effective troubleshooting. (See Figure 1.)

The various tests are selected from a menu displayed on the CRT screen. Selection is made by pressing a single key. If you get confused or lost, the various functions are explained through a help command. By pushing "?" combined with the feature's letter, you bring up an explanation of the desired command.

### Hardware

The logic analyzer board, mounted inside the computer, provides the interface circuitry and test circuits. Active circuitry is contained within the test pods, which connect to the device under test (DUT). Spring-loaded microclips provide the connections between the interface pods and the DUT. Where possible, dip

clips can be attached to the DUT. The dip clips make the interconnection with the logic analyzer much easier.

The microclips use color-coded wire, which helps identify the individual leads. Even so, writing down the clip color-coding and IC pin numbers helps avoid confusion. It's not unusual to have 16 or 32 leads running around, which can lead to interconnection errors.

The interface pods use active circuitry to present a high-impedance load to the DUT. The impedance is greater than 1 MΩ combined with less than 5pF capacitance. Two pod types can be purchased. The standard pod uses TTL logic-level circuitry. A CMOS pod also is available. Most troubleshooting applications require the TTL pods.

The logic analyzer board relies on high-speed random access (RAM) chips and a programmable comparator. The comparator acts as the high-speed trigger circuit. The analyzer is capable of detecting pulse durations as short as 10ns.

The internal processor clock permits the analyzer to store the waveform timing information in 50ns increments, which is a 20MHz clock rate. The internal clock is capable of being set in a 1-2-5 sequence, much like an oscilloscope horizontal sweep rate control. The clock can be varied over a range from 50ns to 32ms. An external clock input allows the logic analyzer to store information in

# High Performance Video Image Processing and Machine Control System from Amherst

## The Amicon Intelligent Controller

Using advanced microprocessor control, the AMICON packs high performance image processing and machine control functions into a rugged, single rack high chassis. Its unique "Open Bus" design lets you add new functions as you need them, through software, conserving space and dollars.

Standard features include:

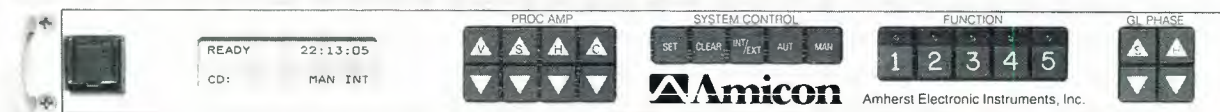
- **32-Line Time Base Corrector** with subcarrier feedback for full bandwidth performance.
- **RS170A Color Field Sequencer** for cleaning up mismatched color frame edits.
- **Full Proc Amp Controls** with presets and front panel LCD display of parameter readings.
- **SMPTE/EBU Time Code** and Control Track Reader.

- **PC Control** from IBM PC or compatible.
  - **Modem Control** for remote operation via telephone line, with keyboard override.
  - **Machine Control** for VTRs, switchers, etc.
- Operated from its own front panel or from a PC, the Amicon is designed to be easy to use and to service.
- Help menus guide the user as needed.
  - New functions and updates can be installed in the field.
  - Multiple units tie together via RS232, and stack easily with daisy-chain power runs.
  - Built-in diagnostics can be accessed by phone.
  - Rear panel circuit breaker resets quickly.

Dealer inquiries invited.

**Amherst Electronic Instruments, Inc.**

P.O. Box 201, Haydenville, Massachusetts 01039 / 413-268-7204



Circle (81) on Reply Card



Character generation  
should be as easy as

CLEAN  
ANGLES

SMOOTH  
CURVES

COLORIZING

CLARITY  
WITH  
SIMPLIFIED  
CONTROL

MULTIPLE  
FONTS

and cost this much

**\$1,995.**

## The ICM CG-7000 character generator.

In character generators, quality doesn't have to mean complicated — or expensive.

The CG-7000 from ICM is simple to operate, regardless of your background. Its capabilities are as wide ranging as many models that cost far more, from genlock to colorizing, from special effects to the availability of multiple fonts. And its utility is rock-solid: the CG-7000 will do what you want, simply, swiftly, surely. There's even an unlimited modular memory capacity to let you store material forever.

What it won't do is burden you with an enormous investment cost. For full information on the CG-7000 and its base price of \$1,995, *call Toll Free or write for a free catalog today.*



P.O. Box 26330 701 W. Sheridan Ave.  
Oklahoma City, OK 73126 Toll Free (800) 426-9825

Circle (82) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)

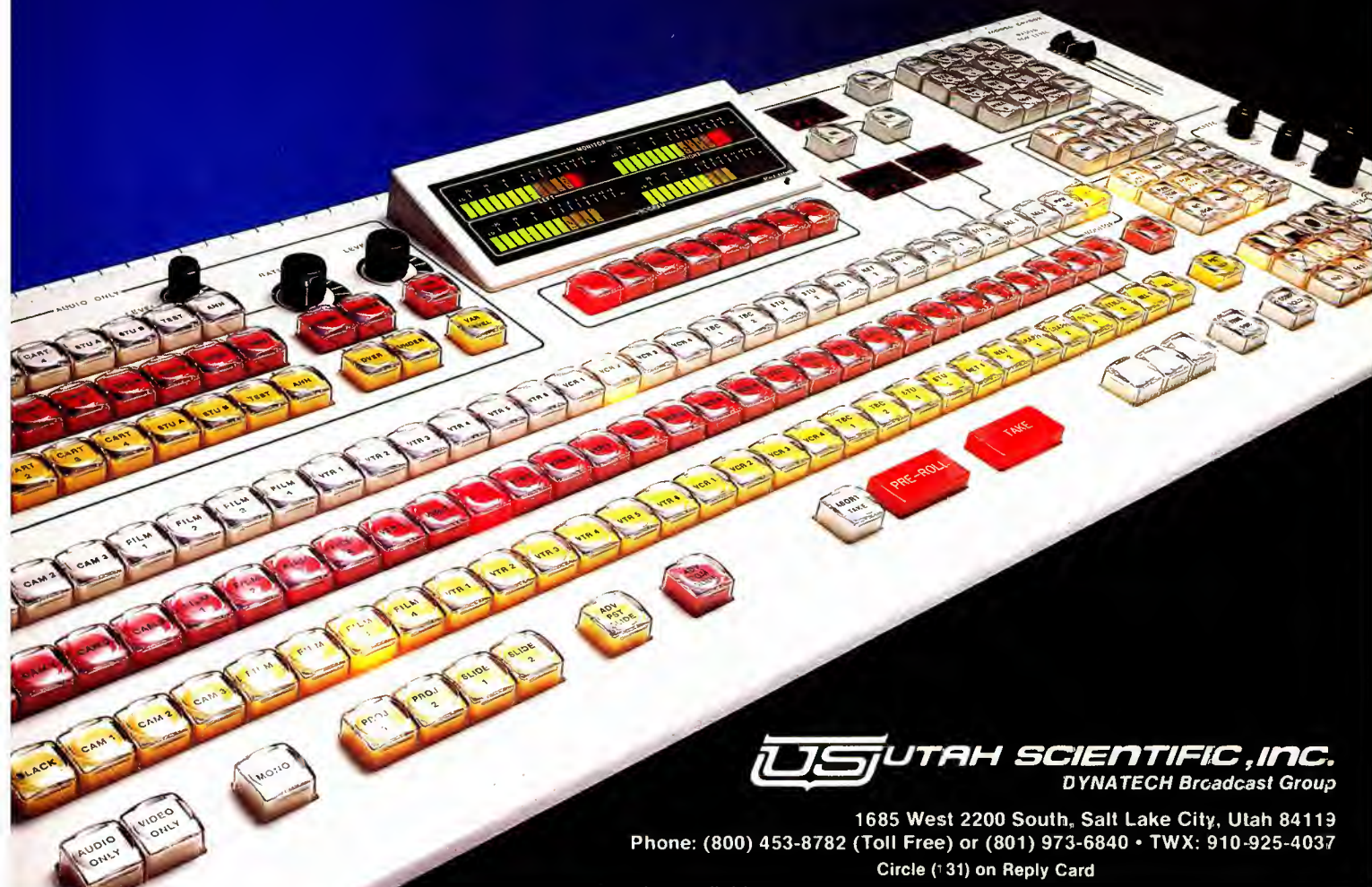






# MASTER CONTROL

Over sixty of our new MC-500 series **MASTER CONTROL** Switchers are in operation at television stations throughout the country, many with full *station automation* also supplied by Utah Scientific. These customers include some of the country's most prestigious broadcasters. Call or write for our 100% Users List to learn firsthand the many advantages offered by this state-of-the-art product.



**UTAH SCIENTIFIC, INC.**  
DYNATECH Broadcast Group

1685 West 2200 South, Salt Lake City, Utah 84119  
Phone: (800) 453-8782 (Toll Free) or (801) 973-6840 • TWX: 910-925-4037  
Circle (131) on Reply Card



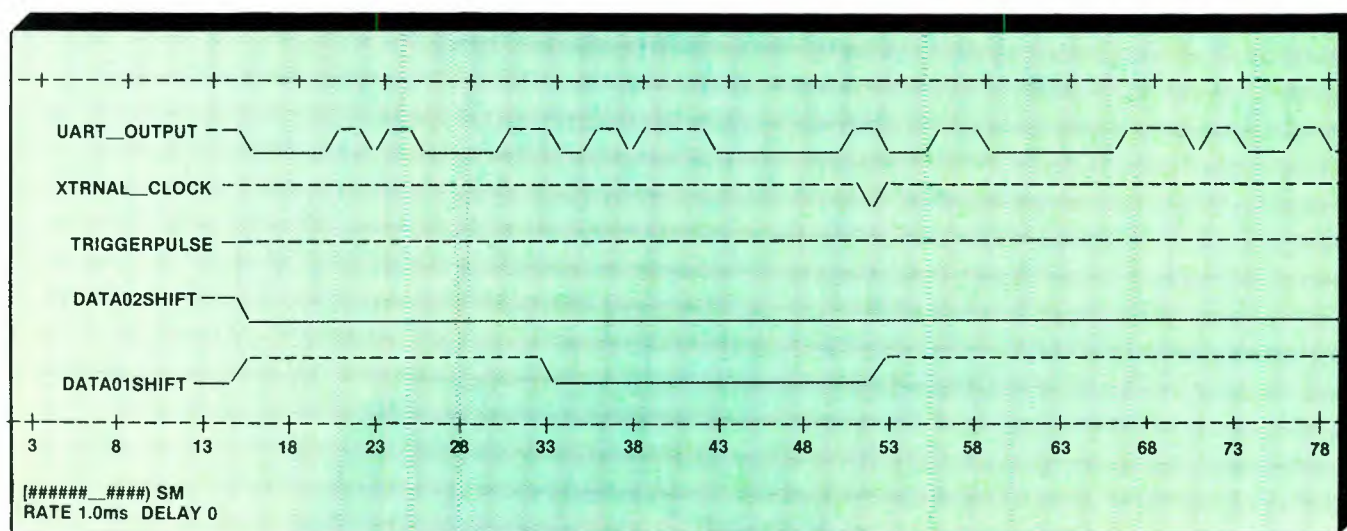
When the logic analyzer is properly connected and the trigger is programmed, the operator pushes "G" to begin capturing the data. As soon as the trigger occurs, and 1,000 samples have been collected, the logic analyzer displays the DUT waveforms. The *names* option permits the operator to create individual names to identify each line of data. The displayed waveforms can be printed for later examination, as shown in Figure 3. A movable cursor permits scrolling through the data. You can calculate the timing intervals between

The logic analyzer provides a powerful correlation feature, which can be used to locate differences between the data of a known-good unit and a faulty DUT. Tests can be performed on a working piece of equipment with the results stored on disk. Later on, if that equipment fails, the previously stored good data can be compared bit by bit with the current bad data. Any differences can then be easily spotted and analyzed to discover likely circuit failures.

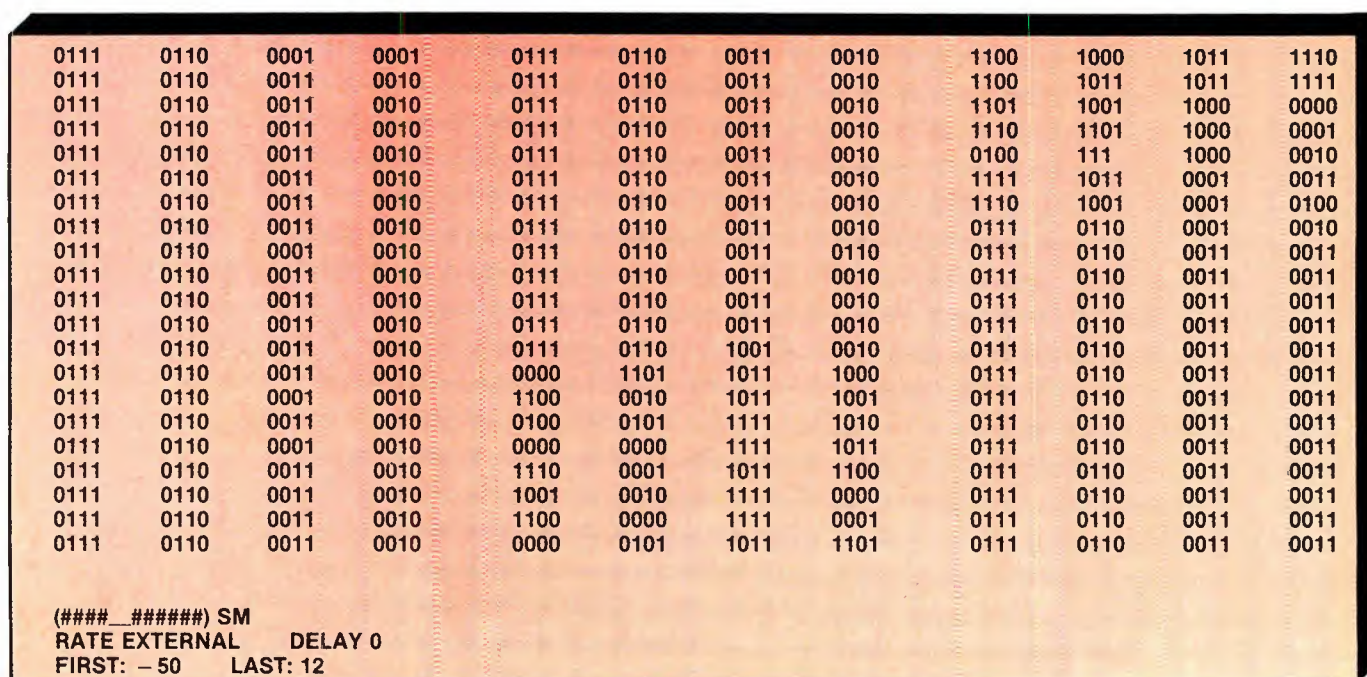
The analyzer will display data in numerous forms using the option menu and the dump display. For example, data can be displayed in hexadecimal, octal, decimal or binary. (See Figure 4.) Instruction disassembly can be performed on microprocessor programs. Histograms that show the addresses being used by

Several broadcast equipment manufacturers are producing equipment that permits the device's microprocessor to *free run* through its address space. This hardware feature permits the owner to apply the powerful techniques of *signature analysis* to troubleshooting. The device's signature analysis feature stores up to 14 circuit signatures at once. By capturing and storing signatures from known-good equipment and then comparing these signatures with signatures from a bad board, a technician can quickly narrow down a circuit fault to a small region on the printed circuit board. The test also could be used to easily generate and store fresh signatures each time a circuit board is updated.

*Continued on page 140*



**Figure 3.** Printout of waveform display with operator-programmed names for each channel.



**Figure 4.** Typical dump display of binary data.



# Above the Pack!

## IKEGAMI'S ITC-730A/AP PULLS AHEAD WITH GREATER FLEXIBILITY

While other broadcast quality camera manufacturers struggle to catch up to our ITC-730A and ITC-730AP (Plumbicon® version) cameras, Ikegami moves even further ahead by offering total compatibility with the Sony Beta recorder.

Great news for corporate, industrial, educational, cable and smaller station camera buyers; bad news for the competition.

Ikegami's 730s are low cost/high-performance 3-tube prism-optic color cameras that offer value second-to-none in their class. They feature high sensitivity, resolution and S/N ratio; combined with low power consumption, registration error and weight. In addition, the ITC-730AP provides superior highlight handling capabilities.

Special features include dynamic beam stretch, a 2-line vertical enhancer, and wide dynamic range. For EFP, a small CCU can be operated up to 1,000 feet away in the A/C power mode and up to 300 feet using DC power at the camera head or CCU.

For a complete demonstration of the ITC-730A and AP and other Ikegami cameras and monitors, contact us or visit your local Ikegami dealer.



Circle (84) on Reply Card

*Adapts to Sony Beta Recorder*

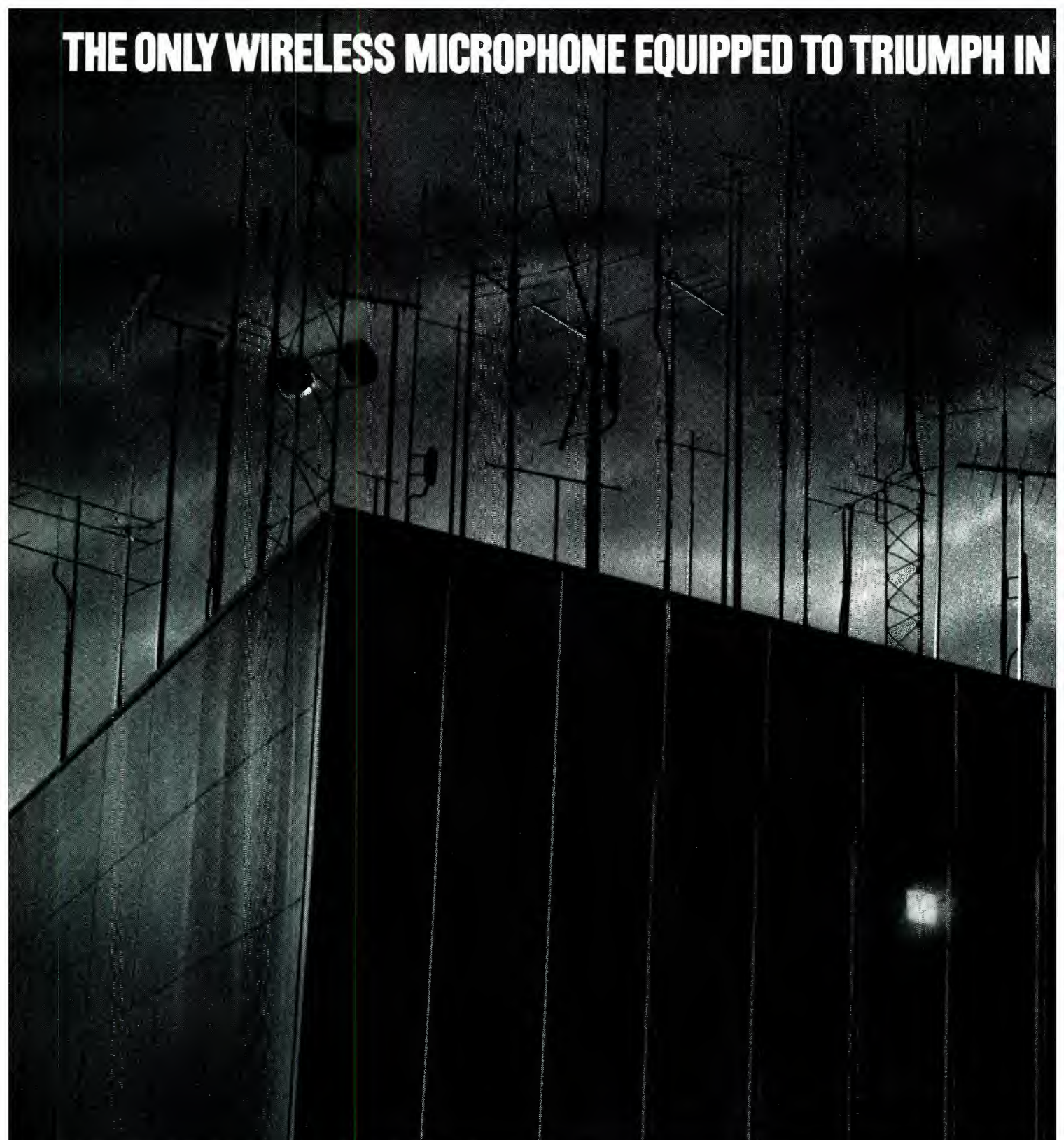
# Ikegami®

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) 233-2844 Midwest: (312) 834-9774

[www.americanradiohistory.com](http://www.americanradiohistory.com)



# THE ONLY WIRELESS MICROPHONE EQUIPPED TO TRIUMPH IN



The airwaves are bursting with interference. TV broadcasts, police emergency calls, taxi dispatches, even other wireless microphones.

All of which can make a performer look bad, and an engineer look worse. But fortunately, Sony has created an effective alternative to the anxiety of conventional wireless microphones. The VHF Synthesized Wireless System.

## TUNE YOUR WAY OUT OF A JAM.

Other wireless microphones are pre-tuned to just one channel. Each electronically synthesized Sony VHF wireless microphone, on the other hand, gives

you 48 channels — 48 opportunities to get on the air without interference. With a mere push of a button.

In fact, with as few as 4 Sony wireless microphones and a tuner, you can reach 168 microphone channels. And the Sony Wireless System makes it possible to use up to 13 microphones in the same place at the same time. Also, Sony's tuner gives you an easy-to-read LCD display. Which is an indispensable asset when you happen to be in a big hurry.

In addition, Sony's wireless microphones won't leave you wincing at poor dynamic range. Thanks to a companding technique which yields a dynamic range

©1985 Sony Corp. of America. Sony is a registered trademark of Sony Corp. Sony Communications Products Co., Sony Drive, Park Ridge, N.J. 07656. Use of Sony wireless devices is regulated by the FCC as described



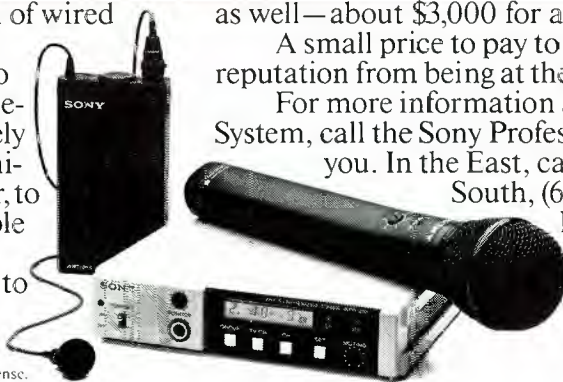
# THE BATTLE OF THE BANDS.

in excess of 94dB. Well within the realm of wired microphone performance.

The Sony system is also designed to withstand the rigors of live recording. Besides being lightweight, it's also extremely sturdy. Including everything from the microphones, to the body pack transmitter, to the tuners, to the shock-resistant portable cases and rack-mounting brackets.

An arsenal of equipment designed to be invaluable to you in the battle of the bands. And to be an exceptional value

in Part 74 subpart H of the FCC regulations and requires an appropriate license.



as well—about \$3,000 for a full-diversity system.

A small price to pay to keep a respected engineer's reputation from being at the mercy of a taxi dispatcher.

For more information about the Sony Wireless System, call the Sony Professional Audio office nearest you. In the East, call (201) 368-5185; in the

South, (615) 883-8140; in the Central Region, (312) 773-6002; and in the West, (213) 639-5370.

**SONY**  
Professional Audio

Circle (85) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)



The analyzer comes complete, and no options are required to immediately begin learning about digital circuitry. A pattern-generator option is available, which can be used to provide digital patterns to exercise a circuit. An EPROM programmer also is available for those wishing to make backup copies of the EPROM used in much of today's equipment.

The analyzer's computer portion can be serviced by local Kaypro repair depots. The logic analyzer portion can be repaired by the owner or returned to the company for servicing. The logic analyzer card is mounted on the top of the computer boards and is easy to install and remove. Replacement microchips and active circuit pods also are available from the company.

#### Instruction manual

The instruction manual is nearly 200 pages long. The instructions are clearly written and contain numerous illustrations. The manual is designed with edge-strips that can be used to open the book to the appropriate heading. In addition to the detailed instructions, a quick-start chapter gets a new operator up and running within minutes. For example, our staff was able to begin capturing data from a camera microprocessor card in less than 20 minutes after receiving the logic analyzer.



Logic analyzer is shown connected to a routing switcher for troubleshooting.

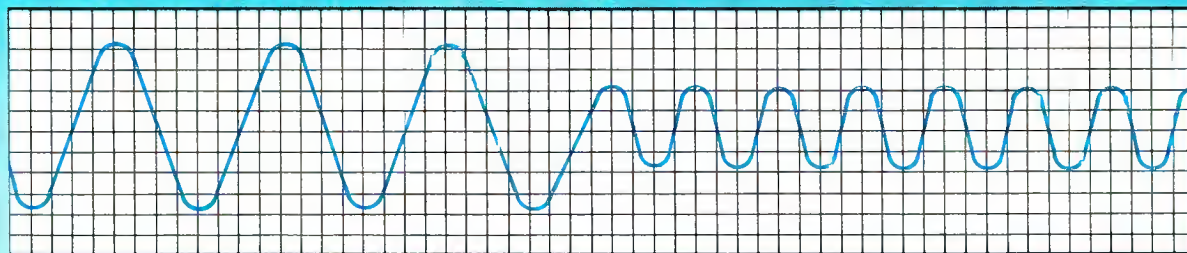


The technician is performing tests with the analyzer. Note the two impedance interface pods that connect the analyzer to the equipment under test.

## OVERVOLTAGE

OR

## UNDERVOLTAGE



THE SOLUTION —  
THE PESCHEL  
AUTOMATIC  
VOLTAGE  
REGULATOR  
(PAVR)



PROTECT YOUR EXPENSIVE LINE EQUIPMENT FROM THE DANGERS OF VOLTAGE FLUCTUATION. KEEP YOUR PLANT RUNNING SMOOTHLY.

- MONITORING VOLTAGE
- AUTOMATIC VOLTAGE CORRECTION
- PROTECTS SENSITIVE EQUIPMENT

The Peschel Automatic Voltage Regulator is designed for loads that do not require instantaneous voltage correction. The regulator that corrects for line voltage variations instantly sacrifices efficiency, size, weight, output accuracy, serviceability, produces wave form distortion and is expensive. Most applications, even most computer applications, do not require a line voltage correction to be made instantly to within  $\pm 1\%$  of the nominal voltage. Why pay extra for a regulator that corrects instantly like an electronic tap changer or a saturating core type, when your equipment does not need it?

A PAVR, often equipped with a transient suppressor, will provide the protection you need. If you're going to buy an electromechanical type, don't buy an antiquated, induction voltage regulator. There is an alternative.

The PAVR is an electromechanical regulator (easy to understand and service) that is designed specifically for medium to high power loads. It is efficient, reliable and economical.

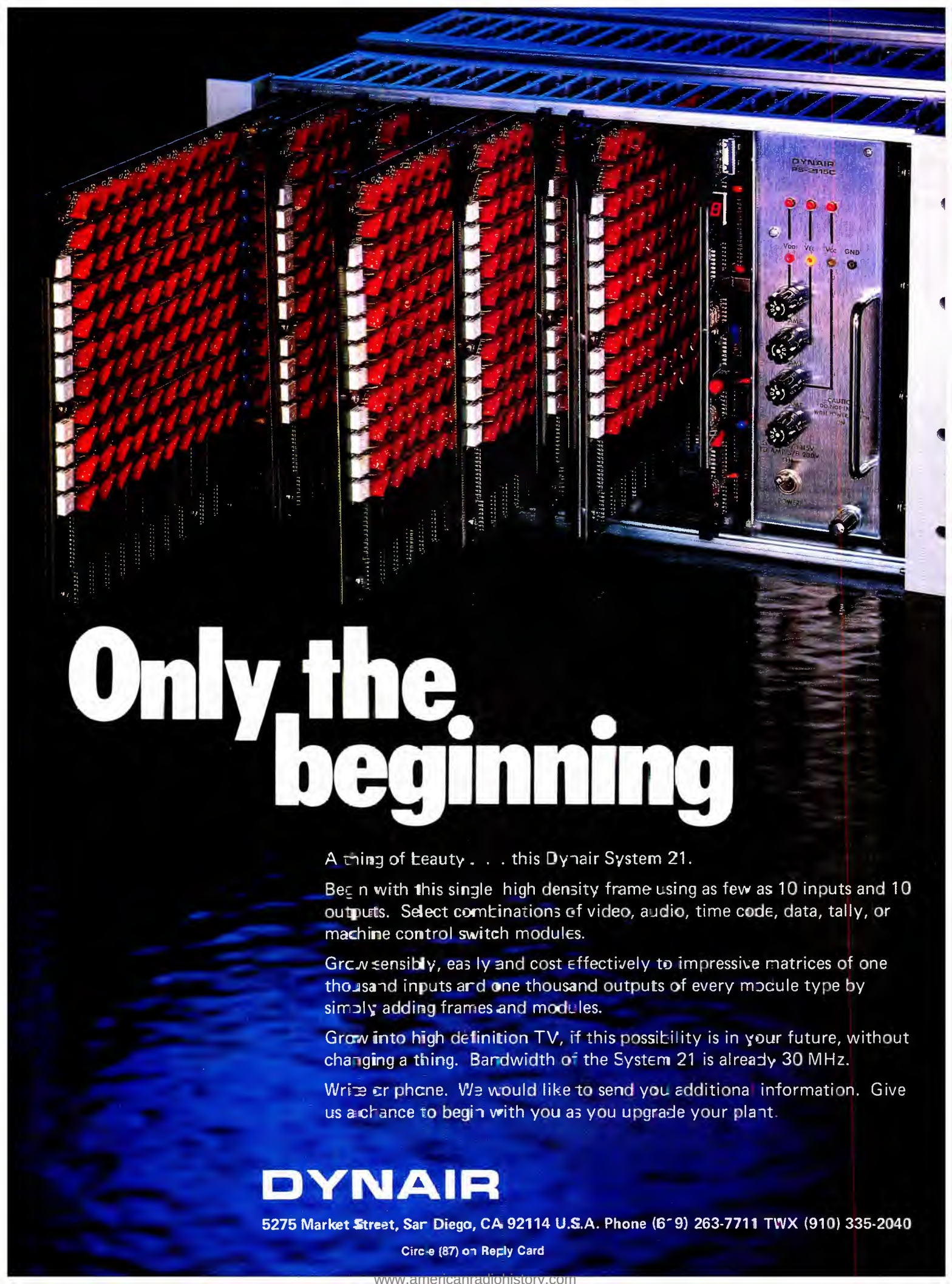
From the World Leader in High Voltage Technology



P.O. Drawer A, Route 22, Brewster, New York 10509 Phone (914) 279-8091 Twx: 710-574-2420 HIPO BRWS NY Tlx: 425476 HIP U

Circle (86) on Reply Card





# Only the beginning

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

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

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

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

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

## DYNAIR

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

Circle (87) on Reply Card



1) START OF RANGE: 0 1111  
2) END OF RANGE: 1 1111

3) NUMBER OF ACCUMULATIONS: 1  
4) RANGE SCALING FACTOR: 5

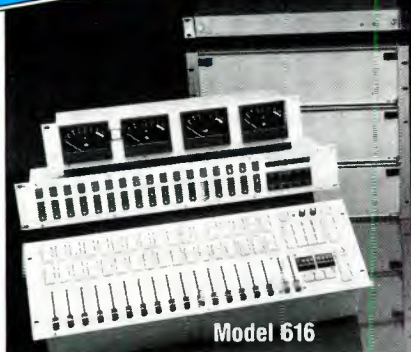
| SAMPLES | % FREQ OF LAST SAMPLE | % CUMULATIVE FREQUENCY |
|---------|-----------------------|------------------------|
| 100 +   |                       |                        |
| 40-99   | 47 #####              | 47 #####               |
| 20-39   |                       |                        |
| 10-19   |                       |                        |
| 5-9     |                       |                        |
| 4       |                       |                        |
| 3       | 7 ##                  | 7 ##                   |
| 2       | 45 #####              | 45 #####               |
| 1       |                       |                        |

Figure 5. Histogram display showing percent of activity of circuit under test.

## NEED TO EDIT AUDIO FASTER?

*We have the Solution...*

With Our  
**Edit Suite  
Audio Mixers**



Model 616



Model 612



Model 608 (New for '86)

Specially designed for television, the ESAM from Graham-Patten Systems lets you edit audio the same way you do video...operating from the edit keyboard. Only the ESAM has a proven track record in edit system integration: for Ampex ACE, CMX, Calaway, Convergence, Grass Valley Group, and other editing systems that operate a production switcher. Tailored to the needs of every facility, ESAMs are offered in 8-, 12-, and 16-input models. Additionally, an electronically controlled programmable equalizer is available for the 12- and 16-input models. Here are just a few other innovative ESAM features:

- Operates like a video switcher with preset, program & preview busses
- Manual & full edit system control of source selection, transitions, & previews
- Separate electronics & control panels for maximum flexibility & compact size
- Delivers high quality demanded by recording & post production professionals

Yet there's more! For a complete brochure, call us toll free:



**GRAHAM-PATTEN SYSTEMS, INC.**  
P.O. Box 1960, Grass Valley, CA 95945

Inside Calif.: (800) 422-6662 • Outside Calif.: (800) 547-2489 • TWX 910-333-6065

### Operator training

Some engineers may be intimidated by the prospect of using such a device to troubleshoot their equipment. Most other troubleshooting techniques require only one or two test leads and maybe a couple of traces on a scope. The prospect of looking at eight or more scope traces or a display filled with binary or hexadecimal digits might send the engineer running to the phone for help.

However, because today's equipment is becoming so complex, different troubleshooting techniques have to be learned. These new techniques often require sophisticated test equipment. The key to repairing the new broadcast gear is to get this new generation of test equipment into the hands of maintenance engineers and give them a chance to learn how to effectively use it.

If you have ever been faced with repairing a complex microprocessor device, you have some idea of how difficult it can be. Scopes, logic probes and counters are often insufficient to effect repairs. On the other hand, if you learn how to use a logic analyzer, you can drastically cut that repair time. In some cases, repairs may be impossible without such a device. To be effective, however, the engineer needs time to become thoroughly acquainted with the equipment.

The Omni 4 logic analyzer provides troubleshooting capability not available in other devices. It's not a simple device. Modern test equipment seldom is. However, properly used, it can help you repair complex broadcast equipment.

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

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

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement or disapproval by **Broadcast Engineering** magazine.



Circle (115) on Reply Card





TRUTH...

OR  
CONSEQUENCES.

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

**TRUTH:** A lot of monitors "color" their sound. They don't deliver truly flat response. Their technology is full of compromises. Their components are from a variety of sources, and not designed to precisely integrate with each other.

**CONSEQUENCES:** Bad mixes. Re-mixes. Having to "trash" an entire session. Or worst of all, no mixes because clients simply don't come back.

**TRUTH:** JBL eliminates these consequences by achieving a new "truth" in sound: JBL's remarkable new 4400 Series. The design, size, and materials have been specifically tailored to each monitor's function. For example, the 2-way 4406 6" Monitor is ideally designed for console or close-in listening. While the 2-way 8" 4408 is ideal for broadcast applications. The 3-way 10" 4410 Monitor captures maximum spatial detail at greater listening distances. And the 3-way 12" 4412 Monitor is mounted with a tight-cluster arrangement for close-in monitoring.

**CONSEQUENCES:** "Universal" monitors, those not specifically designed for a precise application or environment, invariably compromise technology, with inferior sound the result.

**TRUTH:** JBL's 4400 Series Studio Monitors achieve a new "truth" in sound with

an extended high frequency response that remains effortlessly smooth through the critical 3,000 to 20,000 Hz range. And even extends beyond audibility to 27 kHz, reducing phase shift within the audible band for a more open and natural sound. The 4400 Series' incomparable high end clarity is the result of JBL's use of pure titanium for its unique ribbed-dome tweeter and diamond surround, capable of withstanding forces surpassing a phenomenal 1000 G's.

**CONSEQUENCES:** When pushed hard, most tweeters simply fail. Transient detail blurs, and the material itself deforms and breaks down. Other materials can't take the stress, and crack under pressure.

**TRUTH:** The Frequency Dividing Network in each 4400 Series monitor allows optimum transitions between drivers in both amplitude and phase. The precisely calibrated reference controls let you adjust for personal preferences, room variations, and specific equalization.

**CONSEQUENCES:** When the interaction between drivers is not carefully orchestrated, the results can be edgy, indistinctive, or simply "false" sound.

**TRUTH:** All 4400 Studio Monitors feature JBL's exclusive Symmetrical Field Geometry magnetic structure, which dramatically reduces second harmonic

distortion, and is key in producing the 4400's deep, powerful, clean bass.

**CONSEQUENCES:** Conventional magnetic structures utilize non-symmetrical magnetic fields, which add significantly to distortion due to a nonlinear pull on the voice coil.

**TRUTH:** 4400 Series monitors also feature special low diffraction grill frame designs, which reduce time delay distortion. Extra-large voice coils and ultra-rigid cast frames result in both mechanical and thermal stability under heavy professional use.

**CONSEQUENCES:** For reasons of economics, monitors will often use stamped rather than cast frames, resulting in both mechanical distortion and power compression.

**TRUTH:** The JBL 4400 Studio Monitor Series captures the full dynamic range, extended high frequency, and precise character of your sound as no other monitors in the business. Experience the 4400 Series Studio Monitors at your JBL dealer's today.

**CONSEQUENCES:** You'll never know the "truth" until you do.



JBL Professional  
8500 Balboa Boulevard  
Northridge, CA 91329

Circle (90) on Reply Card





# Freeze.

**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 resolu-

tion to direct screen photography or thermal video image recorders.

**If you use video, you need FreezeFrame.**

FreezeFrame has hundreds of uses for anyone who uses video in their profession. It can be used in broadcast, production and advertising to proof, edit, storyboard or reference. It can be used to pull a

print off a just-breaking news story, or for color correcting a proof. It can even help in film-to-video transferring. Medical professionals can use FreezeFrame for diagnostic recording, patient referral or teaching. And it's the easiest way to get slides or prints for presentations or training.

**FreezeFrame can improve your image.**  
FreezeFrame



System includes Video Image Recorder, control console, and print film camera/adaptor. 35mm camera/adaptor optional.





# Frame.

connects easily to video cameras, professional VCR's, laser disc players and computer graphics systems.

You can preview and even improve the video image because FreezeFrame has a full range of image enhancing controls including tint, contrast, color, sharpness, brightness and raster fill. And if you're shooting prints, FreezeFrame uses a new color print film specially developed for use with video imaging.

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 800-225-1618, 9 a.m. to 6 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 Corp., Dept. 671, P.O. Box 5011, Clifton, NJ 07015.

☐ Please send more information.

☐ I'd like a demonstration.

BE 11/1

Name \_\_\_\_\_

Title \_\_\_\_\_

Organization \_\_\_\_\_

Address \_\_\_\_\_

City \_\_\_\_\_

State \_\_\_\_\_ Zip \_\_\_\_\_

Telephone \_\_\_\_\_

Video Source \_\_\_\_\_

Application \_\_\_\_\_

\*Suggested list price. "Polaroid"® "FreezeFrame"™ © 1986 Polaroid Corporation

Circle (91) on Reply Card

November 1986 **Broadcast Engineering** 145



## Extending multigeneration limits

By Michael Arbuthnot

**T**wenty-three generations with a type C VTR? It sounds impossible (and is not necessarily recommended) for an analog machine, but it is possible. The problems of multiple analog generations stem from several factors. Understanding and controlling those factors can extend the format's capability.

### Sources of degradation

Conventional wisdom holds that today's 1-inch type C videotape recorder can deliver only five to eight generations of broadcast-quality images before the signal becomes unusable. Most people believe noise is the chief cause of picture degradation.

Whenever a videotape is reproduced, noise is present. That noise becomes part of the video signal, which is rerecorded in post-production. With each playback, the image is degraded to some extent. After a number of dubbing passes, the result becomes objectionably obvious.

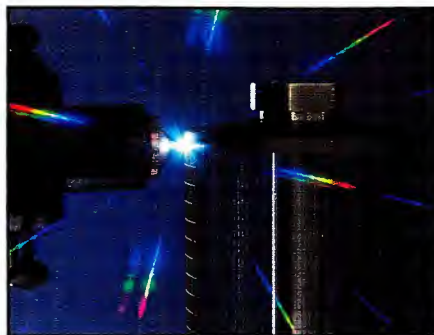
Some control over noise is possible. Filtering can reduce the amount of noise in the reproduced video, but to do an effective job, high-frequency filtering takes a toll on the signal components responsible for picture detail.

Other factors affect the signal-to-noise ratio, too, such as recording levels and track widths. These parameters have already undergone a good deal of optimization for the C format. Little, at present, can be done to improve on that.

Although noise has been considered a prime culprit of multigeneration degradation, other controllable factors have had a more significant impact. Accumulated errors in the setup of the VTR, TBC and other production equipment are one source. Accumulated uncorrected velocity errors are another form of degradation. Both are frequently mistaken for noise.

### Setup errors

Typically, an operator adjusts the VTR for a recording while monitoring color bars. In accordance with the waveform and vector monitors, black level, white level, chroma amplitude and phase, differential gain and phase and record



currents are adjusted.

Although the setup may *look* accurate, absolute accuracy is difficult to achieve, even for the experienced operator. A slight error in a setup parameter will ad-



**Figure 1.** A split-screen presentation of seventh- and 23rd-generation video recorded with a VPR-3 and Zeus shows little difference in the image. The arrows indicate the line between the two signals.

versely affect the recording. What is not immediately obvious, for example, is that a 1IRE error in black level accumulates into 10IRE units of error by the 10th generation. In the same way, a 1° error in the chroma phase adjustment becomes a 10° error by the 10th genera-

tion. Other errors are similarly compounded.

### Fighting fate

Dubbing degradation is a future problem. It compounds with each generation, and only becomes obvious after the damage has been done. One solution would be to see into the future, while adjusting parameters in the present. That possibility would allow reduced setup errors before they occur. But how do you see into the future?

A means to look into the future was one of the goals of Ampex design engineers. With a VPR-3 VTR and Zeus video processor, an operations menu selection called *M GEN* (multiple generations) places the machine into the insert mode. The electronics are set for playback, but armed for recording.

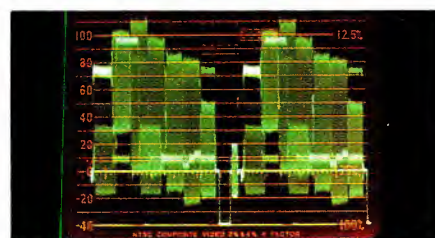
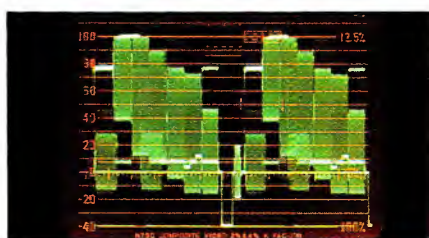
When the *M GEN* function is activated, the VTR displays 10 generations of color bars in a real time continuous loop. Starting from a first-generation recording of a color-bar signal, the operator can see the evidence of accumulated errors.

The mechanism for seeing into the future is based upon automatic scan tracking with a playback head mounted on piezoelectric material. The VTR plays a field of the original generation of a color-bar signal and passes it to the video proc-

### First generation



### 10th generation



**Figure 2.** In a side-by-side comparison of first- and 10th-generation color bars, vector and waveform monitor displays indicate the accumulation of uncorrected errors.

Arbuthnot is product manager for the VPR-3 and Zeus video processor, Ampex AVSD, Redwood City, CA.



# Anything less than a Neve is just a lot of...

Bells and whistles may be all you need for New Year's Eve... or a birthday celebration. But is a desk full of bells and whistles enough for the demanding art and science of broadcast production? You need the Neve difference.

At Neve, the first name in audio mixing control and distribution systems, we offer you all the bells and whistles your creativity demands... as well as the sonic quality, reliability, and ease of operation that sets Neve apart from the rest.

Neve's versatile 51 Series, for example, gives you the full range of advanced facilities you want, plus the virtually unlimited versatility you require... to let your creativity soar. With features that include:

- 16-to-60 inputs
- Custom configurations

- Stereo or mono modules
- A choice of 4 standard consoles
- Up to 8 auxiliary outputs
- Multitrack recording capability
- 4-band Neve Formant Spectrum Equalization

Hear the Neve quality difference for yourself. Find out firsthand how Neve advanced engineering gives you "a touch of the future."

Circle the bingo card for a literature pack. Or call (203) 744-6230 for a demonstration of Neve sound at your location.



- Nothing sounds as good as a Neve... because nothing else is.

#### Rupert Neve Incorporated

Berkshire Industrial Park  
Bethel, Connecticut 06801  
Telex 969638  
Facsimile (203) 792-7863  
(203) 744-6230

#### Neve Electronics Int'l Ltd.

Cambridge House, Melbourn, Royston  
Hertfordshire SG8 6AU, England  
ph (0763) 60776 fax (0763) 61886  
telex 81381

7533 Sunset Blvd.  
Hollywood, California 90046  
(213) 874-8124  
Facsimile (213) 874-1406

P.O. Box 40168  
Nashville, Tennessee 37204  
Telex 786569  
(615) 385-2727

 **Neve**  
A Siemens Company

See Us At AES  
Booths 200, 202, 204,  
301, 303, 305

# NOISE

Circle (92) on Reply Card

NEV100004 WLM 467



# Do We Have Connections!



We're very close to most of the world's top personalities! They may not realize it, but Switchcraft audio connectors have long been the audio engineer's first choice for everything from a major address by one of our presidents to the smallest studio recording session. Professionals such as yourself appreciate the kind of reproduction quality, product flexibility and durability that results from our 40 year commitment to excellence in all our products.



From stereo phono jacks to quick-ground connectors, from versatile audio adapters to advanced mixers and switching components,

Switchcraft makes just the right connection for the most demanding requirements.

To improve your connections and make a very sound quality decision, plug into the possibilities with Switchcraft.



Tell me more about your impressive connections

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

My area(s) of interest is: ☐ Switches ☐ Connectors ☐ Power Cords  
☐ EAC Receptacles ☐ Jacks/Plugs  
☐ Molded Cable Assemblies ☐ Jack Panels/ Jack Fields

My application 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

## Switchcraft

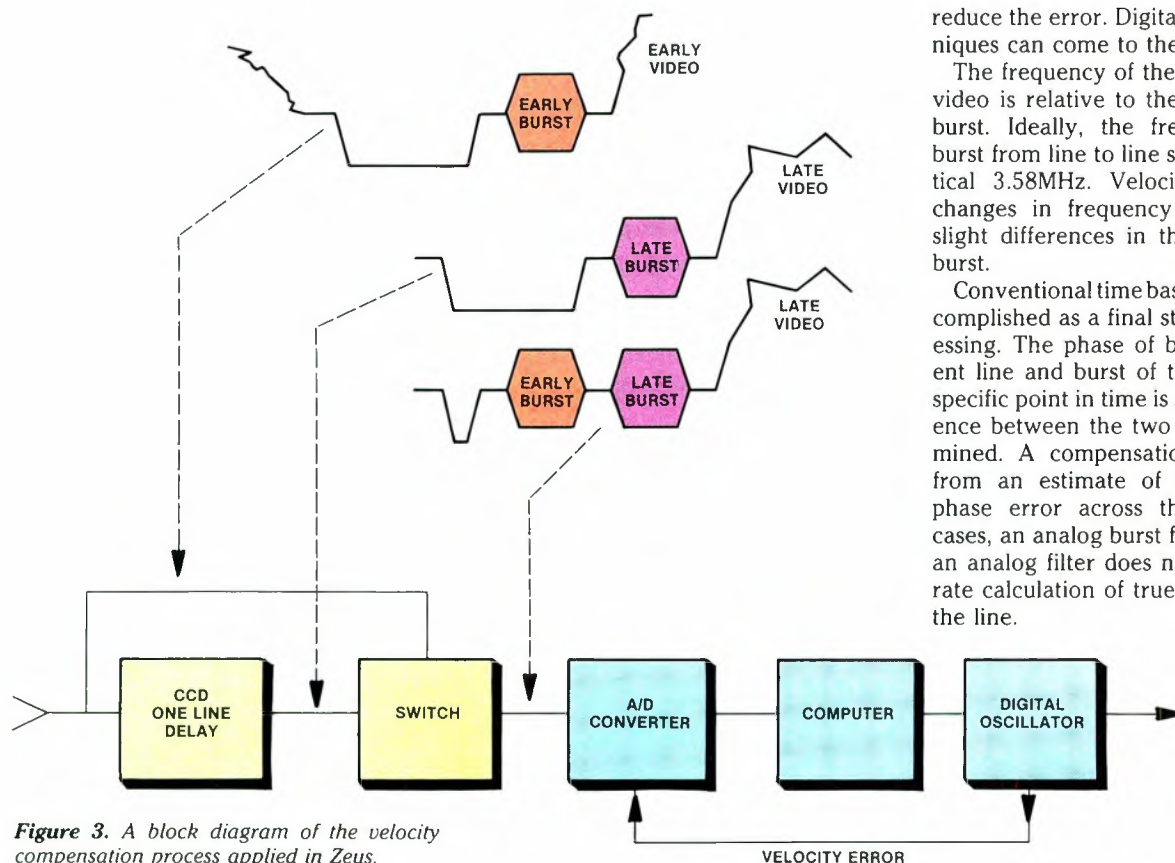
A Raytheon Company

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

Circle (93) on Reply Card

BE11-86





**Figure 3.** A block diagram of the velocity compensation process applied in Zeus.

error. The signal is routed back to the VTR and recorded again. The newly recorded track is now the playback information. This loop repeats until the 10th field.

After the 10th field, the VTR exits record mode for one field in order to read one field of the original first-generation test-bar pattern. This cycling through 10 field-by-field generations is repeated three times per second.

### Beyond the VTR

With the look-ahead feature, VTR parameters can be fine-tuned for a minimum degree of variation between the first and 10th generations. These parameters include black, video and chroma levels, chroma and equalization burst phases, record current and differential gain and phase. Eliminating accumulated setup errors in the VTR is only part of the solution.

All other devices in the video signal path are equally suspect in producing errors, from the TBC and machine distribution amplifier to the routing or production switcher. Unseen setup errors in the signal path of associated production equipment eventually become obvious.

The 10-cycle sequence described for the VPR-3 and Zeus processor may be used for other studio equipment. Instead of returning directly to the VTR, the output of the processor passes through the

routing switcher, for example. When the routing switcher is properly adjusted, the signal is routed through other individual units and adjustments are made for each.

### Improving VEC

Eliminating setup errors alone, however, will not significantly improve multi-generation capabilities. Another pseudo-noise degradation, the result of velocity errors, also exists.

Velocity error refers to compounded slight variations in the speeds of the tape moving along its path and in the rotation of the video head scanner. The result is a variation in the way information is recorded on the tape. That is, the minute changes in the speed at which the signal is written to tape will cause minute changes in signal frequencies. During playback, a different set of variations will occur, introducing even more error.

As playback progresses, variants in speeds and frequencies introduce a shift in color. Like setup errors, velocity errors compound with each generation, the previous record and current playback errors mixing with current record errors. By the 10th generation, massive color shifts can result.

Velocity error compensation is not new and nearly every TBC provides some degree of compensation. For multiple-generation work, however, an extra degree of compensation must be used to

reduce the error. Digital-processing techniques can come to the rescue.

The frequency of the color in a line of video is relative to the frequency of its burst. Ideally, the frequency of each burst from line to line should be an identical 3.58MHz. Velocity error creates changes in frequency and subsequent slight differences in the phase of each burst.

Conventional time base correction is accomplished as a final step of signal processing. The phase of burst on the present line and burst of the next line at a specific point in time is sampled. A difference between the two samples is determined. A compensation can be made from an estimate of the accumulated phase error across the line. In most cases, an analog burst filter is used. Such an analog filter does not allow an accurate calculation of true velocity error of the line.

Working in the digital domain, velocity compensation can be accomplished at the beginning of processing. A line of input video is routed to a 1-line delay holding area. As the following line is received, burst from the new line is gated into the delayed line, yielding a line with two bursts.

After the A/D conversion, 32 samples taken from each of the two bursts are compared. The error is a precise measurement of the phase difference between the present and future bursts. The difference controls a digital oscillator used for the A/D clocking process. Because the oscillator frequency now includes the same error as the line of video being converted to a digital stream, the error is removed during digitization. Subsequent processing will deal only with velocity error-free data.

### Combining two worlds

There has been speculation that the type C format must yield to digital-recording systems when more than a few generations of material are necessary for post-production. Noise will still exist, but in the absence of setup and velocity error, its effect is far less apparent.

Through digital and digitally controlled processing, an increase in type C generations by a factor of two can be achieved without significantly increasing signal degradation. [:-:~:~:~]]



## Enter the world of CAD PC boards

By Marvin C. Born

**M**any engineers have faced the problem of designing special, one-of-a-kind circuits. Constructing the device is one of the first decisions made. Most of the time, unfortunately, the circuits end up looking like a rat's nest with point-to-point connections. Although a printed circuit board design might be preferred, it is often too difficult, time-consuming or expensive for one-of-a-kind projects.

For simple projects in which the circuit is not complex, the advantages of using a printed circuit board are numerous. A PC board makes the installation and replacement of parts easier. The completed circuit also may be more reliable because of the stability provided by the PC board. Finally, a PC board is cleaner looking than point-to-point wiring. The drawback of using PC boards in typical construction projects, though, is the laborious process of making the board.

Usually, the engineer is forced to use manual paste-up methods to construct an acetate model of the desired circuit. The process is complex and time-consuming. For the inexperienced engineer, it also can be expensive because tape material is wasted in trying to develop a perfect acetate circuit drawing.

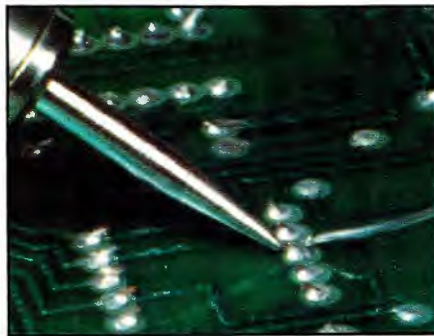
After the acetate is completed, a photographic process is required to generate a properly sized negative for exposing the circuit board. Because few stations have access to the equipment necessary to expose and develop the negatives, outside help is required.

### CAD approach

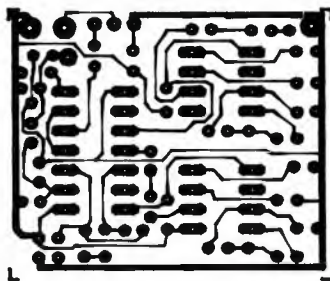
There is now a faster and more accurate method of making circuit boards. Through computer-aided design (CAD) software, a desktop personal computer, and printer or plotter, the typical radio or TV station can develop custom PC boards.

Although CAD software and hardware have been around for several years, the process generally referred to large-scale computers working on complex design problems. Until recently, CAD also meant big-buck expenses—far beyond what most stations could afford.

That has now changed. With the proliferation of personal computers, printers and plotters, several CAD packages have



been developed to help solve this problem. One recently developed software package, ProDesign II, makes it possible for a station to inexpensively enter the world of CAD PC boards. The combination of CAD software and a plotter allows you to move from the schematic phase to the construction phase in a matter of hours, not days.



*The actual-size plotted output for the CAD-designed printed circuit board.*

### How it works

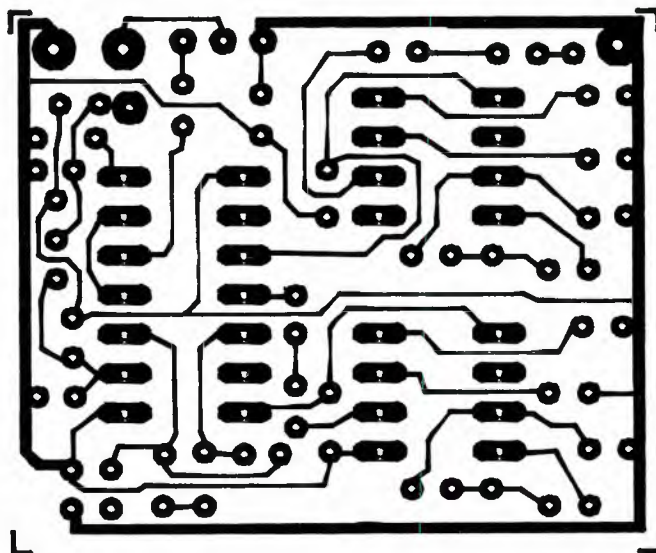
Today's small electronic components don't lend themselves to point-to-point wiring like circuits of years past. Although wire-wrap circuits are easy to

construct, they are difficult to troubleshoot, sometimes unreliable and definitely not attractive. The only really reliable construction method is the PC board.

The key to successful implementation of any computer-aided design process is the user interface. With CAD software, the operator lays out the PC design on the video screen. The screen acts as a large piece of paper where the various elements can be easily located, erased or moved. Any solder pads, interconnecting wires or terminals are simply figures on the screen.

The first step to using the software is the installation. As with any program, be sure the software will work properly with your hardware. Most installation routines allow you to select from a menu of devices. The program then installs the appropriate drivers to interface the software to your specific hardware.

After the software has been installed, the next step is learning to use the program. Although it takes a while to learn to lay out any PC board, there is no wasted material with CAD. It's been my experience that an engineer can spend a lot of time and use up expensive supplies just getting the first working circuit off the drawing board. The CAD approach allows the operator to design, print and check circuits in a matter of minutes. If a



*Drawings by Steve West, KRIS-TV*

*The enlarged (2X) plotter output demonstrates how much easier it is to troubleshoot an enlarged CAD-produced PC board before it is constructed.*

Born is director of engineering for KRIS-TV, Corpus Christi, TX.





# When You're Tired of Playing Power Protection Games

It's amazing how many companies claim to have the answers to your power-related equipment problems. And no doubt, you've tried some of their products in your desperate attempt to improve operational productivity.

Well if you're tired of playing their games, let Transtector Systems solve your power problems once and for all.

Only Transtector offers you this kind of full-service, problem-solving expertise:

- More than 80 solid-state transient suppressor models
- Applications engineering
- Power line diagnostic equipment
- Intensive educational seminars for you and/or your staff
- 24-hour, toll-free hotline

So pick up your phone (assuming it still works) and call Transtector now to receive a complete package of information on "How To Solve Power Line Problems Without Playing Games."

**1-800-635-2537**

**TRANSTECTOR® SYSTEMS**

10701 Airport Drive, Hayden Lake, ID 83835, (208) 772-8515

Circle (94) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)

© 1986 Transtector Systems, Inc.  
Transtector is a registered trademark of  
Transtector Systems, Inc., a publicly  
traded corporation (NASDAQ:TTOR).







TTV 1530, the middle-weight video camera which takes on all-comers. Now, Thomson presents a team of all-round champions.



# NEW MIDDLE WEIGHT CHAMPION

TTV 1530 is a professional 2/3 inch studio and OB camera. For the least possible investment, it gives you the best of Thomson's technology and quality: the know-how of a world leader in advanced electronic equipment. Great image quality, automatic setup and all the operational facilities of bigger cameras. Compact, maneuverable and lightweight.

## THOMSON VIDEO EQUIPEMENT

Because the best need the best

FRANCE (HEAD OFFICE)  
THOMSON VIDÉO ÉQUIPEMENT  
17, rue du Petit Albi - CERGY-SAINT-CHRISTOPHE  
BP 8244 - 95801 CERGY-PONTOISE CEDEX  
Phone (1) 34.20.70.00 - Telex 204.780 F  
Fax (1) 34.20.70.47

U.S.A.  
THOMSON-CSF BROADCAST Inc.  
37 Brownhouse Road - STAMFORD  
CT 06902 - U.S.A.  
Phone (1203) 965.7000 - Telex 6819035 TCS FB.  
Fax (1203) 327.6175.

Circle (95) on Reply Card



## TV innovators receive Emmys

The coveted Emmy statuettes were recently awarded to several manufacturers and industry leaders in recognition of outstanding achievements in engineering development at separate ceremonies held in New York and Pasadena, CA.

The 36th annual Academy Awards ceremony was held by the Academy of Television Arts and Sciences in Pasadena, Sept. 6. The academy, most commonly known for its Primetime Emmy awards, presented an Emmy statuette to Stefan Kudelski for his work in the development of the Nagra recorder. The academy recognized the importance of the Nagra recorder to the TV industry because of its combination of portability, sonic quality and its capability to record and play stereo sound synchronous to the picture source.

Sony, CBS and Cinedco also were honored with statuettes for their design and implementation of electronic editing systems for film programs. Development of an electronic editing system without cutting or splicing, which would be comfortable for film editors, began in 1977. By 1979, an operational prototype without the traditional knobs and buttons of a video editing system was complete. The



system uses only a picture monitor, a data monitor and a light pen. The commercial appearance of products based on this design technology such as EditDroid and Montage underscores the importance of this development to the film community. CBS currently uses its system with Betacam sources to edit its weekly *Twilight Zone* TV series.

In New York, the National Academy of Television Arts and Sciences held its 9th annual Engineering and Scientific Awards ceremony on Sept. 10. The academy is best known for its Daytime Emmy awards. There were several recipients of this year's Engineering and Scientific Emmys. They include:

- Abekas Video Systems for its achievement in engineering development for the Abekas A62 digital videodisc recorder.
- Ampex was awarded two Emmys for the development of the VPR-3 micro-

processor intelligent production videotape recorder and for its development of advanced digital picture processing and time base correction techniques used in the Zeus.

- dbx for its research, development and implementation of the multichannel sound system (MTS) used in the voluntary broadcast TV standard (BTSC).

- The Electronic Industries Association for its administration of the development, testing and documentation of a single voluntary technical standard (BTSC) for multichannel stereophonic TV broadcast sound.

- JVC for its development of a consumer videotape recorder that makes it possible for the consumer to time shift recording and viewing.

- Matsushita (Panasonic) for the manufacturing and marketing of a consumer videotape recorder making time shift recording and viewing possible.

- M/A-Com for its contribution to satellite TV encryption and scrambling technology. M/A-Com's VideoCipher encryption system is used by Home Box Office, Showtime, Cable News Network and other TV programmers who use satellites to distribute programming.

- NBC for its work in developing and implementing MTS stereo sound for broadcast television.

- Quantel was awarded two Emmys for its painting and graphics generation with the Quantel Paintbox and for achievement in digital video mixing, processing and compositing for the Quantel Harry.

- RCA received two Emmys for its development and implementation of BTSC and its pioneering efforts in the development of component video recording technology for broadcast television.

- Sony received two Emmys for its Betacam format video recording system and for its design and manufacture of a consumer VCR that makes time shift recording possible.

- Zenith Electronics for its research, development and implementation of the MTS system used in BTSC stereophonic TV broadcasting.

Each Emmy was the result of recommendations of special committees, and was voted on by the board of governors of each respective academy.



Accepting Emmys for the design and implementation of electronic editing systems for film programs are (from left to right) Adrian Ettlinger, Cinedco; William Connolly, Sony Communications Products Company; and Joseph Flaherty, CBS.



# Microdyne presents the first automatic satellite program shifter.



## MAT: Microdyne Automated Terminal

Now you can take full advantage of the wealth of programming available via C- and Ku-band satellites with the only TVRO system that's as easy to use as a home VCR.

### Rely on M.A.T.'s memory instead of your own.

M.A.T.'s microprocessor stores hundreds of program pre-sets—satellite position, signal polarization, transponder format and frequency. Once M.A.T. is programmed, subsequent reception is push-button easy. You enter a simple program code and M.A.T. does the rest, right down to peaking its motorized, high-resolution fiberglass antenna.



### Turns on, tunes up, automatically.

M.A.T.'s system clock automatically turns the system on and tunes in the programming you want for any particular day and time. You can set it for one program, or a succession of programs, for as long as you want. It even controls descramblers, video recorders or other external equipment. And you can operate M.A.T. through its own front panel keypad or by remote terminal.

### Economical base price, broadcast quality options.

No other satellite TVRO system is available anywhere, at any price, with the capabilities of

M.A.T. And you can have the flexibility and unlimited program access of M.A.T. for under \$20,000, installed. Options include a 5 or 7 meter antenna to meet the stringent requirements of broadcasters and cablecasters.

### Installed and backed by Microdyne.

M.A.T. is built, installed, and backed by Microdyne, a company committed to exceptional reception and service since the beginning of satellite communications. Call (904) 687-4633 or write for more information today.



**Microdyne Corporation**

491 Oak Road • P.O. Box 7213  
Ocala, FL 32672 • TWX: 810-858-0307



## SBE comments support NAB position

The Society of Broadcast Engineers has filed comments in support of the National Association of Broadcasters' filing, in opposition to the further sharing of UHF spectrum by private land mobile radio users.

In the initial proposed rulemaking, the FCC contended that sharing by land mobile users would result in minimal impact on UHF reception. The SBE filing affirmed the NAB's disagreement with this conclusion, citing the susceptibility to interference of new, synthesized, frequency-agile receivers to second and third-adjacent channel interference, an issue not addressed in the notice of proposed rulemaking on Docket 85-175.

The SBE urged the commission to deny land mobile type services shared use of the TV UHF band, allow sharing for broadcast aural STL, and to come down in favor of spectrum-efficient techniques, such as amplitude-companded sideband and spread spectrum technology, and stringent prior coordination requirements.

1:7-:)))

### Statement of Ownership, Management and Circulation (Act of August 12, 1970: Section 3685, Title 39, United States Code).

- 1A. Title of publication: Broadcast Engineering
- 1B. 338-130
2. Date of filing: Sept. 30, 1986
3. Frequency of issue: Monthly except in the fall, when 2 issues are published.
- 3A. Number of issues published annually: 13
- 3B. Annual subscription price: \_\_\_\_\_
4. Complete mailing address of known office of publication (Street, city, county, state, zip code): 9221 Quivira Road, Overland Park, Johnson County, KS 66215.
5. Location of the headquarters or general business offices of the publisher (not printers): 9221 Quivira Road, Overland Park, Johnson County, KS 66215.
6. Names and complete addresses of publisher, editor, and managing editor. Publisher (Name and Address): Duane N. Hefner, 9221 Quivira Road, Overland Park, KS 66215. Editor (Name and Address): Jerry Whitaker, 9221 Quivira Rd., Overland Park, KS 66215. Managing Editor (Name and Address): Dan Torchia, 9221 Quivira Road, Overland Park, KS 66215.
7. Owner (If owned by a corporation, its name and address must be stated and also immediately thereunder the names and addresses of stockholders owning or holding 1 percent or more of total amount of stock. If not owned by a corporation, the names and addresses of the individual owners must be given. If owned by a partnership or other unincorporated firm, its name and address, as well as that of each individual must be given. If the publication is published by a nonprofit organization, its name and address must be stated.) Intertec Publishing Corp., a Macmillan Inc. company, 9221 Quivira Road, Overland Park, KS 66215.
8. Known bondholders, mortgagees, and other security holders owning or holding 1 percent or more of total amount of bonds, mortgages or other securities (If there are none, so state): None.

|                                                                                         | Average No. Copies Each Issue During Preceding 12 Months | Single Issue Nearest To Filing Date |
|-----------------------------------------------------------------------------------------|----------------------------------------------------------|-------------------------------------|
| A. Total No. Copies Printed (Net Press Run) .....                                       | 40,088                                                   | 42,000                              |
| B. Paid Circulation                                                                     |                                                          |                                     |
| 1. Sales through dealers and carriers, street vendors and counter sales .....           | -                                                        | -                                   |
| 2. Mail subscriptions .....                                                             | 35,804                                                   | 36,050                              |
| C. Total Paid Circulation .....                                                         | 35,804                                                   | 36,050                              |
| D. Free Distribution (including samples) by mail, carrier delivery or other means ..... | 2,338                                                    | 3,995                               |
| E. Total Distribution (Sum of C and D) .....                                            | 38,142                                                   | 40,045                              |
| F. Copies Not Distributed                                                               |                                                          |                                     |
| 1. Office use, left-over, unaccounted for, spoiled after printing .....                 | 1,946                                                    | 1,955                               |
| 2. Return from News Agents .....                                                        | -                                                        | -                                   |
| G. Total (Sum of E and F should equal net press run shown in A) .....                   | 40,088                                                   | 42,000                              |

I certify that the statements made by me above are correct. (Signature of editor, publisher, business manager, or owner.)

DUANE HEFNER  
Publisher

## Introducing a better way to put leader tones on tape — Model 927 Programmable Reference Tone Generator.

# 400 Hz Will Never be the Same

■ **A Unique Product** RTS Systems' Model 927 is designed for use in making master and/or duplicate audio or video tapes. Operating in a *stereo* mode, it offers a significant improvement in record/playback audio *quality assurance*. In addition to discrete tones, white noise, pink noise, noise reduction tones, and stereo channel I.D. are available.

■ **Software Programmable** The Model 927 is user programmable, with 9 separate registers for up to 27 different tone events per sequence. Frequency, output level, duration and channel routing can be programmed with each tone event.

Please call or write for literature.

**RTS SYSTEMS**

1100 West Chestnut Street • Burbank, CA 91506 • Telephone 818 840-7119

Circle (97) on Reply Card



# WE HAVE MORE COLORS THAN YOU CAN IMAGINE!

Actual raster photo

Large color palettes in a character generator are great, but the question is, "How many colors can you put on a single page?" The LAIRD 1500 and 1500 PROM can simultaneously display 970 colors per page from an on-line color palette of 65,536 colors.

Our unique coloring system enables the 1500 to instantly place a different color on every visible scan line of both the background and characters. With so many usable colors it's easy to create fade-ins and fade-outs, color shading and color cycling. Using the built-in keyer and Color Block Program, the 1500 can also match and save to disk, virtually any color from an external video source.

## AND IF THAT'S NOT ENOUGH . . . . .

Both the LAIRD 1500 and 1500 PROM standard features include up to 100 pages of internal (RAM) storage, Proportional Spacing, Auto sequencing, Dual Channel Operation, CharacterTuck/Overlap and adjustable Flash, Crow, Roll and Title modes, eight Edge Intensities, Drop Shadows, Italics and real-time Insert and Delete Editing.

## BEST OF ALL . . . . .

The LAIRD 1500 with dual 3 1/2" disk drives, 70 disk loadable fonts and an updatable operating system, sells for \$7,695.\* The 1500 PROM with RAM capacity for up to 100 pages and 6 resident fonts is priced at \$4,500.\*

## EXPANDABLE OPTIONS

|                                       |                                                                                                                      |         |
|---------------------------------------|----------------------------------------------------------------------------------------------------------------------|---------|
| 1530 DUAL DISKS —<br>(1500 PROM only) | Two 3 1/2" disk drives and 65 disk loadable fonts. (Required for options 1528, 1524 and 1526.)                       | \$3,695 |
| 1528 FONT COMPOSE —                   | Resizes and edits any of the disk loaded fonts.                                                                      | \$495   |
| 1524 DATA TABLET —                    | Logos and fonts can be drawn into the 1500. Also speeds the editing process.                                         | \$1,495 |
| 1526 CAMERA ENTRY —                   | Digitizes art work and graphics instantaneously for editing and coloring. (Requires separate camera and copy stand). | \$1,995 |

\*Manufacturer's suggested list price.

User's choice of broadcast or industrial encoder required for color operation.



## LAIRD TELEMEDIA INC.®

2424 SOUTH 2570 WEST • 801 972-5900

SALT LAKE CITY, UTAH 84119

Circle (98) on Reply Card



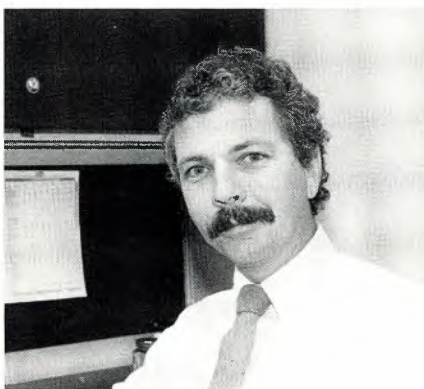
## BE names new video technical editor

By Jerry Whitaker, editorial director

We at **Broadcast Engineering** endeavor to lead the industry and our readers with the most up-to-date and accurate technical information available. This not only requires dedication, but a staff that has hands-on experience with the challenges, frustrations and needs of engineers and managers. Toward this end, we have again expanded our editorial staff to include the new position of video technical editor.

Our new video technical editor is **Ned Soseman**. He will be sharing editorial responsibilities with Carl Bentz, special projects editor and Brad Dick, radio technical editor. Soseman brings to **BE** a diversified background in broadcast engineering, production management and professional video and broadcast equipment sales.

Soseman, a Kansas City native, returns to the area from Santa Monica, CA, where he was vice president of engineering and market development for Master Digital Inc. Soseman oversaw the design, construction, training and operations of Master Digital's on-line 1-inch and interformat editing facility. He designed and implemented a Betacam field-production unit and off-line A/B roll VHS editing, bringing the company into



full-service in-house production, duplication and fulfillment. He also created and initiated new marketing concepts to take advantage of these new capabilities.

Prior to Master Digital, Soseman was a consultant with Broadcast Technology Consultants (B-T-C), Mission, KS. B-T-C works with owners and CEOs of broadcast TV and teleproduction facilities in remodeling and new construction management.

Soseman worked with many network affiliates and helped start up two, new full-power UHF stations: KLJB-TV, Davenport, IA, and KSAS-TV, Wichita, KS. While with B-T-C, he purchased more than five million dollars worth of TV equipment for clients.

Soseman spent more than 12 years as an engineer with WDAF-TV, Kansas Ci-

ty, starting as vacation relief in 1966. In 1976, he saw his first sit-down editing system, Sony VO-2850s and an RM-400, and jumped at the opportunity to introduce these new products for Sony's Video Products division as a district sales manager.

Following several years at Sony, he started and managed a local professional video dealership in Kansas City, and later left the world of sales to rejoin the WDAF-TV engineering department in 1982. He was promoted to engineering operations supervisor at WDAF, the local NBC affiliate that also operated the only C-band uplink in the area. While operations supervisor, he developed many training programs for engineers and operators, and created a zero-discrepancy program for interdepartmental feedback at the station.

Soseman began his career in broadcasting in 1964 at KXTR-FM, Kansas City, as an engineer, for \$1 an hour, at the suggestion of a fellow amateur radio operator.

He attended Pittsburg State University, Pittsburg, KS, and the University of Kansas, Lawrence, where he majored in journalism, broadcast news and broadcast management.

**Charles A. Steinberg** and **Robert L. Wilson** have been appointed positions with Ampex, Redwood City, CA. Steinberg is president and chief executive officer of Ampex Corporation. He was executive vice president. Wilson is vice president and general manager of Ampex Magnetic Tape Division.

**Kenneth R. Schwenk** has been appointed president and chief executive officer for Rohde & Schwarz, Lake Success, NY. Schwenk is a former president of product management and development of Harris Broadcast Division.

**John Parke** has rejoined Acrodyne Industries, Blue Bell, PA, as vice president of sales and marketing. Parke is responsible for directing all marketing efforts aimed at increasing awareness and sales of high-power TV transmitters, and low- and medium-power broadcasting equipment. Parke was director of TV sales and marketing for Harris from 1983 to 1986,

and before that was with Acrodyne as vice president for 14 years.

**Jerald C. Murphy** has been appointed president and chief operating officer for Utah Scientific, Salt Lake City. Murphy founded Digital Logic Corporation and M & M Computer Industries, and for the past several years has been a partner with Leider, Murphy & Associates.

**Gary Kimball**, **John Preston** and **Peter Nehl** have been appointed positions with Advanced Video Systems, a new company. Kimball, a former VEA president, is president; Preston, the company's founder, is general manager of engineering; and Nehl, NCEC vice president, is vice president of engineering.

**William J. Nanney** has been appointed plant manager at the Eimac division of Varian Associates, Palo Alto, CA. He is responsible for research and

development, production, inventory, quality, marketing and sales strategies, and program management.

**Colin J. Brown** has been appointed executive vice president of Rank Cintel, Ware Herts, England. He joined Rank Cintel Inc. in a senior management position at the company's corporate head office in the United Kingdom.

**Donald A. Carlsen** has joined Aurora Systems, San Francisco, as Western regional manager. He will be responsible for marketing operations in the 13 Western states and will be located in southern California.

**John Nash** has been named regional sales manager for the Midwest for Lenco Electronics, Jackson, MO. He will be serving the Midwest area from his office in Minneapolis.

!:-:~)))))



# THE PERFECT MATCH. MADE BY SONY.



There's only one way to earn the kind of reputation the Sony Betacart® system enjoys in broadcast operations: performance.

And there's only one videocassette that can match it: the Sony BCT Series Betacam® cassette. Because both are built to the same demanding standards.

One reason Sony Betacam videocassettes achieve such high sensitivity and signal-to-noise ratios is because of Sony's Vivax™ magnetic particles. They're cobalt-enriched ferric oxides that are finer and more evenly dispersed than in other videocassettes.

Another example is Sony's back coating and cassette shell components: they're treated with antistatic agents for improved conductivity while maintaining a very low friction coefficient, dramatically reducing dropouts.

Sony BCT Series Betacam cassettes also maintain their high performance time after time after time. Because our Vivax

particles aren't just finer, they're also tougher. And our binder system holds them better than ever before.

Thanks to Sony's demanding quality control, every Sony Betacam cassette is a perfect match for the Sony Betacart. From our standard lengths to the Sony BCT-20K, which only we could produce.

Proven on-air performance and durability you can really count on, over and over again.

The Betacart and the BCT Series Betacam cassette. Made for each other. Made by Sony.



© 1986 Sony Corporation of America. Sony, Vivax, Betacart, Betacam and The One and Only are trademarks of Sony.

Circle (99) on Reply Card

www.americanradiohistory.com



## Sony forms organizations, marketing program

*Sony Corporation of America*, Park Ridge, NJ, has formed two divisions to handle all sales and marketing of the company's non-consumer products.

A new Communications Products Company will assume responsibility for all sales to the broadcast, institutional video and professional audio markets.

The second group, the Information Systems Company, is responsible for information products, government systems sales and new business development.

A promotional marketing program for computer animation products also has been announced by *The Sony Communications Products Company*, Teaneck, NJ, and *Integrated Technologies*, Greenboro, NC. Sony's broadcast sales organization in the U.S. and Canada began selling ITI's line of Ani-Maker and Image-Maker 3-D computer animation products in broadcast and TV post-production applications on Sept. 1.

## EECO acquires Acquis

EECO (ASE/EEC), Santa Ana, CA, has

acquired 100% of the stock of privately owned Acquis Corporation and its wholly owned subsidiary, Convergence Corporation. The company, headquartered in Irvine, CA, will become a wholly owned subsidiary of EECO and will continue to develop, manufacture and market videotape editing systems and related equipment. EECO's existing video products division will be merged into the company and will operate under the Convergence Corporation name.

## Amek receives Greene Street order

*Amek Consoles*, North Hollywood, CA, has announced the sale of the first APC1000 console to Greene Street Recording, New York. The desk is expected to be operational in December.

## Ampex receives equipment orders

*Ampex*, Redwood City, CA, has received several equipment orders. KPIX-TV, the CBS affiliate in San Francisco, has purchased two ADO 2000 digital-effects systems and two AVC-33 switchers.

Video Tape Associates, Atlanta, has purchased six VPR-3 type C 1-inch videotape recorders linked with six Zeus advanced video processors and three ADO digital-effects systems with a concentrator.

Thames Television is installing an Ampex major edit suite. The equipment is comprised of four VPR-3 videotape recorders, an ACE computer editing system, a dual-channel ADO digital optics system with the infinity package, and an audio mixer.

Fountain Television, London, has ordered two VPR-3 videotape recorders with Zeus 1 advanced video processors, which will be added to its existing Ampex-based system.

## Quantel demonstrates Paintbox

*Quantel*, Kenley, England, demonstrated its Paintbox at IBC. The unit was shown in stand-alone form and in conjunction with a digital library system. Paintbox was also seen on the Sony stand at IBC working in conjunction with the BVH2500 stop-frame recorder via a



When format, polarity, phase or routing errors threaten your stereo image, reach for the SCIP Stereo Signal Manager.™ Comprehensive signal monitoring and manipulation features let you *diagnose, reconfigure, correct* and *calibrate* stereo signals quickly and precisely. Even *azimuth* errors from fixed audio head VTR's. Give yourself the latitude to enhance your mono capability and stereo imaging.

**3302 Stereo Signal Manager ≡ The Control Solution**

**SCIP**  
ELECTRONIC SYSTEMS®

16169 Sunset Boulevard  
Pacific Palisades, California  
90272 ☎ 213-454-1889

Circle (100) on Reply Card


**CORNELL DUBILIER**

## Mica Capacitors

**LARGE**



**STOCK**



## VACUUM CAPACITORS

# JENNINGS

**SURCOM ASSOCIATES, INC.**

305 Wisconsin Avenue  
Oceanside, California 92054  
(619) 722-6162

Circle (123) on Reply Card



# The Go Anywhere Aural STL



**Go around corners...leap tall buildings...do creative path diversion...  
without affecting the purity of your sound.**

TFT's 8300 Series Aural STL with its unique, innovative IF Repeater approach keeps your on-air audio sounding as it does at the studio...several hops later.

The TFT IF Repeater technique is unique. At relay points, we don't take your aural signal down to audio baseband. We use the 63 MHz IF instead.

Results? How about 55 dB stereo separation even after a few 10, 20, or 25 mile hops? Or  $\pm 0.1$  dB frequency response from 30 to 15,000 Hz?

Plus, we offer a selectable IF bandwidth (SAW Filter) to minimize adjacent channel interference.

The 8300 Series is available in Composite, or Dual "Hot Standby" Composite configurations.

AM Stereo? Go FM composite to your transmitter and our Stereo Decoder Option will give you left and right signals to drive your AM Stereo Exciter.

If your frequency is one of those listed by the FCC,\* we guarantee delivery within 2 weeks after we accept our dealer's order.

All of this backed by a 2 Year Warranty.

Get to the top of the hill, cleanly. Go TFT. Contact your favorite TFT dealer for more details.

\*¶ 74.502 of the Rules.



Circle (101) on Reply Card

*... Where new things are happening!*

3090 Oakmead Village Drive, Santa Clara, CA 95051 Phone: (408) 727-7272 TWX: 910-338-0584



Lyon Lamb controller to produce full-frame animations and retouching work.

Also, the BBC will take delivery of its 15th Paintbox.

Quantel also has received three awards. Two Emmy awards, one for Paintbox and one for Harry, were awarded by the National Academy of Television Arts and Sciences. The third award,

the BDA Industry Service Award, was awarded by the Broadcast Designers Association.

#### McMartin relocates

McMartin International has relocated to P.O. Box 4500, Gunnison, CO 81230; 303-641-5500. The new plant is located at 111 Camino Del Rio, Gunnison, CO

81230. McMartin has hired an entire new staff, two design engineers, production managers, sales managers and electronic assemblers.

#### Harris awarded NBC contract

Harris Corporation, Melbourne, FL, has been awarded a contract by NBC to provide a voice and data satellite communications system linking NBC's Skypath and Skycom satellite control center in New York City with the news-gathering trucks of NBC's network affiliates. The system will consist of a Harris Ku-band satellite hub, situated in Melbourne, FL; network control terminals at NBC in New York; and a network control system, including video data terminals, computers, telephone circuits and software. Also, NBC has named Harris the exclusive supplier of the communications control package used aboard the satellite news-gathering trucks of NBC affiliate stations.

#### Microdyne installs Ku-band satellite

Microdyne Corporation, Ocala, FL, through its Canadian distributor, Inco-spec Electronics, has delivered a fixed, Ku-band satellite video uplink to Pathonic Communications, Quebec. This will be the first privately owned Ku-band uplink in Canada. The uplink, which will employ a Microdyne scrambling system for fully encrypted audio and video signals, will be used for intra-network communications and news broadcasts. It was installed and put into operation Sept. 8.

Also, Microdyne's QuickLink, a Ku-band satellite news-gathering vehicle, has been approved by GTE for use with GTE News Express satellite network service.

#### Midwest acquires Bennett

Midwest Communications Corporation, Edgewood, KY, has acquired Bennett Engineering, Seattle, WA. Stan Bennett, Bennett Engineering's owner, will remain with Midwest in a management role. This acquisition is Midwest's first West Coast office.

#### NewStar adopts new company name

Dynatech NEWSTAR, Madison, WI, formerly the NewStar division of Color-Graphics Systems, has become a separate company. L. Sanders Smith, previously vice president and general manager of the division, is company president. Dynatech NEWSTAR is a wholly owned

*Continued on page 166*



You can fill in missing time code gaps with the CDI-716A's unique multi-function jam sync, which permits correction of errors produced by head offset, mistracking, and tape dropouts.

The microprocessor-based Time Code Generator is a cost effective answer to

the needs of today's video, audio, production and post production studios. It handles both SMPTE and EBU longitudinal time code formats for data, user data, status and flag bits. And, like all Cipher Digital products, it carries a 3 year warranty.



#### Sophisticated timing

The CDI-710A Time Code Reader offers all the latest features demanded by today's professionals.

It's completely regenerated time code output corrects incoming code for phase shift and short and long-term timing error. When used with the error bypass feature it actually eliminates

defective code. This feature is particularly important where code fed to a computer editor has been displaced in relation to the video signal, causing edit aborts.

The CDI-710A. The answer for today's sophisticated video production.

For more details on both of these fine products, contact Cipher Digital today. Call (800) 331-9066.



**cipher digital, inc.**  
P.O. BOX 170/FREDERICK, MD 21701  
(301) 695-0200 TELEX 272065

*Timely today, consistent with tomorrow.*

Circle (102) on Reply Card



**THE  
SOLUTION  
OF THE  
FUTURE.**

# NOW

**30 kW fully solid state VHF TV transmitter EVHF 30 000s**



- High efficiency
- Low operating cost
- Easy to maintain
- Built-in redundancy
- Built-in input voltage regulator
- Rapid pay-back

\* Not yet approved by FCC



## THOMSON-LGT

Circle (103) on Reply Card

Laboratoire Général des Télécommunications  
1 rue de l'Hautil/Z. I. des Baudries/787 Conflans'Ste. Honorine/France



***Panasonic® brings you M-II.  
The broadcast recording system our  
competition can't seem to duplicate.***





## Now you can shoot, edit and broadcast with 1" quality—on 1/2" cassettes.

When it comes to broadcast systems, it appears our competition has been eased. Because no other format can match the spectacular performance of M-II from Panasonic.

With M-II's metal particle-tape system, you can use the same compact 90- or pocket-size 20-minute cassette from ENG/EFP right through editing to on-air broadcast. With 4.5MHz bandwidth (-3dB), 50dB S/N and burst signal insertion for phase alignment and jitter correction, M-II is the single solution to all your broadcast needs.

In fact, each unit in the M-II line offers some pretty uncommon common features like four audio tracks (two linear and two FM), an integral longitudinal and vertical interval time code/time base generator with presettable user bits and Dolby®-C noise reduction. And M-II products utilize a standard edit control interface, so you can upgrade gradually as you like.

**AU-650 Studio VCR.** This compact, rack-mountable VCR has all the advantages and functions of conventional recorders with

the benefit of the M-II format. The AU-650 provides video and audio performance as good as—if not better than—that of 1" VTRs. In a 1/2" cassette format that lends itself to station automation. It records and plays either 90- or 20-minute cassettes, and provides smooth action, variable slow motion as well as freeze frame. And the AU-650 can perform frame-accurate automatic editing with multi-generation transparency. There's also an internal TBC to assure on-air quality playback.

**AU-500 Field Recorder.** The AU-500 offers the portability and functions demanded by ENG/EFP users, while providing picture quality comparable to 1"—all on either a 90- or 20-minute cassette. This small, ruggedly designed unit is equipped with confidence field color playback, automatic backspace editing, TBC/DOC connection, search function and warning indicators that alert the operator should recording problems arise and the AU-500 accommodates NTSC composite or various component input signals.

**The AU-400 Camera Recorder.** This lightweight, compact camera recorder provides ENG users with more than 20 minutes of recording, and a picture quality that rivals that of 1" VTRs. The AU-400 also features B/W video confidence playback through the camera's viewfinder, a chroma confidence indicator and audio confidence output through a speaker.

There's even an automatic backspace editing function and warning indicators. And the AU-400's rugged construction provides excellent resistance to dust and moisture.

M-II, it's the only broadcast system of its type in the industry. And it's available now. Two of the best reasons to go with M-II from Panasonic.

To get the complete picture, call or write Panasonic Broadcast Systems Company, One Panasonic Way, Secaucus, NJ 07094. (201) 348-7671.

# MII

THE NEW STANDARD  
FOR BROADCAST.

Circle (104) on Reply Card



subsidiary of Dynatech Corporation, Burlington, MA. The decision to split NEWSTAR away from ColorGraphics was made because of the diversity of market and product lines.

The independent company's first installation of the NEWSTAR Discovery

system was completed in late June at WAJR-AM/WVAQ-FM, Morgantown, WV. Selkirk Broadcasting also has ordered the newsroom system.

**CompuSonics relocates**  
CompuSonics Corporation and Compu-

Sonics Video Corporation have consolidated their operations at a new national headquarters in order to better enable both companies to use and access the latest developments in digital technology available in the Silicon Valley area of northern California. The companies are located at 2345 Yale St., Palo Alto, CA 94306. CompuSonics' new telephone number is 415-494-1184; CompuSonics Video's new telephone number is 415-494-2308.

### Logica receives TVS order

Television South (TVS) has ordered two Gallery 2000 TV digital still-picture systems from Logica, London. The order will be delivered and installed in late 1986 at TVS's production centers at Maidstone and Southampton.

### California Microwave receives Herald-Sun order

California Microwave, Sunnyvale, CA, has announced that its subsidiary, Satellite Transmission Systems, has received a contract from Herald-Sun TV PTY Limited, Melbourne, Australia. It will supply the electronic equipment and assume overall turnkey responsibility for Herald-Sun's new 13m Ku-band video uplink satellite earth station. STS will provide redundant up- and downlinks with 2kW high-power amplifiers, automatic uplink power control and a remote monitor and control system.

### CBS buys

#### Marconi NewsHawks

Marconi Communication Systems, Chelmsford, England, has been awarded a contract to supply CBS in New York with two rapid deployment earth terminals (RADETS) based on the NewsHawk design. The equipment will be in addition to the RADET in service with CBS.

### Leaming Industries delivers SPC equipment

Leaming Industries, Costa Mesa, CA, has delivered its program audio SPC equipment to Scientific Atlanta's International Division for use in Gabon, Africa. This equipment order includes KM731 and 811D frequency-agile modulators and demodulators.

### Orion relocates

Orion Research, Cleveland, has relocated to 4650 W. 160th St., Cleveland, OH 44135. Sales and service call phone number is 1-800-82-AUDIO. In Ohio and outside the continental United States the telephone number is 216-267-7700.



Barco Industries has exciting new products and expanded user support.

Our new CVS microprocessor-controlled broadcast monitors, for example, are the first truly intelligent monitors. They have both an analog and a digital bus. Plus four plug-in slots for today's options and those yet to come, like self diagnostics and digital interface modules.

You can also store, and automatically recall, either calibrated presets or your own preferred presets. Up to forty CVS monitors can be controlled from one master remote.

CVS monitors accept both component and composite inputs, and color alignment is automatic. And, as in our best

master control monitors, Automatic Kinescope Biasing (AKB) maintains color and black level stability.

As for support, we now have a national service center with an 800 number and a nationwide network of factory trained dealers.

We also have a full line of other monitors, as well as HDTV, Chroma Decoders, and CATV equipment. Call or write 170 Knowles Drive, Suite 212, Los Gatos, CA 95030. Phone: (408) 370-3721.



Barco Industries, Inc., is a member of the ACEC group. © Barco Industries, Inc. 1986  
Circle (105) on Reply Card



**"We wanted the best standards converter on the market. In side-by-side tests, SATIN was clearly superior."**



*Gerry Citron (left), President of Intercontinental Televideo; Nigel Toovey (right), Vice President.*

Gerry Citron, President of Intercontinental Televideo, the oldest and one of the largest conversion facilities in the country, knew exactly what he wanted: "The very best, the latest, the finest converter available." Here's why he bought the Quantel Satin:

"We made our own demo tape," Gerry said. "A very difficult tape, with lots of graphics and movement. We converted that tape on Satin and on the leading competitor..."

**Everybody picked Quantel Satin.** "We asked knowledgeable people from the Broadcast Industry to view the tapes side-by-side in a split screen test. Everybody picked Satin."

"In signal-to-noise ratio, color imagery, resolution and movement interpolation, Satin was significantly superior," according to Intercontinental's Vice President, Nigel Toovey.

"We were also attracted by Satin's all digital design," Toovey continued. "Digital VTR is the next thing, and Satin, with its direct 4:2:2 interface, will put us in the forefront of that movement."

**And price?** "We didn't buy on price," stated President Citron. "We bought on performance, reputation, technology and support. But the price was competitive. Quantel's Satin offers much more than early systems for almost the same cost."

Satin's superior picture quality and outstanding price/performance will convert you, too.

For information, contact Intercontinental Televideo at (212) 719-0202, or write to Quantel, 3290 West Bayshore Road, Palo Alto, CA 94303, (415) 856-6226.



*Step into the digital studio*



**QUANTEL**

Circle (106) on Reply Card

November 1986 **Broadcast Engineering** 167



### Soundcraft receives SAC2000 orders

Sales of the SAC2000 stereo on-air console from *Soundcraft*, Borehamwood, England, have more than doubled in the last year. Radio Rhema Incorporated, New Zealand, a Christian Radio Broadcasting Network, purchased four consoles. The desks are intended for a new studio complex under construction in Christchurch. Ranson Audio, London, has just sold a SAC2000 to Tube FM, Dunkirk, France. The console is part of a major refurbishment package and will be the main on-air console. An SAC 2000 has been purchased from Soundcraft Canada by the Instituto Cubana de Radio y Televisión (I.C.R.T.) and will be installed in Radio Progreso Havana Cuba.

### Camera Mart generates power for Liberty weekend

*Camera Mart*, New York, supplied the units that generated energy for virtually all of the video and lighting equipment on Governors Island for the Liberty weekend centennial. There was insufficient power available to handle the addi-

tional power load, and only one generator could be used.

The generator supplied power to NBC, WOR-TV, WOR Radio, United Stations, UPI, AP, WMAL, WNYC, WINS, Visnews/Conus, Independent Network News, WNBC, WNYW and Gannett Newspapers as well as Telco dishes and microwave uplinks. A backup unit stood ready to come on-line in a matter of seconds if the main unit failed.

Equipment provided ranged from tulip cranes and dolly to walkie talkies for the media and the Coast Guard, plus more than 40 monitors for David Wolper's opening ceremony.

Camera Mart has relocated to 1900 W. Burbank Blvd., Burbank, CA 91506. This division of Camera Mart/NY will be known as CMTV. It will have its own sales, rental and maintenance departments.

### Proposed merger of AMS and Calrec

A proposed merger between *AMS Industries plc*, Burnley, England, and *Calrec Audio Limited*, Hebden Bridge, England, has been announced. A meeting of

AMS shareholders was held Aug. 20 to consider the acquisition of all capital shares of Calrec.

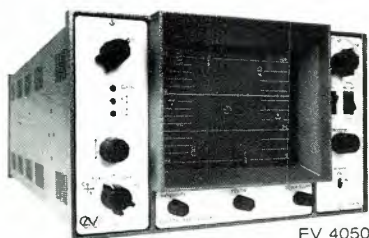
AMS and Calrec address the professional audio recording and broadcast marketplaces with different but complementary products. Both companies are involved in research and development of digital audio techniques. The merger would allow Calrec to relocate its operations to the new AMS headquarters 14 miles from Calrec's existing premises.

EMI Abbey Road Studios, St. John's Wood, London, has purchased a Calrec UA8000 music console for installation in studio 3. This console will be the first UA8000 supplied in England and also the first Calrec by AMS music console to be delivered. The desk is a 48-channel format and installation is scheduled for this month.

### Mitsubishi becomes limited partner

*Conus Communications*, Las Vegas, has announced that Mitsubishi will become a limited partner in Conus. Mitsubishi is involved in media and telecom-

## COMPONENT TELEVISION SIGNAL MONITOR



EV 4050

*PLUS* Vector display of  
color diff signals

- Multi-standard waveform monitoring
- Y, B-Y, R-Y / GBR / YIQ / NTSC
- 3 looping inputs plus ext ref
- Self-contained sequential switcher
- Individual or simultaneous monitoring of any 3 synchronous signals
- Parade or overlay display
- Expanded overlay allows timing measurements to 5ns resolution

## broadcast video systems ltd.

1050 McNicoll Avenue, Agincourt, Ontario M1W 2L8  
Telephone: (416) 497-1020 Telex: 065-25329

Circle (107) on Reply Card

**FREE 32pg Catalog & 50 Audio/Video Applic.**

PHONO, MIC, PWR SUPP. EQ, TRANS. ACN, TAPE, VIDEO, LINE, OSC

Stereo/Mono Pwr Ampl.

8-in/2-out, 12-in/4-out, 16-in/4-out

Video & Audio Dist Amps. TV Audio & Recd Prod Consoles

**OPAMP LABS INC (213) 934-3566**  
1033 N Sycamore Av LOS ANGELES CA, 90038

Circle (108) on Reply Card

**SESCOM, INC.**  
"the audio source"

FOR ALL OF YOUR AUDIO NEEDS

2100 Ward Drive Henderson, NV 89015 U.S.A.

CALL TO RECEIVE A COPY OF  
OUR POCKET-SIZED CATALOG

CATALOGS & ORDERS: (800)634-3457  
OTHER BUSINESS: (702)565-3400  
TWX(910)397-6996

Circle (109) on Reply Card

## CLEARLY SUPERIOR



ASK YOUR DEALER FOR A  
DEMONSTRATION OF THE FULL LINE OF  
STATUS DISPLAY MONITORS FROM

## Listec Video

- HIGH RESOLUTION
- ZERO CROSSTALK
- LOCK TO ANY SCAN FREQUENCY  
from 15.75 KHz (normal video)  
to 32 KHz (computers)

Available in:

- 9" and 12" sizes
- Rack Mounted or Stand Alone
- Amber, Green or White Phosphors

Distributed by

## Listec Video CORP.

30 Oser Ave., Hauppauge, New York 11788  
Telephone: (516) 273-3020  
Telex: 5106018234 Fax: (516) 435-4544

Circle (110) on Reply Card



# THE NEW TSM-60 WAVEFORM MONITOR & VSM-60 VECTORSCOPE



Both available in PAL and PAL-M standard.

## Simply the Best.

*Prove it, you say? Frankly, we welcome the opportunity.*

**Performance:** In frequency response tests, the TSM-60 Waveform Monitor is flat to 10 MHz and is as accurate at 20 MHz as most others at 5!

**Features:** The TSM-60, with its impressive array of standard features, is the only waveform monitor to offer both Line Select and selectable 1H/2H Display Modes.

**Delivery:** You don't have to wait months or even weeks for a waveform monitor or vectorscope.

Videotek sets the industry standard by consistently delivering in just days!

**Support:** If you ever need an answer or technical backup, you can count on us. Our "Distinguished Video Industry Service Award" attests to that.

**Value:** Compare Performance vs. Cost of the TSM-60 and VSM-60 to any others in our field, and you'll find none better.

*Need more proof? If so, we invite you to personally evaluate the TSM-60 Waveform Monitor and VSM-60 Vectorscope in your own facility. Contact your Authorized Videotek Dealer or the Videotek office nearest you, and we will arrange for you to prove to yourself what we mean by Simply the Best.*



**VIDEOTEK** INC.



munications-related projects in Japan, including a subsidiary, Space Communications Corporation, which will offer domestic telecommunication services to Japanese customers through its own satellite network. Through Mitsubishi, Conus hopes to export its products. Although no Ku-band broadcast satellites are presently in orbit over Japan, the first such satellite is scheduled for launch in 1988. It will be stationed in a geosynchronous orbit.

### **Audio Kinetics installs equipment**

*Audio Kinetics*, Borehamwood, Herts, England, has installed its Eclipse audio editor at the ITN studios in London. Other installations include five systems in Canada, including two at CFTO and one each at Service Audio Mixon, Pierre-Daniel Rheault and Pathe Films. Another system has been installed in Switzerland.

Audio Kinetics has also sold a Mastermix console automation system, for Audio International's 48-channel Cadac console. Olympic Studios has purchased its second Mastermix, for its 32-channel

Trident console at its new studio in Chelsea.

### **GEC receives order from Taiwan**

Three video conference studios have been ordered from *GEC Video Systems*, Port Chester, NY, by the Republic of Taiwan. Add-on equipment has also been ordered.

### **Advanced Video Systems is formed**

A new company, *Advanced Video Systems*, San Francisco, has been formed to provide video system consultation, design, installation, maintenance and repair, and documentation. The company is formed through the consolidation of Video Engineering Associates (VEA) and the Northern California Engineering Co-operative (NCEC).

### **Studer/Philips form joint CD venture**

A joint venture by *Studer*, Switzerland, and *Philips*, the Netherlands, encompassing research and development in CD

systems, has been established. The agreement specifies that each partner holds a 50% share in the new company, designated *Studer and Philips CD Systems AG*. The new company will be located in Regensdorf, Switzerland, with management formed on an equal share basis. Dr. Willi Studer will be chairman of the board, with Dr. Pieter Berkhout of Philips serving as managing director.

Also, *Studer Revox America* has moved its New York City field office to 161 Avenue of the Americas, Suite 901. The telephone number is the same.

### **Basys delivers newsroom systems**

*Basys*, Mountain View, CA, has received orders for three electronic newsroom systems. The BBC Television News signed a contract to buy a 100-plus terminal electronic newsroom system that began operation in October.

The Finnish Broadcasting Company (YLE) will install a Basys computerized newsroom system in its radio and TV operations, with the installation of 82 devices at YLE's Helsinki studios. More

# **F A R - R E**

## **Wireless mobility and the future of shotgun microphones.**

*Rapidly evolving film, ENG and EFP technologies demand accuracy, better sound and more. Beyer shotgun mics add the mobility of wireless to the longest available reach for new applications, new possibilities.*

*Beyer has developed a comprehensive system with the expanded versatility required of a modern shotgun. Our CK 706 and CK 707 shotgun capsules (part of the MCM condenser system) interface with the Beyer Wireless System. This true diversity system has totally reliable glitch-free signal scanning and virtually inaudible LN companding for unparalleled sonic integrity. The wireless option lets you work from the optimum position in relation to the source, to maximize S/N*

*ratios and minimize off-axis interference — without the hazards and inconvenience of long cable runs.*

## **Shotguns that stay with the source, even when far away.**

*The new performance standards implicit in the Beyer MC 736 short shotgun and MC 737 long shotgun (cabled) enable them to cope with the wide range of field conditions. Both are designed with extremely low self-noise (— 13 dB) and coloration for critical studio or location situations requiring absolute silence. Yet they can also withstand up to 135 dB as protection against radical surges in volume.*

*The MC 737's tight, highly directional lobe pattern and longer barrel provide the longest reach and highest sensitivity when isolating sources*

**ACCURACY IN AUDIO**



than 200 devices will be installed by 1989.

CKNW, a Vancouver radio station, has installed the Basys system to facilitate news broadcasts of the 1986 World Transportation and Communication Exposition.

### UEI consolidates

UEI, Kenley, England, has consolidated Link Electronics and Quantel in order to increase market penetration and efficiency of operations. Link's camera and other video product development and manufacturing will move to Newbury to integrate with Quantel's operation. Link's system business will remain at Andover and become a center for systems engineering and installations specializing in studio and OB vehicle design.

### Thomson receives equipment orders

Bonneville International Corporation's flagship station, KSL-TV, Salt Lake City, has purchased its second Vidifont V graphics and animation system from Thomson, Stamford, CT. The dual-chan-

nel system will be used both for internal production and by KSL-TV's Video West production division for animation of retail and corporate commercials. Thomson also has received from France an order for the TTV 1530 production camera.

### Otari forms support group

Otari Corporation, Belmont, CA, has formed an engineering support group. The group will study the applications of Otari's machines and orient them to fit the U.S. market, including the implementation of any machine modifications, design accessories, and software changes and updates. The group also will design quality control and service guidelines for new machines.

### WDR orders Neve mixing system

Neve Electronics, Bethel, CT, has delivered a DSP sound mixing system to WDR, a German broadcast network. The console will be installed in the concert hall of the new cultural center built by the city of Cologne.

### Brown Boveri delivers radio transmitter

BBC Brown, Boveri & Company, Baden, Switzerland, has supplied a 300kW medium-wave broadcast transmitter to Cameroon. The station was installed at Bamenda, the capital of Cameroon's northwestern province. Brown Boveri also supplied the omnidirectional antenna, the power equipment fed from the 30kV network and the standby generator.

### COMSAT designs satellite network

COMSAT Corporation, Washington, DC, has been awarded a 5-year contract by the United States Information Agency to design and implement for the Voice of America (VOA) a satellite network capable of interconnecting VOA broadcast stations around the world. COMSAT will provide four U.S. earth stations, operational in 1987, that will be used to transmit overseas VOA's daily radio broadcasts. VOA may also contract for two more U.S. earth stations and 16 new relay stations around the world.

1:~:~)))))

# A C H I N G



from long distances. To reduce off-axis coloration and low end distortion, the Beyer lobe pattern stays tighter in the critical region below 200 Hz. For even greater control, all of our shotguns are supplied with built-in bass rolloff filters and -12 dB attenuators. Exceptionally quiet at the critical outer limits of the lobe pattern, the MC 737 allows optimum signal to noise (74 dB) at the source point to further maximize the already extended reach of the microphone.

### Designs that perform with test bench accuracy in real world use.

Field production can test the will and the equipment with unfamiliar terrain and fast-changing atmospheric conditions. Beyer shotguns are constructed to new standards of ruggedness and reliability

to prevent downtime. Internal shock mounts reduce handling and boom noise. For maximum flexibility in the field, the MC 736 and MC 737 are phantom-powered and compatible with any source from 12 to 48V. Beyer's comprehensive line of pistol grips, windscreens and shock mounts meets any studio or remote miking situation.

European engineers already know about the expanded range and applications possibilities of Beyer shotguns. The best way for you to appreciate the advantages of a Beyer shotgun mic is to rent one.

Beyer Dynamic Inc., 5-05 Burns Avenue, Hicksville, NY 11801 (516) 935-8000

Canada: ElNova Ltd., 4190 Seré St., St. Laurent, Quebec, Canada H4T 1A6

England: Beyer Dynamic (G.B. Ltd), Unit 14, Cliffe Industrial Estate, Leaves BN8 6JL, England

Germany: Eugen Beyer Elektrotechnische, Fabrik GmbH & Co. Theresienstrasse 8, Postfach 13 20, D-7100 Heilbronn, West Germany, Tel: (07131) 617-0, Telex: 726771

**beyerbroadcast**))))



# New products

## Portable oscilloscope and picture monitor

Tektronix has introduced the following products:

- The 2225 dual-channel portable oscilloscope is the latest addition to the 2200 series. It features 50MHz bandwidth, alternate magnification, 500 $\mu$ V sensitivity, peak-to-peak auto trigger mode and high-frequency/low-frequency trigger filtering. The oscilloscope's TV trigger comes with the capability of selective triggering on TV lines or TV fields.
- The 651HR-C picture monitor combines a measurement quality decoder and direct component inputs, allowing the user to view picture quality before and after encoding to PAL. The monitor is compatible with RGB, SMPTE parallel, Betacam and M format. A front-panel switch allows the operator to monitor the working component analog format and to make comparisons of the same signal before and after passing through a PAL encoder.



Circle (350) on Reply Card

## Cartridge monitor



ITC/3M has introduced the DCM-1 dynamic cartridge monitor that continuously verifies audio broadcast cartridge performance before and during on-air broadcast. When used in conjunction with a station's cartridge machine system, the cartridge monitor assists in identifying worn out or problem cartridges so operators can remove them from an active library before they can fail on the air.

The monitor evaluates small changes in cartridge tape speed by monitoring a special reference tone located on a previously unused portion of the cue track. When speed changes, which are displayed on an LED indicator, reach a limit predetermined by the station, the operator can remove the cartridge from service.

Circle (351) on Reply Card

## Stereo cartridge recorder

Pacific Recorders & Engineering has introduced its stereo cartridge recorder to its MICROMAX Series.

The electronics feature: low-noise DC-servo feedback head preamplifiers, active audio/bias summing record head drivers that eliminate bias traps, adjustable record phase compensation, and CMOS control logic with replay lockout.

The compact stereo recorder comes equipped with the MAXTRAX half-track format tape heads that yield higher tape output and less tape noise. Optional NAB format quarter-track heads are available.

Circle (352) on Reply Card

## Broadcast transmitter

Broadcast Electronics has introduced the FM-30A single-tube, 30,000W FM broadcast transmitter. It uses the same folded half-wave cavity as the FM-30. This design eliminates plate-blocking capacitors and sliding contacts. Other features include: modular slide-out IPAs, automatic power control, and an air-cooling system. The transmitter also contains the provision to add the optional microprocessor video diagnostic system.



Circle (353) on Reply Card

## TV stereo test generator

RE Instruments has introduced the RE540 programmable TV stereo generator for testing the audio circuits of stereo TV sets conforming to the BTSC multichannel sound recommendation. The generator can produce a dbx-encoded stereo signal with greater than 60dB of separation and <0.03% distortion. Other features include: baseband RF outputs; SAP channels; programmable synthesized modulation sources for both main channels and SAP with distortion <0.03%; selectable noise reduction and pre-emphasis; composite video input for phase locking of pilot frequency; and multitone signal generation. All features are fully programmable via an IEEE-488 bus.

Circle (354) on Reply Card



### Spectrum analyzer

*Hewlett-Packard* has announced the HP 8590A portable RF spectrum analyzer with a 10kHz-1,500MHz range. The analyzer is fully programmable and has many of the data-processing and measurement functions of the HP 8568B. The analyzer is intended for bench applications in R&D and manufacturing, and for on-site measurements at remote locations. The analyzer has an optional cover that protects the front panel from dust, moisture and impact, and provides storage for the operating guide or a hand-held computer. The unit features dedicated pushbuttons and menu-labeled softkeys for manual operation.



Circle (355) on Reply Card

### Satellite video source identifier

*QSI Systems* has announced the Star-2400 satellite video source identifier. It uses the multiline technique and will display 24 characters consisting of the 10-digit telephone point-of-contact, transmitter license number, user alpha-numerics and a 2-digit operator number. The telephone and operator numbers are front-panel programmable with the remaining 12 characters programmed via internal DIP switches using the ASCII 64-character menu.

Circle (356) on Reply Card

### Monitoring system

*Marconi Instruments* has introduced a broadcast network monitoring system that offers an integrated system for monitoring TV and radio signal quality. Its modular design combines signal analyzers, audio and visual test insertion instruments, and switching and routing equipment. These are computer-controlled via the GPIB to allow system control from a central site. The system uses insertion test signals, added to the spare lines of TV transmissions to assess the quality of video signals. The system checks regularly acquired broadcast data and monitors signal loss every second.

Circle (357) on Reply Card

**Exclusive, triple patented dynamic cap and coil analyzing . . . guaranteed to pinpoint your problem every time or your money back**



**with the all new LC75 "Z METER 2"  
Capacitor Inductor Analyzer  
Patented \$995**

The "Z METER" is the only LC tester that enables you to test all capacitors and coils dynamically — plus, it's now faster, more accurate, and checks Equivalent Series Resistance (ESR) plus small wire high resistance coils.

**Eliminate expensive part substitution and time-consuming shotgunning** with patented tests that give you results you can trust every time. Test capacitor value, leakage, dielectric absorption, and ESR dynamically; with up to 600 volts applied for guaranteed 100% reliable results — it's exclusive — it's triple patented.

**Save time and money** with the only 100% reliable, in- or out-of-circuit inductor tester available. Dynamically test inductors for value, shorts, and opens, automatically under "dynamic" circuit conditions.

**Reduce costly parts inventory** with patented tests you can trust. No more need to stock a large inventory of caps and coils. The "Z METER" eliminates time-consuming and expensive parts substituting with 100% reliable LC analyzing.

**Turn chaos into cash** by quickly locating transmission line distance to opens and shorts to within feet, in any transmission line or cable.

**Test troublesome SCRs & TRIACs easily and automatically** without investing in an expensive second tester. The patented "Z METER 2" even tests SCRs, TRIACs, and High-Voltage Diodes dynamically with up to 600 volts applied by adding the new SCR250 SCR and TRIAC Test Accessory for only \$148 or FREE OF CHARGE on Kick Off promotion.

To try the world's only Dynamic LC Tester for yourself, CALL TODAY, WATS Free, 1-800-843-3338, for a FREE 15 day Self Demo.



**Call Today Wats Free 1-800-843-3338**

**SENCORE**

3200 Sencore Drive  
Sioux Falls, SD 57107  
605-339-0100 In SD Only

*innovatively designed  
with your time in mind.*

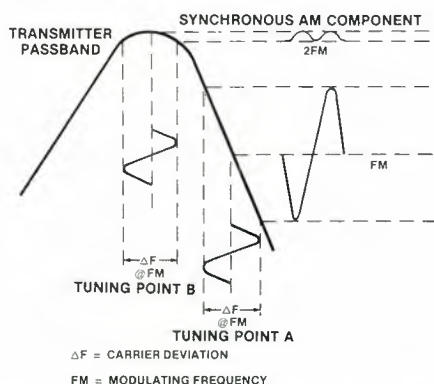
Circle (114) on Reply Card



## Corrections

The k factor or Boltzmann's constant relates molecular activity with temperature. The k relationship, discovered by the physicist Boltzmann, does include temperature in degrees Kelvin ( $^{\circ}\text{K}$ ). This led to some confusion in the September "Satellite Technology" column.

A typographical error was made on a diagram in the August "Circuits" column. The legends, *Tuning Point A* and *Tuning Point B* were transposed on Figure 1 (page 16). The corrected Figure 1 is shown below.



## Video packs

Kangaroo Video Products has introduced the KVP-25 case designed for the Sony BVW-25 Beta format recorder and the BVW-21 playback unit as well as Thompson models VT-624 and VT-626. Features include detachable Kangaroo Klips that offer versatility in organizing camera and microphone cables, and a combination pocket that holds up to three Beta cassettes or two cassettes and, in a padded section, a BP-90 battery. The case loads from the top and is cradle-designed to prevent the loss of the deck through the bottom of the case.



Circle (358) on Reply Card



## PATTERN WORK ....

In over a dozen years of providing formal directional patterns to both the FCC and DOC, Shively has never had a pattern rejected; ever. We've earned the trust of the industry in all aspects of pattern work. What are your requirements?

# Shively Labs

a division of Howell Laboratories, Inc.

51 Harrison Rd  
Bridgton, ME 04009  
(207) 647-3327

TWX-710-223-8910 SHIVELY BRGT  
call or write for more information

Circle (88) on Reply Card

## Nothing Comes Remotely Close SPECTRUM RPU LINKS



### TX FEATURES

- VHF & UHF Units
- 2-75 Watts
- Direct FM
- Front Panel Metering & Indicators
- Built-in AC Supply
- 12VDC Input or "Battery Backup"
- 19" Rack Mt. - Cabinets Available
- FCC Type Accepted. Parts 74, 90

### SCT500 RPU Transmitter

**The Spectrum SCR500 & SCT500 are a series of high performance broadcast quality RPU Receivers and Transmitters.** They incorporate the latest advances in solid state technology—brought about by Spectrum's more than a decade of experience in the two way radio field. These rugged units use the highest quality components & construction for high reliability in either fixed or mobile applications.

### RX FEATURES

- VHF & UHF Units
- High Sensitivity & Selectivity
- High Rejection of IMs & strong local signals
- 4 IF Bandwidths Available
- Very Low Distortion
- Full Panel Metering
- Built-in AC Supply
- Many Advanced Features



### SCR500M RPU RECEIVER



**SPECTRUM COMMUNICATIONS CORP.**

Call or Write for Details. Data Sheets & Prices  
1055 W. Germantown Pk. • Dept BE • Norristown, PA  
19403 • (215) 631-1710 • Telex: 846-211

Circle (89) on Reply Card





# Yamaha introduces microphones for every instrument we make. And the one we don't make.

Designed to reproduce both vocal and instrumental music, the MZ Series of professional microphones were a long time in the making.

For nearly 100 years, Yamaha has been building musical instruments. Everything from piccolos to grand pianos to synthesizers.

We took this musical heritage and combined it with our expertise in electronics and acoustic engineering. The result is a line of five microphones that, unlike others, go beyond mere transducers.

The diaphragms in the three MZbe models are the first to use beryllium. This rare metal's low specific gravity and exceptional rigidity permit an extended high frequency range for a sound that is both crisp and sweet at the same time.

A specially developed damping and three-point suspension system for long-term stability and durability is used throughout the line. As are gold-plated connectors.

But because of Yamaha's musical experience, the real accomplishment of our new microphones is certainly greater than the sum of the parts. You might even think of them as musical instruments in themselves.

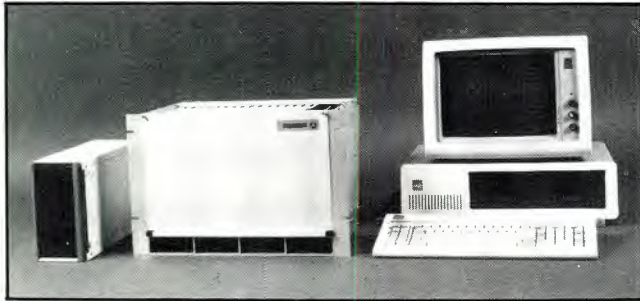
For complete information, write Yamaha International Corporation, Professional Audio Division, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Ave., Scarborough, Ont., M1S 3R1.



Circle (116) on Reply Card



## Digital slide store/paintbox



Thomson Video-Equipment has introduced the following products:

- The ANDI TTV 3100 digital slide store is a digital system for still-picture archiving, corresponding to digital broadcast standards and based on WORM-type laser recording techniques. A central unit stores pictures on-line or off-line and can transmit those pictures to local units for consultation or broadcast. The picture management system runs on IBM PC/AT or compatible and retrieval is possible through key words or by category.
- The MINIPAINT paintbox is an anti-aliasing system that reduces sawtooth lines when tracing curves and diagonals. Its workstation configures a graphics pad with an IBM PC compatible computer. The unit is appropriate for reproduction of

pastels, charcoal drawings, watercolors and transparencies.

Circle (359) on Reply Card

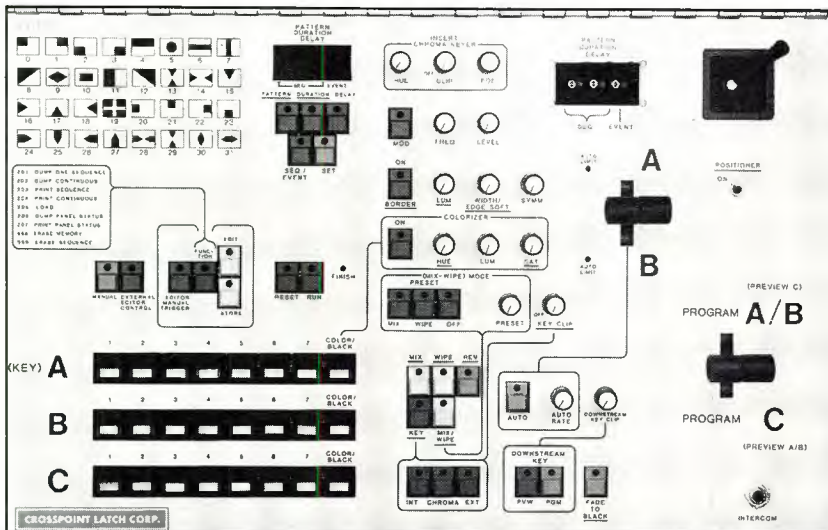
## Equipment protectors

MCG Electronics has introduced the Surge-Master Avalanche 3200A and 4200A series. Equipment damage is prevented by clamping ac line transients directly at the equipment input. The unit's backup consists of 2,000J of metal oxide varistors separated by a fuse. The varistors are in standby mode ready to protect equipment from a catastrophic power surge. The unit consists of matched, heavy-duty diodes to directly shunt transients around the sensitive load, in less than 1ns. The unit also employs a triple redundant approach.



Circle (360) on Reply Card

# HOW WOULD YOU LIKE THIS IN YOUR SWITCHER?



## Model 6109

32 PATTERNS  
PATTERN MODULATOR  
RGB CHROMA KEYER  
TRUE POSITIONER  
TWO FADER ARMS  
DOWNSTREAM KEYER  
FADE TO BLACK

\$7240

with options for  
SECOND CHROMA KEYER  
(RGB or Encoded)  
STEREO AUDIO MIXER  
GENLOCK SYNC GENERATOR

AND THE ABILITY TO UPDATE AT ANY TIME TO A POWERFUL PROGRAMMABLE AND EDITOR CONTROLLABLE SWITCHER WITH DISC STORAGE?

400 EVENT REGISTERS IN 100 PROGRAMMABLE SEQUENCES.

ALL ANALOG FUNCTIONS CAN BE PROGRAMMED FOR SMOOTH SIMULTANEOUS CHANGE.

**CROSSPOINT LATCH CORP.**

95 PROGRESS STREET • UNION, N.J. 07083 USA  
Country Code 1 • (201) 688-1510 • TELEX 132850

Circle (117) on Reply Card



# THE 81ST CONVENTION OF THE AUDIO ENGINEERING SOCIETY—

LOS ANGELES  
CONVENTION CENTER &  
THE LOS ANGELES HILTON



THE ONLY U.S. AUDIO  
EVENT OF 1986! EXHIBITS,  
WORKSHOPS, TECHNICAL  
PAPERS AND TOURS, & MORE.

THE AUDIO ENGINEERING SOCIETY  
50 EAST 42ND STREET — RM. 2520  
NEW YORK, NY 10165 (212) 661 2355

LOS ANGELES, CA.  
NOV. 12-16, 1986



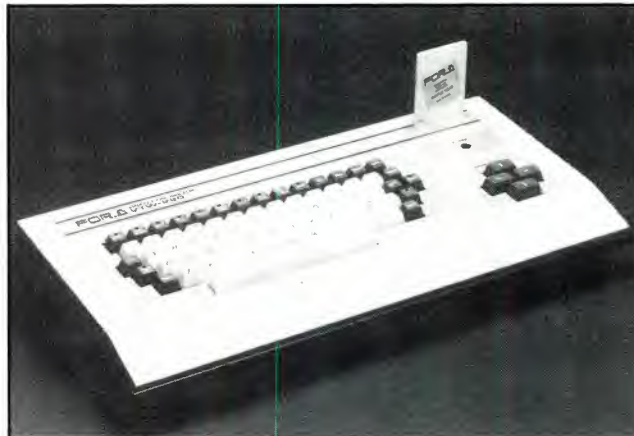
### Camera support



*Visual Departures* has introduced the Steadybag camera support. It combines the stability of a tripod with the flexibility of hand-held shooting. The beanbag support ensures steady imaging and balance on every surface in the studio or on location. It is lightweight and filled with polypropylene beads that are double bagged in a waterproof and spill-proof Parapac nylon casing. The fittings are made of non-scratch nylon. The bag is compatible with all ENG-EFP and film equipment.

Circle (361) on Reply Card

### Video character generator



*For-A* has introduced the VTW-220 video character generator with built-in performance. The unit integrates into any video system to produce characters in four different sizes. The character generator provides 512-color selection with a 14-color palette, character-by-character underline, 9-speed roll and crawl, adjustable matte, text-editing capabilities, 32-page memory, expandable to 64 pages, and an RS-232C port for computer interface.

Circle (362) on Reply Card

# The SSL Stereo Video System

## The Practical Standard For MTS Production

**Before and beyond the transmitter, Multichannel Television Sound is an art.** In the studio and post-production suite, the creative use of stereo can do as much or more than lighting, lensing, colour and video effects to give depth, impact and immediacy to the television picture. It quite literally adds an entirely new dimension to the viewing experience.

In stereo, television is a whole new ball game — or newscast, or series, or advert, or sitcom, or special. Because stereo is both natural and compelling, the programming possibilities are as broad as the imagination and skills of today's sound designers. Technical limitations and the constraints of time are the only obstacles. And that's where SSL can help.

Our SL 6000 E Series Stereo Video System handles complex MTS production with unrivalled ease and efficiency. Designed to simultaneously speed and enhance all aspects of television audio production,



the SL 6000 E Series makes innovative stereo programming practical on a daily basis.

Only SSL has triple stereo mix buses for stereo music, dialogue and effects, plus rapid mix-minus matrixing for Second Audio Program creation. Only SSL provides compressor/limiters, parametric equalizers, expanders and noise gates on every channel — plus balance and image width controls for all stereo sources. And only SSL provides such time-saving operational features as patch-free audio subgrouping and pushbutton signal processor routing. For post-production efficiency, even the multitrack electronics remotes are built right in. And that's just the new line standard equipment!



Options include Total Recall™ — an SSL exclusive, completely independent of the audio path, which allows any operator to recreate the most intricate console setups for any programme with rapid accuracy, week after week. Programmable dynamic stereo equalisation and panning may also be added, along with



### Condenser microphone

*Sennheiser Electronics* has introduced the MKH 20 P48 transformerless omnidirectional studio condenser microphone. Optimal resistive loading of the microphone diaphragm results in a highly linear frequency response and an inherent noise level. The microphone responds to both high and low sound pressure levels, and is suited for the reproduction of acoustic string and wind instruments.

Circle (363) on Reply Card

### Effects and animation stand

*Euro Equipment Service* has introduced the Magstand Automatic Plus 2 system. The dual- or simultaneous-use film and video stand is available with five stepping or five dc motors. The carriage itself has a maximum north/south movement of 400mm and an east/west range of 700mm. The stand is designed to take flip and circle elements and also can be equipped with an aerial image and can accommodate a black-and-white video camera for permanent monitoring. The stand is equipped with a floppy disk capable of storing a 20-minute real time program. The system also has 64K of free memory for special programs available from the custom-designed library.

Circle (364) on Reply Card

### DTMF remote control

*Monroe Electronics* has announced the 5001 DTMF remote

control that answers DTMF-coded inquiries and generates alarm reports in English using synthesized speech. The device monitors 16 on/off type logic inputs and controls 16 outputs through built-in Form C relays. Communication with the unit is through DTMF signals from any touch-tone telephone or over any other voiceband link equipped with a touch-tone keypad.



Circle (365) on Reply Card

### Wideband klystrons

*EEV* has introduced wideband, high-power TV klystrons and circuit assemblies covering the power range of 5kW to



multi-repeatable Events Control, Automatic Dialogue Replacement, and centralised command of up to five synchronised audio and video machines. All of this is thoroughly integrated with the SSL Studio Computer — the world's number one choice for mixing automation.

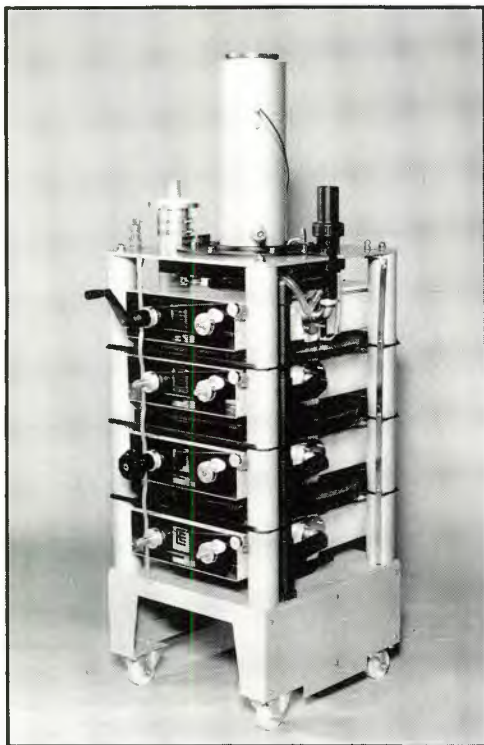
Best of all, the SSL Stereo Video System is not a hasty revamp of an old mono design. Nor is it an experimental project in search of a guinea pig. It is a practical, reliable international standard for advanced television audio production — proven in well over half a million hours of network and independent studio and mobile operation — in Great Britain, Japan, Germany, Scandinavia, Australia, Canada and all across the United States.

Take advantage of our experience. Call or write today for a free 40 page colour brochure describing the operation and applications of the SL 6000 E Series Stereo Video System. If your station or facility is contemplating an upgrade to full MTS production capabilities, we'll be happy to arrange a complete demonstration. And be sure to ask about our training programmes.

## Solid State Logic

Begbroke, Oxford, England OX5 1RU • (08675) 4353  
200 West 57th Street • New York, New York 10019 • (212) 315-1111  
6255 Sunset Boulevard • Los Angeles, California 90028 • (213) 463-4444  
Circle (120) on Reply Card





60kW at frequencies ranging from 470MHz to 860MHz. The klystrons use external cavities to cover the U.S. frequency range and offer simplified installation, easy tuning, and reductions in spares inventories. The klystrons feature a beam control device that enables operating efficiencies in excess of 70% to be achieved by pulsing the klystron.

Circle (366) on Reply Card

### ADP script archive system

*Dynatech NewStar* has introduced the attached database processor system (ADP). It was developed to augment NewStar by having database-oriented newsroom applications processed on a separate but attached computer. The ADP model 1 version is implemented on an IBM-PC/AT, and offers script archive, tape library and Rolladex applications.

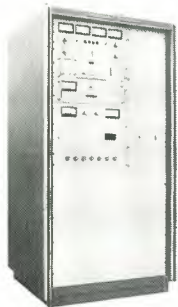
Circle (367) on Reply Card

### Pedestals and tripods

*Vinten* has introduced the following products:

- The MIDI PED is a lightweight pedestal. It incorporates an adjustable pneumatic center elevation column and can be separated into two units for portability. The center column can be pressurized to counterbalance pan and tilt heads and ENG/EFP cameras, and usually does not require external charging. Brake and friction controls also are incorporated. The tracking base provides two fixed positions for the column. The wheel units can be individually locked in position or all three can be locked for straight-line tracking.

## New Class A Winner



Continental's Type 814B 4.3 kW FM Transmitter uses the Type 802A Exciter to deliver a crisp, clean signal.

With an output of 4,300 watts, it has plenty of power reserve for Class A operation on a 2-bay antenna system. It's solid-state except for one 4CX3500A Tetrode in the final amplifier. A built-in harmonic filter is just one of many outstanding operating benefits. For a brochure, call (214) 381-7161. Continental Electronics, a Division of Varian Assoc., Inc. PO Box 270879 Dallas, Texas 75227.

Transmitters 1 to 50 kW AM and to 60 kW FM, FM antennas, studio & RF equipment. ©1986 Continental Electronics/6213



**Continental Electronics**  
a DIVISION OF VARIAN



Circle (130) on Reply Card

## We've taken apart half a million videocassettes and saved our customers 2 million dollars



Before we'll reload a 3/4" u-matic videocassette we take it completely apart and rebuild it inside and out. We replace wiper flaps, friction pads, tape guides and leader — everything that's needed to make the cassette test as good as new. Only then will we reload it with new 3 M videotapes or other major brands. If we can't rebuild it we won't reload it.

Coarc also loads new cassettes with broadcast quality videotape for Betacart and 3/4" cart systems.

**CoarcVideo**™

Custom Loaded Videocassettes (518) 672-7202  
P.O. Box 2, Route 217, Mellenville, New York 12544

3/4" RELOADING □ PROFESSIONAL VHS & BETA □ 1/2" AND 3/4" CART CASSETTES

Circle (121) on Reply Card

## PRECISION MAGNETIC TEST TAPES



Standard Tape Laboratory, Inc.  
26120 Eden Landing Road #5, Hayward, CA 94545  
(415) 786-3546

Circle (122) on Reply Card

Reconfirm your involvement  
in the  
broadcast industry!  
Renew your subscription  
today.



- The Vision range consists of three tripods and three pan and tilt heads designed for ENG and EFP use. It incorporates calibrated fluid drag control, external rotary control to give balance through 180° of tilt, and pan and tilt brakes. The tripods consist of ENG models in both 1- and 2-stage formats and an EFP 2-stage tripod.



Circle (368) on Reply Card

#### Aural modulator

ITS has announced the ITS-27 aural IF modulator. It is designed to convert the RCA G-line VHF transmitter for stereo and multichannel TV sound. The product is housed in a single 19-inch rack-mount tray. It contains a 41.25MHz IF oscillator that is modulated by incoming audio and subcarriers. The oscillator is phase-locked to the G-line via a 10MHz reference input that comes from the transmitter. This maintains the 4.5MHz aural to visual separation. The aural IF output connects to a BNC connector on the existing exciter, and the modulator becomes the aural IF source.

Circle (369) on Reply Card

#### Lenses

Fujinon has introduced the A15 x 8ESM and A18 x 8ESM studio zooms and offers modular design concepts in 3/8-inch formats, resulting in improved performance, reduced size and weight and increased reliability and serviceability. Major components are modular and interchangeable. Controls and adjustments, accessible with the shroud in position, include back-focus adjustment and lock, servo/manual switch for the built-in 2X extender, pattern projector color levels and chart

## Perfect Timing

### CLOCKS AND TIMERS

FROM \$174



TO \$495



(213) 322-2136

142 Sierra Street, El Segundo, CA 90245

Circle (124) on Reply Card



# OUR FM MONITOR DESERVES A SECOND GLANCE.

BUT IT DOESN'T NEED IT.

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

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

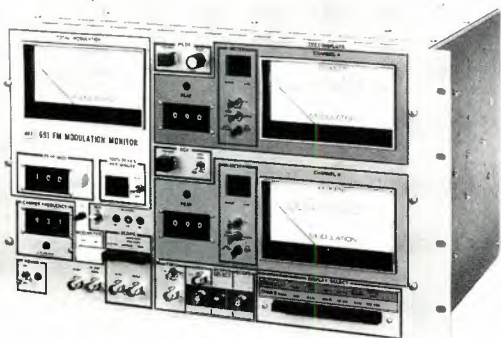
Other benefits of the 691 include over 40 proof-of-performance and signal quality measurements. Add a scope and use the 691 as a spectrum analyzer . . . or get a vector display of L/R phasing. Perform a Bessel-Null calibration in minutes. Measure clipped composite accurately and quickly.

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

## QEI Corporation

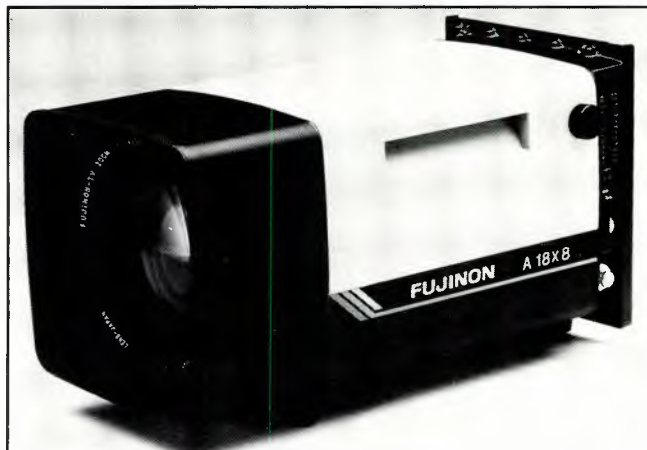
One Airport Drive □ P.O. Box D  
Williamstown, NJ 08094 □ (609) 728-2020

Call Toll Free (800-334-9154)



Circle (125) on Reply Card

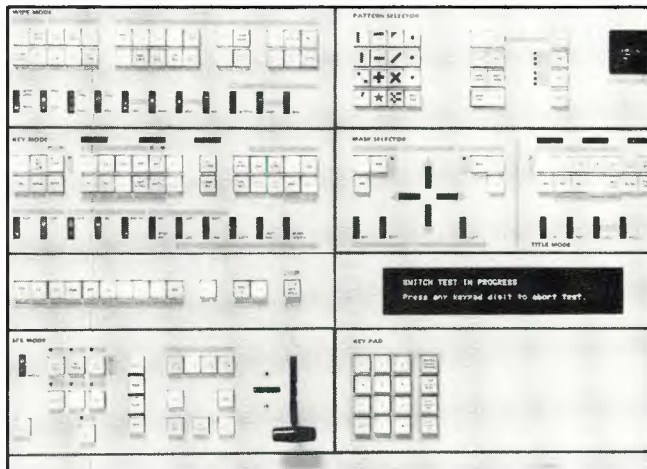
positioning, and tally light switch. LEDs on the side of the lenses provide information such as focal height and aperture.



Circle (370) on Reply Card

### Video production switcher

*Central Dynamics* has introduced the Strata-7, a 7-signal level processor that uses microprocessor control to process up to seven different video levels simultaneously. The unit features a range of key title level source and level modifiers, plus fill selection. Other features include: level priority transitions; five transition linearity modes; three full-facility pattern generators; 10 matte generators; four mask generators; two independent, full-facility, 1- to 4-line analog keyborder generators addressable to four levels; review selector; and RS-422 communication.



Circle (371) on Reply Card

### Gain control amplifier

*Leaming Industries* has announced the AGC622 audio automatic gain control amplifier. It is designed to maintain average program levels within a reasonable range without reducing the dynamic range to the extent that quiet passages are no longer quiet and loud passages are no longer loud. The amplifier includes a gated-chain compressor and a peak limiter. When the program level falls over 20dB below normal, the compressor assumes that there is a pause in the program and holds its gain setting for 10 seconds. If the program level has not come back above the threshold after 10 seconds, the compressor slowly resets its gain to 0dB. The limiter is



used to keep sudden peaks from causing overmodulation. The AGC may be defeated for testing by a front-panel switch, or remotely. There are two pairs of left and right inputs (A and B) that may be selected by remote or local control. The stereo synthesizer may be activated by selection of input B. Up to three amplifiers may be mounted in one PMS600 19-inch rack-mounting frame.

**Circle (372) on Reply Card**

### Battery accessories



Anton/Bauer has introduced the following products for use with video cameras:

- The DataTap measures and displays camera power consumption, permitting full discharge of a battery. The system sandwiches between the camera snap-on bracket and battery. The LCD readout displays ampere-hours consumed.
- The ADM (automatic discharge module) fully discharges any 12V to 14V snap-on battery, ProPac 90 VTR battery and the PowerStrap. It is equipped with a dc output for optional digital voltmeter/chart recorder to detect shorted or low capacity cells. ADM's load device and automatic cutoff circuit takes batteries through a full discharge cycle.
- The PowerStrap is a 12V, 4AH battery strap. It is designed for use with all portable video recorders and low-voltage lighting equipment. The unit mounts directly to the existing VTR shoulder strap or can be worn as a conventional belt.
- The 1-hour Mobile Fast Charger (MFC) provides overnight charge capability from most vehicles with or without the engine running. An integral protection circuit disconnects the charger from vehicle power if the voltage drops below 10.5Vdc. The MFC is a single-position charger that accepts all 12V to 14V snap-on and VTR nicad batteries and operates on 11V to 18V input.

**Circle (373) on Reply Card**

### Switch matrix

ADM Technology has introduced the RM1010 active switch



# IN SEARCH OF EXCELLENCE.

Long before it was a popular management theory, broadcasters were searching for excellence. Excellence of Sound.

The search is still on, but the goal is now within the reach of every FM broadcaster.

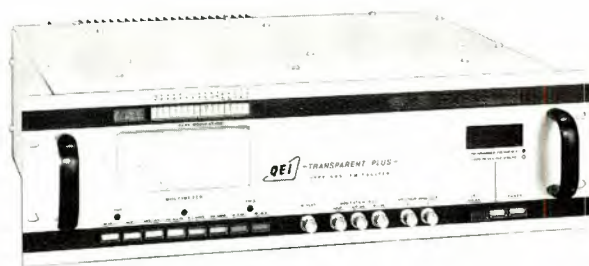
The 695 is an exciter without equal . . . in quality sound . . . in versatility . . . and in value. Any type of distortion you can name (THD, TIM, IMD) is less than .025 percent. This isn't an environmentally controlled lab figure, but rather one that is measurable over the operating temperature range of the equipment. Moreover, noise is so low that it's virtually impossible to measure.

QEI's 695 offers features that the competition has never even dreamed of. A peak counter with LED display, modulation measurements on the front panel, and a measurements grade linear demod built in. It is synthesized, has wideband circuitry, a 3-color LED bar graph for modulation display, a 10-position meter, and many other features that are best described in our new brochure.

For more information on QEI and the 695 Exciter just write or call us. You'll see why our search for excellence has produced the best value on the market today.

## QEI Corporation

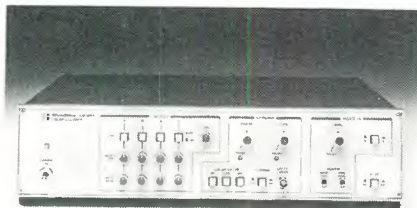
One Airport Drive P.O. Box D  
Williamstown, NJ 08094 (609) 728-2020



**Circle (126) on Reply Card**



# THE TRUE MEASURE OF PERFORMANCE



## ASACA/SHIBASOKU CD10A1 Color Decoder

The CD10A1 is the New World Standard Color Decoder for use with all systems to decode a composite signal to RGB.

- Switchable Comb Filter.
- Color is demodulated on the I & Q Axes.
- 2 signal inputs selectable from the front panel.
- Alarm indication when the signal is higher or lower than the rated value.
- Sync may be independently added to R,G,B, and Y output signals.
- 10 Output signals are available: RGB, Y, I,Q,R-Y,B-Y, Blanking, Burst Flag, Sync, Sub Carrier, and Y + Sync.
- Available in NTSC, PAL, SECAM.

Measure your performance with the best.

**ASACA/SHIBASOKU CD10A1.**  
The color decoder with character.

For complete specifications, write:



ASACA/SHIBASOKU CORP.  
OF AMERICA  
12509 Beatrice Street, Los Angeles,  
California 90066  
Sales, Service:  
(800) 423-6347 • (213) 827-7144

Circle (127) on Reply Card

matrix. It is designed to select the audio track output of any 2-channel source and distribute the output as a stereo signal. The matrix includes a selection of left only, right only, stereo or mono. A left channel phase reverse switch has been added to solve the mono sum problem associated with out-of-phase stereo program material. The matrix includes a stereo monitor circuit that consists of stereo analog metering, a line level monitor output with level control and a stereo head-phone jack.

Circle (374) on Reply Card

## Digital storage oscilloscope

*Kikusui International* has introduced the COM 7101 4-channel, dual-time base, digital storage oscilloscope. It features a 50Ms/per second sampling rate, digitizing of 100MHz repetitive signals, 20MHz transient capture, full CRT readout, and front-panel control. Standard equipment includes the 7101 built-in, bi-directional GPIB interface bus. The unit is suited for waveform analysis in production, field service, engineering, ATE and R&D environments. The oscilloscope has no keyboards and there are no menus. Other features include an on-screen DVM and frequency counter. The scope also doubles as a full-feature 100MHz analog oscilloscope.

Circle (375) on Reply Card

## Tripod cases and chart



*Nalpak Video Sales* has introduced the following products:

- The Tripaks are a line of rotationally molded tripod cases and light stands. There are three heights in the 11-inch diameter from 23 inches to 49 inches; four heights in the 9-inch diameter from 26 inches to 52 inches. The cases are molded from crosslinkable polyethylene and they include twin handles, telescoping caps and a roll resistant shape.
- The Mini-Chart consists of a color reference chart, registration chart and logarithmic reflectance chart in a 4½" x 6" size in a spiral bound book.

Circle (376) on Reply Card

## Personal computer/archiving system

*Basys* has introduced the following products:

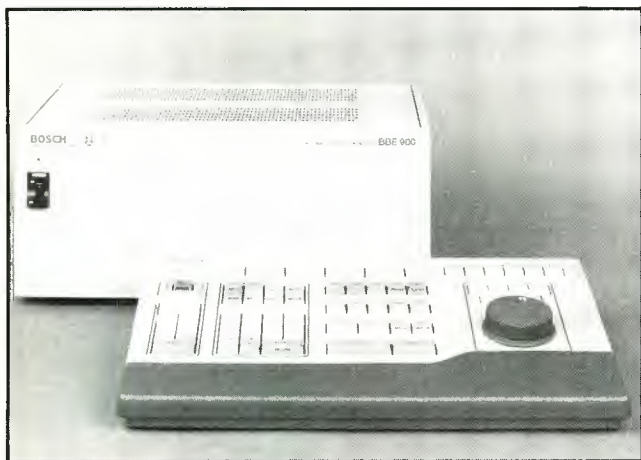
- The BRAT, a high-performance PC AT with 1Mb of internal memory and up to an 85Mb Winchester disk drive. The PCs will be linked via Ethernet for complete fault tolerance in both data and hardware. The network also will be used to support concentrators that will provide an extra eight serial ports for each CCU added.



- An on-line archiving system that provides TV and radio newsrooms with high-speed access to their own library of data. Material can be fed in at archive terminals or transmitted from the newsroom system and automatically indexed. Searches can be performed involving logical operators, date ranges, alphanumeric ranges and precedent, and can be done from terminals on the newsroom system. Access also can be restricted by user or terminal. Storage capacity can be expanded by boosting disk capacity or with expansion units.

Circle (377) on Reply Card

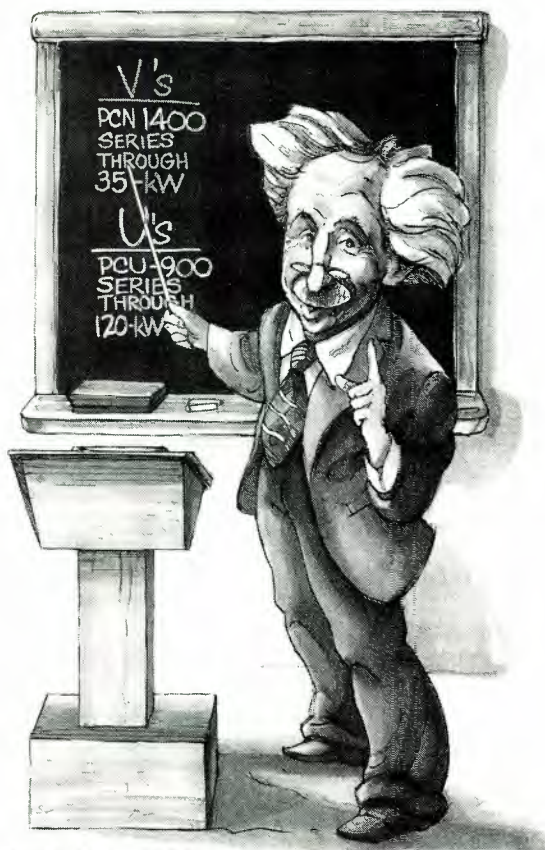
### Recording equipment/editing system



BTS has introduced the following products:

- BCB 21 is a compact and lightweight field player with a versatile power supply. Features include search mode with monochrome picture, available at  $\pm 3.5$  times normal speed; 2-channel audio with noise reduction; optional time-code reader; and plug-in RF modulator.
- BCB 25 portable Betacam recorder/player has all the features of the BCB 21 plus composite and component input/output, built-in time-code generator/reader and external TBC connection. Back-space editing gives continuous recording without a picture break-up at the transition point.
- BCB 15 player is a studio component for the recorder camera family. It offers built-in EBU/SMPTE time-code reader, color composite video signal, component signal and compressed time division multiplex, and still-frame picture capability.
- BCB 40 recorder/player has built-in editing allowing insert and assemble edits to be performed in video, audio 1 and 2 and time code; automatic edit simulation; and edit monitoring. The unit also has a time base corrector and a built-in EBU/SMPTE time-code generator/reader.
- KCB 1 is a combination of KCF 1 color camera and a recorder. The camera is equipped with three  $\frac{1}{2}$ -inch Plumbicon pickup tubes. The component signal recording system consumes only 10W of power and has a maximum of 36 minutes recording time. Features include EBU/SMPTE time-code generator, independent time-code track, two audio channels with noise reduction and automatic assembly editing.
- BBE 990 is a post-production editing system. Up to four VTRs can be controlled in an A/B roll edit. Any VTR can be controlled while an automatic event involving the other VTRs is taking place.

Circle (378) on Reply Card



## AT NEC, WE REALLY KNOW OUR V's AND U's

*A worldwide leader ought to know how to put state-of-the-art television transmitter technology to work. That's why NEC transmitters are installed in over 1400 locations all over the globe. NEC's full line of VHF and UHF transmitters feature high performance exciters, a remarkable 30% reduction in exciter parts (meaning a 50% improvement in MTBF — 30,000 hours). 100% solid state to 10 kW (UHF/VHF); only one tube to 35 kW (VHF), broad power output ranges and a design that accepts stereo — without modification. For transmitter technology that's sure to stimulate your imagination, look to a leader. NEC.*

# NEC

IMAGINE WHAT WE'LL DO FOR YOU

**C&C** COMPUTERS AND COMMUNICATIONS

NEC AMERICA, INC., Broadcast Equipment Division  
1255 Michael Drive, Wood Dale, IL 60191  
Toll free 1-800-323-6656 In Illinois 312-860-7600

Circle (128) on Reply Card



|                                      | Page<br>Number | Reader<br>Service<br>Number | Advertiser<br>Hotline |                                  | Page<br>Number | Reader<br>Service<br>Number | Advertiser<br>Hotline |
|--------------------------------------|----------------|-----------------------------|-----------------------|----------------------------------|----------------|-----------------------------|-----------------------|
| Abekas Video Systems                 | 7              | 7                           | 415/571-1711          | Marconi Communications Systems   |                |                             |                       |
| ADM Technology, Inc.                 | IFC            | 1                           | 313/524-2100          | Ltd.                             | 115            | 64                          |                       |
| Alpha Audio                          | 124            | 74                          | 804/358-3852          | MCL, Inc.                        | 122            | 71                          | 312/354-4350          |
| Amber Electro Design Inc.            | 98             | 52                          | 514/735-4105          | Microdyne Corp.                  | 155            | 96                          | 904/687-4633          |
| Amherst Electronic Instruments, Inc. | 132            | 81                          | 413/268-7204          | Midwest Communications           |                |                             |                       |
| Ampex Corp. (AVSD)                   | 44-45          | 28                          | 415/367-2911          | Corp.                            | 1              | 3                           | 800/543-1584          |
| Ampex Corp. (MTD)                    | 31             | 18                          | 415/367-3809          | Mitsubishi International Corp.   | 85             | 41                          | 415/651-9931          |
| Angenieux Corp. of America           | 92             | 48                          | 305/595-1144          | Moseley Associates Inc.          | 108            | 113                         | 806/968-9621          |
| Anton/Bauer Inc.                     | 131            | 80                          | 203/929-1100          | National Video Service           | 86             | 43                          | 415/846-1500          |
| Arrakis Systems, Inc.                | 21             | 13                          | 303/224-2248          | NEC America Inc.                 | 83             | 39                          | 800/323-6656          |
| Asaca/Shibasoku Corp. America        | 190            | 127                         | 800/423-6347          | NEC America Inc.                 | 191            | 128                         | 800/323-6656          |
| Audio Precision                      | 42             | 26                          | 800/231-7350          | Neve, Inc.                       | 147            | 92                          | 203/744-6230          |
| Audio-Technica U.S., Inc.            | 125            | 75                          | 215/443-0330          | Northwest Broadcast Lab          | 108            | 113                         | 806/968-9621          |
| Barco Industries, Inc.               | 166            | 105                         | 408/370-3721          | Odetics, Inc.                    | 113            | 62                          | 800/243-2001          |
| Beyer Dynamic Inc.                   | 170-171        | 112                         | 516/935-8000          | Opamp Labs Inc.                  | 168            | 108                         | 213/934-3566          |
| Boonton Electronics Corp.            | 123            | 72                          | 201/584-1077          | Orban Associates Inc.            | 17             | 12                          | 800/227-4498          |
| Broadcast Video Systems Ltd.         | 168            | 107                         | 416/697-1020          | Orban Associates Inc.            | 116            | 65                          | 800/227-4498          |
| BTS Broadcast TV Systems GmbH        | 127            | 76                          | 201/529-1550          | Otari Corp.                      | 15             | 11                          | 415/592-8311          |
| C.O.A.R.C.                           | 186            | 121                         | 518/672-7202          | Pacific Recorders & Engineering  |                |                             |                       |
| Canon USA Inc., Broadcast Lens       | 27             | 15                          | 516/488-6700          | Corp.                            | 128            | 79                          | 619/438-3911          |
| Canon USA Inc., Broadcast Lens       | 107            | 58                          | 516/488-6700          | Paco Electronics                 | 100            | 54                          | 213/747-6540          |
| Centro Corp.                         | 29             | 17                          | 619/560-1578          | Panasonic                        | 40-41          | 25                          | 201/348-7336          |
| Centro Corp.                         | 89             | 45                          | 619/560-1578          | Panasonic                        | 164-165        | 104                         | 201/348-7336          |
| Chyron Corp.                         | 81             | 37                          | 516/249-3018          | PESA                             | 129            | 118                         | 800/872-7372          |
| Chyron Corp.                         | 109            | 59                          | 516/249-3018          | Philips Test and Measuring       |                |                             |                       |
| Chyron Corp.                         | 103            | 56                          | 516/249-3018          | Instruments                      | 134            | 83                          | 201/529-3800          |
| Cipher Digital Group                 | 162            | 102                         | 301/695-0200          | Polaroid Corp.                   | 144-145        | 91                          | 800/225-1618          |
| Circuit Research Labs, Inc.          | 13             | 10                          | 800/535-7648          | Polyline Corp.                   | 86             | 42                          | 312/297-0955          |
| Comsat General Corporation           | 182-183        | 119                         | 202/863-7326          | Potomac Instruments              | 80             | 36                          | 301/589-2662          |
| Continental Electronics,             |                |                             |                       | QEI                              | 188            | 125                         | 800/334-9154          |
| Div. of Varian                       | 186            | 130                         | 214/381-7161          | QEI                              | 189            | 126                         | 800/334-9154          |
| Crosspoint Latch Corp.               | 176            | 117                         | 201/688-1510          | Quantel                          | 167            | 106                         | 415/856-6226          |
| Data Check Corp.                     | 32             | 19                          | 619/578-0101          | RAKS                             | 23             | 14                          | 201/438-0119          |
| Datatek, Inc.                        | 101            | 55                          | 201/654-8100          | Ramsa/Panasonic                  | 91             | 47                          |                       |
| Datum Inc.                           | 82             | 38                          | 714/533-6333          | Richardson Electronics Inc.      | 99             | 53                          | 800/323-1770          |
| Dialight Corporation                 | 121            | 70                          | 201/223-9400          | RTS Systems, Inc.                | 156            | 97                          | 818/843-7022          |
| Digital Video Systems Div.           | 128            | 78                          | 416/299-6888          | SCIP Electronic Systems          | 160            | 100                         | 213/454-1889          |
| Dubner Computer Systems              | 9              | 8                           | 201/592-6500          | Sencore                          | 173            | 114                         | 800/843-3338          |
| Dynair Electronics Inc.              | 141            | 87                          | 619/263-7711          | Sescom, Inc.                     | 168            | 109                         | 800/634-3457          |
| EEV, Inc.                            | 105            | 57                          | 914/592-6050          | Shively Labs                     | 174            | 88                          | 207/647-3327          |
| EG&G Electronic Components           | 84             | 40                          | 617/944-0634          | Shure Brothers Inc.              | 11             | 9                           | 312/866-2553          |
| ESE                                  | 187            | 124                         | 213/322-2136          | Shure Brothers Inc.              | 114            | 63                          | 312/866-2553          |
| Gentner Engineering Co., Inc.        | 28             | 16                          | 801/268-1117          | Solid State Logic                | 184-185        | 120                         | 212/315-1111          |
| Gentner RF Products Div.             | 110            | 60                          | 801/268-1117          | Sony Corp of America (A/V &      |                |                             |                       |
| Graham-Patten Systems Inc.           | 142            | 115                         | 916/273-8412          | Pro Aud)                         | 138-139        | 85                          |                       |
| Grass Valley Group, Inc.             | 118            | 67                          | 916/273-8421          | Sony Corp of America (Broadcast) | 34-35          |                             |                       |
| Gray Engineering Laboratories        | 118            | 68                          | 912/883-2121          | Sony Mag. Tape Div.              | 159            | 99                          |                       |
| Hannay Reels                         | 78             | 33                          | 518/797-3791          | Sound Technology                 | 47             |                             | 408/378-6540          |
| Hewlett Packard                      | 117            | 66                          | 800/556-1234          | Spectrum Communications          | 174            | 89                          | 215/631-1710          |
| Hipotronics, Inc.                    | 140            | 86                          | 914/279-8091          | Standard Tape Laboratory, Inc.   | 186            | 122                         | 415/786-3546          |
| Hitachi Denshi America Ltd.          | 3              | 4                           | 800/645-7510          | Studer Revox America Inc.        | 79             | 35                          | 615/254-5651          |
| Howe Audio                           | 90             | 46                          | 800/525-7520          | Studer Revox America Inc.        | 77             | 34                          | 615/254-5651          |
| IGM Video                            | 133            | 82                          | 405/232-5808          | Surcom Associates Inc.           | 160            | 123                         | 619/722-6162          |
| Ikegami Electronics Inc.             | 43             | 27                          | 201/368-9171          | Switchcraft Inc.                 | 148            | 93                          | 312/792-2700          |
| Ikegami Electronics Inc.             | 137            | 131                         | 201/368-9171          | TASCAM Div. Teac Corp. of        |                |                             |                       |
| Ikegami Electronics Inc.             | 87             | 44                          | 201/368-9171          | America                          | 97             | 51                          | 213/726-0303          |
| Intergroup Video Systems Inc.        | 111            | 61                          | 800/874-7590          | Tektronix Inc.                   | 95             | 50                          | 800/452-1877          |
| Intl. Tapetronics Corp./3M           | 119            | 69                          | 800/447-0414          | TFT, Inc.                        | 161            | 101                         | 408/727-7272          |
| Intl. Tapetronics Corp./3M           | 37             | 22                          | 800/447-0414          | Thomson-CSF Broadcast            | 153            | 95                          | 203/965-7000          |
| JamPro Antennas Inc.                 | 36             | 21                          | 916/383-1177          | Thomson-CSF/DTE                  | 74-75          | 32                          |                       |
| JBL Professional                     | 143            | 90                          | 818/893-8411          | Thomson-CSF/LGT                  | 163            | 103                         |                       |
| JVC Company of America               | 49-56          | 30                          | 800/582-5825          | Total Spectrum Manufacturing,    |                |                             |                       |
| JVC Company of America               | 57-63          |                             | 800/582-5825          | Inc.                             | 38             | 23                          | 914/358-8820          |
| JVC Company of America               | 65-72          |                             | 800/582-5825          | Transtector Systems              | 151            | 94                          | 800/635-2537          |
| Laird Telemedia                      | 157            | 98                          | 801/972-5900          | Utah Scientific Inc.             | 135            | 84                          | 800/453-8782          |
| Leader Instruments Corp.             | 5              | 5,6                         | 800/645-5104          | Varian                           | 33             | 20                          | 415/592-1221          |
| Leitch Video of America, Inc.        | 93             | 49                          | 804/424-7290          | Videotek, Inc.                   | 169            | 111                         | 602/997-7523          |
| Lerro Electrical Corp.               | 19             |                             | 215/233-8200          | Ward-Beck Systems Ltd.           | BC             |                             | 416/438-6550          |
| Listec Corp.                         | 168            | 110                         | 516/694-8963          | Wheatstone Broadcast Group       | IBC            | 2                           | 203/393-0887          |
| MCG Electronics, Inc.                | 73             | 31                          | 516/586-5125          | Winsted Corp.                    | 124            | 73                          | 800/328-2962          |
| Magni Systems, Inc.                  | 39             | 24                          | 503/626-8400          | Yamaha International Corp.       | 175            | 116                         |                       |



**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

**STEIGER, HURRAY &  
ASSOCIATES INC.**  
CONSULTING ENGINEER SERVICES  
6816 Westview Drive  
Cleveland, OH 44141  
(216) 526-7187

**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  
206 North Bergan  
Peoria, Illinois 61604  
(309) 673-7511  
Member AFCCE

**Radiotechniques**  
RADIO CONSULTING ENGINEERS  
STATION DESIGN AND SERVICE  
ELECTRONIC PRODUCT DESIGN  
Edward A. Schober, P.E.  
402 Tenth Avenue, Haddon Heights, NJ 08035  
(609) 546-1841

**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

**LAWRENCE L. MORTON  
ASSOCIATES**  
21671 SUPERIOR LANE  
LAKE FOREST, CALIFORNIA 92630  
**LAWRENCE L. MORTON, E.E.**  
AM • FM • TV  
APPLICATIONS • FIELD ENGINEERING  
ANTENNA BROADBANDING FOR AM STEREO  
(714) 859-6015

**American Tower &  
Communications**  
1. SALES  
2. Tower erection  
3. Maintenance  
4. World wide services  
B'ham, Alabama (205) 854-9866

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.**  
(313) 562-6873

**SELLMEYER & KRAMER, INC.**  
CONSULTING ENGINEERS  
J.S. Sellmeyer, P.E., S.M. Kramer, P.E.  
AM FM TV MDS ITFS LPTV CATV  
APPLICATIONS • FIELD ENGINEERING  
P.O. Box 841 McKinney, TX 75069  
(214) 542-2056

**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. EFF. EDIT  
SYSTEMS, MONITORS, TEST EQUIP. SONY, JVC,  
PANASONIC, TEKTRONIX — UPS & AIR FREIGHT.  
PUDEL 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

**MEDIA COMMUNICATIONS, INC.**  
COMPLETE ENGINEERING NEEDS  
Allocations • AM, FM, LPTV  
FCC Information  
P.O. Box 37732/Shreveport, LA  
71133-7732  
Phone (381) 746-4332

**Why not run your business  
card here?**  
Only \$65 per insertion.  
Frequency discounts available.  
Call 913/888-4664

**Why not run your business  
card here?**  
Only \$65 per insertion.  
Frequency discounts available.  
Call 913/888-4664

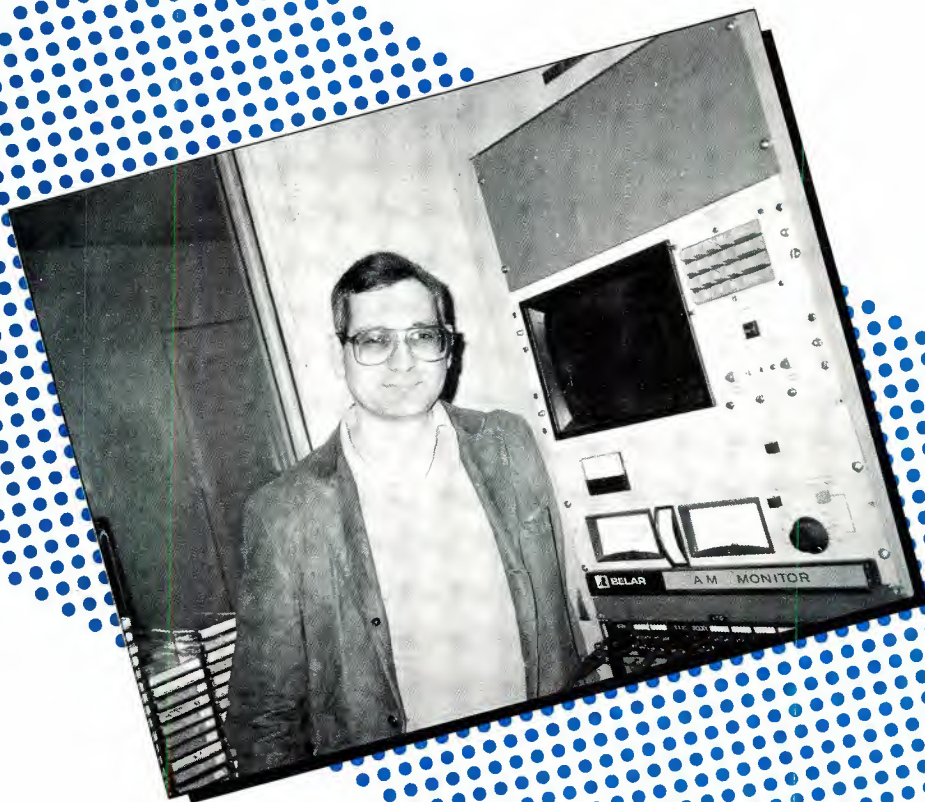
HOW SAFE IS YOUR TOWER?  
  
**Alpha Tower Design, Inc.**  
901 Waterfall Way, Richardson, Texas 75080  
214-783-2578  
STRUCTURAL ENGINEERS SPECIALIZING IN TOWER DESIGN  
REGISTERED TO PRACTICE IN 49 STATES...THREE DIMEN-  
SIONAL COMPUTER ANALYSIS WITH LATEST DESIGN TECH-  
NOLOGY...INSPECTION & REVIEW TOWER MODIFICATIONS

**Why not run your business  
card here?**  
Only \$65 per insertion.  
Frequency discounts available.  
Call 913/888-4664

**Why not run your business  
card here?**  
Only \$65 per insertion.  
Frequency discounts available.  
Call 913/888-4664

**Why not run your business  
card here?**  
Only \$65 per insertion.  
Frequency discounts available.  
Call 913/888-4664





"I regularly remove technical articles from broadcast magazines and file them in my PC's database for future research and reference.

So far, the articles I have saved run three to one in favor of *Broadcast Engineering*!

Barry A. Chickini  
Chief Engineer  
Radio Station WTIK  
New Orleans, LA

**BROADCAST**  
engineering



# 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

**VACUUM TUBE REMANUFACTURING**—Save 60. Longer life. Better performance. We specialize in Transmitting Tubes, Vacuum Capacitors, Power Tubes. All major types. Write or call: FARADEX ELECTRONICS COMPANY, 150 Main Street, Port Washington, New York 11050, (516) 775-7838. 8-86-6t

**3-D TELEVISION**,—true stereographic NEW! LeaVision tm-over/under (not red/blue). Viewers, consulting, lens rental. Info-SASE. DEMO (VHS/BETA)®photo® viewers-\$29.95 • \$2 S&H. TVLI-BE, CS3030 Lindenhurst, NY 11757 (516) 957-4393 (212) 245-6119. 9-86-tfn

**TRANSMITTER TUBE REBUILDING SINCE 1941:** 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. FREELAND PRODUCTS CO., 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

**FOR SALE: VIDEO EQUIPMENT**—Ditech 40x60 three level routing switcher, Convergence 204 editing system, two Phillips LDK-25 cameras with Angenieux 14x1 lenses, Sony BVP-330 camera with Fujinon 14x1 lens, Quantum Q-8P audio console. Call Mark Piechan at (313) 548-2500. 10-86-3t

**FOR SALE: R.C.A., BRAND NEW** from factory. 16mm Telecine Projectors, TP-66 with R/C and lens. Call Mr. Frank N. Bovino, S.B. Video, 201-489-6358. 10-86-tfn

**SONY BVT-2000 TBC.** Good, clean TBC for sale. 16 line machine. Slo-mo capable with Sony 1 inch machines, or use with 3/4-inch. \$4,800 or best offer. Call 301-220-0662 for further information. 10-86-2t

**RCA TT-30FL** dual VHF television transmitter. Excellent condition. Contact C. Whitlatch, KJRH-TV, 918-743-2222. 10-86-3t

**AMPEX ACR-25 VIDEO CART** reproducer/sequencer. Excellent condition. Includes several headwheel panels and numerous video tape carts. Full documentation, well maintained. Contact C. Whitlatch, KJRH-TV, 918-743-2222. 10-86-3t

**CONSOLE. MCI 528B** with all options; 28 inputs, 32 busses, plasma display, automation, 8 returns, send meters, phase meter. Large producers desk. Asking price \$30,000. Call 305-940-7971. 10-86-tfn

## HIGH POWER UHF-VHF TUBES FOR SALE

|            |        |                     |
|------------|--------|---------------------|
| 4CX1500B   | 8890   | <b>CAMERA TUBES</b> |
| 4CX5000A   | 8916   | XQ1020 Series       |
| 4CX15000A  | 8984   | XQ1070 Series       |
| 6166A/7007 | 9007   | XQ1427 Series       |
| 892R       | VA891H | H8398A Series       |
| 833A       |        | H8397A Series       |

All Under Warranty.

Partial Listings Only—Many Other Types in Stock.

VARIAN, EIMAC, RCA

Your Source for Tubes: (Camera, transmitting, etc.)

**TEMTRON ELECTRONICS LTD.**

15 MAIN STREET, EAST ROCKAWAY, NY 11518

(800-645-2300) (516-599-6400) 11-86-1t

**NEW UNUSED TV EQUIPMENT** at deep discount prices. **SHINTRON** 375 "Super Switcher" 12 input special effects generator; Quanta Select 7-7 Character Generator; Harris Broadcast Receivers 6522; and more. Phone 318-371-0458. 10-86-2t

**BRAND NEW CONRAC MONITOR 5725/C13**, \$2700.00. Brand new Wavetek Model 1080 sweep generator \$2,400.00. Brand new Wavetek Model 190 20MHz function generator \$750.00. Brand new RCA heads 2 each 431474, \$750.00 each - 1 each 431473, \$750.00 - Plus lots of Eimac tubes all new. Contact. AMEX Electronics, 501 New York Avenue, Union City, N.J. 07087. Telex: 132853. Phone (201) 348-3363. 9-86-3t

Want more information  
on advertised products?  
Use the  
Reader Service Card.

**COPPER!** For all your broadcast needs. #10 ground rails; 2, 4, 6, 8" strap, flyscreen, counter poise mesh. 317-962-8596. Ask for copper sales. 7-86-6t

**FOR SALE**—Editing system—Microtime 2020 TBC, JVC KM 2,000 SEG, JVC 5550, 8250, 88U controller. 212/807-8504. 11-86-2t

**SATELLITE DISH:** 3.66m Microdyne PR-12 transportable C Band down link—KU Band up link. C Band dual feed and 50' hardline only \$4,000.000, (818) 888-7197. 11-86-1t

**TEKTRONIX 465 SCOPE**, w/DM44, ea. Cart, Tektronix 465 scope w/DM43/40 & cart. \$1500 ea. Tektronix 455 portable scope \$1100.00. Good condition, with manuals, extra graticule, X10 probes, temp. probes & vinyl covers. Price includes shipping. Contact Fred L. Wood, (309) 787-1625 or (309) 796-2424. 11-86-1t

**MICRODYNE PR-12** 3.66m transportable C Band down link, KU up link C Band feed only. Excellent condition, \$5000. OBO, Phone 707-795-5640. 11-86-1t

**M-FORMAT CLEARINGHOUSE:** New, DEMO, & Used Panasonic/RCA VCR's, Adapters, Editors, TBC's, Cameras, Accessories, at surplus clearance prices. Package discounts, Trade-ins considered. WIEGAND AUDIO VIDEO, 7558 Lafayette N.W., Newark, Oh. 43055, 614-967-0059. 11-86-2t

**FOR SALE: TCR-100/SP-100 S.N. D302-3010.** EPIS, random home, editor with video/audio or video only insert, add-on, preview. Also available are approximately 1300 carts. Contact: Lanny Nass, (216) 782-1144. 11-86-1t

**90' TOWER.** ROHN S.S.V. Self-supporting with O.B. Light package. Available in Jan. 1987. Contact: John Gebhard, Chief Engineer, Telemation Productions, 3210 W. Westlake Ave., Glenview, IL 60025. 312/729-5215. 11-86-2t

**2 RCA TK-44 CAMERAS** complete with pedestals and extra tubes. On line and in service at this time in good condition. \$5,000.00. Call Mr. Gill at WKG-TV. (504) 928-0632. M-F 9:30-4:30. 11-86-1t

**CLOSE-OUT-SALE! USED-DEMO-NEW EQUIPMENT:** ENG-Broadcast-SK 91 and SK 81, Demo's w/warranty and 14x lens from \$5,995.00. **DIGITAL-EFFECTS** GML-Proteus \$16,995.00, new. **DIGITAL-EFFECTS** NEC-E-Flex \$19,995.00, NEC-Opti-Flex \$24,995.00. **MONITORS:** Panasonic, Philips, Tektronix from \$395.00. **SYNC-GENERATORS:** Leitch, Lenco from \$1,295.00. **WAVEFORM-MONITORS & VECTORSCOPES:** Video-tek, Tektronix, new from \$1,495. **CHARACTER-GENERATORS:** Quanta, Mycrotek from \$1,495.00. **TIME-CODE-EQUIPMENT:** United Media, Sony. **A/B-ROLL-TIME-CODE-EDIT-CONTROLLERS:** United Media Commander II w/3 Interfaces from \$11,995.00. **STANDARDS-CONVERTERS:** CEL-P156/2 and Quantel from \$9,500.00. **TRIPODS W/FLUID-HEADS:** Sachtler Video 20 and Hot Pod, new, \$3,450.00. **CALL FOR DETAILED LIST:** Inter-Cine-Video Corporation, Ph.: 312-872-1665, Telex 857192. 1-86-1t

**FOR SALE:** Grass Valley 1600-1X switcher with EMEM, chroma key, serial editor interface, excellent condition. All equipment professionally maintained and in service in major teleproduction facility. Broker participation welcome. Contact Pat Scholes at (901) 725-0855, Ardent Teleproductions, Memphis, TN. 11-86-1t

**SONY VO 2860A** 3/4" Editing VCR's \$1500 ea. Sony Slo 325 1/2" Beta Industrial VCR's \$500 ea. 818-352-6619. 11-86-1t

**TEN MONROE 3000 R14** commercial inserters controls two channels with one deck. Only \$1900 each. (904) 252-0871. 11-86-1t

## 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 Throncliffe 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

## EMPLOYMENT OPPORTUNITIES

### WE PLACE ENGINEERS

CHIEFS, ASST. CHIEFS, MAINTENANCE TECHNICIANS, EDITORS, GRAPHICS

America's Leading Source for a Decade

ITV STATIONS, PRODUCTION FACILITIES, CORP. TV, MFG., CATV

For information phone or write Alan Kornish



**key systems**

479 Northampton Street  
Kingston, PA 18704

Employer  
Paid Fees

(717) 283-1041

**JOB HUNTING?** The best jobs are on the line... MediaLine. We dig up the freshest television and radio engineering jobs. Subscribe for 6 or 13 weeks to get your pick of broadcast engineer jobs. Learn more. 312-855-6779.

*MediaLine*  
THE BEST JOBS ARE ON THE LINE



## HELP WANTED

**MAINTENANCE ENGINEER.** Top Ten Market, PBS Station: Excellent opportunity. Applicant should have a minimum three years maintenance experience. SBE Certification, FCC General Class; College degree preferred. Good benefits, competitive salary. Resumes to: Gilda Jones, KERA TV/FM, 3000 Harry Hines Blvd., Dallas, Texas 75201. 9-86-4t

**TV MAINTENANCE ENGINEER:** Maintain latest state-of-the-art video broadcast equipment, including Sony one-inch machines. Experience in RCA TK-47's and TCR-100 cart machines desirable. Salary commensurate with experience. Send resume to Chief Engineer, P.O. Box 400, Hampton, VA 23669. A Belo Broadcasting Company. An Equal Opportunity Employer. 11-86-2t

**WANTED: BROADCAST ENGINEER** to maintain production/post facility. Experience on the following equipment helpful: Ikegami HK322 cameras, Ampex VPR 2B, VPR 6, TBC's, 4100, ACE, ADO 2000, Dubner CBG2. For more information, write or call Dick White, Director of Broadcast Operations, In Touch Ministries, 796 West Peachtree Street, N.W., Atlanta, Georgia 30308. Telephone: (404) 881-1221, Ext. 270. We also have openings for Radio and Cassette Duplicators. 11-86-1t

**STUDIO MAINTENANCE ENGINEER**—Immediate opening for an experienced television maintenance engineer. Must have FCC First Class License. Send resume, application, and salary requirements to: Al Deme Dept., KGGM-TV, 13 Broadcast Plaza, SW, Albuquerque, NM 87104. EOE. 11-86-1t

**IMMEDIATE OPENINGS:** Assistant Chief Engineer. Candidate must have a minimum of five years experience and be familiar with all phases of broadcast engineering. License required. Also looking for qualified maintenance engineer with a minimum of two years experience. Send resumes to Broadcast Engineering, Dept. 671, P.O. Box 12901, Overland Park, KS 66212. EOE, M/F. 11-86-1t

**SEEKING SENIOR MAINTENANCE ENGINEER** specializing in telecine and related equipment for major Chicago post production facility. Send resume and salary history to: Jerry Hummel, Editel, 301 E. Erie Street, Chicago, IL 60611. 11-86-1t

**TELEVISION—HELP WANTED—TECHNICAL.** TV Broadcast Maintenance Engineer for one of top 5 rated ABC affiliates. Minimum 5-7 years recent experience with state of the art studio equipment plus AE degree or equivalent. Must work with minimum supervision. Resume to Chief Engineer, KOAT-TV, P.O. Box 25982, Albuquerque, NM 87125. 11-86-1t

**MAINTENANCE ENGINEER:** Immediate opening for a qualified broadcast technician. A strong broadcast maintenance background is required with a minimum of two years experience at television broadcast maintenance. Harris VHF transmitter experience a plus. Good working conditions and benefits. Salary commensurate with experience. Send full resume to: Chief Engineer, KBMT-TV, P.O. Box 1550, Beaumont, Texas 77704, (409) 833-7512. EOE. 11-86-1t

**CHIEF ENGINEER:** Class B FM and Directional AM. Medium Market in New England. 3 years experience required. Salary Negotiable. Broadcast Engineering, Dept. 673, P.O. Box 12901, Overland Park, KS 66212. 11-86-1t

**CHIEF ENGINEER** for Midwest affiliated television station. Bachelor's degree in Electrical Engineering or equivalent combination of education and experience, first class radiotelephone license and 6-8 years' television broadcast engineering experience necessary. Need common sense person who can watch costs through wise purchasing and capable preventative maintenance. Experience in plant expansion planning preferred. Submit letter of application and resume by November 28, 1986. UNIVERSITY OF MISSOURI-COLUMBIA; Employment Services; 201 S. Seventh Street; Heinkel Building, Room 130; Columbia, MO 65211. AA/EOE. 11-86-1t

**ASSISTANT DIRECTOR,** Assists the Director of Operations and Engineering in supervising the technical operation and maintenance of the WHMM-TV facility. Also, ensures the transmitter is functioning at optimum capacity and in compliance with FCC regulations. Successful candidate must have BS degree or equivalent in Electrical Engineering with three (3) years of supervisory radio or TV engineering work experience in management or maintenance. Must have a valid FCC first class license with a demonstrated knowledge of digital electronics and state of the art television equipment. Salary is \$38K or commensurate with experience. Submit resume to Howard University Department of Personnel Services, 4th and Bryant Streets, N.W., Washington, D.C. 20059. AA/EOE. ATTN: Mr. James Johnson. 11-86-1t

**UHF TRANSMITTER MAINTENANCE**—We are looking for a person who will take pride in beaming a crystal clear full coverage TV signal to the Washington, D.C. market. Our transmitter is young with some projects to be completed including multichannel sound. Microwave and two-way radio experience is desirable. Resume and salary requirements to Howard University, Department of Personnel Services, 4th and Bryant Streets, N.W., Washington, D.C. 20059. AA/EOE. ATTN: Mr. James Johnson. 11-86-1t

**CHIEF ENGINEER.** UHF ABC affiliate. Responsible for overall engineering operation, including studio & transmitter maintenance, crew training & supervision, budgeting, FCC compliance. Candidate should have experience which would enable her/him to coordinate studio relocation to new site within the next 2-4 years. Resume/salary requirements to Scott Vaughan, GM, KESQ-TV, P.O. Box 4200, Palm Springs, CA 92263. EOE. 11-86-1t

**CHIEF ENGINEER.** Small Market, southeast affiliate. On air 5 years. Good company and benefits. If you have been number 2 for too long this could be your opportunity. 11-86-1t

**DIRECTOR OF SALES—BROADCAST EQUIPMENT MANUFACTURER.** Growing manufacturer of high-tech radio and TV broadcast equipment seeks an ambitious and resourceful EXPERIENCED SALES PROFESSIONAL to assume full "hands-on" responsibility for organization, planning and execution of our sales efforts, both direct and through distributor/rep's. A working knowledge of broadcast equipment and the radio/TV marketplace are required, along with prior demonstrated sales achievement. Limited travel required. Our mid-size company, located in the Northeast, offers a stimulating and supportive work environment along with an attractive salary/benefits package. The timing is excellent...our newest product is out of the lab and ready to be launched. Come aboard and grow with us! Send resume (in confidence) to: Broadcast Engineering, Dept. 672, P.O. Box 12901, Overland Park, KS 66212. 11-86-1t

**REMOTE TRUCK MAINTENANCE ENGINEER** for Midwest area. Working knowledge of analog and digital circuits. Must have leadership qualities and be willing to travel. Excellent pay and benefits. Send resume to Personnel Director, 140 West Ninth Street, Cincinnati, Ohio 45202. 11-86-1t

**BROADCAST ENGINEERS:** The University of South Florida seeks qualified applicants to fill positions at WSFP-TV and WSFP-FM in the Fort Myers area and WUSF-TV and WUSF(FM) in the Tampa area. MINIMUM QUALIFICATIONS: High School diploma and four years experience in the maintenance and operations of broadcast equipment, or equivalent vocational/technical training in communications electronics, or equivalent military electronics training. STARTING SALARY: \$15,868.80 TO \$17,455.78 annually, depending on experience. SEND RESUME TO: Mr. John Ralle, Broadcast Stations, University of South Florida, 4202 Fowler Avenue, Tampa, FL 33620-6800, (813) 974-2996. 11-86-1t

**MAINTENANCE ENGINEER**—For stereo TV station, production facility and satellite uplinking facility. Experience in TCR-100, TR-600, Sony 1", GVG Switchers, and Sony ¾". Good salary, benefits, M/F, E.O.E. Send resume to Jim Moore, KPLR-TV, 4935 Lindell Boulevard, St. Louis, MO 63108. 11-86-1t

## Advertising sales offices

### CHICAGO, ILLINOIS

Tom Nilsen  
Phone: (312) 887-0677  
(312) 887-0684  
15 Spinning Wheel Rd.  
Ste. 430  
Hinsdale, IL 60521

### NEW YORK, NEW YORK

Joe Concert  
Phone: (212) 682-6630  
(212) 682-6631  
Josh Gordon  
Phone: (212) 687-5076  
(212) 687-5077  
630 Third Ave., Eighth Floor  
New York, NY 10017

### SANTA MONICA, CALIFORNIA

Herbert A. Schiff  
Phone (213) 393-9285  
Jason Perlman  
Phone (213) 458-9987  
Chris Woodbury  
Phone (213) 451-8695  
Schiff & Associates  
501 Santa Monica Blvd., Ste. 504  
Santa Monica, CA 90401

### NORWOOD, AUSTRALIA

Haswell, Williamson, Rouse Pty. Ltd.  
P.O. Box 419  
Norwood 5067, Australia  
Phone: 332-3322  
Telex: AA87113

### LONDON, ENGLAND

Nicholas McGeachin  
Suite 460, Southbank House  
Black Prince Rd.  
London SE1 7SJ  
Telex: 295555LSPG  
Telephones: 01-582-7522  
01-587-1578

### TOKYO, JAPAN

Haruki Hirayama  
EMS, Inc.  
Sagami Bldg., 4-2-21, Shinjuku  
Shinjuku-ku, Tokyo 160, Japan  
(03) 350-5666  
Cable: EMSINCPERIOD  
Telex: 2322520 EMSINCJ

**INTERTEC**  
PUBLISHING CORPORATION

©1986. All rights reserved.

# SAVE TIME

*For fast, accurate service, please remove the peel off label used to address your magazine, and attach it to the Reader Service Card, the Address Change Card or to any correspondence you send us regarding your subscription.*



# Multiple Choice:

## What do you need in an audio console?

Every application is different; what are your requirements? Should the input section be stereo or mono, mic or line? What kind of outputs and subgrouping do you need? Is a matrix mix important? Do you require mix-minus capabilities? What about metering, timers, tape remotes, mainframes, future expansion?



A-500 Radio  
On-Air



TV-80 Television Master

So whatever your application, stereo or multi-track production, television master control, on-air, video edit, or mobile installation, consult WHEATSTONE.

WHEATSTONE consoles give you all the choices. Our sales engineers listen to your requirements, then work with you and plan your console from the first module to the last VU meter. The result is custom-configured equipment built specifically to your needs.

The truth is, there's only one choice when specifying broadcast equipment: **QUALITY**. There's simply no room in broadcast for cutting corners; when you're on-the-air the phrase "Time is Money" takes on real meaning.

SP-5 Stereo  
Production



3224 Multi-Track

**QUALITY**  
*There's No Better  
Choice.*

 Wheatstone Corporation

5 Collins Road, Bethany, CT. 06525 (203-393-0887)  
6720 VIP Parkway, Syracuse, NY 13211 (315-455-7740)

Circle (2) on Reply Card

[www.americanradiohistory.com](http://www.americanradiohistory.com)





## 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.



First by Design.

### The Ward-Beck D8212 System – An Investment in Quality!



Ward-Beck Systems Ltd., 841 Progress Avenue, Scarborough, Ontario, Canada M1H 2N4. Tel: (416) 438-5550 Tlx: 065-25399.