

BROADCAST[®] engineering

AN INTERTEC PUBLICATION

November 1991/\$4.50

Annual station maintenance report

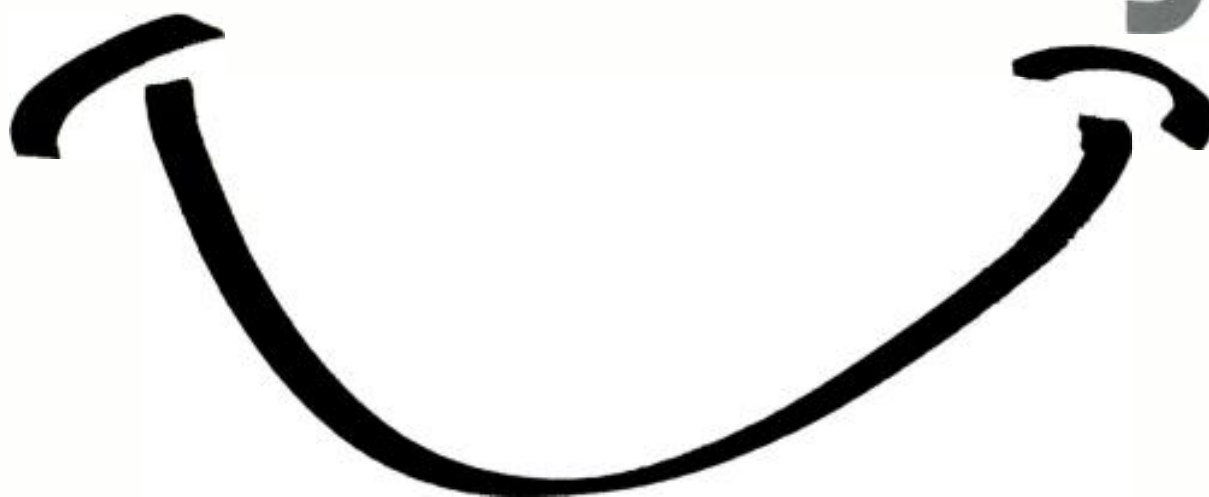
33100-----MYE757000 XXXX REQ
E 1080190000000 23 A 001
MOND MEYERS PRES DIR
'MARK COMMUN CORP
N 75TH AVE FL 33155

10011110011011001100111000101
000011011001100111
001101100110011100010110
110110011001110001
1011001100



Building a fiber system
p. 78

Real-time, real friendly.



The CG4733 respects your creativity and is extremely responsive to your artistic inspirations. It doesn't overexpose you to a blizzard of menus and pushbutton manipulations. It's simply sophisticated and a true ally during on-air panics and posting deadlines with your nervous client.

The CG4733's intuitive software, 10 MIPS Digital Signal Processor, 4:4:4:4 architecture, and easy to use, menu-free operation set the stage for a lasting relationship. And there are many more qualities you'll like when you get to know the CG4733...

- Instant character resizing (with edge effects) from 8 to 512 lines.
- Antialiasing with 4.6nS resolution and real-time rendering of 10 standard typeface masters—over 1500 URW typefaces available.
- Three microprocessors with 32 bit processing, 40 MByte on-line storage, and local area networking capability.
- RGB/Y/P inputs/outputs or optional D1 video I/O capability.
- Only 3RUs. Keyboard is 1RU and slides into a 19" rack.

- Graphics Plane Option.** • High performance unit with dedicated graphics processor.
- 32 bits/pixel frame buffer with 2 picture memory, real-time frame grabber, 16.7M color palette with full paint facility.
- Digital linear keyer and dual channel capability.

Wouldn't you like to meet? Call for a demo.

Pesa America Inc., 2102 West Ferry Way, Huntsville, AL 35801 205-880-0795 Fax 205-881-4828
West: Burbank, CA 800-323-7372 East: New York City 800-328-1008



The CG4733 Character Generator with graphic plane option.
Real-time...real friendly

 **PESA**

Over 100 CG4733s will keep pace with
the 1992 Olympians in Barcelona.



Circle (1) on Reply Card

Being born into a famous family is no free ride.

Standards are high.
Expectations are great.

So when Shure unveiled its L Series Wireless Microphones a few years ago, we knew they had to be better than good.

They were. In fact, the L Series has emerged as one of the most affordable, trouble-free lines in the business. One that includes nearly every kind of wireless – from hand-held to lavalier to instrument systems – with both diversity and non-diversity receivers.

The all-new, L11 body-pack transmitter is a prime example. With its compact surface mount construction, the L11 is the smallest unit in its class. Battery life is 40 to 50% greater. And its crystal clear output signal lets you operate more systems simultaneously than ever before.

Of course, the L11's reliability is a given. After all, we have a family reputation to uphold.

For information on the L Series of wireless microphones and accessories, call 1-800-25-SHURE. The Sound of the Professionals®... Worldwide.

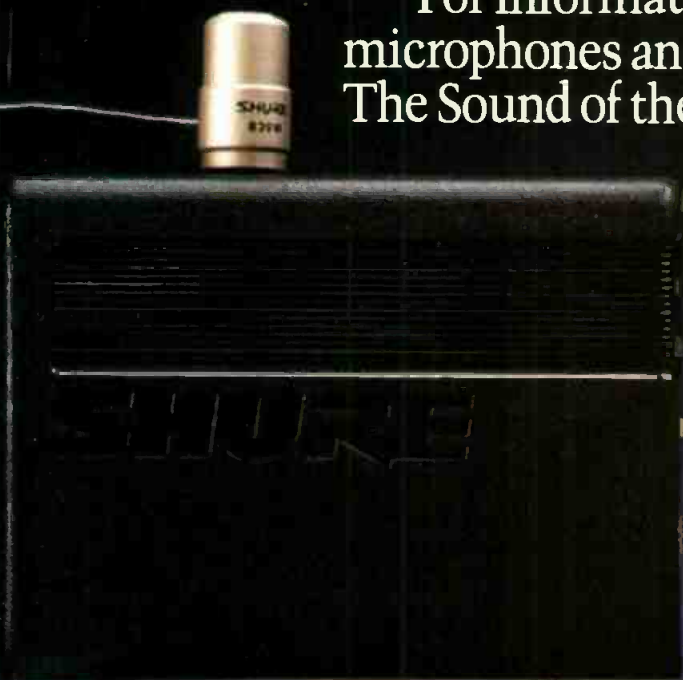
SHURE

The Only Wireless That Lives Up To Its Name.

THE SHURE WIRELESS

L SERIES

Circle (4) on Reply Card



SHURE

L4 DIVERSITY WIRELESS

POWER

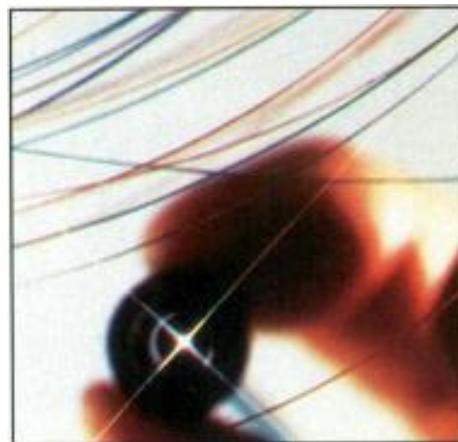
BROADCAST[®] ENGINEERING



Page 26



Page 48



Page 78

MAINTAINING BROADCAST AND PRODUCTION FACILITIES:

As equipment becomes more complex and sophisticated, the types of skills needed to maintain it change dramatically. System-level servicing, as opposed to component-level servicing, becomes the primary tool.

FEATURES:

26 Analog Troubleshooting Basics

By Roald Steen, electronics instructor

Most equipment in today's broadcast facilities is still analog — and still needs repair.

32 Monitoring the Serial Digital Signal

By Ken Ainsworth, Tektronix

Understanding the basics of serial digital video can open a new avenue for distributing digital video signals.

48 Caring for High-Power Tubes

By Brad Dick, editor

By following a few simple steps, you can increase the life of your transmitter's tubes — which can save money.

60 Rebuilding TV Transmitters

By Don Newman, General Electric Support Services

The task: to inspect, clean and rebuild the transmitter cavities. The result: The station saves the expense of replacing transmitters.

OTHER FEATURES:

68 Testing Coaxial Lines Part 2

By Don Kolbert, KLSE-FM and KZSE-FM

Budget applications of TDR can solve transmission line problems.

78 Building Fiber-Optic Transmission Systems Part 1

By Brad Dick, editor

The advantages of fiber outweigh the complex design process.

DEPARTMENTS

- 4 News
- 6 Editorial
- 8 FCC Update
- 10 Strictly TV
- 12 re: Radio
- 14 SBE Update
- 16 Circuits
- 18 Troubleshooting
- 20 Management for Engineers
- 98 Field Report: Continental XL-301
AM transmitter
- 104 People and Business
- 108 New Products
- 116 Preview

ON THE COVER

Modern broadcast and production equipment often relies on digital technology. The cover illustrates the importance of VLSI circuits in making digital audio and video signal processing possible. (Cover credit: Design by Tektronix.)



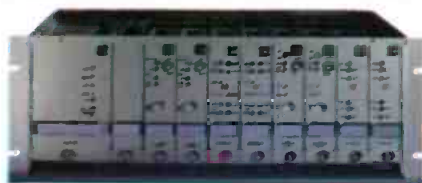
For Putting Video On Fiber, The Choice Is Clear.

For point-to-point, STL or multipoint distance learning and video conferencing applications, fiber is a clear choice. So is the company that can help you put that video signal over fiber...ADC Telecommunications.



FN 6000

- full presence multipoint, distance learning/video conferencing
- drop and insert capability
- up to 16 channels/50 miles



- LC SERIES**
- point-to-point, STL, RS-250C shorthaul
 - up to four audio channels
 - up to 15 miles

ADC can help you configure the rest of your system with copper and fiber cable management and switching products for a total systems solution. For more information, call 1 800 726-4266 or send in the coupon for a free brochure.

I'd like to know more about how ADC can help me put video over fiber.

Name

Title Phone

Company

Address

City State Zip

Mail or Fax To:
ADC Telecommunications, Inc.
Mail Station 72
4900 West 78th Street
Minneapolis, Minnesota 55435
FAX (612) 893-3050



ADC Telecommunications

"Where Quality Runs Full Circuit."

Circle (5) on Reply Card

By Dawn Hightower,
senior associate editor

New York ceremony awards Technical Emmys

The National Academy of Television Arts and Sciences (NATAS) presented the Technical Achievement and Scientific Development Engineering awards at its 1990-1991 annual technical engineering Emmy awards ceremony, September 24, in New York.

The Emmys were awarded to 15 companies and one individual.

The academy bestows the technical achievement Emmys to individuals or companies for engineering developments that are either extensive improvements or so innovative that they materially affect the transmission, recording or reception of television.

The following companies were awarded more than one Emmy: Sony was honored with three Emmy statues and NEC received two. Masahiko Morizono, chief adviser for technology, Sony, was the sole individual honored with an Emmy.

The following companies were each awarded with one Emmy: Accom, Abekas Systems, Faroudja Laboratories, The Grass Valley Group, Magni Systems, Matsushita Electronic Corporation (Panasonic), Philips, Radamec EPO Ltd., Telettra USA, Tektronix Television Division, Toshiba, T.S.M. and Vinten Broadcast.

Listed in alphabetical order is the complete list of the awardees and achievements honored with technical Emmys.

- *Accom* for digital encoding from 525/625 analog and digital component to analog and digital composite.
- *Abekas Video Systems* for multilayer real time component digital video compositing technology.
- *Faroudja Laboratories* for techniques for minimization of NTSC artifacts through advanced encoding techniques.
- *The Grass Valley Group* for multilayer real time component digital video compositing technology.
- *Magni Systems* for development of test signals and measuring equipment for performance evaluation of component video systems.
- *Mr. Masahiko Morizono* for technical vision and leadership in the TV industry.
- *NEC* for pioneering work and implementation of data compression techniques for real time TV transmission. Also for CCD imaging technologies.

- *Matsushita Electronic Corporation (Panasonic)* for CCD imaging technologies.
- *Philips* for the development of digital audio technology leading to the compact disc.
- *Ramadec EPO Ltd.* for computerized robotic camera systems.
- *Sony* for outstanding achievement in scientific and technological development. Also for CCD imaging technologies and the development of digital audio technology leading to the compact disc.
- *Telettra USA* for pioneering work and implementation of data compression techniques for real time TV transmission.
- *Tektronix Television Division* for development of test signals and measuring equipment for performance evaluation of compact video systems.
- *Toshiba* for CCD imaging technologies.
- *T.S.M.* for the development and implementation of TV camera robotics system.
- *Vinten Broadcast* for computerized robotic camera systems.

Consumer Electronics Group forms DAR subcommittee

The Electronic Industries Association's Consumer Electronics Group has formed a digital audio radio (DAR) subcommittee to initiate activities to centralize DAR system technical analysis, comparative testing, system selection and standards development. The committee is chaired by Randall Bruns of Delco Electronics.

The R-3 digital audio radio subcommittee was formed to organize and initiate a fair and impartial analysis, testing and standards-setting program in order to determine which DAR technical system will best serve EIA membership and consumers. Complete system performance that affects sound quality, such as program source encoder/decoder, transmission systems elements and the receiver, will be given primary consideration.

NAB wants FCC to scrap broadcast fines

The National Association of Broadcasters (NAB) wants the Federal Communications Commission (FCC) to scrap its new fine and forfeiture schedule, which is a price list for broadcast rule violations, because it was crafted without the required public comment period. This vio-

Continued on page 102

EDITORIAL

Brad Dick, *Editor*
Carl Bentz, *Special Projects Editor*
Rick Lehtinen, *Technical Editor*
Sklp Pizzi, *Technical Editor*
Dawn Hightower, *Senior Associate Editor*
Stefanie Kure, *Associate Editor*
Tom Cook, *Senior Managing Editor*
Pat Blanton, *Directory Editor*

ART

Kim Bracken, *Graphic Designer*

BUSINESS

Cameron Bishop, *Group Vice President*
Duane Hefner, *Group Publisher*
Tom Brick, *Marketing Director*
Czadana Inan, *Group Director, Special Projects*
Evelyn Hornaday, *Promotions Manager*
Sally Nickoley, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Mary Birnbaum, *Advertising Production Supervisor*
Michele Costlow, *Advertising Coordinator*
Mia Fountain, *Classified Advertising Coordinator*

ADMINISTRATION

R.J. Hancock, *President*
Doug Wilding, *Circulation Director*
Customer Service: 913-541-6628

TECHNICAL CONSULTANTS

Jerry Whitaker, *Editorial Consultant*
Eric Neil Angevine, *Broadcast Acoustics*
John H. Battison, *Antennas/Radiation*
Dennis Ciapura, *Radio Technology*
Dane E. Ericksen, *Systems Design*
John Kean, *Subcarrier Technology*
Donald L. Markley, *Transmission Facilities*
Harry C. Martin, *Legal*
Elmer Smalling III, *Cable/Satellite Systems*

MEMBER ORGANIZATIONS

Sustaining Members of:
• Acoustical Society of America
• Society of Broadcast Engineers
• Society of Motion Picture and TV Engineers

Member,
Association of Business Publishers

Member,
Business Publications
Audit of Circulation



BROADCAST ENGINEERING is edited for corporate management, engineers/technicians and other station management personnel at commercial and educational radio and TV stations, teleproduction studios, recording studios, CATV and CCTV facilities and government agencies. Qualified persons include consulting engineers and dealer/distributors of broadcast equipment.

BROADCAST ENGINEERING (ISSN 0007-1794) is published monthly (plus three special issues) and mailed free to qualified persons within the United States and Canada in occupations described above. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to **Broadcast Engineering**, P.O. Box 12960, Overland Park, KS 66282-2960.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, \$50.00. Qualified and non-qualified persons in all other countries; one year, \$60.00 (surface mail); \$115.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

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.

CORRESPONDENCE

Editorial and Advertising: P.O. Box 12901, Overland Park, KS 66282-2901. Telephone: 913-888-4664; telex: 42-4156 Intertec OLPK; fax: 913-541-6697.

©1991 by Intertec Publishing
All rights reserved.

Advertising offices listed on page 119.



INTRODUCING OUR S9x5.5 ENG/EFP LENS

The point of news coverage and field production is to be in close. Broad in scope. With no distortion. All while capturing shots as appealing as a wide slice of pepperoni pizza.

Nikon's new S9x5.5 lens, with internal focus, was made to order. Search far and wide and you'll find, for being near (about 1') and wide ($77.3^{\circ} \times 61.9^{\circ}$), no one else gives more. The crisp image, sharp from corner to corner, comes courtesy of Nikon's famed optics and ED glass. You glide through the 9x zoom ratio — from 5.5mm to 49.5mm — smoothly. And we include a 1.7x extender.

The internal focus extends your creative options to include matte boxes and a full range of filters. And, like all Nikon ENG/EFP lenses, its lightweight design and rigid construction can't be topped.

The S9x5.5. Expect no less from Nikon. After all, we create the world's finest video lenses — from a complete line of HDTV lenses to converters that transform your Nikon F-series SLR lenses into a complete menu of special effects lenses for your CCD camera.

For more information, write or call: Nikon Electronic Imaging, Dept. D1, 101 Cleveland Ave., Bayshore, NY 11706, 1-800-52-NIKON (526-4566).

**AT 77.3° NO ONE
GIVES YOU A TASTIER
SLICE-OF-LIFE.**



Nikon
ELECTRONIC IMAGING

r e c r e a t i v i t y

Gutsy move

It took guts, but two industry associations recently took the major step to combine the exhibition portion of their trade conventions. The Society of Broadcast Engineers (SBE) and the Radio and Television News Directors Association (RTNDA) boards of directors each voted unanimously to combine the exhibition area of their conventions beginning in 1993.

Each association will continue to maintain separate convention programs. Only the exhibition area is involved in the joint effort. Both groups have expressed interest, however, in holding at least one joint seminar on an area of common interest. That

wouldn't be hard, given today's need for cooperation between the engineering and news departments.

The agreement was first announced at the October SBE convention in Houston. Reaction to the news from attendees and exhibitors was positive.

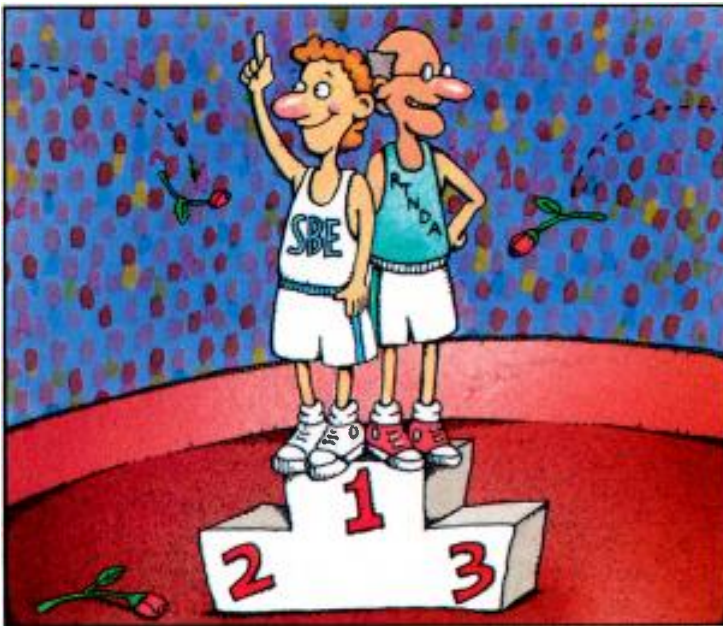
Exhibitors seem pleased with the prospect of having to attend one less show. Faced with rising costs, cost-conscious exhibitors are often torn between attending multiple and competing shows. This is especially the case where the product lines cross several markets or applications. Exhibitors want their products shown to as many prospective customers as possible. Unfortunately, it's seldom possible to cost-justify attending every trade show that claims to have attendees who can buy the hardware.

The joined forces of SBE and RTNDA may now be able to create a show with such powerful attraction for exhibitors that the net result is more than one plus one. Companies that previously attended only the spring NAB show may now give a second look to the larger SBE/RTNDA show floor. For a little extra expense, a new set of potential customers could be available to the exhibitor.

The attendee gains from the agreement, too. A larger exhibition means that more equipment and vendors will be on-site for inspection. A primary attraction of the SBE show was its smaller size, which allowed close contact with the vendors and equipment. That same advantage will be present with the new show floor, but more options for equipment and vendors will be available.

The final winners in this collaborative effort are the two associations. The leadership of SBE and RTNDA realized that one large and strong trade show will mean greater benefits to both memberships than would two smaller events. Deciding to unite efforts has been a tough pill to swallow for some board members, but they made the right choice.

SBE and RTNDA are to be congratulated on their effort to support each other — and the industry. It was a gutsy move, and one where everyone comes out winning.



Brad Dick

Brad Dick,
editor

PURE DIGITAL.

HIT PICK HIT PICK HIT PICK
NAB
BROADCAST
1991
HIT PICK HIT PICK HIT PICK



Bottom Line Orientation.

Creating a "sound" that attracts and holds the largest possible audience is the bottom line in the radio business. And the new OPTIMOD-FM Digital 8200 is a technological breakthrough with bottom line impact.

Digital Makes the Best Even Better.

The power of digital propels the 8200 to new levels of performance and functionality. OPTIMOD-FM 8200 is a *true* digital audio processor—the audio is digitized and all control functions are digital.

What is the value of digital processing and control? In addition to a better sound, digital makes the OPTIMOD-FM more user-friendly, more programmable, more flexible. Simply put, because the OPTIMOD-FM is easier to adapt to a station's programming needs, it will produce more benefit, more of the time.

The Processor with Multiple Personalities.

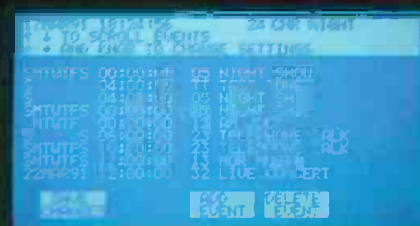
With most conventional processors, multiple processing configurations require multiple boxes. With the 8200's Multiple Variable Processing (MVP) architecture, processing configurations can be

changed with the push of a button—select the protection MVP for total transparency, or the two-band MVP for an improved version of the traditional open, bright and natural OPTIMOD-FM sound which helped make thousands of stations successful. Choose the optional multi-band MVP and meet the challenge of competitive major-market processing with selectable speeds to match any format.

Power. Potential. Profitability.

Take advantage of the power, potential and profitability of the OPTIMOD-FM 8200. Call your dealer now for a personal, hands-on evaluation of the 8200.

The OPTIMOD-FM 8200 is a technological breakthrough with bottom line impact. The power of OPTIMOD—in pure digital.



Use the 8200's Automatic Preset Switching to automatically change the processing on a programmed schedule. Ideal for dayparting or multi-format stations.

OPTIMOD-FM
D I G I T A L

orban

A Division of AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, CA 94577 USA
Tel: (1) 415/351-3500
Fax: (1) 415/351-0500

© 1991 AKG Acoustics, Inc.
Orban and Optimod are registered trademarks of AKG Acoustics, Inc.
AKG is a registered trademark of Akustische U. Kino-Geräte Ges.m.b.H. Austria

Circle (7) on Reply Card

www.americanradiohistory.com



Commissioner states views on DAB

By Harry C. Martin

FCC Commissioner Sherrie Marshall stated her views on the future of digital audio broadcasting (DAB) at the NAB's Radio 1991 Convention in San Francisco this September. DAB is viewed as a threat by many existing broadcasters, because the FCC has yet to decide what and how much spectrum will be dedicated to the new service, to what extent existing stations will be invited to participate, and how much new competition will be created.

In her speech, Marshall offered broadcasters positive forecasts "for surviving and perhaps even thriving" with DAB. She pointed out that existing radio stations are in a particularly good position to take advantage of DAB because they have significant experience in providing free, locally distributed and universally available programming. However, significant questions remain as to how DAB will be implemented and how it will impact local radio broadcasters.

Marshall predicted that DAB would be available through national, multiple channel, satellite-originated sources delivered via wire or satellite directly into the home. Such services most likely will include a combination of commercially sponsored and subscription programming services. The same multichannel packaging that is reshaping the video world, the commissioner said, will allow a program provider to reach a mass audience by capturing many narrow audiences.

Marshall noted that current developments in channel compression may allow existing FM stations to compete on a multichannel basis. However, "in-band" DAB technology, if implemented, would pose the following significant policy questions:

- Would terrestrial broadcasters have to wait to implement DAB until in-band is perfected, while satellite-delivered DAB is permitted to get a head start?
- Would AM broadcasters end up as a permanent technological underclass absent a DAB spectrum allocation for their use?
- Would such an allocation create a technological parity that would unfairly diminish the investment premium paid for and expected by FM broadcasters?

The commissioner pointed out that im-

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

plementation of any DAB scheme depends upon the spectrum allocation decisions to be made at the February 1992 World Administrative Radio Conference (WARC), which will convene in Spain. The U.S. position on spectrum for DAB has not been determined.

Entrepreneur's preference urged

The FCC is considering the adoption of an "entrepreneur's preference" in comparative hearings. The preference would be available to a party who successfully pursues an FM allotment through the commission's rulemaking process. At least three rulemaking petitions advocate the adoption of such a preference, and NAB has filed comments supporting the idea.

NAB's position is that currently there is little incentive for an existing broadcaster to seek out an FM frequency, because once allotted, the frequency is open for applications from all newcomers. The entrepreneur who has expended the considerable effort and money in locating the vacant frequency receives no preference in the ultimate licensing process. In fact, a broadcast entrepreneur usually is at a disadvantage vis-a-vis other applicants in a hearing because an existing operator has little flexibility to structure its ownership to take advantage of comparative preferences. Few broadcasters are willing to take the initiative to propose new FM channel allocations under these circumstances.

Under the proposed entrepreneur's preference, the party who invests "sweat equity" in finding a vacant frequency would be given a preference that would be weighed against other available preferences, such as those awarded for media diversification, integration of ownership into management, local ownership and minority control.

FCC chairman advocates "video dial tone"

In a September address in New York, FCC Chairman Alfred C. Sikes advocated as a national goal the provision of a "video dial tone" as early as customer demand warrants. The video dial tone concept entails allowing local telephone companies to offer their customers easy video access

to a multiplicity of video services, including 2-way interactive services.

Sikes outlined a 6-step program to allow market forces to work in developing video dial tone capabilities:

- Make sure the telephone company does not have to get local permission to install and operate a data, voice and video network.
- Make sure the phone companies, where they are monopolies, serve as common carriers, but allow them to offer a full range of advanced information services as well.
- Make sure the telephone company's network is open and that access to transmission paths or network computer functions is reciprocal.
- Make sure the telephone companies, not regulators, price retail services that are competitively provided.
- Allow phone and cable TV companies to enter into arrangements that would allow cable operators to invest in, not simply lease, facilities for carriage of video programming.
- Restrain telephone companies — at least on a transitional basis — from full program involvement.

Existing TV stations, Sikes pointed out, have little chance to be true integrated, broadband network providers. However, broadcasters will want a significant role in how such providers are regulated, because such providers may well have control of their distribution channels. Cable companies, on the other hand, are working to upgrade their plant and to block the telephone companies from competing as broadband video providers.

Sikes sees these conflicts being resolved, at least to some extent, through teaming efforts where broadcasters and cable operators would provide programming but use telephone company facilities to create or expand their services. In this connection Sikes noted that, due to legal restrictions, telephone companies have virtually no experience in video markets.

Sikes favors continuing restraints on the telephone companies to prevent them from full involvement in provision of video programming, at least on a transitional basis.

||:~:~:~:||||



“What I Like About the Odetics Cart Machine.”

“When I joined WTVH two years ago, the existing cart handling equipment was more than 15 years old. There was a real need for a new, more reliable cart machine. I took a serious look at the machines out there, then settled on the Odetics TCS2000.

Since we installed the TCS2000, everyone here has come to share my appreciation of its capabilities. We’ve especially liked the computer-based playlist. We had been manually checking play information against a paper log. Now we download the information directly from our traffic computer, and the TCS2000 generates a playlist. With the human-error factor eliminated, on-air discrepancies have become practically non-existent.

The efficiency of the Odetics equipment has streamlined our entire operation. Our older technology machine would hold only 24 spots at a time. We load over 400 spots into the new machine. Also, we use the Odetics machine’s multi-cut feature, and that’s increased our on-line spot capability by about 33 percent.

At WTVH we run 2-1/2 hours of local news every day, so last-minute changes are routine. Using the Odetics keyboard, we

can insert new material up to 30 seconds before going on air. Deletions need only two seconds lead time.

One of the most useful aspects of the machine’s software is the reports it generates. For example, I can pull a report any time showing what spots are needed that are not already in the machine. In the past, we might not know we were missing a spot until just before air time.

This machine has certainly made my own job a lot easier. That’s what I like most of all. I don’t hear any more comments at staff meetings about spots being lost on-air, and it’s a pleasure to see those blank discrepancy reports.

If you’re considering installing a new cart machine, give me a call at (315) 425-5555. I’ll be glad to talk with you firsthand about the advantages the Odetics TCS2000 has brought to WTVH.”

**Jim Bernier, Director of Engineering
WTVH Syracuse**

**Odetics
Broadcast**



© NATAS

Director of Sales
Bill Keegan
(714) 774-2200

1515 South Manchester Avenue, Anaheim, California 92802-2907 (800) 243-2001 or (714) 774-2200

Northeast
Ray Baldock
(201) 305-0549

Southeast
Emerson Ray
(813) 960-0853

West
Chuck Martin
(818) 999-9796

North Central
Bill Boyd
(612) 894-2121

South Central
David Scally
(800) 243-2001

Circle (8) on Reply Card

www.americanradiohistory.com

PCs for TV

TV multimedia

By Rick Lehtinen, technical editor

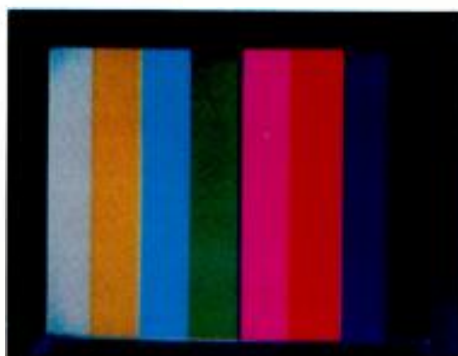
Last month's column discussed how a station could build an inexpensive PC-based station ID system that could play computer-generated ID slides and play back audio tags. This month we will address how an emerging technology called *multimedia* may impact the TV business.

TV multimedia

Multimedia generally implies the use of a computer to control several pieces of audio and video equipment. The output of this equipment may be displayed on audio and video monitors, or it may be transformed into signals that can be displayed on the computer's screen. To be useful in television, the system must have a high-quality video output. One way to do this is to synchronize the computer to the video and key the computer images over it. Devices that do this are often called *genlocks*. Another way is to reclock and interpolate the computer display, and make it a video signal. Devices of this type are called *scan converters*. In most cases, scan conversion is the better process, but it's usually more costly.

A multimedia system is similar to an edit controller. Both orchestrate the movements of VTRs and ATRs.

A multimedia system is similar to an edit controller. Both orchestrate the movements of VTRs and ATRs. Newer non-linear editing systems are even closer to multimedia. They store images on a random-access medium, such as laserdisc, recordable optical disc or CD-ROM. The editing system or multimedia controller accesses each item off the disc as it is required, regardless of the order in which it was recorded. The latest multimedia systems and non-linear editors use digital compression techniques and special cards to store high-quality imagery with greatly reduced memory requirements.



Two paths

One area in which editors and multimedia diverge is in the treatment of audio. An editor is likely to treat audio as a linear signal, to which it will add and subtract during processing. A multimedia system may also work this way, or it may store the audio as data files, usually compressed. These are reproduced using special audio playback cards. The system may also make use of the musical instrument digital interface (MIDI) protocol to control various synthesizers, instruments or signal-processing devices. In this manner, a multimedia system often re-creates, rather than merely replays, the audio.

Another difference between editors and multimedia is their range of peripherals. Using GPI triggers and other interfaces, editors often activate still-stores, character generators, switchers and mixers. Multimedia systems could also do this, but their application is usually live, not recorded. Thus, a multimedia system may control a room full of presentation, lighting and sound equipment, in addition to the video and audio playback devices.

User access is also another issue. A fast-paced business, such as broadcasting, often needs control panels with one function per button. This promotes operator familiarity and speed. There has been some backlash against soft keys, particularly if the menu is more than a few layers deep. However, today it is possible to buy a complete computer for less money than it takes to manufacture some control panels. This has led some broadcast manufacturers, and nearly all multimedia providers, to adopt a PC as the universal front-end. The subject of system control is open for further study. Touch screens and voice recognition will likely figure heavily in next-generation products.

Multimedia impact

So what effect will multimedia have on television? It is an enabling technology that could help thousands of people who might never have considered creating video to enter the arena. At least a portion of these people may come to depend on true video facilities for effects and video processes beyond their own desktop capabilities. This may increase the demand

for traditional video production facilities that can market to this segment. Similarly, the video facility too firmly rooted in the status quo may find itself threatened as new users undertake the simpler video production tasks on their own.

Today it is possible to buy a complete computer for less money than it takes to manufacture some control panels. This has led some broadcast manufacturers to adopt a PC as the universal front-end.

Another multimedia fallout may be pressure on traditional equipment manufacturers. They may be forced to offer lower-end products (less expensive) to compete with the PC-based systems. For instance, there are now PC-based products that can provide many types of video production effects: switching, still-store, CG, paint, 3-D animation and even special effects. (See "PC-Based Effects Systems," February 1991.) The advent of these less-expensive products may actually be good for the market. Such products can introduce many new users to the arena of video production.

The PC-based systems will not in the short term completely replace the high-dollar production hardware. Such equipment offers the professional users many operational advantages that PC-based systems are not yet able to provide. In addition, the issue of image quality always comes to mind when comparing the output of video production systems. The jury is still out on whether these PC systems will be able to compete at the broadcast and production house levels when maximum image quality is of primary concern.

Acknowledgments: The author wishes to thank Henry Mietrot, Video Associates, Austin, TX, for help in the creation of this article.

[:?>)]])

Now You Can Create Your Broadcast STL From Our Field-Proven Line Of Broadcast Radios.

With one broad stroke we've positioned Microwave Networks as the industry's premiere video supplier. By using video technology from Rockwell International Corporation, we have added 2, 6, 7, 8, 11 and 13 GHz video radios to our line of MicroNet products. Microwave Networks can now meet all your Studio-to-Transmitter Link (STL) requirements.

Along with our 15, 18 and 23 GHz radios, Microwave Networks has become a leading provider of broadcast links by offering a complete line of 2 through 23 GHz video radios.



Our MicroNet family of analog radios provide the highest quality video and audio transmission for both NTSC and PAL/SECAM. They meet or exceed all EIA short-haul RS250C specifications and deliver true common carrier performance to assure broadcast quality. With simplex, duplex and multiple channel configurations, MicroNet radios can solve any video transmission requirement.

And that means flexibility! The flexibility to expand or upgrade your MicroNet radio network quickly and easily.

Microwave Networks provides unmatched service and support, including site and system engineering, frequency analysis, installation and training. We even have a 24-hour customer-service hotline.

Quality engineering, reliable product design and complete customer support. It's no wonder we're the first choice in video transmission. Call Microwave Networks today! 1-800-749-2577.



10795 Rockley Road, Houston, Texas 77099
(713) 495-7123 FAX (713) 879-4728

The MVR-1000 Series of microwave video radios are manufactured under license from Rockwell International Corporation.

Circle (9) on Reply Card

www.americanradiohistory.com



Have your cake....

You can have it both ways with System One.

Most audio test sets fall into one of two categories...

There are the specialty testers, like tape recorder test sets, video/audio monitors or pricey short interval test systems. Then there are conventional general purpose audio testers, which can do basic testing but lack the capability to fill today's specialized testing needs.

Investing large amounts in specialty systems that don't also meet your day-to-day audio testing needs is both expensive and frustrating.

SYSTEM ONE solves the problem by providing both high performance general purpose audio testing and innovative specialty testing functions. Basic SYSTEM ONE configurations are priced competitively, yet can grow with your needs to include these advanced functions:

FASTest – Test any audio channel in 2 seconds or less

MLS – Quasi-anechoic measurements of loudspeakers

FM – Automated Stereo Proofs

TV BTSC – Automated Stereo Proofs

DUAL DOMAIN TESTING – Direct digital domain testing of digital audio and interfaces.

TAPE TESTING – Complete magnetic tape recorder and media testing.

SPECTRUM ANALYSIS – Audio FFT analysis

EBU 0.33 – Short interval testing

Circle (10) on Reply Card

and eat it too.

With System One, you can have it both ways!

Audio precision

P.O. Box 2209, Beaverton, OR 97075
503/627-0832 1-800/231-7350
FAX: 503/641-8906, TELEX: 283957 AUDIO UR



INTERNATIONAL DISTRIBUTORS Australia: IRT (02) 439 3744 Austria: Eastern Europe: ELSINCO elektron GmbH 222 812 17 51 Belgium: Trans European Music NV, +02/466.50.10
Canada: GERR Electro Acoustics Ltd., (416) 868 0528 China, Hong Kong: ACE (HK) (852) 424-0387 Denmark: AudioNord Danmark/nph 86 57 15 11 Finland: Genelec OY, 77 13311 France:
ETS Mesureur (1) 45 83 66 41 Germany: RTW GmbH 221 70 91 30 Holland: Trans European Music, +03408 70717 Israel: Dan-El Technologies Ltd 3-544 1466 Italy: Medea S.r.l. 2 4840 1780
Japan: TOYO Corporation 3 (5688) 6800 Korea: Myoung Corporation 2 784 9942 New Zealand: Audio & Video Wholesalers, Ltd. 71 73 414 Norway: Lydconsult (09) 19 03 81
Portugal: Acutron ELA 1 941 40 87 Singapore & Malaysia: Systems PTE Ltd 298 2608 Spain: Telco Electronics, S.A. 531 7101 Sweden: Tal & Ton AB 31 80 36 20 Switzerland:
DeW.A. (Guntter) AG, 10 41 41 41 Taiwan: L.T. Technologies Ltd 2 758 179 NLK: SSF Marketing Ltd 71 387 4262



SBE gavel passes to Farquhar

By Bob Van Buhler

New SBE president Richard Farquhar accepted the leadership position from immediate past president Brad Dick at the annual convention in Houston. Farquhar previously served as vice president for the past two years, and as secretary for two years.

Newly elected vice president Jerry Whitaker from Beaverton, OR, is a broadcast technical author and editorial consultant. He holds the grade of Member and Fellow within the society. Whitaker was instrumental in the founding and growth of the SBE National Convention since it was first established. As vice president, he will assume the duties of CompuServe Sysop for the SBE Forum and will handle relations with the trade press.

Looking back

At his inaugural annual meeting in Kansas City, MO, in 1989, Dick's first promise was to hold directors and officers accountable to the membership for attendance and voting records. This was accomplished by regularly reporting the performance of the national officers to the membership through national office communications and publication in the yearly ballot.

The accountability of directors and officers is now codified in the bylaws, which permits the removal of directors who don't attend board meetings and participate in the society's business. Members voted for this proposed bylaws change by a margin of seven to one.

Also under Dick's leadership, the board of directors recruited and hired Steven Ingram, a full-time executive director.

The high point of Dick's presidency was the formation of a strategic plan for the society. Through the efforts of the directors and officers, the society has a game plan for the 1990s and beyond. These articulated goals represent a road map for the society, with clear destinations and priorities.

Dick noted that the past two years were ones of growth and improvement. Membership is up 18% for this year, and SBE member certification grew from 50% to 63% during his 2-year presidency.

SBE and other groups

During the national convention, the SBE board of directors inked agreements with other organizations for future cooperation. Most important was the decision to combine the exhibition portion of the national convention with the Radio-Television News Directors Association (RTNDA), starting in two years. Separate but simultaneous conventions will be held with a common exhibit hall beginning in Miami, in September 1993.

The focus on radio and TV technology, which is common to SBE and RTNDA, is expected to generate added exposure for exhibitors and to help both conventions to grow.

The joint convention addresses common industry complaints that manufacturers and other potential exhibitors find it difficult to attend the numerous national conventions and shows.

The officers of the Korean Broadcast Engineers and Technicians Association (KBE-TA) signed an affiliation agreement with SBE. They have promised to cooperate in the formation of SBE chapters in Korea and other Asian countries, and to exchange documents and information to the international broadcast community.

In addition, delegations from Mexico and the Philippines attended the SBE Convention and made contact with SBE leaders.

The convention floor

The 1991 SBE Convention was also a joint event held concurrent with the Texas Association of Broadcasters (TAB) annual meeting. The TAB event was originally scheduled to be held in San Antonio, but was moved to Houston in order to take advantage of the added traffic generated by the SBE show.

The presence of the TAB attendees swelled the exhibit hall, helping to offset a predicted drop in attendance because of tough economic times.

SBE brought 109 exhibitors, all technically oriented, to share the floor with the 31 TAB exhibitors. The TAB exhibitors were a mixture of Texas broadcast manufacturers and suppliers, programming and service providers, and government and civic organizations.

Digital dominates

New technologies dominated the discussion at the convention. There was an on-site meeting of the Committee for Digital Radio Broadcasting (CDRB), and special digital radio sessions were held during the *Broadcast Engineering* seminars.

The Canadian Broadcasting Corporation (CBC) provided a report on its field tests with digital radio, giving engineers a glimpse at the real world capabilities of the Eureka 147 system.

On the TV front, station automation, audio production with MIDI and computerization of audio post-production were among the subjects examined at length.

Engineers who didn't attend the convention missed the sessions on automated TV plants and video cart machine automation, video library systems and newsroom hardware and software.

Michael Rau, senior vice president of engineering and technology for the National Association of Broadcasters (NAB), addressed the conference. He reviewed NAB's assessment of the many technical developments in the industry, including HDTV, in-band and Eureka 147 digital radio and RDS.

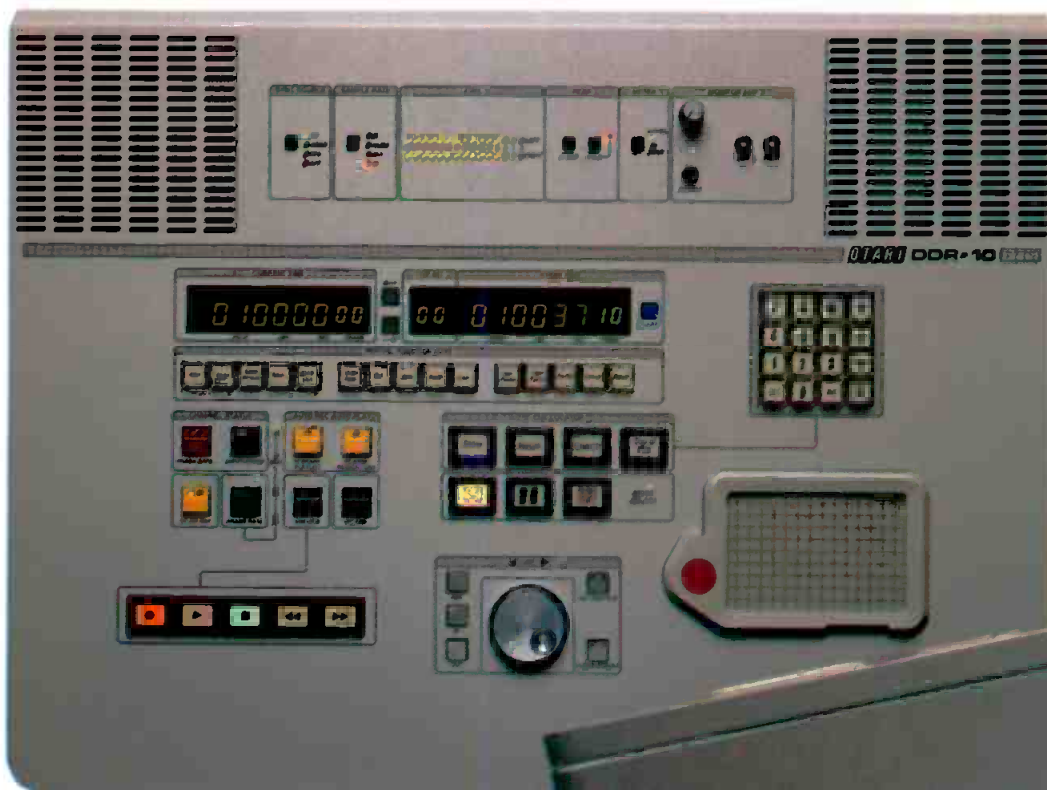
Election results

The society elected three new directors in its annual election. Michael Fast of Baltimore, Troy Pennington of Birmingham, AL, and Frederick Baumgartner of Indianapolis, were chosen to serve by the membership.

Returning to the board will be directors Terrence Baun of Milwaukee, Paul Montoya of Denver and Edward Roos of Palm Beach, FL. All of the new directors will be the last to serve 3-year terms. Bylaw revisions adopted by the membership will restrict future directors to 2-year terms. Previous bylaws specified a renewable 3-year director term.

Van Buhler is manager of engineering at KNIX-FM/KCWW-AM, Phoenix.

COMING FACE TO FACE WITH THE FUTURE
IS A LOT MORE FAMILIAR THAN YOU MIGHT THINK!



We don't ship tape recorders to you in pieces; you won't get our new disk recorders that way either.

Our new DDR-10 digital disk recorder is a fully integrated system that comes ready to roll in and turn on. There's no assembly, no cabling, nothing more to buy. *And because it looks great, clients simply love it!*

If you know tape recorders, you're ready to go the minute you sit down at the DDR-10's control panel. The buttons and knobs are familiar, and they do what you expect. It's the only audio disk recorder in the world designed in this way — designed for the professional.

With up to 60 hours of the highest quality, full-bandwidth digital audio, *and* extensive editing capabilities, the DDR-10 delivers the best "power-to-price" ratio you can buy. And its standard Macintosh[®] SCSI

buss (rather than a proprietary design), means you're free to take advantage of future advances in the computer industry. This way, you're not locked-in to a system which seemed "special" at first, but quickly became *ancient*.

For your convenience, CD replication directly from your DDR-10 soundfile is now available. For more information about this service, and the DDR-10, call Otari; a company famous for technical support and customer service, worldwide.
(415)341-5900

OTARI

© Otari 1991
Macintosh is a registered trademark of Apple Computer, Inc.

Circle (11) on Reply Card

An in-depth look at analog ATR circuits

Taking EQ one step further

By Gerry Kaufhold II

Last month we looked at the equalization circuits of a typical analog audiotape recorder. Recording speed, frequency and the tape head gap all affect record frequency response. Depending on the tape formulation, magnetic audiotapes require fixed boosts of approximately 6dB for frequencies below 400Hz, and approximately 10dB for frequencies above 4kHz.

In playback mode, the equalization circuits compensate for the tape's uneven frequency response by attenuating the low- and high-frequency signals. This gives the deck a flat frequency response. Equalization controls allow the user to trim the circuits to maintain proper frequency response as the recorder system ages.

This month we'll take a brief look at *active equalization*. The equalization circuits mentioned so far have not taken into account the way human hearing works or the frequency content of the material being recorded. Active equalization improves recording by considering these things. It also gives the benefit of lowering the apparent signal-to-noise ratio.

Active equalization

The circuit in Figure 1 operates in parallel with the fixed equalization system discussed last month. A frequency discriminator monitors the relative signal strengths of low-, medium- and high-frequency inputs. A comparator circuit trips if a certain minimum signal level is not present. This cuts in the active equalizer, overriding the standard fixed circuitry.

The rear graph in Figure 2 shows a typical spectrum analysis of modern, highly produced popular music. There is a wide range of frequencies. The distribution of frequencies and sound levels is fairly uniform between 20Hz and 20kHz. With signals such as these, the comparator deactivates the active equalizer. The equalizer applies fixed gains to the low- and high-frequency portions of the signal. The wide range of frequencies will mask high-frequency tape *hiss* and low-frequency *rumble* from the listener's ears.

The forward graph in Figure 2 shows a quiet solo passage. A high-frequency in-

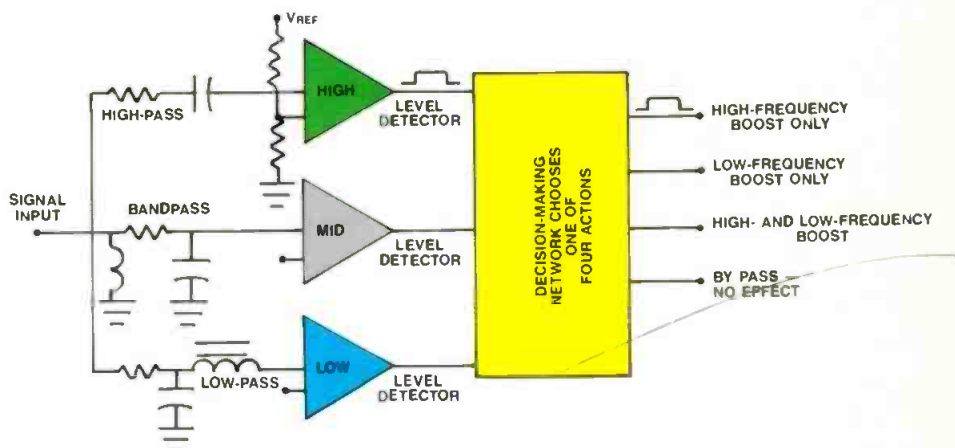
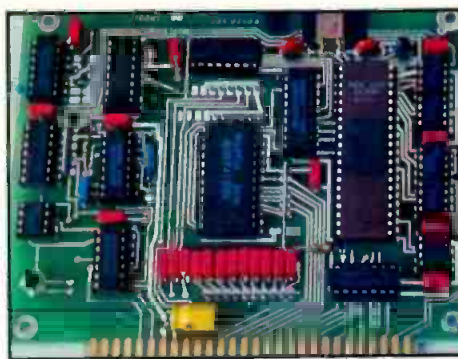


Figure 1. The frequency and acoustic energy-sensing circuit activates appropriate portions of the active equalization circuitry, depending on program content.

strument, such as a piccolo, is the only one playing. This signal will only use half the dynamic range of the tape if the fixed frequency equalization is used alone. The lack of mid- and low-frequency acoustic energy must be taken into account. For the quiet solo passage, the frequency discriminator keeps the active equalizer active.

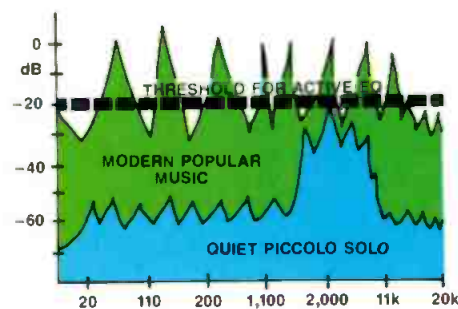


Figure 2. The frequency and acoustic energy content of two different signals indicates the application for active equalization systems.

Because there is little low-frequency energy, the normal low-frequency boost is not applied. On playback, the fixed attenuation of the playback equalizer actually reduces the low-frequency response. This eliminates rumble that might detract from the quiet sound of the piccolo solo.

The midrange is neither boost nor cut. The active equalizer gives the high fre-

quencies an extra 6dB of gain by the active equalizer. Therefore, even the quiet passages provide a signal that is quite near the tape's recording saturation level.

Enhanced playback

In playback mode on a normal tape player with fixed playback equalization, the piccolo solo will sound somewhat louder than when it was recorded. However, the higher signal level will mask the background tape hiss.

In playback mode with an active equalization circuit, the frequency discriminator of the active equalizer will recognize that the signal was enhanced during recording. Sometimes this takes place via proprietary encoding systems, and other times by analysis of the playback frequency spectrum. The active equalizer will turn on its high-frequency attenuator circuit, reducing the playback level of the quiet piccolo solo to its original level. This will also reduce tape hiss by the same amount, further masking high-frequency noise.

Next month we will examine an audiotape recorder's analog servo control loop. This is the control system that keeps the tape moving at a constant velocity with respect to the fixed record and playback heads.

Kaufhold is an electronics industry analyst based in Tempe, AZ.

The Most Widely Used Headphones.

As a broadcast professional, you need to listen to the audio—not the headphones. You want to feel the emotion and excitement exactly the way your audience does. That's why so

many broadcast professionals rely on AKG headphones.

It's no wonder that the 1990 and 1991

Billboard surveys of U.S. studios found

that AKG headphones are the "#1 Most Widely Used Studio Headphones."

Made in Vienna, AKG headphones are the product of Austria's musical heritage. Our engineers have designed their pure love of music into the best headphones in the pro market.

If you're not using our headphones now, try a pair on—and you'll hear why we're #1.



AKG Acoustics, Inc.
1525 Alvarado Street
San Leandro, California 94577 USA
Tel: (1) 510/351-3500
Fax: (1) 510/351-0500

© 1991 AKG Acoustics, Inc. AKG is a registered trademark of Akustische U. Kino-Geräte Ges.m.b.H., Austria.

Circle (12) on Reply Card

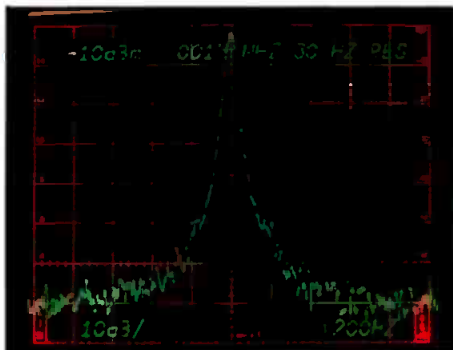
A Hit.



Optimizing 2-track analog ATRs

Tape path failures

By M. Raymond Jason



Tape-path failures are manifested as frequency response problems, signal-to-noise ratio degradations or high-frequency instabilities. The physical balance of a tape path is delicate, so avoid altering components or alignments unless you have first isolated a problem as mechanical in origin.

Isolating mechanical problems

The best way to verify that a machine's playback electronics are not the source of trouble is to employ the flux-loop method described in last month's column.

On the *record* side, you can measure bias/erase frequency and distortion, and obtain some comparative indication of their amplitudes by using a flux loop as a pickup on the record or erase head. These tests should be performed in record mode with no signal input. Measured amplitudes should approximate those from known-good units of the same model ATR. Because the pickup point is the head itself, these tests are sensitive to all failures between the bias oscillator and the head windings. Check record electronics with an oscilloscope at the output of the record amplifier. A low-pass filter to block bias allows measurement of audio distortion and frequency response.

If these tests uncover no defects, yet the machine's audio performance remains poor, a tape-path failure must be the cause.

Troubleshooting tape-path problems subdivides three ways: 1) tape guidance and tensioning, 2) head alignment, and 3) head surface condition. Guidance and alignment ensure that the tape and head gaps bear correct relative positioning. Surface condition and tensioning are critical to the micro-geometry of the tape-to-head interface, and therefore to accurate magnetic recording.

Because tape *heads* are finely adjustable along or around multiple axes, and tape *paths* are relatively inflexible, the logical approach to troubleshooting or alignment always starts with guidance, then proceeds to heads.

Tape guidance

The plane of the tape's surface should

be consistently perpendicular to the deck plate. There should be no warping, in which the top edge of the tape is not directly above the bottom edge (assuming a horizontal deck plate). Nor should there be tilting, in which the direction of tape travel diverges from perfectly parallel to the deck plate. Scraping sounds or oxide shedding indicate that the tape is being forced to tilt or warp. Careful observation of reflections off tape from a flashlight is useful. You should see no ripples or curls.

Most 2-track ATR transports use non-shimmed fixed guides at the entrance and exit of the head stack. Heights of all adjustable elements in the path should be set relative to these guides, starting with the supply reel turntable. The machine's service manual should provide details. If you alter the tape path vertically, you may need to replace or rotate fixed guides because of their wear grooves. For similar reasons you may also need to relap or replace the heads.

Finally, ensure that the play tensions are correct as described by the service manual before moving on to head alignment.

Head alignment

A line drawn through the gaps on a head should be parallel with the plane of the tape (correct *zenith*), perpendicular to the direction of tape travel (correct *azimuth*) and centered within the area of maximum pressure (correct *wrap*). Furthermore, the two gaps should be equidistant from their respective tape edges (correct *height*), and the tape's bend angle around the head should be optimized (correct *penetration*).

Full head alignment should be performed when a new ATR is purchased or upon head replacement. After a day or two of use, many heads already contain wear patterns that make further alignment, particularly height and zenith adjustments, difficult or impossible.

Check *zenith* visually, using a flashlight, relative to the fixed guides or capstan, and from head to head. Check *record-head height* by recording 100Hz at standard level, then "developing" the tape using a magnetic developer (liquid-suspended iron powder) and a microscope. The tracks should be equidistant from their respec-

tive edges. Correct the height if necessary. Next, check *play-head height* by recording 5kHz, flipping the tape over, and checking for equal level on the two channels.

Check *rough wrap* by "painting" the heads with a non-permanent marker, then playing several minutes of tape. Using a magnifying glass (or microscope, if necessary), verify that the gaps are laterally centered within the area worn clean of marker ink by the tape. Set *fine wrap* for the play head by recording 20kHz at 15ips (or 10kHz at 7.5ips) while gently adjusting play-head wrap for maximum output level.

Play-head penetration should be the minimum required for good high-frequency stability, typically less than ± 0.1 dB of wobble on an analog meter for 20kHz playback at 15ips (10kHz at 7.5ips). *Record-head penetration* can be visually matched to the play-head setting.

Azimuth is set with a standard alignment tape. On most headstacks, these alignments are interactive to some degree, so you may need to iterate the previous steps several times.

Head wear

Normal wear usually entails the development of a rectangular flat spot centered over the head gaps.

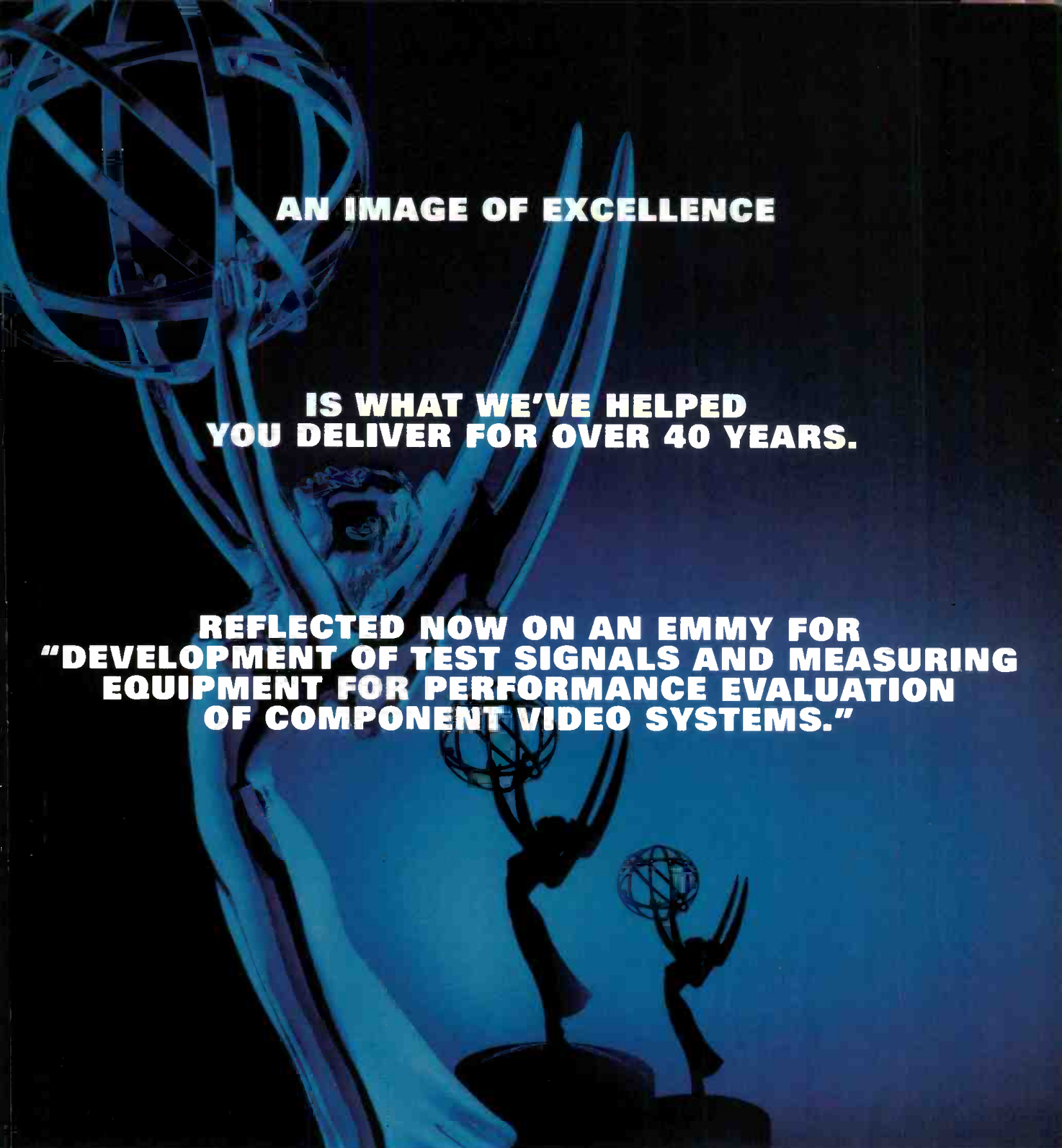
Problematical wear results from poor wrap, zenith, height or penetration. In each case, the wear pattern differs from normal, either the pattern isn't rectangular (e.g., trapezoidal), it's not centered over the gaps or both.

To check head performance, compare standard alignment tape playback response to flux-loop response on the play head. If these responses differ by more than 1dB at 10kHz, it's time to relap or replace the play *and* the record head (assuming they are both of the same age). Or, record a 20kHz tone at 15ips (10kHz at 7.5ips). If the peak-to-peak instability (on an analog meter) of the tone is greater than ± 0.1 or 0.2dB upon playback, the heads need relapping or replacement.

Whenever record or erase heads are replaced, the bias oscillator must be realigned in frequency and amplitude, along with the bias traps.

[:~:))]]

Jason is an electronic engineer at National Public Radio, Washington, DC.



AN IMAGE OF EXCELLENCE

**IS WHAT WE'VE HELPED
YOU DELIVER FOR OVER 40 YEARS.**

**REFLECTED NOW ON AN EMMY FOR
"DEVELOPMENT OF TEST SIGNALS AND MEASURING
EQUIPMENT FOR PERFORMANCE EVALUATION
OF COMPONENT VIDEO SYSTEMS."**



Tektronix
COMMITTED TO EXCELLENCE

Circle (13) on Reply Card

Copyright © 1991 Tektronix Inc. All rights reserved. TVG-120



Working smarter

How to organize a meeting

By Judith E. A. Perkinson

In order to make attending meetings as painless as possible, they should be conducted with a purpose. Organizational skills are essential for conducting a meaningful meeting. If you plan on having your staff take an hour from their work, have a set purpose and goals that you want to accomplish.

Don't hold a weekly staff meeting just because it has always been done. The meeting is not a purpose, it is a habit. If you are going to call a meeting, it should have a motive. Why should the staff be there? What needs to be discussed? What is going to be accomplished by meeting?

Necessary attendees

No one wants to waste an hour listening to issues that have nothing to do with them. When you are planning a meeting, identify the purpose and decide who should attend. If it does not affect the entire department, do not have the whole department attend. You can offer the option of attending to those individuals who may want to listen and learn, but only require the attendance of those people who are essential to the purpose of the meeting.

This consideration communicates your respect for the staff, and lets them know that their time is valuable and that you recognize them as professionals.

This is also the time to consider if other people from other departments need to be included in the meeting. If the problem affects the sales department, then include key people from that department.

You should include those people in the meeting depending on what they can bring to the process of accomplishing the goals of the meeting. In most instances, participants should include:

- Those who will affect or be affected by the issue or subject.
- Those who will provide valuable information about the issue or subject.
- Those who will be making decisions concerning the issue or subject.

When there is potential conflict, it may be necessary to have the meeting chaired by a neutral facilitator.

No matter who is included, be sure they have a reason for being there. Furthermore, be sure that they are the best people to help you successfully complete the goal of the meeting.

Don't start the trip without a map

In the project management series (see the October and November 1990 "Management for Engineers"), the importance of having a written plan before you begin a project was stressed. That plan gave the project direction and structure. In meeting management, that direction and structure begins with a written agenda. Before you plan and call a meeting, take the time to organize what needs to be accomplished and the steps you want to take.

Every meeting should have an agenda. This will force you to examine the organization of the meeting, make sure that subjects flow in a logical sequence, and gives you the foundation for your meeting plan.

Well-planned meeting time

The agenda will provide a list of topics to be covered and the order in which they are to be presented. The next step is to calculate how much time each section of your agenda should take. By doing this, you will know if you have placed more on the agenda than can reasonably be accomplished in the time you set aside.

If you don't have a clear purpose for the meeting, your agenda may become overcrowded. Know what you want to accomplish, and you will be less likely to stray from the program.

Another common mistake is to underestimate the amount of time needed to complete an agenda item. So allow time for participants to ask questions or discuss issues. It is also up to the person running the meeting to control the flow of participation. (This will be discussed in next month's column.)

Be sure to give some thought as to how long it will take to present, process and respond to each agenda item. Check the

relevancy of each subject in relation to the purpose of the meeting. If it looks as if you have too much on the agenda, reconsider the items, pare down unnecessary topics and focus on the purpose of the meeting.

Get the word out

If you are planning a meeting, make sure everyone knows when, where and what time it will take place. After you have made a list of people you want to attend, make sure they are present. A poorly attended meeting is as great a waste of time as a poorly planned one.

If the meeting is worth holding, it is worth taking the time to contact the people you want to be involved. Personal contact is important if an individual's attendance is critical to the purpose of the meeting.

Preparation

Worthwhile meetings begin with you. Preparation and organization are vital to good meeting management. When you develop a reputation for holding good meetings, it pays off. The right people attend, more work gets accomplished and less time is wasted. And you will be holding meetings that run like a well-oiled machine.

Next month, we'll look at how to conduct a meeting.

MEETING CHECK LIST:

- What is the purpose of your meeting?
- Who should attend?
- Do you have an agenda?
- How much time will it take?
- Do people know about the meeting?

Perkinson is a senior member, the Calumet Group, Inc., Hammond, IN.

With seconds to go and the game on the line, who would you rather have take the last shot?

You know the feeling. The air thick with tension. The biggest game of the year on the line. Isn't it comforting to know that you're shooting with Ikegami's remarkable HK-355 studio chip camera, engineered to provide superb colorimetry, exceptionally fine detail and extensive computer controls.

Ikegami's HK-series studio/field cameras include the flagship HK-355, HK-355P hand-held companion, the economical HK-353 studio/field camera, the new HK-343 studio/field camera and HL-43 hand-held companion. With the arrival of the HK-343, Ikegami introduces yet another breakthrough in technology,

(SHBA), Super High Band Aperture, to achieve a horizontal resolution of 850 TVL.

Every HK series camera, leads its price/performance category, with industry-standard technology, specifications and value. That's why broadcast, commercial and industrial video professionals including mobile video operators continually purchase Ikegami's HK-series studio/field cameras.

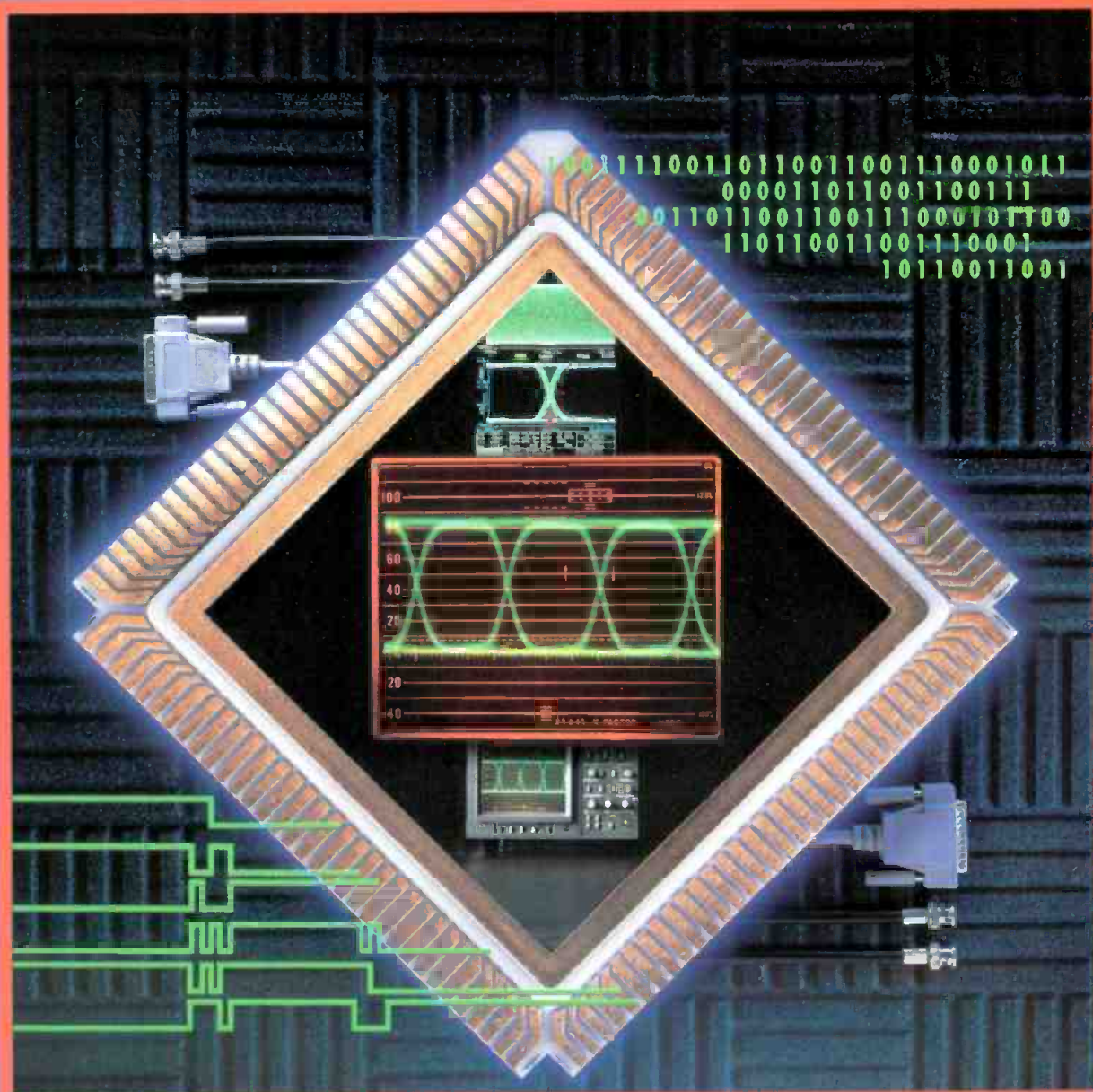
Think about it. Why invest in a "good-enough" camera when you can own an Ikegami? For a demonstration of an Ikegami HK-series camera, please contact your Regional Sales Office.

Ikegami *The Professional's Choice*

Ikegami Electronics(U.S.A.),Inc. 37 Brook Avenue Maywood, NJ 07607
East Coast: (201) 368-9171 West Coast: (213) 534-0050 Southeast: (305) 735-2203
Southwest: (214) 869-2363 Midwest: (708) 834-9774

Circle (14) on Reply Card





Annual station maintenance report

Maintaining today's sophisticated equipment requires special skills.

Few things are more important than keeping the facility up and operating. There is no room for down time. The term *zero defects* might describe how today's broadcast and production environments must operate.

This places increased emphasis on equipment maintenance. The person who can repair today's hardware is a valuable and important part of any operation. Sometimes, the successful maintenance technician can rely on experience. However, today's hardware is often so reliable that experience on any one device is limited. Furthermore, when the device does fail, there's no time to learn how to repair it.

This special issue addresses three important areas of technology within broadcast and production facilities: analog equipment, serial digital video signals and high-power tubes. Each of these areas requires special skills to properly maintain the hardware.

Although digital is the key word in hardware today, much of the equipment used still relies on analog techniques. Today's sophisticated analog equipment provides high-quality performance. Keeping this equipment operating properly can be a challenge if you don't use the proper techniques. "Analog Troubleshooting Basics" will highlight some procedures that will lead to rapid repair of this type of equipment.

The new generation of digital video equipment places special requirements on troubleshooting and repair. This is especially the case with serial digital signals. Although few standard test signals and practices currently exist, there are a few "tricks of the trade" that can be applied. "Monitoring the Serial Digital Signal" offers guidelines to checking those serial video signals.

Most broadcasters still use tubes in their transmitters, and today's tubes are reliable and efficient. Yet, to maintain long life, they need proper care and treatment. "Caring for High-Power Tubes" looks at how tubes are constructed, with an eye to the steps an engineer can take to ensure their long life.

In today's tight economy, many stations are looking for ways to extend the life of high-dollar equipment. TV transmitters are first among those expensive items that can be brought back to life through good engineering management. "Rebuilding TV Transmitters" provides a real-life example of how one station saved tens of thousands of dollars by rebuilding the station transmitter. The result was improved signal delivery in a cost-effective way.

No matter how good your maintenance techniques are, systems occasionally fail, and a quick fix is the only answer. This is often the case with coaxial cable. Often

buried underground or clamped to a tower, coax can be difficult to troubleshoot. Part 2 of "Testing Coaxial Lines" looks at ways that standard equipment can be used effectively to isolate problems in coaxial cable.

Finally, this month's lineup contains the first of a 3-part special report on the design of fiber-optic cable systems. "Building Fiber-Optic Transmission Systems" provides a tutorial approach to understanding how fiber can be used as a replacement for coax and even RF links. The first part of the series outlines the basic factors in designing a fiber system.

- "Analog Troubleshooting Basics" 26
- "Monitoring the Serial Digital Signal" 32
- "Caring for High-Power Tubes" 48
- "Rebuilding TV Transmitters" 60
- "Testing Coaxial Lines" ... 68
- "Special Report: Building Fiber-Optic Transmission Systems" 78



Brad Dick, editor

**If you can't guess why we put over a million
each camera, just take a shot in the dark.**

Sony Pictures and Production Company. Copyright © Sony Pictures Entertainment, Inc. All Rights Reserved. Sony and the Sony logo are trademarks of Sony.

SONY

lenses in

When it comes to shooting in challenging lighting conditions, Sony has the answer.

Our full line of CCD cameras has



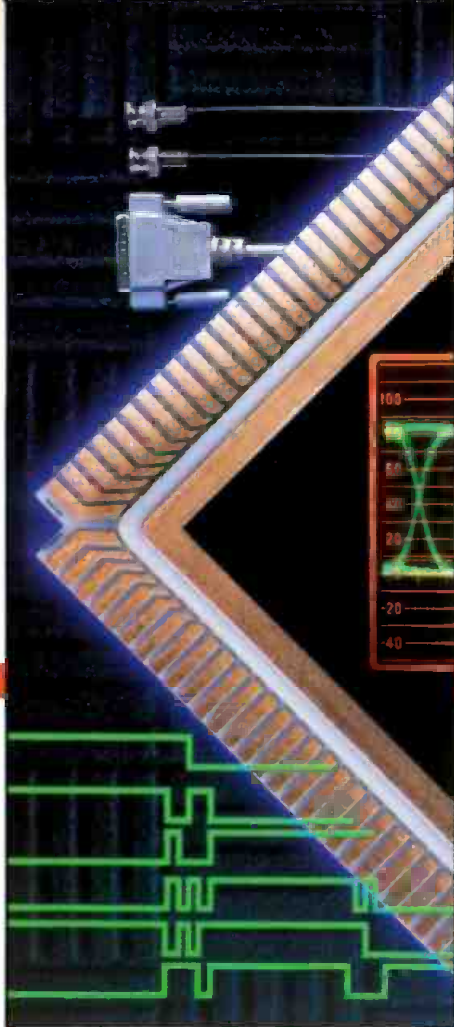
Hyper HAD™ technology to make it the most sensitive camera line available. With the Hyper HAD design, all three CCD chips have a light-magnifying lens on every pixel—a total of over a million lenses.

This exclusive On Chip Lens technology sets new standards in sensitivity by effectively doubling your light gathering capability. It allows you to use virtually all available light. And with our cameras, vertical smear is reduced to insignificant levels.

What's more, Hyper HAD technology joins the advances already in our Studio, EFP and ENG cameras to give you the highest quality image available.

To learn more, call us at 1-800-635-SONY, ext. 105. Once you do you'll never be left in the dark again.

Business and Professional Group.



Analog troubleshooting basics

Most equipment in today's broadcast facilities is still analog — and still needs repair.

By Roald Steen

Analog broadcast equipment includes most audio, video and RF amplifiers, transmitters and many tape decks. In fact, the bulk of all older broadcast equipment uses analog signal paths.

Repair techniques for troubleshooting an analog system are quite different from repairing digital hardware.

Each major piece of broadcast equipment in a facility should have a technical log listing all of its problems as they are observed, and how each problem is solved. This log allows the maintenance technician to determine if the problem is a new one or a recurrent one.

Once you have found out as much as possible about the problem (either in the form of a report from the person who observed the defect, or by doing as many tests as you can without disassembling the system), you are ready to start the troubleshooting procedure.

A primary rule in analog troubleshooting is to proceed from the simplest possible problem toward more complicated causes. Before you begin any in-depth troubleshooting, start with the obvious points — make sure all the necessary parts are plugged in, turned on and connected.

Also, check to see that all switches are in the right positions and that no knobs are loose, because this could cause a control to appear to be in a different position than it really is.

In analog equipment and digital equipment, a large proportion of all malfunctions are mechanical instead of electronic. Among the possible causes for mechanical malfunctions are switches that don't make proper contact, plugs that are not firmly seated in their sockets, and relays that have become worn or are in need of contact cleaning or burnishing.

Check faulty equipment whenever possible by substitution. For example, you may quickly determine if a distortion problem is caused by a microphone by substituting the microphone with another one. A visual inspection will often give you clues to the nature of the problem, especially if you remove the chassis of the equipment that you are troubleshooting.

Look for cracks on circuit boards. Deposits indicate that it may have been wet; brown or black areas may indicate components that have overheated. Furthermore, look for cracked components and loose leads and wires.

Power supply

Many electronic problems are found in components that pass high currents, because they aren't always able to dissipate heat as effectively as necessary.

The power supply is one of the modules in a broadcast system that has to deal with high current levels. Begin with a visual inspection of the fuses.

Sometimes, fuses will blow without clear visual indication. If in doubt, a voltmeter will tell you if the fuse works by checking

the output voltage from the fuse. You may also remove the fuse to determine if it is open on the ohmmeter function of the multimeter. If you have disconnected a circuit that receives current from the power supply, the power supply may appear in good working order even if it has a malfunction. Some problems only become apparent in the form of reduced voltages once the power supply is connected to a load.

Safety

Concern for personal safety is critical when troubleshooting electronic equipment. Be especially careful when you are working around power supplies and broadcast transmitters. TV monitors also contain high voltages that can be dangerous.

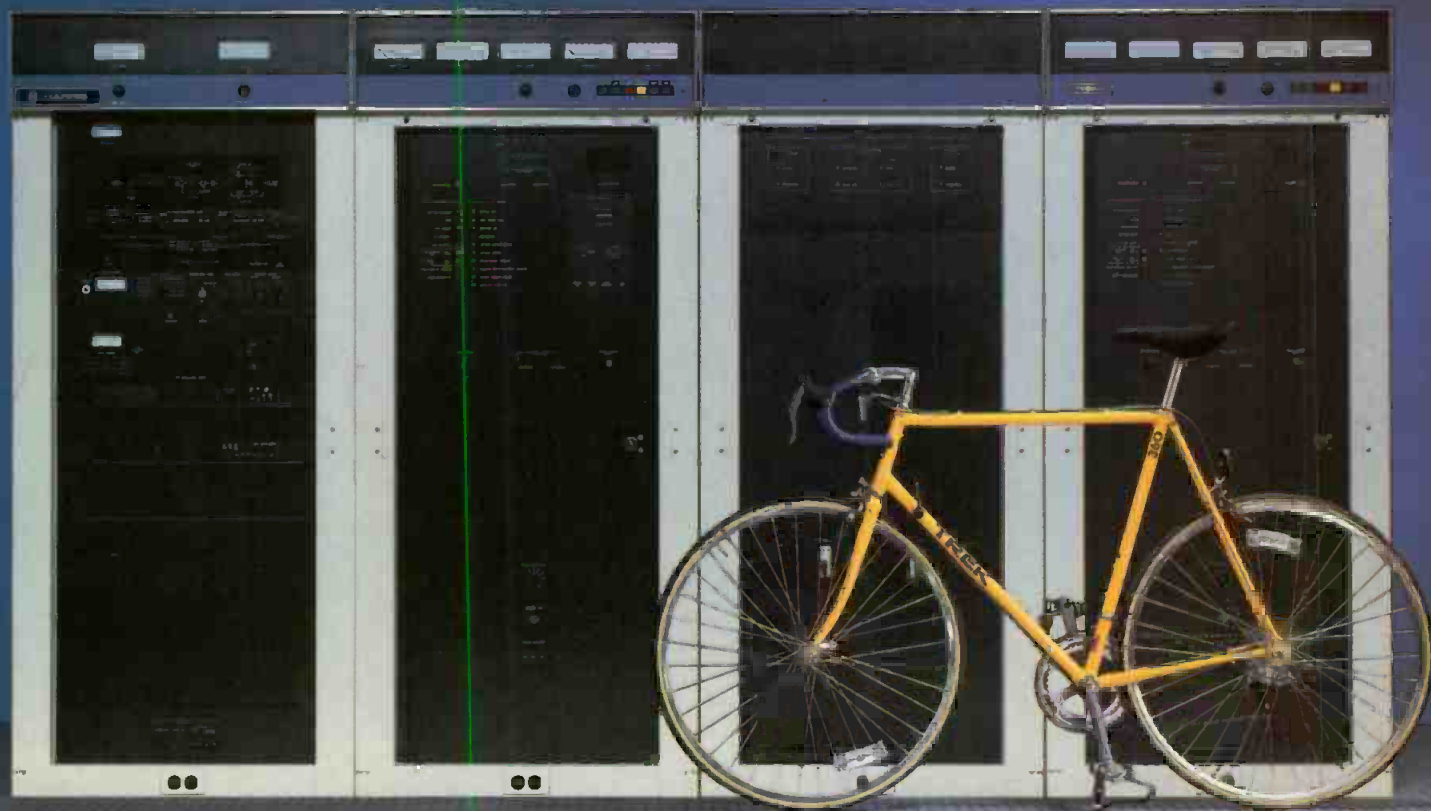
When checking a power supply, be careful not to touch any "hot" sections. It's best to remove metal jewelry when working with high voltages.

Another safety precaution is to keep one hand in your pocket while testing a power supply. This is done to avoid touching a high voltage with one hand and a ground point with the other. If this condition should occur, the shortest point to ground is across the chest, maximizing the risk of cardiac arrest from electric shock.

Keep one hand in your pocket (preferably the left), because if your right hand does touch a high-voltage source, the shortest path to ground is usually through the right foot to the floor. Therefore, the

Steen is an electronics instructor in the Minneapolis/St. Paul area.

RELIABLE EFFICIENCY



Sometimes you get further ahead by not re-inventing the wheel. For proof, take a look at our high-efficiency UM Series UHF transmitters. Their evolutionary MSDC klystrons can cut your power costs in half. Without compromising 24-hour-a-day, 365-day-per-year reliability.

MSDC klystrons build on proven familiar technology to give you advantages no other high-efficiency power amplifier can offer. They don't need crowbar protection. They don't compel your technical staff to undergo lengthy and expensive retraining. They won't restrict you to a single

source, either—MSDC klystrons are available from Philips, EEV and Varian.

Harris UM Series transmitters lead the industry in serviceability as well. Exciters and IPAs are easily accessible from the front of the transmitter. Cooling system filter replacement and most other routine maintenance operations can be performed without taking the transmitter off the air or reducing power.

Bold thinking and common sense solutions: You'll find ample evidence of both in our new 60, 120, 180 and 240 kW UM Series UHF transmitters. That's why so many

UHF stations are choosing Harris as their manufacturer. If you'd like to cut power costs without giving up dependability, call (217) 222-8200, Extension 3408 for more information on Harris UM Series UHF transmitters. (Outside the continental US, phone (217) 222-8290 or telefax (217) 224-2764.)



Harris Allied Broadcast Equipment
Television RF Products
P.O. Box 4290, Quincy, IL 62305-4290 USA
Tel (217) 222-8200, Ext. 3408
Fax (217) 222-7041

© 1990 Harris Corporation

Circle (15) on Reply Card

www.americanradiohistory.com

impact on the heart is reduced. Insulated shoes will help minimize the risk of this occurring. However, they should not be regarded as immunizing you from shock. At high voltages and frequencies, insulated shoes may not afford much protection.

Try to avoid working on transmitters or large power supplies alone. Even if you are with someone who is not a trained broadcast engineer or technician, that person can be invaluable in getting help should an accident occur.

Test instruments

Once you have checked mechanical components and your power supply, it's time to begin analog troubleshooting. How you will proceed depends on what types of test equipment are available.

The minimum test equipment you will need includes a multimeter, an oscilloscope and a signal generator. This test equipment will uncover most problems that occur in audio equipment.

If you service a lot of RF equipment, you may want some more advanced pieces of test gear, such as a frequency counter, a frequency selective voltmeter and a spectrum analyzer.

A variety of probes and connectors should also be part of your test set. These are essential to the efficient application of any test equipment package.

Test equipment can also malfunction. Test equipment that isn't operating properly can, of course, indicate problems that do not exist or send an engineer on wild troubleshooting goose chases. Probes and probe leads are subject to much wear and tear, and therefore will often develop malfunctions and intermittents.

Many types of analog test instruments need periodic calibration. You can perform some calibration tasks yourself by checking instruments against each other. Other types of calibration must be performed in a manufacturer's laboratory.

If you encounter test results that don't make sense, make sure that the problem is not in the test equipment by checking the circuit with another test set or probe. Consider the possibility of intermittents in the test leads.

The inputs to many types of test instruments are fused to protect the instruments against overvoltages and high currents. If the test instrument does not show the expected reading, it may be caused by a blown input fuse.

Signal tracing

Signal tracing, signal injection and continuity testing are among the most useful troubleshooting techniques when you are repairing analog equipment.

Signal tracing simply follows the signal from the point where it originates, or from where it enters the device under test (DUT), to the point at which the signal disappears. An oscilloscope is usually the best

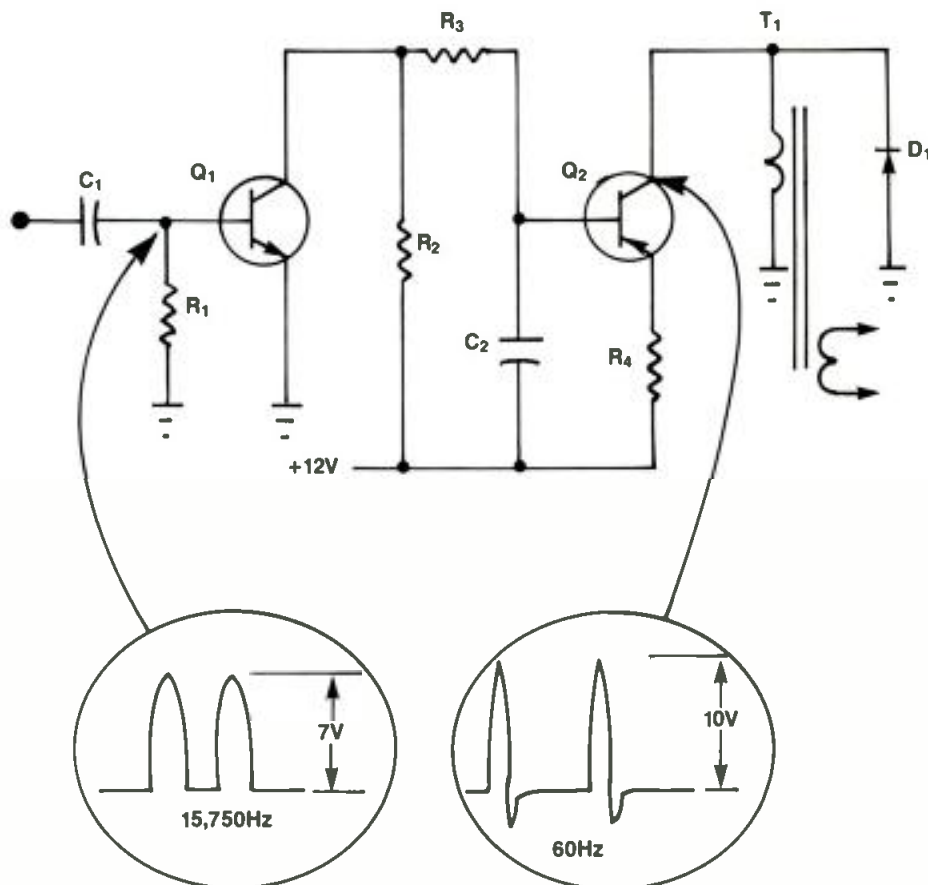


Figure 1. A service schematic showing level, frequency and waveform that should be found at various test points. For waveform displays, the manual should include the proper scope time base settings.

instrument for tracing a signal.

Use the manual to follow how the signal moves through the device that is being fixed. Good manuals will give indications of signal *levels* at a number of test points throughout the set. They may even give illustrations of the waveforms that should be seen on an oscilloscope at those points. (See Figure 1.)

Make notes on the schematic, especially if you're dealing with a type of equipment that is frequently serviced. Note signal levels and waveforms that you are seeing.

Once the signal disappears while tracing it from stage to stage, you know the general area of trouble. But don't fail to consider that the problem could still be in the output coupling of the preceding stage.

Signal injection

When injecting a signal, start with a steady-state tone from a signal generator at the DUT's input, and monitor its output on an oscilloscope. If the equipment is faulty, an improper display or no display will be seen on the scope.

Move the injection point forward from amplifier stage to amplifier stage through the device until the problem clears. Be sure to use the right frequency and level on the signal generator at each stage. Once the scope display becomes normal, it's fairly safe to assume that the trouble is in the stage immediately preceding the

one being fed by the signal generator at the time.

If the manual does not give a clear indication of signal levels at each amplifier stage, you may determine the correct signal level by observing the same stage in a set that is in good working order.

Continuity checks

Continuity tests are performed with the ohmmeter function of a multimeter. These are used on passive parts of the chain (interconnecting paths, transformers) to verify that they are passing signals. First, shut down the system under scrutiny. Interconnecting paths should be tested without the presence of their normal signal flow.

A coaxial cable can be checked — after you have disconnected it from its input and output — by checking the resistance between its shield and center conductor. The ohmmeter should show an infinite resistance. (See Figure 2.)

Next, use a clip lead at the far end of the coax cable to connect the center conductor to the shield on that end. In a good coax cable, the ohmmeter should show a short. Some coax cable problems don't show up in a continuity test, such as signal attenuation, but this test will at least tell you if the cable has an open or a short. (See Parts 1 and 2 of "Testing Coaxial Lines," in the October and November 1991 issues.)

Similar continuity tests can also be used



THE HEART OF A GREAT TV TRANSMITTER!

Thomson Tubes Electroniques!

Make sure the UHF transmitter you invest in comes with the unique competitive advantage of a TH563 tetrode from Thomson. With 25 kW in common and 40kW in vision-carrier amplification, the TH563 is based on the same principles as the TH582, which routinely achieves more than 10,000 hours of operational lifetime.

Efficient, compact, linear - TV transmitters using the new TH563 tetrode from Thomson outperform their competitors with unsurpassed reliability.

 **THOMSON TUBES
ELECTRONIQUES**

Circle (16) on Reply Card

France : BOULOGNE-BILLANCOURT
Tel. : (33-1) 49 09 28 28
Fax : (33-1) 46 04 52 09

Asia : SINGAPORE
Tel. : (65) 227 83 20
Fax : (65) 227 80 96

Brasil : SAO-PAULO
Tel. : (55-11) 542 47 22
Fax : (55-11) 61 50 18

Deutschland : MÜNCHEN
Tel. : (49-89) 78 79-0
Fax : (49-89) 78 79-145

España : MADRID
Tel. : (34-1) 519 45 20
Fax : (34-1) 519 44 77

India : NEW DEHLI
Tel. : (91-11) 644 7883
Fax : (91-11) 645 3357

Italia : ROMA
Tel. : (39-6) 639 02 48
Fax : (39-6) 639 02 07

Japan : TOKYO
Tel. : (81-3) 3264 63 46
Fax : (81-3) 3264 66 96

Sverige : TYRESÖ
Tel. : (46-8) 742 02 10
Fax : (46-8) 742 80 20

United Kingdom : BASINGSTOKE
Tel. : (44-256) 84 33 23
Fax : (44-256) 84 29 71

U.S.A. : TOTOWA, NJ
Tel. : (1-201) 812-9000
Fax : (1-201) 812-9050

www.americanradiohistory.com

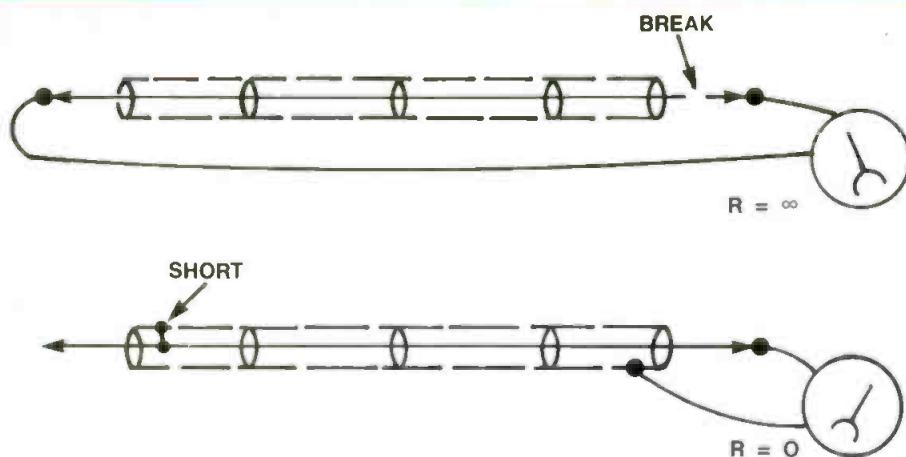


Figure 2. Checking for cable shorts and opens is a simple process using an ohmmeter.

to check other types of interconnecting wiring or to locate cracks on circuit boards.

Isolating the component

Once you have determined the problematic *stage* in an analog broadcast system, it's time to isolate the *component* that has malfunctioned. Here again, a quick visual inspection may be your best start.

Check to see if anything has come loose, or if there is visible evidence of a crack or some other problem on a component. Check for deposits from moisture or corrosion. Also, check for excessive heat in

the form of melting or charring.

The multimeter may reveal a malfunctioning bipolar transistor when, compared with a transistor that is in good working order, it shows an excessively high or low emitter-to-collector voltage.

Some components can best be checked out-of-circuit. Components with only two leads can be checked out-of-circuit by removing only one lead.

Several transistor checkers are commercially available. They are most reliable when testing out-of-circuit transistors and diodes, but may also give a valid indication for in-circuit components. Transistor

checkers even work for some integrated circuits.

If you don't have a transistor checker, the ohmmeter function of the multimeter may serve as a transistor checker by enabling you to check the transistor's junctions. Remember, however, that a transistor that passes junction tests may still malfunction in circuit. As the transistor passes current and heats up, it may fail even though it looked fine when examined out-of-circuit.

Intermittents

The malfunctions that tend to cause the most trouble are intermittents. A log is especially useful in dealing with an intermittent problem, because it helps trace its history. Trends or the existence of a specific set of problem-causing conditions may become obvious from reading the log and doing a little deductive reasoning. (For example, a transmission line difficulty may occur only when it rains.) Without the log, these causes might remain mysterious for some time. The log also tells you what remedies have been tried before, and with what results. If you work in a large shop with many operators and multiple maintenance technicians, a log is even more essential for basic communication and common awareness of equipment service histories.

Continued on page 100

WELL-CONNECTED

Only *Matrix Plus* stations operate over single-pair wiring using fully digitized audio. Such a simple and economical solution, you'll wonder why all intercom systems aren't designed this way. *Matrix Plus* also features:

- Plug-in interface cards for fool-proof external communication with the right connections built in for telephones, two-way radios, IFB systems, cameras, PL systems and just about any equipment made by Clear-Com, RTS and others.
- PC programming and local station reprogramming to provide access to every combination of stations and interface cards.

***Matrix Plus*... The Digital Intercom System that's so advanced it's simple!**



USA/Canada
945 Camelia St., Berkeley, CA 94710
TEL 415-527-6666 FAX 415-527-6699
International-FAX 415-932-2171



©1991 Clear-Com Systems

Circle (17) on Reply Card

WHAT YOU NEED IS WHAT YOU GET.



BT-H1350Y 13 INCH COLOR VIDEO MONITOR



BT-S1360Y 13 INCH COLOR VIDEO MONITOR



BT-S1370Y 13 INCH COLOR VIDEO MONITOR

In video monitors, it always seemed you either couldn't get exactly what you were looking for or you got more than you actually needed. That was before the Panasonic BT-series family of monitors.

Panasonic's new BT-H1350Y (13-inch*) Color Video Monitor gives you SMPTE C Phosphors and an extra sharp 750 horizontal line resolution for the demanding requirements of presentation and measurement.

The new BT-S1360Y (13-inch*) Color Video Monitor couples a wide range of professional features with underscan, cross pulse, selectable color temperature (9300K/6500K) and more.

The new BT-S1370Y (13-inch*) Color Video Monitor gives you many of the same essential

professional features like 4-system compatibility, comb filter for NTSC, and blue signal only, at a resolution of 420 TV lines.

The new BT-S900Y (9-inch*) monitor offers underscan, cross pulse, S-VHS compatibility, blue only, comb filtering and AC/DC operation. The

BT-S901Y offers the same professional features in an AC, dual rack-mountable configuration.

This entire family of professional monitors couples today's modern technology with Panasonic's

quality and stable performance.

When you're choosing professional video monitors, it's great to know that with Panasonic you never have to pay for more than you need. In our minds, that may be the most important feature of all.



BT-S900Y COLOR VIDEO MONITOR



BT-S901Y RACK MOUNTABLE COLOR VIDEO MONITORS

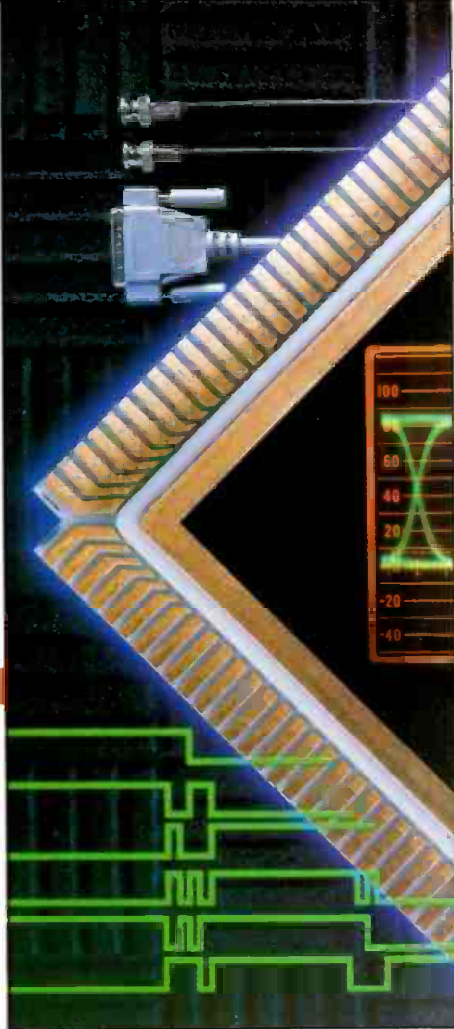


Screens have been simulated

For the Panasonic Professional Video Dealer nearest you, call 1-800-524-0864
Panasonic Communications & Systems Company
Division of Matsushita Electric Corporation of America
One Panasonic Way, Secaucus, NJ 07094

*Measured diagonally

Panasonic



Monitoring the serial digital signal

Understanding the basics of serial digital video can open a new avenue for distributing digital video signals.

By Ken Ainsworth

Serial digital video equipment offers many advantages. First, it uses coax, not bulky multiconductor cables. This means facilities can use existing wiring, and that new cable installations are much cheaper than with parallel digital video. Furthermore, parallel cables have a maximum usable length of approximately 50m (due to timing skew between bits). Serial links of more than 300m have been demonstrated by several manufacturers.

However, serial also presents some new challenges. Engineers must understand and deal with these to achieve reliable, predictable system operation. Serial has high bandwidth requirements, and noise and distortion affect digital transmission systems differently than the more familiar analog systems. These differences can surprise the video engineer who is venturing into serial. A basic understanding of digital transmission system characteristics is helpful when planning an installation and developing a strategy for maintaining it.

Understanding PCM

Most of today's digital systems use pulse code modulation (PCM). In serial systems, each video sample is coded into a sequence of 10 binary symbols. This requires considerably more bandwidth than the original signal. However, as long as the re-

ceiver circuitry can differentiate a binary 1 from a 0, additive noise does not degrade the recovered signal. This allows PCM signals to be repeated and regenerated as needed without degradation, which simplifies distribution.

Serial brings with it some new challenges. Engineers must understand and deal with these to achieve reliable, predictable system operation.

PCM adds noise and distortion to the original message signal in two ways: quantization noise and detection error. Quantization noise results from representing the analog signal by a finite number of discrete levels. With uniform quantization, 10-bit representations yield a little more than 60dB S/N. Eight bits give just a little more than 48dB. Detection errors occur when a receiver incorrectly interprets a transmitted pulse. This can come about by a low S/N or distortion in the channel. In most PCM systems, the relationship between S/N ratio and the probability of detection error is extremely steep. A change of just a few decibels in S/N will cause the

error rate to change by several orders of magnitude. (See Figure 1.)

In a typical PCM system, the detection error is practically zero when the S/N exceeds 15-20dB. Beyond this point, quantization noise dominates. Designers typically set up PCM systems to operate in this quantization noise-limited region, sometimes referred to as the *saturation region*. The flatness of the output S/N in the saturation region gives PCM considerable tolerance to changes in the channel S/N.

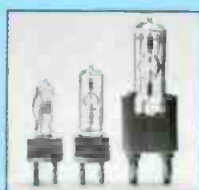
This is sort of a double-edged sword. The insensitivity to input S/N also gives you no warning if you are close to entering the detection error-limited region — the *digital cliff* or *crash-point*. One of the challenges for serial installations is to find out where the system is operating with respect to this threshold point.

Serial error rates

An operating serial system requires an unusually low error rate. Although bit error rates (BERs) of 1×10^{-6} are adequate for many digital transmissions, serial systems demand a BER of less than 1×10^{-9} and probably less than 1×10^{-13} .

There are several reasons for this. The scrambling system used in serial systems multiplies channel errors by six at the receiver. A single channel error has a 50% probability of causing an error in the most significant bit (MSB), and a 70% probability of causing an MSB or MSB-1 error.¹ Therefore, one out of two channel errors

Ainsworth is a senior engineer for Tektronix's Television Division, Beaverton, OR.



The new Dimension in Fresnel Lighting. Director from Sachtlar.

For successful lighting: Sachtlar Reporter, Production, Director.

Sachtlar is now extending its lighting range with the Director Series of Fresnel Lights for studio and location work.

They are available in the most commonly used power sources. The Director Series for daylight use features the most advanced bulb technology with single ended bulbs from Osram and Phillips. In wattages of 125 W, 250/270 W, 575 W, 1.2 kW and 2.5 kW, the new Director Fresnel Lights offer excellent light output and distribution. For example:

Sachtlar Director 575D produces 14,500 lux (1,400 fc) in spot (5°), 500 lux (48 fc) in flood (50°) measured at 5 m (16.5 ft.) distance.

The Director Series for tungsten halogen bulbs are available in 300 W, 650 W, 1 kW and 2 kW. All Sachtlar Director Lights are setting new standards, and feature:

- Smooth focusing lamp base running on linear bearings to provide trouble free operation.
- Powerful convection cooled design for long bulb life.
- Housings made of die-cast aluminum for toughness and light weight.
- High efficient light traps prevent light leakage for fast and easy light setting.

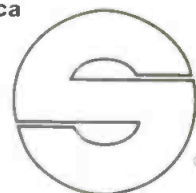
See for yourself. Test the new Sachtlar Director Fresnel Lighting. Call or write today for more information and the location of your nearest Sachtlar dealer.

The new dimension in lighting.
Circle (18) on Reply Card

sachtlar
corporation of america

55 North Main Street
Freeport, N.Y. 11520
Phone (516) 867-4900
Telex 140 107 sac frpt
Fax: (516) 623-6844

California office:
3316 West Victory Blvd.
Burbank, CA 91505
Phone (818) 845-4446



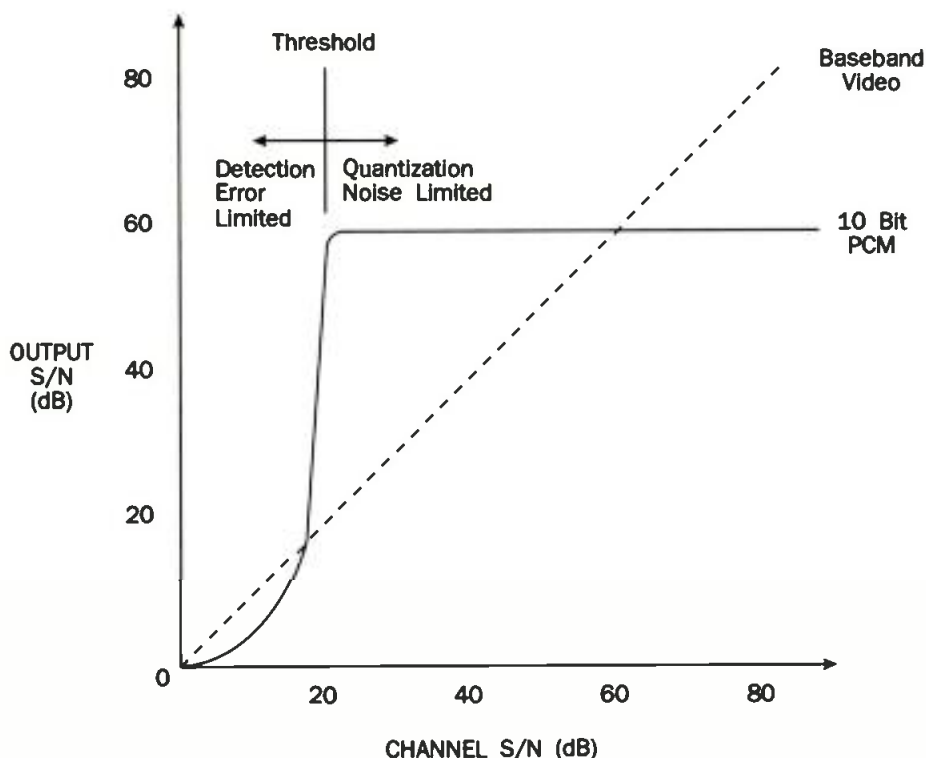


Figure 1. The relationship between S/N ratio is such that a change of just a few decibels will change the error rate quite a bit. The detection error is practically zero when the S/N exceeds 15-20dB. Beyond this point, quantization noise dominates. This is called the saturation region.

will cause a visible picture defect, seen as a short black or white dash. Picture monitors spatially map the video. This makes even occasional errors visible. Also, technical quality standards in most video facilities are high. Although no error rate standards for serial exist yet, acceptable performance will likely dictate between one error/minute and one error/day. For 143Mb/s NTSC, this corresponds to channel bit error rates of 2.3×10^{-10} and 1.6×10^{-13} , respectively.

tains significant spectral energy up to the clock frequency. For 143Mb/s NTSC, this is approximately 30 times the bandwidth of the baseband signal. This wide bandwidth is a result of the PCM representation of the signal, and it places severe demands on the channel (usually coax) and the receiver. Reflections in the channel can distort the transmitted pulses and increase the detection error. Also, coax can be quite lossy at the higher frequencies and needs equalization in the receiver for everything but extremely short runs.

Bandwidth requirements

The non-return to zero inverted (NRZI) channel coding used in serial video con-

Serial monitoring needs

Users can successfully install short seri-

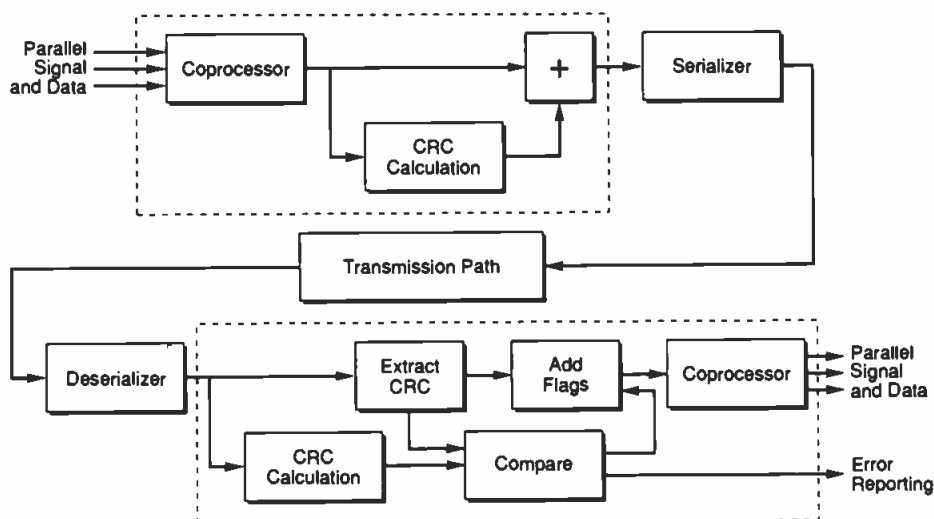


Figure 2. The error detection and handling (EDH) system generates a cyclic redundancy code (CRC) check word for each video field, which travels with the video signal. At the receiver, circuitry compares the transmitted CRC with a locally generated one to catch errors.

al systems without any special test gear. "Short" is defined as a coax path in which the loss is well within the equalization capabilities of the receiver. It is often desirable to determine how far the link is away from detection error-limited operation. This is called the *link margin*. It is also useful to know if transmission impairments are causing a higher-than-necessary error level. Test equipment can help solve these problems and speed fault diagnosis if a system fails.

Monitoring serial signals can be broken down into five classes. The first is straightforward and familiar. Simple content/picture monitoring involves converting a serial signal to analog, and using it to drive a conventional picture and waveform monitor. This allows the signal to be viewed and identified. Experience has shown that most serial errors produce visible picture defects. These can often be spotted with a picture monitor. However, staring at a monitor can get tedious.

A better way to monitor error rate is to determine if the received message matches the transmitted one. Embedded indicators, such as parity check codes, help confirm that the message was correctly received.

One proposed monitoring scheme detects if an entire field's worth of video was correctly received.² The system is called error detection and handling (EDH), and it generates a cyclic redundancy code (CRC) check word for each video field. This check word travels with the video in an ancillary data packet. At the receiver, circuitry compares the transmitted CRC with one that is calculated from the incoming video. If they don't match, the system flags the video field as erred. (See Figure 2.)

Tests have shown that EDH is a sensitive and accurate way of determining if serial data errors are occurring in a link. SMPTE is considering EDH for possible standardization.

Figure 3 shows how EDH data might be displayed. Note that rather than indicating an error rate, the display indicates the number of program seconds that contained errors. Many experts feel this is a better indication of a link's condition than a straight BER number, particularly if the errors occur in bursts.

The kind of processing necessary for EDH is also well-suited to provide other information about the serial signal, such as the presence of embedded audio and other ancillary data, and simple format errors.

Channel monitoring

A third monitoring scheme examines the communications channel. Poor pulse shape can raise the detection-error threshold and degrade the link margin. Parameters, such as pulse amplitude and

Our new panel design — Take a close look at our new front panel. The VL-D500 capitalizes on the easy operation built into Hitachi's 1-inch video recorders. Functionally, it even resembles the 1-inch VTR panels you're used to.

New menus that set you free—Now you can do all your everyday operating functions with controls right on the front panel, without getting lost in tedious menus!

Smaller and more efficient—It's smaller than any other S/M/L-cassette D-2 VTR, and less than half the size of a 1-inch video recorder. The Hitachi VL-D500 requires only 7 rack units.

Built-in digital test generator — Eliminates the need to buy a separate test generator. That's a big savings, and more built-in value.



Hitachi D-2. The 2nd generation.

Presenting the second generation of Hitachi's VL-D500. With a new panel design and a streamlined menu system, this is the simplest and most efficient broadcast quality D-2 VTR ever conceived.

The VL-D500 can flatten your digital learning curve—and make your transition into D-2 fast, easy and affordable.

Learn more about the new VL-D500. Contact the Hitachi Denshi America regional office nearest you.



NEW YORK 516-921-7200 • ATLANTA 404-451-9453
CHICAGO 708-250-8050 • DALLAS 214-891-6381
LOS ANGELES 213-328-6116 • CANADA 416-299-5900

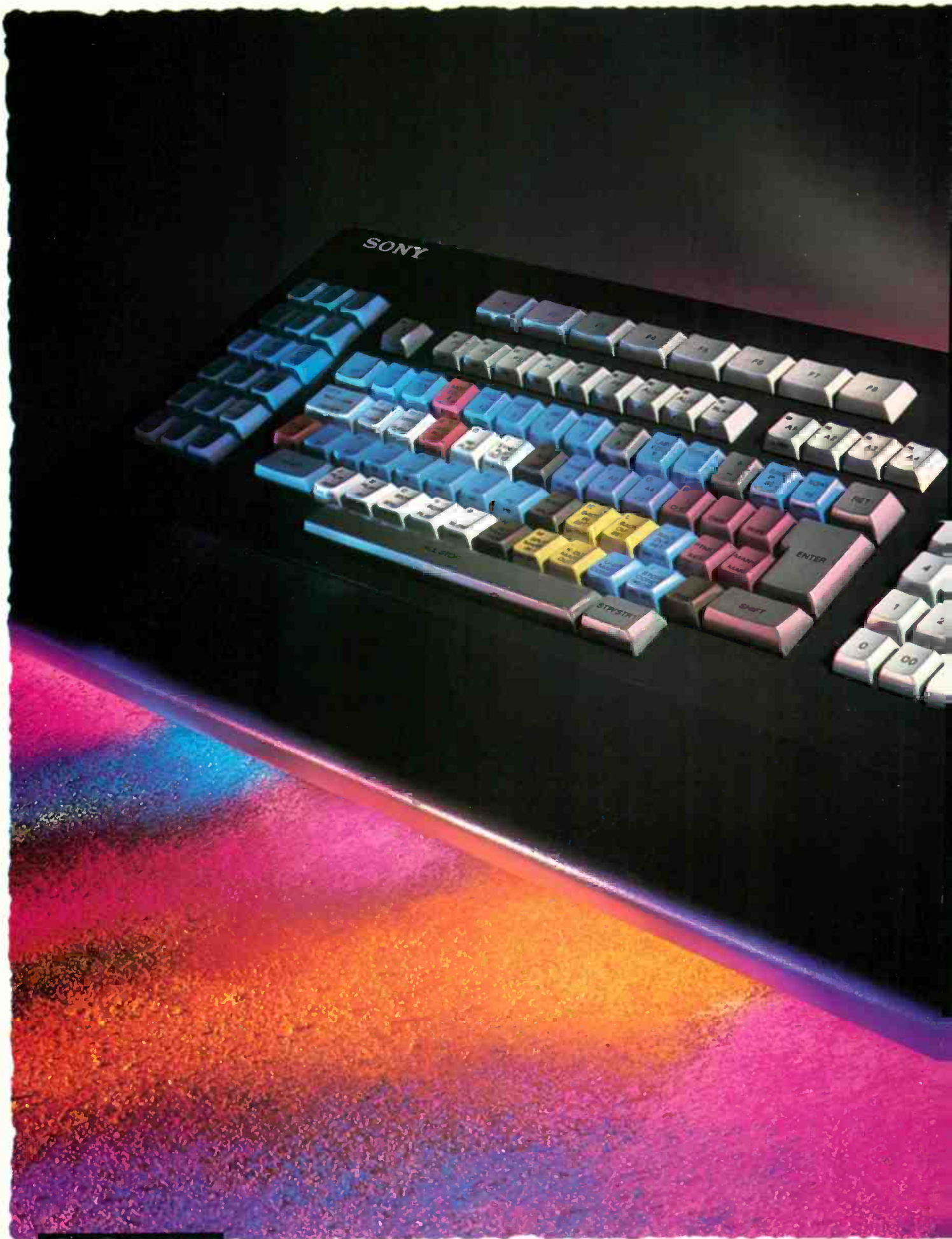
Now, D-2 is even easier—Easier to learn, and easier to use, the VL-D500 makes digital recording and editing more productive.

Digital compression—Time compression and expansion is simple on the VL-D500. And of course, with digital signal processing, your program is compressed without losing a generation.

All three D-2 cassette sizes—Hitachi's VL-D500 gives you the max in versatility.

Longer and more comprehensive warranty — Only Hitachi offers *one full year on site*, for both parts and labor. No other D-2 recorder comes close to the VL-D500.

If you've been dreaming of the perfect editor, consider this your wake-up call.



SONY



Sony, Business and Professional Group, 1-800-635-SONY, ext. 772, is a trademark of Sony.

Sometimes dreams do come true. Thanks to the new Sony BVE-9100, that time is now.

The BVE-9100 offers an array of exciting advances and proven features to suit your own editing style. It gives you superior switcher and machine control with up to 14 VTRs on line. You can select your choice of EDL screen color and position. You can even reassign any key on the keyboard.

The BVE-9100 also lets you store switcher data, audio mixer data and digital color correction information in an EDL. So revisions are quick and accurate.

In addition, its advanced software option gives you on-line trace, quick trace and 16 multi-EDL's. It also has automatic time track capabilities—even context-sensitive and slow-motion matching.

To learn more, call us at 1-800-635-SONY, ext. 772. And find out why this is not just another editor to yawn over.

Business and Professional Group.

EMF HOW DANGEROUS?

**A Major Two-Day
Conference Designed
To Keep You Totally
Informed About Electric
And Magnetic Fields**

March 9-10, 1992

Transmission & Distribution Magazine's Second EMF Conference and Debate will be held at Crystal Gateway Marriott Hotel, Arlington, VA. It is designed to provide you with a continuing dialogue about one of the most controversial and critical environmental issues of the 1990's.

T&D Magazine's two-day conference will feature 16 hours of lively dynamic commentary and discussion on the details of EMF. A blue ribbon panel of experts will discuss the important topics that surround the debate.

Who Should Attend

Electric Utilities; Telephone Companies; Electrical Contractors; Electricians; Broadcast Engineers; Federal, State, Local Governments; School Systems; Health Agencies; Legal Firms responsible for litigating the issue; and Trade Organizations and Groups concerned about the issue.

What You'll Learn

- An International Perspective of the EMF Issue
- A Complete Review of Scientific Research
- What to Expect from Government
- Regulating EMF and Litigating EMF in Court
- The Impact of EMF on Workers—Electric Utility and Telephone Workers, Electrical Contractors, and Electricians
- What Consumer Groups Are Doing about EMF
- Case Studies—Industry's Position and Perspective of the EMF Issue
- The Costs of EMF to Industry

For more information call
Barry LeCerc/ Carolyn McNasby
Tel: 215-359-1249

Circle (19) on Reply Card

Continued from page 34

rise time, and aberrations caused by reflections in the channel, jitter and additive noise are all important. They should be examined to ensure the best link performance.



Figure 3. One possible EDH display indicates the number of program seconds that contained errors instead of a straight bit error rate number.

The philosophy of the serial system has been to specify the transmitter waveform and the frequency response of the coax channel. Receivers are then designed with varying degrees of performance, depending on the application. Figure 4 illustrates recommended specifications for 143Mb/s NTSC.

A common method for estimating the health of PCM systems is the "eye pattern" of the signal. Eye patterns are typically formed by triggering an oscilloscope at some fraction of the clock frequency and applying the PCM signal to the scope's vertical channel. The resulting overlaid display shows the region over which the transmitted levels can be unambiguously separated — the so-called "eye opening" of the signal.

The eye pattern is the primary means for evaluating channel performance. High bandwidth analog, digitizing and sampling scopes can all make this display. Although a 1,000MHz bandwidth is required to faithfully display small signal aberrations, in most cases, 300MHz will do the job. The return loss of the scope input is more important than the bandwidth. Using a 75Ω feedthrough terminator on a 1MΩ, 20pF scope input will display pulse distortions that are actually caused by the poor termination. The best scopes for this use are those with 75Ω inputs, or 50Ω scopes with a 50/75Ω min-loss pad.

Passive loop-throughs

A powerful channel-monitoring tool is the passive loop-through oscilloscope. The passive loop-through allows the scope to sample the serial link channel at various locations in the system. It can often help find channel problems that would be awkward to detect using a 75Ω terminated scope.

Figure 5 shows a transmitter output that is displayed on a TV oscilloscope using equivalent time sampling. This measurement was made near the transmitter end of the link. Figure 6 shows the effect of an 18-inch open stub placed on the line near the transmitter. Such a stub might have been unwittingly installed as a troubleshooting aid. Although the stub would be of no consequence with 5MHz base-band video, it renders the 143Mb/s serial system inoperative.

Figures 7 and 8 demonstrate the problem that 50Ω line sections can cause. An 18-inch length of coax was inserted into the 75Ω channel. (This might occur if the signal passed through a 50Ω patch cord.) In Figure 7, the 50Ω section was inserted between the transmitter and the loop-through monitor, with the remainder of

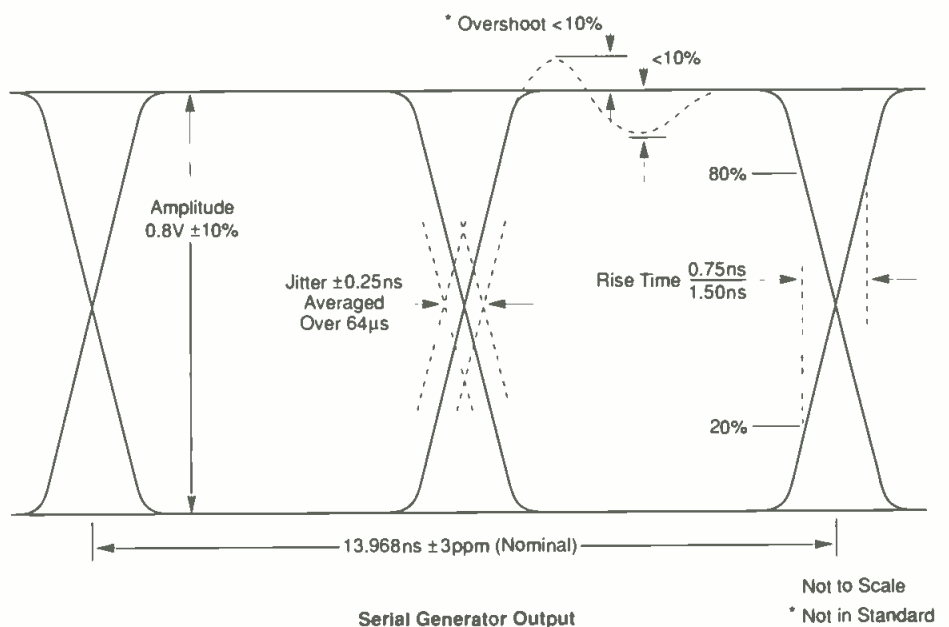


Figure 4. Recommended specifications for 143Mb/s NTSC serial video.

Multifunctional MP-10 portable mixer for retransmittals

AEQ - MP - 10



MAIN CHARACTERISTICS

- Dual Mode Dialler, which permits telephone communications in either pulse or tone dialling modes, through a programme output with an impedance matching circuit.

- Two independent circuits which enable different communication modes (2 or 4 wire) with a double hybrid control unit.

- Five transformer balanced mixing inputs selectable MIC/Line level inputs and one additional for the technician or commentator's headsets, with the possibility of user selectable PHANTOM power feed.

- An identification message of up to 32 seconds in length can be recorded into a solid state memory for later replay, using a 4 bit, ADPCM compression and storage in static RAM.

- A test tone Generator at a frequency of 1.9 KHz is very useful as a remote control and testing signal.

- Several Mixers may be cascaded together for the purpose of increasing the number of input channels.

- In addition to the control technician's headphone output, there are three headphone outputs for commentators and guests. All are 600 Ohms.

- The Mixer provides a transformer balanced programme output, an electronically balanced auxiliary output and a bus output for cascade connections.

- The talkback output is also transformer balanced.

- A level meter on the front panel permits to measure the programme and talkback signals and to check the condition of the internal batteries.

- The equipment is operated by means of an external mains supply or internal Ni-Cd rechargeable batteries, which have a 4 hour operating autonomy. The batteries are recharged automatically when the equipment is connected in the mains supply. Should said electric supply be interrupted, the batteries automatically enter into operation to guarantee programme continuity.

MADE BY:



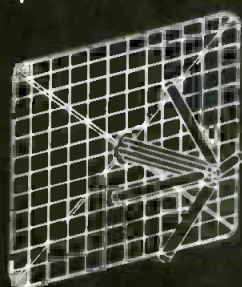
APLICACIONES ELECTRONICAS QUASAR, S.A.

Pol. Ind. Leganés. C/ Rey Pastor, 36. 28914 LEGANÉS. MADRID (SPAIN)
Phone: +34 - 1 - 686 13 00 - Fax: +34 - 1 - 686 44 92

Circle (20) on Reply Card

WHEN YOU WANT MORE THAN JUST AN ANTENNA

JAMPRO has been providing the broadcasting industry with state-of-the-art antennas for over 35 years, longer than any other US antenna manufacturer. With over 3000 antenna systems delivered, at JAMPRO you don't just buy an antenna, you invest in experience.



JAHD CP
Arrowhead
Screen Dipole

THE LEADERS IN ANTENNA TECHNOLOGY

- Complete line of FM & TV broadcast antennas
- RF components, Filters & Combiners
- Modern 7000 ft FULL SCALE test range
- Directional antennas and pattern studies.

Call or fax us your needs today.

(916) 383-1177

Fax (916) 383-1182



6939 Power Inn Road
Sacramento, CA 95828

Circle (21) on Reply Card

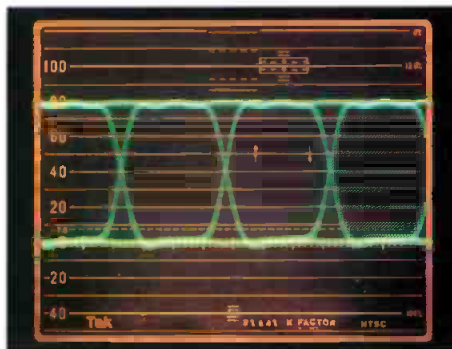


Figure 5. This normal eye pattern display shows the region over which signal bits can be clearly discerned as being 1s or 0s. The narrower the eye, the worse the bit error rate.

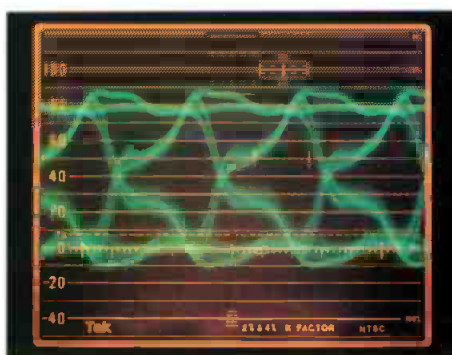


Figure 6. An 18-inch coaxial stub on the line, although transparent to baseband video, renders a 143Mb/s link inoperative.

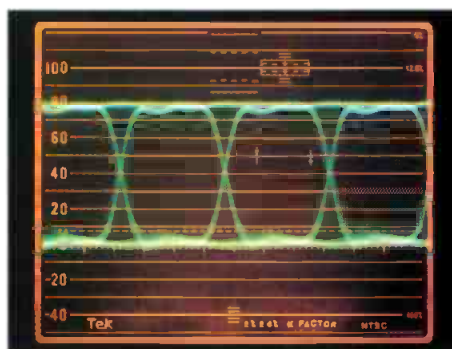


Figure 7. This eye pattern shows the effect of inserting a 50Ω section of line between the transmitter and the monitor, with the remainder of the 75Ω link on the scope's other side. Compared with Figure 5, there is extremely slight eye closure just after a bit transition.

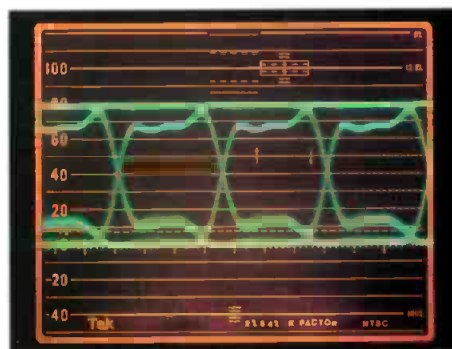


Figure 8. In this figure, the 50Ω section was moved to the other side of the monitor. Reflections are now causing approximately 30% eye closure.

the 75Ω link on the scope's other side. Compared with the output (see Figure 5), there is extremely slight eye closure just after a bit transition. In Figure 8, the 50Ω section was moved to the other side of the monitor, placing it in the receiver half of the link. Note that there is approximately 30% eye closure.

High-quality double-shielded coax is important, particularly at the receiver end of the link where the signal levels may be small.

These effects are explained in Figure 9. The signal that goes through the 50Ω section reaches 96% of its final value immediately, and 99% after twice the electrical length of the 50Ω cable. This is a small amount of distortion. On the source end of the 50Ω line, however, there is a -20% reflection that heads back toward the transmitter. This reflected pulse leads to the large eye closure.

As expected, the threshold point for these two links is substantially different. At 143Mb/s, an all 75Ω link started showing errors at 375m. Placing the 50Ω line on the transmitter side decreased this to 370m. The same line section placed on the receiver side caused this to fall to 325m (distances are for Belden 8281 coax).

These performance differences illustrate an important point. Passive loop-through oscilloscopes are ideal for discovering channel reflection problems. But passive loop-through inputs are vulnerable to nearby channel reflections. Some operational gear may use passive loop-through inputs, such as for a DA input. These systems will require careful inspection for reflections.

What's really important

Experience with 143Mb/s systems has shown that pulse amplitude and large channel reflections hurt system performance the most. Pulse amplitude affects some automatic receiver equalizers, and it directly changes the signal power in the channel. Large reflections reduce the eye opening, consequently raising the detection error threshold.

High-quality double-shielded coax is important, particularly at the receiver end of the link where the signal levels may be small. Inferior coax can add unnecessary noise. Less important parameters are rise time, jitter and small channel reflections, such as from 50Ω connectors. Jitter may become an issue when using many serial regenerators.

The real news is GVG's New Model 250.



- Program/ Preset mixer for live action.
- Seamless integration with DPM-100 or DPM-700 digital picture manipulators for automatic auxiliary bus control.
- Expands to 6 auxiliary buses for multiple feeds.
- Instant control of external devices via Peripheral Interface II Bus.
- Includes E-MEM® Effects Memory for instant recall of stored effects.
- Available in composite or component versions.

Introducing the Model 250. The first 200 Series switcher for live production.

You already know what GVG® Model 200 switchers are doing for the world of post production.

Now GVG is making that same power and flexibility available for live production, with the new Model 250 Production Switcher. For up-to-the-minute details, call your GVG sales representative now.

Grass Valley Group®

A TEKTRONIX COMPANY

At the heart of Television

NORTH AMERICA Grass Valley, CA (916) 478-3000 SOUTH AMERICA Miami, FL (305) 477-5488 EUROPE Basingstoke, UK (0256) 817817 ASIA Hong Kong (852) 7874118 JAPAN Tokyo, Japan (813) 5992-0621

Circle (22) on Reply Card

www.americanradiohistory.com

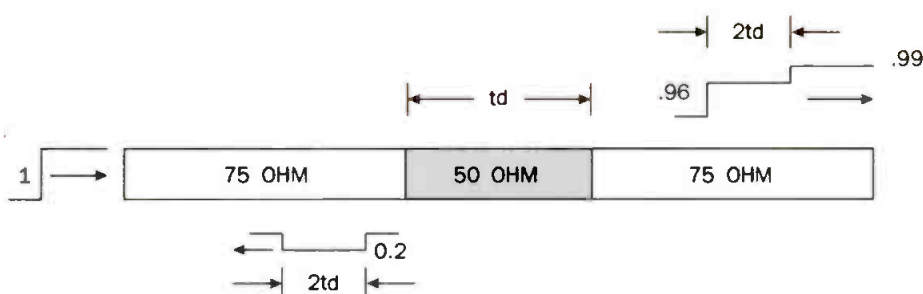


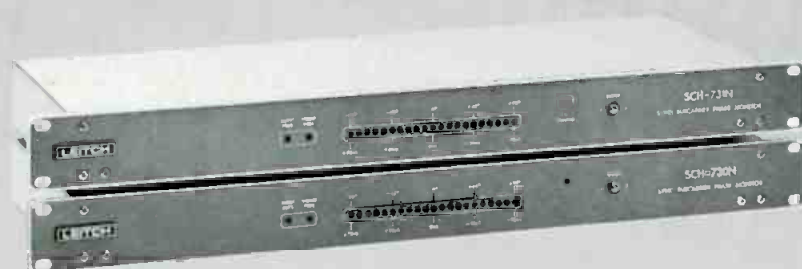
Figure 9. A signal passing through a 50Ω discontinuity on a 75Ω line will be only slightly affected downstream of the discontinuity, as in Figure 7. Reflections on the upstream side will cause major disturbances. (See Figure 8.)

Receiver performance is generally the largest single factor affecting link dynamic range. Optimizing the previous parameters can make a good receiver even better.

Other monitoring

The final two monitoring methods are digital format error checking and ancillary data (including audio) content monitoring. Some limited format checking can be done in the receiver, as discussed previously. To do much beyond this requires a tool, such as a logic analyzer. This typically involves converting the serial data to parallel and then feeding the analyzer. Content monitoring of ancillary data is accomplished with an appropriate data decoder.

VERIFY YOUR



SC/H INTEGRITY

The SCH-730N and SCH-731N provide an accurate visual display of the SC/H phase relationship of all your video signals for quick 'Go / No Go' decisions.

All for as little as \$1350.

Editing? The SCH-731N's timing LED indicates when two video signals are in the same color field, always ensuring perfect SC/H edits.

Want more? Contact your local LEITCH dealer, or call Toll Free:

In U.S.A.: 1-800-231-9673 In Canada: 1-800-387-0233

LEITCH

Leitch Incorporated

825K Greenbrier Circle, Chesapeake, VA 23320

Telephone: (800) 231-9673 or (804) 424-7920 Fax: (804) 424-0639

Leitch Video International Inc.

220 Duncan Mill Rd., Suite 301, Don Mills, Ontario, Canada M3B 3J5

Telephone: (800) 387-0233 or (416) 445-9640 Fax: (416) 445-0595

Stress testing is highly recommended when a system is first installed. Logging the results and repeating the tests at intervals will pinpoint deteriorating performance.

Stress testing

Simply monitoring error rate will not tell how far a serial link is from threshold. As discussed earlier, this is because the error level is practically zero above a certain channel S/N. Error monitoring will tell you when you've reached threshold. Although this is nice to know, the link is effectively broken at this point. For example, an experimental 143Mb/s system showed no errors at 370m, occasional errors at 380m and large numbers of errors at 390m (Belden 8281 coax).

You can estimate the link margin or headroom by measuring how much stress must be added to the system before the link enters threshold. One common method is to add additional loss to the channel. This can be done by adding coax until the error rate becomes observable on a picture monitor or EDH indicator. The results can be quantified in "meters of coax" or (preferably) in decibel loss at half the clock frequency.

It is easy to transfer this latter method between different types of coax. For example, Belden 8281 coax has approximately 7.5dB of loss per 100m at 71.5MHz (half of 143Mb/s). Thus, a link that entered threshold with 50 additional meters of 8281 would have 3.7dB of margin.

Other stresses might include varying the transmitted pulse amplitude, adding noise and jitter, and using bit sequences that

WIRELESS INTERCOM FLEXIBILITY



Telex® Radiocom™

You're in a fast-paced, unpredictable business. Sometimes the last thing you need is to be limited by a wired intercom system. Telex Radiocom, which interfaces with most wired systems, can give you wireless freedom to do your job more effectively.

Four belt pack transceivers can operate in full duplex from the multi-channel BTR-200 base station. Connect two base stations together to create a larger communication network of up to eight wireless head-

set stations. Carefully selected frequency groups in the 150-216 MHz range avoid interference from low band signals, and several frequencies are available in stock. Radiocom's rugged TR-200 belt packs feature an impressive 24-hour battery life for worry-free communication with crews in the broadcast van or out in the field. And if you already have a sufficient supply of headsets from your current system, you won't have to purchase more. TR-200s are designed for compatibility with most standard four-pin



intercom headsets.

Telex Radiocom features made-in-the-U.S.A. quality, as well as the exclusive Telex three year limited warranty. For more information on how wireless intercom makes sense for you, contact Telex Communications, Inc., 9600 Aldrich Ave. So., Minneapolis, MN 55420, (612) 887-5550.

©1991 Telex Communications, Inc.

TELEX®

Circle (24) on Reply Card

www.americanradiohistory.com

If your satellite rates are skyhigh, Dolby digital audio can bring them



down to earth.

Dolby AC-2 digital audio coding provides two channels of CD-quality audio at only 256 kbits/sec.

That means you need less bandwidth and less power than conventional analog and digital systems. Your satellite costs are lower, yet you get higher audio quality than with analog or more primitive digital systems.

Dolby AC-2 combines Dolby's unique knowledge of psychoacoustics with advanced digital audio coding techniques. Frequency-domain signal processing in 24 "critical bands" confines quantization noise to narrow spectral regions, where it is masked by spectral components of the audio signal itself. Dolby AC-2 is the one digital compression scheme that combines significant data reduction with audio quality meeting the highest standards.

Dolby DP500 Series encoders and decoders coupled with 256 kbits/sec digital modems.

Modem interface is via standard RS-422/449 connections.

A 1200 bps RS-232 auxiliary channel incorporated in the data stream simplifies control

operations. SCPC, band-edge, or digital video subcarrier systems can all benefit from

Dolby AC-2. For further information on the DP500, call us at 415-558-0200. That small step can lead to a big revelation, and a big savings.



Model DP501 Encoder

To take advantage of Dolby AC-2, all you need are

stress equalization and clock recovery circuits.³

Stress testing is highly recommended when a system is first installed. Logging the results and repeating the tests at intervals will pinpoint deteriorating performance.

Monitoring topologies

Figure 10 shows two suggested monitoring connections. In Figure 10(a), a serial source connects to a single input receiver, such as a video processor or VTR. The input signal loops through the waveform

A serial overview

Serial digital is created by converting parallel digital video into serial form and transmitting it one bit at a time. Because video is represented with 10-bit words, the serial clock rate is 10 times that of the parallel clock. There are three rates: 143Mb/s for NTSC composite, 177Mb/s for PAL composite and 270Mb/s for 4:2:2 component.

A typical serial system consists of five parts: a transmit co-processor, a serializer, a transmission channel, a deserializer and a receive co-processor.

The transmit co-processor adds a line rate synchronizing signal to the incoming parallel video. This timing reference signal (TRS) synchronizes the serializer and deserializer. TRS is only added to composite video, because the EAV and SAV signals in 4:2:2 component perform this function. The serial signal has space allocated for ancillary data, such as AES/EBU digital audio. The co-processor can insert this data.

The serializer latches the parallel data from the co-processor and shifts it out one bit at a time, using a phase-locked clock running at 10 times the parallel clock rate. Serial systems always use 10-bit representations. If 8-bit video is input, then the serializer sets the two LSBs to zero.

Next, the serial data is scrambled. The scrambler alters the data spectrum to enhance clock recovery at the receiver and to reduce the signal's DC component. The scrambled signal goes to a coder that represents 1s as data transitions and 0s as no transition (NRZI coding). An output stage provides the power to drive the channel, nominally 75Ω coax.

The loss of metallic cable, expressed in decibels, is proportional to the square root of frequency. For example, if the loss at 50MHz is 5dB, then the loss at 200MHz should be 10dB. This loss characteristic is specified for the serial channel. Cable lengths up to about 300m are the most common.

Other channels, such as optical fiber, may be used as long as a compatible receiver equalizer is employed.

The new Tek VS210.

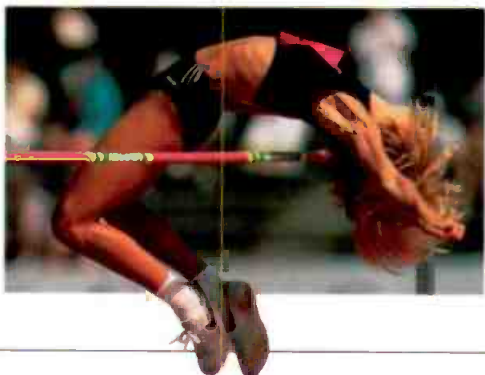
Finally you can afford to sync everything into your picture!



The new Tek VS210 NTSC Video Synchronizer is every bit a match for the world's best performance! It sets a new standard of comparison — at a price highly competitive with lesser products.

Rely on the VS210 for synchronizing microwave or satellite feeds and you'll see no decoding artifacts or picture shifts. It provides transparent performance through 10-bit quantizing and 4-field memory. There's nothing like it for maintaining picture continuity without any breakup, streaking or freezing — even in the presence of noise.

The VS210's digital processing amplifier provides video gain, chroma gain, black level and hue adjustments using either internal controls or the RC210 Remote Control Unit. The versatile RC210 also provides adjustment of output timing, selection of picture freeze and setup of VS210 operating modes.



A front panel display gives instrument status information. Up to six VS210 Synchronizers can be controlled by a single RC210.

And for flexibility in system design, the VS210 provides composite analog and composite digital inputs and outputs.

But don't just read about it. Ask your nearest Tektronix representative to demonstrate the VS210's transparent performance. What it can mean in your operation is perfectly clear!



Tektronix
COMMITTED TO EXCELLENCE

BUILT TO HANDLE A LIFETIME OF QUICK CUES, REVIEWS AND SHUTTLES. EVERY DAY.



The TASCAM 112B is a broadcast deck that doesn't know the meaning of the word "downtime."

And, while not as full-featured as the industry standard TASCAM 122MKII that inspired it, the 112B is a top-end machine built to get the job done. Day-part after day-part. Book after book. Year after year.

The "B" in 112B is for "balanced," as in +4 dBm balanced XLR Ins and Outs.

But that's just the beginning.

The 112B also features Cue & Review for quick and convenient open-reel style cueing and shuttling in both the fast-forward and rewind modes. Two long-wearing permalloy heads (erase and record/repro) for crisp, clean sound. Choice of Dolby[®] B, C and HX-PRO for enhanced sonic quality. And, at only \$749, a suggested retail price that even the most money-minded station manager would find hard to ding.

You asked us to build a broadcast deck as rugged and reliable as the 122MKII, but with fewer features and a lower price.

We did.

Now all you have to do is call or write TASCAM and put the hard-working 112B to work for you.

TASCAM[®]

© 1991 TEAC America, Inc., 7733 Telegraph Road, Montebello, CA 90640. 213/726-0303.
*Dolby B, C and HX-PRO are registered trademarks of Dolby Laboratories Licensing Corporation.

Circle (27) on Reply Card

monitor just before terminating at the receiver. This allows content monitoring of the incoming signal and inspection of the eye pattern. The receiver's regenerated output loops through the second input of the monitor, and then either terminates or is sent to another device. An EDH-equipped monitor can then measure the serial receiver's error rate. This is possible because the regenerated serial output is derived from the equalized and detected input, and will, in general, contain the same errors that are experienced by the receiver.

Continued on page 114

At the de-serializer, an equalizer compensates for the transmission channel losses. These equalizers are often automatic, based upon the signal's amplitude and presumed loss characteristics for the channel. Next, a clock recovery circuit extracts timing information from the signal and uses it to lock-up a 10 times parallel rate oscillator. This clocks the de-serializer.

The signal is then converted from NRZI to NRZ coding, descrambled and fed to a shift register, which does the serial-to-parallel conversion. TRS (or EAV/SAV for component) is recovered prior to parallel conversion to frame the shift register. This ensures that the recovered parallel words consist of the proper bits, not bits from two adjacent words.

If the de-serialized signal is composite, then non-video data, such as TRS and ancillary data, are removed by the receive co-processor. The co-processor might decode this data or strip it off, depending on the application. Because the 4:2:2 component standard allows ancillary data, stripping isn't required for component video.

Serial's primary use is to interconnect digital video equipment. Interfaces are already showing up on a variety of tape recorders, switchers, routers, DAs and video processors. However, because serial can be repeatedly regenerated and has good immunity to noise (such as hum), it can also help with difficult analog signal distribution problems. In this case, the footprint of the A/D and D/A conversion process must be traded off against the advantages gained by digital distribution.

One For All.



The Waveform Monitor/Vectorscope That Keeps Everyone Happy.

Engineers need to perform complex signal analysis. Operators want equipment that's easy to use. The boss wants it to be affordable. Now there's a product that satisfies everybody. It's our new, easy-to-use TVM-710 with two operating levels. Level I lets operators display waveforms, vectors and pictures. While Level II gives engineers a complete range of tools, including digital line selects, SC/H phase displays, measurement cursors with on-screen digital readouts, even 3-D vector display. We have a whole new family of test and measurement equipment available in composite or component, NTSC or PAL, and with auto-measure. Call us today to find out about all seven American-made innovations from Videotek.

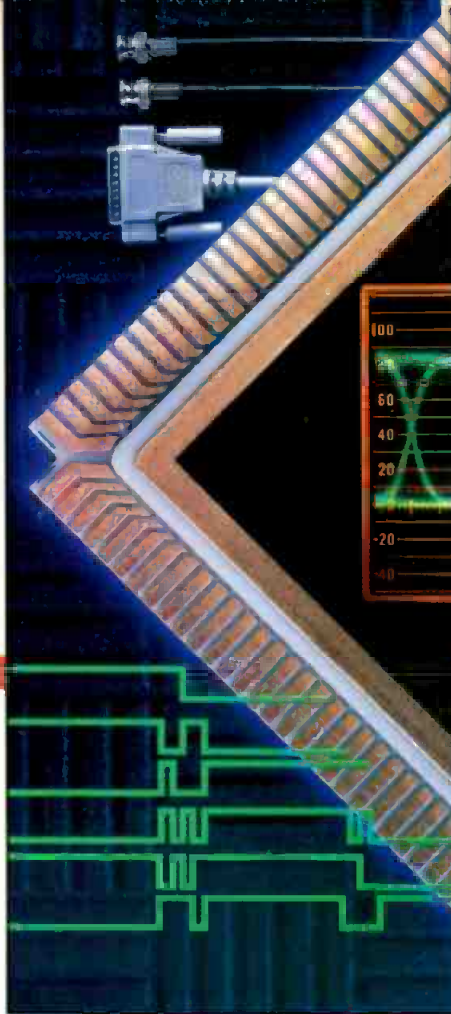
VIDEOTEK™
First, we listen.

243 Shoemaker Road, Pottstown, PA 19464 (215) 327-2292 Fax: (215) 327-9295

Circle (28) on Reply Card

www.americanradiohistory.com

1991
JAN 1991



Caring for high-power tubes

By following a few simple steps, you can increase the life of your transmitter's tubes — which can save money.

By Brad Dick, editor

Although solid-state technology is becoming more familiar in the RF world, tubes are still the most common amplifier device in broadcast transmitters. The advantages of tubes are numerous and have been discussed in previous articles in *Broadcast Engineering* magazine. (See "Solid-State vs. Tubes in TV Transmitters," May 1991.) Because tubes still compose the backbone of the RF section of radio and TV stations, the care of these devices is paramount to long-term and profitable operation. If tubes are installed properly and maintained carefully, they can provide reliable service.

Tube basics

A vacuum tube consists of a vacuum envelope containing various electronic elements used to emit, control and collect a flow of electrons. (See Figure 1.) A filament or cathode provides a source of electron emission. The control grid, screen grid and suppressor grid control the flow of electrons within the tube. A plate or anode collects the electron flow. Electrical energy that is not transferred to the load is converted to heat at the anode.

The electron emitters in vacuum tubes can be either directly or indirectly heated. This article will look only at the directly heated (filamentary) tubes. Although there are similarities between the two types of tubes, the proper operating techniques for filamentary tubes are not necessarily correct for tubes with indirectly heated cathode emitters. In particular, the

operation of cathode-type tubes at reduced heater voltage can be destructive to the tube. Keep this in mind when considering the adjustments on your particular transmitter.

Filament designs

Directly heated tubes have either spiral, parallel bar, hairpin or mesh filament structures. The *spiral* filament structure consists of one or two strands of wire, which are spiral wrapped around a central support rod. This design is found in older, lower-power tubes. Spiral filaments are subject to sagging and shorting between the turns.

The *hairpin* structure, which is shown in Figure 2, is found in the majority of today's tubes. It consists of a number of parallel elements bent into the shape of a hairpin. The hairpin filament support

structures have built-in spring compensation, which allows for the thermal expansion of the filament. These filament structures can have all tube voltages applied without filament warm-up. Although the tuning will drift somewhat because of the slight movement of the tube elements as they reach thermal equilibrium, there is no danger of shorting. Some tube designs require surge current limitation for the filament when initially turned on. This protection should be provided for in the transmitter's design and should not be bypassed.

Mesh filaments are composed of filament wires woven to form a basket-type structure. (See Figure 3.) The wire joints are spot welded or diffusion bonded at the intersections. Mesh filaments are being used in more new tube designs, because they allow a denser, more closely spaced structure. This provides higher stage gain, increased efficiency and higher frequency operation.

The mesh structure relies on thermal expansion of the ridged upper filament support structure to compensate for thermal expansion of the filament. Mesh filaments require a longer warm-up period than hairpin designs. This is because the thin, low-mass filament wires come to temperature immediately as voltage is applied. As they heat, they expand, and until the more massive and slower to heat support structures reach their operating temperature to compensate for this expansion, the filament wires warp in and out. A warped

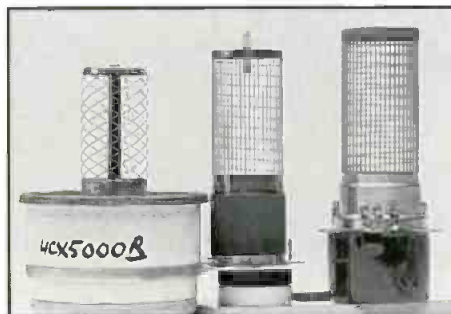
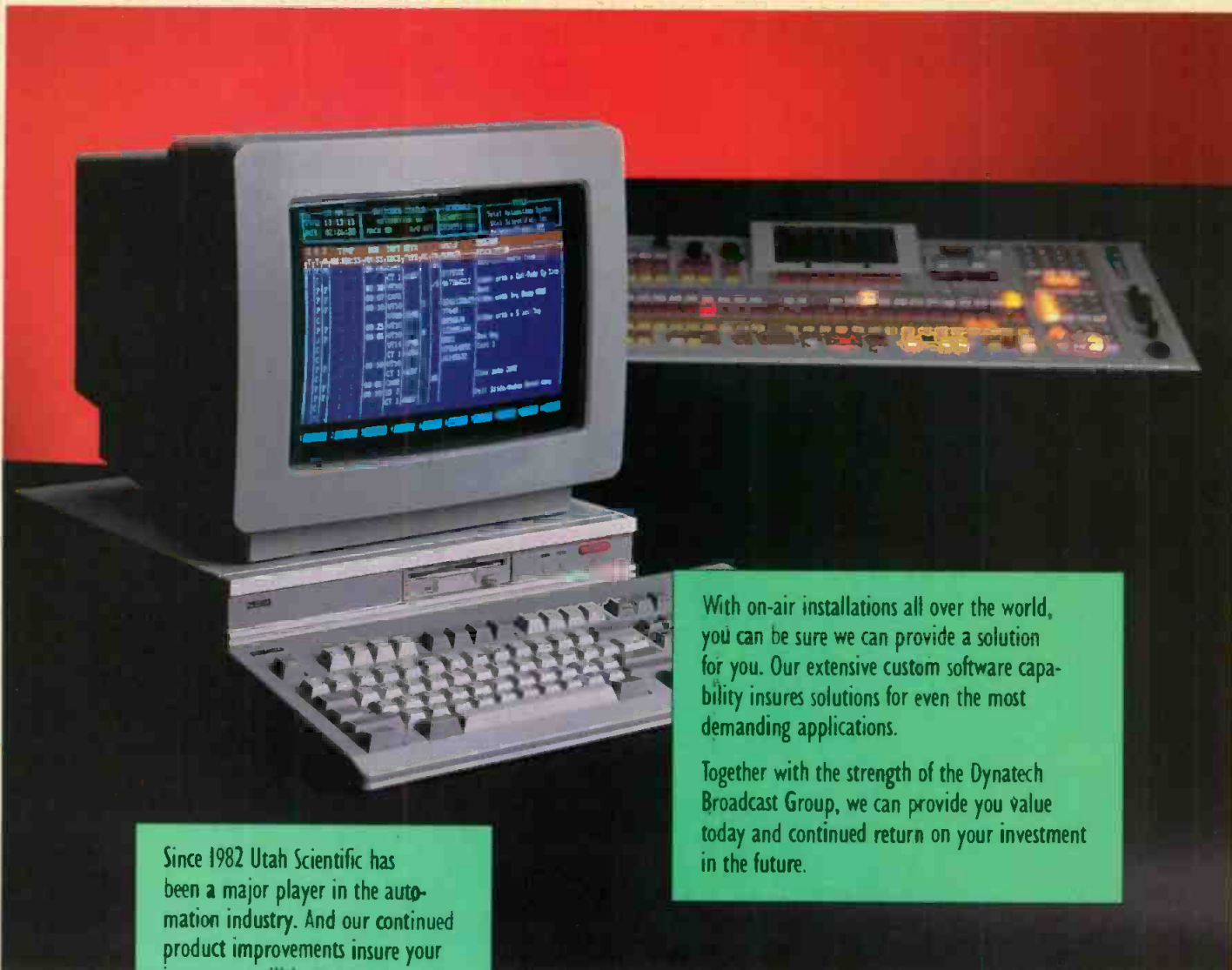


Figure 1. Interior elements of a tetrode. Mesh filament is on the left, control grid center and screen grid are on the right.

Increase Efficiency and On-Air Quality



Since 1982 Utah Scientific has been a major player in the automation industry. And our continued product improvements insure your investment will keep pace as your needs expand.

Our systems approach to your automation problems has created a complete family of products. Router Automation System (RAS) offers complete control of the routing switcher. Total Automation System (TAS) provides you with a 100% accurate as-played list, allows instant manual intervention, and provides complete reconciliation to your business traffic system.

With TAS you can be sure the right spot will air at the right time, boost station performance, free operators for more important tasks.

Instead of a headache, managing the playlist becomes a simple, easy job.

With on-air installations all over the world, you can be sure we can provide a solution for you. Our extensive custom software capability insures solutions for even the most demanding applications.

Together with the strength of the Dynatech Broadcast Group, we can provide you value today and continued return on your investment in the future.

DYNATECH BROADCAST GROUP

US UTAH SCIENTIFIC, INC.

V I S I O N.

V A L U E.™

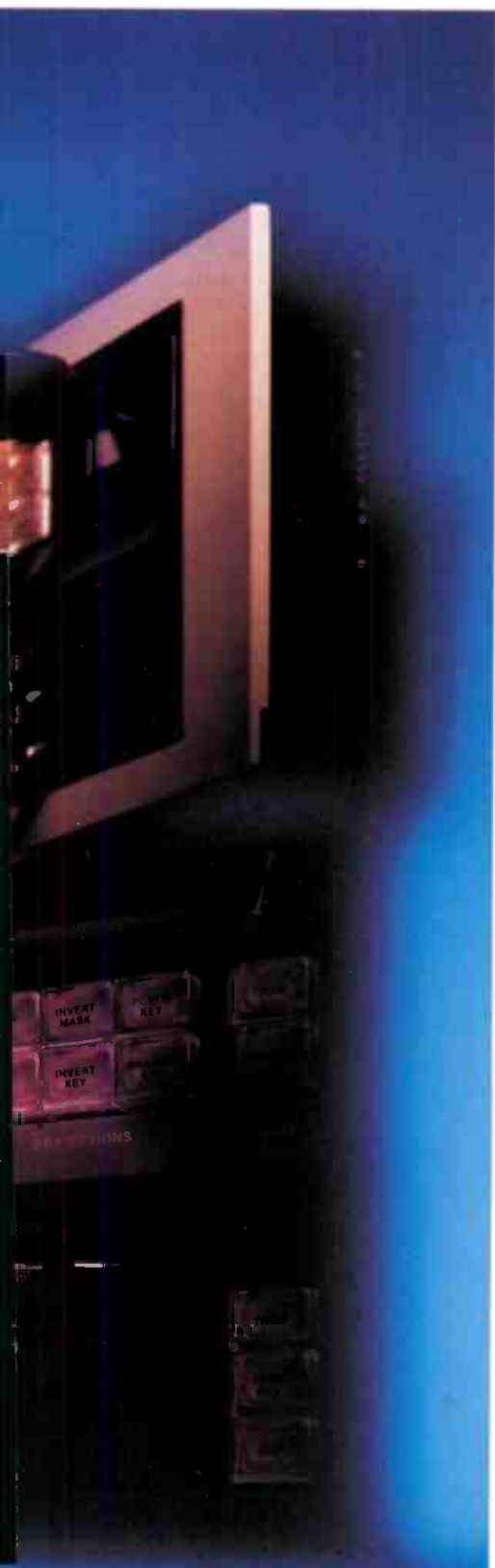
To GET THE PICTURE Contact US at:
4750 Wiley Post Way
Salt Lake City, UT 84116
800-453-8782 or 801-575-8801

Circle (29) on Reply Card

At Ampex, we engineer for



your future, not just ours.



AT AMPEX, we believe that the best way to move into the digital future is by leveraging your current investment in analog.

The fact is, while digital technology may be revolutionary, the market for it will be evolutionary. The economics simply don't support all-digital environments for the vast majority of work being done today. Clients aren't willing to pay more money for a routine effect just because it's done on a flashy new system.

It's also a fact, however, that the digital day is coming. The image clarity and purity, the creative flexibility and opportunities, and the multi-generational capabilities are significant advantages that the market will increasingly demand.

But we think you can move into this future in stages, from composite analog to composite digital to component digital, moving as the market builds and the technologies mature (and become less costly).

The first step is to phase out your analog VTRs as they age, and replace them with D2™ composite digital machines such as our VPR™-300 or -200 Series. The next step is to integrate digital capability into your analog switcher. And to help you do that, we've introduced a revolutionary new system called ADAPT.™

ADAPT is a digital layering device that can be used with any analog switcher to create a "hybrid edit suite." It accepts up to four composite digital sources and up to six analog sources, and allows you to mix or layer any two of those inputs with virtually no loss of quality.

Whether you use it for downstream mixing and keying, creating digital matte reels, or for many generations of work, the ADAPT switcher meets your needs—and your client's needs—by economically adding digital capability to your existing analog facility.

Why did we invent the ADAPT switcher? Simple: to meet your needs. We recognize that you're in a tough, competitive business. And you're in that business to make money. We see our job as using our engineering excellence to develop products that help you achieve your professional goals, creatively and financially.

You see, at Ampex, technology doesn't exist in a vacuum. We don't build things and then convince you to buy them just because they're new and hot. We build things, like the ADAPT switcher, that help you get from where you are today to where you want to be tomorrow.

We've been a part of this industry from the very beginning. We have a long perspective to draw from. The future is exciting and bright. And we'll be here to help you get there.

AMPEX

Ampex Corporation, 401 Broadway, Redwood City, CA 94063 1(800)25AMPEX

Circle (30) on Reply Card

www.americanradiohistory.com

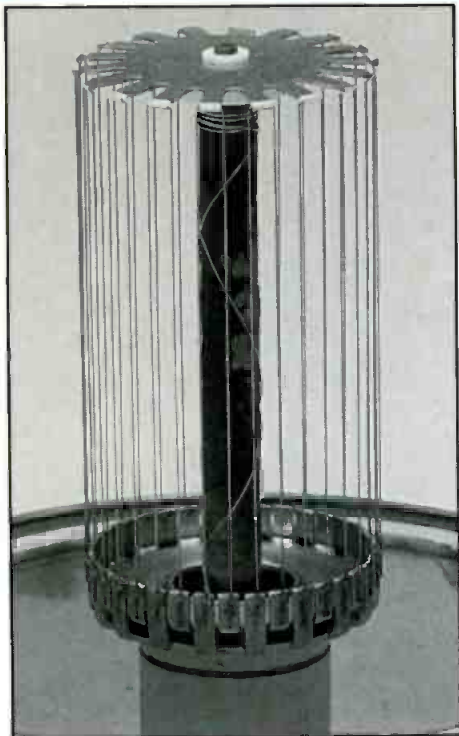


Figure 2. Hairpin filament structure. The current path is up one leg, across the top and down the adjacent leg.

filament greatly increases the possibility of a thermal grid-to-filament short.

Grids

Grid structures are generally composed of wires spot welded together to form a circular structure that completely surrounds the emitting surface of the filament. The grid controls the flow of electrons from the filament. Grids are coated

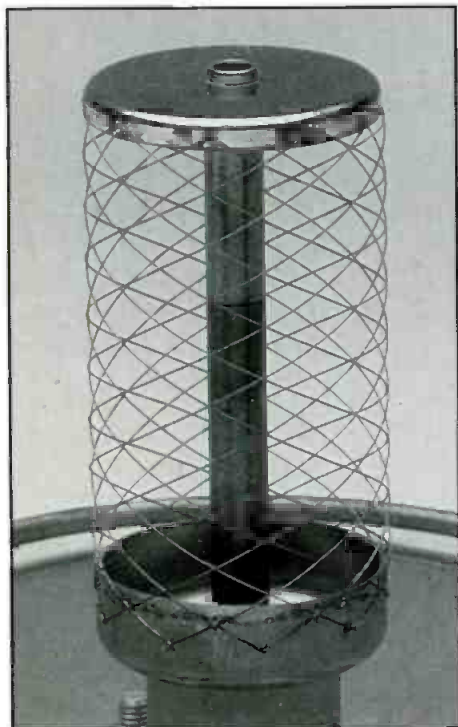


Figure 3. Mesh filament structure. The current path is from base, up through the mesh filament, across the top and down through the center support rod.

with various materials compounded to suppress the emission of electrons from the grid.

Anodes

Anodes are copper cylinders or drawn cups that collect the flow of electrons within a tube. Air-cooling fins or water-cooling jackets brazed to their exterior are used to remove the heat generated from power that is not being completely transferred to the load.

Plating

The external metal parts of tubes are plated with nickel or silver. Socketed tubes should be silver plated. The soft silver provides a better contact interface than the much harder nickel. The silver deforms slightly under contact pressure, providing greater contact area. Silver plating has a dull, whitish cast, whereas nickel has a hard metallic appearance.

Nickel is resistant to discoloration because of the heat from normal operating temperatures. However, silver will easily tarnish. Often, the heat patterns on silver-plated tubes are helpful in problem analysis. If a nickel-plated tube shows any sign of heat discoloration, a serious cooling or operational problem exists.

Safety considerations

Power tubes and the transmitters in which they are installed have lethal voltages. You must be extremely careful when working with these devices.

Access panels to all high-voltage cabinets should always be installed. Interlocks should never be bypassed. High-voltage cabinets should be equipped with a shorting bar connected directly to the equipment ground. Use the bar to ground all high-voltage areas before reaching into any high-voltage area or circuit.

All high-voltage circuits should have bleeder resistors in place to discharge any residual voltage to ground when the equipment is turned off. Remember, this process may take several seconds. Don't assume that the circuits are discharged — use the shorting bar.

Tube installation

Prior to installing a tube, inspect the socket. Look for any broken pieces of fingerstock. These small particles can fall into other circuits, causing shorts and other damage. If any pieces are missing, find and remove them before you install the replacement tube.

Don't be too concerned, however, if a few pieces of fingerstock are gone. The contacts can break off on occasion and as long as they are located and removed, the socket ring does not require replacement. However, if more than 20% of fingerstock is broken off, the entire contact ring should be replaced. Consecutive gaps around the tube can cause improper tuning, instability and premature tube failure,

as shown in Figure 4.

Repair kits are available from the manufacturer for most sockets. Replacing a single ring is far cheaper than replacing the entire socket. If you have trouble locating repair kits, contact the transmitter manufacturer or a tube rebuilder.

Socket problems

Loose contact by fingerstock with the tube will always lead to problems. Some socket designs have a wire-wound spring encircling the outside circumference of the fingerstock to increase individual finger contact pressure. These springs should be replaced if they break or lose tension. Adequate contact pressure is vital for proper operation and long tube and socket life.

Some sockets have stops that are set so that the tube has the grid contacts in the middle of the contact area when the tube is fully inserted. This positioning can be checked by inserting and then removing a new tube. The scratch marks on the grid contacts will show the position of the tube relative to the socket contacts.

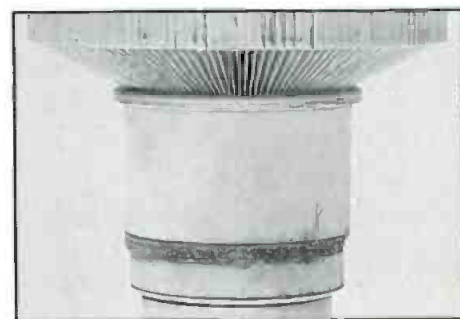


Figure 4. Note the burned and melted grid ring near the base of the tube. Failure was caused by poor contact between the grid ring and socket.

Tube insertion

Inserting a replacement tube must be properly done. Gently rock and slightly rotate the tube as it is being inserted into the socket. This will help avoid bending and breaking of fingerstock. Be sure to apply sufficient force to seat the tube all the way into the socket. Never use a lever or hammer on the tube to set it into the socket. Manual pressure should be adequate.

An intermediate point is reached when the grid contact fingerstock slides up the tube sides and first encounters the contact area. It's important that the tube is fully inserted in the socket beyond this initial point of resistance.

Tubes without sockets

Many industrial and AM transmitter tubes are not socketed but installed by bolted or clamped connections. Stainless steel has a much lower coefficient of thermal expansion than copper. Therefore, clamped stainless steel anode connections should have some method of strain relief to prevent excess pressure from collapsing the tube's anode as it heats up.

GROWTH ORIENTED...

With the new Series 32 multi-level routing switcher from Sierra, your next choice in systems expansion has never been easier.

Rear view of standard Series 32 frames.
32 x 32 video, 32 x 32 stereo audio,
32 x 16 video plus stereo audio,
32 x 16 component video
Multiple frames can be connected
together to build larger systems.

Size

Series 32 systems range from 32 x 8 one level to 32 x 64 eight levels: Plenty of room to grow.

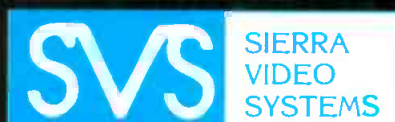
And thanks to unique Sierra compact crosspoint module design, a 32 x 32 video router is only three rack units tall. A full 32 x 32 stereo chassis is the same size. Combined, a Series 32 VAA 32 x 32 router takes only 10.5" of rack space! That's because matrix expansion is board level, with no separate input or output modules required: ideal in tight quarters.

Bandwidth

Forty MHz is standard. For higher resolutions, seventy and one hundred MHz versions are available.

Price

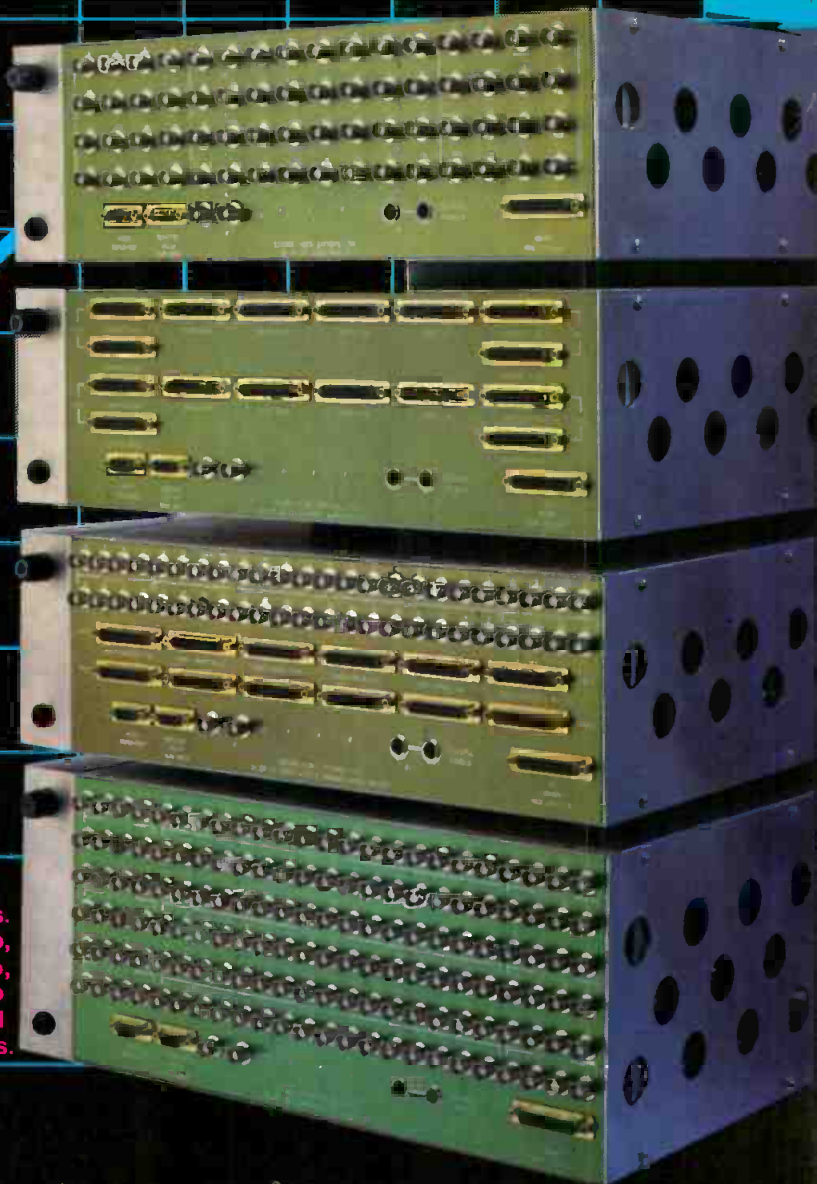
A single level 32 x 32 system starts at under \$18K. If you need to start smaller, a 32 x 16 system is under \$10K.



Grass Valley, CA (916) 273-9331

Leave it to the fastest growing company in the business to give you the value you need today, and the room to grow that you'll need tomorrow.

Circle (31) on Reply Card

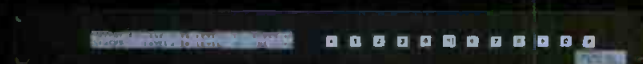


Control

- RS-232 Terminal
- RS-232 Host Control (PC software included)
- RS-485 Two-wire (5,000 ft) party line X/Y, single bus, and full-status display keypad controllers



Desktop keypad control panel



Rackmount keypad control panel



32 x 32 "X/Y" pushbutton control panel



Single bus pushbutton control panel

PEOPLE - PRICE - PERFORMANCE

www.americanradiohistory.com

All bolted or screwed connections should be tight. Verify that the clamps are snug and provide a good electrical contact around the entire circumference of the tube. Because of the RF fields present, all clamps and bolts should be made from non-magnetic materials. Copper, brass or non-magnetic series 300 stainless steel fasteners are preferred. Stainless steel is not a good conductor of electricity, and although it may be used for clamping, it should not be part of the current path.

Tube cooling

With the single exception of the temperature necessary to obtain proper filament electron emission, heat is the enemy of vacuum tubes. Although the transmitter may be properly designed for adequate cooling, incorrect installations can result in tube damage or shortened life. (See Figure 5.)

Air-cooled power tubes generally don't require special maintenance throughout their normal operating life. However, it is critical that the socket is in good condition and the cooling fan filter is cleaned or replaced periodically.

Tubes are typically cooled with squirrel cage blowers. Check the impeller blades occasionally, and make sure they aren't filled with dirt, which can drastically reduce their efficiency and airflow through the tube. If the blades are dirty, scrape them with a screwdriver blade or knife to remove caked on dirt. A brush can also be an effective cleaning tool.

Also, check the cooling fins on the tube anode. If they are plugged, remove the tube and use an air hose to blow the dirt from the fins. Blow the cleaning air in the reverse direction of normal airflow through the tube. Pay particular attention to the area of the tube where the cooling fin attaches to the anode. The greatest blockage occurs at the point where the cooling air first hits the fins. This is also the point of maximum temperature and, therefore, maximum heat transfer to the airflow.

Air-cooled tubes require greater airflow when operated at higher altitudes because of the decreased density of the air. The



Photo courtesy of Econco

tube data sheet will provide the correct information for high-altitude operation. External arcing at high altitudes may occur, requiring a lowering of plate and screen voltages.

Air-cooled tubes should have an air interlock switch to prevent the application of any voltages to the tube unless cooling air is flowing. The switch should be checked for proper operation. Without adequate cooling airflow, the heat generated by the filament alone can destroy a tube.

AM and FM transmitters should never have air duct work fastened directly to the exhaust port. Ducting increases back pressure, restricting airflow, which can result in excess tube temperature. Some exhaust ducting use fans to help move exhaust air. However, if improperly designed, they can actually reduce airflow. Keep in mind that if this fan fails, it will definitely reduce cooling airflow.

Try this technique if your installation requires exhaust ducting. Construct a hood over the transmitter with a 6-inch open air gap between the transmitter and the duct work. This will trap and exhaust the hot air without increasing back pressure.

Tube life

The proper adjustment and regulation of filament voltage is the single most significant area where a tube user can affect tube life and performance. The following are some critical factors to consider:

- The metering of filament voltage on the majority of equipment is not accurate. Often, the metering is a multimeter that is switched to read various operating parameters. To be useful for filament metering, the meter must be calibrated to read voltage at the tube socket and must be capable of being read accurately to one tenth of a volt.

- Often, the filament voltage is measured at the input to the filament transformer. In high-current circuits, such as the filament, the voltage drops in the wires going to the tube can be significant. All filament meters should be calibrated with an

accurate iron vane or rms-responding digital meter. The calibration voltage should be measured at the tube socket or connections with the filament operating. This will compensate for any I/R losses. In locations where the line voltage fluctuates more than 5%, the supply to the filament transformer should be equipped with a constant voltage transformer or regulator circuit.

The thoriated tungsten filaments used in power vacuum tubes depend upon sufficient filament temperature to provide adequate electron emission. Power tubes should not be operated in an *emission-limited* mode. The use of filament voltage to control output power is not the correct method of operation. It will destroy a tube quicker than operation at overvoltage.

Each tube is unique. Although one tube may make full operating power at a filament voltage of 7.3V, its replacement may require 7.4V to attain the same power. For this reason, all tuning should typically be done at the rated filament voltage. After tuning is complete, the voltage can then be reduced to provide extended life.

Although cathode-type tubes can be damaged by operation at reduced filament voltage, operation at a reduced voltage *after* tuning has been completed will generally extend the tube's operating life. It is important to initially operate and tune the tube at its rated filament voltage for the first 100 to 200 hours. Only then can it be reduced as described later.

Initial operation and tuning

Upon initial installation, the filament should be run for a period of 100 to 200 hours at its rated filament voltage. This initial operation allows the getters — materials that absorb and hold residual gas — to complete the vacuum of the tube in its actual operating environment. After this initial run-in time, it is excellent practice to operate the filament at a reduced voltage, provided that proper operating parameters can be maintained.

First tune and operate the transmitter at normal conditions with the filament at rated voltage. Then, without changing any other adjustments, reduce the filament voltage until the tube output begins to fall. This point is the beginning of *emission-limited* operation. *Continued operation at this point can be destructive to the tube.*

Increase the voltage by 0.1V to 0.2V above the lowest point where the tube worked properly. This will help maximize tube life with no reduction in performance. The 0.1V to 0.2V setting above the emission-limited voltage allows for minor line fluctuations and requires less frequent adjustment as the tube ages. A power tube operated at a properly reduced filament voltage can reduce tube operating costs by almost 50%.

Continued on page 58

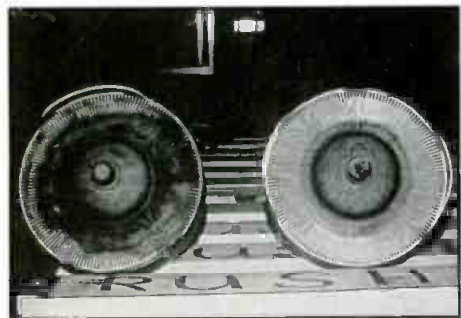


Figure 5. Comparison of normal heat dissipation from the tube on the right vs. darkening of the silver coating caused by excessive dissipation (heat) on the left tube. The cause is either restricted air flow or improper loading.



**Only SIAT® lets you test
audio quality during
program time.**

**Without
disturbing your
audience.**

Everyone knows it's not polite to interrupt. But the fact is, the need to test audio quality is most critical *during* key programming times. Which is precisely when testing for noise, distortion, crosstalk and more is most difficult and intrusive.

You have to contend with heavy carrier signal traffic. You have to risk disturbing—and losing—listeners and viewers.

Or, you have to settle for inaudible test systems that can't measure noise at program levels—and that fail to account for poor transient response or distortion caused by overload.

But now, there's SIAT®, the in-service audio testing solution from Schmid Telecommunication.

Only SIAT can test up to 10 critical parameters of your audio transmission in 5 seconds or less.

That's fast enough to test during program breaks or station IDs, without disturbing your audience. And it's fast enough to test lines that are busy 24 hours a day.

Best of all, SIAT is fully automated and incredibly easy to use. Tests can be pre-programmed and conducted automatically. Or they can be triggered manually by pushing a single button. Tests can even be pre-recorded and aired with program material.

Give your audio the SIAT advantage. Call 1-800-955-9570 today for more information and a free SIAT video.



The SIAT Advantage Technical Characteristics

- ☐ 5-second stereo test includes frequency response, phase response, differential gain, THD, second harmonic distortion, crosstalk left, crosstalk right, terminated noise weighted, terminated noise RMS flat and channel transposition.*
- ☐ Go/no-go reports based on pre-set tolerances you program
- ☐ Network software available, as well as optional hardware for full automation
- ☐ Signal generators and receivers identified individually for network testing purposes
- ☐ Common-mode rejection: 60 dB (50 Hz - 20 kHz; $V_{in} \leq 1$ kV)
- ☐ Maximum input: 1.5 kV differential
- ☐ Balanced input and output; electrically isolated
- ☐ Self-contained processor and printer
- ☐ External alarming and triggering of tests
- ☐ Built-in intelligence allows measurement of audio characteristics only when transmission is fully stabilized
- ☐ RS-232C modem port for easy telecommunication, fully automatic operation and collection of test results from remote sites

*SIAT tests 19 different audio parameters, including intermodulation distortion. Up to 10 parameters can be included in a 5-second test.

SZ Schmid
Telecommunication

Intelligent by design

15 West 26th Street □ New York, NY 10010

Circle (32) on Reply Card



MII VS. “ME, TOO.”

In 1985, MII proved that a small format videotape system could offer you quality comparable to one-inch, Type C. Its detractors first said, “It can’t be done.” But then they said, “Me, too.”

In 1989, MII demonstrated that full NTSC bandwidth ought to be available to users of 3/4-inch videotape systems. The nay sayers said, “No way.” And then they said, “Me, too.”

In 1990, MII delivered full NTSC bandwidth VTRs priced more like 3/4-inch systems. True to form, the competition said, “No!” And now they are saying, “Me, too.” Imitation may be the sincerest form of flattery, but it can’t take the place of true innovation.

Even on the lowest cost MII machines, Panasonic kept professional features such as two linear audio tracks *and* two FM tracks for superior dynamic range; amorphous heads; information panel for machine status and diagnostics; full-featured editing, such as auto-tag split audio and full RS-422A control (which will even drive

the “Me, too’s”); plus a full-featured auto-tracking player for still and slow motion editing.

All MII VTRs are built on die-cast aluminum chassis; all tape transport guideposts resist abrasion by using ball bearings and ceramic flanges. All MII tape drive motors are direct drive, and you don’t have to move them to accommodate different size cassettes.

MII never traded off your quality: one tape formulation, one format. All Panasonic MII machines are designed specifically for metal particle tape, so frequency response and signal-to-noise are maximized, not compromised.

It’s quite simple. While the others have been spinning their wheels developing one new system after another, Panasonic has continually refined its half-inch technology. While the others have been making light of MII’s virtues, they have been busy copying MII’s performance and value. Isn’t it time to find out why you, too, should join the growing body of video professionals saying, “Panasonic MII is for ‘me, too.’”



The A J-65 Studio Edit/Record VTR, the AO-20 Digital Processing Camera with AU-410 Dockable Recorder and the AU-520 Portable Field Recorder

For more information call: 1-800-524-0864
Panasonic Communications & Systems Company
Division of Matsushita Electric Corporation of America
One Panasonic Way, Secaucus, NJ 07094

Official Video Equipment Sponsor 1992 Olympic Games



36 USC 380

Continued from page 54

The effects of this practice are shown in Figure 6. The first tube, shown in *red*, was operated at its rated filament voltage of 7.5V for its entire life. The tube failed at 5,400 hours.

The second tube, shown in *blue*, was initially operated for 200 hours at the rated voltage of 7.5V. The filament voltage was then dropped as low as possible for normal operation. This tube lasted 10,000 hours. This simple procedure can reduce tube costs by almost 50%.

Tube failure point

The normal end of a power tube's life occurs when the filament's emission falls below the point where it is no longer able to sustain full output power, or distortion levels exceed allowable limits while operating at its rated voltage. This failure is due to decarburization of the filament.

During tube manufacturing, carbon is burned into the raw thoriated tungsten filament. This process is called carburization. As a tube operates, the carbon is slowly burned out of the filament, which is decarburization.

Three primary factors determine the life of a tube. The first factor is the amount of carbon originally processed into the filament. The maximum amount of carbon that can be burned into a filament is limit-

ed by increasing fragility as the carbon level is increased.

Second, the residual vacuum level in a tube affects its life span. The rate of decarburization is a function of residual gases, primarily oxygen and nitrogen, reacting with the filament. Good vacuum processing and proper gettering result in the lowest residual gas levels. (Getters are materials placed within the tube envelope that when heated absorb and hold residual

gases within the tube, which improves the ultimate tube vacuum.) Gettering action continues throughout the life of the tube. However, the most beneficial action occurs in the first hours of operation.

Third, the rate of decarburization is proportional to the filament's operating temperature. The filament temperature is determined by power on the filament and is therefore controllable by adjustment of the filament voltage.

These various items taken together determine the normal life of a tube. In broadcast transmitters, which operate into a fixed load, the vast majority of failures are due to loss of emission as a result of decarburization.

Tubes will continue to be an important part of many broadcast transmitters. Because of their reliable operation, maintenance is usually simple and quick. By following the few simple procedures described in this article, you can help ensure the longest life possible for your transmitter tubes.

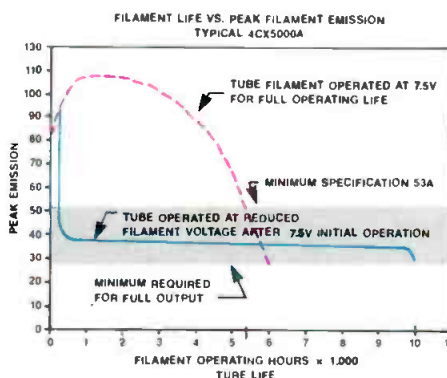


Figure 6. This chart depicts the operating life for two tubes. The red trace shows the life of a tube operated at its rated filament voltage for its entire life. This tube failed at 5,400 hours. The blue trace shows a tube operated at a reduced filament voltage after initial burn-in. Its life was 10,000 hours. The result is approximately a 50% reduction in tube costs.

Editor's note: This article was prepared from the booklet, "Tube Topics, A Guide to Vacuum Tube Users in a Transistorized World." It is available from Econco.

1:7-)))

CLEAN AS YOUR AUDIO

This compact yet powerful 11 kW FM transmitter receives your high quality audio and transmits it with the same quality provided by your compact disc. Combining efficiency with outstanding specifications provides your station with another competitive advantage.

All Continental transmitters come standard with a 2 year limited parts warranty and 24 hour technical service via phone. Leasing packages are available upon request.

Contact your local Continental sales manager to get information on increasing your competitive advantage.



Continental Electronics Corporation

P.O. BOX 270879

DALLAS, TEXAS 75227-0879

214-381-7161

TELEX: 73-398

FAX: 214-381-4949

Circle (33) on Reply Card



“During prime time
last night, our viewer base increased
300% at 317 Elm St. ... “

**TRASAR® VHF
and UHF Broadcast
Antennas**

*Broadcasting Quality
You Can See.*

“...and in thousands of other homes where our signal quality had been poor. Recently, we installed a new Andrew TRASAR® antenna. We know that plenty of homes are wired for cable, but usually only one set in each home. Our advertisers are buying the potential of reaching everyone in the house — Mom, Dad, and the kids. Because of the Andrew Trasar's circular polarization, we believe that we can more easily reach those second, third and fourth sets, plus all the non-cable homes in our coverage area.

“Today, we face more diverse competition than ever before. Every additional set we can reach is part of our competitive edge. Upgrading our broadcast signal is an investment in our future that's paying off today.”



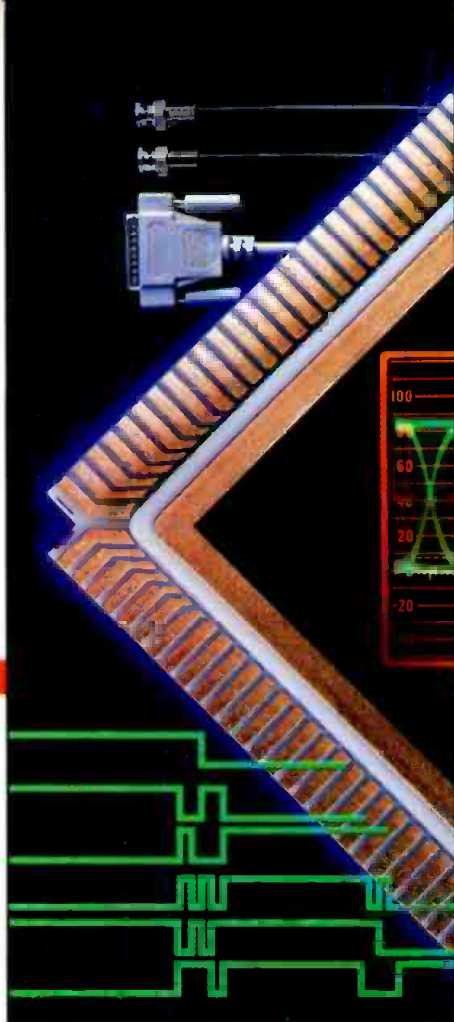
*John Dorkin
President and
General Manager
WDRB-TV
Louisville, Kentucky*

**ANDREW**

Andrew Corporation
10500 W. 153rd Street
Orland Park, IL U.S.A. 60462
1-800-255-1479

Circle (34) on Reply Card

www.americanradiohistory.com



Rebuilding TV transmitters

The task: to inspect, clean and rebuild the transmitter cavities. The result: The station saves the expense of replacing transmitters.

By Don Newman

After more than a decade of dependable service, the time had come for some major maintenance work on the transmitters at WABC-TV, Channel 7, in New York. This article will detail the planning, implementation and benefits of the project. A unique aspect of the project is that station staff worked closely with GE Support Services/RCA Broadcast organization to bring the project to a successful conclusion.

Station background

WABC-TV operates two RCA TT50FH 50kW transmitters from the top of the World Trade Center. Both transmitters were purchased new and installed in 1979. They have been in service for more than 12 years.

Each transmitter consists of two independent transmitters operated in combination. This provides 50,000W of RF output into a filterplexer, which feeds the transmission line and antenna. If one side shuts down because of a failure or because it needs maintenance, the system can still deliver half-power — 25kW.

The station is committed to maintaining full-power operation 24 hours a day, seven days a week. This is accomplished by operating the primary transmitter into the main antenna, while operating the secondary transmitter as a hot standby into the auxiliary antenna. If the primary

transmitter shuts down, applying plate voltage to the standby transmitter puts it into operation without loss of power or air time.

Reasons for the rebuild

In late 1990, station engineering management decided to rebuild the transmitters' existing visual PA, aural PA and visual IPA cavities. The decision to rebuild the cavities was based on the length of service, plus the fact that the station was having increasing difficulties keeping the cavities properly tuned. Universal joints on the tuning controls were becoming sloppy, and in some areas they had become totally inoperative. This made it necessary to move tuning controls by hand, a difficult situation at best.

Other factors influencing the decision were the condition of the cavity fingerstock, which was deteriorating with age. The Kapton plate-blocking capacitors, although still holding, were suspect. The cavity walls had, in some cases, become so worn that it was necessary to tune them slightly off their desired positions, and then compensate in other sections.

The environment was another problem. There are many corrosive elements in New York City's atmosphere from smog and from the nearby ocean. This also adversely affected tuning. Cavity walls and other areas in the transmitters had become so contaminated that it was difficult to maintain satisfactory operations.

A final justification was cost. Extending

the transmitters' life saved the station a lot of money. The station estimates that the rebuild added five to six years of life to its transmitters. The cost to WABC-TV was approximately \$70,000, which included all parts and labor. Had WABC-TV purchased new transmitters, the cost would have been more than a million dollars, plus installation and the hassle of getting through the shakedown period, which is typically at least one year. There would also have been the effort of disassembling and removing the old transmitters. (See the related article, "Is It Worth It?" p. 64.)

Clean up work

Transmitter clean up began in January, when the transmitter engineers disassembled each cavity's inner and outer covers for cleaning. They used general-purpose cleaners to remove accumulations of dirt and grease.

This job involved 12 cavities, each containing four inside covers and four outside covers. The initial cleaning took five weeks, with noticeable improvements observed along the way.

After the initial cleaning, engineers determined that all the cavities' covers could be restored. This alone represented a savings of more than \$8,000. The station then called RCA Broadcast in Mt. Laurel, NJ, and requested a complete list of replacement parts for each cavity. They ordered the required parts in March 1991, and had them delivered to the site before starting the major rebuild.

Newman is a technical specialist for General Electric Support Services, Mt. Laurel, NJ.

Belden has **BIG NEWS** for the broadcast industry



Belden is on the air with the industry's largest portfolio of new broadcast cables.

More than 60% of the products listed in Belden's new Broadcast Catalog didn't even exist just 2 years ago! Belden's new 48-page Broadcast Cable and Connector Catalog provides specifications for the industry's most complete line of cabling products, including audio multi-conductor cables, microphone cables, video coaxial cables, video triaxial cables, audio & video composite cables, bundled coaxial composite cables, fiber optic cables, cable assemblies and connectors.

New levels of excellence and innovation

During the past few years, Belden has introduced more product innovations for more broadcast cabling applications than any other cable company. This commitment to innovation and technical excellence is the reason Belden remains the broadcast industry's No. 1 cabling choice, worldwide. It's a position we've worked hard to earn and will fight hard to keep with new products, new options and even higher levels of excellence in the future.



For a FREE copy of Belden's new Broadcast Cable & Connector Catalog plus updates on our latest

product innovations, contact your local Belden distributor or call toll-free: **1-800-BELDEN-4**



BELDEN

Circle (35) on Reply Card

www.americanradiohistory.com

Copyright ©1991 Cooper Industries, Inc.



A contact ring and filament contact from one of the transmitters shows heat discoloration, tarnish and accumulations of dirt and grease due to environmental pollutants.

Planning ahead

In a job of this magnitude, which started on April 1 and continued through April 26, planning was crucial. There could be no interruptions once the job was started. The 24-hour schedule had to be maintained, including transmitter backup capability.

The station contracted with RCA Broadcast to provide an on-site technical specialist to supervise the work. Two station engineers and the contract supervisor

were scheduled for five 8-hour shifts, midnight to 8 a.m., Monday through Friday. This schedule provided for completion of one side of each transmitter per week. The crew could have finished faster by working weekends, but the station chose a less-aggressive timetable to reduce the likelihood of human error.

At midnight on April 1, the station shut down one side of the current standby transmitter, leaving the other side operational. If the on-air transmitter suffered a

failure, the station could still maintain half-power operation.

Each cavity required complete disassembly, with removal and cleaning of the old parts. The engineers used silver polish to remove corrosion and restore the original silver surfaces. Furthermore, any arc marks and worn areas on cavity walls were removed by electroplating. New parts were then installed where needed, and the units were reassembled.

To achieve the desired results, engineers laid out each step prior to starting work. The crew rebuilt one cavity at a time. Then, they tested it at full power before proceeding to the next one. This way, any problems encountered when the transmitter was powered up for testing could quickly be identified and repaired. Also, they completed and tested both sides of one transmitter before starting work on the second.

The job proceeded as planned and, with one exception, was completed on time. The exception occurred when a blower motor with defective grease seals blew grease into the system. This required extra cleaning time.

Because the rating sweeps were due to start, the cavities on the last side were left unfinished. Their completion was scheduled at a later date.

SOME OF OUR BEST CUSTOMERS DON'T RENT OUR VIDEO EQUIPMENT. THEY BUY IT.

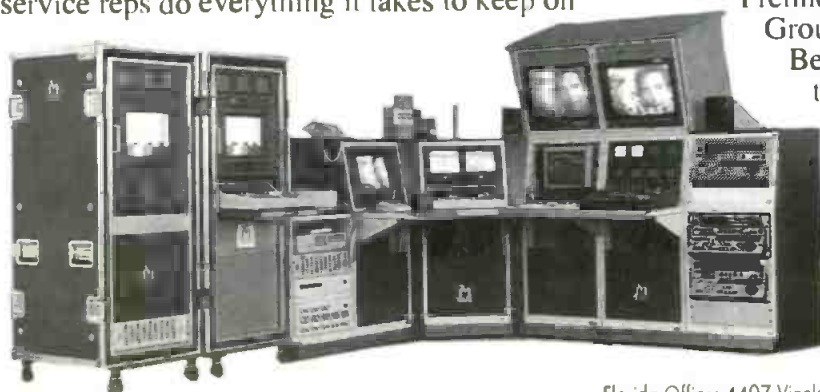
Companies who want to buy the most advanced broadcast/industrial video equipment come to I.V.I. Because no one knows how to take care of their needs better than we do. Our trained staff of sales people, broadcast engineers, and customer service reps do everything it takes to keep on

top of the ever-changing high-tech world of video.

We regularly attend the latest manufacturers seminars and training programs. So, our engineers know the equipment inside out.

We're the New York Distributor for: Sony Premier, Sony Broadcast and, the Grass Valley Group.

Before you invest in video equipment, come to the company that has what you need.



IMAGING VIDEO inc

540 West 36th Street, NY, NY 10018
(212) 947-5888 • Fax: (212) 947-5894

Florida Office: 4407 Vineland Rd., Orlando, FL 32811 • (407) 425-7454 • Fax: (407) 425-7217
Circle (36) on Reply Card



**Nature has its own
professionals of
sound and vision.**



The wonders of sound and vision found in nature are hard to reproduce. In fact, if anyone has come close it's EEV.

Whatever your broadcast requirements, you'll find EEV has the technology to match. High-efficiency UHF Television Klystrons from 5kW to 70kW for Television Transmitters. A range of Broadcast Tetrodes and Vacuum Capacitors for AM and FM transmitters, and Leddicon® camera tubes to fit virtually every broadcast color camera available today.

Our experience is the key to technological leadership. Our manufacturing know-how ensures the highest quality and reliability.

Above all, our professional dedication to our customers' needs makes us the natural choice of broadcasters the world over.

® Leddicon is the Registered
Trade Mark of EEV Lead Oxide
Camera Tubes.

EEV

Technology for the Broadcast Industry



USA: EEV Inc, 4 Westchester Plaza, Elmsford, NY 10523. Telephone: (914) 592 6050 or 'Toll Free' 1-800-DIAL EEV Telex: 6818096 Fax: (914) 682 8922
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) 493493 Telex: 99103 Fax: (0245) 492492

Subsidiary of the General Electric Company plc of England. **S&C**

Circle (37) on Reply Card
www.americanradiohistory.com

A stitch in time

An important benefit of doing a job of this nature is that it can uncover other potential problem areas. Rework of this scale will often reveal problems that ordinary routine maintenance procedures may miss.

The true cooling criterion is air density — any reduction is detrimental to tube life. In one case, a blower boot was found to have incorrect mounting brackets. This caused air leakage. The diminished air supply to the cavities may have caused inadequate cooling.

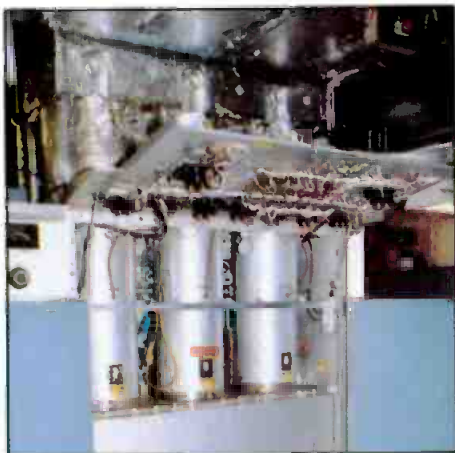
The engineers also found and replaced a bad vent fan. In both transmitters, some of the sound-deadening foam material had deteriorated and broken loose. It lodged in the honeycomb material of the sliding RF shorts that surround each cavity, restricting air conduction.

Furthermore, the engineers found a burned set of bleeder resistors in one transmitter. They fixed a bent elbow in one transmitter's visual output transmission line. They also replaced a sticking screen voltage meter. The 4N25 optoisolator ICs in some of the overload sequencer modules were found to be defective and were replaced.

Why bother?

The rebuild fixed some serious problems and headed off others. One of the first benefits of the cavity rebuilding was an improved tuning process. Each refurbished cavity now provides excellent operation. The previously erratic visual frequency response is now completely solid. With the transmitters in like-new condition, there is no longer a need to compensate for worn tuning areas. All tuning controls responded properly. In addition, future cavity component failures are now likely to be minimal.

WABC-TV's decision to rebuild the transmitters proved to be advantageous. The station feels it has achieved its goal with minimal cost. The transmitters are like new, and will provide the optimum per-



The rebuilt aural power amplifier (PA), visual intermediate power amplifier (IPA) and visual PA of one side of one of the transmitter pairs.



Various parts that were replaced during the WABC-TV transmitter rebuilding project.

formance and stability that is essential to the station's operation. WABC-TV recommends that other station engineers consider this overhaul at their own stations.

Acknowledgment: GE Support Services thanks Ray Johns, assistant director of engineering and Don Di Franco, transmitter engineer at WABC-TV, for their assistance in developing this article.

Is it worth it?

By Marvin Born

Looking at the financial aspects of rebuilding vs. replacing a transmitter reveals many zeros in the numbers. The article "Rebuilding TV Transmitters" listed the cost of the reconditioning at \$70,000 for two dual transmitters vs. \$1 million to replace them — a difference of \$930,000.

How would the numbers look if the \$930,000 was placed in the bank? The authors estimate the rebuild will allow the station to hold off purchasing a new transmitter for five years. At 10% interest for five years, compounded monthly, the account will equal \$1,573,200. That would cover half the cost of a new transmitter system. If the money was placed in the bank for only one year, the future value is \$1,027,383, or \$97,383 paid in interest.

Most stations aren't able to pay \$1 million in cash for equipment or place \$930,000 in an account to draw interest. So what is the real cost of rebuilding vs. replacing if both scenarios are financed using 10% interest compounded monthly? (For simplicity, no down payment will be used.)

Because the rebuild is expected to last five years and a new transmitter is expected to last 15 years, we will use five and 15 years, respectively, to compute the monthly payments.

Initial investment: \$70,000 \$1,000,000

Monthly payments: \$1,487 \$10,746

Total cost at the end of each year:

Year 1 —	\$17,844	\$128,952
Year 2 —	\$35,688	\$257,904
Year 3 —	\$53,532	\$386,856
Year 4 —	\$71,376	\$515,808
Year 5 —	\$89,220	\$644,760

...

Year 10 —	\$1,289,520
Year 15 —	\$1,934,280

As you can see, the cost of the first year's payments for new transmitters exceeded the total cost of rebuilding.

Now we can play with the numbers a bit. If the station was to rebuild the transmitters paying cash for the repairs plus putting the \$10,746 per month in the bank, the down payment on the new transmitters could be \$644,760 after five years. This would leave \$355,290 to be financed for the 15-year life of the new transmitters.

Financing \$355,290 for 15 years would require payments of \$3,817 per month, or a total of \$687,136 over the 15 years.

If the transmitters were purchased new (without the rebuild) and financed, the total costs would be \$1,934,280. If the original was rebuilt and used for five years, then replaced as described, the cost would be \$687,136 plus \$70,000 or \$757,136.

Subtracting \$757,136 from \$1,934,280 gives a savings of \$1,177,143 by rebuilding the original for five years while building an annuity for the replacement.

These figures show how much a station can save by rebuilding a transmitter instead of buying a new one. Is it worth it?

[:-)]

Born is vice president of engineering, WBNS stations, Columbus, OH.

D2 FRAME SYNCHRONIZERS • UP/DOWN TIMERS • ANALOG
CLOCK DISPLAYS • DISTRIBUTION AMPLIFIERS • D2
SYNC/TEST GENERATORS • CODE CORRECTORS • SOURCE
IDENTIFIERS • CODERS/DECODERS • STILL FILES • VIDEO
ROUTERS • DISTRIBUTION AMPLIFIERS • D2 FRAME
SYNCHRONIZERS • UP/DOWN TIMERS • ANALOG CLOCK

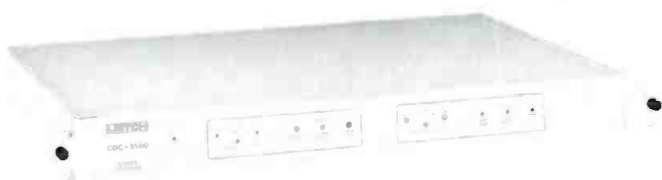
'91 NEW PRODUCTS by LEITCH

DSF-3120 STILL FILE Gateway

Fast, compact, and inexpensive 4:2:2:4 digital component still store. Multiple units (component and composite) can be networked (Ethernet) to provide transparent exchange of material. Optional Film Transfer software includes comparison wipes, windows, cut and paste, and pixel value (RGB) determination.

CDC-3500 Coder/Decoder

Converts 4:2:2 (D1) into various analog formats, including RGB, YIQ, Betacam, composite, etc.



ADC-5100 Series Analog/Digital Clock

Quiet and economical solution to studio timekeeping. Displays are self-setting, stand-alone, featuring sweep or step display of seconds.

UDT-5701 Rack-mounted Up/Down Timer

1RU, fully programmable, Up/Down Timer with all the features of the popular desktop version UDT-5700.



DigiBus Modular Digital Frame

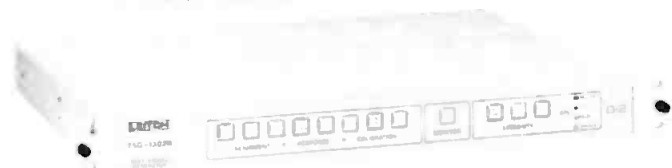
The right tool for distribution and conversion between different digital (serial/parallel) and analog signals within a single frame.

Serial D2 DigiPeek

Compact and convenient, the D2 DigiPeek is ideal for monitoring a composite digital video data stream.

SPG/TSG-1302N D2 Sync/Test Generators

New frame designs that allow easy customer upgrades, and multi-use analog NTSC/D2 functions within the same frame.



1302SI Source Identifier Module featuring full screen and vertical interval text insertion.

1300CC Code Corrector Module adapts real Time Code to video Time Code (jam sync).

SPG-1500P PAL Master Sync Pulse Generator

Modular, 1RU design that includes a high-stability (0.1Hz), no warm-up, temperature-controlled master oscillator, all the test options available in the SPG-1510P, and more ...

FR-681AV Audio/Video Mounting Frame

1RU frame accepts any combination of up to two 680 Series video amplifiers and 880 audio amplifiers. It also accommodates the new ADA-885 Stereo Audio DA.



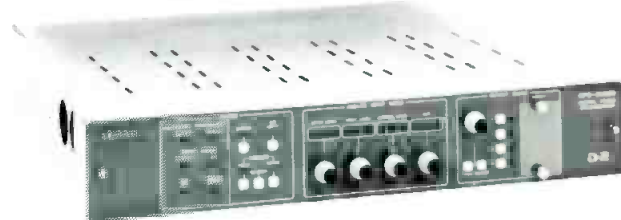
VCA-680 Video Clamping Amplifier Module

featuring 8 outputs, 30 MHz bandwidth, and enhanced luminance clip.



DFS-3002N Digital Frame Synchronizer

Full processing frame synchronizer that provides both analog NTSC (10-bit A to D) or D2 (8/10 bits) inputs and outputs. Standard features include a 4-field memory, and comb filter.



HEDCO's 16Xplus Video Router

A new 100MHz addition to the popular 16x line of routers.



LEITCH®

Leitch Incorporated, 825K Greenbriar Circle, Chesapeake, VA. U.S.A., 23320 - Tel. (804) 424-7920 Fax. (804) 424-0639

Leitch Video International Inc., 220 Duncan Mill Rd., Don Mills, Ont., Canada M3B 3J5 Tel. (416) 445-9640 Fax. (416) 445-0595

See us in September at;
Video-Expo, NY

See us in October at;
**AES New York, and
SBE Houston, TX**

NEW PRODUCTS FOR THE NEXT DECADE AND BEYOND...

If you think there's no difference between monitors, we have a few problems for you.

Wouldn't it be great to have a TV station monitor that could help you detect problems in your other equipment. A monitor with SMPTE C phosphors to prevent **COLOR INCONSISTENCY** between monitors. And over 600 lines of horizontal resolution to eliminate **FUZZY** details.

Of course, it would be really great if it had a beam current feedback system to stop **COLOR DRIFT**. And a broadcast CRT with an aperture grille designed to handle higher brightness without **WARPING** or **BOILING** - while maintaining color purity and uniformity. And if it had a **FLATTER** screen to provide you with a truer **PERSPECTIVE** and an auto set up system to let you avoid **TWEAKING**, that would be ideal.

Well, that's the right word for Sony's BVM-1915. It was specifically designed to meet the broadcast industry's tough standards for precise **COLOR** reproduction and reliability.

If you're using anything else, your idea of what a TV station monitor can do for you may be a bit **CLOUDY**.

For more information on how easily the newest

rence between TV station
oints we'd like to illustrate.



member of the BVM family can fit into your budget, just give
us a **"RING"** at 1-800-635-SONY. **SONY**

BUSINESS AND PROFESSIONAL GROUP

Testing coaxial lines



Budget applications of TDR can solve transmission line problems.

By Don Kolbert

Part 1 of this series, which began in October, introduced the technique of time domain reflectometry (TDR) to measure the length of transmission lines. It also showed how cable measurements can be made with inexpensive "service-type" test equipment when the more expensive industrial/scientific instruments are not available.

Part 2 will show how to use TDR to measure impedances and identify faulty cable fittings and connectors. The effect of impedance mismatches on voltage standing wave ratio (VSWR), and the characteristics of an oscilloscope for best results in TDR measurements will also be covered.

When dealing with transmission lines, such as line pairs and coaxial cables, a few electrical parameters have great influence on the cables' ability to transfer energy from one place to another. Among these are surge impedance (Z_0), the dielectric constants (k) of the insulating materials, and the velocity of propagation (V_p) of electromagnetic waves, both in free space and within the transmission lines.

In a coaxial cable, with a single center conductor and an outer conductor, the surge impedance is determined by this relationship:

$$\text{Equation 1: } Z_0 = \frac{138}{\sqrt{k}} \times \log_{10} \frac{D}{d}$$

Kolbert is chief engineer at KLSE-FM and KZSE-FM, Rochester, MN.

where k = the dielectric constant of the insulating material
 D = the inside diameter of the outer conductor
 d = the outside diameter of the center conductor

In 2-conductor transmission lines, the surge impedance is determined by this relationship:

$$\text{Equation 2: } Z_0 = \frac{276}{\sqrt{k}} \times \log_{10} \frac{2S}{s}$$

where k = the dielectric constant of the insulating material
 S = the spacing between the centers of the two conductors
 s = the diameter of the conductors

(Diameters and spacings can be measured in either centimeters or inches.)

If the inductance and capacitance per foot (or meter) of the transmission lines are given by the manufacturer, the surge impedance can be calculated by this relationship:

$$\text{Equation 3: } Z_0 = \sqrt{L/C}$$

where L = quoted inductance per unit length
 C = quoted capacitance per unit length

Note that the actual *length* of the line is not a factor in any of these formulas. The surge impedance of the line is independent of cable length, and wholly dependent on cable type.

One common variety of 1/2-inch foam dielectric coaxial cable has an inductance per foot of 0.058 microhenries (μH) and a capacitance per foot of 23.1 picofarads (pf). Its surge impedance is therefore:

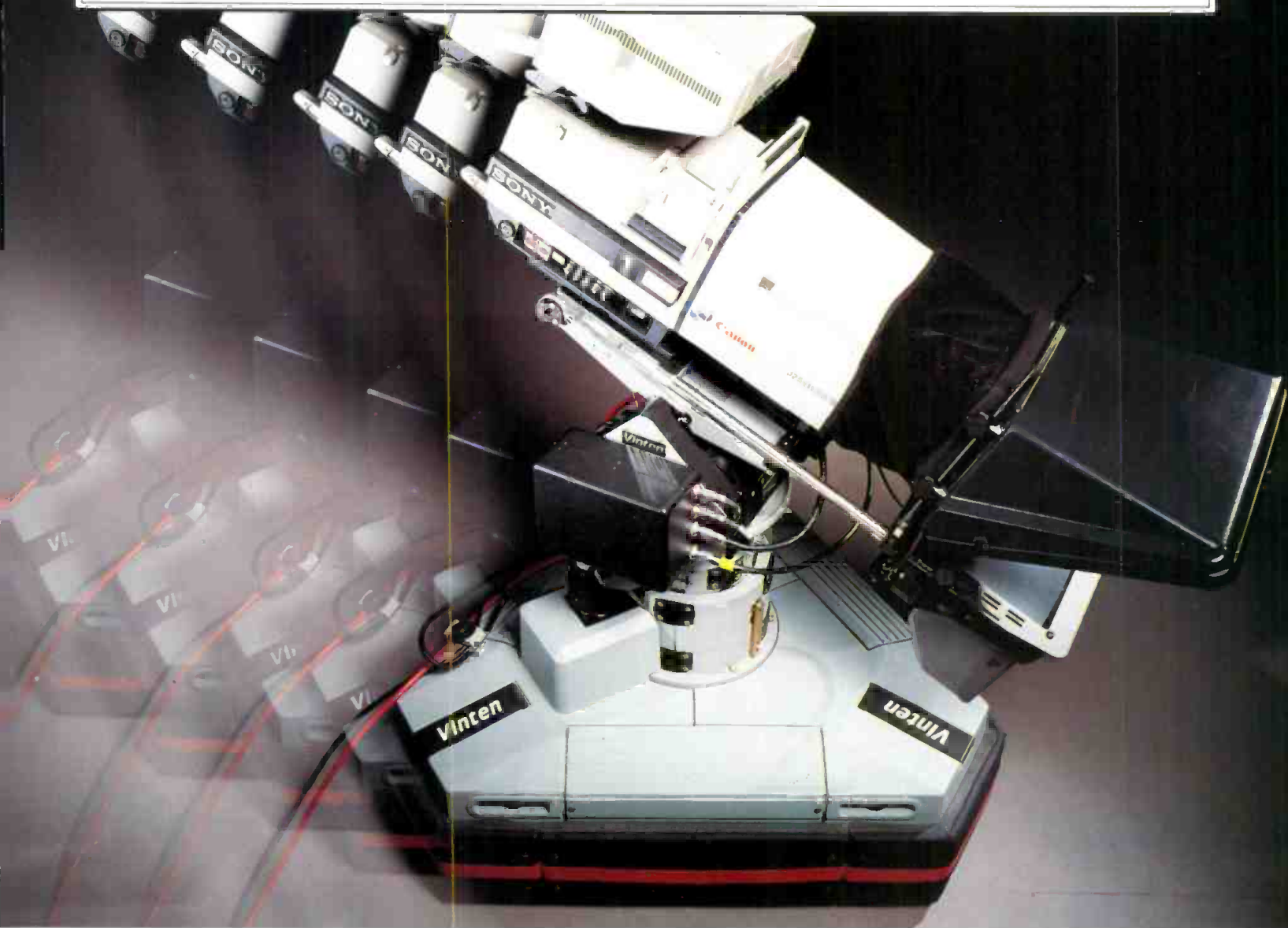
$$Z_0 = \frac{1}{\sqrt{(0.058 \times 10^{-6}) / (23.1 \times 10^{-12})}} = 50\Omega$$

Most transmitters use 50 Ω or 52 Ω coaxial transmission lines to feed energy to an antenna. (Translator manufacturers offer either 50 Ω or 75 Ω lines.) Receivers have traditionally employed 75 Ω or 300 Ω input impedances. The 75 Ω may either be coax (single-ended) or 2-conductor (balanced), and the 300 Ω is 2-conductor balanced (commonly called 'twin lead'). This report will deal with single-ended cables that are most commonly used in broadcast transmission. (Some of the references listed at the end of the article describe the procedures used with balanced transmission lines.)

Crimps and mismatches

Because the surge impedance of a transmission line is based upon its cross-sectional characteristics, its impedance can be changed if the cable is compressed or bent past its recommended bend radi-

Vinten experience and an EMMY.[®] The only robotic system with both.



MICROSWIFT[™]

Perfect playback every time. You have to see an automated camera system in action to realize they aren't all created equally. More than half a century of engineering the world's finest camera support systems is reflected in Vinten's MicroSwift Studio Automation.

Here are some of the results:

- Incredibly precise repeatability of all pedestal and head movements
- Instant switchover to full manual control of all pedestal, pan/tilt functions with traditional manual "feel"
- Totally automated pre-programmed control
- Free navigating EXY-Ped and height servoed H-Ped pedestals plus a variety of pan/tilt heads
- High velocity EXY-Ped movement (10"/second), ultra smooth starts and stops
- Extra quiet for on air operation
- Built-In power backup for absolute positioning without re-initialization, battery back up to maintain memory

A single MicroSwift system can consist of up to eight cameras on free navigating and static pedestals as well as on fixed heads, storing up to 500 shots each. A wide variety of control systems include control panels that can also operate with a graphics tablet. And now, there's a new Touch Screen control system with its own trim panel.

Continuously evolving — never obsoleting — MicroSwift offers you everything needed to automate a two-camera news set, an 8-camera multi-set studio or anything in between. For more information and all the MicroSwift advantages, call the location nearest you.

FOR EMMY[®] WINNING
ROBOTICS. IT'S VINTEN
MICROSWIFT

Vinten

Vinten Broadcast Inc.,

44 Indian Lane East, Towaco, NJ 07082 (201) 263-4000 Fax (201) 263-8018
South — Coral Springs, FL (305) 345-2630
West — Sun Valley, CA (818) 767-0306

us. The inner and outer conductors would no longer have the same spacing between them at that point, causing a change in impedance there. (See Equation 1.) This change of impedance causes some of the energy in the line to be reflected in both directions. Some of the energy never reaches the load. Standing waves are created, which in turn cause energy to be radiated by the transmission line. (A perfectly matched transmitter, line and load system has no standing waves, no lost energy except for dielectric losses, and no radiation from the transmission line itself.)

A crimp in a line will cause an increase of capacitance at that point. This will cause the impedance to be reduced. The resulting TDR waveform is shown in Figure 1.

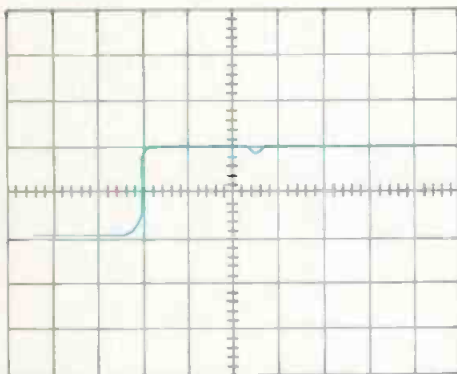


Figure 1. Simulated display showing the effect of a crimp in a transmission line.

Now, consider a 75Ω load connected to the end of a 50Ω coaxial cable. The TDR waveform that results from the mismatch at the end of the line is characterized by an upward deflection of the waveform shown in Figure 2, similar to that exhibited by an open condition. In the mismatch, however, the $E_{REFLECTED}$ (E_R) is not the same amplitude as the $E_{INCIDENT}$ (E_I). The voltage ratio of E_R to E_I is denoted by the Greek letter rho (ρ):

$$\text{Equation 4: } \rho = E_R/E_I$$

The absolute value of ρ may be either positive or negative, depending on whether a mismatched impedance is higher (positive) or lower (negative) than the source impedance. For the example shown in Figure 2, $E_R = 1$ division and $E_I = 5$ divisions. That means $\rho = 0.2$. If the vertical sensitivity is set at 0.2V per division, that would mean that $E_R = 0.2V$ and $E_I = 1V$.

To determine the load impedance (Z_L) once ρ is known (and verify that it is equal to 75Ω), employ this useful formula:

$$\text{Equation 5: } Z_L = Z_0 \frac{1 + \rho}{1 - \rho}$$

The distance to the impedance mismatch will be calculated as shown in Part 1, using $D = V_P \times T/2$. For RG-58/U, the

ρ	MULTIPLIER	Z_L	
		$Z_0 = 50\Omega$	$Z_0 = 75\Omega$
+1.000	∞	∞	∞
+0.980	100	5,000	7,500
+0.970	60	3,000	4,500
+0.961	50	2,500	3,750
+0.905	20	1,000	1,500
+0.818	10	500	750
+0.667	5	250	375
+0.333	2	100	150
+0.000	1	50	75
-0.333	0.5	25	37.5
-0.667	0.2	10	15.0
-0.818	0.1	5	7.5
-0.905	0.05	2.5	3.75
-0.961	0.02	1.0	1.50
-0.970	0.167	0.833	1.25
-0.980	0.010	0.500	0.75
-1.000	0.000	0.000	0.000

Table 1. ρ values, multipliers and their corresponding Z_L values for 50Ω and 75Ω surge impedances (Z_0).

V_P is 0.65 ft/ns. If $T = 280$ ns, $D = 91$ feet to the mismatch.

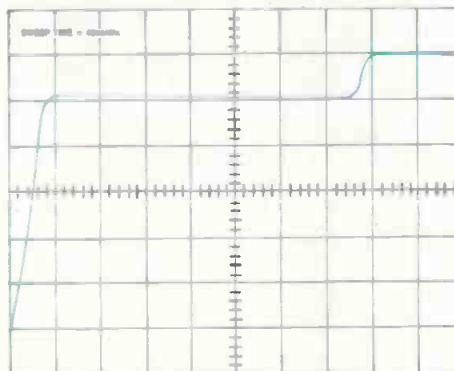


Figure 2. Simulated display showing the effect of connecting a 75Ω load to a 50Ω transmission line (cable).

Table 1 shows 16 ρ values, the corresponding multiplication factors, and the resultant Z_L for 50Ω and 75Ω values of Z_0 .

Mismatches can even occur between connectors and sections of transmission line. Manufacturers will often specify what type of cable a connector is to be used with instead of listing its surge impedance. Although this may be adequate for ordering connectors for a given installation, consider the spare parts stock issue. What happens when you reach in the parts drawer for a BNC or N connector and grab the first one you see? Unless you have an experienced eye, you're liable to pick the wrong one and create a mismatch.

If you try to use a 50Ω N connector on a 75Ω N fitting, you will not only have an impedance mismatch, but you will also split the 75Ω female fitting. This will, of course, create an intermittent connection, especially when the cable is hanging loosely or when there are extreme temperature changes.

A 75Ω connector placed between two

sections of 50Ω cable will cause an upward bump in the waveform, as shown in Figure 3.

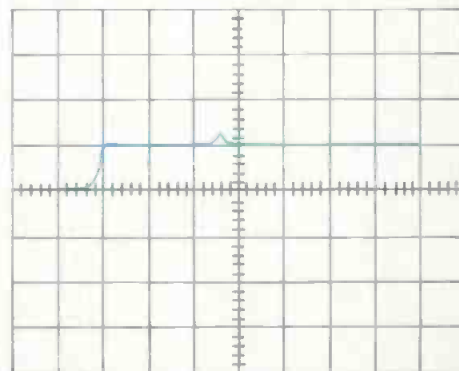


Figure 3. Simulated display showing the effect of placing a 75Ω connector between two sections of 50Ω cable.

Naturally, voltage standing wave ratio (VSWR) has a part in this analysis. Remember that $VSWR = Z_1/Z_2$, where Z_1 and Z_2 represent the two impedances involved in the mismatch (the larger impedance is always the numerator so that $VSWR \geq 1$). VSWR is, in fact, what Z_0 is multiplied by in Equation 5 to find Z_L :

$$\text{Equation 6: } VSWR = \frac{1 + \rho}{1 - \rho}$$

So, a 50Ω to 75Ω mismatch not only has a VSWR based on $75/50 = 1.5$, but also a VSWR derived as follows:

$$VSWR = \frac{1 + 0.2}{1 - 0.2} = 1.5$$

Meanwhile, power is proportionate to the square of voltage, and ρ is the ratio of E_R to E_I . It follows that the ratio of reflected power (P_R) to forward power

Continued on page 74

TAKE IT ON THE ROAD. SEE WHAT IT WILL DO.

Rack-Pack™ cases are tough. Hit the road with them and you'll know just what we mean. Bumps and jolts typical of location shooting can take its toll, even when you're being careful.

That's why we put those unique little ribs in the pliant high density polyethylene shell, to absorb shock. The Rack-Pack does just that, it repeatedly handles virtually all impact. Minimal vibration reaching the interior is instantly overcome by the elastometric shock mounts supporting the rack frame. Delicate equipment remains totally unharmed.



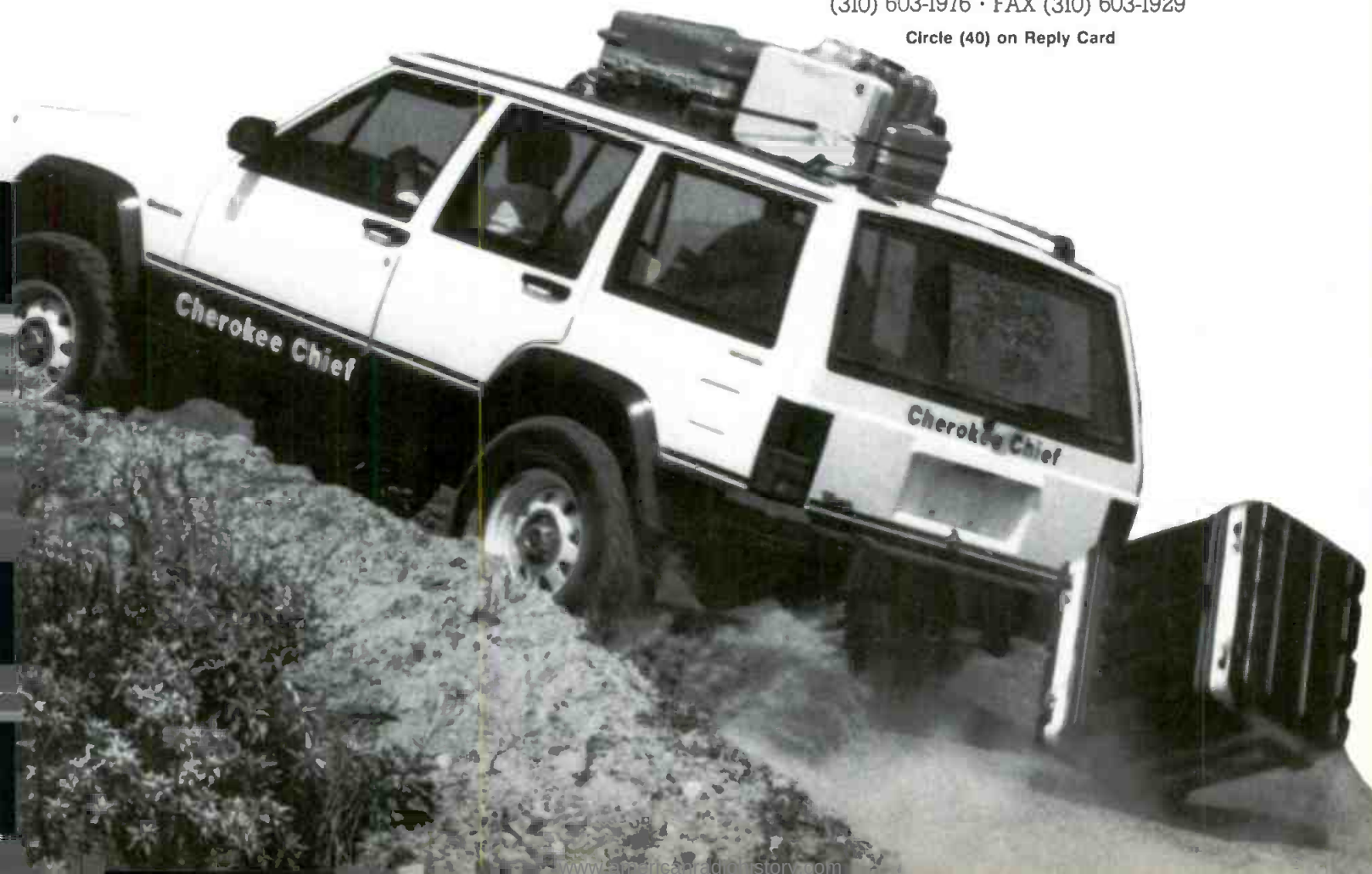
Water tight? You bet. And, versatile because Rack-Pack opens both front and back, so everything can be pre-wired in advance. You can be up and running in minutes, not hours. Also, interlocking Rack-Packs can be stacked to form modular workstations.

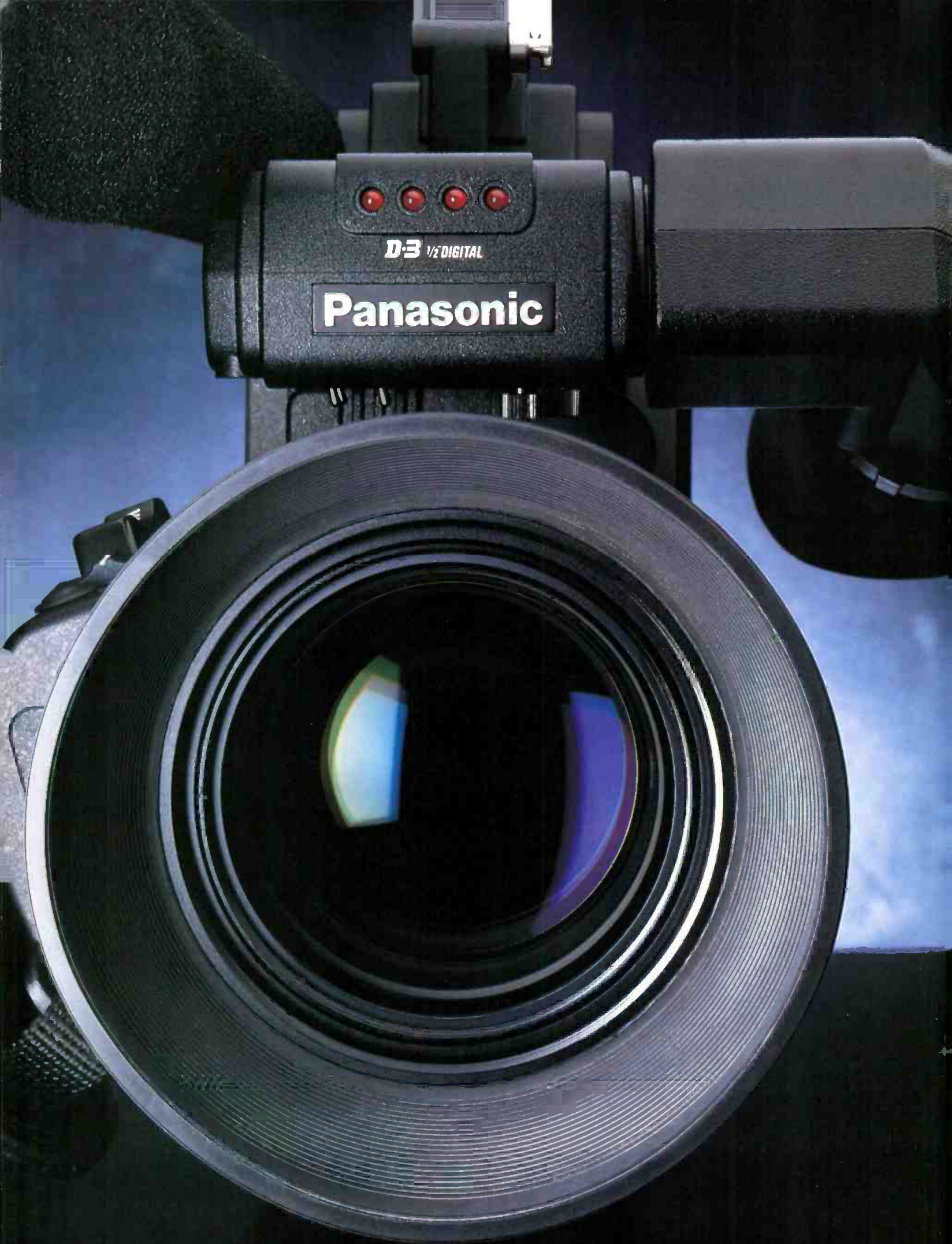
So, the next time you and your equipment decide to hit the road, you'll be better off leaving those fragile old plywood and fiberglass cases at home. Move out with Thermodyne cases, and you move out with total confidence.

**T THERMODYNE
INTERNATIONAL LTD**

20850 Alameda Street, Long Beach, CA 90810
(310) 603-1976 • FAX (310) 603-1929

Circle (40) on Reply Card





D-3 ACQUISITION IS JUST THE START OF SOMETHING BIG.

Panasonic D-3 is the *only* system that gives television producers the quality and reliability of digital technology from *start-to-finish*.

Panasonic's D-3 system starts with a family of digital processing cameras including the AJ-D310 camcorder, the AQ-225 Studio/Field Digital camera, and the highly successful AQ-20, the world's first all digital processing camera. The D-3 system includes a truly field-portable recorder as well as a state-of-the-art studio VTR, the AJ-D350. Now, each and every producer—from sports, to programming, to commercials—can originate in digitally recorded video.

For Panasonic, a fully digital camera/recorder is just the start. D-3 post-production on the AJ-D350 is exactly what post-production should be—precise and agile. While a newly developed 8-14 Channel Coding approach to composite digital assures excellent pictures, shuttle speeds provide viewable video at up to

100 times normal; a special edit guardband provision assures accurate editing every time and maximizes tape interchangeability, VTR to VTR. A special audio recording system and a flying erase head allow cross-fades, V fades and the conventional editing techniques that fine programs

require. Plus, Panasonic D-3 recorders support 4 channels of PCM audio. RS-422 control, thorough attention to connectivity, and easy interfaces to digital as well as the analog worlds, assure users of smooth systems integration.

Panasonic D-3 is already off to a great start. It's the official video recording system for the production of

the Games of the XXVth Olympiad in Barcelona, and the choice of prestige broadcast producers here and abroad for drama and sports program production and post-production.

Panasonic D-3 proves an adage known to producers everywhere: The only thing as important as a great start is a great finish.



DIGITAL FINISHING ROOM

For more information call: 1-800-524-0864

Panasonic Communications & Systems Company
Division of Matsushita Electric Corporation of America
One Panasonic Way, Secaucus, NJ 07094

Official Video Equipment Sponsor 1992 Olympic Games



36. USC 380

Continued from page 70

(P_F) is equal to ρ^2 . Therefore, if you know ρ and the forward power, the reflected power can be calculated in this manner:

$$\text{Equation 7: } P_R = \rho^2 \times P_F$$

Multiple mismatches

Unfortunately, if there is more than one discontinuity in the cable system, it becomes more difficult to determine the impedance of the second and subsequent mismatches.

Some TDR manufacturers have attempted to provide correction factors to account for multiple mismatch errors, but they won't work for all situations. In general, the larger the first mismatch, the greater the error in calculating the second mismatch. When the values of the mismatched cable sections and/or loads are known, you can work backward and calculate what the ρ values should have been. When the cable values and/or loads are unknown, only the first mismatch can be calculated accurately.

Mismatches can even occur between connectors and sections of transmission line.

Note that when a 75 Ω cable is connected to a 50 Ω pulse generator, the first mismatch has already occurred, so the second mismatch will not have the proper value of ρ . A simple L-pad between the 50 Ω generator and the 75 Ω cable can create the proper impedance match and avoid this problem.

"Dribble up"

If you tried some of the TDR techniques from Part 1, you may have noticed that some cables take a long time to 'charge up.' This is sometimes described as *dribble up* and is caused by high-frequency losses. It is particularly noticeable in long lengths of cable. Cables often have a fast rise time for the first half of the pulse step, and then a slow charging rate for the last half. Therefore, the step response (rise time) is often measured from 0% to the 50% point (this value of rise time will give a more accurate indication of the cable's bandwidth than the 10% to 90% figure used in amplifiers). Dribble up is not usually a problem in short cable runs.

Because of dribble up you will have to be careful where, on the vertical scale, you measure the ρ value. Be sure to measure the pulse amplitude for the incident and the reflected voltages at the point where

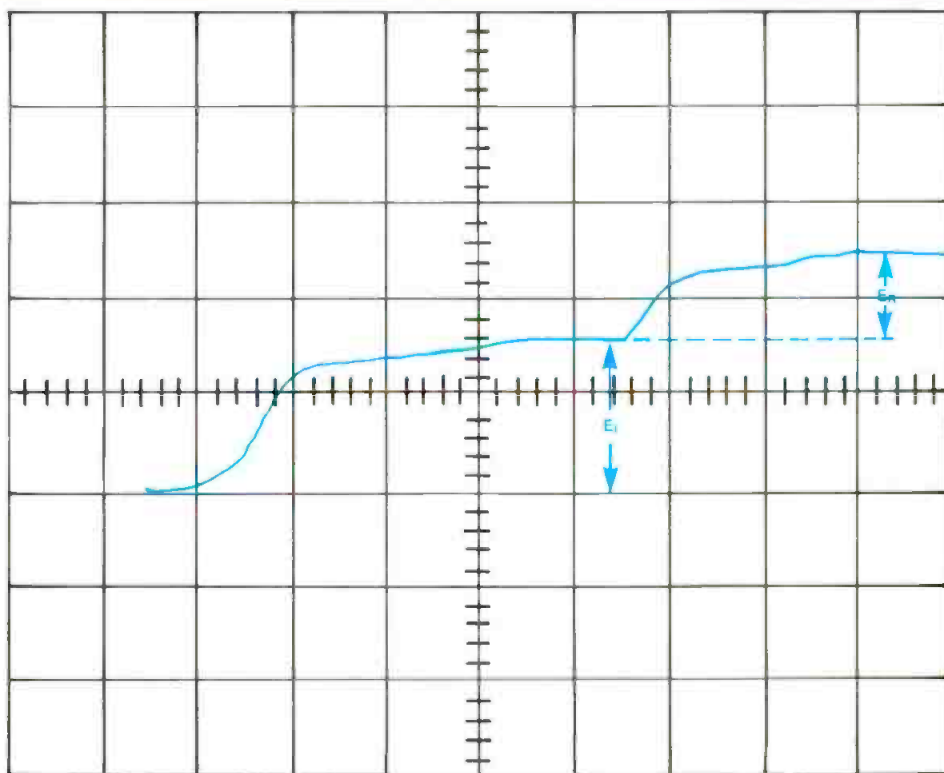


Figure 4. Simulated display illustrating the phenomena of "dribble up" caused by high-frequency losses in a transmission line.

they have reached full charge, as shown in Figure 4.

Test equipment requirements

Keep in mind that most service-type oscilloscopes are limited in vertical amplifier bandwidth and horizontal sweep frequency ranges. They also use analog technology, for the most part.

The vertical amplifier bandwidth will affect the displayed pulse rise time, thus limiting your ability to define beginning and ending points on the waveform, and masking some of the cable characteristics that occur closest to the test instruments. Limited horizontal sweep frequency range will affect the resolution required to accurately determine distances.

Consider these characteristics, therefore, the next time you buy an oscilloscope. You (and your manager) may cringe at the price of a 100MHz oscilloscope, but it could be an extremely wise investment. It assures you a rise time of 3.5ns (a leading-edge error of about 1 foot with polyethylene dielectric cables) and typically provides a horizontal sweep frequency of 5ns/division (with a 10 $\times$ magnifier), which would allow a distance resolution

of 1.75 feet per major division and 0.35 feet per minor division. (These figures take into account that the waveform represents round-trip time, so it's 3.5ns/2 and 5ns/2 times the velocity factor.) A special feature called *delay time multiplication* is available with most 100MHz oscilloscopes, and it allows extremely accurate timing measurements.

In Part 1, the pulse generator was briefly mentioned. The rise time of the pulse becomes even more critical when your oscilloscope has a fast rise time. In fact, the total rise time ($T_{R \text{ total}}$) of the pulse generator and the oscilloscope is as follows:

$$\text{Equation 8: } T_{R \text{ total}} =$$

$$\sqrt{(T_{R \text{ pulse}}^2 + T_{R \text{ scope}}^2)}$$

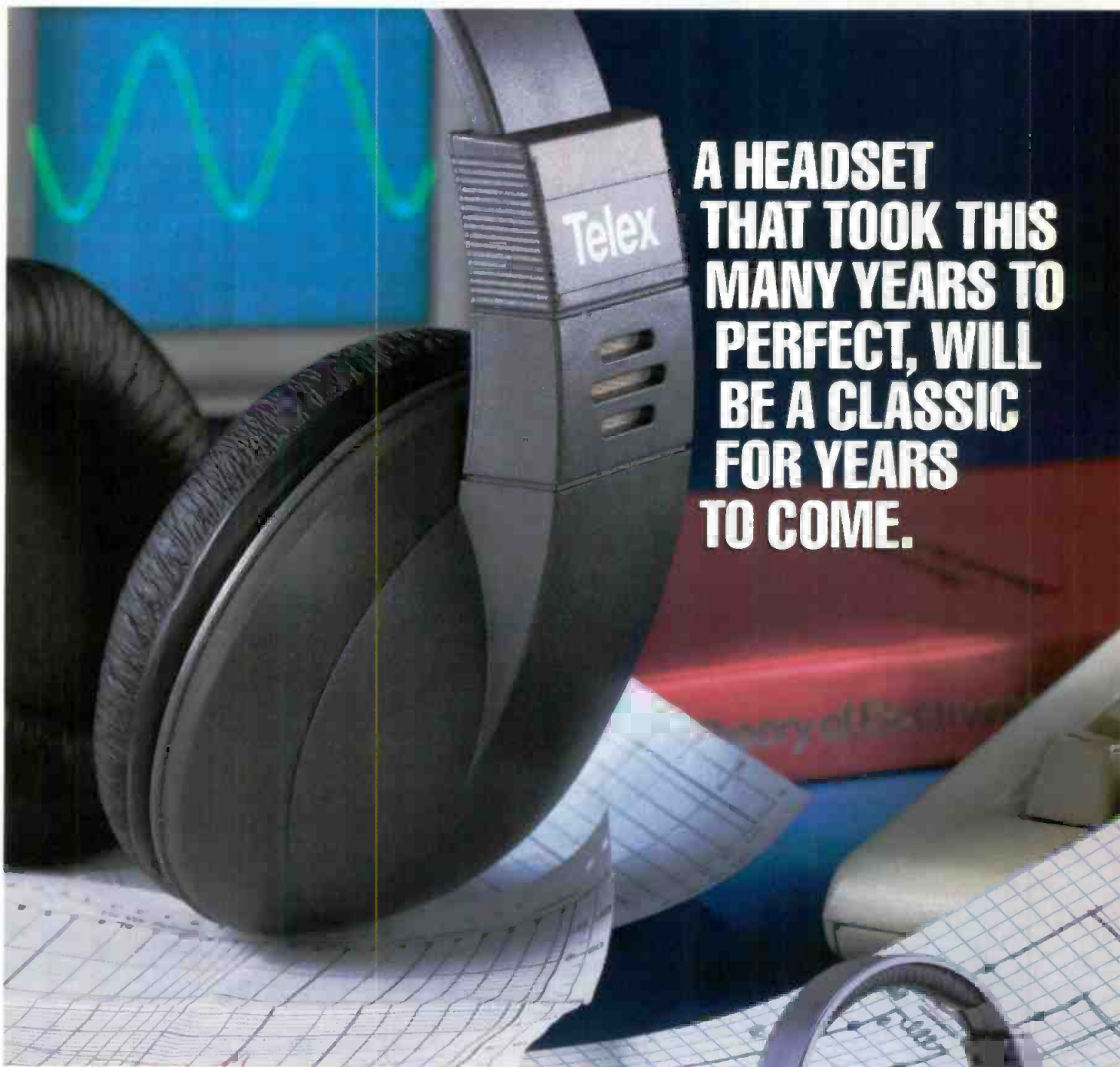
An oscilloscope with a 3ns rise time and a pulse generator with a 3ns rise time would have a total rise time of:

$$T_{R \text{ total}} = \sqrt{(3^2 + 3^2)} = \sqrt{18} = 4.24\text{ns}$$

If your equipment uses digital computers and control logic, rise times become extremely significant, particularly where gates are concerned. You simply can't look at rise times with a 10MHz oscilloscope when the synchronization of a control function depends on multiple gate inputs reaching the turn-on threshold within 2ns or 3ns. The 100MHz oscilloscope provides waveform analysis and time domain reflectometry to a high degree of accuracy.

Many of the newer industrial and scientific oscilloscopes are microprocessor-controlled and/or use digital sampling circuitry. The price of these instruments is

Cables often have a fast rise time for the first half of the pulse and a slow charging rate for the last half.



**A HEADSET
THAT TOOK THIS
MANY YEARS TO
PERFECT, WILL
BE A CLASSIC
FOR YEARS
TO COME.**

**Get this *new* classic today
and avoid the rush.**

No one knows exactly what makes a product a classic but everyone knows which products qualify. We do know that "standards" of the industry always excel in technical performance, comfort,



Earcup fits any
head shape or size.

durability and appearance, so with these as our criteria the V Series was designed to be superior to any headset on the market. By all accounts, after years of development, we succeeded.

Technically, the V Series specs are a cut above the rest.

But classics are created over time by the people who use them, not by manufacturers' claims, so let your own ears confirm our data. The revolutionary floating earcup conforms to any head shape or size for a more comfortable fit. But, of course, you'll realize that after one of those long, grueling production days. We know the materials and workmanship are second to none, but only time can tell about its durability. However, when enough time has passed to be a fair test, the V Series will already be a classic.

For complete details about the unique V Series modular ordering concept, outstanding specs and the comfortable



Model V220 with
MB-11 Dynamic
Mic option.

new earcup design write to Telex Communications, 9600 Aldrich Av. So., Minneapolis, MN 55420, (612) 887-5550.

© 1991 Telex Communications, Inc.

TELEX®

Circle (41) on Reply Card



PHILIPS

Circle (43) on Reply Card

www.americanradiohistory.com



high, but well worth the money for the type of applications they are designed for. Most broadcast applications have not needed that many sophisticated features in the past, but this may not be true in the

Building fiber-optic transmission systems



Photo courtesy of AT&T Bell Laboratories.

The advantages of fiber outweigh the complex design process.

By Brad Dick, editor

The use of fiber-optic cable is increasing rapidly. Lower cost, the need for additional bandwidth and higher quality are all driving forces behind this growth. If your facility isn't already using fiber, get ready, it's on the way.

Fiber-optic cable (FO cable) is no longer something that only NASA or the telephone company uses. It can provide cost-effective solutions to many of the problems faced in today's audio and video applications. These solutions, now easy to implement with modern equipment, not only improve quality, but can also do so in low-cost form. If you're installing new cable, you need to give fiber a close look. It could shed some new light on your problems.

This article will describe the process of determining the technical requirements for a fiber-optic system. This 3-part series (Parts 2 and 3 will appear in the December and January issues) will provide the background needed to understand fiber terms, to determine specifications, and then to design your own system. Part 1 reviews the terminology of fiber cable and how cable is constructed. Part 2 will show you how to determine the mechanical and optical specifications for a system. Part 3 will review fiber systems and cost-performance trade-offs.

The language of fiber

To better understand FO cable, some basic terms must be defined. All FO terminology can be divided into two basic groups: the fiber or cable, and the optical. Each of these areas will be addressed separately.

Optical fibers have at least two, but most often, three distinct regions. These regions are the core, the cladding (or clad) and the buffer coating (or coating).

The core of an optical fiber is that central region of the fiber. (See Figure 1.) Most of the light travels in this area.

The cladding area surrounds the core, confines the light to the core and provides additional strength to the fiber through an increase in diameter.

The buffer coating insulates the core and cladding from the environment. The buffer coating helps the fiber retain its intrinsic strength.

The fiber's core, cladding and buffer coating can be made of different materials. The actual fiber used for communication applications is composed of either glass or plastic materials. The core and cladding also can be made from either glass or plastic materials. However, the buffer coating is always made of a plastic material.

The variety of materials used in the core

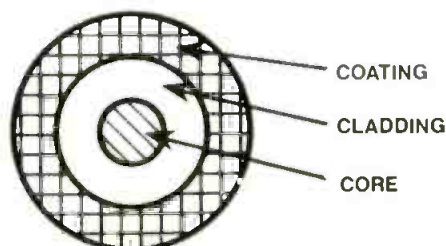


Figure 1. Fiber cables usually have three distinct regions: the core, the cladding and the buffer coating. The core carries most of the light. The cladding confines the light to the core and the buffer acts as a protective coating.

and cladding results in a variety of fibers being produced. They are summarized in Figure 2. Most, but not all, fibers used in communications have glass cores and glass claddings.

The buffer coating may not be required if the cladding is a plastic material. In this case, the plastic cladding provides additional strength and insulates the fiber from its environment.

Fibers have a wide range of dimensions. However, the all-glass fibers most commonly used in audio and video applications have core diameters of eight to 10 microns for single mode fibers, and 50 to 100 microns for multimode fibers. Fibers with glass cores and plastic cladding have core diameters of 110 to 200 microns, and cladding diameters of 125 to 380 microns. Fibers with plastic cores and plastic cladding have core diameters of greater than 220 microns and cladding diameters of greater than 250 microns.

Buffer coatings for all-glass fibers have standard diameters of 250 or 500 microns. However, other buffer coating diameters are available. (Editor's note: The term "standard" means industry-accepted standard. It does not mean that the buffer coating diameter meets the requirements of a standard-issuing body.)

The primary design difference between the two types of fiber, single mode and multimode, is the manner in which rays of light travel through the cable. In multimode fibers, rays of light travel in paths that are not necessarily parallel to the fiber axis, as shown in Figure 3(A). Some of the light rays move parallel to the axis and some do not. The result is that some

**In the past year, ABC, CBS, CNN and NBC
used it to carry the Super Bowl,
the World Series, Monday Night Football,
Desert Storm coverage and more.**

**Vyvx NVN, the first
nationwide switched
fiber-optic television
transmission network.**

Broadcast quality fiber-optic television transmission is no longer a futuristic technology. It's here. It's established. It's proven. Just ask the major broadcast and cable networks who use it for transmitting news, sports and other programming.

For more and more broadcasters each day, fiber optics offers an affordable, secure, reliable, and high-quality means of delivering television signals.

Vyvx NVN operates the country's only nationwide switched fiber-optic television transmission network. Our growing

system currently serves the top 50 U.S. TV markets and is able to route your programming instantly and on demand.

**Engineered for
reliability and quality.**

Signal purity is an unmatched feature of fiber optics, making it free from uplink interference and electrical impedance. Unlike satellite transmission, fiber can't be affected by solar flares or rain attenuation. And unlike other terrestrial systems, it's impervious to water and other liquids.

Our 11,000-mile fiber-optic network is the most secure with key segments inside decommissioned steel pipeline and along pipeline and railroad rights of way.

**Easy to access and
economical to use.**

Access to our network is easy via analog last-mile facilities obtained at your request. We also provide the codecs.

The point is, fiber-optic television transmission is no longer an emerging technology. Broadcasters are already relying on it and Vyvx NVN for their most critical transmission needs.



A Revelation in
Sight and Sound.™

For more about the Vyvx NVN switched fiber-optic television network, call 1-800-324-8686.

A Subsidiary of WilTel, Inc.

Circle (44) on Reply Card
www.americanradiohistory.com

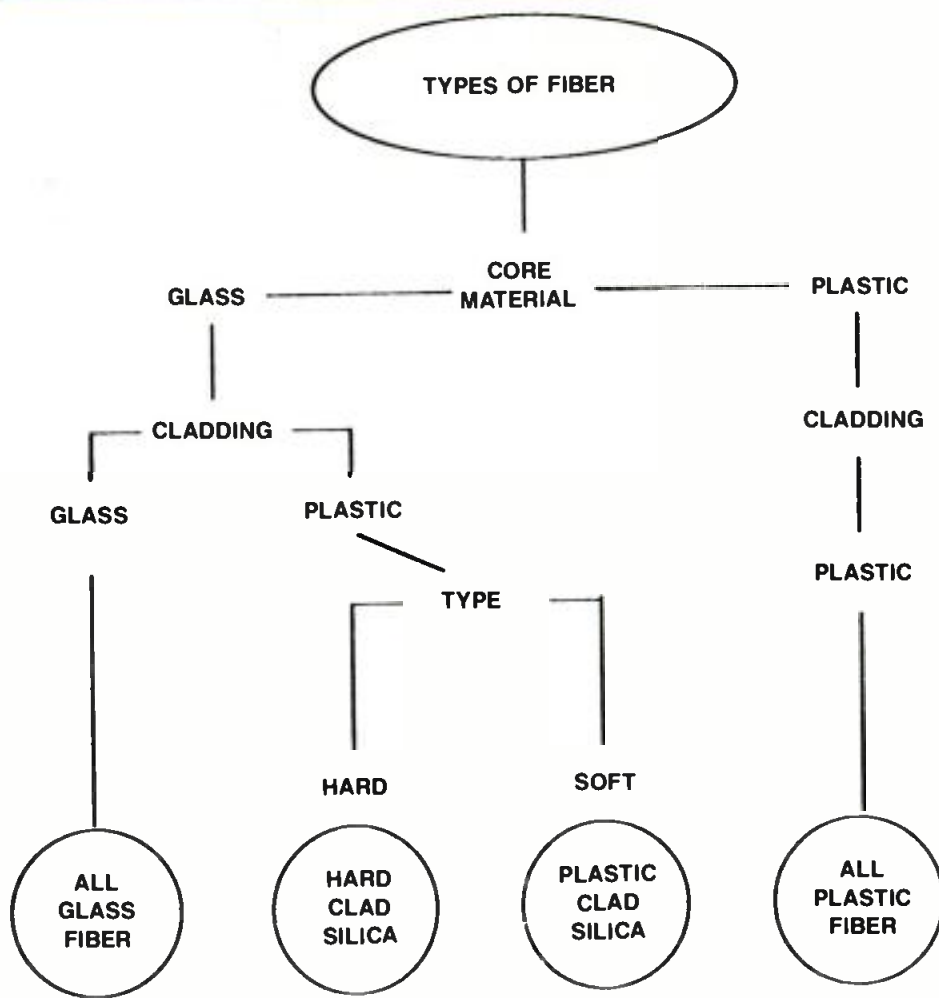


Figure 2. Fiber-optic cable can be broken into four basic types: all glass, hard clad silica, plastic clad silica and all plastic. Most communication applications rely on glass cores and cladding.

rays of light end up traveling a longer distance than others. Therefore, not all rays arrive at the end point at the same time. In single mode fibers, all rays of light travel parallel to the axis of the fiber, as shown in Figure 3(B).

This is an important difference between the two type of fibers. The result is that single mode FO fibers carry much more information than multimode cables. In multimode fibers, most of the light energy travels in the core. In single mode fibers, a significant portion of the light energy travels in the cladding.

Most data communication systems currently use multimode fiber. However, single mode fiber is expected to become the fiber of choice for most communications applications over the next five to 10 years because of its almost unlimited bandwidth and low attenuation.

Types of cable designs

The first step in packaging an optical fiber into a cable is the extrusion of a layer of plastic around the fiber. This layer of plastic is called a *buffer tube*, and it should not be confused with the buffer coating. The buffer coating is placed on the fiber by the fiber manufacturer. The buffer tube is placed on the fiber by the cable manufacturer.

This extrusion process can produce two

different cable designs. In the first design, the inner diameter of the plastic (the buffer tube) is the same size as the outer diameter of the fiber, and is in contact with the fiber around its entire circumference. This is called the *tight tube* design. [See Figure 4(A).]

In the second design, the layer of plastic is significantly larger than the fiber, so that the plastic is not in contact with the fiber around the entire circumference of the fiber. This technique is called a *loose tube* design. It is illustrated in Figures 4(B) and 4(C).

Note that the loose tube design is available with either a single fiber per tube (SFPT) [see Figure 4(B)] or with multiple

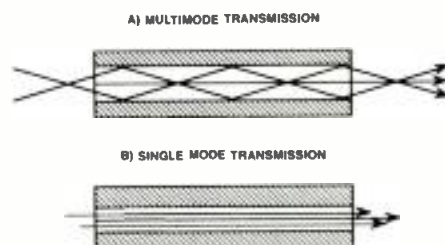


Figure 3. Fiber cable can be divided into multimode and single mode types. In a multimode cable, the light travels along different paths, reflecting off the core/cladding boundary. In single mode cable, the light rays travel parallel to the axis of the fiber.

fibers per tube (MFPT). [See Figure 4(C).] The MFPT designs allow many fibers per tube. The 6-fiber-per-tube designs are often used for data communications, because this is the type specified by Bellcore for use by telephone companies.

Once a fiber or group of fibers has been surrounded by a buffer tube, it is called an *element*. The cable manufacturer uses these elements to build up the desired type of cable. In building the cable from elements, the manufacturer can create six distinct designs:

- breakout design
- MFPT, central loose tube design
- MFPT, stranded loose tube design
- SFPT, stranded loose tube design
- star or slotted core design
- tight tube or *stuffed* design

Breakout design. In the breakout design, shown in Figure 5, the element or buffered fiber is surrounded with a flexible strength member, often Kevlar. The strength member is surrounded by an inner jacket to form a *subcable*, as shown in Figure 5(B).

Multiple subcables are stranded around a central strength member or filler to form a cable core. This cable core is held together by a binder thread or Mylar wrapping tape. The core is surrounded by an extruded jacket to form the final cable. [See Figure 5(C).]

Optional steps for this design include additional strength members jackets or armoring. The additional jackets may be extruded directly on top of one another or separated by additional external strength members. [See Figure 5(D).]

MFPT central loose tube design. Here, the fibers are placed together to form groups. Sometimes, the fibers are laid along a ribbon in groups of 12, as shown in Figure 4(E). These ribbons are then stacked up to 12 high and twisted. This version of the central loose tube design is called *ribbon design*, and was developed by AT&T. The space between the fibers and the tube can be filled with a water-blocking compound.

The MFPT stranded loose tube design. In this design, shown in Figure 6, multiple buffer tubes [see Figures 6(A) and 6(B)] are stranded around a central strength member or filler to form a core. This cable core is held together by a binder thread or Mylar wrapping tape. The core is surrounded by an extruded jacket to form a finished cable, as shown in Figure 6(C). Optional jacketing, strength members or armor can be added.

The SFPT, stranded loose tube design. This type of cable is manufactured similarly to MFPT cable. The difference is that the cable has one fiber per tube and smaller diameter buffer tubes.

Serial digital? We're with you all the way! The world-proven performance of Tektronix television test and measurement equipment is now available in products which fill the requirements of the serial digital environment.

Just as always, we're right there where you need us.

front panel recalls, full line select and dual filter, dual channel display.

The 1730 D is a versatile tool you can use as a system monitor for new digital recorders and telecines. And for maintenance it provides a precision point of reference for evaluating DACs and filters in production equipment.



Introducing the Tek 1730 D Waveform Monitor. The 1730 D gives you direct serial and parallel composite digital inputs along with standard analog inputs, independently or simultaneously, for NTSC applications. All in a compact, familiar package that fits in half a rack.

The 1730 D's unique eye pattern display of the 143 MB/s NTSC serial digital signal makes it easy to check transmission path integrity. And the high return loss of its loop-through serial digital inputs permits observation in the same cable that reaches destination equipment.

Also included are features that make the 1730 Series the world's most popular line of high performance waveform monitors:

The Tek TSG-170D Option 1S is a complete NTSC sync and test signal generator. You get serial and parallel digital and NTSC analog test signal outputs, AES/EBU serial and parallel digital and analog audio tone outputs, and RS-170A black burst outputs for master SPG applications. Plus 12-character identification, tape leader countdown and digital genlock with output timing offset.

Both products are tailored for the serial digital environment, so you don't pay for capability you don't need and won't use.

Ask your Tek representative for a demonstration. You'll find that when it comes to serial digital, nobody meets the challenge like Tek.



SERIAL DIGITAL

Tektronix
COMMITTED TO EXCELLENCE

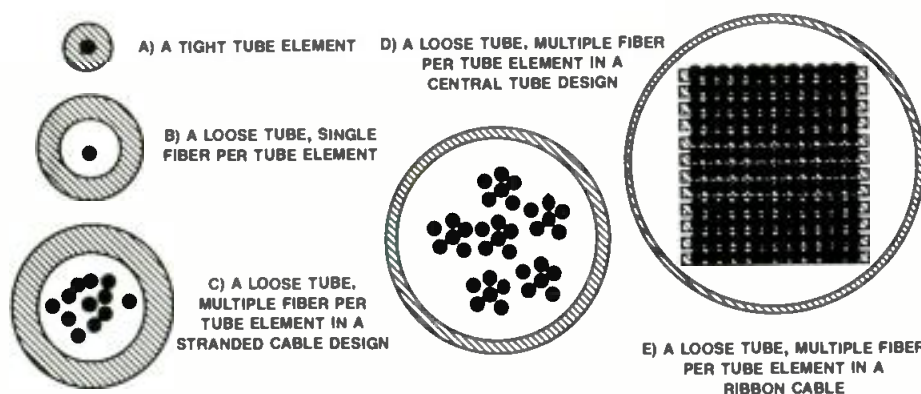


Figure 4. Loose tube cables are available in either single fiber per tube (SFPT) or multiple fiber per tube (MFPT). In both cases, the diameter of the plastic tube surrounding the core is larger than the outside diameter of the core, thus the loose tube connotation. A tight tube cable is shown in Figure 4(A). Here, the inner diameter tube is the same as the outer diameter of the fiber.

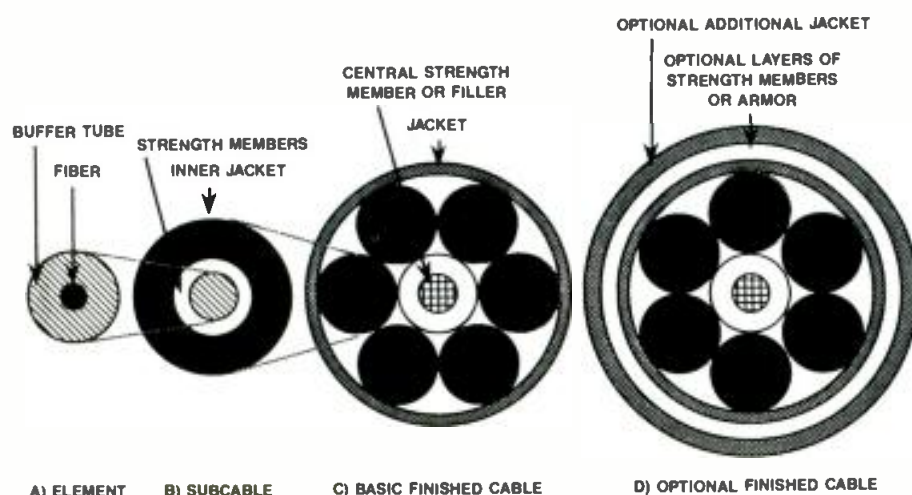


Figure 5. In the breakout type of cable, each element is surrounded by a flexible strength member, which is then surrounded by an inner jacket. This forms a subcable, which is incorporated into a larger cable. Optional additional jackets or armor can be applied, as shown in Figure 5(D).

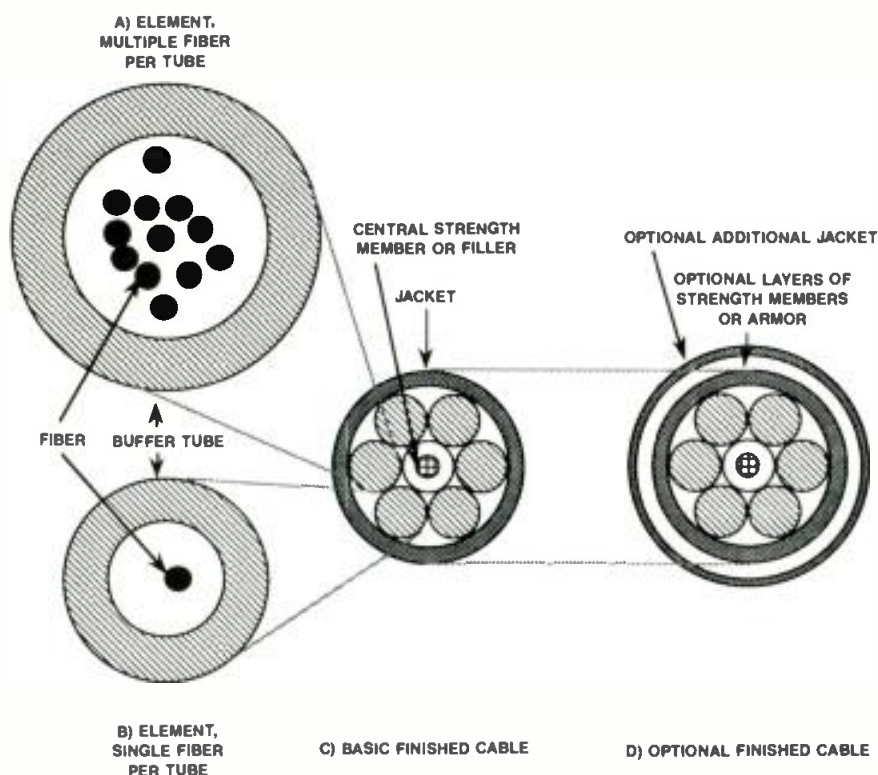


Figure 6. The MFPT, stranded loose tube design relies on a center strength member to form the cable core. Multiple elements are then added to build up the desired capacity cable.

The star or slotted core design. This design is seldom used in the United States. In this scheme, the buffer tubes (usually MFPT) are laid in helical grooves, which are formed in the filler in the center of the cable. The core is then surrounded by an extruded jacket to form a finished cable. One variation of this design, shown in Figure 7, is used by power/utilities. This optical cable provides a conductive ground path from end-to-end. Instead of a jacket, the cable has helically wrapped wires, some of which are conductors and some strength members.

The tight tube, stuffed design. This design is based on the tight tube element. The designs are common in that the core is filled or stuffed with flexible strength members, usually Kevlar. The design usually provides two or more fibers. (See Figure 8.)

Pick your advantage

Performance advantages exist for all designs, depending on what performance parameter is considered. For instance, the tight tube design can force the ends of a broken fiber to remain in contact even after the fiber has broken. The result is that transmission may still be possible. When reliability is paramount, this feature may be important.

Loose tube designs have a different performance advantage. They offer a *mechanical dead zone*, which is not available in tight tube designs. The effect is that stress can be applied to the cable without that stress being transferred to the fiber. This dead zone exists for all mechanical forces, including tensile and crush loads and bend strains. Tight tube designs do not have this mechanical dead zone. In the tight tube design, any force applied to the cable is also applied to the fibers. Loose tube designs also offer smaller size, lower cost and smaller bend radii than tight tube designs. In general, the environmental performances of the designs can be made equivalent.

When cable cost alone is considered, loose tube designs have the advantage over tight tube, breakout designs in long-length applications. However, when total installation cost is considered, the loose tube designs may or may not have a cost advantage. This is because loose tube designs have higher connector installation costs.

This cost factor is composed of two parts: labor cost and equipment cost. This cost is not required for breakout designs. Some of the cost trade-offs between loose tube and breakout designs will be examined in Part 2 of this series.

All designs, other than the breakout design, require handling of bare fibers or fibers with tight tubes. During this handling, fibers can be broken, especially where inadequately experienced person-

SEE WHAT A LITTLE FIBER CAN DO FOR YOUR SYSTEM.



No doubt about it. Adding fiber to your system can put you in great shape. Especially if you need to fit more signals in cable trays or conduits. Run cable up to 5km. Eliminate EMI interference and ground loops. And ensure signal security.

And *especially* at \$900 per link. Because now there's the DYNAIR Series 400 and Series 1200 video distribution system. With the industry's best differential phase/gain and signal-to-noise.

Consider our Series 400, stand-alone fiber links that fit anywhere, go anywhere: Building-to-building, on-location, in the studio. With our fully compatible Series 1200, running both fiber and coax is a snap. Run fiber in/coax out. Or coax in/fiber out. Or fiber to fiber. And coax to coax. All in one modular package.

You can upgrade to serial D2 and wideband, too. Without changing frames or power supplies. Of course, all this is just to whet your appetite. For the full DYNAIR fiber story, call or fax us today.



DYNAIR

Call 800-854-2831. Or fax 619-264-4181.

Circle (48) on Reply Card

www.americanradiohistory.com

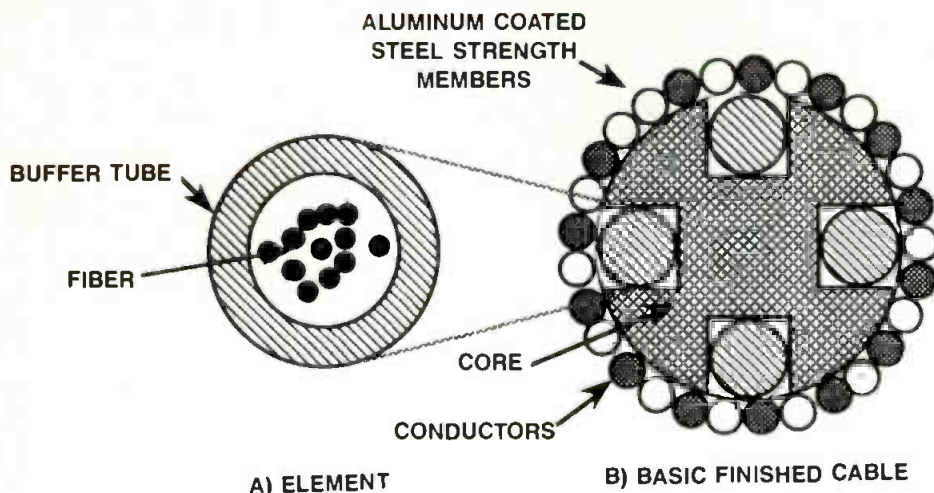


Figure 7. Utility companies sometimes use the optical power ground wire type of cable, because it incorporates a metallic power ground wire within the design. The cable is based on a slotted core design, but with the addition of helically wrapped wires around the outside for strength and conductivity.

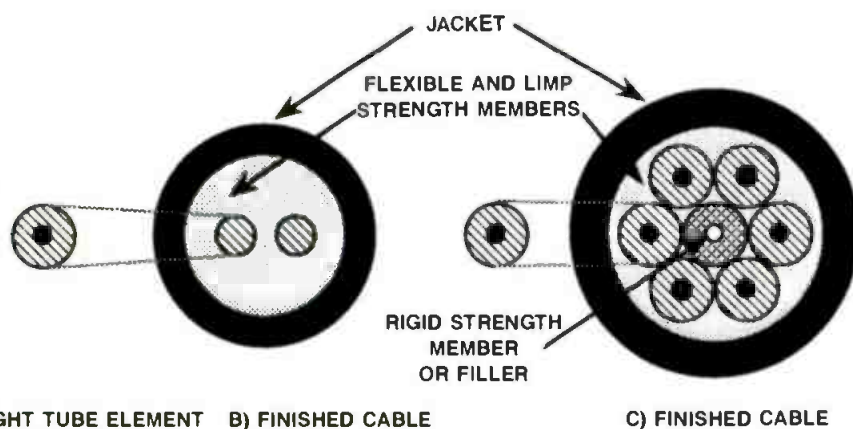


Figure 8. The tight tube stuffed design relies on a core, which is filled with flexible strength members, usually Kevlar. Typically, two or more fibers are contained within the cable.

nel are involved. This is why the break-out design offers a more convenient installation.

The next step

This completes Part 1 of the series. The basic fiber-optic cable terms and how fiber cable is constructed have been reviewed. The next step is to determine the cable's required mechanical and optical specifications.

The mechanical specification process looks at installation and environmental considerations. The optical specification process is the most complex of the two and can be approached in three basic

ways. Part 2 will review these options. The final part in the series will review system specifications and look for possible cost-performance trade-offs that can be made.

Editor's note: This article is based on the publication "How to Specify and Choose Fiber-Optic Cables," by Eric Pearson, president, Pearson Technologies, Acworth, GA. Because of the limited space available, not all of the factors related to FO system design can be covered here. Readers may wish to consult the above publication for additional detailed information on the design process.

Fiber-optic STL systems

By Lonnie Pastor and Dean Rosenthal

You have probably heard how improved transmission quality, increased bandwidth and unique dielectric properties will make fiber optics the broadcast transmission medium of the future. KSMO-TV, an independent UHF station in Kansas City, MO, recently saved big money by taking advantage of another fiber characteristic — the ability to carry multiple light signals at various frequencies.

As part of a complete reconstruction that included new studios and a new antenna, the station needed a new STL. There were several problems in establishing the link, not the least of which was a tight budget. Conventional wisdom dictated microwave, but the necessary transmission hardware for the 17km link was a 6-figure proposition. The line of sight was poor. The area's 7GHz primary frequencies were used several times over. At 13GHz, the STL would have required two hops, more equipment and tower or rooftop leases. Rain fade at 13GHz was also a problem. A hot standby was advisable. This would have meant equipment expense far beyond the capital budget.

After researching the problem, KSMO engineers realized that fiber-optic video transmission hardware would cost a fraction of the price of microwave (not including the cost of the fiber plant itself). Installing new fiber was out of the question because of the inherent expense of the fiber and the labor to install it. However, KSMO's new transmitter was near a fiber-optic hub site operated by Kansas City Fibernet, a local alternate access telecommunications carrier. (Alternate access carriers provide signal transport in the local, wide and metropolitan area data network markets, as well as providing interconnection between end-users and their long-distance carrier's local point of presence.)

The station first approached K.C. Fibernet about providing a dark (unused) fiber, but there was none. They did find one fiber that could do the job, but it was in use. This is when wavelength division multiplexing (WDM) entered the picture.

Window of opportunity

Multiple optical signals can transmit simultaneously over the same fiber at different wavelengths. There are transmission windows at 840nm, 1,310nm

Pastor is business manager and Rosenthal is senior applications engineer for the Professional Audio & Video Group at ADC Telecommunications, Minneapolis.

Free Catalog & Audio/Video Applications
Mic, EQ, Line, Tape, Phono, Osc, Trans, Video, ACN, Pwr. Supp.

Press Boxes
1-in/16-out Video/Audio
2-in/24-out Audio

Video & Audio Dist. Amps.
RGB-Sync Dist. Amps.

OPAMP LABS INC (213) 934-3566
1033 N Sycamore Av LOS ANGELES CA, 90038

Circle (69) on Reply Card

VTR CONTROL & AUTOMATION
THE MCS-100 SYSTEM

- SIMPLE TO OPERATE
- EASY TO EXPAND
- SINGLE COAX CABLE
- SERIAL & PARALLEL VTR'S
- AFFORDABLE!

Queue Systems (818) 895-8510

Circle (66) on Reply Card

WHEN THE ICE CAME,



OUR PIROD TOWER DIDN'T EVEN SHIVER.



Dave Turner
WMCC TV, Channel 23
Indianapolis, Indiana

"With more than two feet of ice at the antenna of our 1,000-foot PiRod tower, and guy wire ice eight inches in diameter, our tower bent like a banana. I recall my engineer saying that the tower wouldn't last five more minutes. But our solid rod PiRod tower stood there and straightened as the ice melted. No damage. No stress fractures. No problems. I guess that's when the quality of a solid rod PiRod tower comes through."

Solid Rod, Solid Service, Solid Value



***Solid rod, free-standing or
guyed towers custom designed
to your specifications.***

For a free guide to tower selection
and fast, courteous response to your
requests for quotation, contact:



PIROD INC.
P.O. Box 128
Plymouth, Indiana 46563-0128
Telephone (219) 936-4221

Circle (47) on Reply Card

www.americanradiohistory.com

and 1,550nm. These are available using a wavelength division multiplexer, which is a passive optical device.

The existing signal was operating in the 1,310nm window. It was suggested that they could multiplex a 1,550nm signal with it.

K.C. Fibernet was charged with providing a specific level of optical performance for the KSMO STL. The company spliced two WDMs onto the fiber trunk cable. A fiber drop from one side of each WDM was pulled into KSMO's facilities and connectorized. This fiber link delivered a manageable loss budget, and a minimum of 40dB directivity (near-end isolation) for the WDM. (See Figure 1.)

Because of the need for tight spectral width and high launch power, a WDM must be fed by a laser transmitter. KSMO examined equipment from several man-

ufacturers, and chose the ADC FN6000™ fiber-optic transmission system.

After the fiber was installed, operating the system became a simple matter. The on-air feed was connected to the fiber transmitter, and KSMO was up and running. Rain fade and congested airwaves became non-factors. Because of the inherent reliability of the fiber-optic system, KSMO opted to go without a hot standby. The degree of certainty allowed by fiber permitted KSMO's insurance provider to lower its transmission interruption insurance deductible from 24 to eight hours.

KSMO was able to transmit one NTSC composite video signal with stereo audio while delivering RS-250-B shorthaul performance over *existing* fiber plant. No other mode of transmission would have fit the budget.

Lessons

By using *existing* fiber plant instead of leasing a dedicated dark fiber, a broadcaster pays only for the bandwidth used. When a service provider can better leverage its existing plant by sending more traffic through it, the broadcaster is in a desirable position to receive a more reasonable tariff.

Broadcasters can now take advantage of high-performance, reasonably priced, easy-to-use fiber-optic video transmission hardware for STLs, TSLs, uplinks and downlinks. At the same time, they will improve their transmission quality and preserve their capital budgets. By using fiber already in the ground and on poles, wavelength division multiplexing becomes a win-win situation.

KSMO FIBER-OPTIC STL

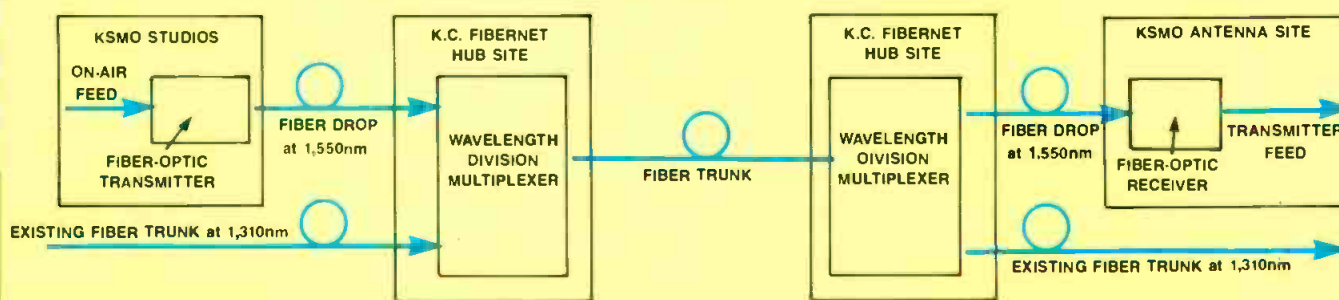


Figure 1. KSMO's fiber-optic STL used wavelength division multiplexing (WDM) to achieve a high-quality STL path at a low price.

The case for fiber

By Rick Lehtinen, technical editor

Before the advent of satellites, microwave and conditioned telephone, circuits were the only means of transmitting TV signals from city to city. This was an effective method, but there was difficulty reaching some areas. Accordingly, when satellite distribution became an option, broadcasters jumped at the opportunity. By 1985, all the networks used satellites to distribute their feeds. Although satellites are better than past technologies, they are not a remedy. Networks still face certain concerns in their use.

- **Reliability.** Reliability is a key concern of anyone who distributes TV signals. Satellites have a unique set of problems. Sun outages, for instance, occur whenever the receive antenna encounters so much solar noise that it blocks the desired downlinked signal. Similarly, severe rainfall or an accumulation of snow and ice in the receiving dish can render a satellite feed unacceptable.

Fiber-optic systems, on the other hand, aren't troubled by such factors. Na-

tional fiber-optic networks that specialize in TV signal delivery have developed. These networks are engineered for high reliability. Redundant routes between cities can make the fiber systems even more robust.

- **Security.** Hackers and pirates have made headlines by interfering with the signals of several networks. Similarly, unintentional interference by careless operators or failing equipment has often caused difficulties. These problems are likely to grow more frequent as the number of uplinks increases.

Another problem with satellites is that unauthorized users can receive proprietary signals. To counteract this, users have invested millions of dollars in encryption and decoding equipment.

Fiber optics can provide a secure TV transmission medium because the signals cannot be intercepted. This is a major advantage, because the signal is secure even without the expense of scrambling.

- **Cost.** Fiber-optic and satellite transmission offer comparable costs. The initial setup to receive a fiber signal is usually much less than the cost of building an uplink or downlink, and the hourly costs are approximately the same.

The costs of fiber and satellite are affected by the potential for greater channel capacity per carrier. Fiber capacity is almost unlimited. New techniques allow simultaneous transmission of more data. On the other hand, satellite transponders will soon double or triple their capacity because of the introduction of digital compression techniques.

The cost of switching to fiber from an existing system is typically minimal. Fiber requires little, if any, training and no additional manpower. However, many facilities have made substantial investments in satellite earth stations and encryption equipment over the last five years. No doubt, these *sunk costs* will delay the adoption of long-distance fiber. Nevertheless, it is likely that some facilities will begin to take advantage of fi-

THE NEW TV TRANSMITTER FOR VHF BAND III



TV Transmitter System 2100

At the forefront of communications.

In its new 10-kW TV Transmitter NT 413 S Rohde & Schwarz presents a fully mature and solid-state system concept for the next generation in broadcasting.

Major advantages:

- high availability of the entire transmitter
- high reliability and long service life
- easy to maintain, modular transmitter architecture
- amplifier units exchangeable without breaks in transmission
- simple and clear operation
- monitoring of quality during ongoing broadcasts

The same architecture, the same amplifier modules and the same power-supply units for all power categories mean rationalized stocking of spares and cost-attractive maintenance.

Our specialists can advise you on all matters of TV transmission and TV testing and measurement. We guarantee optimal performance of a project through to punctual installation, make sure your transmissions start up correctly and securely and offer highly qualified training of operator staff.

**It's never too early to talk to
Rohde & Schwarz.**



Circle (46) on Reply Card

An independent concern, founded in 1933.
5000 employees, represented in 80 countries.
Design and turn-key installation of systems
with software and servicing.
Calibration, training and documentation.



ROHDE & SCHWARZ

W-8000 München 80 Postfach 80 14 68
Telex 523 703 (rus d) Telefax (089) 41 29 - 21 64
Tel. internat. + (4989) 41 29 - 0

ber, where appropriate, by gradually adopting it for their occasional-use traffic.

- **Quality.** The transmitted signals must always maintain broadcast quality. Satellite signals can degrade as the signal is affected by weather and interference. Fiber is generally immune to such impairment. Fiber delivers approximately 64dB SNR.

Digital techniques contribute to this quality level. Many fiber networks send video in the DS-3 signal standard, which operates at 45Mbps.

Last mile

As useful as fiber is, there will always be a place for satellites, microwave and coaxial cable in network signal distribution. One example is the *first and last mile*. Fiber is great going where it goes, as is a railroad track. However, when the desired destination is off the fiber path, the customer system must use other means to complete the journey. (See Figure 1.)

A TV switching center may consist of analog audio and video routing switchers, encoding and decoding equipment (codecs) and a digital cross connect (signal switch). The analog signal is routed

to the codec, which converts it to digital. The digital switch then routes the signal to the correct destination. At the fiber's other end, the process is reversed.

Working together

In some situations, users can derive benefits by using fiber and other techniques together. Many fiber operators have discovered that the composite multiplexed audio-video signal from most microwave receivers can be fed directly down most analog fiber systems. This helps keep the video and audio pristine as it leaves the composite form only at the fiber terminus. This may also sim-

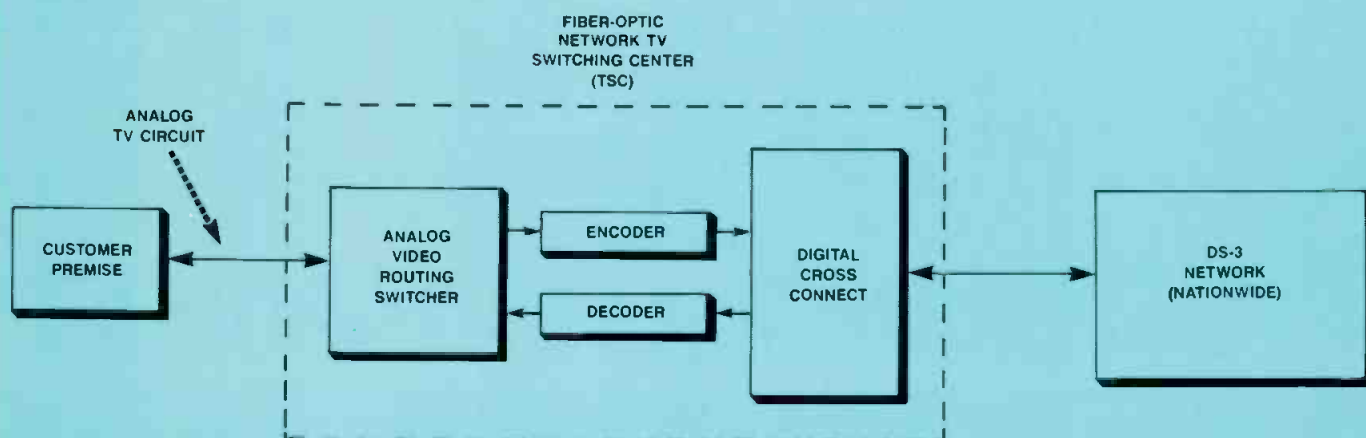


Figure 1. This fiber-optic TV switching center converts the customer's analog TV signal, delivered by conventional means, into a DS-3 digital signal that can travel down a national fiber-optic network.

FIBER OPTICS AND SATELLITES: A QUICK COMPARISON

Issue	Fiber	Satellite
Quality	64dB SNR returned.	50 to 60dB SNR returned.
Reliability	99.999% uptime.	Inherently weaker: • Rain attenuation. • Sun spots. • Earth-based microwave interference.
Security	Inherently secure from interception.	Easily intercepted. Security requires scrambling.
Costs:		
• Initial	Last mile installation typically \$500 to \$1,500 per point.	Uplink can cost \$300,000 to \$500,000.
• Monthly	\$8,800 to \$140,000 depending on distance and terms.	\$50,000 to \$150,000 depending on satellite availability and terms.
• Hourly	\$400.	Comparable — \$200 to \$780 depending on vendor, satellite, rate period, etc.
Availability	Nationwide long haul network is growing.	Slightly constrained. Future capacity is contingent upon launches in 1992 and after.



"Our business at Teleport Communications—New York is providing broadcast-quality video transport services to anyone who wants it. And with clients like the stock exchanges, the broadcast networks, brokerage

houses and the information services industry, we need the best fiber optic transmission equipment money can buy."

"Which is why we buy from Artel."

"Artel's SL3000 Video Communication System is an essential part, for example, of the telecommunications links we provide for the financial markets. Video and audio from the trading floor are sent via fiber optic cables to our earth station on Staten Island for uplink. News services then have instant access to live broadcast-quality coverage of activity at the exchanges. On the data side, we use the SL3000 for moving digital data from the trading and brokerage companies to the floor."

"We also use the SL3000 to provide the information services industry with video networks, and to provide broadcast-quality studio-to-antenna video

**"Thanks
to Artel,
we can
uplink video
from the studio
to anywhere
in the world."**

Jim McRobbie
Manager, Network Management Center,
Teleport Communications—New York

services to the 'Big 3' networks here in Manhattan—all with extremely high service availability. In fact, the reliability of the Artel equipment allows us to offer virtually 100% uptime—something the networks insist upon."

Artel's SL3000 gives you on-line diagnostics and metering, and meets or exceeds EIA-250-B short haul specifications for ranges up to 78km, or 200km with repeaters.

If your customers are looking for video services, you should be looking for Artel.



Artel Communications
22 Kane Industrial Drive, Hudson, MA 01749
Tel: (508) 562-2100 • Fax: (508) 562-6942
Application Hotline 1-800-225-0228



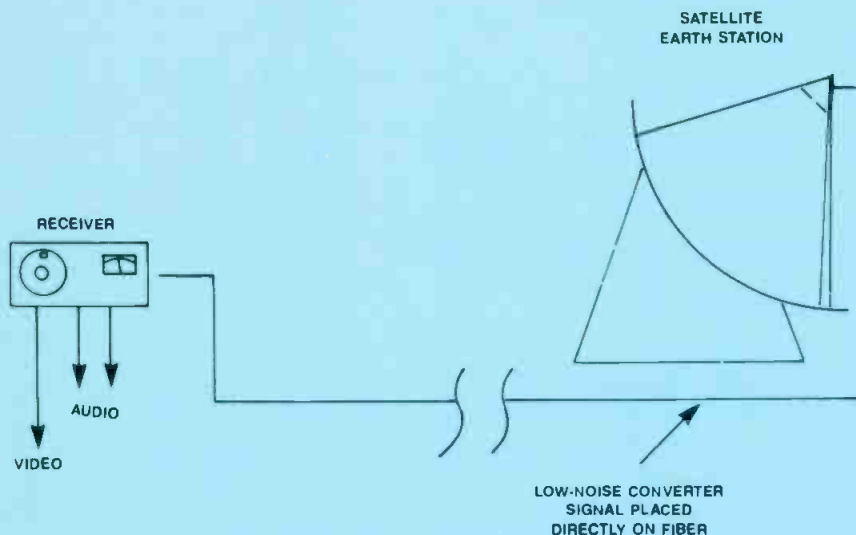


Figure 2. Fiber's broad bandwidth can enhance conventional satellite techniques. Several proposed systems improve system signal-to-noise and multiply fiber channel capacity by sending composite signals down fiber to the receiver. Signals are decoded by the receiver at fiber end.

plify the microwave system, because no provision for multiplexing and demultiplexing in repeaters along the path is needed.

Several sophisticated new fiber-optic snakes have adopted this technique. Some companies are even promoting it as a way to improve the quality of satellite feeds. The output of the satellite receive dish's low-noise converters are fed directly to a fiber. Only at the fiber's end do the signals enter the receiver for conversion. This may not only improve the signal-to-noise ratio of the incoming signal, it also puts all the satellite transponders down the fiber at once. (See Figure 2.)

Acknowledgment: Thanks to Howard Melseles, Vyxx National Video Network, Tulsa, OK, for assistance in the preparation of this article.

1:2:~|||

NEW SMPTE-EBU Time Code Analyzer Model TCA-143

If your edit problems are SMPTE Time Code related, Gray Engineering's new Time Code Analyzer pinpoints the error, displays code faults and corrects for phase and amplitude error.



Code Conditions at a Glance

- Phase Error/Display
- Sync Word Error
- Bit Count Error
- Sequential Count Error
- Color Sync Frame
- Code Level
- Flag Bits
- Video Sync Loss
- Code Loss

When a time code error occurs, a front panel light is illuminated, and an audible alarm is activated.

3 Output Modes

- :BY-PASS—(E to E)
- :RESTORE (restores amplitude and reshapes) (DUB)
- :REPHASE (rephases, restores amplitude and reshapes)

List Price \$2595.00
5-Year Warranty—
Parts & Labor



GRAY ENGINEERING LABORATORIES

INCORPORATED

504-P W. Chapman Avenue • Orange, CA 92668 714-997-4151

© 1988 Gray Engineering Laboratories

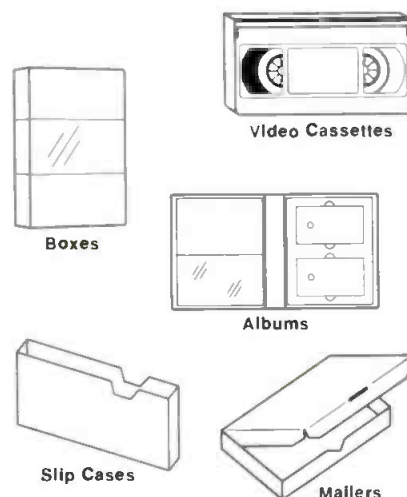
Circle (50) on Reply Card

Q102-6

VIDEO PRODUCTION & PACKAGING SUPPLIES

Immediate Shipment • Competitive Pricing

Ask for our Free Catalog



PolyQuick

1243 Rand Road Des Plaines IL 60016
Phone: (708) 390-7744 Fax: (708) 390-9886

Circle (51) on Reply Card

Power Spotlight

Deltec's Full-Featured Protection

For two decades, Deltec has been manufacturing high-quality ac power protection equipment, ranging from uninterruptible power systems (UPS) to isolation transformers, for a wide spectrum of applications in business, industry, government and education.

With product offerings in power ratings of 500VA to 150kVA, Deltec manufactures systems that ensure "computer-grade" power for sensitive loads — from personal computers to mainframes, as well as telecommunications systems, process control devices and other sensitive microprocessor-based equipment.

The performance and reliability of Deltec equipment have been demonstrated in a variety of environmental conditions throughout the world — from controlled computer rooms to the most severe industrial situations.

The first manufacturer to introduce the now-popular "line interactive" UPS technology, Deltec maintains true on-line operation along with significantly reduced size and increased operating efficiencies that allow users to enjoy substantially lower operating costs.

The technology features extremely low input current distortion. This eliminates troublesome problems that result when undesirable harmonic currents are imposed on the utility line.

This design also offers high overload capacity, so there is no need to pay for an oversized UPS just to handle heavy startup load current.

"Deltec is one of the world's largest UPS

America and Asia.

"Our private label customers put our products through grueling tests because they demand the highest levels of quality and reliability to back up their sensitive systems. As a result, all of our customers can be assured of the highest standards in the industry.

"In addition, this extensive installed base enables Deltec to offer a worldwide network of factory-trained and supported field service engineers to assure maximum responsiveness."

Deltec was purchased by Fiskars Corporation of Helsinki, Finland, in January 1989. Among the world's oldest industrial companies, Fiskars (manufacturer of the famous orange-handled scissors) was established in 1649 and maintains Deltec as an independent operating unit.

With extensive modern facilities, Deltec is a major employer in the San Diego area, devoted to advanced research and development. The company continues to develop a sophisticated system of automating the many aspects of its test and manufacturing facilities.

Because of the numerous technological innovations, Deltec is able to offer leading edge technology and proven reliability at competitive prices.



manufacturers," said Susan Connell, Deltec's director of marketing. "Unfortunately, sometimes we're not recognized as such because many of our sales are through private label agreements with computer manufacturers throughout the United States, Europe, South

Protect computers & other sensitive equipment from evil and monstrous things with a DELTEC UPS — the finest power protection available...



DELTEC

It's been estimated that as many as 50% of computer service calls can eventually be traced to power problems. With two decades as a leader in the power industry, Deltec offers the most reliable and cost effective power solutions for computers and other sensitive, microprocessor-based equipment. We KNOW how to keep systems up and running, no matter what evil may lurk in the power lines. Our Uninterruptible Power Systems feature:

- ☐ the most technologically advanced *true* on-line design available
- ☐ smallest footprints in the industry for full-featured power protection
- ☐ unsurpassed operating efficiency
- ☐ impressive harmonic distortion specs



With UPSs from 500VA to 150KVA, Deltec can back up critical systems with confidence — from PC to mainframe, office automation to industrial controller.

2727 Kurtz Street • San Diego, CA 92110
(800) 854-2658 • (619) 291-4211 • FAX (619) 291-2973

Please send for our **FREE Product Guide**

A Fiskars Company

Power System Protection Alternatives

By Jerry Whitaker, editorial consultant

Disturbances on the AC power line are what headaches are made of. Outages, surges, sags, transients: They all combine to create an environment that can damage or destroy sensitive load equipment. They can take your system down and leave you with a complicated and expensive repair job.

Ensuring that the equipment at your facility receives clean AC power has always been important. But now, with microcomputers being integrated into a wide variety of electronic products, the question of AC power quality is more critical than ever. The high-speed logic systems prevalent today can garble or lose data because of power-supply disturbances or interruptions. And if the operational problems are not enough, there is the usually difficult task of equipment troubleshooting and repair that follows a utility system fault.

Elements of the AC power system

The process of generating, distributing, and controlling the large amounts of power required for a municipality or geographic area is highly complex. However, each system, regardless of its complexity, is composed of the same basic elements with the same basic goal: Deliver AC power where it is needed by customers. The primary elements of an AC power system can be divided into the following general areas of technology:

- Power transformers.
- Power generators.
- Capacitors.
- Transmission circuits.
- Control and switching systems, including voltage regulators, protection devices and fault isolation devices.

The path that electrical power takes to end-users begins at a power plant, where

electricity is generated by one of several means and is then stepped-up to a high voltage (500kV is common) for transmission on high-tension lines. Step-down transformers reduce the voltage to levels appropriate for local distribution and eventual use by customers.

Power distribution

The distribution of power over a utility company network is a complex process involving a number of power-generating plants, transmission lines and substations. The physical size of a metropolitan power-distribution and control system is immense. Substations use massive transformers, oil-filled circuit breakers, huge strings of insulators, and high-tension conductors in distributing power to customers. Power-distribution and transmission networks interconnect generating plants into an *area grid*, to which *area loads* are attached.

Most utility systems in the United States are interconnected to one extent or an-

other. In this way, power-generating resources can be shared as needed. The potential for single-point failure also is reduced in a distributed system.

A typical power-distribution network is shown in Figure 1. Power-transmission lines operate at voltage levels from 2.3kV for local distribution to 500kV or more for distribution between cities or generating plants. Long-distance, direct-current transmission lines also are used, with potentials of 500kV to 600kV. Underground power lines are limited to short runs in urban areas.

Increased installation costs and cable heat-management considerations limit the use of high-voltage underground lines. Wide variations in standard voltage levels can be found within any given system. Each link in the network is designed to transfer energy with the least I^2R loss, thereby increasing overall system efficiency. The following general classifications of power-distribution systems can be found in common use:

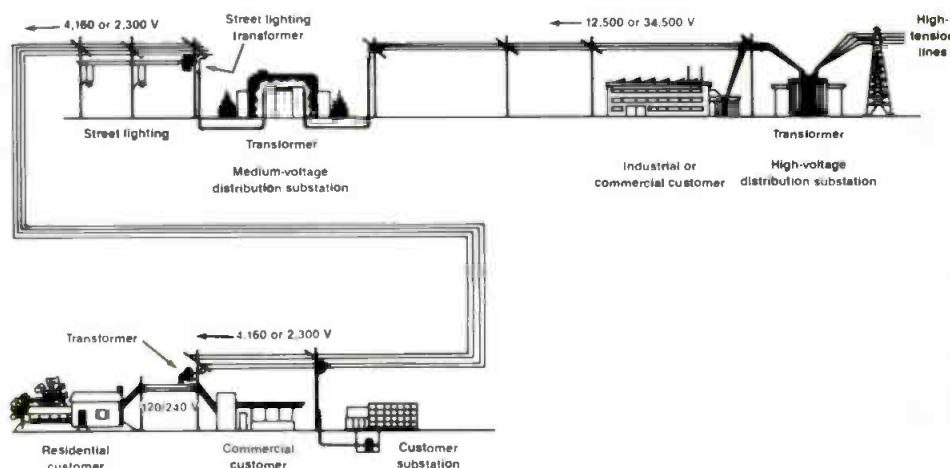


Figure 1. Simplified power-distribution system.

- **Radial system.** The simplest of all distribution networks. A single substation supplies power to all loads in the system.
- **Ring system.** Distribution lines encircle the service area, with power being delivered from one or more sources into substations near the service area. Power is then distributed from the substations through the radial transmission lines.
- **Network system.** A combination of the radial and ring distribution systems. Although such a system is more complex than either of the previous configurations, reliability is improved significantly.

Utility company interfacing

Most utility company-to-customer connections are the *delta-wye* type. This transformer arrangement usually is connected with the delta side facing the high voltage and the wye side facing the load. This configuration provides good isolation of the load from the utility and somewhat retards the transmission of transients from the primary to the secondary.

The individual 3-phase loads carry load currents. For a wye-connected system, it is important that the building neutral lead is connected to the midpoint of the transformer windings. The neutral line provides a path for the removal of harmonic currents that may be generated in the system as a result of rectification of the secondary voltages.

In some areas, an *open-delta* arrangement is used by the utility company to supply power to customers. Users often encounter problems when operating sensitive 3-phase loads from such a connection because of poor voltage-regulation characteristics during varying load conditions. The open-delta configuration is also subject to high third-harmonic content and transient propagation.

Other primary power connection arrangements are possible, such as *wye-to-wye* or *delta-to-delta*. Like the delta-to-wye configuration, they are not susceptible to the problems that may be experienced with the open-delta (or V-V) service.

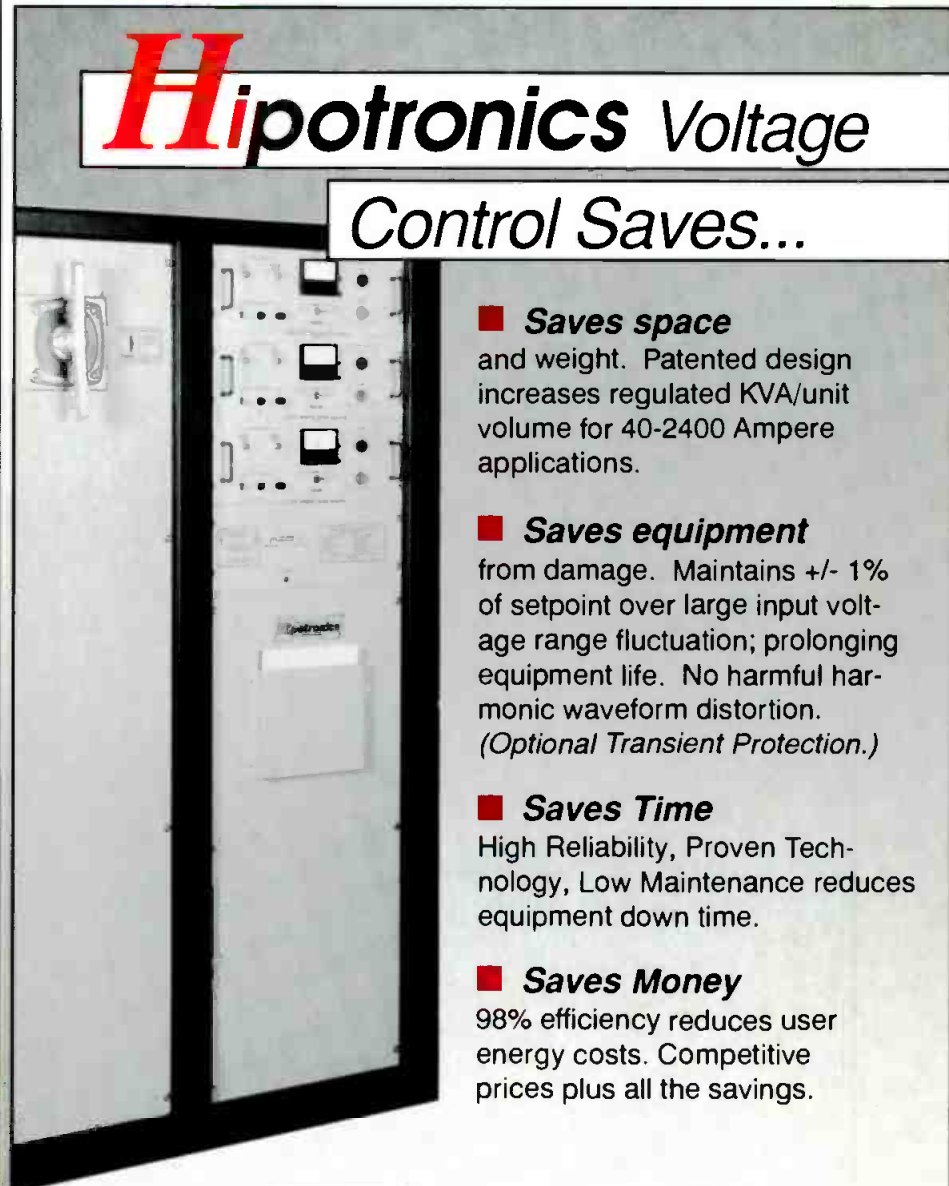
The open-delta system can develop a considerable imbalance among the individual phases in either voltage or phase or both. This can introduce a strong 120Hz ripple frequency in 3-phase power supplies, which are designed to filter out a 360Hz ripple. The effects of this 120Hz ripple may be increased noise in the supply and possible damage to protection devices across the power-supply chokes. Depending on the loading of an open-delta transformer, high third-harmonic energy

can be transferred to the load, producing transients of up to 300% of the normal voltage. The result could be severely strained rectifiers, capacitors and inductors in the power supply as well as additional output noise of the supply.

Phase-to-phase balance

The phase-to-phase voltage balance of

a utility company line is important at most types of facilities, not only because of the increased power-supply ripple that it may cause, but also because of the possible heating effects. Even simple 3-phase devices, such as motors, should be operated from a power line that is well-balanced, preferably within 1%. Studies



Hipotronics Voltage

Control Saves...



- Saves space**

and weight. Patented design increases regulated KVA/unit volume for 40-2400 Ampere applications.
- Saves equipment**

from damage. Maintains +/- 1% of setpoint over large input voltage range fluctuation; prolonging equipment life. No harmful harmonic waveform distortion. (Optional Transient Protection.)
- Saves Time**

High Reliability, Proven Technology, Low Maintenance reduces equipment down time.
- Saves Money**

98% efficiency reduces user energy costs. Competitive prices plus all the savings.



Your bottom line is our top priority.

For more information write:
P.O. Drawer A, Brewster NY 10509 USA
Tel: 914-279-8091 Fax: 914-279-2467

Circle (53) on Reply Card

have shown that a line imbalance of only 3.5% can produce a 25% increase in the heat generated by a 3-phase motor. A 5% imbalance can cause a 50% increase in heat, which is potentially destructive. Similar heating also can occur in the windings of 3-phase power transformers used in industrial equipment.

Phase-to-phase voltage balance can be measured accurately over a period of several days with a slow-speed chart recorder. The causes of imbalanced opera-

tion are generally large, single-phase power users on local distribution lines. Uneven currents through the utility company power-distribution system will result in uneven line-to-line voltages at the customer's service drop entrance.

Reliability considerations

Electrical energy is transmitted from the point of generation to end-users through a highly complex transmission and control system. This network consists of a

grid of conductors with numerous embedded components. A typical system may consist of thousands of nodes. The network is further complicated by the interconnection of individual systems. These interconnected systems must be capable of supplying energy despite diverse and challenging physical conditions. Detailed reliability analysis is required to provide an acceptable level of performance to customers.

Control Concepts

When it comes to designing voltage surge suppressors for medical and industrial applications, Control Concepts can be found at the top of the list. The Binghamton, NY, company, which is a newly acquired subsidiary of the Liebert Corporation, has enjoyed an annual growth in sales of about 25% for the past several years, partly because of its dedication to these fields.

Control Concepts manufactures the Islatron line of power conditioners. They are strong enough to protect equipment from powerful lightning-induced voltages, and

they also guard against everyday spikes and transients with the exclusive Active tracking filter.

The Islatron line is used principally to protect medical imaging equipment (MRI, X-ray and CAT scan systems) and sensitive industrial controls (programmable logic controllers and variable speed drives).

For the broadcast and video industries, Islatron protects video switchers, graphic generators, electronic editors, videotape decks, audio mixers and lighting control units.

Customer records prove that with an Islatron installation, operational time is improved by 25% while maintenance problems can be reduced as much as 75%.

Current Technology

Current Technology is a nationally recognized leader in power protection products. For 20 years, the Dallas-based manufacturer has protected the electronics investments of hundreds of America's top corporations.

Founder and president Barry Epstein, who holds 24 patents, designed the original Power Sifter, the foundation of Current Technology's current line. To this day, every Power Sifter bears the initials of the assembler in its serial number, and each assembler's compensation is based upon achievement of total zero defects during the product's warranty period.

Virtually all products achieve UL best per-

Handles anything the world can throw at it.



The **Furman AR-PRO** is the ultimate voltage regulator/power conditioner/distribution device for the most demanding audio and video applications. Its technology is unique—there is nothing like it elsewhere at any price. The AR-PRO can accept any line voltage you'll find anywhere in the world, from 88 to 264 volts, saggy, spiky, and unreliable. It'll give back **30 amps** of clean, tightly regulated 120 VAC*—enough to power an entire stage or studio. The AR-PRO weighs just 49 lbs., occupies only two rack spaces, and keeps magnetic leakage to a minimum.

The AR-PRO has many unique features that make it particularly suitable for use with audio and video equipment. Call or write us to get the complete details on how the AR-PRO or one of Furman's other AC power handlers can help you handle what the world throws.

* Models available for other output voltages.

FURMAN
Power Conditioning

Furman Sound, Inc.
30 Rich St.
Greenbrae, CA 94904 USA
Phone: (415) 927-1225
Fax: (415) 927-4548

Circle (54) on Reply Card

To get a good idea of what a great idea we have in Image Watches... paste your color logo here.

OR EVEN BETTER

Send us your color logo
(Any size letterhead, photo, brochure, artwork which need not be returned)

along with U.S. \$14.50 each*
(*Tax, shipping included.)
(special below-cost introductory offer)

and we'll rush you a personalized working quartz watch sample as our convincer!

Your company logo in full color on the dial of a deluxe, water-resistant wristwatch. 18K Goldplated case, water-resistant leather strap, battery powered quartz movement with a 1-year no-service-charge warranty (battery included). Men's and women's styles. Remarkably inexpensive even in small quantities.

Limit: 2 samples per company @ \$14.50 each

IMAGE WATCHES,™ INC.
400 S. Atlantic Blvd., Suite 302
Monterey Park, CA 91754 • (213) 726-8050
Attn: Mr. Kero
9am - 5pm Mon. - Fri., Pacific Coast Time

Logo Watch Leader for over 10 Years

Unconditional Money Back Guarantee

Circle (68) on Reply Card

Furman Sound

When Furman Sound, Greenbrae, CA, was founded in 1974, its initial product offering was a line of signal processors and mixers for pro audio applications. But for the past decade, Furman has also been known for an innovative line of power conditioning products.

The AR-PRO AC line voltage regulator is

the latest in Furman's power conditioning line. It handles 30A at 120V through a twist-lock connector (a mating connector is supplied with the unit.) Housed in a 2-rack space, it supplies clean, regulated AC power at each of 12 rear-panel and two front-panel outlets.

It can supply a nominal 120VAC output from any input from 88V to 264V, making it an ideal power distribution system for equipment that may be transported anywhere in the world.

Special features include 21-LED bar graph meters for input voltage and output current, and three status lights indicating output regulation. The AR-PRO also provides complete spike and surge suppression and substantial RFI filtering. An AR-PRO may be turned on and off remotely, and multiple units may be turned on either simultaneously or in a delayed sequence by switching an internally derived control voltage. Adjustable rear rack ears are supplied with the AR-PRO for secure rack mounting.

Furman's other power conditioning products include 120V and 220/240V regulators and UPS, and the PL-PLUS rack-mount conditioner with slide-out lights for rack illumination.

Hipotronics

Hipotronics, Brewster, NY, has been manufacturing high-voltage, high-power test equipment for almost 30 years. It became apparent to the company that the available methods of voltage regulation and control were not reliable or rugged enough to meet its high-power requirements. Because of this shortcoming, it became necessary for Hipotronics to develop the Peschel Variable Transformer (PVT) and the Peschel Automatic Voltage Regulator (PAVR).

The PAVR has been in worldwide use with all types of broadcast transmitters (UHF-TV, VHF-TV, SW, MW and FM). The PAVR overcomes the problem of improper voltage caused by line sag, brownouts and other types of fluctuations, which degrades performance and shortens the life of the elements of a high-power transmitting tube. Among Hipotronics' customers are broadcast transmitter manufacturers, with several hundred units in operation.

The PAVR is a 50/60Hz, wye- or delta-connected (wye required for individual phase regulation, line balancing) dry-type, convection cooled regulator. It will regulate line voltage to $\pm 1\%$ of nominal, with in-

formance ratings, and Current Technology's internal life test standard is more than 10 times the UL requirement. This year, Current Technology added power supplies to its product line in response to continued customer requests. All power supply products are required to meet a minimum 48-hour, full-load burn-in at elevated temperature without failure.

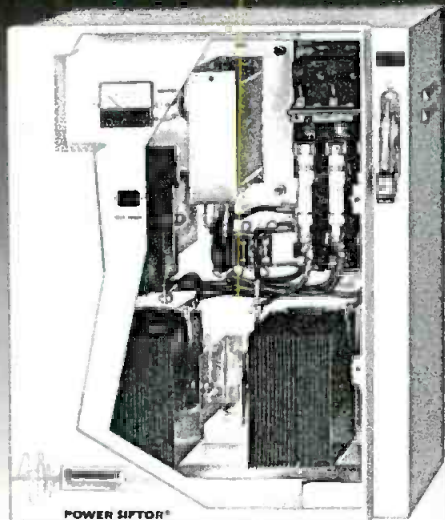
According to company test results, with the Power Sifter, hardware failures reduce by up to 75%, and software glitches decrease by up to 80%.

In addition to the Power Sifter series, Current Technology manufactures the DataSifter series, Power Server, Power Supplies Plus series, and the Professional series.

MAXIMUM RELIABILITY POWER CONDITIONING

Backed by two decades of broadcast industry leadership.

- Transient voltage surge suppression
- Electrical noise filtering
- Protection from damaging spikes, lightning strikes and facility-generated disturbances
- Superior construction



MP Power Sifter®

**Current
Technology**

800-238-5000

101 W. BUCKINGHAM • RICHARDSON, TX 75081

Circle (55) on Reply Card

When your critical 286 and 386 PC LAN systems can't take a "break".



PQI Series



UPSY Series



PPC Series



STABILINE® Voltage Conditioning Equipment

Uninterruptible Power Supplies provide a reliable source of clean, continuous, sine wave AC power and are a must for the network file server. These on-line systems regulate voltage, protect from noise and provide battery backup for power failures. Cabinet and rack mount models rated from 400 to 1250 VA, 60 Hz, 120 V and 50 Hz, 220/240 V.

Power Quality Interfaces are ideal for laser printer and other workstation protection. They are transient voltage suppressors/RFI filters that divert and attenuate electromagnetic interference, spikes and transients. Feature bidirectional protection from source or load disturbances, input/output option choices and fax/modem telephone line protection. Ratings 120 V, 15 A and 240 V, 20 A.

PPC Series Power Conditioners are the right choice for network workstation protection from surges and other voltage disturbances. Output voltage will be regulated to 120 VAC rms $\pm 5\%$, 60 Hz. Also provide 120 dB common-mode and 60 dB transverse-mode protection. Ratings of 150, 300, 450 and 600 kVA. Convenient carry top.

RESELLERS WANTED!

For data call Ted Gladis at 1-800-446-6161.



Superior Electric

Bristol, CT 06010
Tel: 203/582-9561
Fax: 203/589-2136

Circle (56) on Reply Card

put voltage variations from +9/-14% to as much as $\pm 30\%$.

The PAVR is neither an impedance changing nor ferroresonant device and does not use SCRs. It is an electromechanical device, using an electromagnetic transformer action to regulate. It does not cause any sine wave distortion nor does it create any harmonics. The PAVR is available in all standard service line voltages with current ratings from 40A to 2,400A.

Superior Electric

This manufacturer of the STABILINE voltage conditioning line has been in the business 53 years, long enough to develop many different products and sell to a varied customer base. The original STABILINE product series has evolved into more than 360 standard catalog models from which to choose.

The STABILINE group includes automatic

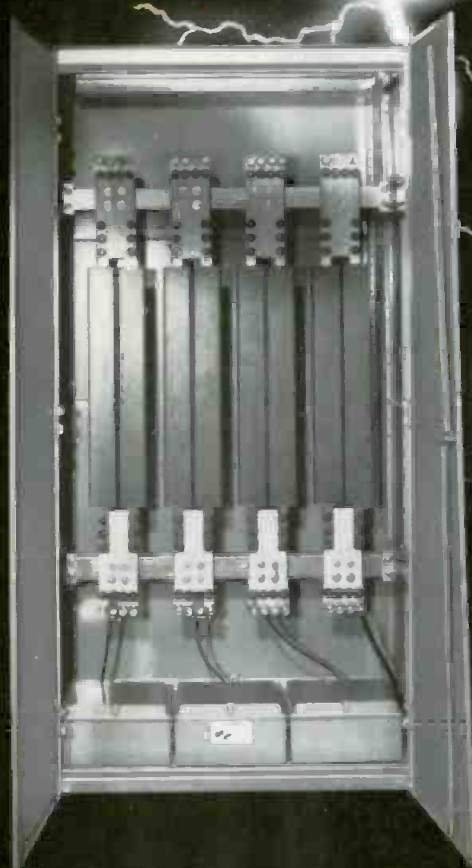
voltage regulators, power conditioners, cabinet and rack-mount uninterruptible power supplies, transient suppressors and filters, AC voltage monitor systems, and REMOTECTOR detector modules. Most are UL and CSA listed.

Because the customer base is so varied, Superior Electric is marketing the STABILINE with a 2-tiered approach, according to Michael Miga, marketing manager. The first tier is in the lower priced and lower power range (less than 10kVA). The second tier is 10kVA and above.

The company's first product offering was the POWERSTAT variable transformer, which remains the flagship line.

The home base for corporate and manufacturing operations is a 425,000-square-foot facility in Bristol, CT. Superior's parent company is Dana Corporation, an international conglomerate with headquarters in Toledo, OH.

Islatron® before the "damage" is done...



Islatron power line protection safeguards both your income and your broadcast investment.

Islatron's patented Active Tracking® technology not only protects your station from lightning induced voltages, but also from the cumulative daily degradation of your equipment caused by electrical disturbances present on your distribution systems. This constant protection means longer equipment life and less maintenance.

I.E.E. studies indicate every location has at least 3 damaging disturbances per day. Remote control systems, satellite links, VCR's, switchers, carts, microprocessors and solid state equipment all need Islatron protection. Units are available for your lowest power requirements up to the largest FM and TV transmitters. MTBF more than Ten Years, 5 Year Warranty.

Free: Get the facts on the exclusive Islatron Active Tracking system...before the damage is done.



CONTROL CONCEPTS BROADCAST GROUP
P.O. BOX 1380
328 WATER STREET
BINGHAMTON, NY 13902
(607) 724-2484

It is not uncommon for a utility system to experience load swings of as much as 150MW per minute, mainly the result of changing heavy industrial loads. Such fluctuations introduce a host of challenges to reliability engineers. Primary design requirements include:

- The ability to handle large, constantly changing load demands from customers.
- A high degree of power-supply reliability.
- Tight voltage regulation across the system.
- A strong power source to provide for high inrush currents typically experienced at industrial plants.
- Rapid and effective fault isolation. Failures in one part of the system should have minimal effect on other portions of the network.

Utility companies are meeting these goals with improved reliability analysis, more operating reserve and computerized control systems. Rapid response to load changes and fault conditions is necessary to ensure reliable service to customers. Improved telemetry systems provide system controllers with more accurate information on the state of the network, and advanced computer-control systems enable split-second decisions that minimize service disruptions.

1:~:~)))))

Circle (81) on Reply Card



Get Auditronics' 900 audio console... for television that sounds as good as it looks

Upgrade your stereo audio to full parity with your video using the Auditronics 900 Series of audio consoles designed specifically for television news and production.

Now you can deliver seamless, glitch-free audio with source and assign switching functions controlled by the 900's built-in hard-disk computer. The console's computer remembers up to 64 set-ups and communicates with your house audio/video router via an RS232 or 422 communications bus.

Our 32-input 900 with 12 microphone and 20 line-input modules handles 48 mic and 200 stereo line inputs. And Auditronics' deft design crams all this functionality into a one-operator console that uses less than 20 square feet of precious control room space.

If you're ready for stereo audio production that makes your station sound as good as it looks, get your hands on Auditronics' computer-based 900 television console.

Call today for your information package.



auditronics inc.

3750 Old Getwell Road
Memphis, TN 38118
901-362-1350
FAX 901-365-8629



Circle (57) on Reply Card

Continental XL-301 AM transmitter

By Dennis J. Martin

Solid-state technology has profoundly affected all areas of broadcasting. AM transmitters are also reaping the rewards of advancing technology. One example is the Continental XL-301.

An overview

The XL-301 is a modularly built, fully solid-state 1kW AM transmitter. Six rack chassis, or modules, mount in a single rack cabinet. The transmitter control module has five plug-in PC boards inside, as well as three analog meters, and all the transmitter's control switches on its face. The switching supply module contains two low-voltage, low-current switching power supplies. The RF module holds a control PC board and five plug-in PA modules. Other modules are the Tee network and the output filter. The power supply at the bottom of the transmitter provides the high-voltage (70V nominal), high-current (up to approximately 40A) power for the PA modules.

Three 110 CFM fans draw air through a large foam filter on the transmitter's rear door. These fans mount on the rear panel of the RF rack and provide low-velocity cooling for the PA modules. No other fans or blowers are used.

A combination of hinged and removable panels provide easy access to most of the transmitter. AC power requirements are 180V to 250V, 50/60Hz, single phase.

Simplified controls

The transmitter control panel is straightforward, and features a total of nine switches. The low, medium and high switches select one of three preset powers. An off switch turns the PA voltage off. Raise/lower switches control a motorized pot that adjusts power over more than a 30% range. A local switch disables remote-control operation. A lamp reset switch resets temperature and current fault LEDs. A fault reset switch resets PA modules locked out by detection of a fault.

The operating indicators are also straightforward. Two of the meters are for PA voltage and current. The third is a



Performance at a glance:

- Three preprogrammable power output levels
- Frequency response: ± 1 dB or better, 20Hz to 12kHz at 95% modulation
- Harmonic distortion: 1.5% or better, 20Hz to 12kHz at 95% modulation, 1kW
- Noise: better than -60dB, unweighted, below 100% modulation
- Maximum RF power output: 1.1kW

switch-selectable forward/reflected power meter. Three LEDs serve as troubleshooting aids for each PA module. These indicate lockout, temperature and current. The lockout LED illuminates when a PA module has been clamped off because of low-power operation or a detected fault. The temperature LED will illuminate if there is a high-temperature condition, which might be caused by the failure of one fan. The current LED shows that a module has suspended operation for a period of several RF cycles, possibly as the result of a power-line surge.

How it works

The transmitter uses RF pulse-width modulation (PWM) at the carrier frequency. This maximizes the control pulse sampling rate. Because a high-level PWM fil-

ter (typically 70kHz) is not needed, it also decreases phase delays that can affect stereo operation.

The transmitter's design prohibits modulation excursions in excess of -100%. Positive peak modulation capability is 125% at 1.1kW. RF power output encompasses the limits of 10W minimum to 1.1kW maximum.

Five plug-in PA modules that use eight MOSFETs each develop the 1.1kW of rated power. One PA module covers the range of 10W to 40W. A second module increases power to 160W. Three are capable of 360W, and four are capable of 640W. All five modules together provide 1kW operation. Audio performance and efficiency remain largely unaffected at reduced power levels.

DIP switches and multitrans pots are used to program three levels of operating power. These preset power outputs are selected from the front panel.

The input to each PA module is a TTL RF signal, which means input tuning is not required. Module outputs are series-summed. However, a failure of one module does not cause a failure of the transmitter. An SCR on each PA module automatically bypasses those that are not operational. This feature allows the transmitter to continue to operate, albeit at reduced power.

Extensive fault detection protects the transmitter against damage. Each PA module has on-board temperature sensing and a crowbar circuit on its power supply line. Overcurrent protection operates within one RF cycle. VSWR monitoring protects all modules against problems that develop in the antenna system. MOVs in the power supply ward off transients. The transmitter normally requires no external AC power-line filtering or transient suppression equipment.

Simple installation

The transmitter was relatively easy to install — the most complicated aspect was the many available remote-control functions. Aside from the usual PA voltage and current outputs, there are samples of forward and reflected power and AC line voltage. Six remote status indicators, which include interlock and fault-sum readbacks,

Martin is maintenance engineer for KBIG-FM, Los Angeles. He wrote this article when he was chief engineer for KMET-AM/KOLA-FM, San Bernardino, CA.

aid in remote diagnosis.

Because the transmitter is factory-tuned to a specified load impedance (typically 50Ω, non-reactive), field tuning is not usually required. This can make installation a matter of connecting the audio, the antenna and the AC power, then turning the transmitter on.

Audio input is active balanced and adjustable over a -10dBm to +10dBm range. Input impedance is jumper-selectable to provide 150Ω or 600Ω source termination. A stereo interface comes as standard equipment.

Test results

The transmitter tested far better than either its published specifications or the company's expectations. (Being an unrestricted Class IV station, the tests focused on 1kW operation.)

Frequency response of the XL-301 at 95% modulation was specified as ±1dB, 20Hz to 12kHz. Measured results were +0, -0.7dB. Response was flat from 20Hz up to 2,000Hz. Above 2kHz, it fell smoothly to -0.5dB at 10kHz, and concluded at -1.9dB at 20kHz. (See Figure 1.)

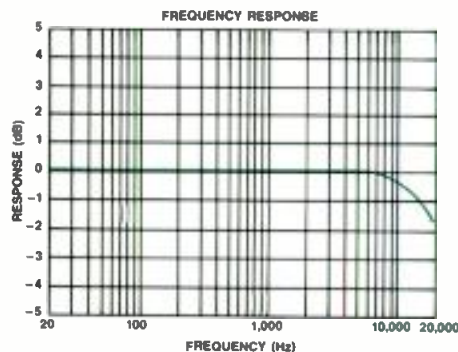


Figure 1. Frequency response at 95% modulation is perfectly flat from 20Hz to 2kHz. Between 2kHz and 20kHz, a smooth rolloff is observed.

Harmonic distortion is said to be 1.5% at 95% modulation, at 1kW. It was discovered that this was a compromise adjustment for multiple operating powers. If the transmitter was left at one power level, a single multiturn pot can be adjusted to minimize distortion. The following measurements were taken after this adjustment.

The transmitter was tested for second and third harmonic distortion of a 1kHz fundamental over a 30dB range (0dB = 95% modulation). Second harmonic distortion usually measured below 1%, but peaked to 1.1% at -7dB. In contrast, third harmonic was always below 0.6%.

THD+N also measured impressively low, less than 0.8% from 20Hz to 10kHz at 95% modulation. THD+N increased slightly as the modulation level was reduced. The maximum value measured was 1.05% at 10kHz and 50% modulation.

Intermodulation, the final distortion test, was 1.40% using 60Hz and 7kHz tones

mixed in a 1:1 ratio, and 2.60% using a 4:1 ratio.

To determine whether noise was significantly affected by operating power, tests were performed at three power levels: 900W, 1kW and 1.05kW. (All noise tests conformed with the recommendations of NAB Standard E-416, unweighted. This called for full-wave detection, RMS meter calibration, VU meter dynamics and a 20Hz to 20kHz bandwidth.) At 900W, noise measured -69.1dB referenced to 100% modulation, -72.3 at 1kW, and -70.4dB at 1.05kW. The manufacturer specification for this test is a conservative

-60dB.

One-third octave noise floor tests showed that noise at 20Hz was -105dB, and rose to approximately -77dB at 125Hz, then fell to more than -81dB at 20kHz. (See Figure 2.)

Carrier shift was difficult to measure because of its exceedingly small value. Best estimates put it at +0.5%. The manufacturer's specification is 2% maximum. A positive value of carrier shift may seem surprising to some. According to the manufacturer, this occurred because transmitter efficiency increases with modulation.

The next set of tests relied upon a wave-



MONEY CRUNCHER.

Graphics Factory. There's one way to stay creative and competitive in today's economic crunch. Graphics Factory is the integrated approach to total graphic production.

Graphics Factory is modular in design, flexible in concept. It has the features you need today, and the expansion you'll want for tomorrow. CG and paint, animation and still store, modeling and rendering. Everything you want, *when* you want it. That makes good business sense.

Graphics Factory. The graphic potential to crunch your bottom line.



Dubner Computer Systems, Inc., a Grass Valley Group Company
New York (201) 845-7988 Chicago (708) 310-9190 Dallas/Fort Worth (817) 483-7447
Atlanta (404) 493-1255 Los Angeles (818) 999-2303

Circle (72) on Reply Card

form not commonly used in field-testing AM transmitters — square waves. After a bit of experimentation, it was decided to test at a level of 60% peak modulation, as indicated on a modulation monitor. This produced a PA current reading roughly 10% below that of a sine wave at 95% modulation.

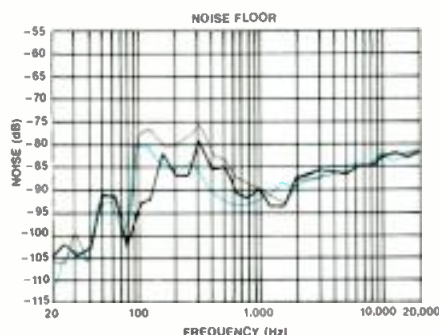


Figure 2. The noise floor is essentially the same for the three power levels tested. Across the band, noise components are below -76dB.

Figure 3 is a scope photo of a 1kHz square wave applied directly to the input of the transmitter and demodulated by our modulation monitor. A slight amount of overshoot is visible — about 2.5% on the leading edge and roughly 1.6% on the trailing. Although it's symmetrical, one

possible explanation for the 0.9% difference in overshoot is that the transmitter is more efficient with positive modulation.

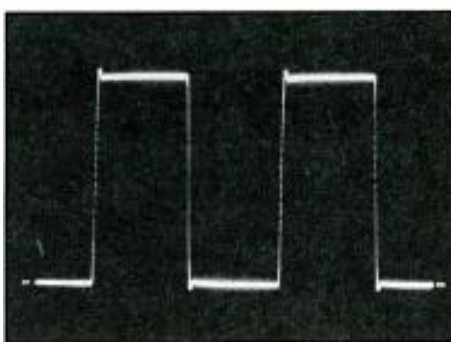


Figure 3. Response to a 1kHz square wave is excellent. Overshoot is minimal and measures roughly 2.5% positive, 1.6% negative. (Sweep speed = 200μs/cm.)

The final test used a 100Hz square wave. This test revealed approximately the same overshoot (2.2% leading, 1.6% trailing), but also showed roughly 1.9% of trailing-edge droop with respect to the wave crest. This was excellent square wave response for the transmitter and modulation monitor.

Looking back

The transmitter's 1,300-mile journey west took its toll. We found an assortment

of hardware that required tightening, and two connections in need of resoldering. Also, one trim pot (carrier regulator) was set incorrectly, and the (+/-) audio inputs were reversed. Otherwise, the overall construction and assembly were good.

The transmitter's manual is more than an inch thick, and it gives good insight into its operation.

Looking ahead

Despite the excellent audio performance and expected longevity of the Continental XL-301, certain financial aspects have impressed station management the most. Power bill savings for the transmitter and air conditioner have already been substantial. Furthermore, not having to buy four costly tubes each year will be a welcome relief.

Once again, solid-state technology has established a new level of performance, while rescuing broadcasters from steadily rising operating costs.

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, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

! : ? () ||

Continued from page 30

Ambient conditions are always something to suspect when sorting out an intermittent. Naturally, a device that is exposed to the elements is even more susceptible to weather-related variations. Other questions to consider include:

- Does the problem occur when the equipment is used at certain locations?
- Does the malfunction occur mostly when the equipment receives its power from certain types of power supplies, such as batteries or generators?
- Is there any relation to power service outages or surges or thunderstorms?

A frequent cause for intermittents is insufficient heat dissipation. A bigger and better heat sink or better ventilation may prevent transistors and other solid-state components from malfunctioning.

Check to make sure the air filter is clean when dealing with equipment that is equipped with a cooling fan. Sometimes, installing an additional cooling fan will remove the cause for intermittents. In other cases, positioning in a rack will cause overheating. Warmer-running equipment should be placed *high* in the rack, with sufficient space above and below. Avoid putting hot equipment low in a rack, because it adds to the heat load of the hardware above it. In most cases, a device is

only heat-sinked enough to dissipate its *own* heat. Additional heat from a device below it can easily raise the ambient temperature in the device out of its operating range, even though the room seems adequately cooled.

Finally, a fair amount of equipment in today's broadcast facilities is *digitally controlled*, even though the signal paths remain analog, and is therefore considered analog equipment. Although signal-path troubleshooting techniques remain the same, solving control problems may require a different approach. This hybrid equipment is prone to many of the sensitivities (especially power-line related ones) and failures of fully digital equipment, and requires some versatility on the part of the maintenance engineer in alternating between analog and digital domains when troubleshooting.

Conclusion

"Don't overlook the obvious" is always rule No. 1. Before starting to disassemble a failed unit, check to make sure that all user functions are appropriately set, and that all connectors and fuses are okay.

When dealing with a difficult problem, don't hesitate to call someone who has special knowledge of the equipment involved. Furthermore, once you have completed your repairs, test the system thoroughly to confirm that you really did fix the problem.

! : ? () ||

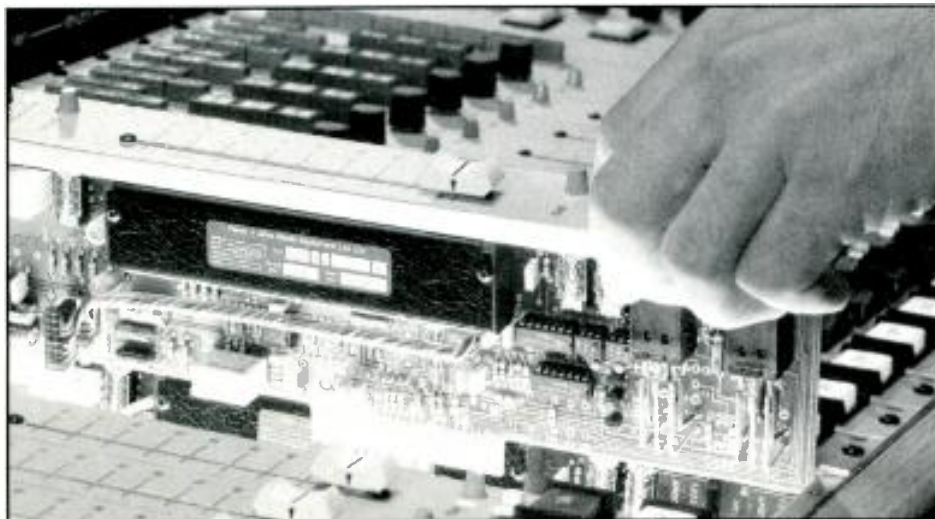


Photo courtesy of Wheatstone Corporation.

*"The **paragon—transmission** is an audio engineer's dream come true! Its sonic flexibility and peak control without clipping provide a whole new range of processing possibilities." "It's the fidelity and flexibility that counts, and the **paragon—transmission** is a fine musical instrument."*

Dennis R. Ciapura, Senior Vice President
Noble Broadcast Group

paragon—transmission

Features:

- Digital 4-Band Compressor
- Digital 4-Band Limiter
- Digital Wideband AGC
- Digital 10-Band Graphic EQ
- Touch Screen Controlled
- "On-Air" A/B Comparison
- Storage & Recall of User Created Processor Setups
- On-Line Help Screens
- Digital I/O Card (sold separately)

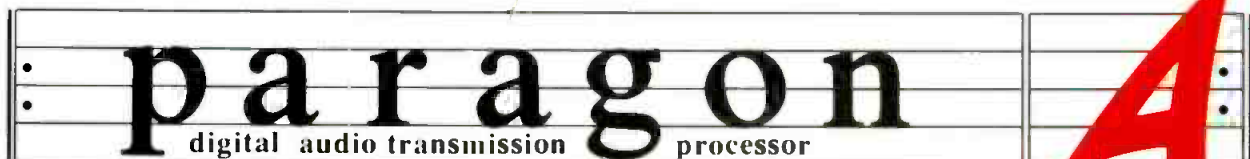


The paragon—transmission is now being shipped with Version 2.0 software.

Featuring:

- **Compressor & Limiter Zoom-Detail Screens**, which provide additional in-depth processing parameters
- **AGC Detail Screen**, which offers many new AGC parameters
- **Peak Controller Detail Screen**, offering full control over all parameters
- **5-New Setup Files**. Created by radio's top Program Directors and Engineers

Circle (58) on Reply Card



6632 Central Avenue Pike ■ Knoxville, Tennessee 37912 ■ (615) 689-2500

Euro-Distributor Info: JWM (M) Ltd., P.O. Box 115, Swindon, Wiltshire, SN2 1DA, England
Phone: (Int. 44) 637 877170 ■ Fax: (Int. 44) 637 850495

www.americanradiohistory.com

**AUDIO
ANIMATION
INCORPORATED**

News

Continued from page 4

lated the due process rights of broadcasters.

In comments to the FCC, the NAB charged the commission with skirting comment-and-review laws by styling its action as a "policy statement," rather than conducting the required rulemaking. According to the NAB in taking this action, "the commission has deprived FCC licensees of their procedural and substantive rights."

The NAB wants the FCC to throw out the new fine schedule and initiate a rulemaking that would allow broadcasters to review and comment on any FCC proposals that propose specific fines for rule violators.

Citing federal case law, NAB pointed out how the FCC's fine schedule does not constitute a policy statement exempt from notice and comment rulemaking requirements.

ATVA announces second HDTV system

The American TeleVision Alliance (ATVA) has announced its second, all-digital high-definition TV (HDTV) system, the Alliance Progressive. It has been precertified for testing by the FCC as a national standard for terrestrial broadcasting.

The Alliance is an HDTV joint development program of General Instrument and the Massachusetts Institute of Technology (MIT).

The Alliance Progressive is a replacement for MIT's hybrid Channel Compatible HDTV system, which was precertified as an all-digital submission by the FCC's Advisory Committee on Advanced Television in late March. The Alliance Progressive is scheduled for FCC testing in the spring of 1992.

SMPTE '92 sails into Sydney's Darling Harbor

SMPTE '92, the 5th Annual International Conference and Exhibition of the Society of Motion Picture and Television Engineers, Australian section, is moving to Australia's Darling Harbor Convention and Exhibition Centre on the shores of Sydney Harbor. It will be held from Aug. 31 to Sept. 3, 1992.

An outstanding growth for SMPTE in Australia has led to the new venue, and a new convention title and theme: "SMPTE '92 — New Horizons for Creative Production and Global Distribution."

An expanded conference program will address the development of technologies, such as DAB, HDTV and the digital production and transmission of images and

sound. Practical and theory workshops and manufacturers' demonstrations will also be featured.

Zoning laws hurt broadcasters and consumers

The NAB, concerned about state and local zoning laws that place unreasonable restrictions on interstate communications, has asked federal regulators to assert their authority and remove the arbitrary local barriers that impede the best placement of broadcast towers and consumer antennas.

In comments to the FCC, NAB said it is time for the federal government to take steps to supersede state and local zoning laws, because they slap a patchwork of burdensome and inconsistent restrictions on the placement of satellite dishes, broadcast transmitters and consumer antennas.

The FCC's "licensing powers may be greatly impaired if a licensed station is not permitted to erect the tower it needs to broadcast its signal, or if the viewer or listener is restricted from employing the equipment necessary to receive such a signal."

NAB said the FCC has the authority to supersede local and state zoning laws. As part of its regulatory mandate, the FCC is charged with overseeing the regulation of the telephone, cable and broadcast industries.

NAB's reform proposal is not without precedent. In 1985, the FCC took a similar action that should have voided several local zoning laws that unfairly limited the placement of antennas used by amateur radio operators. In this vein, NAB said the FCC must close a federal loophole that allows communities to arbitrarily limit antenna use if they impose a blanket ban on such broadcast equipment.

WGBH initiates viewing process

WGBH-TV, Boston, has begun production of three of its programs — *The New Yankee Workshop*, *This Old House* and *The Victory Garden* — using the SuperNTSC encoder for advanced TV transmission (ATV) to all Public Broadcasting Service (PBS) homes. The encoding equipment provides enhanced signal quality and improved picture, with dramatic improvement visible on TV sets equipped with SuperNTSC receivers.

WGBH has also formed the Public Video Service, which is a home videotape service offering more than 500 public TV program titles. Following its launch this past winter, WGBH will expand the service from selected test markets to nationwide this fall.

STATEMENT OF OWNERSHIP

Statement of Ownership, Management and Circulation (Act of August 12, 1970: Section 3685, Title 39, United States Code).

1. Title of publication: Broadcast Engineering.
- 1A. 00071794.
2. Date of filing: Sept. 17, 1991.
3. Frequency of issue: Monthly, except in Fall when two issues are published.
- 3A. Number of issues published annually: 13.
- 3B. Annual subscription price: FREE TO QUALIFIED.
4. Location of known office of publication (street, city, county, state, zip code): P. O. Box 12901, Overland Park, KS 66282-2901.
5. Location of the headquarters or general business offices of the publishers (not printers): 9221 Quivira Road, Overland Park, Kansas 66215.
6. Names and addresses of publisher, editor and managing editor. Publisher: Duane Heffner, 9221 Quivira Road, Overland Park, Kansas 66215. Editor: Brad Dick, 9221 Quivira Road, Overland Park, Kansas 66215. Managing Editor: Tom Cook, 9221 Quivira Road, Overland Park, Kansas 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 non-profit organization, its name and address must be stated.) Intertec Publishing Corporation, 717 5th Ave., 22nd Floor, New York, NY 10022.
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.
9. For completion by non-profit organizations authorized to mail at special rates: Not Applicable.
10. This item must be completed for all publications except those that do not carry advertising other than the publisher's own and are named in sections 132.231, 132.232 and 132.233, postal manual (Sections 4355a, 4354b, and 4356 of Title 39, United States Code).

	Average No. Copies Each Issue During Preceding 12 Months	Single Issue Nearest To Filing Date
A. Total No. Copies Printed (Net Press Run)	39,148	43,400
B. Paid and/or Requested Circulation		
1. Sales through dealers and carriers, street vendors and counter sales	0	0
2. Mail subscriptions	35,387	35,407
C. Total Paid and/or Requested Circulation	35,387	35,407
D. Free Distribution (including samples) by mail, carrier delivery or other means	2,660	2,761
E. Total Distribution (Sum of C and D)	38,047	38,168
F. Office use, left over, unaccounted, spoiled after printing	1,101	5,232
G. Total (Sum of E and F should equal net press run shown in A)	39,148	43,400

I certify that the statements made by me above are correct. (Signature of editor, publisher, business manager, or owner.)

Sandra Stewart,
Circulation Director

Hold Everything.



Textbook Perfect SMPTE Bars Are Now At Hand.



It's everything you told us you wanted in a portable test signal generator. Accurate. Lightweight. Battery or AC powered. American-made. And very affordable. The new BTG-100 from Videotek even lets you generate up to 20 alphanumeric characters for source ID. Whether you're setting up equipment or tracking down a problem, you'll find it an indispensable tool to have. Call us today to find out more about the BTG-100. Another technological innovation from Videotek.

VIDEOTEK™
First, we listen.

243 Shoemaker Road, Pottstown, PA 19464 (215) 327-2292 Fax: (215) 327-9295

Circle (59) on Reply Card

www.americanradiohistory.com

People/ Business

Richard Broadhead has joined Jampro Antennas' sales and marketing team. He is responsible for sales and customer support in all states east of the Mississippi River.

John DeBrocke has been appointed Midwest regional sales manager for HM Electronics, San Diego. He oversees the management of all dealers, sound and communications contractors, representatives and house accounts in the Midwestern third of the United States. He also supervises the distribution of all the company's products in his territory.

John Marino and **Ken Springer** have been appointed to positions with the National Association of Broadcasters' (NAB) Science & Technology department. Marino is manager, technical and regulatory affairs. He is responsible for policy and technical support for NAB's representation of the broadcasting industry before the FCC and other federal agencies. Springer is staff engineer. He assists with policy and technical development of digital audio and digital TV systems.

Brian M. Maloney has been named vice president/general manager of the Harris Broadcast Division, Quincy, IL.

Mark Adams and **J. Robert Heron** have been appointed to positions with Thomson Broadcast, Englewood, NJ. Adams is camera product manager. He oversees all aspects of marketing the company's cameras throughout the United States. Heron is national sales engineer. He is responsible for supporting the company's line of 4:2:2 digital component products.

Thomas N. Thiele has been appointed director of Best Power Technology's Power Generation Division. He is responsible for continuing UBS product development, and marketing it domestically and internationally.

Joseph A. Sciuilli, president and CEO of Telecommunications Techniques Corporation (TTC), has been named High Technology Entrepreneur of the Year for 1991 by the Montgomery County High Technology Council.

Michael Zablocki has been appointed vice president of sales and marketing for Nesbit Systems, Princeton, NJ.

Steve Cheung, **Gail Moore**, **Mike Smyth** and **Paul Smith** have been appointed to positions with Audio Processing Technology, Belfast, Northern Ireland.

Cheung is sales and marketing manager. **Moore** is marketing assistant. **Smyth** is R&D manager, and **Smith** is R&D development engineer.

Jeff Kunzler has been named regional sales manager for Mitsubishi Professional Electronics Division, Somerset, NJ. His territorial responsibilities include 11 states in the Midwest.

Michael Skryha has been named national sales specialist for Toshiba Video Systems, Wayne, NJ. His responsibilities include training sales representatives and promoting the technical features and benefits of the company's products to dealers and end-users.

Mitch Hill has been appointed audio services manager and senior audio editor for Stewart Digital Video, Primos, PA.

Bob Adams has been named director of technical support operations for Liebert Customer Service and Support (CS&S), Worthington, OH. He is responsible for directing technical support operations for power, UPS and site products. He also directs CS&S and customer training.

Robert A. Slutske has been appointed marketing programs manager for complementary products for BTS, Salt Lake City. He is responsible for developing marketing strategies for products produced by a variety of manufacturers and distributed worldwide by BTS.

Albert A. Drewke has been named manager of technology for Varian's microwave equipment products business unit. He is responsible for applications engineering, new product development, research and development, and the business unit's bid process.

Robert I. Knudson has been appointed president of Alta Group, the San Jose-based division of Dynatech Broadcast Group.

Tom West has been named national sales manager for Lightning Master Corporation, Clearwater, FL. He is responsible for major account sales, and for coordinating the activities of the company's North American network of distributors and sales representatives.

Jonathan C. Stilwell has been appointed as an engineer for Hammett & Edison, San Francisco.

Scott Sajer has been named national sales engineer for Thomson Broadcast,

Englewood, NJ. He is responsible for sales and engineering support for the company's ENG, EFP and studio cameras as well as Thomson's studio and ENG-sized HDTV cameras.

W. Kent McGuire has been appointed international and Western U.S. radio and TV sales representative. He works with the domestic dealers in the western United States.

John Puetz has been appointed digital audio products manager for ComStream Corporation, San Diego, CA. He is in charge of integration and marketing of the company's DCA201 digital audio card and future digital audio products.

Peter A. Hayes has been named vice president of marketing for E-mu Systems, Scotts Valley, CA.

Bob Adams, senior design engineer for Analog Devices, has been awarded a Society Fellowship by the Audio Engineering Society's board of governors.

Elizabeth Jefferson has been appointed district sales manager for the Sony Professional Tape Division, Park Ridge, NJ. She manages the sale of Sony professional tape products to production houses, broadcasters and corporate users in Texas, Oklahoma and Louisiana.

BTS reorganizes U.S. operations

BTS, Los Angeles, has announced a comprehensive reorganization of its U.S. operations to provide a more efficient framework for the company's expansion in the '90s. The company is separating its marketing, sales, service and business development operations from its manufacturing center in Salt Lake City, creating two independent units. No staff reductions are anticipated in the reorganization, and some new positions are being created.

MGI and Quantel announce agreement

Management Graphics Incorporated (MGI), Minneapolis, has announced a worldwide OEM relationship with **Quantel**, who will use MGI's Solitaire Image Recorders with its Paintbox AV creation systems.

Sprague Magnetics and Ampex announce agreement

Sprague Magnetics, Van Nuys, CA, and **Ampex**, Redwood City, CA, have reached an agreement that allows Sprague Magnetics to provide Ampex's customers ongoing service and support for Ampex audio recorders worldwide.

THE ASSAULTS:

...635A thrown in the path of a Seattle Transit bus and ran over repeatedly.

"Next time have exact change, pal."

...635A entombed in a watermelon and hurled off a three-story building.

"A splattering experience."

...635A attached to a basketball, bounced, and then slam dunked.

"No harm, no foul."

...635A run over by a ten-ton steamroller.

"Major headache."

...635A blasted by a Seattle Police shotgun.

"Only a flesh wound."



Television and radio

635A

ENG crews have for years used the 635A dynamic microphone from *Electro-Voice®* because of its superb sound clarity and ability to consistently *survive* the most severe field conditions. As a result, it seems that almost every field crew has their own favorite story about the reliability and durability of the 635A, better known as the "Hammer." ¶ The

most recent story comes from

KPLZ, a top radio station in Seattle,

where morning crew *Kent & Alan* recently aired an ongoing segment dedicated to their "Incredible, Indestructible 635A." ¶ They explain: "We unleashed almost everything imaginable on our 635A — drops, slam dunks, a lawnmower, a ten-ton steamroller, a car crusher — and the only assault to

Kent — DJ from KPLZ, in Seattle.



"You Can't Keep a Good Mic Down"

...635A devoured by the jaws of a car crusher.

"Job stress."

...635A eaten by a lawnmower.

"Just a little off the top please."

...635A teed off by a wicked one wood.

"Par for the course."

...635A watched a bowling match from atop a headpin.

"Cheap seats."

Result of these heinous crimes:

THE HAMMER LIVES!

inflict 'serious damage' was a blast from a Seattle Police *shotgun*. To fix this serious damage, we had to go to the trouble of hooking up a wire. ¶ *Frustrated* by our attempts at physical damage, we decided to try a *psychological* approach. A life insurance salesman gave our 635A an hour-long presentation, but the mic emerged *unfazed*. There were no noticeable effects or damage. ¶ The microphone looks and *sounds just fine* after going through these torture tests. Of course, it's bent and twisted a bit, but then again, aren't we all? The 635A 'Hammer'

from EV is truly one incredible, indestructible microphone."



Alan — DJ from KPLZ, in Seattle.



Electro-Voice® a Mark IV company 600 Cecil Street Buchanan, MI 49107 616/695-6831

In Canada 613/382-2141

Circle (79) on Reply Card

www.americanradiohistory.com

The agreement allows Sprague to purchase all existing inventory of Ampex audio recorder parts. It also appoints Sprague as the sole authorized source for replacement parts for Ampex audio recorders. Sprague has assured Ampex that parts and service will be available to its customers through at least 1995. For additional information, contact Sprague Magnetics at 800-553-8712. In California call 818-994-6602.

Thomas & Thomas opens on West Coast

Thomas & Thomas, a manufacturers' representative company, has been launched by former Midwest Communications' sales engineers, branch managers and vice presidents.

The company will initially handle Ampex, TSM, Hitachi, Ikegami, Pesa, Schwem, Harrison Audio, Superior Satellite Engineers and Microdyne.

All of the representatives have extensive experience in broadcast TV and video equipment sales. They will be responsible for sales as well as follow-up service and warranty work.

James Grunder appointed distributor for Hamlet Video

James Grunder & Associates, Mission, KS, has been named as the exclusive U.S. distributor for Hamlet Video International's waveform/vector and stereoscope units.

I.Den acquires Jazz systems

I.Den, San Diego, has acquired the Jazz product line from Electrohome Limited, Kitchener, Canada.

I.Den will distribute the product line through its six international offices.

Moseley purchased by senior management and investors

Moseley Associates, Santa Barbara, CA, has been purchased from GRC International by Moseley's senior management and investors.

Vistek wins top Montreux award

Vistek Electronics Limited, Palo Alto, CA, has received the 1991 Peter Wayne Award for outstanding design and technical innovation at the Montreux International Television Symposium.

The award was presented to Vistek for its pioneering work in motion compensation for international standards conversion as incorporated in its V4501 vector motion compensation system.

Studer acquires Digitec

Studer Revox AG (SRAG), Regensdorf, Switzerland, has completed the acquisition of a majority interest in Digitec S.A., Chatou, France.

Digitec has changed its name to Studer Digitec S.A., and operates as a full family member under the Studer Division of SRAG.

AVS Broadcast appoints ComLogic as distributor

AVS Broadcast, Chessington, England, has appointed ComLogic as the West Coast distributor of its FloatingPoint character generator.

AF Associates, Northvale, NJ, is the East Coast sales and service organization for FloatingPoint.

DATA Group is formed

The Digital Audio Technology Alliance (the DATA Group), composed of communications companies interested in the development of digital audio technology, has been formed.

The companies initially participating in the alliance include SCI, LDL Communications, and du Treil, Lundin and Rackley (DLR).

The DATA Group will attempt to test and develop a successful in-band digital audio broadcasting (DAB) system that meets certain implementation and technical criteria.

APT relocates sales and marketing division

Audio Processing Technology (APT) has relocated its sales and marketing division, formerly situated in Bedbroke Oxford, England, to its corporate headquarters in Belfast, Northern Ireland.

Tannoy named Bruel & Kjaer distributor

Tannoy/TGI, Ontario, Canada, has been named as the exclusive U.S. distributor of Bruel & Kjaer audio products.

Canon USA relocates Broadcast Western region

Canon USA, Broadcast Equipment Division, Costa Mesa, CA, has relocated its Western regional offices to Irvine, CA. The address is 15955 Alton Parkway, Irvine, CA 92718-3614; telephone 714-753-4000; fax 714-753-4337.

R.F. Industries appoints reps and distributors

R.F. Industries, San Diego, has appointed A.R. Gray, Quebec; Masco Electronics, Brea, CA; and More Sales, Phoenix and Albuquerque, NM, as sales representatives. The company has also appointed Grove

Technologies, Las Vegas; Marketronics, Sunrise, FL; Primus Electronics, Joliet, IL; and Allcan Electronics, Alberta, Canada as distributors.

BBT system used in fiber-in-the-loop trial

BroadBand Technologies, Research Triangle Park, NC, has announced a fiber-in-the-loop technology trial with BellSouth in a residential development in Chattanooga, TN.

BellSouth has begun installation of BBT's fiber loop access system (FLX 100), which will demonstrate the consumer and technical benefits of extending the reach of fiber-optic technology in residential applications. The community will eventually include around 400 homes in an area covering approximately 470 acres in eastern Tennessee. The residential development, called Council Fire, is the site of BellSouth's first deployment of the FLX system. The first phase of installation and testing will include plain old telephone service (POTS) to approximately 30 homes.

The distribution trial will provide BellSouth direct insight to customer usage and requirements.

TTC announces LP Com acquisition

Telecommunications Techniques Corporation (TTC), Germantown, MD, has acquired LP Com, a subsidiary of Tektronix.

Richardson Electronics signs agreement

Richardson Electronics, LaFox, IL, and *Ward Leonard Resistors* have signed a worldwide distribution agreement naming Richardson as a stocking distributor for Ward Leonard's wire-wound resistor products.

Richardson has also been named as a stocking distributor for Powerex's entire line of power semiconductors.

Clarification

We would like to acknowledge A.F. Associates' help in supplying three of the photographs used in the September "Advantages of 3-Stage Switcher Design."

We wish to give credit to ADC Telecommunications for the photograph of fiber-optic cable on page 56 of the September "Fiber-Optic Routing Switchers" article. It was inadvertently left off.

1:~)))

Probably not. But the new Shure VP64 microphone could go on with show, after show, after show.

The new Shure VP64 is good news for broadcasters — and their audiences.

In short, it delivers all the qualities you demand for a broadcast microphone — and then some. A high-energy neodymium magnet in the VP64 maximizes signal-to-noise

ratio. Result: your on-the-scene reports cut through background clutter to make sure your audience gets the message. What's more, the frequency response is tailored for unbeatable speech clarity and crispness, while all but eliminating boominess and low frequency background noise.

And you won't find a better looking,

easier-handling microphone anywhere. All of which makes the competitively priced VP64 the best value in its class.

See the biggest news in broadcast microphones today at your Shure dealer. For more information, call 1-800-25-SHURE.

The Sound Of The Professionals®...Worldwide.

SHURE®



If You Were Dropped
6 Feet, Head First,
Would You Still Be Able
To Cover The Story?

Circle (60) on Reply Card

www.americanradiohistory.com

Tape storage

By 3M Company

- **DAT Hanger Bars:** locking case for shipping or storage of DAT cassettes; case large enough to hold two cassettes; design permits cases to be hooked onto special aluminum bar for convenient storage; maintains dust-proof seal to protect the cassette.

Circle (391) on Reply Card

Analog audio medium

By Ampex Recording Media

- **#499 Grand Master Gold:** mastering tape for analog audio; low noise and distortion from operating levels of +9dB or greater; high output, wide dynamic range and low print-through characteristics; in 1/4-, 1/2-, 1- and 2-inch widths.

Circle (392) on Reply Card

Portable mixer

By Comrex Corporation

- **Talk Console:** lightweight unit combines two microphone inputs, line-level input, mix-minus feed, two headphone outputs, two self-adjusting hybrids, telco couplers and dialing pad; remote contact closures available to start tape recorder or delay unit; may be used with frequency extender systems for expanded bandwidth response.



Circle (396) on Reply Card

Audio system testing

By Audio Precision

- **Portable One Plus:** 2-channel test set with graphic seeps, hard-copy output; provides graphic and numeric data from frequency, distortion and phase sweeps; with external source sweep offers recorder and disc reproduction or end-to-end transmission channel measurements.

Circle (394) on Reply Card

Digital audio distribution

By BEC Technologies

- **Pro-Line/Pro-Series:** modular system for 64-channel bidirectional, full duplex communication; AD16 16-channel 16-bit

A/D converter, DA16 18-bit D/A converter; MP16 16-channel mic pre-amp; FB2 FO transceiver; can be configured for operation as digital audio snake with 1,000-foot twisted pair cable; to 10,000 feet with fiber transmission path.

Circle (395) on Reply Card

DAs, processing systems

By Apex Systems

- **Model 8126:** modular audio distribution amplifiers without transformers; servo-balanced output stages; input includes RF suppression; red/green LED indicates module status; 11 modules fit in one rack.
- **9000 series:** includes 9251 aural exciter, 9301 compeller, 9611 expander/gate, 9651 expressor; all in modular form permitting 11 units to fit in 9000R rack system, which is compatible with dbx modules.

Circle (393) on Reply Card

Aural STL

By Dolby Laboratories

- **DP5500 DSTL:** spectrum efficient 950MHz digital studio-transmitter link; increases fade margin, reduces interference problems; AC-2 audio coding data reduction algorithm with digital modulation requires occupied bandwidth less than 300kHz.

Circle (399) on Reply Card

Digital audio product

By Apogee Electronics

- **AD-500 A/D converter:** portable stereo device serving all 16-bit audio applications; handles signal levels to +27dBu; operates at 32kHz, 44.1kHz, 48kHz and 44/056 sample rates with crystal locking to PAL, NTSC or 60Hz monochrome video; locks to external AES/EBU, optical, word clock and SPDIF sources; capable of locking to one input frequency while providing an output at another rate.

Circle (351) on Reply Card

Clock systems

By ESE

- **ES-2695, ES-2743A converters:** allows conversion between SMPTE and ESE time codes; allows a clock system of 100 ESE slave clocks to be driven from a SMPTE time-code source.

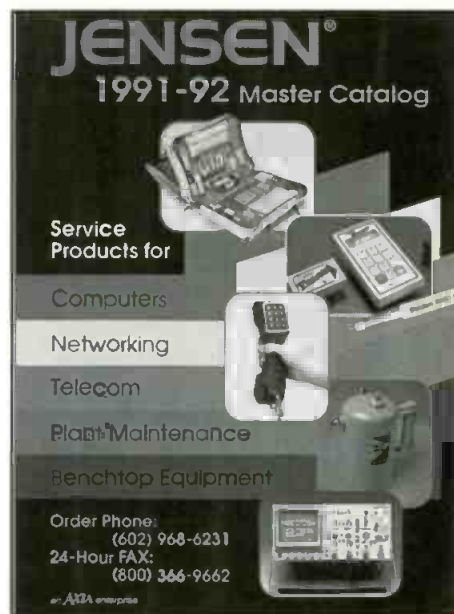


Circle (355) on Reply Card

Product catalog

By Jensen Tools

- **1991-1992 Master Catalog:** 256-page publication of tools, analyzers, monitors, meters, soldering supplies and more; includes most major brands of inspection and field-service instrumentation.



Circle (359) on Reply Card

Workstation enhancement

By Digital Audio Research

- **SoundStation upgrades:** AutoCon-form for automated processing in transferring, track laying and conforming audio to edited video with standard EDL formats; multitrack emulation to 16 tracks without long lock-up times and spooling delays typically associated with tape transports; automatic sorting of source events by reel and source time code.

- **SoundStation SIGMA:** integrated digital audio production system; touch-screen console controls assignment or copying of 4-band EQ, gain and pan parameters with each segment of audio; for 8- or 16-channel simultaneous analog or digital record and playback.

Circle (353) on Reply Card

Audio processors

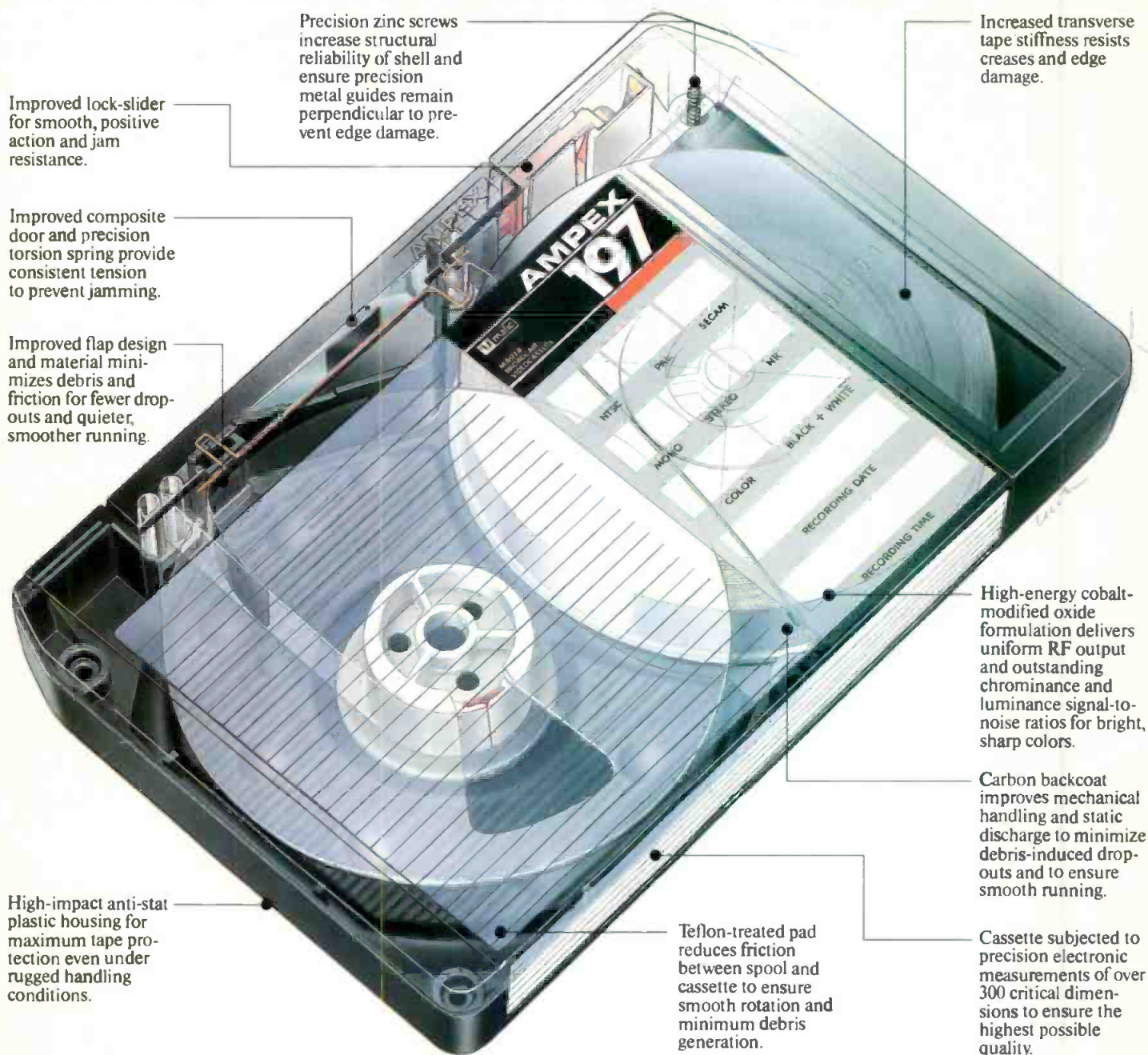
By Gentner Electronics

- **Lazer 2.0:** digital limiter with stereo generator for FM broadcast; wideband AGC in addition to 3-band, wideband and composite limiting; 25μs and 50μs pre-emphasis selections; "watchdog" feature monitors operation to detect changes in operation following lightning or reset conditions.

- **Prizm 2.0:** 4-band preprocessor using fully digital signal path; wideband AGC circuit and "watchdog" monitoring system.

Circle (402) on Reply Card

At Ampex, we engineer to meet your needs.



U-matic is still a workhorse of the video industry. And Ampex makes a full range of U-matic products as rugged and long-lasting as the format itself.

Our 197/187 Master Broadcast Videocassettes are continually being



improved to meet the changing needs of the marketplace and the changing challenges of your environment. So we always build our U-matic products with the latest manufacturing technologies to make our cassettes tougher, more durable, and a lot more reliable.

But when you asked for even more performance from the U-matic format, we created Ampex 297 SP. This is tape designed for the new generation of SP recorders—and for the most demanding users.

And as you demand even more

from your U-matics, you can be assured that our U-matics will continue to meet the challenge, whether it's in ENG/EFM, editing, duplicating, or any other application.

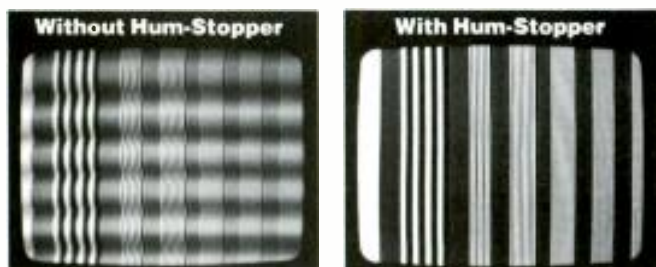
From the tape to the flaps to the doors to the box, we engineer Ampex U-matic tapes to roll right through the toughest job—even on older systems. And it's all backed by the industry's most acclaimed customer service and technical support.

Ampex 197/187/297. Engineered to meet your toughest needs.

AMPEX

QUICK! PICK A HUM-STOPPER!

- Eliminate ground-loop problems (hum, cross-talk, voltage differentials, etc.) on video and other wideband data lines.
- Insure outstanding signal transmission with over 120 dB attenuation of interference at power line frequencies.



For details, call: 516-671-5700.
Or write for our new catalog.

North Hills

Formerly North Hills Electronics, Inc.

A Porta Systems Company.

1 Alexander Place, Glen Cove, NY 11542-3796
(516) 671-5700 Telex 46-6886 Fax 516 759-3327

Circle (62) on Reply Card

Winsted®

Match your
electronics
with our

EDITING CONSOLES

No matter what editing system you use, Winsted offers Editing Consoles to match your requirements! Our designs are based on consultations with professional users like yourself.

You've chosen your equipment carefully, to meet your specific needs. Now choose the Editing Consoles that fit your equipment—quality consoles from Winsted.

For our free full-color
FULL-LINE CATALOG
call us toll free:

800-447-2257

THE WINSTED CORPORATION

10901 Hampshire Avenue So. • Minneapolis, MN 55438 • 612-944-8555

Preferred by Professionals Worldwide

FAX: 612-944-1546

Circle (63) on Reply Card



Digital audio equipment

By Comrex

- **DXR/DXP audio codecs:** rack-mount and portable units for full-duplex audio communication with 7.5kHz bandwidth; compresses signal bandwidth for transmission over channel path normally able to carry only a 300Hz to 3kHz frequency range; compatible with 56kb/s and 64kb/s digital services.



Circle (352) on Reply Card

PC TBC

By Digital Processing Systems

- **Personal TBC II:** time base correction unit on a PC plug-in card; 4-pin DIN S-VHS input; four BNC connectors and RS-232 serial port; offers proc-amp, timing and color balance control through PC for desktop video or editing system; infinite correction window for synchronizer applications with VCRs, video-disc and camcorder sources.

Circle (354) on Reply Card

Video capture camera

By For-A Corporation of America

- **HMC-1040 multicam:** 720 × 485-pixel resolution with direct interface for NTSC RGB monitors, D-I component DVE or PC graphics equipment; single CCD senses R,G,B color information sequentially through rotary color filter; produces inputs for graphic systems devoid of color registration error.

Circle (356) on Reply Card

Solid-state recorder

By Getris Images

- **ARAMIS option:** silicon recording option for VENICE 2-D/3-D animation system; modular design permits 10-80s recording of 4:4:4 live video or animation sequences along with key information.

Circle (357) on Reply Card

Audio logger

By Eventide

- **VR240 signal logger:** DAT-based system tracks AM, FM, TV programming to 24-channels on a single machine; one cassette holds 168 hours, less with multiple channels used; log contest, request lines, other stations, public service scanner signals, etc.; date-time search function permits fast location of an segment; single or dual transport versions include automatic switching for two week unattended logging in a single-channel operation.

Circle (401) on Reply Card

10



Reasons To Specify MCL Klystron High Power Amplifiers.



Microprocessor main-frame shown (standard logic unit is similar, except with analog metering).

- 1** MCL's versatile Klystron High Power Amplifiers are designed for SATCOM C-Band and Ku-Band applications, as well as for other bands, and are recognized throughout the industry for their wide spectrum coverage and consistent, reliable performance.
- 2** Designed to operate under various environmental and specialized mechanical conditions, and engineered for minimal maintenance.
- 3** Full microprocessor or standard CMOS Logic system control.
- 4** Modular construction for rapid sub-assembly access.
- 5** Motorized channel selectors available (most models).
- 6** RS232, RS422, IEEE488, or Remote Contact Interfaces.
- 7** Electrical/mechanical "no-step" or SCR AC line regulation.
- 8** Beam supply on casters, all other assemblies on slides.
- 9** Ruggedized for transportable applications.
- 10** MCL's design, manufacturing and quality control processes ensure the highest quality satellite communications amplifiers and allied equipment available on the market today. All at competitive prices.

For your FREE Engineering Guide,
call or write MCL today.



MCL/INC.
501 S. Woodcreek Road
Bolingbrook, IL 60440-4999
708-759-9500
Fax: 708-759-5018

MCL provides 24-hour, seven day a week service and maintenance support throughout the world. 24-Hour Emergency Service Number (312) 461-4536

Video switcher systems

By James Grunder & Associates

• **Models 6119, 6119Y/C:** production switchers for composite and component video signals; 12-wipe pattern generators with GPI triggering, two linear keyers, integral colorizer; automatic horizontal and vertical timing; variable border, soft edge control for wipes; DSK feature using matte key; full control of 6119Y/C from external computers, editors through serial interface.

Circle (358) on Reply Card

Analog O-scopes

By John Fluke Manufacturing

• **PM-3090 oscilloscopes:** 4-channel operation with bandwidths to 200MHz; sensitivity to 2mV per channel; makes dual trace differential measurements from two traces; for maintenance and adjustment of digital HDTV, computer and communications equipment; a product from Philips Test and Measuring.

Circle (360) on Reply Card

Metal-working tools

By Leads Metal Products

• **Chassis punches:** 1/16 DIN for 45mm x 45mm square and 1/32 DIN for 45mm

x 22.5mm rectangular holes; hardened steel design with easy removal of slug; for hand or hydraulic driven knock-out in material to 14 gauge; resharpening service available through the manufacturer.

Circle (361) on Reply Card

Audio processing

By Summit Audio

• **Model DCL-200:** dual-channel audio compression and limiting using 12AX7A tube gain-stage design; 1:1 to 7:1 compression ratio variation; adjustable threshold, output levels and attack, release times; operable as dual, mono or stereo-linked unit over 5Hz-70kHz range.

Circle (365) on Reply Card



Automation networking

By Louth Systems

• **ADC-100 system:** PC-based automation control using Ethernet; up to eight controllable devices connect to a server

through serial protocol; PC workstations network to server via Ethernet LAN; multiple channel output capability allows each device to be used as an individual channel base; multiple play and record lists possible; menu operation with mouse, trackball and keyboard control.

Circle (362) on Reply Card

Digital audio equipment

By nVision

• **NV4448:** sample rate converter tracks an input range of 28kHz to 54kHz with output at standard rates from 32kHz to 50kHz; synchronous conversion from 44.1kHz to 48kHz at 24-bit accuracy; asynchronous conversion with distortion less than 0.05%.

• **EM1020 codec:** full duplex stereo audio per AES/EBU specifications; 18-bit, 64x oversampled A/D conversion; 20-bit 8x oversampling on D/A conversion; 44.1kHz or 48kHz sampling rate; 2-way stereo conversion on single card.

• **EM1021 digital DA:** options provide balanced or coaxial I/O with linear pre-amp and equalizer; input impedance adjusts from 75Ω to 250Ω.

Circle (410) on Reply Card

Multi-Channel Systems Antenna

MCI offers broadcasters a new **Multi-Channel All Band High VHF (CH. 7-13) and UHF (CH. 14-69) Antenna System** designed for use in multi station and HDTV applications.

During the **HDTV simulcast** period, it will be desirable or even necessary for both NTSC and ATSC signals to be transmitted from the same antenna.



MCI's new broadband multi-channel antenna will radiate both signals with the same *foot print pattern*.

Omni and directional patterns are available.

Only from **MCI**, the Innovators in standard and custom design RF components for

the Broadcast Industry. Call now for information and pricing.

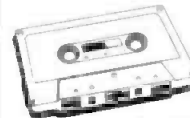


MICRO COMMUNICATIONS, INC.
Leaders in RF Technology Since 1966.

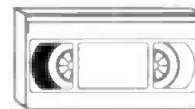
Tel. (603) 624-4351 • Fax. (603) 624-4822
P.O. Box 4365, Grenier Field, Manchester, N.H. 03108-4365

Circle (74) on Reply Card

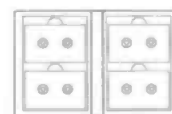
AUDIO/VIDEO PRODUCTION & PACKAGING SUPPLIES



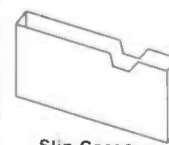
Blank Cassettes



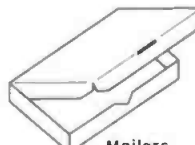
Boxes



Albums



Slip Cases



Mailers

All items shipped from stock
Midwest and West Coast warehouses

ask for our free catalog
Chicago area (708) 390-7744 Los Angeles area (818) 969-8555

PolyQuick
1243 Rand Road, Des Plaines IL 60016

Circle (73) on Reply Card

Microwave link

By Optical & Textile

• **ENG/EFP TV link:** 19.6-channel microwave system operating between 2.460GHz and 2.700GHz with 20MHz spacing; external switch controls operating frequency with synthesized control; 6.8MHz and 7.5MHz audio subcarrier channels; compact transmitter measures 2.5" x 3.5" x 2.5"; 1W output with 12VDC input; 6" x 4" x 3" receiver mounts on tripod with receiving antenna.

Circle (363) on Reply Card

ENG/EFP cassettes

By Sony Magnetic Products Group

• **HMEX Hi-8ME videotape:** metal evaporated recording media for ENG and EFP applications; manufactured with vacuum evaporation process for high-particle packing density using cobalt alloy particles; 1.5x greater retentivity than standard 8mm metal tape; 5dB increase in RF output and carrier-to-noise ratings; cassette engineered to reduce electrostatic discharge noise, jitter.

Circle (364) on Reply Card

Liquid level sensing

By TankMate

• **Model MK IIIS:** capacitance probe capable of sensing level information in tanks to 12-foot depths; precision determination of cooling system liquid volume in holding vessel with unit designed to meet sanitation standards; controller unit has capacity for eight separate probes if expanded monitoring is required.

Circle (367) on Reply Card

Aural STL

By TFT

• **Model 9200/9205:** mono studio-transmitter link with synthesized frequency control; single-channel or redundant dual-channel stereo operation in 800-960MHz or other bands permitting STL service; 7.5W RF output from transmitter; receiver input rated at 15µV sensitivity with 50dB S/N ratio; channel spacing of 200kHz and 100kHz available; multiplex/service channel optional.



Circle (415) on Reply Card

Satellite tracking

By Superior Satellite Engineers

• **AutoTrak, AutoAccess revisions:** software upgrades to support steerable satellite antenna systems; permits antenna systems to 10m diameters to track movement of inclined-orbit satellites and to re-establish the link with a satellite at any point along an inclined orbit; AutoPeak module handles peaking of antenna on a satellite in geostationary orbit after manually positioning the antenna on nominal look angles.

Circle (366) on Reply Card

1:~:~)))))

Reduce Bandwidth 75% for Digital Audio Transmission



Intraplex PT/PR-150 modules use 16-bit coding and compression algorithm to transform 15 kHz audio into 128 kb/s bandwidth; 7.5 kHz into 64 kb/s.

- 4:1 bandwidth compression
- Selectable bandwidths 15 & 7.5 kHz
- Two circuits per module stereo or monaural operation
- Remote programability
- Plug-in modules for use with Intraplex Multiplexers.



Intraplex, Incorporated, 80 Taylor Street, Littleton, MA 01460-3427
TEL: (508) 486-3722 / FAX: (508) 486-0709

Circle (64) on Reply Card



Video Measuring JUMPS! DOWN in size and price ... and UP in performance

PVM-1073

Vectorscope, waveform monitor, oscilloscope, color frame timing with SC/H phase measurement... In the palm of your hand!

■ Many more features

■ \$2,995 list

Available now

Dealer inquiries invited

Call NOW

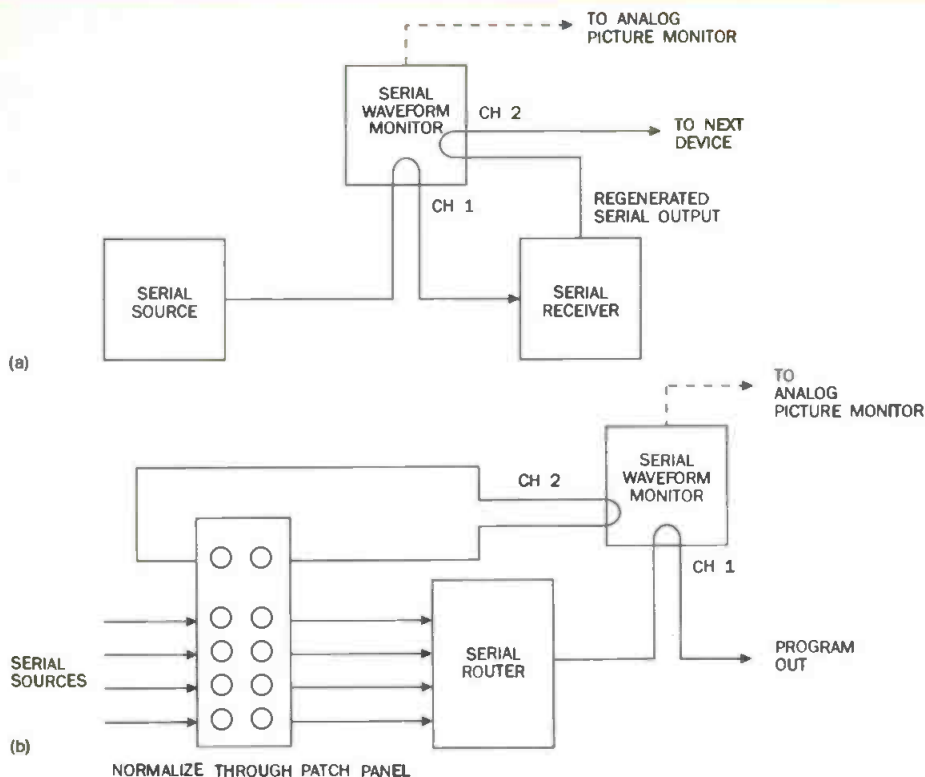
The PVM-1073 Video Multimeter. LCD digital readout, no cursors to fumble with, no drift CRTs, no graticle marks to interpret. Automatic monitor mode with audible alarm. Dual input electronic camera matching includes nonvolatile memory. Battery or AC operation. ±0.5 IRE and ±0.6° accuracy.



12001 Mathis Way • Grass Valley, CA 95949

(916) 268-0190 Pacific • Fax: (916) 268-3986

Circle (65) on Reply Card



Continued from page 46

Figure 10(b) shows a serial router with a single output. The channel 1 monitor connection allows content and error rate monitoring, as well as checking the program out eye pattern. The second input can be put in series with any of the input signals via the patch panel.

As simple as it sounds, one of the most useful troubleshooting aids is being able to determine if a serial signal is present in the cable.

Summing up

Serial digital video represents a new way of distributing digital video in a TV plant. It will solve some of the problems of parallel distribution, but will bring with it some new ones. Understanding what makes serial tick, together with a strategy for monitoring link performance, will minimize these problems.

Figure 10. Two suggested monitoring connections. In (a), the serial signal loops through the waveform monitor before termination at the receiver. In (b), any router input can be monitored via the patch panel.

Footnotes:

1. Ainsworth, K.M. and Andrews, G.D., "Evaluating Serial Digital Video Systems," presented at the Fourth International Conference on Television Measurements, June 20-21, 1991.
2. Elkind, Bob and Fibush, David, "Proposal for Error Detection and Handling in Studio Equipment," presented during the 25th SMPTE Television Conference, Feb. 1-2, 1991.
3. Sony SBX1602A Serial Interface/Transmission Decoder Specification, pp. 22-23, Sony Corporation, 1991.

1:7-)))



PROBLEM SOLVERS

TURN EMPTY SLOTS IN YOUR DA FRAMES* INTO MONEY SAVERS



CARDKEY
Linear
Video Keyer

- A low cost version of our successful MASTERKEY
- Seamless inlay of antialiased key sources
- Self key or external key
- Upstream, downstream or stand alone
- Mix to key via remote, illuminated pushbutton
- GPI contacts provided
- User selectable mix to key rate



CARDPROC
Video Processing
Amplifier

- Regenerates sync, blanking & burst
- 40db common mode hum rejection
- Chroma on/off, burst on/off, proc bypass switching
- User adjustments for video, chroma, sync, burst & setup levels, blanking width, start & end of sync, black & white clip, equalization, horiz and burst phase.

*Both cards will plug directly into Leitch Video or GVG DA frames. They are also available in our 1/2 rack width self-powered frame.

broadcast video systems ltd.

40 West Wilmot Street, Richmond Hill, Ontario L4B 1H8
Telephone: (416) 764-1584 Fax: (416) 764-7438

Circle (76) on Reply Card



For AM, FM, SCA
and TV modulation monitors.

WHEN ACCURACY COUNTS...COUNT ON...

Call (215) 687-5550 or write for more
information on Belar AM, FM, Stereo,
SCA and TV monitors.



BELAR
ELECTRONICS LABORATORY, INC.
LANCASTER AVE. AT DORSET, DEVON, PA 19333

Circle (77) on Reply Card

www.americanradiohistory.com

jensen
TRANSFORMERS, INC.

The leading
maker of
professional
audio trans-

formers for almost 20 years...
but that's not all:

- Twin-Servo Mic Preamps
- Advanced Retrofits for Magna-Tech Reproducers
- Comtran Circuit Design & Optimization Software
- Free Circuit Design Consultation

Visitors by appointment only. Closed Fridays.

10735 Burbank Boulevard
North Hollywood, California 91601
FAX (818) 763-4574 • Tel (213) 876-0059

Circle (67) on Reply Card

The DigiCartTM is here

It's fast becoming the most popular digital audio recorder in the broadcast industry. And for good reason: DigiCarts make your spots sound like CDs. They're also a fast digital editor. And they do play-listing. And they have hard disks for days of storage, plus cartridges for portability. Get instant access to every cue in the station, or tie in with PC-based live-assist computers. All this for \$3,995 with a cart drive, and \$5,595 with a hard disk!

DigiCarts are *available now* from selected broadcast distributors. Write for detailed information on how you can go digital—for the price of a cart machine.

360 SYSTEMS, Broadcast Products Group
18740 Oxnard Street, Tarzana, California 91356
Phone (818) 342-3127 • Fax (818) 342-4372

360 Systems

Circle (80) on Reply Card

MADE IN USA



DigiCartTM

Made in USA by

360 Systems

Preview

December...

TECHNOLOGY FORECAST FOR 1992

• State of the Industry Report

One way to help make the correct decisions is to pool the knowledge of your fellow professionals. The annual State of the Industry Report has become the hallmark barometer for the broadcast industry's health and direction.

• View from the Top

Learn what future technological developments are foreseen by three experts in the industry. Peek into their research laboratories and see what may be appearing soon in your facility.

• Profiting from Technology

The most successful stations look to value-added areas to help increase their profits. Often it's the station technical staff that helps the manager see how technology can improve the bottom line. The article looks at ways technology can reduce costs and provide additional revenue sources.

January...

REMOTE PRODUCTION SPECIAL REPORT

• Fiber's Digital Solutions

Remote broadcasts can be a lucrative — or a losing — proposition. The difference usually depends on the technology needed to distribute and back-haul broadcast audio. The article shows the reader that the dial phone is no longer the only way to relay the signal back to the studio. Digital telephone techniques (ISDN, Switched 56) and analog and digital fiber systems are available to improve the transmission process.

• Remote Production Equipment

Remotes can be difficult if the right equipment isn't available. Selecting from the wide variety of equipment on the market can be just as challenging. The article will walk the reader through the decision-making process to select the best equipment for any remote production or recording application.

• News Coverage: Behind the Scenes

No event receives more attention than a presidential news conference. In addition to the standard technical equipment needs, security arrangements add a whole new layer of problems for engineers and producers. The article will take the reader behind the cameras, and show what equipment is used and how reporters and technical crews must work within a strict arena, controlled by the Secret Service.

• Intercom System Design

As stations try to originate programming from remote and studio locations, communication becomes the difference between delight and disaster. The article reviews the different types of intercom system designs, and offers suggestions on how to select the options your facility may need.



Discount prices on everything!
Over 300 top quality product lines at prices so low we promised not to print them!

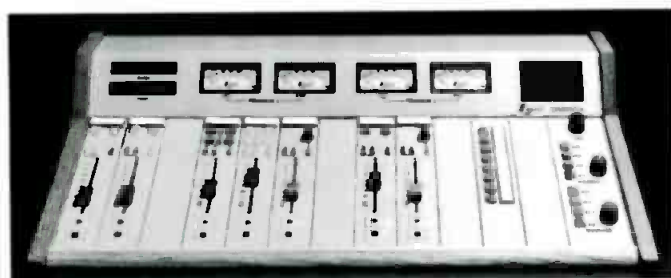
1-800-356-5844
AUDIO • VIDEO • LIGHTS

FULL COMPASS

Consultation: 608/271-1100
5618 Odana Rd., Madison, WI 53719

Circle (70) on Reply Card

GETTING SOAKED? GET A MARINER!



The MARINER On-Air Console

- Waterproof Switches & Pots
- Works while dripping wet
- 6, 12 or 22 Mixer Modular Frames
- 3 Styles of Mixers
- 6-Button Integrated Machine Controls
- Connections via QCP® Terminal Posts
- Optional Clock, Timer & Backup Supply
- Built for Reliability & Low Service

Logitek

When it has to
work right!

Call 800-231-5870 for your nearest Logitek Dealer.
(Alaska, Hawaii, Canada : 713-782-4592)

Circle (71) on Reply Card

Professional services

NETCOM (201) 837-8424

NETWORK COMMUNICATIONS CONSULTANTS
931 TEANECK RD TEANECK, NJ 07666

STATE-OF-THE-ART ENGINEERING FOR AUDIO & VIDEO

- FACILITY PLANNING
 - SYSTEM DESIGN
 - CAD SERVICES
- JAMES TRONOLONE
ENGINEER

TEKNIMAX

TELECOMMUNICATIONS

DENNIS R. CIAPURA
PRESIDENT

11385 FORESTVIEW LN.
SAN DIEGO, CA 92131 (619) 695-2429



hemec
COMMUNICATIONS, INC.
1-800-444-0856

Satellite Systems Engineering Design & Construction
T.I. Busting • Tracking Systems • Transportable and Fixed Uplinks
(805) 963-3765 FAX (805) 962-0920
427 E. Montecito St., Santa Barbara, CA 93101
Washington DC • Lake Tahoe • Los Angeles • Seattle

Robert J. Nissen

THE NISSEN GROUP, INC.

Communications Technology Consultants

32 Ridge Drive • Port Washington, New York 11050
(516) 944-5477

ERIC NEIL ANGEVINE, P.E.

architectural engineer

specializing in broadcast studio acoustics

1002 Greystone Street Stillwater, OK 74074
405-744-6444 405-372-3949

JOHN H. BATTISON PE.
CONSULTING BROADCAST ENGINEER,
FCC APPLICATIONS AM, FM, TV, LPTV

Antenna Design, Proofs, Fieldwork
2684 State Route 60 RD #1
Londonville, OH 44842
419-994-3849

PROMOTE YOUR SERVICES
and increase business
for as low as \$133 per insertion.
Call 913/541-6745.

East Coast Video Systems

A full service
company providing...

- Consultation
- Engineering & Design
- Installations
- Training

ON-LINE IN-TIME

Serving...

- Cable Systems
- Corporate Facilities
- Broadcast Facilities
- Teleproduction Facilities

52 Ralph Street, Belleville, NJ 07109 (201) 751-5655

D. L. MARKLEY

& Associates, Inc.
CONSULTING ENGINEERS

2104 West Moss Ave.
Peoria, Illinois 61604
(309) 673-7511
Member AFCEE

Classified

HELP WANTED

TECHNICAL DIRECTORS

QVC Network, a cable shopping network reaching more than 40 million homes, is looking for your expertise as we start our exciting new venture — The QVC Fashion Channel.

Working at our state-of-the-art facility in West Chester, PA, you will work on a 24-hour television operation controlling several robotic cameras, while directing and technical directing a live TV show.

If you have solid TV production experience, knowledge of Grass Valley Switchers plus a lot of ambition and energy, we'd like to hear from you.

We offer a competitive salary and benefits, including relocation assistance. Please mail or fax your resume to: Maryanne Delaney, QVC Network, Goshen Corporate Park, West Chester, PA 19380. Fax (215) 430-2368. We are an equal opportunity employer, m/f.

QVC
NETWORK
Quality Value Convenience

HELP WANTED

YUBA COMMUNITY COLLEGE offers a SBE certificate program. Electronic technologist certificate available at completion of course. Marysville, CA. Contact: Dan Vitale, 916-741-6753. 10-91-61

WDSU-TV IN NEW ORLEANS, LA is seeking an ENG Maintenance Engineer. Must be a highly qualified engineer in Beta, U-Matic, and field equipment repair. Applicant should have 3-5 years experience and should be capable of handling the pressure of our high energy News Department. Send resume to Carolyn Simmons, personnel coordinator, WDSU-TV, 520 Royal St., New Orleans, LA 70130. NO PHONE CALLS, PLEASE. E.O.E. 11-91-21

TRANS/STUDIO MAINT. ENGINEER 3-5 yrs. experience required on maintenance of VHF transmitter & studio equipment background required. Salary range 25-30K. Send resume to WXEL - Personnel - P. O. Drawer 6607, W. Palm Beach, FL 33405. or call Ed Murphy (407) 737-8000. EOE. 11-91-21

VIDEO ENGINEER Leading Chicago post house seeks video engineer. 3-5 years experience. Emphasis on integration of computer workstations with video on-line, 2-D and 3-D graphics systems preferred. Work with the best. Reply P. O. Box 12901, Broadcast Engineering Dept. 727, Overland Park, KS 66282. 11-91-11

BROADCAST PROJECT ENGINEER WNYC Public Radio and TV currently seeks a Broadcast Project Engineer to work in the Operations and Engineering Department. Responsibilities include systems design, autocard drawings and related activities. Occasional troubleshooting and repair of finished systems. Requirements include a BS Degree in Electrical Engineering, three years recent experience in Broadcast Systems Design and a motor vehicle driver's license valid in NY. Salary: \$30,810 + 3 weeks vacation and benefits. If interested, please send resume to WNYC, Personnel, Dept. 16 E, 1 Centre Street, 26th Floor, NY, NY 10007. EOE. 11-91-11

SEEKING KNOWLEDGEABLE INDIVIDUAL with a strong desire to maintain television transmission, microwave and studio facilities. Must possess FCC license or SBE certification. Send resume and cover letter to Curt Morgan, CE, WPBN TV, P. O. Box 546, Traverse City, MI 49685. 11-91-11

HELP WANTED

ENGINEERING SUPERVISOR

Engineering Supervisor sought by New York's leading independent TV station. We're looking for someone to handle major project management, scheduling and assisting in labor relations. Top technical and people skills necessary. Send resume and salary requirements to:

Employment C
Human Resources Department
WPIX-TV
11 WPIX Plaza
New York, NY 10017



W P I X

A Tribune Broadcasting Company.
An Equal Opportunity Employer

Classified

EQUIPMENT WANTED

USED
SNAP-ON® (PROPAC® 13/14) BACKPLATES
OR DEAD BATTERIES
\$50 EACH
CALL 914-347-5776
 * SNAP-ON, PROPAC are registered trademarks of Anton/Bauer, Inc.

WANTED: USED VIDEO EQUIPMENT. Systems or components. **PRO VIDEO & FILM EQUIPMENT GROUP:** the largest USED equipment dealer in the U.S.A. (214) 869-0011. 4-91-tfn

SERVICES

FINALLY!
2 GHZ. VIDEO MICROWAVE EQUIPMENT AVAILABLE FOR RENT ANYTIME!
 21 Channel Selectable 3/12 Watt Portable AC/DC Transmitters & Receivers with 2 Channel Audio. • Also — Dishes, Dualrods, Tripods, Back-up Units, Wireless Cameras, Live Truck & Eng. Crews
 • **SPECIAL DISCOUNTS** for Long Term & Multiple System Rentals
 • Emergency/Rush Delivery Capable
 24 Hours a Day
216/494-9303
ImageVideo
 LIVELINK SERVICES
 6756 Freedom N.W. N. Canton, OH 44720

TRANSMITTER TUBE REBUILDING SINCE 1941: 3CX2500, 4CX5000, 4CX15000 and many others. Write for details. **FREELAND PRODUCTS INC.,** 75412 Hwy. 25, Covington, LA 70433, (504) 893-1243 or (800) 624-7626. 1-91-tfn

BROADCAST STANDARDS CONVERSIONS
VIA STATE-OF-THE-ART, 4 FIELD, EMMY AWARD-WINNING CONVERTER
PAL BETACAM SP • PAL 1" • S-VHS
3/4" • D-2 • HI-8 • VIDEO-8 • 1/2"
VIDEO DUPLICATION
ALL FORMATS
1-800-USA-DUB1
1-800-872-3821
USA STUDIOS

UNBEATABLE PRICES

FOR THE BEST QUALITY
VHS DUPLICATION
PAL DUPLICATION
STANDARDS CONVERSION
100% Guaranteed
Same Day / Overnight Turnaround
(714) 646-6802
PERFECT UNLIMITED CO.
 474 E. 17th Street, #103,
 Costa Mesa, CA 92627
FAX (714) 646-6221

TRAINING

FCC GENERAL CLASS LICENSE. Cassette recorded lessons with seminars in Washington, Newark, Philadelphia. **Bob Johnson Telecommunications,** Phone (213) 379-4461. 5-90-tfn

FOR SALE

NEW PANASONIC EQUIPMENT!
BROADCAST-PROFESSIONAL-INDUSTRIAL
FANTASTIC PRICES—FULL WARRANTY
FACTORY AUTHORIZED TOP QUALITY!
ADVANCED VIDEO SYSTEMS
800-233-2430, 9am-7pm, M-F

6 1/8" COAX, 75 ohm, 20' sections. EIA flanges, 37 sections, w/hangers. \$200/section, \$7000/lot, on tower. Call **Mike Burnham, 813-923-8840.** 11-91-tf

CAPACITORS OVERNIGHT

• Power Supply—computer grade: up to 450VDC
 • Transmitting - MICA — Sangamo, Cornell-Dubilier
 • Oil Filled — Non-PCB Oval, Rectangular
 Relays • Filters • Transistors
 Any Parts starting with 1N or 2N
1-800-323-0460 FAX 1-802-425-3664
Kellner Electronics, Inc., Charlotte, VT 05445

TUBES 4CX1000A, 4CX250B, 4-1000A, 4CX15000A, and more. We carry large inventory. all major brands (EIMAC, AMPEREX, RCA) Call **Stew 1-800-842-1489.** 1-91-tfn

GENLOCK YOUR SYSTEM BLACK-BURST, SYNC, AUDIO TONE \$289

Need to genlock your video system? The **BSC-50** from **HORITA** generates black-burst, composite sync, and a 1-KHZ audio tone. Provides 6 separate outputs of any mix of up to 4 each of RS-170A black or sync. Also provides subcarrier, blanking, drive. **UN-CONDITIONAL GUARANTEE.** Contact your local video dealer or

HORITA • P.O. Box 3993,
Mission Viejo CA 92690 (714) 489-0240

The Best Values in used broadcast equipment are in our FREE Catalog!
Call, Write or Fax today!

MICOR VIDEO EQUIPMENT

5545 N. Clark Street, Chicago, Illinois 60640-1222
 312 334 4300 Telex 910 240 9449 Fax 312 334 4385

Need some power and ultra compact portable light unit? **NEW KA 2500** with **Eimac 3CX1500A7**, fully electronic protected, 87, 5-108 MHz, 2500 Watt only 0-65W. excitation, Low pass filter, 18 months warranty life parts and labor only \$8,105: in stock! **EURO TECH.** full line FM exciters, FM tube and solid state amplifiers, microwave links, transmitting antennas, calibrated cables coupling, splitters, low pass filters and more. Catalogs, quotes at **201-434-5729 Fax: 201-332-0751**

Classified advertising now available as Classified Display or By-the-word.
Classified Display: \$107 per column inch, per insertion, with frequency discounts available. 1 inch minimum, 10 inches maximum per ad. Blind ads \$40 additional. Reader Service number \$50 additional. Spot color available for \$150 (color determined by publisher).
By-The-Word: \$1.75 per word, per insertion. Initials and abbreviations count as full words. Blind ads \$40 additional. Minimum charge \$40 per insertion. No agency discounts allowed for classified ads.
 Contact **Renée Hambleton**, at (913) 541-6745, for information on frequency and pre-payment discounts. To place your classified ad send your order and materials to **Broadcast Engineering, Classified Ad Mgr., P.O. Box 12901, Overland Park, KS 66282.**

FOR SALE

SONY, PANASONIC, JVC Authorized Parts Distributor SEI ELECTRONICS

2520-22 N. Broad St., Philadelphia, PA 19132
 215-223-9400 • 800-523-0894
 FAX: 215-223-9423

Circle (89) on Reply Card

COPPER • For Construction. Strap, screen, #10 wire. 800-622-0022. 9-91-8t

LNAs & LNBs - C & Ku

Low AS 30° & .7dB
Pro 2 - 5 Yr. Warranty
30 Day Trial
800 624-6599
 Low Temp. Units "Kill" Noise



AVAILABLE IMMEDIATELY - 67 KHz subcarrier on Toronto Class B FM station. 875 ft. H.A.A.T., downtown TX site. For more info, contact **John McKay, Chief Engineer.** Call (416) 378-1829 and leave name and phone number. 11-91-tf

"Professional Camera Tubes"

New & Demos With Warranty
Now In Stock!

H4101's & H8399's for JVC & Ikegami cameras.
XQ1427's, 3427's, 1410's, others.

Special Discounts!

Also: transmitting tubes, studio lamps, tape RCA parts, vacuum caps, RF transistors, etc.

FUSION ELEC. LI., N.Y.

Many types of Beta, SP, C.G.'s, demo broadcast equipment available.

Toll Free: 800-645-2300

NY 516-887-4660 (FAX) 516-599-6495

INVITATION FOR BID #1350-2. The Maricopa County Community College District is accepting sealed bids for one (1) "three-slot mono cartridge deck with reproduce and record capabilities". Written, sealed bids will be received at the office of the Purchasing Agent, 2411 W. 14th Street, Tempe, Arizona 85281, until 3:00 PM (MST), January 7, 1992. Mark the outside of the envelope with the bid number, name and time of bid opening. For further information, call or contact the Purchasing Office, tel: 602-731-8524 or fax: 602-731-8560, and ask for Frank Urtuzastegui. 11-91-tf

AT LAST...VTR REMOTE CONTROL
JUST THE WAY YOU WANT IT
THE ST60 VTR CONTROLLER
LOW COST - EASY TO USE - LOTS OF FEATURES

DNF Industries (213) 650-5256
 1032 N. Sweetzer, #212, L.A. CA 90069

Advertising sales offices

NEW YORK, NEW YORK

Gordon & Associates
210 President Street
Brooklyn, NY 11231
Telephone: (718) 802-0488
Telefax: (718) 522-4751
Mike Trerotoli
Telephone: (212) 332-0632
Telefax: (212) 332-0663
888 7th Avenue, 38th Floor
New York, NY 10106

CHICAGO, ILLINOIS

Vytas Urbonas
Telephone: (312) 435-2361
Telefax: (312) 922-1408
55 East Jackson
Suite 1100
Chicago, IL 60604

SANTA MONICA, CALIFORNIA

Herbert A. Schiff
Telephone: (213) 393-9285
Jason Perlman
Telephone: (213) 458-9987
Kelly Daugherty
Telephone: (213) 451-8695
Schiff & Associates
501 Santa Monica Blvd, Ste. 401.
Santa Monica, CA 90401
Telefax: (213) 393-2381

OXFORD, ENGLAND

Nicholas McGeachin
Intertec Publishing Corp.
Unit 3, Farm Business Centre
Clifton Road
Deddington
Oxford OX15 4TP
England
Telephone: (0869) 38794
Telefax: (0869) 38040
Telex: 837469 BES G

TOKYO, JAPAN

Mashy Yoshikawa
Orient Echo, Inc.
1101 Grand Maison
Shimomiyabi-Cho 2-18
Shinjuku-ku, Tokyo 162, Japan
Telephone: (03) 235-5961
FAX: (03) 235-5852
Telex: J-33376 MYORIENT

FREWVILLE, SOUTH AUSTRALIA

John Williamson
Hastwell, Williamson, Rep. Pty. Ltd.
109 Conyngham Street
Frewville 5063
South Australia
Phone: 799-522
FAX: 08 79 9522
Telex: AA87113 HANDM

CLASSIFIED ADVERTISING OVERLAND PARK, KANSAS

Renée Hambleton
P.O. Box 12901
Overland Park, KS 66212
913-888-4664

Classified

FOR SALE

AG-6810
PANASONIC VHS
DUPLICATORS
Refurbished with new parts including:
+ reel motor pulley + idler wheel
+ brake bands + pinch roller
90 days parts & labor warranty
\$595 each
Tel: 708 673 5400
Fax: 708 674 1960
CORPLEX

Circle (90) on Reply Card

-NEW- COLOR BARS, BLACK SYNC \$379

The CSG-50 from HORITA generates both SMPTE or full-field color-bars or black-burst, and composite sync signals. Built-in timer switches from color bars to black after 30 or 60 seconds. Full RS-170A spec. Genlock your system, laydown color-bars and black. Decktop and rackmount versions. UNCONDITIONAL GUARANTEE. Contact your local video dealer or

HORITA - P.O. Box 3993
Mission Viejo CA 92690 (714) 489-0240

CALL US

For New and Rebuilt
Radio Broadcast Equipment

HE HALL
Electronics

(804) 974-6466

1305-F Seminole Trail • Charlottesville, Va. 22901

Circle (91) on Reply Card

NEW from DENECKE, INC.



\$395

The Dcode™ Syncbox™ Time Code Generator

for use with the
Denecke Dcode™ IS-1 Time Code Slate
or alone as time code &
sync pulse generator.

DENECKE, INC.

5417-B Cahuenga Blvd., N. Hollywood, CA 91601
(818) 766-3525 or FAX (818) 766-0269

FOR SALE

PRO

The PRO in PROVID SUPPLY means you get experienced professional help from a sales team, each with over 20 years in the industry. You deal with specialists who know first-hand about all video and audio applications. Our staff features PROs in:

- Complete Systems—Andy Turner, Lee Ruber or Frank Agnello
- Studio, Field & Post—Lee Ruber & Frank Agnello
- Audio from Mics to Mobile Studios—Frank Agnello
- Transmitters & Microwave—Mike Stevens
- Lighting & Grip—Stuart Willis
- VHS, U-Matic & Lower format equipment—Regina Szpak

**FOR INFORMATION ABOUT MOBILE TRUCKS,
BROADCAST STUDIO CAMERAS AND HIGH-END
GRAPHICS/CHARACTER GENERATORS...**

**CALL PROVID SUPPLY ST. LOUIS AT
(314) 469-7297**

**THOUSANDS OF ITEMS LISTED BY THE FINEST
POST/PRODUCTION FACILITIES IN THE COUNTRY...**

**MANUFACTURERS' & DEALERS' DEMO STOCK
FOR SALE AT SIGNIFICANT SAVINGS...**

MOBILE TRUCKS... Sports Trucks; KU Uplink Trucks; many trucks from \$15,000...

COMPLETE EDITING SYSTEMS... Interformat Editing Systems & Suites; Betacam A/B Roll Systems; M-II A/B Roll Editing Systems; 3/4" Cuts & A/B Roll Systems...

BETACAM... SP Betacam & regular Betacam recorders and players at significant savings!!!

CAMERAS... Hundreds of cameras from \$2,500!!!

U-MATIC & VHS... Complete A/B Roll 3/4" Systems from \$27,850, Cuts Systems from \$3,500

CHARACTER GENERATORS... Chyron, Laird, Quanta... Many CG's as low as \$1,000

DIGITAL EFFECTS... Abekas, Ampex, Microtime, CEL, NEC and many more...

GRAPHICS... Cubicomp, Silicon Graphics, Chyron, Artstars, Quantel Paintboxes and more...

ONE INCH... Many units to choose from starting at \$8,750

SWITCHERS... Grass Valley, Ampex, Sony, JVC, Panasonic, Echolab just to name a few...

MICROWAVE... KU uplink Flyaway systems & C-Band systems available...

Confidence & Value Through Experience
Let us shop for you!!
PROVID SUPPLY CORPORATION
(708) 670-PROS FAX (708) 670-7892

Media Advertising Drives Profitability*

Advertising is not a "frill". It is a crucial part of successful business.

Media advertising...

- creates product or service awareness.
- demonstrates your sales and promotion efforts, which helps your customers learn more about your product or service
- builds increasing preference for your product or service.
- generates increased profitability!

Frequency is vital! Businesses that advertise more than competitors get results!

You Can't Afford Not to Advertise

Call Renée Hambleton, Classified Ad Manager — 913-541-6745 for rates and frequency discount information or fax your ad to 913-541-6697. *Cahners Advertising Research Reports

Ad index

	Page Number	Reader Service Number	Advertiser Hotline		Page Number	Reader Service Number	Advertiser Hotline
ADC Telecommunications	3	5	800-726-4266	Leitch Video of America, Inc.	42,65	23,38	800-231-9673
AEQ SA	39	20		Logitek	116	71	713-782-4592
AKG Acoustics Inc.	17	12	415-351-3500	MCL Inc.	111	75	708-759-9500
Ampex (AVSD)	50-51	30	800-25-AMPEX	Micro Communications	112	74	603-624-4351
Ampex Recording Media	109	61	415-367-3809	Microwave Networks, Inc.	11	9	713-495-7123
Andrew Corp.	59	34	800-255-1479	Nady Systems, Inc.	76	42	415-652-2411
Artel Communications Corp.	89	49	508-562-2100	Nikon Electronic Imaging	5	6	800-NIKONUS
Audio Animation, Inc.	101	58	615-689-2500	North Hills Electronics Inc.	110	62	516-671-5700
Audio Precision	13	10	800-231-7350	Odetics, Inc.	9	8	800-243-2001
Auditronics, Inc.	97	57	901-362-1350	Opamp Labs, Inc.	84	69	213-934-3566
Belden Wire & Cable	61	35	317-983-5200	Orban, Div of AKG Acoustics	7	7	415-351-3500
Belar Electronics Laboratory	114	77	215-687-5550	Otari Corp.	15	11	415-341-5900
Broadcast Video Systems Ltd.	114	76	416-764-1584	Panasonic	31,56-57,72-73		800-524-0864
Clear-Com Intercom Systems	30	17	415-527-6666	Pesa America	IFC	1	205-880-0795
Continental Electronics	58	33	214-381-7161	Philips Components	77	43	800-447-3762
Control Concepts	96	81	607-724-2484	Pirol, Inc.	85	47	219-936-4221
Corplex	119	90	312-673-5400	Plateau Digital Technology	113	65	916-268-0190
Current Technology Inc.	95	55	214-386-5400	Polyquick	90,112	51,73	708-390-7744
Deltac Corporation	91	52	619-291-4211	Queue Systems	84	66	818-895-8510
Dolby Labs Inc.	44	25	415-558-0200	Rohde & Schwarz, GMBH	87	46	
Dubner Computer Systems	99	72		Sachtler Corp. of America	33	18	516-867-4900
Dynair Electronics, Inc.	83	48	800-854-2831	Schmid Telecommunication	55	32	800-955-9570
EEV, Inc.	63	37	800-DIAL-EEV	SEI Electronics	118	89	215-223-9400
Electro-Voice	105	79	616-695-6831	Shure Brothers, Inc.	1,107	4,60	800-25-SHURE
EMF Seminar	38	19		Sierra Video Systems	53	31	916-273-9331
Full Compass Systems	116	70	800-356-5844	Sony Business & Professional Group	24-25,36-37,66-67		800-635-SONY
Furman Sound	94	54	415-927-1225	The Superior Electric Co.	95	56	203-582-9561
Grass Valley Group	41	22	916-478-3000	Tascam	46	27	213-726-0303
Gray Engineering Laboratories	90	50	714-997-4151	Tektronix, Inc.	19,45,81	13,26,45	800-TEK-WIDE
Hall Electronics	119	91	804-974-6466	Telex Communications, Inc.	43,75	24,41	800-828-6107
Harris Allied	27	15	800-622-0022	Thermodyne	71	40	213-603-1976
Hipotronics Inc.	93	53	914-279-8091	Thomson Components & Tubes	29	16	331-604-8175
Hitachi Denshi America	35		516-921-7200	Utah Scientific	49	29	800-453-8782
Ikegami Electronics Inc.	21	14	201-368-9171	Videotek, Inc.	47,103	28,59	215-327-2292
Image Watches Inc.	94	68	213-726-8050	Vinten Broadcast Inc.	69	39	201-263-4000
Imaging Video Inc.	62	36	212-947-5888	VYVX	79	44	800-324-8686
Intraplex, Inc.	113	64	508-486-3722	The Winsted Corporation	110	63	800-447-2257
Jampro Antennas, Inc.	40	21	916-383-1177	360 Systems	115	80	818-342-3127
Jensen Transformers Inc.	114	67	213-876-0059				
JVC Professional Products Co.	BC		800-JVC-5825				
Leader Instruments Corp.	IBC	2,3	800-645-5104				

DO IT ALL!



NTSC COMPOSITE, SUBCARRIERS,
ALL CHANNELS/VHF/UHF/CATV,
INT/EXT VIDEO & AUDIO MOD
CIRCLE, DEMOD ALIGNMENT
BURST FLAG, BLACK BURST
RGB, Y/B-Y/R-Y, Y/C, REM.
REMOTE CONTROL, ON-
SCREEN PROGRAM,
15 MHz MULTIBURST,
15 MHz VIDEO SWEEP
DOT/CROSSHATCH
MOD STAIRCASE
CHECKER, SYNC
CHROMINANCE
LUMINANCE,
SMPTE BARS
GENLOCK,
100 PRESET
WINDOW
RASTER
Y/C, E
BLACK
SUB
S'

The world of technology has become much less simple than in times past. Equipment once run from a single **composite** feed may now be driven by **S-VHS, Hi-8, or component** signals, not to mention **VHF, UHF, and CATV**. To meet all these expanding signal source needs — and more — Leader introduces the Model 408 general-purpose video test generator.

The **GENLOCKable 408** also produces **multiburst** and **video sweep** to 15 MHz, as well as many more **precision test signals**. And **on-screen programming** provides for easy signal creation for wide-ranging test situations. For routine testing, create up to **100 preset** test setups. And there's much more to this uniquely feature-rich generator. There's even a PAL version available.

Circle (2) on Reply Card for product information.
Circle (3) on Reply Card for product demonstration.

To get the whole long story of Leader's amazingly versatile Model 408, call toll free: 1 800 645-5104. In NY, call 516 231-6900. See what our new do-it-all can do for you!

1 800 645-5104

LEADER
FOR PROFESSIONALS WHO KNOW
THE DIFFERENCE

Leader Instruments Corporation, 380 Oser Avenue, Hauppauge, New York 11788
Regional Offices: Chicago, Dallas, Los Angeles, Atlanta. In Canada call Omnitronix Ltd., 416 828-6221.

JVC's KY-35U and KY-90U...

You'll be attracted
to their
outer beauty ...

You'll fall in love
with their
inner strength

JVC's KY-35U and KY-90U broadcast 3-CCD cameras are as magnificent to hold as they are to behold. Each camera provides incredible balance as well as superb video performance through the use of improved sensitivity chips and the latest microlens technology.

They share 700 line resolution, S/N ratio of 62 dB, and an astonishing sensitivity of f7 at 2000 lux. With an advanced IC card memory system, each camera stores complete settings for automatic one-touch recall.

JVC's optional triaxial system lets you operate the cameras from nearly 5,000 feet away. And its component transmission system lets you output the highest quality composite and component signals for razor-sharp chroma keys.

The KY-35U, with three IT CCDs, and the KY-90U, with three FIT CCDs, will strengthen the power of all your video productions. For more information, call 1-800-JVC-5825 or write JVC PROFESSIONAL PRODUCTS COMPANY, 41 Slater Drive, Elmwood Park, New Jersey 07407.

JVC[®]
PROFESSIONAL