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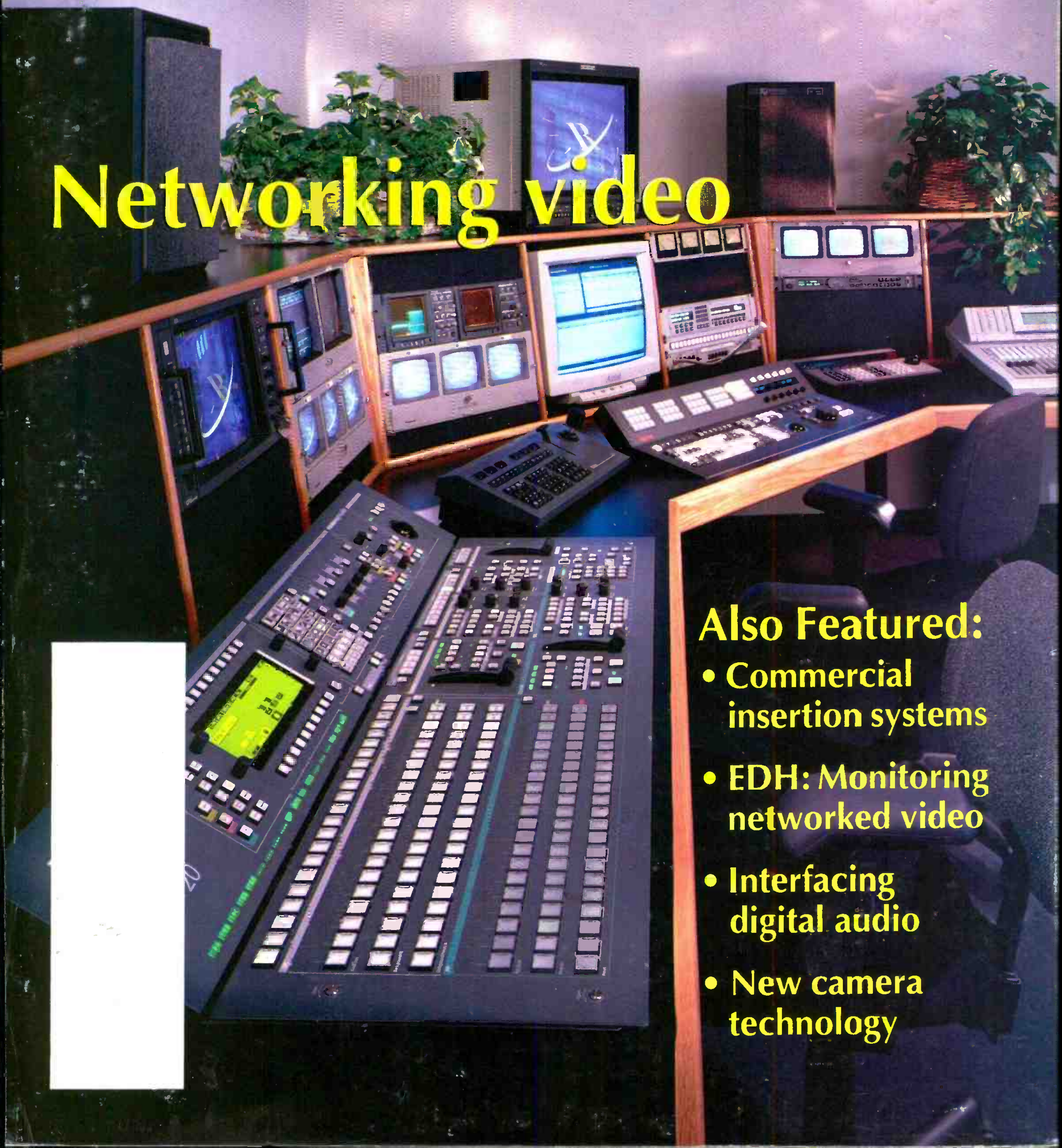

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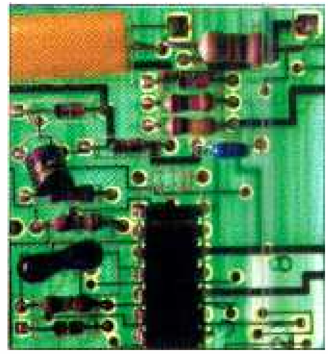
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ON THE COVER: The new Philips Diamond 20 production switcher in use at Realtime Video. The switcher provides advanced digital processing. Photo courtesy of Realtime Video.

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NEWS

By Dawn Hightower, senior associate editor

Tornado twists WCOV-TV tower

WCOV-TV's 800-foot broadcast tower was destroyed by a tornado on March 6. Although the tower was destroyed, there were no deaths or injuries at the station.

The good news was that in less than 12 hours WCOV was back on the air with the emergency generator for TCI Cable and Prattville Cable customers. TCI Cable worked all day and installed a direct link from the studio and fed it to a nearby fiber-optic loop. Within 36 hours, Time-Warner Cable of Wetumpka had restored WCOV to its 16,000 subscribers.

To further accommodate central Alabama, WCOV-TV planned to have a temporary tower constructed and on-line within 10 days to two weeks.

The tower damage was so unusual that video of the wreckage was carried all day on CNN and The Weather Channel.

SBE's EAS Primer

The Society of Broadcast Engineers (SBE) EAS Committee, in cooperation with the Ennes Educational Foundation, is offering the EAS Primer as a guide to building the emergency alerting system.

The primer will explain the makeup of the mandated national/state EAS. Additional topics include: EAS basics, system requirements, operational options and procedures, technical specifications, diagrams, developing a local plan, guide for SECC chairs, Q&As, summary of the network chain, Part 11 information and EAS-related releases. To order the EAS Primer, contact the SBE by phone: (317)253-1640 or by fax: (317)253-0418.

ATSC adopts standards for U.S. ATV system infrastructure

The U.S. Advanced Television Systems Committee (ATSC) has formally adopted two additional standards, "Program Guide for Digital Television," and "System Information for Digital Television," as part of the advanced digital TV broadcasting system being standardized in the United States. These standards supplement standards adopted by the ATSC in 1995 for digital television and for digital audio compression (AC-3).

System Information and Program Guide information are contained in digital messages accompanying the digital video and audio in the digital TV signal. System Information defines the transmission parameters digital decoders need to acquire and process digital and analog transmissions. The System Information database includes frequencies, modulation methods, virtual channel descriptions and other data for the decoder to facilitate user-friendly navigation among the profusion of digital services that will be offered.

The Program Guide document specifies a program guide database transmission standard for broadcast TV applications. Both documents are available on the ATSC WWW home page at http://www.atsc.org.

ATSC appointments

Two recent appointments include Robert K. Graves and Mark Richer. Graves is chairman, succeeding James C. McKinney who retired last December. Since 1991, Graves has been involved in efforts to establish a U.S. standard for digital broadcast television, representing AT&T and the HDTV Grand Alliance. He has served on the FCC's Advisory Committee on Advanced Television since 1992 and on the executive committee of ATSC since 1993.

Richer is executive director. He joins the ATSC after 16 years with PBS where he was vice president of engineering and computer services. He also served as chairman of the System Subcommittee Working Party on Test and Evaluation for the FCC Advisory Committee on Advanced TV Service.

Willi Studer passes on

Founder of the former Swiss Studer Revox Group in Regensdorf-Zurich, Willi Studer, died on March 1. He was 84 years old.

He started his career in 1948 in Zurich by building a small electronics equipment factory. For his tape recorders, he chose the name REVOX. He also developed a big tape machine, the STUDER 27, for radio stations.

In 1960, he started the cooperation with EMT Wilhelm Franz GmbH, Wettingen/Switzerland to open the world market for professional Studer products.

In 1978, Studer was awarded an honorary doctorate in Technical Sciences by the Swiss Federal Institute of Technology in Zurich. The gold medal of the Audio Engineering Society was bestowed on him at the 1982 AES Convention.

In 1990, Studer sold his company to the Swiss Motor Columbus Group. Today, the Studer Professional sector is owned by the American audio group Harman International Industries.

SCTE celebrates grand opening of national headquarters

The Society of Cable Telecommunications Engineers (SCTE) celebrated the grand opening of its national headquarters building on Feb. 29. The building is located at 140 Philips Road, Exton, PA 19341-1318 in the Pickering Creek Industrial Park.

Almost 100 guests had an opportunity to see the facility's on-site cable museum, the conference room, plus the training room with a cafeteria to accommodate the technical training seminars that will be offered at the headquarters.

Sony joins Intercast Group

Sony Corporation of America has joined the Intercast Industry Group (IIG), which was launched last October to promote a digital medium called Intercast.

The IIG is comprised of media and cable companies, software suppliers and communications equipment suppliers. IIG was formed to support and promote the Intercast medium, a new method for delivering Internet content through TV broadcasts into the home computer market.

UCCE to sponsor digital image course

The University Consortium for Continuing Education (UCCE) is sponsoring a course on "Digital Image/Video/Audio Coding: Standards & Techniques," which will be held May 20-21 in Palo Alto, CA. It will focus on standards related to interactive image/video/audio communication and storage devices. The fee is $945 and includes a copy of the textbook.

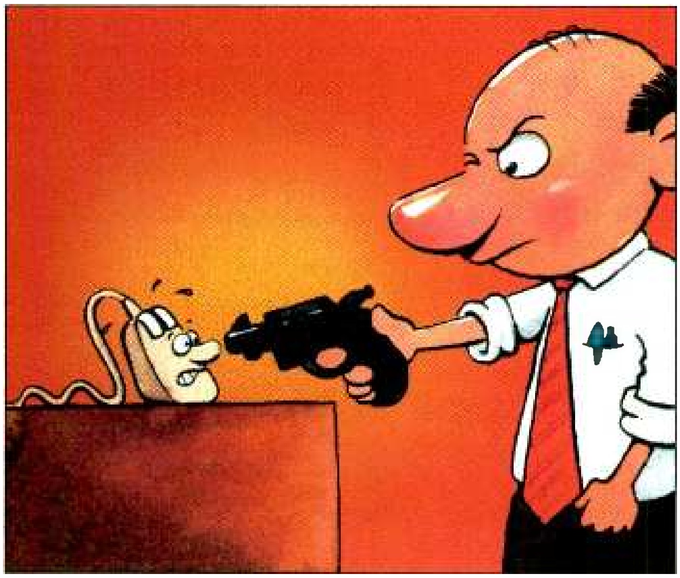
On Aug. 19-22, the UCCE will sponsor a 4-day course, "Error Correcting Codes with Application to Digital Storage Systems," in Boulder, CO. The cost is $1,495 and includes a copy of the textbook. Call Joleen Packman at (818)995-6335 for more information.

Plastic poop

The little suckers are everywhere. Evidence of their presence is seen in most offices and even homes. They're on desks, hidden under books and papers, and even in desk drawers. With their long tails, they sneak onto your desk, disrupting any organized flow of information. They command a huge amount of desk space, and people have to refocus their entire work flow around these little devils.

I hate them. With modern technology, I'd think that someone would have found a way to eradicate these nuisances from the face of the earth. Even though they have short life spans, they continue to proliferate. They often die after coughing up dust and fuzz, creating hazards for everyone around them.

They look like they would be easy to control, but their simplicity belies a narcotic effect. Once touched, users can't get rid of them. Options are few, in fact, their demonic presence has infected the entire industry.



I'm, of course, talking about the computer mouse and I hate it! The guy who thought up the mouse should be strung up by his thumbs and made to type with his nose! Using a mouse is about as useful and efficient as trying to swim with a bowling ball tied to your leg.

Having to use a mouse does nothing but get in the way of productivity and speed. Don't believe me? I'll take on anyone in just about any computer task with a keyboard vs. a mouse-driven program. Give me an ALT+R command for flush right anytime. How about F12 for delete sentence or F11 for delete word. While you're still trying to get that screwy little arrow into some icon about the size of a large period, I'll have already reformatted my page and moved on to something else. I'll have left you in the (mouse) dust.

Want to move, delete or copy text? I can whack a document into shreds and put it back together again with my XyWrite program faster than Zorro can cut a "Z" in your shirt. Try that with your Word or WordPerfect programs and you'll fail miserably. Why? Not because the programs themselves are bad, but because they rely on that damn mouse to do everything. Sure, the mouse can do everything, maybe even enter the text, but it's so slow and cumbersome that even your grandmother typing with chopsticks clenched in her dentures would be faster.

Windows programs totally frustrate me when I can't access a feature without having to use the mouse. What's wrong with using a function key or ALT+ function? If I want to designate F5 to launch Quattro Pro, why can't I? The interface programmers must think those 12 function keys are simply spares to be swapped when the other keys wear out. Why don't the arrow keys work either? Spreadsheet programs seem to be able to use them, why can't Windows? No, you have to use the mouse to get from icon to icon.

Ever use CompuServe WinCIM? The program says you can "custom program your function keys." Wrong. What it means is that you can program an Alt+ number key. Why can't I program the real function keys you software dummies? Why do I have to either use an ALT+ number key or push that plastic cow patty around my desk instead of just hitting F3?

Computers can be made user friendly, but in their zeal to do so much, the interface programmers rely solely on the mouse. The result is an inefficient, time-consuming, ergonomically inefficient, carpal tunnel-inducing and frustrating experience. The other day, my mouse ball was so stuffed with dust bunnies the cursor wouldn't move, or when it did, it skipped. I got so frustrated that I ripped the mouse right off of its cord and threw it across the room. That'll teach the little devil to mess with me!

I just don't understand why someone hasn't written an interface that focuses on *keyboard* control and eliminates as many required mouse functions as possible. Then, I could stop wasting time shoving this computer version of plastic poop around on my desk and get some work done.

Brad Dick, editor

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Little-noticed provisions of the Telecom Act

There are many little-noticed and little-discussed provisions in Section 403 of the 1996 Telecommunications Act, which could have substantial impact on broadcasters and other FCC licensees. Among them are the following.

Foreign officers and directors. Prior to the enactment of the 1996 Telecommunications Act, broadcast and common carrier radio licensees were prohibited from having alien (foreign) officers or directors, and no more than one fourth of the directors of parent corporations of licensees could be aliens. The 1996 Telecommunications Act deleted these provisions. However, limitations on alien ownership of the equity of licensees were not altered in the legislation.

Deletion of silent station authorizations. The 1996 Telecommunications Act added the following provision to Section 312 of the Communications Act:

"(g) If a broadcasting station fails to transmit broadcast signals for any consecutive 12-month period, then the station license granted for the operation of that broadcast station expires at the end of that period, notwithstanding any provision, term or condition of the license to the contrary."

This could be a dangerous provision for long-dark stations and for broadcasters waiting for approval of modifications to commence operations. An FCC rulemaking to implement this statutory provision will commence shortly.

Modification of construction permit requirement for broadcast minor changes.

The 1996 Telecom Act amended Section 319(d) of the Communications Act by striking the last two sentences and inserting the following language:

"With respect to any broadcasting station, the commission shall not have any authority to waive the requirement of a permit for construction, except that the commission may by regulation determine that a permit shall not be required for minor changes in the facilities of authorized broadcast station. With respect to any other station or class of station, the commission shall not waive the requirement for a construction permit unless it determines that the public interest, convenience and necessity would be served by such a waiver."

While some relaxations with respect to obtaining a construction permit for minor modifications will be a boon to broadcasters, the definition of "minor" will have to mean that the change will cause no or minimal additional prohibited interference to other licensees.

It is expected that the FCC will commence a rulemaking proceeding on this matter in the near future.

Supreme Court to hear must-carry case

The Supreme Court has decided to hear an appeal of the recent decision by the U.S. District Court for the District of Columbia, which upheld the must-carry provisions of the 1992 Cable Act. However, the court rejected the request of cable TV operators for an expedited hearing, and as a result, the case will not be heard until this fall, with a decision expected in the spring of 1997.

While the District Court recently upheld the must-carry rules, that decision had weaknesses that could result in a reversal by the Supreme Court. However, the FCC's must-carry rules will remain in effect at least until the Supreme Court issues its decision.

As a result of the continued validity of the must-carry rules, commercial TV broadcasters will have to again go through the process (first done in the summer of 1993) of notifying every cable TV operator in their market of their station's election of either must-carry or retransmission consent status. The deadline for this election is Oct. 1, 1996. Any commercial TV station that fails to make an election will be deemed to have elected must-carry. All elections go into effect on Jan. 1, 1997. Non-commercial TV stations need not make elections since they have must-carry rights, but no retransmission consent rights. Of course, non-commercial stations, like commercial stations, will have to actively review their carriage status on local cable TV systems to ensure that they are obtaining the carriage to which they are entitled.

While commercial stations will have to provide their election to all cable TV operators in their market, the definition of TV market for the purposes of cable carriage rights may be revised as a result of a pending FCC rulemaking and language in the 1996 Telecommunications Act. Although the commission has tentatively concluded in its proceeding that it should continue to use the Arbitron 1991-92 ADIs to define such markets, it nevertheless sought comments on a proposal to use Nielsen DMAs, either in the 1996 must-carry election period, or for elections in 1999 and beyond. ■

Harry C. Martin and Andrew S. Kersting are attorneys with Fletcher, Heald & Hildreth, P.L.C., Rosslyn, VA.

DATELINE: MAY 31

Annual employment reports (Form 395-B) are due to be filed by all stations on or before May 31.

Commercial stations in the following states must file their annual ownership reports or report certifications by June 3: Arizona, Washington, DC, Idaho, Maryland, Michigan, Nevada, New Mexico, Ohio, Utah, Virginia, West Virginia and Wyoming.

TV stations in the following states must file their license renewal applications by June 3: Washington, DC, Maryland, Virginia, West Virginia. LPTV renewals for Idaho also are due by June 3.

Appointment

Harry C. Martin has been appointed by the president of the Federal Communications Bar Association as co-chair of the FCBA's FCC Performance Review Committee. He will work with FCC officials and FCBA committee heads to help streamline FCC processes.

Barrett to leave FCC post

FCC commissioner Andrew Barrett plans to leave the commission soon. His position expired at the end of June last year, but he was expected to stay until late this summer when the commission is scheduled to complete its first wave of rule changes under the new telecommunications law.

Barrett's position will not soon be filled, however, because President Clinton must nominate another Republican who will be acceptable to Senate Republicans.

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EAS update

EAS security

By Leonard Charles

As the industry converts from EBS to EAS, it transforms from a system based completely on operator intervention to one capable of being automated. In the automatic mode, however, the EAS creates new security concerns.

The security of the EBS was totally based on an operator authenticating the received message using specific words in a sealed envelope. This envelope was replaced on a regular basis to minimize the predictability of its contents. Though perfectly acceptable at the time of its origin, this process now seems cumbersome.

Today's world and its technology dictate that a high speed of message dissemination is a top priority, justified by the number of lives that can be saved by such speed. Unfortunately, today's technology also brings with it a challenge to the "hacker," who may find satisfaction from infiltrating the EAS for the distribution and broadcast of fallacious messages.

Alternate schemes

In the new EAS rules, the FCC provides for national-alert security by the same means used in the EBS: the authenticator lists. Yet, EAS equipment can be set to automatically relay messages without operator verification and still be in full compliance. In fact, if a station chooses unattended operation, then by mandate it must, at minimum, set the equipment on automatic relay of the national emergency code and, therefore, lose the security of verification.

The FCC's EAS office admits that the word-comparing form of security is only effective in the first link from the White House to the Primary Entry Point (PEP) stations, because these messages will be non-encoded voice-only and easily authenticated. Beyond that, the message will be EAS-encoded, so only stations opting for manual operation of the EAS equipment will have the benefit of further verification.

Though the FCC did not accept numerous suggestions of electronic security schemes in comments for rulemaking and in petitions to reconsider, it does offer some security suggestions outside of the rules for those willing to put forth the effort.

First, the FCC would consider the use of one section of the EAS header to embed security bits. That section is required to include station call letters or other system identification and is signified in the rules as LLLLLLLL. According to the EAS office, a state, operational or local area may devise a viable scheme to use these eight characters for security instead of identification, and approval will be considered on a case-by-case basis. Because that portion of the header is now required to be automatically embedded into the EAS message by the encoder, users would need to work with manufacturers to facilitate this method of security.

Another method for local-system security that would *not* require FCC approval uses encryption external to the EAS equipment. To use this form of security, a scrambling device is installed at the output of (some or all of an area's) EAS encoders and corresponding descramblers are used at the input of each decoder that monitors those sources. The encryption used must not degrade the digital header to the point of its inability to be accurately EAS-decoded.

With the goal of creating an open architecture system, the FCC felt it could not mandate electronic security. Besides, publishing any encryption system in the rules would immediately render the coding scheme useless. In contrast, a specific region's own encryption scheme can be unique and confidential. ■

Leonard Charles is chief engineer at WISC-TV in Madison, WI, and he chairs the SBE National EAS Committee.

By Richard A. Mizer

Transporting component digital video

ANSI/SMPTE 125M-1992 defines an interface for System M (525/60) digital TV equipment based on CCIR Recommendation 601. This standard has applications over distances up to 1,000 feet. In April 1994, Pacific Bell introduced a service to transmit component digital signals over the telephone network. Advanced Video Service-Component Digital (AVS-CD) provides for the transport of 4:2:2 video, compressed to 45Mb/s, over unlimited distances. Video quality is excellent, even after several compression/decompression stages.

Extensive testing has taken place in Pacific Bell's research facility in San Ramon, CA, and with Sunset Post, a production facility in Hollywood, as well as ongoing testing with other research, standards and test equipment facilities to determine the suitability of the video quality. The concern has been that while 45Mb transmission was acceptable for review of work in progress, it was insufficient for transmission of the master footage. Test results conclude that it's possible to use this technology, especially when the final product is destined for TV distribution.

Background

Although early experiments with digital technology were based on sampling the composite NTSC signal, it was realized that for the highest-quality operation, component processing was necessary. Recommendation ITU-R BT.601 (formerly CCIR Recommendation 601) is not a video interface standard, but a sampling standard, that evolved out of a joint SMPTE/EBU task force to determine the parameters for digital component video. The sampling structure defined is known as 4:2:2 and specifies orthogonal sampling at 13.5MHz for luminance, and 6.75MHz for the two color-difference signals.

Working group T1A 1.5 multimedia coding and performance of the ANSI accredited T1 committee has an active project developing the performance criteria for the transmission of component digital component signals. The working group has reached a consensus on a general model to enable component digital video transmission over a telecommunications network. In developing this proposed standard, they needed to understand the use and interface requirements of the TV and motion picture production industry so that the system meets the needs of the potential users.

Questions regarding this model were sent to interested parties to solicit user input to the development of this model. One current standard that was considered came from the European Telecommunications Standards Institute, ETS 300 174. It constitutes a common standard for the coding and transmission of component TV signals at bit rates in the range of 34-45Mb/s in the format specified by CCIR-601. The standard embraces the coding algorithm needed for digital picture coding at about 34 and 45Mb/s, and their interface with the transmission network.

Provision is made for the transmission of audio and teletext services to accompany the video and for the application of scrambling for conditional access. ANSI has recently approved the U.S. adaptation of this standard for interoperability with the European Community. SMPTE has organized working groups to address packetized TV interconnectivity and TV compression systems.

The component codec

When transmitting digital 4:2:2/525 signals, the I/O interface provides for the separation of horizontal line synchronism from the video signal, which consists of three components Y, C_r and C_b. The original bit rate is reduced to less than 40Mb/s by first mapping the video signal with the DCT and then by coding the transformed digital signal according to run-length technique and entropy code.

DCT operation is performed in the DCT while entropy coding is performed in the buffer and processor unit, which also provides a buffer to adapt the variable coding rate to the fixed line bit rate. The bit-rate reduction is achieved by applying the DCT algorithm first on rows and then on columns of each 8x8 size block of luminance (Y) and chrominance difference signals (C_rC_b). Two different processors operate in parallel, one for luminance, the other for chrominance differences C_r and C_b alternately. The computational structure of DCT has different modes of operation that are selected based on the occupancy of the buffer store at the codec output. These modes include scaling of transformed data with a multiplicative coefficient adapted in relation to buffer occupancy. (See Figure 1.)

At the output of the scaler, 12 bits are

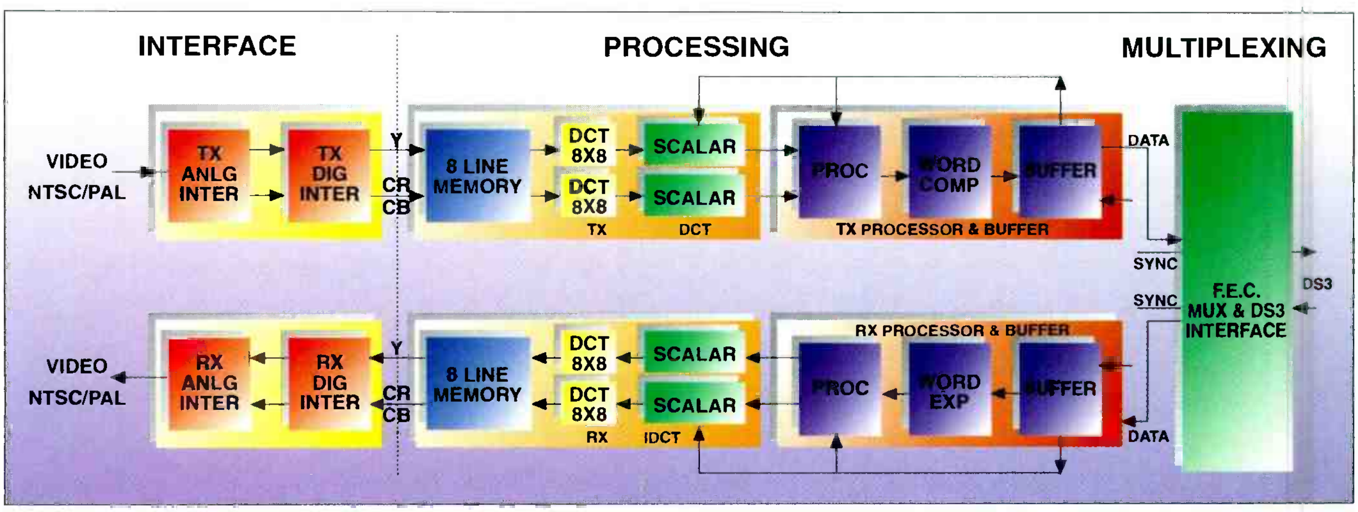

Figure 1. Basic block diagram of the video portion of the codec used by Pacific Bell to provide AVS-CD service.

retained for data to be sent to the following data processor, but only a maximum accuracy of 10.5 bits per word is used in the subsequent parts of coder. Data that are different from zero are sent transparently to the variable-word length coder (VWLC), which reduces the average rate considerably by coding runs of zeros as run-length words and by assigning shorter codes to the few most likely output values and longer codes to the many unlikely output values. The output of VWLC is smoothed to a constant bit rate for transmission in the word compactor and buffer.

In order to eliminate the effect of transmission errors, the video signal is processed according to a forward error correction (FEC) technique. It is an interleaved code that is able to correct single and double errors, as well as error bursts up to 32 bits in a 272-bit block. The encoded video signal is then multiplexed into the DS3 frame together with associated signals, like sound programs or control channels in the DS1 stream. The line interface function inserts the proper DS3 control bits and framing information.

Codec testing

The first step of the test process was to make multiple-generation recordings through the codec. Using an uncompressed compilation of test signals recorded on D-1 as test control, the tape was comprised of three different types of signals:

- Dynamic test signals;
- Static test signals; and
- Live action.

Many of the signals were chosen because of the dynamically changing nature of their datastream, which should put the most stress on the data-recovery portion of the unit.

Initial indications showed no serious errors in data transmission. However, the video range indicators showed numeric values outside of the recommended range, which indicated that the codec was changing the values of the signals as it passed through the compression/decompression process. Further testing was required with each subsequent revision level, and minor power consumption, heat failure and buffer capacity issues were identified and resolved. The final revision level was provided in June 1994, and after lab evaluation was released for general deployment.

Future directions

Over time, it may be possible to transport uncompressed digital video using SONET/ATM technology. The problem with uncompressed transmission is the incompatibility with the phone network of the 270Mb stream, although tests of serial digital transmission over fiber have been conducted as part of this project. Options under evaluation include:

- Local transport over fiber;
- MPEG-2 4:2:2 Profile using Sony Serial Digital Data Interface (SDDI);
- Computer networking using transmission media, such as Fibre Channel;
- Development of 270Mb ATM/SONET user network interface.

Fiber: Manufacturers of fiber-optic transmission systems for digital video provide a solution for transmitting serial digital signals over distances of up to 10km (newer high-power lasers may increase that distance to 40km) in a point-to-point configuration. External audio channels and other data transmission are not inherently provided for, and it is not clear that existing fiber facilities will provide error-free transmission.

While this technology appears to meet the requirements of the production industry for interstudio transmission, its limitations may hamper its usefulness. It requires an "overlay network," which phone companies are reluctant to provide, and its distance limitations prevent wide area networking.

SDDI: Next, is the Sony Serial Digital Interface (SDI) protocol (standardized as SMPTE 259M to carry baseband digital 4:2:2 video and audio). To expand this network's capability, Sony selected SDDI, a variation of SDI that adds data communication capability, but the video signal is compressed using MPEG-2 4:2:2 profile.

Sony's SDI and SDDI provide a clear path toward LAN-based media facilities using new and traditional storage and switching equipment. The obstacle remains in the wide area networking of 270Mb traffic, where available networking options, such as ISDN, will be a bottleneck for real-time video transmission.

Fibre Channel: a general name for an integrated set of standards developed by ANSI for new protocols requiring about a gigabit per second that can run over existing optical fiber or coax cable allowing an open architecture framework for a wide variety of TV and computer equipment.

Although it can be employed in several ways, for video data applications fiber channel could be used in a configuration similar to a TV router, with a cable connecting each device to a central switch. Unfortunately, the basic speed of 800Mb/s creates even greater problems for transmission over phone networks,

ATM/Sonet: Unlike other communication technologies, ATM is designed to accommodate a variety of traffic types with differing quality of service characteristics. ATM assigns all traffic to one of four basic classes:

1. Class A Service — the data rate is constant and a timing relationship exists between the source and destination (e.g., voice or fixed rate video);
2. Class B Service — variable bit rate service (e.g., differentially encoded video);
3. Class C Service — the connection between the source and the destination is asynchronous and the data rate can be variable (e.g., file transfer);
4. Class D Service — connectionless data transport (e.g., SMDS).

ATM/SONET is best-suited for long-haul use outside of the facility and may not be optimized for an in-house studio network. However, the 155Mb/s payload limitation of STS-3/OC-3 means that the ATM cells representing a particular 270Mb/s circuit have to be interleaved across a pair of OC-3c channels.

A target scenario for tomorrow's production and post-production facilities might be the coexistence of uncompressed non-real-time video and compressed real-time video. Few compression schemes can hold up to the rigors of production. To maintain the high level of picture quality required in multigenerational TV production and post-production applications, what is required is a sophisticated "compression engine" that operates on the 4:2:2 studio video components using only intrafield techniques with compression ratios no more than 2-4:1. MPEG has proposed the 4:2:2 Studio Profile. I-frame only (or I-B. I-P) with a group of pictures (GOP) of 1-2.

But the final consideration that must be included in the choice of technology to provide for the transmission of component digital TV signals over the telephone network is the economics. For example, R/Greenberg Associates plans to have ATM technology become the backbone of a transparent studio with the capability to run real-time video in Los Angeles from a video disc in New York. The economics of this are compared to AVS-CD, for which a coast-to-coast link would run an estimated $400 an hour, but which is dedicated to just one task — editing video. While ATM can also connect computer and voice resources as well, the cost of investing in the hardware, and the near-prohibitive cost of a full-time ATM link — which can run between $20,000 and $70,000 a month — is difficult to justify.

The goal is to achieve an improvement in connectivity at an attractive price, while being able to carry all video service variants (uncompressed, compressed, non-real-time and real-time) on the same network. ■

Richard Mizer is a technology consultant for Pacific Bell, San Ramon, CA.

"CLEARLY THE RESULT OF AN EARLY EXPERIMENT IN COMPRESSION..." MUSED WILCOX.

By Curtis Chan

Power and influence

The past decade has changed the corporate landscape of broadcasting just as it has for other industries. Downsizing, restructuring and re-engineering are terms with the same bottom-line effect — company attrition. Personal power, the ability to communicate and manage information to advance a personal or business agenda, is critical to individual or business success for those who are just starting out in management and for those who are moving up the ladder.

This month, we will focus on the ability to leverage power and influence so you can make a difference. One book with impact that has come out is Robert Dilenschneider's "Power and Influence."

In his book, Dilenschneider wrote, "In order to influence opinion, you have to be an able communicator. If you can't communicate, you won't influence opinion. And if you can't influence opinion, you won't get very far in management."

Communication is the heart of management. Your ability to create clear and distinct messages from solid thinking is the first goal of a good communicator.

With good communication skills, you are apt to be more recognized, hence your influence circle grows. For the engineer turned chief engineer or engineering manager, you must focus on your communication and practice and hone your communications skills. Good communication skills are the foundation to building a power base. And one of the fundamental tools used to develop a power base is to build interpersonal relationships (and earn credits for your favor bank).

Building a favor bank

Increasing your circle of relationships can help stack winning credits in your favor bank. The concept of the favor bank is to do favors for others, so when you are in a time of need, you can "draw" favors from your bank, which will increase your influence.

The favor bank is like a savings account where the money (favors you do) you put in gains interest (influence) over time. But when you stop putting in money or pull out all of your money, your bank balance (your ability to draw more favors) goes to zero. In other words, the favor bank operates similar to the sayings, "what goes around," "do unto others as..." and "I'll scratch your back if you scratch mine."

Leveraging favors

Now it's time to leverage the bank to your advantage. First, get credit for your favors, and second, advertise your favor bank balance. There's a saying in the movie business about getting ahead, "Early to bed, early to rise and advertise like hell!" Advertise your balance discretely and softly. If done properly, your influence will increase with each gesture of recognition from your peers.

The last recommendation is to keep balances abroad. Now, more than ever, leveraging your influence circle worldwide is a crucial strategy in keeping your position and perceived power base intact.

Investing in the favor bank

1. Be responsive, not offensive. You never know who's going to put an obstacle in your way.
2. Support the rainmakers or the members of the favor bank when they call. No matter how inconvenient it may get, you want to maintain an active balance in the bank.
3. As in any networking community, find out whom you need and who needs you. This balance should be split between your personal account and your business account. In order to draw from the bank, you must also perform favors.
4. Plan on drawing from the bank when change is imminent, like launching a program or fixing a large problem. In each case, choose carefully the people that can help make the change easier. Also, get authorization before you tap into the savings account...especially if you're a manager and the CEO or president holds the files where the balances are kept.
5. Look for ways to keep a good credit rating at the favor bank. Do this by performing good deeds and mixing it with the ones nobody wants to touch. This also helps build good will.

Influential leaders

More fundamental than the favor bank is identifying characteristics that are common to all influential leaders. Here is a summary:

1. Focus your energies and your objectives with passion and a sense of urgency.
2. Declare victory. If you're in a position of power, look for opportunities to declare victory. If a restructuring has just occurred and you sense that morale is fading, then focus on several short-term goals that can easily be achieved; achieve them and then get the message out of the accomplishments.
3. Bestow honor carefully.
4. Make change an ally. As Frank Zappa used to say, "Change is not only necessary, it's inevitable." When change occurs, neutralize the risks, find the opportunities and make sure they come true and publicize them.
5. Make change positive, bold and promising. Point out how any change benefits the company and your employees.
6. Pin on medals for small achievements as well as big ones. Reward the rank and file as well as those on top.
7. Empower the company. If you're going to get things done, get away from the Ivory Tower syndrome and delegate responsibility downward.
8. Recognize when your influence is growing. Always be on the alert to see when your boss asks you to prove your ability or to exert influence.
9. Know when your influence is shrinking. Be wary when you're being taken off of the short list or when you're given impossible assignments that could add a black mark on your record.
10. Know when your influence status is undecided.
11. Use your influence as much as your authority. Insecure leaders and managers lean on their authority, while astute leaders and managers use motivation, persuasion and positioning to influence people, hence creating a higher perception of power.
12. Associate with the right people and get involved with projects that deliver impact. Set a style for your efforts and focus on issues with tenacity. Be energetic and low-key, but keep visible enough to be noticed.
13. Always serve your customers' values first. Remember, "service before sales."
14. Be heard in the right circles. Having the perception of influence also means being in the right circle, gaining recognition for your achievements and making sure that the right people know of your accomplishments. ■

Editor's note: Robert L. Dilenschneider is the author of "Power and Influence," Prentice Hall Press. Some excerpts in this article were taken from the book.

Curtis Chan is president of Chan & Associates, a marketing consulting service for audio, broadcast and post-production, Fullerton, CA.

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Circle (7) on Action Card

By Sally Heldrich

Production on a shoestring

We'd all rather work with generous budgets and all of the latest toys, but "production on a shoestring" means accepting real-world limitations. You have to separate what's necessary from what would be nice from what's out of the question — and then make the project fly.

First, be prepared to say no. Often clients who are working on a shoestring haven't done TV production before, and they don't have a realistic understanding of what's required and what it costs.

A shop owner may not understand why you can't just take a few more pictures of his store. After all, your crew is there — what's a few more minutes of tape? Having a monitor along in this situation can help a lot. Show the proprietor the shot you've just set up and then turn the camera 180°and show what *that* looks like in comparison. If you do go ahead with the extra shooting, get written authorization for the extra work and cost overrun.

If clients call to inquire about the hourly rate to rent your studio, make sure they don't plan to rent the studio for an hour to tape a 1-hour show.

Working inexpensively is a discipline that requires you to work quick and work smart. It takes a base of solid competence, plus a lot of experience to produce good work on a limited budget. It also takes creativity and the ability to think on your feet. This is the skill that tells you to bounce light off of foamcore when there are no reflectors in your light kit, for example.

This work takes confidence, too. You have to be sure enough of what you're doing and why you're doing it to risk experimentation and the possibility of looking different on the set. Your proof will be in the tape.

Creative control

For some shoestring productions, you'll be asked to handle a job from concept through completion. When that happens, you're ahead of the game. You can write a script to be shot in one location. You can design a set that's lightweight and quick to build. But whether you've done the creative or not, if you're working with a small budget, some practices always apply:

- *Make a plan and stick to it.* Everyone says this, but when you're doing production on a shoestring, it means a lot more. Be efficient, be careful and be prepared for surprises. You can't control everything, but you can anticipate problems. Be ready to deal with them. For example, you may not be able to work with wireless mics, but you can make sure to frame your shots carefully and dress the cables well. It's a small thing that makes a big difference. Experience plays a role here, of course, but being aware of the variables is what's most important.

- *Seek out a multitalented crew.* If you work with an in-house staff, make sure that everyone has good fundamental skills and that they have opportunities to develop additional expertise in the area(s) of greatest interest to them. When you hire outside crew, choose specialists with a "pitch-in" attitude.

Anyone who's done production on a shoestring is familiar with writer/producer/videographers, shooter/grip/recordists, client/talent, director/TDs and CG/DVE/tape operators. The real stars in this universe know how to do lots of jobs, and how (and when) to apply that knowledge, depending on their role at each job.

When you have a good, multitalented crew, and the producer/director has made sure that everyone knows just what the job is and what their roles are, the production can rise to a higher level on creative energy alone; not to mention that this kind of teamwork can be lots of fun.

- *Use the right equipment.* Understand the operation of your gear and take good care of it. Know what each piece of equipment can and can't do well. Production on a shoestring will constantly attempt to stretch the limits of the equipment at your command.

You may also find it helpful to study older shows and production techniques. Lots of new equipment is created to make it easier to do something that creative people found ways to make old equipment do; but be careful here. Time is at a premium and you have to make sure the effect you're going for will serve the project's basic communication need. When time is not a factor, experiment and push the envelope to see what your equipment will do.

- *Stay focused on the essentials.* Remember that you're working with light and sound. The camera is the eye of the audience. You may think it's looking at an actor, a product or the trees, but what the camera sees is light. If you understand light, you can get pleasing pictures no matter what camera you use. You may have to start with higher light levels overall or you may need to plan fewer or tighter shots. Every camera has a range of sensitivity. Know it, and use it with the proper lighting.

Don't forget sound. In editing, a well-placed sound effect has real punch. Well-chosen music is a good way to enhance pacing and create mood. Combined sounds add power to a show. When you're shooting, never record video without sound, even if you think you won't need it, and even if you're working alone. You can always choose not to use the natural sound you record, but there's rarely money for a foley stage when you're doing production on a shoestring.

A few suggestions

There are lots of ways to add to your capabilities inexpensively. Renting equipment may be an option. You can get some lighting instruments, microphones or even a doorway dolly for less than $50 a day. Your contact at the rental house can be a valuable resource, too. Don't hesitate to ask what equipment is recommended to solve a particular problem. Get on mailing lists and ask to be notified of special seminars. These seminars may or may not be organized to promote particular equipment, but you can learn a lot, in any case.

Your collected "bag of tricks" may contain plenty of odd, inexpensive items. For instance, always carry plenty of clothespins and a selection of filters in your light kit. Even if you don't have filter hardware, filters can be pinned to barn doors, which will let you combine tungsten lamps with sunlight or fluorescent light in your shots.

Over time, you'll assemble plenty of other tools and techniques that will allow you to do great work without the high costs. But they'll all be based on these ingredients: attitude, skill, creativity, preparation and attention to the basics of light and sound. Stir well and see what happens.

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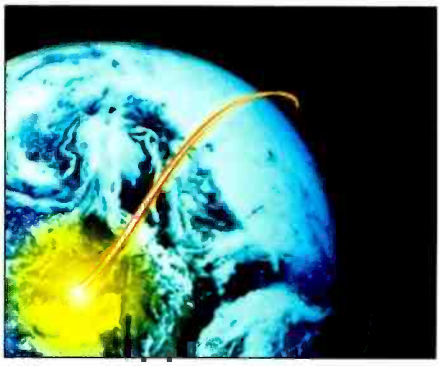
By Carrie A. Poland

Finding manufacturer web pages



Numerous new web pages appear everyday on the Internet by companies joining the rush to make information and products easily accessible to users. Unfortunately, there is no comprehensive Internet yellow pages to find or keep up with the addresses of every new and existing web site. The only way to find things on the Internet is to look for them, and that means using a web searcher.

A web searcher, such as Yahoo or WebCrawler, works in conjunction with a web browser, such as Netscape or Spry Mosaic, to help users find web pages. A web page is a site where people can access data, such as background on the particular company running the page, its products, new information and customer comments. Through these pages, users generally will have the ability to download needed information, contact the company via E-mail and search for additional information through hypertext links.

Using one web searcher is much like using any of them — users insert the key word(s) of what they are looking for. The searcher tries to match the key words with words in the documents that it has access to and then a brief description and offers hypertext links to the web sites that had matching entries. Because some searchers catalog more information than others, the number of possible web sites listed after a search will vary.

There are three basic categories that broadcasters will likely use to search for information — a specific company name, a specific product name and a general type of product. To demonstrate what a typical search for information may yield, these categories were each given a topic and a search was run for them in four different web searchers — Yahoo (http://www.yahoo.com), Lycos (http://www.lycos.com), WebCrawler (http://www.webcrawler.com) and Alta Vista (http://www.altavista.digital.com).

By company name

Looking for a specific company name is usually black-and-white; either the company has a web site or it doesn't. But even if a company does not have its own site, a search can produce further information about the company, such as product reviews, articles or product help that may exist on other web sites.

The company name randomly selected for this search was Tektronix. The name was found in all of the web searchers, but each one came up with a different number of possible web sites. Yahoo found four, including the company's web site, as well as the sites of other companies that feature Tektronix products.

The other searchers came up with more, the most being from Digital Electronic Corporation's recently opened Alta Vista, which found more than 27,000 documents that included the name Tektronix. There were web sites for specific Tektronix products, entire catalogs, jobs with the company and a site that offered a demo of the company's Interactive Application Note.

Depending on the kind of information needed about a company, having 27,000 entries to look through could be a plus or a minus, but searchers do help users by first listing those documents that most closely match the search phrase.

By product name

Trying to find a product by name is usually a yes-or-no search, as well. If the company doesn't have a web site, the searcher may or may not be able to come up with any other documents mentioning the product. Other web sites not associated with the company may have information about the product, which could be helpful for gathering data from sources outside the company. If the manufacturer does have a web page, users will likely receive links to the site, as well as the specific product page within the web site.

For this category, Viewgraphic's Dataview SDA-21 was chosen as the search item. Three of the four searchers found matching entries (Yahoo did not find any). Lycos found four and WebCrawler found two, but the links provided by both would only link users with the manufacturer's web page and other points within that same web site.

Alta Vista, like some other searchers, lets users choose to search for the words as a complete phrase or as separate words within the same document. When using the product name as a complete phrase, it came up with two entries that gave users links to Viewgraphic's web site. Searching for Dataview SDA-21 as two separate words brought in 300 possibilities, which would link users to Viewgraphic's web site, as well as offering web sites where users could read reviews about Dataview and get help in using the product.

By product type

Searching for a type of product is sort of like watching the home shopping channel — you get to shop from the comfort of your own home (or desk), but you get to search for the products that you want when you want them.

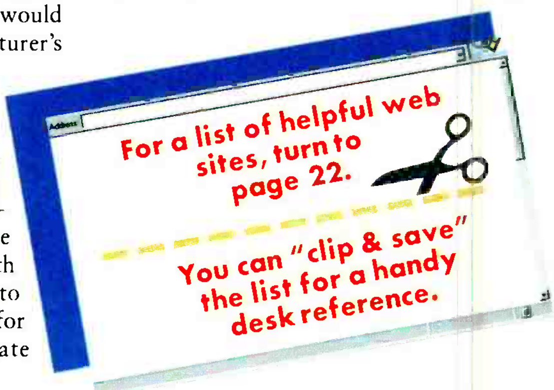
Users will find information that will link them to manufacturers sites, as well as catalogs, shopping sites, forums where products and usage can be discussed, articles about companies and products and product reviews. Because the topic is more general, there will be a lot more information to sift through to find manufacturer sites.

For this search, audio amplifiers was the topic used. The web searcher that came up with the least extraneous information was Yahoo with seven matches. Five of the entries it listed linked users with manufacturer's web sites, including Ashly Audio, BGW Pro Audio, Marchand Electronics and Opamp Labs. It also listed two distributors of audio amplifiers.

The other searchers came up with more matches, ranging from 181 to 400. Lycos had several links to manufacturers, but it also had a lot of entries for audio shopping and general interest sites. Alta Vista's search yielded 400 matches with many products that would link users with manufacturer pages, as well as links to sites for reviews, shopping and help.

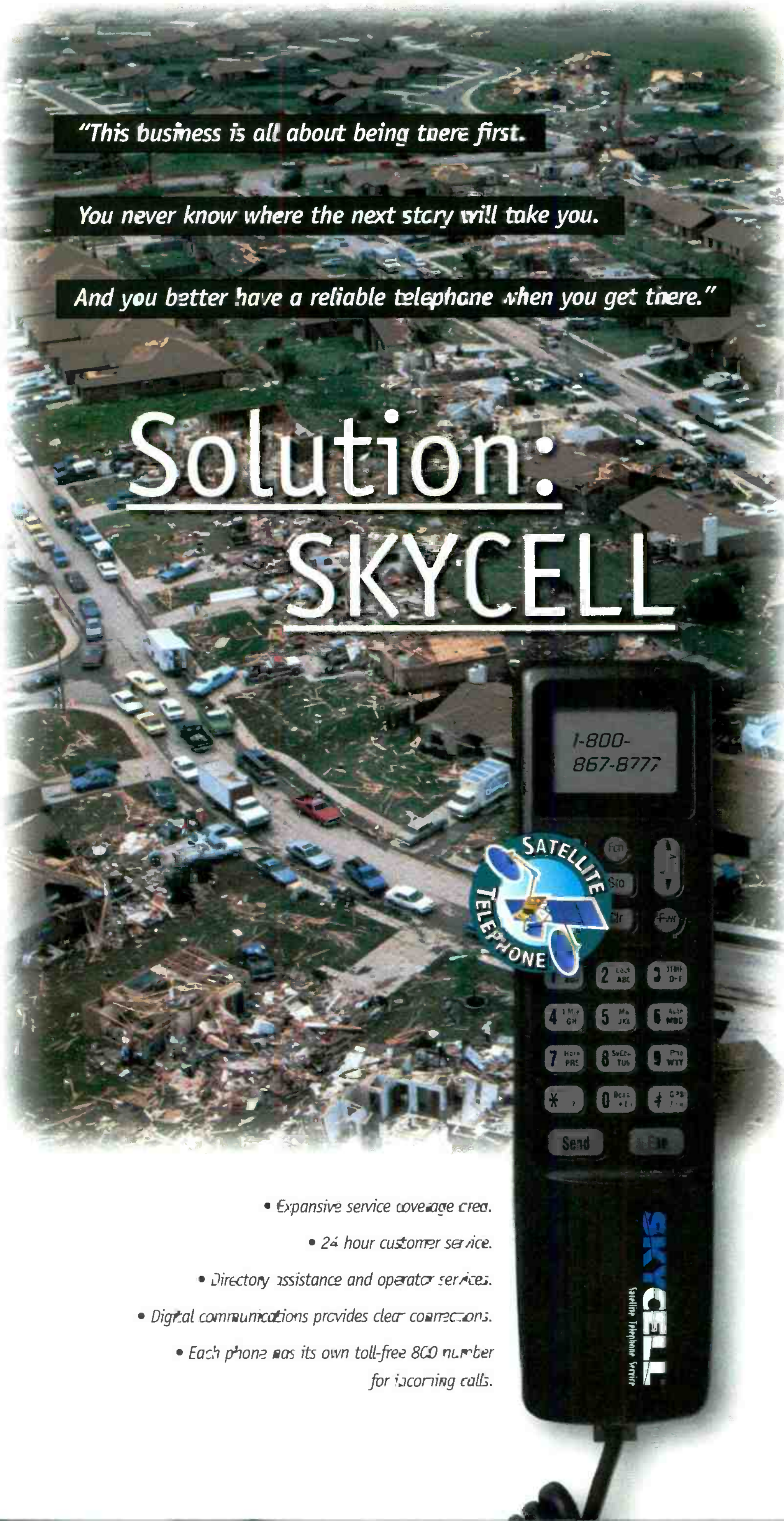
Spelunking

There are more topics and more web searchers than the ones discussed here. With all of the information available, users shouldn't have trouble finding information. It's just that finding the needed information may take a little time, patience and exploring. ■



A few manufacturer sites

Abekas: http://www.abekas.com
ACE Audio Visual: http://www.avinfo.com/ace
Adcom Electronics: http://www.adcom.com
Andrew Corporation: http://www.andrew.com
Ashly Audio: http://www.ashly.com
Audio Broadcast Group: http://www.abg.com
Audio Processing Technology: http://www.aptx.com
Avid Technology: http://member.aol.com/AvidNewMed/Avid.html
B&B Electronics: http://www.bb-elec.com
Baydel Ltd: http://www.baydel.com
Bell Microproducts: http://www.bellmicro.com
BGW Systems: http://www.bgw.com
Broadcast Electronics: http://www.bdcast.com
Burk Technology: http://www.burk.com
BSS Audio: http://www.bssaudio.co.uk/bss
Caligari Corporation: http://www.caligari.com
Canon: http://www.canon.com
Carver Corporation: http://www.carver.com
Circuit Research Labs: http://www.crlsystems.com
Communications Specialties: http://www.commspecial.com
Data Translation: http://www.media100.com
Datatek: http://www.datatek.com
Dialog4 System Engineering GmbH: http://www.proaudio.de/dialog4
Digital Processing Systems: http://www.dps-inc.com
Discreet Logic: http://www.discreet.qc.ca/
Dolby Labs: http://www.dolby.com
Dynatech: http://www.dynatech.com
EAO Switch Corporation: http://www.eaoswitch.com
E-mu Systems: http://www.emu.com
ENCO Systems: http://www.enco.com
Eventide: http://www.eventide.com
Extron Electronics: http://www.extron.com
FAST Electronics: http://www.fast-multimedia.com
Fluke Corporation: http://www.fluke.com
Focal Press: http://www.bh.com/bh/fp
General Instrument Corporation: http://www.gi.com
Genesis Microchip: http://www.genesisus.com
Gentner Communications: http://www.gentner.com
Global Access: http://www.glblaccess.com
Hallikainen & Friends: slonet.org/~hhallika
Harris Broadcast: http://www.broadcast.harris.com
Harris Corporation: http://www.harris.com
Hewlett-Packard Corporation: http://www.hp.com
International Tapetronics (ITC): http://www.ict-net.com
Intraplex: http://www.intraplex.com
Jampro Antennas: http://www.jampro.com
Kintronic Laboratories: http://www.kintronic.com
Knox Video: http://www.knoxvideo.com
Leitch Inc.: http://www.leitch.com
Lightworks: http://www.lightworks.com
Logitek Electronic Systems Inc.: http://www.broadcast.net/logitek
LPB: http://www.lpb.com
Matrox: http://www.matrox.com
Microwave Filter: rway.com/mwfilter
Mobile Satellite Products Corporation: http://www.mobilesat.com
Monster Cable: http://www.monstercable.com
Navitar: http://navitar.com
Neumann/USA: http://www.neumannusa.com
Nvision: http://www.pic.net/nvision
Odetics: http://www.odetics.com
Opamp: http://www.opamp.com
Opcode Systems Inc: http://www.opcode.com
Optibase: http://www.optibase.com
Philips: http://www.philips.com
Philips Semiconductors: http://www.semiconductors.philips.com
Power Trends: http://www.powertrends.com
Reed Reference Publishing: http://www.reedref.com
SB Electronics: http://www.to-be.com/sbe
Scitex: http://www.scitex.com
Scott Studios: http://www.highbbs.com/scott.htm
Sennheiser Electronic Corporation: http://www.sennheiserusa.com
Silicon Graphics: http://www.sgi.com
Sony: http://www.sony.com
Svetlana Electron Devices: http://www.svetlana.com
Tektronix: http://www.tek.com
Telecast Fiber Systems: http://www.telecast+fiber.com
Telect Inc: http://www.telect.com
Telos Systems: http://www.telos.com
Toshiba: http://www.toshiba.com
Tripp Lite: http://tripplite.com
Truevision: http://www.truevision.com
Videomedia: http://www.videomedia.com
Viewgraphics: http://www.viewgraphics.com
Xing: http://www.xingtech.com
ZERO Stantron: http://www.zerocorp.com/stantron.htm



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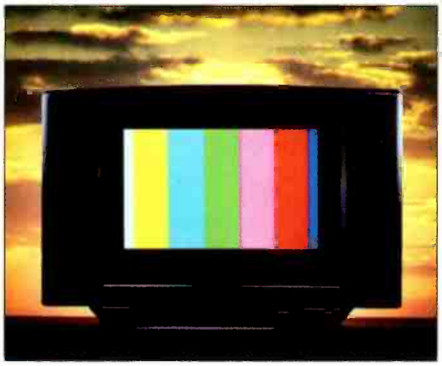
Circle (19) on Action Card

By Louis Libin

The Grand Alliance/FCC standard — What's here



The Grand Alliance (GA) consortium has ceased to exist, and we are left with a terrestrial transmission standard that will soon be an FCC standard. You should note that the Grand Alliance/FCC standard is a transmission standard only; it is not a production, display or user-interface standard. The standardization is the definition of the bitstream and a technique for its digital transmission in a 6MHz RF channel.

The Grand Alliance ATV system

There is no question that the GA system will supply the home with superb images and spectacular sound, while also, as part of the National Information Infrastructure (NII), relaying digital data. The GA ATV system is based on the MPEG-2 video compression and transport protocol, and includes the ability for multiple transmission formats, Dolby AC-3 digital audio and vestigial sideband digital modulation.

The six important system functions of the system include format selection, video coding, audio coding, transport, transmission and interoperability.

Format selection

Many TV applications have different performance requirements. This fact, combined with the fact that the transmission will be digital and that there will be space available for other data, provides the appeal of multiple formats. The multiple formats allow tradeoffs specific to each family of program material. Also, the digital representation and processing in an ATV system allow the support of more than one scanning format, while facilitating interoperability among formats and different video services and applications. The GA system provides well for the different format selections.

Video coding

The GA system uses a motion-compensated discrete cosine transform (DCT) algorithm for compression of video signals. DCT exploits spatial redundancy, and motion compensation exploits temporal redundancy. DCT was chosen for its good energy-compaction properties, and the many fast algorithms available afford low-cost implementation.

In addition, the system employs source-adaptive coding and other techniques for greater coding efficiency. MPEG-2 syntax from the Moving Picture Experts Group will be used, and the MPEG-2 tool kit supports most of the compression algorithms used by the system proponents. The video encoder has been designed to support 1,080-line interlaced and 720-line progressive formats. It also supports bidirectional-frame (B-frame) prediction, wide motion-estimation ranges, field and frame motion vectors, and adaptive field and frame DCT coding, as well as forward analysis with localized quantization-level control and automatic film detection for high picture quality.

By predicting the current frame from past and expected frames, B-frame prediction improves compression efficiency. The wide motion estimation ranges (up to ±127 horizontal and 31 vertical in the prototype hardware, but fully compliant with MPEG-2 requirements) are needed for tracking fast motion. The field and frame motion vectors and the adaptive field/frame DCT coding greatly improve the compression efficiency of the 1,080-line interlaced format. The forward analysis with localized quantization-level control further decreases the visibility of the compression artifacts by exploiting the characteristics of the human visual system. The video decoder has been designed and tested to support all of the encoder's features.

With the approval of the Grand Alliance/FCC HDTV standard, home theaters will soon feature 16x9 widescreens, like this CinemaScreen TV G34170AT from RCA.

Audio coding

The GA system improves audio quality. Discrete multichannel digital audio works well for digital high-definition widescreen pictures resulting in sound to the home theater that is better than CD quality. The audio is supplied by Dolby Lab's AC-3 digital audio compression system. The AC-3 perceptual coding system encodes discrete multichannel sound (left, center, right, left and right surround and low-frequency enhancement channels) into a bitstream at a rate of 384kb/s.

Transport

The ATV system owes much of its power and flexibility to the packetized transport technology employed for the broadcast delivery of the multimedia service. The MPEG-2 systems standard, on which the GA HDTV system is based, encapsulates the compressed video, audio and auxiliary data bitstreams in information packets of a fixed length. These packets are well-suited for terrestrial channels, where transmission errors and data loss are likely.

Besides packetization, the transport technology provides two other important functions: multiplexing and synchronization of the services that comprise a program. The transport technology creates a stream of fixed length information packets from a variety of elementary bitstreams. Each packet contains only one type of data: video, audio or ancillary. Because there is no fixed mix of packet types, the transport mechanism can dynamically allocate the available channel bandwidth for complete flexibility.

Each transport packet consists of a 4-byte packet header followed by 184 bytes of payload. The header includes means for synchronizing packets and identifying payload service. The sync byte, always the first byte of the packet header, contains a fixed pre-assigned value. A 13-bit field called the packet identifier, also found in the packet header, affords a way of multiplexing various elementary bitstreams. Since the location of the packet identifier field is fixed, packets corresponding to a particular elementary bitstream are simple to extract once packet synchronization has been established.

Transmission

The transmission system uses a vestigial sideband (VSB) technique. Although the spectrum of VSB resembles that of other digital modulation methods, the signal has additional features that enhance it when recep-

Continued on page 134

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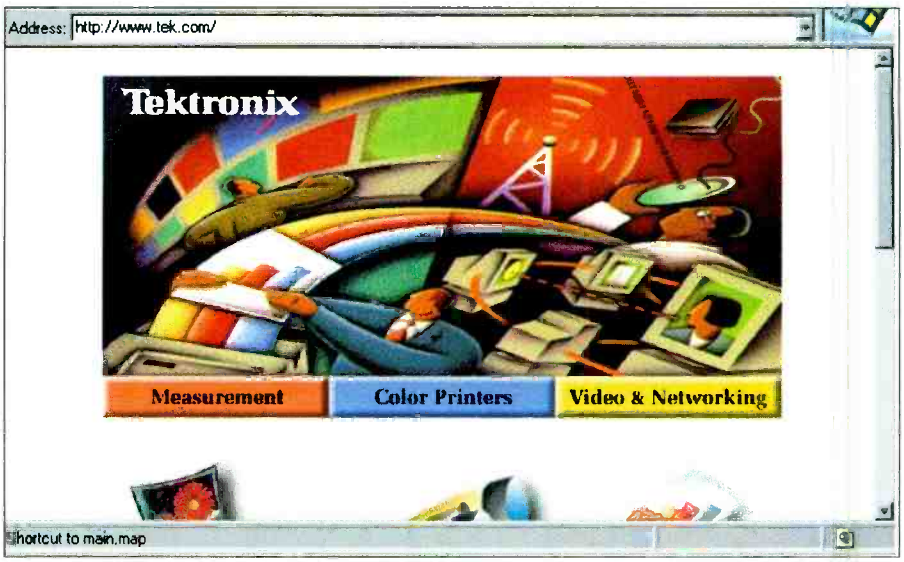
Caught in the web: The who knew of new media

Who expected the phenomenal growth of the World Wide Web?



By Marjorie Costello

In the last year, the World Wide Web has taken the Internet and the headlines by storm. Although services like America Online (AOL) and CompuServe have also grown in the past year, it's the web that has become the darling of the on-line world. And the web is growing geometrically, accompanied by even more impressive multimedia offerings, thanks to the efforts of creative developers and new content-creation tools.

Until a few years ago, the web was an off-the-beaten-path research tool for physicists and computer hackers. Today, there are more than 100,000 web sites, visited by millions of people for personal and business reasons. And every two months, the number of sites is doubling, as many companies, organizations, educational institutions, government agencies and individuals "put up a home page" — or establish a site — on the web.

It often leaves many heads spinning, shoulders shrugging and people remarking: "Who knew?" Even the pace of change is changing in the world of new media. It's approaching warp-speed velocity.

1995: The web year in review

What is particularly amazing is that even the most computer-savvy did not predict the web's phenomenal growth. Take software giant Microsoft, for example. When the software company was planning its new on-line service, the Microsoft Network (MSN), Microsoft wanted to attract subscribers to MSN's content, chat sections, transactional services and E-mail.

At MSN's launch in August, timed with the release of Windows 95, a shift in strategy was becoming apparent. MSN started offering web access that month — through a Windows 95 web browser — several months ahead of schedule. By fall, Microsoft chairman Bill Gates and company had decided that MSN's real mission was to provide web access. The company is currently testing Windows 3.1 and Macintosh versions of its Internet Explorer web browsing software. And, Microsoft has made the Internet the centerpiece of its corporate strategy for the future.

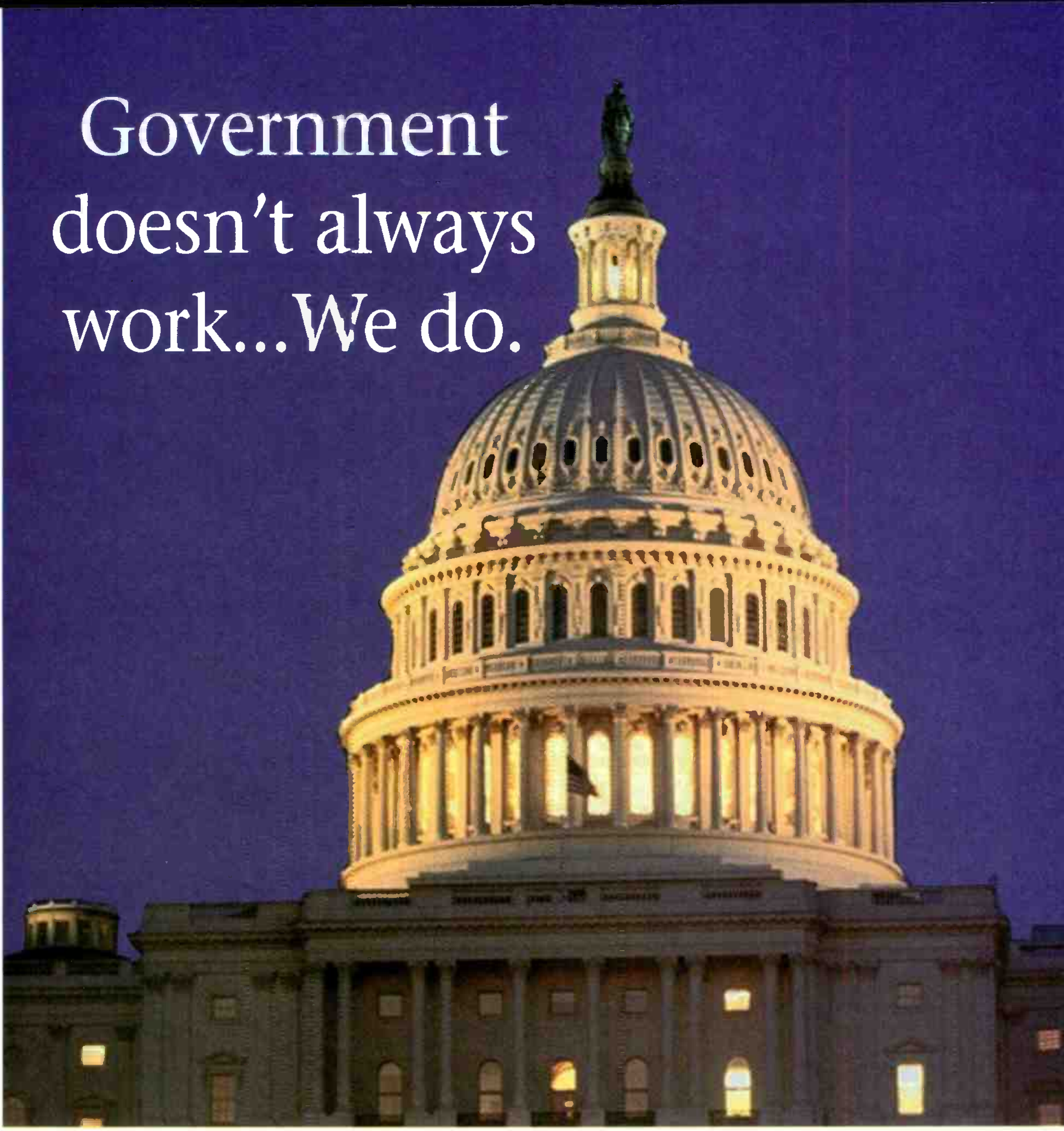
CompuServe, AOL and Prodigy also offer web access with browsers you can download on-line. All three provide tools for creating a simple home page on the web, accessed through the services. And each is hatching plans to offer additional Internet-related services.

During 1995, Netscape, which makes the leading web browsing software, became one of the hottest stocks on Wall Street when the company went public. Sun Microsystems's new Java technology was also a hot topic because it allows content-rich and platform-independent "applets" to be sent over the Internet. This sets the stage for applications and data to reside in the network, rather than in the computer, reducing the need for internal or other types of storage. Companies, such as Oracle and Sony, are reportedly working on lower-cost desktop and hand-held computers that exploit the Java protocol.

Getting untangled

Whether you are familiar with the web or about to get tangled up in it for the first time, you face several challenges: typing (addresses) and waiting (for screens to fill). While most people understand that in a keyboard-bound culture typing is to be expected, most of us are not accustomed to waiting for high-tech to perform its magic.

Web addresses often have intimidating-looking names that are called Uniform Resource Locators (URLs). The first part is the protocol, which in most cases is **http**, for Hypertext Transfer Protocol. Next, you'll see a colon and two forward slashes followed by www. — short for World Wide Web. Then, there is the domain name or computer address, such as sony.com. When an address ends in com, that means it is a commercial or company site; edu indicates an educational institution; org is an organization site and gov is a government site. All



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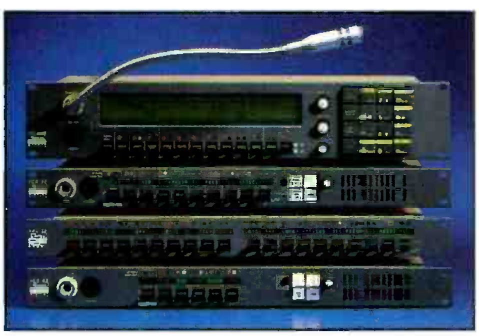

From the top, a 12-key LCD display station, a 9-key LED display station, a 20-key LED expansion panel, and a 5-key LED display station.

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of this information gets you to the home page or starting point for an individual web site.

Once you are in a domain, you can branch to subsections by clicking on underlined text or icons, which add more words, symbols and punctuation marks to the address path. Web pages usually end in html, for Hypertext Markup Language, the scripting language of the web. Fortunately, most web browsers let you store your favorite addresses, eliminating the tedious typing each time you want to visit.

The waiting game

Perhaps the biggest challenge facing web users and developers is the waiting game: Conventional phone lines and modems are just not fast enough to keep up with the transmission speeds required to deliver the graphics, audio and video offered on the web.

Video presents the greatest challenge because of its bandwidth demands. As a result, on-line video is not only slow, it is typically confined to a portion of the screen and suffers from poor resolution.

Consequently, some of the leading companies in broadcasting, cable, consumer electronics, satellite and computers are exploring ways to deliver Internet data faster to the PC.

Cable modems tackle the bottleneck

During 1996, more cable companies will be offering web access through cable modems. Cable modems are connected to a PC through an Ethernet card or port and access data through a cable channel at speeds up to 1,000 times faster than telephony modems. Currently, cable modems are leased by cable companies to customers because of price and compatibility problems.

Cable modems — from such companies as Zenith, Motorola, Intel and Hewlett-Packard — cost between $400 and $500. And, a cable modem used with one cable system may not work with another system.

Setting interoperability standards for cable modems has become a priority among cable systems and vendors for 1996. Once standards are set, prices are expected to fall to the $300 level, and more cable companies will offer Internet access. Standards and lower prices will also make it possible for companies to sell cable modems at retail, which is likely to occur by 1997.

Cable modems also open the door for more video on the web, a development that should be of special interest to production professionals. This past December, when NBC and Microsoft announced their joint venture to launch MSNBC Cable and MSNBC Online — two all-news services — cable-modem delivery was cited as an anticipated pathway for offering the on-line service.

Gates and NBC executives made it clear that video would be an important feature in the new on-line service. At the international videoconference announcing the venture, Gates said, "Video will become [as] impor-

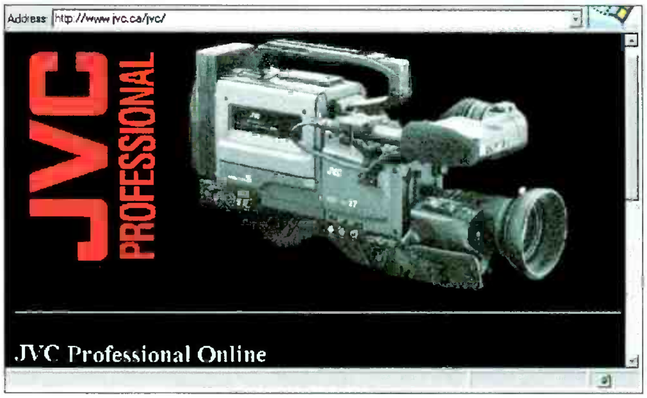
tant in the future as text and audio is now."

Relying on the VBI

In addition, companies are also tapping the vertical blanking interval — and other parts of the broadcast spectrum — to send data at faster speeds. This past October, a new industry consortium, the Intercast Industry Group, was formed to begin exploiting the VBI — among other potential pathways — to link the Internet and the PC.

With charter members including Intel, NBC, Packard Bell, Gateway, CNN, QVC, Viacom, Netscape, En Technology and America Online — among others, the Intercast group predicts widespread availability of its boards and services in the second half of 1996. Intercast content will be created using HTML, the language of the World Wide Web.

A PC equipped with Intercast technology could, for example, display an actual TV broadcast — of a news show or a TV commercial — in the top left corner of a computer screen. In the bottom half of the display, consumers could read additional historical information related to the news story or the web pages corresponding to the product featured in a TV ad.



Web data descending from the sky

Another new and faster Internet connection expected in 1996 will be available from the Digital Satellite System (DSS). DSS is a particularly attractive TV technology for transmitting data because of its large channel capacity, all-digital service and technology-savvy audience. As a result, DirecTV plans to transmit data via its DBS satellites by next summer to PCs equipped with DSS integrated receiver/descrambler (IRD) boards.

Current DSS owners would install a PC IRD board and connect it to their dish provided they have more deluxe dual-output assembly. Also, computer owners who buy the IRD package could add a DSS set-top box to also receive the TV programming packages.

DirecTV is working with computer companies, such as Compaq and Gateway, to develop the hardware for the new service. Sony and others are designing new, higher-resolution monitors that will present crisper and sharper-looking web pages.

DirecTV's sister company, Hughes Network Systems, is currently offering the DirecPC data service geared toward commercial customers and high-end consumer Internet users. Customers downlink data from Hughes' Galaxy satellite with a 24-inch dish to PCs equipped with a special card.

Video resources on the web

Once you are on the web, you may start looking for familiar names from our industry that have established a presence. Among leading hardware companies, the professional divisions of Sony and JVC both post information as part of their corporate web sites. (A list of relevant web addresses is included at the end of this article.)

Other companies, such as Tektronix/Grass Valley, Abekas and Silicon Graphics are also on the web. Panasonic will be linking its

SpaceWorks on-line presence to the web in the near future.

Many computer hardware and software companies are on the web, including familiar desktop video names, Adobe and Macromedia. Some companies are mentioning their web address in their ads and brochures. Industry associations, such as the ITVA and the NAB, also have sites on the web; and the list is expected to grow during 1996.

In addition to video-related companies and organizations on the web, there are also innovative uses of video that you should find interesting and even a bit amusing. Professionals and amateurs are sending feeds from video cameras featuring everything from a view of Maui sunsets and a glimpse inside a college dorm, to a peek at downtown San Francisco and a view of Pike's Peak. Updated periodically, these feeds — of what amounts to video stills — are being transmitted by a growing number of TV stations and production companies.

Video producers are turning their video cameras on their cities and studios, offering the view as part of their web site. In some cases, the station's web site will show you what they are broadcasting on the air at the time.

There are web addresses with links to dozens of camera-related sites. Once you find your favorites, you can note their specific address and access them directly.

And, if you want a peek at what major dollars and talent can accomplish on the web — including dazzling graphics, audio and video delivered to your computer — check out the Paramount home page. ■

Marjorie Costello is a broadcast and video industry consultant and a *Broadcast Engineering* contributing editor based in New York.

Site search engine for TV professionals

When you are on the web, you can use the various search engines or indexes — such as Yahoo, Lycos, Infoseek and WebCrawler — to find out if a company has a web site.

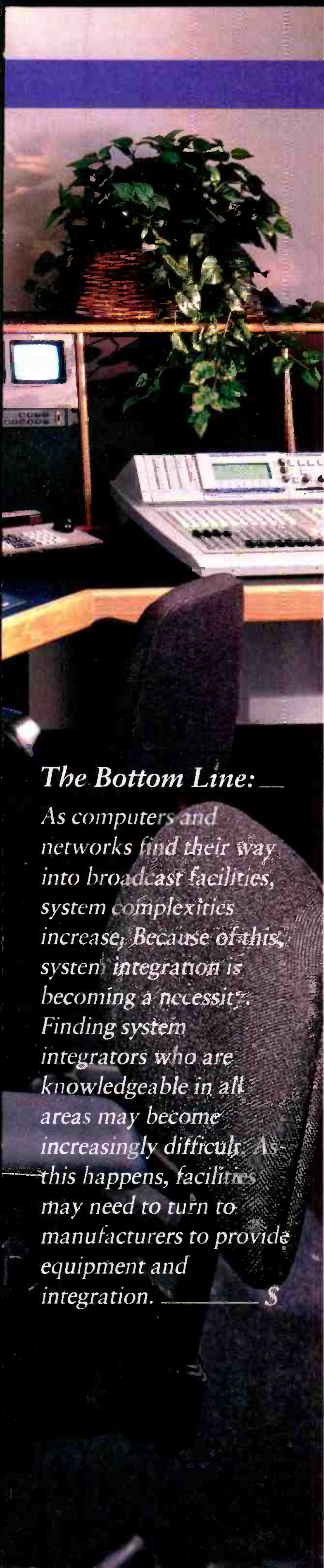
To keep you from getting tangled, here is a list of the web addresses of the sites mentioned in this column:

http://www.sony.com (Sony)
http://www.tek.com (Tektronix and Grass Valley)
http://www.jvc-us.com (JVC)
http://www.abekas.com (Abekas)
http://www.sgi.com (Silicon Graphics)
http://www.adobe.com (Adobe)
http://www.macromedia.com (Macromedia)
http://www.ece.ucdavis.edu/~maania/l1.html (collection of — with links to — live camera feeds from all over the world, including TV stations)
http://www.columbia.edu/~ta43/looksee/html (another video camera feed collection with links)
http://www.paramount.com (Paramount)
http://www.nab.org/ (NAB)

Let us know about any web sites you have discovered that may be TV or video-related. If you are a company or organization with a home page, we would like to know about that as well. Please E-mail the web address to me at either: MACostello@aol.com or 71044,1067@compuserve.com.

Internet: be@intertec.com
CompuServe: 74672,3124
FAXback: 913-967-1905


PHILIPS
Diamond digital 20



The Bottom Line:

As computers and networks find their way into broadcast facilities, system complexities increase. Because of this, system integration is becoming a necessity. Finding system integrators who are knowledgeable in all areas may become increasingly difficult. As this happens, facilities may need to turn to manufacturers to provide equipment and integration. $

By Peter A. Dare

The future of networking

Broadcast facilities are changing, and networks are integral to new facility designs.

To many, this year's NAB was different than previous years. It is no longer possible to purchase equipment and simply assume it will automatically interface with existing systems. New buzzwords include: integrated systems, compression and signal interconnection systems. Products connected to these new video or audio networks must be configured and tested to work together in an optimal fashion. Key technological issues include networking, compression, and finally, software. All of these elements will need to be integrated into new system designs.

The different digital video topologies and the increasingly complex and confusing nature of the integration will force the broadcast or post-production user to search for the best systems provider, rather than the flashiest product. This will not be an easy task. The broadcaster will need someone who can turn visions into reality. They must be able to provide application-specific systems integration to migrate today's investment into tomorrow's new world.

Networking

Key questions to determine if the network solution being offered is appropriate to the application include:

1. How is the network controlled?
2. What signal system is being used?
3. What is the physical layer transporting the signal?

Ethernet, as an example, has been chosen by many as a control network and, in some cases, pass low bit-rate video. Real-time commands used in today's broadcast facilities are typically handled by some form of point-to-point RS-422 control. In this example, the Ethernet system is used as a non-deterministic control device, while the current RS-422 control provides real-time commands to various devices. The current RS-422 protocol can play a disc as if it is a VTR, but it cannot close a file, open a file, name a file or control the disc as a nonlinear device. A new RS-422DP protocol provides real-time commands for VTRs and disc-based systems. In this scenario, Ethernet still plays a role in downloading nonreal-time or time-line commands to be executed at a later time.

It is essential, however, in addressing file servers that respond in real-time can still be achieved. In many cases, the file server will emulate a VTR, and as such, must be capable of fast forward, reverse play, jog, program play, etc. A file server cannot be simply viewed as a set of hard disks. It has to be viewed as a product with mechanisms and circuitry that will allow it to perform functions, such as dual processing, separate manipulations of audio and video files and processing of the compressed video signal during nonreal-time playback. Functions that are resident in today's VTR, must be resident in tomorrow's file servers. In addition, material that exists on the file server may be accessed by multiple user's with different requirements.

After considering how elements on the network are controlled, the broadcaster must also think about the signal or signals that have passed over the network, and what the physical layer over which these signals have passed. Is it full bit-rate SDI or is it compressed data over SDDI, ATM, P1394 (Firewire), FDDI or Fiber Channel? In reality, each network topography has its own merits and demerits. The final decision on which network or networks are to be used will be up to the system design engineer, along with which interface manufacturer's support. The criteria for choosing an appropriate network include:

- Whether it must be isochronous;
- Whether it should be bidirectional; and
- Can it handle the required data rates?

In addition, if a network is being shared, the presence of a resource manager responsible for judication and conflict resolution must also be considered. In light of all this, Sony has chosen SDI and SDDI as the networking bridges for the future. We see this as the best solution, because SDDI is a simple mechanism for transportation that is totally isochronous and synchronous.

In addition, the SDDI platform permits transmission of the 27MHz clock, and as part of the header and descriptor, information on the format. The SDDI physical layer is capable of transporting many different types of compression schemes, handling fixed or variable block data and provides compatibility with existing digital broadcast routers. As part of the SDDI header information, there are source and destination addresses. While in the current implementation there is no use for these addresses, SDDI does act as a bridge to the possible future implementation of packet switching, such as ATM.

The issue of variable or fixed block sizes that are transmitted with compressed video images must be decided when the TV facility of the future is being designed. Blocks can be transmitted in fixed sizes containing a large amount of information, with little header information; or in variable sizes that hold smaller amounts of information with a large overhead being attached to the header and descriptor information. The knowledgeable systems integrator will be able to develop the correct total solution for the digital TV facility of the future.

In suggesting that SDDI will provide a bridge to packet switching in the future, there seems to be a lot of interest in ATM switching. I believe that there are problems still remaining that need to be resolved before high-bit-rate real-time transmission schemes are practical. However, it is true that for some applications where nonreal-time video and low bit-rate video is involved, ATM switching could be practical today.

In some areas of our industry, the IEEE P1394 standard is another option. It is a technology that could be developed for the professional TV industry in the future, it is isochronous and it is capable and defined up to 1.2Gb/s. Currently, the defined cable length of 5.3 meters (maybe 200 meters in the future) is a severe limitation. In addition, the number of nodes that can exist on each P1394 network feed is insufficient for many broadcast applications and would force an additional distributor or hub to be included.

A compressed TV facility now and in the future will likely rely upon full bit-rate SDI for many applications. SDI will continue to be the backbone, with SDDI providing the future-proofing that many customers desire. The point here is that this new environment demands more than the old plug-and-play world that we lived in before.

Compression

The next key technology issue that broadcasters will be faced with will be the various compression schemes being offered. The issue is really not whether these schemes work, but whether they are suited to the specific application under consideration. When trying to answer this question, the solutions and answers will be based upon such factors as concatenation, codec costs, bit rates, latency and the ability to switch and manipulate the picture. These factors are important because television is not just a continuous video data flow; it is switched and manipulated regularly.

This calls for many steps in the process where compression and decompression could take place. Compression and decompression within the same format is not concatenation. Concatenation is where the values of the data are changed, forcing the compression technology to once again recompress the signal.

In the compressed world and in the planned TV facility of the future, it is conceivable that the signal will be subjected to at least five codecs between network acquisition and delivery to the home. (See Figure 1.) In reviewing compression technology it is important that the selected bit rate is compatible with the storage availability, transfer rates of the format and bandwidths on the network.

Data recorders with transfer rates in the 75-100Mb/s range will make it possible to record compressed audio and video files as data. Audio and video streams compressed to 20-25Mb/s could then be transferred at faster than real-time rates. The capability to record audio and video data as files and volumes within a directory structure provides additional tools to the broadcaster that are not available on traditional VTRs. These data recorders could enhance field acquisition, as well as archiving operations.

Software

What used to be hardware functionality is now software functionality. The issue here is how anyone can evaluate software. Do you evaluate it by simply looking at the GUI, or do you determine how the soft-

Continued on page 124

Realtime Video D-1suite

By Howard Sherman

Realtime Video, a post-production, editing and graphics company in San Francisco, has invested close to $1 million in a powerful new component digital on-line editing suite.

According to Realtime Video president Will Hoover, power and flexibility are the common factors to all of the company's hardware decisions. New for newness sake isn't a sufficient reason to make a hardware purchase.

Realtime did make a recent purchase in order to provide clients with improved image quality and to provide operators with additional flexibilty. The company purchased a new Philips Diamond-digital 20 serial component production switcher. The new switcher is the first one to be installed in the Bay Area.

With a switchable M/E architecture-to-layering capability, improved chroma-key, sizing, positioning, wipe generator and edge-softening applications, plus a wealth of options, the investment was worthwhile to Hoover and his clients.

Realtime Video's new suite provides component digital on-line editing for any commercial or broadcast project without having to tie up the Quantel Henry suite. D-1 projects can be worked on simultaneously and independently of each other. Because the facility if fully networked, elements of projects can be moved between any of the edit suites without going to tape.

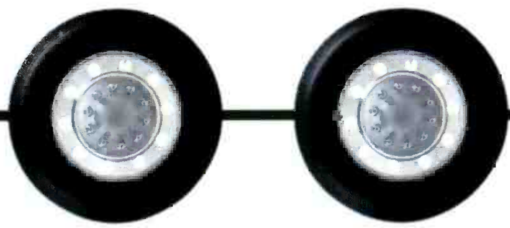
Realtime's D-1 suite also offers a dedicated Abekas A57 DVE for digital effects, an Abekas A72 text generator and a Graham-Patten digital audio board. Other new equipment includes a new digital Betacam DVW700 camera, which enables the facility to acquire field video in digital Betacam format and then edit in post without going to analog.

The new suite is fully integrated with Realtime's network that links 13 rooms, 25 desktops, 10 PCs, two Unix computers, an Internet gateway and a comprehensive line of blue-chip editing and graphics technology. The result is a framework of computer power that provides clients almost limitless, yet cost-effective, creative options.

Hoover is convinced that tape-based technology will remain viable for some time to come, and is confident that the new D-1 suite will reflect the best-of-breed profile that the company has been nurturing since its move to 60 Broadway in 1993. ■

Howard Sherman is an editorial consultant for Realtime Video, San Francisco.

Confidently making the transition from the editing room to the road, Sony's DVS-7000 Live Production Switcher is designed for the demanding pace and creative challenges of live production. Right from the start, operators will notice how comfortable they feel behind the wheel of the DVS-7000. Its 3.5 M/E control panel is like second nature to experienced technical directors. Its multiple downstream keyers and multiple re-entry capabilities make it faster and simpler to layer graphics and DME moves into a show. And it shifts truck efficiency into high gear, by reducing the size and power consumption of its electronics—plus adding special mobile support features like redundant power supplies and advanced diagnostics. Sony has also created a revolutionary link between our DME effects system and our DVS-7000. It's called DME-Wipe



Networking your facility

By Kevin McNamara

Discussions about LANs generally center on connecting a group of PCs (also called *workstations* or *clients*) to one or more shared and usually more powerful computers (called *servers*).

However, the broadcast and production industries have found many new uses for LAN technology, which go far beyond just shipping data and control signals around the facility. Video networking includes the storage and distribution of real-time digital video and audio signals. Video networking is a complex subject and any engineer contemplating the installation of such equipment must have more than a working knowledge of LAN technologies.

Network fundamentals

Virtually all of the network products are based partly (or entirely) on a 7-layer architecture known as the open systems interconnection (OSI). Each layer outlines services and protocols that when combined form the framework for networking and integrating different types of networks (see Figure 1). The seven layers of the OSI are:

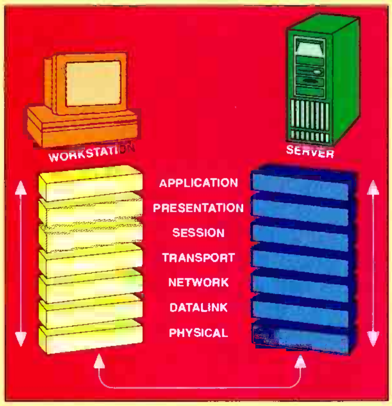


Figure 1. There are seven basic layers in the OSI stack. Engineers typically need to be concerned about only two: the physical and the application layers. Network software/hardware will usually take care of the other layers.

1. *Application layer.* The top layer in the OSI stack. It provides the interface between the network and the application. Reading and/or writing files between the server and workstation are examples of processes handled at this level.
2. *Presentation layer.* Translates data and formats between different platforms, (i.e., a PC and a Mac).
3. *Session layer.* Sets up the connection between communicating applications. Once connected, it maintains the integrity of that connection.
4. *Transport layer.* Maintains the integrity of the data communications element, such as flow control and error recovery.
5. *Network layer.* Provides a means to reliably route data across the network.
6. *Datalink layer.* Packages the data and adds the appropriate header information needed by other computers on the network.
7. *Physical layer.* The physical hardware necessary to interconnect the computers in the network. This typically includes the network interface card (NIC) in each computer, the cabling and connectors.

In order to visualize how the OSI works, let's assume we have a simple 2-node network. The network consists of one workstation and one server with a word processing program running on the workstation. Issuing the save command on the workstation would cause the system to save that file on the server's hard drive. The data to be saved would first flow from the application layer down to the physical layer and then be transported to the server. When the data reaches the server, the process is reversed.

CATEGORY	MAX. RATED SPEED	TYPICAL USE
1	No performance criteria	
2	1MHz	Telephone wiring
3	16MHz	Ethernet 10BaseT
4	20MHz	Token Ring, 10BaseT
5	100MHz	100BaseT, 10BaseT

Table 1. Specifying the performance level determines the speed at which the network can operate and the type of wiring needed. Obviously, as the requirement for higher network data rates increase, so do installation costs. Be careful about specifying a higher-speed LAN than you really need.

Topologies

Topology describes how the network is interconnected (see Figure 2 on p. 44). Of all the layers defined by the OSI, engineers need to be most familiar with the physical layer. The physical layer deals with the cabling, connectors and interfaces required to attach the computers to the network. The most common types of topology are:

- *Bus.* Typically composed of coaxial cable, twisted pair or fiber and terminated on each end. Devices requiring access to the network tap into each section using a "tee" connector. The traditional "loop-through"-type connector used in video is seldom used in data networks.
- *Ring.* Similar to the bus, except the ends are joined. In practice, the ring configuration consists of dual counter-rotating concentric rings, one carrying the signal out and one returning. Devices attached to a ring network will have "in" and "out" ports, which are connected to the appropriate ring. Because this approach requires two paths (rings), media, such as twinax or composite fiber-optic assemblies consisting of two cables, are used.
- *Star.* More commonly referred to as a hub configuration. The signals are carried from each device on the network to a central point (the hub). These hubs can be passive or active. Passive hubs provide only a simple termination/mixing point for the signals; an active hub electronically regenerates the signals. Systems employing active hubs can use special unshielded twisted pair (UTP) cable.

Hubs, bridges and routers

For star-type systems, additional network interfaces are typically needed. These interfaces may include hubs, bridges or routers. The network hub acts as a common terminus for star networks. Depending on a network's size, the hub can be as simple as a small box with a handful of ports or a large rack-mounted system with many ports.

The two general varieties of hubs are *passive* and *active*. A passive hub is essentially a resistive combining network for LANs using coaxial-based media. Passive hubs are seldom used today.

Active hubs electronically regenerate the signals that appear on its ports. The specific selection of a hub is based on the network protocol selected for the LAN. The hub can be viewed as a major intersection in the network and, therefore, signifies a critical element in the delivery of traffic across the network. Hubs can support data rates up to 100Mb/s and many are available in a modular or stackable form to allow mixing and matching of data rates, protocols and media types. If data rates in excess of 100Mb/s are needed, switching hubs should be used.

It's occasionally desirable to combine two or more individual LANs within an installation. A *bridge* is used to perform this interface. It reads buffers and resends information between LANS operating on different protocols. A bridge makes the two networks appear as one to the system. A *router* is a network device that relays network traffic between the LAN and other network peripherals.

Simple network management protocol (SNMP) is software used to simplify the task of managing devices, such as hubs, bridges, routers and network interfaces. This application allows network managers to view, configure and troubleshoot the devices on the network.

Channel access methods

Each device on the network must be able to access the network, but only in an orderly fashion. Any one of three methods may be used to accomplish this. These are called *channel access methods* and they include:

- *Contention.* All devices can transmit at any time. If two or more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devices transmit at the same time, each device waits a random interval of time and tries to rebroadcast the data. This process is repeated until a reliable delivery is made. This method is used in bus and star configurations.

• *Polling.* The server initiates queries to other devices on the network in a predetermined order. Attached devices only respond when queried.

• *Token passing.* Imagine a "token" signal circulating around a ring (the cable): the token is passed around the ring in an orderly fashion. A device on the network can only transmit when it is in possession of the token; once finished, the token is released. This protocol is used exclusively in ring-type network configurations.

Because of its speed and inherent reliability, the token ring network has been the preferred choice for larger networks. In fact, it is the only method used by systems using fiber-optic backbones, such as the Fiber Data Distribution Interface (FDDI). Systems using FDDI operate at speeds in excess of 100Mb/s. In the past, most businesses found the cost to deploy FDDI prohibitive and often relied instead on copper-based Ethernet protocol, which operates at the slower speed of approximately 10Mb/s. Recent advances in Ethernet technologies have brought the speed in line with FDDI, with the advantage of using the less-expensive UTP cable.

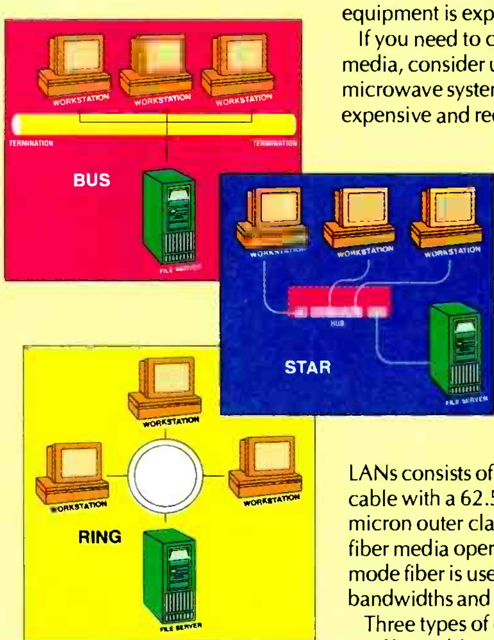


Figure 2. There are three basic topologies for local area networks: bus, ring and star. In addition, the various configurations can be intermingled to create combinations, which allow groups of users to cooperate as independently (and efficiently) as desired, yet still share network resources.

Network protocols

Currently, the 100Mb/s Ethernet protocol has become the LAN protocol of choice for most new installations. In planning the physical layout of your system, it will be essential that you understand these standards.

Three types of media have been specified to transmit 100Mb/s Ethernet signals:

1. 100BASE-TX (Fast Ethernet). Fundamentally a faster "contention"-type access method.
2. 100BASE-T4 (100VG-AnyLAN). Uses a new approach to access the network called "Demand Priority." This system also supports "token passing." One of the advantages of this method is that it uses four pairs of telephone voice-grade (VG) cable.
3. 100BASE-FX. Fiber-based "Fast Ethernet" similar to FDDI.

Here are a few more alternative high-speed protocols you should be aware of:

• Asynchronous transfer mode (ATM). A technology based on high-speed packet switching. This is an ideal protocol for supporting multimedia and other complex applications. ATM can use UTP or fiber cabling. ATM's ability to use simpler (and cheaper) cabling allows practical delivery of high-speed data to the desktop. ATM is capable of data rates from 51 to 622Mb/s. However, at this point, ATM is primarily directed at telco-type applications. Interfacility applications are still too expensive and too complex for most video/audio needs.

• Copper data distribution interface (CDDI). FDDI using copper-based media instead of fiber.

• Fiber Channel. Developed jointly between Hewlett Packard, IBM and Sun Microsystems. Fiber Channel requires the use of fiber cabling and is capable of passing data at rates from 266Mb/s up to several Gb/s. This protocol is becoming more popular, especially for high-speed video applications.

These are just a few of the high-performance protocols available. Although not considered a high-speed protocol, wireless Ethernet is developing into a popular media for connecting portable workstations, such as laptop computers, to a LAN or for connecting LANs between different buildings where laying a cable is impractical. The FCC has permitted unlicensed operation of these spread spectrum systems at 902-928MHz and 2.4-2.483GHz. Most will handle data rates from 2Mb/s, at distances of approximately 30 miles with directional antennas. For higher data rates, designers should consider using a standard point-to-point T-1 microwave system. The advantage is much more channel capacity. The disadvantage is that the equipment is expensive and requires FCC licensing.

If you need to carry high data rates via a wireless media, consider using a standard point-to-point T1 microwave system. This approach is commonly more expensive and requires FCC licensing.

Cabling and hardware

Coaxial cables, once the de facto cabling standard, are becoming less common. Unshielded twisted pair (UTP) and fiber cables are increasingly popular. Depending on the size of the LAN and the distances involved, the cabling and installation costs will be a substantial portion of the project. Each type of cable has its own set of advantages.

The typical fiber media used for LANs consists of a graded index multimode fiber-optic cable with a 62.5 micron fiber-optic core and 125 micron outer cladding. The light source used to drive the fiber media operates at a wavelength of 1,350nm. Single-mode fiber is used in applications requiring wider bandwidths and longer distances.

Three types of connectors may be used for connecting the fiber cable to an interface:

1. *FDDI media interface connector (MIC).* These connectors are keyed in various ways and care should be taken to identify the proper keying arrangement.
2. *Duplex SC connector.* Designed for simplicity, the connector is just pushed onto its mating section and the connection is completed.
3. *ST connector.* A spring-loaded bayonet-type connector. The outer bayonet ring and inner sleeve are keyed. To make a connection, just line up the keys to the mating receptacle, push and twist to lock.

Losses on a fiber cable should not exceed 11dB, including connectors. Expect 1dB to 2dB of loss per 1,000 feet of cable. The cabling isn't where the losses become significant— it's the connectors that add most of the loss. Connector loss will range from 0.5dB to about 2dB each, depending on how well that connector was installed. Dust or skin oils on the connectors will substantially add to the system losses.

Caution must be exercised when installing either fiber or copper-based cabling. Kinks, sharp bends and incorrect connector attachment can wreak havoc on the best-planned installations. Installation errors typically express themselves as either slower than expected throughputs, data errors or poor reliability. The EIA and Telecommunications Industries of America (TIA) have produced a set of standardized installation practices known as EIA/TIA 568. This guideline covers all aspects of cabling methods, from specifying the proper cable type to connector selection and installation (see Table 1 on p. 40).

Although this has just been a review of the basics, there is a lot of information about networking and LANs in print. A search on the World Wide Web will provide a virtually unlimited source of up-to-the-minute information on the subject. ■

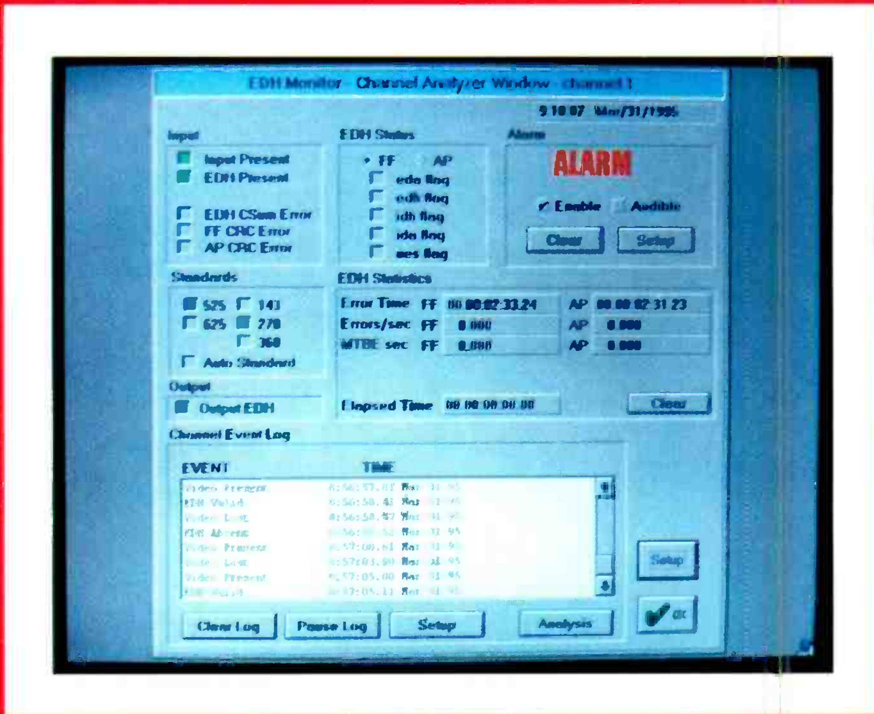
Kevin McNamara is president of Exegesis Technologies, a developer of applications for computer/telephone integration and computer-based mapping.

By Debby Canto

EDH: Monitoring networked video

The Bottom Line:

Now that more facilities are expanding their use of serial digital video, monitoring the networks' integrity is more important than ever. Error detection and handling is a new technology that measures errors in serial digital signals. Now, engineers have a way to measure errors and correct the situation without taking the system down.



Use of EDH testing techniques is recommended in serial digital TV installations as an in-service quality-check system, and the sky's the limit on its other uses.

Error detection and handling (EDH) is a powerful new technology developed to measure errors in serial digital TV signals. It provides a precise method of reporting errors, enabling engineering personnel to take action to correct the situation.

The future of EDH is exciting. The technology can be applied to the inputs and outputs of all signal processing equipment, and EDH may eventually lead to automatic rerouting of signals around faulty paths or devices.

Digital video signals are inherently more complex than analog signals. It might be better to describe them as predominantly video, since they can contain up to four channels of audio, as well as a digital equivalent of vertical interval time code and other ancillary data.

Photo: This screen shows a typical status monitoring view from Leitch's EDHview software.

Also, digital signals are more robust and less subject to losses, and when errors do occur, they are less catastrophic. A bit loss may not be noticeable in terms of picture, but it can cause a loud pop in monitored audio or create a time-code discontinuity.

Because these errors may not be detectable when viewed on traditional test equipment, new methods of measuring serial data validity have become necessary. This is where EDH technology comes into play.

How EDH works

The principle of EDH is based on techniques similar to those used in other digital communications: an EDH transmitter is located at the front of the signal path and an EDH receiver is located at the end of the path.

The first EDH device performs calculations based on the digital picture bits in each picture field and inserts this information as ancillary data in the blanking interval at the beginning of the following field. This integrity checking data is then passed on through the transmission path.

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The second EDH device, located downstream, repeats the same calculations, comparing the result with the ancillary data contained in the signal. If the two numbers don't agree, then one or more errors have been detected. These calculations result in what is known as a checkword, which is calculated using the Cyclic Redundancy Code (CRC)/ International Telegraph and Telephone Consultation Committee (CCITT) polynomial generation method.

Figure 1 illustrates EDH insertion at the output of a serial digital device. The parallel data is passed through a coprocessor that counts field by field and generates a CRC per field. The CRCs are muxed or multiplexed into the parallel data and then the parallel signal is serialized and transmitted down the coaxial cable to the next device.

The serial signal is received at the input of the next serial digital device. The signal is deserialized into parallel data, and the CRC from the previous device is extracted. A new CRC is calculated and compared to the CRC from the previous device. (See Figure 2.) If the comparison fails, then an error is found, and these discrepancies are inserted as flags in the outgoing parallel data. At this point, these discrepancies can be reported to the user. (See Figure 3.)

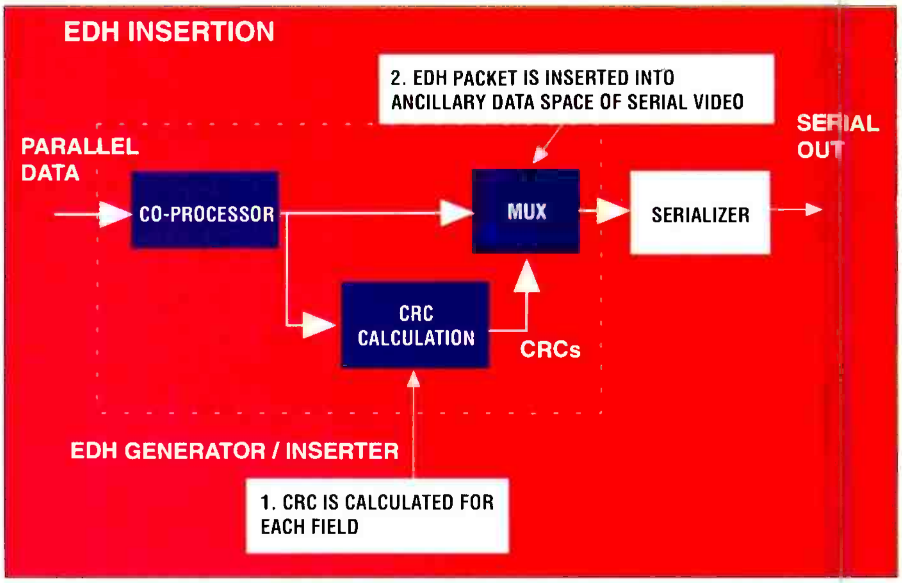

Figure 1. EDH insertion at the output of a serial digital device first involves CRC calculation for each field.

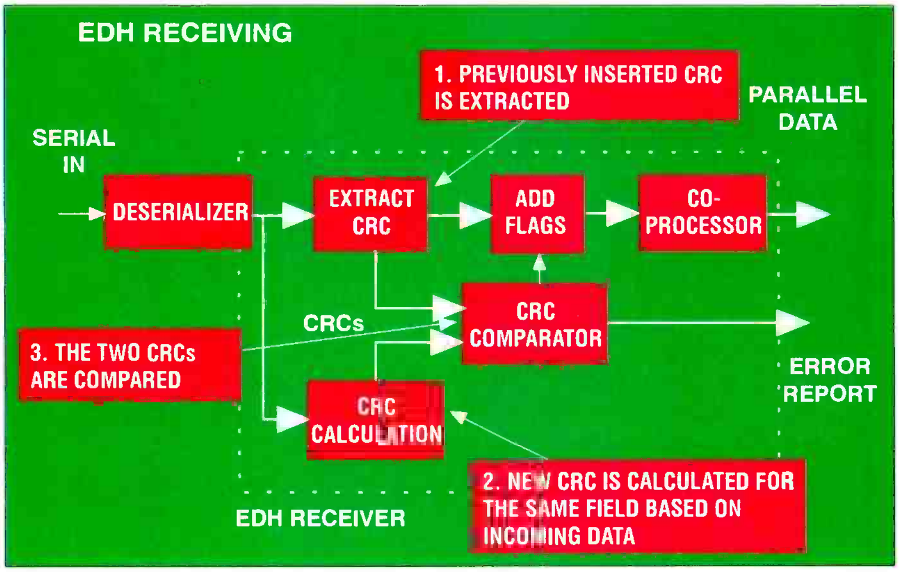

Figure 2. After the previously inserted CRC is extracted from the next serial digital device, a new CRC is calculated.

Benefits of serial digital signal handling

The benefits of component video have been clear for some time, but the cost of installing three cables in the analog domain can be expensive, not to mention the work involved in routing and timing those cable signals. The benefits of digital circuits are also well-known, especially in communications. Therefore, a combination of component and digital makes an ideal medium for video signals.

Initially, the parallel distribution of digital video signals was time-consuming to install and suffered from bit slippage over long distances, resulting in signal losses. Thus, a new method — serial distribution — was developed to overcome this, and it was ratified by the then International Radio Consultative Committee (CCIR), a branch of the International Telecommunications Union (ITU). The results became the SMPTE 259M and ITU-R BT601-2 standards.

Initially, the only chipset able to accomplish the results of this standard was available from Sony; more recently, Thomson Broadcast, GVG/Tektronix and Gennum have also developed alternatives. Each has its own merits and all have a common function — serialization and deserialization of component digital signals.

Testing serial video signals

Digital TV signals are powerful. Experience has shown that errors in these signals are often fleeting or transient, or they can't even be detected visually before the picture suddenly disappears completely. This sudden disappearance is commonly called the cliff effect. The phenomenon occurs when the data quality of a seemingly perfect picture deteriorates to the point where, if a few more meters of cable were to be added, the signal would become useless.

That's why trying to measure a digital TV signal with conventional test equipment,

FLAG	ERROR STATUS	INTERPRETATION
EDH	ERROR DETECTED HERE	ERROR DETECTED
EDA	ERROR DETECTED ALREADY	ERROR DETECTED UPSTREAM
IDH	INTERNAL ERROR DETECTED HERE	EQUIPMENT ERROR DETECTED
IDA	INTERNAL ERROR DETECTED ALREADY	EQUIPMENT ERROR DETECTED UPSTREAM
UES	UNKNOWN ERROR SEQUENCE	NON-EDH SIGNAL SOURCE

Table 1. For each of the three picture areas that EDH examines, SMPTE RP165 provides for the optional use of these five different flags.

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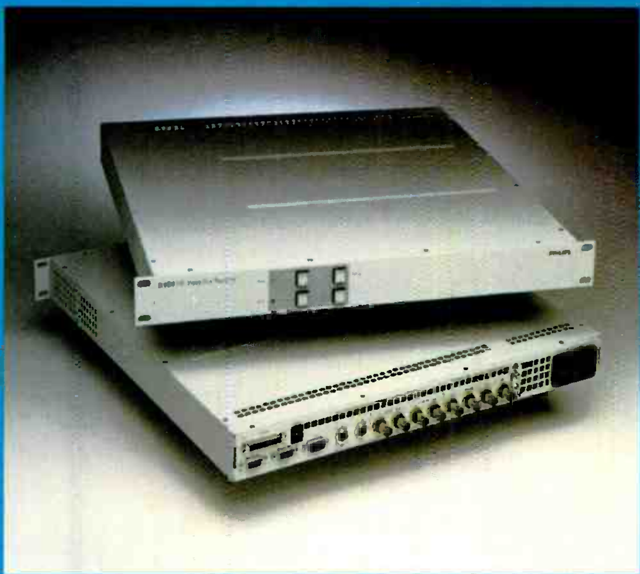

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such as waveform monitors and vetorscopes, required the signal to first be passed through a digital-to-analog converter. Still, what must be found are bit errors in the signal, and this is where EDH technology makes its contribution to the digital world.

Digital errors

A single error is defined as one data word whose digital value is different at the destination from what it was at the source. Such errors can be caused by faulty equipment, poor installation or more commonly by excessive cable lengths. Typical errors fall into three categories: bursts of errors, processing errors and marginal errors. All digital TV systems suffer from errors.

Bursts of errors may be caused by coupling external sources of impulse noise into the serial data path. Often these errors span many picture lines and may affect more than one signal path. Generally, this is only a problem in cases where the impulses are of significant magnitude and have fast rise times. But most power-line transient sources have long rise and fall times sufficient enough to prevent an error from bit-cell to bit-cell.

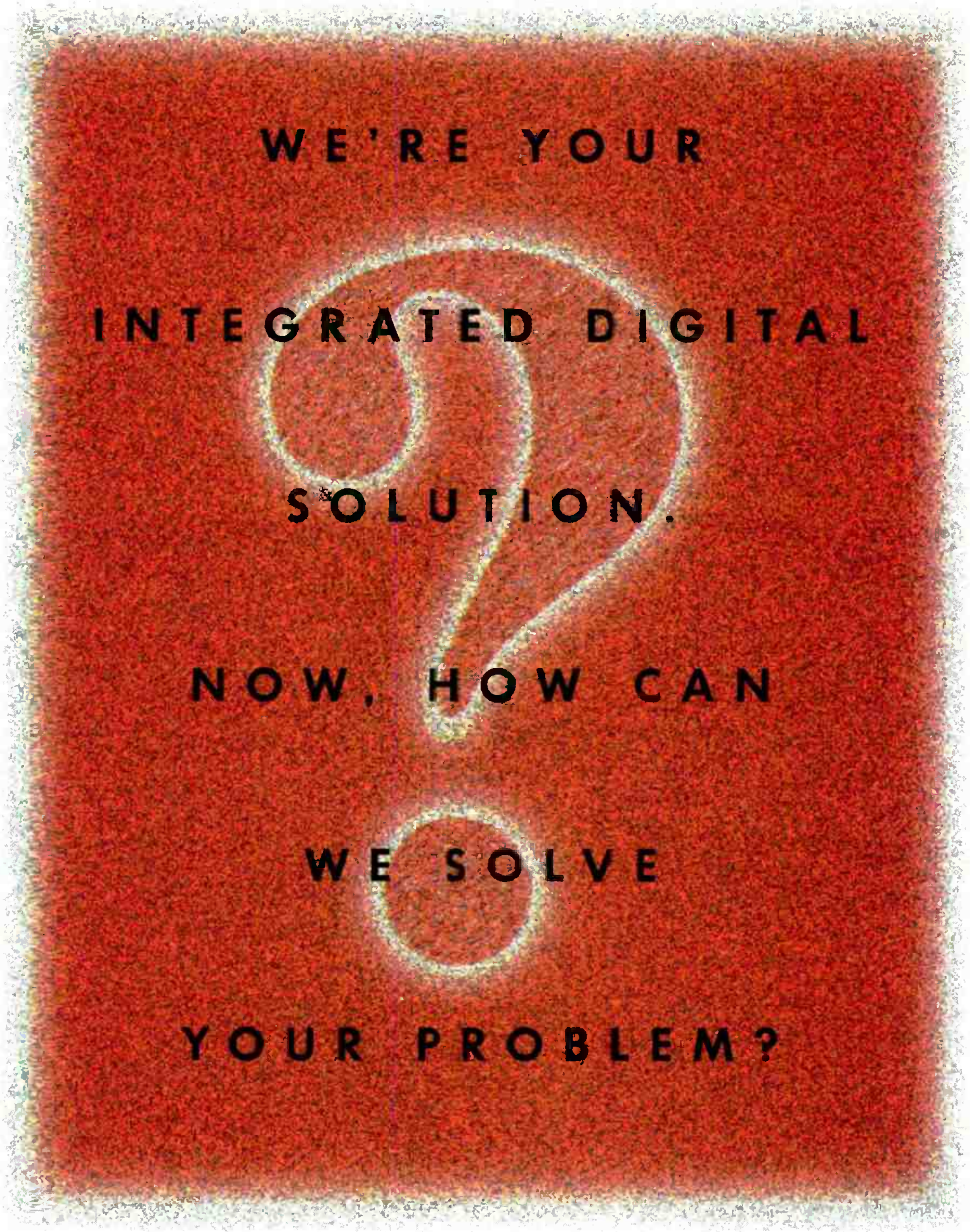
Marginal errors are the most insidious type of serial digital fault.

Processing errors occur when a piece of equipment is not fully transparent to the digital data. This could be due to modification of any common picture parameter, such as gain, digital filtering or rounding errors during processing.

Marginal errors are the most insidious type of serial digital fault. These path errors are caused by the receiving device's inability to sample the data accurately. They are common in serial systems and are the most difficult to identify and solve.

Under normal circumstances, no errors whatsoever should be expected in the digital TV environment. But when an error does exist, it may be taken as a sign that the transmission path is stressed and in need of corrective action. Attention to the error is vital when the digital signal is carrying embedded audio, because noise due to bit errors is more disturbing to the ear than it is to the eye.

In communications, the goal is to reproduce the signal without modifications. Unfortunately, TV pictures are continuously undergoing change. A producer may want to add a logo or message, and sometimes it is necessary to add or delete captioning or



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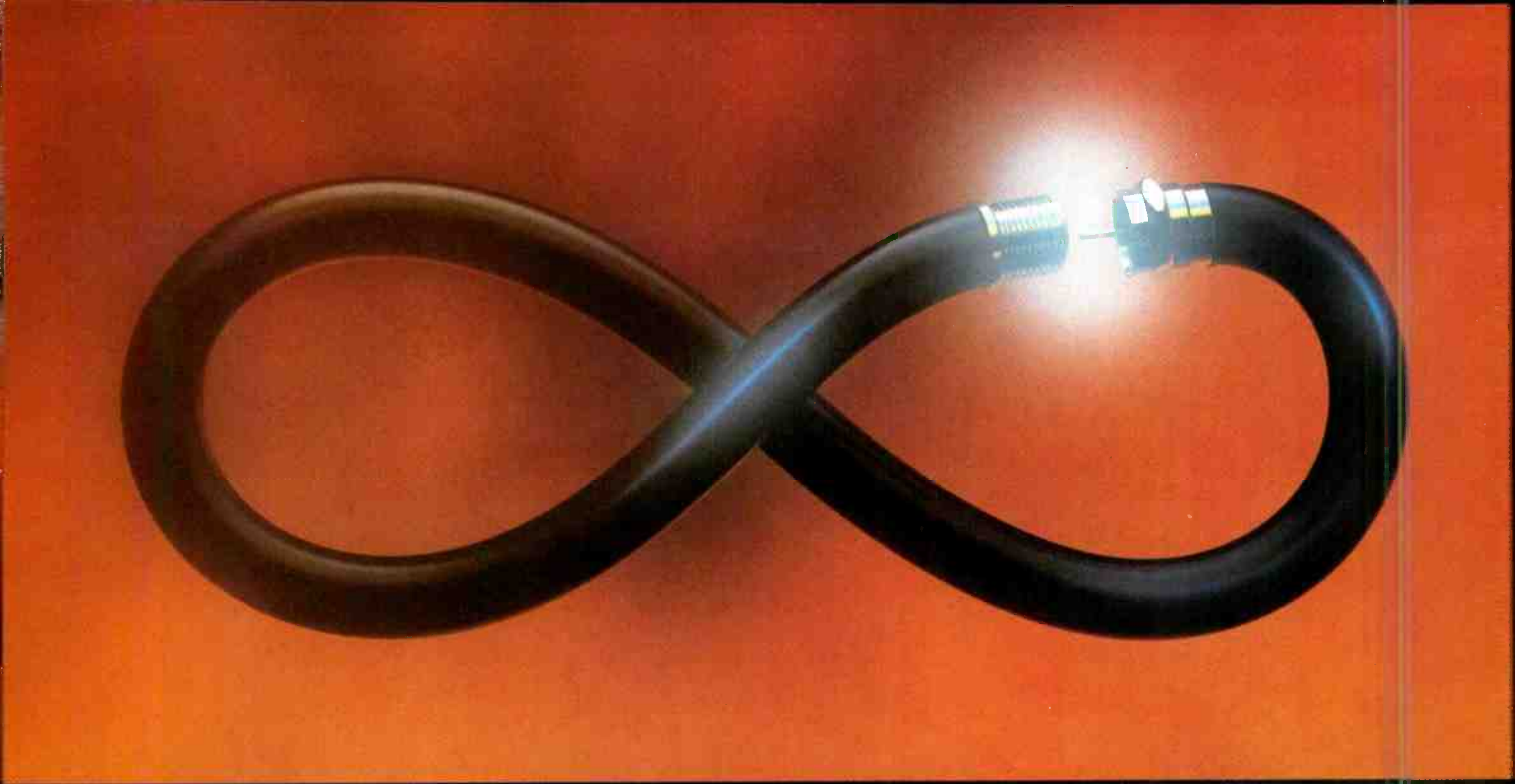

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other data. When this happens, how does the EDH device distinguish an error from a desired picture change? It can raise a flag to tell an operator that there has been a change, and it can tell him or her if the change is in the active picture or in the blanking interval. It can also let the operator know if an error occurred in the last link of the chain or further upstream in the transmission path.

SMPTE's RP165 describes error detection checkwords and status flags for use in serial digital interfaces for television. To provide a means for checking integrity of the serial digital transmission path, SMPTE has issued a proposal for manufacturers. The plan calls for EDH circuitry to be incorporated into serial transmitters and receivers to generate and detect checkwords. This can identify errors in the digital bitstream.

Interpretation of this proposal has been left to manufacturers to determine the best ways to handle error reporting. Some new products have already emerged offering EDH signal insertion and detection capabilities, and it's anticipated that as integrated circuits become available, EDH analysis techniques may be applied to most digital signal processing equipment.

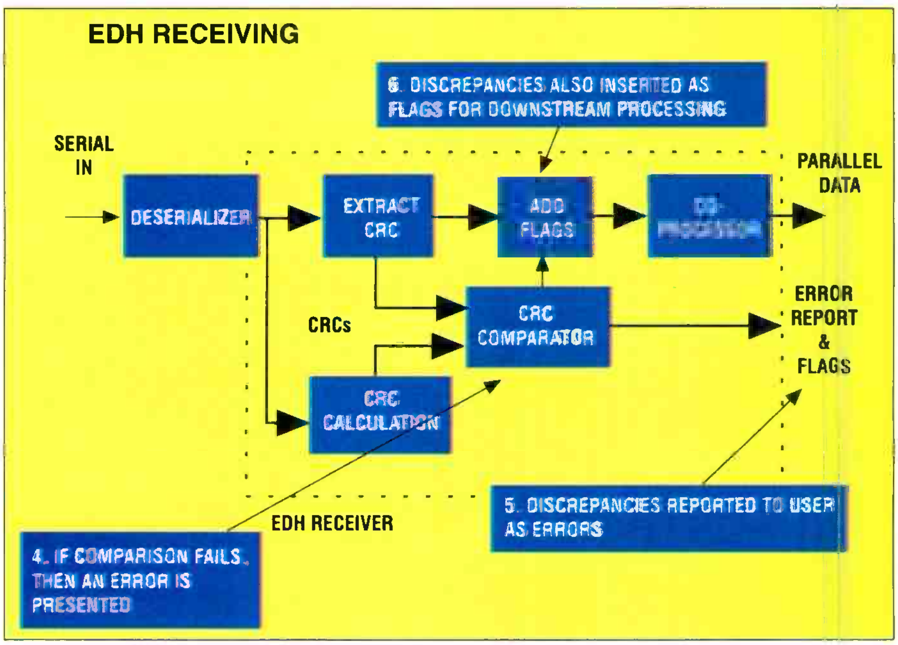


Figure 3. If an error is found at this point, the discrepancies are inserted as flags in the outgoing parallel data before they're reported to the user.

Error flags

EDH uses a series of error codes or flags located in the ancillary data portion of the signal to determine errors. Logically analyzing these flags and their respective positions in a digital system can provide an overview of a complete systems' operation.

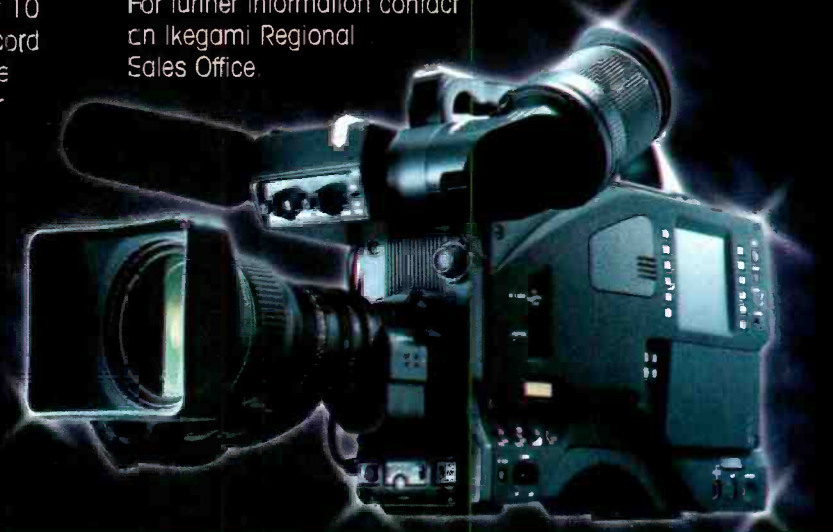
CRCs are calculated for and EDH examines three areas of the picture: the full field (FF), active picture (AP) areas and ancillary data (ANC) for which a checksum is made. In this way, the EDH detector is able to identify if an error is in the active picture area or in the blanking interval. For each of these three areas, the SMPTE RP165 provides for the optional use of five different flags. (See Table 1.)

If an EDH device receives a clean signal with EDH information but no errors, the checkwords are entered as ancillary data on the following field, and none of the flags are set. If the signal contains no EDH information, the Unknown Error Signal (UES) flag is set.

If an error is detected in the active picture, for example, then the AP Error Detected Here (EDH) flag is set and the new checkword is recorded in the following field. The next downstream EDH device will set the AP Error Detected Already (EDA) flag, and it will reset the AP EDH flag back to zero.

At this point, someone monitoring the system would know that there were no errors in the chain but that an error did occur further upstream. An engineer could, therefore, quickly check the entire system by simply looking for the presence of an EDA flag upstream at the start of the chain. The EDA flag is never reset until the error is corrected.

The future prospects for automatic signal rerouting in event of failure are indeed promising. Imagine a routing switcher redirecting an EDH signal error around a



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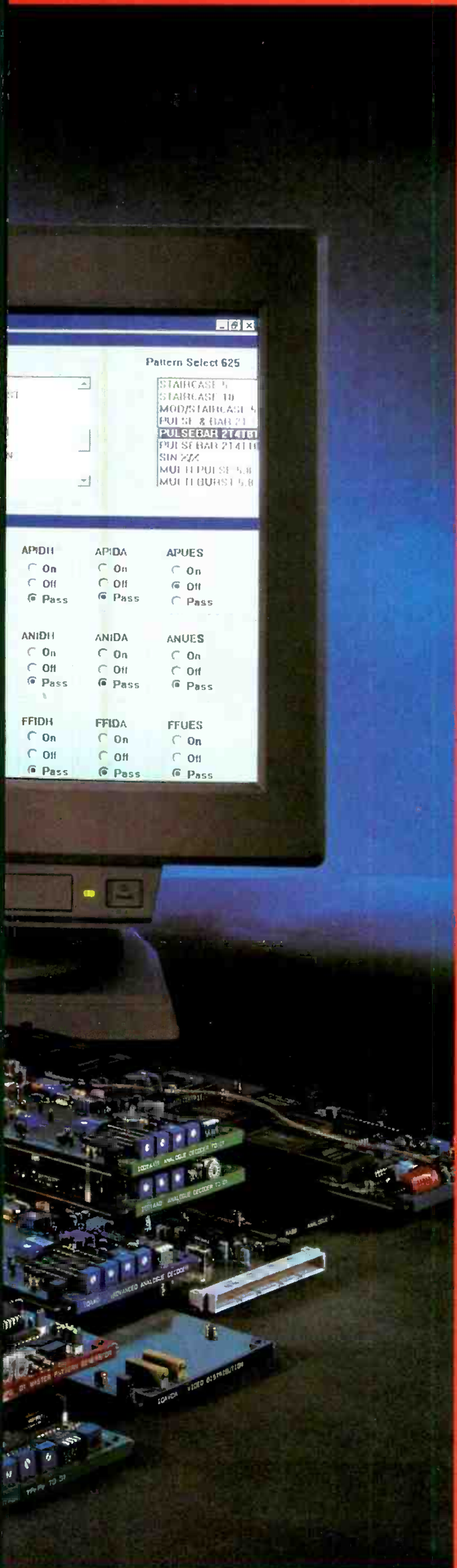
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FFUES

path that has reached its fault threshold. The station's system itself could advise a centrally located operator of the exact room, rack, frame and frame position of the faulty equipment or path.

The implementation of EDH on a systemwide basis can simplify error detection, act as an in-service quality check or make the vision of a self-monitoring TV station a reality.

Debby Canto is a marketing specialist for Leitch, Chesapeake, VA. Contributing to the article were sales, marketing and engineering personnel from Leitch Technology International, Toronto, Canada and Leitch Europe Ltd., United Kingdom.

A solution to EDH

Leitch Technology Corporation has developed an EDH status monitoring system called EDH*view* that will simplify the error monitoring and detection process. It enables a number of EDH devices, such as DACs, ADCs, routers and switchers, to operate under a common monitoring system.

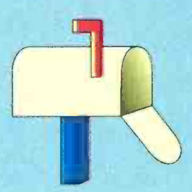
With the Leitch system, the status of all EDH-equipped serial signal paths throughout a complete installation or TV station can be monitored automatically. The system will also maintain a complete log of errors — all without operator intervention.

The hub of the EDH*view* system is a host PC that runs simple-to-use EDH*view* Microsoft Windows software. The PC runs a serial communications network to all EDH-equipped devices or nodes. The status of the EDH data from every node is fed back to the PC, which will interpret it and react according to the respective node set-up. When EDH errors are reported, the PC can raise an alarm.

Every node is capable of being configured separately by the user to respond with visual, audible and/or external alarm notification to a multitude of different situations. The error-reporting characteristics of each node allows channel-by-channel determination of what class and degree of error constitutes an alarm. Higher degrees of protection monitoring can be used on critical paths, whereas occasional use and other lower-priority paths may be considered more tolerant of signal loss and configured accordingly.

Accumulated errors on a system-wide, node-by-node basis will be logged continuously with a date and time stamp. Thus, a complete log file may be viewed on the PC or routed to a printer. A complete history of errors over every signal path in an entire TV station could be available at a glance.

Leitch's high-speed DigiNet control network — which is now used with the DigiBus system and to integrate routing systems — allows random access and real-time reporting for the EDH*view* system and other similar programs that may be developed.



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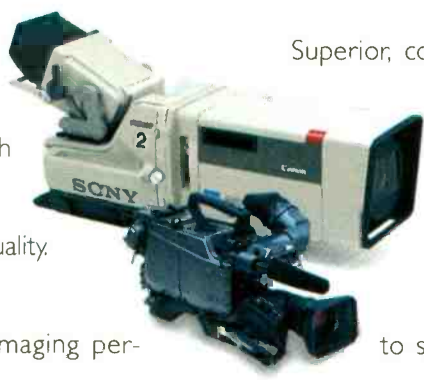
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By Charlie Goode

Commercial-insertion systems

After years of dominance by tape-based systems, commercial-insertion tasks are now being handled increasingly by disk-based systems.

At WWCP-TV, Johnstown, PA, an Odetics Spotbank is used to provide automated playback. The adjacent C-format and Beta-format machines provide the long-form playback needed while the video on-air caching is provided by ASC disk recorders.

The Bottom Line:

Commercials are the lifeblood of every TV station. If mistakes occur and a spot doesn't air, that piece of time is lost forever. As the digital evolution continues, this critical task is now increasingly being handled by video disk players or servers. However, developing a reliable system involves much more than just dumping your tape to disk. $

When the first automated digital commercial-insertion systems hit the market two years ago, it may have marked the beginning of the end of videotape as the medium of choice for playing TV spots and programming to air.

Disk-based replay systems hold a number of advantages over their tape-based predecessors. They can operate continuously with little or no operator assistance, while simultaneously supporting multiple output channels. They also make it simple to broadcast any recorded material in the station's inventory on short notice — including news segments that need to be reorganized to accommodate a breaking story or commercials during a live sporting event where the frequency and duration of breaks is unpredictable.

Digital commercial-insertion systems work by compressing video data and storing it on a computer disk where it remains cached (temporarily stored) until it is played to air. The amount of material stored on a disk varies, depending upon the system's design. A basic all-disk system might use 10 9GB disk drives to store 10 hours of material. The more advanced cache systems are often linked to a tape library and, therefore, require less disk space.

A number of developments in data storage technology helped digital commercial insertion move quickly from a pipe dream to a reality. Once video could be compressed to a manageable file size, it wasn't long before affordable JPEG and MPEG video-compression equipment became available. At the same time, the cost of hard-disk storage plummeted. By 1994, the technology was feasible for broadcast applications and the first disk-based insertion systems were unveiled.

According to industry estimates, more than 500 digital commercial-insertion sys-

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TESTING THE CHANGING WORLD OF COMMUNICATIONS

Tektronix

Circle (40) on Action Card

tems are in place throughout the world. That number will multiply as aging manually loaded equipment becomes too costly to run and maintain. With the prices of digital storage continuing to drop and storage capacities doubling every 18 months, the end is no where in sight.

Basically, two digital insertion configurations are available today: The all-disk models and disk-caching systems linked to automated tape libraries.

The disk-caching systems can typically accommodate nearly any VTR format, which makes it easy to rotate your spots onto disk for air play as they are needed.

All-disk configuration

All-disk systems are being marketed as the digital solution for stations ready to replace their sequencers or manual replay equipment.

For stations that need less than 12 hours of storage, an all-disk system is considered more practical than those linked to library management systems. At the 12-hour mark, the tape-based library management option becomes more economical because of its greater storage capacity.

All-disk system packages usually include a control computer, a digital video disk recorder, program and record/dub switchers, interfaces for additional VTRs and monitoring equipment.

Here is how they typically work: After the playlist is downloaded into the system, it prompts the operator to load the required spots on to the disk, well in advance of their scheduled air time. The spots stay on the disk after being played to air until space is needed for new material. If the disk system is sized properly for the operation, all currently needed material will be on the disk and only new material coming into the facility would need to be added each day.

All-disk systems allow the operator to preview programs and mark in and out points for entry into the database. The system also switches in and out of network feeds to provide a consistent on-air presentation.

To guard against errors that can occur with paper logs (and manual data entry), most systems include a traffic and scheduling interface. Schedules can be transferred to the system via disk, serial interface or network connection. The system software also manages the recording and identification of new material and tracks all of the spots and programs in the system database.

Because video disks are the heart of the system, a disk-drive failure could spell disaster. To prevent this, most all-disk systems have a built-in hard-disk redundancy feature that allows the system to continue to operate with no loss of data even if a drive fails. The most common solution is called Redundant Array of Independent Disks (RAID). At least five levels of RAID protection are available through this technology. For more information, see "RAID Storage Technology," August 1995.

Digital commercial-insertion systems work by compressing video data and storing it on a computer disk where it remains cached until it is played to air.

RAID level 0 indicates no protection for the data from disk failure. If a single disk fails, the system will not be able to perform the task. RAID level 5, on the other hand, allows even the parity drive to fail, and the system can still recover without loss of data or interruption of the operation. A RAID level 3 or above will provide continuous output even if a data drive fails. The missing data will then be rebuilt onto the replacement drive in the background.

Shown in the mid-construction phase, the Spotbank system at KIMO-TV, Anchorage, AK, is tied to Beta decks for long-form playback.

Disk-caching systems

Stations with extensive spot inventories and those wishing to automate the presentation of programming and commercials from disk will use a disk-caching approach. In this configuration, a video disk recorder (VDR) is used for the actual on-air playback. However, the long-term storage of the material remains on tape. Because this approach is integrated with a cart machine or library system, the disk-cache approach provides more flexibility than its all-disk counterpart. Commercials and programming are archived on videotapes stored in the cart machine. Depending on how the system is configured, as many as 7,000 spots and 30 programs can be stored in a cart machine library and accessed by a disk-cache system.

An important key is to know what material to store on the disk and how long to leave it there. This is important so that the tapes don't have to be repeatedly dubbed into the system, which causes wear and takes time. Also, there is the need to minimize needed disk storage space, even if it is relatively inexpensive.

Using a storage scheme adapted from the computer industry (see sidebar, "Borrowing Techniques from the Computer Industry," on p. 70), archived spots are transferred by the system to the digital cache, where they are played directly to air. Only one copy of a spot is dubbed to the cache; no matter how often it is scheduled, it doesn't have to be downloaded again. These systems use smaller capacity disks than the all-disk models, because the automated tape library moves material from tape to disk, as needed.

With material played to air from disk rather than tape, only one VTR is needed. That leaves the remaining VTRs to be put to work for additional on-air channels or recording program material. Furthermore, with less reliance on videotape, the tape library can now be used solely for ar-

chiving, allowing a station to consolidate numerous spots on one tape, if desired.

The reliable nature of these systems is one of their major selling points. However, to protect against catastrophic events that may interrupt a broadcast, most video disk-cache systems include a second disk recorder that receives duplicate material. If the first disk fails, the output is switched to the backup disk.

Multichannel capabilities

A client-server network can be built around a disk-based insertion system to manage multiple channels from a single location. The most powerful systems on the market support up to 30 output channels with 10 disk recorders all linked to one library.

An example installation is at station KIMO-TV in Anchorage, AK. The station uses an all-disk configuration arranged in a network where the operators also program for stations in Fairbanks and Juneau. All material originates from Anchorage, including each of the stations' individual station IDs, promotions and spots. The feeds are satellite fed to the sister stations for on-air playback. The system includes a

According to industry estimates, more than 500 digital commercial-insertion systems are in place throughout the world.

network delay to capture downlinked network programming, store it on the video disk in Anchorage and broadcast it four hours later. In a similar arrangement, WWCP in Johnstown, PA, controls spot insertion for WATM in Altoona, PA.

One major advantage of such centralized operations is lower operating costs. This will become an even more important element as stations need to originate multiple channels of programming under the new ATV rules. For group stations, the caching system means there is no need to record a composite dub reel. Just one video disk recorder supports one record input and as many as three independent output channels. Because the storage media is common to all output channels, spots and other material need be downloaded only once, but can be used by all three channels, even simultaneously.

Multi-output channel systems are ideal for stations with local market agreements or for cable applications, such as pay-per-view movies. The technical requirements

for on-air broadcast and cable pay movies are different so systems are tailored for the specific application. With cable, multiple output channels are more important than image quality. For broadcast, the ability to provide high-quality images and shuttle in and out of commercials as needed is more important. This is clearly a case of where one size doesn't fit all.

The news department can also benefit from a dual-channel system. In such a configuration, one channel runs programs while the other handles spot insertion, leaving some transports free for automating tape replay during the newscast.

Labor and maintenance savings

Can this technology save you money? In a word — yes. Typically, by playing spots from disks, stations see a dramatic drop in videotape and VTR purchases (and maintenance). In fact, stations that upgrade from direct tape-to-air playback systems to digital commercial-insertion systems can expect to see a 50% to 80% drop in VTR maintenance costs. At the same time, the material played off of a video disk is consistent in quality because, unlike tape, disks don't degrade with every play.

Also, because these systems can operate with little or no attention from an operator, stations in smaller markets have saved $200,000 a year in labor costs after implementing a single-channel commercial-insertion system.

Finally, thanks to the system's inherent reliability, there are typically few make-goods. If a spot does need to be re-cued or replaced at the last minute, the system will access and cue the right spot within a few seconds. Try that with your 1-inch machine or library system.

The future

Today's digital commercial-insertion systems foreshadow major changes in the way we will be handling spots and programming in the near future. As the cost per megabyte continues to drop and more broadcasters switch from tape to disk for air purposes, videotape will shift to primarily an archival medium. Note that archival doesn't necessarily mean "old stuff." Shipping tapes around is still the most convenient way to get spots across town or to capture that satellite feed. So, don't throw away that tape machine yet. It's still not ready for the junk pile. ■

Charlie Goode is vice president of engineering for Smith Broadcasting, Miami.

Borrowing techniques from the computer industry

The hierarchical storage system that gives advanced digital insertion systems their multichannel random-access power got its start in the computer lab.

Some 30 years ago, random-access disk drives redefined the way computers archived data. Rather than backing up data on miles of unwieldy magnetic tape, users could store vast amounts of information on digital disks and later access that data instantaneously. When the disk drives reached their capacity, more drives were added. The problem was that eventually there was a limit to the practical number of drives that could be purchased — or housed by any facility.

The new approach involved something called hierarchical storage management (HSM). HSM provides virtually unlimited storage capacity and requires little or no operator intervention. With HSM, the information used most frequently is kept in cache on the disk drive. Meanwhile, the information used least often is stored on the more cost-effective medium — tape, which is managed by an automated tape library.

Manufacturers of disk-based insertion systems for broadcast use the HSM "caching" concept to handle frequently used material. In these systems, the software analyzes the need for each element and determines if it would be more efficient to leave it stored on disk or to retrieve it from tape when needed. If the material is needed repeatedly, then it is kept on the disk for playback. Other, less-often used elements are left on tape and then dubbed to disk only when they are needed. Other long-form material, like programming, plays direct to air from videotape. The software has the ability to search playlists for cacheable material well in advance of air time. All of these functions take place in the background without operator intervention. ■

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Circle (48) on Action Card

By Kenneth Hunold

New camera technologies

Innovations abound in the latest generation of cameras.

TV cameras are often considered the most visible, and therefore, perhaps the most important tools of the TV industry. Subwoofers notwithstanding, television is still considered primarily a visual medium. As such, the TV camera is often placed at the apex of the production technology pyramid. While fancy, whiz-bang effects have gotten a good portion of the recent press, live TV events still need to be seen by the TV camera before they can be seen in the home. Like the proverbial tortoise, camera technology has been moving at an evolutionary pace with advances coming slowly, but surely. This does not mean that camera technology is standing still. It only has the appearance of lagging behind the rest of the production process in the race for the latest and greatest innovation on the block.

Above photos: The Hitachi Z-2000 uses single LSI processing and features a fuel battery gauge in the viewfinder and a streamlined menu system.

Sony's DNW-7 digital camcorder uses the Betacam SX format, and can be used for high-speed transfers into a nonlinear system.

Panasonic's AJ-D700 camcorder is one of several units that incorporates DVCPRO recording.

Digital processing

Studio cameras already exceed the maximum resolution that our transmission system can provide. Hand-held cameras have become so lightweight that they no longer counterbalance the weight of the lens when placed on an operator's shoulder. Does this mean that there is no need for improvement in camera technology? Is there truly nothing new under the TV sun? Hardly! Thankfully, no upper limit for luminance resolution was specified when the production portion of the NTSC system was developed. Even so, while the picture quality (resolution, colorimetry, etc.) of TV camer-

The Bottom Line:

From the outside, cameras appear to have changed little over the last few years. However, internally it's another story. Today's cameras are lighter, smaller and capable of taking pictures under a wider range of conditions. These innovations are possible through the use of sophisticated DSP circuitry. Lower cost and improved picture quality, combined with a wide range of features, may mean now is a good time to upgrade. $

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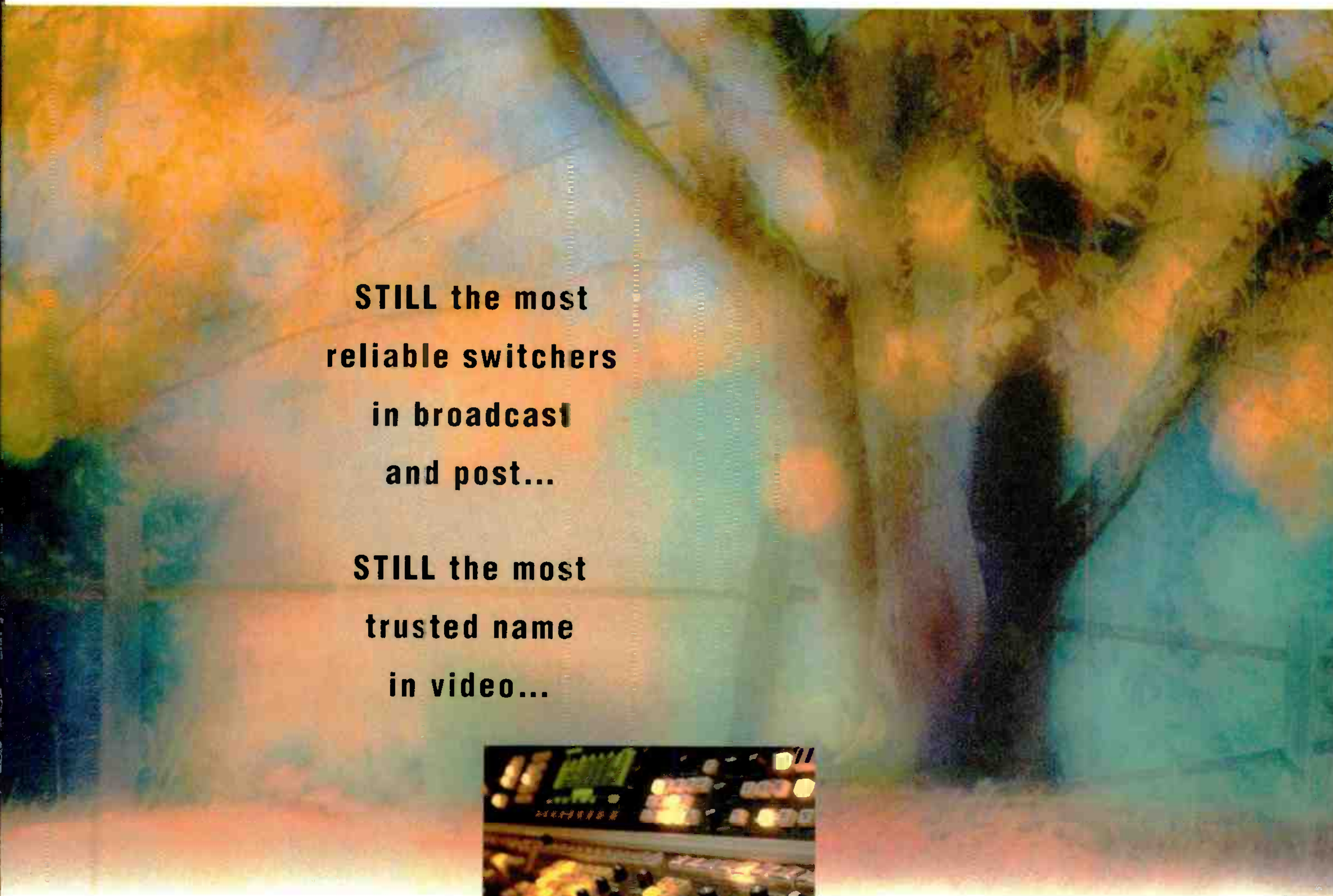

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as has probably reached its peak for the majority of NTSC applications, new features and new methods of controlling those features continue to be developed and included in new camera models every year.

The push toward processing TV signals in the digital domain has worked its way from its digital recording and playback roots out to the extreme ends of the production process. There it meets its greatest challenge — converting our primarily analog world into an electrical representation, then delivering it to our primarily analog senses. It is at these human interface points where digital processing is most difficult to implement. The CCD devices used in today's cameras, while considered solid-state digital devices, still process signals in the analog domain. Even though the images are sampled and scanned in a digital device, they are usually not quantized (or digitized) at this point. As is the case with audio signals, the video signal must first be amplified considerably before it can be quantized with sufficient resolution to avoid distortion.

The Ikegami DNS-11 camcorder features hard-drive-based recording and editing.

Where digital technology has been widely used is in the control and processing of signals after they have been amplified, preprocessed and quantized. Numerous automatic circuits, scene files (or memories) and setup cards abound in today's high-end cameras. Auto-knee circuits can extract meaningful visual detail from scenes that have contrast ratios much greater than what normally can be displayed on TV monitors. Properly adjusted, they can work with an automatic iris circuit to give the illusion that the TV system (camera and monitor) actually have the dynamic range of our eyes and our brain. Setup cards can customize a generic camera for use in special situations or on special programs. Parameters stored on the setup card can give the camera (and by extension, the show it is used on) its special look. Setup cards can even store operator preferences for how the camera should look and feel while it is being operated.

Skin-detail enhancement has become almost as necessary today as auto iris and auto white balance were a decade ago. The primary use of these circuits has evolved into wrinkle reducers for on-camera talent, but don't lose sight of the original intent of all detail enhancement circuits. Originally, detail enhancement (often referred to as aperture or contour enhancement) was intended to make the image appear sharper. Skin-detail circuits can be used just as effectively to enhance an attribute of a product on a commercial shoot by highlighting a part of a product or its packaging.

Getting the picture

The 700- to 900-TV line resolution capability of the newest camera heads is being relayed to the camera control unit with higher resolution (read that "wider bandwidth") camera cable systems. Wideband triax systems are increasing the amount of detail that gets to the camera control unit and, ultimately, the video output BNC connector. Digital triax systems and fiber-optic camera cables are being deployed to reduce the losses associated with transmitting a camera image over miles of camera cable, as is the case in some remote EFP applications.

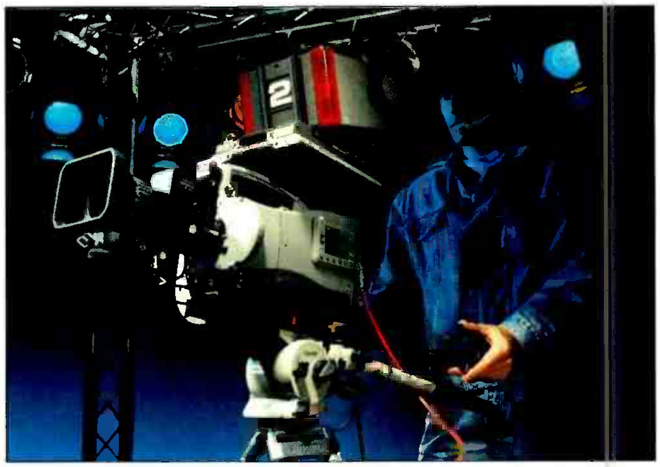
Today, in our transition to widescreen ATV, a camera needs to be able to make the transition from today's 4:3 aspect ratio to tomorrow's 16:9 widescreen aspect ratio. Various schemes of managing the allocation of picture elements on the CCD that are literally etched in silicon have been developed. New cameras can now switch aspect ratios on-the-fly to accommodate 4:3 scanning today, while supporting the new 16:9 widescreen format when desired. Different cameras go about this task in different ways, and dealing with different aspect ratios demands that some compromises be made. Some cameras deal with this challenge by adding another CCD sensor to the green channel. This increases the resolution capacity of the system at the expense of adding another light-splitting port to the optical prism. Other cameras re-map the CCD pixels to maximize resolution for each aspect ratio.

TV lenses, although primarily optical devices, have also been affected by digital processing technology. New technology is allowing greater flexibility and repeatability of control over many of the optical and mechanical elements and electrical parameters that go in to a modern TV lens. The precision with which the optical elements are moved determines, to a large degree, the resolving power of the lens.

Onboard storage

In many ways, some of the new technology in today's cameras is blurring the distinction between imaging device and production device. It is tempting to think of a one-piece camcorder as an extension of the camera itself. Advances in compression technology have allowed digital recording to be implemented on the camera operator's shoulder, either through a compressed digital videotape format or a hard-disk-based recording media.

New, as well as existing, videotape formats using compressed digital video are opening up new applications for compression technology. The original use of compression technology was to allow high bit rate video information to either be recorded on a lower bit rate recording system or transmitted through a lower bit rate transmission system. Data compression can also be used to compress the time it takes to transfer video data between two points when a high-speed data link is available.



The LDK 10P offers Dynamic Pixel Management (DPM), which provides quick switching between aspect ratios. An automatic dual skin contour system provides precise control over flesh tones and skin quality.

Many transmission protocols are being submitted to standardization organizations. These systems will stand alongside standard transmission protocols, such as ATM, Firewire and others. Off-the-shelf computer hardware is being incorporated into some new cameras to allow faster than real-time transfer of recorded images from the remote site to the station or between video file servers.

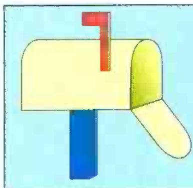
JVC's GY-X2B is an advanced version of the GY-X2. The 3CCD S-VHS camcorder features excellent low-light performance.

Incorporating non-linear recording media into a camera will certainly change the way that cameras are used in the future. Also, do not forget that every year at NAB, new videotape formats are introduced. The principle technology that linear and non-linear recording share is that they are digital. Clearly, there are enough applications for both types of recording in the industry.

On the technological horizon, the coming of ATV will bring a whole new generation of technological developments. The many different scanning formats that will be supported in the Grand Alliance system will allow the development of higher-definition cameras using new constructions of CCD imaging devices. These cameras will operate in many different scanning standards, anywhere from the existing 720H x 480V pixels up to 1,920H x 1,080V pixels and may operate in either interlaced or progressive scan. Actually, the CCD structure is similar for interlaced and progressive scanning. The difference is the order in which the charges corresponding to the image are clocked out of the device and is also constrained by the speed at which the device can operate. New digital systems will have to handle these higher data rates, and routing systems will need to be able to keep up with these high data rates and distribute them throughout the facility. New compression algorithms will allow transmission of more of this information and other data to the end-user.

Digital computer technology has been adapted for use in the video production and post-production industries, and microprocessors control many of the functions in today's cameras. New camera technology may not grab the headlines, but these new implementations of digital processing and control continue to push the envelope of camera technology. Camera technology is where it all starts, and the needs and desires for improved and sharper images drive the development of the equipment to which it is connected. ■

Kenneth Hunold is an audio/video project engineer at the ABC Engineering Laboratory, New York.



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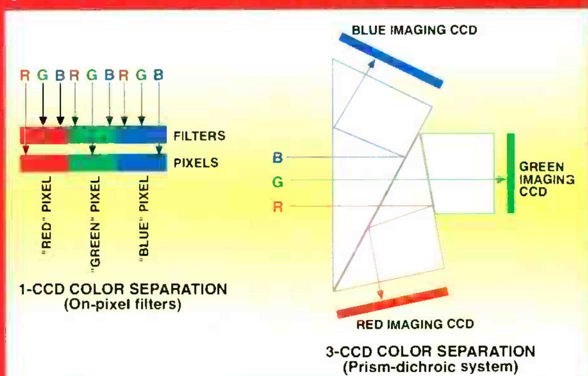
Light sensitivity in 1-CCD vs. 3-CCD cameras

By Bob Eather

There are inherent differences in the light sensitivity, resolution and color reproduction between 1-CCD and 3-CCD cameras, especially at low light levels. 1-CCD cameras use filters deposited on the CCD chip over individual pixels in a mosaic or striped pattern. Only one-third of the light entering a camera with an RGB on-chip filter actually reaches the light-sensitive elements on the CCD. Each filter only passes a single color, blocking the other two. In the 3-CCD camera prism separation system, all of the incident light is directed to one of the three CCDs. Depending on the spectral distribution of the incident light, this more efficient use of available photons translates to some combination of better sensitivity, resolution and S/N.

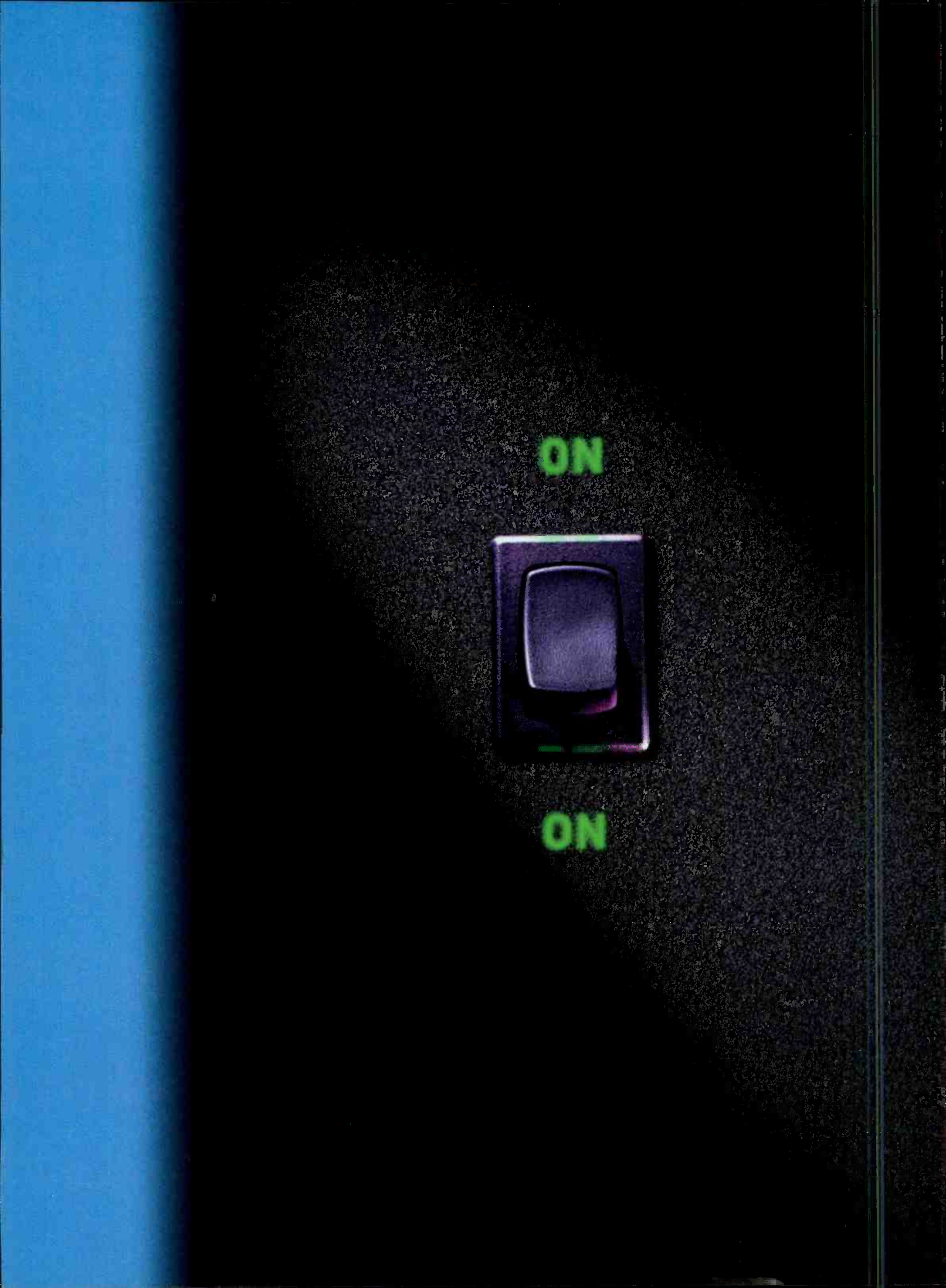
To increase sensitivity of 1-CCD cameras, complementary color filters (yellow, cyan and magenta) with twice the spectral bandwidth or RGB filters are used. This increases sensitivity by a factor of two, but seriously compromises color reproduction at low light levels. This is because the RGB signals are derived by arithmetic operations on the signals from the complementary filters. At low light levels, the subtraction of two small numbers with significant noise attached gives poor accuracy and high noise. The 1-CCD cameras that use RGB filters (usually only industrial models) give better color reproduction, but less sensitivity.



Color separation used for single-CCD systems allows only one-third the light to reach the CCD. However, virtually all of the available light reaches the CCDs in the prism-dichroic systems used with 3-CCD cameras.

These limitations are reflected in the specifications for 1-CCD cameras, where minimum illumination (rather than sensitivity) is normally quoted. At first glance, quoted numbers of two to three lux seem to be better than 3-CCD professional cameras that cost many times more. However, you must realize that the associated S/N is typically only 45dB to 50dB, some 15dB less than professional cameras (60dB to 62dB) and the 1-CCD cameras are generally specified at lower IRE levels. For more information, see "Evaluating Low Light Camera Performance," July 1995.

Bob Eather is president of Keo Consultants, Brookline, MA.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By Kenneth Hunold

Interfacing digital audio

Keeping audio in the digital domain requires some new understanding.

The Bottom Line:

Digital audio is moving into TV facilities, bringing with it new advantages and new challenges. Alongside it, a significant amount of analog audio equipment will continue to be used for some time. Broadcasters need to familiarize themselves with new interconnection practices between these systems in order to maximize digital audio's potential assets. $

Fifteen years ago, the standard interface to digital audio equipment was an analog connection. Digital interconnections were often proprietary, and usually were provided only as a means for the manufacturer to test the digital inner workings of the box. Any digital I/O was planned for future development or needed a cumbersome adapter to talk with any other digital device.

In 1985, the Audio Engineering Society (AES) and the European Broadcasting Union (EBU) agreed on an RS-422-based transmission standard for digital audio that has become known as the AES/EBU digital audio interface. AES3-1985 (as the AES standard is officially known) and its update, AES3-1992, describe the interface. (See Figure 1.)

Photo: Today's TV audio production requires substantial interfacing between the analog and digital domains, as in this facility at NHK, Tokyo. (Courtesy of Solid State Logic.)

Although AES/EBU is the most commonly used digital audio interface today, a few other systems developed in the 1980s are still around. These were developed by manufacturers for interconnecting consumer (and some professional) equipment. Sony and Philips together developed the Sony Philips Digital Interface (SPDIF) for consumer use. Except for electrical levels and some status-byte protocols, the AES/EBU and SPDIF standards are identical, and often both interfaces are provided on digital equipment.

Reference levels

As audio operators are well aware, the concept of a standard operating level in the analog domain is, to put it kindly, a moving target. If not addressed properly, the same problem can exist in the digital domain. The definition of what analog level will correspond to the maximum digital level (meaning that its peak voltage will just reach the maximum numeric code allowed) is known as the full-scale digital value. This is specified as 0dBFS (0dB referenced to full scale).

Different international broadcasting organizations have developed their own definitions of what analog level will equal 0dBFS. The only SMPTE recommendation published to date that deals with this issue is RP155, which recommends that the operating level in a digital VTR (the nominal or "line-up" level) be set 20dB below the full-scale level or -20dBFS. This allows 20dB of headroom and, more importantly, also allows for the proper interchange of program material between facilities — even those that have different definitions for their *analog* reference level.

Therefore, one of the core decisions that must be made in the design and implementation of a digital system is what analog

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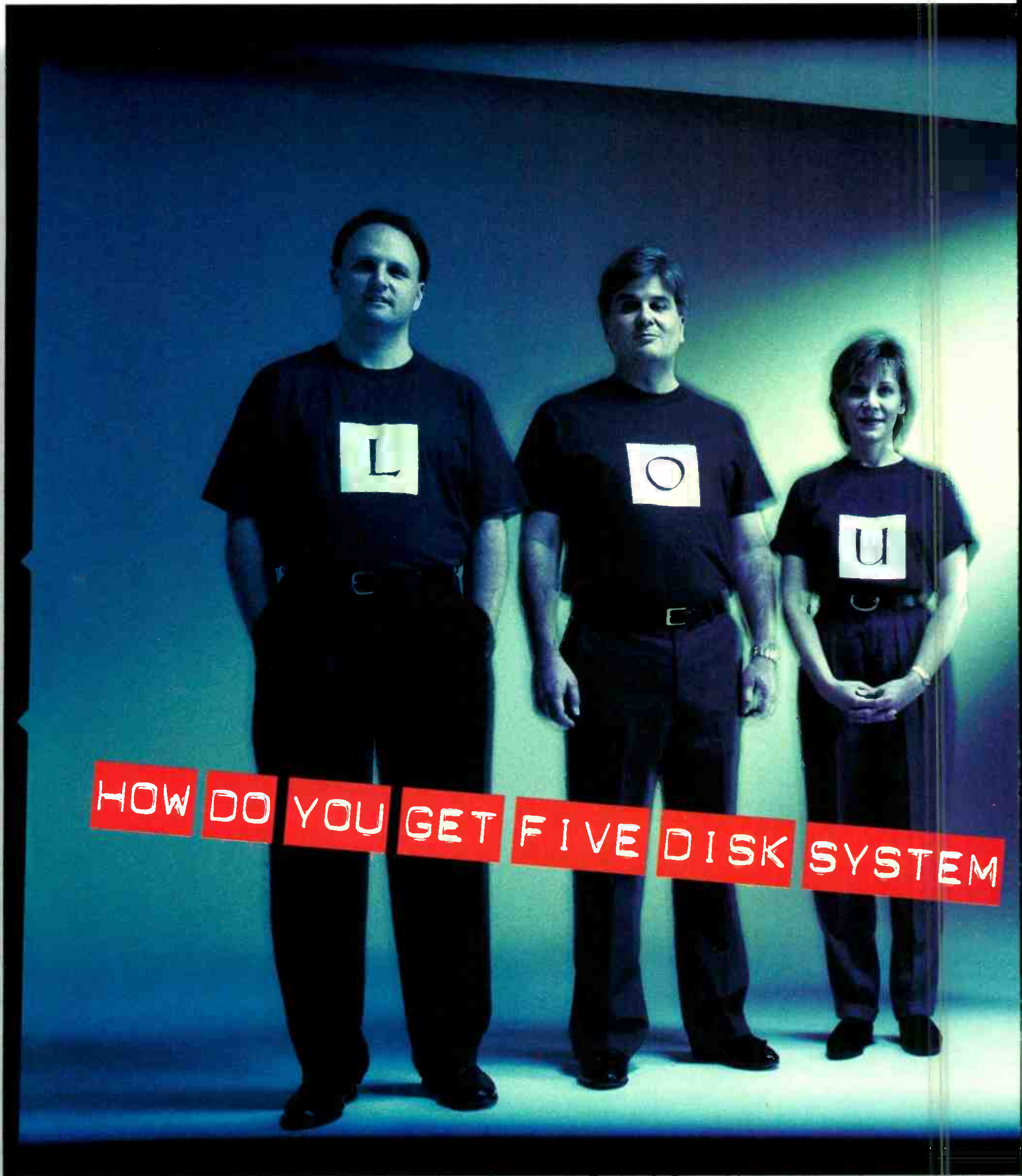
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level should correspond to 0dBFS. This definition must be applied consistently throughout the facility. If the analog operating level is +4dBu, then the 0dBFS level should be +24dBu, according to SMPTE RP155. All A/D converters in the facility should be set so that the +4dBu reference signal will be converted to -20dBFS in the digital domain. Conversely, all D/A converters should be set so that a -20dBFS digital signal is converted back to the +4dBu analog reference level. Without such consistency, level errors can occur at any A/D or D/A conversion, and the errors could accumulate as the signal passes through the facility.

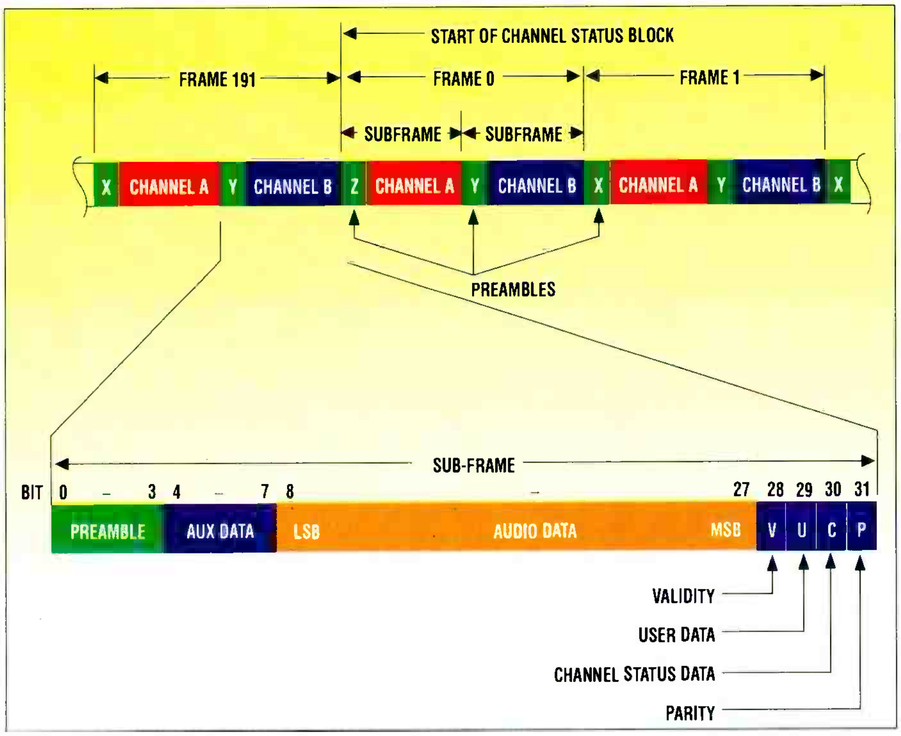

Figure 1. The framing structure of AES/EBU audio signals. Frames are composed of two 32-bit subframes (one for each audio channel of a stereo pair), each identified by its preamble. Channel status blocks are assembled over 192 frames. (Source: AES3-1992.)

Sampling rates

Although the AES/EBU interface is capable of supporting sampling rate frequencies ranging from approximately 25kHz to 54kHz, most equipment will only operate at specific sampling rates. Some standard sampling rates have evolved over time, the most common ones being 32kHz, 44.1kHz and 48kHz. The 32kHz rate is used sparingly in professional broadcast circles, while the 44.1kHz rate is the compact disc (or consumer) standard. The 48kHz rate is the professional standard used by most broadcasters for original recordings and transmissions.

Therefore, digital video equipment almost always uses 48kHz, but TV stations and post-production facilities often use a lot of CD-originated material in their productions, requiring them to deal with 44.1kHz audio as well (if they wish to avoid unnecessary A/D and D/A conversions).

These problems require the use of a *sampling rate converter* to convert audio samples made at one sampling rate to a different quantity of samples at another rate. Even though this process operates in the digital domain, it is not a completely transparent process and can have an audible impact on the signal. An alternate method involves conversion back to analog and reconversion to digital at the different sampling rate. This also risks degradation of the signal, but it may be a less problematic approach. The basic rule is to keep either type of conversion (A/D-D/A or sampling rate) applied to an audio signal to a minimum.

Synchronization

Adjunct to the issue of sampling rate conversion is the larger point of sampling rate *synchronization*. Digital devices (audio and video) have their sampling rates determined by an internal clock oscillator. While the nominal sampling rate of two DAT machines, for example, may be 48kHz, it is highly unlikely that their sampling rates will be identical. Over time, any two oscillators will drift out of (and perhaps back through) synchronization.

Loss of synchronization between devices can cause audible artifacts (typically pops and clicks) or worse, the destination device may not be able to recognize the incoming audio datastream at all. One solution to this problem involves locking all of the audio equipment to a common reference, as all of the video gear already is. Most digital video equipment derives its video and audio clock and sample rates from the same oscillator or time base. Because most digital video equipment is already referenced to a common source (either sync or composite black burst), and because the audio sampling rates on these devices are counted down from this common source, the sampling rates of these gen-locked devices are identical.

However, there are problems with extending this gen-lock philosophy to the rest of the facility. The first is that most digital audio gear will not accept a video signal as a reference. The reference input (if any) on digital audio equipment would more likely be an AES/EBU or SPDIF audio signal or a *word clock* signal (a square wave at the sampling frequency) from another digital audio device. The second problem is that video equipment will not accept any of the audio reference signals for its video reference, either.

Therefore, merely locking the audio and video signals to a common reference will not always prevent AES frame discontinuities when mixing or switching digital audio signals. (Frame discontinuities are the most common causes of those mysterious pops and clicks.) In order for switches to be pop-free, they must be made on AES frame boundaries, with the source and the destination devices having coincident frame boundaries and identical sampling frequencies. This is described as *synchronous operation.* (See Figure 2.)

All previous references to sampling rates in this article have only addressed their frequency. No mention has been made of the relative *phase* of these sample clocks or any other aspect of the AES bitstream. The analogous (no pun intended) situation in video occurs when the subcarrier frequency is the same, but the vertical and horizontal sync pulses are not coincident. The term *isochronous* is used to describe this "locked but not phased" condition, while the term *synchronous* is reserved for signals that have their timing references coincident. This is similar to switching video during the vertical interval to avoid a roll or a glitch. For glitch-free video switches to occur, the vertical interval (and hopefully horizontal interval, as well) of both signals must be coincident. This is not guaranteed, however, even in facilities that are all locked to the same frequency standard.

AES vs. NTSC

This problem of switching audio on AES frame boundaries is especially difficult for

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NTSC video systems, because there is not an integer number of AES frames in an NTSC video frame. In NTSC systems, there are 1,601.6 AES frames per video frame. (There are an even 1,920 AES frames per PAL video frame.) This means that an AES frame boundary and an NTSC video frame boundary will only coincide every five video frames. Further complicating matters is the random video-to-audio phase upon power-up that some equipment exhibits.

While operating video and audio equipment referenced to a common oscillator will go a long way toward eliminating pops and clicks, the only way to guarantee a clean transition is to break the AES bitstream down to the subframe level, perform the switch and then reformat the data maintaining an uninterrupted AES frame sequence.

Another possible solution is to distribute audio and video reference signals throughout the facility, allowing each piece of equipment access to the proper reference source (composite blackburst, AES digital audio reference, word clock or audio black). By placing the most stable (and perhaps most accurate) time base at the top of the timing chain, all other references can be counted down from this common reference, ensuring the most consistent, jitter-free reference network possible.

Embedded audio

Another way to distribute digital audio through a video facility is by multiplexing it into the digital video signal. SMPTE digital video standards refer to this as *embedded audio*, in which AES-formatted digital audio signals are carried in the ancillary data space of serial digital video signals. (See "Transition to Digital," July 1995.) This allows routing of video and multichannel audio signals through a single wire and a single level of a routing switcher. This is a particular advantage for facilities (or portions of a facility) that only route or pass signals through without modifying the content in any way.

Embedded audio loses its appeal in facilities where a break-away switch is required. Break-away switching occurs when either the video or audio of a combined digital audio/video datastream needs to be changed. In these cases, the video and audio must be separated with a device called a demultiplexer or disembedder. The desired changes can then be made, after which the video and audio are recombined.

The disembed/re-embed process introduces additional delay into the signal, with the greater delay applied to the audio. This defies the conventional wisdom that the *video* signal is subject to greater throughput delays due to processing, frame synchronization and the like. Therefore, facilities using serial digital video with embedded audio must have the capability of delaying either video or audio with respect to each other.

These elements necessitate additional expenses and complexity that need to be balanced against the cost of additional audio levels in the routing matrix. Note also that neither embedded audio nor separate routing levels for AES signals can guarantee glitch-free switches.

Putting AES audio in the video facility

The electrical requirements of AES3-1992 specified the transmission of data over a balanced, twisted-pair cable with a characteristic impedance of 110Ω and terminated in an XLR-3 connector. As the AES standard was developed by the audio engineering community, it made sense to use a cable and connector type that was familiar, reliable and readily available. Now that digital audio is being widely implemented in video facilities, there is a desire to use a cable and connector type that is familiar, reliable and readily available in *these* installations.

Using 75Ω coaxial cables with BNC connectors would satisfy these needs. It would also allow the re-use of analog video cables, DAs and routing systems left behind as the facility converted to digital video distribution. Both SMPTE and AES have drafted mutually compatible documents describing the transmission of AES/EBU digital audio over coaxial cables. The transmission format of the signal is identical for either 75Ω unbalanced coax or 110Ω balanced twisted-pair cable and the two formats can be interconnected with either passive or transformer-coupled matching networks.

The data rate of an AES/EBU signal generates frequencies with fundamentals below 6MHz (similar to analog video), well within the bandpass of standard, non-clamping analog video DAs. Engineers at video facilities have become familiar with cabling, routing and distribution procedures for coaxial cables. Transmitting AES/EBU signals via these coaxial cables is a simple and cost-effective means of their distribution over distances greater than the 100m, often specified as the maximum recommended distance for 110Ω balanced twisted-pair. Acceptable performance has been reported using coaxial cable on lengths greater than 1,500 feet and even up to 4,000 feet depending on the type of cable used.

If longer lengths are desired, equalization networks are available for coaxial receivers (just as they are for twisted-pair distribution). Automatically equalizing and reclocking distribution amplifiers are now becoming available for AES/EBU signals, which are similar in operation to their serial digital video cousins. Although you won't be able to use your old analog video DAs for this, you can use the same distribution, routing and patching schemes via coaxial cable.

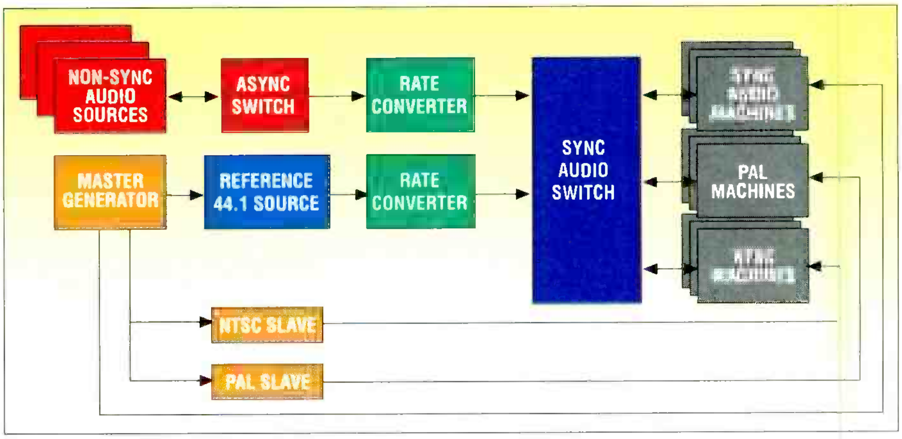


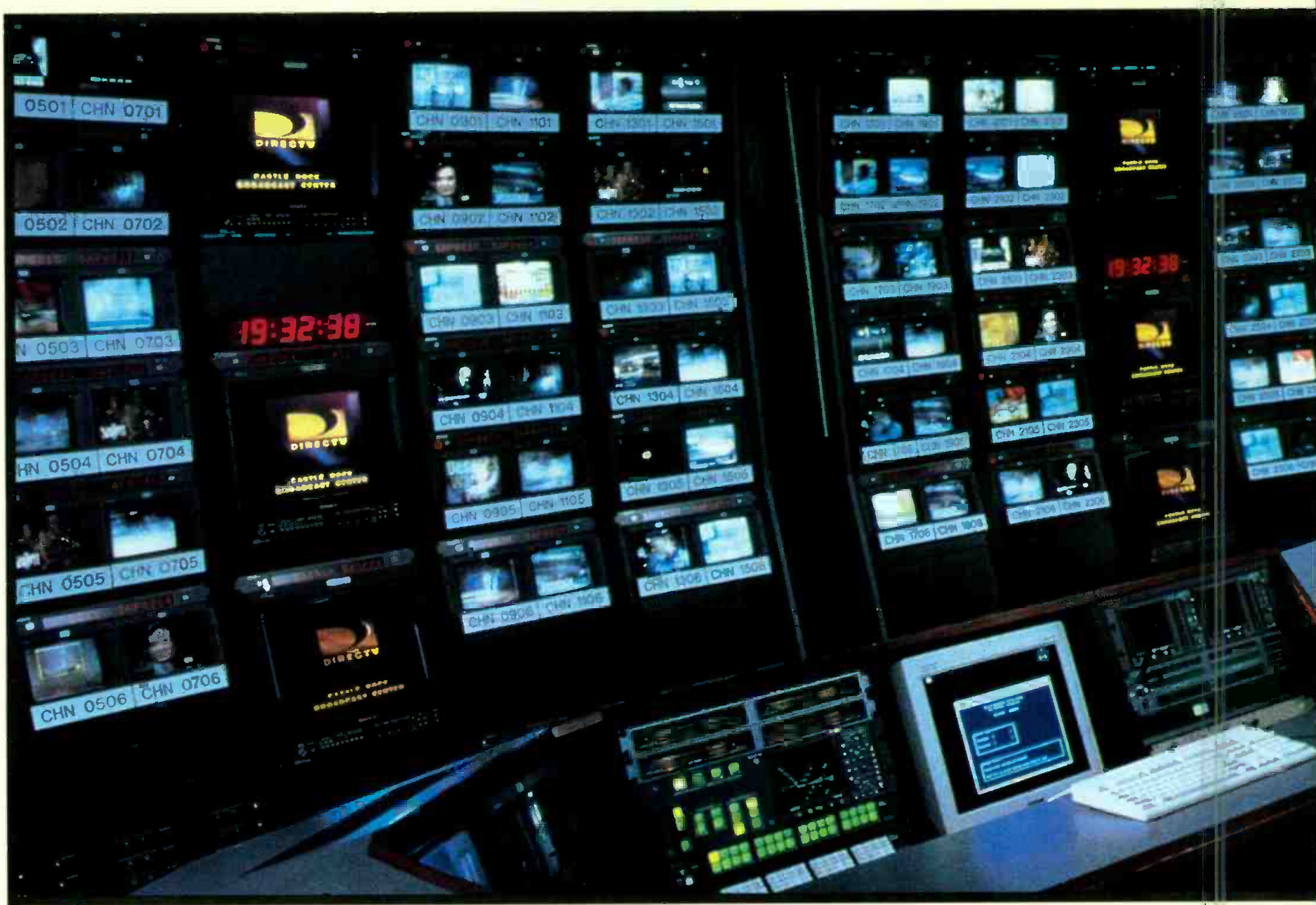
Figure 2. A conceptual block diagram for one method of facility-wide digital audio/video synchronization. (Courtesy of N-VISION.)

All of this must be balanced against the cost of coax-to-twisted-pair baluns and attenuation networks, where needed. Also note that AES3-1992 allows a peak-to-peak voltage range of 2V to 7V, while the specification for signal voltage levels over coaxial cable is 1V.

Interface issues, such as the items discussed in this article, must be recognized and clearly understood. Only then can digital audio systems make good on the promise of being a reliable, efficient and high-quality means of production and delivery. ■

Kenneth Hunold is an audio/video project engineer at the ABC Engineering Laboratory, New York.

For more information on digital audio interfacing, circle (200) on Action Card.



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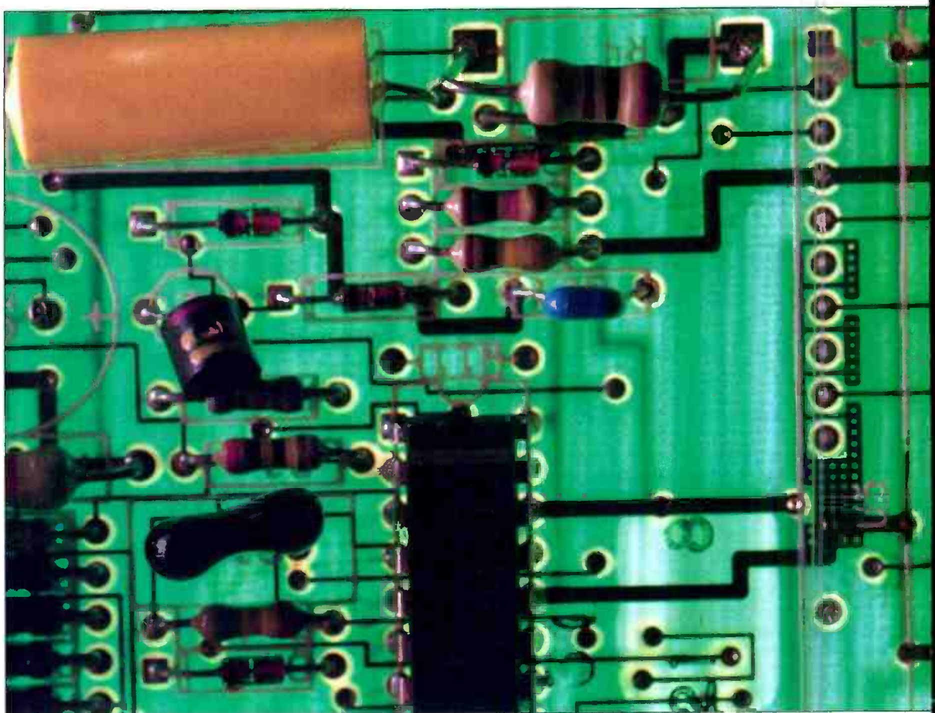
By Jeff Noah

Performing QC on digital audio



The Bottom Line:

To properly troubleshoot today's digital audio systems, an understanding of how digital audio works is essential, but so are some new analytical tools made especially for this purpose. Armed with such knowledge and hardware, quality control (QC) ultimately becomes easier and more predictable in the digital audio world. $

Some specialized hardware and techniques have been developed for monitoring digital audio.

If you've upgraded some or all of your facility to digital audio gear, you're probably finding that only a few of the traditional, day-to-day maintenance and monitoring tasks apply to your new equipment. In fact, aside from phase and level monitoring, most of the duties you'll perform or problems you'll encounter are unique to the digital domain.

One category of problems relates to interfacing. These issues are most often thought of as occurring during equipment installation, but they can crop up any time you put a digital tape into a player.

Another class of problems includes difficulties in signal transport. These can turn up at any time, and their solution requires analysis of the high-frequency datastream carrying the digital audio signal.

AES format review

Before discussing interface problems, a brief review of the AES/EBU subframe structure is in order. (See "Interfacing Digital Audio," p. 80.) A 32-bit subframe is the basic data unit of the AES/EBU format. Two subframes make a frame (each subframe contains an audio sample from one audio channel of a stereo pair) and 192 frames make a block. Each subframe has its own preamble, audio sample data, validity bit, user and channel status bits and parity bit. (See Figure 1 on p. 84.)

The preamble marks the beginning of the subframe. It's followed by an audio sample of up to 24 bits. The next bit, the validity bit, should be low in most cases. If it's high, it indicates that the audio sample is not suitable for conversion to analog. One condition where the validity should be expected to be high is when consumer digital audio devices, like CD players and laserdisk players, are in the pause mode.

User bits are loosely defined and not used often. When they are used, they're often applied in unique ways to specific applications. Their use, or lack of use, rarely causes a problem. Channel status bits, however, are tightly defined and are almost always used.

At the end of each AES/EBU block, 192 channel status bits for each audio channel will have accumulated in a buffer at the receiver. Those are broken down into 24 8-bit words. All of this data describes various aspects of the signal contained in the block. (More on this later.)

Last is the parity bit. It sets the parity for the subframe in which it's included. The AES/EBU standard uses even parity.

Channel status incompatibilities

One of the main problems with channel status data is its great flexibility. While the

decoding of this data is well-defined, different manufacturers' equipment reacts to the decoded data in different ways.

A common problem occurs when you connect a consumer device to a professional recorder. Because 16-bit CD audio sounds quite good and there's a wide selection of music libraries available in that format, its use in professional environments is widespread. However, attempts to do a digital-to-digital transfer are sometimes thwarted by a professional recorder that refuses to accept consumer-formatted digital data. The only difference is that the first bit of the first 8-bit word is a 0, indicating consumer digital audio, instead of a 1, which indicates professional.

Solving this problem requires analysis of the digital audio datastream. A number of purpose-built analyzers for this purpose have recently become available, greatly simplifying the troubleshooting of digital audio systems.

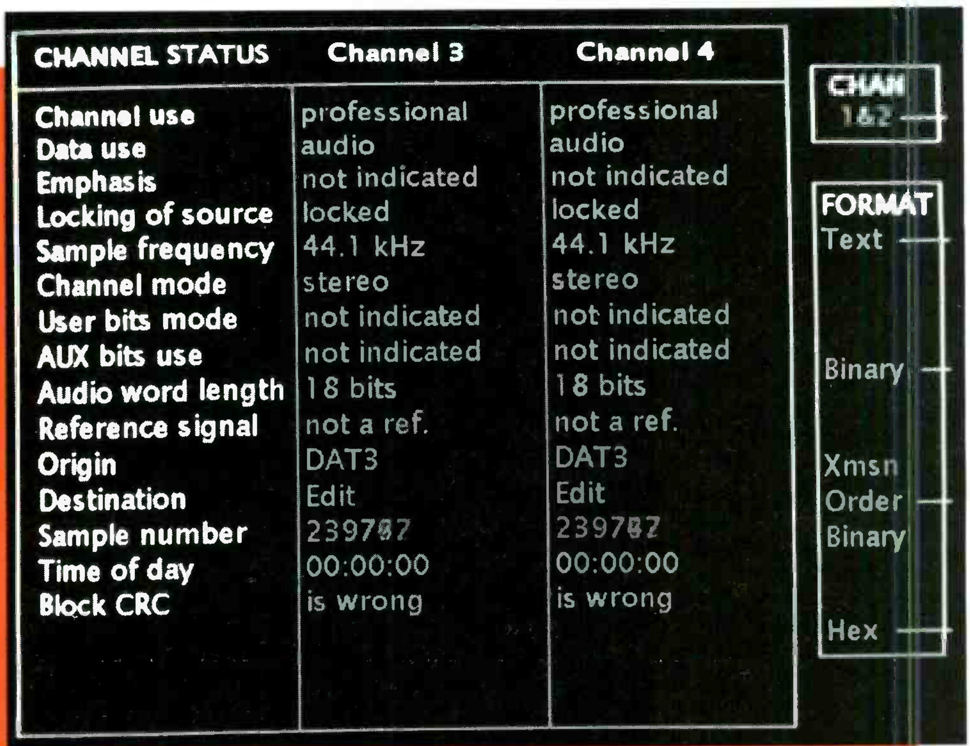


Figure 1. Decoding channel status into English simplifies troubleshooting of interface problems.

Sometimes, devices are incorrectly programmed such that they send audio data at a particular sample rate, but indicate a different rate in their channel status data. Some receiving devices don't pay any attention to the indicated sample rate in channel-status data, looking only at the incoming signal for sample rate information. Other devices always assume that the channel status data is accurate, and when it's not, they may receive the data improperly. The result could be as minor as an occasional pop or click or as bad as no sound transfer at all.

Another fairly common situation that can cause serious problems is trying to record a consumer-formatted signal that has the *Serial Copy Management System* (SCMS) copy-inhibit bit enabled when it shouldn't.

Fortunately, there are at least three solutions to these incompatibility problems. The best solution is to reprogram one of the two devices to remove the conflict. If that's not possible, you can temporarily use a specialized digital audio troubleshooting tool — a sort of breakout box for digital audio — that enables real-time editing of the channel status bits. As a last resort, you can always connect the two devices analog to analog.

Figure 1 shows one of the currently available AES/EBU channel status decoders. You can see from this figure the amount of detailed information carried in the 192 channel status bits. Having a monitoring tool at hand with these capabilities is essential for quickly uncovering and eliminating channel status incompatibilities.

Signal transport problems

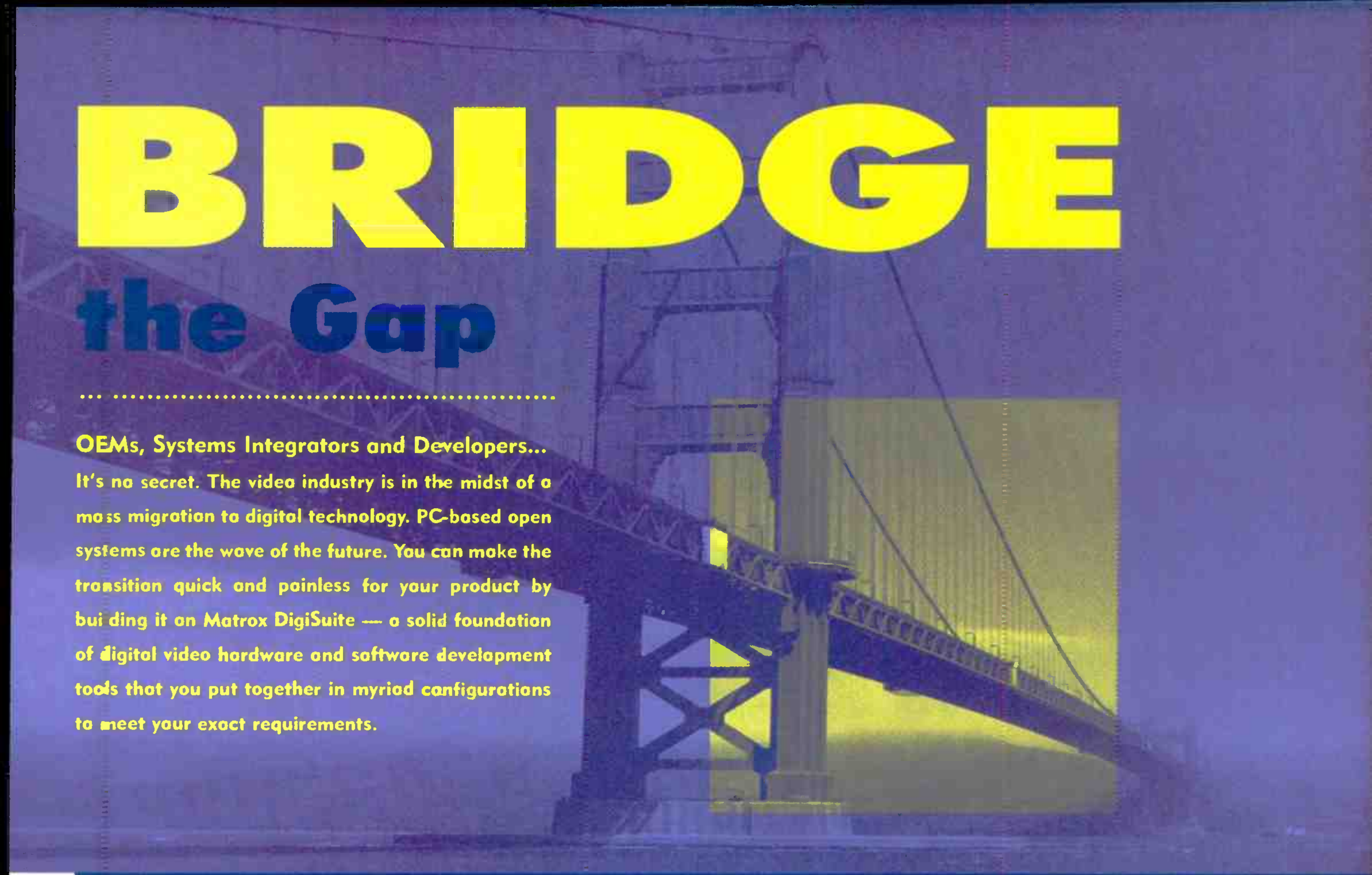
Signal transport problems are caused by degradations in the signal path or related difficulties. These problems prevent two pieces of digital audio equipment from "locking up" (i.e., synchronizing themselves) or otherwise threatening the reliable transfer of data between devices. Unlike interface problems, where data exchange does not take place due to coding incompatibilities, transport problems are generally caused by electrical and physical shortcomings. The ability to monitor and distinguish transport problems is helpful in sorting out any bumps in the otherwise smooth operation of your facility.

The AES/EBU standard uses a bi-phase mark coding system, which includes a transition (either low-to-high or high-to-low) at the beginning of each bit interval. This allows clocking to be extracted from the received signal, keeping two channels of audio and synchronization data all on a single electrical path. This "self-clocking" scheme places an additional transition in the middle of the bit interval to indicate a "1" and no additional transition to indicate a "0."

The AES/EBU signal is, therefore, polarity independent, and it is also tolerant of a wide range of electrical levels (2V to 7V), so it is fairly immune to problems in the amplitude domain. The frequency domain is a different story, however. Because of its reliance on data timing of the received signal, AES/EBU is quite dependent on frequency stability and adequate bandwidth across transmission paths. Bit-interval transitions must remain identifiable to the receiver. For this reason, whenever coding errors occur in the signal, the possibility of losing lock increases. This type of error is detected by the AES/EBU receiver chip and is flagged by the display of some monitors.

Moving into the digital realm exponentially increases the number of parameters that an engineer must monitor.

Other types of errors, such as cyclic redundancy checking (CRCC) errors and parity errors, indicate that some portion of the signal wasn't received in the same way it was sent. In AES/EBU audio, a CRCC checksum is generated only for the channel status data. By contrast, each subframe of audio data contains a parity bit. Monitoring CRCC and parity provides greater as-



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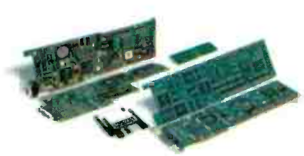

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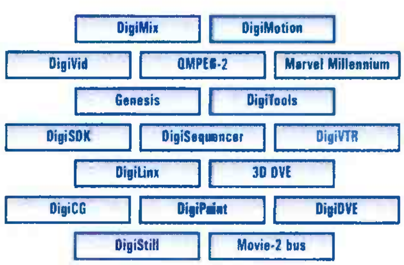

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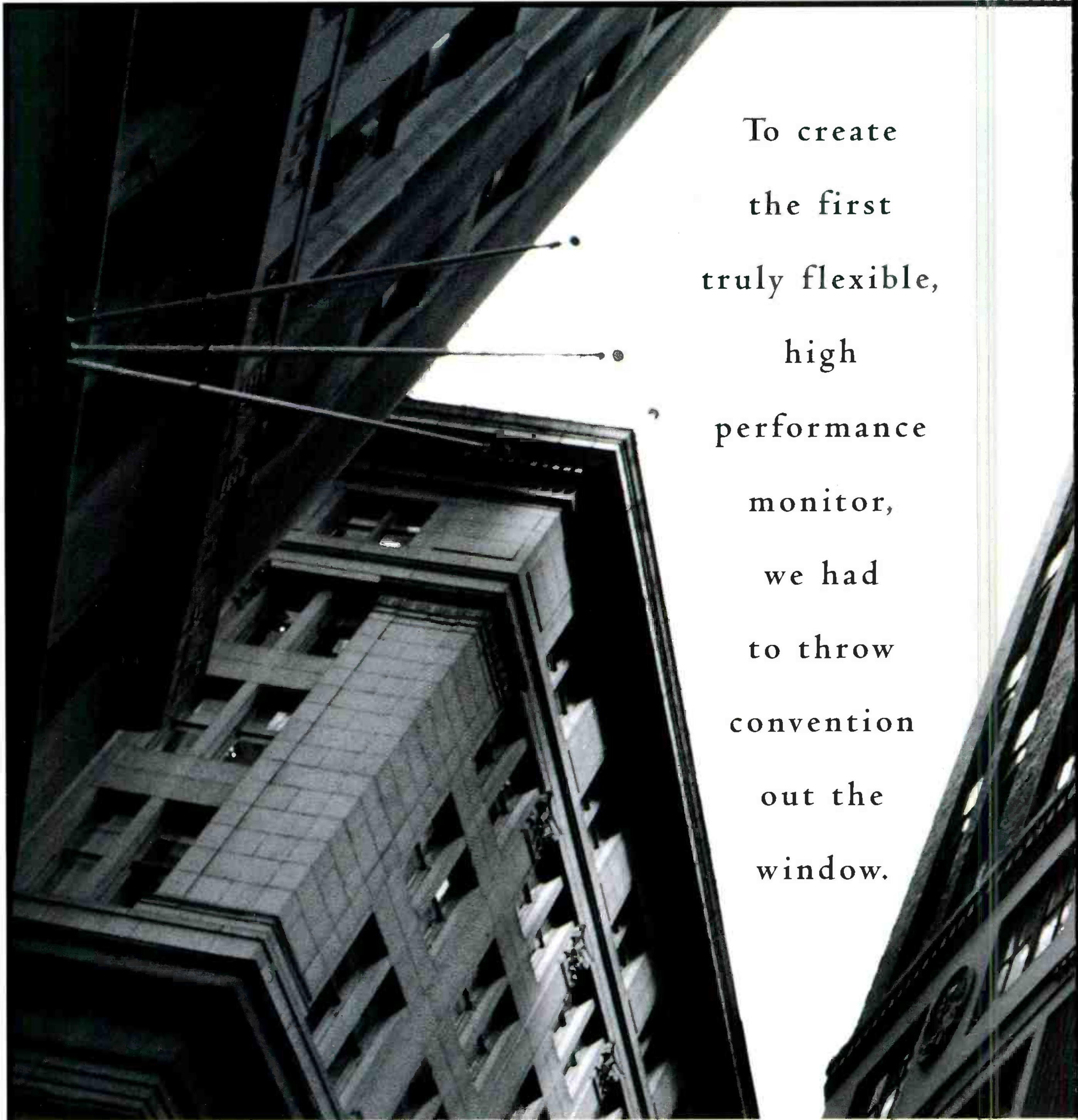

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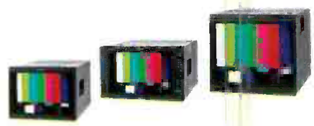

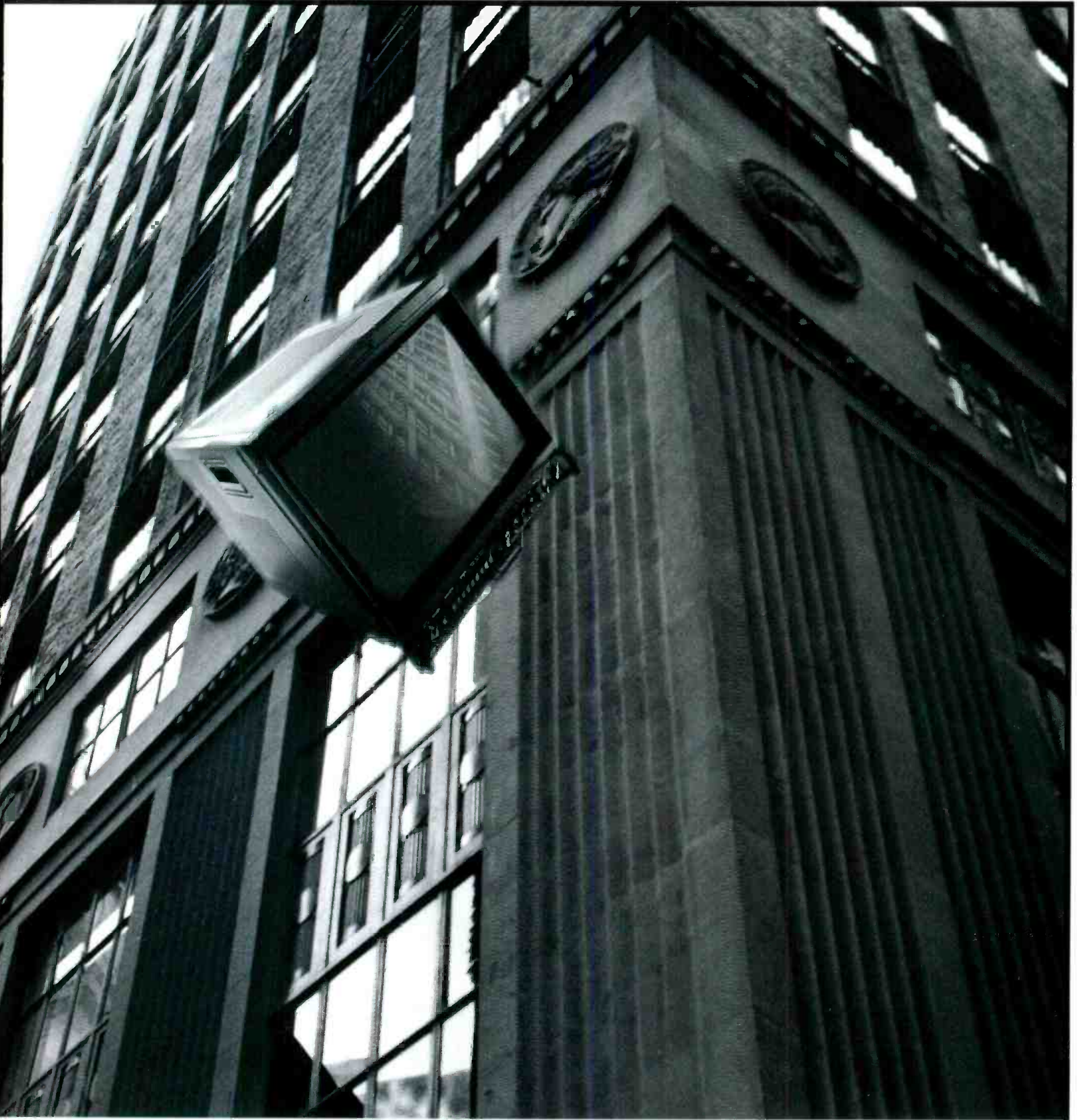

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Sample slipping is another transport-related problem. This is rarely a problem between two signals of a left/right pair.

Using a DSP-based correlation meter to monitor phase lets you see the phasing of any signals at any amplitude.

More often, synchronization problems occur between a reference signal and a program signal, or between two program pairs, when the phase of two supposedly locked pairs is drifting relative to each other. Identifying and resolving this problem without a digital monitor borders on the impossible.

Having too long of a cable run reduces AES/EBU signal level and induces jitter in the electrical signal. This combination of degradations reduces the signal's eye-pattern opening. If the degradation is severe enough, you'll lose synchronization. From a certain level of eye closure up to the point where you lose lock, the AES/EBU receiver chip sets a *low-confidence* flag. This indicates a marginal transmission path that can't be trusted to faithfully or reliably transfer the signal.

Incidentally, the low-confidence error flag can be raised by any condition that *either* reduces the signal's amplitude sufficiently or causes a large amount of jitter. It doesn't require *both* conditions simultaneously, such as the effect of an overly long cable run generally produces.

Finally, besides total loss of signal, excessive signal attenuation or excessive jitter, there is one other condition that can cause transport problems: a sample rate that's beyond the range of the receiver.

All of these causes produce the same effect — loss of lock. Figuring out which one is the culprit is a challenge to the troubleshooter. An AES/EBU monitoring device is helpful in sorting this out. Alerting the user in a timely fashion to the *occurrence* of these errors is also a priority, regardless of the source of the error flag. One way such messages can be indicated is alongside a level display for the channel that's having the problem, as shown in Figure 2.

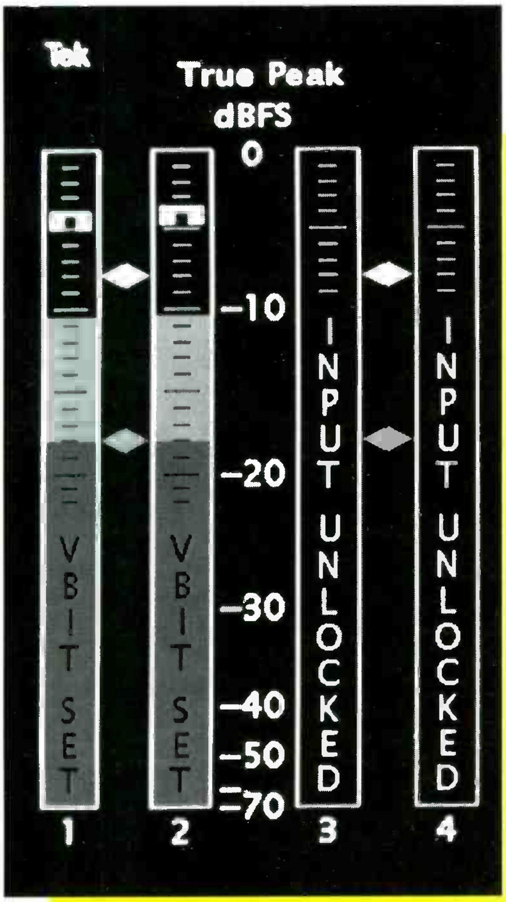


Figure 2. Problems such as Input Unlocked and Validity Bit Set are readily seen when placed inside the level bar for the affected channel(s).

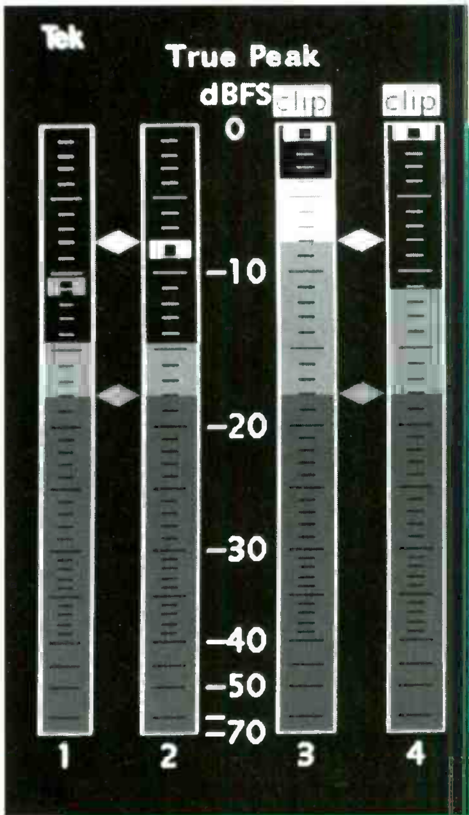


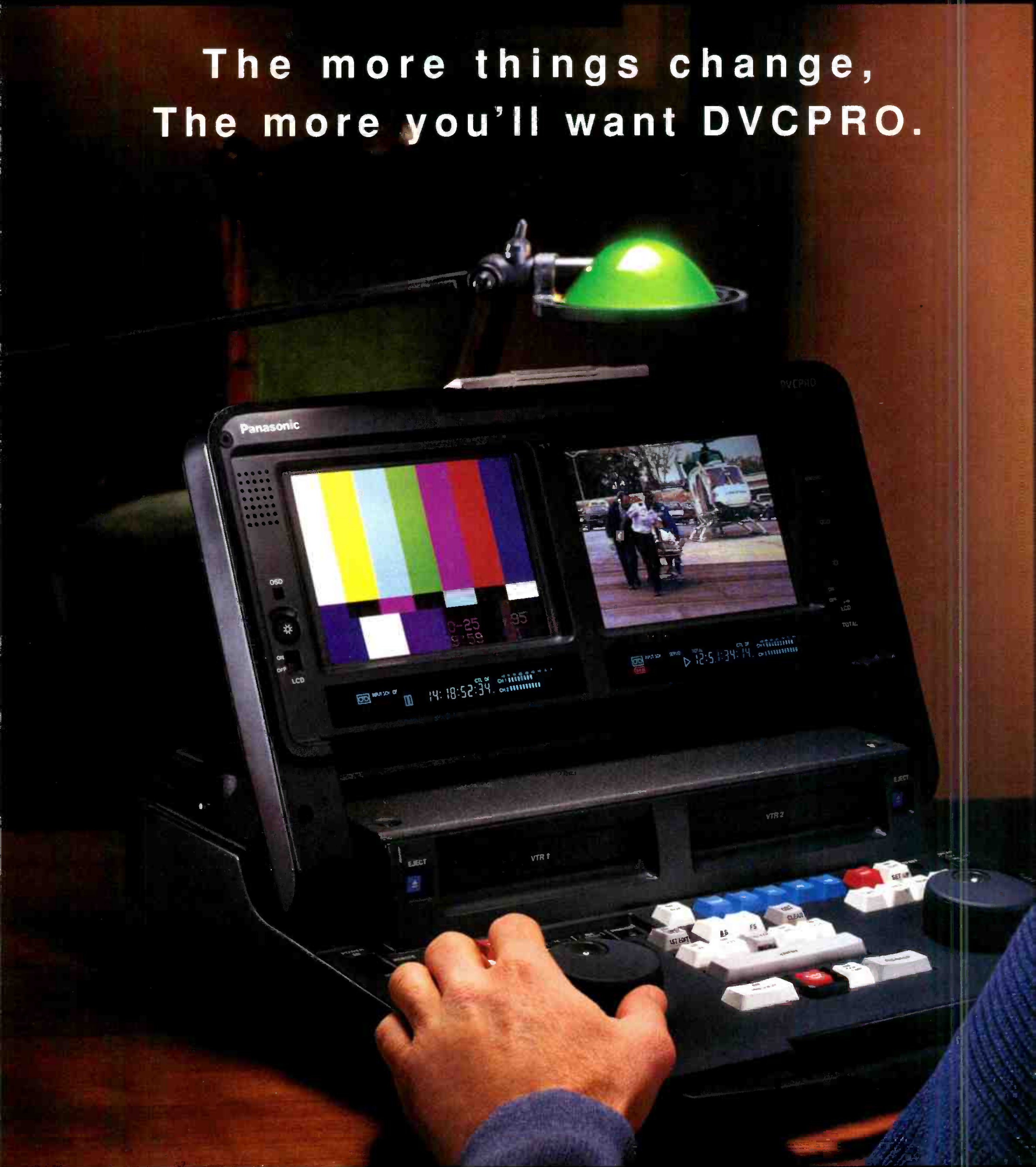
Figure 3. One implementation of a digital level meter, featuring a CLIP flasher above the bar where a clip occurred.

Unattended QC

In the past, the engineer keeping an eye on the level meters had to do just that — look at the level meters (and maybe a phase meter, as well). Moving into the digital realm exponentially increases the number of parameters that an engineer must monitor. Keeping track of measurements also is more important in digital audio, because it may be the only way of knowing that a catastrophic failure is on the way. The audio quality of the signal itself may never indicate that something's about to crash. Unlike the analog domain, digital audio's "cliff effect" often dictates that everything will sound just fine until the signal suddenly starts dropping out or mutes completely.

One method of freeing the operator's attention from tracking all of these important empirical details is to log important events and errors for the duration of a session. Not only does this reduce the number of parameters an operator must monitor, but the same batch of session statistics can double as a quality-control report. Include that report with your finished work and you've documented, in a quantifiable way, the technical quality of your product. If you add the capability to time-stamp those logged events with time code, you can use the report to locate spots in a program needing subsequent technical correction.

Controlling quality in a digital audio facility requires a few additions to the well-established practices.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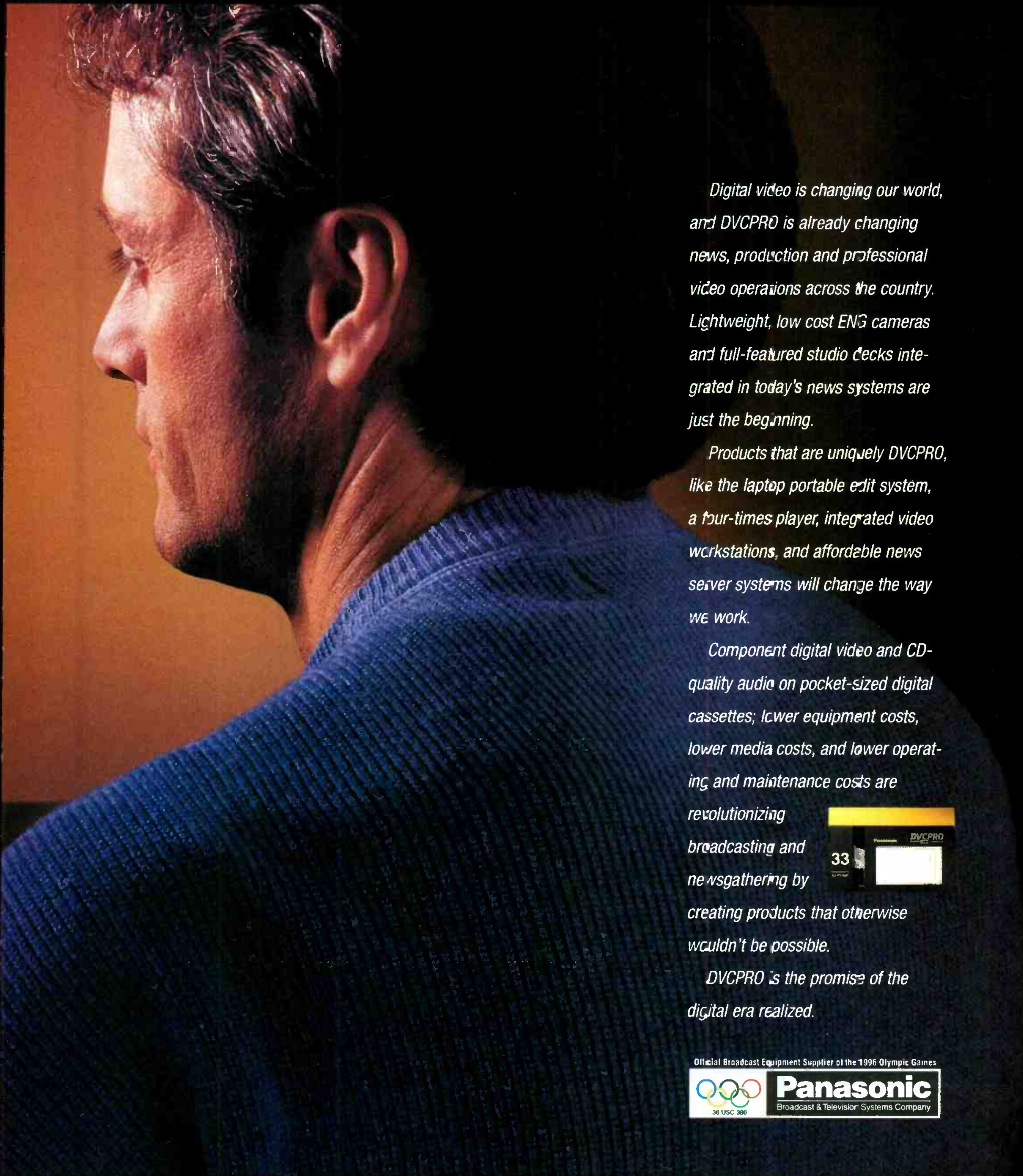

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Level monitoring — with a twist

There are two different requirements to level monitoring in digital audio: checking program audio or line-up levels and detecting clips or mutes. It's widely acknowledged that clipping in the digital domain is a more serious event than it is in the analog domain. Digital clipping results in immediately audible and unpleasant distortion, so occurrences of clipping in a digital signal must be flagged in a highly visible manner. Any losses of signal (mutes) should also be detected and flagged in the same manner.

Digitally based monitoring equipment can easily enable clip and mute indication by flagging any samples containing all ones (full-scale) or all zeros (no signal) respectively. But a single full-scale sample doesn't necessarily indicate signal clipping; it could simply be a loud point in the program using the full dynamic range of the system. Whenever *two* or more consecutive samples are full scale, then it is likely that the audio signal carried in the digital domain exceeds the digital system's dynamic range. Engineers have differing opinions about the number of consecutive full-scale samples (if any) that they'll allow.

The sophistication built into today's latest monitors can do a lot of your work for you.

Clip indicators must demand an operator's attention, but ideally there should be some way to accommodate different standards of acceptability. If some engineers don't mind an occasional full-scale sample in their material and don't consider that a true instance of clipping, there should be an adjustable threshold on their clipping indicators so a variable number of consecutive full-scale samples can be specified before the operator is notified. On the other hand, some purists won't tolerate a single full-scale sample in their recordings, claiming that you'll only lose about 0.001dB of dynamic range by scaling back the loudness to one bit below full scale. (See Figure 3.)

With the inherent accuracy of digital systems, you might assume that all digital level meters always indicate the exact amplitude of the audio signal by simply reading the sample level and indicating that on the display. Unfortunately, this is not the case. Peaks in the analog signal represented by digital data rarely fall precisely at sample points. The effect on a monitor that simply reads sample values is an underestimation of the actual audio level. To reduce this effect, a level meter must perform *interpolation* via an oversampling filter. By using four-times oversampling, a monitor can virtually eliminate this underestimation of peak levels.

Another problem you'll run into if your monitor does not use interpolation is that steady-state tones at submultiples of the sampling frequency often fluctuate in amplitude. It's relatively common to see this effect on line-up tones. Again, interpolation dramatically reduces this effect.

Phase monitoring

Monitoring digital audio phase is, for the most part, a similar process to phase-monitoring an analog audio signal. A Lissajous display of left vs. right will show you the balance of your signal and most phase-error problems. In today's digital audio for television, however, you're likely to find yourself working with a *pair* of stereo signals (four channels), or perhaps even more channels, and you'll need to check the phase between all of them. Comparing the phase of channels *within* a pair (1 vs. 2, 3 vs. 4, etc.) presents no challenge, but comparing *between* stereo pairs does require a monitor with that special capability.

Digital audio's wide dynamic range complicates the phase monitoring task because audio is often recorded at lower levels than it might be in the analog domain. This means that these quieter passages are often below the range of the AGC circuits used in traditional Lissajous displays. Monitoring their phase remains important nonetheless. Using a DSP-based correlation meter (such as the example in Figure 4) to monitor phase lets you see the phasing of any signal at any amplitude. Again, if the signal level was small enough, for example, -50 dBFS, a standard Lissajous pattern would show just a small dot, too small to read any phase information from. A correlation meter, on the other hand, still accurately indicates the phase relationship between the left and right channels. Also, rotating a pan-pot on a stereo signal can't fool a digitally implemented correlation meter.

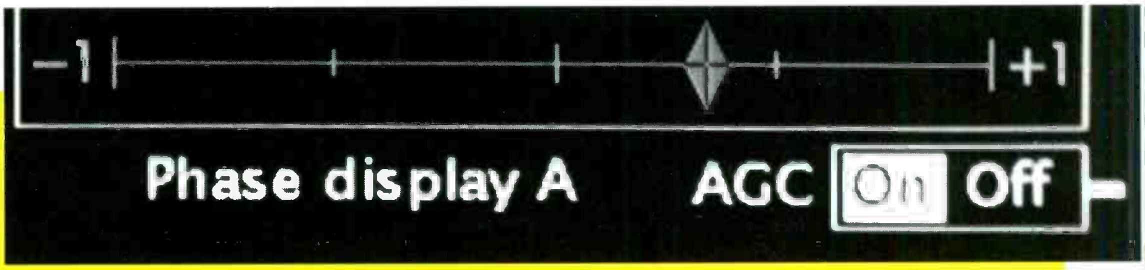
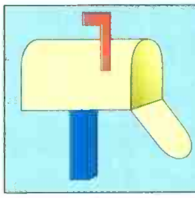


Figure 4. A digitally implemented correlation meter accurately indicates phasing at all signal levels.

Controlling quality in a digital audio facility requires a few additions to the well-established practices of level and phase monitoring. Beyond that, the sophistication built into today's latest monitors can do a lot of your work for you. This helps smooth the transition to digital systems without extensive staff training. It can also give you immediate confidence in the technical quality of your digital sound. ■

Jeff Noah is an applications engineer for the audio product line at Tektronix, Beaverton, OR.

For more information on digital audio monitoring, circle (291) on Action Card. See also "Analyzers, Audio System," p. 85 of the 1996 BE Buyers Guide.



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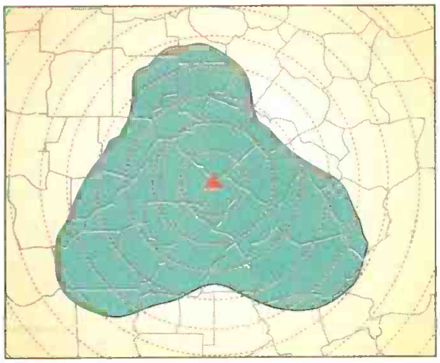
By Don Markley

A UHF primer for VHF engineers, part 1



The change to ATV is primarily going to use UHF channels — at least according to current FCC thought. As a result, many transmitter operators are going to have to rethink the way in which they construct and operate RF facilities. This article is primarily intended for those who have been living the good life up to now. That is, those technicians who have been working only in the quiet world of VHF.

Proceed with caution

First, be careful not to make foolish statements when visiting your first UHF facility. This author has experienced the initial visit to the transmitter site by a VHF chief engineer who supposedly was competent and experienced. His first comment, while gazing happily on the waveguide combining network, was "What's all of the ductwork for — the cooling system?" This immediately established his bona fides with the station staff, one of whom was hyperventilating in the corner.

The degree to which techno-shock will be experienced will primarily be controlled by the transmitter power involved. Again, this is going to be controlled by the final manner in which the ATV conversion takes place. While the average power apparently will be much less than for NTSC, the peak power may not be significantly lower, which would result in the continued use of some of the existing high-power UHF devices. The lower-powered UHF transmitters more closely resemble VHF equipment, because they are essentially all solid-state.

All UHF transmitters of any power level start off with an exciter, just as is found in current VHF systems. The complete signal, visual and aural, is developed in the exciter, and all necessary correction is usually introduced at this level. The correction is primarily for correcting non-linearities found in the driver and final amplifier stages. Other than the frequency of the final upconverter, the exciter should be familiar to VHF technicians.

The normal amplifier chain will include a driver stage, followed by one or more high-power stages. The driver may be a separate design or may be the same as the solid-state output stages, depending on the overall system design. In most modern designs, the driver will be a wideband amplifier that will not need tuning over the UHF band.

Remember, the system configuration is not the same for all manufacturers any more than it is for VHF systems. The design of a modern transmitter still involves trade-offs between engineering choice and fiscal reality. As a result, significant differences exist from manufacturer to manufacturer.

For the beginner in the UHF field, purchasing new equipment should include an in-depth study of the transmitter design and careful discussions with manufacturer reps and with the station's consulting engineer. Design differences simply reflect how each manufacturer decided to put together a complete system. There are no bad transmitters on the market. However, differences between manufacturers' products may be significant in particular systems, just as is the case in all parts of the station.

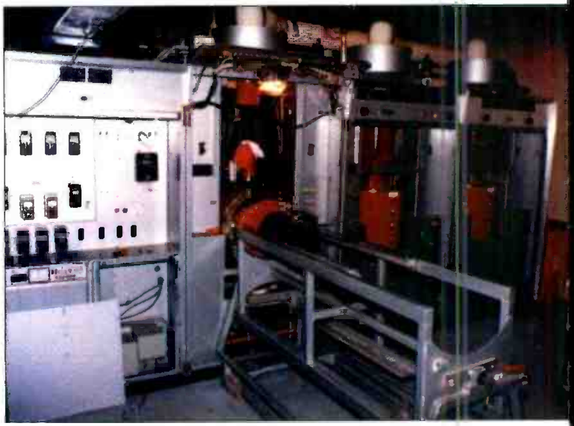
A combiner network using waveguide is common in UHF transmitter installations.

Final amplifiers

Some UHF transmitters use separate amplifier chains for aural and visual signals, just as in VHF. In those cases, the two signals are diplexed at the output, usually in a waveguide-based device. Normally, the outputs of the separate amplifiers are routed to the combiner/diplexer system in coaxial cable.

For larger amplifiers, more than one visual amplifier may be used with their outputs combined prior to diplexing with the aural signal. The actual combiners/diplexers use waveguide for simplicity and power-handling capacity. Their output may go back down to coaxial cable or stay in waveguide, depending on the power levels involved and the system design.

The final amplifiers run a wide gamut of devices. The smaller solid-state amplifiers usually run a few hundred watts per module with multiple modules combined to reach the final power. In many cases, multiple amplifier modules drive one or more final amplifier devices. In those cases, provision is usually made to bring out the driver signal



Klystron removal and installation can be considerably more involved than working with tetrodes.

and take it directly to the antenna in case of failure of the final amplifier.

The final amplifier stage(s) may be a tetrode or one of a wide family of klystron-based devices. Tetrodes are popular from the lower power levels up to around 30kW peak visual power. One manufacturer, Acrodyne, is marketing a 60kW transmitter using a tetrode-type device called a Diacrode. Traditionally, tetrodes have the advantage of high efficiency, but they have required much higher drive power than klystron-type devices and have had significantly shorter life spans. Again, that may now be considered old technology. That determination is left up to the buyer and manufacturer to discuss.

In the klystron field, older transmitters primarily used either a 4-cavity klystron with external cavities or 5-cavity devices with internal cavities. Again, the type preferred varies with manufacturers and users. The choice is much akin to arguing whether MS-DOS-based machines are better than Macs.

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A portion of the heat exchanger along with the pumps and tank used for a water/vapor cooling system for klystrons. (Photos courtesy of David Birdsong, KSMO-TV.)

In any case, most new transmitters have moved on to such devices as Klystrodes, multiple stage-depressed collector (MSDC) klystrons or inductive output tubes (IOT). These are essentially all variations on the basic klystron with the exception of the Klystrode, which is a marriage of tetrode and klystron technologies.

The nicest thing about all of these devices is that they are stable as a rock. Once properly tuned on channel, minimal if any adjustment will be needed during the life of the device. Speaking of device life, the klystron family devices can normally be expected to run in excess of 25,000 hours. It is not unusual to experience usable lifetimes in excess of 40,000 hours even in visual service. Modern tetrodes are not expected to last that long, but may be expected to meet full specifications for up to 20,000 hours.

As to the tuning, it is preferred to use a sweep-type device, such as the Tektronix sideband adapter, to solve the gain vs. bandwidth problem. Do not, under any circumstances, simply tune for maximum power.

Cooling and power systems

Cooling is normally handled in one of three ways. Smaller transmitters need only a filtered source of air, and that air must either be cooled itself or exchanged with outside air as necessary. For larger powers, liquid cooling is used. This can be either direct cooling by liquid or vapor phase cooling where water is allowed to boil off the collector of the device with the steam being subsequently cooled. In any case, the cooling water must be cooled in a heat exchanger.

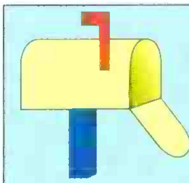
In many cases, the direct coolant is distilled water that can touch components where high voltages are present. If the coolant does not contact high voltages, it can be mixed with chemicals to prevent freezing and the heat exchanger can be placed outdoors with protection from falling ice. Otherwise, the heat exchanger must be protected to prevent it from freezing during cold weather. The purity of the distilled water must be watched to prevent embarrassing off-the-air periods.

The power supply for the transmitter will usually be broken into two major pieces. All low-power equipment, like the driver, exciter and control systems, will be powered by conventional systems located in the main cabinet. For higher-power transmitters, the power supply is usually a packaged system that is separate from the transmitter cabinet. Some modern designs, one by Comark in particular, control the high-voltage magnitude, which is claimed to improve amplifier performance.

The thing to remember about a UHF transmitter is that it is just another big box to be learned. It will be more sensitive to the changing of components than a VHF transmitter because of the shorter wavelengths involved. You will be using a waveguide combiner/diplexer rather than the old coaxial distillery reject on the back wall. On the good side, the new transmitters are as stable and as easy to operate as their VHF relatives.

Next month, we will look at transmission lines and antennas for UHF. ■

Don Markley is president of D. L. Markley and Associates, Peoria, IL.



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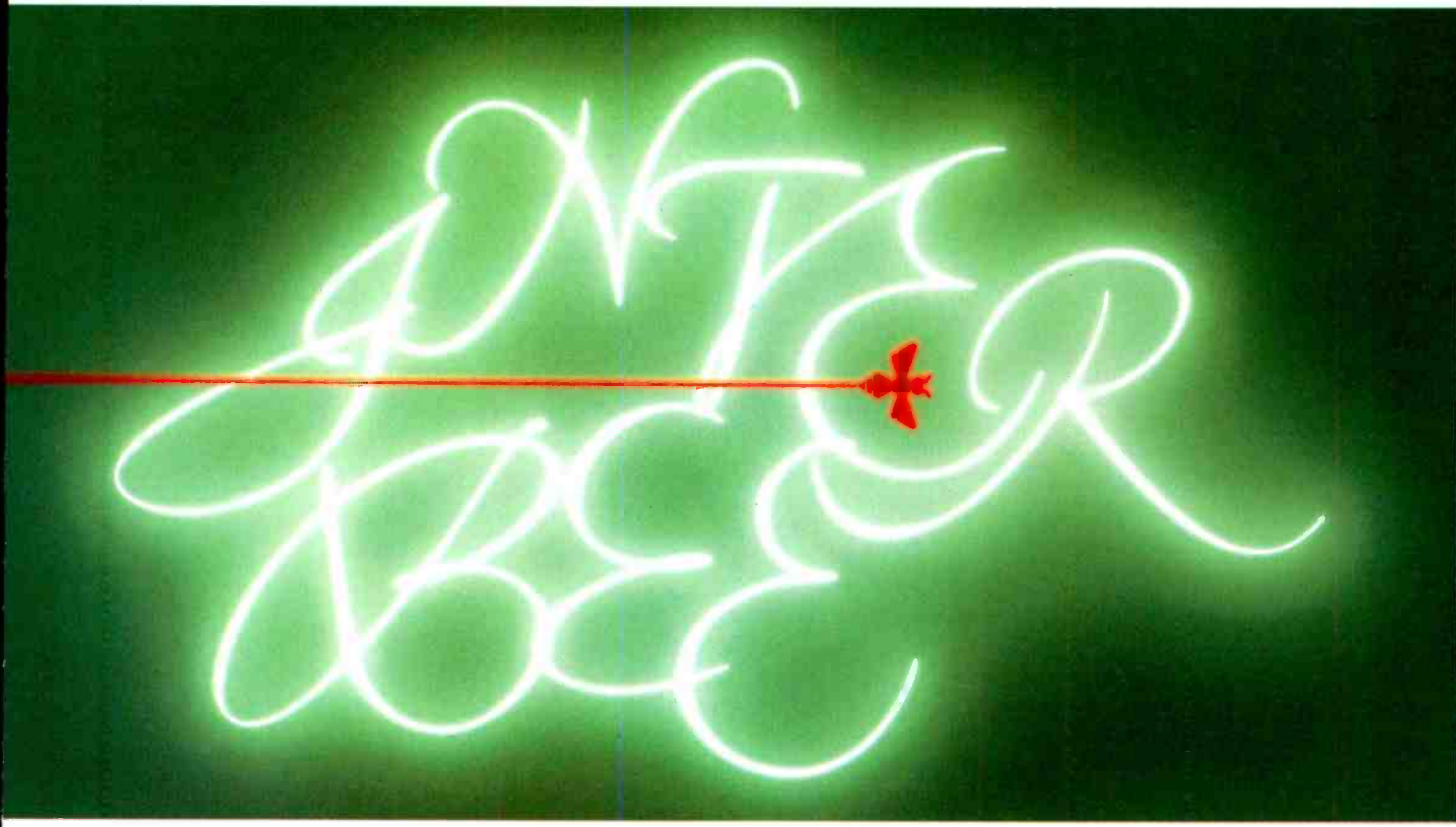

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Circle (56) on Action Card

By Dane E. Ericksen, P.E.

RFR and unattended operations

Two SBE panels at the spring 1996 National Association of Broadcasters' Engineering Convention in Las Vegas explored recent (for unattended operation) and expected (for radio-frequency radiation) FCC regulatory changes. The Unattended Operation panel addressed the Dec. 1, 1995, deregulation that now allows broadcasters to operate their stations using unlicensed operators or, subject to minimal automation requirements, without any operators or unattended, if they wish. The new rules allow any combination of direct (manual) control, remote control or automated operation. Of course, licensed duty operators may still be used, if the station wishes.

The RFR panel discussed the long-awaited Report and Order (R&O) to ET Docket 93-62. This R&O proposes to update the commission's current guideline, the ANSI C95.1-1982 standard, to the new ANSI/IEEE C95.1-1992 standard. Comments to this rulemaking exceeded 4,000 pages, with the initial comment deadline extended twice, and the reply comment deadline extended an unprecedented three times.

The FCC has been mulling over the comments and reply comments since April 25, 1994. A Report and Order, or possibly an Order and Further Notice of Proposed Rulemaking, was expected in March. If a combination Order and Further Notice is adopted, the commission is under a 6-month deadline imposed by Section 108(b) of the 1995 Telecommunications Bill to complete action in ET Docket 93-62.

More on RFR

Because of critical comments filed by the Environmental Protection Agency (EPA) incorrectly alleging that the ANSI/IEEE C95.1-1992 standard is a thermally based standard (see Editor's note), the commission may instead end up adopting the guidelines of the National Council for Radiation Protection and Measurements (NCRP), which the EPA comments favored.

Like ANSI 92, NCRP is a 2-tiered standard, occupational and public, with the public portion of the standard five times more stringent than the occupational portion. The rationale for a 2-tiered standard is that for occupational exposures, it is presumed that workers are in reasonably good health and can be instructed to take safety precautions to ensure that excessive exposures do not occur. However, for public exposures, these assumptions cannot be justified.

Furthermore, since the primary known harmful effect of RF exposure to living tissue is thermally based, then persons with health problems that impair their ability to tolerate a thermal load, for example, diabetics with poor circulation in their extremities, might be at greater risk than the general population. Therefore, like ANSI 92, the NCRP standard lowers the allowable power density limit to 200μW/cm² at VHF frequencies.

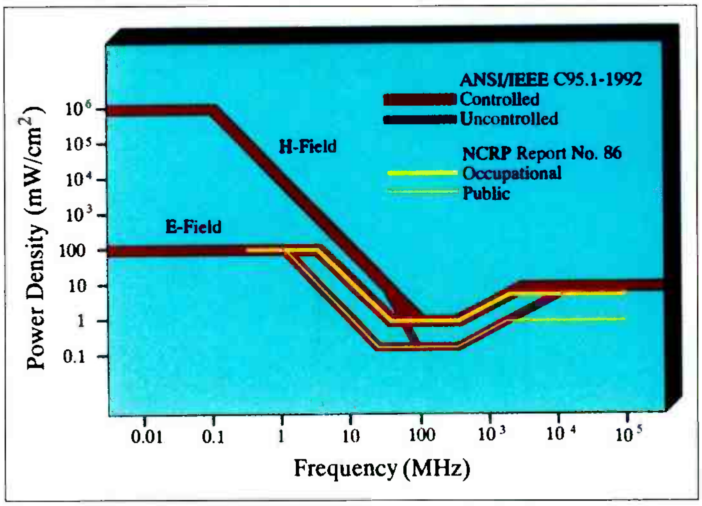


Figure 1. The current radio-frequency radiation standard.

If adopted by the FCC, the NCRP standard would, like the ANSI 92 standard, regulate contact currents for the first time. However, unlike the ANSI 92 standard, the NCRP standard has no limits for induced body currents.

There is also the possibility that the FCC will "cherry pick" and adopt portions from both standards for an RFR regulatory smorgasbord, if you will. One thing is sure: both of the new standards are significantly more complex than the current standard, as demonstrated by Figure 1.

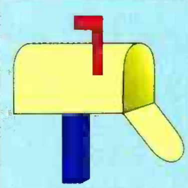
Other major RFR regulatory issues are the acceptability of protective clothing, such as suits made from the German-manufactured Naptex material, and federal pre-emption of RFR standards that are more restrictive than those ultimately adopted by the FCC. Indeed, Section 108(a) of the Telecommunications Bill contains a clause granting such pre-emption, but only to Personal Communication Services (PCS) licensees.

Why such a narrowly focused pre-emption? Two reasons: 1) the PCS proponents "paid" for such favorable legislation, fair and square, and apparently saw no reason to share the benefit of this sorely needed federal pre-emption with other radio services; and 2) Congress appears to be in love with the revenues generated by spectrum auctions, for which PCS has been a major contributor. However, the adage "A rising tide raises all ships" is appropriate here. Even the narrowly focused RFR pre-emption clause in the Telecom Bill will establish a precedent that hopefully the FCC will run with, and issue a companion rulemaking that would extend federal pre-emption to all other non-categorically exempted radio services.

Regardless of which standard ends up being adopted, it is clear that life is going to become more difficult for broadcasters when it comes time to certify compliance with the applicable RFR standard at their next license renewal, or sooner, if a facility's change triggers an earlier evaluation under a new standard. ■

Editor's note: The developers of the ANSI RFR standard made no presumption that the only effect of radio-frequency energy was thermal. Instead, the criteria used in developing the standard was "work stoppage" in animals. It was then found that the only identifiable mechanism was the thermal effects, so the standard then became based on the concept of Specific Absorption Rate (SAR). The unlimited-time (continuous exposure) SAR limit for humans is 0.4W/kg of body mass for controlled (occupational) exposures and 0.08W/kg of body mass for uncontrolled (public) exposures. At VHF frequencies, these SARs correspond to power densities of 1,000μW/cm² and 200μW/cm², respectively.

Dane E. Ericksen is chairman, SBE FCC Liaison Committee.



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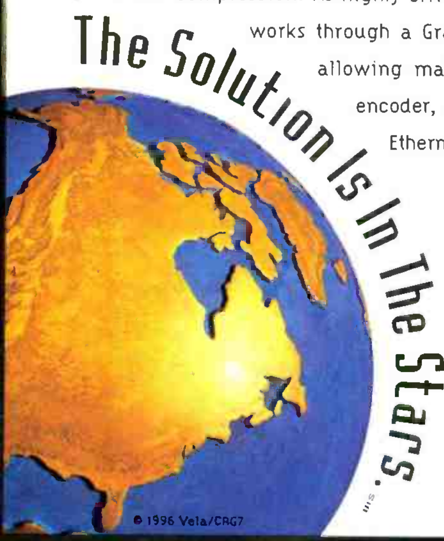

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Circle (57) on Action Card

By John Ajamie

BTS Saturn switcher

Performance at a glance:

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- Flexibility in routing source assignments to air
- Intensive audio metering front control panel

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Related equipment

One major criteria we kept in mind was the related equipment that would interface with the switcher. We opted to purchase the BTS Venus router and Jupiter control system. We also added the BTS Mars router as a backup device and the Media Pool file server for commercial and promotional spots.

The Saturn master control system has two options for routing sources through the switcher. It can be used as a router control panel for the Venus router matrix, and the Saturn comes equipped with an internal 16x5 matrix router mezzanine board. We chose to use both. The Saturn communicates to our 64x64 router by selecting sources to air. We also use secondary outputs of the essential on-air sources for the smaller matrix as a backup router. This gives us the redundancy needed in our system.

The Jupiter system and its *Pathfind* function, increases our flexibility to access any routable source through the Venus router. The Jupiter control system's MC 3000 panel will also provide serial or parallel control over multiple videotape recorders or a disk-based file server system.

The Mars routing system acts as a backup switcher to the Saturn switcher. Mars uses an MPK panel that mounts within the Saturn control panel, but acts mechanically as a separate device, giving us more rack and console space. This provision makes training more convenient for those operators who are new to the Saturn switcher.

The Media Pool is an expandable multichannel digital video storage device with variable compression that network control and post-production can access simultaneously. The Saturn switcher can access the Media Pool either via the GPI or via serial control interface.

Saturn features

Saturn uses parallel control for the Odetics TCS-90 cart machine, which houses six digital Beta decks. Future plans will use the Saturn to trigger the Media Pool for commercial breaks and the cart machine for program material.

> *After researching the market and talking to those who were using the Saturn, we decided to purchase the BTS 601 and AES master control processors.*

The Saturn can be configured to operate up to 16 individual channels. An additional switcher processor and current control panel would enable us to broadcast another feed as our network demands grow.

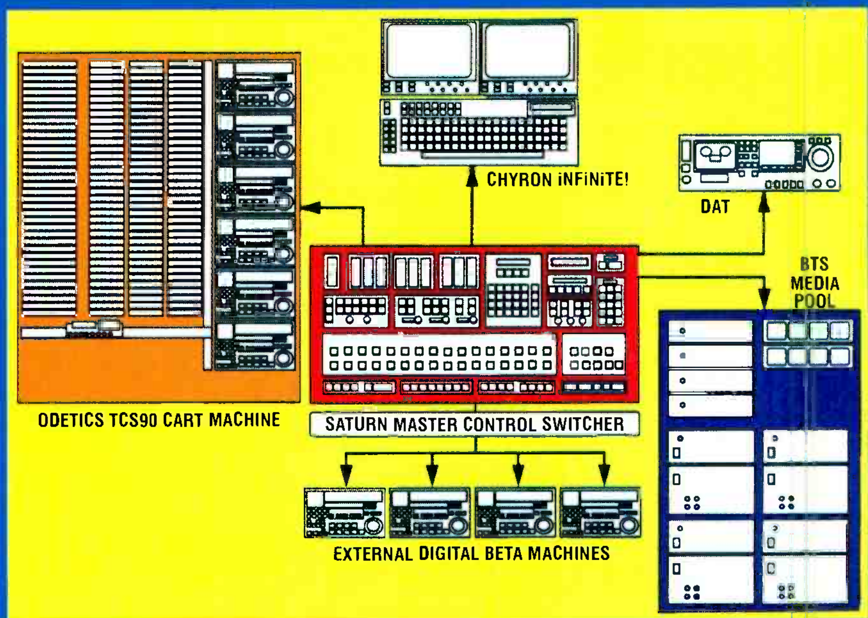
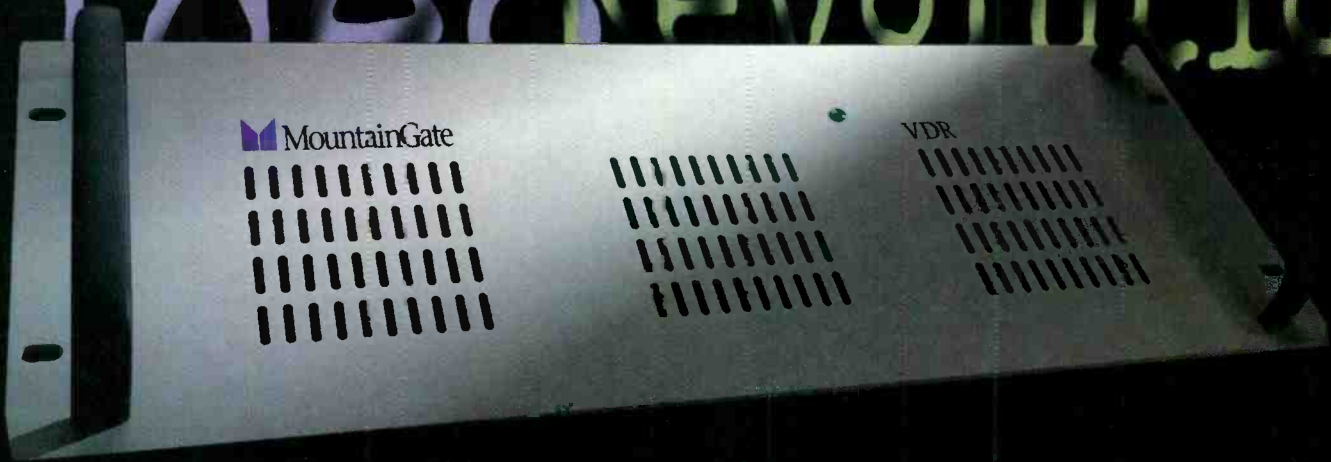


Figure 1. The BTS Saturn switcher provides flexible control over a variety of external devices.



We're Not Just Promising a Revolution in Digital Video Editing and Storage, We Can Back It Up.

MountainGate
A Lockheed Martin Company

Introducing, a mind-altering line of **uncompressed** digital video disk recorders from MountainGate, the world leader in high-end storage.

Unlike other digital disk recorders, which typically hold just 30 to 120 seconds of uncompressed storage, the MountainGate VDR holds over **50 minutes** of uncompressed D-1 and over 100 minutes of D-2 video. Now you can preview **long-form** programs such as music videos and television shows without first converting them to tape. And, you can search through tens of thousands of frames quickly and easily. No more pre-rolls or shuttling VTRs. No more tape degeneration. And that means **faster** and more cost-effective sessions.

Thanks to a direct high-speed SCSI interface, the **MountainGate VDR** is fast enough to eliminate the bottlenecks commonly associated with post-production work. And, you can use the VDR's network interface to send source material **digitally** to any number of workstations. Another time, and cost, saving measure.

Our new VDR handles **multi-video** formats, including D1, D2, RGB, and HDTV. Plus, you can choose from many extras, such as independent 4- or 8-channel AES/EBU digital audio.

The video revolution is happening, and it's coming from a company that can **back it up.**

For information or a demonstration of the new MountainGate VDR line, call 1-800-556-0222 or visit our web site at http://www.mountaingate.com.

Circle (58) on Action Card

DataShuttle™ features portability and patented shock-isolation technology with capacities up to 18 GB.

Renegade™ our RAID system holds up to ten storage devices in one chassis with storage capacities over 87 GB.

PassPort™ our 1 GB removable hard drive resists shock up to 150Gs.

Chaparral™ our versatile family of mass storage library systems offer up to 74 TB of storage.

IncreMeg™ the ultimate in removable hard drive storage, offers up to 4 GB of storage and 8ms access times.

Stampede™ line of disk arrays accepts multiple drive form factors with total capacity in excess of 400 GB.

With the aid of Jupiter, A/V monitoring on the switching control panel allows the selection of any desired feed. The ability to delegate various feeds to one panel also can reduce the future expense of setting up multiple control rooms.

Additional features for our operation include serial control (through Jupiter) and transition control of external sources. Transition modes make switching look studio produced and variable preroll transition time gives us the flexibility needed for live applications.

The switcher provides two independent linear keying channels that support our 2-channel Chyron iNFiNiT! with Transform. Included with the keying features are clip, gain and matte controls.

The Saturn's flexible key assignments of the program and preview bus make this device user- and engineer-friendly. The key caps can be electronically labeled with up to eight alphanumeric characters. This eliminates making new labels for key caps if we want to rearrange the inputs.

Adding or changing source assignments to the router is simple. While running on the backup switcher, the Jupiter configuration software can be used to edit changes in the router. The changes are then downloaded to the Saturn switcher via the LAN, eliminating the need to burn PROMS and avoiding any on-air error when rebooting.

The source and assign memory panel will allow internal routing control from Venus to the program and preset bus. This makes it simple for operators to arrange key assignments and provide another level of redundancy should a deck or a key source fail.

The Saturn's flexible key assignments of the program and preview bus make this device user- and engineer-friendly.

The audio metering control panel makes it easy for the operator to monitor VU or PPM left and right channels. Indicator lights will warn the operator if the audio is out of phase. A preset audio ratio can be set on the Saturn control panel for voice-over insertions. Saturn can trigger either the Media Pool or the DAT machine as a backup audio source for these needs.

Individual audio balance phase reversal and channel swap controls make it easy for the operators to correct errors before they air. Audio gain for each channel can be adjusted individually, which gives operators the ability to adjust the levels on the preset bus before a spot goes to air. Included in the audio display is the ability to monitor preset, program and off-air audio channels.

Fitting our needs

When we first purchased the BTS Saturn master control switcher it was an evolving product and not all of the features were operational. The support and software upgrades to this product have been truly an enhancement. The functions we use on this switcher have been flawless. The flexibility and reliability make the Saturn the only switcher on the market that fits our needs. ■

John Ajamie is director of network operations & duplications, Home & Garden Television Network (HGTV), Knoxville, TN.

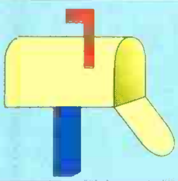
Editor's note: Headquartered in Knoxville, TN, with offices in New York, Los Angeles, Chicago and Detroit, HGTV reaches more than 10 million TV households, including DirecTv and C-band satellite subscribers nationwide.

Editor's note: Field Reports are an exclusive *Broadcast Engineering* feature for broadcasters. Each report is prepared by well-qualified staff at a broadcast station, production facility or consulting company.

The reports are performed by the industry, for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested.

It is the responsibility of *Broadcast Engineering* magazine to publish the result of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

The BTS Saturn master control switcher in its all-component digital environment at the Home & Garden Television facility in Knoxville, TN.



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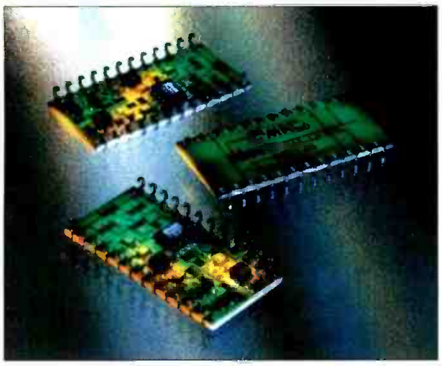
By Keith Watts

C-MAC filters



Although digital signal processing has largely replaced analog processing, it's still necessary to use analog buffering, filtering and DC control before and after digitization.

In an effort to integrate these functions and reduce engineering and manufacturing costs of video hardware equipment, C-MAC manufactures and markets a line of active video modules for these purposes. This article details the reasons for and advantages of these new approaches.

The importance of video filtering

The analog real-time video filter is a key element in clean video processing. The input, or anti-aliasing filter, is required prior to digitization, while the output, or reconstruction filter, is needed after the digitized signal is converted to analog.

The digital sampling process can introduce aliasing (or moiré) components, noise and distortion that cannot be removed by later processing. The minimization of these artifacts is important when video compression is applied to the signals.

Digitized artifacts add to the complexity of video signals, causing the compression process to become less efficient. This results in lower levels of achievable compression. Because video compression techniques are rapidly becoming standard in all video processing and transmission systems, the importance of proper filtering will increase.

Oversampling techniques are now common for sampling and reconstructing analog video signals, and allow the use of clock frequencies that are multiples of the pixel clocks. They use sharp cutoff, digital finite impulse response (FIN) filters to reduce the analog filtering requirements.

Current technology only doubles the pixel clock rates so the filtering process is still not trivial, especially for higher-quality systems that require flat response and minimum group delay. Oversampling digital filters requires a lot of silicon and can be expensive.

Above photo: C-MAC produces a wide range of monolithic filters for analog and digital applications. Shown above is a C-MAC ST-12S Smart Filter, designed for multichannel video workstations.

Anti-aliasing filtering

Aliasing is an artifact added when a video signal is not properly filtered before being digitized by an A/D converter. The resulting moiré effect cannot be removed by later processing. The A/D conversion process produces upper and lower sideband replicas of the input signal at harmonics of the sample rate. A properly designed filter will remove most signal and noise components above one-half the sampling frequency (Fs/2).

For example, if you sample at 10MHz, the Nyquist bandwidth is 5MHz. If you input 5.5MHz, the moiré will be at 4.5MHz. Furthermore, if you input 9MHz, the moiré is at 1MHz (a lower frequency and, therefore, more visible).

The amplitude of the moiré will be equal to that of the input frequency causing it, modified by the slope of the filter. High-frequency moiré, allowed by a sharp cutoff filter, is less apparent than the lower-frequency moiré allowed by an inadequately sharp filter, or worse, no filter at all.

Tests have shown that there are definite trade-offs between the visual effects of brick-wall filters vs. less gradual filters that allow some aliasing. It is now common to see large amounts of low-frequency moiré when digitizing unfiltered signals from computer graphics devices and PC video cards, which contain modern high-speed D/A converters.

Because video compression techniques are rapidly becoming standard in all video processing and transmission systems, the importance of proper filtering will increase.

Reconstruction or post-filters

The function of a post-filter is similar to that of the prefilter. The output of a video D/A converter (DAC) has double sideband replicas of the desired output signal at harmonics of the clock frequency. Severe moiré (aliasing) results if these sidebands are not removed.

Post-filters have the additional requirement of providing an SinX/X characteristic to compensate for the aperture rolloff of

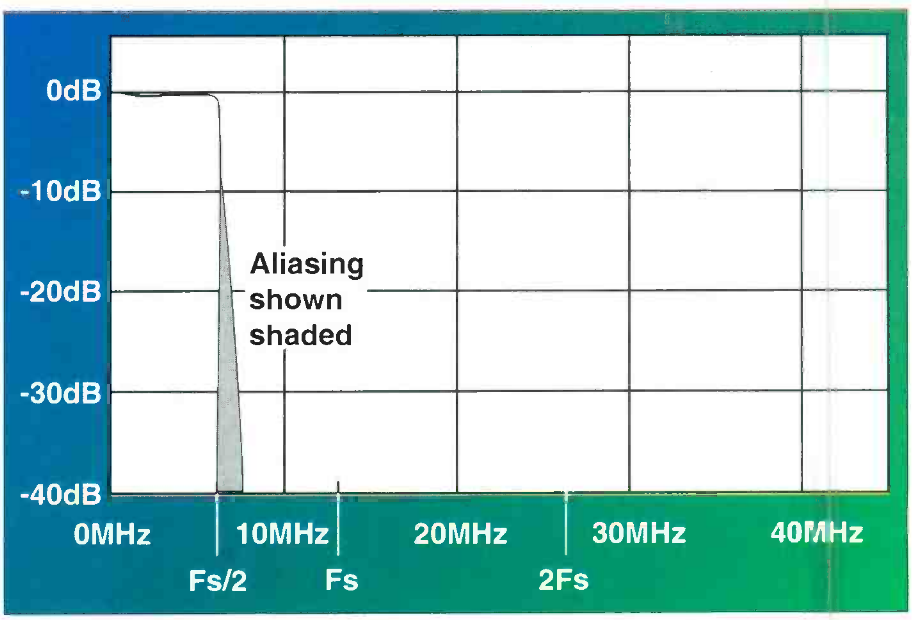


Figure 1. The output of a properly input-filtered D/A converter. Note the significant reduction in aliased signals.

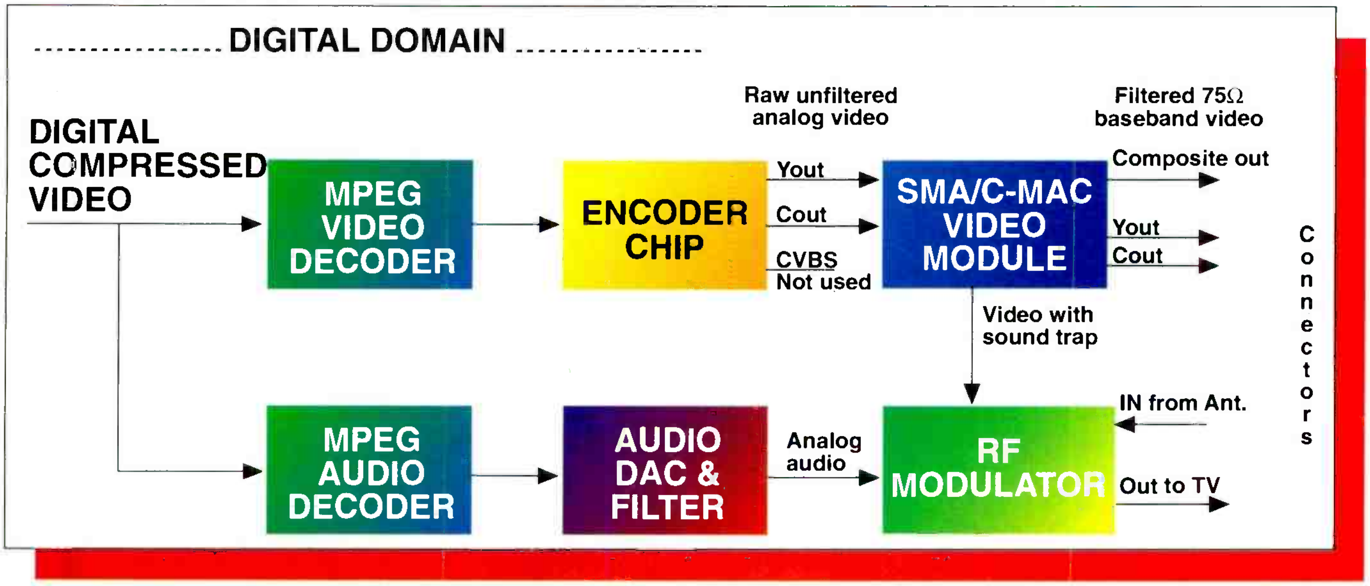


Figure 2. Partial diagram of a set-top box. The need for proper filtering will become even greater as manufacturers need to interface older-type analog devices to the new range of digital sources, like DBS, ATV and multimedia signals.

the DAC, which depends on the clock frequency. These sidebands produce the steps that are visible in the waveforms at the output of the DAC. The steps indicate that the DAC has a "sample-and-hold" characteristic that produces a frequency response rolloff dependent upon the clock frequency (Fs).

In Figure 1, a properly filtered signal shows a great reduction in aliasing and a flat passband response due to SinX/X compensation in the filter.

Practical considerations

Low-impedance passive filters require high Q inductors to minimize losses, which can be significant (1dB or more). Passive reconstruction filters must also have at least 2.5dB of additional loss to allow for SinX/X boosting.

Buffered hybrid filter modules contain high-impedance filters with extremely high output impedance so that there are no losses within the filter, even with SinX/X compensation.

Gains are inherently unity, and grounding a precision internal voltage divider can provide an exact gain of two, often needed when driving 75Ω loads.

Resistor tolerances in thick film versions can exceed 0.25%, allowing the gain to be precisely controlled.

The form factor of thick film module packaging can be either that of a SIP package, which uses minimum board area or that of J-lead packaging that has a short mounting height.

One advantage of combining the entire filtering and buffering functions in a single factory-tested module is minimal crosstalk and digital noise pickup when compared with discrete circuitry. This is important when circuit boards contain a large number of high-speed digital VLSI parts. The C-MAC filters provide inherent power supply noise rejection and contain onboard decoupling for high stability.

Multichannel analog video modules

The latest generation of monolithic video encoders and decoders have created the need for low-cost multichannel video modules. An important example, shown in Figure 2, is the high bandwidth video obtainable from the new digital set-top boxes.

Composite video from the digital encoder sent to the internal RF modulator can create an annoying audible buzz if the video contains 4.5MHz (NTSC) or 5.5/6MHz (PAL) frequencies at a vertical rate. This condition is particularly likely when graphics and menus are displayed. The solution is to incorporate a high-Q trap in only the video sent to the RF modulator. The trap is delay equalized for optimal transient response. The same module also provides wideband, SinX/X-equalized 75Ω composite and Y/C baseband outputs.

Even higher performance, multichannel video modules are available without the trap and equalizer to provide optimum performance for computer graphic workstations and PC cards. The 75Ω Y/C and two composite video channels are generated by resistively adding Y and C after filtering and buffering so that there are no differential phase or gain errors.

All digital encoder outputs have DC offsets due to their single power supply. Rather than using large AC coupling capacitors, the video filter modules provide level shifting with DC coupling to remove offsets, eliminate tilt, improve reliability and reduce cost. Delay differences between the channels are typically less than 10ns.

Future trends

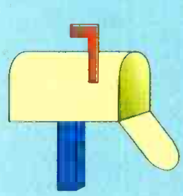
Eventually, standard digital consumer video interfaces will remove the need for most analog interfaces. In the meantime, the trend in VLSI chips will be toward analog interfaces with 4x oversampling and built-in analog filtering.

Newer generations of video modules will contain lower-cost, lower-power opamps and more precise components. Also, the cost and size of hybrid video modules will continue to fall and new applications will be found.

C-MAC provides a broad line of filters for analog and digital applications. ■

Keith Watts is senior applications engineer for C-MAC Microcircuits, United Kingdom.

For more information on C-MAC filters, circle (202) on Action Card.



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INDUSTRY BRIEFS

BUSINESS

Leitch, Chesapeake, VA, installed StillFile Systems in state-of-the-art hockey arenas for the Ottawa Senators and the Montreal Canadians. The systems will store stills of the hockey players, their stats and commercial advertisements for instantaneous playback during games.

Tektronix Video and Networking Division, Beaverton, OR, announced the formation of Tektronix Video and Networking Systems. Turnkey system services will be offered for the integration of Tektronix, Grass Valley and Lightworks Editing Systems products, as well as other manufacturers' products.

Thomson Broadcast Systems, a subsidiary of Thomson multimedia, Paris, has signed a distribution agreement with Getris Images. Under the terms of the agreement, Thomson Broadcast Systems will be the sole distributor for Getris Images graphics systems.

Chyron, Melville, NY, has joined Silicon Graphics as one of the certified application vendors for the SGI IndyStudio program. The Chyron Liberty Paint digital paint graphics package has been bundled together with the Chyron Cindy video board for Indy workstations. When used with the SGI IndyStudio program, the package provides an affordable broadcast paint system for SGI platforms.

CBS News chose Discreet Logic and Silicon Graphics systems for the development of real-time virtual set-style graphics for CBS News primary and election night broadcasts.

Sony, Park Ridge, NJ, has sold DVW-700 digital Betacam camcorders to ProVideo, Madison, WI; Spectrum Productions, Milwaukee; Beachwood Studios, Beachwood, OH and Pacific Coast Productions, West Los Angeles.

Sony Electronics Systems Integration is designing and implementing studio equipment and an OB truck for LIN Productions, Arlington, TX, a company formed by LIN Television Corporation to produce regional baseball telecasts.

A flagship PBS station, WGBH/Boston, purchased Sony's VideoStore system to further its automated insertion capabilities for on-air promos, bumpers and interstitials.

Solid State Logic, United Kingdom, has sold digital production and/or post systems to KCPQ-113 Fox, Tacoma, WA; Walt Disney Imagineering, Glendale, CA; Video Post & Transfer, Dallas; Fox Animation Studios, Phoenix; Post Audio, Prairie, MN; Audio Recording Unlimited, Chicago and Cresent Moon, Miami.

Technical Industries, Atlanta, GA, was selected by Panasonic/MEI to perform all detailed engineering and installation of the International Broadcast Center for the 1996 Summer Olympics.

Discreet Logic opened a sales office in the New York Information Technology Center, located in lower Manhattan at 55 Broad Street. The office will house a full state-of-the-art demo facility showcasing Discreet Logic technology, including a demo center for VAPOUR, the company's virtual set technology. For more information, contact Discreet Logic headquarters; telephone (514)272-0525; fax (514)272-0585; E-mail infodiscreet.com.

C-Cube Microsystems, Milpitas, CA, announced that Data Translation selected C-Cube's CLM4100 encoder family as the core digital video engine for Data Translation's new Broadway MPEG-1 authoring solution.

Panasonic, Secaucus, NJ, sold 25 AG-EZ1U DV camcorders to Video News International (VNI), Philadelphia. In addition, VNI purchased eight AJ-D750 DVCPRO studio editing decks for playback of DV videotapes.

Walters-Storyk Design Group is involved in more than 40 projects in the United States, Latin America and Southeast Asia. The architectural and design assignments total more than $25 million in construction and range in size and location from an expansion for the Howard Schwartz studio complex in New York to a 700-seat performing arts center in Kuala Lumpur, Malaysia.

Quantegy, Mountain View, CA, announced that the Canadian Broadcasting Corporation (CBC) selected Quantegy's Ampex 208 Betacam videotape to use for its 1996 Summer Olympic broadcast coverage.

Philips Electronics North American Corporation, New York, has completed its acquisition of Alamar Electronics USA. Alamar will continue to operate within its existing management structure.

A nonprofit organization, the Citizens Democracy Corps (CDC), Washington, DC, is recruiting U.S. volunteers with senior-level experience in production and general management in the TV, cable TV and radio industries. The CDC's Enterprise and Economic Development Program provides assistance in these areas of specialization to small and medium-sized companies in newly democratic countries. For more information, contact: CDC, 1400 Eye St. NW, Suite 1125, Washington DC 20005; telephone (202)872-0933 or (800)394-1945.

PEOPLE

Bruce Williams was appointed vice president, manufacturing and operations for Alamar USA, Campbell, CA.

Also, Tom Zades was promoted to chief financial officer for Alamar USA.

Charles Goodwin was promoted to vice president, manufacturing for Leitch, Chesapeake, VA.

Also, Steve Hathaway was appointed to director of European operations for Leitch.

Stephen A. Savitt joined Telemetrics, Mahwah, NJ, as assistant sales manager.

Michael Creamer joined Telecast Fiber Systems, Worchester, MA, as senior sales engineer.

Joe Cirincione has been placed in a newly created position for Leitch, Chesapeake, VA, as product manager for StillFile, MediaPort and the Client workstation. Cirincione will divide his time between the Chesapeake manufacturing facility and the Toronto facility in Canada.

John Knapton was promoted to sales director for Audio Processing Technology, Belfast, Ireland.

Fred Scott was named vice president in charge of broadcast and professional video product/sales for Fiber Options, Bohemia, NY.

Mark S. Podesla was appointed director, marketing and sales for Nova Systems, Canton, CT.

Jeffrey Gottlieb was appointed product specialist for nonlinear video editing equipment for the Panasonic Broadcast & Television Systems Company, Secaucus, NJ. ■

Clarification

In the "Video servers" article featured in the 1996 February issue of *BE*, the author for the section on Hewlett-Packard's video server (p. 60) should read "By Mary Louise Bucher."

Why Settle For Less Than 100% Digital?

The Hitachi SK-2600 is the only *fully digital triaxial camera system* in the world.

Fire, floods, world upheavals — whatever the year 2000 brings, the "2600" is the camera you'll want to shoot it with. This is the camera that will not only make you look good today, but will keep on making you look good 10 to 12 years into your buying cycle — well into the new millennium.

We start with a completely digital triaxial system and add such advanced technologies as a 4:3 aspect ratio, easily switchable to 16:9. Of course we offer flesh tone detail that keeps your talent as youthful as your system. Our six-vector color corrector allows you to paint and fine tune individual colors to make matching extremely easy. The unique LSI processor processes RGB in a single wafer, eliminating cross talk and noise. And only with digital technology can you set up one camera the way you like and transfer the information precisely to all other cameras for an exact match.

These ahead-of-their-time features are just part of the reason that, whatever the next millennium brings, if you own a 2600, the one thing it won't bring you is regrets.

Hitachi's SK-2600 Offers You All These Breakthrough Technological Advantages:

Full digital transmission system

4:3 aspect ratio, easily switchable to 16:9

Flesh tone detail for a softer, more youthful look

Six-vector color corrector and true linear matrix operating simultaneously

Single LSI does RGB processing for ultra-pristine image

13 to 18 bit digital processing

Precision digital file transfers

Extreme range of detail in viewfinder, even in low-level lighting

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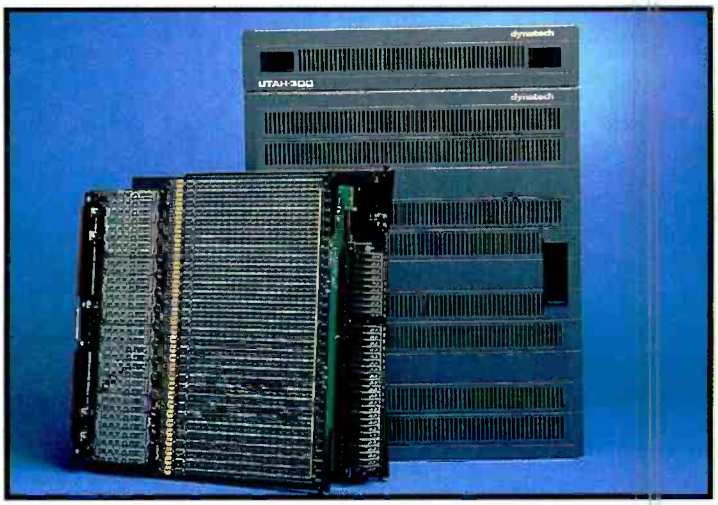
NEW PRODUCTS

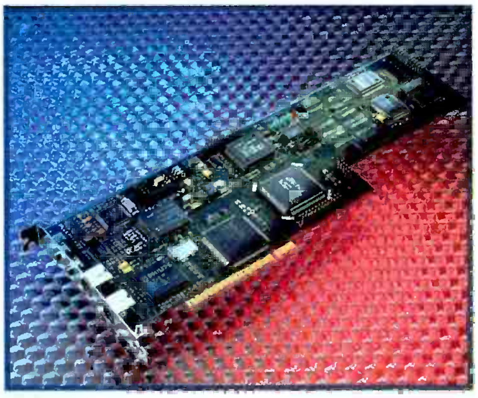
By Deanna Rood



Router control system
Utah Scientific

• SC-3: an advanced router control system designed to complement the UTAH-300 router; the SC-3 is compatible with all Utah Scientific, Alpha Image and Dynatech routers; a new control panel bus runs at 2MHz and provides the faster switching time that will be necessary for products of the future; 2-level tie line management allows facilities to incorporate existing matrices and makes multiformat switching transparent to the user (for instance, the system will automatically handle the connections between analog and digital routers); the SC-3 incorporates Utah Scientific's RealTime switch allowing the UTAH-300 router to switch in real time.

Circle (350) on Action Card



Nonlinear editing and video capture boards
Fast Electronics

• AV Master/AV Master Pro: nonlinear editing and video capture boards that use next-generation Philips PCI chips to combine high-quality 60 fields/s Motion JPEG capture, onboard CD-quality digital audio recording and Windows NT/95 compatibility; high resolution S-Video throughput and bus mastering technology deliver superb picture quality with video data rates of 5MB/s (4:1 compression); the AV Master Pro meets CCIR 601 specifications (720x525 lines of resolution).

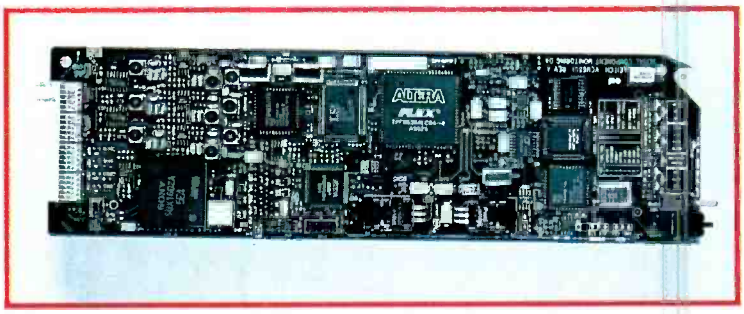
Circle (353) on Action Card

Single-channel digital transport system
ADC Video Systems

• DV6300: a single-channel universal digital transport system designed to support the greatest variety of video and telephony channels available today; the flexible reconfigurable design of the DV6300 offers unlimited potential for any single-channel video or digital application; single channels can be economically inserted into or dropped from a high-speed DV6300 2.4Gb/s digital multichannel stream to support point-to-point single-channel applications, local video transport, studio to production house or transmitter interconnects and interfaces between live events and long-distance networks; in addition, the DV6300 can be used to implement stand-alone single-channel optical links.

Circle (351) on Action Card

Video DAs
Leitch



• VCM-6801 *(photo)*: a serial component monitoring distribution amplifier that combines the functions of equalizing, reclocking serial DAs and 4:2:2-to-component analog video converters on single DA-sized cards; the component analog outputs permit monitoring of 270Mb/s signals without the added expense of serial digital monitors; if an incoming signal is lost, an internal flywheel will maintain the sync outputs.

• VDA-683: a general-purpose video distribution amplifier that features excellent linearity and gain stability for solving common mode errors; this 8-output DA can handle anything from .7V peak-to-peak noncomposite video to 2V peak-to-peak subcarrier; used with FR-680 analog frames, these units provide differential input when equalization and clamping are not required; units feature low power consumption and high temperature stability.

• VDA-6830: a video distribution amplifier that helps make the transition from analog to digital a less expensive process; using these DAs in FR-6800 digital frames allows analog and digital to coexist simultaneously until the analog device is eventually replaced; once the analog device is replaced, the DAs are removed from the frames and replaced by digital DAs; this amplifier can also serve as a distribution for unbalanced or single-ended AES/EBU transmission; features include differential input, AC coupling and a 30MHz bandwidth.

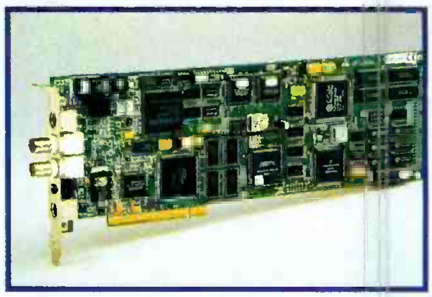
• VRG-683: a video remote gain amplifier designed for remote-control adjustment of video and chroma signal amplitude; the units have a continuous adjustment of video gain over a range of ±6dB and a chroma gain over a ±3dB; features include differential input, six outputs, cable equalization of up to 300 meters and a bandwidth of 30MHz.

Circle (352) on Action Card

Network adapters/loop hubs
Prisa Networks

• NetFX-HIO64 network adapters and NetFX loop hubs: a 2-pronged solution that, when coupled with the NetFX workstation cards, allows the movement of large blocks of data at more than a gigabit per second between Silicon Graphics servers and workstations, RAIDs and other peripheral devices; the networking hardware and software system is designed to solve the information bottleneck in computer-generated motion picture and TV production.

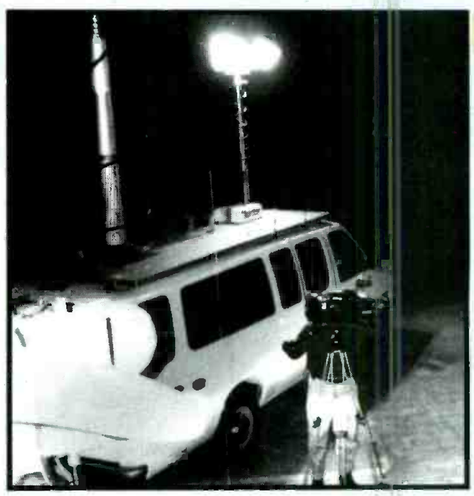
Circle (354) on Action Card

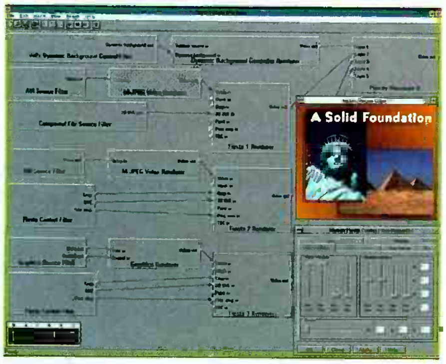


MPEG encoding system
Optibase

• MPEG Forge: a high-quality MPEG-1 and MPEG-2 encoding system that not only creates MPEG-1 SIF, but also MPEG-2 half D-1 streams; the system allows users to create high-quality video at reasonable data rates; the 2-board plug-and-play solution includes a PCI video encoder and an ISA audio encoder and features component input, onboard video filtering, VTR device control and batch encoding; for users that start with MPEG-1 and MPEG-2 Half D-1, and then plan to move into MPEG—2 Full D-1 later, the option to upgrade to MPEG Fusion is available.

Circle (356) on Action Card





Quartz implemented in DigiSuite

Matrox

• Quartz architecture in DigiSuite: DigiSuite, Matrox's new generation of digital video products, features software development tools based on Microsoft's new multimedia architecture code-named Quartz; the DigiSuite implementation of Quartz overcomes the well-known limitations of Video for Windows (VFW) and delivers a standard, reliable software development framework robust enough to meet the demand of the professional video industry.

Circle (355) on Action Card

Broadcast VideoStore system

Sony

• VideoStore insertion system: a hard-disk-based ad insertion and program delivery system that provides greater on-line storage capacity and lower maintenance costs while significantly improving the quality of a station's on-air look; based on Redundant Array of Inexpensive Disks (RAID) technology, the VideoStore system combines quick random access, large storage capacity, and high-quality compressed video in an integrated, multichannel video transmission system; features include Sony software, flexible and expandable open architecture and media units comprised of six hard-disk drives with either two or four GB of storage.

Circle (357) on Action Card

Mobile lighting system for nighttime remotes

Will-Burt Company

• Night Scan ENG: an ENG telescoping mobile lighting system in a compact, self-contained roof-top unit; Night Scan ENG elevates 3,200°K quartz lights to six feet above an ENG vehicle in 20 seconds; all functions are remotely controlled, including deployment, full pan and tilt lighthead control and Auto-Stow, a 1-button command that automatically retracts and stows the unit to a low-profile travel position.

Circle (358) on Action Card

Continued from page 36

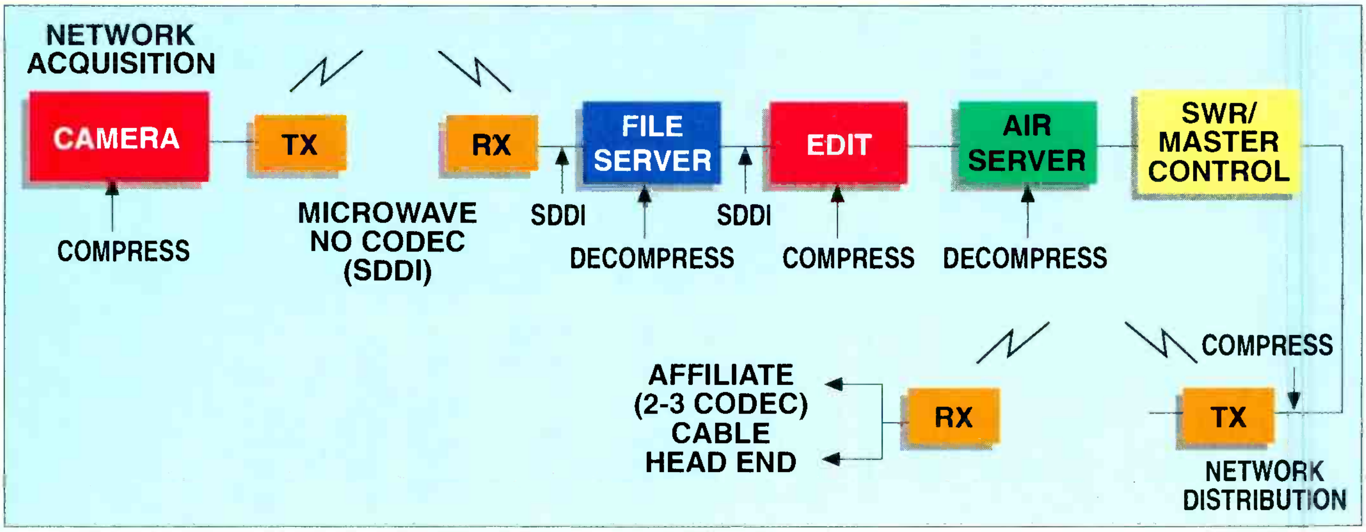


Figure 1. The path from network acquisition to the viewer may involve five or more compression/decompression cycles. Local acquisition to the viewer could include two or three cycles.

ware being offered handles fault tolerance, plug-and-play, gateway user configurations or whether the software has peer-to-peer relationships or client/server relationships? In addition, in some areas there will be the issue of how to license the software, whether the software is per seat, per person or per bits of bandwidth.

Certainly, there will be a mix of all of these possible configurations. Then, there is the perennial question of how reliable the software is. If the software is controlling a revenue stream, it has to be super-reliable at the time when it is installed. I am not convinced that there is any magical way to evaluate software without extensive demonstration at the manufacturers' sites. In this short review of technology issues facing the broadcaster, I believe that the software issue is one of the most predominant aspects that has yet to find a quantitative way of evaluating the real performance of the software.

Conclusions

Customers will be faced with the challenge of vendors providing complete solutions to their problems. The key to their success is to provide a formula, a product strategy and a system design that's flexible and compatible with existing technology, yet also provides a migration path to the vision of a complete digital system. The marketplace wants to make the best use of digital hardware and software, using it to optimize performance for greater ease of use, with enhanced functionality within individual application and between systems.

Using advanced technology to develop new revenue streams and new business opportunities --- especially in the area of true multimedia production --- in today's multichannel distribution broadcast model is absolutely key to the broadcast industry's future success. We cannot afford to take too many steps backward in our rush to embrace compressed TV facilities. We must seriously look at all of the implications and the solutions being offered with a long-term vision rather than a short solution. ■

Peter A. Dare is senior vice president, technology, for Sony Electronics Inc., San Jose, CA.

Editors note: This article was adapted from a pre-NAB speech given by Peter Dare. It has been edited and reformatted to fit this magazine.

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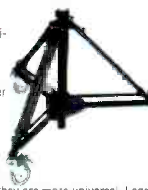
sachtler

VIDEO 14/100 FLUID HEAD

- Sachtler Touch and Go System
- Integrated sliding battery plate
- Strengthened dynamic counterbalance in 2 steps
- Frictionless leak proof fluid damping with three levels of drag
- Vibrationless vertical and horizontal brakes
- Built in bubble for horizontal leveling

HOT POD TRIPOD SERIES

Especially developed for use in ENG, the Hot Pod tripod is the fastest in the world. The central locking system is activated on all three legs at the same time, while the pneumatic center column easily makes it possible to have the lens at a height of over 7 feet. The elevation force of the center column is factory set and doesn't require any setup. When moving to another location it can be carried by its handle located at the center of gravity.



ENG TWO-STAGE TRIPOD SERIES

Sachtler two-stage tripods have an enlarged height range (lower bottom and higher top position) so they are more universal. Legs can be locked in seconds with Sachtler's quick clamping. There are also heavy duty versions for extra stability. The heavy duty aluminum has a 20mm diameter tube vs. 16mm and the heavy duty carbon fiber has a 24mm diameter tube vs. 22mm. All heavy duty two-stage tripods have a folding tripod handle.

NEW ! Sachtler CADDY Systems

Now Sachtler quality is available to low budget users. The price of a CADDY system includes the new 7-step dampened CADDY fluid head, ultra-light but rugged carbon fiber tripod, lightweight spreader and either a soft bag or cover. The CADDY fluid head features an adjustable pan arm, 7 step adjustment for quick counter balance and the self-locking Sachtler Touch and Go System.

CAD 01
Single-Stage ENG Carbon Fiber System:
- CADDY Fluid Head
- ENG Single-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader
- Transport Cover 100

CAD 2A
2-Stage ENG Carbon Fiber System:
- CADDY Fluid Head
- ENG 2-Stage Carbon Fiber Tripod
- SP 100 Lightweight Spreader
- Soft padded ENG Bag

Vinten

THE ADVANCED RANGE OF VISION LIGHTWEIGHT HEADS AND TRIPODS

Vision SD 12 and SD 22
Pan and Tilt Heads with Serial Drag

The Vision SD 12 and SD 22 are the first heads with the "Serial Drag" pan and tilt system. The system consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. So for the first time, one head gives you all the advantages of both fluid (viscous) and lubricated (LF) drag systems – and none of their disadvantages. Achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature. The Serial Drag system provides the widest range of infinitely variable precise settings with repeatable, consistent drag in each pan and tilt direction.

Features:
- Simple, easy-to-use external control for perfect balance
- Patented spring-assisted counter-balance system permits perfect "hands-off" camera balance over full 180° of tilt.
- Instant drag system breakaway and recovery overcome inertia and friction for excellent "whip pans"
- Consistent drag levels in both pan and tilt axis
- Redesigned flick on, flick off pan and tilt caliper disc brakes
- Greater control, precision, flexibility and "touch" than any other head on the market
- Touch activated, time delayed illuminated level bubble
- Environmental working conditions from as low as -40° to as high as +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 lbs
- SD 22 weighs 12.7 lbs and supports up to 55 lbs

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

The ultimate in lightweight and innovative tripods, they are available with durable tubular alloy (Model #3513) or the stronger and lighter, axially and spirally wound carbon fiber construction (Model #3523). They each incorporate the new torque safe clamps to provide fast, safe and self-adjusting leg clamps that never let you down. Two stage operation gives them more flexibility when in use as well as greater operating range.

- "Torque Safe" requires no adjustment. Its unique design adjusts itself as and when required, eliminating the need for manual adjustment and maintenance and making for a much more reliable clamping system.
- New hip joint eliminates play and adds rigidity.
- They both feature 100mm levelling bowl, fold down to a compact 28", and support 45 lbs.
- The #3513 weighs 6.5 lbs and the #3523 CF (Carbon Fibre) weighs 5.2 lbs.

Vision 12 Systems

All Vision 12 systems include #33643 SD 12 dual fluid and lubricated friction drag pan/tilt head, single telescoping pan bar and clamp with 100mm ball base.

SD-12A System
- 3364-3 SD-12 Pan and tilt head
- 3518-3 Single stage ENG tripod with 100mm bowl
- 3363-3 Lightweight calibrated floor spreader

SD-12D System
- 3364-3 SD-12 Pan and tilt head
- 3513-3 Two-stage ENG tripod with 100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

SD-12LT System
- 3364-3 SD-12 Pan and tilt head
- 3523-3 Two-stage carbon fibre ENG tripod w/100mm bowl
- 3363-3 Lightweight calibrated floor spreader
- 3425-3A Carry strap
- 3340-3 Soft case

Vision 22 Systems

All Vision 22 systems include #3386-3 SD-22 dual fluid and lubricated friction drag pan and tilt head, single telescoping pan bar and clamp with dual 100mm/150mm ball base.

SD-22E System
- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3516-3 Two-stage EFP tripod with 150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

SD-22 LT System
- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3523-3 Two-stage carbon fibre ENG tripod w/100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader
- 3425-3A Carrying strap
- 3341-3 Soft case

SD-22 ELT System
- 3386-3 SD-22 Pan and tilt head
- 3219-52 Second telescoping pan bar and clamp
- 3383-3 Two-stage carbon fiber EFP tripod w/150mm bowl
- 3314-3 Heavy-duty calibrated floor spreader

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Logic Series DIGITAL Gold Mount Batteries

The Logic Series DIGITAL batteries are acknowledged to be the most advanced in the rechargeable battery industry. In addition to the comprehensive sensors integral to all Logic Series batteries, each DIGITAL battery has a built-in microprocessor that communicates directly with Anton/Bauer InterActive chargers, creating significant new benchmarks for reliability, performance, and life. They also complete the communications network between battery, charger and camera. With the network in place, DIGITAL batteries deliver the feature most requested by cameramen: a reliable and accurate indication of remaining battery power.

DIGITAL PRO PACS

The Digital Pro Pac is the ultimate professional video battery and is recommended for all applications. The premium heavy duty Digital Pro Pac cell is designed to deliver long life and high performance even under high current loads and adverse conditions. The size and weight of the Digital Pro Pac creates perfect shoulder balance with all cameras/camcorders.

- **DIGITAL PRO PAC 14 LOGIC SERIES NICAD BATTERY** 14.4v 60 Watt Hours. 5 1/8 lbs. Run time: 2 hours @ 27 watts, 3 hrs. @ 18 watts
- **DIGITAL PRO PAC 13 LOGIC SERIES NICAD BATTERY** 13.2v 55 Watt Hours. 4 3/4 lbs. Run time: 2 hours @ 25 watts, 3 hours @ 17 watts

GOLD MOUNT BATTERIES

Logic Series Gold Mount batteries are identical to the respective DIGITAL versions with respect to size, weight, capacity, IMPAC case construction, and application. They are similarly equipped with micro-code logic circuits and comprehensive ACS sensors. They do not include DIGITAL microprocessor features such as the integral diagnostic program "Fuel Computer", LCD/LED display and InterActive viewfinder fuel gauge circuit.

- **PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt Hours)
- **PRO PAC 13 NICAD BATTERY** (13.2 v 55 Watt Hours)
- **TRIMPAC 14 NICAD BATTERY** (14.4v 40 Watt Hours)
- **TRIMPAC 13 NICAD BATTERY** (13.2 v 36 Watt Hours)
- **COMPAC 14 NICAD BATTERY** (14.4v 40 Watt Hours)
- **COMPAC 13 NICAD BATTERY** (13.2v 36 Watt Hours)

Century precision optics

WIDE ANGLE ADAPTERS
Tools For Creative Videographers

Century Precision's wide angle adapters open new possibilities for videographers. By providing a wider angle of view they let you capture more of the action from close up–especially crucial when shooting in tight quarters. Using a wide angle adapter also yields increased depth of field and shorter MOD (minimum object distance), enabling you to move closer to the subject and to arrange subjects within a shot over a greater range of distance relative to the lens. Century's wide angle adapters are divided into two classes: fixed focal length adapters and zoom-through converters. The Wide Angle Adapter Set, .6X Double Asphere and Super Fisheye are designed for use with a zoom lens set at its widest focal length. With one of these adapters a zoom lens performs as a wide or super wide angle fixed focal length lens. (Focus is done by using the lens' macro function.) For zoom-through applications, the .8X Wide Converter is perfect for shooting situations which require wide angle and the ability to zoom.

WA-7X5X WIDE ANGLE ADAPTER SET

- Compact, lightweight and economical, the Wide Angle Adapter Set is the industry standard. The set consists of two lenses; the .7X Wide Angle and .5X Super Wide Angle. The .7X attaches to the front of a zoom lens, increasing coverage by 30%.

- For example, when attached to a lens that zooms to 9mm, the .7X W/A adapter shortens the effective focal length to 6.3mm. Adding the .5X Super Wide further alters the wide end of the lens to just 4.5mm. Thus producing coverage nearly double that captured by the lens alone.

WA-7X93	.7x Wide Angle Adapter	445.00
WA-5X45	.5X Super Wide Angle Adapter	535.00
WA-7X5X	Wide Angle Adapter Set (WA-7X93 and WA-5X45)	895.00
FA-6X	Step-up Ring (specify 75mm, 80mm, 85mm, 90mm)..ea.	104.95

SUPER FISHEYE ADAPTER

- When you need the widest possible angle of view, the Super Fisheye Adapter produces an extraordinary degree of barrel distortion for a magnification factor of approximately .55x. For example, adding the Super Fisheye to a modern 15x 8 lens results in a 116° horizontal angle of view—a remarkable 145° when measured diagonally.
- Due to the Super Fisheye's characteristic barrel distortion, extreme low and high angle shots are also made more dramatic. An attic crawlspace can induce heightened claustrophobia or a forest of tall skyscrapers made to bend menacingly over the audience. And since the Super Fisheye takes in a much wider angle of view than the human eye, it can also be used to plunge the audience into a scene— surrounding them with a noisy crowd or exiling them to a lonely beach.
- The Super Fisheye's tremendously wide field of view suggests a myriad of creative possibilities—from panoramic vistas that seem to stretch to the edge of the earth, to comical forced perspective close-ups, in which an actor's distorted features seem to pop through the video screen. While extreme telephoto shots tend to flatten the subjects against the background, the Super Fisheye exaggerates depth, pulling nearby objects closer and causing distant objects to recede into the background.
- In addition to the Super Fisheye (designed for the newest generation of internal focus zooms) Century Precision also offers the Fisheye Adapter for industrial video zoom lenses with 75mm lens fronts.

WA-FESU	Super Fisheye Adapter (specify lens front diameter)	1049.95
WA-FE75	Fisheye Adapter for industrial zoom lenses with 75mm fronts	445.00
FA-6X	Step-up Ring (specify 75mm, 80mm, 85mm, 90mm) ea.	104.95

.8X ZOOM-THRU WIDE ANGLE CONVERTER

The .8X Wide Converter offers the high quality, economical way to expand a lens' angle of view when the shot requires a zoom—as well as situations which require both a wider angle of view and the ability to zoom.

- The .8X attaches quickly to the front of a zoom lens, effectively shortening its focal length while maintaining full zoom capabilities. With the converter attached, 20% more coverage is realized when the lens is set to wide angle, telephoto or anywhere in between. For example, when added to an 8.5-119mm lens, the .8X Wide Converter alters the focal range to 7-98mm. This can be especially advantageous when shooting in confined quarters.

- The .8X not only expands field of view but also reduces minimum object distance (MOD). The camera can therefore move considerably closer to the subject while maintaining focus. And because there is no light loss with the .8X, there is no need to change exposure or lighting.

WA-8XCV	.8X Wide Zoom-Thru Converter	1479.00
FA-388X	138mm Filter Adapter	164.95

.6X DOUBLE ASPHERE WIDE ANGLE ADAPTER

- Unequivocally superior to every other wide angle adapter, the .6x Double Asphere utilizes a single element with two aspheric surfaces. This design ensures a performance that is not possible with conventional single element adapters. The adapter minimizes distortion and reduces chromatic aberration while dramatically increasing edge resolution.
- Remarkably lightweight and compact, the .6X was created especially for use with the latest internal focus lenses like Canon and Fujinon's 15x8. The .6X increases their coverage 40%, effectively changing a15x8 into a super-sharp 4.8mm fixed focal length lens.
- The .6X fits most lenses via interchangeable adapter rings. An accessory Lens Shade/Filter Holder accepts either a single 4x5 or Panavision-size filter holder.

WA-6XAS	.6X Double Asphere (fixed focal length)	1225.00
FA-6XAS	Sunshade for .6X Double Asphere with slot to accept one 4x5 or 4x5.65 filter in a holder	349.95
FH-4X50	4x5 Filter Holder	199.95
FH-4565	4x5.65 Filter Holder	199.95

SONY
DFS-300 DME Switcher

The world of video has changed, simple wipes and transitions are no longer the norm. Today, both the video producer and the client expect a blend of dazzling special effects and sophistication. Many desktop systems can deliver these elaborate visuals, but sacrifice ease of use and dependability. The DFS-300 has both desktop versatility and hardware reliability. It features basic transitions such as wipes and mixes, as well as complex DMEs, or digital multi effects. The DFS-300 allows you to insert sophisticated patterns like picture-in-picture, mosaic, mirror, slide and matrix wipe designs. And with the optional BKDF-301 3D Effects board installed, you can perform three dimensional rotations, page turns, image twists, multi-splits and 3D spherical effects—in real time. No sitting around waiting for loading or rendering. With it's digital multi-effects, numerous keying options, 3D transitions and user-friendliness, the DFS-300 is in a league of its own.

POWERFUL MULTIPLE EFFECTS

Up to 500 Effects
- There are 330 factory preset 2D effects and wipes stored in the DFS-300 for immediate use. These include wipe, compression, rotation, slide, split, mirror, stream, etc. as standard.
- With the optional BDKF-301 3D board installed, 130 additional preset effects such as twist, page turn, sphere, etc. can be memorized and recalled whenever required.

Powerful User Program
- The DFS-300 provides powerful, yet easy to operate effects programming using the positioner and other controls to build your own effects. Cut, mix, wipe, slide, rotation and many other 2D effects and optional 3D linear and digital effects such as page turn, roll and sphere can be created with the unit's programming function. Up to 20 created effects can be stored for instant recall and that is doubled when the 3D board is installed.

Effects Modification
- To suit individual tastes in creative program production, effects modification is provided for some of the preset effects such as mosaic, posterization, solarization, wave, multi-picture, strobe, frosted glass, cinema mode, etc.
- Fine control over various parameters such as size, density and amplitude further enhances effects editing.

Transitions
- 111 of the most frequently used wipes are available from the preset patterns and 13 of them are directly accessed with a press of the keypad.
- Mixes, wipes, as well as digital effects transitions can be performed manually or automatically with the fader lever. The automatic transitions can be varied from 0 to 999 frames in duration for both foreground and background bus transitions and the Downstream Key transitions.

HIGH PERFORMANCE SWITCHER

Multi-Format Inputs/Outputs
Has four primary video inputs. The first three accept composite, S-video and component signals. The fourth input accepts either component, R/G/B/Sync or a computer generated RGB signal. Independent color correction can be applied to any of the four inputs. There are two program outputs that likewise provide composite, S-video and component signals.

Built-in Matte Generator
Most digital video switchers have only one built-in matte color generator. The DFS-300 has three matte generators for backgrounds, which can be a solid color or one of 31 different textured patterns, border matte and effect matte signals. Also instantly-selectable color bars, grid pattern and solid black. With the optional BKDF-504 Downstream Key installed, you get two more independent matte generators for Downstream Key (DSK matte) and border colors (DSK border matte) with independent adjustment of luminance, saturation and hue parameters.

Luminance Keyer
- Foreground sources such as titles, captions or figures can be self-keyed over a background source and rotated, compressed and positioned optionally in 3D space.
- Any of the preset effects can be applied to the keyed picture.
- External key input also provided to accept a key source signal.
- A box mask is provided for masking an unwanted portion of the foreground picture.

Chroma Keyer
- Superimpose video from a foreground source onto a background source.
- Clip and Hue can be controlled for clear and sharp key edges.
- Any preset effect can be applied to the chroma keyed picture.

Optional Down Stream Keyer
- An optional 8-bit linear DSK (Down Stream Keyer), the BDKF-504 lets you introduce captions, characters, etc. with clear edge quality, after mix/effects processing.
- DSK key input accepts composite, component or RGB signals.
- Position and type of the DSK are selectable and a box mask is provided to mask unwanted areas of the picture.

Snapshot Function
The DFS-300 can store up to 99 control panel settings in it's "Snapshot" memory for instant recall of a specific combination of effects and parameter settings. Every parameter such as background color hue, border width, shadow density, etc. can be stored and recalled at any time.

Built-in Color Corrector
For white balance adjustment or to give some special tonal effect, color correction of foreground or background sources can be applied. Hue, offset and chroma gain of the selected signal can be controlled independently.

Other Features
- Four different title modes offer the ability to perform key effects suchas luminance key, chroma key external key or downstream key from a variety of input sources.
- Equipped withthree black-burst outputs to provide synchronization to VCRs, cameras and other equipmenta requiring sync signals. A genlock input allows the DFS-300 to be synchronized to an external timing source.
- When used with a compatible editing controller, the DFS-300 allows two-machine editing with effects. In a simple A-roll system, effects such as a color background or external titles can be keyed in during editing.

SONY COLOR MONITORS

PVM-1350
13" Presentation Monitor

- Employs a P-22 phosphor fine pitch CRT to deliver stunning horizontal resolution of 450 horizontal lines.
- Equipped with beam current feedback circuit which eliminates white balance drift for long term stability of color balance.
- Has analog RGB, S-video and two composite video (BNC) inputs as well as 4 audio inputs.
- Automatic Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Using broadcast standard color bars as a reference, this function automatically calibrates chroma and phase.
- Chroma/Phase adjustments can also be easily performed with the monochrome Blue Only display. In Blue Only mode video noise can be precisely evaluated.
- Factory set to broadcast standard 6500K color temperature.
- On power up, auto deguassing is performed. There is also a manual degauss to demagnetize the screen.
- Provides an on-screen menu to facilitate adjustment/operation on the monitor. The on-screen menu display can be selected in English, French, German, Spanish or Italian.
- Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for multiple monitors to all be controlled at the same reference.

PVM-1351Q
13" Production Monitor

Has all the features of the PVM-1350 *PLUS*-
- Is also a multisystem monitor. It accepts NTSC, PAL and NTSC video signals. NTSC 4.43 can also be reproduced.
- Equipped with a SMPTE 259M Serial Digital interface. By inserting the optional serial digital interface kit BKM-101C for video and the BKM-102 for audio the PVM-1351Q can accept SMPTE 259M component serial digital signals.
- Equipped with RS-422 serial interface. With optional BKM-103 serial remote control kit all of the monitor's functions can be remotely controlled with greater confidence and precision.
- Equipped with input terminals such as component (Y/R-Y/B-Y), analog RGB, S-video, 2 composite video (BNC) & 4 audio terminals for complete flexibility.
- Aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.
- Underscan and H/V delay capability. With underscan, entire active picture area is displayed. Allows you to view entire image and check the picture edges. H/V delay allows viewing of the blanking area & sync/burst timing by displaying the horizontal and vertical intervals in the center of the screen.
- Color temperature switchable between 6500K/9300K/User preset. 6500K is factory preset. 9300K is for a more pleasing picture. User preset is 3200K to 10,000K.

PVM-1354Q/PVM-1954Q 13" and 19" Production Monitors

All the features of the PVM-1351Q *PLUS*.
- SMPTE C standard phosphor CRT is incorporated in the PVM-1354Q/1954Q. SMPTE C phosphors permit the most critical evaluation of any color subject. Provides over 600 lines of horizontal resolution.
- The PVM-1354Q mounts into a 19-inch EIA standard rack with the optional MB-502B rack mount bracket and SLR-102 slide rail kit same as PVM-1351Q. The PVM-1954Q mounts into a 19-inch EIA rack with the optional SLR-103 slide rail kit.

Sony BPPG products are not available for sale outside continental USA

Why pay $10,000 to $15,000 for a BROADCAST QUALITY CHARACTER GENERATOR when you can get it for only $2995?

Introducing the new.........

VIDEONICS
POWER Script™
Animated Postscript Character & Graphics Generator

A technological and engineering breakthrough, the PowerScript sets new price/performance standards for broadcast video production, multimedia and industrial applications. It delivers the huge range of titles and graphics supported by PostScript display technology, plus animation, effects, transparency and keying. It features anti-aliased, 17.5 ns (nanosecond) pixel resolution and 4:2:2 broadcast-quality video, plus high-speed RISC processing to provide real-time Level 2 PostScript imaging and fast rendering—even with the most complex images. The PowerScript works stand-alone or with a computer, has a built-in TBC, offers a powerful and intuitive interface, and is suitable for the desktop or can be rackmounted.

Powerful Character Generator
- Choose from 35 built-in fonts or download hundreds of PostScript fonts from your computer. With its high-speed RISC processor, it provides real-time PostScript Level 2 imaging—the full power of the PostScript language is at your command.
- Characters can be rotated at any angle, scaled to any size, stretched horizontally or vertically.
- Styles include variable bold and italic, underline and shadow (drop shadow, variable displacement and opacity). Each character can be adjusted separately.
- Text can be positioned anywhere on the screen or automatically centered, vertically or horizontally.
- Left, right, top, bottom & center justification is provided as well.
- Characters are automatically kerned, using the font's standard kerning information.
- Spacing is highly flexible with variable word and letter spacing and line spacing (leading).

Intuitive User Interface
The user interface is fast and intuitive, easily supporting the rapid pace of real life video production.
- Built-in real-time object-based drawing tool and text editor—no external computer or software required. Design can be done ahead of time and displayed later, or can be done on the fly. Display is real time.
- Supplied keyboard and mouse are used with easy on-screen menus to place and modify graphics and text.
- Customizable function keys let you change fonts, colors, and other characters instantly.
- Separate preview output allows you to create and edit titles while another set of titles is being displayed.

Transparency and Colors
- Characters can be made transparent (0-100%) over video, other characters and graphics with 64 levels of transparency.
- Opaque characters can use over 4,000,000 colors, transparent characters can use over 8,000.
- Different colors can be used for fill and outline (variable width), and each letter and each graphic can use different colors.

Roll, Crawl, Animation, Effects
Variable speed roll, crawl and push (slide) in all directions—plus extensive animation capabilities as well.
- Every text object, graphic, and logo can be separately animated. Complex animations include ability to have elements follow paths, bounce, etc.
- Elements can change outline and/or fill color, transparency, position as they move and results are displayed in real time.
- Move individual characters in different directions; make colors change; flash words; make letters and words bounce; spin a letter across the screen.
- Use effects like fades and wipes to transition between titles and video or between two pages of titles.

Two GPI Inputs
The GPI automatically plays a sequence of titles when a pulse appears at one of the two inputs.

Keyer
- Internal linear keyer superimposes characters and graphics on S-video or composite sources.
- Also provides anti-aliased down-stream keying via a separate linear KEY output.

Backgrounds and Graphics
- Titles can be placed on solid color, patterned or graduated backgrounds, or they can be genlocked to incoming video.
- Lines, squares, rectangles, ovals and circles can be created and placed anywhere on the screen.
- Each graphic object can use a different color, transparency, rotation, size, fill and outline.

Imported Logos and Graphics
- Can import and display complex graphics created with standard Macintosh, Windows, DOS, Amiga and UNIX-based programs, such as Photoshop, Corel Draw and Adobe Illustrator. Accepts most PostScript or EPS format graphics without modification.
- Imported images can be any size and can be scaled, skewed, and rotated when placed on screen.
- Transparency and anti-aliasing can be defined when graphic is generated.

Built-in TBC
The PowerScript has a built-in full-frame (dual field) time base corrector that constantly locks the signal to a reference input. If no reference is connected, the signal is synced to an internally-generated RS-170A time base.

Expansion Capabilities
Although the PowerScript operates on its own, you can still add peripherals and connect to a computer or network. Two PCMCIA (accepts Type I, II and III cards) slots allow the addition of non-volatile flash-RAM and Ethernet (file transfer protocol using TCP/IP) cards and an RS-232 serial port allows simple connection to desktop computers. This allows you to add storage capability and to download fonts and graphics from a computer. This means you can save titles to your computers hard or floppy disk, or download fonts and graphics files from a desktop publishing system.

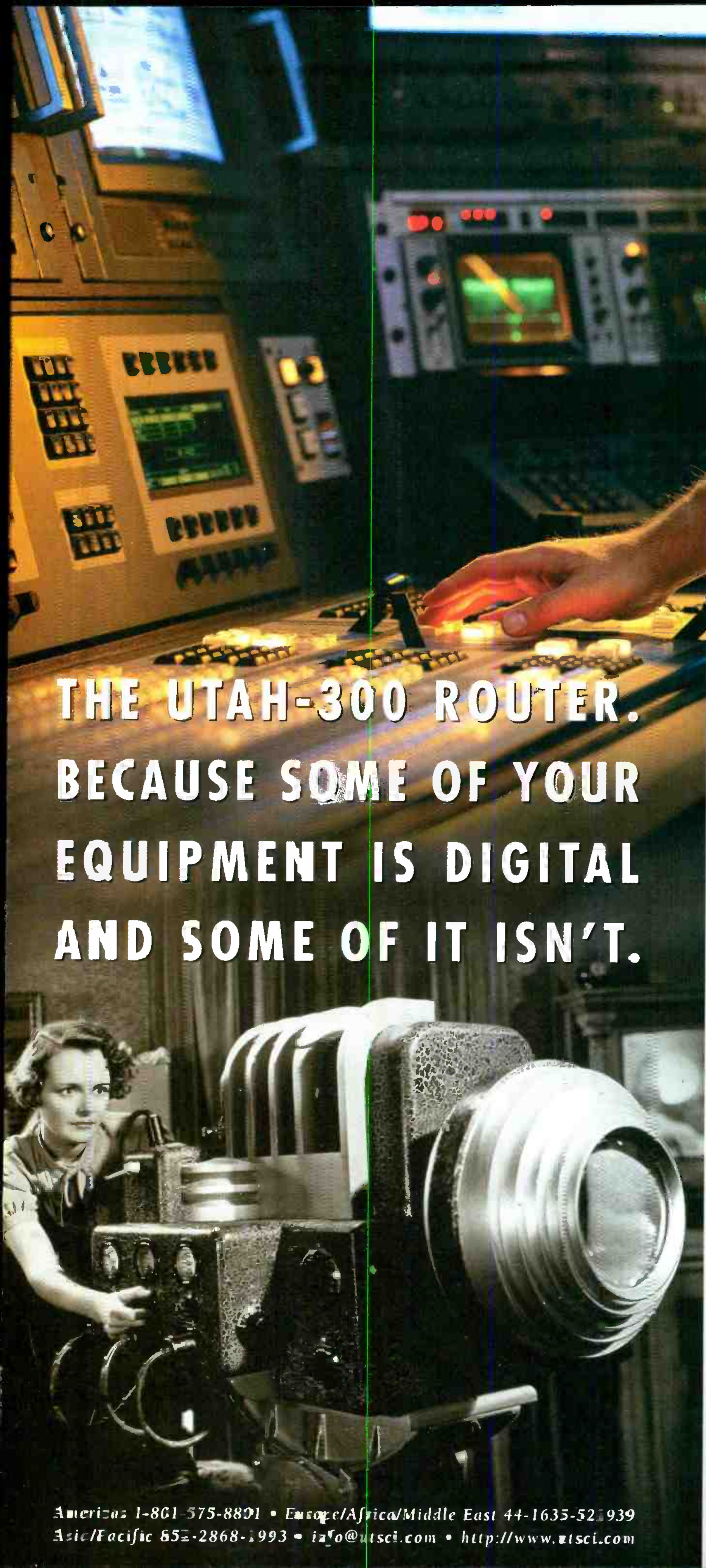
Clock/Calendar
The PowerScript has a built-in clock/calendar that displays current date, time, or elapsed time(stopwatch) counter in a wide range of formats, using any color or font. Clock/ calendar can also activate selected titles at predefined times.

Built-in Test Generator
The PowerScript can generate standard video test patterns including color bars, crosshatch, ramp, gray wedge, multiburst and blackburst. Titles can be placed atop any of the patterns.

Other Features
- Split screen titling allows definition of two titling windows with separate rolls and crawls defined in each.
- Small footprint makes it ideal for the desktop, or it can be rackmounted with optional rack kit.

Still not convinced, then call us for a free PowerScript demo tape and see for yourself.

The GALLERY



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Continued from page 24

tion is difficult. For broadcast, the system uses a signal designated 8-VSB, comprising a 4-level AM vestigial sideband signal, plus trellis coding that turns its 4-level input into 8-level output signals. The basis data transmission spectrum is flat over most of the channel, with a rolloff region at either edge, like a quadrature amplitude-modulated (QAM) spectrum. But unlike QAM, where the suppressed carrier is in the center of the band, VSB's suppressed carrier frequency is at the rolloff of the lower band edge.

Constant value data would ordinarily produce a non-uniform spectrum, increasing the interference into existing NTSC stations. For this reason, input data is modified by a known pseudo-random scrambling sequence, which flattens the spectrum on average. Because the MPEG-compliant data generated by the GA video compression system is segmented into 188-byte packets, including a sync byte, data is transmitted in similar segments. Each contains 187 databytes, 20 Reed-Solomon parity bytes for forward error correction, and one segment sync byte, which can be re-inserted as required at the receiver.

Over cable, where the signal-to-noise ratio is controlled, a 16-level VSB modulation suffices without trellis coding. The increase in the number of levels does not alter the signal's spectrum, but does double the available data rate vis-à-vis 8-VSB.

The special features added to the VSB signal assist the receiver in acquiring and locking onto that input, even under the occasionally extreme conditions of terrestrial broadcasting. The idea is to provide a known and stable reference for the various carrier and clock recovery functions. The receiver is then sure to acquire the signal whenever the data itself is usable. A small pilot carrier is included instead of the totally suppressed carrier usual in QAM. The pilot is placed so that it falls on the Nyquist slope of NTSC receivers, minimizing co-channel interference into existing service. If there are no other channel impairments, this pilot can even be acquired down, including low signal-to-noise conditions.

Interoperability

Because of the proliferation of standards in some industries and the lack of standards in other related industries, merging a disparate collection of TV, imaging and information systems together is difficult. Therefore, interoperability was an important design goal for a U.S. ATV system. These systems, which might include broadcasting, cable television and consumer electronics, as well as computing and telecommunications, are not especially interoperable with one another, yet there are good reasons for making them interoperable with HDTV. The GA systems seems to provide good interoperability. ■

Louis Libin is director of technology for NBC, New York.

Still some unfinished business

The basis for the Grand Alliance/FCC standard has been established, but there are many unanswered questions. Many issues remain open that need to be tested and standardized prior to going on the air with ATV. For instance, the receivers must be able to demodulate the transmitted signal and interpret the bitstream to recreate the high-quality picture, sound and data. These issues are being defined and will be prioritized by the various broadcast organizations that will be performing the work. The following are examples of some of the activities that will be required.

Terrestrial transmission

Though the terrestrial transmission standard has been forwarded to the FCC for approval, there are still open issues related to the broadcasting of over-the-air signals. For example:

1) The ATV broadcast transmitter performance needs to be ascertained.
2) The emission mask that establishes the limits of out-of-band signals for the ATV transmission system needs to be specified. It is necessary to allow ATV adjacent-channel operation with NTSC stations without significant degradation to the NTSC received signal.
3) The input signal interfaces of the system components and equipment to be used in broadcast transmission facilities must be compatible. This includes signal sources, such as test equipment, microwave and satellite facilities.

Receiver specifications

A set of recommended practices must be developed to be used in the design and implementation of ATV receiving systems. For example:

1) The tuner performance and immunity from interference must be ascertained to meet industry requirements.
2) The true extent of coverage must be determined by matching prediction models with actual coverage through field measurements and studies.
3) Margins need to be specified and documented. This is necessary because reception margins or signals in excess of that needed to achieve error rates that no longer produce artifacts on the broadcast signal require evaluation.

Performance and compliance

The first-generation ATV equipment must meet initial performance requirements. Encoder equipment, including pre-processors, video and audio compression, the transport system and modulation, must be evaluated to ensure compliance with industry standards. The receiving systems performance must be identified including the tuner, adaptive channel equalizer, transport, video, audio and ancillary data decoding equipment.

Resources: Hardware and standardization

Various organizations will be needed to perform all of the required activities. The organizations are divided into two categories. *Hardware Development & Evaluation* and *Standards & Documentation*. The standard-setting organizations involved with this phase of ATV development are the ATSC, the EIA, the IEEE and SMPTE. Some of the organizations that may be involved with the hardware development and evaluation include:

- Equipment manufacturers;
- NIST/ATP program (a group of companies that are developing critical technologies needed to enable production and delivery of ATV);
- Experimental ATV station (a transmission facility strategically located and operating at full power to enable propagation, equipment and receiving testing).

Needed: Broadcaster support

There is a need to get these projects done! Your role will be to provide support for the projects. Station groups and networks will participate in various parts of the projects, and one of the goals is to have an experimental broadcast station where these tests and developments will be performed. ■

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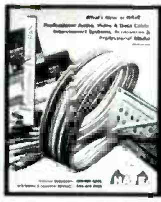

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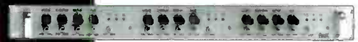

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By Paul McGoldrick

Converting parallel to serial

Last month's article described the mechanical difficulties associated with handling parallel digital video, both at the equipment and in the nature of the multicore cable required. The reliable transmission distance is also so short as to raise considerable concerns about its viability in anything except a small digital island. The answer to these problems is to handle the digital signal in a serial stream.

The serial digital interface (SDI) was developed by Sony, but is not considered proprietary. Converting the 10-bit digital component parallel stream (with 27MHz clock) into serial requires a data rate of 270Mb/s. Figure 1 shows the complete path from parallel to serial receiver and we will refer to parts of this here. The transmission medium is 75Ωcoaxial cable, and a number of fundamentals need to be considered. First, however, the co-located samples of the parallel system need to have a transmission order defined for serial. That is done as CB, then Y, then CR.

A 270Mb/s signal (actually higher with the overhead needed) on a coaxial cable is no longer video: it is RF. The handling of the serial signal is a great deal easier thinking as an RF engineer. The video engineer can easily find some pitfalls or "illogical" happenings if the signal is thought of as baseband. Coaxial cable is funny stuff: it doesn't like low frequencies; its characteristic impedance isn't the same at all frequencies, and connectors need to be dressed correctly for wideband performance.

The choice of 75Ω with BNC connectors was not one that most RF engineers would have made for a wideband transmission system — better cables and connectors are available for 50Ω. Given that there is no choice, care should be taken over the coaxial cable specified, route cable with generous loop radii, and take great care over the BNC connectors. Use solder in preference to crimp, and make absolutely sure that the vendor's equipment and your connectors are 75Ω, not 50Ω. Also, manufacturers have had considerable difficulties achieving the return loss specification. If in doubt, measure it.

Transmission standards

Transmission standards for the serial datastream are such that the drive level is +10dBm into 75Ω, which corresponds to about 866mV. With output circuit and connector losses, this is quoted as 800mV±10%. For most receive-end equipment, the lowest raw level that can be safely considered is -20dBm (i.e., a total circuit loss of 30dB) which corresponds to 27.4mV — usually quoted at 30mV. With 1dB loss in the sender, 0.5dB in each connector and 0.5dB loss in the receive-input circuits, 27.5dB loss in the cable can be considered. This could be up to 300 meters (1,000 feet) of really good cable and perhaps 200 meters of average cable.

The ability to receive a usable datastream is not, however, simply raw amplitude. The signal itself must be reasonably undistorted (and better definitions will hopefully fall out of work being done on serial data test equipment, not just in the video industry), and reflections must be of an amplitude that does not confuse the receive circuits. This is the reason why return loss is significant. It is important to recognize that in marginal return loss situations, a few inches difference in cable length can cause completely different reflections, and thus, either a recoverable or non-recoverable output.

At the transmission end, the parallel data is shift registered at 270MHz to produce a 1-bit-wide stream. This serial stream is then scrambled by an algorithm that minimizes the DC content of the signal (coax limitations, again), and the signal is subsequently encoded by a non-return to zero inverter (NRZI), which removes DC content even further. The resultant signal is then available for transmission to the coaxial cable.

At the receive end, it is standard for reclocking to take place (to remove jitter) after automatic equalization and amplification. The signal may be almost sinoidal at the receiver point. That is totally recoverable provided there are little or no distortions or additional signals added.

For example, there have been reports of some difficulties at sites where a VHF transmitter is co-located. Because the nature of recovery of the signal is either a yes/no situation, the condition of connectors and cables should be regularly checked.

The serial digital interface is also applicable to composite digital signals. A 14.3MHz NTSC digital composite signal of 10 bits requires a serial stream of 143MHz. A similar PAL signal would need 177MHz (both plus overhead).

Higher data rates are already being discussed for advanced TV systems, and we should expect to see higher than 900Mb/s systems. Although cable losses may be higher at such frequencies, there is no reason why good engineering practices will not result in excellent distance results.

Next month, we will look at interface and codec questions.

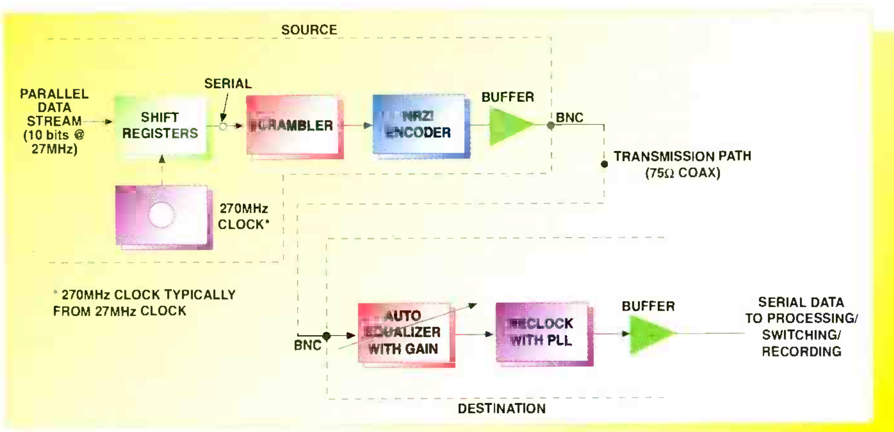
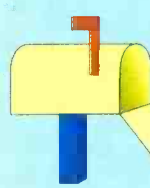


Figure 1. Signal path used to convert parallel component digital to a serial datastream for transmission.

Paul McGoldrick is a free-lance writer and consultant based on the West Coast.



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