BROADCAST ENGINEERING

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August 1997/$10.00

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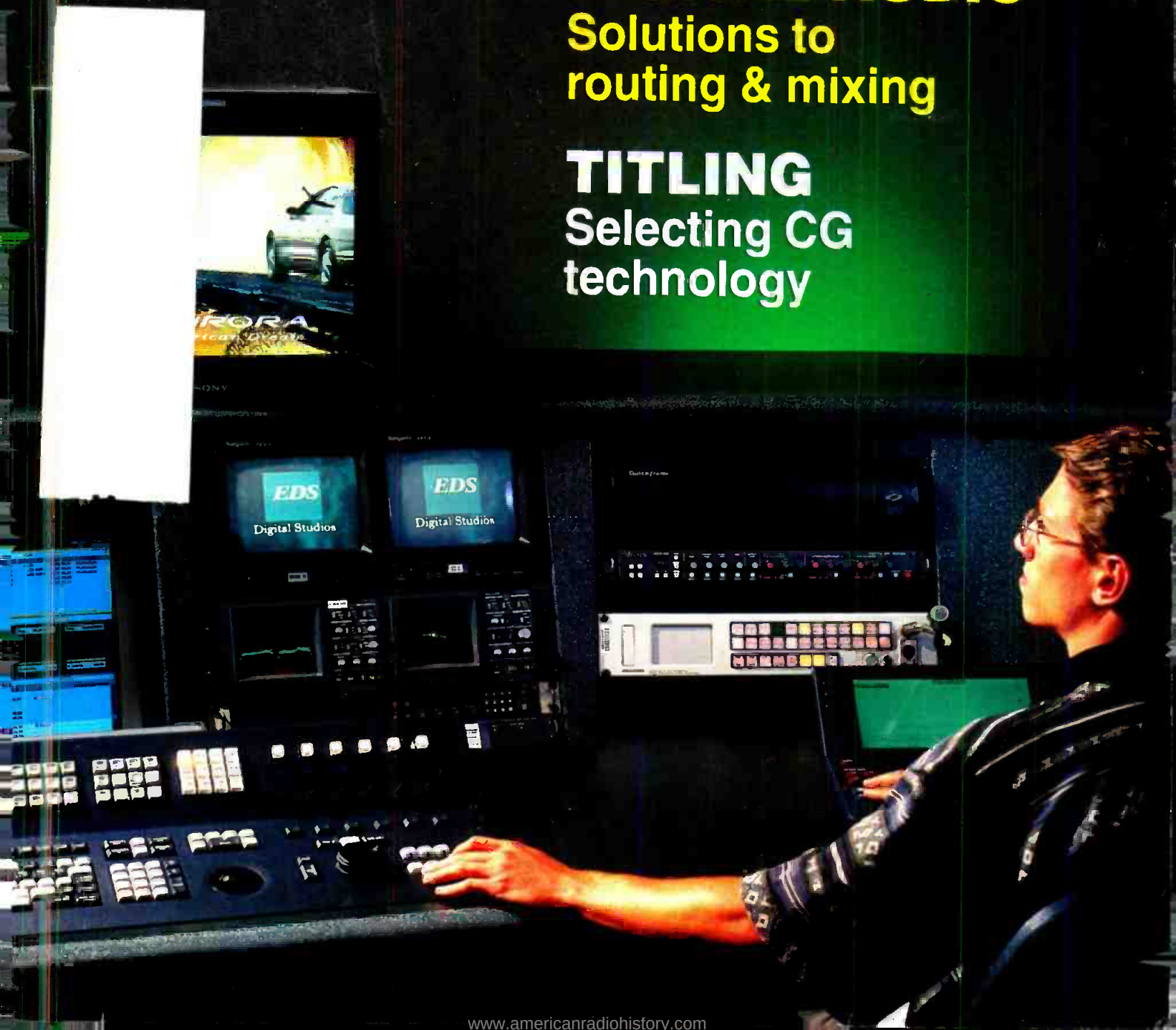
Can the VDR replace the VTR?

DIGITAL AUDIO
Solutions to routing & mixing

TITLING
Selecting CG technology



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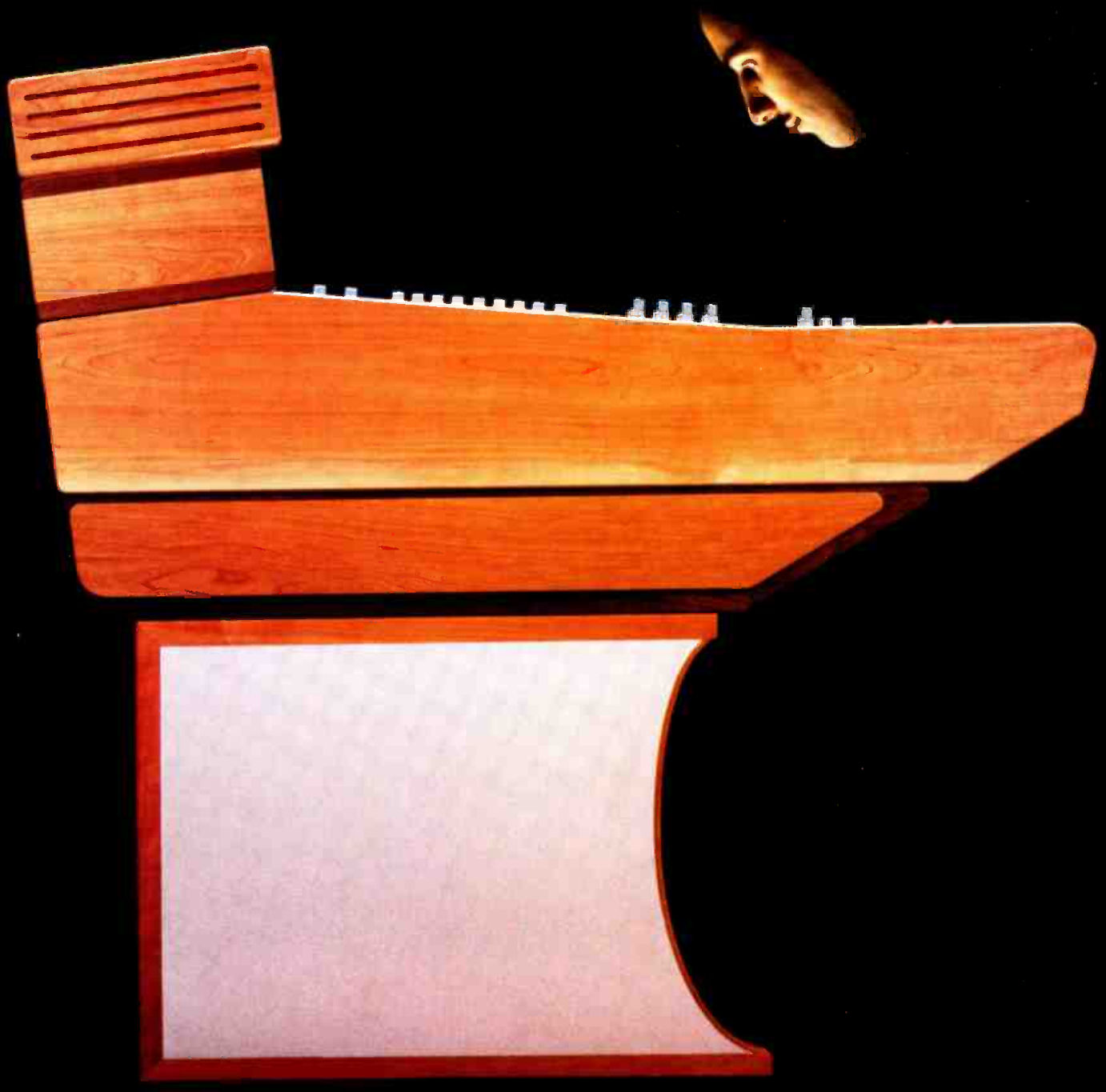

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THE TRUTH ABOUT DTV.

See page 10

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BROADCAST® ENGINEERING
August 1997
Volume 39, Number 9

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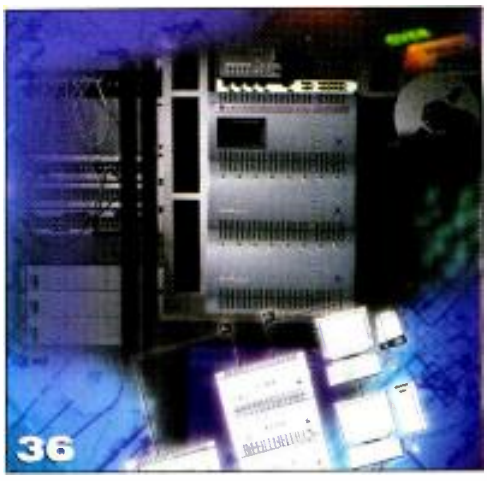

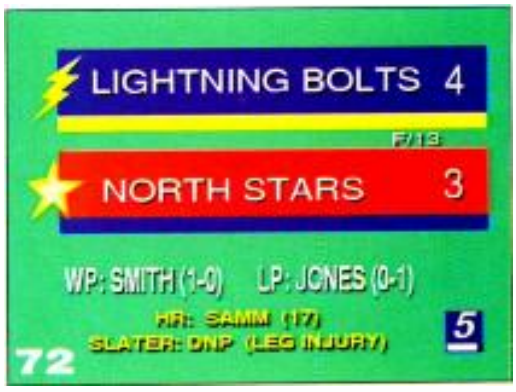

ON THE COVER: EDS studios in Burbank, CA, uses uncompressed digital storage and distribution technologies based on the Sierra Design Quick*frames*. Shown on the cover is one of the Quick*frames* in an EDS on-line edit suite. Photography by Doug Schwartz, Sterling Communications, Santa Clara, CA.

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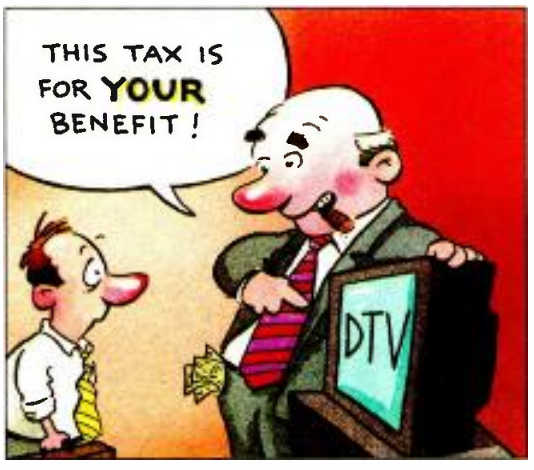
A tax on your DTV

I just terminated my cell phone service. No, the service wasn't bad. No, I didn't want to change to PCS. In fact, from a service standpoint, there was no reason to stop the service. So, then why disconnect something that was working perfectly fine? Because government got involved.

In its great wisdom, the Kansas legislature, encouraged by the FCC's warped mentality, decided that competition wasn't driving down the price of telephone service enough (for some people). The bureaucrats said telephone service was becoming too expensive. And, to protect the disenfranchised, they needed to take action. Their solution was to invent what's called "The Universal Service Fund," which is nothing more than a social engineering tax.



Now, phone service in Kansas is taxed at almost 10% to develop a pot of money the state bureaucrats can dole out as they see fit. And, just to be sure everything is handled to their desires, these bureaucrats get to skim more than a few buckos off the top to line their coffers.

Well, excuse me. It's not my responsibility to ante up $100 a year to pay someone else's phone bill or fund another bureaucratic boondoggle. So, after I calculated that a year's worth of this new tax was equivalent to an entire month of my cell phone service, I told Southwestern Bell to stuff it.

Unfortunately, I can't disconnect my residential phone (my teenage son would die without it), so I'm forced to pay the tax on that bill. However, because of this tax, I won't be installing the second phone line for my computer. The bottom line is that whenever possible I'll avoid funding another bureaucratic social program so these guys can justify their existence under the guise of helping the so-called disenfranchised.

So what has this to do with broadcasting? Thought you'd never ask. The same kind of scam is apparently now being considered at the national level. So, at the same time Congress is crowing about the new tax cuts they approved, work may be under way to gouge you with a new tax.

Rumblings are now being heard claiming that the new DTV system will take TV service away from the poor. Because they won't be able to buy these new $3,000 TV sets (hell, I won't either, but that's beside the point), the poor won't be able to get the new DTV signals. And, when NTSC goes dark, the theory goes these people won't have any TV service at all!

Anyway, DC Potomac logic says that putting a tax on all new DTV equipment could kill two birds at once. First, to speed penetration of the new sets, the government will subsidize new DTV sets for the poor. The subsidy might take the form of credits usable toward the purchase of a new DTV set by those currently receiving public assistance.

Second, by seeding the market with DTV receivers, broadcasters will be prevented from using low penetration rates as an excuse to delay DTV broadcasting. Keeping broadcasters' feet to the fire will force them to convert to DTV and thereby release their analog channels for auctioning. And, it's that 'pot-o-gold' called *spectrum* that Congress really wants.

Now, lest you think Congress would never approve such a 'consumption tax,' think about the last time you bought tires or paid your telephone bill. Both have federal consumption taxes. The federal excise tax you still pay on both items was originally designed to *temporarily* control the consumption of a limited resource. Since when are tires or telephone service limited resources? Also, don't forget that a model for taxing receivers is already in place. You need only look across the Atlantic to see how our British cousins do it.

If you ask me, those dunderheads in Washington will never learn that it's our money in the first place, and whether or not a person has a DTV receiver shouldn't be influenced by congressional social engineering. The last thing we need is another tax, especially one destined to pit one economic group against another, while squeezing broadcasters in the middle.

Brad Dick

Brad Dick, editor

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news

By Dawn Hightower, senior associate editor

CDS and Microwave Radio Communications offer DTV solutions

Comark Digital Services (CDS), a division of COMARK Communications, Inc., and Microwave Radio Communications (MRC), a division of California Microwave, have joined forces to provide broadcasters with solutions for transitioning to digital television. The two divisions will offer integrated systems for digital television and will work together to ensure interoperability of DTV equipment and systems. CDS will market and sell MRC digital studio transmitter link (STL) products to broadcasters.

Philips offers DTV training seminars

Near the end of June, Philips brought together more than 60 engineers, representing more than 600 TV and production facilities, for training on DTV. The meetings were held at the Philips Research facility in Briarcliff Manor, NY. The purpose was twofold: 1) to help educate attendees as to what was available for implementing DTV; and 2) to get input for future product offerings.

Topics covered included MPEG technology and standards, MPEG bitstream splicing, DTV receiver format conversion and potential video acquisition formats. Along with the training seminars, attendees were shown a variety of possible implementation scenarios, as well as potential product offerings for the consumer and professional.

Based on feedback from the first seminar, Philips is preparing to offer additional seminars this fall at other locations around the country. Dates and locations have not yet been finalized, but you can contact your local Philips representative for more information.

CEMA agrees with FCC's closed-captioning rules

The Consumer Electronics Manufacturers Association (CEMA) applauds the FCC's decision to establish rules that will implement the closed-captioning requirements of the Telecommunications Act of 1996.

All video programming distributors, including broadcasters, cable operators, satellite operators and other providers, must implement closed-captioning. These rules will increase the amount of closed-captioning video programming available to the more than 22 million Americans with hearing disabilities.

According to CEMA president Gary Shapiro, "It simply makes good sense that all video program providers do their share in making TV accessible to hearing impaired Americans and those that are learning English as a second language."

Congress to sell ENG spectrum

With negotiations over the balanced budget amendment, broadcasters will end up losing some of their electronic newsgathering spectrum. The bill puts 20MHz of the ENG spectrum in the 2GHz band on the auction block. Broadcasters get to keep another 85MHz in the band now, but could lose another 15MHz down the road.

Congress also told the FCC to auction an additional 15MHz, in addition to the 20MHz of ENG spectrum.

ATSC names executive director

Robert K. Graves, chairman of the Advanced Television Systems Committee (ATSC), has appointed Craig K. Tanner as the executive director. Tanner has more than 20 years of experience in the telecommunications and TV industries, including his previous positions as senior vice president of Advanced Technologies at TELE-TV Systems and vice president of Advanced Television Projects at CableLabs. He also served on the FCC Advisory Committee on Advanced Television Service.

SBE announces award winners

The Society of Broadcast Engineers (SBE) has announced the following award winners. Clay Freinwald, CPBE, has been named *Broadcast Engineer of the Year*. He is the chief engineer for KBSG AM/FM in Seattle, WA. He served as his chapter's program chairman and is a member and chairman of the State Emergency Coordinating Committee for Washington. He was responsible for conducting the monthly meetings to establish the EAS plan for the state. Through his efforts, Washington's EAS plan has been used as a model for other states. He traveled around the state to

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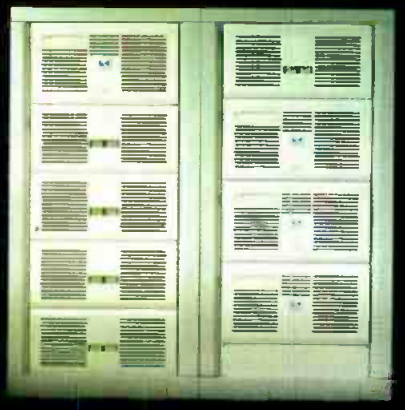

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Harris offers the widest range of proven technology.

Harris can provide every step in the digital path — from your studio to your transmitter and antenna — and can do it with more *proven* technology than anyone in the industry. How proven? In 1990, the ATTC used our RF test bed to establish U.S. standards for HDTV. Our studio and teleport systems were instrumental in the launch of America's first all-digital television network.

We delivered the first broadband antenna specifically developed for NTSC-DTV simulcasting. We have more UHF and VHF transmitters on-air in the U.S. than any other manufacturer, *by far.* We're the only company to offer digital-ready IOT *as well as* Solid State UHF transmitters — with a choice of Bipolar, Silicon Carbide or LDMOS technologies. Our Platinum Series VHF transmitters are the world standard in Solid State. And when it comes to the heart of a DTV transmitter — an 8-VSB exciter — Harris is the *only* choice. ***Only we can provide all of this DTV technology right now!***

Harris is the only company that manufactures a complete DTV exciter.

The Harris CD 1 is the world's *only* commercially-available exciter to meet the Grand Alliance 8-VSB guidelines. *All others are merely a combination of various components from several manufacturers.* The Harris CD 1 has amassed thousands of hours of problem-free on-air operation. Its patented high-performance technology generates a signal of superior integrity, and virtually ensures that it will remain the world standard. ***Only we can provide the CD 1 DTV exciter right now!***

5 of the first 7 U.S. stations on-air with DTV selected Harris digital transmitters.

On July 23, 1996, WRAL-HD became the first commercial television station to transmit HDTV signals over the air. Their transmitter? *A Harris SigmaCD.* When KCTS-HD in

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DEEDS, NOT PROMISES.

Seattle became the first HDTV-capable public broadcasting station, *they too chose Harris.* And WETA in Washington D.C., WCBS in New York and Oregon Public Broadcasting in Portland all rely on Harris transmitters to send their DTV signals over the air. At NAB '97, KLAS-HD used a Harris transmitter to go live as part of the

ATSC on-air demonstration. Why is Harris such a clear choice when choosing a digital transmitter? Because from VHF to UHF...Solid State to IOT...low power to high power...and the only complete 8-VSB exciter, we represent *so many* proven choices. ***Only Harris has this depth of on-air DTV experience!***

Harris provides complete end-to-end systems for DTV.

From studio facilities to ENG, SNG, mobile production units, microwave links, satellite uplinks and teleport facilities, Harris provides the products and services to create all-digital and digital-ready state-of-the-future systems. Whether you're building new, or retrofitting an analog station, Harris experts will assist you in all aspects critical to your success. That includes proposal development and budgeting, building design and architecture, custom fabrication, system designs and optimization, program and facilities management, installation, commissioning and documentation, training, warranty protection and comprehensive systems support. ***Only Harris does all this, and does it in-house!***

No other company matches our level of support.

Harris is the only transmitter manufacturer that has staffed technical assistance available 24 hours a day, 365 days a year. So instead of an answering service or voice mail, you can speak with a service expert whenever you need to. We're also the only manufacturer to provide around-the-clock parts support, with a multi-million dollar inventory on hand to meet your demands as quickly as possible. To assure that your digital needs are met today, tomorrow and beyond, we have established a DTV Applications Engineering Group to assist in your transition to digital. And no transmitter manufacturer but Harris offers you the benefits of a dedicated training center with ongoing, regularly scheduled general and product training programs. ***Only we can provide this high level of DTV support!***

Put Harris to the test.

Before you stake your station's future on a promise, ask your prospective partners to prove their claims. Harris welcomes the opportunity to show you how we're most qualified to help you make the most efficient, cost-effective and successful transition to DTV. **For tried and true solutions that best prepare you for tomorrow, *that only we can provide,* contact Harris today.**

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conduct seminars and educational sessions to help other stations attain compliance with the new system.

Michael P. Scott, CPBE, has been named *Educator of the Year* for the second consecutive year. He is the lead instructor at the Communications Technologies Department at Bates Technical College in Tacoma, WA. Scott redesigned and recertified the Broadcast Technologies Course with SBE at Bates. He also organized a two-day training seminar, the DTV Transmission Conference.

These and additional awards will be presented at the Central New York SBE Regional Convention and SBE National Meeting on Sept. 26 in Syracuse, NY. Contact the SBE at 317-253-1640 or its web site at www.sbe.org for more information.

FOX awards NDS Americas contract for digital broadcasting equipment

In a major strategic step for FOX in its digital conversion plans and building a state-of-the-art digital cable distribution network, NDS Americas was awarded a contract from FOX Cable Services to provide transmission systems for use with FOX Sports Net, FX and fXM cable networks.

The NDS System 3000 transmission systems will broadcast up to eight channels of programming from one satellite transponder. Acquiring the NDS equipment is the network's first step toward converting its existing infrastructure of analog broadcast systems to the new MPEG-2/DVB-compliant digital format.

IDRC '97 to reveal future of large flat-panel displays

The 17th International Display Research Conference (IDRC) will be held at the Sheraton Centre Hotel in Toronto, Canada, from Sept. 15 to 19. The conference will cover a range of research developments relating to electronic information displays.

Yoshito Yamaguchi, senior managing director of digital broadcasting development for Mitsubishi Electric Corporation, will give a special address entitled "Past, Present and Future of Large-Area Displays."

For more information, contact Ralph Nadell, conference coordinator at 212-620-3341; fax 212-620-3379.

Associated Press conducts worldwide data broadcasting network trial

The Associated Press Television (APTV), in conjunction with NDS Limited, has successfully completed a major trial of its Data Broadcasting Network (DBN). The trial broadcast a data carousel of multimedia content simultaneously with APTV's international news video feed. The signal was uplinked from Teleport London International throughout North America, Europe and the Pacific Rim.

Data was transmitted at 6Mb/s in addition to a sample 2Mb/s video signal from APTV. The test was conducted using only a quarter of a single satellite transponder's bandwidth.

Digital Television 97

At *Broadcast Engineering*'s fourth annual conference on advanced television, you can find out how to design and build the digital facilities you need now.

The conference will be held Dec. 3-5 at the Westin Hotel O'Hare in Chicago.

For a brochure on how you can face the most significant challenge since color, call 800-288-8606 or 303-220-0600 or call FAX ON DEMAND at 800-601-3858.

Coming in the September issue of *Broadcast Engineering*:

- Digital Audio Update
- SDI's Achille's Heel: Embedded Audio
- Networking Digital Islands
- The Road To Digital TV: Warp Speed on a Rocky Road
- Facility Power Systems
- Installing Grounding Systems
- Sony does the Derby

in addition to the regular columns and departments

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Digital Dynamo.

IKEGAMI'S HL-59 DIGITAL PROCESSING CAMERA

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The HL-59 employs three 2/3" 520,000-pixel FIT CCDs, which deliver over 850 TVL, and a S/N ratio of 62dB or more. The camera is also available in a switchable aspect version—the HL-59W, with 2/3" 520,000-pixel FIT CCDs, for instant switching between 4:3 and 16:9.

The HL-59 is a true field production camera, and can be docked to a variety of 1/2" VCRs. Triax operation can be achieved, and a variety of control panels are available including: Digital Remote Control, Digital Remote Set-up, Maintenance Control (with memory card) and a joystick Operating Control Panel.

Populor Ikegami feotures, including "Fountain of Youth" Skin Tone Detail with AHD (Auto Hue Detect), are digitally generated along with Diagonal DTL, Slim DTL, DTL Boost Frequency and Black Stretch. The HL-59 also features a new high-performance viewfinder.

Production companies will enjoy the versatility and quality of the HL-59, while rental houses will have more to offer their high-end customers: A Digital Dynamo...the HL-59.

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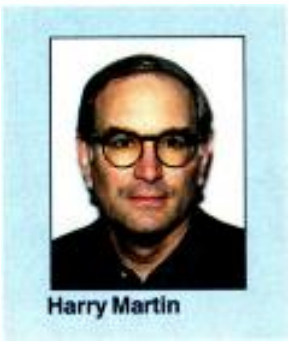
By Harry Martin and Richard Estevez

Reallocating Channels 60-69

On July 9, the FCC proposed reallocating Channels 60-69 (the 746-806MHz band) to other services. The 24MHz of spectrum at 764-776MHz and 794-806MHz would be assigned for public safety use. The remaining 36MHz at 746-764MHz and 776-794MHz would be allocated to the fixed and mobile services, but with co-occupancy by new TV stations.


Harry Martin

The re-allocated spectrum to be retained for possible TV use, as well as for non-broadcast uses, will be subject to further proceedings dealing with the size of spectrum blocks for assignment, service areas and spectrum aggregation. The reallocated TV spectrum will not simply be assigned to existing TV stations now operating on Channels 60-69, whose channel assignments will be governed by the DTV transition rules and table. The FCC plans to auction the new channels to the highest bidder.

A proposal will be issued in the future to develop rules for the new services that will operate in the Channel 60-69 spectrum. This subsequent proposal will include the criteria for protecting existing analog TV and future DTV stations against interference.

The FCC is requesting comments on ways of alleviating the impact of this reallocation on low-power TV (LPTV) and TV translators. In developing the DTV transition plan, the FCC has taken several actions to mitigate the impact on low-power operations, including those operating in TV Channels 60-69. The secondary status of LPTV and TV translator stations has not been altered.

Regulatory fees due in September

Commercial TV licensees must pay their FY 1997 annual regulatory fee to the FCC during Sept. 15-19, 1997. Stations will be fined a 25% penalty if they don't meet the deadline. Fee payments must be sent to the appropriate fee window at Mellon Bank in Pittsburgh and must be accompanied by an FCC Form 159. See Table 1 for the 1997 fee schedule.

Main studio/public file rule relaxation proposed

A rulemaking notice has been issued proposing to relax the main studio and public inspection file rules. It proposes replacing existing principal-community-contour standard governing the location of a station's main studio in an effort to provide licensees greater flexibility in locating their main studio.

The FCC proposed permitting licensees to locate their public files at their main studios, regardless of where their studios are located. The commission also seeks comment on proposals to clarify and streamline its requirements regarding the contents of the file and retention periods for various documents.

FEE CATEGORY	FEE AMOUNT
VHF Commercial:	
Markets 1-10	$35,025
Markets 11-25	$28,450
Markets 26-50	$18,600
Markets 51-100	$9,850
Remaining Markets	$2,725
Construction Permits	$4,800
UHF Commercial:	
Markets 1-10	$16,850
Markets 11-25	$13,575
Markets 26-50	$8,750
Markets 51-100	$4,725
Remaining Markets	$1,350
Construction Permits	$2,975
Satellite Television Stations (All Markets)	$950
Construction Permits - Satellite Television Stations	$345
Low Power TV Stations	$220
Broadcast Auxiliary (47 CFR Part 74)	$25

Table 1. 1997 TV regulatory fees.

The FCC plans to require that the file be kept at a station's main studio even if that studio is some distance from the community of license. Licensees may be required to make the file accessible in this circumstance by providing free transportation to the studio or delivering the file to a location specified by the requesting party.

Generally, retention periods for many public materials would be increased to reflect the new eight-year license terms mandated in the 1996 Telecom Act. ■

Harry Martin and Richard Estevez are attorneys with Fletcher, Heald & Hildreth, PLC., Rosslyn, VA.

dateline

Commercial TV stations in the following states or territories must file their annual ownership reports or ownership report certifications on or before Oct. 1: Florida, Puerto Rico, Virgin Islands, Iowa, Missouri, Alaska, Guam, Hawaii, Oregon, Washington and Samoa/Marianas. TV stations in Iowa and Missouri must file their renewal applications on Oct. 1, 1997.

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Soon the price of a serial digital video facility will be lower than the equivalent analog facility. One major reason is a whole new line of Serial Digital Video and Serial Digital Audio routing switchers from Sierra Video Systems.

The 64x64 Serial Digital Video and Serial Digital Audio routing switchers pictured are each only 7" high (4RU). These compact routing switchers can be configured in increments of 16 inputs or 16 outputs. Redundant power supplies are standard.

The powerful control system is based on our proven Tahoe three port control architecture. For added control flexibility the new Alpha/One control panel is now available. This unique remote control panel features a large, full color display and easy user customization of the panel's operating modes.

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Siskiyou routing switchers use a unique, patent pending, design allowing for the 256x256 Serial Digital Video switcher to be housed in a frame less than 34RU high, and the 256x256 Serial Digital Audio in less than 20RU high frame. Automatic signal and path failure detection, combined with automatic failure bypass using fully redundant switching matrices, provides the ultimate operational confidence and reliability.

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Call Sierra Video Systems today for pricing and additional information about these unique routing switchers.

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By Jerry Whitaker

Testing serial digital

The creating, processing, storing and transmitting of video using digital signals has numerous, well-documented advantages over using analog signals. Using the *serial digital interface* (SDI) to move signals within and among facilities has become commonplace. However, like all good things, the use of SDI is not problem-free.

Jerry Whitaker

The baseline

Specifications for digital video signal paths have been established to ensure proper operation under a variety of conditions. Like analog signal specifications, digital signal specs also establish operational limits for the sending and receiving equipment. In the digital environment, small violations typically do not have a detrimental effect in the delivered data. This, of course, is the nature of digital information transfer and one of its better-known attributes.

The purpose of a serial digital interface is to transfer data from one point to another. For reliable operation, three elements must be considered:

1. the transmitter;
2. the receiver; and
3. the interconnecting medium.

It can be safely assumed that professional digital video products meet the SDI specifications. Therefore, it is the interconnecting medium that is of most concern for SDI system design and maintenance — the main focus being the signal delivered to the input terminals of the receiver.

SDI receivers can reliably recover data from signals that fall within a fairly wide range. (See Figure 1.) Variations within the specified tolerances are acceptable and will not result in lost information. Variations greater than the stated specifications may result in unpredictable receiver operation. If further degradation occurs, eventually catastrophic errors will be generated that cannot be masked or recovered by the system. Welcome to the "digital cliff."

Because the digital cliff is rather broad in digital video systems, users often operate without much regard for the specified parameters. However, reliable operation of a video facility dictates that safety margins be measured and documented and, in some cases, monitored on a prescribed schedule. The latter case applies to mission-critical links, including those capable of taking down the facility if they fail. Other links that need regular monitoring include systems subject to physical stress, such as those used in remote operations.

SMPTE 259M

SMPTE 259M defines a 270Mb/s datastream that can accommodate eight- or 10-bit video, with audio (if required), in real time using a single 75Ω coaxial cable. Video signals transferred using SDI can be either composite or component. Key among the specifications are the peak-to-peak value of 0.8V±10% and a rise time of 0.4ns to 1.5ns (20% to 80%). If the signal transmission path had infinite bandwidth and no group delay, the 259M signal would appear as a perfect square wave pulse train. However, no path is ideal and herein lies the rub.

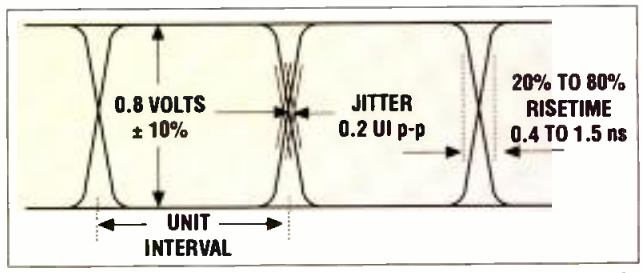

Figure 1. Specification for the SDI signal calls for a peak-to-peak voltage of 0.8V±10% with a jitter specification of less than 0.2UI.

As stated, the weak link in an SDI system is the path between the transmitter and receiver. This path typically consists of several runs of coax interconnected through a router and/or patchbay. Although connectors can influence the signal quality (the use of high-quality 75Ω BNC connectors is recommended), the cable itself represents the greatest potential for problems when long path lengths are required. Coax can be modeled as an infinite network of inductive and resistive components in series with distributed shunt capacitance. This, in effect, describes a low-pass filter whose poles increase in number and whose corner frequency moves closer to zero with extending length. (For more information on filters see "Using DSP Technology," p. 54.) The attenuation, which increases with frequency and distance, can deteriorate the SDI signal to the point that it becomes unusable.

It is intuitive that different video signals result in

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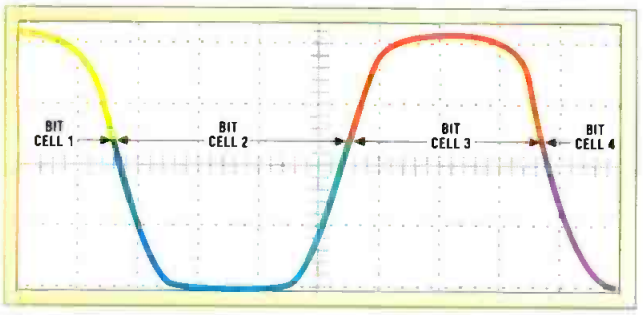


Figure 2. A portion of a SMPTE 259M datastream showing three successive ones.

different data patterns in a digital system. Consider the case of successive "1s" as illustrated in Figure 2. This condition results in a true square wave of 50% duty cycle. Real-life video, of course, results in an unpredictable variety of ones and zeros producing — in effect — rectangular square waves whose duty cycle is less than 50%. To properly define these rectangular square waves, a more dense spectrum of harmonics is required. It follows that considerable low-and high-frequency harmonics will be present in the SDI signal. This condition is illustrated in Figure 3A. Note the significant amplitudes of the third harmonic. Note also that significant energy extends to beyond 1GHz. After passing through 1,000 feet of coax, the waveform will be essentially stripped of all harmonic components. (See Figure 3B.) For the receiver to accurately decode the SDI signal ,only

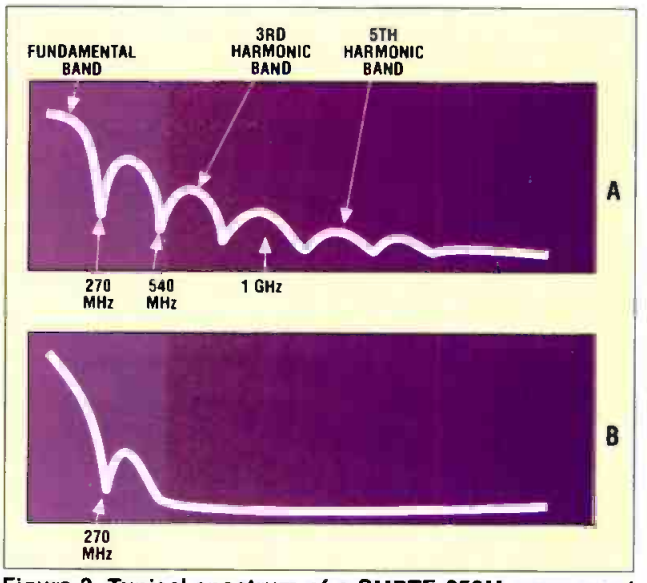
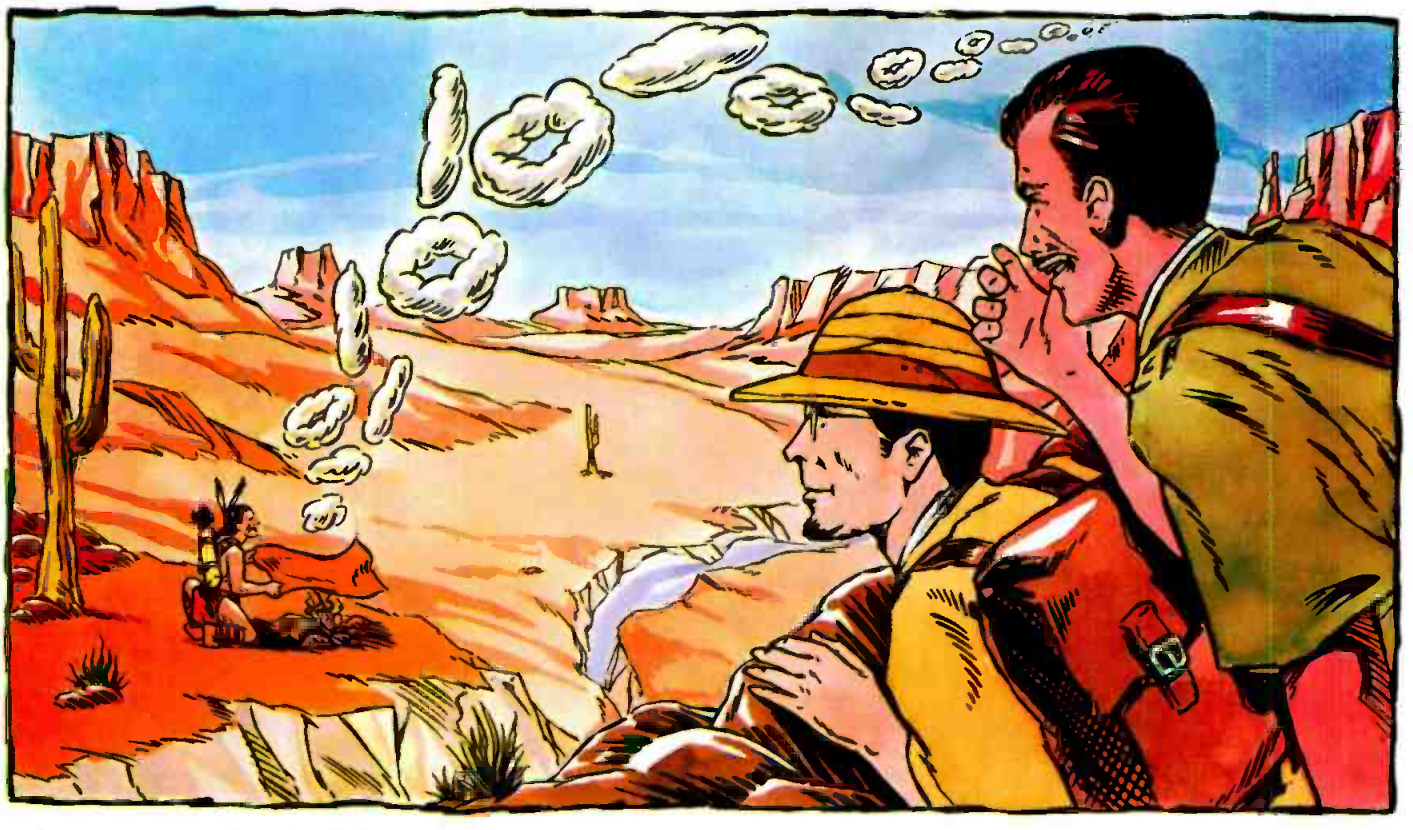


Figure 3. Typical spectrum of a SMPTE 259M component signal (A) as it leaves the transmitter and (B) after 1,000 feet of coax.

a certain maximum level of waveform degradation can be permitted. Some have stated that with the frequencies involved with SDI, the signal over coax may best be viewed as RF through a transmission line.

Jitter

Another distortion in the SDI signal is *jitter*. Jitter is defined as the difference in timing between where a



"LOOK WILCOX, THE DIGITAL COMMUNICATIONS TREND IS CATCHING ON EVERYWHERE," WHISPERED SNELL.

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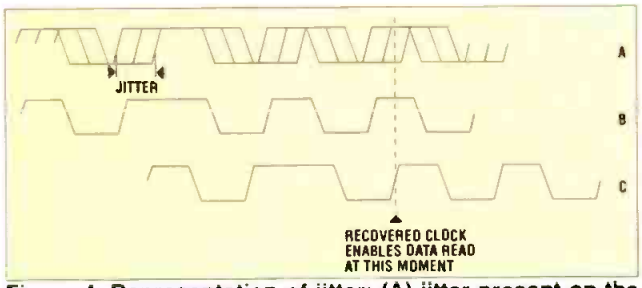

Figure 4. Representation of jitter: (A) jitter present on the measured waveform, (B) data correctly centered on the recovered clock, (C) signal instantaneously advanced as a result of jitter.

data transition *should occur* and where it actually *does occur*. As illustrated in Figure 4, imperfections in the generation and transmission of the datastream can result in displacement of the transition points to either before or after their proper locations. This timing offset can remain relatively stable or oscillate between two or more points in time. The latter case is what most engineers consider to be *jitter*. Minimizing jitter is critical to the performance of SDI-based systems.

As part of the process at the receiver, a clock is recovered from the datastream. This recovered clock is used to facilitate decoding of the received data. Because the data transfer is asynchronous, sufficiently large variations in time can result in received data being incorrectly interpreted. Lost data is the result. Fortunately, test instruments and installation guides are available to minimize this form of distortion before it becomes a problem. Jitter specifications have evolved since the original SMPTE 259 standard was written. Originally, the maximum permissible jitter was 0.5ns. Currently, jitter is defined in terms of *unit intervals*, which are a fraction of a clock period. At present, the standard calls for a maximum jitter of less than 0.2UI. This specification ties the amount of permissible jitter to the clock rate rather than simply fixing it in time.

Next month, we will examine how to determine how far your system is from the SDI cliff and how to maintain a safe distance. ■

Jerry Whitaker is a consulting editor for Broadcast Engineering *magazine.*

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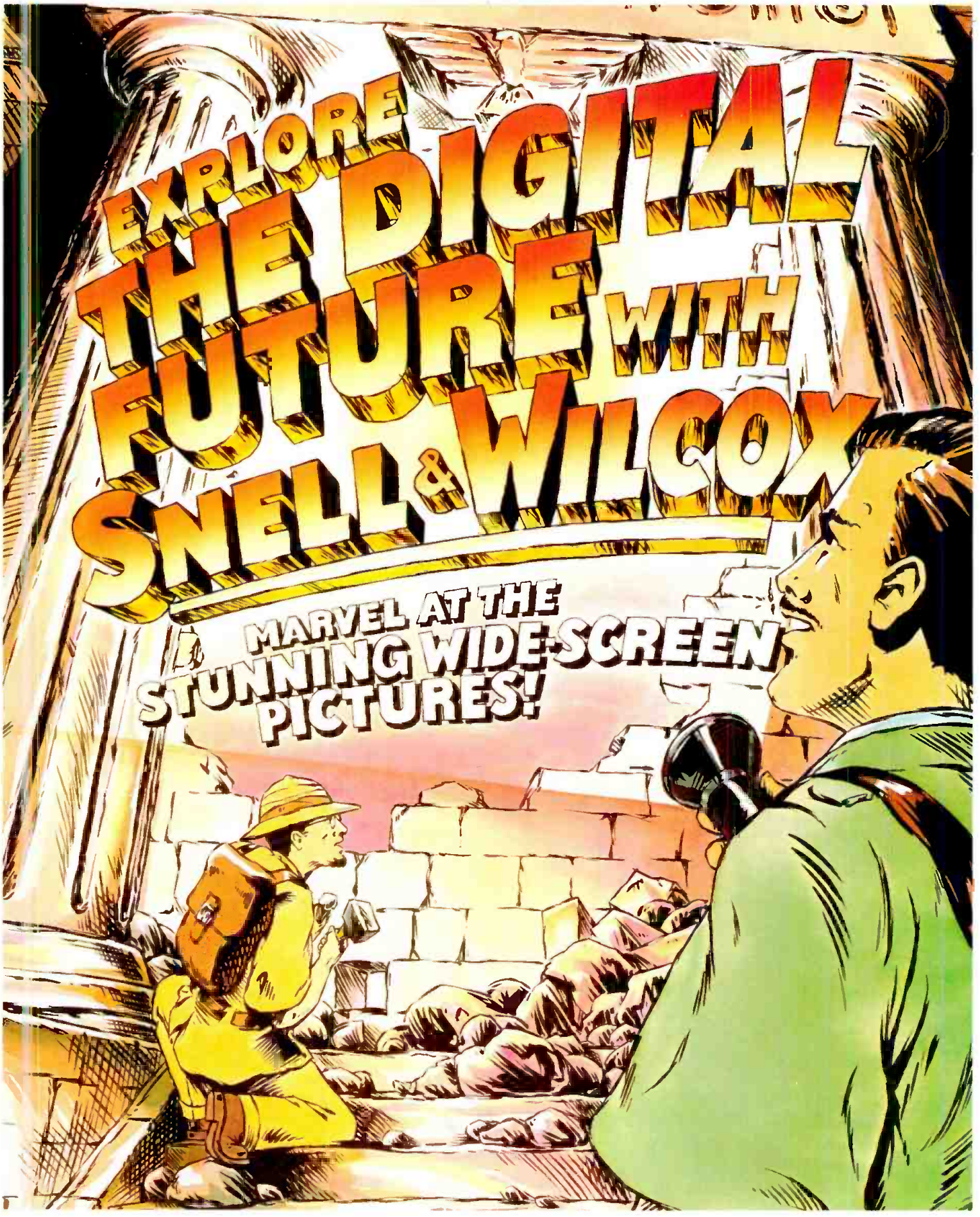

SNELL & WILCOX

Engineering with Vision

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By John Ajamie

A successful working relationship

On Sept. 9, 1987, I was hired by Mark Hale, who at the time had just completed the build and launch of the Movietime channel in Hollywood, CA. My first day on the job, he pulled out a grease board and began drawing a vectorscope and waveform monitor and a schematic of master control. This was my first introduction to whom I was dealing with — someone who goes to the basics to get his point across and helps you understand.

I continued to work with Mark when he built and launched E! Entertainment Television in Los Angeles. Working with the latest technology and staying on-air during an earthquake were some of our daily challenges.

A few years ago, I moved to Knoxville, TN, to continue to work with Mark at Home & Garden Television (HGTV), where he built and launched yet another winner. He continues to teach me to work with the latest technology, ironically while still using a grease board.

Mark Hale, senior vice president of operations for Home & Garden Television, Knoxville, TN.

Characteristics that make the manager

A knowledgeable manager is imperative. Taking the time to instruct your staff, even when your job becomes hectic, can help them grow and learn. If your staff understands your priorities and what you are passionate about, they will try harder and stay focused on their work.

Good managers are open, concise and supportive communicators. They instill their values throughout their staff, daily. Good managers find the strong points in their employees. They also trust them and let them learn on their own so they can develop a sense of independence. No one wants to be micromanaged, but at the same time, good managers should be open with their staffs and direct them when needed.

Mark is a good manager because he has progressive-thinking, common-sense management skills combined with great leadership ability. He pushes new technology and looks to take everything to the next level. For example, years ago, Mark built an all-digital component facility. We talked about why and where technology was headed. We also discussed file server technology and the impact it would have in a digital world, along with how compression technology might affect it. We knew the challenges would be difficult initially, but in the long run it would serve our needs.

Mark balances the technology as well as the aesthetic appeal of the building. This is beneficial because it supports the employees' integrity in striving for perfection with the technical product. Furthermore, the professional setting provides an environment where the employees truly care about the company because they know the company cares about them.

Great leadership pushes boundaries

During the past 10 years, I have been through major technological changes and have endured the growing pains of three different networks, but one thing has remained the same, great leadership.

I have learned how to push technology in order to better the network and run my department more efficiently. We have a technically superior on-air signal and a professional operation. This is due to the discipline, dedication and detail that come from good management.

I have also learned that taking some calculated risks can pay off operationally and financially. I'm a conventional thinker, but I don't believe I would have developed a higher standard had I not broken some of my traditional habits.

In working with the same supervisor over a long period of time you know what the other person thinks and can foresee what to expect. You don't need to consult with your supervisor on every issue, and this can be advantageous to both of you because it can save time and money.

Diversity and change are good, but longevity amongst your ranks will enrich your operation. This is built upon good, solid leadership. Great supervision offers unlimited opportunities, challenges and a never-ending education. ■

John Ajamie is director of network operations & duplication services for Home & Garden Television, Knoxville, TN.

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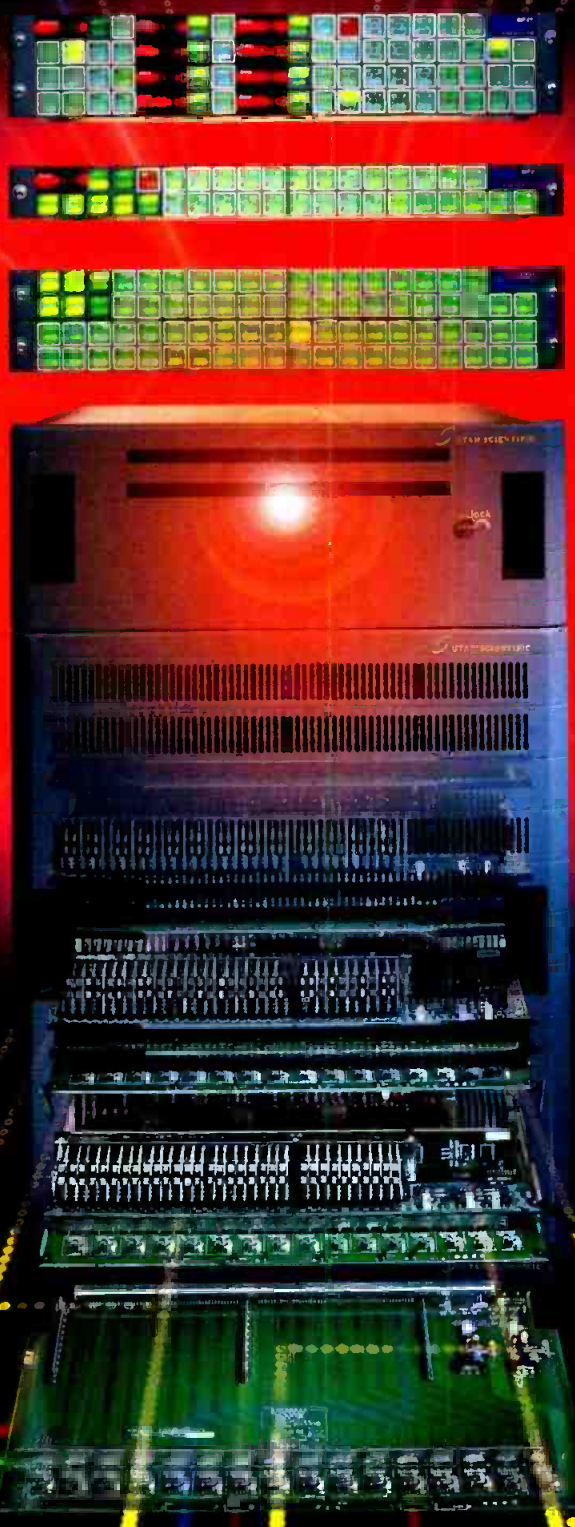

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By Brad Gilmer

LAN cabling

Wiring and terminations for wiring can be one of the biggest headaches in your entire system. Do it right and it will require essentially zero maintenance. Do it wrong and you can spend countless man-hours chasing ghosts in your network. The work that you do on the front end will determine what sort of experiences you have over the life of your network.

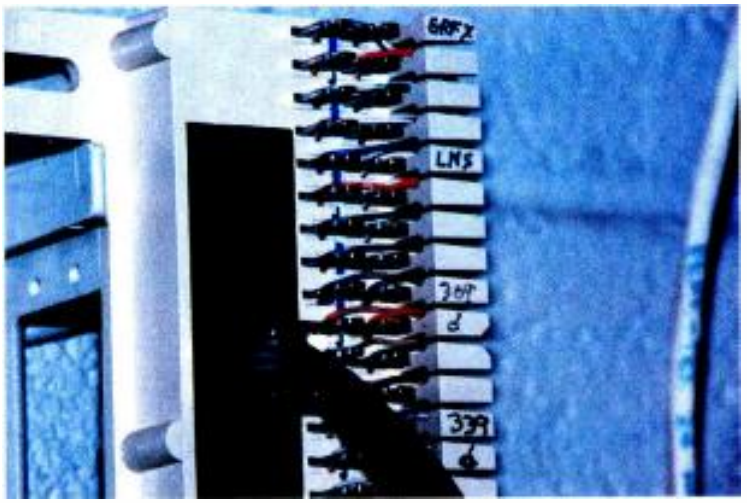
Brad Gilmer

Unshielded twisted pair

Three types of wiring are in common use today for networks: unshielded twisted pair (UTP), Thinnet (RG-58 coax) and fiber. As in most wiring situations, run plenty of spare conductors. Extra cables and/or fibers ar fairly inexpensive as part of the original installation, but adding a few later is far more costly.

Installed in 85% of all computer networks, UTP looks similar to the telephone cable used in your house. It is a multiconductor unshielded cable terminated by plastic telephone-type RJ-45 connectors. Because UTP is essentially a transmission line, a consistent and accurate twist per foot is imperative. I learned this the hard way at Turner early in our networking experience. (See "Cable Without a Twist, Computers With a Problem.")

A typical punch block for 10BASE-T networking features RJ-45 telephone-type connectors and telephone-style punchdowns. The RJ-45 cable connects the circuit on the punch block to the concentrator. The punchdown terminals on the right are the terminating point for wiring that typically comes from a wall plate in an office or technical area.



A 10BASE-T network uses RJ-45 cable connectors and punchblocks, which makes installing a UTP network straightforward.

Several quick notes about UTP installations:

- Use CAT-5-certified cable. Properly rated CAT-5 UTP wiring can support 100Mb/s data rates and higher.
- Be sure to use punch blocks that are specifically made for UTP and computer networks.
- Make sure wires are kept twisted to within one-half inch of any punchdown or connector. This specification ensures signals can travel through your system unimpeded.

Continued on page 110

Cable without a twist, computers with a problem

When we installed our first UTP-based network, we came up with some cable that was easy to work with. The cable was flat, rather than round, and it was easy to strip and terminate.

Because the cable was so easy to strip, it should have been obvious that it did not have the standard UTP twist. In fact, it had no twist at all. We ran into trouble quickly. Some computers were reporting time-out errors. This meant they had tried to send packets to another computer on the server a number of times without success. Other computers had intermittent problems that caused their response to slow considerably.

The lack of twist caused a major discontinuity in the transmission line at higher frequencies. This rolloff was even worse on long cable runs. Several days later, we discovered that the cable was the culprit. We replaced all the flat cable in our system, and things have worked perfectly ever since. ■

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By Christopher Lyons

More zip for your zoom

Widely used since the 1930s, mid-side (MS) microphones are increasingly being employed to capture audio realism in stereo broadcasts heard on radio and television. Three factors are responsible for this trend. First, MS microphones are creatively flexible tools for providing convenient and adjustable single-point stereophonic pickup that satisfies the needs of everything from ENG and sporting events to post-production tasks. Second, while their stereo imaging can be extremely accurate, they are fully mono-compatible, as well. Therefore, monaural sound quality isn't sacrificed at the expense of capturing the best stereo possible. Third, they can be used for wide sound fields or simple ambience.

An MS microphone is generally a probe-shaped, condenser device outfitted with a forward-facing "mid" cartridge residing at the tip of the microphone body. Typically, this cartridge has a cardioid pickup pattern. Mounted behind the mid capsule is the "side" element, which is bidirectional. Its pickup pattern resembles a figure eight that is aligned sideways or perpendicular to the mid element, allowing it to capture sounds on both sides of the microphone body.

The independent signals received by each element are combined inside the microphone via an MS matrix to create left channel and right channel output. While left channel audio is the sum of the mid and side cartridges, right channel audio is created from the difference between the mid and side cartridges. That is, one is subtracted from the other electrically to produce a right channel. Also, consider that the technique is similar to that used to broadcast FM stereo radio, where engineers don't actually transmit a left and right channel, because not everyone is listening in stereo. They broadcast a mono signal instead, along with everything else needed to make stereo. Then your stereo receiver does the matrixing to create left and right channels.

A flexible reputation

Most MS microphones are equipped with a selector switch that enables the user to control the degree of stereo "spread" and ambience pickup. Some models, like Shure's VP88, are equipped with the capability to provide individual mid and side outputs directly. The latter feature is useful in post-production because it provides undiluted mid and side cartridge output that can be matrixed in the studio to design a stereo image of your choice.

Using the VP88 as an example, the selector switch described above found on most MS microphones provides three different spatial arrangements for stereo: low, medium and high. The advantage of this type of feature is that you can define a stereo image not only with a single mic, but with three different levels of intensity, all without ever having to move the microphone's position.

> The versatility inherent in MS microphone design makes them ideal for field use.

The versatility inherent in MS microphone design makes them ideal for field use. They can be quickly set up to reliably supply stereo signals and collect raw mid and side signals, which can be manipulated later in the studio or fine-tuned to meet exacting expectations.

By their nature, they will be asked to go where other mics fear to tread. For this reason, if you're thinking of adding an MS mic to your field arsenal, make sure it's rugged and can withstand the elements. Power is also a consideration. If you intend to be extremely mobile, something with an internal power supply is a must. Models thus equipped, usually can be run with an onboard battery or with the flick of a switch, enabled for phantom power.

Operating within a role as an environmental pickup for broadcast ambience, MS microphones add realism by defining motion. Creativity like this in system design is vital to microphone performance. The goal in using one or more MS microphones in any broadcast situation is to provide a believable, stable audio perspective. In the end, adapting MS microphone techniques requires the same understanding that applies to all creative audio endeavors: Listen, experiment and ultimately, trust your ears. ■

Christopher Lyons is a member of Shure's Applications Group at Shure's world headquarters in Evanston, IL.

Editor's note: Special thanks to Shure Brothers' David A. Ross for providing vital background information used in creating this article.

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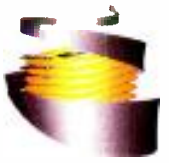

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By Mark Dillon and Steven Blumenfeld

Are we really digital ready?

In a previous column, at the same time we were describing how Internet chat and broadcast television were coming together to each other's benefit, Time-Warner was shutting down the first all-singing, all-dancing interactive TV system — its "Full Service Network" in Orlando, FL. Are digital and analog processes and products really converging? Let's take a look at the production and creative environments as they go digital.

Mark Dillon and Steven M. Blumenfeld

Internet TV

What can you watch on Internet TV today? NBC ended *The Pretender* season with the launch of "The Pretender Adventure" game on the Internet. The news bureaus of ABC, NBC and CNN all maintain Internet news services. You can even use one of the TV listings databases on the web to match your mood with what's coming through your cable box right now.

Does this mean the Internet is merging with television? Only if you think slide shows are the same as movies. It is the extension of the Internet onto TV screens; it is not the expansion of broadcast television anywhere.

Digital systems and subsystems have begun to play a significant role in some highly defined areas, such as signal processing and editing. Regardless, there are many obstacles to the true merging of digital and analog systems or the replacement of analog by digital.

End-to-end data flow

Analog data is usually device independent. We're more concerned about having the right connector/adapter (anyone got a BNC...RCA...to...!?) than the right data type. But because digital protocol is as much about describing the data as the data itself, transfer from device to device, or even between software versions, can be impractical.

As an analog network, broadcast studios work fine. As a digital network, protocols present problems. Protocols such as the SMPTE 259M serial digital interface are insufficient when connecting different devices over computer networks because the descriptive data (the "meta data") is lost. It is critical that adaptive transport and display capabilities be available and virtually transparent.

Compression is the replacement of data by a description of how to recreate the data. Because digital pipes are skinnier than analog pipes, compression is required by demands on local network traffic, storage and distribution. In general, data between ATSC, 19Mb/s, MPEG-compressed streams is difficult to edit, insert or manipulate. Each time you move between protocols and compression algorithms, the data must be decompressed, manipulated and then recompressed. This process tends to add time and some annoying artifacts.

End-to-end creative flow

The primary target market for an analog product usually determines the production format — 35mm film for theaters, D-1 for broadcast and Beta for news. Screen size, audience size and even the number of times a single viewer may watch the program are all part of the choice of analog formats and the general production value. One business attraction of digital productions is that they may be distributed in a variety of formats and thus, the thinking goes, generate multiple revenue streams. In reality, the creative demands of combining a babel of data types and displaying them across a broad spectrum of screen resolutions make it extremely difficult to create quality "cross-platform" creative products.

In addition, the legal system is full of questions regarding the multiple use of intellectual property rights: Should authors/creators be compensated every time their work is copied or viewed? What compensation is due when fragments of an author's work are used, but cannot be identified with the original? And who is going to track all of this?

What seem to be multilevel incompatibilities can be traced to fundamental differences between digital and analog media. Broadcast systems excel at presenting an uninterrupted stream of data for telling stories. Digital systems excel at providing users with access to small chunks of data from vast amounts stored all over the world. So, what do you want to do today? Watch television — or surf the net? ■

Mark Dillon is vice president, on-line services with GTE, and Steven Blumenfeld is general manager for GTE Internet Television.

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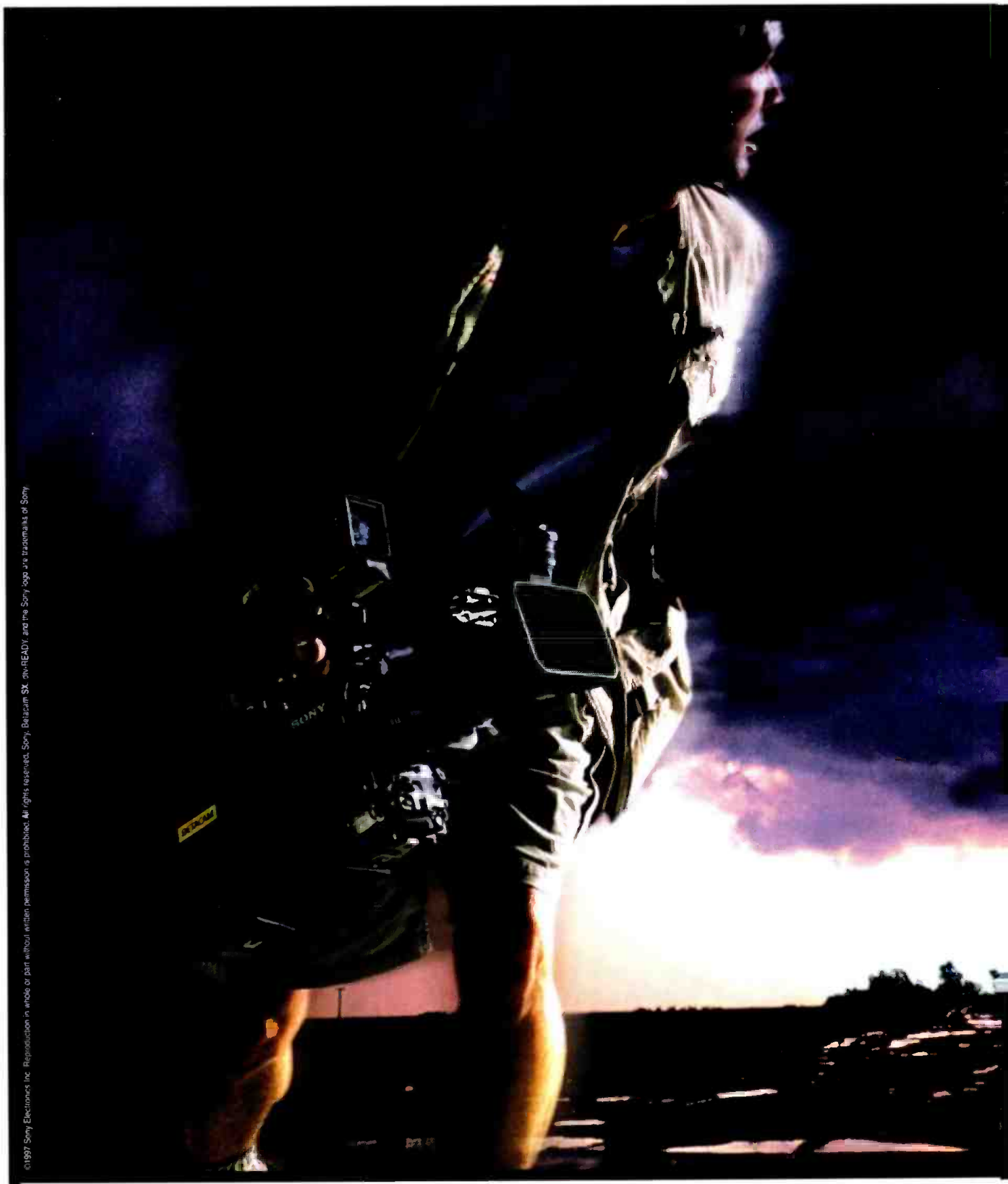

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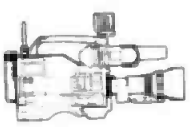

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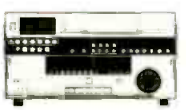

Recording

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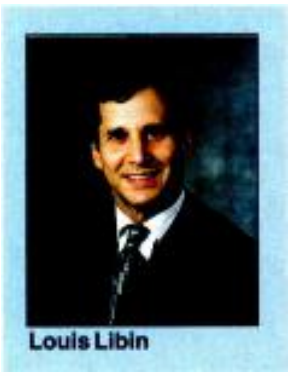
By Louis Libin

No easy answers

DTV is coming and the most obvious quality improvement that DTV will have over NTSC is that it will deliver HDTV programming with double the resolution of NTSC, along with a wider aspect ratio. But DTV provides many other advantages, whether it is used for one HDTV program or multiple standard definition programs. For instance, DTV eliminates the interference between brightness and color (chroma crawl) that is inherent in NTSC. In addition, there is no noise in the picture that most viewers experience in varying degrees due to poor off-air reception or noisy cable systems. With DTV, there is no problem with the ghosting normally associated with NTSC viewing. When DTV reaches our living rooms, the quality of the picture will be the same for all viewers who receive the signal.


Louis Libin

There still remain many substantial issues which need to be addressed prior to going on the air with DTV. For instance, the receivers must be specified and built. They must be capable of demodulating the transmitted signal and interpreting 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 or perhaps just the manufacturers who will be building the systems. The following issues have yet to be resolved.

People who now have poor quality NTSC reception due to low signal strength and severe multipath and noise may not ever be able to receive DTV.

Correcting the UHF handicap

Many believe that the FCC has a singular chance to alleviate the historic UHF/VHF coverage inequity. Others believe that the inequity is nothing more than the realities of different businesses. So the question remains, should the commission give a better break to UHF stations that now operate below their assigned maximum power? Those stations could be permitted to use enough transmitter power and antenna height to cover the potential service area if they were at maximum power and height. Some UHF stations choose to operate below maximum power because of their transmitters' high electricity costs. If a station doesn't choose to spend the money for full power and height, should it be permitted to locate small booster or translator transmitters to cover parts of that same entire area?

LPTV and translators

The core channel approach to the DTV channel allotment and assignment takes a toll on LPTV and translator stations. Broadcasters requested the FCC abandon its plan to pack most of the digital channels in the band between 7 and 51, and instead use the entire available spectrum from Channels 2 to 69. That would not only improve the odds for coverage that replicates the reach of current analog transmitters, but would leave spectrum for translator stations that could extend TV signals into hard-to-reach areas.

Reception anomalies

Viewers may be annoyed by the longer time needed for the receivers to display a new picture when changing channels. Also, people who now have poor-quality NTSC reception due to low signal strength and severe multipath and noise may not ever be able to receive DTV. Viewers may have to invest in not only new TV sets, but also better antenna systems. The specifics of digital reception is a complex phenomenon with many varying situations, and often no simple solutions.

Market research is needed

Market research would give broadcasters, a feel for what is realistic and what direction to take. Should all the prime-time schedule be in true high definition? DTV to the real masses may not be easily affordable in the near future. If so, then stations should begin to equip themselves for digital alternatives including crisp digital production with widescreen SDTV cameras, but forego the expense of HDTV hardware at this time. ■

Louis Libin is broadcast/FCC consultant in New York and Washington.

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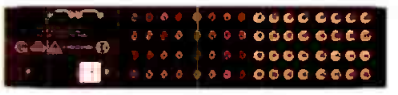

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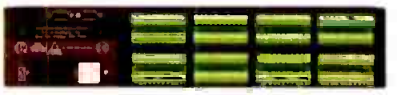

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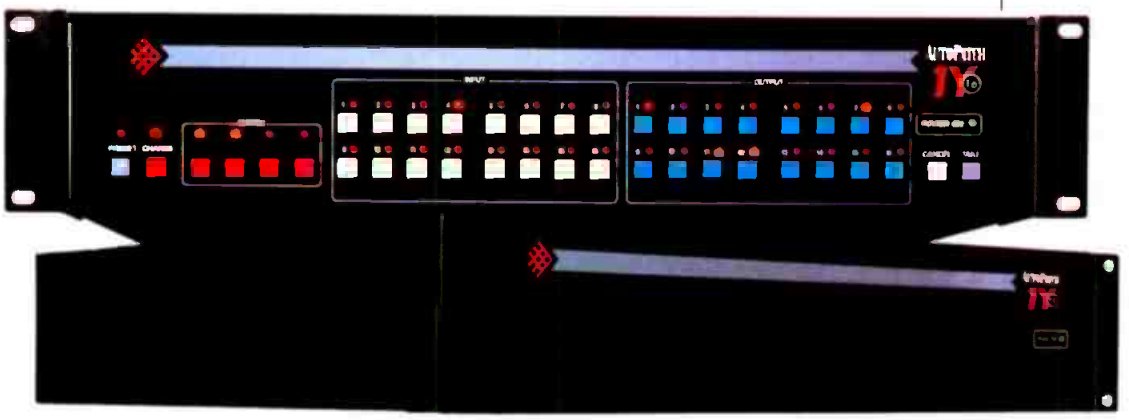

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By Skip Pizzi

Interactive TV

The word "interactive" is usually said with a wry smile in today's TV industry. Most broadcasters are aware of the debacles that interactive TV (ITV) ventures and tests have left in their wake, with results ranging from disappointing to disastrous. Most notorious are TCI's massive losses on interactive investments and Bell Atlantic/NYNEX/PacTel's failed attempts to launch Tele-TV.

Skip Pizzi

These collapses followed a previous round of unfulfilled hype around the 218MHz wireless interactive initiative, spearheaded by EON (previously TV Answer). Such a consistently poor scorecard has given the "I-word" a negative connotation.

Yet ITV won't go away. Some observers think it retains formidable potential that has not yet ripened. It may just be in need of a catalyst to get it there. An example of this process is DBS television. That technology languished for years among hype and hoopla, with licenses granted and traded, fortunes and companies lost, and the rest of the industry chuckling. Then along came the data-compression breakthrough and what had been a three-to-five channel-per-orbital-location game changed to a 50 or 100+ channel-per-license deal. With the economics of the business so dramatically altered, the hype quickly turned real and DBS became a major success.

Turning the corner

It's hard to say what, if anything, could apply the same acceleration to interactive television, but the emergence of a digital TV platform in the consumer marketplace could have an effect. The other pivotal element involves just how the convergence of TV and PC progresses. Finally, how the market forces in the broadcast, telco, cable and DBS industries drive their respective wagons in the next couple of years will also create an impact. These technical processes will affect the cost of service and may influence the fortunes of interactive delivery.

As critical as these delivery techniques are to a system's success, content will be the most powerful factor in deciding the fate of interactive television. The "killer ap" will be driven by what users find worthwhile, simple and cost-effective. As it has for any other new technology, Wilbert Schramm's fraction of selection applies:

$$\text{CHOICE} = \frac{\text{perceived benefit}}{\text{perceived difficulty}}$$

This is just a fancy way of saying that consumers' preferences are influenced positively by how much benefit they think they'll receive and influenced negatively by how difficult they think these gains will be to achieve.

The most painful and telling lesson of ITV pioneers has been the cost of creating compelling interactive content. This area needs the most development to make ITV viable, although most efforts are still being concentrated on improving delivery systems. Interactive content is expensive to produce, but it doesn't have to be. There are inexpensive alternatives that, although technically inelegant, may meet with the greatest consumer acceptance in the early going of ITV. These include shopping services and simple games or game "shells" added to existing standard TV content.

Two sides of the fence

ITV is at the apex of the convergence intersection, where computers and television meet. But how you approach this point varies with the direction you're coming from. Is it television adding interactivity (like the VBI or embedded data systems and 218MHz wireless formats) or computers adding audio/video (like WebTV, DirectPC, @home, xDSL or other Internet-based services)?

Another way to phrase the question might be, "What's your preference — limited interaction or poor audio/video quality?" One problem that early tests have unearthed is that today's audiences have little tolerance for low-resolution video. This may stem from lack of experience with it. Unlike audio, where a variety of fidelity is routinely encountered, the typical consumer has had no exposure to anything but broadcast-quality video. Lower-fidelity video seems primitive and often unacceptable. Meanwhile, consumers' growing familiarity with powerful PC software makes them increasingly less tolerant of the minimalistic interactivity offered by some ITV systems.

ITV's road ahead remains rocky, perhaps becoming steeper as consumer expectations increase over time. Nevertheless, if a successful media convergence is in the cards for the TV industry, it's becoming clear that some form of ITV will be centrally involved. ■

Skip Pizzi is a contributing writer to Broadcast Engineering *and editor in chief of its sister publication,* BE Radio *magazine.*

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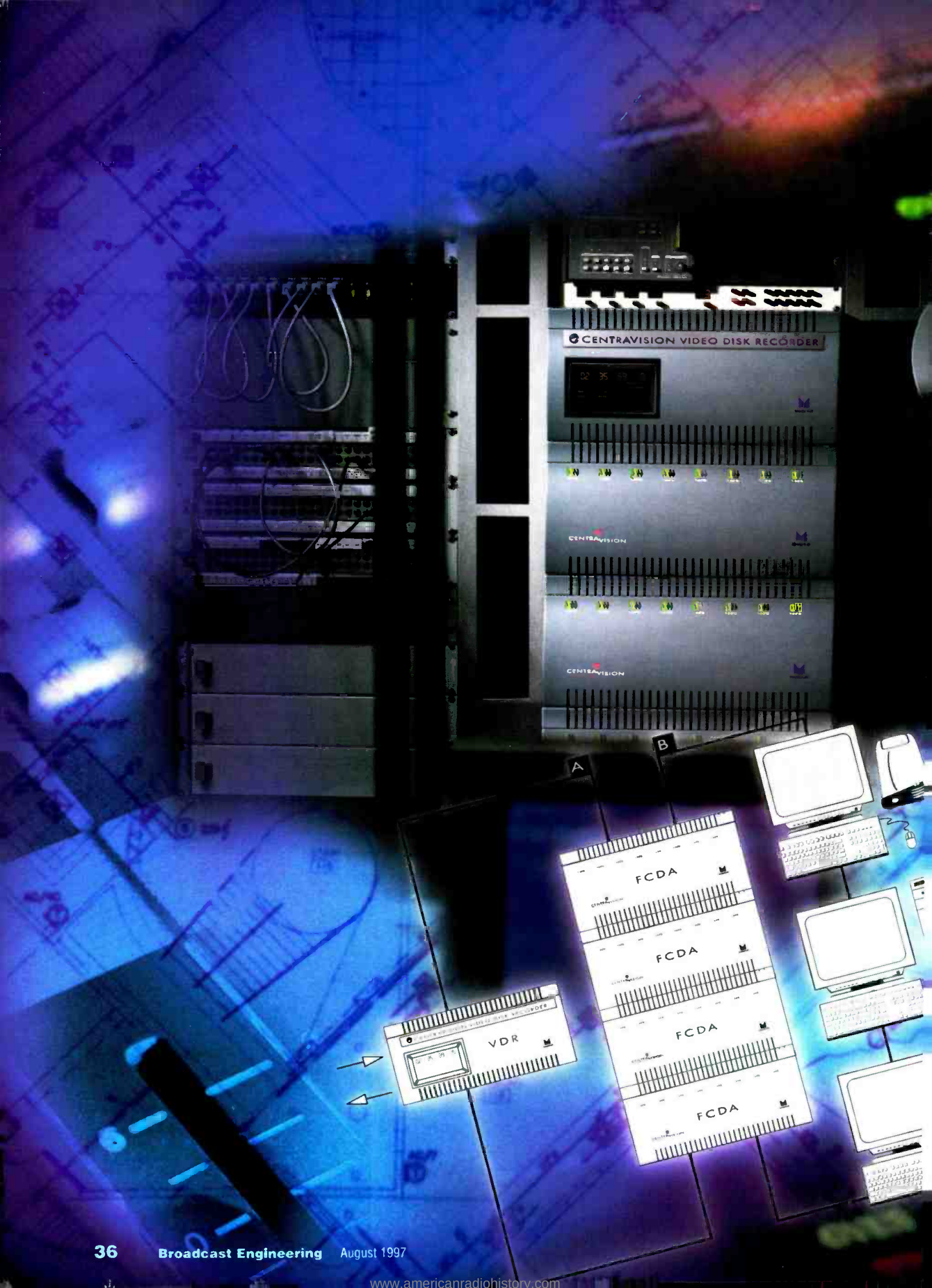

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Video disk recorders

Increased capacity and speed have made VDRs useful in a wider range of applications.

By Philip Hejtmanek

THE BOTTOM LINE: As technological improvements have allowed greater storage density and faster I/O, video disk recorders are being used more and more in applications previously reserved for tape machines. Many times, disk recorders can be used to reduce the wear and tear on tape machines, prolonging the useful life of the tapes and machines. $

Video disk recorders (VDRs) have come a long way from the original analog "slo-mo" video disk products of the '70s. Disk-based video storage systems come with a variety of features and benefits, but virtually all share one primary trait — the ability to randomly access a frame or clip of video without the time delay associated with shuttling videotape. VDRs are commonly known as digital disk recorders (DDRs). The terms are essentially interchangeable, though technically, a VDR need not use a digital recording format. Today, they are found in a variety of traditional video applications, from editing and post-production to graphics and animation. VDRs are also used as the primary source of mass storage for video servers, still-stores and similar products.

The earliest VDR products were created to allow a short clip of video to be played back in slow motion for live sporting events. These complex analog devices were physically bulky and were quickly replaced in remote applications by type C VTRs. In the 1980s, manufacturers modified traditional

Photo: Providing high quality and fast access, VDRs are becoming key elements in today's video storage and processing systems. Photo concept illustrates the building block approach afforded by VDRs. Photo and graphical design courtesy MountainGate.

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Video disk recorders

computer disk drives to deliver the high data rates needed to output real-time digital video and a new class of product was born. These early DDRs found application in high-end edit suites and graphics environments. Today, advances in disk technology have enabled a variety of manufacturers to produce products for a host of applications at a range of prices.

Applications

The selection of a specific VDR is primarily driven by the desired application. In general, VDRs are designed to effectively replace videotape recorders. By nature, VTRs are sequential storage devices that require tape shuttling to get from clip to clip. They also contain numerous moving parts and require frequent maintenance. VDRs, on the other hand, are mechanically simple and rely on magnetic or optical recording technologies commonly used for computer mass storage. It should be no surprise that the random-access nature of VDR disk storage is viewed as a major benefit in time-critical uses.

The VDR is not necessarily the perfect substitute for the VTR, however, most VDRs use fixed media (hard drives) that cannot be easily removed from the main assembly. Systems offering the highest levels of video output quality are usually capable of only a few minutes of storage time, with 30 seconds being the typical minimum. Many systems can be expanded by adding hard drives. In large systems, the cost per megabyte of digital storage is much higher in a disk system than a tape drive. Often, VDRs form a buffer for a large digital tape-based library in server applications.

VDRs used in computer graphics or animation environments generally serve as a buffer between the workstation and a digital videotape machine. Prior to the common availability of VDR systems, single graphic frames were rendered on a computer or workstation and then edited individually to a videotape, with the corresponding tape control/shuttle time delays. Today's VDRs connect directly to the workstation through a variety of digital interfaces and can store frames as fast as they can be rendered. When the animation is complete, the VDR can play the finished clip in real time to an analog or digital videotape machine or transfer the clip as a file to a data tape drive or some other computer storage device. VDRs targeted for this type of application generally operate at the highest possible quality levels.

> The VDR is not necessarily the perfect substitute for the VTR.

In many traditional broadcast applications the look and feel of the VTR is desirable. For that reason, many VDR products have standard VTR inputs and outputs for audio, time-code and video (in analog and/or digital formats), and some even fit the physical form of the VTR they are meant to replace. Most of these products generally emulate the operational features of videotape recorders and allow for external control, using the common serial protocols supported by most linear editing systems. These units support frame-accurate editing for video and audio, variable speed playback (forward and reverse), edit previews and preread functions. Some have software "control panels" that duplicate the popular VTR control functions.

Video disk recorders are important components in video server systems. Video servers supply streams of audio and video data to client devices on high-speed computer networks. Servers are frequently used for commercial spot or news clip playback at stations or as a mass storage/library system within a post-production or graphics environment. VDRs aimed at server applications generally use video compression and large disk arrays to economically provide many hours of storage.

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Video disk recorders

Quality issues

For many, the most important feature of the VDR is video quality. In general, the higher the output quality expected, the greater the video resolution and data rate at which the system must operate. Many VDRs record and play eight-bit video, while others handle 10-bit, and some can use either word length. The price point of a specific VDR product is generally related to the output quality of the video and the versatility of the device with respect to system interface. It should be noted, however, that relatively low-cost systems offering high-performance features are entering the marketplace.

Depending on the application, the VDR may need to cope with conversion from RGB color space, commonly used within graphics workstations and the YUV color space native to CCIR-601 component digital video. Units may also be required to handle analog composite or analog component video input and output, as well as analog or AES/EBU digital audio formats. Time-code capability is essential for any editing operations.

High-end VDR systems are expected to store and play back real-time 4:2:2 serial component video at 270Mb/s without the use of video compression. This data transfer rate is significantly greater than the capabilities of typical commercially available computer disk drives. Several schemes have been developed to boost the speed of the storage subsystem.

The earliest digital VDR products overcame these transfer rate limitations by using specially modified disks. These disks featured a multihead read channel built into the drive. These units were expensive, but provided excellent results for short-duration clips. However, the trend toward the use of standardized components and computer platforms for digital video equipment has made this option less popular.

Another proven method of increasing the performance of disk-based video systems is to segment the high-speed datastream and distribute these segments to a group of individual disk drives. This process, known as striping, allows the use of slower, less-expensive commercial disk drives and can, through the use of redundant array of independent disks (RAID) technology, provide protection against data loss. Most of today's high-performance video disk recorders use striped disk arrays that feature high-speed individual drives to achieve 4:2:2 serial component data rates and more.

One way to avoid dealing with high data rates is by reducing the number of bits involved. Bit-rate reduction or video-compression techniques are used by many VDR manufacturers to decrease the amount of recorded data, thereby decreasing the data throughput requirements of the disk subsystem. These solutions are not without cost. Excessive video compression can result in visible artifacts, which are unacceptable in some applications. Some video disk systems use a combination of mild (mathematically lossless) compression and disk striping to achieve a desired cost/performance ratio. Other systems feature user-selectable bit-rate reduction, with the levels of compression equated to the performance of different videotape formats. For example, a VDR operating at uncompressed D-1 quality might be overkill in an otherwise Betacam-SP video environment. Careful selection based on a specific application is important.

Several VDR systems use optical recording technology instead of the magnetic methods found in standard computer hard-disk drives. Using optical disk systems offers several advantages. First, the media can generally be removed from the drive for archival storage. Second, the bit density of optical media is quite high and, in large library systems, the cost per gigabyte is much lower than that of hard drives.

> The price point of a specific VDR is generally related to the video output quality and the interface versatility.

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VDR interfacing

Interfacing VDRs to computer systems is frequently an important application issue. Many VDRs operate in a stand-alone mode as a substitute for a videotape recorder, however, many others are peripherals in graphics, animation or medical systems. These systems may include a variety of other digital devices. VDRs use a number of standard computer interfaces, along with traditional video and audio I/O ports. SCSI has been the primary interface standard for connecting VDRs directly to computer workstations. Several variations of SCSI exist with the main difference being maximum data transfer rate. In addition, some VDRs support Fast 100BaseT Ethernet and the GIO high-speed I/O bus used with Silicon Graphics workstations.

A large number of VDR manufacturers have begun to support the Fibre Channel interface. Fibre Channel can support data rates in excess of 1Gb/s using either copper or fiber-optic cable, depending upon the distance required. Fibre Channel Arbitrated Loop (FC-AL) network topology can be used to link an array of up to 126 devices, including other devices together, at data rates of 80MB/s or more.

Selecting the right product

VDRs come in many shapes and sizes. To determine the right VDR for an application, start by asking a few questions. First, what level of video quality is really needed? Some applications will require uncompressed 4:2:2 D-1 picture quality, while others work fine with Betacam-equivalent compression levels. Audio requirements need to be considered because some VDRs are video-only.

Second, what are the interfacing requirements? Some disk systems are based on an open PC platform running Windows NT, while others are proprietary. A few products are designed to work specifically with a single computer type such as SGI workstations. Computer interfaces (SCSI, Ethernet, etc.) and video/audio connections and formats (analog composite, serial digital component) are important considerations for current and future applications.

Third, does the VDR have companion software or drivers to work with the desired computer workstation or editing applications? Most stand-alone VDRs can emulate a BVW-75 VTR, while others are controlled via an Ethernet or SCSI connection. Make sure the individual parts of the complete system can talk to each other.

Fourth, how much will the unit cost? There is a wide range of cost points for VDR products in the marketplace. However, it can generally be assumed that over time, the cost of individual hard-drive components will decrease and bit density per drive will increase, making larger arrays (and longer storage times) more economical in the future.

Fifth, how much record time is needed? Unlike tape machines, with most VDRs you can't just put in another piece of media, the amount of record time is fixed. Producing a single 30-second spot requires only a few minutes of VDR storage time. If the spot is loaded, produced and then unloaded, storage requirements are minimal. If, however, 10 or 20 30-second spots are in production simultaneously, VDR storage must accommodate all of them. Otherwise, time will be spent getting the footage on and off the VDR. Time spent moving footage back and forth can add up quickly.

Putting it all together

Once the real requirements of the disk system have been identified, the process of identifying the best VDR for the job can begin. Take the time to study the specs and, if possible, get one or more product demonstrations before making the final decision. Time invested in this stage of the game can save money and headaches in the future. ■

Phil Hejtmanek is the director of technical operations at WWJ-TV, Detroit.

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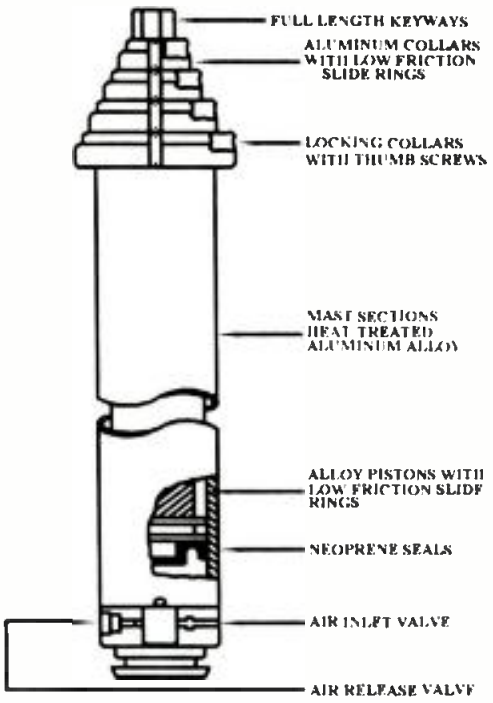

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SYSTEMS INTEGRATION

Routing and mixing digital audio

Digital audio systems are becoming the format of choice.

By Kenneth Hunold

THE BOTTOM LINE:
More broadcast facilities and post houses have come to rely on digital audio sources for their digital mixing and routing. Although there are many advantages over analog, the robustness of digital does not come without a price. Each facility must decide where and how it should implement the different types of routing systems based on function and/or cost. $

Digital audio systems are now reaching "critical mass" and are becoming the format of choice for a growing number of facilities, both large and small. Once the number of digital sources exceeds a handful, and once the number of places these signals must be delivered to exceeds one, mixing and routing of these digital signals is necessary.

Audio has, to repeat the old cliché, been characterized as the forgotten stepchild of television. However, even in audio-only facilities, it is amazing how

Photo: ABC News, NY, and The Discovery Channel presented "Discovery News Special Report: Mars Live" on July 4. Solid State Logic's Axiom digital console became the audio mission control for the live broadcast from Pasadena, CA.

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Routing and mixing digital audio

often the basics of electronics are ignored as audio signals are haphazardly combined and passed from one device to another. When these systems are scrutinized (often because a seemingly minor change has disrupted the whole system) only then are these oversights discovered.

One of the greatest advantages of digital audio transmission is that once an analog value has been converted to a digital code, it is difficult if not impossible, to change that code as the signal travels through a facility, regardless of how many DAs the signal passes through. In practice, it is not quite this simple, but it is still a much different situation than in the traditional analog facility where level, response and phase can be altered at almost every point in the distribution chain.

Unfortunately, the robustness of digital audio systems does not come without a price. The cavalier attitude toward routing and distribution that has existed in the analog world will not fly in the digital domain. There is an increase in the complexity of digital audio that, when viewed at the system level, bears a striking similarity to video distribution. (Maybe this will start to gain audio some respect from the video side of the house?)

Digital audio introduces the concept of synchronization to audio. Previously, analog audio circuits were concerned about synchronization only as far as the relative phase of a stereo signal was concerned. The AES/EBU digital audio standard introduces preambles, frames and status bytes that define the type, identity and format of the data contained in the interface. Think of these preambles as synchronization points in the datastream (sync pulses, if you will). Switching and mixing devices need to be aware of these codes in order to carry out their functions properly. It should probably be noted that many digital systems also allow for asynchronous transmission, but these signals are often synchronized before any manipulation of the data is performed.

> The cavalier attitude toward routing and distribution that has existed in the analog world will not fly in the digital domain.

Digital audio mixers now exist in many forms, from the modular single card version through the medium-sized edit suite packages, all the way up to consoles so wide you would need roller skates to go from one side to the other. Most often the mixing function is done by a processor that performs high-speed numeric computations. (Often, in the analog world, a mixer is nothing more than a few resistors.) The hardware used in a digital mixer expects the data to be synchronous. The datastream, which by definition is a serial signal, must be broken down to parallel bits for manipulation by the processor. The idea of a single signal path through a device does not really apply in these mixers, and this can be disconcerting to some engineers who like to follow the audio path through a device when troubleshooting.

Digital audio systems are "sampled" systems that treat a continuously varying signal as a series of discrete samples. The number of samples is determined by sampling theory, and the sample rate must be at least two times the highest audio frequency that is desired to be passed. The sample rate used in audio systems is often 44.1kHz (CD players and some DAT recorders) or 48kHz (almost everything else), but other systems exist with sample rates from 32kHz (consumer DV camcorders and some radio systems) to 96kHz (high-resolution audiophile recorders). The AES interface will support signals with sample rates varying from about 27kHz to 54kHz. Digital signals with different sampling rates will not be synchronized, but signals with the same nominal sample rate (44.1kHz or 48kHz) could be.

There are many advantages to using

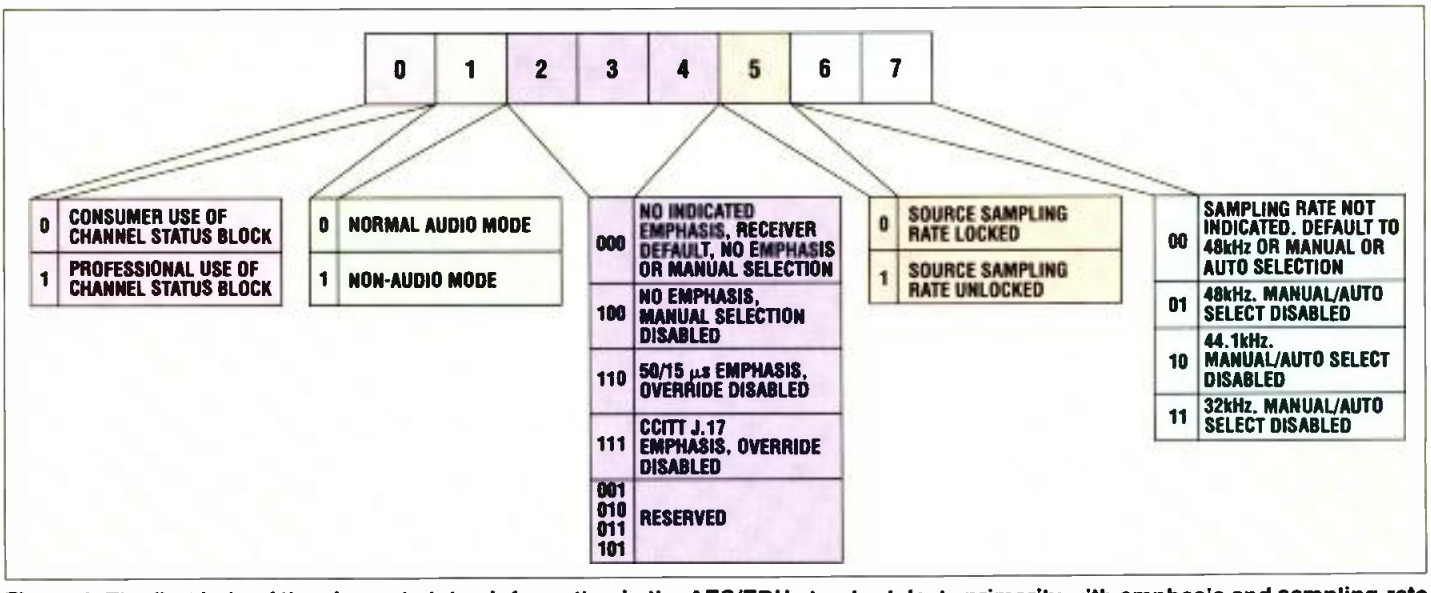

Figure 1. The first byte of the channel-status information in the AES/EBU standard deals primarily with emphasis and sampling-rate control.

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Routing and mixing digital audio

one common sample rate clock in digital audio systems. At the front end of a digital audio system, the sample rate of all analog-to-digital converters (ADCs) should be locked to the same rate. This is done for a variety of reasons. An ADC samples an analog signal at a precise moment in time. Another ADC operating at a different sample rate will sample a signal at a different point in time. However, when these samples are processed by a mixer, they will be treated as if they were taken at the same time. If these converters are sampling the same signal (such as two microphones on a podium), this time difference will manifest itself as a phase delay and phase cancellation will result.

Digital mixers often use digital signal processors, or DSPs, which among other things can be programmed to perform the computations necessary to mix the audio samples. These DSPs can also be programmed to be equalizers, compressors, pitch shifters and delays.

Digital mixers process data on a sample-by-sample basis, and require that the data be synchronous. But what if it is not? Devices known as sample rate converters process digital data sampled at one rate and convert it to equivalent data sampled at a different rate. Ideally, this is done by interpolating the values between samples, and not just by dropping or repeating samples. Think of this as the same process that goes on when re-sizing a picture in a DVE or when converting video between different line and field rates.

One part of the AES datastream is the channel status block. This block holds a wealth of information about the digital audio data. This information includes, among other things: consumer or professional status, type and presence of equalization, sample rate and even source and destination name.

One of the biggest barriers to successful transmission of digital audio is the proper handling of these channel status bytes in the channel status block. A piece of equipment will be branded "finicky" if the unit acts strangely at different times with different signals. Often, this is a case of a piece of equipment trying to make sense of conflicting information provided to it by the preceding piece of equipment. If you experience strange problems trying to record or transmit digital audio, check those channel status bytes. Some pieces of equipment will choke when the sample rate indicated in the status bytes does not agree with the sample rate of the interface that the unit is receiving.

> Digital audio has introduced the concept of frames, frame blocks and subframes to audio transmission.

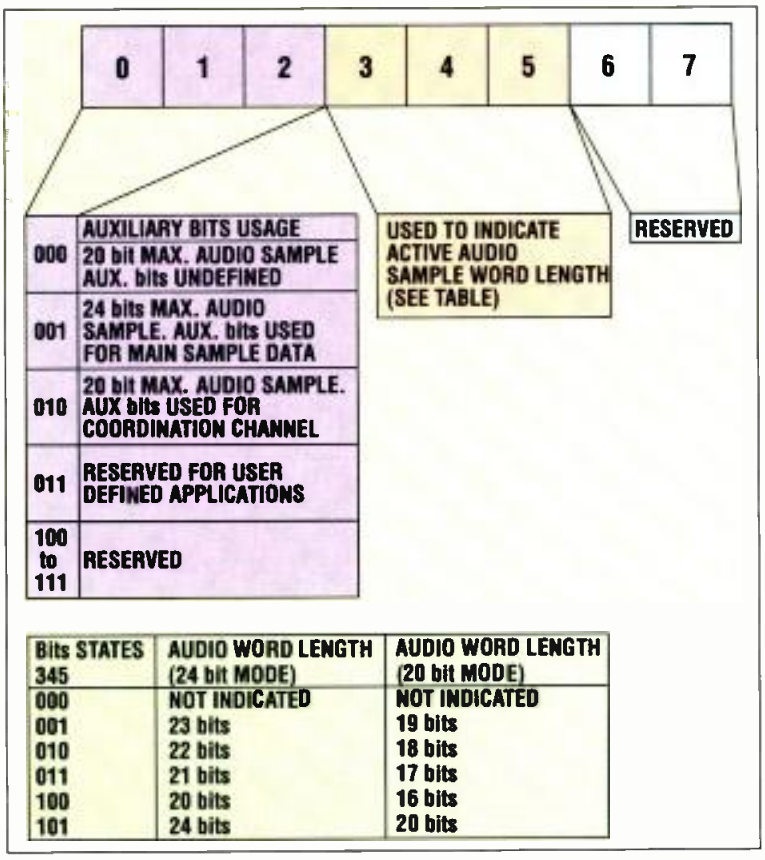

Figure 2. Format of byte 2 of professional channel status.

Other professional units may refuse to operate if the channel status bytes indicate that the sender is a consumer device (because the codes have different meanings depending on whether the unit is consumer or professional). Sample rate converters are often big offenders here, but they are not the only ones. The jury is still out on how these status bytes should be handled by such devices. It is generally agreed that sample rate converters should change the channel status to indicate the actual output sample rate, but leave all others unchanged. Unfortunately, some of the ICs available at different price points do not support this flexibility — caveat emptor.

Once the digital signal has been sampled, processed and mixed, it must be distributed from one device to another. Here is where different philosophies and topologies of routing digital audio signals are used. The simplest distribution system is a point-to-point wire from one device to another. The AES/EBU standard specifies that the signal can be transmitted over a balanced, twisted pair cable terminated in XLR connectors. The AES datastream is a pulse train, and the specification allows peak-to-peak amplitudes of the interface anywhere from 2Vpp to 7Vpp. The most common voltage level seems to be hovering around 4V due to the hardware devices used by many manufacturers. Because the AES is composed of audio engineers, it made sense to use a cable type and connector that was familiar to them. At the time, mic cable and XLR connectors seemed appropriate.

Another implementation of AES has emerged that has become popular with video and TV facilities. This implementation takes the same data from the 110Ω balanced interface and places it on a 75Ω coaxial cable. The peak-to-peak voltage is standardized at 1V (+/- 10%)

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Routing and mixing digital audio

and is terminated in a BNC connector. Because of the frequencies used in the multiplexing and serialization of the data, the frequency spectrum occupies about the same range as a video signal (up to 6MHz and beyond.) Indeed, most distribution equipment designed for video signals (DAs, routing switchers, patch cords and cables) can be used to transport this signal. Put simply, the trade-offs are that the 75Ω implementation uses inexpensive cable and connectors (compared to XLR connectors), while the 110Ω implementation is currently more prevalent. Adapters exist to convert between the two, so either (or both) could be used.

When the complexity of the system grows beyond what can be efficiently managed with just a few DAs and patch cords, a routing matrix must be considered. Coincidentally, switching digital audio bears many similarities to switching video. Almost all video switchers coordinate their switch points with a frame marker (i.e., the "vertical interval"). Just as "glitch" switches are undesirable for video signals, random digital audio switches almost always cause pops, clicks or mutes when switching between sources.

As mentioned previously, the 75Ω interface digital audio can use video DAs and routing switcher matrices. The following discussions will be based on the 75Ω implementation, but the principles are just as valid if you use the 110Ω interface for distribution.

Digital audio has introduced the concept of frames, frame blocks and subframes to audio transmission. Just as in the video world, it might be obvious that switching two non-synchronous signals will cause problems. A switch between two such digital audio sources will always cause a pop or click (or worse). However, even in facilities where all sources are locked to a common reference, pop-free switching is still not assured. The ubiquitous eight (or 10 or 12) by one video switcher does recognize AES frames or the preambles used to define them. Switching during frames causes the device downstream to receive corrupted data, resulting in a pop, click or mute as the device tries to decode the corrupted frame.

Synchronous digital audio routing performs switches on AES frame boundaries. Synchronous video routing performs switching on NTSC frame boundaries. There is an additional wrinkle in the digital audio switching process for NTSC video systems. The 29.97 Hz NTSC frame rate results in a non-integer number of AES frames per NTSC frame. Actually, AES and NTSC frames line up only once every five frames. This helps explain why embedded audio systems still have pops and clicks on most switches. One solution would be where audio and video switching would occur only when NTSC and AES frames coincide. Unfortunately, this would mean that you could only switch on every fifth video frame — not a good solution. A more acceptable solution would be to switch the video at the vertical interval, but delay the AES switch until the next AES frame. The next AES frame would occur within 20 microseconds or about one third of a line.

Each facility must decide where and how it should implement the different types of routing systems based on function and/or cost.

Even a synchronous switch can cause audible clicks in the audio, even though the frame sequence is not interrupted. It is still possible to switch from a signal that is at its instantaneous positive peak to another signal that is at its instantaneous minimum peak. There is no problem with this switch at the digital interface level, but when the resulting signal is converted to analog, the analog signal must change between two different amplitudes in a short period of time (one AES sample) and this transition sounds like a click. (For a complete description of this effect see "Distributing Digital Audio," *BE* September 1996.) Of course, analog audio routers could also exhibit this problem, but it is usually masked with a combination of bandwidth restrictions and device slew rate limitations.

One way to eliminate every last pop or click from a digital audio switch (or even an analog one, for that matter) is to perform all switches during silence. This even includes switches during program material. This is accomplished by doing a short "V-fade" where the signal is faded down to silence, the switch is performed and the new signal is faded up to unity. This could be done fast enough that the fade would not be objectionable.

There is no "one-style-suits-all" solution to digital audio routing. Each facility must decide where and how it should implement the different types of routing systems based on function and/or cost. These functions can be broken down into a few categories: 1) off-line preset switches, possibly between different sample rates, where any frame discontinuities would be sorted out before the signal is transmitted; 2) digital transmission where AES data format integrity must be maintained across all switches and 3) on-line switching where "objectionable" pops and clicks must be avoided.

Digital audio distribution is desirable today because of the ability to distribute perfect copies of audio signals through lengthy and complicated transmission systems. This ability does not come without a price, and that price is the additional time and effort it takes to understand the complicated processes involved in handling digital data.

Many of these concepts have been developed and implemented in digital and analog video systems. If the procedures developed and lessons learned from video system design can be maintained and applied as digital audio systems are implemented, we should be able to exploit the advantages of digital audio production and transmission. ■

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

The diagrams in this article are from "The Video Engineer's Guide to Digital Audio" by John Watkinson, courtesy of NVision.

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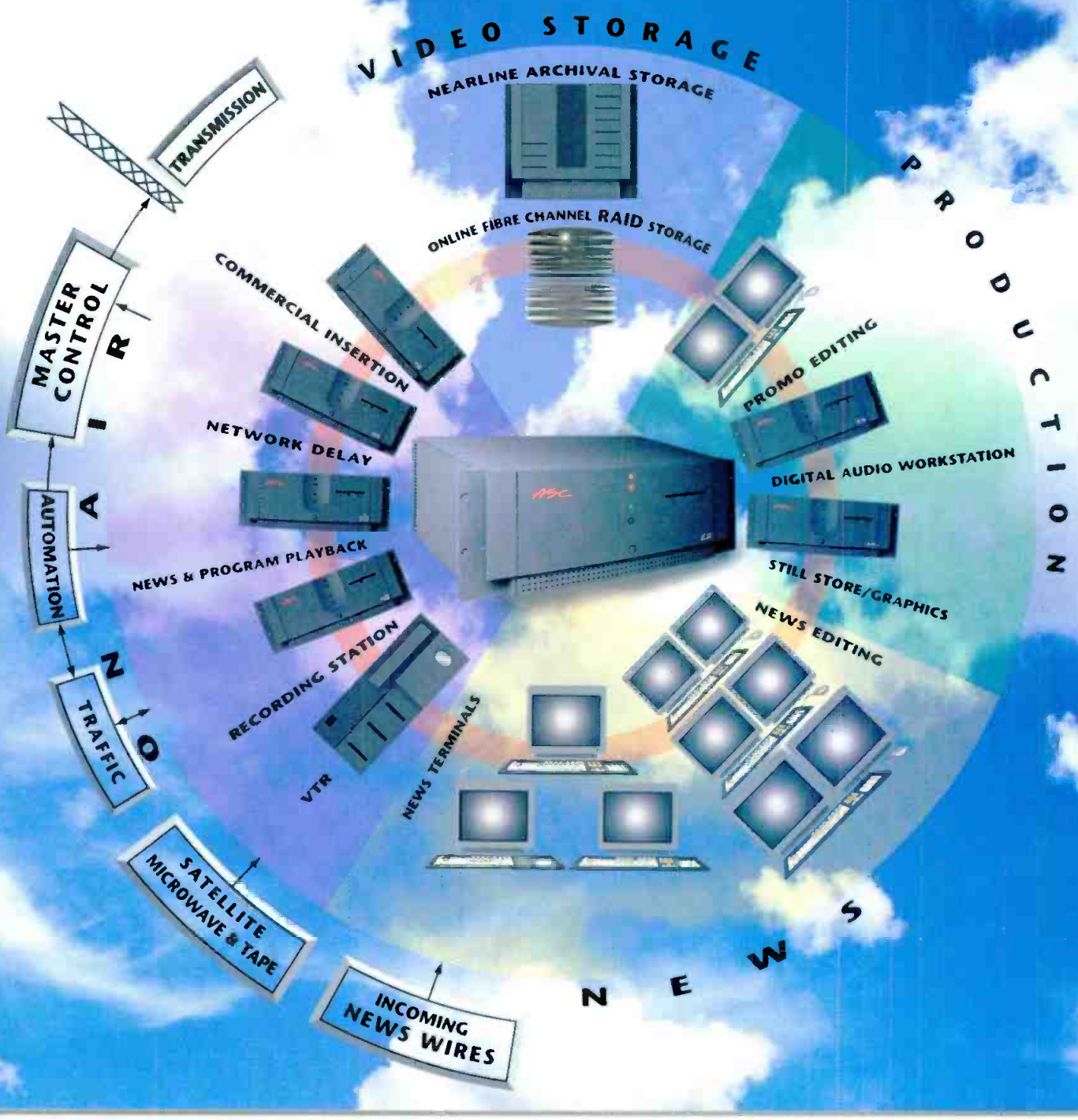

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Using DSP technology

Like microprocessors, DSP chipsets are found in many of today's electronic devices.

By Jim Boston

THE BOTTOM LINE:
DSP technology is one reason why today's electronic systems are smaller and lighter than most of their predecessors, despite being more complex. DSP circuits provide powerful signal-conditioning tools in a small package, making it possible to build compact, cost-effective equipment that can be used throughout a wide variety of applications. $

Digital signal processing (DSP) is one of our industry's most overused acronyms. It is generally believed to be a good thing and can be found throughout professional video facilities; digital video switchers, audio mixers, processing amps and digital cameras are a few obvious places. Some not so obvious places include PC modems, some camera robotics systems, cellular phones and VTR video, audio and servo paths. Common DSP functions can be broken down into mixing, filtering, level manipulation and frequency conversion of digital signals. This article looks at why DSP can be beneficial to a system, how DSP performs its magic and how engineers implement a DSP design.

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Using DSP technology

Camera DSPs

Before covering the DSP arena in general, let's start by looking at how DSP can benefit a particular piece of equipment, in this case a camera. Figure 1 is a functional block diagram of a DSP camera. It must perform most of the same functions as a non-DSP camera, albeit with a different approach. In older analog tube cameras, the signal was continuous and remained entirely within the analog domain. The pickup tubes developed continuous analog signals from incoming light. Camera electronics processed and combined the signals into a composite signal output. With the introduction of CCD imagers the camera moved from the continuous analog domain into the discrete analog domain. The signal from the CCD imagers was no longer one continuous entity, but a series of samples.

Looking at a CCD's output reveals a series of analog values. These values can change only at a predetermined sample rate. The sample rate, in the case of a CCD camera, is dependent on the number of cells (pixels) in the CCD imager. Today, the number of cells in studio cameras generally ranges from 400k to 640k. The CCD block is basically a sample-and-hold circuit. In the case of the common 520k imager, the array is 1,038 wide by 504 tall (the active picture area is 980 x 494). Photon energy is captured and converted into a volume of electrons representing the amount of light hitting that cell. The resultant 523,152 pixels are marched out 30 times each second, translating to approximately 15.7 million pixels or discrete samples every second. With the addition of horizontal and vertical blanking, the overall pixel rate is ap-

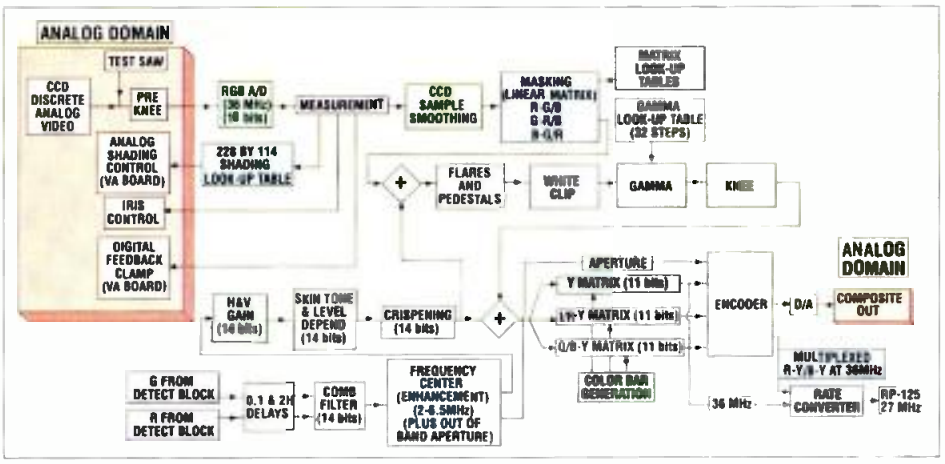

Figure 1. The block diagram of a typical camera shows many areas that can benefit from DSP technology.

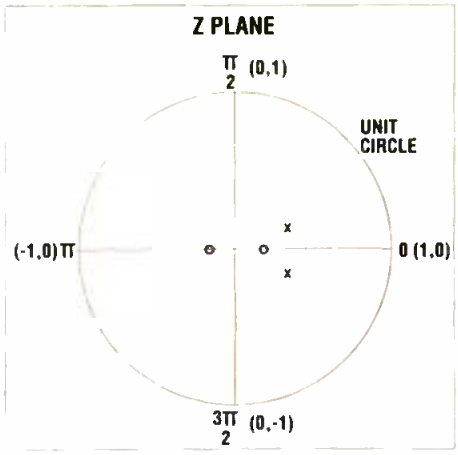

Figure 2. The Z-plane display provides a method to display frequency domain information. Frequencies begin at the zero position (three o'clock) and increase counterclockwise. The zeros and x's represent the zeros and poles (respectively) of a digital filter.

Where does analog make sense?

By Kenneth Hunold

Increasingly, digital systems are being installed in facilities across the country (and also around the world) with good reason. Pound for pound (or rack unit for rack unit), digital systems are often smaller and lighter than their analog equivalents. They typically consume less power, are more reliable and are less expensive. Analog facilities are often looked upon as inefficient, substandard and out of date. Is such a characterization valid? Absolutely not! Are there areas where analog systems make perfect sense? Absolutely!

Even if digital transmission systems have significant advantages over analog transmission systems, there are still places where analog systems can be used successfully and appropriately. For audio, if the sources are primarily analog (such as microphones or analog VTRs) and the destinations are analog (such as analog VTRs, satellite uplinks or many fiber circuits), there is no requirement for the production system to be digital. This assumes the production system is reasonably compact and extensive pre- or post-production is not needed. If the material will subsequently undergo extensive post-production, it makes sense to acquire this material in a format (most likely digital) that could later be manipulated with as little generation loss as possible. Nothing here precludes the use of digital controls over analog processes. The concept of digital storage for analog settings using snapshots, pre-sets and scene files allows the benefits of digital control to be applied to analog systems.

For low-level audio and video signals, analog processing is still the only way to go. The tiny signals produced by microphones and video camera pickup devices must be amplified considerably before they can be distributed with comparatively little loss. Microphone pre-amps, even the ones with digital outputs, amplify the signal from the transducer using analog circuits. The types of circuits used still vary, and there are branches of audio philosophy dedicated to the various ways that these analog signals are processed (e.g., vacuum tubes or transistors, discrete devices or integrated circuits, oxygen-free copper or gold conductors, etc.). Low-level video processing, such as black shading and pre-gamma processing, even from such allegedly digital devices as CCD imagers, is still performed in the analog domain. Digital techniques have not progressed far enough to allow these low-level signals (at these frequencies) to be digitized at sufficient resolution to avoid visual distortion. Audio signals are commonly digitized at resolutions approaching 20 bits, while video signals are commonly digitized, for transmission, at eight or 10 bits.

In audio and video effects processing, there appears to be

Continued on page 60

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proximately 18MHz.

The analog value of the pixel output of these cameras can change every 55.555ns or 980 times per active line. Because this is a discrete signal, it comes with a potential problem — aliasing. When the Nyquist sample theorem is applied to this situation, scenes with the equivalent of 490 vertical lines or more will result in aliasing. To reduce the amount of frequencies above half the sampling rate, the image is filtered optically (and electrically) at the front of the camera. The optical filtering is accomplished through the creative use of birefringence (variable refraction based on light polarization) within pieces of glass. This works out to be an optical low-pass filter.

From the discrete analog domain out of the imager, the signal moves to the discrete digital domain. However, while still in the analog domain, video highlights as high as six times normal are compressed to nearly 200% of normal. This lowers, by two bits, the number needed to handle extreme overexposure. Ten bits can adequately handle the range from 0 to approximately 200IRE. Then each analog signal (R, G, B) is double sampled at 36MHz. The green CCD is spatially offset by half a pixel from red and blue and is delayed by half a pixel when it is converted to a digital signal. Double sampling allows the pixels to be properly aligned spatially. This is one of the "tricks" camera manufacturers use to coax resolutions of more than 800 TV lines from these cameras. (For more information, see "CCD Technology," July 1993.) The analog values are then converted into 10-bit binary numbers (many new cameras are moving to 12-bit samples) and the signal, now digital, consists of three (R, G, B) 10-bit parallel number sequences.

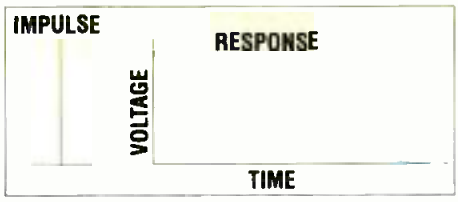

Figure 3. As a design aid, circuitry is tested for impulse response. An analog circuit's response to the impulse shown on the left could be the curve shown on the right.

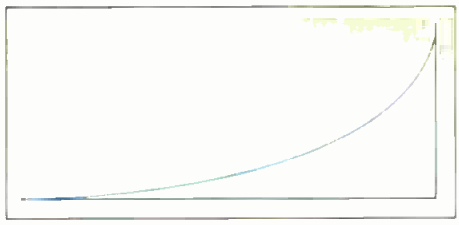

Figure 4. The first step in convolution is to reverse (in time) a circuit's time response. This is the result of reversing the response shown in Figure 3.

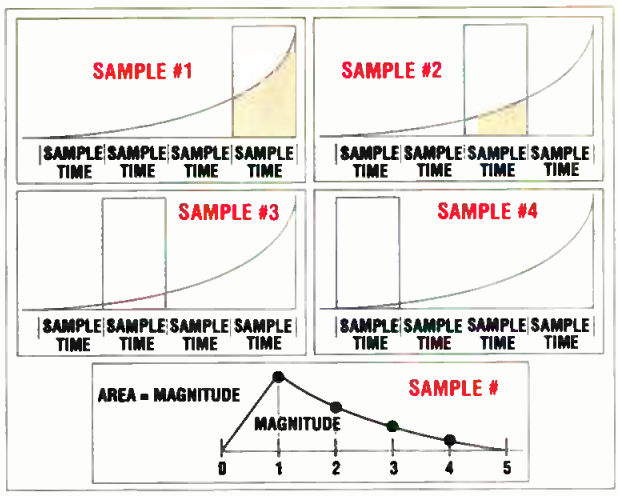

Figure 5. After reversing the time response, the area under the curve is calculated. The results are plotted and form the response curve that an equivalent digital curve must mimic.

Processing in the digital domain

Let's explore how a digital system processes these number sequences. The snap answer is with digital adders and subtractors (or two's compliment addition), right? Actually, the heart of most DSP algorithms is the multiply and accumulate function. This function takes successive digital words (pixel values in the case of a camera) and multiplies them with some value or coefficient at each stage of a DSP pipeline. These values are then passed to the next stage and multiplied with another value. The multiplication results of all the stages are then summed for a final output.

The most common use for DSP

Continued from page 56

a split personality regarding the analog-digital question. Some insist on analog methods to attain the effects that were used in the past and, perhaps, define the concept of "good sound." Others use digital methods to ensure that the effect that was created in a particular session or location can be repeated tomorrow, next week or next year, either in the same facility or in one on the other side of the globe. Some, however, say the effects made 20 to 40 years ago were made in spite of the equipment available then, not because of it — talent always overcomes technology.

At times, it seems analog makes sense only when "digital" has not progressed far enough to be economically implemented. Digital means of modulating AM transmitters have been available for years. FM exciters that operate in the digital domain have become available to complete the digital chain from CD to transmitter. Even the 8-VSB modulation scheme developed for the new digital TV service selected by the ATSC uses analog transmission methods to transmit digital data.

But just as "a rising tide raises all boats," the same rising tide that brings digital techniques to more applications also raises the analog "boat" in the process. Properly designed analog audio circuits can exceed the 105dB (or so) dynamic range of real-world digital circuits. The same advancing technology has also allowed notebook-sized audio mixers to rival the specifications of the best six-figure consoles of a few years ago. (But don't base all of your decisions on the price tag alone.)

Going analog doesn't necessarily mean going cheap. Even the latest high-definition video gear uses analog distribution for reference sync. The tri-level sync signal was developed specifically for analog distribution. Ironically, it might cost extra to integrate this analog signal into an otherwise digital facility, even though it is currently assumed that there is a premium to be paid for "going digital."

Analog or "analogous" signals were developed to mimic real-world phenomenon. Especially in terms of the "transducers" used to capture and radiate sound and light energy, those processes are likely to remain analog for some time to come. However, many of the methods used to process those signals will become digital as larger amounts of processing are needed, and are likely to remain analog when the processing required is minimal. ■

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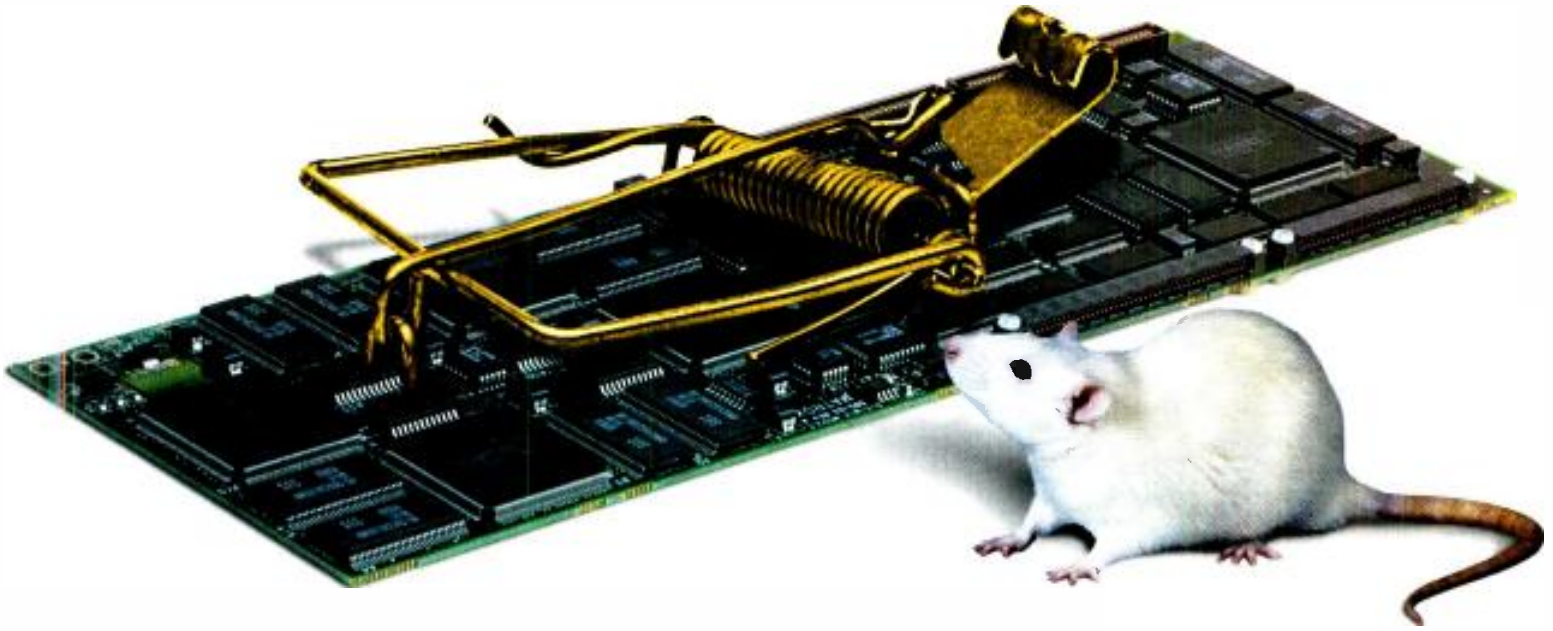

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is in filtering. In the lower left quadrant of Figure 1 are instances of bandpass filtering. Additionally, the encoder block must low-pass the two chroma channels to meet output requirements. In the case of cameras that output digital component signals, the data must be converted from a 72MHz parallel byte rate (36MHz for Y, plus 18MHz each for R-Y and B-Y) to the equivalent of RP-125 4:2:2 at 27MHz.

Many DSP designs start with an analog perspective and then transform or equate the analog design to a digital design. For signal processing, it is often easier to work in the frequency domain and some newer DSP ICs can do this. As an example, a DSP system in the frequency domain could demodulate an AM signal simply by breaking a received signal into its frequency components and placing them in "bins." The DSP system would simply have to look at these bins to determine the baseband (demodulated) signal. This is simpler than the envelope detection method used in the time domain.

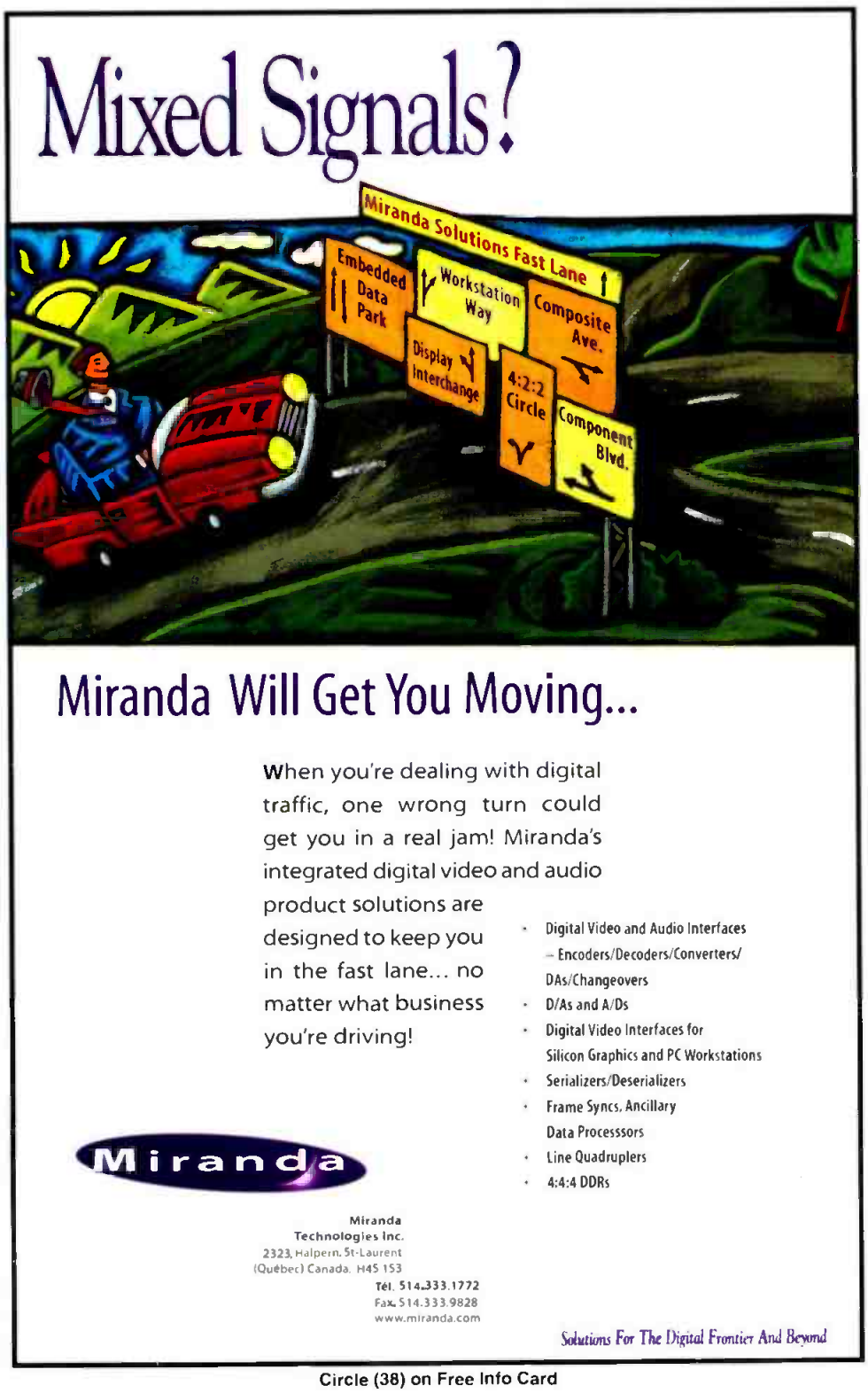
In the analog domain, functions are usually thought of in terms of frequency. In the early part of the 19th century, Baron Jean Fourier found that overall thermodynamic cycles could be explained by breaking out the individual temperature cycles that combined to make the complex thermal function. The same can be done with electrical functions (i.e., video waveforms). He found that harmonic sine waves of the proper amplitude and phase can be added with a sine wave at the fundamental rate to build any periodic (repeating) function.

A designer of a wideband analog system (like a video camera) might first determine the highest-frequency function a system needs to pass and then create a system to pass the harmonics required to realize a reasonable representation at the output. Designers also typically limit the passband in the system, mainly to minimize noise.

In our simplistic explanation, a transfer function would be determined and a Bode plot (response vs. frequency chart) would be crafted. This is usually done in the frequency domain because in the time domain, the math is much tougher. It is possible to create a mathematical function of the bandpass you want in the time domain, but the problem of creating such a signal or just about any signal, requires capacitance and inductance. Most circuits have both and capacitors tend to integrate the signal over time, while inductors differentiate the signal over time. Differential equations are used to cope with such circumstances, but not many engineers enjoy such endeavors.

There are techniques that convert these problems to algebraic exercises, among them are Laplace transforms. Mathematically, designers can take standard wave shapes in the time domain requiring differential equations and transform them to a simpler algebraic function in the frequency domain. This is done by moving functions that are dependent on time, to ones that are dependent on frequency.

Simply put, a transfer function is a



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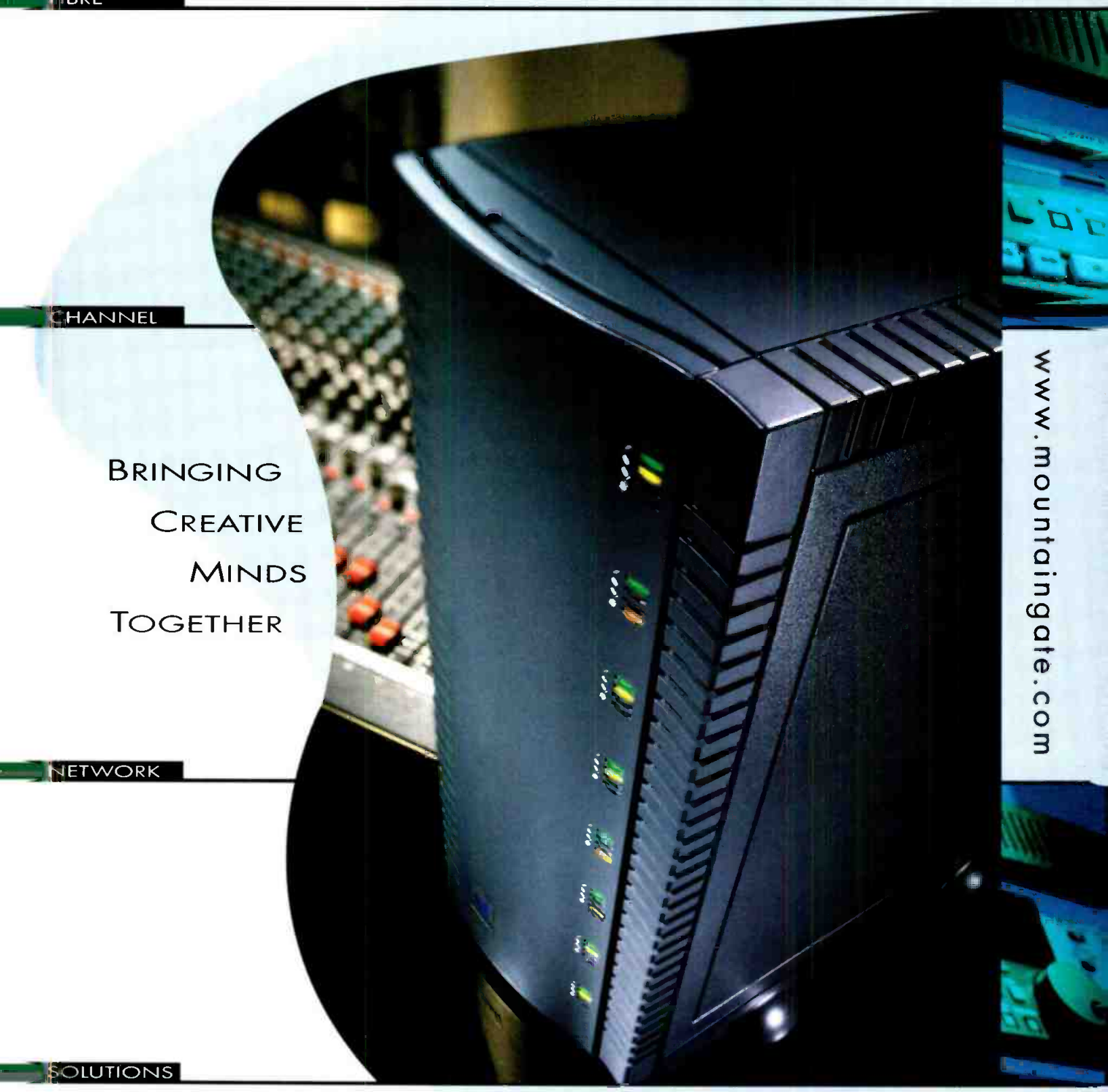

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fraction representing the output vs. the input.

$$\text{Transfer function} = \frac{\text{Output}}{\text{Input}}$$

Once a transfer function is reduced to its simplest form, the roots of the numerator and the denominator are found. Roots in the numerator are called zeros and roots in the denominator are called poles. Poles make the response curve in a Bode plot break upward, while zeros make the curve break downward. Generally, the more zeros the faster the rolloff. Realistic transfer functions cannot have more poles than zeros. Once poles and zeros are found, actual values for inductance, capacitance and resistance, along with the system gain can be determined.

This explanation is greatly simplified, and in reality, each block on a block diagram would have its own individual transfer function. In many cases, blocks are broken down into subblocks, each with its own transfer function. Once every block and subblock's function is determined, they could all be multiplied together (as any cascaded system) to determine a system transfer function. However, the result would most likely be too cumbersome to use or understand.

Today, computer tools have replaced the manual analysis required to check designs. A program called Spice takes all the components in a circuit and through nodal analysis (based on Kirchoff's current law) produces time domain and frequency domain analysis of proposed circuit designs. Spice has been in widespread use for more than 20 years and is slowly being replaced by more advanced analysis packages. Today, engineers can describe the external specifications of a proposed design and software can propose the actual circuitry needed. Two of the best-known programs of this type are Verilog and VHDL, both of which are known as hardware-descriptive languages.

A different set of tricks are used for circuitry that does processing in the digital domain. Instead of the Laplace transform, the Z transform is the transform of choice. Like Laplace transforms, the Z transform allows designers to move from the time domain to the frequency domain and vice versa. Instead of a horizontal frequency display (as seen on a spectrum analyzer), the Z transform rolls the spectrum response into a circle, somewhat like a vectorscope display, as shown in Figure 2.

Designers calculate the desired response, craft a transfer function in the frequency domain of the Z transform (see Z transform sidebar) and then perform an inverse Z transform to get back to the time domain. At this point, designers can use the function, now described in terms of time instead of frequency, to find the impulse response. Impulse response is determined by passing a narrow pulse through an equivalent analog circuit. In the case of a low-pass filter the time response might look like the function on the right in Figure 3, with the impulse signal on the left.

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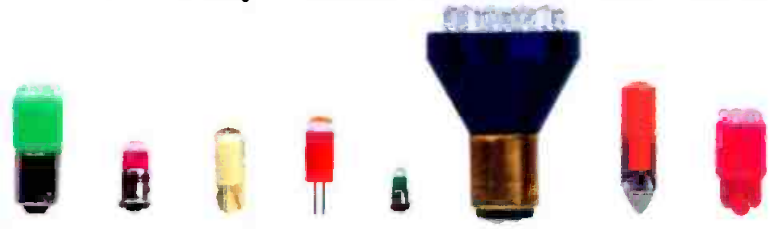

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A circuit's impulse response can be used to determine the circuit's response to a rectangular pulse. A process known as *convolution* is used to get from one response curve to the other. Convolution works as follows (refer to Figures 4-6):

- First, the time response is reversed in time (Figure 4).
- Next, the square wave is moved through the response in time steps equal to the sampling rate (Figure 5).
- At each point the area of overlap between the square wave and the response is integrated.
- The area found by integration is used as the magnitude at that point in time.

The digital circuit must mimic this response characteristic. The circuit shown in Figure 6 is one possible solution. The magnitude at each sample point found by convolution becomes a coefficient used by the multipliers. The circuit shown handles only eight bits, but it could easily be expanded. For instance, most professional cameras currently use a minimum of 10 bits and as many as 14 bits to minimize rounding errors in gamma and detail circuits.

Figure 6 depicts a simple digital filter. With only the last four samples summed at any one time this circuit could only mimic a single-pole low-pass filter. To mimic filters with more complex functions, additional samples would have to be summed concurrently, requiring a wider array of registers. These registers are often referred to as taps and some off-the-shelf DSP filters use as many as 55 horizontal taps. Taller arrays are used to handle more bits. Off-the-shelf field-programmable gate arrays (FPGAs) are often used to produce single-chip circuits, such as the one in Figure 6. This allows a single IC type to be used to craft many different filter responses.

The multipliers allow this circuit to act like a low-pass filter. Going back to Figure 5 and examining the resultant response obtained from convolution, the first sample is the highest. If that is called unity (or 1), each succeeding sample is something less than unity. The second is two-thirds of the first, the third is two-thirds of the second and so on. To mimic the required response, multiplier 1 is set to 1, multiplier 2 to 0.66, multiplier 3 to 0.44 and multiplier 4 to 0.29. If an impulse or any other signal arrives at the input, it will produce an output that acts like a simple one-pole low-pass filter. That can be extrapolated to mean this digital circuit has a transfer function matching its analog equivalent. Be aware the circuit shown is simplified, because the gates required to implement the Boolean algebra for the multipliers and the summer are not shown.

This filter is known as a finite impulse response (FIR) filter because it responds to a given input for a finite length of time, in this case, exactly four clock (or sample) periods.

Much simpler would be the infinite impulse response (IIR) filter shown in Figure 7. The transfer function found from convolution had a 0.66 multiplication factor. Therefore, the multiplication shown in Figure 7 could ap-

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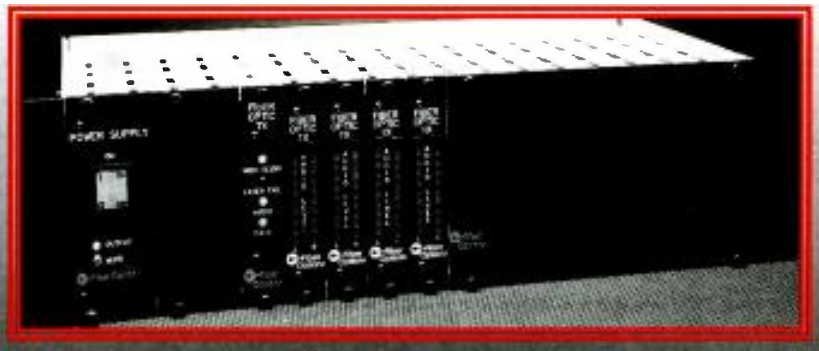

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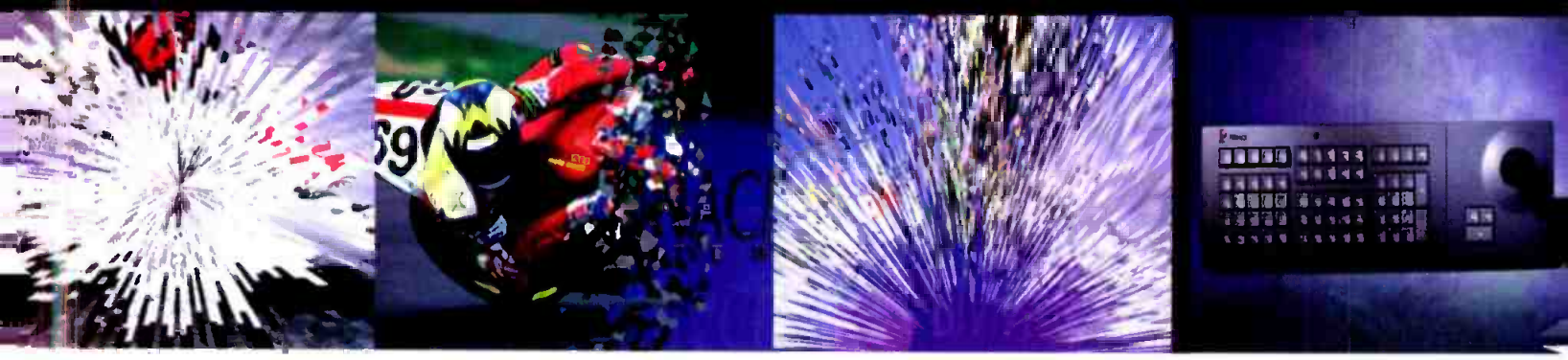

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proximate our simple FIR low-pass filter. For Figure 7, the input, output, multiplier, adder and register handle a single bit and must be repeated for the additional bits of an eight-, 10- or even 14-bit signal. The IIR approach works well for simple functions, whereas the FIR approach is needed for more complex functions.

Other DSP uses

Another function necessary in digital cameras is rate conversion, which also uses low-pass filtering. The camera shown in Figure 1 converts a 72MB/s parallel datastream down to the 27MHz rate needed by the component digital output. It would appear all that is needed is to subsample (or throw away some current samples — a process known as decimation) the incoming stream at a three-eights rate and the result would be

Continued on page 70

Z transform

Referring to Figure 2, the point marked 0 on the circle (at the three o'clock position) initially represents a frequency of zero into a system. The relative response for a given frequency is represented by the distance from the center of the circle. Moving counterclockwise around the circle, the frequency fed through the digital system increases. Arriving back at zero, the system reaches the Nyquist rate. Any response on the circle after that results in aliasing. A second trip counterclockwise around the circle increases the frequency to the sampling frequency. Theoretically, you can continue around the circle two more times, going from the sample rate to twice the sample rate. This can continue indefinitely, but serves no purpose because the response will be the same each revolution around the circle. The Z transform display clearly demonstrates how in digital design everything is tied to the sample rate. At the most basic level, a designer of a digital processing system doesn't care if the sampling rate is 10Hz or 100MHz (as long the actual circuitry can handle the clock rates). The desired response is found relative only to the sample rate.

The zeros and the x's represent zeros and poles respectively. The number of poles and zeros will vary based on the response desired. Points can be on or off the X axis. Points off the axis represent complex numbers; numbers with both a magnitude and direction. On the Z plane they are reduced to having an X and a Y component, which are also known as the real and imaginary components.

Complex numbers, which also show up in Laplace transforms are a method of representing phase and magnitude within an equation. The actual response at any point on the circle can be calculated by adding the lengths of all the vectors from each zero to the point on the frequency/response circle and then subtracting the lengths of the vectors from each pole to the same spot on the circle. ■

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a parallel bitstream at the correct rate. Interpolation could be used, taking every eight samples, weighing them and creating three samples. But these solutions are no different than sampling the 18MHz pixel rate at 27MHz, which is below the required Nyquist rate and will result in aliasing. Whether the signal is initially undersampled or sampled adequately initially and subsampled later, the results are the same. Rate conversion must use digital low-pass filtering to prevent aliasing.

Another operation performed extensively in DSP cameras is the use of look-up tables. Values in the look-up tables are added to video pixel values. Here, multiplication and the overall summation functions are typically not needed. Areas that make use of look-up tables include:

- *Shading*. Values are added to pixel values based on the pixel's spatial location.
- *Masking*. Correction values are added to each channel's (R, G, B) pixel value to correct for imperfections in the prism's ability to separate the primary colors.
- *Flares*. Correction values are added based on pixel intensity due to optic imperfections.
- *Gamma*. Values are added based on pixel intensity to achieve the desired intensity transfer function. Multiple gamma look-up tables are generally available.
- *Image capture smoothing*. Correction values are used for pixel imperfections in the CCD block.
- *Knee*. Values are added to achieve the desired intensity non-linearity above the desired pixel intensity.

Most camera manufacturers use proprietary DSP chipsets tailored to perform the described camera functions. These sets, often referred to as DSP engines, are used mainly for speed. Many DSP designs use generic DSP processors from a number of manufacturers, such as Motorola, Analog Devices, TI and IBM. These ICs are specialized microprocessors geared for data (such as CCD pixel data) throughput. In contrast to the dedicated DSP chips, which rely heavily on hardware (with lots of internal microcode) for speed, the generic DSP chips rely on a generic hardware architecture and specialized software written for the specific application. This specialized software was written in assembly language, but today it is often written in high-level languages such as C, using compilers supplied by the DSP chip manufacturer.

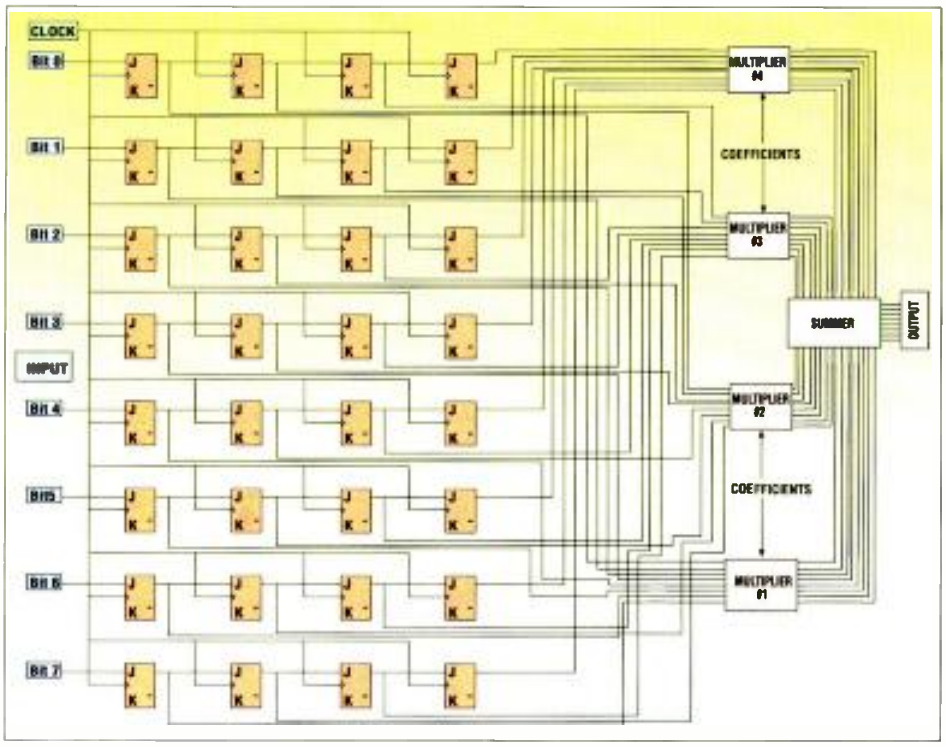

Figure 6. Using digital circuits, a digital equivalent of an analog filter can be constructed. This circuit, with the proper coefficients acts as a low-pass FIR filter.

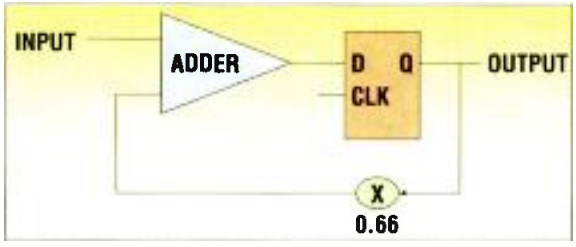

Figure 7. A single-bit low-pass IIR filter can be constructed with a simple set of components.

Implementing DSP designs

Today's generic DSP IC uses an architecture commonly called Harvard architecture, which has separate internal buses for process data and DSP control operations. Some of these DSP ICs use as many as eight separate internal buses. Bus widths can be as wide as 64 bits, but 16 and 32 are the most common. The multiply and accumulate sections of these ICs can have data paths as wide as 96 bits.

To increase throughput, most DSP ICs can perform multiple operations and instruction caches as large as 2k can be found. Although clock speeds can be as high as 200MHz, simultaneous command execution allows a single IC to perform on the order of 1.6 billion instructions per second. Most ICs also allow commands to be issued once and repeated many times. Today, many of the bottlenecks are not due to data processing, but are caused by data movement around the IC or between other DSP ICs that comprise a system. Some implementations leave the data in a common memory and allow other DSP components to look at and change, but not to physically move the data.

The $2.5 billion generic DSP chip industry still has many advantages over what can be done with a standard PC or even a workstation platform. In fact, more than half of today's generic DSPs are used in PCs. The DSP market is expected to quadruple by 2000. More and more, expect to see these ICs in various forms of professional TV equipment. ■

Jim Boston is a consulting engineer based on the West Coast.

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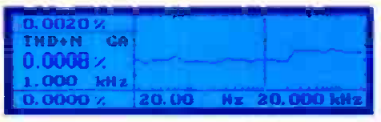

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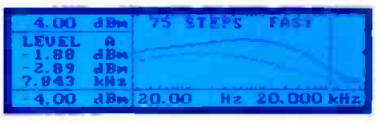

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Desktop CG solutions

Lots of features and options on the menu.

By Moe Rubenzahl

THE BOTTOM LINE:
Character generators (CG) have undergone tremendous transformation in the last few years. From stand-alone, one-task black boxes, to today's small, cost-effective, multifeatured systems, there is a CG to fit every application. For users, the decision isn't whether to buy a new one, but which technology to buy. The author reviews some of the key points to consider when looking for that new on-screen look in a CG. $

In earlier days, the broadcast industry had money to burn. With quality, speed and performance ever paramount, cost wasn't the deciding factor. Today, however, broadcasters are asking, "How much can I get and still stay within my budget?" Fortunately, PC power has resulted in a multitude of solutions at prices to please even the most penny-pinching accountant.

Although there will always be a place for high-end character generators, there is a growing demand for high-quality character generation at more affordable prices. This article explores a new range of CG applications made possible by new generations of computer software and hardware capabilities.

The ideal CG should be fast and flexible enough to serve as a primary character generator, yet small and simple enough to fit in a remote truck. It needs to provide character quality that meets the needs of higher-end users and yet be priced at a level that meets today's most cost-conscious budgets. Finally, a CG's computer-interface capabilities should open the door for advanced applications that might normally require a more expensive solution.

Broadcast applications

News and sports coverage demand a compact CG, suitable for the limited space in remote trucks. Such applications do not necessarily need all the capabilities of a big on-line system. Speed of operation and reliability are key concerns in an environment where extremes of temperature, vibration and production deadlines are the norm.

Broadcast and production facilities often have those places where a CG would be handy, but the budget just won't stretch far enough for lots of 'bells and whistles.'

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Sometimes, that's the case even for the big boys.

For example, ABC shoots soap operas in a downtown studio that doesn't even have a character generator. Every day, the cast changes so operators would fax the credits to their midtown studio where a CG operator would enter the text creating the credit roll. The footage was then sent back to the studio via microwave or on one-inch tape by courier. Although the solution was obvious, the desired $30,000 CG system didn't fit the budget. A little investigation showed that a variety of CG solutions were available — and at cost-effective prices. The result is more control on site and fewer chances of problems developing if the microwave (or bicyclist) dies.

New production markets

New delivery channels, such as cable and DBS, have spawned a growing number of video production sources. Most of these new program producers need CG capability.

While cable operators used to have limited needs to title video, today's community access channels, local news programs and advertising have created a strong demand for CG capability. In many of these cases, the applications require a cost-effective solution.

Another place for CGs is in today's fast-paced edit suites. Here, titling can be handled by editors as a part of their editing duties. However, despite the advantages of incorporating CG features in a non-linear editing system, there are many benefits to having a separate downstream system.

For instance, if the CG can accept industry-standard fonts, such as those in PostScript, then a stand-alone CG can match titles created by the non-linear editing system, allowing creators to combine titles from both sources. This also allows a suite to off-load the CG work to someone else while the editing is taking place.

Things to consider

First, consider the whole package. When purchasing any character generator, first consider the quality and performance relative to budget — the price/performance ratio. Foremost on your list of considerations must be image quality.

Image quality can be measured in terms of rise time in nanoseconds (ns). A 20ns CG, for example, would be considered to have a higher resolution (sharper edge) than a 70ns CG. However, be careful when comparing this specification across products. With modern anti-aliasing techniques, this specification can be misleading because the same CG could be quoted in different ways. Be sure you're comparing apples to apples.

For most applications, the numbers are a bit academic anyway. Today's transmission systems are bandwidth-limited, which effectively limits CG quality to about 35ns. More important are the CG system's bandwidth and signal-to-noise ratio. In both cases, the higher the number the better the quality. Professional systems should provide a minimum bandwidth of 5MHz and S/N of 60dB or better.

While today's CGs are all digital-

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based, all digital systems are not equal. It is important to look at how the video images are generated. Although eight-bit 4:1:1 digital is common and adequate for most applications, 10-bit 4:2:2 processing provides substantially better color fidelity and crispness. Just be sure you understand what you're buying and be sure the comparisons between systems are for like parameters.

Systems and options

Regardless of its specs, a character generator must be easy to integrate into a facility's current video production system. It must have all of the capabilities you need, while being able to work with your existing equipment. Sometimes, this aspect needs an extra bit of consideration.

A small studio would be likely to use a character generator in what's known as an *internal keying* mode. Such a CG would then need to provide an internal keyer capable of overlaying titles on the video directly, complete with transition effects, rolls and crawls.

Higher-end applications may require *external keying* with a linear key output signal that can feed a switcher in downstream key mode. Many installations operate as a timed system using house black as the reference. This requires that timing controls be provided on the character generator's key output. This allows engineers to adjust color subcarrier phase, horizontal delay and key delay. In other words, if you're going to use the CG in anything but a closed suite environment, be sure the CG can be timed into the house system.

In addition, high-end facilities typically require a character generator that can handle component signals in addition to standard composite and Y/C signals. When considering features, it's easy to fall prey to 'feature creep.' Be sure to ask yourself if you really need all of this capability, because each additional feature carries a price tag.

Ease of use

Once upon a time, CGs were complex and required trained operators. Some operators were even further specialized to the point of only using a few CG models or only one brand. Early systems required long training times to master the art of titling.

Today, few facilities have the luxury of that degree of specialization. It's important that each piece of studio gear be easy to learn. And, with roles and duties constantly changing, the equipment needs to be able to accommodate new operators without requiring an extensive learning cycle.

Image rendering

There is one area that novice CG buyers often overlook. *Rendering*. This is one place where horsepower is important. Look for a system that keeps render-

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ing internal to the CG, rather than in a connected computer. In some CG systems, changing an image from 37 to 38 scan lines high or changing it to italic or even tilting the image, requires that the font be re-imaged by the PC and shipped back over to the CG. This takes time. Whether it's important in your application will take a little thought on your part.

A few new character generators are based on the Postscript technology. A standard graphics and font description mechanism in the computer industry, Postscript brings a slew of important advantages. Postscript display technology allows a CG operator to place text anywhere on the screen and arbitrarily size, rotate, skew and stretch characters without the need to re-render the font, all on the fly.

Graphics

If you are adding a new CG to an existing facility, consider its capability to handle your current inventory of legacy graphics. This would include station IDs, logos, corporate IDs and accent graphics. If you're a production house, don't forget that your clients are often armed with their own graphics. You don't want to have to recreate any of these images.

Look for a CG that can use these graphics as an on-screen element without any re-creation. Be sure the CG is capable of not just displaying the graphic, but using it as an element to mix with other characters, including motion such as rotate and move.

Networking and automation

Finally, while a stand-alone CG offers important advantages in flexibility, simplicity and speed of operation, some applications may require network connectivity. Although the subject of networking is best left to another article, decide now if a new CG needs this capability. If not now, will it in the future? There are many advantages to having the CG reside on a house network. In addition to remote-control capability, a networked system allows images to be transferred between systems or even between different sites.

Network connections make storage of title pages easy and make it possible to develop pages at one location and send them to a remote display location.

So, what's the bottom line to someone looking to buy a new CG? PC and new software have made it possible to deliver complete CG solutions, including Postscript technology, excellent speed and ease of use, computer connectivity and excellent on-screen performance at affordable prices. The result is that a wide range of potential CG solutions have suddenly come within the scope of even the skinniest budgets. ■

Moe Rubenzahl is product manager, PowerScript CG, at Videonics, Inc., Campbell, CA.

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By Don Markley

Filing for your DTV channel

With the publishing of the infamous Fifth and Sixth Reports and Orders, and depending on the outcome of a couple of hundred petitions for reconsideration, the new world of digital television seems to be upon us. However, in talking with chief engineers, there seems to be a massive misconception concerning the facilities permitted and just how to go about getting those facilities.

Don Markley

The commission has essentially licensed a DTV station for every existing full-power TV licensee and holder of a construction permit (almost). But that license isn't a real license like we are all used to working with. Instead, each station must file an application for a construction permit, like always, before construction or program testing can begin. The application is the familiar FCC Form 301 (340 for non-commercial stations) with a new section *V-D, DTV Broadcast Engineering Data*. A construction permit will then be issued, to quote the commission, "within a matter of days," if certain criteria are met.

And the criteria are . . .

The new section V-D contains a check list of five questions at the beginning. (See Figure 1.) If all five questions are answered "yes," filling out the rest of the application becomes just a matter of data entry. If any boxes are checked "no," further studies by the commission will be needed.

The check list is straightforward. The first question requires the station to certify that it will operate on the assigned DTV channel, at a site within 3.1 miles of the reference site, and with no more power than specified in the original assignment. Those are the significant points. After that, the station specifies that the non-ionizing RF levels comply with the applicable standard; that the city of license will be within the coverage contour; that there is no problem with radio astronomy; and that the tower is either registered or approved by the FAA or does not require registration.

As everyone in the industry is aware (or should be), the commission has attempted to assign a DTV authorization that will duplicate as much as possible the coverage area of the existing or authorized NTSC station. Toward that end, Table 1 of Appendix B of the Sixth Report and Order lists each station along with the new allotment. It also includes the maximum DTV power in average kilowatts ERP and the maximum height above average terrain of the center of radiation. The table then compares the current and new service areas and population and states the match area in percent. If a station decides to accept the assigned value, the check list on the form gets lots of "yes" check marks and a permit will be forthcoming "in a matter of days" (yet to be defined). It isn't necessary to accept the FCC's limitations on power and height.

Section 73.622(f)(3) of the new rules and regulations clearly states, "DTV licensees and permittees may request an increase in either ERP in some azimuthal direction or HAAT, or both, that exceed the initial technical facilities specified for the allotment in the Sixth Report and Order, up to the maximum permissible limits on DTV power and antenna height set forth in this section or up to that needed to provide the same geographic coverage area as the largest station within their market." That sentence is important, so go back and read it again.

The maximum permitted by the new rules would be the equivalent of:

	Zone I	Zone II or III
Low-band VHF	10kW @ 305m	45kW @ 305m
High-band VHF	30kW @ 305m	160kW @ 305m
UHF	1,000kW @ 365m	1,000kW @ 365m

Equations are contained in the section to calculate the allowed power for heights greater than that shown above.

The kicker is any request for an increased power level and/or HAAT must either show that the change will not result in new interference or must contain an agreement from the parties involved to accept such interference. Section 73.623(c) of the rules contains the criteria to determine interference. The method to be used is contained in OET Bulletin No. 69 and is *NOT* simple. If a study is needed, it will probably be necessary to contact a consulting engineer who has loaded the system and has the hardware to make it work. The data files alone for the commission's method are 1.8GB.

The big point here is that the power and height shown in the original commission assignment are not cast in

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bronze. The values in the table are based on an attempt to replicate the existing coverage (with a minimum ERP of 50kW). It is possible to improve the DTV facility up to the values in the table or more (based on the other stations in the market) by having the required study done and filing the necessary paperwork. The same applies for the 3.1 mile restriction on the site. If it is desirable to move to another site, a study has to be done to demonstrate that the change won't cause interference.

One final problem is that the construction permit from the commission won't be granted in a matter of days. Wouldn't that be a surprise! If you want a facility for DTV that is either larger than in the assignment table or a different location, call your consulting engineer.

As a last point, the interference study would be made with regard to stations at the power and height listed in the assignment table as modified. In other words, you protect everyone for the quasi-authorized facility. As their allocations are amended, your protections will become more severe. The handwriting is clear — if you aren't happy with your DTV assignment — change it now. It's only going to get tougher. ■

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

Section V-D-DTV BROADCAST ENGINEERING DATA

Name of Applicant **Call Letters (if issued)**

Certification Checklist: A correct answer of "Yes" to all of the questions below will ensure an expeditious grant of a construction permit. An answer of "No" will require additional evaluation of the applicable information in this form before a construction permit can be granted.

1. The proposed DTV facility complies with 47 C.F.R. Sections 73.622 and 73.623 in the following respects:

(a) It will operate on the DTV channel for this station as established in 47 C.F.R. Section 73.622. ☐ Yes ☐ No

(b) It will operate from a transmitting antenna located within 5km (3.1 miles) of the DTV reference site for this station as established in 47 C.F.R. Section 73.622. ☐ Yes ☐ No

(c) It will operate with an effective radiated power (ERP) and antenna height above average terrain (HAAT) that do not exceed the DTV reference ERP and HAAT for this station as established in 47 C.F.R. Section 73.622. ☐ Yes ☐ No

2. The proposed facility will not have a significant environmental impact, including exposure of workers or the general public to levels of RF radiation exceeding the applicable health and safety guidelines, and, therefore, will not come within 47 C.F.R. Section 1.1307. ☐ Yes ☐ No

3. Pursuant to 47 C.F.R. Section 73.625, the DTV coverage contour of the proposed facility will encompass the allotted principal community. ☐ Yes ☐ No

4. The requirements of 47 C.F.R. Section 73.1030 regarding notification to radio astronomy installations, radio receiving installations and FCC monitoring stations have either been satisfied or are not applicable. ☐ Yes ☐ No

5. The antenna structure to be used by this facility has been registered by the Commission and will not require reregistration to support the proposed antenna. OR, the FAA has previously determined that the proposed structure will not adversely effect safety in air navigation and this structure qualifies for later registration under the Commission's phased registration plan. OR, the proposed installation on this structure does not require notification to the FAA pursuant to 47 C.F.R. Section 17.7. ☐ Yes ☐ No

Figure 1. To prepare your station for digital transmission, you must file FCC Form 301, which includes a new section called V-D, DTV Broadcast Engineering Data. The first part of section V-D (shown above) consists of five questions.If you can answer "Yes" to all five questions, filling out the rest of the application becomes a matter of data entry. But if you answer "No" to any question, further studies by the commission will be required.

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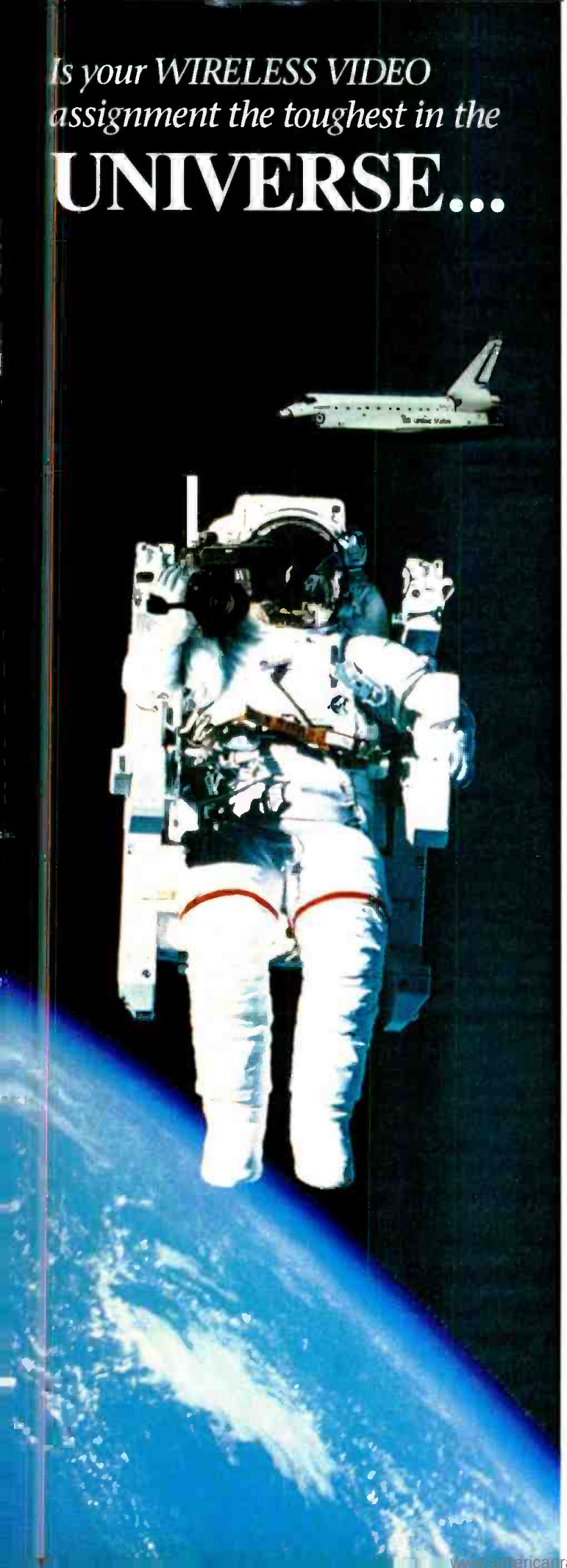

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The CamLink II Wireless Video System is being used all over the planet to cover breaking news, sports, live events, and feature film production. Even spacewalking NASA and MIR astronauts who need to send broadcast-quality pictures back to their spacecrafts will use the CamLink II. You too can depend on CamLink II's reliability, stability and exclusive features:

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By Allan Arthurs

Java on Quantel

Developed originally as part of a research project to produce a programming environment for use in myriad consumer electronic devices — anything from TV sets to telephones and even toasters — Java has recently been touted as a means of bringing web pages to life. Sun Microsystem's new software programming language is subsequently evolving into a whole lot more. It is capturing the imagination of the entire computing world and beyond.

Sun describes Java as an object-oriented, general-purpose programming language. Nothing new, you may say. But what distinguishes it from any other computer language is its ability to run on any computer platform. Java is truly platform independent. It has the added advantages of being simple to program, easy to use and extremely robust in operation.

With Java on Quantel, you have the freedom to run limitless applications, alongside the Quantel feature set, on the same platform.

At present, Java is best known for its widespread use on the World Wide Web, for enhancing the content of web pages with graphic animation and sound. The way it works is fairly straightforward. Java applications are small programs that run specifically in Java-enabled web browsers, such as Microsoft's Internet Explorer or Netscape's Navigator.

But the web is just one example of a growing number of opportunities Java has spawned. As a general-purpose programming environment, Java is also creating a real buzz. It has become eminently suitable for a range of what are referred to as *industrial-strength applications*. But what possible use could it have for the broadcast professional?

Quantel has been monitoring the progress of Java since its inception and has closely studied the potential benefits that such applications could bring to its users. Java's ability to circumvent the inherent differences between different computing platforms makes it the perfect solution for general-purpose applications.

Broadcast Java

At this year's NAB convention in Las Vegas, Quantel announced that its engineers had successfully integrated the Java Virtual Machine into the company's unique dedicated platform. This means that software developers versed in the Java language will now be able to write applications for the entire family of Quantel products.

The ramifications of Java on Quantel to a broadcaster or a post facility are far-reaching. Users will have the freedom to run limitless applications, alongside the Quantel feature set, on the same platform. Effectively, anything that can be programmed on a computer can be accomplished with a Java application running on Quantel.

It is probably too early at this stage to speculate on the extent of Java on Quantel. It *is* expected, however, that successful applications will be those that make use of the full capability of the individual Quantel platform and add value in terms of the additional features provided, while also maintaining the same familiar look and feel of the Quantel Man Machine Interface (MMI).

Java is a perfect fit with Quantel's philosophy that the technology should never stand in the way of creativity. No changes in hardware will be required to accommodate the Java applications. They will run seamlessly alongside the standard Quantel feature set. Furthermore, the tried-and-tested Quantel pen and tablet and menu-driven interface will remain intact.

Operation is simplicity itself. Users enter the realms of Java space by a simple tap of the pen on an extra menu box built into the Quantel system. Operators can then scroll through their Java applications to find the one they want. Such programs are expected to come from a variety of sources — developed through an in-house Java programmer, imported from a third-party software developer or, in certain cases, downloaded (and customized as necessary) from the web. In effect, Quantel users will have unprecedented access to a host of external creative resources. And, as each program is customizable, facilities can offer their customers some-

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thing unique, and as such, set them apart from other Quantel owners.

Hand-in-hand

The transparent process is perhaps best illustrated with the aid of an example. Consider one of the sample applications demonstrated at NAB called *Circular Text*. This neatly conveys how a user could make use of a Java program to extend the capabilities of the Quantel system and how the Java application works hand-in-hand with the Quantel platform.

Figure 1 shows an example of the result of this simple Java application designed to produce text arranged around the circumference of a circle. The artist selects the diameter of the circle and the text itself. The Java application reaches inside the Quantel platform to produce this text using any one of Quantel's 1,085 vector-based, anti-aliased fonts.

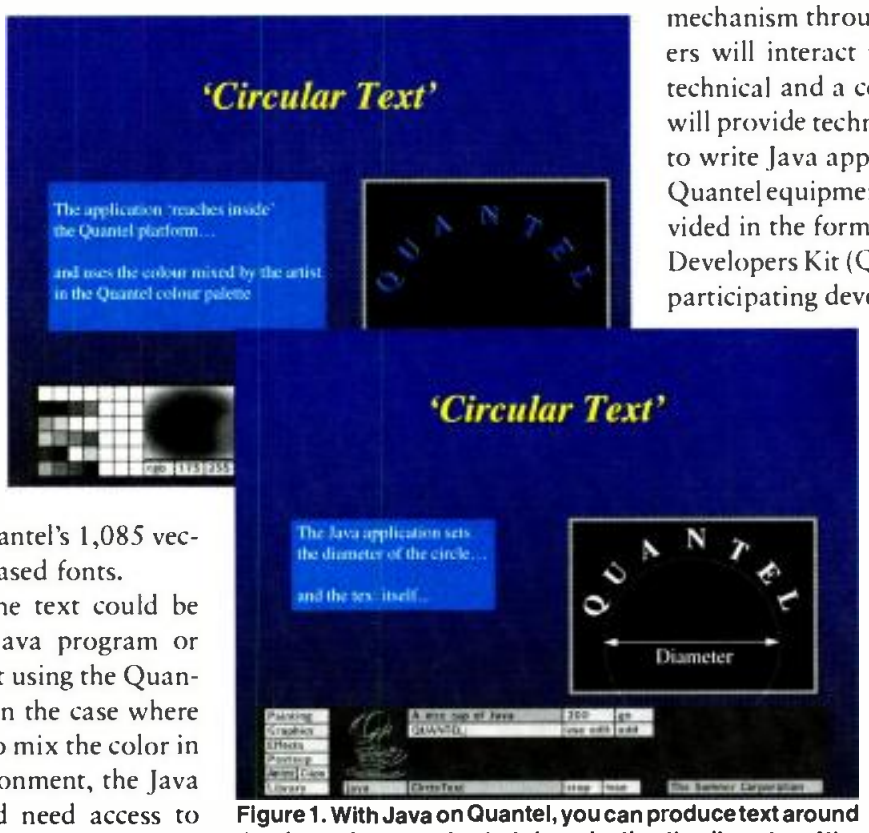

Figure 1. With Java on Quantel, you can produce text around the circumference of a circle by selecting the diameter of the circle and the text itself. The Java application reaches inside the Quantel platform to produce this text, using any one of Quantel's 1,085 vector-based, anti-aliased fonts.

The color for the text could be specified in the Java program or mixed by the artist using the Quantel paint palette. In the case where the artist wishes to mix the color in the Quantel environment, the Java application would need access to the color information on the end of the pressure-sensitive pen. Thus, Java programmers have at their disposal access to the functionality of the host Quantel platform, while still maintaining a seamless operating environment for the artist via the Quantel Virtual Machine.

As always, speed of execution is critical. This is not an issue with Java on Quantel, because Quantel platforms are not reliant on the speed of Java. Rather, it is the way in which the Java applications interact with the Quantel platform that produces the quick results.

The Virtual Machine

The Quantel Virtual Machine fulfills three important roles. It provides the essential environment for the Java application. It also provides the interface between the Java application and the Quantel platform, and it maintains the consistent MMI to ensure seamless integration of the functionality of the Java application with the standard Quantel feature set.

Early next year, the Quantel Virtual Machine will be available as an upgrade option on current Quantel products with a direct MMI; this effectively means Paintbox, Picturebox, Hal, Newsbox, Editbox, Henry and Domino. No hardware modification is required, provided the system reflects the most recent upgrade status for that product. Older versions can be Java-enabled by first bringing them up-to-date before installing the Quantel Virtual Machine.

Support is clearly paramount and is an issue Quantel is seriously addressing. The company is establishing a range of services to support the developer community. The Quantel Developers Program is effectively the mechanism through which developers will interact with Quantel at a technical and a commercial level. It will provide technical details of how to write Java applications to run on Quantel equipment. This will be provided in the form of a Quantel Java Developers Kit (QJDK). In addition, participating developers will benefit from a dedicated web site, specialist training and developer conferences.

In essence, the advantages of Java on Quantel lie in extending the Quantel feature set, not in replacing it. In view of this, Quantel will not be undertaking to develop Java applications *per se*, but will continue to develop and add to the tools that will most benefit customers. It is anticipated that Java applications produced by third-party developers will result in new extensions to the Quantel feature set.

Such extensions are likely to go beyond the one-off special effect — a twinkle, an explosion, a slit-scan effect or a flash — to the more day-in, day-out uses — like importing statistics to better illustrate share price updates or election results. Java will undoubtedly open up a new set of opportunities for Quantel customers. The truth of the matter is that the nature of these applications is limited only by the imagination of the users and the ingenuity of the individual Java programmer. It is impossible to predict the real extent of Java on Quantel, but one thing is certain, Java developers will be in big demand. ■

Allan Arthurs is a developer/program manager for Quantel, Darien, CT.

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By Oliver Carmona

ASC's FibreDrive

The introduction of Fibre Channel technology is redefining storage and bandwidth management in the next-generation digital broadcast facility. The advantages of using a video server with on-line RAID storage to replace maintenance-intensive VTRs are widely understood. Broadcast facilities worldwide use video server technology to reduce maintenance costs, improve productivity and standardize video quality.

Enter Fibre Channel

Fibre Channel (FC) is a serial interface that supports the high-bandwidth storage requirements of on-air playback servers. Fibre Channel is currently the fastest interface available, supporting a peak bandwidth of 1Gb/s. It differs from previous architectures because it offers true storage/network integration providing built-in capability for channel and network applications.

Fibre Channel supports different topologies: 1) *point-to-point*; 2) *arbitrated loop (AL)*; and 3) *fabric* (a switching interconnection, similar to a telephone switch).

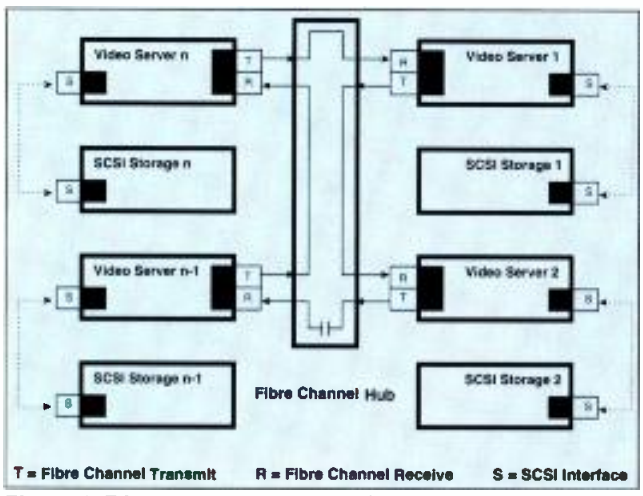

Figure 1. FC network implementation with SCSI storage.

Only one video server solution currently implements Fibre Channel as a high-bandwidth storage interface. ASC is the first to adopt FC's channel implementation for use with its Virtual Recorder line of broadcast video servers.

The FibreDrive difference

FibreDrive, ASC's patent-pending Fibre Channel implementation, allows multiple video servers to share network-attached storage. The resulting architecture is one in which every video channel has instant random access to shared Fibre Channel RAID storage. This eliminates the need for local buffers or data transfers from one set of storage to another.

Figure 2 shows a typical FibreDrive configuration—a Fibre Channel arbitrated loop (FC-AL) with multiple VR300 video servers and FCR300 Fibre Channel RAID storage systems connected via a Fibre Channel hub.

By extending Fibre Channel's 1Gb/s bandwidth down to the disk drive level, FibreDrive architecture provides a new level of functionality to broadcasting applications. Moreover, VR300 video servers with FibreDrive are more flexible, scalable and reliable.

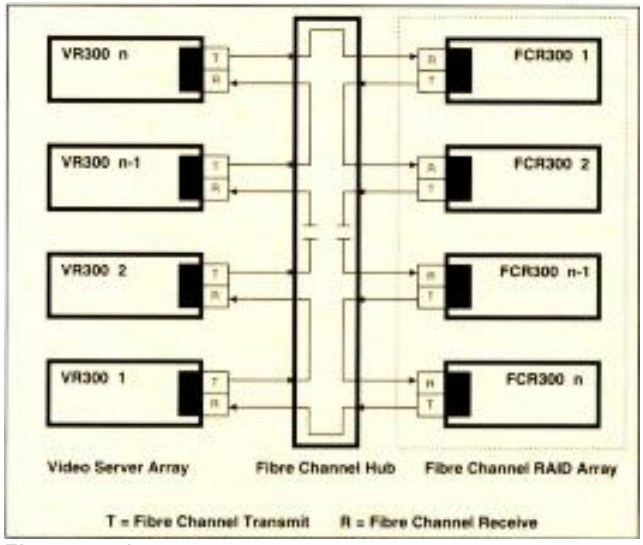

Figure 2. Fibre Channel Arbitrated Loop with network-attached FC storage.

FC network implementation

Some video server vendors have chosen Fibre Channel for its network-based functionality. In this network-only implementation, FC is used to transfer video files from one SCSI-based video server to another, in factors of real time.

These implementations typically use an arbitrated loop with multiple video servers and SCSI storage systems connected via a Fibre Channel hub. (See Figure 1.)

This network architecture forces users to transfer files by creating multiple copies of the same video material. Most important, users do not have instant random access to all video material. For example, if an operator wants to playback material stored on SCSI storage 2 from video server 1, the file must be trans-

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ferred over the Fibre Channel network and then stored in SCSI storage 1. Due to SCSI bandwidth restrictions, file transfers are a real-time operation — in many cases, even slower-than-real-time.

Instant random access

ASC's FibreDrive architecture is different in two ways. First, FibreDrive uses network-attached storage. Disk drives are connected directly on the Fibre Channel network as opposed to being connected to a video server. (See Figure 2.)

Second, ASC uses Fibre Channel disk-drive systems, not SCSI. So, every disk drive has a direct connection to every server on the loop. This approach takes full advantage of Fibre Channel's 100MB/s bandwidth. SCSI and ultraSCSI systems are limited to 20MB/s and 40MB/s, respectively.

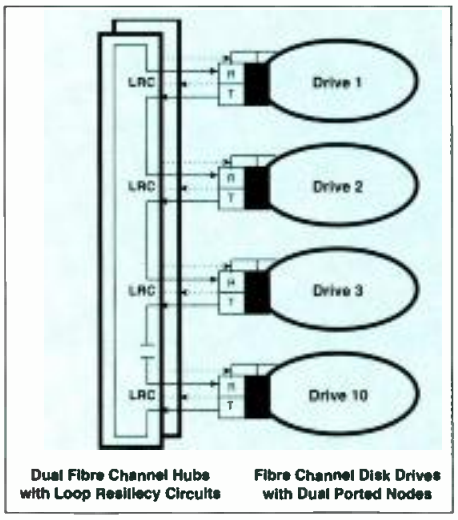

Figure 3. Dual Fibre Channel hubs and disk drives with dual-ported nodes provide total system redundancy.

Total system redundancy

FC-AL topology supports several predefined hardware mechanisms for providing redundancy. First, Fibre Channel hubs provide loop resiliency circuits (LRC) for high-speed bypass. (See Figure 3.) LRCs detect the presence or loss of a connected port and either switch into or out of the loop. A failing port is simply shunted out, maintaining the integrity of the loop. If a port returns, it is detected and switched back into the loop.

Realizing that the actual loop presents a single point of system-wide failure, FC-AL defines the concept of dual-ported nodes. Each node has a second port that may be connected to an entirely separate loop. Both loop channels are concurrently active and automatically transfer traffic between each other.

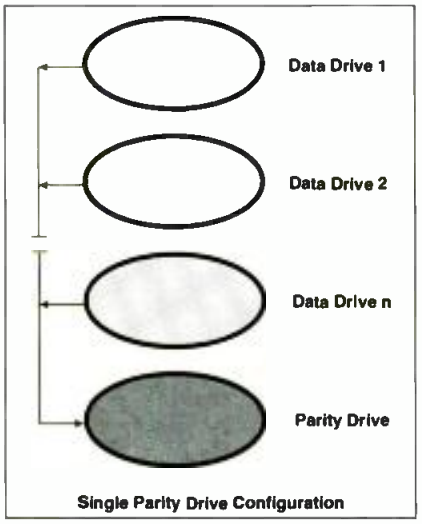

Figure 4. RAIDsoft implementation.

Software-based RAID technology

ASC has developed multiple strategies of software RAID implementation for the Fibre Channel environment. RAIDsoft, ASC's software RAID technology, offers a significant advantage over traditional hardware-based RAID. Hardware controllers, the physical processors that manage RAID striping, are a requirement of every SCSI-based RAID system. This hardware becomes a single point of failure in the system and costly to replace or duplicate. Software RAID eliminates the need for additional hardware.

RAIDsoft can be implemented in single- and multiple-parity drive configurations. In the single-parity drive approach, data is organized into stripes of data pieces, the sizes of which are defined as Sb/Dn, where Sb is a given buffer size and Dn is the number of disk drives. (See Figure 4.) Parity information is always read and decoded, improving the capability of error detection, as well as data performance during error correction.

An improved software RAID approach involves using multiple-parity drives. The two advantages of this approach are: 1) double data drive errors can be corrected; and 2) single unknown location data errors can be corrected.

Also, hot stand-by disk drives can be added to the array for an extra level of redundancy. In the event of a disk drive failure, the lost information will be rebuilt automatically in the background to a hot spare. That way, the failed drive can be removed at the next scheduled maintenance interval.

Unrivaled channel capacity

Fibre Channel's extraordinary 100MB/s bandwidth can support up to 24 simultaneous channels at 24Mb/s, each with instant random access to shared online digital storage. (Fibre Channel does incur a 30% loss in performance for overhead; 100 x .70/3MB/s = 23.33≈24.)

This Fibre Channel arbitrated loop topology is the ideal foundation of a shared-storage video server system. Increasing available bandwidth (and resulting channel capacity) of a Fibre Channel-based system can be achieved by adding fabrics. Fabrics can be used to connect several arbitrated loops, providing a compromise between connectivity and performance.

Building block modularity

FibreDrive architecture is extremely modular and scalable. Online digital storage can be increased by simply adding FCR300 storage systems to the loop.

Similarly, FibreDrive's building-block approach means channel capacity can be expanded by adding VR300 servers to the loop.

ASC's FibreDrive topology integrates the latest in server, digital storage and software technologies. FibreDrive allows on-air playback servers to be more flexible, scalable and reliable than ever before. ■

Oliver Carmona is marketing manager for ASC Audio Video Corporation, Burbank, CA.

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industry briefs

Business

The Harris Corporation, Quincy, IL, announced plans to establish a $10 million Worldwide Digital TV Center in the Cincinnati area. It will expand the company's engineering, administrative and manufacturing capacity to meet the needs of the many broadcasters converting to the new digital technology.

Harris plans to build the 130,000-square-foot facility at Governor's Pointe North in Deerfield Township in Warren County, OH, to serve as the new headquarters for the company's worldwide broadcast operations. All of the company's resources related to digital television, including key product management, engineering, sales and marketing and selected senior administration staff, will be based at the center.

DVE leader Pinnacle Systems, Mountain View, CA, signed a letter of intent to acquire the assets of miro Digital Video Products Group from miro Computer Products AG. The $21 million deal was based on Pinnacle's interest in miro's new DV line of codecs. The acquisition rounds out Pinnacle's product line to encompass all of the raw elements of the digital studio-in-a-box concept.

Communications Engineering, Inc. (CEI), Newington, VA, delivered a 50-foot production trailer, which features a 38-foot expanding section, to Black Entertainment Television (BET). The BET truck was designed and engineered to accommodate the widest range of anticipated environmental conditions out on location and includes extensive considerations for power, HVAC, soundproofing, operator console ergonomics, technology access and storage.

Solid State Logic's Axiom digital console became the audio mission control for the live broadcast of "Discovery News," a science news show co-produced by the Discovery Channel and ABC News covering the Mars Pathfinder's landing. The Axiom, from Oxford, UK-based SSL, was used for the entire hour-long live special. The console was also used on the breaking news inserts that ran throughout the day, some of which were up to 15 minutes long.

Discreet Logic, Montreal, announced an agreement for the acquisition of D-Vision Systems, Chicago. The $20 million purchase extends Discreet Logic's market, through D-Vision's OnLINE software, as a multiplatform editing software provider, complementing the company's real-time Silicon Graphics-based non-compressed editing system, FIRE. Additionally, the acquisition adds Windows NT engineering development expertise to Discreet Logic's stable, as D-Vision's nonlinear editing solutions were created to run on NT.

TV/COM, San Diego, CA, has spun-off its Analog Business Group to form Aegis Integration, Inc. The spin-off allows TV/COM to focus its product development, manufacturing and sales of end-to-end digital compression systems for cable, satellite, PC and telecommunications customers worldwide.

Aegis Integration will service and support its customers at its new headquarters in San Diego. Under terms of the agreement, all business related to the SIGMA product line of addressable encryption systems for cable, satellite and MMDS, the ProGuard encryption system, and Orion products will be sold and supported by Aegis.

Aegis can be reached at phone: 619-675-6490; fax: 619-675-0704; E-mail: info@aegisint.com.

Located atop Twin Peaks in San Francisco, Sutro Tower has been scheduled for an expansion project administered by Chicago-based McClier Corporation. The project will make Bay Area viewers among the first to receive DTV signals. McClier will expand the 31,000-square-foot facility to accommodate more than twice its present amount of transmitting equipment and infrastructure.

WNED-TV, a public TV station in Buffalo, NY, purchased five Hitachi SK-2600PW digital studio cameras, based on the cameras' 4:3/16:9 switchability. The new cameras will significantly upgrade the station's two studios, which were previously equipped with 25-year-old Fernseh KCU 40B cameras.

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A federal judge in Philadelphia has affirmed an earlier jury finding that Harris Corporation's Broadcast Division willfully infringed on Southwick, MA-based Comark Communications' patent for its Aural Carrier Corrector.

Last April, a jury awarded Comark $7.7 million based on a finding of infringement. Because Harris' infringement was "knowing and intentional," the judge has now doubled the judgment against Harris and has also ordered the payment of prejudgment interest and granted Comark's request for reimbursement of attorney's fees. The total judgment against Harris could exceed $18 million.

Time Warner, Inc. installed Maynard, MA-based SeaChange International's SPOT digital advertising insertion system in its Syracuse, NY, and Austin, TX, cable systems in combined deals valued at approximately $1 million. The systems support five zones and 54 channels in Syracuse and two zones and 32 channels in Austin.

The Russ Berger Design Group (RBDG), Dallas, provided acoustical design and performed the renovation for Lyrick Studios' expansion of its audio post and video editing capabilities into the Dallas Communications Complex in Irving, TX. RBDG has worked closely with Lyrick, distributors of *Barney & Friends*, in the design of its production studios over the past 15 years.

V&P News Service, New York City, recently converted its ENG operations to Panasonic DVCPRO with the purchase of two AJ-D700 camcorders, an AJ-D650 studio editing VTR and an AJ-D640 recorder/player. V&P specializes in the acquisition of raw footage of news events that is delivered to broadcast stations for local newscasts.

Louth Automation, Palo Alto, CA, has received contracts to provide automation systems to system integrators for two major new facilities.

The new FOX Broadcasting center in Los Angeles is installing multiple ADC-100 automation systems for the first large-scale implementation of Fibre Channel using Tektronix PDR 200 Profiles and Ampex DST for near-line storage. Tektronix Corporation, Beaverton, OR, is the integrator of the project.

Harris Corporation is the overall integrator for the new Georgia Pacific Television facility in Atlanta. Louth ADC-100 systems will control seven on-air channels, using an array of equipment including BTS Media Pool, Tektronix Profiles and Panasonic SmartCarts.

Chyron Corporation, Melville, NY, became part of the Smithsonian Institution's Permanent Research Collection of Information Technology Innovation at the National Museum of American History when the 1997 collection was formally presented to the institution in Washington, DC. This year, 321 innovative applications of information technology from 39 states and 21 countries will be presented to the Smithsonian.

People

Bruce Allan will head Harris Corporation's worldwide broadcast operations and lead the company's DTV business. Harris named Bruce vice president — general manager of the company's Broadcast Division, effective immediately.

Edward Grebow was appointed president and chief executive officer of Chyron Corporation, Melville, NY. Edward was also elected to Chyron's board of directors.

Rüttger Keienburg was appointed vice president and managing director of Europe for Scientific-Atlanta, Atlanta.

Bob Howard joined DG Systems, San Francisco, as vice president of sales.

Mark Everett

Mark Everett was promoted to vice president, product development for Videotek, Pottstown, PA.

Also from Videotek, Lou Rubinfield has been promoted to vice president, engineering.

Lou Rubinfield

James Kutzner was named director of engineering for Comark Digital Services, Alexandria, VA.

Thomas Elliot joined CableLabs, Louisville, CO. Thomas will work on special projects dealing with digital television.

John Mulcair was appointed president and chief operating officer of Alpha Technologies, Bellingham, WA.

Terry Priesont was promoted to manager, implementation services for National Teleconsultants, Glendale, CA. ■

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new products

By Deanna Rood

Digital-S camcorder

JVC

• DY-700U: a high-quality 4:2:2 digital camcorder priced at a fraction of the high-end digital formats; by integrating JVC's three-chip camera technology with the recording capabilities of Digital-S, this field camera outperforms Beta-SP and DV-based digital camcorders; JVC has reduced the number of onscreen menus and the DY-700U features an array of automatic functions, such as full time auto white that tracks color temperature automatically and a continuous auto black circuit that assures perfect black balance under changing environments; the DY-700U uses the Digital-S ½-inch metal particle tapes, available in lengths of 10, 34, 64 and 104 minutes.

JVC, 41 Slater Dr., Elmwood Park, NJ 07407' 800-582-5825 or 201-794-3900; fax 201-523-2077; 74166.120@compuserve.com; www.jvc-us.com

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ENG hand-held zoom lens

Fujinon

• A20X8EVM/ERD: this small, lightweight lens that has an extremely broad zoom range and is well-equipped for all hand-held shooting applications; the A20x8EVM/ERD features AT2, a technological advancement that combines Fujinon's Aspheric Technology with a new inner focusing system; the lens has a minimum object distance of 0.8 meters and other features include a smooth, responsive servo control and Fujinon's V-Grip that allows the grip to be adjusted in five steps to balance any load; the zoom rate can also be adjusted from wide-to-tele between one and seven seconds directly from the grip.

Fujinon, 10 High Point Dr., Wayne, NJ 07470; 201-633-5600; fax 201-533-5216

Circle (254) on Free Info Card

Digital video disk recorder

Doremi Labs

• V1D: a digital video disk recorder that features serial digital interface; it is 3U high and has full front-panel controls, including jog/shuttle, autolocator and audio input level; the V1D features a full screen NTSC (720x480 lines) and PAL (720x576 lines) resolutions and records field accurate compressed video with two audio tracks and time code; it can be set to a ratio as low as 2:1 to offer virtually lossless compression; two RS-422 serial ports are available with Sony 9-pin protocol; through the SDI, the V1D can record directly from a digital Betacam or a D-1 format DVR.

Doremi Labs, 3631 Cahuenga Blvd. West, Los Angeles, CA 90068; 213-874-3411; fax 213-874-3401; www.doremilabs.com

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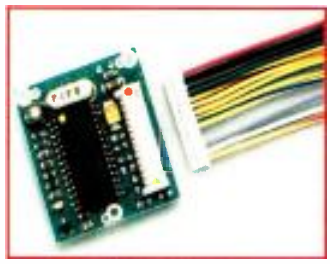
Miniaturized encoder module

Pipo Communications



• AE-2: a dual-tone, multifrequency encoder module that features six programmable memories; it can be set to send as many as 180 digits in any conceivable configuration of pauses, waits, delays, speed adjustments and memory loops; programmable features are configured through a compact hand-held programmer or on a PC with the Pipo interface box and accompanying software.

Pipo, P.O. Box 2020, Pollock Pines, CA 95726;916-644-5444; fax 916-644-7476

Circle (264) on Free Info Card

Content options for MindSet virtual set

Evans & Sutherland

• Virtual Prop Shop: a series of standardized content options designed to support Evans & Sutherland's MindSet, a Windows NT-based alternative to expensive virtual set systems; the Virtual Prop Shop consists of a library of complete sets that can be used immediately with MindSet systems, as well as a library of virtual set components (such as walls, floors, textures, lamps, pictures, etc.) that users can snap together without additional programming; MindSet is designed to import and use elements from a variety of popular modeling applications, such as 3D Studio MAX, GameGen, Lightscape and Softimage.

Evans & Sutherland, 600 Komas Dr., Salt Lake City, UT 84108;801-588-1000; fax 801-588-4511; www.es.com

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Rack-mount adapter kit for Audio-Technica's 300/900 series wireless systems

Audio-Technica

• AT8633: a rack-mount adapter kit that allows the receivers for the 300 and 900 series to be housed in a standard audio rack; the dual-shelved AT8633 is a rugged, all-metal unit that allows up to two Audio-Technica ATW-R03 (300 series) or ATW-R09 (900 series) to be mounted in a single 19-inch rack space.

Audio-Technica, 1221 Commerce Dr., Stow, OH 44224; 330-686-2600; fax 330-688-3752

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Component triax system

Telemetrics

• TM-9660: a component triax system that provides portable cameras with component output and full-featured studio operation; the TM-9660 offers the operational advantages of processing component video signals, and using triax cable between the camera and its base station; processing and transmitting component video in the studio and triax multiplexing system prior to encoding results in a substantial improvement of video quality; in addition, recording, playback, generating special effects, digitizing for transmission and video switching are greatly enhanced with component video.

Telemetrics, 6 Leighton Place, Mahwah, NJ 07430; 201-848-9818; fax 201-848-9819

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Multiple receiver wireless video diversity system

Dynatech Tactical Communications (DTC)

• DynaPIX TRIAD system: a multiple receiver wireless video diversity system that uses between three and five receivers to overcome most multipath problems associated with mobile video transmission in studio and ENG applications; each unit offers three selectable video channels, stereo audio and optional time-code window and various antenna arrays are also available; the TRIAD system comes with an FCC Part 15/Industry Canada approved transmitter, or a 250MW transmitter for use under FCC Part 74 rules.

DTC, 77 Northeastern Blvd., Nashua, NH 03062; 800-233-8639 or 603-880-4411; fax 603-880-6965

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Video line transmitters, receivers and amplifiers

Kramer Electronics

• TP series: a series of video line transmitters, receivers and amplifiers that allow you to transmit video signals with audio over simple, standard twisted pair wires; the TP-1 and TP-5 video line transmitters and the TP-2 and TP-4 video line receivers transmit and receive video signals over any twisted-pair wire; the TP-1 and TP-5 transmitters maintain the bandwidth of an industrial color video signal up to several hundred meters and broadcast quality signals up to 100 meters.

Kramer, 350 Main Rd., Montville, NJ 07045; 888-303-5600; kramerel@netvision.net.il

Circle (278) on Free Info Card

Wide-angle ENG lens

Fujinon

• S12X5BRM: a low-cost, wide-angle ENG lens for 1/2-inch format color cameras; it has an extremely wide angle of 65 ° making it the widest angle ENG lens available for ½-inch cameras; the lens features electron beam coatings for improved contrast, while reducing flare and ghosting to the lowest possible levels; in addition to a comfortable servo grip, all functions are easily accessible by hand; the lens has a focal length of 5mm to 60mm, MOD of 0.5 meters, F-number of 1.8 from 5mm to 54mm, and 2.0 at 102mm and iris range of F1.8 to F16.

Fujinon, 10 High Point Dr., Wayne, NJ 07470; 800-533-6611 or 201-633-5600; fax 201-533-5216

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Mini master control switcher

Ross Video

• AVM-7900: a four-input audio/video mixer designed in conjunction with cable and satellite companies to meet the requirements of Channel Transmission Scheduling/Local Insertion Systems and Satellite Broadcasting specifications; it comes complete as a four-input (stereo) audio and video mixer with cut, dissolve and master fade to black features, as well as a full-fledged keyer with linear, external and self-keying capabilities; both video and audio transitions can be previewed before they transition to air; the AVM-7900 can be controlled by an optional control panel or by a remote automation controller using GVG 100 protocol.

Ross Video, P.O. Box 220, 8 John St., Iroquois, Ontario, K0E 1K0 Canada; 613-652-4886; fax 613-652-4425; solutions@rossvideo.com; www.rossvideo.com

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new products

Video scan converter
RGB Spectrum

• Videolink 1650: the latest addition to the RGB/Videolink family of video scan converters that are used where high-resolution computer information must be converted to video format for broadcast or videotaping; model 1650 employs the same high-end scan conversion technology used in the Videolink 1700 but at a lower price; it accepts interlaced or non-interlaced RGB inputs from virtually any workstation or desktop computer and automatically sets up the parameters for the sharpest picture; Videolink 1650 synchronizes to all computer signals with screen resolutions up to 1,600x1,280 pixels and wtih scan rates from 15kHz to 90kHz; it will output broadcast-quality NTSC and PAL composite video, S-Video (S-VHS, Hi-8) and component analog video (Betacam/MII) and includes features such as zoom function, broadcast quality gen-lock and selectable flicker filters.

RGB Spectrum, 950 Marina Village Parkway, Alameda, CA 94501; 510-814-7000; fax 510-814-7026; www.rgb.com
Circle (263) on Free Info Card

Twisted pair wire
Prime Image

• A/V Twister: this product allows you to replace video and stereo cables with twisted pair wire; the transmitter and receiver weigh eight pounds each and the video signals can be sent up to 3,000 feet, with a self-powered in-line amplifier at each 1,000-foot interval; there is no measurable loss of quality in either video or audio signals, and each transmitter can feed as many as 15 receivers.

Prime Image, 19943 Via Escuela, Saratoga, CA 95070; 408-867-6519; fax 408-926-7294; primeimagein@earthlink.net; www.primeimageinc.com
Circle (265) on Free Info Card

UHF rack-mount receiver
Azden Corporation

• Model 412UDR: a UHF rack-mount receiver that features a unique detachable antenna system allowing the antennas to be located in the front or back; featuring ¼-inch and XLR outputs, the receiver has 63 onboard user-selectable frequencies within the 794MHz to 806MHz range; two complete, separate receivers are housed in the all-metal casing, and the transmitter/microphones are available as 41HT (hand-held) and 41BT (body pack).

Azden, 147 New Hyde Park Rd., Franklin Square, NY 11010; 516-328-7500; fax 516-328-7506; azdenus@aol.com; www.azdencorp.com
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Digital-S editing recorder
JVC Professional

• BR-D85UNS: the BR-D85U Digital-S editing recorder with pre-read has been repackaged; the new version offers serial digital interface as an option allowing users with analog systems to perform layering and A/B style editing with only two VTRs at a reduced price.

JVC, 41 Slater Dr., Elmwood Park, NJ 07407; 201-794-3900; fax 201-523-2077
Circle (267) on Free Info Card

Air-cooled UHF tetrode for HDTV
Siemens Components

• RS 10366L: a forced-air-cooled 10kW tetrode for combined video and sound operation in UHF TV transmitters; the air-cooled tretrode eliminates water problems in the transmitter that can be caused by leaks in alternative water-cooled systems; in addition to improved reliability, it is less costly to operate.

Siemens, 186 Wood Ave. South, Iselin, NJ 08830; 800-888-7729; fax 732-632-2743
Circle (268) on Free Info Card

Circle (48) on Free Info Card

Environmentally safe magnetic head cleaning solution
Maxell Corporation of America

• CL-S: a non-chlorine-based cleaning solution for magnetic heads and transports of professional VCRs and other professional equipment; it is also good for connector restoration and for cleaning metal connecting points of electronic equipment; an innovative fluoride additive establishes a molecular film on the head surface and the cleaning solution has an extremely low surface tension and hygroscopic propensity that allow it to clean small gaps, while preventing corrosion of metal parts caused by wear; CL-S is non-flammable and does not harm rubber or plastics.

Maxell, 22-08 Route 208, Fair Lawn, NJ 07410; 201-794-5922; fax 201-796-8790; www.maxell.com
Circle (266) on Free Info Card

RAID 5 solution
MicroNet Technology

• Advantage RAID: a platform-independent, self-contained desktop RAID 0/1/5 storage solution that connects to any computer system with a SCSI port or host adapter; in addition to a built-in RAID controller, the unit also contains a high-performance 32-bit RISC microprocessor, 2MB of static RAM and level 2 microprocessor battery backed-up cache, redundant power supplies and a front-mounted LCD panel that eliminates the need for specialized GUI software; available in a 20GB configuration, the compact Advantage RAID houses six hot-swap hard disk drive modules and a RISC-based embedded RAID 5 controller.

MicroNet, 80 Technology, Irvine, CA 92718; 800-650-DISK or 714-453-6100; fax 714-453-6101; www.micronet.com
Circle (269) on Free Info Card

LightWave 3D software upgrade
NewTek

• LightWave 3D version 5.5: this version is the latest update to the photorealistic 3-D animation system for desktop computers; it features a highly streamlined user interface and increased interactivity, as well as new features that dramatically improve character and background animation, add a new volumetric rendering engine and particle system, and better support multiprocessor hardware systems; one important feature is the Morph Gizmo that makes complex movements, such as lip synching, easier and more realistic.

NewTek, 1200 Executive Dr., Topeka, KS 66615; 913-228-8000; fax 913-228-8099; www.newtek.com
Circle (286) on Free Info Card

www.americanradiohistory.com

System 2000 Hytron battery
Anton/Bauer

• Digital HyTRON battery: the latest addition to the InterActive 2000 system for portable power; the lightweight HyTRON battery features new cell technology making it possible to safely and reliably address the HyTRON's advanced nickel metal hydride cells that require precise controls; the HyTRON batteries are compatible with existing late-model Logic Series chargers and the InterActive 2000 PowerChargers (with a simple software update).

Anton/Bauer, One Controls Dr., Shelton, CT 06484; 203-929-1100; fax 203-929-9935
Circle (256) on Free Info Card

Video windowing system
Miranda

• Screen-16: a PC-based high-quality video windowing system that displays up to 16 real-time uncompressed video windows simultaneously; designed for analog and digital video applications, both modules automatically detect 525- and 625-line formats; the windows can be positioned, overlapped and independently sized using a built-in resizing filter that allows for consistently superior video quality; Screen-16 comes bundled with the Video Display software library so you can tailor your own applications.

Miranda, 2323 Halpern, St-Laurent Quebec, Canada H4S 1S3; 514-333-1772; fax 514-333-9828; www.miranda.com
Circle (270) on Free Info Card

Digital audio signal analyzer
Scheck Audio/Alphaton

• DA-1000: a small-sized testing unit for digital audio signals and transmission lines; 25 LED indicators simultaneously display channel status, sampling frequency, errors and power supply status; it includes AES/EBU input and S/PDIF input with sampling frequencies between 25kHz and 55kHz; the DA-1000 features a high-quality 18-bit D/A converter that allows stereo signal monitoring through headphones or even sensitive loudspeakers; it can be powered by standard batteries or rechargeable batteries, when you connect an AC adapter, it recharges automatically without operation interrupts.

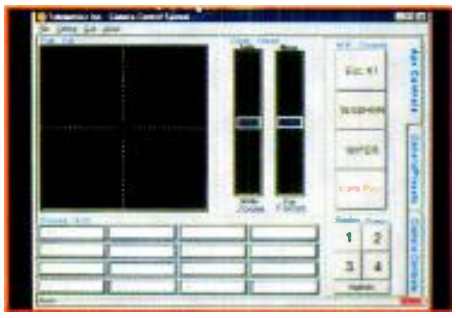
Scheck Audio GmbH, Ill. IndustriestraBe 5, D - 68804 AltuBheim, Germany, +49 62 05 35 22; fax +49 62 05 3 74 13; info@scheckaudio.com; www.scheckaudio.com
Circle (273) on Free Info Card

Panel mount feed-thru connectors
Bi-Tronics

A family of four-, six- and eight-pin mini-din panel-mount feed-thru (female to female) connectors that eliminate the need for in-field soldering; the connectors are offered as low-profile, flange-mounted connectors requiring three holes or a simple bulkhead-mount that requires the drilling of only one ½-inch D hole.

Bi-Tronics, 76 Main St., Tuckahoe, NY 10707; 800-666-0996; fax 800-569-4244
Circle (271) on Free Info Card

Camera control software
Telemetrics



• Telemetrics Control Panel Software (TM-CPS): an advanced camera control software for use with the Weatherproof Camera Robotics System; it provides complete remote operation of robotic functions for up to 44 individual units, as well as camera control functions; the software can be custom configured by Telemetrics to provide comprehensive control capabilities for each users' specific camera; the TM-CPS is an ideal control solution for traffic monitoring systems with multiple outdoor camera systems.

Telemetrics, 6 Leighton Place, Mahwah, NJ 07430; 201-848-9818; fax 201-848-9819
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Website: www.bvs.on.ca

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www.americanradiohistory.com

Comprehensive synchronization solution
Opcode Systems

• Studio 64 XTC: this product eliminates having numerous sync boxes in your facility by synchronizing virtually every recording device that you have; it provides accurate synchronization of analog or digital multitrack machine with PC-based and Mac-based hard-disk recording systems; with simultaneous Word-clock and Superclock outputs, Studio 64 XTC allows sample accurate sync of ProTools hard-disk tracks with many Word-clock capable digital recorders.

Opcode Systems, 3950 Fabian Way, Suite 100, Palo Alto, CA 94303; 415-856-3333; fax 415-856-0777; www.opcode.com
Circle (274) on Free Info Card

Lithium ion charger
IDX Technology

• KL-4: this lightweight battery charger was created for the IDX Technology's NP-L40 NP-shaped lithium ion batteries; the KL-4 weighs three pounds and uses a four-channel sequential cycle to dramatically reduce the cost; a four-channel simultaneous overnight charge is also possible and the simultaneous charges allows four NP-L40 lithium ion batteries to charge to 50% power in 30 minutes.

IDX Technology, 5466 Complex St., Suite 202, San Diego, CA 92123; 619-560-9779; fax 619-560-5075; www.idxtek.com
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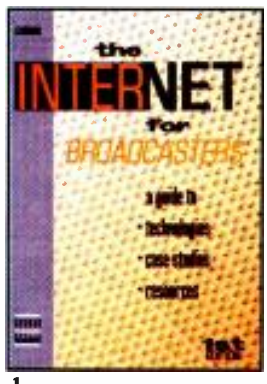

This first edition of an annual publication covers the effects of the Internet on broadcasting. The content includes technology and management articles, case studies, and a directory of Internet resources, which lists Web sites and email addresses for equipment suppliers, services, information sources, and organizations, as well as newsgroups and search facilities of interest to broadcast, video, and audio professionals. Softbound, 92 pp. ISBN #0-95178-267-3.

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DVD authoring brochure
Philips Electronics

• Mastering and Duplication — Authoring DVD: a free six-page color brochure that provides an overview of DVD and the processes used in creating it; topics covered include audio and video preparation/encoding, subtitling/disc definition, multiplexing, disc building and simulation, as well as channel encoding for DVD mastering.

Philips, 2099 Gateway Place, Suite 100, San Jose, CA 95110; 408-453-7373; fax 408-453-6444; www.philips.com/pkm/bumd/
Circle (277) on Free Info Card

Quick zoom added to Fujinon's AT2 lenses
Fujinon

A new quick zoom has been added to the AT2 family of ENG lenses—the A10X4.8EVM wide-power hand-held ENG lens, A15X8EVM hand-held ENG zoom lens and the A20X8EVM telephoto ENG zoom lens; in addition to Aspheric Technology and a new inner focusing system, the zoom function allows for simple and accurate focus setting; after a frame is shot, a push and hold of the quick zoom button initiates a fast zoom to the telephoto position and once the quick zoom button is released, the lens automatically returns to the initial frame position.

Fujinon, 10 High Point Dr., Wayne, NJ 07470; 800-553-6611 or 201-633-5600; fax 201-533-5216
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Worldwide timing reference generator
Videotek

• VSG-10: a video synchronizing generator for PAL and NTSC systems that provides three stable blackburst outputs for sync reference; the mode selection for PAL or NTSC standards and power source selection for 115 or 230VAC, 50/60 Hz are jumper selectable; using a standard IEC-320 power inlet, the VSG-10 has cord sets available for any country, and it is CE certified; the VSG-10 is also available as the VSG-10F for the Videotek OMNI-FRAME system that can mix and match up to 10 modules for sync and test generation, analog video and audio routing and distribution, and digital video distribution and transcoding.

Videotek, 243 Shoemaker Rd., Pottstown, PA 19464; 610-327-2292; 610-327-9295
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Routing switchers
Pesa Switching

• Ocelot family: a line of routing switchers built on basic 8x8 and 16x16 matrix sizes with modules designed to allow flexible customization; it can be configured with RS-232 or RS-422 serial interfaces; housed in a compact 1RU chassis, the modules can include an XY control panel on the front of the chassis; Ocelot is compatible with many third-party control products, and as many as seven Ocelot switchers can be addressed through a single RS-422 control port.

Pesa, 330A Wynn Dr., Huntsville, AL 35805; 800-328-1008 or 205-726-9200; fax 205-726-9271; www.pesa.com
Circle (280) on Free Info Card

Serial digital color corrector
AJ Technology

• Courtyard CY600D: this serial digital component video color corrector features an advanced digital processor that corrects for poor camera setups, picture-to-picture differences, lighting changes and incorrect recording levels; ideal for post-production and live applications, the Courtyard CY600D allows you to correct all serial digital component video signals from cameras, tape sources, still-stores and film-to-tape systems.

AJ Technology, 265 Otis St., West Newton, MA 02165; 617-969-0547; fax 617-969-3889
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Compact distribution amplifiers
Kramer Electronics

• VM-3 series:

high-quality distribution amplifiers that are small enough to fit in your pocket; the VM-3V and VM-3S (for S video) split a single input source into three identical outputs with no noticeable signal degradation in the signal; both amplifiers have a high bandwidth that exceeds 60MHz and both feature a signal-to-noise ratio of better than 70dB; the VM-3C offers these same features, as well as a composite video output allowing it to be used as Y/C to composite transcoder; the VM-3D is the smallest composite to Y/C converter on the market and features a built-in Y/C delay correction and maximal luminance bandwidth of 10MHz; it does not need a time base corrector to stabilize the composite source and can convert old composite material to Y/C at a high quality; the VM-33V is the smallest vertical interval switcher.

Kramer, 350 Main Rd., Montville, NJ 07045; 888-303-5600; kramerel@netvision.net.il
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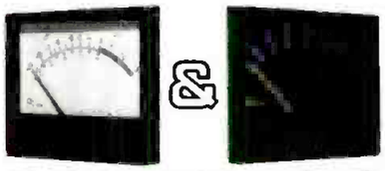

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- Dynamic fluid drag control
- Sliding/quick release camera platform
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- Counterbalance system compensates for nose heavy or tail heavy camera configurations and permits fingertip control of the camera throughout the tilt range.
- Includes independent pan and tilt locks, bubble level, dual pan handle carriers and integrated 75mm ball leveling

Miller 25-Series II Fluid Head

- 100mm ball level fluid head • Robust, lightweight low profile design
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- Multi-step fluid drag system and integrated counterbalance system provide ultra-smooth, repeatable pan-and-tilt fluid control and finger-tip camer balance for ENG camcorders, industrial CCD cameras or small studio cameras

#601-Lightweight Tripod

- Weighs 4.5 lbs., supports up to 30 lbs.
- Minimum height down to 24" maximum height to 57"
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- Fast, one turn, captive leg locks
- Includes 75mm (3") ball levelling bowl

#649-2-Stage Tripod

- Two extension sections on each leg. Operates at low levels as well as normal heights without the use of mini legs
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- Includes 75mm (3") ball levelling bowl

System 20 #338—Miller 20 Head, 601 Lightweight Tripod, On Ground Spreader

System 20 ENG #339—Miller 20 Head, 649 2-Stage Aluminum, On Ground Spreader

System 25 #500—Miller 25 Head, 611 Lightweight Tripod, On Ground Spreader

System 25 ENG #502—Miller 25 Head, 641 2-Stage Aluminum, On Ground Spreader

Vinten

Vision SD 12

Pan and Tilt Head with Serial Drag

The Vision SD 12 head features "Serial Drag" pan and tilt system. System consists of a unique, permanently-sealed fluid drag and an advanced lubricated friction drag. You achieve the smoothest pans and tilts regardless of speed, drag setting and ambient temperature.

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- Working conditions from as low as -40° up to +60°C.
- SD 12 weighs 6.6 lbs and supports up to 35 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 & spirally wound carbon fiber construction (Model #3523). They incorporate torque safe clamps to provide fast, safe & self-adjusting leg clamps

- "Torque Safe" requires no adjustment. Its unique design adjusts itself when required, eliminating 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 26", and support 45 lbs.
- #3513 weighs 6.5 lbs - #3523 CF (Carbon Fibre) weighs 5.2 lbs

Vision 12 Systems

Vision 12 systems include #3364-3 SD 12 dual fluid & lubricated friction drag pan/tilt head, single telescoping pan bar & clamp with 100mm ball base

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

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

VIN-5ST and VIN-10ST

- Compact & lightweight, they maintain Vision performance and quality.
- Provide total stability and durability with payloads up to 33 lbs.
- Ideal for the latest generation of dockable and one-piece camcorders.
- Compatible with all Vision accessories.

VIN-5ST includes Vision 5LF head, single stage toggle clamp tripod, spreader and soft case.

VIN-10ST includes Vision 10LF head, single stage toggle clamp tripod, spreader and soft case.

QUICK DIAL 74

Canon

IF+ Series 1/2-inch & 2/3-inch Zoom Lenses

Canon's IF+ family of lenses are engineered to meet the needs of the next generation of broadcasting while meeting the standards of today. Besides having the widest wide angle lens available, the IF+ lens series have wider angles at shorter M.O.D. (Minimum Object Distance), provide higher MTF performance and incorporate Hi-UD glass for reduced chromatic aberration. In addition to superb optics they're all designed with Canon's "Ergonomic Grip" for fatigue-free shooting over an extended time. IF+ lenses are your assurance of unsurpassed quality and performance for today and tomorrow.

J15ax8B

A next generation internal focusing lens with the shortest MOD and widest angle of any standard lens, the J15aX8B IRS/IAS is a standard ENG lens that lets you shoot in tight or restricted areas at the closest minimum object distance ever possible and capture more of the subject. It incorporates all the great features of IF+lenses including a built-in 2X extender, high MTF performance, Hi-UD glass, square lens hood and Canon's "Ergonomic Grip"

J20ax8B IRS/IAS

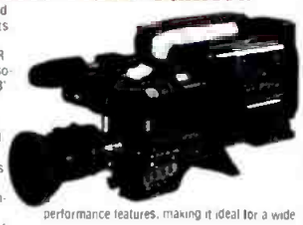
Excellent for ENG, sports and production, the J20aX8B IRS/IAS lets you squeeze in shots from 8mm and still take you all the way out to 320mm with its built-in extender. Incorporates all IF+ features, plus is the only lens (besides the J9aX5.2B IRS/IAS) with aVari-Polar lens hood, enabling rotation of attached filters.

JVC GY-X2B 3-CCD S-VHS Camcorder

- Newly designed three 1/2" CCD image sensors deliver 750 lines of horizontal resolution and superb signal-to-noise ratio of 62dB
- Micro-lens technology provides exceptional sensitivity of F8.0 at 2000 lux and LOLUX mode lets you shoot with almost no light! Shoot superb footage with excellent color balance at a mere 1.5 lux
- Variable Scan allows flicker-free shooting of a computer screen
- Full Time Auto White circuit lets you move from incandescent to fluorescent to outdoor lighting without changing white balance or the filter wheel.
- Quick Record Mode - when turned on the camera is set to the auto iris even if lens is set at manual. Also activates Automatic Level Control and Extended Electronic Iris which provides both variable gain and variable shutter. Shoot continuously from dark room to bright outdoors without having to adjust gain, iris or ND filter.
- Dual output system allows camera output to be connected directly to an external recorder

NEW! KY-D29 3-CCD Color Video Camera

One of the most sensitive cameras ever developed, the KY-D29 sets the standard for 3-CCD cameras and is also ideally suited for today's digital recording formats. With a sensitivity F11 at 2,000 lux, the KY-D29 can shoot in light as low as a remarkable 0.35 lux. It also offers a signal-to-noise ratio of 65 dB (with its DNR function on), and delivers 850 lines of horizontal resolution. The exceptional resolution and sensitivity of the KY-D29 are achieved by three new 760,000 pixel 2/3" interline transfer (IT) CCDs, the highest pixel count in the industry.



All-New Digital Signal Processing

- Advanced 14-bit Digital Signal Processing (DSP) and 3-dimensional Digital Noise Reduction (3D DNR) circuitry make this camera ideal for acquisition with todays popular digital formats, especially JVC's revolutionary new Digital-S
- DSP within the camera provides astonishingly crisp, high-quality images, while minimizing analog distortions and noise. DSP also makes the camera more flexible and easy to use. It even smooths the transitions between gain and white balance settings so that viewers won't notice sudden changes of settings while the tape is rolling.
- Digital signal processing is enhanced with new 3D digital noise reduction circuitry to make it even more practical. By mixing multiple frames to cancel out random noise, then using motion detection to minimize lag, JVC's exclusive 3-D DNR produces dramatic results, far superior to any other DSP camera.

Super LoLux for Extremely Low Light Shooting

- Incredible new Super LoLux technology allows you to obtain a broadcast-quality picture in light as low as 0.35 lux. This extraordinary low light capability is the best ever achieved, and is made possible by utilizing JVC's exclusive LoLux dual pixel readout technology (increasing gain by 6 dB without introducing noise) while at the same time doubling the pixel readout integration time to 1/30 second.

Versatile Docking Capability

- Extremely high quality 4:2:2 digital recordings can be made by docking the KY-D29 to JVC's Digital-S BR-D40 dockable recorder. This digital combo produces recordings far superior to any component analog camcorder or 4:1:1 digital camcorder. The KY-D29 also docks directly to JVC's BR-DV10 DV-format and BR-S422 S-VHS dockable recorders and can dock to Betacam SP recorders using an adapter.

Features for a Wide Range of Applications

- The KY-D29 is loaded with a wealth of high-performance features, making it ideal for a wide range of broadcast and professional applications. Built-in continuous auto black (CAB) continuously takes a black balance setting, and full-time auto white for continuous compensation of color temperature changes, balance the camera in real time, all the time. This allows you to concentrate on getting the shot, and not on adjusting the camera.
- Because different shooting situations require flexibility, the KY-D29 offers selectable vertical resolution. In the Standard Mode, the camera produces 380 TV lines of vertical resolution. However, in the "V-Plus" high vertical resolution mode, the camera puts out 420 TV lines of vertical resolution, allowing you to increase vertical resolution without sacrificing sensitivity or lag, while maintaining 850 TV lines of horizontal resolution.
- Focusing is easier than ever with Accu-Focus. By momentarily decreasing depth of field, fast & critical focus is achieved instantly.
- Commonly used features can be activated without having to scroll through layers of menus. Features such as shutter control, variable scan, Black Stretch, black compress, CAB, iris modes, Accu-Focus, DNR and zebra are all menu-free. And for those times when events move so fast it prevents you from making any settings whatsoever, the KY-D29's Full Auto Shooting (FAS) mode controls all of the camera's requiring you control only the focus, zoom and trigger.
- Other camera features include a built-in time/date, built-in zebra level selection switch, an f-stop display in the viewfinder, and a "battery remaining" display for Anton Bauer battery packs. A special Black

Panasonic

Broadcast & Television Systems

AG-DP800H SUPERCAM

S-VHS 3-CCD Digital Signal Processing Camcorder

- Three high-density 380,000 pixel CCDs with half-pitch pixel offset achieves 750 lines of horizontal resolution, S/N ratio of 60dB and sensitivity of f8 at 2000 lux. Additionally the Frame Interline Transfer (FIT) CCDs minimize vertical smear even in very bright illumination
- Digital Signal Processing circuitry provides four valuable benefits
  1) Consistently reliable up-to-spec performance.
  2) Fine adjustment of a wide range of parameters.
  3) Memory storage and instant recall of specific settings.
  4) More flexible and higher quality image processing, easier maintenance.
- Super High Gain mode allows shooting under illumination as low as 2 lux while retaining detail and color balance
- Synchro Scan function allows flicker-free shooting of computer monitors. Electronic shutter increments can be set variably from 1/61 seconds to 1/253 of a second.
- Built-in internal time code generator lets you record with SMPTE LTC/VITC (Longitudinal/Vertical Interval) time code
- Two Hi-fi stereo audio channels with a dynamic range of 80 dB, as well as two linear audio channels with Dolby NR.
- Has a 26-pin connector for convenient backup recordings using an additional VCR equipped with a 26 or 14-pin connector
- Phantom power can be supplied to an optional mic. Power can be switched off to prevent battery drain when not in use

wDP-800H "LS" Package:
- DP-800H Supercam 3-CCD camera head with 1.5" electronic viewfinder and Anton Bauer Gold Mount battery plate
- Fujinon S14x7.5 BRM 14:1 servo zoom lens
- CC-S800 soft carrying case
- WV-QT700 tripod mounting plate

DP-800H "XL" Package:
- DP-800H Supercam 3-CCD camera head w/1.5" electronic viewfinder and Anton Bauer Gold Mount battery plate
- Fujinon S14x7.5 BRM 14:1 Servo zoom lens
- CC-H800 Thermodyne hard shell carrying case
- WV-QT700 tripod mounting plate
- Two Anton Bauer Digital Trimpack 14 batteries
- Anton Bauer 2-position quick charger

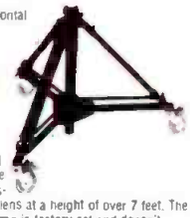
QUICK DIAL 72

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

Libec MATTHEWS

P100 Portable Pneumatic Pedestal

The P100 is a small size pedestal that offers great flexibility without taking up too much space. Featuring an advanced air pressure system, the P100 smoothly handles loads up to 66lbs., easily accomodating professional cameras used in a studio. Ideal for CATV, small studios, event and wedding video as well as all kinds of industrial and institutional applications.

Air Pressure System:
- Air pump attached to the main body frame allows air to be pumped into a column anywhere and anytime – even while a camera is mounted on the pedestal. This allows you to check and adjust the air pressure while using the pedestal and avoid over-filling of air.
- Air pressure can be gradually adjusted by discharging air through a bleed valve when too much air has been pumped into the column. There is also a relief valve that automatically lets air out when air pressure inside the column exceeds the uniform value, bringing it below the uniform value.
- Large double wheel 5" casters allow the P100 to move smoothly and quickly. Wheels and caster axles are easily fixed by the double stopper system.
- A track lock mechanism locks the wheels of the pedestal so that it only moves in a desired position.
- Cable guards prevent the casters from rolling over and becoming tangled in camera cables when the tripod is moved around in a studio.
- Large steering wheel affords greater ease in handling when shifting columns up and down or when moving the pedestal.
- Maximum and minimum height is 31" to 61". By attaching the optional LA-100 Low Angle Adapter to the dolly for shooting at low angles. (Height from the ground to mount is only 10").
- The column and dolly can be quickly disassembled for convenient transport. The column weighs 18 lbs. and the dolly 16 lbs.

H80 Professional Fluid Head

A premium fluid head, the H80 incorporates a patented drag control system that provides the smoothest pan and tilt available.
- Unlike conventional drag systems that have click stops at predetermined points, Libec's Continuous Drag Control System provides infinite control of drag tension allowing smooth, rapid movements as well as very slow movements.
- Continuous Counter Balance Control System provides optimum camera balance with tilt angles of + 90° or -90°
- Designed to withstand the most demanding environments, the H80 is fully operational even in temperatures as low as -22°F.
- H80 supports up to 37 lbs. and has a 100mm claw-ball to simplify camera leveling

H70 Professional Fluid Head

The H70's patented counter balance mechanism supports various operating configurations including stand-alone cameras, camcorders and studio cameras with large viewfinders. Perfect balance can be obtained with settings from 0 to 3, depending on camera weight (from 15 to 33 lbs.) and tilt angle.
- Sliding balance plate features a locking mechanism and allows a total of 4" (100mm) of travel for camera balance. Has a 100mm claw ball.

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B&H PHOTO - VIDEO - PRO AUDIO

QUICK DIAL 70

NRG

POWER VEST SYSTEM

The Power Vest combines the comfort and convenience of a photo-journalist style vest with the power of NRG's highest capacity power belt. Available in two styles, the **Field** model is designed for use in a field production environment while the **Event** model is for shooting events where style is everything. The Field model is ruggedly constructed from black high density weatherized ballistic nylon and has an open-cut style that makes it comfortable to wear in a variety of climates. Also has a highly adjustable design to fit almost any physical proportion.

- Internal and external pockets for blank tapes and accessories, a clear insert window for a press pass or business card, D-rings for cables and microphones, and an integral padded camera rest on the right shoulder.
- Cleverly concealed inside the vest is your choice of 12-volt 86 watt hour or 13.2-volt 95 watt hour nicad cell packs.
- A control box on the front features dual power outputs (dual cigarette, plus XLR or mixed).
- 7-stage "fuel-gauge", charge status indication and auto-reset short/overload protection.

The **Event** model is very similar to the **Field** except in place of rugged fabric and pockets it features shoulder to sternum black satin tux fabric. Worn under a suit coat, the **Event** model is indistinguishable from a formal dress vest and it still retains interior and low-profile exterior pockets. Both vests include 300-series charger (12 hrs.) and can be used with the optional Intelliquick Fast Charger (1 hrs.).

POWER CAN SERIES

For powering single or multiple pieces of 12v DC equipment for extended periods of time, nothing beats the power and convenience of NRG's Power-Can Series. It integrates an ultra-high capacity, high-discharge capable UPS type lead acid power cell, a world-wide fast charger, and computer controlled monitoring system with display—in a single, rugged package. Connect up to four pieces of equipment simultaneously. From a midnight emergency scene to a wedding reception in the park, the Power-Can delivers ample power for extended running time.

- Recharge in 8-10 hours by simply plugging the Power-Can into any source of AC power (90-250v AC).
- LCD display shows discharge/charge status, voltage etc.
- An optional "Power Dolly" allows the Power-Can to be rolled for easy transport.
- Available in 18, 28 and 40 amp versions, each Power-Can has either four cigarette lighter connectors, four 4-pin XLR connec-

HORITA

BSG-50

Blackburst/Sync/Tone Generator

The BSG-50 provides an economical means for generating the most common RS-170A video timing signals used to operate various video switchers, effects generators, TBCs, VCRs, cameras and video editing controllers.

- 6 BNC video/pulse outputs
- Now available, 6 blackburst, 4 sync, 2 subcarrier
- Each sync output individually settable for composite sync, composite blanking, H-drive, or V-drive.
- Separate buffer for each output–maximum signal isolation
- 1KHz 0dB sinewave audio tone output, locked to video
- Outputs can easily be configured to meet specific user and equipment needs. $269

CSG-50

Color Bar/Sync/ Tone Generator

- Generates full/SMPTE color bars, blackburst and composite sync signals.
- Built-in timer can automatically switch video output from color bars to color black after 30 or 60 seconds. Easy and convenient for producing tape leaders and striping tapes with color bars and black.
- Front panel selection of full-field or SMPTE color bar patterns or color black (blackburst) video output.
- Includes crystal-controlled, 1KHz, 0dB audio tone output.
- Outputs: video, sync, ref frame, 1 KHz, 0dB
- Audio tone switches to silence and color bars change to black when using 30/60 second timer.
- Fully RS-170A SC/H phased and always correct. No adjustment required. $349

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

WG-50 -	Window Dub Inserter
TG-50 -	Generator/Inserter
TRG-50 -	Generator/Inserter/Search Speed Reader
TRG-50PC -	Has all of the above plus RS-232 control.
VG-50 -	VITC Generator. LTC-VITC Translator
VLT-50 -	VITC-To-LTC Translator
VLT-50PC -	VITC-To-LTC Translator / RS-232 Control
RLT-50 -	Hi8 (EVO-9800/9850)TC to LTC Translator
TSG-50 -	NTSC Test Signal Generator
SCT-50 -	Serial Control Titler "Industrial" CG. Time-Data Stamp. Time Code Captioning
SAG-50 -	Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

QUICK DIAL 72

GLIDECAM INDUSTRIES

V-16 AND V-20

Professional Camera Stabilization Systems

The GLIDECAM V-16 and V-20 Camera Stabilization Systems allow you to walk, run, go up and down stairs, shoot from moving vehicles and travel over uneven terrain without any camera instability or shake. Designed primarily for professional video and 16mm motion picture cameras, the Glidecam V-16 stabilizes cameras weighing from 10 to 20 pounds and the V-20 from 15 to 26 pounds. They are both perfect for shooting the type of ultra-smooth tracking shots that take your audience's and client's breath away – instantly adding high production value to every scene. With either of the "V" series stabilizers you'll be able to offer the type of professional shooting techniques that were previously available only to clients with full budgets. Whether you are shooting commercials, industrials, documentaries, music videos, news, or full length motion pictures, the Glidecam "V" series will take you where few others have traveled.

The Glidecam Support Vest

The lightweight and comfortable Support Vest can be adjusted to fit a wide range of operators. High endurance, closed cell, EVA foam padding and integral T6 aluminum alloy create a vest which can hold and evenly distribute the weight of the Glidecam V-16 and V-20 msystem across the operator's shoulders, back, and hips. For safety, quick release, high impact buckles allow the vest to be removed quickly.

The Three Axis Gimble

A free floating, precision Gimble incorporating Integrally Shielded Bearings creates the super-smooth and pivotal connections between the front end of the Dyna-Elastic Arm and the Camera Mounting Assembly. The Three Axis Gimble provides the operator with finger tip control over fluid tilting, panning and rolling. A locking mechanism allows the Gimble to be placed at varying positions on the Central Support Post. Moving the Gimbie effectively adjusts the Systems Center of Gravity. The upper portion of the Sled's central support post includes guide markings. These markings allow for accurate gimble positioning.

The Dyna-Elastic Arm

The Exoskeletal, Dyna-Elastic Support Arm is designed to counteract the weight of the combined camera and Camera Mounting Assembly by employing high carbon alloy springs. The arm may be boomed up and down, as well as pivoted in and out, and side to side. It is the combined booming and pivoting action of the arm which creates the shock absorption necessary for ultra-smooth camera movement and mobility. The spring force is field adjustable to allow for varying camera weights. For safety, a Dual-Spring design is employed to reduce spring failure damage.

QUICK DIAL 74

lowel

ViP Video Lighting System

Designed for video, ViP systems provide 55 to 500 watt capabilities, powered by AC or DC. Mount one on-camera, on-stand, or hand hold it. Some ViPs feature adjustable beam angles. All are light weight and convention cooled.

V-light

Efficient enough to light a small room yet small enough to fit in a large pocket, the V-light provides a broad key light, back light or fill light (with umbrella or gel).

- Extreme wide-angle multi-use halogen source
- Mounts on stand, clamps, boom, wall, window, door-top
- 500 watt, AC powered (lamps not included)

i-light

Battery powered light provides excellent fill light, eye-light, or high-lights, with good contrast control for news and documentary shooting.

- Small and lightweight (18 oz.) for on camera use
- Multi-use 6:1 focusing range with i-100 lamp (lamps not included)
- 55 or 100 watt (12/14 volts DC)
- Includes cig. lighter connector or optional 4-pin XLR

Pro-light

Can be used as a low-level key or accent light, fill light (w/diffusion), backlight or background light.

- Multi-use halogen, focusing/tilting controlled with one hand.
- 125 or 250 watt AC, 100 watt 12 volt, or 200 watt 30 volt DC
- Optional cigarette, 4-pin and 5-pin XLR connectors
- Lamps not included.

Complete line of Lowel lights, lighting kits and accessories in stock...Call

Tota-Light

Provides a base or bounce light, backlight, or background light. Use it with an umbrella or gel frame with a diffusion kit. It is an ideal fill light or small soft key or illumination for copy work.

- Multi-use halogen source with 360° no-yoke tilting
- Choice of 300, 500, 650, or 750 watt AC lamps (not included)
- Gull-wing reflectors close compactly for storage and travel

Omni-Light

Produces the ideal key or back-light, and with diffusion or an umbrella, it becomes a great soft fill source. With accessories, hand-hold the Omni, camera mount it, or choose from a wide variety of mounting systems.

- Multi-use halogen source provides a non-crossover beam
- Choice of optional quick-change Super-Spot Reflector for exceptionally long throws at all voltages
- Choice of lamps: 420 or 500 watt 120v AC; 650 watt 220/240v AC; 250 watt 30 volt DC; 100 watt 12 volt DC (lamps not included)

DP System

Only 3.9 pounds the DP Light offers a very powerful key, backlight, or background light with or without diffusion. When used with its umbrella or diffusion it provides a soft key, fill, or side light. It includes a #1 reflector for an 8:1 focusing range and a large cool-operating hand grip and knobs.

- Multi-use halogen source with 170° no-yoke tilting
- Choice of 500, 750, or 1000 watts 120 volts; 650 or 1000 watts 220/240 volts (Lamps not included).

anton bauer

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 ultimate professional video battery and 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. It's size and weight creates perfect shoulder balance with all 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

DIGITAL TRIMPAC

Extremely small and light weight, the Digital Trimpac still has more effective energy than two NP style slide-in batteries. High voltage design and Logic Series technology eliminate the problems that cripple conventional 12 volt slide-in type batteries. The professional choice for applications drawing less than 24 watts.

- **DIGITAL TRIMPAC 14 LOGIC SERIES NICAD BATTERY**
  14.4 v 43 Watt Hours, 2 3/4 lbs. Run time: 2 hours @ 20 watts. 3 hours @ 13 watts.

InterActive 2000 Power/Chargers

QUAD 2702/2401

Four-Position Power/Chargers

The lightest (and slimmest) full featured four position chargers ever. They can fast charge four Gold Mount batteries and can be expanded to charge up to eight. They also offer power from any AC main: all in a package the size of a notebook computer and weighing a mere four lbs! The 40 watt 2401 can charge ProPacs in two hours and TrimPacs in one. Add the Diagnostic/ Discharge module and the QUAD 2401 becomes an all purpose power and test system. The 70 watt QUAD 2702 bundles all Power/Charger features in the ultimate professional power system.

Dual 2702/2401

Two-Position Power/Chargers

The DUAL 2701 (70 watt) and 2401 (40 watt) are sleek, rugged and economical two position Power/Chargers that have all the features of InterActive 2000 technology including DC camera output and LCD display. The DUAL 2701 will charge any Gold Mount battery in one hour, the DUAL 2401 charges ProPac batteries in two hours and Trimpacs in one. Their compact, lightweight package design makes them the ultimate travel Power/Chargers. They can also be upgraded with the Diagnostic/Discharge Module and/or with the Expansion Charge Modules to charge up to six batteries of any type.

PROFESSIONAL VIDEO TAPES

QUICK DIAL 71

fuji

Professional Grade VHS

PG-30	2.29	PG-60	2.49	PG-120	2.69

Superior Grade Double Coated VHS

SG-30	3.39	SG-60	3.99	SG-120	4.49

H471S S-VHS Double Coated

ST-30	6.99	ST-60	7.49	ST-120	7.99

M221 Hi 8 Double Coated

Metal Particles			Metal Evaporated		
P630HMP	4.99		E630HME	8.39	
P660HMP	6.49		E660HME	10.49	
P6120HMP	8.49		E6120HME	13.99	

M321SP Metal Betacam (Box)

05S	17.95	10S	18.49	20S	19.95
30S	22.95	60L	31.95	90L	49.95

DP121 DVC PRD

12M (Med.)	8.29	23M	9.99	33M	12.99
63M	22.49	64L (Lg.)	23.99	94L	34.99
123L					46.99

maxell

HiB Metal Particle (XRM)

P6-120 XRM	6.59

Broadcast Quality HiB Metal Particle

P6-30 HM BQ	5.39	P6-60 HM BQ	6.09
P6-120 HM BQ			7.99

P/I PLUS VHS

T-30 Plus	1.69	T-60 Plus	1.99	T-90 Plus	2.09
T-120 Plus		2.19	T-160 Plus		2.69

HGX-PLUS VHS (Box)

HGXT-60 Plus	2.69	HGXT-120 Plus	2.99
HGXT-160 Plus			3.99

BQ Broadcast Quality VHS (Box)

T-30 BQ	5.49	T-60 BQ	6.19	T-120 BQ	7.39

BQ Professional S-VHS (In Box)

ST-31 BQ		7.19	ST-62 BQ		8.09
ST-126 BQ		8.39	ST-182 BQ		17.49

Betacam SP

B5MSP	15.75	B10MSP	17.75	B20MSP	19.75
B30MSP	20.50	B60MLSP	29.75	B90MLSP	46.49

Panasonic

Mini DV Tape

AY DVM-30	9.95	AY DVM-60	11.99

DVCPRO

AJ-P12M (Medium)	10.99	AJ-P23M	12.99
AJ-P33M	15.99	AJ-P63M	29.99
AJ-P64L (Large)	29.99	AJ-P94L	49.95
AJ-P123L			64.95

SONY

Hi-8 Professional Metal Video Cassettes

P6-30 HMPX	4.59	P6-30 HMEX	7.99
P6-60 HMPX	6.59	P6-60 HMEX	11.49
P6-120HMPX	8.89	P6-120HMEX	15.49

Hi-8 Metal Evaporated Editor (HMEAD)

E6-30 HMEAD	10.49	E6-60 HMEAD	14.89
E6-120 HMEAD			20.19

PR Series Professional Grade VHS

T-30PR	2.39	T-60PR	2.59	T-120PR	2.79

PM Series Premier Grade Professional VHS

T-30PM	3.49	T-60PM	3.99	T-120PM	4.79

BA Series Premier Hi-Grade Broadcast VHS (In Box)

T-30BA	3.59	T-60BA	3.99	T-120BA	4.79

MQ Master Quality S-VHS (In Box)

MQST-30	7.49	MQST-60	7.99	MQST-120	8.39

BRS 3/4" U-matic Broadcast Standard (In Box)

KCS-10 BRS (mini)	8.29	KCS-20 BRS (mini)	8.99
KCA-10 BRS	8.19	KCA-20 BRS	8.69
KCA-30 BRS	9.69	KCA-60 BRS	13.39

XBR 3/4" U-matic Broadcast Master (In Box)

KCS-10 XBR (mini)	8.79	KCS-20 XBR (mini)	10.19
KCA-10 XBR	9.29	KCA-20 XBR	10.69
KCA-30 XBR	11.99	KCA-60 XBR	15.69

KSP 3/4" U-matic SP Broadcast (In Box)

KSP-S10 (mini)	9.59	KSP-S20 (mini)	11.09
KSP-10	10.09	KSP-20	11.59
KSP-30	12.99	KSP-60	16.99

BCT Metal Betacam SP Broadcast Master (Box)

BCT-5M (small)	14.99		BCT-10M (small)		15.99
BCT-20M (small)	17.99		BCT-30M (small)		18.99
BCT-30ML	21.49	BCT-60ML	27.99	BCT-90ML	41.99

Mini DV Tape

DVM-30EXM w/Chip	15.99	DVM-60EXM w/Chip	19.95
DVM-30EX "No Chip"	12.95	DVM-60EX "No Chip"	14.99
DVM-30PR "No Chip"	9.95	DVM-60PR "No Chip"	12.95

Full Size DV Tape with Memory Chip

DV-120MEM	29.95	DV-180MEM	34.95

PVD Series Professional DVCAM Tape

PDVM-12ME (Mini)	24.50	PDVM-22ME (Mini)	26.95
PDVM-32ME (Mini)	29.50	PDVM-40ME (Mini)	31.95
PDV-64ME (Standard)	39.95	PDV-94ME (Standard)	44.95
PDV-124ME (Standard)	49.95	PDV-184ME (Standard)	59.95

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Panasonic

WJ-MX50 Digital A/V Mixer

- Four input switcher and any two sources can be routed to the program busses
- Two-channel digital frame synchronization permits special effects in each A/B bus
- Combination of 7 basic patterns and other effects creates 287 wipe patterns
- External edit control input for RS-232 or RS-422 serial controls. Also has GPI input.
- Wipe boundary effects: soft/border (bold, 8 background colors available)
- Digital effects: strobe, still, mosaic, negative/ positive, paint, monochrome, strobe, trail, and AV synchro
- Real-Time compression - entire source image is compressed inside a wipe pattern
- "Scene Grabber" – move a pattern while upholding the initially trimmed-in picture integrity.
- Non Additive Mix (NAM): selects between A and B sources, passing only the signal with the highest luminance value.
- Fade-in and fade-out video, audio, titles individually or synchronously faded.
- Down stream keyer with selectable sources from character generator or external camera
- Eight separate memories enable instant recall of frequently used effects
- 8 preset effects including: Mosaic Mix, Position Stream, Corkscrew, Bounce, Flip, Shutter, Vibrate, and Satellite.
- Audio mixing capability of 5 sources with 5 audio level adjustments.

BT-S1360Y

13˝ Color Video Production Monitor

The BT-S1360Y is a full-function, professional 13˝ production monitor with a wealth of features. They include, superb 420-line horizontal resolution, S-Video input and output, advanced automatic white balance circuitry, blue-only mode, underscan and pulse-cross. All this, housed in a rugged, rack mountable metal-hybrid cabinet. So, for long-term reliability in any professional application, the BT-S1360Y is the ideal choice.

- Incorporates advanced, proprietary white balance circuitry that stabilizes white balance to provide outstanding picture performance automatically.
- S-Video input and advanced video circuit technology provides a remarkably sharp picture with over 420 lines of horizontal res
- External sync inputs and outputs provide for synchronization with other equipment fed with the same sync signal.
- Blue Only mode plus Chroma selection provide a monochrome image for fine adjustment of contrast, brightness, chrominance & hue.
- Pulse Cross – displays horizontal and vertical intervals at the center of the screen so you can examine data in the blanking area and also sync/burst timing
- Two sets of video/audio inputs and outputs.
- Underscan –shrinks the scanned area of the picture tube approximately 5% enabling the entire active picture area to be displayed. Lets you detect intruding cameras and mike booms.
- Switchable color temperatures of 6500°K (broadcast standard) or 9300°K (for pleasing picture).
- Built-in speaker and headphone jack.
- Rack-mountable with optional BA-131 brackets

BT-S 1360Y Olympic Demo Special!

We have a limited stock of BT-S1360Y monitors that were used by Panasonic exclusively at the 1996 Olympics in Atlanta. Used only by Panasonic engineers in broadcasting the summer games, these monitors are like new.

Demo Special $599

($400 less than our regular selling price on this monitor)

SONY

PVM-14N1U/14N2U & 20N1U/20N2U

13" & 19" Presentation Monitors

With high quality performance and flexibility, Sony's presentation monitors are ideal for any environment. They use Sony's legendary Trinitron CRT and Beam Current Feedback Circuit for high resolution of 500 lines as well as stable color reproduction. They also accept worldwide video signals, have a built-in speaker and are rack mountable. Four models, the PVM-14N1U/20N1U are designed for simple picture viewing, the PVM-14N2U and 20N2U add RGB input and switchable aspect ratio for more sophisticated applications.

They Feature:

- 500 lines of resolution to match DV, DVCAM and DVCPRO recording capabilities
- Beam Current Feadback for color temperature stability
- They handle four worldwide color systems: NTSC, NTSC 4.43, PAL, and SECAM.
- On screen display in five languages. Picture adjustments (chrome, phase, contrast, brightness) and setup adjustments (volume, aspect ratio) are displayed as easy-to-read on screen menus.
- Built-in speaker for small audiences without the expense of an external sound system.
- Closed captioning is available with the optional BKM-104 Caption Vision Board.
- Designed with a sturdy metal cabinet for stability, durability and rack mounting. The 13-inch series mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 19-inch monitors with the SLR-103A Slide Rail Kit.
- **PVM-14N2U/20N2U Only:**
- Remote Control (Last Input Switch) - Contact closure remote control allows you to wire a remote to an existing system so that the monitor's input can be remotely controlled to switch between the last previously selected input and the current input.
- With the PVM-14NU2 and PVM-20N2U Series, the aspect ratio is switchable between 4:3 and 16:9 simply by pressing a button.

PVM-14M2U/14M4U & 20M2U/20M4U

13" & 19" Production Monitors

Sony's best production monitors ever, the PVM-M Series provide stunning picture quality, ease of use and a range of optional functions. They are identical except that the "M4" models incorporate Sony's state-of-the-art **HR Trinitron** CRT display technology and have SMPTE C phosphours instead of P22.

- HR Trinitron CRT enables the PVM-14M4U and 20M4U to display an incredible 800 lines of horizontal resolution. The PVM-14M2U and 20M2U use an aperture grille dot pitch of 0.25mm to offer 600 lines of resolution. M4 models also use SMPTE-C phosphours for the most critical evaluation of any color subject.
- Dark tint for a higher contrast ratio (black to white) and crisper, sharper looking edges.
- Beam Current Feadback Circuit • 4:3/16:9 switchable aspect ratio.
- Each has two composite (BNC), one S-Video and component input (R-Y/B-Y, analog RGB) for flexibility. For more accurate color reproduction, the component level can be adjusted according to the input system. Optional serial digital interface kit BKM-101C (video) and BKM-102 (audio) for SMPTE 259M component serial digital input
- True multi-system monitors they are equipped to handle four color system signals: NTSC, NTSC 4.43, PAL, and SECAM.
- External sync input and output for synchronization with other equipment. Can be set so that it will automatically switch according to the input selected.
- Switchable color temp: 6500K (broadcast), 9300K (pleasing picture). User preset.(3200K to 10000K).
- Underscan and H/V delay capability. In underscan mode the entire active picture area is displayed, allowing you to view the entire image and check the picture edges. H/V delay allows viewing of the blanking area and sync/burst timing.
- Using color bars as a reference, Chroma/Phase setup mode facilitates the complex, delicate procedure of monitor adjustment. Especially convenient when used with computer-based editing systems.
- On-screen menus for monitor adjustment/operation.
- Parallel remote control and Tally via 20-pin connector.
- Sub control mode allows fine, on-screen adjustment of the center "detent" value of the contrast, brightness, chroma and phase knobs.
- PVM-14M2U/M4U mount in a 19-inch rack with the MB-502B Rack Mount Bracket. The 20M2U/M4U monitors mount with the SLR-103A Slide Rail Kit.

SENNHEISER

Condenser Microphones

Unlike traditional condenser microphones, the capacitive transducer in Sennheiser condenser microphones is part of a tuned RF-discriminator circuit. Its output is a relatively low impedance audio signal which allows further processing by conventional bi-polar low noise solid state circuits. Sennheiser microphones achieve a balanced floating output without the need for audio transformers, and insures a fast, distortion-free response to audio transients over an extended frequency range. The RF-design yields exceptionally low noise levels and is virtually immune to humidity and moisture. The comparatively low RF-voltage across the elements of the transducer also eliminates arcing and DC-bias creeping currents. Sennheiser employs RF-technology to control residual microphone noise. Optimizing the transducer's acoustic impedance results in a further improvement in low noise performance. Sennheiser studio condenser microphones operating according to this RF-principle have proven their superior ruggedness and reliability in the past decades under every conceivable environmental condition.

MKH 40 P48U3

Cardioid

- Highly versatile, low distortion push-pull element.
- Transformerless RF condenser, high output level.
- Transparent response, switchable proximity EQ. Recommended for most situations, including digital recording, overdubbing vocals, percussive sound, acoustic guitars, piano, brass and string instruments, Mid-Side (M-S) stereo, and conventional X-Y stereo. Vocals when used with a pop-screen.

MKH 60 P48U3

Short Shotgun

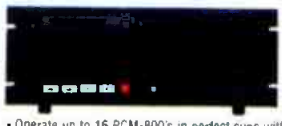
- Short interference tube RF condenser.
- Lightweight metal alloy, transformerless, low noise, symmetrical capsule design.
- Smooth off-axis frequency response. Handles extremely high SPL (135 dB), ideal for broadcasting, film, video, sports recording, interviewing in crowded or noisy environments. Excellent for studio voiceovers.

Digital Multi-Track Recording

TASCAM DA-88

- ATF system ensures no tracking errors or loss of synchronization. All eight tracks of audio are perfectly synchronized. It also guarantees perfect tracking and synchronization between all audio tracks on all cascaded decks - whether you have one deck or sixteen (up to 128 tracks!)
- Incoming audio is digitized by the on-board 16-bit D/A at either 44.1 or 48KHz. The frequency response is flat from 20HZ to 20KHz while the dynamic range exceeds 92dB.
- Execute seamless Punch-ins and Punch- outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into tight spots. You can even delay individual tracks to generate special effects or compensate for poor timing.

SONY PCM-800



- Flawless sound quality, outstanding reliability and professional audio interfacing with AES/EBU digital I/O and XLR analog I/O connections.
- Combines audio functions such as precise auto punch in/out digital cross fade technology, external synchronization with SMPTE/EBU time code and selectable sampling frequencies of 44.1 and 48kHz.
- Shuttle dial for precise tape control, variable speed playback of 6% in 0.1% increments and a flat frequency response from 20Hz to 20kHz.
- Operate up to 16 PCM-800's in perfect sync with optional RCC-S1 sync cables,for up to 128 channels of digital audio recording.
- Optional OABK-801 Sync Board provides SMPTE/EBU time code generation and chase sync. It locks to the incoming time code with subframe accurate offset— ideal for audio-follow-video applications. Also synchronizes to external video reference signal.
- Optional RM-D800 provides comprehensive remote control over all PCM-800 functions. The RM-D800 can control up to six units for up to 48 channels of digital audio.

ALESIS adat xt

8-Track Digital Audio Recorder

An incredibly affordable tool, the ADAT-XT sets the standard in modular digital multitrack recording. With new features and enhanced capabilities, the ADAT-XT operates up to four times faster than the original ADAT, offers an intelligent software-controlled tape transport and provides onboard digital editing and flexible autolocation.

- Onboard 10-point autolocate system provides quick access to multiple tape locations. Four specialized locate points make your recording sessions quicker and easier.
- Includes remote control with transport and locate functions, offers a footswitch jack for hands-free punch-in.
- Advanced transport software continuously monitors autolocation performance and the head constantly reads ADAT's built-in sample-accurate time code—even in fast wind modes.
- Dynamic Braking software lets the transport quickly wind to locate points while gently treating the tape.
- Servo-balanced 56-pin ELCO connector operates at +4dB to interface with consoles with +4 dB bal/unbal inputs/outputs. Also unbalanced -10dB inputs/outputs (phono connectors).
- Has an electronic patch bay built-in so it can be used with stereo and 4-bus consoles.
- Make flawless copy/paste digital edits between machines or even within a single unit. Track Copy feature makes a digital clone of any track (or group of tracks) and copies it to any other track (or group) on the same recorder. This allows you to assemble composite tracks for digital editing.

ANTEX StudioCard

4-Channel Digital Audio Card for Windows

The next generation in digital audio for the desktop. StudioCard is a premium-quality digital audio adapter with advanced features. Studio-quality specs and professional connections. Unmatched in quality, flexibility and expandability, it features 4 tracks of audio sound and real-time digital mixing capability,making it the ideal board for musicians who want digital multitracking and mixing on their PC, or producers looking for a versatile board for post-production digital audio editing and uncompromised audio quality. StudioCard is Windows 95˝ plug and play compatible plus includes drivers for Windows NT as well.

- Key to StudioCard's amazing sound is the marriage of a low noise analog I/O section and high quality A/D and D/A converters. A PCI-based 32-bit memory mapped board, it delivers less than 0.003% total harmonic distortion and 92dB dynamic range. Plus, a PLL-based sample clock generator that can be locked to an assortment of clock sources.
- Incorporates a Programmable 32-bit 40 MHz DSP and pro connections like 4 independent balanced analog I/Os (+4dBu or -10 dBV) and AES/EBU or S/PDIF digital I/O. It also offers a MIDI port with deep buffers and time stamping. No matter which type of equipment you have StudioCard will integrate into standard studio environments.
- Compatible with film, video or MIDI. StudioCard offers synchronization via SMPTE, MTC, word and pixel clocks, and composite video. Plus, the StudioCard not only reads SMPTE timecode, but generates it as well.
- Unique to the Antex design is StudioCard's multiple adapter capability. This means you can install multiple StudioCards in a single computer for up to 16-track recording. Start with one StudioCard today - add more StudioCards tomorrow. Also included is an on-board SPx expansion connector for plugging in optional daughtercards for compression or enhanced DSP operations.

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KNOX VIDEO

RS4x4/8x8/16x16/16x8/12x2

Video/Audio Matrix Routing Switchers

Knox's family of high performance, 3-channel routing switchers are extremely versatile, easy-to-use and very affordable. Housed in an ultra-thin rackmount chassis they accept and route (on the vertical interval) virtually any video signal, including off-the-air and non-timebase corrected video. They also route balanced or unbalanced stereo audio. The audio follows the video or you can route the audio separately (breakaway audio). Each of the switchers offers easy manual control via front panel operation. They can also be controlled remotely by a computer, a Knox RS Remote Controller, or by the Knox Remote Keypad via their RS-232 port. Front panel LEDs indicate the current routed pattern at all times, and an internal battery holds and restores current patterns in case of power interruption. Totally versatile, Knox switchers are ideal for applications such as studio-feed control and switcher input control, plus they have an internal timer allowing timed sequence of patterns for surveillance applications as well.

- Accept and routes virtually any one-volt NTSC or PAL video signal input—including off-the-air and non-timebase corrected –to any or all video outputs.
- Accept and route two-volt mono or stereo unbalanced audio inputs to any or all audio outputs.
- Video and audio inputs can be routed independently (breakaway audio), they don't need to have the same destination.
- Can store and recall preset cross-point patterns. (Not available on RS12x2.)
- Front panel key-pad operation allows easy manual operation.
- Can also be controlled via RS-232 interface with optional RS Remote Controller or Remote Keypad.
- Internal timer allows manual or automatic timed sequence of patterns —ideal for surveillance applications.
- Front panel LED indicators display the present routing patterns at all times.
- An internal battery remembers and restores the current pattern in case of power failure.
- Internal vertical interval switching firmware allows on-air switching.
- Housed in a thin profile rackmount 1" chassis.
- Also except the RS12x2 are available in S-Video versions with/without audio.
- Models RS16x8 and RS16x16 are also available in RGB/component version.
- With optional Remote Video Readout, the RS16x8 and RS16x16 can display active routes on a monitor at remote locations, via a composite signal from a BNC connector on the rear panel.
- The RS4x4, RS8x8 and RS16x16 are also available with balanced stereo audio. They operate at 660 ohms and handle the full range of balanced audio up to +4 dB with professional quick-connect, self-locking, bare-wire connectors.

nova SYSTEMS, INC.

StudioFrame

Modular Video Processing System

The Nova StudioFrame Series is a modular, flexible, digital/analog signal processing system. It is designed to efficiently and effectively combine a wide variety of individual function (or processor) boards such as A-D and D-A converters, video signal encoders and decoders, audio and video distribution amplifiers and frame synchronizers into more complex function groups, all in one equipment mainframe. The scalable nature of the StudioFrame design allows it to be easily reconfigured and/or upgraded as today's video standards and requirements continue to evolve. The system is based on two rackmount frame models (the SF-3 and SF-1) allowing up to thirteen front loading processor boards and thirteen rear mounted passive interface cards to be accommodated in a single chassis. Both the StudioFrame SF-1 and SF-3 chassis are designed to meet the most stringent broadcast requirements. The SF-3 is a thirteen slot, 3RU chassis while the SF-1 is a 4 slot 1RU chassis. All studio cards as well as the two chassis are backed by a two year warranty on parts and labor with guaranteed 24-hour turnaround service. The units are ruggedly constructed to endure studio rackmount, production van and OB (Outside Broadcast) mobile applications. A universal power supply operates at either 110 or 240 VAC, 50/60 cycle. DC operation is optionally available as is a redundant supply with automatic switchover. Dual exhaust fans maintain proper airflow and cooling. "Hot Swappable" front card loading allows power-on removal/insertion of individual processing modules without disturbing others in the system. All cabling can remain in place while you service" any module. An intelligent "centerplane" provides power, sync, timing and data distribution, facilitating expansion to more complex, more cost-effective signal processing functions.

NovaASD/NovaSDA

Analog to Serial Digital & Serial Digital to Analog Converters

Components of the Nova StudioFrame series, the NovaASD and the NovaSDA incorporate the latest digital video processing techniques for high speed A-D and D-A signal conversion. They are designed to meet the most stringent broadcast requirements and their "hot swappable" front card loading facilitates servicing without disturbing other cards in the system. The NovaASD is ideal for for interfacing analog signals with digital video formats and the NovaSDA for interfacing serial digital signals with

SDA-1 Serial Digital Component to Analog Component Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input.
- Equalized and reclocked serial digital component output
- Analog component video (Y, R-Y, B-Y/Y, V, RGB or RGB/S outputs
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

ASD-1 Analog Component to Serial Digital Component Converter
- Analog component video (Y, R-Y, B-Y/Y, V, RGB or RGB/S Input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- Picture positioning control
- NTSC and PAL compatible

SDA-2 Serial Digital Component to Composite and S-Video Converter
- SMPTE 259M 4:2:2: Serial Digital Component (D1) input.
- Equalized and reclocked serial digital component output
- Dual composite & dual S-Video outputs
- Color bar output selectable
- 10-bit D/A converters
- Output level control
- NTSC and PAL compatible

ASD-2 Analog Composite and S-Video to Serial Digital Component Converter
- Analog composite and S-Video input
- Dual SMPTE 259M 4:2:2 Serial Digital Component (D1) outputs
- 10-bit D/A converters
- NTSC and PAL compatible

SDA-3 Serial Digital Composite to Analog Video Converter
- SMPTE 259M Serial Digital Composite (D2,D3) input.
- Equalized and reclocked serial digital composite output
- Four analog composite video outputs
- Color bar output selectable • 10-bit D/A converters

ASD-3 Analog Composite to Serial Digital Composite Converter
- Analog composite video input
- Dual SMPTE 259M 4:2:2 Serial Digital Composite (D2/D3) outputs
- 10-bit D/A converters
- Input gain adjustment

NovaMNR Median Noise Reducer

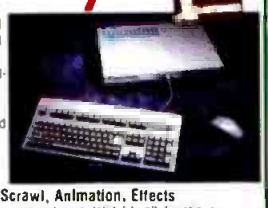
The NovaMNR is a StudioFrame card that eliminates impulse and transmission noise, cleans up satellite, microwave and fiber feeds and fills CODEC and time-based corrected videotape drop-outs. It features full bandwidth, uncompressed 10-bit digital processing for ultimate video transparency as well as analog composite inputs and outputs.
- Eliminates "sparkles", those black and white dots that sometimes appear on remote video feeds. The NovaMNR incorporates a proprietary adaptive three-dimensional median filter that analyzes pixels from several fields of video and replaces the impulse noise with uncontaminated, clean video.
- Universal drop-out compensation replaces missing video information, whether it is from a time-base-corrected VCR source or the decoded output of a CODEC feed. The NovaMNR effectively fills in drop-outs with replacement video from the surrounding pixels and previous video field.
- Controls are accessible locally or remotely. A three position threshold switch (off/low/high) adjusts system noise sensitivity while a bypass/operate switch is also included. Both switches are remoteable via RJ-11 jack.
- Also available in PAL and PAL-M versions.

NC-8 RGB/Component to Composite/S-Video Encoder

- 10-bit processing, 8-bit D/A conversion
- Zero insertion delay, frame of memory
- Two composite and one S-video output
- Analog RGB (Sync on Green or all three), RGB/Sync and YUV (Betacam) inputs. Also available with looping inputs.
- Variable chrominance notch filter
- Variable Chroma Bandwidth for optimum encoding performance
- Remote serial control • Output level control
- Color bar output selectable
- Designed to meet the most stringent broadcast requirements
- Hot swappable' front card loading facilitates servicing without disturbing other cards
- Available in PAL and PAL-M versions

VIDEONICS POWER Script™

Animated Postscript Character and Graphics Generator



The most advanced character generator ever designed for video production, multimedia and industrial applications. PowerScript delivers the huge range of titles and graphics supported by PostScript display technology, plus animation, effects, transparency and color keying. It features two GPI inputs, anti-aliased, 17.5 ns (nanosecond) pixel resolution and 4:2:2 broadcast-quality video. It also offers 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 PostScript fonts from your PC. PowerScript's high-speed RISC processor provides real-time PostScript imaging.
- 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 and center justification is also provided.
- 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
- Built-in real-time object-based drawing tool and text editor—no computer or software required. Design can be done ahead of time and displayed later, or can be done on the fly.
- Supplied keyboard and mouse are used with easy on-screen menus to place and modify graphics and text.
- Change fonts, colors, and other characters instantly.

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) as well as each letter and each graphic.

Roll, Scrawl, Animation, Effects
- Variable speed roll, crawl and push (slide) in all directions.
- Every text object, graphic and logo can be animated. Complex animations include having 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 fades and wipes to transition between titles and video or between two pages of titles.

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
- Accepts most PostScript or PCX 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.

Expansion Capabilities

Although PowerScript operates on its own, you can still add peripherals and connect to a computer or network. Two PC-card slots allow the addition of non-volatile flash-RAM and Ethernet cards. RS-232 port allows connection to desktop computers for added storage and downloading of fonts or graphics from a PC.

LEADER

Manufacturing test and measurement equipment for over 40 years, Leader Instruments is the standard which others are measured against for reliability, performance, and most important—cost effectiveness. Before a Product is brought to market, an exceptional degree of energy and effort go into its design. Prototypes are built and tested to withstand environmental and other factors far exceeding actual operating conditions. These include high humidity, extremes of heat, cold, shock and vibration. Manufacturing quality is built in every step of the way and only the finest parts are used. At each production run, subassemblies are separately tested before they are integrated into the finished product, then each product is tested again. This is why less than half of 1% of all Leader products are ever returned for warranty repair or adjustment.

5860C WAVEFORM MONITOR

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 s/div and 2V mag time bases as well as vertical amplifier response choices of flat, IRE (low pass), chroma and DIF-STEP. The latter facilitates easy checks of luminance linearity using the staircase signal. A PIX MON output jack feeds observed (A or B) signals to a picture monitor, and the unit accepts an external sync reference. Built-in calibrator and on-off control of the DC restorer is also provided.

5850C VECTORSCOPE

The ideal companion for the 5860C Waveform Monitor, the 5850C adds simultaneous side-by-side waveform and vector monitoring. Featured is an electronically-generated vector scale that precludes the need for fussy centering adjustments and eases phase adjustments from relatively long viewing distances. Provision is made for selecting the phase reference from either A or B inputs or a separate external timing reference.

5100 4-Channel Component / Composite WAVEFORM

The 5100 handles three channels of component signals, plus a fourth channel for composite signals, in mixed component / composite facilities. Features are overlaid and parade waveform displays, component vector displays, and automatic bow-tie or "shark fin" displays for timing checks. Menu-driven options select format (525/60, 625/50, and 1125/60 HDTV), full line-select, vector calibration, preset front-panel setups and more. On-screen readout of scan rates, line-select, preset numbers, trigger source, cursor time and volts.

5870 Waveform/Vectorscope w/SCH and Line Select

A two-channel Waveform/Vector monitor, the microprocessor-run 5870 permits overlaid waveform and vector displays, as well as overlaid A and B inputs for precision amplitude and timing/phase matching. Use of decoded R-Y allows relatively high-resolution DG and DP measurements. The 5870 adds a precision SCH measurement with on-screen numerical readout of error with an analog display of SCH error over field and line times. Full-raster line select is also featured with on-screen readout of selected lines, a strobe on the PIX MON output signal to highlight the selected line, and presets for up to nine lines for routine checks.

5872A Combination Waveform/Vectorscope

Models 5872A offers all the operating advantages of the 5870, except for the following: SCH is deleted from the 5872A (line select retained), making it ideal for satellite work.

5864A Waveform Monitor

A two-input waveform monitor that offers full monitoring facilities for cameras, VCRs and video transmission links. The 5864A offers front panel selection of A or B inputs, the choice of 2H or 2V display with sweep magnification, and flat frequency response or the insertion of an IRE filter. In addition, a switchable gain boost of X4 magnifies setup to 30 IRE units, and a dashed graticule line at 30 units on screen facilitates easy setting of master pedestal. Intensity and focus are fixed and automatic for optimum display. Supplied with an instruction manual and DC power cable.

5854 Vectorscope

A dual channel compact vectorscope, the 5854 provides precision checkout of camera encoders and camera balance, as well as the means for precise genlock adjustments for two or more video sources. Front panel controls choose between A and B inputs for display and between A and B for decoder reference. Gain is fixed or variable, with front panel controls for gain and phase adjustments. A gain boost of 5X facilitates precise camera balance adjustments in the field. Supplied with a DC power cable.

Designed for EFP and ENG (electronic field production and electronic news gathering) operations, they feature compact size, light weight and 12 V DC power operation. Thus full monitoring facilities can be carried into the field and powered from NP-1 batteries, battery belts and vehicle power. Careful thought has been given to the reduction of operating controls to facilitate the maximum in monitoring options with the operating simplicity demanded in field work.

ALL ITEMS ARE COMPLETE WITH ALL ACCESSORIES AS SUPPLIED BY MANUFACTURER

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Continued from page 22

Fiber installations require special connection systems and cabinets to protect the cable from damage.

Thinnet

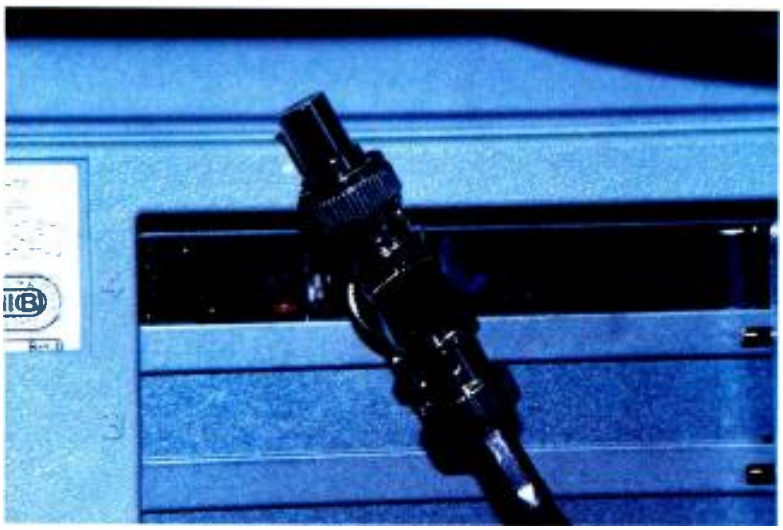
Thinnet, also known as 10BASE-2 Ethernet, is based on 50Ω coax cable and BNC connectors. The cable should be either RG-58 C/U or RG-58 A/U, and it should have a stranded center conductor. Thinnet cable runs should not be longer than 185 meters. The "2" in 10BASE-2 refers to this length limitation, rounded up to 200 meters.

Thinnet segments are different from the other topologies in this article in that the connections daisy-chain from one computer to another using BNC "T"s. The whole segment should not have more than 30 computers connected to it, and the segment must have a 50Ω terminator at each end. That is exactly two 50Ω terminators — not more, not less. Anything else and you are asking for trouble. Note the terminator on one side of the BNC "T" on a computer at the end of a segment.

> Never use a coaxial stub to connect the center portion of the "T" to the computer.

There are a couple of things to watch out for in Thinnet systems. Be sure you are using the correct cable and connectors. There is a lot of RG-59 floating around in TV stations. RG-59 is 75Ω cable. You might be able to get away with using RG-59 instead of RG-58, and then again, maybe not. One or two weekends spent chasing an intermittent caused by the wrong cable and you will wish you had done it right in the first place.

Also, 50Ω and 75Ω connectors are different. You might not be able to see the difference, but it's there. The same thing goes for the terminators. Use 50Ω, not 75Ω. Finally, never use a coaxial stub (a short coaxial section) to connect the center portion of the "T" to the computer, no matter how tempting. The Ethernet specification calls for a limit of about 1½ inches from the center of the "T" to the Ethernet transceiver. Anything longer and you will have trouble with reflections in the cable.



Note the 50Ω terminator connection to one side of the BNC "T."

Fiber

The cost and complexity of fiber systems have changed over the last few years. Today, fiber is really not much more expensive to use than UTP, and it has several advantages over 100BASE-T systems. First, it allows you to make your cable runs more than four times as long (412m, compared to 100m for 100BASE-T or UTP). Second, it provides complete DC isolation between the computer and concentrator. Third, cable runs are immune to RF and impulse noise.

However, there can be a downside to using fiber. It can be unforgiving when it comes to physical abuse. Fiber cabinets allow you to protect your cables when fanning out a multiconductor cable. They can also keep you from accidentally kinking or overbending a fiber cable.

Clearly, fiber is the path to the future. UTP and coax will carry us only so far in the race to increase network speed and performance. Fiber allows for much longer cable runs and much higher operating speeds. Some of the new gigabit networks are being built using conventional copper cable, but the majority of these networks will be built using fiber.

You can find more information about networking on Dr. Spurgeon's Ethernet page at wwwhost.ots.utexas.edu/ethernet. ■

Brad Gilmer is director of advanced network operations & technology for Turner Entertainment Networks.

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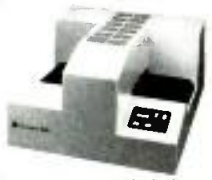

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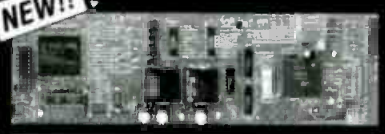

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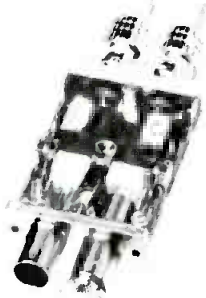

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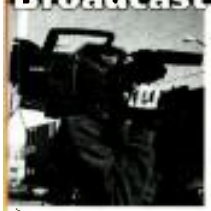

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TECHNICAL SUPPORT ENGINEER The Department of Communication at Bradley University invites applications for a technical support engineer in the Global Communications Center. Responsibilities include trouble shooting, component level repair and routine and emergency maintenance of a variety of state-of-the-art audio, video and computer equipment in university production center. Person also provides training in use and maintenance of equipment to faculty and students. Provides production and curricular support as appropriate. Minimum of two-year degree in related technical field; demonstrated interpersonal skills. Current experience in maintenance and repair of professional-level production equipment required. Current or recent experience in trouble shooting, routine and emergency maintenance and repair of wide range of professional level video, audio, broadcast, computing, and telecommunications equipment also required. Send resume, names, addresses and telephone numbers of three references to: GCC Engineer Search, Department of Communication, Bradley University, Peoria, IL 61625. Search beings immediately and will remain open until filled. Bradley University is an Equal Opportunity Employer.

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BROADCAST MAINTENANCE ENGINEER Self-starter with experience repairing digital and analog studio equipment. Requires strong background in computer hardware/software assoc. with automation systems, video servers and computer networks. Sony VTR and LMS or high power UHF transmitter experience a plus. Resume to KTXH UPN-20, Dept. B/E, 8950 Kirby Dr., Houston, TX 77054. EOE

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MAINTENANCE ENGINEER WFTX TV36, FOX affiliate in Ft. Myers market, is seeking a self-motivated Maintenance Engineer. Experience with station systems, component level repair, cameras, Odetics TCS2000, 3/4", Beta, SVHS, ENG and News experience a must. SBE certification and UHF experience are desirable. Work hours are Sunday-Wednesday from Noon-11PM. Please send resume and salary requirements to: Ryan Steward, Chief Engineer, WFTX-TV, 621 SW Pine Island Rd., Cape Coral, FL 33991 or E-mail: rsteward@wftx.com. We are an equal opportunity employer.

CHIEF ENGINEER Eastern Washington Fox Affiliate seeks Chief Engineer with 3+ years of hands-on UHF transmitter experience in TV broadcasting. Some travel involved. Send resume and salary expectations to GM, KAYU-TV, P.O. Box 30028, Spokane, WA 99223 or fax to (509) 448-1223. EOE.

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VIACOM O&O in sunny South Florida seeks a **Maintenance Engineer** who has experience repairing and maintaining a major TV broadcast/production facility. The person we're looking for should be able to trouble-shoot at component level, have working knowledge of BTS switchers, Phillips media pool, Harris Transmitters, Avid Media Composers, Chyron Max, and Sony 1" and BetaCam formats. RF experience and SBE certification a plus. Send resume & cover letter to: Dept. #ME-211, **WBFS-UPN 33**, 16550 NW 52nd Ave., Miami, FL 33014. No phone calls, please. EOE.

MAINTENANCE ENGINEER: KSPR-TV, an ABC network affiliate, seeks a maintenance engineer with a minimum of three years experience with Beta/Beta SP and Studio systems. Knowledge of UHF transmitters, Microwave and Computer systems also a plus. Located in the Missouri Ozarks where recreation and entertainment opportunities abound. Please submit cover letter, resume and salary requirements to: Monte Chaney, Chief Engineer KSPR-TV, 1359 St. Louis Street, Springfield, MO 65802. EOE.

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By Paul McGoldrick

ITS, telecines and profits

The International Teleproduction Society (ITS) has re-invented itself. At the annual forum in Beverly Hills in July, it was obvious there is new life at the top — and just in time. The teleproduction industry is going to be going through a boom the likes of which hasn't been seen for a long time. There are going to be multiple losers . . . and major winners. And it's going to happen at a speed few people could have imagined. The days of one house undercutting another in copying, editing, standards conversion, whatever, will all but disappear because all the top-end companies will be snowed under with work.

Paul McGoldrick

This, at a time when we don't have a single digital video standard. The FCC, in its "let the market decide" decisions (which probably could be interpreted as "we don't want to do anything we might be sued for") has allowed for a smorgasbord of possibilities. It has allocated terrestrial UHF channels and told the four networks when they must be on the air. So, the decision about what to transmit has become a market-interest situation. Come May 1, 1999, ABC, CBS, Fox and NBC, either O&Os or affiliates must be on the air at UHF in the top 10 markets, with markets 11-30 following by Nov. 1, 1999. (Of course, there will be slippage on those dates. The FCC has not adhered to an implementation date in my professional lifetime.)

CBS believes, and hopes, that the standard of request by the broadcasters and the public will be HDTV, although the network accepts there will be periods when either SDTV or multiplexed-SDTV will be transmitted. Either way, there will be a lot of additional data services carried. These services will be making use of bits not being used by the video because it's slow-moving or without many cuts. That income stream, whatever it can legally be, is of intense interest to the broadcasters. For the teleproduction house, it's bonanza time. If the majority of programming is HDTV, it will originate in Hollywood in the unified standard. Even if it isn't broadcast in HDTV immediately, there is going to be hesitation about producing material in any lesser format, for fear of throwing away the investment.

To check the value of its current inventory, CBS also reported on work it has done to see how 35mm, Super 16mm, 16mm and 8mm film looks when converted to HDTV. Just comparing exposed areas, each of the film standard's resolutions was about 6dB worse. The 16mm and 8mm film conversions were unacceptable. Grain at anything below 35mm was marginal. It was striking how closely the numbers came to the measurements of HDTV and 35mm film. The HD standard is right on the 35mm performance lines.

Film to video

Broadcasters may deal with the conversion of existing film inventories to HDTV on a real-time basis — on air. That is unlikely, because the skills of real broadcasting continuity are present only in news operations. More likely, there will be new transfer suites set up with much of the service handled outside by ITS members.

It is not surprising that there is a resurgence of interest in telecines. Philips tells us that the future will be film-to-data, with the user pulling out the right datastream based on the standard needed. Maybe. Sony has the opinion that it will remain a real-time conversion to tape. Maybe. Or maybe both?

What is Sony doing in such a niche market? The answers have not been terribly convincing. The existence of Sony Pictures is relevant, but guesses beyond that would be only that. Some of the solutions that Sony has come up with in its prototype are so inventive that I will dwell on them in next month's column.

ATM and D-1

Cinebase (Los Angeles) is a leader in the field of multimedia databases. At NAB, it introduced a product that transports D-1 through switched ATM circuits in an extremely elegant manner, even providing a simple user interface. Getting video and audio material between different production and processing areas has already become a big deal and this makes it easier. The product, the Fiber Hydrant, takes advantage of wavelet compression using Analog Devices' ADV601 wavelet video codec that was announced in this column last year.

This month, the ADV601LC, a new version of the chip, will be announced (LC for lower cost) with simplified interfaces, costing $14.95 each in 10k quantities instead of $30.90 for the original IC. ■

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

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