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November 1995/\$5.00

engineering



Cover Story: Avoiding the digital cliff



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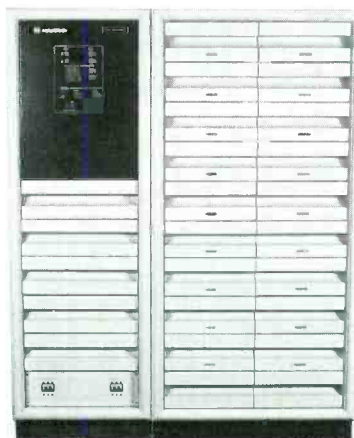
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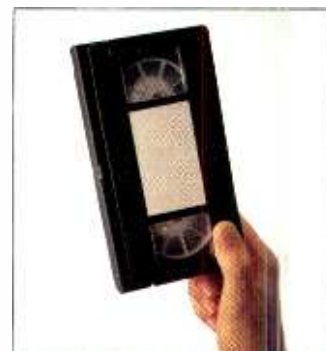
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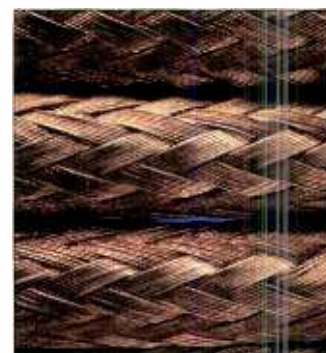
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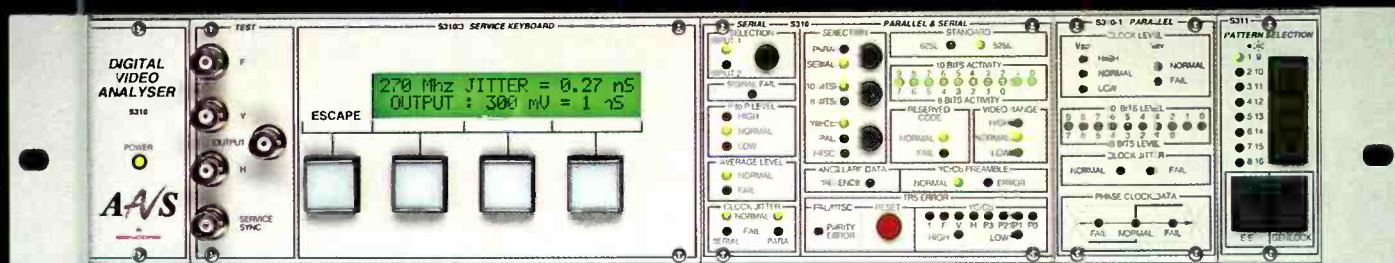


ON THE COVER: Testing digital video requires specialized equipment. Knowing what tests to perform and what equipment is needed is part of overcoming the "digital cliff." Cover design and photography courtesy of AAVS Sencore.

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EIA victorious on UHF performance filings

At the request of the Electronics Industries Association's Consumer Electronics Group (EIA/CEG), the FCC proposes to eliminate the requirement that parties who manufacture, import or market TV receivers file reports concerning the UHF noise figure performance of new models. The FCC called this requirement obsolete and burdensome for government and industry resources.

The EIA/CEG maintains that compiling and submitting test data after the receiver has been verified and is compliant with the FCC's rules is unnecessary and inconsistent with the verification procedure for equipment authorization. Past filings of UHF performance records show a high level of compliance with the rules.

In the mid-1970s, UHF broadcasters asked the FCC to require TV manufacturers to maintain a 14dB UHF noise figure, which led to the initial UHF performance requirements. Since then, technology has improved, and it is relatively easy for TV manufacturers to maintain the 14dB level.

If the new ruling is approved, the regulatory burden on manufacturers and importers will be reduced and could decrease overall TV prices. Compliance with the 14dB requirement will be maintained through the verification process and routine follow-up testing as the manufacturer or importer believes is necessary.

Up-front spectrum auctions would endanger free TV

According to the NAB, up-front spectrum auctions of advanced TV spectrum would destroy broadcasters' ability to compete in the emerging video marketplace envisioned by the telecommunications bill. It would also deny consumers long-term access to quality, free over-the-air TV service.

In a Senate Commerce Committee hearing on spectrum auctions, NAB Television Board chairman Ralph Gabbard said that broadcasters are ready to compete in the new environment and have invested millions in new digital technology. According to Gabbard, broadcasters must have use of a temporary channel to make the transition to digital. The use of the additional channel is temporary, and broadcasters will return one channel to the government once the transition is complete.

Gabbard also told the committee that the transition to advanced television will be difficult and expensive for small-market broadcasters. An up-front auction would make that transition impossible and would

lead to less service to those communities.

Gabbard also urged the committee to reject accelerated auctions, which would disenfranchise millions of Americans who cannot afford or should not be forced by the government to buy expensive TV sets before their existing sets wear out.

A successful IBC '95

The management committee described the first annual IBC in Amsterdam as extremely satisfactory. Attendees from 98 countries totaled almost 18,500. Further proof of the success of the third IBC was confirmed by the fact that at the close of the show, 240 exhibitors had already booked 19,500 square meters of space for IBC '96.

IBC '96 is scheduled for Sept. 12-16. For more information, contact IBC at +44 171 240 3839 or by fax at +44 171 240 8830.

In other news at IBC, Stanley N. Baron, president of SMPTE, was presented with the IBC John Tucker award. The award is given in recognition of an internationally significant contribution by an individual or group from any country on any aspect of broadcast communications, including research, design, development, manufacture, operational practice or management.

Baron was recognized for his work and original contributions spanning more than 32 years in digital television, and specifically, for his leadership in establishing international digital terrestrial TV broadcasting (DTTB) standards.

NATAS awards 1994 Technical Emmys

The 1994 Technological Achievement and Scientific Development Emmy Awards were presented by the National Academy of Television Arts and Sciences (NATAS) on Oct. 12 in New York.

The following companies were awarded the coveted statue: Leitch Corporation for the development of the subcarrier and horizontal phasing monitor technology; Panasonic (Matsushita) and Sony Electronics for the pioneering development in 1/2-inch component digital videotape recording technology; DirecTV and PrimeStar Partners for pioneering development of direct-to-home digital satellite broadcasting; the European Broadcasting Union and the Audio Engineering Society for the standardization of serial digital audio transmission systems.

SBE elects 1995-1996 officers

The Society of Broadcast Engineers (SBE) has elected its officers and board of directors

for the next year.

Terrence M. Baun is president; Edward J. Miller is vice president; Martin Sandberg is secretary; and Troy D. Pennington is treasurer. Elected to 2-year terms on the board of directors are James T. Bernier, Marvin Born, James Butler, Richard L. Edwards, Robert Reymont, Larry J. Wilkins and filling an unexpired term is W. David Johnson. Continuing on the board of directors are Leonard Charles, Michael A. Fast, Michael G. McCarthy, John F. Schneider and Thomas P. Weber.

NAB '96 call for presentations

The 50th Broadcast Engineering Conference, the second NAB/ITS Advanced Teleproduction Conference and the fourth NAB MultiMedia World Conference are scheduled for April 14-18, in conjunction with NAB '96 in Las Vegas.

These conferences provide an opportunity to present tutorials or system and equipment descriptions on state-of-the-art broadcast and multimedia technologies. The author of an accepted presentation will receive a technical conference presenter kit that contains information on presentation preparation. A presentation will be considered for publication in the *Proceedings*. Finished manuscripts and disks are due to NAB by Jan. 19.

If you are interested, send a 1-page proposal to NAB Technical Conference Committees, NAB Science and Technology, 1771 N Street, N.W., Washington, DC 20036; fax 202-775-4981.

Include the author's name, conference of interest, address, E-mail address, phone and fax numbers. For more information, contact John Marino, director of technical conferences, NAB Department of Science and Technology at 202-429-5391 or by E-mail to jmarino@nab.org.

30th annual SMPTE advanced motion imaging conference

The 30th annual SMPTE Advanced Motion Imaging Conference is scheduled for Feb. 1-3, at the Sheraton Seattle Hotel and Towers in Seattle, WA. The conference "The Convergence Continues...Computer Technology and Television" will feature a 3-day technical program with papers on the leading-edge of motion imaging technology. For more information contact Marilyn Waldman at SMPTE at 914-761-1100.

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For sale to the highest bidder

In Congress's struggle to balance the budget and reduce the deficit, government agencies and federal expenditures and resources that would never before have received the slightest attention are suddenly under intense scrutiny. This includes the FCC — and the spectrum over which it governs.

At first it was easy to justify some of the revenue-generating proposals. For instance, increasing fees for federal attractions and resources. OK, so it costs \$2 more to enter a national park or the per-night camp fee is now \$10 instead of \$5. Some may justify these types of charges as appropriate "user fees." After all, these taxes only affect those who "use" the resources or services. If you don't play, you don't have to pay. (Kind of like goring the other guy's ox.)

Unfortunately, Congress seems to have its collective hand out to potentially collect (tax) perhaps billions, yes, that's billions, from broadcasters by selling TV channels. Under the guise that other industries have to pay for spectrum, why shouldn't broadcasters? The FCC has begun a dangerous lean toward supporting what will be a catastrophic tax upon TV stations.

From the beginning, broadcasters have enjoyed (and rightly so) certain flexibility in how they used their channels. In return for the spectrum, stations provide many free services to the public. Now, as the result of more than 35 years of Congress's tax and the "spend" attitude reaches the crisis point, our elected officials are looking for easy solutions, and they want to break that contract.

The most recent budget reconciliation bill would require the FCC to auction to the highest bidder *all* future spectrum assignments. If approved, this bill would undermine the contract that broadcasters have always had with the federal government. In return for the use of the spectrum, broadcasters provide local news, public affairs and other free services to the public. No one has to pay the local TV station for watching *The Simpsons*, David Letterman or Jay Leno. The local news is self-supporting and doesn't require viewers to subscribe to the service. America has free TV at its best.

Yet, under this bill, broadcasters would have to bid for their broadcast channels. This would be especially disastrous to TV stations who now must begin building their HDTV/ATV channels. Now, in return for helping lead their audiences into the digital future, TV stations would be charged for the privilege of spending billions just to do so.

The NAB has rightly brought the matter to the attention of the House/Senate reconciliation committee. However, it's important that broadcasters (and viewers) make their voices heard on this issue. From the beginning, the American public has benefitted from the free over-the-air programming provided by broadcasters. Forcing TV stations to rent or buy their RF channels would cause many to go dark, and could bring an end to free TV.

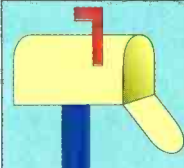
Such a quick money-grabbing scheme as taxing broadcasters for spectrum is just another example of Congress putting the blame (and looking for the solution) on the backs of the American public.

To you politicians in Washington, "Keep your hands out of my pocket and off my free TV!"



Brad Dick

Brad Dick, editor



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FCC schedules wireless cable auctions

three calendar years. Benefits available to small businesses include reductions in the minimum upfront payment, a 15% discount on the winning bidding price and low-interest installment payments.

FCC waives settlement caps

Faced with a continuing delay in developing criteria for deciding comparative hearings, the FCC will waive two of its rules that limit terms for settlement. The waiver will lift the rules for settlement for competing applicants for new broadcast facilities and in contested renewal cases for a period of 90 days, until Dec. 14, 1995.

The waiver will allow competing applicants for new broadcast facilities, either already designated or scheduled for comparative hearings, to settle for any amount. In the case of contested renewals, settlement will be limited to out-of-pocket expenses.

iting from their proposals."

Commissioner Andrew C. Barrett dissented with the FCC announcement, referring to the action as a "bandage approach for dispensing these mutually exclusive applications." Instead, Barrett believes that the FCC should directly address the criteria problems cited by the court's decisions. Barrett fears the waiver will serve the interests of a few individuals and not the general public.

FCC refuses to reduce EEO forfeitures

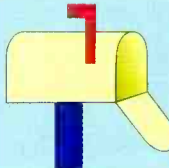
The recent rejection of two requests to reduce EEO fines shows that the commission is closely examining these requests with an eye toward rejecting them.

With every Notice of Apparent Liability, the commission must take into account a licensee's ability to pay when assessing a fine. The decision to allow the reduction, however, is made by the FCC. It requires extensive disclosures, which include statements of income from broadcast operations, expenses and payments to principals.

The FCC also rejected a Request for Rescission from a licensee for failure to disclose certain financial information. Although the licensee's statements showed a loss over several years, they also included a note from the accountant that the licensee had omitted information about cash flows and retained earnings. The licensee argued that this wasn't relevant, but the FCC found that the information could have an impact on its decision.

In another decision, the FCC found that financial disclosures, which included one station, are insufficient for a group owner. The licensee had provided properly prepared statements for the station, which showed that the station had no assets and that its liabilities exceeded its ability to pay. However, the licensee failed to include information about its other stations, particularly about the proceeds of a recent sale approved by the commission. Because this information was absent, the FCC found that the financial statements were not sufficient to show that the company was unable to afford the fine. ■

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



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On the heels of its success in raising \$7 billion from the recent auction of PCS licenses, the FCC has scheduled auctions for multichannel multipoint distribution service (MMDS) licenses, which are used in connection with "wireless cable" video services. Auctions were scheduled to commence on Nov. 13, 1995.

The MMDS auction is evidence of the growing wireless cable industry, in which operators combine MMDS channels with leased channel space from Instructional Television Fixed Service (ITFS) educational licensees to provide more than 30 channels of video. With the advent of digital facilities, observers predict that digital compression will allow wireless cable operators to provide more than 100 video channels with the possibility of data and voice transmission.

Further evidence of the growing industry is the recent transactions in which one major wireless cable operator has been purchased by Pacific Telesis for \$175 million, and another major operator received \$100 million in equity from NYNEX and Bell Atlantic. Although a substantial number of new entrants are in the multichannel video market, it's clear that wireless cable will be a player over the long term.

The auction consisted of bidding for authorizations for 493 basic trading areas (BTAs). Winning a BTA authorization gives a party the right to construct and operate facilities on all MDS channels within the BTA. This is subject to the requirement to protect existing MDS and ITFS licenses and applications from harmful interference. Winners also bargained to lease additional channel capacity on new ITFS systems within the BTA.

The MMDS auctions will have special benefits for bidders that qualify as a small business and for applicants consisting of a consortium of small businesses. For the purpose of this auction, a small business is an entity that, together with its affiliates, has average annual gross revenues of less than \$40 million for each of the previous

DATELINE:

DEC. 1

On or before Dec. 1, 1995, TV stations in the following states must file their annual ownership reports: Alabama, Georgia, Colorado, Minnesota, Montana, North Dakota, South Dakota, Connecticut, Maine, Massachusetts, New Hampshire, Rhode Island and Vermont.

The FCC is trying to clear the backlog of cases caused by an FCC freeze on mutually exclusive proposals for broadcast facilities and comparative renewals. The freeze was prompted by a U.S. Court of Appeals decision that struck down the criteria set by the commission for deciding among competing applications. The situation was made worse by a recent Supreme Court decision calling into question policies that provide preferences for minorities. The FCC's former criteria included such a preference and the replacement criteria was also expected to contain such a preference.

The commission hopes the waiver will result in agreeable resolutions of various proceedings that are currently subject to the freeze. The agency emphasizes that the waiver is temporary, and affirms its support for the rules limiting payments in application settlements. The FCC explains "that many of the applications...were filed during a lengthy period of time when the applicants could have had no reasonable expectation of prof-

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EAS update

A Typical EAS installation in a TV facility

By Paul Montoya

Thus far in this series, we have explored the technologies behind EAS and the potential for its use. Now, it's time to put what we've discovered into practical application.

The beauty of EAS is the flexibility of the system in use at various application points. This would include decoding capabilities of the consumer end user, but we'll get into that in a future article. Cable equipment manufacturing companies are adapting new technologies to the FCC EAS standards at an incredible rate. Some of these technologies could be applied to the type of TV facilities that we will explore in this article.

Megamedia television

Let's look at a full-blown news-intensive

facility that we'll name Megamedia Television. First, we must recognize that the existing EBS system can only accomplish two tasks: sound the alarm and give brief information in an audible fashion. This alarm sounds the same for all situations, from a simple test of the system to a full-fledged hurricane. It also has no basic way of storing this information if no one is paying attention at the time the alarm is sounded.

EAS allows voice and data information to be transferred to the facility. With this data transmission capability, we now have the potential to feed video monitors and word processors for immediate editing through internal computer networks and even directly into character generators or closed-captioning equipment. The possibilities are only limited by what equipment manufacturers can imagine.

We also have the capability to send larger amounts of information by emergency management and government officials than ever before. Everything from press conference announcements to evacuation information can be sent in a detailed format by any agency of the local or state web network.

Naturally, the next question is: "Won't facilities begin to ignore these sources of information based on all the 'junk messages' that could potentially be sent from these government agencies? That's the advantage of the priority level coding built into the EAS protocol. Decoding equipment can be set up to accept and route informational data to

one area of a computer, watch information in another area and warning/emergency information into yet another area. Only emergency information could be directly routed to master control and even loaded directly into a character generator automatically. By using the power of computer networks within the Megamedia Station and the creativity of software programmers, EAS information could be routed whatever way the station personnel see fit. Think about taking emergency information only and routing it to a paging terminal capable of sending text information. Your news crews could be alerted to an emergency situation even before the assignment editor has the chance to determine who is to go where.

Local areas could even expand the EAS protocol coding within the first few lines of the datastream to further categorize the information being sent. For example, the EAS protocol has no alert level for press conferences or disaster follow-up. These codes could be agreed upon within a community, and computer software could be maintained in each facility to handle these special codes. With the multiple-source technologies built into the EAS web, continuous data could be fed through non-broadcast portions of the link without interrupting any broadcaster. This might be by means of a 450MHz link, one station's PRO channel or through the cable system — whatever works for your area.

One-man-band station

What if you own a smaller station? Maybe you only have a staff of four people, and take most of your programming directly off a satellite. You may have remote monitoring of your transmitter by a separate contractor, or even better, maybe the commission has approved unattended operation. Let's call this facility the one-man-band station.

Using the same data capabilities discussed earlier, this data could be utilized to automatically cause certain things to be put into motion. Emergencies could automatically be routed to a character generator in master control and then switched right onto the air without any human intervention and without disturbing any existing programming.

Non-emergency information could be stored in a voice-mail system that could be accessed from home periodically by the general manager to find out what the mayor might be planning. The possibilities are only limited by the creativity of the people who are involved.

It will take a fair amount of setup by broadcasters to put together effective links. It will take even more work by government agencies to put out accurate and pertinent information. But with the capabilities of EAS technology, we will no longer have an excuse for being uninformed. ■

Paul Montoya is president of Broadcast Services of Colorado, a contract engineering firm in Lakewood, CO.

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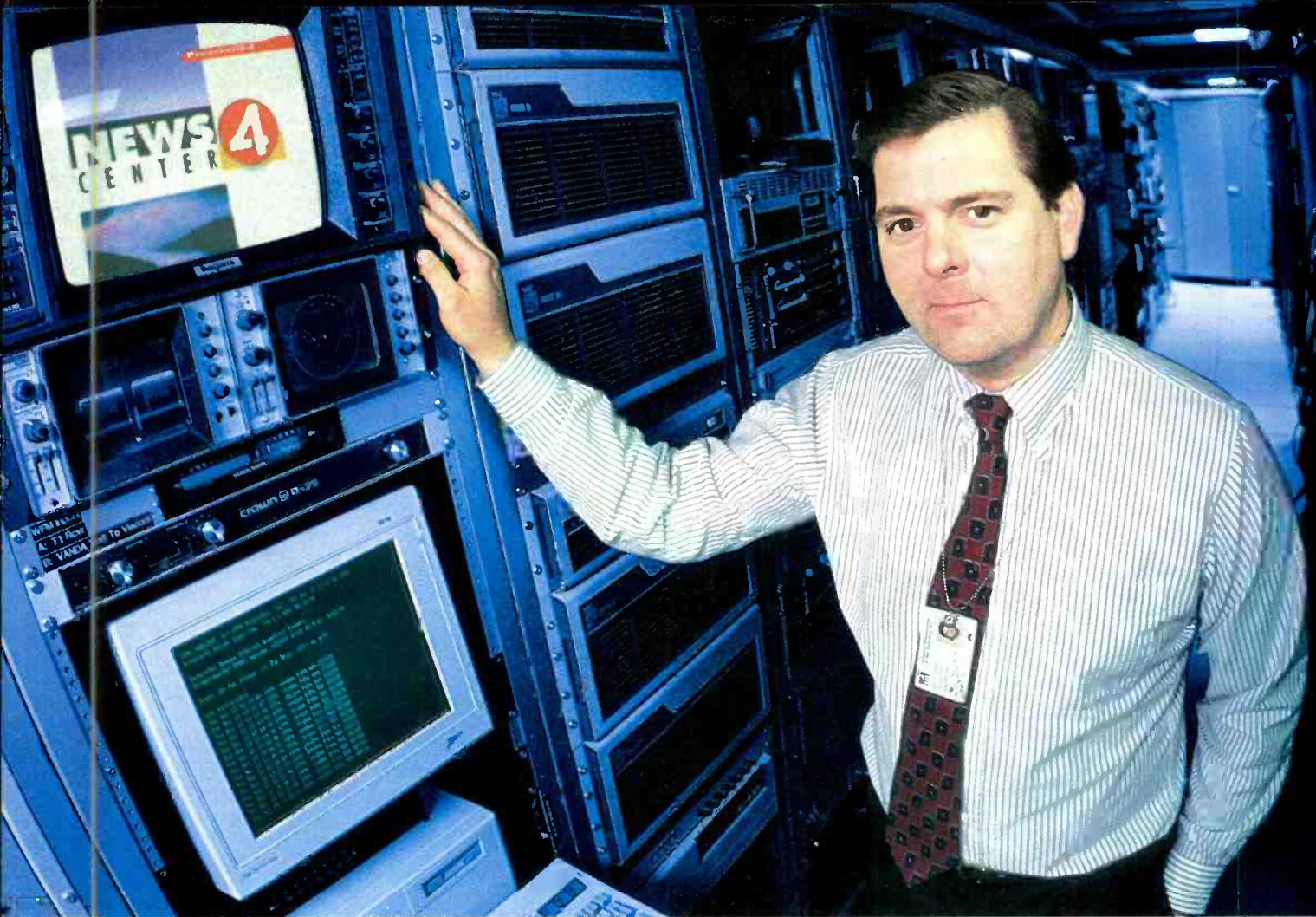
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"We've been delivering MPEG digital video over T1 lines 24 hours a day for 8 months."

Craig Porter, KRON TV, San Francisco

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In your job you interact with those in authority. And chances are that you've been turned down by a supervisor at least once for something you requested. Often times, that request has been about resources. Resources in this context are any tangible or intangible assets that will support your cause, like equipment, personnel, money, supplies, perks, promise of support or just goodwill.

Whether you're an employee, owner or manager, this article will help you negotiate for resources by understanding how a company functions and by identifying leadership styles.

Leadership styles

It's important to understand the leadership styles of your company's leaders. After you identify the leadership style of the person you are dealing with, you can then decide the type of approach you need to use in the negotiation process. The seven styles of leadership are:

1. *The Prophet* is a visionary who creates the breakthrough and the energy to propel the company forward. If you work for a Prophet, don't expect him to give you specifics on a project or follow up on the details of your work. Prophets value thinking and intelligent communication on macro ideas. If you have Prophets working for you, recognize their creative abilities and reinforce and encourage those talents, heed their ideas and be patient.

2. *The Barbarian* is the leader of crisis and conquest who commands the company on the march to rapid growth. The personality of the Barbarian is depicted by a single-minded dedication to a mission or goal with a strong sense of urgency. Barbarians are decisive decision makers and turnaround artists. They are authoritarian or dictatorial and have little patience with planning and administration. If you work for one and want to make a request, get to the heart of the matter quickly, directly, concisely and honestly. The Barbarian will make the decisions and you'll carry them out. If you manage Barbarians, be sure their assignments are ones where command and single-minded action are appropriate. Let them know what

Identifying leadership styles

their responsibilities are and what you expect of them. Help them learn leadership skills by getting them involved with strategic issues, as well as teaching them to delegate.

3. *The Builder and Explorer* are developers of the specialized skills and structures required for growth who shift from command to collaboration. At this growth stage, leadership is shared, delegated and becomes collaborative. The Builder is a tactician who's interest is short-term — getting a product produced or service delivered. If you work for a Builder, bring solutions to the table, have clear and specific written objectives and don't expect much positive reinforcement. If Builders work for you, give them their autonomy and hold them accountable for improvements. Offer support where needed and reward them for improving a process, not for the result.

The Explorer is competitive and a convincing and enthusiastic communicator. If you work with Explorers, you'll win points by gaining new business, bringing in planned results and talking about strategic issues and how to win them. If you have Explorers working for you, recognize their achievements, help them to develop realistic expectations and make the best use of their time.

Administrators will recognize and reward you for conforming rather than creating.

4. *The Administrator* is the creator of the integrating system and architecture who shifts the focus from expansion to security. As a company matures, there is an inherent conflict between the creative impetus toward growth and the need for order. In most cases, order becomes the victor and the age of the Administrator begins. Leadership provides the vision, values and purpose that creates momentum while management channels the energy that leadership creates. In order to inspire workers and gain their loyalty, leaders appeal to intuition and emotion while administration appeals to the rational intellect. Administrators believe that order and systems will result in performance (focus on how and not what or why). Administrators will recognize and reward you for conforming rather than creating.

5. *The Bureaucrat* is the imposer of a tight grip of control, who crucifies and exiles new prophets and barbarians, assuring the loss of

creativity and expansion. As you head into the declining era of a company, the Bureaucratic age begins. In this age, the members of the company spend their declining energies on the struggle within the company. The more they focus on internal discord, the less they are capable of responding creatively to challenges. If you work for bureaucrats, remember that they need order and conformity. Also, serve as a buffer for your employees while shielding them from your bureaucratic boss, so that they will have a chance to produce creative solutions. On the other hand, if one works for you, put him in a staff position rather than a line position so he won't have a chance to stifle the Builders and Explorers. Also reward them for developing and managing efficient administrative processes.

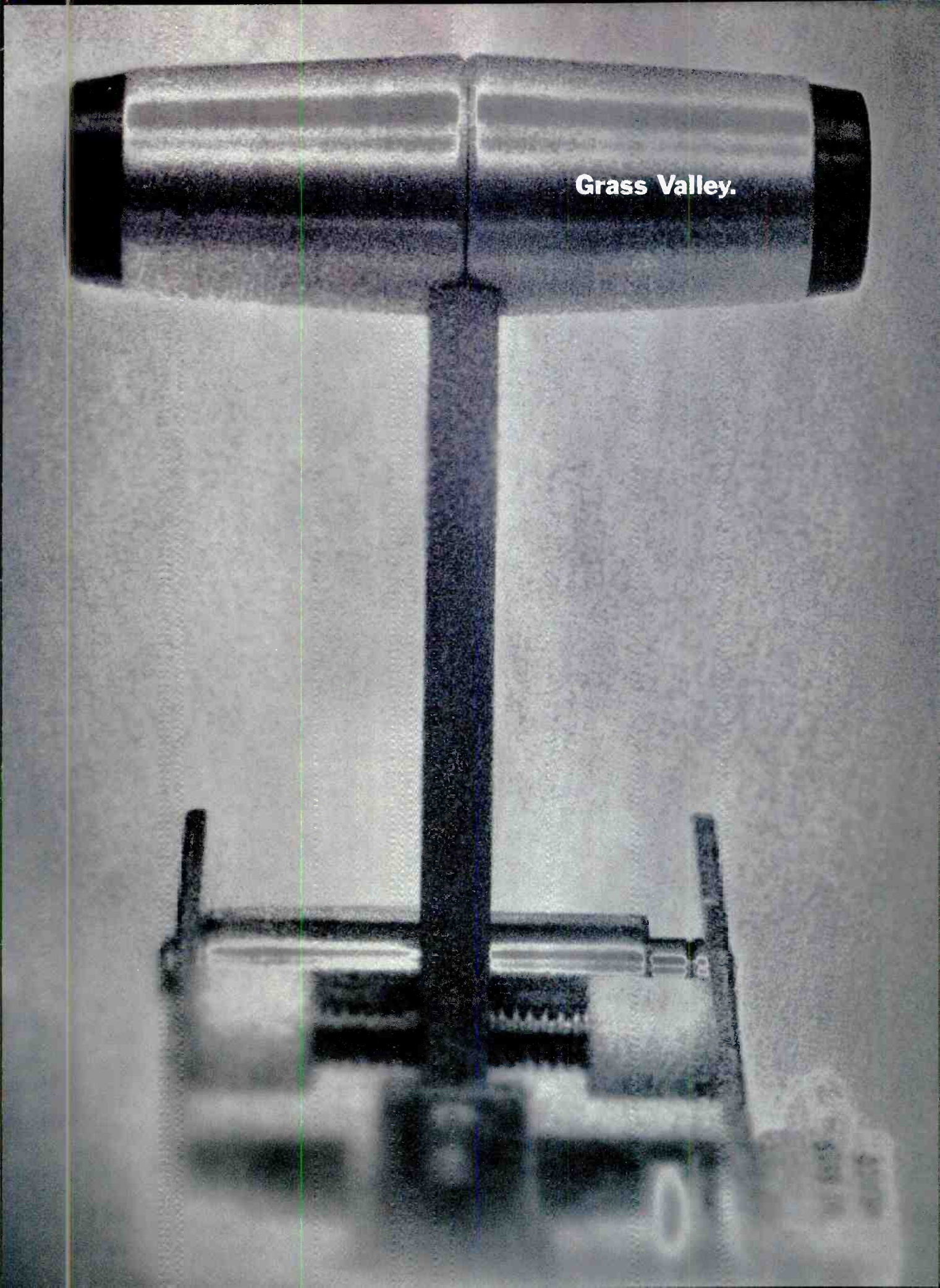
6. *The Aristocrat* is the inheritor of wealth, alienated from those who do productive work, and who, in most cases, is the primary cause of rebellion and disintegration. Managers must develop a sensitivity to the development of class distinctions and set up structures and systems to minimize those distinctions. This environment is characterized by managers having lost the desire to perform. Every relationship must have a balance of power, a mutual concern and respect. When these mechanisms break down, leadership acts on its own interests and contrary to the interests of its employees, and rebellion inevitably results. Aristocrats look for ways to manipulate the numbers, and don't concentrate on the quality of production, selling or developing new products. If you manage Aristocrats, focus on how to redirect their energies toward productivity with specific milestones.

7. *The Synergist* is the leader who maintains the balance, and continues the forward motion of a large, complex structure by unifying and appreciating the diverse contribution of all of the previous leaders and their respective characters. The final lesson in this part is that decline isn't inevitable, only probable. The best managed companies have a mix of leadership skills that allow human energy to focus on internal cooperation and external competition. Its leaders, the Synergists, are a blend of the seven leadership styles. The synergist organization achieves higher levels of integration and has a strong tendency toward development and market dominance. ■

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

Next month:

Understanding how management and communication interact in a company.

A black and white photograph of a professional video camera, viewed from the side. The camera has a large, cylindrical viewfinder on the left and a smaller, similar viewfinder on the right. The text "Grass Valley." is printed in white on the right-hand viewfinder. The camera is mounted on a tripod, which is visible at the bottom of the frame. The background is a plain, light-colored surface.

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Once limited to the world of production video effects, component digital video is rapidly becoming the common interconnect format throughout TV facilities.

The 270MHz serial interconnect is simpler and more robust than analog circuits of the past. The circuit is still analog, carrying data as voltage changes rather than a direct voltage representation of the signal. And because it is data, the three color-component channels, associated program audio channels, and timing signals can all be multiplexed on a single coaxial cable.

The data signal in serial digital systems can be completely recovered and program information accurately reproduced if all of the voltage transitions are correctly sensed. The polarity of the data signal is not important; that a transition has occurred (or not) conveys the necessary data.

Like analog video and audio, successful interchange among various equipment is made practical by standards.

Like analog video and audio, successful interchange among various equipment is made practical by standards. SMPTE 259M and EBU Tech. 3267 define the data interface. The original analog luminance and color-difference signals are sampled at 13.5MHz and 6.75MHz respectively, and the samples are ordered in Cb,Y,Cr,Y sequence to create parallel 10-bit data words at a 27MHz rate. End-of-active video (EAV) and start-of-active video (SAV) timing sequences are added to permit word framing, plus optional audio channels and other ancillary signals, then the data is processed into a 270MB serial datastream. The serial data is then scrambled using a known

Testing serial video

algorithm, assuring an abundance of transitions for subsequent clock recovery and preventing long runs of zeros. If the data arrives at the next digital receiver in satisfactory condition, it can be deserialized and the data samples perfectly recovered.

Testing the data signal

Serial digital systems tend to work with perfect data transfer until system performance limits are exceeded — then the system crashes. As long as the serial digital system operates within limits and the data signal is accurately received, the program material may be faithfully recovered for processing and subsequent retransmission. This makes it difficult to determine digital link headroom by simply observing the resulting video. It is practical, however, to observe the in-service signal path for distortions that might cause a failure. Special test signals may be used out-of-service to stress the data receiver. Using these methods, a judgment can be made concerning how close a signal path is to failure.

In the serial digital system, there is no

separate clock for synchronization. The data receiver must extract sufficient timing information from the serial datastream to create a sampling clock at the received data rate. This is accomplished by processing the 270MHz datastream with a non-linear element, such as a squaring amplifier. This non-linear element is necessary because, due to the Non-Return-to-Zero Inverted (NRZI) coding, the datastream has no energy at 270MHz. This non-linear element converts signal energy near 135MHz to 270MHz for clock recovery.

For stress testing, there exists a special worst-case signal, with digital values of 200H (Cb and Cr) and 110H (Y), creating an occasional line of 20 bits high and 20 bits low after scrambling. This signal, transmitted intentionally by a test signal generator or accidentally in a gray graphic, will stress the receiver clock's ability to accurately lock to the signal by making available a minimum of energy at 135MHz.

Due to the frequency-dependent loss of interconnecting coaxial cable, receivers attempt to equalize the incoming data signal,

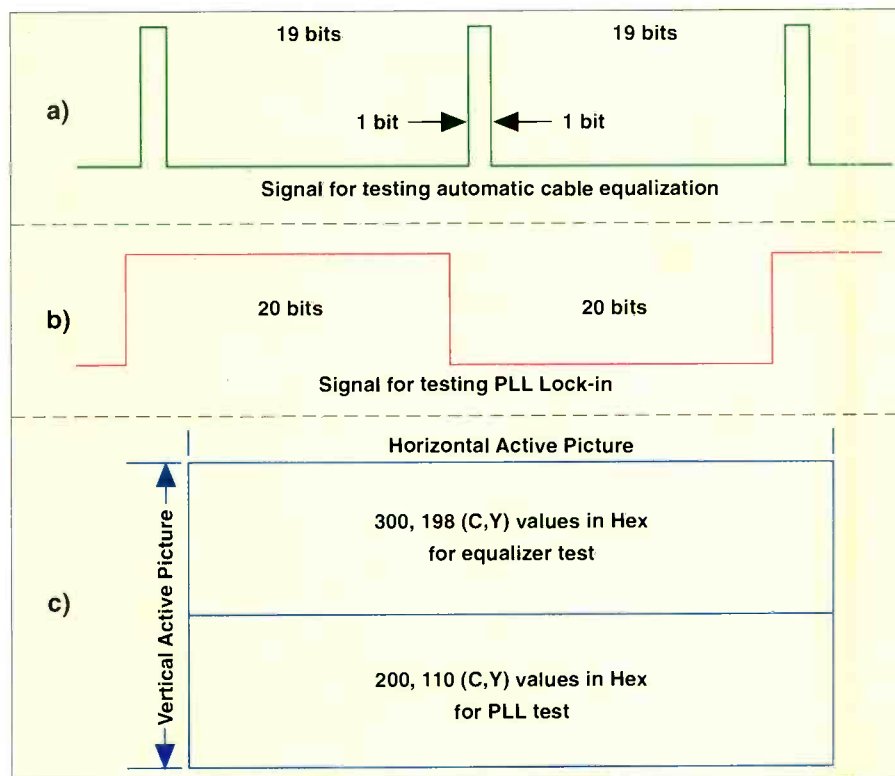
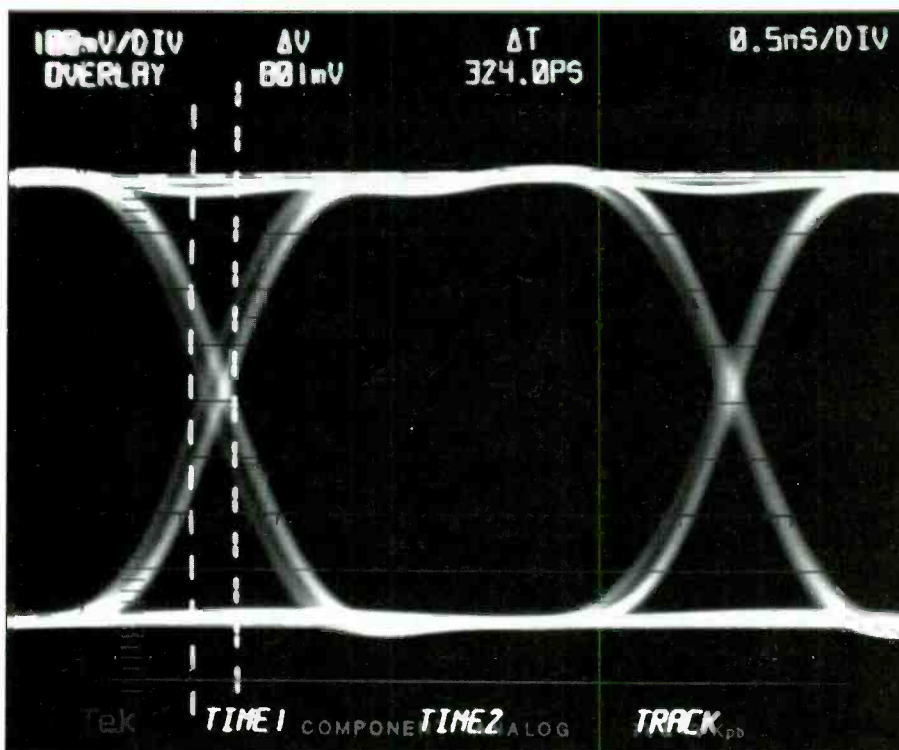


Figure 1. Pathological tests can be performed using signals that stress the system. Transitions indicate "ones" and no transition indicates a "zero." Test generators should test both polarities of a given test string. a) A string of 19 "zeros" followed by two "ones" produces a signal with large DC content; recovery of this signal stresses cable equalization circuitry; b) Signals consisting of strings of 20 "zeros" followed by a single "one" stress receiver clock recovery due to the small number of transitions; c) the SDI check field produces both of these test strings, and is used for testing digital signal paths.

restoring frequency response balance from low frequencies through approximately 270MHz. A special test signal with worst-case Cb and Cr values of 300H and Y values of 198H (purple), stresses the system by creating an occasional line with relatively large low-frequency components, possibly fooling the receiver into poor equalization.

Longer cables will cause loss of higher-frequency data information and marginal data reliability as the receiver equalizer tries to recover data transitions among the noise. This may be tested by measuring data signal power or by adding lengths of cable until the failure point is identified.

Jitter in the transmitted data signal reduces the receiver's ability to recover a properly phased sampling clock for data recovery, especially when other signal degradations are present. Instruments are available to measure alignment jitter in the arriving signal relative to a recovered clock. To measure true alignment jitter, measure the relative timing jitter between the recovered clock and the received data. By using an oscilloscope triggered with the recovered clock, alignment jitter can be evaluated by



Scope trace of an eye-pattern display with cursors and alphanumeric readout.



"YES! THE WAY AHEAD TO DIGITAL CAN BE PRETTY TRICKY" CAUTIONED SNELL.

observing the resulting eye pattern. A convenient way to determine channel amplitude and jitter characteristics of the data signal, along with the signal's video characteristics, is to use a waveform monitor with a built-in eye-pattern display.

Amplitude and alignment jitter measurements are simplified by using the waveform monitor's voltage and timing cursors. Because the recovered clock from the receiver under test is not often available, serial component waveform monitors may recover the clock with a choice of selectable bandwidths. This recovered clock then triggers an eye-pattern display, effectively high-passing the displayed jitter since the high-pass corner frequency is roughly equal to the clock recovery bandwidth. The low-bandwidth selections are provided to evaluate the total jitter via the horizontal displacement of the eye-pattern display. Higher-bandwidth choices allow the engineer to ignore low-frequency jitter that typically does not bother clock-recovery circuits.

A sampled eye-pattern display may also be used to check distortion of the data signal due to impedance irregularities or improper termination, provided the monitor is in the active data transmission path. This check confirms the physical integrity of the data

path, and may help discover improper or damaged cables, connectors or terminators. On a malfunctioning link, being able to determine if the serial signal is present or missing is an important capability.

All of this assumes that the data itself is correct. Many instruments, fixed and handheld, are available to assure compatible data, correct format, legal video and ancillary data values, and correct insertion of embedded audio signals. Also, there is operational monitoring of the video and audio used to make the data. This operational monitoring is often done with conventional analog displays.

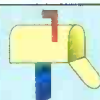
Serial component video is no more complex than analog and can be easier to understand. In today's facilities, digital video is easily implemented and its quality is easy to maintain and verify. Most of the old familiar tools are still available, and only a few new ones are needed. Cameras may still be set for the creative effects you want, and creating those effects are now technically easier. Work may be stored, recovered and sent on to the end user with confidence that it will be reproduced with the creative effects intended.

Guy Lewis is a product manager for Tektronix, Beaverton, OR.

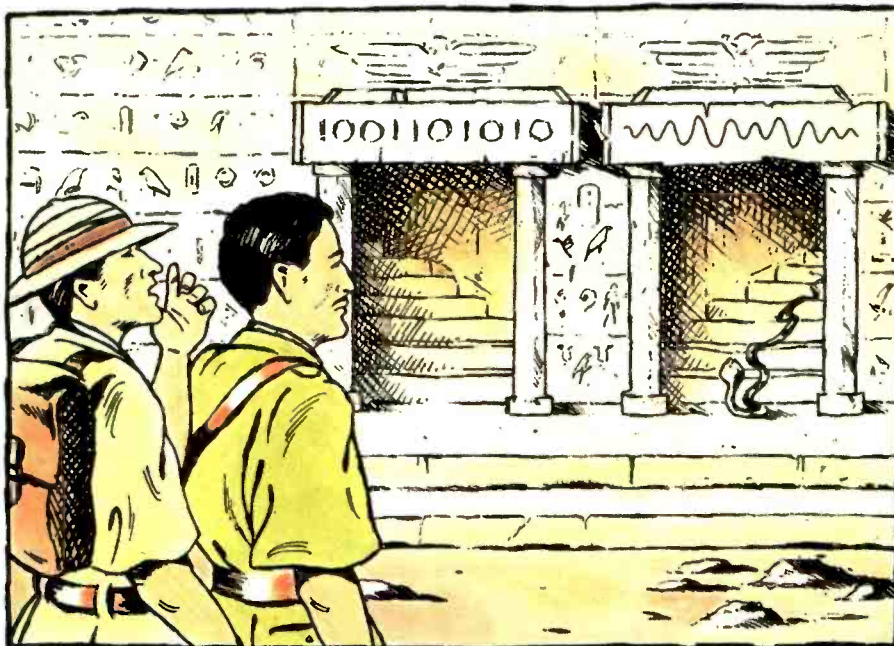
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Today's TV audio consoles have become quite complex, especially compared to the ones of just a few years ago, which weren't much more than big radio consoles. TV production is caught between the conflicting requirements of shrinking manpower budgets and ever more complicated programs. It is common practice to use many more microphones and other audio sources than before. A simple "one-mic show" like *The Nightly News with Tom Brokaw* can easily occupy a 36-input console.

A careful analysis of input requirements is necessary, and this one factor will largely determine which console you buy and how much it will cost.

Input requirements

Although many consoles have input switching, it is not a good idea to put the backup lav mic from your anchor on the "B" side of an A/B input switch. Besides the fact that you cannot pre-hear the mic to verify that it's working, significant noise could accompany a hot changeover.

Some operations will want to set up one or more shows on the console and leave them in place. This may require more inputs. Others will look to automated consoles. Today's console automation requires careful investigation. Some types will store the control setting information, while others will move the controls into their stored positions. Furthermore, some will store *snap-shot* settings (or *scenes*), while others will allow fully dynamic, time-variant control of some or all settings to be stored and recalled.

Differing needs

Some programs will need the console to perform all show functions. Other large entertainment-type productions will divide the mixing requirements between separate consoles (and control rooms). Meanwhile, a complex news show (like *Nightline* or election-night coverage) might require a sub-control room to organize and mix news remotes and manage multiple mix-minus backfeeds.

Some method of grouping mixes is required, either by audio subgroups, VCA

Choosing an audio console

groups or both. A need for 10 to 20 groups is not unusual.

Extensive mix-minus capabilities are used today to feed studio-talent IFBs, telephone hybrids, subcarriers for remote IFB, overhead studio floor feeds by zone, audience PA by zone, iso feeds to iso tape machines, satellite uplinks and more. It's handy to have the ability to accomplish these feeds without tying up the main buses of the console, perhaps implying an outboard mix-minus matrix or submixer. Nevertheless, all mix-minus or aux sends must still be easily monitored in the main control room via auxiliary monitor-source switching, and each mix-minus feed should be assigned to its own dedicated, full-time meter.

Two different types of input sensitivity trims are available — either stepped or continuously variable. The stepped approach offers the benefit of repeatability, but variable allows you to adjust the level while "live" without audible jumps. The best solution may be a stepped attenuator with a $\pm 10\text{dB}$ trim pot.

The inevitable issue of digital vs. analog must be faced.

Each input module should include extensive EQ, several aux sends, (pre- and post-fader and EQ), and dynamics control (compression/limiting/expansion/gating). The latter feature is a relatively recent innovation, but it is a real requirement today, and improves the level-management and overall sound of music and sports programs.

Mixing for stereo television requires some additional items. These include polarity reversal switches, pan and balance pots, left/right/stereo/mono-sum switching on each input, a monitor section that allows instant one-button comparison between mono and stereo (preferably with the mono mix coming out of a single center speaker), some type of phase-correlation meter or scope and stereo input modules with stereo faders for all line-level stereo sources. It is simply not reasonable today to use two panned mono faders to control a stereo source. The possible variances are too wide and stereo imaging is too fragile, not to mention the extra console real estate such an approach eats up.

An increasing number of shows are being mixed in surround sound and it is preferable to have a console designed for that purpose, with appropriate panning, routing, metering and monitoring facilities. Insert points are needed for external encoders and decoders.

A few other items to consider: Do you want/need patch panels on the console? What talk-back provisions do you need? Can redundant power supplies be fitted? Do the power supplies make so much noise that they must be remotely located?

Digital vs. analog

Finally, the inevitable issue of digital vs. analog must be faced. Recent advances have substantially reduced the starting prices of fully digital mixers, but the selection and cost-effectiveness of large analog consoles are still hard to match in the digital domain for many applications. Unlike storage and transmission systems, the specifications of top-notch analog consoles are not significantly improved upon by their digital equivalents.

The main advantage of a digital console lies in its configurability, particularly in its use of *assignable* controls. For example, one equalizer module can be assigned to any input and its controls set as needed, then these settings are stored and the equalizer can be assigned to another input. This is in lieu of a dedicated equalizer module on each input.

The other obvious value of a digital console is that it keeps signals in the digital domain, which becomes especially important when the majority of sources and destinations the console connects with already offer digital I/O (such as in a D-2 editing suite). Until that condition exists, however, the digital console cannot achieve its full cost-effectiveness due to the need for many high-quality A/D and D/A converters.

An interesting hybrid is also available: the digitally controlled analog console. This design stays cost-effective by keeping all signal paths analog, but allows the flexibility of digital designs with assignable modules, automation and instant reconfigurability via software. The latter is particularly useful in accommodating the fast-changing surround-sound or multichannel-output requirements of today's TV facilities.

Great variety and increasing price/performance ratios are the rule among audio consoles today. The large number of console manufacturers that have targeted the broadcast/post market assures prospective buyers of plenty to choose from to suit their varied needs. ■

Terry Skelton is an audio consultant and trainer based in Bucks County, PA.



For more information on audio consoles, circle (154) on Reply Card. See also "Audio Consoles, Mixers," p. 50-51 of the BE Buyers Guide.

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Circle (16) on Reply Card



Remember when the fax machine suddenly became a necessity? It is hard to pinpoint the time, but there was a year in the mid-'80s when you suddenly could not compete in the business world without one. Facsimile technology became a hot trend, and in a blink of a business eye, you became a pariah if you weren't able to fax documents to partners and customers. The same transformation is now occurring on the Internet's World Wide Web (web).

Constructing a web site today means that you're not dumb enough to get left behind.

Only a year ago, a web site meant your company was a "leading-edge" corporation astute enough to see the future of distributed communications. Constructing a web site today means that you're not dumb enough to get left behind. Like the fax's golden age 10 or so years ago, the business world is now beginning to fill with voices asking the question that today's corporation can no longer afford to ignore: "What do you mean you don't have a web site?"

Whether or not you have heard the murmuring, it is inevitable that a web site (or "home page" as they are also known) is quickly becoming de rigueur to play within the parameters of today's business world. The reasons for this new prerequisite are many: instant worldwide access to corporate data 24 hours a day, 365 days a year; dynamic control of a corporation's global image in ways previously unknown; a direct connection to your customers; and a quickly evolving multimedia forum to showcase your company's strengths. What could possibly be holding you back from starting a site of your own?

Probably a clue as how to begin. But never

Web publishing: Don't get left behind

fear — web publishing is not as daunting as it may first appear. One of the reasons the web has proliferated so quickly is that the technology requirements are minimal and the costs are reasonable considering the benefits you and your company will reap. To establish a web site, all you have to do is follow these basic steps:

- **Step 1: Register your domain name with InterNic** — This is important because your domain name is literally your web address, and you want people to find you easily just by knowing your company name. A short, logical domain builds easy name recognition and gets people to your site quickly (a boon in these days of instant gratification). InterNic is a government agency and can be reached at www.internic.net. Registration is free, but can take as long as a month to process, so plan ahead.

- **Step 2: In-house or outsource?** — Creating a web site is not hard, but expect a learning curve. How much time do you have on your hands? Like the desktop publishing revolution in the 1980s, the web has given birth to scores of specialty shops specializing in custom publishing. The costs vary by the hour and the project, and while some companies provide the full service of designing and hosting your web site, many others just do the design work and leave the technology to you.

Deciding what you need from an outsourcing company requires some research. The best place to search is at Yahoo! for "Internet presence providers." This kind of search will give you plenty of options, anywhere from big name players like Poppe Tyson (www.poppe.com/) to smaller growing shops like Silicon Reef (www.reef.com).

Doing it yourself requires even more research, but could ultimately provide you with better control of your site. First, you will need a dedicated Internet connection like an ISDN or T-1 line (call a national provider like MCI or go to the catalog of ISPs at www.netusa.net/ISP and find a provider near you), then you need a computer to which your line connects. The Net was born on Unix, but Windows or Mac will work just fine (in fact, Macs are getting a tiny corporate rebirth as web hosts). Go with whatever you feel most comfortable, but make sure that you have a fast processor and plenty of RAM to handle lots of guests visiting your site.

Once you have your server box, you then need your server software. You can get free software from CERN, where the web was born (www.w3.org/hypertext/WWW/Daemon/), or the NCSA, where Mosaic was born (www.ncsa.uiuc.edu/). But if you are

in business, you probably will want to pay for the support. If you are a Unix lover, you can get Netscape for \$1,500-\$5,000 (www.netscape.com). For the Windows user, O'Reilly & Associates WebSite has garnered great praise for its ease of use and the fact it is easily found in local bookstores for a price of \$349. For the Mac folks, the only real option is WebStar from StarNine that sells for \$599 (www.starnine.com).

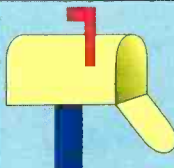
- **Step 3: Create your content** — Now that you have a web-ready box, you need to fill it with interesting material. Once again, the in-house or outsourcing question must be answered. HyperText Markup Language (HTML) is the formatting language of the web, and though it is not hard to learn, it does take time to master. Microsoft and Novell's Wordperfect division have put HTML authoring tools in their word processors, and you can buy tools like HotMetal Pro from SoftQuad to do it yourself.

Whether you do it yourself or not, the critical thing to remember about web publishing is that you are not done once you create your page. The beauty of the web is also its curse: Playing in a dynamic medium means that you must remain dynamic. Updating your web page is crucial and requires re-engineering your internal business processes to include updating and publishing material to your web page.

"What do you mean you don't have a web site?"

Just remember to be interesting. Dumping your brochure on-line won't cut it anymore. Grab your audience with relevant material that tells them why they should care to work with you. Giving things away, such as software or other informative freebies, also doesn't hurt. So join the revolution! Making this move should be easy, unless, of course, you are the type who still doesn't own a fax machine... ■

T.C. Hall is a senior account executive at Niehaus Ryan Haller, a high-technology public relations firm in South San Francisco.



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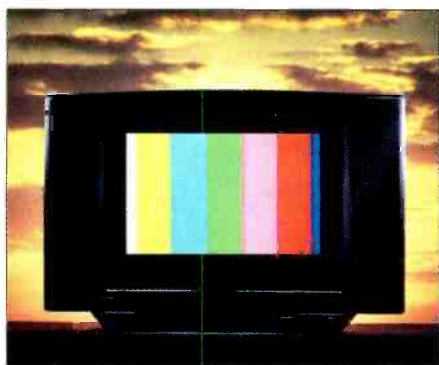
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Will the digital channel replicate my NTSC channel?

A station example

Let's look at an example. (See Table 1.) Assume an existing NTSC VHF station is assigned a mid-UHF Channel 47 for ATV. Also, assume that the ATV power has been set so that the area of the noise-limited reception contour for ATV reception is equal to the area of the station's current Grade B contour. The maximum radial to the Grade B contour is 100.6km. With these givens, evaluate the assignment to verify that the new ATV coverage will indeed cover the station's existing market.

Assuming ATV channel assignments for all stations in the area, the new ATV interference into reception of the NTSC signal can be estimated. Note that the NTSC VHF station already has some loss of Grade B area due to existing interference from other NTSC stations. For this example, the additional loss is 4.3% of the service area, but only 0.8% of the population served.

The service area of the new ATV channel can now be estimated. There may be some loss due to interference from the other new ATV stations and there is also some loss due

to interference from the existing NTSC stations.

The loss of ATV service in the Grade B contour for this example is mostly due to interference from NTSC stations — 0.9% of area and 0.1% of the population. For the NTSC audience, 99.9% will be able to receive the ATV signal. The market impact of introducing ATV in terms of covered population is a near term loss of 0.8% of the NTSC market and a gain of 1.7% over NTSC for the ATV market. In terms of service areas, the NTSC service area is reduced by 4.3%, but the ATV service area is increased by 15%.

You should begin learning how your ATV signal will propagate across your current NTSC coverage area. Armed with the proposed ATV assignment table, engineers can start the evaluation process of ATV vs. NTSC coverage patterns. A little planning now will help you move quickly when the channel assignments are finalized.

We'll examine the 8-VSB modulation system in next month's column.

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

It is now only a matter of months before the FCC will set a standard for a new Advanced Television Broadcast Service (ATV). The commission will also assign each of the approximately 1,700 TV stations a new channel for ATV pairing the new channel with the current NTSC channel. Most of the new ATV assignments will be in the UHF band and each NTSC station will be assigned a new ATV channel with a specific numeric value. In past columns, I have explained the basis for the assignments because this is something you and your station manager should understand. What if your station, now on a low VHF channel, is assigned UHF Channel 68? Will your viewers tune up to Channel 68? Here is how you can begin to answer questions.

Digital television will be different!

An NTSC picture deteriorates gradually with a decreasing signal-to-noise ratio as distance from the transmitter increases. This is a characteristic of NTSC television as an analog system. This will not be the case with a digital TV system; the digital system is designed with built-in headroom that takes natural interference into account. As a result, there is no gradual degradation, the ATV signal is perfect or it can't be received.

Also, because NTSC television is an AM system, the video is subject to multipath "ghosts" and to natural and man-made electrical noise that show up as annoying sparkles and lines in the picture. The quality of the received signal also varies widely from location to location and over time.

The different grades of NTSC reception are statistically derived on the basis of time and location variability. Field tests have demonstrated a high degree of UHF multipath variability. Even a fraction of a foot difference in receive antenna location can result in a significant signal change. This variability can not be attributed to terrain blocking the path; it can be caused only by multipath interference. The proposed digital system is designed to account for such conditions.

EXISTING NTSC VHF CHANNEL

	AREA			POPULATION		
	Area (sq-km)	Losses	%	Population	Losses	%
NTSC VHF CHANNEL						
NTSC Grade B contour	31,816		100.0%	8,583,805		100.0%
Existing NTSC interference		4,394	13.8%		153,805	1.8%
NTSC base line service area	27,422		86.2%	8,430,000		98.2%
NTSC base line service area	27,422		100.0%	8,430,000		100.0%
New ATV interference		1,179	4.3%		67,440	0.8%
Service area with ATV	26,243		95.7%	8,363,000		99.2%
ATV CHANNEL 47						
ATV noise-limited contour	31,816		100.0%	8,583,805		100.0%
Interference from NTSC stations		300	0.9%		6,546	0.1%
Interference from ATV stations		2	0.0%		1,375	0.0%
Combined interference		301	0.9%		7,921	0.1%
ATV service area	31,515		99.1%	8,575,884		99.9%
NTSC base line service area	27,422		100.0%	8,430,000		100.0%
ATV service area	31,515		114.9%	8,575,884		101.7%
NTSC area match	27,395		99.9%			
NTSC not matched		27	0.1%	est.	8,430	0.1%
ATV service gain beyond NTSC	4,120		15.0%	N/A		
Net ATV service gain	4,093		14.9%	145,884		1.7%

Table 1. Using Channel 47 as an assumption, the above table illustrates how to calculate the differences between a station's current NTSC coverage area and the proposed ATV coverage area. The calculations are based on a maximum radial of 100.9km, HAAT 402.3m and an ATV ERP of 852.3kW. In this example, the ATV coverage is 14.9% larger and encompasses 1.7% more population than does the NTSC VHF signal.



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Preview

Coming in December . . .

New recording technology

Take a look forward at how video is recorded today and what new technology lies ahead. Areas that will be covered include disk caching, optical storage, the video CD, digital videocassette, digital VHS, Sony/Philips consumer video CDs.

Disk-based servers for production and broadcast

Servers are now available that can provide multiple streams of real-time video with full CCIR-601 quality. Find out about the technology behind tapeless storage.

Routing video

Getting the signal from here to there used to be straightforward. Now, you must decide analog or digital, component or composite. Once these factors are selected, a whole new realm of transport protocols are available to interconnect the many video devices. Sometimes, it is no longer a case of selecting the router size, but of a virtual routing system where the traditional crosspoint no longer exists. Then you must add the issues of ATM vs. SDI and SDDI topology. Find out whether you will need to route video or whether the routing will be on data.

Preparing for disaster: Lights out

Being able to maintain broadcast operation when the power fails is an expensive, but important operational requirement. By their very nature, natural disasters are unplanned. To avoid being embarrassed and shortchanged, you must plan in advance for such eventualities. Review the latest types of generators, their maintenance and how to properly size and purchase one. ■

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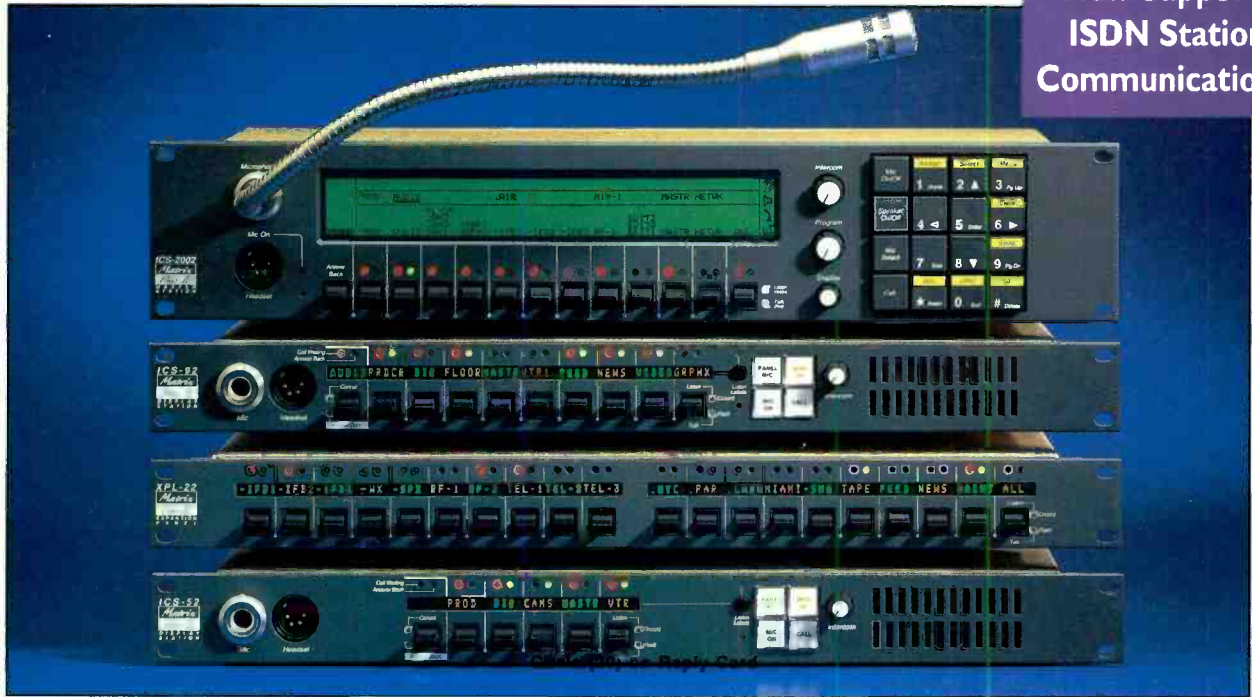
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Broadcast PC platform

Major players tap into the TV bandwidth for new networks to deliver more data to home PCs.

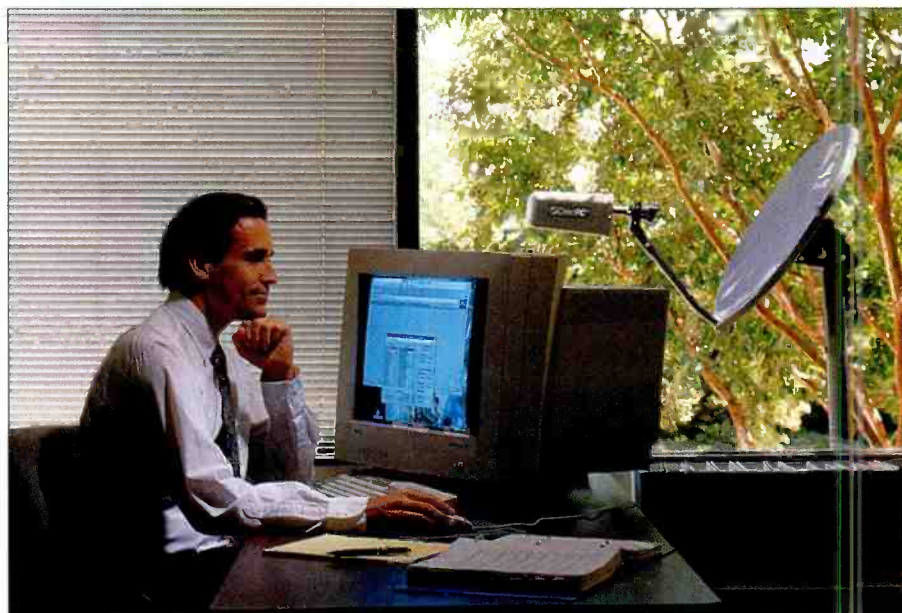
By Marjorie Costello

Sending data over the broadcast TV signal offers potential for linking the television and the computer. In addition, other TV-related pathways are under development, including cable television and satellites. The driving force is the quest for more bandwidth dictated by the limitations of the plain old telephone service (POTS). With millions of new consumers downloading large multimedia files from on-line services and cruising the Internet, the conventional narrowband phone line is just not sufficient.

A host of companies — including major players in computers, cable, satellite, broadcasting, on-line services and consumer electronics — are developing ways to send more data faster. Using the terrestrial broadcast signal — including the VBI — is just one pathway most players are pursuing.

Broadcast network perspective

NBC, the network currently most actively involved in developing datacasting, is not just looking at the VBI. According to Ken Bronfin, general manager, NBC data network, when he considers the various delivery pathways, he is talking in terms of applications that can work on any of those platforms. Bronfin, who also is vice president, NBC cable and business development, explains that his data operation is not necessar-



ily developing something just for VBI, but also for cross-delivery platform use.

Although planning to tap all data delivery networks and speaking with all the players, NBC has a special interest in the VBI. NBC owns and operates a TV network, seven TV stations and two cable networks (CNBC and America's Talking). NBC also is linked by its network to affiliates in markets across the country. As a result, the company controls a significant amount of the VBI.

According to Bronfin, the VBI's appeal in data delivery is that it is ubiquitous. "The technology is well-known, well-tested and the costs have been brought down to chips at a dollar," says Bronfin. And, although the VBI can't deliver video and barely provides audio, Bronfin believes that it can do just about anything else.

One data delivery application that NBC has a strong interest in developing involves interactive advertising. For instance, in an interactive ad for a car, an application can be sent out with a picture that will allow the viewer to change the car's color and spin it around from different angles. The application can be downloaded prior to a 30-second commercial making it available to the viewer the second the commercial comes up. Bronfin says, "You have a 24-hour, continuous datastream [to the home] as long as the TV is on and the PC is on collecting the data." Although the VBI is not superfast, Bronfin says, "You can send a megabyte file and create some nice functionality."

Regarding the use of the Digital Satellite

System (DSS), Bronfin mentions, "We have NBC stations on DSS and CNBC and America's Talking. So I am inclined to provide [data] services over DSS for NBC."

Bronfin believes that data delivery has to be implemented by the network and local stations. He says that at RTNDA/SMPTE, all the affiliates were interested in participating in terms of bringing their local advertisers and local news content.

And Bronfin's group is not the only new media unit at the network leveraging what even broadcasters are now calling *content*. Other NBC multimedia operations include NBC Desktop Video, which provides live video news to business customers; NBC Digital Publishing, which develops CD-ROMs and other digital products; and NBC Online ventures, which launched NBC SuperNet, the TV network's new on-line service on the Microsoft Network.

As broadcasters seek new ways to use — or re-purpose — news, sports and entertainment content and distribute it on as many new networks as possible, they are meeting up with other industries. The computer industry — including hardware and software firms — is one of the major players at the convergence, seeking ways to expand the bandwidth for communication with the home PC.

The computer industry networks

In the computer industry, the word *network* as it relates to sending data to a mass audience of home PC owners goes beyond tap-

Top photo: HNS currently operates a digital communications satellite service, DirecPC. The service is being marketed primarily to commercial customers, as well as high-end consumer Internet users.

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ping NBC, CBS, ABC, CNN or ESPN. Network translates into any pathway — wired or over-the-air, terrestrial or satellite, telco or broadcast — for delivering data to home PCs.

This past summer, software giant Microsoft enunciated its strategy for the broadcast PC platform. In a speech aimed at content providers and developers for the new Microsoft Network (MSN) on-line service, Microsoft senior vice president Craig Mundie noted, "The Microsoft Network and other on-line services have been born in the environment of narrowband communication [POTS]. What we see as an opportunity...is essentially the ability to use the existing broadcast infrastructures — which exist in many forms, such as satellite and cable modems."

Microsoft, based in Redmond, WA, is also exploring use of the VBI to send data and has as its goal the creation of a system that is network neutral. Mundie maintains that the form of data transmission is ultimately up to the people that are going to work with Microsoft to provide these networks and use the company's software.

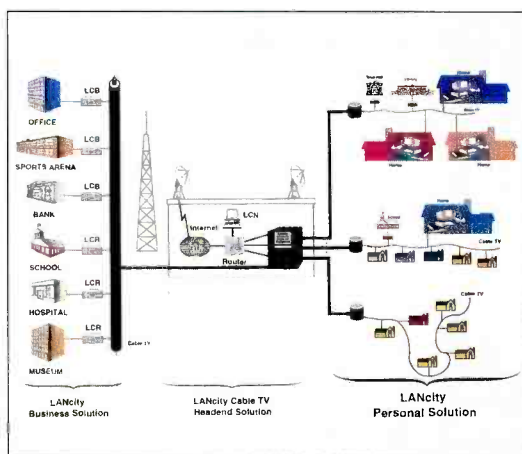
Mundie, who heads Microsoft's consumer systems division, explains that the data could be simulcast, complementing a TV sporting event with statistics or featuring an enhanced version of an on-line service related to a TV program. Another possibility Mundie mentions is using a satellite or terrestrial broadcast system as a bulk data download engine to send video clips to PCs in the middle of the night.

At Microsoft, the goal is not simply to transmit more content-rich multimedia versions of MSN; the company also wants to provide operating system and applications software that will transform the home computer into what Mundie calls "the broadcast-enabled PC."

The importance to the computer industry of exploiting new delivery networks is summarized by an executive at the major microprocessor maker Intel. Avram Miller, vice president of corporate business development, has been leading his company's efforts in this area. According to Miller, in the next 10 years, computers will increase their capabilities by 100 times and there is a need to increase the communications capabilities proportionately.

At major PC direct marketer Gateway 2000, increasing the speed of data to the computer has become a major issue. Tom Grueskin, senior project manager, observes, "Whether it is the network people, the computer companies or the end user, everybody is very focused on that because [the speed problem on-line] is a huge customer satisfaction issue. Nobody likes to wait for anything."

Grueskin also predicts that when the content and services are offered, people will be all



Deployment diagram for the LANcity cable modem.

over it. Grueskin says, "When Microsoft or other companies offer some kind of content that gets our customers excited, we will design a network card and throw it in the system as an upgrade for a couple of hundred bucks."

Data from the birds

Microsoft and others have made no secret of their interest in using satellites to reach home PCs. Of particular interest is the Digital Satellite System (DSS) because, as its name indicates, this broadband TV programming service is all digital.

Shortly after Mundie delivered his speech in July, stories began appearing in the press that Microsoft was finalizing a deal to deliver a multimedia version of MSN on DirecTV. DirecTV is the major programming distribution service and key backer of the direct-broadcast, all-digital TV service referred to as DSS. To date, more than one million DSS 18-inch dishes and IRD set-top boxes (integrated receivers/descramblers) have been installed. This past summer, Sony joined Thomson in marketing home DSS consumer equipment.

Delivering data to home PCs via DSS is one of the major goals for 1996 at DirecTV. "DirecTV will become one service to provide information and entertainment to the entire household, whether that platform is in the den as your PC or in your family room as your TV set," predicts DirecTV's Ed Huguez, vice president, new media and interactive programming. As of early fall, the El Segundo, CA-based company had not made any announcements regarding Microsoft or any other potential data service providers.

At DirecTV, adding data or multimedia services is an extension of its core business. Huguez says, "The assets we have in the sky and in Castle Rock [broadcast center] are already all-digital." He also points out, "It is easy for us to add extra platforms for delivery of data services. [This is] unlike cable and telcos who have to make some significant changes to their systems to deliver digital

services."

DirecTV plans to start offering data services by next summer. The company will follow two approaches, each geared toward different ends of the audience spectrum. For the passive couch potato, DirecTV intends to send data to the DSS set-top box. The information, which could accompany a sports event with relatively simple text and graphics, would be displayed on the TV screen at the press of a button on the DSS remote. And for customers who are interested in more interactivity and are often heavy on-line users, DirecTV will deliver multimedia material that subscribers can download, store and manipulate on a PC.

To receive the enhanced data service, a PC card containing the IRD components will be installed inside the home PC by the PC owner. The consumer would connect the PC to a DSS dish and could also receive the 175 channels of TV fare through a DSS set-top IRD box, provided the dish model featured dual outputs.

Huguez explains that in order to launch the new data service, DirecTV is talking to everyone who is a key player in the computer industry. In order to introduce a product that is PC-centric, the cooperation and the willingness of all the major players is needed.

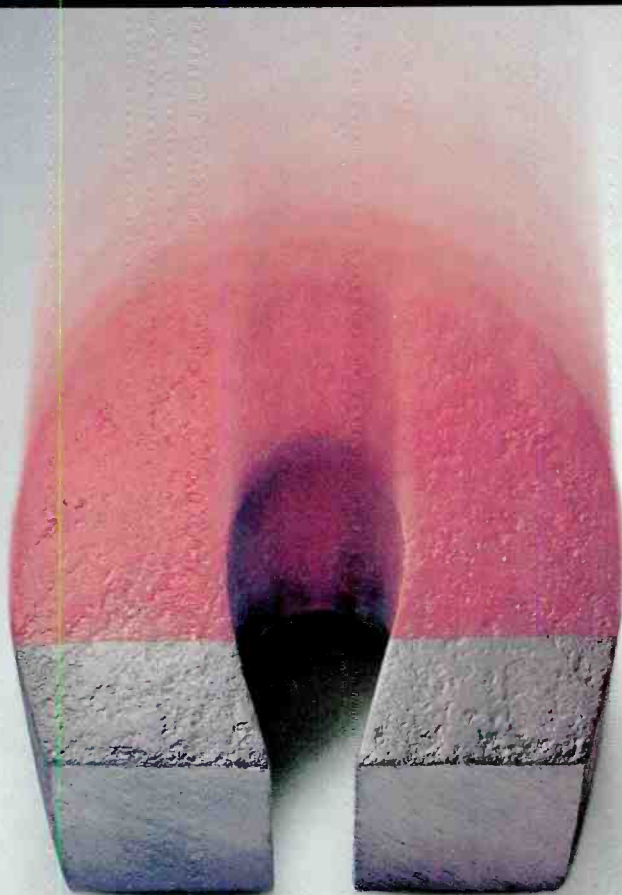
While each DirecTV channel offers the potential of delivering up to 30Mb/s, it's unlikely that any service would be allocated the maximum capacity. The official range cited by DirecTV is zero to 30Mb/s.

For companies that start adding data on the VBI, Huguez explains that DirecTV (which doesn't need or include a VBI on its digital transmissions) could capture the VBI from incoming analog signals, such as ESPN. Then, the data could be digitized and re-inserted, sending it along at the appropriate time with the channel's DirecTV video service.

DirecTV's PC customers who want to access more media-rich versions of on-line services would use the phone line as the return path. Huguez says that on-line services recognize that through the broadband that DirecTV has, they can complement their service. The services can download more robust video and text to the PC that would work in conjunction with that phone-delivered service.

Next year, Thomson and Sony will be joined by Toshiba, Uniden and DirecTV's sister company, Hughes Network Systems (HNS) in offering home DSS equipment. HNS, based in Germantown, MD, currently operates a digital communications satellite service, DirecPC. The service is being marketed primarily to commercial customers, as well as high-end consumer Internet users. In addition to transmitting business-related services to desktop PCs at speeds up to 12Mb/s, DirecPC also offers a Turbo Internet application.

DirecPC transmits on a transponder on the medium-powered Hughes Galaxy satellite,



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in contrast to DirecTV's use of high-powered DBS birds. With DirecPC's 24-inch antenna and ISA PC adapter card selling for \$1,295 (plus a monthly service fee of \$15.95 and user fees), customers can retrieve information from the Internet at speeds up to 400kb/s. The phone line carries user requests back to the Internet, networked by Hughes.

The cable modem connection

The cable industry is also profiting from the pressure to push PC-bound data. The cable modem, as evidenced by the attention it has received at recent cable shows and in field trials around the country, has become one of the promising new revenue generators at cable systems.

With cable penetration at nearly 65% and operators offering 50 and more TV channels, delivering data through a cable modem is becoming another viable network to reach the home PC. In homes wired for 2-way communications, consumers can receive information without tying up their phone line and they can also request data through the cable.

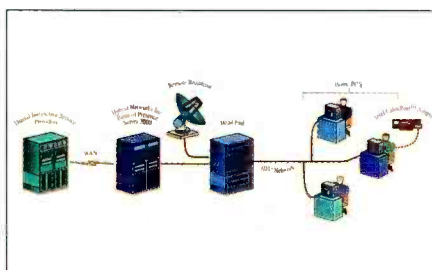
Cable's viability for delivering data is reflected in the major companies that have either announced or are reportedly developing cable modems for consumer use. They include Zenith, LANcity, Hewlett Packard, Intel, General Instrument, Motorola, DEC and Scientific Atlanta. While many cable modems are in trials or in development, only Zenith and LANcity are currently selling a product to cable systems.

However, persuading the cable industry to take data and cable modems seriously took some convincing. According to Intel's Avram Miller, the initial challenge was to make them aware of the personal computer. The cable companies defined themselves as being in the TV business and Miller says it was a "paradigm" change to make them understand that the growing home PC penetration represented a major economic opportunity for the cable industry. Intel's CablePort modem is currently in field trials with Comcast and Viacom, with Intel expecting the unit to reach the market in 1996.

Although the cable industry may recognize the money it can make deploying cable modems, most systems are not equipped to handle 2-way cable communications. Even optimistic estimates place cable system support of 2-way service at only 25%.

However, many cable companies are in the process of rebuilding their facilities to include hybrid coax/fiber systems. When they make that upgrade, they are also adding the capability to offer 2-way communications. Miller figures that systems are upgrading at a rate of about 20% a year.

Zenith, a company active in cable set-top box and TV set sales, has distributed its cable modem to most of the major MSOs. According to Tim Frahm, Zenith's product manager,



The Intel CablePort modem is a component of the Asymmetric Broadcast Communications (ABC) system for interactive PC communications.

data products, "The products we are providing today are being bought because [cable operators] can economically get a good pay-back on their investment and provide data services that no one else can at those speeds."

The company's flagship HomeWorks Universal runs at 500kb/s or 4Mb/s in both directions: downstream to the home and upstream back to the cable head-end. LANcity, in Andover, MA, began shipping its LCP, 10Mb/s cable modem this past August.

Intel's approach was to design its CablePort modem so it could support using the phone line as the return, or upstream, path back to the cable head-end. Explains Miller, "As an interim step, it's possible for the cable operator to offer high-speed data communications at speeds of up to 30Mb/s and use the telephone system as a return path until they upgrade."

Unlike telephony modems, cable modems — at least for the next few years — are sold to cable systems and leased to consumers, as with set-top cable boxes. Cable modems that are now on the market sell in the \$400 to \$600 range. As for service charges, in a market test conducted by Time Warner in Elmira, NY, consumers are charged \$14.95 monthly for a package that includes the modem and access to local services. For an additional \$9.95 per month, customers can receive access to the Internet.

Cable modems today are external devices that connect to the PC through a standard Ethernet card. One of the reasons the cable modem is not inside the PC, explains Lorraine Bartlett, product manager, HP cable modem,

is that cable operators don't want to open up the PC when a customer wants a cable modem. The operation expects to begin shipping its cable modem by mid-1996 offering 30Mb/s downstream/15Mb/s upstream. In addition, the company is developing a server complex for cable systems to run their data network.

Another factor that would make consumers reluctant to buy or install a cable modem in their PC is the absence of standards. If a consumer installed a cable modem and then moved, the modem may not be compatible with the next system's data service.

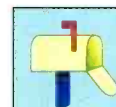
The future: a moving target

Ultimately, as television (including broadcast and cable) moves into the era of advanced all-digital transmissions and the phone companies finally deploy their own 2-way broadband networks, the differences between data and traditional programming will blur. At the eventual convergence, it's likely that the public will see little difference between traditional television and the newer data channels.

Microsoft's Mundie shared several observations that could have also been made by a broadcast or cable network executive involved in new media. Mundie maintains that people in the non-computer environment enjoy real-time voice communication by phone, and entertainment is largely a video or moving-pictures-based medium. Mundie believes that as consumers get involved in a broader array of non-text-oriented on-line services, the tendency will be for them to demand more media-capable delivery vehicles that are faster and can eventually deliver moving pictures.

As Mundie sees it, "People have been socialized by TV and they expect high-quality moving pictures. You can bet the consumer won't be satisfied until that is what they get — whether they think of TVs or PCs." ■

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



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Stop the presses: InterCast group launches

Just at press time, several companies announced their participation in a plan to integrate the broadcasting of data along with video programming. The technology, called *InterCast*, will link the Internet and video on a PC.

The formation of the InterCast Industry Group was announced by media companies NBC, Turner Broadcasting's CNN Interactive, Viacom and WGBH Educational Foundation, programmer QVC, cable operator Comcast; software developers America OnLine, Asymetrix, En Technology and Netscape Communications; PC manufacturers Gateway 2000, Packard Bell and semiconductor manufacturer Intel.

With InterCast, users will be able to receive broadcast Web pages and other data combined with cable and broadcast programming. InterCast content will be created with HTML (WWW language) and include hyperlinks to related information on the Internet. Via modem, users will be able to move transparently between web pages sent over broadcast signals to related Internet sites. See the December issue of *BE* for more details. ■

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QC in the digital environment



The Bottom Line:

As facilities transition from automated digital islands to fully networked digital systems, one of the key benefits is the consistent "look" obtained from a well-thought-out system. Building a system to manage technical resources, including equipment and personnel, is a complex task. Ensuring that such a system can also take your facility into the future is even more difficult.

In today's fast-paced world, facility automation using networked systems is a key management tool.



Station automation systems have evolved from limited control of a few devices to fully automated multichannel systems. The advent of video file servers for use in station and network environments sets us on course for significant developments in this area. Before an automation system is implemented, however, many quality control issues need to be addressed. The purpose of this article is to help understand today's and tomorrow's requirements.

Some of the first questions that arise when assessing automation include the following: What really is automation? How well will it perform labor-intensive tasks? Can it reduce operating costs? Which devices can I expect to automate today and in the future?

Typically, when broadcast facility automation is discussed, what is meant is the automation of the master control area, including the on-air systems. Master control automation can improve the consistency of the on-air look and feel. This can mean anything from simple solutions to complex multichannel configurations.

The important issue is that the proposed automation system be flexible enough to allow the users to implement a basic single-channel solution with an upgrade path to a multichannel environment. This must be possible without requiring significant retraining or recapitalization. One way this is accomplished is by choosing an industry-standard expandable platform. Proprietary or closed network solutions should be avoided because they may be difficult or impossible to expand.

For those wondering where to start or how much automation is enough, the place to look is the bottom line. Anything that adversely affects the bottom line is a potential candidate for automation, especially if it involves tasks that are repeated on a regular basis. Tasks that consistently require some form of make-good, such as missed spots or satellite recordings are primary candidates for some form of automation.

Automation applications

An entry-level automation system might consist of a small routing switcher, a compact master control panel and automation software running on a PC. Control instructions are sent from the PC to the router and master control switchers. Machine control may be accomplished using either the master control switcher or the computer. A robotic cassette library could easily be added to this system. The machine's playlist could simply be triggered by a GPI closure from the master control switcher.

Automating a typical single-channel environment could include such equipment as the master control switcher, a character generator, a still-store and videotape machines, which may or may not include a cassette library. This is usually dictated by whether single or multisegment commercial tapes are used. Automated devices would be connected on an automation local area network (LAN) via an automation device interface (ADI). Each ADI listens to the activity on the LAN and acts on appropriate instructions for the device it is controlling.

Multichannel operation can be achieved by adding more devices to the existing LAN. The event list could be generated either by a workstation residing on the automation system's LAN or it could

Photo: At the Kentucky Educational Television master control area, computer-based automation systems are used extensively for resource management. (Photo courtesy of Bill Straus Photography, Inc.)

be imported from an existing traffic system. The event lists may contain complete information for the on-air schedule. It could also be expanded to include any satellite recordings necessary for future playback needs.

Master control panels and signal formats

One of the most important issues when implementing automation is the ability to manually override the automation computer. It's beneficial to the operator if there is a dedicated manual override button. This button should instantly disable the automation system, allowing manual intervention.

Automation applications vary considerably, especially in terms of the number of signals switched to air. In some cases, multiple channels may be controlled from a single control panel. Some manufacturers provide various master control panel options, tailoring the control panel to best suit a facility's individual needs.

Another important issue is the signal to be switched. Many analog sources remain in on-air systems that are moving toward digital. Any analog system implemented today should be flexible enough to be upgraded to digital in the future without requiring major costs or renovation.

Manufacturers that offer solutions to accommodate analog, analog and digital, and all-digital signals (embedded and separate) have an added benefit from a resource management standpoint. Furthermore, if the same type of master control panel can support all formats, then operator retraining can be kept to a minimum. Because most master control switchers also feed a bypass switcher, it might also be advantageous if the bypass switcher control panel could be mounted into the master control panel and support the above-mentioned formats.

Video servers and automation

Many broadcast facilities maintain a large commercial tape library. The most frequently used commercials are housed in the library system's bins. Commercials are usually played out compiled (the entire commercial break is played out from a single tape) or played out from single-segment tapes (a single tape for a single commercial). Program and



Typically, production control rooms are not included as part of an automation system, however, portions can easily be automated if desired. (Photo courtesy of Bill Straus Photography, Inc.)

promotional material may also reside in the cassette machine's bins. The unit's outputs are normally fed to the master control switcher and taken to air by automation. These machines and tape transports are susceptible to mechanical wear in these applications and subsequent maintenance costs can be fairly substantial.

Recent innovations in computer technology have led to video file servers for automation applications. Typically, these video servers have a storage capacity of several hours and can be used as video cache memory when combined with cassette machines and automation. Controlled by the automation computer, the video server plays out the appropriate commercial when it receives the appropriate command.

To minimize the wear on videotape and cassette machines, the most frequently used clips are dubbed into the video server. Once in the video server, the clips can be played directly to air under automation control via the master control switcher. Assuming the

desired clips reside in the server, last-minute changes are easily accomplished, because the server can access clips randomly.

However, before video servers can be effectively implemented into automated environments, the appropriate application software needs to be installed. Applications may include:

- **Database manager:** A database manager is an application that documents all data associated with each video/audio clip, i.e., compression rate, clip ID, clip titles, group names, clip duration, record date, record time, expiration date and last aired date. When any clips are recorded to the server, these parameters could

be documented. Once a clip is no longer required within the server, it will require archiving. If the database knows the archiving format and associated data, it can provide additional benefits for the archiving function or for data searches. These may include database searches for appropriate clips. Searches could be for a specific clip based on a name or date or setup to find a group of clips.

- **Playlist manager:** The video server could be automated in two ways. First, the video server would contain its own playlist. The playlist could be created either within the video server application or imported from a business traffic system. The video server would be sent the appropriate GPI triggers to initiate or to terminate the playlist by the automation system. Second, the video server's automation device interface (ADI) would initiate individual clips from the video server's database on a clip-by-clip basis as dictated by the automation system.

- **Automated clip manager:** With the appropriate software, clips can be automatically recorded or deleted. Attention to detail is vital. If the automation system requests a clip from the video server, it should reside within the server. If it doesn't, the automation computer should prompt the operator and the clip could be quickly dubbed to the video server. To avoid this extremely undesirable situation, however, the automation computer should check ahead of time to ensure that all the required clips reside in the video server. Doing this ahead of time allows any missing clips to be recorded into the server so that they are available when needed.

Continued on page 40



System automation provides the tools to manage and maintain quality control levels throughout a facility.

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DIGI SUPER70

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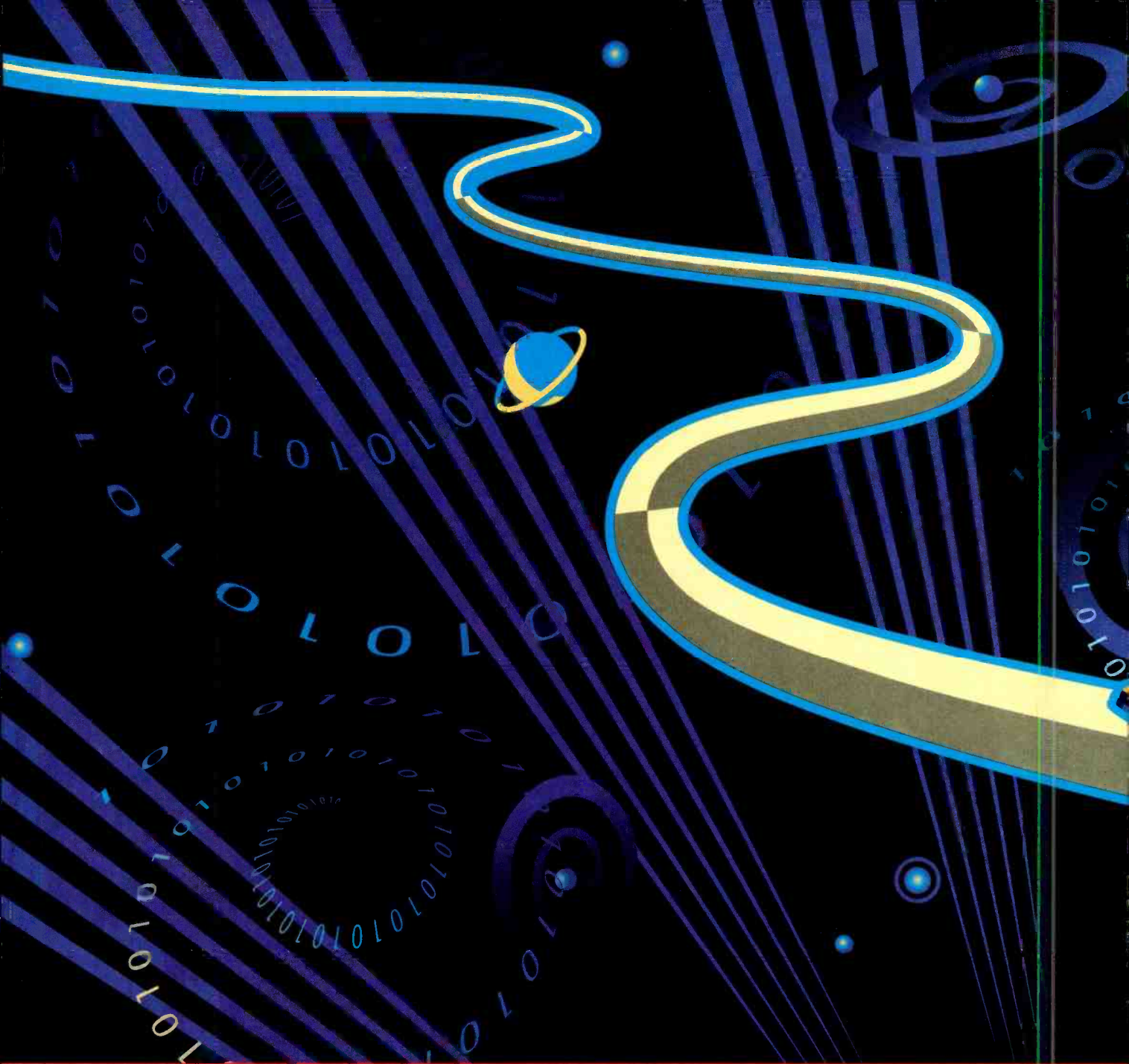
In addition to its new digital electronics, other enhancements to the Digi-Super 70 include: a new servo system with a wider range of focusing speeds; 10-bit iris technology for a precise level of repeatability; LED tally lamps; and a sleek, new, ergonomic design that features improved RF noise shielding and easier access to the lens' electronics.

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Automatic archiving of clips could also be accomplished to avoid occupying unnecessary disk space.

• **Delayed play-out manager:** Another application where video servers offer a clear advantage is in delayed play-out. For example, if an affiliate station has to air the network feed at 10:00 a.m., but a locally produced program is over-running by 15 seconds (news flash) and the station chooses to stay with the local program for the extra 15 seconds, then the affiliate station has two options: It can either switch to the network 15 seconds late or delay the network feed by 15 seconds until the time can be made up. A 2-channel video server with delay play-out software can do this easily. At 10:00 am, the server's record channel would be initiated; 15 seconds later, the network feed would begin playing out. This prevents the viewers from missing the first 15 seconds of the network material. Systems are coming to market with time expansion and contraction capabilities. These units would be able to shrink the 15-second buffer of network material over time, thus allowing the network feed to be taken directly.



So much of today's equipment is microprocessor-based that connecting systems on a LAN is simply an extension of older serial and parallel remote controls.

Additional considerations

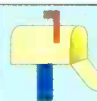
These quality-control applications would reside on Pentium personal computers running Windows NT, and should be device and compression independent. Currently, no application provides a single control point, however, they are under development and may be available next year. By installing a network of computers, station resources can be easily tracked and allocated. With the appropriate driver software, much of today's

dedicated hardware can be tied into the network. For engineers, moving facilities to a networked environment can be challenging and rewarding. Computer expertise either in-house or through integrators is critical.

Computer networks, if designed properly, can provide their own redundancy. Careful planning and integration will allow technical resources to be managed effectively in the future. Automation should produce a higher quality look and better station presentation. With the advent of video file servers, running the appropriate application software should provide broadcasters with more cost-effective solu-

tions while providing the advantages of disk-based video technology.

David Cox is a senior product specialist with Dynatech Video Group, Newbury, Berkshire, England. Jon Hammarstrom is VP, control products and Adware with Dynatech Video Group, Salt Lake City, UT.



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See page 44 for "Battery FAQs"

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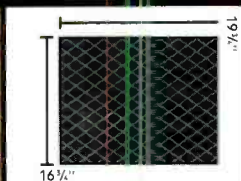
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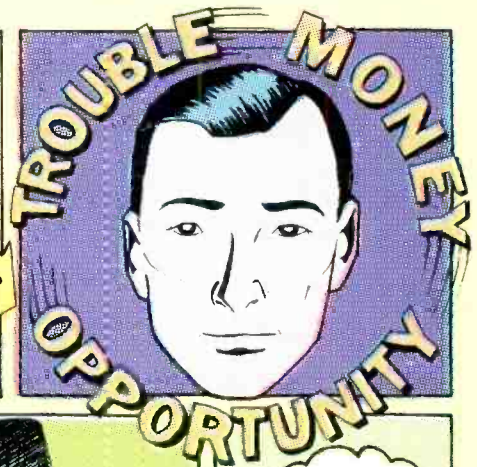
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IT WAS JUST ANOTHER PEACEFUL DAY IN THE LIFE OF
BERT CANAVAN, SALES MANAGER. THEN, THE PHONE RANG...

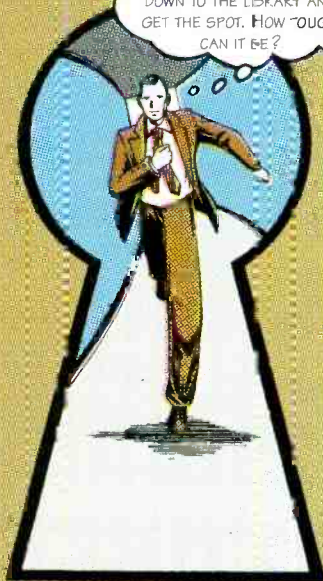
HELLO, MR.
WEINER. YOU
NEED YOUR SPOT
ON AIR? ASAP?!
COST IS NO
OBJECT? ER,
YES SIR!

Wow. WEINER INDUSTRIES IS OUR
BIGGEST ADVERTISER. STILL, THERE
ISN'T MUCH TIME.

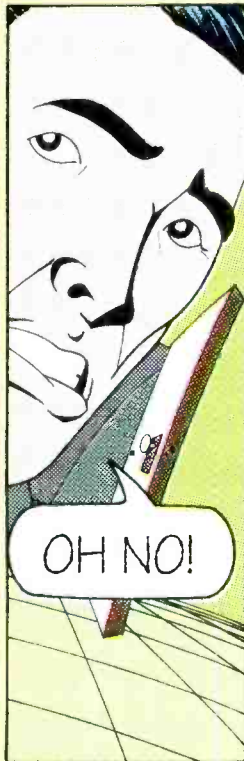
THIS MEANS



O.K. FIRST 'LL RUN
DOWN TO THE LIBRARY AND
GET THE SPOT. HOW 'DOUGH
CAN IT BE?



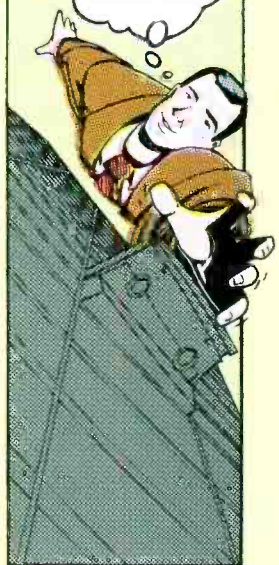
OH NO!



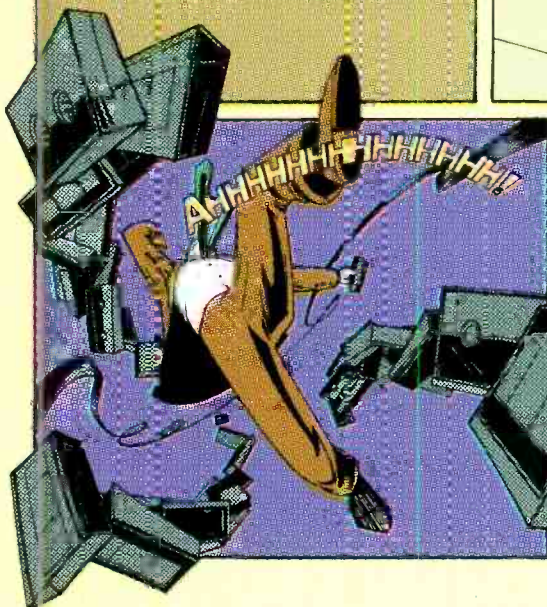
THERE'S
GOT TO BE A BETTER
WAY TO MANGE
SPOTS. THIS
IS INSANE.



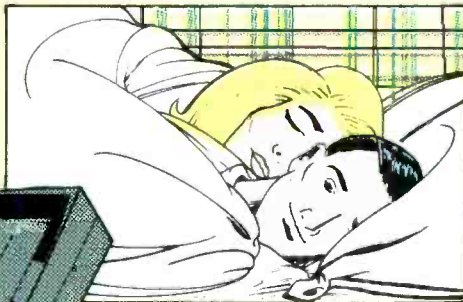
HERE IT IS.
AND THERE'S STILL
A MINUTE TO GO.



FINALLY CANAVAN
LOCATES THE CASSETTE.



UGH, WHAT AN AWFUL DREAM.
THANK GOODNESS MY OPERATION HAS THE
SONY VIDEOSTORE SYSTEM. I GUESS I HAVE TO
LAY OFF THE ANCHOVY PIZZA BEFORE BED.



YOU TOO
CAN END YOUR
COMMERCIAL INSERTION
NIGHTMARES.
THE EXPANDABLE
FLEXIBLE RELIABLE
SONY VIDEOSTORE
SYSTEM ALWAYS
DELIVERS A HAPPY
ENDING.

the end

Battery FAQs

By Alan Lavender

Another important technical resource that requires careful management is battery power. Here are some answers to the most frequently asked questions (FAQs) about nickel-cadmium (NiCad) batteries — the rechargeable battery type that's most commonly used by broadcasters today.

1. What are some common causes of battery failure?

The most common cause of battery failure is *cell imbalance*, which occurs when the individual cells in a multicell battery pack exhibit significantly different capacities (see No. 2 below). Another common cause of failure is *overdischarge* (see No. 4 below).

2. What is meant by the term "capacity" when applied to a NiCad battery and how does it change over a battery's life?

While the voltage of a cell is determined by its chemistry, the cell capacity is infinitely variable. Cell capacity is usually directly related to cell volume (i.e., the bigger the cells, the higher the capacity). Certain cell sizes have become established as industry standards, which means they conform to accepted dimensions of diameter and height. A battery's capacity is its ability to supply power, which is directly related to its amp-hour (Ah) rating. For example, you would expect a 5Ah battery to supply five amps for one hour (or one amp for five hours), which is its nominal capacity.

3. Should we expect a battery of a stated capacity to run all types of equipment for the same amount of time?

No. A battery's capacity in amps over time is directly related to the current drawn from it by the device it's powering. The device's power consumption (which may vary over time during its use) dictates the running time available from the battery.

4. Is it a good practice to discharge a battery to 0V before recharging?

There is no useful advantage in discharging a battery to 0V before recharging. A battery should never be taken below 1V/cell because there is a risk of reversing the polarity of the lowest-capacity cell in the pack and damaging it permanently.

5. Is battery "memory" a real effect, and if so, what is it and how can it be prevented?

Before you apply a cure, you must be sure that you are treating the right complaint. The *memory effect* is a convenient tag to hang on a number of faults that display the symptoms of "memory."

A multicell pack that has gone out of balance will seem to exhibit a memory effect on a discharge graph. As the lowest cell in the pack becomes exhausted, there will be a voltage drop, followed by sustained output at a lower level, while the out-of-balance cell is driven into reverse and destroyed. Overcharging also makes the discharge curve look like it's exhibiting a memory effect, with a pronounced knee in the output voltage beyond a given discharge point.

The "real" memory effect in NiCad batteries is brought about by continuous shallow discharging and recharging by the same amount. The areas of cell that are continually unused will self-discharge, and this leads to the formation of lead sulfate crystals, which create a barrier to the active materials. The resulting discharge curve again suffers a voltage depression knee equivalent to the activated percentage of the cell. If the entire capacity of the cell is regularly activated, this effect will not appear.

6. What is meant by the terms "self discharge" and "equalization"?

It is a fact that NiCad batteries self-discharge, and the rate at which this happens is dependent upon temperature. Because the process is the result of electrochemical reactions, most manufacturers quote a discharge rate of 1% per day at normal room temperature. This implies that a battery will go from full charge to flat in three to six months.

As the individual cells in the pack reach their state of discharge, the chemical process within the cell slows down, thereby *equalizing* the condition of one cell in relation to another. The nitrate ions are reduced to ammonia at the cadmium electrode. They subsequently diffuse to the positive nickel hydroxide electrode where they are oxidized back to nitrate ions in what is known as the *chemical shuttle* process. This process continues until one or both electrodes are fully discharged. With the passage of time, some of the ammonia is oxidized to nitrogen and a cell's discharge rate is reduced. This oxidation is reversible, but may require special conditioning prior to use, such as slow charging. Fast charging immediately after storage is undesirable

because it will overheat the battery during the electrochemical restoration period.

7. What is the difference between "slow," "quick," and "fast-charging," and when should each be used?

• **Slow charge:** The charge current is generally supplied at one-tenth the output capacity of the battery, referred to as C/10. This is an overnight (10- to 14-hour) charge, and it is recommended for batteries that have been in storage for long periods of time or those that have been specifically designed by the manufacturer for use at these charge rates.

Charging at a slower rate enables the recombination of gases without the space provision required for fast charging, which means the cell can be more densely packed. Such higher power-density cells are often used in the communication industries, where size is (and charging time often is not) an important consideration. In an overcharging situation, such lower charge rates are also considered non-damaging to the cell's plate structure and chemistry, so this kind of charge is often used to address cell-imbalance problems.

• **Quick charge:** This charge was originally devised for an older generation of cells (generally in the 4Ah to 7Ah range) that are no longer manufactured. These were normally overnight-charged, but had the capability to be pushed a bit harder without suffering any detrimental effects to safety and cycle life. With some of these earlier cells, however, fast charging would not allow full capacity to be loaded before negative delta voltage and a rapid increase in cell temperature occurred.

• **Fast charge:** Improvements in NiCad technology are mainly resulting from high-volume consumer applications. These improvements have included higher capacity and faster charge-acceptance.

Safety is the most important consideration. The faster the rate of charge, the more accurate the charger system has to be in determining not only the charge termination point but also the fitness of the cell to receive the charge. For the first time, conventional charging technology had been superseded by cell technology. This has led to most of the recent confusion about charging.

8. It is generally recognized that internal overheating during charging is the greatest killer of batteries. Why is this, and how do modern chargers avoid the problem?

Any charging system that causes internal heating of the battery (which typically occurs at the end of the charging cycle) is damaging the cells. The NiCad charging process is an *endothermic* reaction — the internal chemical process absorbs a small amount of heat energy during charging. Conversely, during discharge or overcharge, the reaction is *exothermic* — the battery produces heat. A sufficient amount of this heating can cause cell damage, which is how any charger that continues to apply current after full charge is reached destroys a battery.

To avoid this, today's better chargers use a method more sophisticated than simple temperature-rise or negative delta voltage-sensing to determine the end-of-charge point, thereby removing charge current before any cell overheating occurs.

9. Can a battery be safely charged irrespective of its temperature?

No. NiCad batteries should only be charged at room temperature. Charging extremely cold or hot batteries should be avoided.

10. Is there an optimum temperature at which charged batteries should be stored?

The recommended storage temperature is 0°C to +30°C but cells can tolerate temperatures of -40°C to +100°C for short periods.

Batteries that have been stored correctly for 20 years have been shown to have no detrimental effects on their working life. ■

Alan Lavender is chief executive of PAG Ltd., London, England.



For more information on NiCad battery systems, circle (152) on Reply Card. Also, see "Batteries, Chargers, Analyzers, Reconditioners," p. 93 of the BE Buyers Guide.

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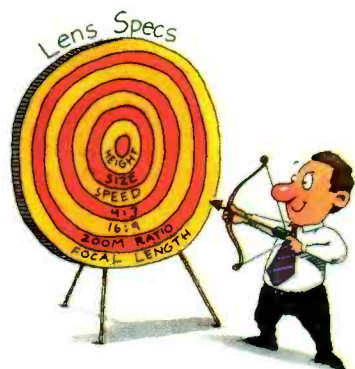
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Selecting lenses



Choosing the right lens now can make shooting easier in the future.

To cinematographers and those in the film industry, lens selection is a critical part of the production process. Videographers, on the other hand, typically view the lens as a permanent fixture on the front of their camera; changing lenses is seldom considered. This article focuses on the specifications and features to consider when choosing a lens. (For additional background information, see "Choosing a Lens," p. 60, *BE* October 1993 and "Camera Lenses," p. 48, *BE* October 1994.) Lenses are critical to camera performance. A poor lens can prevent a great camera from getting even good pictures.

The Bottom Line: —

Lenses are one of the most important camera accessories. The wrong lens can make it impossible to get the shot you need. The right lens, combined with the right accessories, allows the shooter to exercise the creativity needed to turn a good shot into a great shot. 

Lens basics

Before delving into features, some basics must be covered. One of the most basic lens specifications is focal length. What you need is based on the type of shooting you do. If you are shooting news, you could use a normal focal length lens with 15x zoom ratio. If you are shooting sports, a long telephoto of 20x or higher is normally recommended. If you mainly do interviews or shoot indoors in tight situations, a wide-angle zoom lens might be best. Wide-angle zooms are becoming more popular because they enable shooting close to the lens with an excellent depth of field. Today's magazine shows love that "in your face" look while maintaining a balanced composition.

With that in mind, typical lens classifications are as follows:

- *Normal focal length lens*, 15x zoom ratio and a focal length of 8-8.5mm at the wide angle, ranging to a telephoto focal length of 120-127.5mm;
- *Wide angle focal length lens*, 9x zoom ratio and focal lengths from 5.2-5.5mm at the wide angle to a telephoto of 49mm and higher;
- *Telephoto focal length lens*, 20x zoom ratio with a wide-angle focal length of 8mm and a telephoto length of 160mm.

Most ENG lenses include a built-in extender. The extender inserts a magnifier lens and usu-

ally increases the focal length by 2x. For example, a lens with a focal length of 100mm would be extended to 200mm when the extender is engaged. This feature is helpful and can sometimes allow you to get the shot you need. The only drawback is the loss of at least one full f-stop when using the extender. Today's lens extenders are extremely sharp and do not degrade lens performance.

Another lens specification to look at is *maximum relative aperture*. Most ENG lenses have similar aperture ratings at the wide angle. It is important to also look at what happens to the f-stop as you move through the zoom range. For example, a lens with an f-1.7 rating at the wide angle of 8.5mm will change to about f-2.2 when it reaches the end of the focal length at 127.5mm. All manufacturers publish the maximum relative aperture with the extender engaged, which should also be considered.

Common features

One of the most frequently forgotten specifications is the size and weight of a lens. As cameras have gotten smaller and more compact, lens manufacturers have also reduced the size and weight of their lenses. If you compare many of the older short focal length lenses, they weigh more than the newer models with longer focal lengths. Size and weight are important because they will affect camera balance and handling. If a lens is too heavy or too long (physical length), it will make the camera front-heavy. A short or extremely lightweight lens can force the cameraperson to constantly pull the camera down because it is back-heavy. The "feel" of the camera/lens pair is important. Lens and camera manufacturers work together to keep the relative weights and sizes within a comfort zone. Always try out the camera/lens combination with the unit fully rigged with lights, microphones, matte boxes and batteries to be sure of its balance and handling.

Internal focus is the most common feature found on all broadcast-quality ENG lenses. Just a few years ago, only wide-angle lenses had internal focus. Today, all three manufacturers provide



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Canon's DIGI-SUPER 70, the first 70x lens made its debut on Monday Night Football.

internal focus lenses in the normal, wide and telephoto configurations. Nikon invented internal focus lenses in the mid-1970s for 35mm lenses, but it was Canon who first popularized this feature for video lenses with the J14ax8.5 lens.

An internal focus lens enables shooters to place a special-effects filter at the front of the lens and then set it and forget it. The name "internal focus" comes from the fact that the front element of the lens moves internally. On non-internal focus lenses, the front element rotates when the focal

length is changed. Although it may add to some effects, the rotation of the front element generally causes problems when combined with special-effects filters. For example, gradient filters can be used to trick the lenses into thinking the exposure of a bright sky is the same as the subject in the foreground, having one rotate when the focus is adjusted would cause problems. The advent of internal focus lenses has allowed shooters to be more creative and to use filters more often than before.

Internal focus lenses can also take advantage of matte boxes that clip

to the front of the lens. Now shooters can have two stages of filtering without having to use the cumbersome rods always associated with matte boxes. Internal focus lenses allow video cameras to be equipped more like a traditional film camera. Many matte box users also equip their systems with a follow focus knob. This knob, which attaches to the lens

where the focus module attaches on the lens, provides easier lens focus adjustment. For film use, the camera assistant usually uses the follow focus to adjust focus as the subject changes position in the frame.

Another new feature to the ENG lens market has been the adaptation of aspheric elements. Aspheric elements have been around for some time, and ENG lens manufacturers have just started to incorporate these elements into zoom lenses. Fujinon and Nikon have used aspherics to take advantage of their benefits, which include the ability to reduce the size and weight of their lenses.

Aspheric lenses focus the light more accurately through the lens, thus reducing chro-

A high-quality matte box is a creative accessory available for professional and industrial zoom lenses. Shown is the Petroff MB7

4x4 matte box in special direct mount for internal focus lenses. (Photo courtesy of Miller Fluid Heads, USA, Inc.)



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matic aberrations. In addition, aspherics also reduce the minimum object distance (MOD) of the lens. The MOD is a measurement of how close to the front of the lens an object can be located without using the macro feature. Check and compare the MOD on the lenses you're considering. Generally, the shorter the MOD the better. The standard was 0.85m, now in a normal lens (15x) it ranges from 0.75m to 0.55m.

All three manufacturers provide zoom speed adjustments on the lens. This enables the shooter to repeat the same zoom speed over and over again without having to press the zoom rocker exactly right. In the past, zoom speed adjustments could be changed by a screw pot on the front of the lens or through the pistol grip accessory. One manufacturer has also expanded on this idea by providing a zoom torque control on the lens. This feature comes in handy when you need a superslow zoom and need to do it by hand. The torque switch increases the drag on the zoom 20% by employing a lower gear ratio.

Protein paint is being used on many ENG broadcast lenses. This paint coats the outside of the lens with a non-slip finish, reducing the likelihood of having



Nikon's S15x8.5B1-III, a normal focal length lens that features internal focus, a 2.2x extender and zoom speed adjustment.

the lens slip from your hands. It does not, however, give the lens any natural nutrients to make it look better.

For comfort, all manufacturers offer a hand strap that can be adjusted to fit your hand. Some manufacturers have angled the servo zoom housing to provide additional comfort. One company has expanded on this feature to provide an adjustable servo housing that can be moved through several different positions.

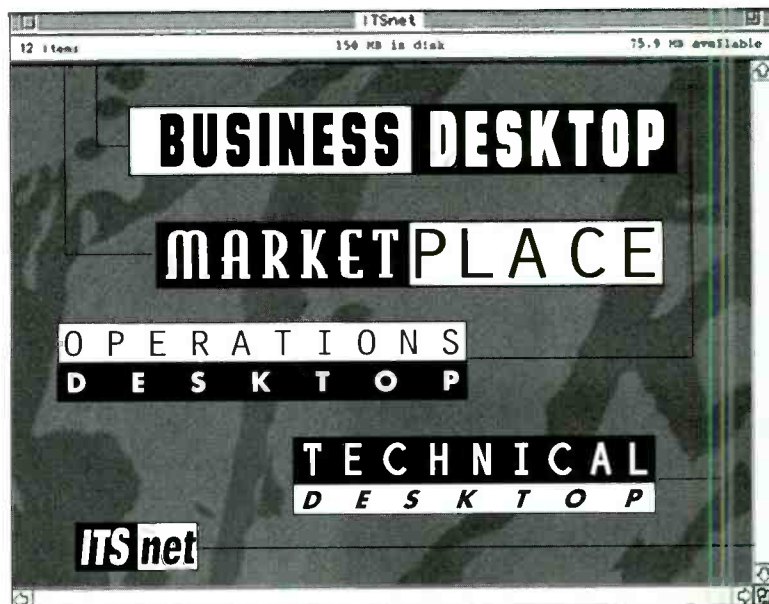
New features

Studio lenses have always been available with full servo options. Most manufacturers now offer this feature for ENG lenses as well. This provides electronic focus control. Most ENG lenses used in a studio configuration use the mechanical module that screws to the lens via a flexible cable. The mechanical method is less costly, but focusing can usually be done faster using the motorized version. The servo focus motor is built into the lens hand grip.

Although few cameras are sold with 16:9 aspect ratio CCDs and prism blocks, all three lens manufacturers state in their literature that the lenses on the market today are compatible with 16:9 cameras. In addition, some manufacturers have shown prototype ENG lenses with built-in 16:9 aspect ratio converters. This converter is built into the lens at the rear, opposite of where a conventional extender is located.

Many of the camera manufacturers provide electronic feedback information from the lens to the camera viewfinder. Now you can see where you are on the f-stop if the extender is engaged and what the focal length is at. The focal length information

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provided in Sony's broadcast cameras is represented by a bar graph at the bottom of the viewfinder. In the future, this could be replaced with an actual number corresponding to the lens focal length position and could be handy in helping judge focus distance from the subject.

Final considerations

The best way to choose a lens is to try it out. It's best to use it on your camera or the camera you plan to purchase. Most dealers can set up a demonstration and let you take the lens and camera for a few days. This way, you can put the combination through its paces, trying it out in real-world situations.

Lens care is important. A well-cared-for lens can last a lifetime. However, it is recommended that problems be checked quickly. All of the manufacturers provide service and there are a few good places throughout the country to get your lens repaired. It is important to see if you can get a loaner lens while your lens is in the shop. One manufacturer offers a loaner lens within 48 hours of your call, for the life of your lens.



The Fujinon A15x8 DEVM internal focus lens features aspheric lenses and is 4:3/16:9 switchable.

Choosing the right lens is as important as choosing the right camera. Before purchasing a lens, be sure to do the following:

- Compare the specifications and try the lens out on the camera.
- Keep an open mind before choosing --- you may find a feature in another brand that works better for your type of shooting.
- If you decide to change brands, check to

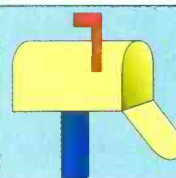
see if any of your accessories are compatible with other manufacturers' cameras.

- Keep your lens clean and always use a protective filter to protect the front element of the lens.
- If you notice any problems, call your manufacturer or local repair facility and send the lens in for repair. Check on the possibility of a loaner lens.

A quality lens can last a lifetime with proper care. Through careful selection, your camera/lens combination can provide you with years of quality images. It can also provide the shooter with the tools necessary to accomplish the job in an

efficient, creative manner.

Evan Krachman is a sales specialist for Nikon Electronic Imaging, Melville, NY.



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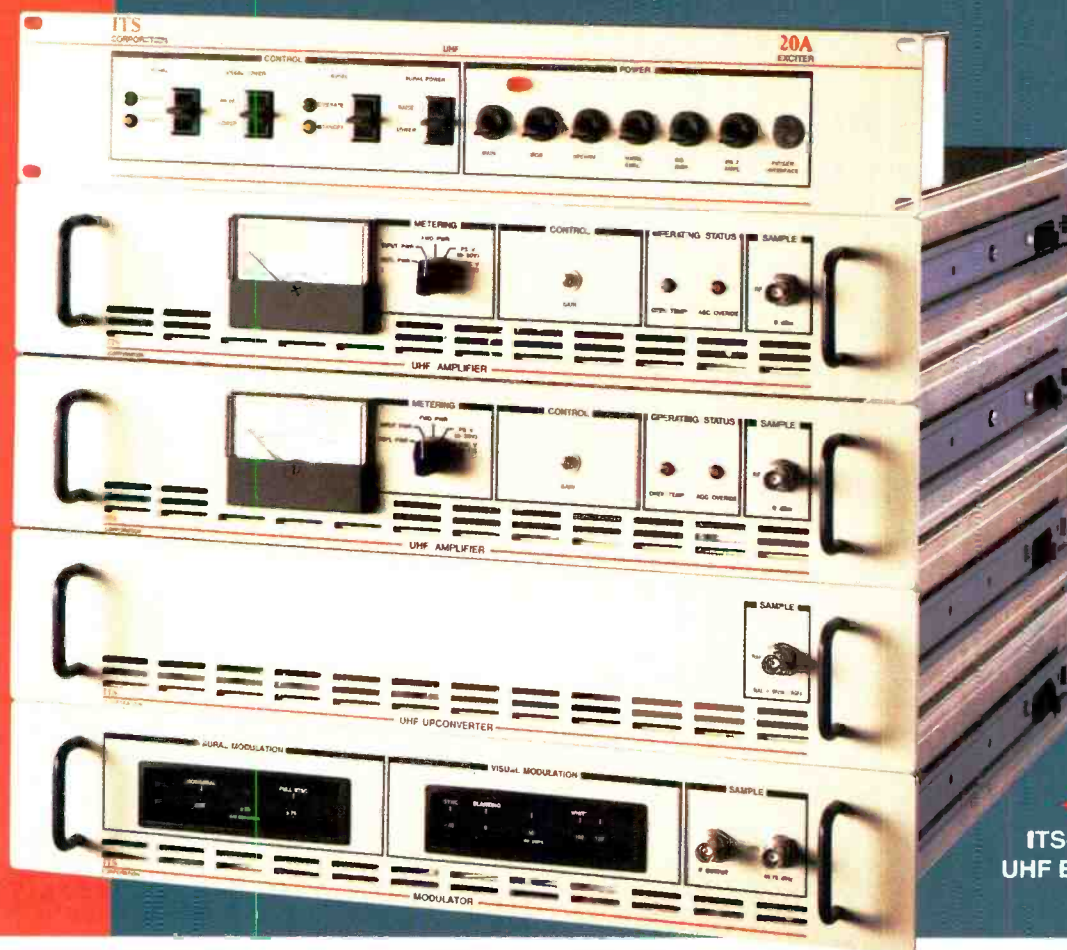
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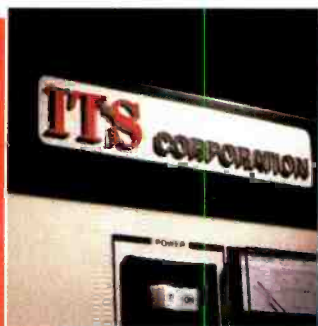
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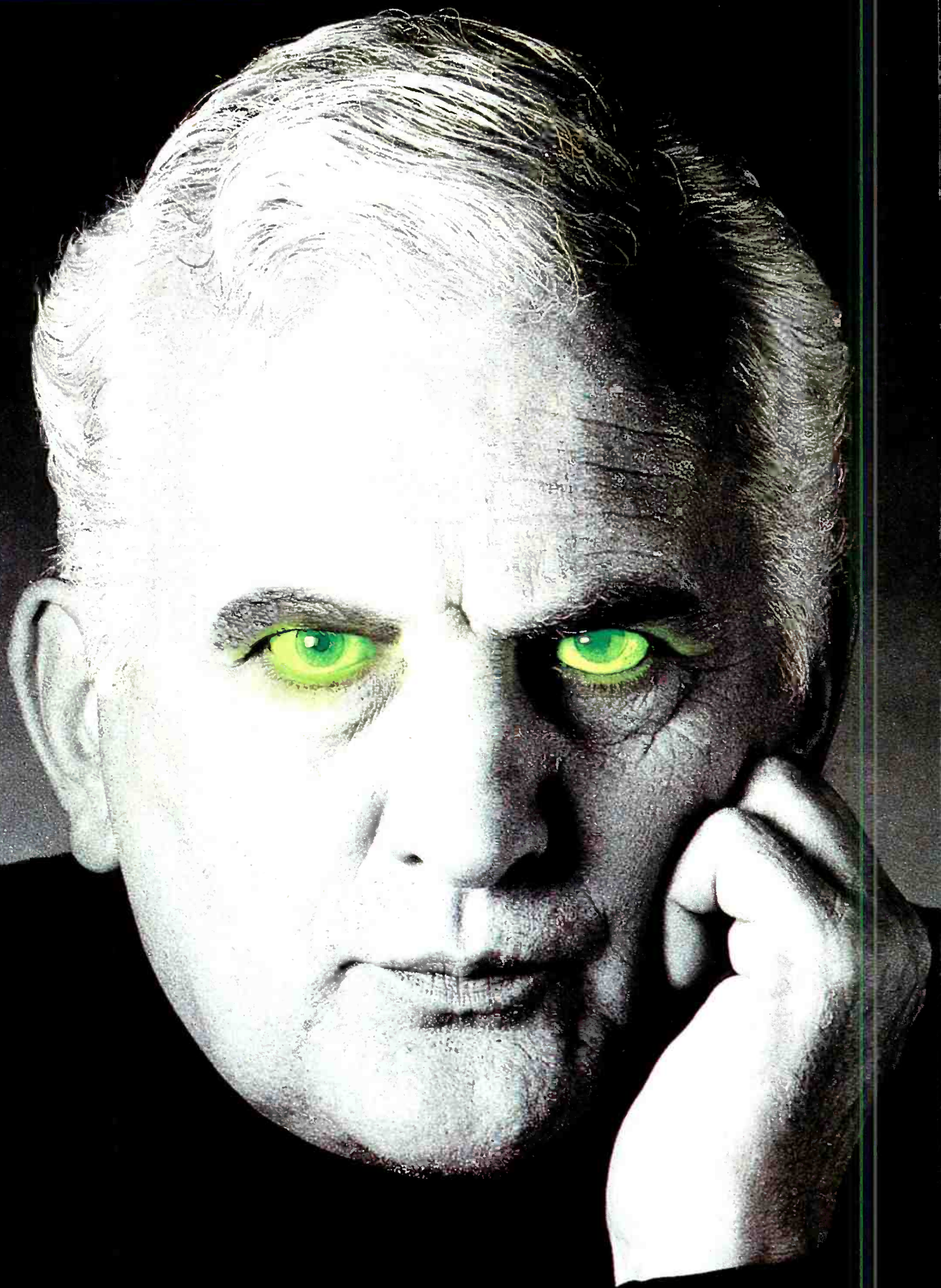


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How can he do it for the price?

Handling videotape

As inexpensive as videotape might be, the material it contains could be priceless.



The Bottom Line: —

Many times, the value of a videotape is far greater than the cost of the tape itself because of the information it contains. Unlike computer files that can be copied without degradation, the quality of analog videotapes is reduced with each generation. Typically, there is only one master tape of any given production. If the master is lost or damaged, replacement costs can be extremely high. — **\$**

As tape libraries grow larger, there is increased interest in videotape care. With the potential for 500 channels to the home, production and broadcast libraries are being viewed as profit centers. Old 2-inch tapes are being dusted off and transferred to new formats for additional programming to fill expanded multichannel broadcast days. Unfortunately, some of this older programming will be lost because of improper storage. Facilities that decided tapes did not warrant proper storage conditions may now be faced with the loss of significant revenue because of lost program material contained on those tapes.

Whenever and wherever programming is created, planning should include proper care of the finished videotapes. After all, the material on the tapes is the result of creativity. Cutting corners when protecting "intellectual property" is not wise. With proper planning, playback of videotapes can be assured throughout their lifetimes.

Today, there are many tape types, from oxide to metal particulate and metal evaporate. Data storage devices may make use of tapes containing cobalt chrome or barium ferrite. Regardless of the tape type, research suggests that all magnetic media, properly stored, can easily last 10 to 20 years. It is not uncommon to find broadcasters transferring 2-inch tapes recorded in the late '50s and early '60s to today's digital formats.

Storage basics

Proper magnetic media storage involves several factors. Considerations include:

- Air flow within the area should be clean and the room(s) should be at a "positive pressure" relative to the surrounding area. This means that there is a micropore filtering system in place with forced air such that when a door into the area is opened, air rushes out. Filters are important because they minimize airborne debris, which can cause immediate performance degradations, including high dropout or error levels. Additionally, foreign material can infiltrate machines and

media and cause long-term maintenance and retrieval problems.

- The temperature should be set at 68°F (20°C) and maintained within $\pm 4^\circ\text{F}$ (2°C) at all times. Tape is sensitive to changes in temperature and will expand and contract. Stable temperatures are important to minimize physical distortions in the tape pack, which can cause tracking and tension problems later.

- Relative humidity should be maintained at about 45%, $\pm 5\%$. Tape will acclimate to the room's humidity, and if it is too high or too low, it can cause problems ranging from excessive head wear to head clogging.

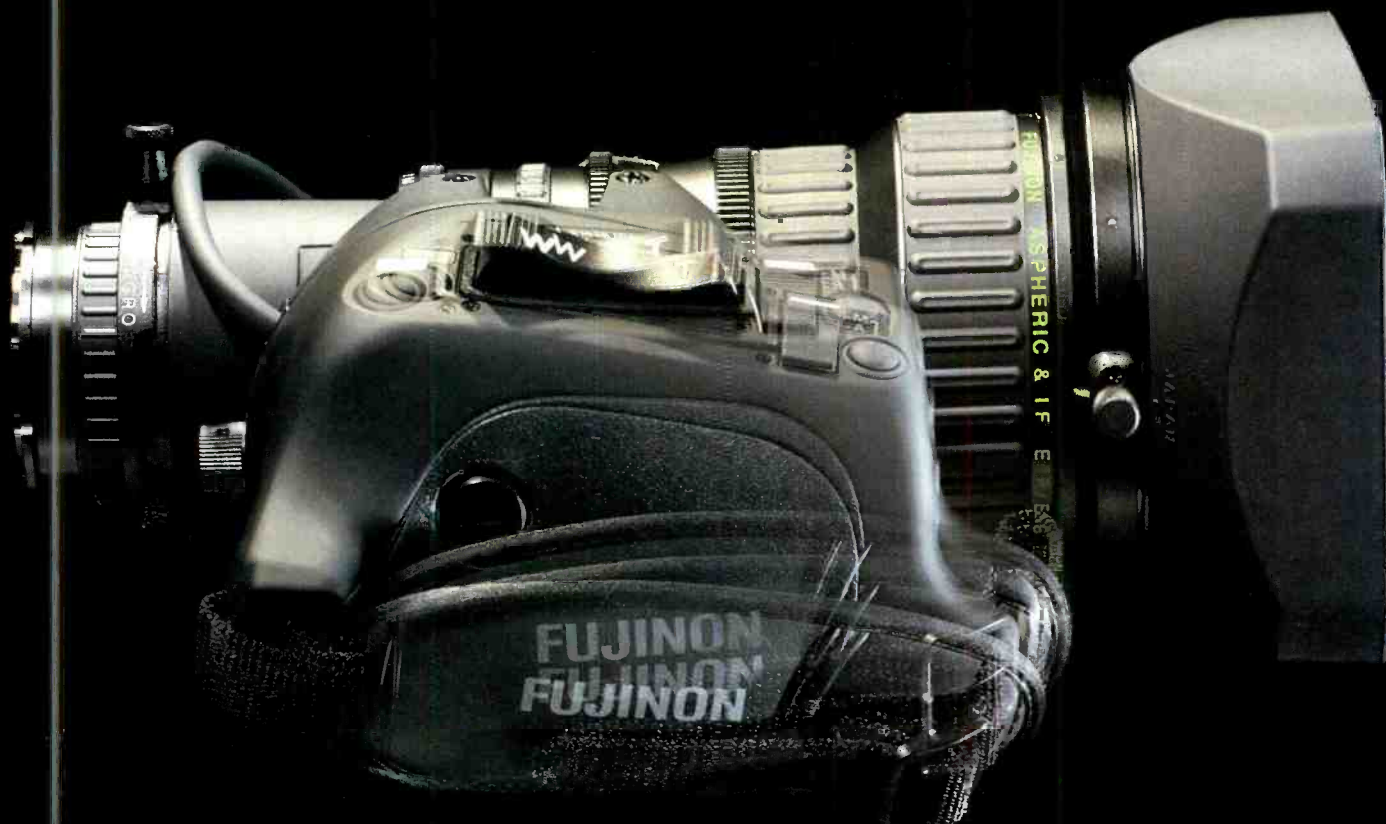
With proper planning, playback of videotapes can be assured throughout their lifetimes.

- Smoking, eating and drinking in tape rooms and libraries should be prohibited. The airborne contaminants create dropout problems in the tape room. In addition, the particles can be wound into the tape pack, creating microscopic distortions and dropout problems when the tape is played back in the future.

- Keep the area clean. Use a sealed tile flooring and dust- or debris-free ceiling tiles. Carpet holds dust and vacuum cleaners stir the dust up and redeposit it on the tapes. Cardboard boxes should be opened elsewhere to keep the cardboard debris out of the area. Dust the equipment and the area often to remove any accumulations of dust and debris.

- In high traffic areas, consider installing adhesive mats that remove dust and dirt from workers' shoes. It is surprising how much can be tracked

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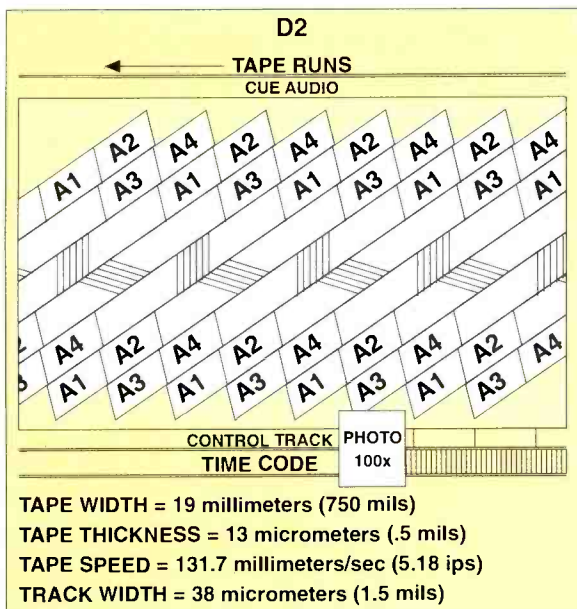


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The diagram shows the layout of tracks used for the D-2 format. The small square indicates the area of tape shown in the photograph. The original photograph was taken using 100x magnification, and is reproduced slightly smaller. The upper area is the control track that is only 0.5mm. Lower area shows a portion of the time code track that is also 0.5mm.

into an area on workers' shoes.

- Fasten open-reel tape ends securely and use high-quality adhesive tape that does not leave any residue when removed.
- Store tapes correctly. Tape should be stored in dust-free boxes. The boxes should support the reels by the hub, not by the flanges. Supporting reels by the flanges can cause edge damage. Tape boxes and cassettes should be stored on edge, never flat. Questions should be directed to the manufacturer

er concerning how to best store tapes. Inspect storage containers for dust and debris prior to removing them or placing them in storage. Wipe them clean if necessary.

- Rewind the tapes. Never store cassettes that have not been rewound to the beginning of the tape. Storing an improperly rewound tape can create severe hub clip impressions that can affect the first several minutes of tape. A good wind is important also if a tape has been shuttled many times



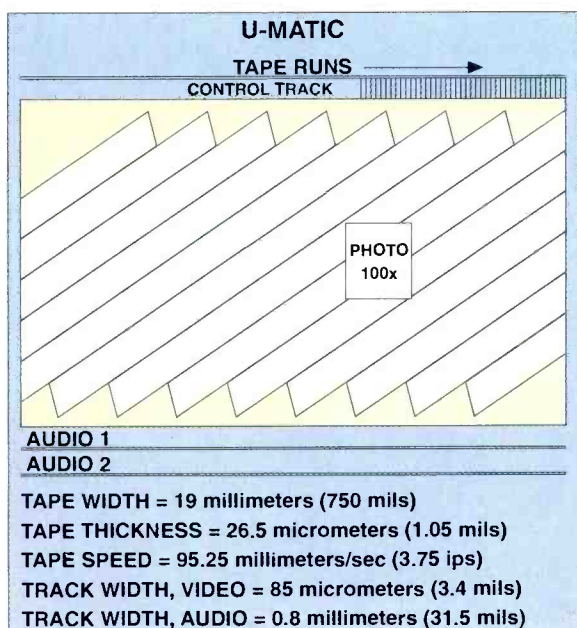
during an edit session, popped into and out of machines and handled many times. Look closely at the tape pack before storage. If the pack is uneven, with many strands close to the flange, take the extra time to rewind the tape to get a better tape pack. Try rewinding at slower speeds, it usually helps produce a better tension profile and a cleaner wind, thereby possibly reducing future problems.

- Keep tapes several feet away from stray magnetic fields. Large transformers, electric motors, permanent magnets (e.g., speakers) and the like can weaken the recorded signals, adding noise to the recordings. Although today's tapes are higher coercivity, which means they are less susceptible to low-level magnetic fields, it is still a good idea to store tapes away from any magnetic source.

Remember, the program material contained on videotapes is a valuable asset. The proper storage of that asset is essential and may be critical to your business future. If your facility does not meet the guidelines previously outlined, take steps to improve it today. Every step taken is a step in the right direction. A plan for the future is important, and proper videotape use and storage areas are key. ■

Tom Becker is in the technical services department of 3M's Audio and Video Products Division, St. Paul, MN.

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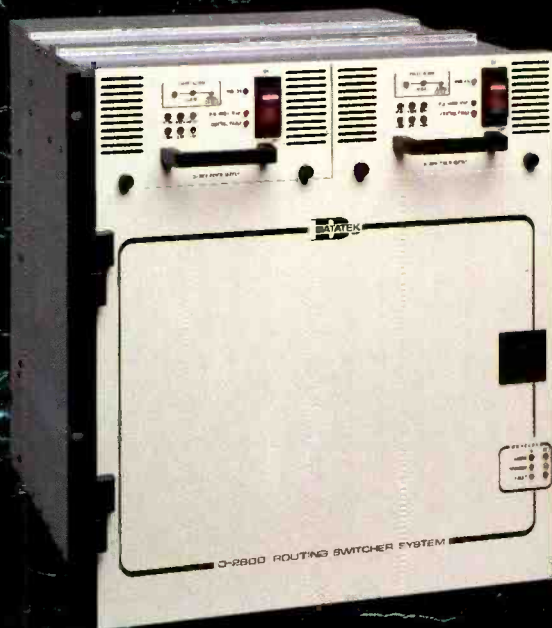


Tracks used for the U-matic format are shown in the diagram. Photo shows the video tracks magnified 100x. The dark area is the recorded information, with the lighter areas used as guard bands. Guard bands are approximately .05mm, the diameter of a human hair.



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Archiving videotape

A proper tape archive requires more than just shelf space.



The Bottom Line: —

Without the proper storage conditions and care, your tape library can become an expensive dustbin. Although many of the tapes that go into your archive will never be needed again, any one of them could become a valuable asset in the years to come — but only if it's still in good condition. Observing some simple rules of storage will maximize the longevity of your archives.

Whether it's an entire award-winning newscast or a short but well-shot clip of special interest to your viewers, the last thing you as a broadcaster want is to have any harm come to your videotape archives. Thanks to advancements in technology, videotape today can withstand a significant amount of normal wear and tear, but optimal long-term storage requires some extra effort.

Protecting your videotape archive is simply a matter of following a few basic guidelines. If you pay close attention to these suggestions, your prized videotapes should be in excellent shape whenever the time comes to air them.

Ambient conditions

Magnetic tape may expand or contract with changes in temperature and humidity, so sudden climatic fluctuations should be avoided. In general, videotape should be archived in the same conditions that people find comfortable. Temperatures between 15°C to 25°C (59°F to 77°F) and relative humidity between 40% and 60% are recommended.

Among the problems that can arise if tape is stored at excessively high temperatures are tape expansion, increased print-through and increased dropouts and noise. Temperatures below the recommended range can cause tape to loosen in the cassette shell, and potentially harmful condensation could be created when the tape is moved to a warmer location. High levels of humidity can speed up the deterioration of the chemical components that make up the magnetic layer. On the other hand, a storage area that is too dry can lead to static electricity in the tape.

When climatic conditions differ greatly between where a tape has been stored and where it will be used, give the tape time to acclimate to the new conditions. Special care should be taken when tapes are used in high temperature and/or humidity. Condensation could form on the tape, cassette or metal reel section, and this

could harm the tape. Condensation can be avoided by allowing the tapes adequate adjustment time to make the transition. Leave tapes inside their cases as long as possible during this transition time.

Winding and storage

Videotape should be correctly rewound before it is stored. Prior to storing, check to see that there is no unevenness (also called *stepping*) in the tape. If stepping appears, the remedy is to carefully rewind the cassette on a VCR or tape player. If possible, rewind at slower speeds for best results. Similarly, avoid storing tapes that have been stopped and ejected mid-tape. Tapes that are stored for long periods of time with uneven winding or stepping can stretch or warp, and the results will be playback with distorted pictures or varying sound levels.

Videotape should be correctly rewound before it is stored.

A note of caution: no programming should be recorded on the first or last 30 seconds of a videotape. These sections can be susceptible to dropouts caused by dust, contamination and the tape's terminal stop.

Always store tapes in their cases in an upright position. Storing tapes stacked on top of one another could result in tape-pack shift. Cassettes may stand either on their sides or their front/back ends. When transporting tapes, arrange them in a snug, upright position so that they will not shift position during transit.

The loose ends of open-reel tapes should be held firmly in place either with high-quality adhesive tape or with special end-stoppers that do not

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deposit any glue onto the videotape surface itself. If the ends are not firmly affixed, wound tape may loosen and cause deterioration in the tape's configuration. Before storing open-reel tapes, remove any twisted or wrinkled end sections.

Labeling

Cassette labels should only be placed on the areas designed for them. When relabeling an already-labeled tape, remove the old label before applying the new one.

Labels placed incorrectly or placed over existing labels can result in improper po-

sitioning of the cassette in the VCR or tape player. This can lead to tape-running problems during playback. Such labels

Tapes need to be played periodically to stay in top shape.

can peel off and cause the cassette to jam in the machine. Improperly placed labels can also impede the motion of moving

parts on the cassette, causing serious operational problems.

Tapes need exercise, too

Tapes actually benefit from use; they are physically and chemically designed for playback and recording in VCRs, tape players and camcorders. They need to be played periodically to stay in top shape.

Leaving tapes wound and unplayed for a long time makes them particularly susceptible to expansion or contraction from temperature and humidity. To avoid these problems, simply fast-forward and rewind the tape from end to end at least once every three years. To be safer, this process can be performed once each year. If you plan to record over a tape that has been stored for an extended period, perform this same operation on it first for best results.

Combating dust

The floor surface of an archival area is often overlooked, a serious mistake since dust is one of the main enemies of tape. Concrete floors should be treated with a sealant to prevent erosion, and tiled floors should not be waxed because wax attracts dust. Carpeting should be regularly monitored for loose fibers and for static electricity build-up.

The archival rooms should also be equipped with air filters to promote a dust-free environment. Maintaining a positive pressure environment in storage rooms can also help to reduce airborne dust levels.

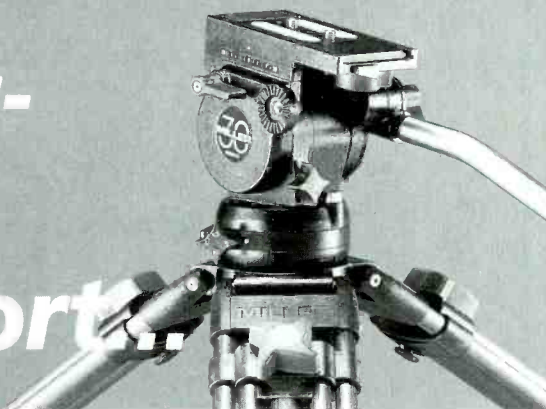
Archival rooms should also be equipped with air filters to promote a dust-free environment.

Your archive facility may be called upon to store tape that originated outside production areas, and these tapes may be dusty. Tapes that may have become contaminated in such circumstances should not be archived. The dust on such tapes can include hard mineral particles like silica or aluminum that can cause dropouts or can even damage tape surfaces and video heads. If you suspect that a tape may have such dust or dirt on it, transfer the recorded material to a clean tape and archive the clean copy.

Avoiding damage

It should come as no surprise that strong magnetic fields can have an adverse effect

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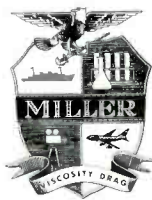
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on archived tape. As a precaution, it makes sense to keep certain items out of your archival room, such as speakers, electrical motors, video monitors, toys or anything else with a strong magnetic field. Magnets can weaken a tape's recorded signal or increase tape noise. Oxide or metal tapes are safe in magnetic fields of less than 4000A/m.

In case of fire in a tape archive, vapor or gaseous-based fire extinguishers are recommended. The powder-based or liquid extinguishers can damage both the performance and the durability of magnetic tape.

It's easy to forget about archived tapes until it's too late to solve their problems.

Tape damage can also occur during playback. For instance, wrinkles or scratches may appear on tapes if they are played on a poorly adjusted tape-path mechanism. Maintaining the quality and durability of tapes is not just a matter of proper tape storage — VCRs and tape players must be in good working order to help ensure that the tapes themselves will last.

Large-format cassettes

The size and mass of the tape packs inside larger videocassettes (such as D-1 and D-2 formats) can cause damage to the shell if the cassettes are subjected to physical trauma or rough handling. For this reason, these larger cassettes should be treated with special care, and carefully checked upon receipt after transit.

Before attempting playback, a thorough inspection of these cassettes might reveal any damage. Look for the following items:

- Broken shell pieces inside the cassette;
- Cracks in the cassette shell;
- Smooth operation of the cassette door;
- Proper operation of the hub-locking mechanism. This can be checked by opening the cassette door and ensuring that both reels are spinning freely, then closing the door and verifying that both hubs are locked;
- Visible tape damage. The cassette door can nick the tape, but still open and close in apparently normal fashion. Such nicking of the tape can result in its complete breakage when the full stresses of loading playback are applied.

If any of these inspections reveals a problem, make a copy of the tape immediately and discard the damaged original.

Out-of-sight, out-of-mind

It's easy to forget about archived tapes until it's too late to solve their problems; don't let this happen to you. Following the simple processes outlined in this article can prevent such a catastrophe from befalling your operation.

The hardest part of instituting these practices is sticking with them for the long haul. This is not a "quick-fix" issue, however, and it's well worth the effort. Taking proper care of videotapes will return the investment over the years with problem-free playback of your valuable archival material. ■

John Matarazzo is technical services manager for Sony Recording Media & Energy Products Group, Montvale, NJ.



For more information on videotape, circle (153) on Reply Card. See also "Recording Tape," p. 71 of the BE Buyers Guide.



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By Philip Giddings, P.E.

Grounding and shielding practices

Proper grounding procedures never go out of style — but there are some new twists.

The Bottom Line: —

In a world of sophisticated audio and video devices that make any form of signal manipulation possible, serious artifacts still turn up because of real-world effects on installed systems. In most cases, these problems can be solved in a cost-effective manner, but the solutions are not always self-evident. Recent research has brought engineers some helpful new information and techniques toward this end. S

To the uninitiated, the attraction of audio and video system design is the thrill and excitement of carefully selecting the audio and video components, determining the correct interconnection of the equipment to provide the system's functionality, installing this equipment into its new home, and testing and commissioning to bring the equipment on-line. It is not long, however, before our new audio-video and systems designer is disillusioned by the effects of the real world on any new system. These effects include noise, hum, buzz, snow on video pictures, shadowing and a variety of other forms of distortion to what was hoped would be a clean signal.

The complexity of the problem of noise in audio and video systems requires an organized, methodical approach to control or minimize its effects. This is important because grounding and shielding systems alone will not provide guaranteed freedom from noise problems. Moreover, the design of the grounding and shielding system is dependent upon other factors in the system. Achieving the right level of hardware installation to optimize system performance and minimize cost of installation must be done with a clear head and a knowledge of the issues that affect the noise in the facility's audio and video signals. It is easy to overdesign and spend excessive time on installation procedures that have little impact upon the system's freedom from noise.

EMI overview

The problem of noise in electronic signaling is universal, and it affects the computer, aerospace and manufacturing fields as much as it does the audio and video industries. The problems that all these operations face with regard to noise in signal systems is referred to as *electromagnetic interference* (EMI). EMI is a well-studied and highly documented science, and solutions to these types of system inade-

quacies are well-developed. (See the references at the end of this article on p. 74.)

It is possible to break down the problem of EMI into a number of individual components that can be studied and dealt with one at a time at the concept, development, design, installation and testing phases of any audio or video system. This systems approach to dealing with EMI is an effective and efficient means of attacking these problems.

Electrical noise has four means of transmission: common-impedance (or "hard-wired") coupling, electric-field coupling, magnetic-field coupling and electromagnetic radiation. When attempting to solve EMI problems, it is of foremost importance to know how the noise is being coupled.

Five well-established techniques are used to control EMI. These include shielding, balancing and twisting, physical separation and routing, isolation and grounding. It is difficult to predict the cost/benefit trade-offs among these techniques in a given installation. In many cases, broadcast system designers may only have substantial control over the areas of signal wiring and equipment selection and in some elements of ground-system design. Nevertheless, these are areas where proper application of good engineering principles can result in measurable, cost-effective benefits, and where some new information has recently come to light. Therefore, the remainder of this article will concentrate on signal wiring and grounding. It assumes that a proper AC grounding system already exists in the facility.

Shields in signal cables

The last few years have brought a number of interesting developments to the area of cables and cable shields. One of the most interesting findings is found in a recent paper by Neil Muncy of Markham, Ontario. It reports that the current flowing in the shield of a cable is not particularly influential to the induction of noise into signal

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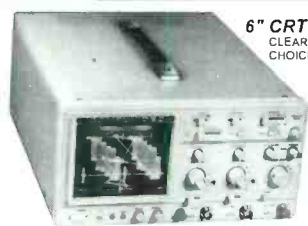
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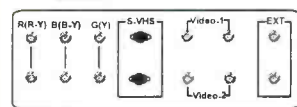
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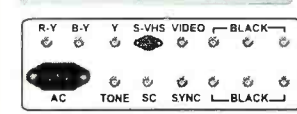
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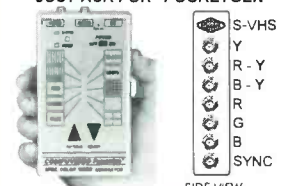
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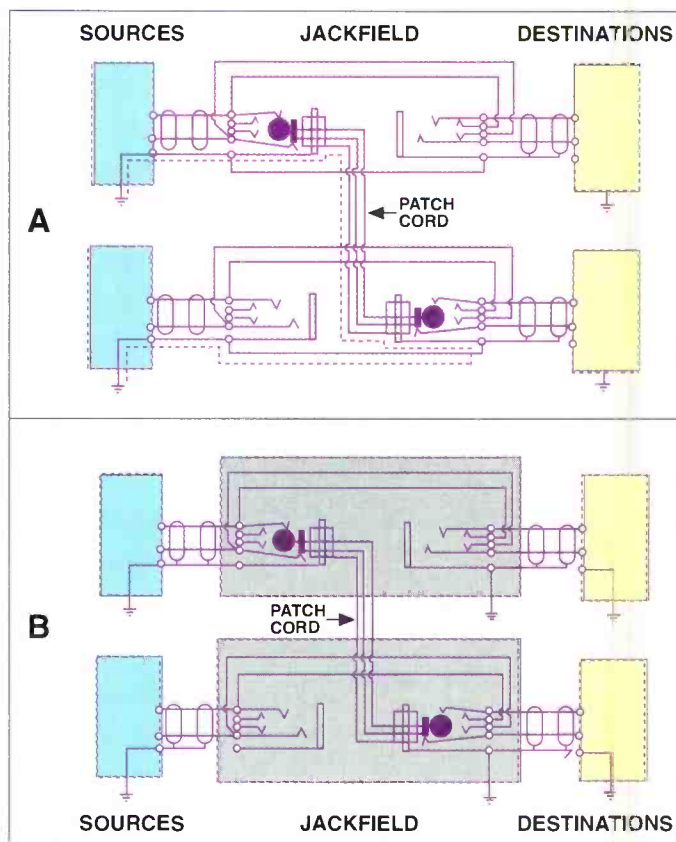


Figure 1. The use of patchbays greatly complicates the shield-grounding scheme because it allows ground loops to be easily created. In the half-normalled jackfield shown in (A), the dotted line follows a ground loop caused by patching. The same jackfield in (B) uses a different grounding scheme that avoids the creation of this loop.

wiring and circuit inputs. (See Reference No. 2 at end of article.)

To understand this, first consider that most ground loops are formed by a cable with its shield terminated at both ends. Under such conditions, the current in the loop flows through the cable's shield and the ground conductors that form part of the technical ground system. In the past, it has generally been thought that the current in the cable's shield induces electromagnetic interference in the signal conductors contained within the cable, and that the current in the ground conductors also created noise because it was modulating the ground reference of the equipment. But new tests indicate that, for most modern cables, the noise induced into a cable's signal conductors of shield currents is insignificant — at least for systems with less than 90dB of dynamic range. This means that ground loops created by shields do most of their damage because of the current they create in the other technical ground conductors that form part of the loop, not the cable shields.

This is an important point, particularly in light of the fact that the shield of a cable is relatively less important with regard to EMI than, say, the twisting of the conductors within. (Note that the telephone company operates with unshielded, twisted-pair cables with great effectiveness, and the use of unshielded cable has other advocates.) Given this new understanding, it becomes extremely important that shield-grounding schemes do not introduce ground loops. Because the shield grounding seems to be of limited importance, the last thing you want to do is create additional problems by implementing it. Therefore, a primary criterion in developing shield-grounding techniques and termination methods is that they do not create ground loops.

In the case of coaxial cable, the shield serves several purposes. It provides a transmission line with constant and specific characteristic impedance — usually 75Ω. It also shields the signal conductor within

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and provides the return current path for this signal cable. This system creates ground loops at every turn because a shield is normally terminated (to ground) at both ends, in order to provide a constant characteristic impedance and a signal return path. Video systems today are fairly resistant to low-frequency hum often associated with these types of ground loops, and a number of techniques are used to overcome problems associated with these ground loops when they do occur. This, however, does nothing for the associated audio equipment that might be operating near the video equipment and affected by the ground loops created. A technique for dealing with this problem (segregating equipment) will be discussed later.

When analyzing the problems of shield-grounding schemes, also remember that the connections for the shield in a twisted-pair cable are wholly distinct from the connections for the signal conductors. Depending on the format of the audio interconnect (balanced or unbalanced, transformer or

electronic), there are different ways to terminate the signal wires. These have nothing to do with the method used for terminating the shield. These are two distinct problems that can be analyzed and resolved separately.

With the notion that ground loops are problematic because of the current that they create in ground conductors, and given that ground conductors will be shared by certain pieces of equipment in an equipment cluster, a ground loop created by one piece of equipment may have an impact on the noise of

another piece of equipment. It can take several years of full-time wiring practice for an installer to develop the skills and understanding required for reliable and fail-safe wiring.

Types of systems

The ground-shielding scheme you use will be determined by the type of system you are working with: fixed or flexible layout systems.

Fixed layout systems are permanently wired and have no built-in ability to be

Secondary voltage	Current limiter resistance	Resistor wattage
6	75 Ω	1
12	150 Ω	2
18	220 Ω	3
24	300 Ω	4

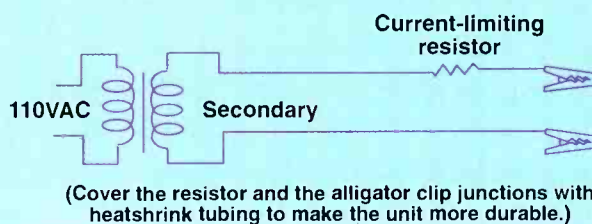


Figure 2. The hummer test determines whether an audio device is sensitive to "the pin-1 problem." (After Windt.)

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repatched or reconfigured. In these systems, shield connection issues are fairly straightforward: Ground the cable shield at *one end only*. (This is often called the OEO rule.) Whether to ground at the input or the output has been the subject of much discussion. I recommend grounding at the output ("source" end of the cable) as a general rule. This is because outputs are never looped together, and thus, you avoid the possibility of creating ground loops in this fashion. On the other hand, inputs are often driven in parallel, particularly in voltage-source ("bridging") systems, and numerous exceptions to the OEO rule would be required if grounding were done at the "destination" end of the cable.

In the case of unbalanced signal paths, such as single-ended (consumer) audio connections or video coax cables, the shield also forms the return conductor for the single signal conductor. In this case, the shield cannot be lifted, and a ground loop is unavoidably formed.

Flexible layout systems use jackfields or other patching means to allow reconfiguration of the system. In practice, the use of patching greatly complicates the shield-grounding scheme, as Figure 1A illustrates. No ground loop exists in the normalized

path from source to destination through the jackfield, but when a patchcord is inserted, a ground loop is formed because of how shield-grounding was handled at the jacks. (There are many ways of implementing grounding schemes through patchfields that will cause ground loops, and this is only one of them. Any proposed shield-grounding

Ground the cable shield at one end only — this is often called the OEO rule.

schemes involving patching should therefore be drawn out and analyzed.)

Note that if the jacks are treated as a piece of equipment, however, in which the shields are either grounded or lifted, the loop is avoided (as shown in Figure 1B).

Other considerations

Because unbalanced, coaxial video connections inevitably create ground loops, it is often appropriate to segregate the equip-

ment into separate racks and to provide individual, isolated ground conductors to these racks from the main AC distribution panel. As a result, the ground loops created by the video system are isolated as much as possible from the more-sensitive audio system. This idea can be taken one step further by segregating less-sensitive systems, such as intercoms and tally, and locating this equipment in other racks as well.

Each of these three rack systems (video, audio and intercom/control) can be free-standing on its own isolating base and fed from power with dedicated technical ground conductors from the local power-distribution point.

As systems become increasingly digital, the differences among all of these types of signals diminish because they all become bitstreams. Nevertheless, the sensitivity of digital signals to ground-loop problems is at least as critical, if not more so, than with analog systems.

Another helpful technique is grouping the grounds. The *loop area* of a ground loop will determine the extent of the current that may be induced into it by nearby magnetic fields. If the ground wires associated with equipment in a rack are grouped together and run parallel, then the loop area will be

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minimized. These ground wires could even be twisted together, thereby dropping the loop area of this portion of the circuit to zero.

In the case of extremely long runs, or for cables running through locations with extremely high EMI fields (such as transmitter sites), it may be preferable not to terminate the cable shields to the electronic equipment at all, but instead to terminate them at an interim terminal block with its own dedicated ground conductor back to the local ground bus. (This avoids the possibility of the pin-1 problem discussed later.)

Shield termination

The following rules and comments may be helpful with regard to the use of cable shields:

- Terminate the grounded end of a shielded cable with an insulating sleeve (preferably shrink-tubing) over the jacket termination and another, smaller-diameter piece of tubing ("spaghetti" or shrink-tubing) over the drain wire. This prevents the possibility of the shield becoming inadvertently shorted to another circuit, shield or ground.
- When terminating shielded cables, always keep the unshielded ("stripped and spread") end portion as short as possible. The unshielded portion should normally be less than an inch (25mm) long.
- Never terminate the shield of a balanced audio line at both ends.

- As noted previously, for long cables — more than 1,000 feet (305m) — or in extremely high EMI areas, it may be desirable to break the shield and ground it as two separate pieces. Alternatively, it is possible to use a capacitor-to-ground at one end, while the other end is grounded normally with a direct connection to ground. This provides high-frequency grounding without introducing a DC ground loop. In areas of extreme EMI, this technique may be helpful even on shorter cables.

- Always avoid or minimize unnecessary breaks or connectors in shielded cables, such as at junction boxes, and always maintain shield continuity and isolation from ground through all boxes or multipin connectors unless the system-design documentation shows otherwise.

- Use shielded cables that have a continuous conductive path around their circumference. This is not the case in some cheaper cables in which a spiral wraps around the cable and lays Mylar insulation against aluminum foil. A fold in the foil is generally needed to ensure conduction at the overlap. Also, the drain wire should lie against the foil side of the shield, making good electrical contact. The number of wraps of this shield around the center conductors should also be investigated. Cables vary significantly in this regard. The more overwrap, the better

the expected shielding is.

- Multiconnector, shielded, twisted-pair cable should have an insulated shield and separate drain wire for each twisted pair of wires.

- Shielded cable may also be used to contain EMI signals. For example, in the case of relay switching or digital control, the shield will help contain the signals and prevent crosstalk into other analog cables.

- Be aware that when a cable specification states that there is 100% shielding, this is an indication of the physical coverage of the shield, not a measure of the effectiveness of the shield. A shield with 98% coverage has openings in 2% of its surface area (typical of braided shields, while foil shields are 100% covered).

The pin-1 problem

The *pin-1 problem* (as identified in Reference No. 2) refers to a means of EMI pickup in audio equipment related to connections to pin 1, the ground pin, of an XLR-type connector. This is also the pin used for cable shield connections. In general, the pin-1 problem refers to the connection of shields to audio equipment and how the connector's pin 1 is internally grounded. In the case of 1/4-inch or other tip-ring-sleeve (TRS) jacks, this would correspond to the sleeve connection.

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The pin-1 problem manifests itself as noise that is induced into the internal circuitry of an audio or video device, which then appears in that device's output. In brief, the problem occurs when the internal circuit grounds are shared with the input and output connector shield grounds. When this occurs, common impedance coupling causes the electrical noise picked up in the cable shields to be transferred to the electronic circuits. A conceptual model for this considers the shield grounds as sewer pipes, while the circuit grounds are freshwater pipes. Keeping these two apart has advantages.

Complicating the pin-1 problem is the fact that a piece of equipment might measure flawlessly on the test bench, but when installed, could become quite noisy. Once all of the shields are connected to the many inputs and outputs of a switcher, for example, the pin-1 problem may manifest itself. Therefore, the noise specifications of most audio devices are rendered meaningless. The pin-1 problem is common in much of today's audio equipment, in everything from large mixing consoles to small processing devices. It is preventable by good electronic design, but users often unknowingly install devices that exhibit the problem, and it remains prevalent. This is a major source of EMI in many audio systems.

One way to minimize the pin-1 problem is

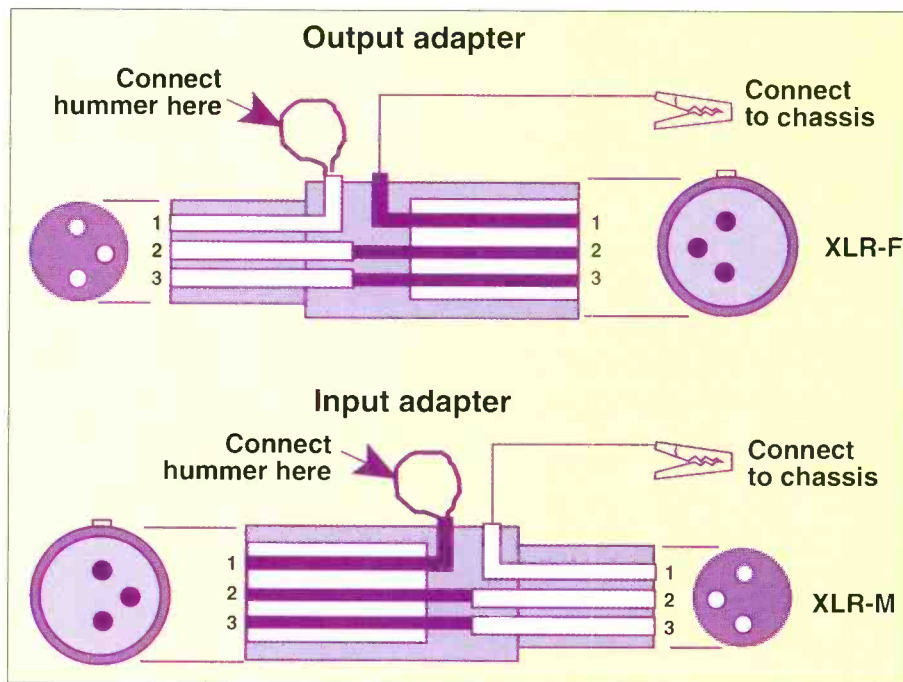


Figure 3. These adapters can make the use of the hummer simple and effective. (After Windt.)

not to connect any of the cable shields to pin 1 at the audio equipment, but rather to ground the shields to some intermediary terminal strip near the audio equipment. This approach applies to twisted shield pair

cable and requires a fully engineered approach to the design and documentation. If comprehensively addressed, a solution to this problem can result in the largest overall improvement to a facility's system noise.

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The hummer

There now is a way to test for the pin-1 problem: the *hummer test* as devised by John Windt of Culver City, CA. (See Reference No. 3 at end of article.) The test determines whether a piece of audio equipment is sensitive to noise being injected on the pin 1 or shield termination points of the audio inputs and outputs. To perform the test, a 60Hz signal is injected into the ground system of a device at two points, using various combinations of input pin-1s, output pin-1s and chassis connections. While this is being done, the output of the equipment is monitored with suitable test equipment. Any change in the noise level in the device's output will be unambiguously due to the noise being injected.

On large multi-I/O devices (such as mixers and routers), a large number of potential paths should be tested. For example, test pin 1 of an input and pin 1 of each of the outputs on a console, then try pin 1 of each input and the chassis of the console, followed by pin 1 of an input and pin 1 of the other inputs to the console, and finally, pin 1 of an output and pin 1 of the other outputs of a console. Depending on how the grounding has been implemented in the console, these will have varying effects on the overall output noise of the console.

Monitoring the output noise is a critical element of this test. The simplest form of test equipment would be a voltmeter or a good loudspeaker monitor system with high gain, allowing you to hear the noise floor of the equipment.

Figure 2 shows the circuit diagram for the hummer. It consists of a 110VAC to 6/12/18 or 24VAC transformer and a current-limiting resistor. The output of the transformer is terminated in alligator clips, which allows it to be terminated as required. The adapters shown in Figure 3 can make using the hummer simple and effective.

One possible solution for a device that has the pin-1 problem is to not connect anything to pin 1 and to ground the incoming shields separately via a terminal block to some other technical ground point in the system, such as the ground block in the rack. Of course, in the case of microphones, phantom power returns on pin 1. Trying this indirect grounding approach in such cases can cause microphone oscillation.

The pin-1 problem and the different internal wiring schemes of various devices can explain why some equipment performs well in some projects and not in others, and why solutions that seemed to solve noise problems in one application don't help in others.

Although it would be nice when designing a system to focus just on the choice and installation of new audio and video equipment, proper grounding and shielding must also be considered. Without it, any other systems in the facility will not perform as well as they could. Careful attention to the design of the grounding and shielding system allows you to get optimum performance under real-world conditions without incurring unreasonable installation costs.

Philip Giddings is principal of Engineering Harmonics, Toronto, Ontario, Canada.

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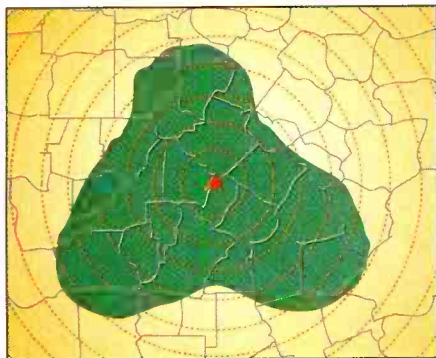
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Last month, we looked at a basic TV transmitter maintenance schedule and the work to be performed regularly. This month, we will look at the needed tools and test equipment and focus on some similarities and differences between the predominant types of transmitters, with an eye toward future upgrades.

Basic toolkits

The list of fundamental tools and test equipment needed for effective transmitter maintenance is relatively short. Even the smallest stations with the tightest budgets can assemble a decent toolbox to meet virtually every primary maintenance need. For day-to-day work, the main items are going to be cleaning supplies. Invest in a good shop vacuum along with the small brush attachments and crevice tools for it. A great additional item is a small, portable vacuum with a hose and attachments. The smaller unit is handy for getting deep inside a high-voltage cabinet or driver tray. Keep a good selection of clean rags and a few rolls of paper towels on hand along with basic household cleaning solutions and sprays.

For most maintenance tasks, you will need a set of basic hand tools. Every toolbox should contain a selection of screwdrivers, nutdrivers, box and open-end wrenches, socket set, Allen wrenches, adjustable wrenches, pliers and so on in metric and standard fractional sizes. For working on high-power tube assemblies, a set of ball-end Allen wrenches is frequently needed. Tube manufacturers often provide extra-long drivers and wrenches for reaching into the tight places around some tuning cavities. Purchasing an extra set of these wrenches can make tube changes much quicker. You may also want a set of brass, bronze or stainless tools for working around energized focus magnets.

Fundamental test equipment

Every TV transmitter site should have on hand, at minimum, a demodulator, aural modulation monitor, high-quality picture monitor,

TV transmitter maintenance basics, part 2

waveform monitor, vectorscope, oscilloscope, frequency counter and multimeter. The demodulator should be highly linear, offer a quadrature signal output for ICPM and sub-carrier measurements, stereo audio outputs, a choice of filters, traps and attenuators and a zero carrier "chopper" pulse for system reference. The modulation monitor should offer a total modulation meter as well as L+R and L-R meters, peak indicators and an IF output. The demodulator and modulation monitor should be calibrated annually, preferably by the manufacturers, to an NIST traceable standard.

Proper video quality control is dependent on a quality waveform monitor, vectorscope and picture monitor. These instruments also need to be highly linear so as not to introduce false indications into measurements. The waveform monitor and vectorscope need to be able to show individual video lines in each field and provide for convenient measurement of differential gain and phase. The picture monitor is not a place to cut corners. Keeping a close eye on a good-quality, fine-pitch picture monitor can sometimes reveal problems that are missed on the scopes.

Rounding out the basic test equipment package are a good-quality 100MHz oscilloscope, a frequency counter and a multimeter with current and high-voltage probes. The oscilloscope should be at least a dual input, be set up specifically for television and have specialized triggers for locking to vertical and horizontal sync rates. Even better is a scope with on-screen measurement cursors and user menus for frequently selected setups. The frequency counter should be capable of resolution to 1Hz at transmitter output frequencies, and should offer variable slope, trigger levels and coupling. It should

also be sent to the manufacturer annually for an NIST traceable calibration.

A useful addition to the toolbox is the spectrum analyzer/sideband adapter combo. Use a spectrum analyzer that is capable of handling input frequencies approximately 20% higher than the first visual harmonic. Most spectrum analyzers on the market today go to 1GHz right out of the box. Also, be sure that your analyzer has an interface for the sideband adapter — it's an option on most analyzers, and it frequently gets forgotten.

What system have you got?

With the basic toolkit, let's look at the specifics of different transmitters. Today's transmitters offer an array of technologies that cover the map from basic to exotic. In many cases, today's VHF engineer is dealing with transistors — lots of transistors. Newer VHF transmitters make extensive use of solid-state amplifier chains, which greatly simplifies maintenance. The most pressing items are cooling system components and control systems. Not to say that the VHF engineer's job has become sleepy by any means, it takes a great deal of clean, filtered air to cool 50kW worth of RF transistors.

By contrast, today's UHF engineer has to keep up with a seemingly ever-expanding list of transmission technologies. The klystron is rapidly fading from view in favor of its more efficient cousins. Although it is beyond the scope of this article to go into each of these technologies in detail, we can examine the basic differences in the systems and differences in maintenance.

First, a quick review of klystron fundamentals. Table 1 summarizes the similarities and differences between different types of transmitter amplifiers. The high-power UHF TV klystron is a large, heavy device — whether of integral or external cavity design. The collector is operated near ground potential inside a cooling water jacket. Cooling systems are usually water or vapor, less often air. Multiple-focus magnets are required to keep the beam coherent as it travels between drift tubes. Gain is high, so power input to these devices is low. Power outputs range as high as 65kW. Overall efficiency of an unpulsed klystron is usually around 20%. (For this article, efficiency figures refer to actual tube or amplifier efficiency, not whole transmitter facility efficiency.) Pulsed, the efficiency rises to a respectable 45% or so. Expected tube life, if well

	Klystron	MSDC	IOT	Tetrode	Diode
Available output (peak visual)	60kW	60kW	60kW	30kW	80kW
Typical input drive	5-20W	5-20W	200-400W	1kW	2.5kW
Gain (approx)	40dB	40dB	20dB	15dB	15dB
HVPS requirements	26kV	26kV*	32kV	8.9kV	8.5kV
HVPS Current**	2-5A	2-5A	.5-1.5A	4-5A	9-10A
Filament V Filament I (typ)	6-9V 25A	6-9V 25A	6-7V 25A	8-9V 185A	8-9V 180A
Typical cooling	Water or vapor	Water, 2-stage system	Water or air	Water or air	Water
Weight	400-600lbs	500-700lbs	50lbs	25lbs	15lbs
Tube Cost**	\$40,000	\$45,000	\$33,000	\$20,000	\$25,000

* Several taps taken off at 25kV, 18.75kV, 12.5kV and 6.25kV for different collector segments.
** All at 50% APL, beam currents in drift tube devices, plate currents in tetrode and diode.
*** Average tube costs compiled from data from several tube manufacturers and distributors. Costs shown are approximately mid-range.

Table 1. Some of the basic similarities and differences between UHF transmitter amplifiers.



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maintained, can be in excess of 40,000 hours. Maintenance focuses mainly on cooling systems and on touching up cavity tuning, focus currents, filament voltages and exciter pre-correction adjustments.

The multiple-stage depressed collector klystron (MSDC) offers all of the advantages of a traditional klystron — high gain, good linearity, long life — while gaining fairly impressive efficiency figures due to the multiple-stage collector. Efficiencies of well-maintained MSDCs approach 75% or better. This is due to the multistage collector that uses stepped high voltages on the collector segments to decelerate the electrons in the beam and recover much of the energy that would be lost as heat in a traditional klystron.

The MSDC also has all of the traditional klystron's disadvantages; it's still big and heavy, still requires multiple focus magnets, tuning cavities and so on. It also offers what some consider a major disadvantage that traditional klystrons do not. Sections of the collector are operated at full HV potential, meaning that cooling water purity is a critical operational and safety issue, but transmitter manufacturers design water purification and conductivity monitoring equipment as an integral part of the system.

Overall, the MSDC offers an attractive alternative to a traditional klystron, and has



A spectrum analyzer and sideband adapter are not required, but can be a nice addition to a facility's inventory of test equipment.

found favor in retrofit applications. Little has to be done to a klystron transmitter to upgrade it to MSDC service other than beam supply retrofit. Therefore, the increased efficiency provides a fairly short payback period. Other than the extreme cooling water

purity and dual-stage cooling system, general maintenance and tuning of an MSDC is similar to that of a traditional klystron rig.

Moving away from klystrons, we enter the world of the inductive output tube (IOT), which is fast becoming the standard in high-power broadcast applications. The IOT design has existed in laboratories since the 1930s, but is just now seeing real-world application. This is mainly due to recent advances in materials science and manufacturing technology allowing a grid made of pyrolytic graphite to be mounted only fractions of a millimeter from the cathode. The IOT is actually a hybrid device that uses the cathode/grid arrangement to inject RF and modulate the beam, and traditional klystron-like drift tubes and collector. Efficiencies range at 85% or better. The IOT is small, lightweight and requires only one magnet for beam focus. Output tuning is accomplished with two cavities operating as a double-tuned tank circuit.

The IOT has its downside as well. It has a lower gain, so input drives in the range of 200W to 400W are typical to achieve 40kW to 60kW output. It also requires a beam supply in excess of 30kV. The technology is quite new, so there is not a long track record of these types of transmitters for purposes of determining expected tube life.

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All of this has ramifications for the retrofit market. Basically, all that is left is the original transmitter cabinet upon upgrading an existing system to an IOT, since the beam supply, exciter and drivers all need to change. Most stations are simply buying whole new transmitters, rather than retrofitting older units. Still, even with the downside, many broadcasters are choosing the IOT over other technologies. At last count, there were eight manufacturers of IOT transmitters worldwide. Because the tube is stable and tuning is a snap, maintenance issues come back to the basics of the cooling system and voltage checks.

Materials science and manufacturing technology advances have also breathed new life into the basic tetrode in recent years with the addition of pyrolytic graphite grids. It is possible to achieve similar power levels from tetrodes as have been common from medium-power klystrons in the past. A tetrode is quite efficient, and modern UHF tetrode transmitters typically show efficiency figures of 40% or better, with power outputs to 40kW peak visual. Power supply systems are much simpler, because the tube requires only around 9kV. Maintenance is simple, involving basic voltage checks and tuning touchups.

A recent entrant into high-power UHF transmission technology is the diacode from Thomson. Again, a design that has been in



Test equipment doesn't have to be the latest and greatest, but it does need to be kept in good repair and calibrated regularly.

the lab for many years is now practical due to pyrolytic graphite, new ceramics and new manufacturing technologies. The diacode is a tetrode with the addition of a tuning cavity that creates a one-quarter wave RF "short circuit" on one end of the tube. This effectively doubles plate current, and as a result, doubles output power. In visual service alone, this tube is rated at 80kW peak sync, 60kW is achievable in common amplification mode. The diacode uses the same technology as a tetrode as far as RF input and output, plate supply voltage and screen voltages. This technology shows great promise for the future because tube cost, size and complexity are all

small. Other advantages include simple power supply design and no requirement for external arc-quenching crowbar circuits. One possible drawback is the high input drive power needed. Inputs on the order of 2,500W are required for 60kW common amplification output. Maintenance is identical to a tetrode transmitter, involving checks and adjustment of plate, screen and filament voltages, along with cooling system maintenance.

It all comes back to the fundamentals

Even though new rigs are being installed in record numbers today, TV transmitter engineers all over the country are successfully keeping 20-, 30- and even 40-year-old transmitters on the air looking and sounding sharp, crisp and clean. Regardless of the type of transmitter you own — VHF solid-state, UHF tube, older klystron technology or the latest and greatest whiz-bang — one fact remains: Keep up with basic maintenance and the system will continue to perform at top level for years to come. ■

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The re-evaluation process

The Certification Committee has been in the process of re-evaluating the institutions that offer SBE certification, either by test or course grade. Currently, 17 of the approximately 50 on its list have been recertified. Some of the criteria used in this re-evaluation process were:

- Current technology curriculum
- Ability to deliver the information to the student
- Ability to measure their results
- Ability to document their efforts
- Ability to assist their graduates with job placement
- Ability to provide continuing education
- Number of students enrolled in their electronics or management programs
- Qualified faculty
- Academic standards
- Evaluation of student scores
- Quality of resources

As part of its ongoing effort, the SBE will re-evaluate each school on an annual basis. This process will ensure that you will always receive the most current information. This is important for a couple of reasons.

Sophisticated computers and telecommunications technologies are fast replacing entire job categories. As these jobs are eliminated, new ones will open up due to the newer technologies. As the new technologies come forth, they will not absorb as many jobs as they eliminate, therefore, you may need to investigate new avenues of employment.

Education is vitally important, and in upcoming years, it will be even more crucial. We need to work together to create the road map that will take us to a new skill level. This new level could be with your current employer, but just in case unforeseen changes are on the horizon, you need to be prepared. By answering the following questions, you can help us with our task of helping you meet your future goals.

1. What educational institutions in your area would you recommend?
2. What should we look for when evaluating a school, university or technical college?
3. What topics would you like to see in an Ennes Workshop in your area?

You may think you don't need these programs. But when I think of education, I'm reminded of a story about a sea captain and his chief engineer who were having an argument as to which of them had the most important job on the ship. Failing to agree, they swapped places. The chief engineer ascended to the bridge and the captain went into the engine room. After a couple of hours the captain suddenly appeared on the deck cov-

ered with oil and soot.

"Chief!" he yelled, wildly waving a monkey wrench. "You'll have to come down here; I can't make 'er go!" "Of course you can't," replied the chief engineer. "We're aground!"

You cannot predict what challenges or opportunities you will face in the future. So you must prepare yourself now so you will not find yourself in the same situation as the sea captain and the chief engineer.

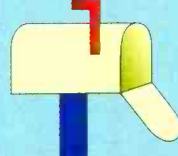
Continuing education

Learning is a lifelong process. Continued education is a link to a lifetime of learning and earning. In 1994, a *U.S. News and World Report* indicated that 42% of the college student population is over the age of 24. This means the competition for your current or future job is increasing. To remain competitive, you must also get on the path to continuing education. Many educational institutions offer a variety of credit and non-credit academic programs. These programs have been developed to meet varying schedules and individual needs. What do you need to move to the next level of expertise? Look over the changes that have occurred in the broadcast industry over the past few years and visualize what changes might occur in the next few years.

I was traveling through Virginia a few weeks ago, and I came across a sign that said, "You'll never steal second when your foot is still on first." Where is your foot? Don't be afraid to take risks. Remember that timing is extremely important. Stay *focused*, continue your *education* and do what all successful Americans have done, *work* hard. Plan every move or significant action you intend to take. Never stop paying attention to the details. Surround yourself with the best people you can. Remember the seven famous words of Winston Churchill: "Never give up, never, never give up." See you at home plate. ■

To respond to the three survey questions or to request the SBE National Certification Committee certified school listing, contact the SBE by phone at (317) 253-1640 or by fax at (317) 253-0418.

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On March 11, 1980, The Harold Ennes Scholarship Fund Trust was adopted by Indianapolis Chapter 25 of the Society of Broadcast Engineers. The trust was created in memory of Harold Ennes who was a member of the National Certification Committee and author of many books on broadcast engineering. The fund was transferred to the SBE in May of 1981. In March 1994, the name was amended to The Harold Ennes Educational Foundation Trust.

Since its inception, the Ennes Foundation has looked for new and exciting methods to further its goals of education for the broadcast engineer. The foundation has grown to provide technical workshops at regional and national conventions. It evaluates educational courses and cooperates with other industry organizations to develop and enhance common technical training courses.

Education

In 1989 there were 503,000 people employed as bank tellers. In 1993 that figure was down to 446,000, and statistics indicate that by the year 2003, it will fall to 223,000. In a local paper, it was reported that in the next 10 years, half of all U.S. bank branches will be gone as the banks turn to electronic transactions. In 1956 more than 250,000 people were employed as telephone operators, and in 1995, that number stands at 60,000 and is still falling.

What does this have to do with the SBE and the Ennes Foundation? One of the goals of the society is to ensure that its members have the tools to guarantee they won't go the way of bank tellers and telephone operators. How is the society working to accomplish this? Education. General George Patton probably said it best, "Intelligence is like eggs, the fresher the better." To ensure that members have access to this fresh information, the SBE and the Ennes Foundation offer educational grants, sponsor regional and national workshops and maintain an internationally recognized program of certification for engineers. There is also a certification program for educational institutions to make sure the right courses are being offered.

Shure Brothers founder dies at 93

Sidney N. Shure, chairman and founder of Shure Brothers Inc., passed away on Oct. 17 in Chicago. He was 93 years old.

In his early days, Shure was an amateur radio hobbyist who worked in a radio factory and as a distributor salesman. He began building his company in Chicago in 1925. The Shure Radio Company began as a small wholesale parts supplier for home radio set builders.

In 1928, the company's name was officially changed to Shure Brothers Company when S.N. Shure was joined by his brother, S.J. Shure. The company soon became Shure Brothers Inc.

The stock market crash of 1929 affected Shure's parts distribution business. And it was during this period that Shure began to concentrate on the microphone business —



engineering, manufacturing and marketing.

In 1932, Shure Brothers produced its first microphone, a 2-button carbon microphone. In 1935, a department was dedicated to research and development.

In 1937, Shure introduced the first modern noise-canceling microphone, then the first controlled magnetic microphone. By 1939, Shure had invented the Unidyne, a single-element directional microphone.

Over the years, the company has continued to grow and develop innovative products.

For more than 70 years, Shure's philosophy of innovation and quality and his unique vision and vigor have made the company a worldwide success. ■

COMING IN JANUARY...

Remotes

Engineers either love them or hate them. For many of us, the thrill (and terror) of working remote broadcasts never goes away. In the January issue of *BE*, we provide the opportunity for you to relive those times while providing a glimpse into some leading-edge technology.

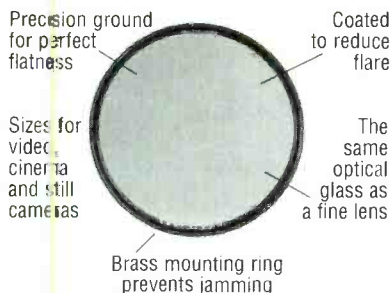
This issue will look at the construction of two multicamera sports trucks. Each truck relies on digital cameras and signal processing to provide the utmost in quality. Whether it's an ENG van or 10-camera, diesel tractor trailer rig, this article will teach you how to incorporate these innovative construction techniques and production capabilities in your remote truck.

Also in January:

Power Conditioning Systems

Jerry Whitaker will review the basics and advance techniques of power systems. He will also show you how to plan a clean power supply system for your station or production facility. Don't let dirty power rob you of a quality signal. See the January issue for answers to your questions.

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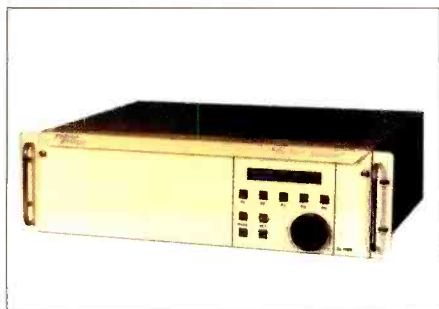


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Prime Image Time Machine

audio passages with minimal impairment to sound and video quality. Furthermore, the quantity of time added or subtracted to these passages can be changed dynamically and during real time. This allows the time-changed signal to be mixed with other

dropped without any noticeable effects.

Applications for the Time Machine include shortening and lengthening programs to fit time slots or to provide room for additional commercials. In live applications, the Time Machine can be used to shrink and grow delays for censoring phone calls or meeting network time at the end of a show. The concept of the Time Machine is based on Prime Image's A/V delay, which is a 1- to 30-second delay device capable of delaying video and up to four channels of audio. An offset provides for different delays of audio and video to accommodate different audio and video path lengths. Video can be adjusted up and down by 40ms (one frame) and audio can be adjusted in 8ms increments. Once set, delays in the A/V delay unit are left unchanged.

The Time Machine provides for variable delays over time. By adding or subtracting frames over time, the amount of delay can accrue upward or downward. By doing this over relatively large amounts of time, the dropped or added packets of audio and video go unnoticed by the viewer. Packets

Since the beginning, broadcasters have been plagued by time. Either there was too much material for too little time or vice versa. In the late 1940s, the tape machine became Bing Crosby's time machine. It allowed him to go on for hours on good days and use the extra for fill material on bad days. Prime Image now has a time machine for the 1990s. Today's time machine is a digital solid-state device capable of increasing or decreasing time. This process, unlike on some units, does not include stretching or squeezing, the result of which is pitch shifting.

The Time Machine changes video and

By adding or subtracting frames over time, the amount of delay can accrue upward or downward.

non-time-changed signals if necessary. To understand the Time Machine, you must think of digital audio and video streams as being made up of individual packets, rather than as a continuous stream. These packets, if handled properly, can be repeated or

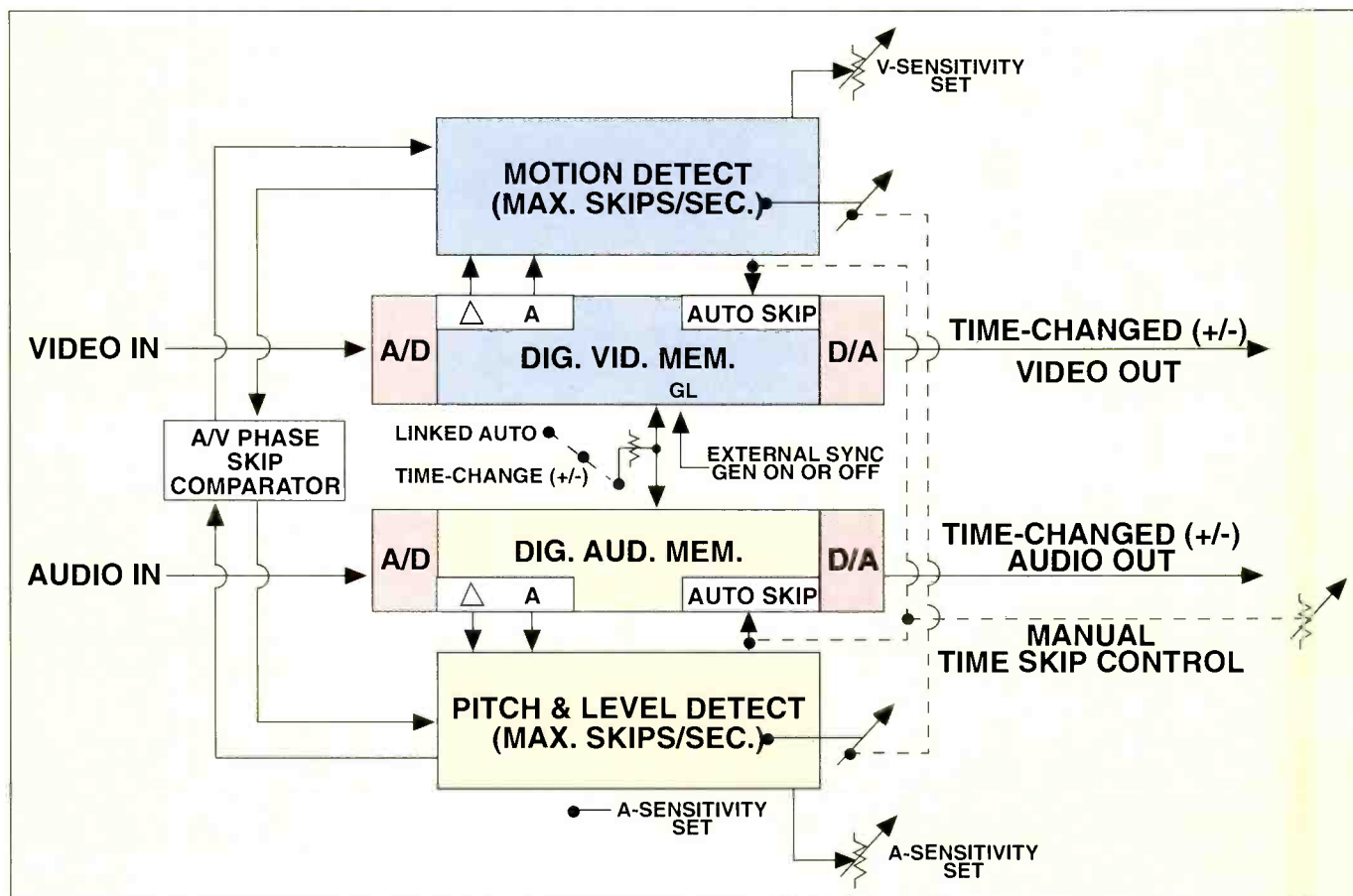


Figure 1. Basic block diagram of the Time Machine. Controls allow pitch/motion sensitivity adjustments as well as manual control of time shifting.

are added or subtracted during similar passages. For video, this means little or no motion. For audio, it means little or no pitch or level change. Several proprietary methods have been developed by Prime Image to drop or insert packets during motion or pitch and level shifts, but they go beyond the scope of this article. Audio and video packets can be removed at different times as long as the audio/video synchrony remains ± 1 frame, thus maintaining lip sync.

Audio and video packets can be removed at different times as long as the audio/video synchrony remains ± 1 frame, thus maintaining lip sync.

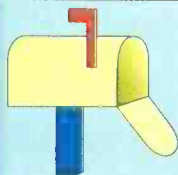
The Time Machine operates on a few basic principles. The first is that audio and video can be delayed variable amounts. The second is that total audio delay must be within one frame of the total video delay. The first assumption holds for exact lip sync, while the second provides for periods of minimal viewer distraction. The Time Machine can be run in either an automatic or manual mode and can be disabled for segments that cannot be changed (commercial spots). Pitch/motion sensitivity can be adjusted to speed up or slow down time accrual.

The unit cannot be used to make up ridiculous amounts of time in a short period, and based on on-board memory, maximum accruals are limited. However, the unit can be used effectively to change the timing of segments with minimal video and audio degradation. In general, the unit is capable of shifting time by one second per minute or 30 seconds in 30 to 60 minutes. This level of time shifting produces minimal degradation in quality. Larger shifts are possible, but can effect quality. Depending on the circumstances involved, however, the impairments may be acceptable for short durations. ■

Bill Hendershot is president and founder of Prime Image, Saratoga, CA.



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Acrodyne Au60D 60kW UHF TV transmitter

The klystron UHF TV broadcast transmitter set the precedent for 60kW of visual power back in the early 1980s. Generally, this was accomplished with one tube for the visual and another of the same kind for the aural. Although the klystron has always boasted long tube life, it is terribly inefficient (even with pulsing) and consequently extremely expensive to operate. With so many klystron transmitters in the field, the setting was fertile to find a better way.

The klystron was the first klystron replacement of any consequence because it moved the class of operation from A to AB — a definite step in the right direction, but fraught with life problems. It was soon replaced with another supplier's equivalent, the *inductive output tube* (IOT). The IOT has been successfully marketed and well-supported by the OEMs using it, but it has had its share of performance and life problems. After five years, it is showing a slow average life improvement as its manufacturer identifies solutions to its problems.

Another player is the MSDC, which shows significant improvement in power efficiency over the klystron, but has been given little support by the industry in general. The MSDC's multiple collector layers also require a complex power supply design.

It is no secret that most UHF TV transmitter manufacturers have opted for the IOT and that dozens are on the air, but even if the tube provided the reliability expected of it, it still has the drawback of not being able to provide the 60kW power level set by the klystron when used in combined amplification. When the klystron reached 60kW, it did so by amplifying only the visual signal. Since then, the trend has been away from separate visual and aural transmitters, so the real challenge has been to do the same thing with one tube in common amplification. All tubes have fallen short of this goal until recently.

A new approach

Physics dictates just how far the state of

an art may go. In the case of the UHF tetrode, this limit appears to be around 55kW peak envelope power without undue compression and distortion. If two major signals are being amplified by a tube like this and their relative power levels are that of the NTSC format (i.e., aural 10% of peak-of-sync), then the highest peak-of-sync signal possible with a tetrode is 31.5kW in common amplification. To go any higher would require more than one tube, or a different approach altogether.

The Acrodyne Au60D takes the different approach. With a tetrode-like tube, the physical limit leading to power-handling capability of the tetrode can actually be doubled without changing any of the tube voltages except the filament. Figure 1 shows the new approach in the form of a comparison between the tetrode and its advanced-concept, double-power tetrode (or *Diacrode*, as it is called).

The Diacrode is not complete without an external cavity connected across its output elements, i.e. between the anode and screen grid. This is a small, DC-blocked cavity that rests on top of the tube. It is a quarter-wave transmission line measured from the top of the cavity to the vertical center of the tube. It is shorted at the top, reflecting an open circuit at the vertical center of the tube. This places an RF open circuit or current minimum at the vertical center of the tube, with a current maximum at the base of the tube like the tetrode, but with a second current maximum above the tube at the cavity short-circuit. This second current maximum is impossible in the plain tetrode, because in the tetrode, the RF current must go to zero at the top end, away from the base end where no connections are made. (If no connections are made, this is an open circuit condition, and the current must go to zero at the top.)

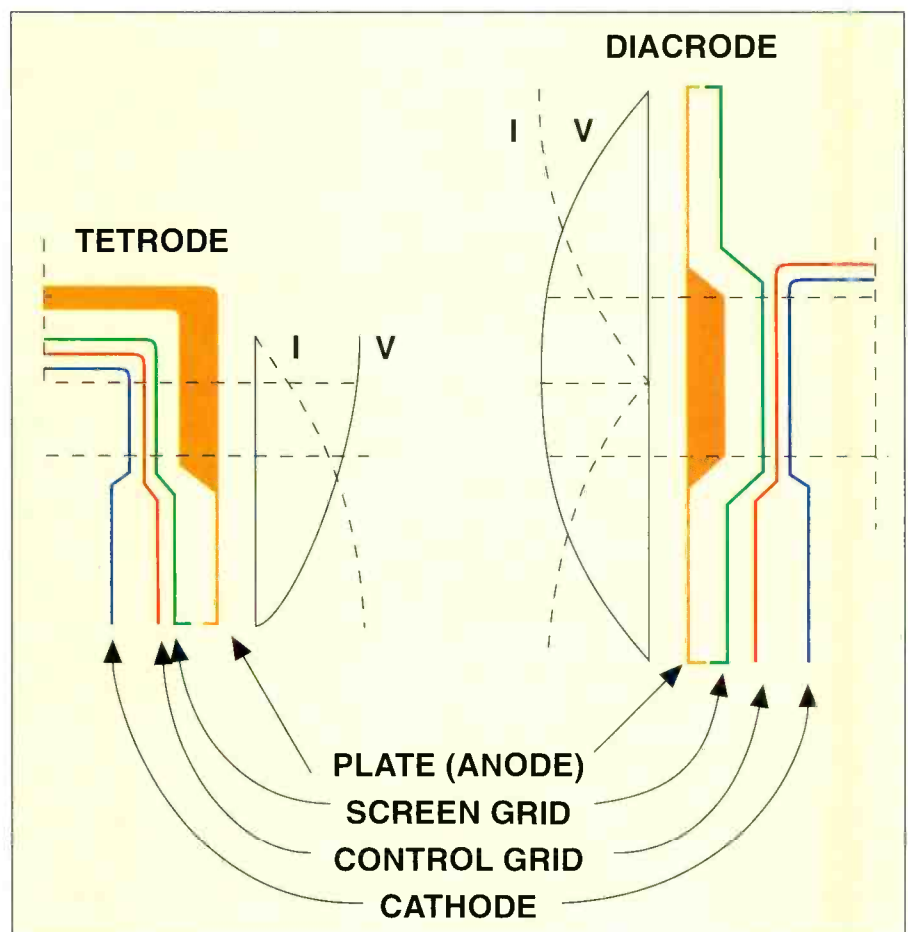


Figure 1. Cutaways of the tetrode and Diacrode comparisons are shown above. The Diacrode is not actually twice as high as the tetrode, but it appears that way electrically because of the Diacrode's upper reflective cavity. Note that RF current (I) peaks above and below the Diacrode's center, while on the tetrode it peaks only once at the bottom.

With two current maximums, the RF power capability of the Diacode is double that of the equivalent tetrode, while element voltages are the same. This is not to say that twice the power comes from doubling the efficiency of the tetrode, but rather that the efficiency is the same (as governed by the AB class of operation) and the DC current is twice that of the tetrode. All other properties and aspects of the Diacode are the same as the tetrode. Gain is typically 14.5dB, heater or filament voltage is twice that of the tetrode (10V at 180A), but anode voltage remains at 8,500V while screen grid voltage is essentially the same at 600V. Control grid bias voltage is the same at about -120V and

The RF-power capability of the Diacode is double that of the equivalent tetrode.

adjusted for 3A of anode idle current.

Therefore, this tube only requires 8,500V and produces 50% more power than the 32,000V IOT in common amplification. Furthermore, because of this low voltage, it doesn't require a crowbar or similar circuit. It is the only technology that stands up to the precedent set by the klystron, and does it with true class AB efficiency.

At this time, there isn't any other way to do this without using more than one tube. Incidentally, this tube weighs only 14 pounds, and replacing it doesn't involve detuning any cavity sections, because the tube is placed externally above the cavity. Its expected life is greater than 20,000 hours, and it is priced at \$25,500. A little arithmetic will display the savings compared to other designs over the life of a transmitter operating at 60kW.

The transmitter

A full 60kW UHF TV transmitter (the Au60D) has been developed around the Diacode, providing 63kW peak-of-sync and 6.3kW of aural power. (The extra power is designed to accommodate output filter losses.) Coupled with new solid-state driver amplifiers (which are capable of twice the power for a given amount of heat-sink real estate as previous designs), the 60kW transmitter only occupies four more inches of floor length than a typical 30kW tetrode transmitter; all other dimensions are the same. Of course, the power

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supply is larger, but it remains comparable to any other 60kW supply, either dry or oil-filled. The heat exchanger is twice the size of the 30kW transmitter because twice the heat is generated. It may use a single distilled-water loop for indoor operation or a double loop for an outdoor installation.

Drive required ahead of the interstage bandpass filter is about 2,500W peak-of-sync, which is a respectable power level using the PA bypass option if the PA needs maintenance (unlike the approximately 400W available with an IOT). You don't need another tube to give you minimum backup power, but if you want it, it isn't difficult to show that over the life of the transmitter, the cost of replacing two Diacrodes will be significantly less than replacing any other power-tube type. Assuming only one Diacrode is used, however, and based on 20,000 hours of life for any tube type, across a 20-year lifespan (175,200 hours), the cost to replace IOTs (in sets of two for 60kW output) is \$665,760, while the cost to replace Diacrodes is only \$219,000.

Because the Diacrode is new, it may have a latent problem somewhere down the road, but no indications of this have become

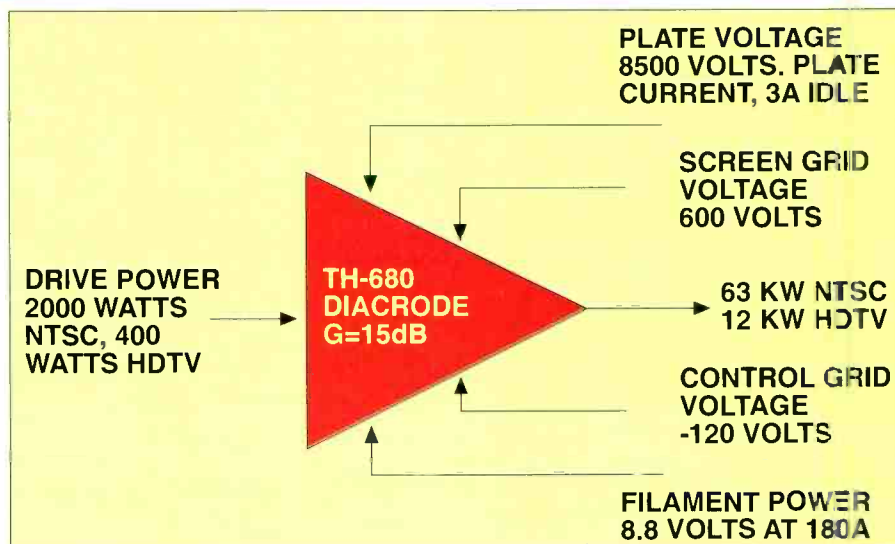
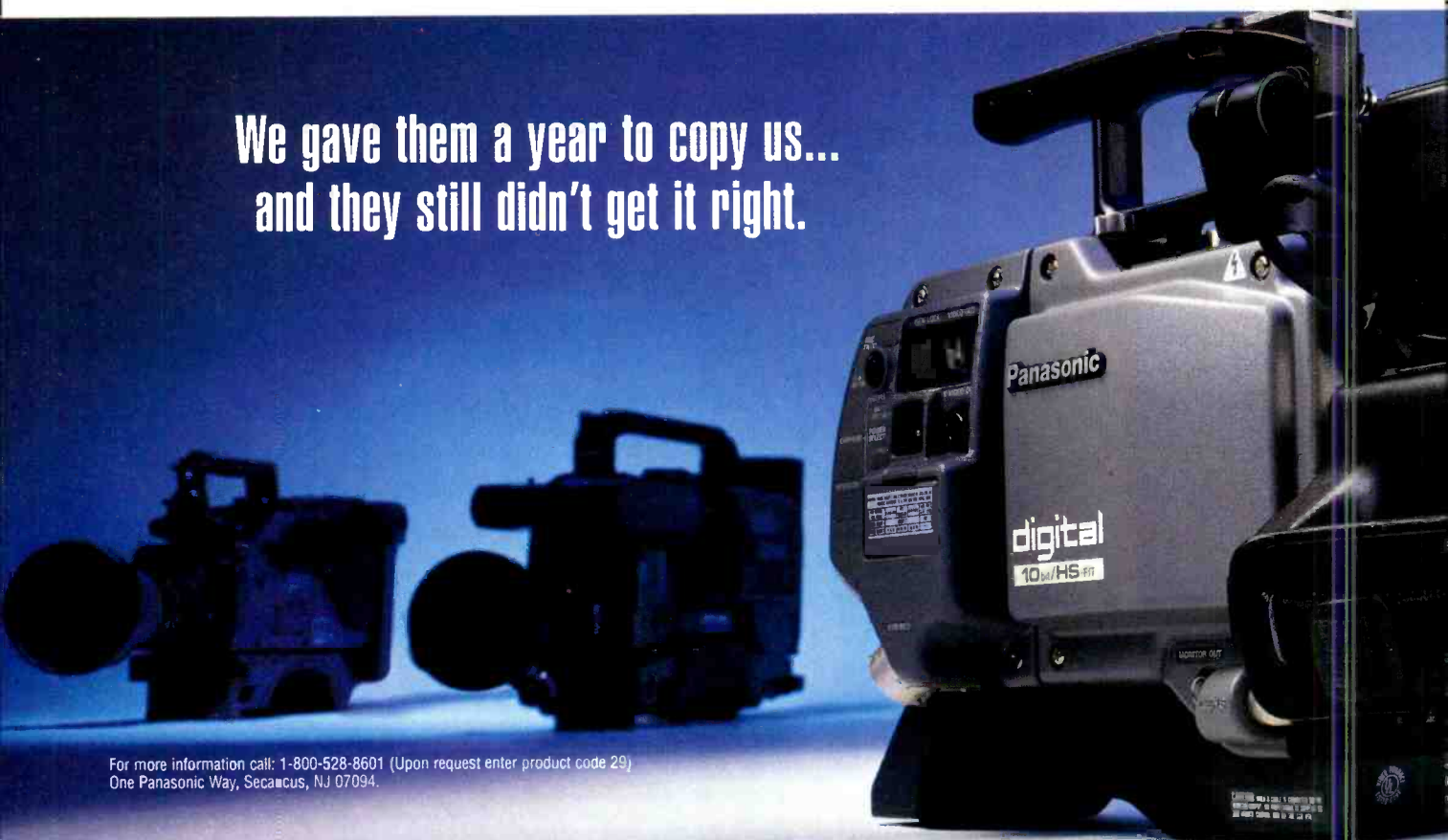


Figure 2. Diacrode support voltages and currents are shown.

evident. There were some start-up problems with the first transmitter, but they were not tube-related. Because so many new components were involved in its design, it was difficult to determine where initial problems came from. For example, at first the upper-cavity tuning seemed to

indicate a bad tube while operating at black picture, but this turned out to be incorrect. Retuning the cavity made everything work fine. Confidence was high, and it was decided to perform a blanking-level heat run at 63kW peak-of-sync and 6.3kW aural power for 24 hours. The entire trans-

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mitter performed magnificently with no failures and no degradation in performance, nor did any parameters or currents drift at all. In addition to all of the other video and audio parameters, the in-band IMD remained constant at an average of -56dB for modulated ramp video and aural pilot protection remained at -48dB at f_H and -42dB at $2f_H$, with all residual modulation out to

Over the life of a transmitter, the cost of replacing Diacrodes will be significantly less than other designs.

200kHz below 7%. Approximate ambient temperature in the room was 32°C.

New introductions are always at risk, and no one likes to make claims prematurely, but the Diacrode transmitter shows every indication of being a well-thought-

out, mature innovation that will prove itself over time. Heat is the great destroyer of transmitters, and unexplainable hot spots just don't exist in this approach. Every BTU is explainable and accounted for, and these numbers point to a successful product that cannot be dismissed simply because it's new. The homework has been done, and there are no unknowns in the equation of tube life.

The product's future

The Diacrode certainly seems to have a bright future in setting a new power and performance standard. Because it is basically a tetrode, it has all the linearity properties of a tetrode enjoyed by only VHF users until now. Required correction is no different than the VHF tetrode, which is far less demanding than the klystron and all of its derivatives.

Digital transmission tests have been run on the Diacrode, and the results have been presented in Europe and the United States, most recently at the IEEE BTS Symposium in Washington, DC, in September. Results are quite good at an average power level of 18kW. A paper written by Michel Langlois of Thomson Tubes Electroniques is avail-

able from Acrodyne.

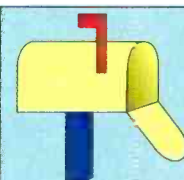
If you haven't yet replaced your old klystron transmitter, the decision process just became a little more difficult with the introduction of the Au60D — or maybe it just became a lot easier. ■

Timothy P. Hulick is vice president, engineering at Acrodyne Industries, Blue Bell, PA.

Diacrode is a registered trademark of Thomson Tubes Electroniques.



For more information on the Acrodyne Au60D, circle (155) on Reply Card.



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The WV-F565 DSP Camera. Still no competition.

When it was introduced, Panasonic's WV-F565 Digital Signal Processing camera set new performance levels with its outstanding resolution, high signal-to-noise ratio and innovative digital processing features. Now, a year later, the WV-F565 still has no real competition.

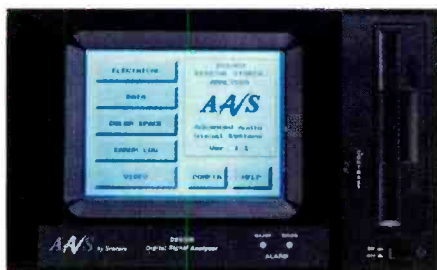
Other DSP cameras that rival the WV-F565's performance carry dramatically higher prices. The other cameras introduced to compete with the WV-F565 are still analog. It's well-nigh impossible to replicate the performance made possible by the WV-F565's digital signal processing package at anywhere near its suggested list price of \$8,000.

Imitation may be a sincere form of flattery, but compared to the WV-F565, it's still only an imitation.



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Digital video processing, storage and transmission have undeniable advantages over conventional analog methods. The near transparency of dubbing in the digital domain, coupled with the seemingly endless variety of special effects, have made digital video indispensable in post-production and increasingly prevalent in broadcasting. Although digital video has eliminated many problems common in the analog environment (generation loss, noise, crosstalk and others) digital video is not as problem-free as you would like to believe. Incompatibilities between different manufacturers' equipment, equipment that does not meet published specifications or accepted standards, mechanical/wiring problems, and old-fashioned breakdowns have challenged the engineering staff of many facilities.

Problems with digital video

In theory, digital video should be flawless. However, in reality, a variety of intermittent and interface problems exist in digital systems. Unlike analog specifications, digital specifications are new and are not always fully understood. In addition, while most analog video system problems affect picture quality and are readily apparent, most digital video system problems manifest themselves during processing and transmission, and rarely, if ever, affect the picture; that is, until the faulty digital video causes a complete loss of picture.

AAVS, a subsidiary of Sencore, recognized this and has developed and introduced a line of test instruments to evaluate digital video system performance and determine the level of deviation from standard specifications. These units can determine the quality of the digital transmission and provide a warning before a failure occurs. The latest instrument to be introduced, the DSA309 digital studio analyzer, not only provides detailed displays depicting measurements of critical digital video signal attributes, but also incorporates conventional analog displays (waveform and vector). This was done to help bridge the gap between analog and digital technologies and make it easier for

AAVS DSA309 digital studio analyzer

the technical support staff to transition from the analog to the digital environment.

Digital video (composite and component) is transmitted in two basic formats; parallel and serial. The mechanical difficulties of parallel cable, along with the length limitations of parallel transfers, have made serial interfaces the method of choice. Parallel connections in new installations tend to be used only for extremely short runs, usually between equipment lacking serial interfaces. Serial routing switchers and parallel-to-serial converters are rapidly becoming standard in digital facilities. The DSA309 provides all of the tests and measurements necessary to evaluate serial data transmission. (Other AAVS products, such as the S310, provide parallel digital video testing.)

Critical test attributes

What follows is a list of critical test attributes within a serial digital video system. These need to be monitored and tested to ensure the smooth operation of any digital video facility.

- **Signal jitter:** Serial digital video is transmitted on a single line, without a separate reference clock. The receiving instrument must capture the signal and derive a reference clock from the datastream. To facilitate this, an NRZI (non-return to zero inverted) system is used, maximizing transitions and

enhancing clock recovery. At transfer rates of up to 270Mb/s, variations in the point of the transitions can cause havoc at the receiving end, rendering the receiving instrument useless (or error prone) by defeating its ability to recover the proper data from the serial stream. (See Figure 1.) Furthermore, jitter errors can introduce signal non-linearities that can directly affect the final product (picture). The serial digital video interface is described under SMPTE 259M. The maximum allowable jitter on the serial datastream is 0.50ns (+/- .25ns) measured over the period of one horizontal line. The DSA309 measures high- and low-frequency jitter and warns the operator in the event that jitter exceeds preset limits.

- **Amplitude measurements:** In contrast to slower-speed data transfers where checksums and handshaking procedures allow errors to be detected and the data resent, high-speed serial digital video transmission provides no error-correcting protocol. As a result, it becomes imperative to monitor the signal's electrical characteristics, including peak-to-peak voltage, DC offset and common mode voltage to ensure the transmission is free from electrical problems. These problems can cause intermittent operation and/or total failure. The DSA309 monitors these parameters and permits the operator to set alarm threshold trigger limits.

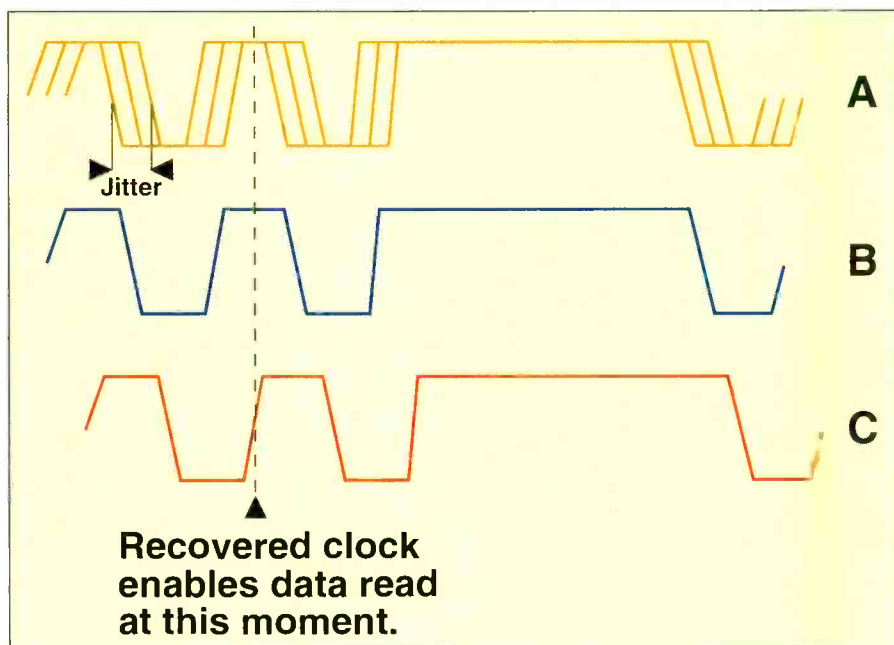


Figure 1. Figure A depicts serial data with jitter. Figures B and C represent possible deviation due to jitter. The recovered clock enables data to be read correctly (B). However, jitter can cause errors in the recovered clock, resulting in data being read incorrectly (C). Reading data during a transition destroys data integrity and produces unwanted errors.

Top photo: The DSA309 is one of the latest test instruments from AAVS.

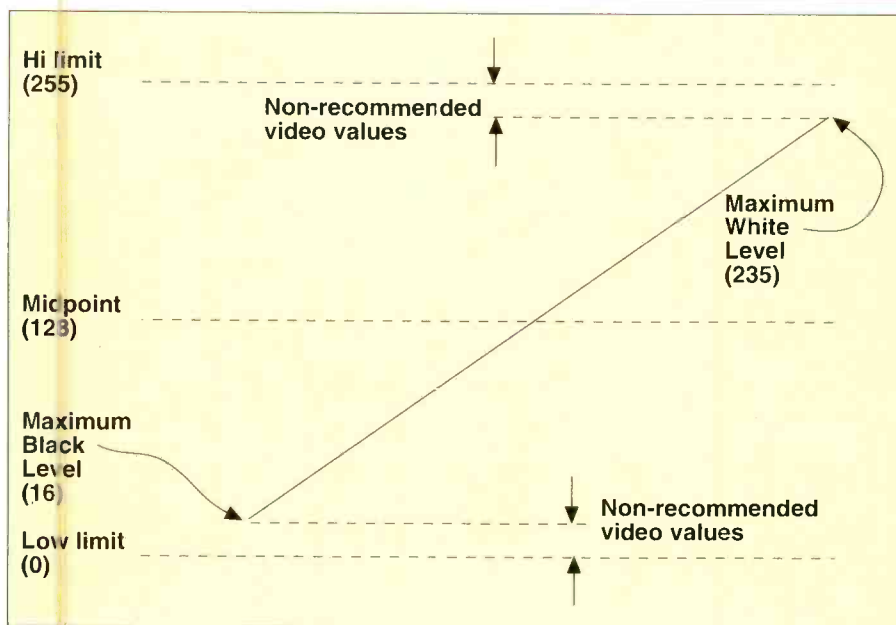


Figure 2. Non-recommended video values have been determined due to their "close" digital nature to reserved code numbers. These restrictions reduce color and luminance headroom. When these limits are exceeded, the result is possible errors in the digital video data.

- **Bit activity indicators:** All serial digital video data is derived from (and translated back to) parallel digital video. One common problem is the failure (either shorts or opens) of the parallel transmission lines. The DSA309 provides bit activity indicators to monitor the serial datastream for "stuck" bits, providing the operator with a warning in the event of a failure.

- **Datastream errors:** In addition to the electrical "carrier" of the data, the actual datastream can contain errors that can adversely affect quality. Timing reference signal (TRS) codes are used with preambles (reserved digital words) to signify the start and end of active video. The presence of reserved codes during active video can cause some equipment to react as if a sync period has arrived, causing false sync triggering.

The DSA309 continually monitors for the presence of reserved codes during active video and indicates their presence. In addition, by connecting a monitor to the test output of the DSA309, the location of these reserved codes can be determined. The position is indicated on an external color monitor, allowing an analysis of the position of the reserved code in relation to picture elements. In addition to monitoring reserve code placement, the DSA309 also monitors and warns the operator regarding non-recommended values. (See Figure 2.)

The DSA309 also provides full error-detection handling (EDH) compatibility. EDH is detected and pre-existing error flags are displayed to warn the operator of possible errors detected in previous processing stages. EDH errors detected but not previously flagged are also displayed.

Additional analysis tools

Extensive analysis of the digital video transmission can be performed by using the DSA309's frame buffer. One full frame of video is stored and can be thoroughly analyzed by the operator — a bit-by-bit analysis can be performed if needed. Live video can be displayed on the DSA309's LCD screen for source identification purposes (SID). Built-in 8-bit D/As provide analog video outputs to an external monitor for detailed video inspection.

The user interface consists of a touch-screen LCD that eliminates the need for cumbersome and failure-prone controls while providing a user-friendly environment. A standard PC-compatible parallel port is provided for printing reports and user-selected information, while the built-in 1.44M disk drive allows the operator to store error reports for continuous off-site monitoring. The unit's firmware is field-upgradeable through the disk drive, permitting the easy installation of upgrades. This allows the DSA309 to keep up with the changing world of digital video, a feature designed into the DSA309 digital studio analyzer. ■

Jason Job is a member of SMPTE's jitter subcommittee and a design engineer for AAVS, Sioux Falls, SD.



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BUSINESS

Following its acquisition of ImMIX last year, **Scitex Corporation Ltd.**, Herzlia, Israel, has acquired **Abekas Video Systems** from Carlton Communications PLC for approximately \$52 million in cash.

Discreet Logic Inc., Canada, has acquired **The Brughetti Corporation**, Canada. In addition to accelerating Brughetti product development activities, the acquisition will combine distribution channels and local customer support resources.

Also, Brughetti has signed an agreement with **Time Inc., New Media** for the provision of graphics assembly, editing, library management and automated scheduling and transmission software for The News Exchange (TNX), North America's first News-On-Demand service.

FloriCal Systems, Gainesville, FL, has expanded to a larger office. The company's new address is: 1206 NW 8th Ave., Gainesville, FL 32601.

The ESPN cable sports network has ordered two **Vistek Electronics Ltd.** Vector standards converters to be installed at ESPN's Broadcast Center in Bristol, CT.

BSkyB, UK, has awarded **Drake Automation Systems** a turnkey automation and systems contract to refurbish the current BSkyB analog transmission facilities. The contract is based on the Drake Multichannel Automation System (D-MAS) managing under program and interstitial materials under automation control to the on-air Tektronix Profiles.

Videotek, Pottstown, PA, is expanding its research and development activities to Beaverton, OR. The Pottstown headquarters engineering group will continue to develop instruments and devices for analog and digital video users. The Northwest Design Center, focusing on emerging markets, began operation last August.

Pixel Power Ltd., UK, has sold two Collage CGs and a Collage to French public broadcaster **TF1**, Paris, France. The two Collage CGs were provided by TF1 for LCI, a 24-hour news and broadcasting channel. The Collage will be used in TF1's news studio.

NewTek Inc., Topeka, KS, and **DeskStation Technology** have announced a joint venture. The companies have created The NewTek Systems Group to provide a set of tools for 3-D graphics and desktop video

that allows for greater functionality and better performance. The first product from the new venture is the NewTek Raptor Designer, a LightWave workstation running the Digital Semiconductor 300MHz Alpha 21164 processor, a powerful Windows NT RISC-based processor.

Oren Semiconductor Ltd., Santa Clara, CA, has made available its OR43100, a new ghost canceler integrated circuit (IC) that performs more than 16 billion operations per second to remove ghost images from TV pictures.

Andrew Corporation, Orland Park, IL, has begun an automated fax-on-demand system. "Answers from Andrew" is a blend of interactive voice and fax that provides information, technical documents and news publications. By dialing 800-861-1700 (or 708-873-3614 internationally), anyone with a Touch-Tone phone and fax machine can access the system.

Sonosax S.A. has announced the second order of Stelladat digital recorders from **NHK** (Japan), making NHK one of the company's largest customers.

Thomson Broadcast Inc., Englewood, NJ, has announced the sale of five of its new 7830 motion-compensated standards converters to **NBC** in Asia.

Also, the company has sold a 9500 component digital switcher to **Roland House**, Virginia.

AMS Neve, UK, has sold a Logic 2 digital mixing desk to **Walt Disney Studios** for its new flagship facility.

Segue Services, Merrifield, MN, a low-power TV (LPTV) engineering and consulting firm is installing and testing equipment for a 17-channel LPTV system in Nebraska. Designed to broadcast scrambled programming, it is equipped with **Acrodyne** solid-state transmitters, a **Communications and Energy Corporation** combiner and a **Jampro** 6-bay, 24-panel broadband antenna system.

GEPCO, Chicago, has announced the installation of its cable in **LIFE Outreach International's** new media center in Euless, TX. Almost 66 miles of cable has been installed in the 84'x84' studio, three post suites, separate video and audio production suites, and a climate-controlled videotape library.

GWNS, Stamford, CT, has received a multi-year, multimillion dollar contract to handle program origination, playback and trans-

mission of **The Learning Channel (TLC)**.

Sony customers who purchase qualifying videocassettes from July 1 through Dec. 31, 1995 will be eligible to participate in the Sony Professional Media Betacam/D-2 Parts & Service Program and receive certificates for parts, service contracts, service training and/or technical bulletins for its Sony Betacam/D-2 video recorders. Qualifying products include BCT-MA series Betacam SP, BCT-D series Digital Betacam, BCT-G series Betacam, UVWT-MA series Betacam SP and D-2 series digital master videocassettes.

Canon's new DIGI-SUPER 70 lens was used by **ABC**, the first company to take delivery of the lens, at Giants Stadium during the Sept. 4 Monday Night Football game between the New York Giants and the Dallas Cowboys.

Euphonix, Studio City, CA, has announced the installation of its new CS2000B computerized console at WFLD-TV, Chicago. The WFLD Euphonix package includes the DSC digital studio controller and the CUBE automated routing matrix.

Quantel, UK, has sold its Paintbox to CBS and Classic Teleproductions, Cleveland. The company has also sold its Paintbox Express to Classic Teleproductions.

Also, **Future Media Concepts (FMC)**, New York, has been named the authorized Northeastern U.S. training center for Quantel's Editbox and Newsbox non-linear, on-line editing systems.

Video Production Systems (VPS), Miami, has signed an agreement with Paxson Communications Corporation to modernize eight TV stations that Paxson has recently purchased across the United States. The deal is expected to bring in approximately \$4 million in revenues for VPS over the course of the year.

Pixel Power Ltd, UK, has announced the purchase of six of its Collage systems, including a fully optioned Collage 2-D system with Ramcorder, to London's **QVC**, the shopping channel. All six Collages will be networked together using Ethernet to form the heart of a system known as L Gen, which will produce in excess of 300 detailed captions a day, live to air.

A fully equipped TV mobile unit, valued at approximately \$3.5 million, has been designed and equipped by **BTS** in Europe for The People's Republic of China. In July, it was delivered to **China Central Television**

(CCTV), the government-run broadcast organization headquartered in Beijing.

Also, NBC affiliate **KOB-TV**, Albuquerque, NM, is renovating its studio routing and control with a complete BTS system installation. The station acquired a Venus routing switcher with a 96 input/64 output and three levels of switching, including video and stereo audio. In addition, a Jupiter control system, Saturn master control switcher and several CP-3000 control panels were purchased.

Panasonic, Secaucus, NJ, has announced the sale of its D-5 digital component equipment to **General Television Network (GTN)**, Oak Park, MI. The equipment will be used for its on-line editing room, which sustains a 10-bit digital component format across the board.

Also, WNRW, Winston-Salem, NC, has purchased four AT-H1905DP digital monitors, a M.A.R.C. 100 automated record/playback system, 36 MII VTRs, two AQ-11D 3-CCD DSP cameras and seven field packages consisting of WV-F565 3-CCD DSP cameras docked to AU-45H MII recorder/players.

PEOPLE

Jeff Gierhart has become systems engineer for **FloriCal Systems**, Gainesville, FL.

Also, **Alan DeVaney** has been named director of sales for **FloriCal**.

Michael MacDonald now serves as director of product marketing for **TimeLine Vista Inc.**, Vista, CA.

Also, **Cynthia F. Jones** has become the first marketing communications manager for **TimeLine**.

John Nemeth has been promoted to product support director of **Solid State Logic**, Oxford, England.

Roi Agneta has been appointed to the newly created position of vice president, strategic planning for **Chyron**, Melville, NY.

Michael Cox, consulting director of **Vistek Electronics**, has been awarded a Fellowship of the Society of Motion Picture and Television Engineers (SMPTE). The award was made in recognition of Cox's contribution and achievements to the TV industry.

Glen Green has been appointed southwest regional sales manager and general manager, southwest operations for **Quantel**.

Richard A. Cooper has joined the sales staff of **Tekniche**, Northvale, NJ.

Also, **Richard Zabel** has become eastern sales manager of **Tekniche**.

Arthur W. Allison III has become a senior engineer with the **National Association of Broadcasters**, Washington, D.C.

Gary Schurte has been appointed as manager of the central United States sales region for **Accom**, Menlo Park, CA.

After 15 years in the telecommunications industry, **Howard N. Miller** has retired from the **Public Broadcasting Service (PBS)**.

Rick Lamb has become an application manager for switching products for **BTS**, Simi Valley, CA.

Also, **Eric Fabianac** has become director of operations for the company's Salt Lake City manufacturing and development facility for **BTS**. ■

Tapeless Technology in Radio Applications - the Users Point of View

SYPHA has published the results of an extensive survey into the use of tapeless technology for cart replacement, station automation and production. More than 500 radio stations in the United States and United Kingdom took part and the issues examined include:

- Awareness and opinion of systems and technology
- Reasons for system selection and purchase
- Expectations of system performance
- Operational and technical support
- Applications and features required
- Investment decisions and future plans
- Sources of information and advice

Broadcast Engineering magazine, **AMS Neve**, **Basys**, **Broadcast Electronics**, **Computer Concepts**, **Harris Allied**, **Korg**, **RCS**, **Sony** and **Studer Digitec** provided the sponsorship necessary to conduct the survey. However, the method and results were independently managed by **SYPHA**.

SYPHA specializes in providing consultancy and research services on the use of random access technologies for audio and picture recording, editing and replay. Other publications available from **SYPHA** include:

- **The Nonlinear Buyers Guide** - a buyers guide to random access video systems covering nonlinear and mixed mode editors, digitizing cards and software, video disks, video servers and RAM stores;
- **The Tapeless Directory** - a buyers guide to digital audio workstations covering production, post production, cart replacement and station automation systems.

Broadcast Engineering readers are entitled to a reduced price of \$325 (reg. \$380). To order your copy of *Tapeless Technology in Radio Applications - the Users Point of View*, enclose this ad with your order and mail to:

SYPHA, 216A Gipsy Road, London, SE27 9RB, UK
or telephone +44 181 761 1042, fax +44 181 244 8758

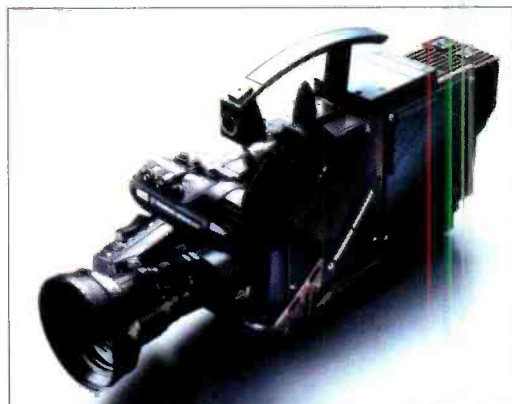
Circle (400) on Reply Card

Portable camera

Thomson Broadcast

- **1657:** a camera featuring high-performance 600,000-pixel $\frac{2}{3}$ -inch CCD sensors that are fitted to the 1657 WIDE FX for 16:9 operation; the dual format camera has a switch selector, 16:9 or 4:3, providing pictures of outstanding quality; a pixel correction feature ensures complete uniformity of black level, regardless of the shooting conditions; the user may choose the color temperature, ranging from 2,500°K to 9,900° in 100° steps avoiding the use of colored optical filters and improving the camera's sensitivity; the 1657 incorporates digital technology to ensure better reproducibility and stability of the camera adjustments; digital adjustments are available in three modes: basic, custom and maintenance.

Circle (350) on Reply Card



Digital video analyzer

SyntheSys

- **DVA184:** a digital video analyzer that measures the quality of a serial digital video signal; it can generate still test images, log error events and complete errored frames; the output can be live input or images from the internal frame buffer; either output can be corrupted with bit errors as well as varied amounts of jitter; trigger events can be defined and automatic errored frame logging to the internal disk drive will occur; analysis includes jitter histogram, component waveform, component histogram, jitter frequency, error detection and handling and much more.

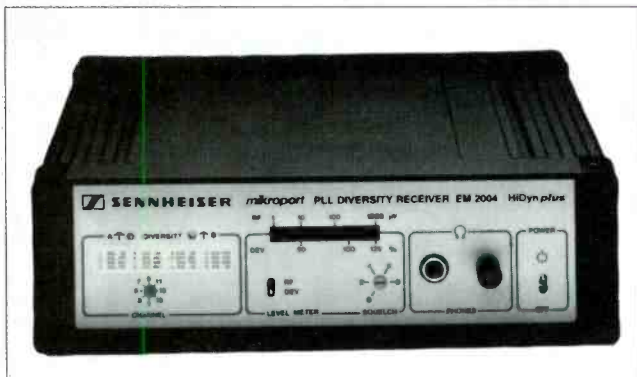
Circle (351) on Reply Card

Surround-sound system

Soundcraft/Interact Systems

- **DC2020 Surround:** a built-in surround-sound system based on the same format as Magtrax TV, a multifunction monitoring panel designed as an outboard device; DC2020 Surround is available in 24-, 32- and 40-channel in-line formats (with or without patchbay), and features 4-band split semi-parametric EQ, six flexible auxiliaries and the unique Soundcraft "floating bus" routing system; the C3-based automation encompasses motorized faders, SMPTE-driven automated cuts and aux sends, with integrated machine control for popular audio multi-tracks as well as 9-pin VTRs; the console offers straightforward connection to 4-, 5- and 6-channel surround-sound systems with integrated monitoring, routing and dual LCRS panners; processor-controlled replay/direct switching, calibrated monitor level adjustment and assignable speaker cut groups add to the console's flexibility.

Circle (352) on Reply Card



Diversity receivers

Sennheiser

- **EM2004-UHF and EM2004-VHF:** diversity receivers that can be tuned to one of 16 preprogrammed channels; with a total bandwidth of up to 24MHz, the EM2004-UHF spans four U.S. TV channels; the EM2004-VHF's bandwidth of up to 4MHz is capable of spanning a TV channel band edge; these bandwidths allow the receivers to be used virtually anywhere in the world; matching transmitters include the SK50-UHF, SK50-VHF and SK250-UHF body packs, and the hand-held SKM5000-UHF and SKM1032-VHF; systems are available in frequencies ranging from 450MHz to 800MHz for the UHF range or 168MHz to 216MHz for the VHF range.

Circle (353) on Reply Card

Continued on page 96

Visit our newly expanded Video Store
and Computer Video Showroom

SONY

EVW-300 3-CCD Hi-8 Camcorder

- Equipped with three high density 1/2" IT Hyper HAD image sensors. Has an excellent sensitivity of F8.0 at 2,000 lux, high S/N of 60 dB, and delivers over 700 lines of horizontal resolution.
- Provides high quality PCM digital stereo and single channel AFM Hi-Fi recording. Has XLR balanced audio connectors.
- Quick start 1.5" viewfinder with 550 lines of resolution plus Zebra pattern video level indicator and color bar generator. Also, quick-start recording - takes only 0.5 seconds to go from REC PAUSE to REC MODE for immediate recording in the field.
- Built-in 8mm Time Code generator records absolute addresses. (Either non-drop frame or drop frame mode may be selected.) Furthermore the EVW-300 incorporates a variety of time code features such as Time Code PRESET/RESET, REC RUN/FREE RUN and Jitter Bits.
- A variety of automatic adjustment functions for different lighting conditions are incorporated into the EVW-300:
 - ATW (Auto Trace White Balance) - when ATW is turned on optimum white balance is always ensured during recording, even for changes in color temperature. Conventional white balance adjustment is still provided with the Auto White Balance.
 - AGC (Automatic Gain Control) - in addition to manual Gain Up AGC provides linear gain up in the range of 0 dB to 18 dB.
 - Intelligent Auto Iris - for situations where the lighting between subject and background is different (subject is underexposed) the Intelligent Auto Iris automatically examines the scene and adjusts the lens iris for proper exposure.
- Selectable Gain-up from 1 dB to 18 dB in 1 dB steps for Mid and High positions.
- Clear Scan function - provides a variety of selection of shutter speeds ranging from 60-200 Hz allowing recording of almost any computer display without flicker.
- Compact, lightweight (12 lbs with NP-18) ergonomic design provides well balanced and extremely comfortable operation.



Quick-Draw Professional FOR CAMCORDERS OR STAND ALONE CAMERAS

The Quick-Draw Camera Case provides a convenient way to carry and protect your camera on the go. In your car and in the air. While much lighter and more compact than shipping cases, this padded nylon case has hard-shell construction and an aluminum viewfinder guard for 100% protection and security. It is particularly designed for working out of the back of a van or the trunk of your car. The top loading case has a wide-open fold back top that stays out of the way.

FEATURES:

- Heavy-duty shoulder strap and comfortable leather hand grip.
- Crush proof aluminum guard protects viewfinder.
- Fits into back seat and fastens securely with seat belt.
- Holds camera with on-board battery attached.
- Lid closes with Velcro for quick opening or secures with full-length zippers.
- Two trim exterior pockets and clip board pocket.
- Dual purpose rear pouch is an expandable battery chamber or all-purpose pocket.



antonbauer

Logic Series DIGITAL Gold Mount Batteries

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



DIGITAL PRO PACS

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

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

DIGITAL COMPAC MAGNUM

Extremely small and light weight (almost half the size and weight of a Pro Pac), the powerful Digital Compac Magnum still has more effective energy than two NP style side-in batteries. The high voltage design and Logic Series technology eliminate all the problems that cripple conventional 12 volt side-in type batteries. The Digital Compac Magnum is the professional choice for applications drawing less than 24 watts. Not recommended when using an UltraLight.

- **DIGITAL COMPAC MAGNUM 14 LOGIC SERIES NICAD BATTERY**
14.4v 43 Watt Hours, 2 3/4 lbs. Run time: 2 hours @ 20 watts, 3 hours @ 13 watts
- **DIGITAL COMPAC MAGNUM 13 LOGIC SERIES NICAD BATTERY**
13.2v 40 Watt Hours, 2 1/2 lbs. Run time: 2 hours @ 18 watts, 3 hours @ 12 watts

GOLD MOUNT BATTERIES

The Logic Series Gold Mount batteries are virtually identical to their respective DIGITAL versions (above) with respect to size, weight, capacity, IMPAC case construction, and application. They are similarly equipped with micro-code logic circuits and comprehensive ACS sensors that communicate directly with all Logic Series chargers, providing the essential data critical for optimum performance, reliability and long life. They do not, however, include DIGITAL microprocessor features such as the integral diagnostic program "Fuel Gauge", LCD/LED display and InterActive viewfinder fuel computer circuit.

- **PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt Hours)
- **PRO PAC 13 NICAD BATTERY** (13.2v 55 Watt Hours)
- **MAGNUM 14 NICAD BATTERY** (14.4v 72 Watt Hours)
- **MAGNUM 13 NICAD BATTERY** (13.2v 66 Watt Hours)
- **COMPAC MAGNUM 14 NICAD BATTERY** (14.4v 43 WH)
- **COMPAC MAGNUM 13 NICAD BATTERY** (13.2v 40 WH)

MP-40 DIGITAL FAST CHARGER w/LCD and DIAGNOSTIC PORT

The most advanced and versatile Anton/Bauer charger. In addition to features such as four-position one-hour sequencing fast charge, five fast charge termination systems, it also has:

- **SSP (Selective Sequence Programming)**, which automatically arranges the charging order among the 4 batteries to assure fully charged batteries in the shortest time possible.
- **Multifunction LCD** checks each of the four battery positions and indicates charge status, available capacity, battery type/rating, percent of maximum charge, battery serial number, date of manufacture, accumulated charge/discharge cycles and other data.

JVC

KY-27C 3-CCD Color Video Camera



- New 1/3" CCDs with 380,000 pixels (360,000 effective) with advanced electronics delivers resolution of 750 horizontal lines and reduced smear.
- Sensitivity of 19.0 at 2000 lux. Min. illumination 7.5 lux with f/1.4 lens, +18dB.
- LULLUX mode allows shooting scenes that were previously impossible due to insufficient lighting. CCDs are maximized for low light sensitivity equivalent to an electronic gain of 24dB plus a JVC pixel readout system which provides an additional 6dB. Together they provide +30dB without the noise and picture degradation normally associated with this much gain. Excellent color balance is maintained even down to 1.5 lux illumination.
- Auto Shooting Mode where you only have to zoom, focus and record. All other parameters are controlled automatically.
- Enhanced ALC (Automatic Level Control) mode for continuous shooting in all light levels. This allows continuous automatic shooting from dark interiors to bright outdoors. Also features an aperture priority mode. Manually set iris for desired depth of focus, and ALC circuit automatically achieves correct video level.
- The Multi-Zone Iris Weighting system gives preference to objects in the center and lower portions of the picture. The Automatic Peak/Average Detection (APB) provides intelligence to ignore unusual objects such as bright lights.
- Auto knee circuitry extends a scene's light to dark dynamic range reproduction by up to five times without overexposure.
- Has large 1.5-inch viewfinder with 500 lines of resolution and SMPTE color bars. Status system provides audio levels, accumulated or remaining recording time and VTR operation. Also battery voltage and camera setup. Zebra pattern indication and safety zones with a center marker are also provided.
- Equipped with Variable Scan function. This allows flicker-free shooting of computer screens. Variable scan enables a precise shutter speed from 1/60.2 to 1/196.7 of a second in 256 increments to be set, matching a computer scan rate. Almost any computer display can be clearly recorded.
- Star filter creates dramatic 4-point star effects. Users can also select from a wide range of optional filters.
- Advanced Memory System (AMS) stores customizable settings for various shooting conditions.
- Docks directly to the JVC BR-5422U, BR-S411UB and BR-S420CU professional S-VHS recorders. Optional adapters for docking to Hi-8 and Betacam SP are also available.

Vinten

THE ADVANCED RANGE OF VISION LIGHTWEIGHT HEADS AND TRIPODS



Vision SD 12 and SD 22

Pan and Tilt Heads with Serial Drag

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

Features:

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

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

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

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

Vision 12 Systems

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

SD-12A System

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

SD-12D System

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

SD-12LT System

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

Vision 22 Systems

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

SD-22E System

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

SD-22 LT System

- 3386-3 SD-22 Pan and tilt head
- 3523-3 Two-stage carbon fibre ENG tripod w/100mm bowl
- 3314-3 Heavy-duty calibrated floor spreader
- 3425-3A Carrying strap
- 3341-3 Soft case

SD-22 ELT System

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

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TASCAM

DA-88 Multi-Track Recorder



The first thing you notice about the eight channel DA-88 is the size of the cassette - it's a small Hi-8mm video cassette. You'll also notice the recording time - up to 120 minutes. These are just two of the advantages of the DA-88's innovative use of 8mm technology.

Intrinsic to the 8mm video format is the Automatic Track Finding (ATF) control system. This approach records the tracking control information, along with the program material, using the helical scan (video) head. Competing S-VHS based system record the tracking data with a linear recording head, independent of the program data. The S-VHS tape must be run at a higher speed (thereby delivering shorter recording time) to deliver control track reliability, and requires some form of automatic or manual tracking adjustment. Synchronization and tracking must be adjusted, either automatically or manually (just like on your home VCR) as the machine ages, or if the tape is played back on another machine.

On the other hand, the ATF system ensures that there will be no tracking errors or loss of synchronization. The DA-88 doesn't even have (or need) a tracking adjustment. All eight tracks of audio are perfectly synchronized. What's more, this system 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 (user selectable). The frequency response is flat from 20Hz to 20KHz while the dynamic range exceeds 92dB. As you would expect from a CD-quality recorder, the wow and flutter is unmeasurable. One of the best features of the DA-88 is the ability to execute seamless Punch-ins and Punch-outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into light spots. You can even delay individual tracks, whether you want to generate special effects or compensate for poor timing. All of this can be performed easily on a deck that is simple and intuitive to use.

OPTIONS

- **RC-808** - Single Unit Remote Control
- **RC-848** - System Remote Control
- **MD-824** - 24 Channel Meter Unit
- **SY-88** - Complete SMPTE/EBU Base Synchronizing and MIDI Machine Control Interface

Fostex

RD-8 Multi-Track Recorder



This digital multitrack recorder is designed specifically for the audio professional. Fostex has long been a leader in synchronization, and the RD-8 redefines that commitment. With its built-in SMPTE / EBU reader/generator, the RD-8 can stripe, read and jam sync time code - even convert to MIDI time code. In a sync environment the RD-8 can be either Master or Slave. In a MIDI environment it will integrate seamlessly into the most complex project studio, allowing you complete transport control from within your MMC (MIDI Machine Control) compatible sequencer.

Full transport control is available via the unit's industry-standard RS-422 port, providing full control right from your video bay. The RD-8 records at either 44.1 or 48KHz and will perform Pull-Up and Pull-Down functions for film/video transfers. The Track Slip feature helps maintain perfect sound-to-picture sync and the 8-Channel Optical Digital Interface keeps you in the digital domain. All of this contributes to the superb sound quality of the RD-8. The audio itself is processed by 16-bit digital-to-analog (D/A) converters at either 44.1 or 48KHz (user selectable) sampling rates, with 64X oversampling. Playback is accomplished with 16-bit analog-to-digital (A/D) and 64X oversampling, thus delivering CD-quality audio.

The S-VHS transport in the RD-8 was selected because of its proven reliability, rugged construction and superb tape handling capabilities. Eight tracks on S-VHS tape allow much wider track widths than is possible on other digital tape recording formats.

With its LCD and 10-digit display panel, the RD-8 is remarkably easy to control. You can rely on 100 local points, and cross-tape time is fully controllable in machine to machine editing. Table of Contents data can be recorded on tape. When the next session begins, whether on your RD-8 or another, you just load the set up information from your tape and begin working. Since the RD-8 is fully ADAT compliant, your machine can play tapes made on other compatible machines, and can be controlled by other manufacturers' ADAT controllers. Your tapes will also be playable on any other ADAT deck.

In addition to familiar transport controls, there are a number of logical, user friendly features. This is the only unit in its class with an on-board, back-lit variable contrast LCD display. It provides all of the information you'll need to keep track of offsets, punch points, generator functions and other pertinent data. Three function keys, combined with HOME, NEXT and UP/DOWN buttons, enable you to navigate the edit menu effortlessly. If you need to have access to the front panel controls, the optional model 8312 remote control gives you remote command of the most common functions.

SENNHEISER

RF SERIES 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 insure 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 20 P48U3 Omnidirectional

Low distortion push-pull element, transformerless RF condenser, flat frequency response, diffuse/near-field response switch (6 dB boost) at 10 KHz, switchable 10 dB pad to prevent overmodulation. Handles 142 dB SPL. High output level. Ideal for concert, Mid-Side (M-S), acoustic strings, brass and wind instrument recording.

MKH 40 P48U3 Cardioid

Highly versatile, low distortion push-pull element, transformerless RF condenser, high output level, transparent response, switchable proximity equalization (-4 dB at 50 Hz) and pre-attenuation of 10 dB to prevent overmodulation. In vocal applications excellent results have been achieved with the use of a pop screen. 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.

MKH 60 P48U3 (Short Shotgun)

Short interference tube RF condenser, lightweight metal alloy, transformerless, low noise, symmetrical capsule design, smooth off-axis frequency response, switchable low cut filter (-5 dB at 100 Hz), high frequency boost (+5 dB at 10 KHz) and 10 dB attenuation. Handles extremely high SPL (135 dB), ideal for broadcasting, film, video, sports recording, interviewing in crowded or noisy environments. Excellent for studio voiceovers.



MKH 70 P48U3 (Shotgun)

Extremely lightweight RF condenser, rugged, long shotgun, low distortion push-pull element, transformerless, low noise, switchable presence (+5 dB at 10 KHz), low cut filter (-5 dB at 50 Hz), and 10 dB preattenuation. Handles 133 dB SPL with excellent sensitivity and high output level. Ideal for video/film studios, theater, sporting events, and nature recordings.

MKH 416 P48U3 Supercardioid/Lobe (Shotgun)

Transformerless, RF condenser designed as a combination of pressure gradient and interference tube microphones. Very good feedback rejection, low proximity effect, 128 dB SPL. Rugged and resistant to changing climate conditions. Ideal for boom, fischpole, and camera mountings. A long-distance microphone for video, film, and studio recording. Excellent for interviewing for reporters, podium or lecture microphone.

MKH 816 P48U3

Ultra-directional Lobe (Shotgun)

Narrow-beam pattern, transformerless RF condenser microphone. Handles 124 dB SPL and has high output voltage. Perfect for crowded news conference, movie sets, TV stages, sporting events and nature recording.

CHYRON Graphics

PC-CODI TEXT and GRAPHICS GENERATOR

A PC-compatible (ISA bus) board, the PC-CODI incorporates a broadcast quality encoder and wide bandwidth linear keyer to provide highest quality realtime, video character generation and graphics display. Used individually or configured with multiple boards, it is a complete and affordable solution for information displays, broadcast, video production or multi-media applications.

- Standard PC/AT ISA bus interface, 2/3 length form factor
- Fully-analysed displays
- Less than 10msec. effective pixel resolution
- 16.7 million color selections
- Fast, realtime operations
- Character, Logo and PCX image transparency
- Display and non-display buffers
- Bitstream typeface library selection
- Variable edges, border, drop shadow and offset
- Variable flush
- Full position and justify control of character & row
- User definable intercharacter spacing (squeeze & expand)
- Multiple rollover speeds • Automatic character kerning

- User definable table/palette fields
- Shaded backgrounds of variable sizes and transparency
- User definable read effects playback; wipes, pushes, fades
- High quality composite & S-video (Y/C) encoder
- Integral composite and S-video linear keyer
- NTSC or PAL sync generator with genlock
- Module switchable NTSC or PAL operation
- Software controlled video timing
- Board addressability for multi-channel applications
- Auto display sequencing
- Local message/page memory
- Preview output with safe-title/cursor/menu overlay
- Composite & S-video input with auto-genlock select

SONY COLOR MONITORS

PVM-1350

13" Presentation Monitor

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



PVM-1351Q

13" Production Monitor

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

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

All the features of the PVM-1351Q PLUS.

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

SHURE



FP32A PORTABLE STEREO MIXER

This small and rugged portable mixer is well equipped to handle the demands of EFP, ENG, live music recording or any other situation that requires a low noise high performance mixer.

- High quality low noise electronics, perfect for digital recording and transmission
- Three balanced inputs, two balanced outputs plus tape out and monitor
- Supports all types of condenser mics with internal phantom supply
- Inputs can be switched between mic and line level
- Each channel has 0.5mV pan pot
- Each channel has illuminated meter and peak indicator
- Two units can be cascaded to provide six input channels
- Internal 1KHz oscillator for record and send time calibration
- Internal (2x3V alkaline) batteries or external power
- Switchable low cut filters

MACKIE



MicroSeries 1202 12-Channel Ultra-Compact Mic/Line Mixer

Usually the performance and durability of smaller mixers drops in direct proportion to their price, making lower cost models unacceptable for serious recording and sound reinforcement. Fortunately, Mackie's fanatical approach to pro sound engineering has resulted in the Micro Series 1202, an affordable small mixer with studio specifications and rugged construction. The Micro Series 1202 is a no-compromise, professional quality ultra-compact mixer designed for non-studio 24 hour-a-day professional duty in broadcast studios, permanent PA applications and editing suites where nothing must ever go wrong. So no matter what your application, the Micro Series 1202 is ideal. If price is the prime consideration, you can't simply want the best possible mixer in the least amount of space, there is only one choice.

CR-1604

16-Channel Audio Mixer

In less than three years, the Mackie CR-1604 has become the industry standard for compact 16-channel mixers. It is the hands-down choice for major touring groups and studio session players, as well as for broadcast, sound reinforcing and recording studio users. For them the CR-1604 offers features, specs, and day-in-day-out reliability that rival far larger boards. Its remarkable features include 24 usable line inputs with special headroom/ultra-low noise Unityplus circuitry, seven AUX sends, 3-band equalization, constant power pan controls, 10-segment LED output metering, discrete front end phantom-powered mic inputs and much more.

TASCAM

M-2600 Series

16/24/32 Channel Eight Channel Mixers



LOW NOISE CIRCUITRY

- Combining completely redesigned, low noise circuitry with Absolute Sound Transparency™ the M-2600 delivers high-quality extremely clean sound. No matter how many times your signal goes through the M-2600, it won't be colored or altered. The signal remains as close to the original as possible. The only coloring you hear is what you add with creative EQ and your outboard signal processing gear.
- Double reinforced grounding system eliminates any hum. World-class power supply provides higher voltage output for better headroom and higher S/N ratio.

THE BEST AUDIO SECTION IN THE BUSINESS

The most versatile AUDIO section in its class, rivaling expensive high-end consoles. 8 sends total, 2 in stereo. Send 8 signal in stereo or mono, pre- or post-fader. Available all at once. Return signal through any of 6 stereo paths.

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HORITA

WG-50 Window Dub Inserter

- Makes burned-in SMPTE TC window dub copies
- Indicates drop-frame or non-drop-frame time code
- Also functions as play speed SMPTE time code reader
- Adjustable for horizontal and vertical size and position
- Dark mask, "see-thru" mask surrounds display
- Provides reshaped time code output for copying TC
- Displays time code or user bits • Display on/off
- Field 1/field 2 indicator • Sharp characters
- Always frame accurate (on time)

\$269

TG-50 Generator / Inserter

Combination time code generator and window dub inserter. It includes all features of WG-50 PLUS—

- Generates SMPTE time code in drop/non-drop-frame format
- Jamsync mode jams to time code input and outputs new TC
- Simple "on screen" preset of time code and user bits
- Run/stop operation using front panel momentary switch
- Selectable 30/60/90/120-second automatic generator back-time
- Make a window dub copy while recording T-20 source tape

\$349

BSG-50 Black Burst/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 switches, effects generators, TBCs, VCRs, cameras and video edit 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 output for each output—maximum signal isolation
- 1KHz, 0dB sine-wave 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 stripping tapes with color bars and black
- Front panel selection of full-field or SMPTE color bar patterns or color/black (blackburst) video output
- Includes master-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 SD/H phased and always correct
- No adjustment required

\$349

TSG-50 NTSC Test Signal Generator

The TSG-50 generates 12 video test signals suitable for setting up, aligning, and evaluating the performance of various video equipment found in a typical video editing system, such as video monitors, distribution amplifiers, VCRs, switches, effects generators, TBCs, etc. In addition to the video signals, the TSG-50 also generates composite sync and, with a video DA such as the Horita VDA-50, becomes a high quality, multi-purpose audio, house sync generator.

- Fully RS-170A SD/H phased and always correct. No adjustments ever required
- Built-in timer automatically switches video output from color bar pattern to black after 30 or 60 seconds. Makes it easy to produce tape leaders of color bars followed by black
- Video signals generated are in accordance with industry standard EIA RS-170A video timing specification
- Audio tone switches to silence and color bars change to black when using 30/60 second timer
- Convenient pattern selection—12 position front panel switch. Includes on/off controlled, 1 KHz, 0dB audio tone output
- Generates precise oscilloscope trigger output signal one H-line before start of color field 1
- Outputs: video, sync, ref frame, 1 KHz, 0dB

\$439

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-800C — Has all of the above plus RS-232 control.
- VG-50 VITC Generator, LTC/VITC Translator
- VL-50 VITC-To-LTC Translator
- VL-50C VITC-To-LTC Translator / RS-232 Control
- RL-50 Hi8 (EVO-9800/9850) TC to LTC translator
- TSG-50 NTSC Test Signal Generator
- SCT-50 Serial Control Title "Industrial" CG, Time-Date Stamp, Time Code Captioning
- SAG-50 Safe Area, Convergence Pattern and Oscilloscope Line Trigger and Generator

SONY

SVP-5600 and SVO-5800 S-VHS Player/ S-VHS Editing Recorder

SVP-5600 and SVO-5800 features:

- By combining the high resolution (400 horizontal lines) of S-VHS with high quality signal processing techniques like DNR, Digital Field DDC and Chroma Process improvement, they deliver the consistent picture quality so essential to editing. They also incorporate a wide video head gap and track width (58mm) for stable and faithful picture reproduction.

- Each has a built-in TBC plus an advanced Digital Noise Reducer (DNR) for both the chrominance and luminance signals to eliminate noise during playback. At the same time, a field memory incorporated in the noise reducer removes jitter to provide sharp stable pictures. The field memory also includes a Digital Field DDC (Dropout Compensator), which replaces signal dropout with information from the previous field.

- They also incorporate Chroma Process improvement circuitry for excellent color picture quality in the playback mode. This advanced circuitry greatly improves the chroma bandwidth, thus enabling sharper and clearer color picture reproduction.

ADVANCED EDITING FUNCTIONS

- For frame accurate editing, both machines employ a sophisticated servo system, an improved quick response mechanism and built-in LTC/VITC time code capability. This makes them ideal for animation and computer graphic recording, where a frame-by-frame editing function is indispensable.
- They are equipped with industry standard RS-422 9-pin serial interface. The 9-pin connector carries edit commands and time code data between the VCR and the edit controller.
- When connected to an RS-422 equipped edit controller, the SVP-5800 functions as an editing recorder. It performs assemble and insert functions and also provides audio split editing capability of normal audio tracks 1 and 2. In the insert mode, video, audio and time code can be inserted independently, or in any combination.



FOUR CHANNEL AUDIO SYSTEM

- They each incorporate four channels of high quality video. There are two channels with Hi-Fi (AFM) tracks and two with longitudinal (normal) tracks. The Hi-Fi tracks provide a wide frequency response from 20Hz to 20kHz and a superb dynamic range of 90dB. The normal tracks incorporate Dolby B noise reduction for high quality sound reproduction. XLR connectors are used for the inputs and outputs for all four channels.

MULTIPLE INPUTS & OUTPUTS

- Both machines employ composite and S-Video connectors. With optional SVBK-170 Component Output Board, they provide component signal output through BNC connectors. With the board, the VCRs can be integrated into Betacam SP editing systems.

USER FRIENDLY OPERATION

- Built-in character generator which superimposes characters on the "video monitor output" signal. This allows time code data, control track, menu setup and VCR function status to be shown on a monitor.
- For more efficient operation they have an on-screen setup menu which allows a variety of customized VCR mode operations. Programmed in the form of a layer structure, you simply go through the menu and initialize VCR operation.
- All parameters of the TBC, such as luminance level, chroma level, setup, hue, V/C delay, sync phase and SC phase are easily controlled from the front panel, and can be remotely controlled from the optional UVR-60 TBC Remote Control. The UVR-60 also accesses feed freeze function in the still mode and allows on/off control of the chroma and luminance noise reducer.
- Quick and smooth picture search can be performed by either using an RS-422 equipped edit controller or the optional SVRM-100 Remote Control Unit. Recognizable color pictures are provided at up to 10x normal speed in forward or reverse.

FXE-100 ALL-IN-ONE VIDEO EDITING SYSTEM

The new FXE-100 is an A/B roll editing system designed for quicker, easier video editing, and is well-suited for today's professional audio-visual communications. It is at once an edit controller which controls basic VCR functions, a special effects generator which cuts, mixes, wipes and composites the video sources with stunning effects, and an audio mixer with various fading and switching abilities. There is no longer a need to configure multiple devices for video editing. With either Hi-8 or S-VHS VCRs and the FXE-100, an ideal professional editing system can be easily configured.



- Switchable machine control of three RS-422 equipped VCRs or three RS-232 equipped VCRs. Basic VCR functions, such as play, stop, still, fast forward, rewind and record are controlled through these interfaces. Variable speed control is also possible for VCRs equipped with Dynamic Tracking.
- Accepts time code, control track (CTL), and 8mm time code as editing references. These can be set separately for each VCR.
- Performs assemble and insert editing (Video, Audio 1, Audio 2). The first EDIT mode, which allows you to record sufficient timecode for synchronization to a new tape is also featured.
- Features a split audio edit function which allows setting of audio and video in-points separately. This permits you to bring in the audio source before a visual transition.
- Store up to 99 scenes, including effects settings, in memory.
- Edit list data can be saved and downloaded to an IBM-compatible PC, allowing you to review or modify edit data at any time.
- The FXE-100 has two program buses, the A- and B-bus. Each bus provides Player 1, Player 2, Aux inputs and Background Color. Both composite and S-Video signals can be input.
- Taking advantage of the freeze function, two machine editing with effect transitions is realized by freezing the recorder OUT point picture. Also, by selecting the same video source in both A and B bus, wipe or mix in/out of the digital effects is possible without picture transition. This "Self A Roll" function is another feature which allows effective two machine video editing.

SWITCHER AND SPECIAL EFFECTS GENERATOR

- Multiple wipe patterns, including picture scroll and slides, are programmed in. Wipe patterns are easily accessed, and transition rates can be set. Soft edges or a choice of 15 color borders can be added to most wipes and effects.
- Variety of mix effects, such as mosaic mix, black and white mix, posternization mix and picture-in-picture (PIP). Also fade to black and fade to white effects.
- Digital effects, such as mosaic, paint, pixel trail, multi-picture, monochrome, and zoom. Picture freeze function is also featured in frame or field mode.
- Because all the special effects can be set separately to the video sources of each bus, wipes or dissolves of the sources with the digital effects can be executed. It is also possible to combine multiple effects to create stunning images, such as wiping the multi-picture effect with the paint effect and dissolving color corrected picture with mosaic effects.

ADJUSTABLE TRANSITIONS

Transitions are done using the fade level, or they can be automatically set. Transition time can be set from 0 to 999 frames. Transition can also be paused and reversed. Other parameters such as GPI timing, wipe selection and pre-roll time can be set.

CHROMA KEYS

The FXE-100 features chroma and luminance keys to superimpose characters, figures, or video sources onto a background. Clip and gain levels can be adjusted to give clean and sharp key edges. Color correction is done via the joystick for both buses with memory to hold a favorite setting for storage and recall.

WIPE CONTROL

By moving the location stick, you can move the closed wipe patterns such as square, circle and heart, around the screen. This function also enables you to start the wipe transition from any desired position on the screen.

AUDIO MIXING

Audio follow-video editing can be performed with the FXE-100. Two channels are assigned to each player VCR's input and one channel for the recorder VCR's input. Two channels of AUX inputs and a MIC input are available for mixing background music with voice-over. All audio input levels can be adjusted separately. Two program output channels and one monitor channel are provided. A switch for 7.5dB and -4.0dB is provided for flexibility in choosing input levels for VCRs with either RCA or XLR connectors.

USER FRIENDLY OPERATION

- All keys and buttons are logically grouped by function, and are color coded for quick identification and economy of keystrokes.
- Permits one monitor operation. No need for multiple monitors. Various editing data, such as edit mode and time code address of each VCR, can be monitored on the same screen.

VERSATILE SYSTEM INTEGRATION

- No need to configure multiple devices. By simply connecting three VCRs, a professional video editing system is formed.
- Two frame synchronizers allow perfectly synchronized wipes and dissolves without time base correctors.
- Equipped with two GPIs for control of external devices, such as character generators and audio mixers. Also has a GPI input, allowing it to be controlled from an external edit controller.
- Has four back burst outputs to distribute internally generated sync signal, synchronizing connected devices. There is no need for an external sync generator.

MAGNI



MM-400

- The MM-400 is a combination waveform and vector monitor especially configured for the cost-conscious producer. A low-cost alternative to CRT-based waveform monitoring the MM-400 produces a video picture of the input signal's waveform and displays it on any video monitor. It provides a simple, affordable and accurate way to set camera levels before a shoot, or to check time base correctors and color fidelity in editing. Problems like hue shift, smearing, muddy contrast and loss of detail are easily identified for correction.

FEATURES:

- Converts waveform or vector display information into a standard video signal which can be displayed on a video monitor or routed around a video facility, no need for additional expensive monitors. Switch between pictures and waveforms at the push of a button.
- Incorporates an advanced SC/H phase and color frame indicator that is a must for editing and post production. At a glance it tells you if a signal's subcarrier-to-horizontal phase is properly adjusted and if the signal's color frame matches the house black burst connected to the MM-400 external reference input.
- Works anywhere and with any analog video format—NTSC, PAL, Component or S-Video. It has automatic detection between NTSC and PAL formats.
- Three loop-through inputs can accept three composite signals or one component, or RGB signal.
- No complex displays or special test signals are required for component video monitoring.
- Interchannel timing and amplitude display make component analog monitoring easy. has color bar limit markings for Betacam, M-II and SMPTE formats.
- Waveform and vectorscope controls, including channel, sweep speed, position control, phase rotation are on easy-to-see dedicated pushbuttons.
- Besides instant toggling between picture and waveform, a mix mode combines waveform and picture displays for simultaneous viewing.
- The MM-400 can be readily used by even novice operators. It has easy-to-understand set-up menus for display color, interchannel timing, SC/H phase alarm.
- Usable in any video facility of any size for displaying signals, its low cost makes it affordable by the smallest studio, while its features and performance make it ideal for monitoring in high-end facilities as well.

LEADER

Model 5850C

Vectorscope

An 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.

Model 5860C

Waveform Monitor

A two-input waveform monitor, the 5860C features 1H, 1V, 2H, 2V, 1 p/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.

Model 5854A

Waveform Monitor

A fully portable waveform monitor for field use, the Model 5854A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

A fully portable waveform monitor for field use, the Model 5854A is a two-channel unit that provides 2H and 2V sweeps with MAG, FLAT and IRE response, and normal and X4 gain.

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Dennis Triola,
Publisher

Data cartridge

HHB Communications

• **DDS90M:** 4mm DAT data cartridge developed to deliver increased reliability and security in a variety of bulk data back-up applications; the recording surface is exceptionally smooth, with a high density of evenly distributed, non-corroding metal particles; immediately beneath the recording surface, the density of the particles is reduced allowing an increased concentration of binding polymers; these developments, combined with a system that precisely controls the migration rate of a special lubricant, result in high-output, low-block error rates and reduced head wear; quoted archival stability for the DDS90M is in excess of 30 years under recommended storage conditions.

Circle (354) on Reply Card

Software
Optivision

• **mpegStudio 2.0:** enhanced software designed to support Optivision's new OptiVideo MPEG-2 encoder and MPEG-2 decoders; the software optimizes compression and decompression performance and the quality of Optivision's new MPEG-2 products; the software provides full compatibility with VideoCD and CD-i players, as well as high-end videotape recorders (VTRs); numerous features for precise control of video encoding and/or decoding with Optivision's MPEG-2 hardware are also included.

Circle (355) on Reply Card

Hand-crank column for OB tripod

Sachtler AG

• **Hand-crank column OB 2000:** a hand-crank column for the Sachtler OB 2000 heavy-duty tripod for outdoor broadcasting that extends the area of application; due to the tripod's lifting range of 36cm (14.2"), the height of the OB 2000 (with integrated rubber feet) is increased to a maximum of 172cm (67.8"); the hand-crank column allows the user to lift heavy equipment mounted on top by simply turning the crank until the desired working height has been reached; the stabilizer integrated into the OB 2000 is designed to clamp the column in a fixed position, avoiding additional costs for a conventional spreader; the crank column OB 2000 permits use of all standard flat base heads and quick-fix devices without an adapter.

Circle (356) on Reply Card



Rotoscoping feature

Abekas

• **RotoPhoto 2.0:** faster running rotoscoping feature for the Abekas A65, A66 and Diskus DDRs; RotoPhoto is a plug-in driver for Adobe Photoshop and version 2.0 now runs in the native mode on the Macintosh PowerPC models 7100 and 8100; in addition, RotoPhoto now includes the plug-in for Adobe Premiere version 4.0 that provides a direct link via the SCSI bus between an Abekas digital disk recorder and the Adobe Premiere user's Macintosh; with the plug-in, the user can import video clips from the A65, A66 or Diskus DDRs into Adobe Premiere, manipulate them and export the finished results back to the DDR; the RotoPhoto package includes a new program called Disknet that performs batch file transfers between Macintosh PowerPC and the A65, A66 and Diskus DDRs.

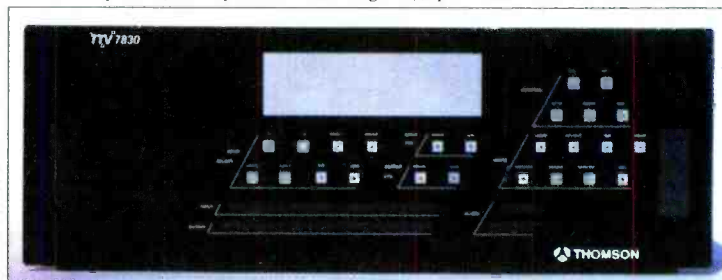
Circle (357) on Reply Card

Motion-compensated standards converter

Thomson Broadcast

• **7830 motion-compensated standards converter:** the 7830 ensures a totally transparent conversion between 625/50/2:1 and 525/59,94/2:1 and accepts any conventional broadcast standard (composite, component and digital); powerful interfaces make use of the most sophisticated digital filtering techniques; the 7830 may also be used in post-production houses to convert 24-frame pictures in the transfer of film sequences; the selected motion-compensation technique fits CCD camera pictures with fast displacements (up to four picture width/s and one picture height/s) and achieves a high precision interpolation ($1/4$ pixel) — this technique also handles complex motion as contained in zoom, rotation and crossing moving objects.

Circle (358) on Reply Card



Digital video multimeter

ComSonics

• **VideoWindow:** a digital video multimeter designed to meet today's NTSC and PAL formats while preparing for tomorrow's technology; the VideoWindow integrates many video instrument functions for complete video signal measurement; the hand-held unit is powered by AC or battery power (eight hours); VideoWindow is fully programmable for automated testing and features more than 90 individual measurements within 49 tests; the readings are in absolute numbers and the measurements are in IREs or volts; the unit features switchable NTSC and PAL formats and has the ability to store and edit readings; other features include selectable averaging and resolution, LIMIT files for PASS/FAIL measurements and a real-time clock for measurement date stamping.

Circle (359) on Reply Card

Editing system

Discreet Logic

• **Fire:** a fully scalable non-linear, on-line, full-resolution digital editing solution on an open platform; Fire features powerful audio and video editing tools and a unique gestural interface that specifically addresses the needs of on-line editors; Fire's EditDesk is a picture-based interface that includes timeline and storyboard editing of uncompressed images; the SoftEdit features allow transitions to be modified at any point in an edit; users can slip, trim or adjust the duration of transitions in real time at full resolution with immediate feedback; the system provides professional quality audio capabilities, including up to 64 tracks of audio with real-time level EQ and crossfaded for simultaneous audio and video editing; the system also features industry-standard EDLs and OMF support.

Circle (360) on Reply Card

Real-time effects software

Pinnacle Systems

• **Alladin StudioPak option:** adds powerful new digital effects and functional enhancements to the Alladin digital video workstation; some of the Alladin StudioPak capabilities include manual highlights, trail flare, strobe, posterize and solarize, variable border color, separate front and back live sources on rotational effects and axis cursor.

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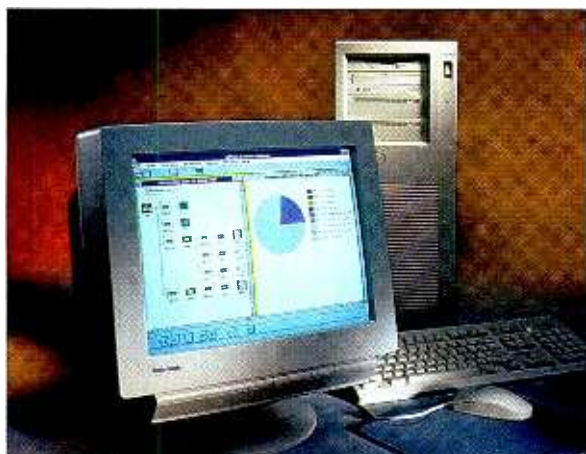
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Hand-held radiation monitors

Wandel & Goltermann

• EMR-10 (photo) & EMR-11: hand-held radiation monitors designed for use in the field by non-technical operators; the EMR-10 measures magnetic fields from 30kHz to 30MHz; the EMR-11 measures electric fields from 100kHz and 3GHz; the measurement ranges and operating parameters of both instruments are optimized to meet the requirements of personal safety applications from the IRPA, WHO, IEEE/ANSI, IEC and NRPB; the monitors are extremely lightweight and compact, and incorporate a unidirectional probe with a wide dynamic range; the instruments are highly resistant to sand, dust, water and temperature extremes and will operate for more than eight hours from their rechargeable NiCad batteries and for about 15 hours from two AA alkaline batteries; operation is simple and all operational functions, as well as measurements parameters and measured values, are displayed on the bright backlit LCD display.

Circle (365) on Reply Card



MPEG-2 gen-lock decoder

Optivison

• MPEG-2 gen-lock decoder: an EISA-based playback card for PCs; the new MPEG-2 gen-lock decoder decompresses broadcast-quality NTSC and PAL video and CD-quality audio simultaneously; MPEG-2 video is decompressed at full CCIR-601 (704x480 resolution) and 601 variants (544x480 and 352x480 resolutions); MPEG-1 source material is decompressed at the full source image format (SIF) resolution of 352x240 pixels for NTSC; the board also supports PAL from SIF resolution of 352x288 to CCIR-601 resolution at 704x576.

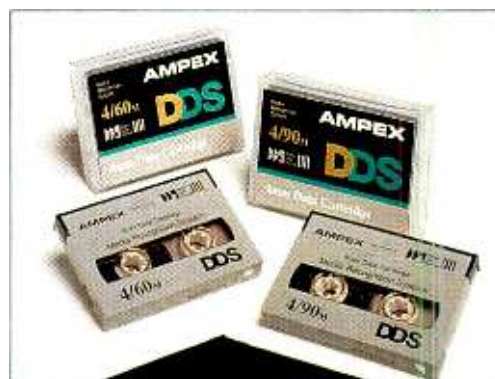
Circle (366) on Reply Card

Data storage product line

Ampex Media Corporation

• DDS series: digital data storage line designed specifically for work with digital workstations and non-linear editing systems; the 4mm DDS format is available in 60- and 90-meter lengths; the cartridges use an advanced metal particle tape formulation that ensures high output levels, extremely low error rates and exceptional durability; cartridges also incorporate the Media Recognition Systems that is designed to prevent the accidental intermixing of incompatible media between audio DAT and DDA formats.

Circle (367) on Reply Card



MPEG generator/analyzer

Tektronix

• MTS100 MPEG test system: a Windows NT workstation is the platform for the MTS100 that includes a datastore system and five application programs; transport stream I/O is provided on a variety of hardware interconnections including TTL serial and ECL parallel; analysis of transport stream data is accomplished with a Windows-based MPEG transport stream analyzer; the MTS100 is fully configured and uses five 2GB SCSI hard drives with a custom I/O board capable of handling MPEG transport streams at throughputs up to 45Mb/s; features include MTS multiplexer, MTS analyzer, MTS datastore control, MTS channel coder and MTS table editor.

Circle (362) on Reply Card

Post-production graphics

Pixel Power

• Collage: a new concept for post-production graphics that provides seamless integration of the tasks normally performed by separate character generators, still-stores and painting systems; a Collage graphics page is composed of a background source (picture or live video) and unlimited number of floating foreground layers — each foreground layer can contain graphics shapes, text, brush strokes, pictures and logos; layers can be animated independently, and a wide selection of interpage transitions are provided; real-time animation effects within a page include smooth rolls and crawls in any direction, reveals, cel animation, fade in/out and logo resize.

Circle (363) on Reply Card

10-bit frame synchronizer

Hotronic

• AT61: a frame synchronizer featuring 10-bit processing that eliminates visual quantization noise; the 20-bit matching audio delay provides audio-to-video lip sync correction; the 1-rack-mount space package features pass VIR/VTI, 10-bit digital comb filter, gen-lock, freeze frame/field and full proc-amp control with no interruption presets; digital audio/video outputs meet new digital requirements.

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TV MAINTENANCE ENGINEER: Opening for qualified maintenance engineer. Individual must be energetic, self-starter with experience in component level troubleshooting, and maintenance of a wide variety audio, video and RF equipment, to include Ampex 1 inch, Sony Beta Cart, Grass Valley production, master control, and routing switchers. Candidate must also have high power UHF transmitter, C band satellite, and 2/7 CHZ microwave maintenance experience. Send resume and salary requirements to Chief Engineer KWEX-TV, 411 East Durango Blvd., San Antonio, Texas 78204. KWEX-TV is an equal opportunity employer.

TELEVISION CHIEF OPERATOR. New England UHF station needs Chief Operator to assume responsibilities for systems maintenance of transmission facilities. Must be able to troubleshoot switching equipment, video tape and satellite receive systems. Strong technical skills necessary. FCC license required, SBE certification a plus. Send detailed resume and salary requirements to: Classified Ad Coordinator, Broadcast Engineering, Dept. 769, 9800 Metcalf, Overland Park, KS 66212-2215.

TELEVISION MAINTENANCE ENGINEER. Repairs and adjustments to television broadcast equipment, construction and installation of new equipment. FCC radiotelephone operator license or other certification and analog and digital troubleshooting required. TV UHF and FM radio transmitter experience desirable. Resume to: Classified Ad Coordinator, Broadcast Engineering, Dept. 770, 9800 Metcalf, Overland Park, KS 66212-2215. EOE.

MAINTENANCE ENGINEER Black Entertainment Television Inc. Ability to troubleshoot to the component level production switchers, digital video effects systems, routing switchers, vtr's character generators, cameras, editing systems and audio equipment. This will include system interfacing to computers and compatible components, equipment installation for studio and remote productions. Must be knowledgeable of system timing theory, broadcast specifications, and electronics course study. Ability to perform fiber switches and satellite downlink. Must have 3 years experience. BET, Corporate Human Resources, 1905-E 9th Street, N.E., Washington, D.C. 20018

STAFF ENGINEER: Charlotte, NC. Post Production/Broadcast Facility has immediate opening for a staff engineer. Candidate must have a degree in electronics. Candidate must also have five years experience as an engineer. EIC or maintenance technician at a post production facility or advanced television broadcast operation. Send or FAX letter, resume, references and salary requirements to David Whaley, Chief Engineer, Creative Post And Transfer, 377 Carowinds Blvd., Suite 101, Fort Mill, SC, 29715, (803) 548-3153.

TV ENGINEER Immediate opening: Maintenance engineer for small market PBS station. 3-5 yr Broadcast/Production engineer experience. U-matic req. 1" Sony a plus. Competitive salary/benefits. EOE. Resume & references to Personnel Mgr, KIXE-TV, 603 N. Market St. Redding, CA 96003.

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BROADCAST MAINTENANCE ENGINEER: Self-starter with experience repairing digital & analog studio equipment, all types of Sony VTR's & automation systems. Sony LMS or high power UHF transmitter experience a plus. General class radio license preferred. Send resume to: KTXH-TV, 8950 Kirby Drive, Houston, TX 77054. EOE.

ATLANTA CHIEF ENGINEER Trinity Broadcast station in the Atlanta area. Experienced in maintenance of UHF transmitter, studio systems as well as personnel supervision and training. SBE certification a plus. Send resumes to Ben Miller, Mail P.O. Box C-11949, Santa Ana, CA 92711; E-mail: BMILLER614@AOL.COM; Fax: 714/665-2101. M/F EOE.

TELEVISION MAINTENANCE ENGINEER CBS affiliate seeking experienced engineer. Must have 3 to 5 years experience in repair and installation of broadcast related equipment. RF and computer experience is preferred. Send resume to: Chief Engineer, KDBC-TV, P.O. Box 1799 El Paso, TX 79999. (915) 532-6551 E.O.E.

HANDS ON CHIEF ENGINEER for growing UHF broadcast TV station. Minimum 10 years broadcast engineering experience, and General Class FCC license required. Must have extensive knowledge of UHF transmitters, VTR repair, microwave, studio maintenance, and satellite. Able to train and supervise staff. Send resumes to Director of Operations, P.O. Box 410472, San Francisco, CA 94141-0472. EOE.

JOB OPENING OCTOBER 6, 1995 Broadcast Maintenance Engineer: Requires 2 years broadcast engineering experience. Job entails maintenance of all TV equipment including cameras, video tape machines, switchers, transmitters, etc. Send resume and salary requirements to: WPEC-TV-12, P.O. Box 24612, West Palm Beach, FL 33416-4612. Attn: Personnel. WE ARE A DRUG-FREE WORKPLACE. AA/EOE. NO PHONE CALLS PLEASE! Equal Employment Opportunity Employer.

WBRE-TV, WILKES-BARRE/SCRANTON MARKET, seeks the right person to assume Assistant Chief Engineer responsibilities. Hands on repair and maintenance with multiple formats, studio and ENG equipment and problem solving abilities needed. Experience with high power UHF a plus. This position is for a mature self-starter with at least two years experience and a FCC General Class License or SBE Certification. Forward resume and salary requirements to: Personnel, WBRE-TV, 62 S. Franklin Street, Wilkes-Barre, PA 18773. EOE.

BROADCAST MAINTENANCE ENGINEER. Must have minimum three years experience in broadcast television maintenance, and an Associates degree in electronics, broadcasting or related field. Must be able to troubleshoot to component level. FCC General Class license or S.B.E. Certification required. This position provides technical support to broadcast facilities in the form of repair, maintenance, design, installation, and modification of broadcasting equipment. Salary: \$24K to \$32K, this position is open until January 15, 1996 or until filled. Immediately send resume to: Broadcast Search Committee, WNIT, P.O. Box 3434, Elkhart, IN 46515. WNIT is an Equal Opportunity Employer. Women and minorities are encouraged to apply.

FM BROADCAST ENGINEER Position requires excellent ethics, and character, previous, and current employment in rated markets, knowledge and experience in contemporary theory and practice. Chris Hicks, 900 East Washington Street, Suite 315, Colton, California 92324. No calls. EOE/EE.

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You'll oversee the operation of satellite and telecommunications equipment, as well as transportation and maintenance of the vehicle. Involves driving the mobile unit to assigned locations and setting up satellite and telecommunications equipment. Requires an Associate's Degree in Electronics, with 3 years' experience as an engineer on a satellite truck and the ability to set up and troubleshoot satellite and telecommunications systems. US Dept. of Transportation CDL is required, along with SBE certification and/or FCC license. Experience with waveform monitors, vectorscopes, spectrum monitors, oscilloscopes, test signal generators, i.v. production equipment, and satellite uplink/downlink equipment also needed.



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Requires 5+ years' experience in the design, operation, maintenance and testing of large scale state-of-the-art analog and serial digital audio and video production, as well as broadcast facilities. Job Code: CCY-VSD

Send responses to: **Sony Electronics Inc., 3300 Zanker Road, MS: SJ-2C2, San Jose, CA 95134; FAX (408) 955-5166. Or e-mail youngc@ccmail.nhq.sony.com. EOE.**

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Boston area acoustics/audiovisual consulting firm with 45 year history seeks senior level video/audiovisual system designer. Experience and interest should include videoconferencing, video production and high-end audiovisual facilities. Computer/CAD literacy is required; good communication skills are essential. The successful applicant will be involved in major projects nationwide.

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Interested candidates should forward their resume with salary history to:

**ITS CORPORATION, HR Department,
375 Valley Brook Road, McMurray, PA
15317, FAX: (412) 941-4603 EOE**

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Alphastar is introducing the first world standard DBS television service to the American marketplace. Building on the strengths of the United States' satellite television industry we are opening a full service Uplink Center in Oxford Connecticut and are looking for dedicated, energetic individuals to join our team as:

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Working on acquiring origination material and building relations with outside studio and tape houses to ensure prompt delivery of quality programming the successful candidate will have a strong background in Television Network operations and excellent managerial skills.

OPERATIONS SUPERVISORS

Our Operations Supervisors will be responsible for the day to day activities in Master Control. This includes transmission schedules, quality control of satellite feeds and managing a team of operators. Ideally the successful candidates will have 3-5 years experience in Network operations and strong team building and managerial skills.

VIDEO SERVER AND MASTER CONTROL OPERATORS

Monitoring file servers, machine control equipment for PPV services, turn around services and commercial insertion and maintaining the broadcast logs these positions are key to ensuring top quality transmissions. The ideal candidates will have previous experience in the broadcast industry and have strong communication and interpersonal skills.

LIBRARY SUPERVISOR, TAPE OPERATORS, TRAFFIC ASSISTANT

These positions will be responsible for maintaining and screening all incoming programming materials including PPV and promotion products. The ideal candidates will have 2-4 years experience in video library services in a network environment. Additionally strong communication and interpersonal skills are essential to success in this position.

As this facility will be operating 24 hours a day, 7 days a week some of these positions will be shift work. To pursue this challenging opportunity and a rewarding career with Alphastar please fax or mail your resume to: **Human Resources, Alphastar, 208 Harbor Dr., Building One, First Floor, Stamford, CT 06904 Fax 1-(203)-359-8281**

Alphastar is an equal opportunity employer. We apologize we are only able to contact those individuals who will be offered an interview.

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Title

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2 Which type of facility or operation best describes your **primary** business classification? (Please check only ONE box.)

- 20 ☐ TV Station (including Networks & Low-Power TV)
26 ☐ Combination TV & Radio Station
39 ☐ Cable (including Networks)
45 ☐ Telephone Companies (Telcos)
28 ☐ Business TV (including Non-Broadcast TV)
29 ☐ Recording Studio
30 ☐ Teleproduction Facility/Independent Program Producer
40 ☐ Post-Production Facility
31 ☐ Microwave, Relay Station or Satellite Company for TV and Cable
32 ☐ Federal, State, Municipal Government
33 ☐ TV Consultant (Engineering or Management)
34 ☐ TV Dealer, Distributor or Manufacturer
41 ☐ Medical Facility
42 ☐ Law Enforcement/Training Facility
43 ☐ Military Broadcast or Video Production Facility
44 ☐ Defense Contractor
35 ☐ Other (please specify): _____

3 Which of the following best describes your title? (Please check only ONE box.)

- A. **Company Management:**
01 ☐ Chairman of the Board
02 ☐ President
03 ☐ Owner
04 ☐ Partner
05 ☐ Director
06 ☐ Vice President
07 ☐ General Manager (other than in charge of Engineering or Station Operations)
08 ☐ Other Corporate/Financial Official
B. **Technical Management & Engineering:**
09 ☐ Technical Director/Manager
10 ☐ Chief Engineer
11 ☐ Other Engineering or Technical Title
C. **Operations & Station Management/Production & Programming:**
12 ☐ Vice President Operations
13 ☐ Operations Manager/Director
14 ☐ Station Manager
15 ☐ Production Manager
16 ☐ Program Manager
17 ☐ News Director
18 ☐ Other Operations Title
D. **Other** (please specify): _____

4 Which statement best describes your role in the purchase of equipment, components and accessories?

- A ☐ Make **final decision** to buy specific makes, models, services or programs
B ☐ **Specify or make recommendations** on makes, models, services or programs
C ☐ Have **no part** in specifying or buying

Please
continue
on to
Questions
5 and 6
below.

5 Which of the following types of equipment will you be evaluating for purchase in the next 12 months? (Check ALL that apply.)

1. **Audio Products**

- 1A ☐ Audio consoles
1B ☐ Digital audio workstations
1C ☐ Distribution amplifiers
1D ☐ Headphones, headsets, intercoms
1E ☐ ISDN telephone interface
1F ☐ Magnetic tape, audio
1G ☐ Microphones
1H ☐ Mixers
1I ☐ Monitors (speakers)
1J ☐ Recorders, players
1K ☐ Switchers, routing

2. **Video Products**

- 2A ☐ Camera heads, tripods, pedestals, booms, dollies
2B ☐ Cameras; lenses
2C ☐ Graphics, titling systems
2D ☐ Desktop editing systems
2E ☐ Digital effects, paint, animation systems
2F ☐ Editing controllers, systems
2G ☐ Frame synchronizers, time base correctors
2H ☐ Lighting systems
2I ☐ Magnetic tape, video
2J ☐ Monitors (picture, studio quality)
2K ☐ Recorders, players
2L ☐ Robotic camera controls
2M ☐ Signal processing
2N ☐ Signal routing, distribution
2O ☐ Standards, format & scan converters
2P ☐ Still store systems
2Q ☐ Switchers, production
2R ☐ Video servers
2S ☐ HDTV Equipment

3. **Test & Measurement Products**

- 3A ☐ Analyzers, audio, video, RF
3B ☐ Audio, video signal generators
3C ☐ Waveform, vectorscope monitors
3D ☐ Digital signal testing

4. **Miscellaneous Products**

- 4A ☐ Battery packs, chargers
4B ☐ Cabinets, racks, consoles
4C ☐ Cables, connectors
4D ☐ Carts, cases (equipment, shipping), tools

5. **RF Products**

- 5A ☐ ENG components
5B ☐ Exciters
5C ☐ Fiber optics
5D ☐ Modulators
5E ☐ Power amplifiers, cavities
5F ☐ Receivers
5G ☐ Remote production vehicles, program relays
5H ☐ Satellite T/R components, electronics
5I ☐ STL components, electronics
5J ☐ Switches, RF coaxial
5K ☐ Transmitters
5L ☐ Antenna systems, towers
5M ☐ Transmitter, remote controls
5N ☐ Tubes
5O ☐ Weather, radar RF products

6. **Automation & Computer Products**

- 6A ☐ Accessories/peripherals, Macintosh
6B ☐ Accessories/peripherals, Amiga
6C ☐ Accessories/peripherals, PC
6D ☐ Accessories/peripherals, SGI
6E ☐ Automation systems
6F ☐ Cards, NTSC graphics interface
6G ☐ Cards, time base corrector
6H ☐ Business automation
6I ☐ Commercial insertion systems
6J ☐ Cards, technical monitoring
6K ☐ Machine control
6L ☐ Newsroom automation
6M ☐ Platforms, Macintosh
6N ☐ Platforms, PC
6O ☐ Platforms, SGI
6P ☐ Record/playback automation
6Q ☐ Software, engineering
6R ☐ Software, production, planning
6S ☐ Software, videographics

7. ☐ **None of the Above**

6 What is the budget for equipment you are evaluating for purchase in the next 12 months?

- 1 ☐ Less than \$10,000
2 ☐ \$10,000 - \$24,999
3 ☐ \$25,000 - \$49,999
4 ☐ \$50,000 - \$99,999
5 ☐ \$100,000 - \$299,999
6 ☐ \$300,000 - \$499,999
7 ☐ \$500,000 and up

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- Component 4:2:2 Serial Input/Serial Output Frame Synchronizer
- Component 4:2:2 Serial Input/Parallel Output Frame Synchronizer
- Component 4:2:2 Parallel Input/Serial Output Frame Synchronizer
- Component 4:2:2 Parallel Input/Parallel Output Frame Synchronizer
- Composite Serial Input/Serial Output Frame Synchronizer
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- Composite NTSC Input/Composite Parallel Output Frame Synchronizer
- Composite Parallel Input/NTSC Composite Output Frame Synchronizer
- Composite Parallel Input/Composite Parallel Output Frame Synchronizer

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- 4:2:2 Serial Logo/Trouble Generator
- 4:2:2 Serial Black Generator
- Serial to Parallel Converter
- Parallel to Serial Converter
- 4x1 Serial Video Router Module
- 16x1 270MB/s Clean Switch Serial Video Router Module
- 16x1 Serial Video Router Module
- Component Analog Video to Parallel 4:2:2 Converter
- Component Analog Video to Serial 4:2:2 Converter
- Key Signal to Parallel 4:0:0 Converter

