BROADCAST ENGINEERING®

An INTERTEC Publication

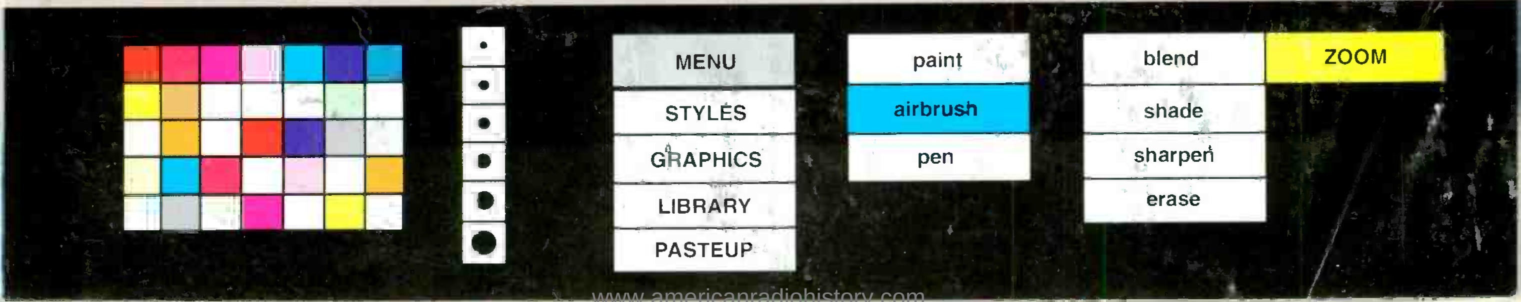
February 1994/$4.50

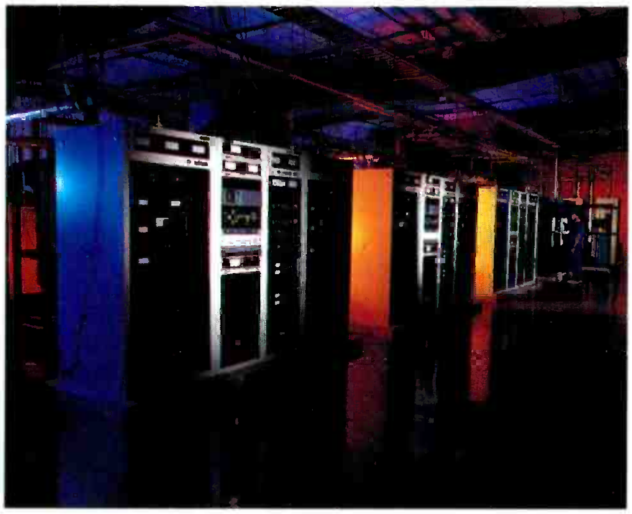
Desktop video and audio

- Desktop platforms
- Buying a desktop video system
- Desktop radio

Also featured:

- Video production switchers
- UHF transmitter technology





Your Ideal System By Design.
Not Luck.

You're planning a broadcast system where multiple components from many suppliers must be precisely integrated.

Where proper system design will be as critical to long-term performance, reliability, and functionality as the quality of the components themselves.

You need more than luck.

Turn to a source with the experience and the expertise to help you avoid costly mistakes.

Turn to a source that designs systems at every degree of complexity on a daily basis, not just occasionally.

Turn to Harris Allied, where it is our business to understand the full scope of technology and its integration.

From the beginning, you will find we are responsive to your needs, your priorities, and your budget. You will find we carefully listen then analyze your requirements before we propose a system.

You will find we will provide any level of assistance you desire, from initial concept and design through final installation, testing and commissioning.

If we can be of service, please contact us:

RF Systems:
Telephone: 217-222-8200
FAX: 217-224-1439

Video and Audio Systems:
Telephone: 606-282-4800
FAX: 606-283-2818

HARRIS
ALLIED

Circle (4) on Reply Card

Contents

February 1994 • Volume 36 • Number 2

BROADCAST ENGINEERING®

Page 30

Page 46

Page 62

Desktop systems:

Desktop technology continues to occupy the fancy of many engineers and producers. Although expectations may sometimes exceed capability, there is no doubt that as computer platforms become more powerful, so too will video and audio desktop production tools.

THIS MONTH...

DEPARTMENTS:

COLUMNS:

ON THE COVER:

Desktop video capability continues to advance as computer platforms become more powerful. On the cover is a system from AVID Technology. Inset photos include a Media Composer 1000 and a screen from a Media Suite Pro. Design by Stephanie Chiles.

News

By Dawn Hightower, senior associate editor

Hundt to address NAB opening ceremony

FCC chairman Reed Hundt will be the keynote speaker at the opening ceremonies of the 1994 NAB Convention, March 20-24, in Las Vegas. For up-to-date convention and registration information, call the NAB '94 Fax-On-Demand service at 301-216-1847.

Engineering award recipients announced

Charles T. Morgan, senior vice president and vice president of engineering, Susquehanna Radio Corporation, York, PA, and Thomas Vaughan, president, PESA Micro Communications, Inc., Manchester, NH, have been awarded the 1994 NAB radio and TV engineering achievement awards. The awards will be presented March 23 at the Engineering luncheon during the NAB convention.

Morgan will receive the radio award for a lifetime of industry work, most notably as chairman of the National Radio Systems Committee (NRSC). He was instrumental in developing the AM transmission and receiver standards, and the RBDS broadcasting standard.

Vaughan is responsible for pioneering work in high-power components and antennas for radio and television, and his contribution to HDTV standards. He founded Micro Communications, Inc. in 1966, and has 16 patents (issued or pending) for broadcast products.

Proposals sought for FM data broadcasting services

Proposals for an FM high-speed subcarrier standard that would allow radio stations to get into the high-speed data broadcasting business are being sought by the National Radio Systems Committee (NRSC) High-Speed FM Subcarrier Subcommittee. The standard will be compatible with the U.S. RBDS standard. It should provide broadcasters, equipment makers and data service providers with a transparent data pipeline suitable for data broadcasting to fixed and mobile environments. Copies of the NRSC request for proposal are available from NAB's John Marino at 202-429-5391 or EIA's Tom Mock at 202-457-4976.

World Media Expo is a combined exhibition

World Media Expo is the name chosen for the combined exhibition associated with the 1994 NAB Radio Show and the conferences of the Radio-Television News Directors Association, Society of Motion Picture and Television Engineers and the Society of Broadcast Engineers. The expo will be held Oct. 13-15 at the Los Angeles Convention Center. The separate conferences will occupy different meeting rooms. Registration for any of the four conferences includes admission to the exhibition. For more information contact NAB's Eric Udler at 202-429-5336.

International News

Studer reorganizes worldwide

Studer France Sarl, Revox France SA, NUMISYS SA and Studer Digitec SA will be merged to form Studer SA. It will be located in Chatou, Paris. Studer Revox UK will close its Revox operation in Thatcham, and the Revox activities will be integrated into the existing Studer operation in Borehamwood. In Germany, the Revox-Pro product range is handled by Studer Deutschland GmbH. An additional sales office has been established in 76477 Elchesheim, Illigen.

European DASH business booms for Sony

Sony DASH multitrack hardware is winning support from the European music recording, broadcast and post-production committee, with sales to Germany, Norway, France, The Netherlands and the United Kingdom.

SSL Studio expands with Spanish studio

Duy Sonido studio complex in Spain has installed a second SSL ScreenSound to provide a digital audio editing capability in its new studio 4. One ScreenSound is already used for post-production. ■

BROADCAST ENGINEERING

EDITORIAL
Brad Dick, *Editor*
Skip Pizzi, *Technical Editor*
Steve Epstein, *Technical Editor*
Dawn Hightower, *Senior Associate Editor*
Tom Cook, *Senior Managing Editor*
Carl Bentz, *Directory Editor*

ART
Stephanie Chiles *Graphic Designer*

BUSINESS
Raymond E. Maloney, *President*
Cameron Bishop, *Group Vice President*
Dennis Triola, *Publisher*
Tom Brick, *Marketing Director*
Stephanie Hanaway, *Group Director, Special Projects*
Kathryn Buckley, *Promotions Manager*
Sandra Tomczak, *Promotions Coordinator*
Dee Unger, *Advertising Business Manager*
Nancy Hupp, *Advertising Production Supervisor*
Susan Jones, *Advertising Coordinator*
Greg Hembree, *List Rental Sales*
Doug Coonrod, *Corporate Art Director*
Virginia Picotte, *Circulation Director*
Customer Service: 913-967-1711

TECHNICAL CONSULTANTS
Ned Soseman, *Contributing Editor*
Eric Neil Angevine, *Broadcast Acoustics*
John H. Battison, *Antennas/Radiation*
Dennis Ciapura, *Radio Technology*
Dane E. Ericksen, P.E., *Systems Design*
John Kean, *Subcarrier Technology*
Donald L. Markley, *Transmission Facilities*
Harry C. Martin, *Legal*
Curtis Chan, *Audio/Video Technology*

MEMBER ORGANIZATIONS
Sustaining Members of:
- Acoustical Society of America
- Society of Broadcast Engineers
- Society of Motion Picture and TV Engineers

Member,
American Business Press

Member,
BPA International

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

BROADCAST ENGINEERING (ISSN 0007-1994) is published monthly (plus three special issues) and mailed free to qualified persons within the United States and Canada in occupations described above. Second-class postage paid at Shawnee Mission, KS, and additional mailing offices. POSTMASTER: Send address changes to Broadcast Engineering, P.O. Box 12960, Overland Park, KS 66282-2960.

SUBSCRIPTIONS: Non-qualified persons may subscribe at the following rates: United States and Canada; one year, $58.00. Qualified and non-qualified persons in all other countries; one year, $60.00 (surface mail); $115.00 (air mail). Subscription information: P.O. Box 12937, Overland Park, KS 66282-2937.

CORRESPONDENCE
Editorial and Advertising: 9800 Metcalf, Overland Park, KS 66212-2215. Telephone: 913-341-1300; Editorial fax: 913-967-1905. Advertising fax: 913-967-1904.

INTERTEC PUBLISHING

Editorial

Nero fiddled while Rome burned

I just finished reading another article in a seemingly never-ending list of stories in the press about the Information Highway (IH). I've seen so many stories on the so-called IH that I'm car sick.

Many of the writers seem to think they can see the highway being built just outside their homes. Oh, here it comes now. The cable/telco truck is in my backyard installing fiber. By noon I'll have access to 500 channels of the Dobie Gillis show. I'll be able to access my bank records to see if I've paid my $100/month cable bill. Or send flowers to my sick aunt by television. Oh, will the wonders never cease?

The fact is that the so-called highway is nowhere near reality as the *megatelecable* industry would like us to believe. Nor is it going to be as inexpensive as the cable and telephone companies are saying. With the talk about pay-per-view movies, interactivity and the ability to do just about anything you want from in front of your television, broadcasters may be feeling they are the electronic equivalent of buggy whips in an information age. Nothing could be further from the truth.

No one should believe that the changes proposed by those who want to exact more money from viewers will be delivered as soon as proposed. Technical and regulatory issues must be overcome. Fiber will not be snaking its way into your home this year or next. It costs too much. The software and hardware the megatelecable industry speaks so highly of hasn't even been invented, let alone tested on a wide subscriber base. Finally, Congress is not likely to leave mergers like the "megamonster," as Sen. Howard Metzenbaum called the TCI-Bell Atlantic deal, untouched. It is likely that the government will mix politics with technology, creating a stew that no one likes.

So where does that leave broadcasters?For the time being, in the driver's seat. Cable does not and will probably never be able to deliver the news, which is a key element in attracting a local audience, like broadcasters do. Cable has failed miserably in doing what broadcasters do daily, which is serve the public interest, convenience and necessity.

Broadcasters are missing a golden opportunity to tell the nation and Congress how important they are to this nation's future. Any discussion about an Information Highway without immediate participation of broadcasters is short-sighted and incomplete. This leads me to my final point.Where the hell is NAB?

In the past two months, I have received no press releases from this industry's primary association, the National Association of Broadcasters. Either they aren't doing anything or they've forgotten the importance of keeping the press informed. I've also yet to see quotes from NAB officials in recent major paper interviews or stories. I see plenty from the cable and telco viewpoints, but broadcasters are seldom mentioned. Perhaps the NAB has forgotten its roots (and members) in its pell-mell race toward becoming an international convention manager.

In its desire to pursue money, it has concentrated on becoming a convention company instead of an advocate for terrestrial broadcasting. One example of this shift is in the type of information the organization provides to the press. In the past year, I've probably received more information about NAB's conventions than all of their other press releases combined.From this seat, the NAB appears to be focusing on conventions rather than lobbying in the press and Congress for its members. I'll be happy to print information on NAB activities that promote and help protect broadcasters' interests. However, to do so requires that the NAB be doing something besides holding another convention.

It reminds me of Nero fiddling while Rome burned. It's time for Nero to put down the fiddle and get back to work.

Brad Dick

By Brad Dick, editor

A 60 Second Look at the Last 25 Years in Commercial Radio.

The DSE 7000.
The fastest digital workstation for radio production.
Simplest to use.
And still the best way to get sixty seconds of history on the air.
Orban.
Celebrating 25 years in broadcast.

The Eagle has landed...New York State Thruway is closed, man...And Pepsi's got a lot to give...Wake Up, Maggie, I think I've got something to say to you...Peace is at hand...Bye, Bye, Miss American Pie...I am not a crook... I shot the sheriff...Plop Plop, Fizz Fizz... Tramps like us, baby we were born to... Hi, I'm Jimmy Carter...Ah, Ah, Ah, Ah Stayin' Alive, Stayin' Alive...No Nukes...Are you better off than you were four years ago?...Have a Coke and a smile...She's got, Bette Davis eyes...Where's the beef?...Beat it!...Beat it!...Four more years...What's love got to do with it?...Gorby! Gorby!..We are the world, we are...The ultimate driving machine...The Dow fell over 500 points today...I'm Tom Bodette for Motel Six...we'll leave the light on for ya... That's "potatoe" with an "E"....You got the right one baby, Uh Huh!

There is just no faster way to slice through 25 years of radio, or your next sixty seconds, than the DSE 7000. *The New Speed Of Sound.*

orban®

A Harman International Company

 1525 Alvarado St., San Leandro, CA 94577 USA Phone 1•510•351•3500 Fax 1•510•351•0500.

Circle (7) on Reply Card

FCC Update

New Cable Services Bureau

By Harry C. Martin and
Andrew S. Kersting

The commission has established a new Cable Services Bureau in order to satisfy the mandate of the 1992 Cable Act. The bureau will consist of a front office and three divisions: the Consumer Protection Division, the Competition Division and the Policy and Rules Division.

• The Consumer Protection Division will be responsible for administering and enforcing the rate regulation, must-carry retransmission consent, customer service, indecency, technical standards, home wiring and consumer electronics equipment compatibility provisions of the Cable Act.

• The Competition Division will be responsible for the ownership and program access provisions of the Cable Act. This division also will analyze all competitive issues within the cable industry at the national level, such as reviewing investments in cable systems, sales and mergers of cable systems, and monitoring the effects of horizontal and vertical integration within the cable industry.

• The Policy and Rules Division will conduct all rulemaking activities and prepare various reports dealing with the cable industry. This division also will conduct studies and collect information to analyze trends and developments in the industry and to assess the effectiveness of the FCC's cable regulations.

Main studio rule

Licensees are generally required to maintain their main studio within the city-grade contour of their station, and they must be capable of originating programming from their main studio.

Licensees also are required to maintain a "meaningful management and staff presence" at their main studio. The FCC has defined "meaningful management and staff presence" as the physical presence of one management person and one staff person at the main studio on a daily basis during normal business hours.

The following positions will satisfy the managerial requirement: president or other corporate officer, general manager, station manager, program director, sales manager, chief engineer with managerial duties, news director, personnel manager, facilities manager, operations manager, production manager, promotion director, research director, controller and chief accountant.

Licensees are generally required to maintain their main studio within the city-grade contour of their station.

Because some of these positions may require the managerial person to conduct significant business outside the office, the FCC does not require management personnel to remain physically present at the main studio during the entire business day. The FCC requires management personnel to report to work at the main studio on a daily basis, spend a "substantial amount" of time there, use the studio as a "home base," and remain responsible for whatever station operations occur from that studio.

With respect to staff personnel, to the extent a staff person may fully perform his or her station functions with time to spare, the staff person also may engage in activities unrelated to station operations (e.g., serve as a receptionist for another local business) so long as the main studio remains attended during normal business hours.

The commission's main studio rule applies in the same manner to licensees that have entered into time brokerage or local marketing agreements.

Public inspection file requirements for radio and TV stations

The following materials must be kept in a radio station's public file for seven years and a TV station's public file for five years:

• FCC applications
• Ownership reports
• National TV network affiliation agreements
• Citizens agreements
• Annual employment reports
• Issues/program lists

The following items must be kept in a station's public file for different periods of time:

• Political and "controversial programming" information (2 years)
• Letters from the public (3 years)
• FCC Procedural Manual (indefinitely)
• Materials relating to an investigation or complaint (must be retained until the FCC notifies the licensee that the material may be discarded)

In addition to these materials, commercial TV stations are required to maintain records demonstrating compliance with the advertising limits in children's TV programming; and a summary of their children's programming, non-broadcast efforts, and support for other stations' programming devoted to children's "educational and informational needs."

Stations may make their children's programming records part of their issues/programs list so long as they are specifically identified, or they may keep them as a separate list and update them either on a quarterly or annual basis. These records must indicate the time, date and duration of the program, and they must contain a brief description of the program or non-broadcast effort made by the station. ■

Date line

As a reminder, on April 1, 1994, renewal applications are due for TV stations in Delaware and Pennsylvania, and LPTVs and TV translators in Montana. Also on April 1, annual ownership reports (or ownership certifications) are due for all radio and TV stations in the following states: Delaware, Indiana, Kentucky, Pennsylvania, Tennessee and Texas.

Martin and Kersting are attorneys with Reddy, Begley & Martin, Washington, DC.

OTARI'S NEW R-DAT:
PROFESSIONAL QUALITY WITHIN YOUR REACH.

When you've had enough of unreliable "warmed-over" consumer decks, we've got a *professional* R-DAT for you at an affordable price.

Our new DTR-90 delivers the rock-solid reliability and superb sound that have made Otari audio machines the choice of professionals everywhere, and at the same time delivers all the performance and features you'll ever need.

For example, so you can make changes fast and easily, the DTR-90 is the only R-DAT available with individual record insert on Ch. 1, Ch. 2, and time-code channel. And its user-friendly front panel features an LCD screen that gives you powerful functions often relegated to DIP switches in other R-DATs—you can even detach the control section of the front panel and use it as a remote unit!

You'll also appreciate the optional Time-code Card with its chase synchronizer for tight lock with VTRs and ATRs, as well as features like read-after-write and punch-in, punch-out.

And if you need a complete electronic editing system, you can't do better than couple the DTR-90 with Otari's CB-149 editor for flawless digital editing.

For the complete story on this quality-built and affordable R-DAT, call Otari at (415) 341-5900.

OTARI

Otari Corporation
378 Vintage Park Drive
Foster City, CA 94404
U.S.A.
(415) 341-5900
Fax: (415) 341-7200

Otari Corporation U.S.A. (415) 341-5900 Fax: (415) 341-7200	**Otari Inc.** Japan (0424) 81-8626 Fax: (0424) 81-8633	**Otari (UK) Ltd.** United Kingdom (0753) 580777 Fax: (0753) 542600	**Otari Deutschland GmbH** Germany 02159/50861-3 Fax: 02159/1778	**Otari Singapore Pte., Ltd.** Singapore (65) 743-7711 Fax: (65) 743-6430

Circle (8) on Reply Card

Part 2

Strictly TV

Digital video

Interfacing

By Curtis Chan

Last month we began a series describing digital video by starting with the component video signal 4:2:2 bit parallel digital interface (ANSI/SMPTE 125M-1992). Part 2 will discuss the relative merits of the parallel and serial interfaces.

Parallel component digital

In recent years, CCIR and Recommendation 656 have adopted SMPTE's 125M and EBU's 3267 interface standards. The interface multiplexes the 10-bit data words in the sequence Cb, Y, Cr, Y, Cb..., resulting in a data rate of 27MWords/s. Timing sequences of start of active video (SAV) and end of active video (EAV) are added to each line.

Because the timing information is carried by SAV and EAV, there is no need for conventional synchronizing signals. The horizontal intervals and the active line periods during the vertical interval may be used to carry ancillary data, including digital audio. A later revision of the document has expanded the sampling precision from eight bits to 10 bits.

Parallel composite digital

Even though digital components were gaining ground in 1985, Sony and Ampex announced the composite digital D-2 standard. The need for digital interface requirements to reduce multigenerational artifacts was recognized shortly thereafter. SMPTE 244M defines the NTSC interface standard using multipair cable and 25-pin D connectors and specifies 10-bit precision (8-bit for NTSC).

The composite digital active line accommodates the analog active line plus the analog blanking edges. Unlike its digital component cousin, the composite version transmits a digital representation of sync and burst during the horizontal interval and the vertical sync and equalizing pulses as well. Unfortunately, the signal still bears the NTSC or PAL footprint during encoding and therefore includes the narrowband information inherent in these coding schemes, making high-quality chroma-key applications questionable.

The standard also implies the composite digital signal be represented by 256 levels on an 8-bit system, limiting its applications in some high-performance areas. Finally, composite digital methods have not been widely accepted in some PAL countries because the 625-line versions still carry the same 8-field color-frame sequence, which makes editing difficult.

Serial component digital

Although the digital component parallel interface was adequate for small or island applications, there was a strong requirement for a digital serial representation of the signal that could be transmitted through coax or fiber. The serialized signal had to ensure edge integrity for reliable clock recovery, to minimize RFI by spreading the energy spectrum and to minimize low-frequency content of the transmitted signal.

The earlier 8-bit, 243Mb/s EBU recommendation has been superseded by SMPTE 259M using scrambling and conversion to NRZI with 10-bit precision at 270Mb/s. Component signals don't need further processing because the SAV and EAV signals provide unique sequences that can be identified in the serial domain to permit word framing. Also, the serial standard carries over all ancillary data from the parallel signal, such as digital audio data.

Serial composite digital

The scrambled NRZI serial interface also provides for the transmission of composite digital signals. The data from the 10-bit parallel interface is serialized, scrambled with the same algorithm used for component, and converted to NRZI. The resulting data rate is 143Mb/s for NTSC and 177Mb/s for PAL. There were some issues to this specification that had to be addressed to make it workable because parallel-to-serial conversion for composite signals proved more complex than for component signals.

Unlike the parallel component interface carrying unique SAV and EAV signals, the parallel composite doesn't have such signals. Provision to insert a 3-word timing reference signal (TRS) was needed before serialization. This 3-word signal is inserted into the sync tip and allows for word framing at the serial receiver end. Also, the composite parallel interface had to make room for sync and burst and didn't provide for the transmission of ancillary data.

Provision was made so that upon conversion from parallel to serial, ancillary data could be inserted in the sync tips.

Proposed audio embedding

Figure 1 shows the horizontal blanking interval where the embedded audio data packets are to be placed. Component signals are similar, but the whole horizontal interval is available for data because no sync or burst information is needed. In this proposed scheme, simultaneous transmission of four to 16 channels (two to eight stereo AES/EBU pairs) of 20-24-bit audio can be accommodated.

Furthermore, an audio control packet is transmitted at the beginning of each field as a separate ancillary packet. This transmission contains information that describes the audio signals present and their respective relationships with the accompanying video.

■

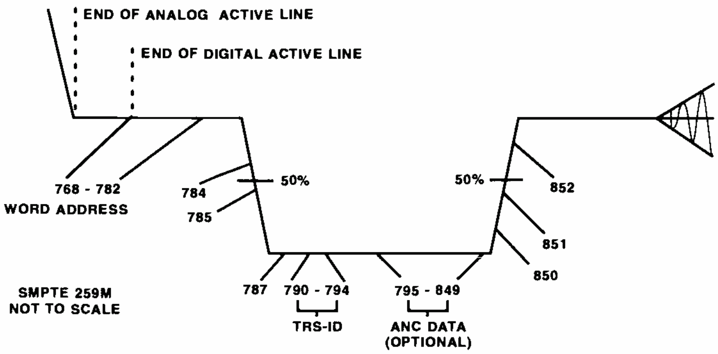


Figure 1. Additional data located in the horizontal blanking interval of a composite digital signal.

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

Part 2

Management

Departmental motivation

Departmental goals

By Rick Morris

Our new chief engineer, Joe, has been successful in sharing the company's vision statement and his own vision for the engineering department with his staff. Now, the tangible results that will show the development of Joe's engineering department as a respected part of the station will take time and work.

Joe is now involved in participating and setting goals for his department. These goals will be expressed in dollar performance, whether he is cutting general expenses, the capital acquisition budget or personnel costs. Joe's general manager wants him to substantially reduce engineering expenses because his engineering department is the single largest cost area of the station.

Although Joe's primary job is to deliver on budget cuts, his engineering department is more than numbers. He has to polish the image of his department and continue to improve his staff's morale.

The need for planning

Planning is a fundamental process of management. It involves setting objectives, determining timetables, allocating resources and communicating these objectives. Setting departmental goals is the first stage in planning.

Goals are more concrete and short-term than a vision statement. Goals involve setting specific numbers, timetables and allocating resources. A goal, for example, to cut engineering expenses by 15% is reasonably attainable and will remain fairly constant. The ultimate goal — cutting expenses — may be given to you as a standard for which you will need to develop subgoals. Subgoals may be broken down by function (saving money on overtime), time (saving 4% during the first quarter because of less activity and few vacations) or other categories (requesting a different energy rating from the power company, outsourcing work).

When setting goals, make sure that they are quantifiable. If the goal is monetary, progress can be tracked through revenue and expense reports. Non-financial performance goals also are important. Although engineering managers may be challenged with significant expense reductions, they also may be considering other important performance goals, such as greater transmitter reliability, the reduction in the number of spots lost because of cart machine failure or reduced bench repair turnaround time for field equipment.

Setting goals involves determining the allocation of resources to achieve these goals. Determining whether expenditures will be necessary to save money, who will be responsible for certain actions, and how personnel levels will be set up for engineering activities are resource allocations important to goal achievement.

Goals, the employee "buy-in" and motivation

It is important to have employees participate in the direction of the company's and department's goals. An employee's sense of contribution is an important motivating factor.

A manager's career hinges on how well his employees contribute to meeting the goals. He needs to discuss the proposed goals with his employees and get suggestions from those who know how the work is done. The purpose of these discussions is to create a plan that states the goals and timetables of the department.

Tracking goals

Goals can be measurable and quantifiable. They should be written down and verified among those who expect performance and those who are to perform. The communication of the goals should be clear. The parameters, timetables and any intermediate milestones should be clearly stated. In order to avoid confusion, the goal statement must be compatible with the vision statement or any outstanding goals.

A mechanism of feedback and tracking must be instituted. In the case of financial goals, a station will introduce periodic financial and budgetary reports. Although it may seem strange, there are stations that do not give engineering departments their pertinent financial data. It is difficult to be held accountable when an individual or department doesn't know how it is performing.

> ***Goals can be measurable and quantifiable.***

If you have not seen your station's feedback mechanisms, ask whether it's possible to receive the information. However, sometimes even the available data follows the transactions by months and is too stale to be meaningful. If you have problems with using the station's data, and have the discretion to do so, consider implementing your own system of generating relevant feedback.

The importance of sharing tracking data cannot be overstated. The employees, if pictured as contributors to a boat race, need to know what direction and how far to go. If they don't, problems can arise in achieving the goals. For example, if their manager does not share that information because "it is not for the employees," then the boat racers may get lost or waste their efforts. Also, if you don't tell them how far they still need to go, they may row too fast, not pace themselves, and then run out of energy before reaching the goal. Initial information and constant feedback is the key to keeping the boat moving toward the finish line. Remember, you also are riding in the same boat.

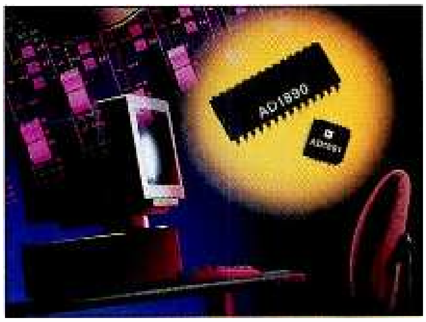
Use of feedback in continuing motivation

Feedback is a method of accountability and an important component of continuing motivation. Employees need to feel a sense of accomplishment. Meeting established goals can provide employee satisfaction. Use successes to your advantage, reward performance, reinforce good work. Use shortfalls to challenge employees to come up with innovative ways to meet the goals that they have helped to set and agreed to. ■

Morris is an assistant professor of radio/TV film at Northwestern University. He is a former TV manager at station and network levels.

Part 2

Production



Microphone basics

Wireless microphones

By Christopher Lyons

A wireless microphone system consists of a microphone, a radio transmitter and a radio receiver. Choosing the proper microphone depends on the same acoustic and cosmetic considerations governing the selection of a wired microphone. (See "Production," January 1994.) Most wireless systems are available with a variety of microphones for different applications.

The transmitter, which is battery-powered, transmits a frequency-modulated (FM) radio signal that is picked up by a receiver tuned to the same frequency. Wireless microphone systems for professional use are available on VHF (169MHz-216MHz) and UHF (450MHz-614MHz and 806MHz-952MHz) frequencies. The VHF band continues to be the most popular because professional-quality units are available at reasonable prices. Interest in UHF wireless systems has grown despite their higher cost, as users seek less-crowded areas of the spectrum.

The FCC has allocated spectrum for wireless microphone use, but it's the responsibility of each user to seek appropriate licensing. In any case, interference-free operation is not guaranteed. For this reason, wireless microphones should not be used on a lark, but only when their attributes are absolutely required by the situation at hand.

Although interference from other users may occasionally be encountered in the field, more common difficulties come from a single operator using multiple wireless microphone systems simultaneously in one location. Careful attention to frequency selection can alleviate such problems, however. (See "Using Wireless Microphones," October 1993.)

New technical features

Wireless microphone technology continues to evolve, and new designs come to market regularly. *Frequency agility*, one of the features most often requested by wireless users in broadcast production, has become available for less than $1,000. Frequency-agile systems allow the user to "change channels" in the field — without test equipment or crystal changes — if interference from other wireless microphones or RF sources are encountered.

Wireless microphones should be used only when their attributes are absolutely required.

Another feature on some recent systems allows users to push the usable range of a wireless system to its limits without increased risk of noise and interference near the edge of the coverage zone. These products use a tone-key squelch system (similar to that used on some 2-way radio systems), which places a subaudible or superaudible identification tone onto the carrier signal along with the audio. If the tone-key signal is lost for any reason (e.g., the transmitter moves out of range or is inadvertently turned off), the receiver's audio output is automatically muted.

Battery life also has been a problem with wireless microphones, so some wireless systems now offer a battery gauge that estimates how much operating time remains in the transmitter battery, rather than simply confirming that the battery is not yet dead.

Production applications

As wireless microphone systems have become more affordable and reliable, users have found novel ways to employ their capabilities in production. For instance, a common method of miking TV and film dialogue is with a shotgun microphone carried on a fishpole. The audio technician has enough to do just keeping the microphone properly positioned over the subject without worrying about entangling or tripping over the mic cable. This problem can be eliminated by connecting the shotgun mic to a bodypack transmitter mounted on the fishpole. The receiver is located on the audio equipment cart and feeds the audio mixer.

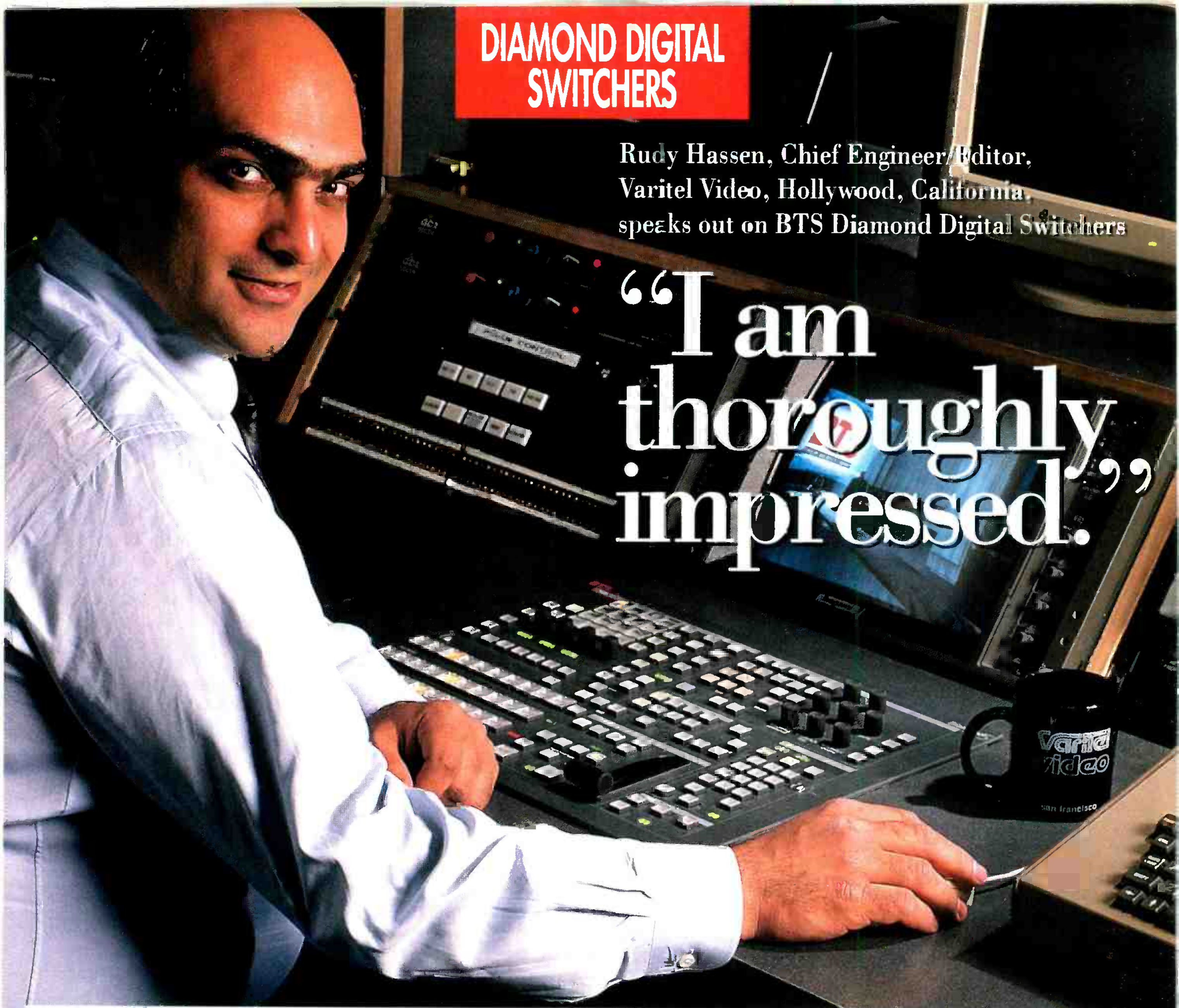
A wireless system also can be used to send audio from the microphone mixer to another location on the set. This can be useful when it is necessary to feed audio to a remotely located recorder, headphone amp or monitor speaker (for client listening or lip/action syncing to playback). An adapter cable (optional with most wireless systems) connects an audio output from the mixer to the input of a bodypack transmitter, which sends the signal to the receiver at the remote device's location. The wireless receiver's line-level output feeds the input of the recorder, powered loudspeaker, etc. With additional receivers tuned to the same frequency, a wireless audio distribution network can be created to feed the audio signal to several different locations on the set simultaneously.

Although all wireless microphone transmitters are battery-powered, many *receivers* offer only AC powering. Recently, however, more wireless receivers have been offered in small, portable, battery-powered packages. These can open up additional possibilities, because both ends of the system are then truly wireless. The receiver can be mounted on a camcorder, enabling the talent and the camera operator to move freely. This is especially useful in the ENG environment. The battery-powered receiver can even be used to supply a wireless IFB backfeed to the "wireless boom" operator.

Perhaps the ultimate in wireless production audio consists of multiple wireless microphones, each with its own battery-powered receivers feeding the inputs of a small battery-powered mixer. The output of the mixer is then connected to a transmitter whose signal is picked up by a battery-powered receiver mounted on a camcorder. In this way, the entire production crew for a multimic location shoot can be mobile. ■

Lyons is an applications specialist at Shure Brothers, Evanston, IL. Respond via the *BE* FAXback line at 913-967-1905.

➡ *For more information on wireless microphones, circle (300) on Reply Card. Also see "Wireless Microphones," pp. 110-114 of the 1994 BE Buyers Guide.*



"We are extremely pleased with the Diamond Digital Production Switcher Model DD-5 from BTS. We did an intensive evaluation, comparing it to similar products from Grass Valley Group and Alpha Image.

"The most obvious advantage the DD-5 has over its competition is its Chroma Keyer. It is by far the most superior we've seen.

"By purchasing our equipment from BTS, we were able to get into D-1 in a big way for about a quarter of what most people think you have to spend. . .it's incredible what you get for the money.

"Every BTS product I've seen is extremely high quality and durable, using state-of-the-arts components and materials. The company just seems to do a very good job of engineering everything they manufacture. Overall, I am thoroughly impressed. In fact, we are looking at acquiring two more Diamond Digital switchers, the DD-20 and the DD-30 for two more suites we are building.

"And this equipment is a tremendous moneymaker. It worked beautifully right out of the box. The BTS switcher was delivered on a Friday, installed over the weekend, and generating revenue on Monday in its first post-production assignment."

Is it any wonder that BTS is the leader in television technology? Call to Jay for information that will change the way you see the world.

BTS

Circle (11) on Reply Card

For more information call (800) 962-4BTS

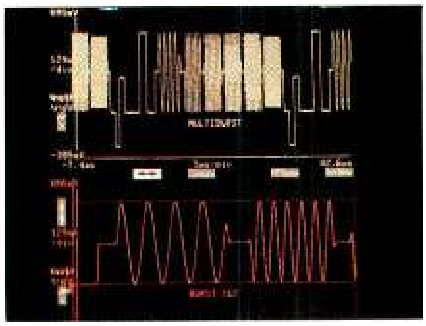
outside the U.S., call (801) 977-1551

A PHILIPS COMPANY

Creative Television Technology from BTS

Part 2

Troubleshooting



Lightning and surge protection

Lightning protection systems

By Michael F. Stringfellow, Ph.D.

Lightning descending to Earth does not know where it's going to strike when it leaves the cloud. A lightning flash's electrostatic breakdown of the air takes place between charged areas in and around the cloud in a number of steps. Each step ranges from a few inches to a few hundred feet long, often branching in multiple different directions. At this stage, the flash is essentially a "self-propelled" chain reaction — it is not pulled to earth from the cloud by potential difference with the ground, as many believe.

If a descending lightning flash, known as a *leader*, approaches within a few hundred feet of the earth, the electric field around it gets high enough to trigger upward discharges from objects on the ground. When one or more of these upward discharges meets the descending leader, a conducting path is established, and the charge stored in the lightning channel drains rapidly to earth. This produces an extremely high pulse of current known as the *return stroke*. Leader currents run at just a few hundred amps, however, return-stroke currents can exceed 100,000 amps, with durations of up to a millisecond.

It is easier for the upward-connecting discharges (*upward leaders*) to occur from high or conducting objects, so broadcast towers are prime targets. Some idea of the total number of lightning strikes to be expected with structures of various heights is shown in Figure 1. This gives the mean expected number of strikes to isolated structures for areas with 20 lightning flashes per square mile per year — a representative figure for much of the Midwest and southeastern United States.

Lightning protection

The components of a lightning-protection system include an *air terminal*, a *down-conductor* and a *ground terminal*. Control of the point of lightning attachment is achieved through the use of air terminals. These are conductors mounted at vulnerable locations on a structure and are intended to provide a preferred trigger point for upward leaders or flashes, and preventing lightning from directly striking sensitive or vulnerable equipment, such as antennas. The vertical lightning rod is the most well-known air terminal, although horizontal conductors and metal structures may be employed.

Benjamin Franklin, the inventor of the lightning rod, originally thought that the installation of sharply pointed rods in the ground might discharge thunder clouds above them in a slow, controlled manner, just as he was able to discharge charged spheres in his lab with grounded needles. Yet, the erection of large numbers of such rods in the Philadelphia area caused no reduction in lightning incidence, and the rods were, in fact, frequently struck by lightning. The structures *adjacent* to the rods were not damaged by lightning, however, so this led Franklin to abandon the prevention idea for a protection scheme.

The idea that thunder clouds can be slowly discharged by conductor arrays is still around, and there are some fancy and expensive air terminals on the market, some of which claim to repel lightning. Others are supposed to attract lightning over long distances. Although it should theoretically be possible to design an air terminal that attracts lightning better than a standard Franklin rod, there is no convincing experimental data that any of today's commercially available devices are cost-effective.

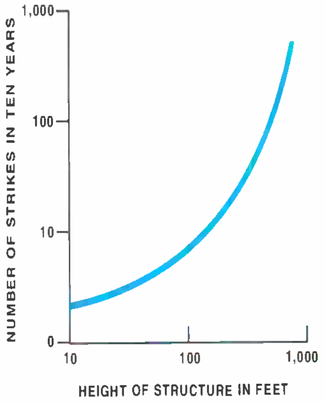


Figure 1. Frequency of lightning strikes as a function of structural height for typical Midwest or southeastern U.S. locations.

Down-conductors

The low-impedance path down the structure may be provided by means of specially installed down-conductors or by using structural steel in the building itself. Reinforced concrete that has electrical continuity also may be used. For structures with substantial steel content, down-conductors may be installed to facilitate electrical bonding between isolated sections.

When lightning strikes a structure, currents will follow the path of least impedance to ground. In structures of substantial size, this usually means the structural or reinforcing steel of the building itself. Attempts to isolate a lightning-protection system's down-conductors from the building structure are only successful if sufficient clearances are maintained to prevent flashover between them. This requires distances of 10 to 20 feet. Merely installing a lightning-protection system on standoff insulators will not suffice. Most protection codes require lightning-protection systems mounted on a structure to be electrically bonded to it to prevent this problem.

Grounding terminals

A grounding grid is most often used to discharge lightning currents into the earth. It usually includes a combination of ground rods driven vertically into the earth and horizontal buried conductors. Buried structural steel, including reinforced concrete, can play an important role in discharging lightning currents. Driving deep ground rods to reach moist or good-conducting soil does not alone provide a sufficient earth terminal for lightning currents because of such an arrangement's high inductance.

Lightning currents are large, with high rates of rise. An effective grounding system must have high capacitance and low inductance as well as an acceptably low resistance. At the high currents involved, soil ionization often occurs, which lowers the effective grounding impedance. In soils of poor conductivity, beneficial esults have been reported from encasing conductors in concrete or chemically treating the soil. In rocky terrain, such as mountaintop locations, a network of horizontal conductors generally gives better results than driven rods.

Next month, this series will conclude with a look at surge protection and methods of keeping such currents out of sensitive equipment. ■

Stringfellow is chief scientist at EFI Electronics Corporation, Salt Lake City. Respond via the *BE* FAXback line at 913-967-1905.

Circle (100) on Reply Card →


People are talking.
Mark In
Sync
Mark Out
You should be listening.
VideoCube™
DIGITAL VIDEO POST PRODUCTION WORKSTATION

The VideoCube has been dazzling customers throughout North America. Just listen to what they have to say.

"The future of post production has arrived... and it's affordable."

" The VideoCube gives us the bells and whistles of a high-end edit suite, at a fraction of what it used to cost.

"The speed, quality, and flexibility of the VideoCube blow all the other systems out of the water. We'll never go back to tape-based editing. Neither will our clients."

Craig Hollenback, President,
Gail Hollenback, Vice President
Abracadabra Animations®,
Member ITVA, Greenwich, CT

"Thirty-seven minutes into a 90-minute program, the client wanted to make a few changes."

" The project had 937 edits, with tons of graphics and titles. It would have taken at least 12 hours to recut the program on a tape-based system.

"With the VideoCube, the revisions took less than an hour to complete. Like I said to the client: no problem."

Ron Cole, President,
Cole Productions Inc., Oakdale, CA

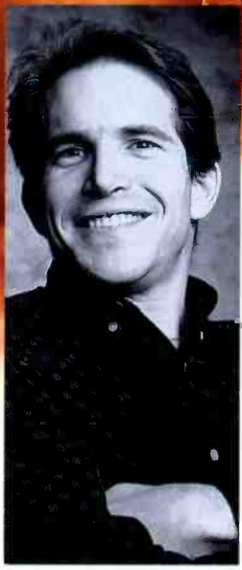
Video

"The VideoCube is the only nonlinear system that meets all of our requirements."

"It's the first system to offer online-quality output at a reasonable price, and provide the realtime effects that my clients demand.

"It's good to know that ImMIX is backed by Carlton Communications. Carlton companies like Quantel and Abekas have a long history of making top-quality products and providing great support."

John Fulford-Brown, President,
Fulford-Brown Productions,
Toronto, Ontario, Canada,
Member, ITVA Toronto Chapter



"We bought three cubes upfront because our markets want to work with them. Many of our major agency clients are buying into ImMIX."

"I don't think people realize the full potential of this "online-in-a-box". Especially with its Mac interface, its ability to link with other programs, and its open architecture.

"Creatively it's a gas to go where no online has ever gone before. The VideoCube is an important new force in nonlinear editing."

Don Levy, President,
Digipix,
New York, NY

cube

You can win a complete VideoCube System — absolutely free!

It's our way of saying thanks for such a positive reception from the industry. Come early to our booth #19758 at NAB for the best opportunity to win!

WIN

A VideoCube SYSTEM

Come to booth #19758 at NAB

Future mass storage

Crystals and polymers

By Curtis Chan

Over the next decade, the dominance of magnetic media storage systems will most likely be eroded by challengers that include optical and magneto-optical, holographic and solid-state technologies. As important as the advances in these basic storage technologies, is the applications in which they'll be used. Computer networks, multimedia and the information highway will have an impact on storage technologies and their uses.

Holographic storage

Volume-holographic storage is on the road toward commercialization. Touting storage densities 10 times greater, these devices have transfer and access rates ranging from 10 to 1,000 times greater than current offerings. Microelectronics and Computer Technology Corporation (MCC) in Austin, TX, has pioneered two patented breakthroughs that have made this technology commercially viable. The first patent involves techniques that create small crystal arrays capable of storing more information than bulk crystal medias. The second patent concerns a non-destructive readout technique.

Efforts have resulted in 3x3x0.5cm crystals yielding 200MBs of storage. They are configured as 64kb pages with up to 50 pages per stack and up to 2,000 stacks per module.

In holographic storage, data is recorded in photorefractive crystals as 3-D holograms in data storage terms. Binary data is written as dark or light dots on 2-D pages, with the pages stacked one on top of the other within a photosensitive crystal. Stacking pages creates the third dimension. Strontium-barium-niobate crystals are the storage material because of high sensitivity combined with high speed. Electronic charge patterns created by the interference of two laser beams are used to create the holograms. (See Figure 1.)

Reading and writing

Light from a laser source passes through a beam splitter that divides the beam into a data beam and a reference beam. The reference beam is used to create the interference pattern and is directed into a path that includes a polarization rotor and a page addressing deflection system. The data beam is directed into an optical expansion system that focuses the beam onto the surface of a 'page composer.' Digital data is then superimposed on the expanded beam using the spatial light modulator with the resulting images appearing as light and dark spots, representing the value of the data. From the page composer, the data beam is converted using a Fourier Transform. It's then focused on the crystallite structure that will hold the hologram. The data beam and reference beam come together again, with the resulting interference producing a grating pattern on a photorefractive material. This modifies the optical properties of the crystallite material with an electronic-charge pattern.

The read cycle is more simple. The data beam is turned off, allowing only the reference beam to focus on the crystal. The reference beam's location is determined by the particular pages to be read. The beam illuminates the interference grating stored at this location, resulting in the reconstruction of original light and dark spots pattern. The pattern is read by a CCD that converts the dark and light spots back to digital electronic data.

The first MCC patent uses multiple crystallites embedded in a supporting matrix. This makes the crystalline material easier and more economical to manufacture. Growing larger crystals of acceptable optical quality is difficult. The crystallite architecture minimizes crosstalk between stacks of pages. In the array, each crystallite holds a separate stack of pages as opposed to pages being placed side by side in a large crystal. This also allows scalability of storage by adding more crystals to the array.

The second patent concerns a non-destructive readout technology that allows billions of read-write cycles to be performed by creating the right balance of static-electric fields in the crystal and the right polarization of the laser beams to accomplish the non-destructive readout.

Polymers from IBM

IBM's Almaden Research Center in California reported that it has developed a set of photorefractive polymer films that can record several erasable holograms in the same spot. This is possible because the recording material is thicker than the light wavelength, allowing several holograms to be stored in the same spot by tilting the data and reference laser beams slightly for each new hologram. The film materials need an external electric field to align the polymer molecules when the hologram is being written or read. When the field is turned off, the hologram disappears, but isn't erased. It reappears when the field is turned back on. From IBM's perspective, polymers have several advantages over crystals – they are cheaper to manufacture, can be formed into useful shapes, such as thin films, coatings and waveguides and their chemical composition can be varied to obtain special characteristics. ■

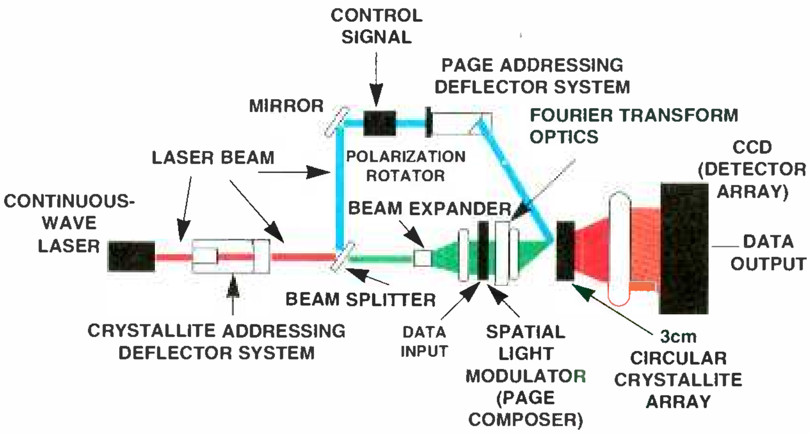


Figure 1. Volume holograms are generated using a 100mW, green light, yttrium-aluminum-garnet (YAG) laser. The beam is split into a data beam and a reference beam. Based on the data stored, interference patterns are formed when the beams re-converge.

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

Desktop video systems

The key to investing in the right desktop system is knowing what you need.

Desktop production. What is it? How can it save me money? What kind of new and creative features can it provide? Does the type of platform make any difference in the system's capabilities? The answers to these questions and more lie in this month's feature coverage.

Desktop video and audio systems are now seen as everyday tools to both production and broadcast facilities. Whether it's a paint/graphics, editing or integrated switching/DVE system, small-computer technology has brought a range of new features to the desktop. Although there are limits to what these systems can do, they are becoming more powerful each day. And that's the good news.

The bad news is that with the wide range of options available, it's often difficult to make the best choice in technology. What platform is best for your application — whether it's a single-purpose or multifeatured system — and how much to spend on the system are difficult choices.

The keys to making the best decision for your facility are to know your needs and to know what product options exist to meet those needs. In this encompassing coverage, *Broadcast Engineering* will give readers an authoritative and in-depth look at the important aspects of audio and video desktop systems. From platform selection to buying the best tailored system, this issue will answer your questions.

Don't miss out on the many excellent features and options desktop technology can provide. The answers to your next graphical/editing questions lie just ahead.

Brad Dick

Brad Dick, editor

Choosing a desktop video platform

It's not easy, but you have to start somewhere.

By Jeff Burger

The Bottom Line

Desktop video is becoming better and more powerful each day. Because of this, video professionals are finding new applications for this technology throughout their facilities. With the wide variety of choices available, choosing a platform upon which a system can be built is no easy task. There are various platforms, each with strengths and weaknesses that make selecting a desktop system easier.

Unless you've been on field shoot for the last few years, it's obvious that desktop computers have become viable tools for video production. With all of the smoke and mirrors associated with the never-ending stream of progress and information surrounding desktop video and multimedia, even the basics of choosing a platform can be a daunting task.

Matching equipment with the task

The first priority in choosing a platform is coming to terms with what you want the overall system to do. We'll assume that most readers want to dedicate machines to media production rather than stretch them to handle business tasks as well. Also determine whether the system needs to do double duty in the production of print, multimedia or high-end audio. Next, target the actual video-related tasks, such as switching, DVE, 2-D paint, animation, 3-D animation, character generation, off-line linear editing or industrial non-linear on-line production.

Some of the overall issues that come to bear are system speed, memory and storage. Some tasks, such as switching, character generation, 2-D still graphics and edit control, don't task a system much. On the other hand, 3-D graphics, animation and non-linear (hard disk-based) editing weigh heavily on all three. Budget for any other peripherals that apply, such as scanners, digital audio boards, video digitizers and NTSC encoding.

Many computers today are sold with built-in audio/video capabilities. For pro work, however, these consumer-level solutions are inadequate. Here's a look at the four main platforms available for desktop video production.

PC

The wide range of PC clones on the market translates to two basic pluses. First, this platform enjoys an installed base of as much as 90% of the general U.S. market. This critical mass, in turn, attracts support from the lion's share of developers.

Second, so many companies offer clones that the performance for the dollar is hard to beat. The current crop of machines based on the 66MHz 486 and the new Pentium processor currently offer the greatest speed for the least expenditure. Capable base machines can be found for less than $2,000, although you'll likely invest a little more to enhance memory and storage.

On the down side, there has been less standardization in PC hardware and software because of the clone war free-for-all. Compatibility and installation issues are still a concern. For example, there are at least three standards for digital video compression: QuickTime for Windows, Video for Windows and Intel's Indeo.

Because the PC's roots lie as a text-only machine, low-priced graphics cards have increased in speed and display capabilities, but they've also suffered from competitive standards. Compatibility and

Burger is the author of *The Desktop Multimedia Bible* (Addison-Wesley), a contributing editor to NewMedia, and an active multimedia producer/consultant.

Video 18/20 Plus.

The Best. For Professionals.

The only high capacity head with super smooth, pure fluid damping, constant and even counterbalance with any load. The new standard!

1 True precise fluid damping: Can be set from "0" for whip pans to the optimum step 7 for extreme telephoto lens.

2 Identical damping levels on pan & tilt. Perfect for any diagonal movement.

3 The first counterbalance system allowing ±90° tilt even under maximum load.

4 Unequalled fast and safe: Touch & Go camera locking system with safety lock.

5 Illuminating spirit level. "Touch & Light", works with standard batteries.

6 Easy to operate: Lightest professional camera heads. All controls are ergonomically designed and positioned.

See us at NAB Las Vegas March 20.-24.1994

The new Plus Heads

camera configurations:
Video 18 Plus up to 22 kg / 48 lb
Video 20 Plus up to 28 kg / 62 lb

sachtler® corporation of America

New York office:
55, North Main Street
Freeport, N.Y. 11520
Phone (516) 867-4900
Fax (516) 623-6844
Telex 140107 sac frpt

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

Headquarters:
Sachtler AG
Kommunikationstechnik
Germany, Gutenbergstraße 5
85716 Unterschleissheim
bei München

sachtler
Support & Lighting

Circle (12) on Reply Card

user-friendliness issues have been reduced since the entrenchment of Microsoft Windows, but not completely smoothed over.

Windows also is a "middle-man" between the user and DOS, thereby slowing down some operations. The architecture of every PC is still based on 12-year-old technology where 640kB represented the maximum memory. Current PCs support far more only by using techniques that might best be described as a kludge.

Until the advent of Windows, few professionals in any media found satisfactory tools on this platform at reasonable prices. That is rapidly changing, however, and desktop video is becoming viable on the PC. To cloud the issue, the clone syndrome has come to PC video. Many companies are making indistinguishable mediocre tools and only a handful of higher-end options exist.

Macintosh

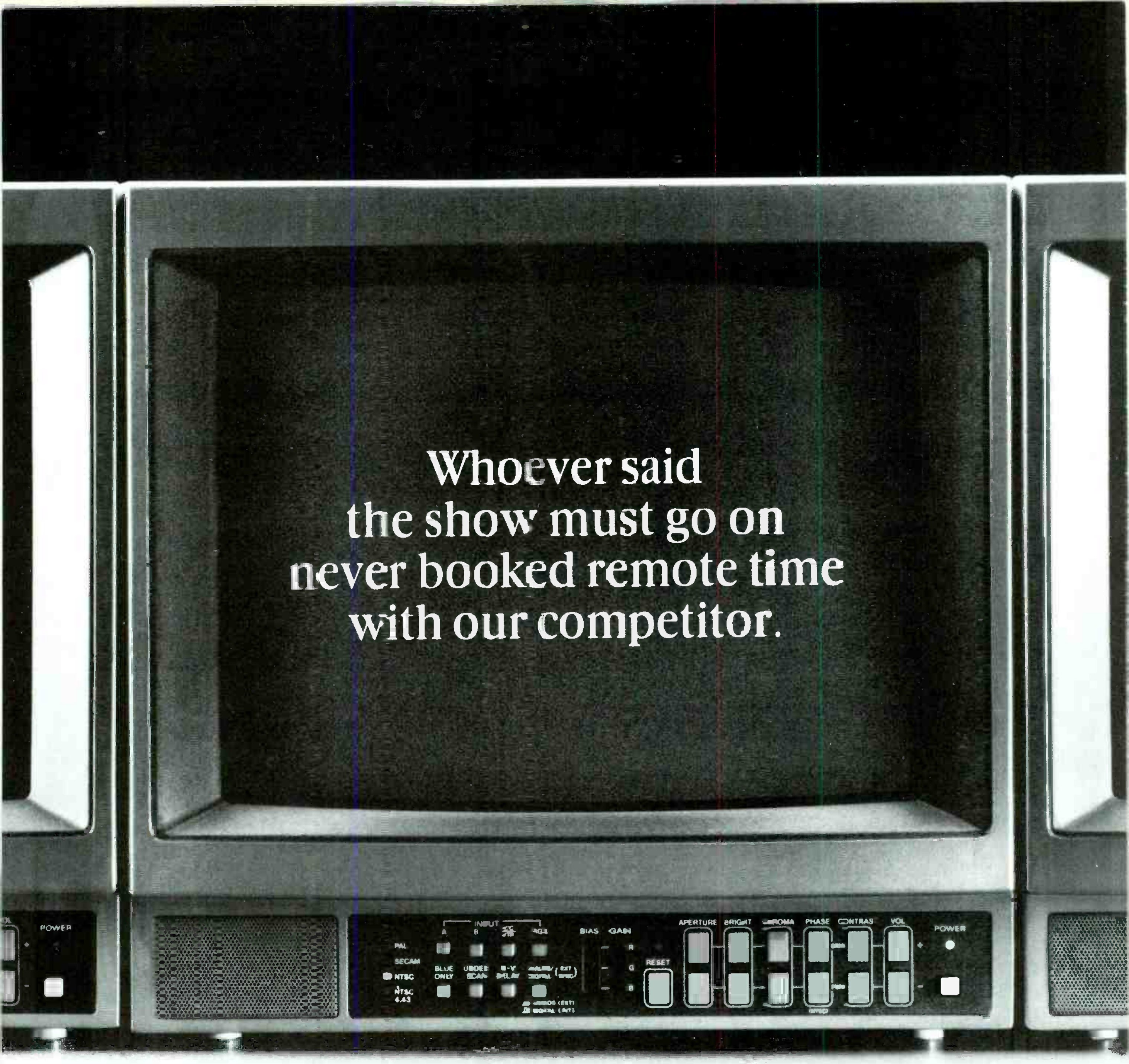
The Macintosh advantage is several fold. Its integral, intuitive point-and-click user interface is but one example of the standards afforded by a single manufacturer steering the direction of the platform. Other software standards have included file formats, managers for elements, such as multiple monitors, MIDI and sound. Hardware standards mean that every Mac comes with built-in audio, a mouse, two serial ports and a SCSI port. Macintoshes also offer simplicity when it comes to software/hardware installation.

The Indy, one of the latest entries into the desktop arena. (Courtesy of Silicon Graphics Inc.)

As a result of these factors, the Mac has been around the longest as an affordable media production engine. Creative professionals have been doing world-class work in the areas of graphics, sound and print production for almost a decade. The Mac is particularly entrenched in the areas of graphics, publishing, audio and multimedia production. (Many multimedia producers develop on the Mac, then port to the PC.) The Mac has attracted this creative community despite higher prices. However, Apple's recent price reduction makes the Mac competitive with PC clones.

Apple's introduction of QuickTime in 1991 standardized digital video compression in an open architecture and has provided the foundation for many video applications and hardware components. Overall, fewer third-party manufacturers are developing for Macintosh than PC, but the quality of the choices often is higher when it comes to creative tools.

Continued on page 27



Picture this. You're a few hours from going on the air. Then suddenly, somebody pays your provider a premium for your time. Which means you're going *off* the air.

That can happen if you haven't booked time with AT&T ACCUNET® Digital Television Service.

Only AT&T ensures remote broadcasters 100% nonpreemptible transmission service at no extra charge.

With the largest all-digital, high speed fiber optic network in the industry, nobody ever gets bumped.

And when you book time with us, you get AT&T quality from end-to-end, providing you with 100% contribution quality pictures. Our competition often has to relay its signals through other networks, resulting in lost quality.

Plus, with our patented AT&T FASTAR℠ restoration system, you get the superior reliability of AT&T's network.

Like to hear more? Just call 1 800 248-3632.

We'll tell you about all our advantages. And how with us you'll never be left out of the picture.

AT&T. The Best in the Business.℠

AT&T

Circle (14) on Reply Card

This Workhorse Leaves Everything Else In The Dust.

Digital Betacam. The New Standard In Broadcast VTRs.

Grab a hold of the future. And get everything you need today. Digital Betacam® VTRs are quickly becoming as accepted as one-inch. And this digital component quality VTR even gives you analog composite quality output* superior to one-inch. It's Betacam® based. It's reliable, consistent, and offers dramatically lower operating and maintenance costs than any other digital recorder. Everything's going digital. But this digital workhorse also pulls its weight today.


SONY
DIGITAL VIDEOCASSETTE RECORDER DVW-A500
Digital BETACAM
ANALOG/DIGITAL
INPUT SELECT
AUDIO INPUT/MONITOR SELECT
CH-1 CH-2 CH-3 CH-4
VIDEO INPUT SELECT
REMOTE
CHANNEL CONDITION
MENU
Digital
VITC
MONITOR SELECT
AES/EBU
ANALOG
CUE
COMPONENT (Y-R,B)
COMPOSITE
RS-232C
SHUTTLE JOG VAR
JOG
REVERSE FORWARD
RESET
SECONDS FRAMES
PLAYER RECORDER
TIME CODE
COUNTER
HOLD
EDIT
REC INHIBIT
SERVO
F FWD STOP

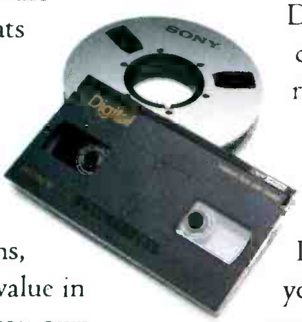
Why Digital Betacam Is The One-Inch Of The 90s.

SONY

We all know the future is digital. But the Digital Betacam® format is the format that also takes care of today. It's the industry's digital workhorse, and the one that should be working for you right now.

We Made Digital Component Quality Affordable.

Production standards are rising all the time, but budgets and project times are not. Many formats and options are available. And naturally you're looking for the best quality, affordable systems, and the greatest value in extending what you own today. You may not know that even in an analog environment, Digital Betacam VTRs give quality in analog far superior to one-inch. In its true digital component domain, it's what you've been asking for: true component quality with many features that save time and money. Our pilot tone technology provides flawless tape interchange and consistently accurate insert edits. Built-in interfaces connect to virtually any system with our 43 connectors. And pre-read capability lets you use two machines in place of three. It all adds up to value.



You Don't Have To Leave The Past Behind.

What about your investment in your present system? Archive materials? Compatibility with other houses and stations? The feed from analog acquisition systems? Not to worry. This VTR is Betacam because that's the format the industry's been relying on for over ten years. You can play analog Betacam tapes in Digital Betacam VTRs.* And with Serial Digital Interface connectors you can easily integrate with no worries that it'll be obsolete tomorrow.

Lower Operating And Maintenance Costs.

All things considered, Digital Betacam VTRs give you a far more economical way to do your broadcast production. It fits with your analog Betacam VTR or one-inch systems. With Bit Rate Reduction, it consumes less tape than any other digital format. This turns a 90-minute cassette into a 124-minute one. And it reduces wear and tear on internal parts as compared to other digital VTRs, keeping maintenance costs, on average, equal to analog systems. For example, you can replace a digital head in under 30 minutes. Which translates into less downtime and a more profitable facility. And because its simple tape transport makes routine maintenance so easy, Digital Betacam VTRs require minimal test equipment or additional training.

Make It Work For You.

It's clear that Digital Betacam is the workhorse for the 90s. All that's left is to get it working for you. To find out how, call 1-800-635-SONY, ext. DVW.

Innovation At Work.

Sony Business and Professional Products Group. 3 Paragon Drive, Montvale, NJ 07645-1735.

*A Series DVW VTRs.

Continued from page 22

Apple is changing the playing field again as you read this. Motorola's highly touted PowerPC chip should make its way into Apple's line by approximately mid-March. The PowerPCs are supposed to emulate both Macs and Windows, allowing software from both camps to run on the same machine at about 80% of their current top speeds. The real kicker is that software written specifically for the PowerPC should run approximately three times faster than the current top-of-the-line Mac.

Amiga

The Amiga entered the market in 1985 with a great deal of creative potential. It had more graphics and sound capability built-in than either the Mac or PC because of custom chips dedicated to these tasks. The custom graphic chips, for example, offered the ability to manipulate large areas of graphics and overlays for tasks, such as smooth animation and keying. Double-buffering also enhanced animation smoothness over that of Mac and PC. (This technique employs two image buffers that are toggled back and forth: One displays the current frame and the next frame is drawn in the other.)

Perhaps more important, the Amiga was the only desktop computer built around NTSC video. Video out was standard, video in was cheap, and the internal architecture made overlaying graphics and animation on video easy. Other standards include serial, parallel and SCSI ports, as well as dual implementation of command-line and point-and-click user interfaces.

The current Amiga 4000 (about $2,400) offers all of this plus 68040 processing power and improved graphics (262,000 simultaneously displayable colors without add-in boards). Unfortunately, the standardization of digital video compression as seen on the Mac and PC platforms has not happened on the Amiga. Although this means that non-linear editing at even the off-line level is not prominent on the Amiga, linear video editing software that controls traditional video transports is certainly available.

A linear desktop editing system based on the Amiga. (Courtesy of RGB Computer & Video.)

The only thing that has saved the Amiga in the United States has been NewTek's Video Toaster. The Amiga literally becomes a Toaster when you install the latter. The Toaster then rides on the NTSC architecture and forms a low-cost system with an internal YIQ format for broadcast use.

The Toaster offers 3-D animation, paint, character generation, switching, DVE and more for the unfathomable price of $2,395. Throw in the Amiga and a reasonable amount of memory and storage media and you're still way under $10,000. The T-Link option ships graphics files back and forth between a Mac. As the icing on the cake, NewTek's $10,000 Screamer rendering engine — sporting four 150MHz R4400 RISC processors — can spit out Toaster 3-D frames on the order of 40 times faster than the Toaster (or Mac or PC) alone.

SGI

Silicon Graphics represents the cream of the crop in desktop graphics at a corresponding price. Although the SGI tools used for the likes of *Jurassic Park* easily fall above the desktop category, the new SGI Indy model lowers the entry point to this technology to $4,495. For that you get a 100MHz R4000PC RISC processor, the IndyCam desktop communication camera, 8-bit dithered color, 16MB of RAM and a 15-inch monitor. The basic system also accepts composite and S-video input, which can be displayed full-screen at 30fps. The price tag increases, however, to around $15,000 to $20,000 by the time you boost the specs to the larger monitor, 24-bit graphics, 32MB to 64MB of RAM, a faster R4000SC processor, 1GB hard disk, and video output capability you'll need to do anything ambitious.

Much of SGI's claim to fame is 3-D graphics and animation. Although the Indy will run all of the 3-D software written for its high-end kindred, it lacks a hardware buffer for the Z-axis (depth). To get hardware buffers for all three axes and the corresponding improvement in rendering performance, we jump to the Indigo² at an entry point of $18,000. This includes IndyCam, 16MB of RAM, a 500MB hard drive, and a 16-inch monitor. Again, you'll want more RAM and storage, which will boost the cost. Video in/out options start at $3,995 and include an upcoming D1 option promised at $6,995.

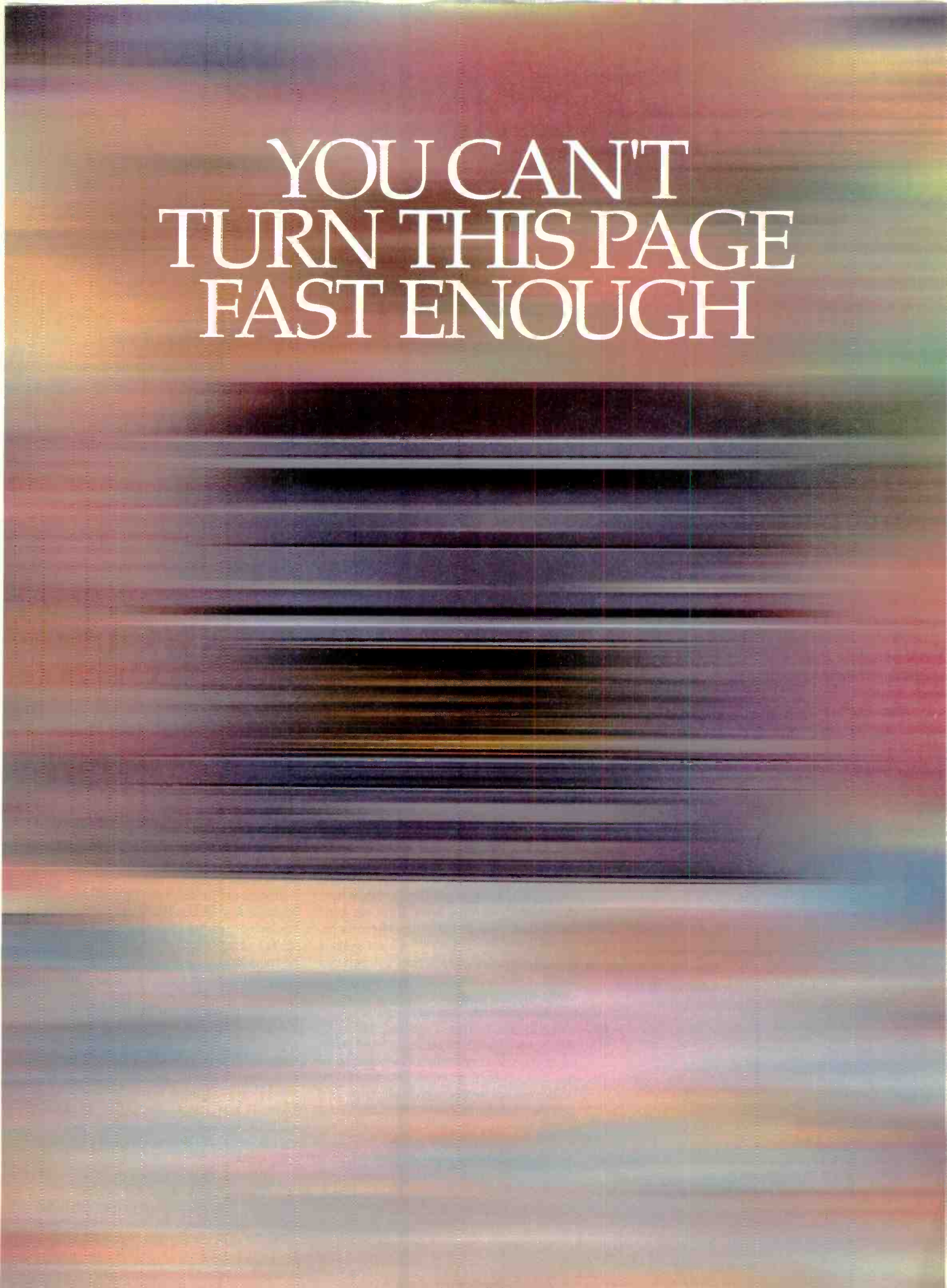
SGI's RISC processors scream compared to the current Intel and Motorola offerings in the other machines. They run at about twice the clock speed, and the RISC architecture is an order of magnitude faster. The internal data path of both SGI machines is 64-bit, pumping twice the amount of information through all internal paths. SGI's GIO bus for I/O operations runs at 267MB/s compared to 20MB/s to 40MB/s on the other platforms mentioned. (The memory bus runs at 400MB/s!) SGI also has implemented QuickTime, with file compatibility with the Mac version.

The other thing to be said for SGI is that the low-end units can run most production software designed for the rest of the line. If you've been drooling over the broadcast and feature film effects afforded by the likes of SoftImage and Xaos Pandemonium but have been shy of $60,000 (or higher) hardware price tags, here's the way to get your foot in the door. Remember that this level of software tool often commands an extra zero itself in the price tag when compared to counterparts on other platforms.

Decisions, decisions

Macs and PCs offer the easiest entry point for basic, all-around production of graphics, audio, scripts, storyboards, presentations and desktop multimedia. They're also the cheapest way to embark into non-linear, off-line editing. Expect to add another $4,000 at least to get on-line industrial quality from companies, such as Fast, Supermac, Radius and RasterOps. Between the two, video pros are likely to find more options on the Mac. Look to spring $10,000 to $40,000 to approach non-linear broadcast quality with systems from companies such as Avid and ImMix.

If non-linear editing is less important than broadcast-quality in all other categories, the Toasterized Amiga is hard to beat, especially for the money. If you plan to do lots of 3-D rendering and animation, the Screamer option should pay for itself in no time and give you quality that has been good enough for the likes of *Star Trek: The Next Generation*, *Seaquest DSV* and *Babylon 5*. (Rumor has it that NewTek isn't asleep at the wheel regarding non-linear editing, either.) Finally, SGIs offer the greatest selection of power tools if you need lots of 3-D rendering, image processing and animation (plus Avid's non-linear editing) if you don't mind paying for it. ■


YOU CAN'T
TURN THIS PAGE
FAST ENOUGH

Buying a desktop video system

Start by picking the platform.

By Tom Ransom

The Bottom Line

Desktop systems are available for considerably less than the cost of a traditional video editing suite. As such, they are an ideal way to increase the production capacity of a facility without spending a lot of money. High-end production equipment can sometimes be overwhelmed by numerous small projects that don't fully use its capabilities. These projects can easily be moved to desktop systems, freeing the high-end gear for projects that are better matched to its capabilities.

Judging by the 1993 NAB Convention, digital video is making its way into post-production suites across America. Aisle after aisle at the show brimmed with the latest digital video products. Systems and solutions based on SGI, PC-compatible, Macintosh and Amiga computers were everywhere.

People have been creating professional quality videos on their PCs ever since Truevision announced its first TARGA videographics engine in 1986. Today, hundreds of desktop video solutions exist. Prices for hardware and software are falling. For $1,500, industrial-quality desktop video packages combine a videographics board with video editing, character generation, paint, animation and presentation software. Three years ago, that bundle would have cost at least $15,000. Although solutions like this exist, assembling a desktop video system isn't always the easy process it appears to be. Many choices are available, with costs ranging from a few thousand dollars to more than $25,000.

The key to buying a system that truly meets your needs is defining what tasks you expect to accomplish. Once you know the tasks, you'll want to determine the platform and select a cost-effective and efficient solution.

Remember early desktop publishing?

In many ways, the state of desktop video is strikingly similar to when desktop publishing first hit the market. Following the introduction of various page layout programs, primarily Aldus Pagemaker for the Macintosh, thousands of corporations, clubs, schools and churches began publishing their own newsletters and brochures without the aid (or expense) of commercial typesetters or designers.

The problems involved in assembling early desktop video systems mirrored the problems encountered by the early adopters of desktop publishing. Software and hardware were extremely expensive and few resellers truly understood the products or market, making it difficult for users to assemble and productively use the available technology.

Advances in Apple's QuickTime and Microsoft's Video-for-Windows (VFW) protocols; enhancements in JPEG and MPEG compression; plummeting prices of mass storage devices; and more robust processors have pushed digital video to the brink of mass acceptance. However, in today's market, analog, not digital, still rules. Facing the facts, hardware-based QuickTime and VFW-equipped systems offer video quality that, at its best, is comparable to VHS. In addition, although the price of storage has dropped to less than $1 per megabyte, JPEG compression allows only about 20 minutes of video and audio to be stored on a 1GB hard disk drive.

Should you wait for digital?

Even if digital video isn't quite ready for prime time, there's no reason to be hesi-

---

Ransom is marketing communications manager for Truevision Incorporated, Indianapolis.

TO MATCH THE SPEED OF THIS MACHINE.

Lightning speed. That's why just about anyone doing anything with video -- from the major broadcast and cable networks to directors at sports arenas -- is doing it with the VDR-V1000 Rewritable Videodisc Recorder from Pioneer.

With 0.3 seconds average access time and two playback heads, you can be cued and ready to switch to the next segment long before the current segment is finished.

Find out why scores of O&O's, affiliates, independents, and PBS facilities including KMEX, KESQ, WSFP, WFMZ, TNN: The Nashville Network, KCOP, KCNC, KDFW, production houses like ReZ.n8 and Videofonics, and corporations like NIKE chose the VDR-V1000.

And if quick return on investment is another one of your speed requirements, call any of the following people to find out why the VDR-V1000 is your ideal machine:

Northeast-Jim Burger at (201) 327-6400; North Central-Mike Barsness (612) 758-5484; Southeast-Rodger Harvey (404) 460-7311; South Central-John Leahy (214) 580-0200; West-Craig Abrams (310) 952-3021.

PIONEER®
The Art of Entertainment

Circle (18) on Reply Card

See us at NAB, Booths 11908 & 17182.

	PICK ONE		ADD THIS	PLUS THIS
	MACINTOSH	PC	ALSO REQUIRED FOR BOTH	VIDEO EQUIPMENT
GOOD	IIci or better Minimum 20MB RAM One RGB and one multisync monitor	486DX with extended keyboard, mouse and VGA board Minimum 16MB RAM One VGA and one multisync monitor	Internal hard disk (120MB minimum) 44MB or 88MB removable disk drive 24-bit videographics card with 2MB VRAM and built-in encoder/decoder Animation controller and software Audio digitizing card	Composite VHS VCR VHS or Super VHS camcorder
BETTER	Quadra 610 or better Minimum 32MB RAM 24-bit videographics engine with 2MB VRAM and built-in encoder/decoder	486DX computer with extended keyboard, mouse and VGA board Minimum 16MB RAM 32-bit videographics engine with 2MB VRAM External encoder/decoder box	Internal hard disk (230MB minimum) External CD-ROM drive (multiple-session, Photo CD-compatible) 44MB or 88MB removable disk drive Animation controller and software Two professional video monitors (13-inch or greater) 16-bit CD-quality audio digitizing card	S-VHS, Hi8 or ¾-inch VTRs ENG-quality camera
BEST	Quadra 950 or higher Minimum 32MB RAM Internal Hard disk (230MB minimum) 32-bit videographic engine with 2MB VRAM	486DX computer with extended keyboard, mouse and VGA board Minimum 32MB RAM Internal Hard disk (230MB minimum) 32-bit videographic engine with 2MB V RAM	External CD-ROM drive (multiple-session, Photo CD-compatible) 1GB external hard disk drive 44MB or 88MB removable disk drive External encoder/decoder box Animation controller and software Two professional video monitors (13-inch or greater) 16-bit CD-quality audio digitizing card	Betacam (SP), MII or higher format VTR EFP or studio-quality CCD camera

tant to take the plunge into desktop video. In fact, with a computer as modest as a 486DX PC or a Macintosh IIci, you're well on your way to setting up a suite. (**Editor's note:** For information on Amiga and SGI systems, see "The Other Platforms," on p. 36.) As digital solutions become more widespread, the system can be upgraded to a fully digital environment.

For simplicity, the focus will be on three systems for the Macintosh and three for the PC, with a good, better and best rating. Our good system is ideal for prosumer and industrial users. The better and best systems, on the other hand, are well-suited for professional users. It's possible to start with a good system and upgrade to a best system by adding software, a more robust videographics engine and professional-level VTRs and cameras. All recommended systems feature off-the-shelf hardware and software solutions that are available at leading computer resellers or via mail order.

A good system

Whether you're working on an AT-class PC or a Macintosh, a good desktop video system should provide all of the tools necessary to create quality presentations or effective training materials. Applications include everything from business presentations to cable TV programming, trade show kiosks and video newsletters.

See the chart for the equipment lists. Optional hardware includes an optical storage device and the fastest CD-ROM player you can afford (if possible, choose a unit that offers 3X sampling rates).

On the software side, you'll need professional-quality painting and image manipulation software; switcher emulation software; image sequencing and post-production software; and 2-D animation software.

The good system should offer professional-quality video capabilities by providing full NTSC and PAL support in a variety of color and spatial resolutions. In addition, frame-accurate animations and special effects using digitized sequential frames of video can be performed. The videographics card or engine controls all of your hardware and software. The type needed for the good system should offer the following functions:

- Onboard encoder/decoder. Allows conversion of video signals from RGB to composite or S-video and back.
- Digital linear keying. Linear keying lets you lay graphics over video. In addition, you should be able to fade to any of 256 colors and crossfade between two color images over a live video source.
- Digital Chroma-keying. Chroma-keying lets you overlay live video against a computer-generated background.
- Video capture. Allows live or recorded video to be captured as digital images for incorporation into video presentations or even desktop publishing documents.

All of these features should be accessible through the video-production software, which often comes bundled with the board.

Who is using good systems? The Florida Farm Bureau in Gainesville, for example, produces video newsletters on its Macintosh II system. Hardware includes a Mac II, accelerator board, videographics engine, 13-inch RGB monitor, 13-inch multimedia monitor and two ¾-inch VTRs.

In Colorado, Gaviota Graphics uses four 486 PCs coupled with a 24-bit videographics engine, S-VHS single-frame recorder and various 3-D modeling and video production software to create 3-D architectural models and animations.

JVC's 525 IS KEEPING SOME VERY IMPRESSIVE COMPANY

BR-S525 EDIT-FEEDER WITH SLOW MOTION

JVC PROFESSIONAL

When we first introduced the 525, we thought you would be amazed by the player's impressive combination of slow-motion playback, excellent picture and low price. But now we're the ones that are amazed. Because, so many of you are finding tremendous success linking the 525 not only with S-VHS systems, but with a myriad of high-end systems.

525 advocates can be found not only among broadcasters, but even at the largest production houses. If you're a video professional employing S-VHS, and either Beta, MII or 3/4", you can now attain slow motion and reverse edits with a unit that's priced thousands less than comparable units from other formats.

The 525 features a TBC with component outputs which allow for its easy link-up. And, JVC's innovative Variable Tracking System provides for noiseless variable-speed playback at speeds from -2x to +3x normal. The unit also boasts JVC's advanced Digital Noise Reduction technology, which improves the signal-to-noise ratio by up to 5dB – all while delivering the most impressive picture quality.

To see first-hand how easily the award-winning 525 can link with your S-VHS, Beta, MII, 3/4", digital or nonlinear system, visit your nearest JVC dealer or call **1-800-JVC-5825.**

JVC. The three most important letters in S-VHS.

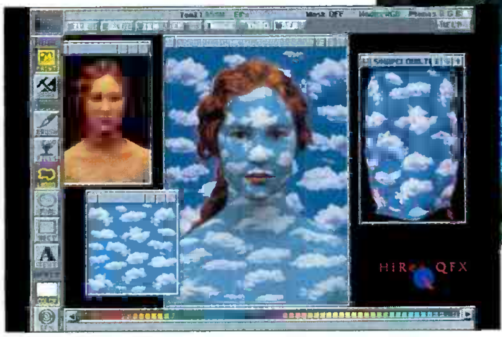
Circle (19) on Reply Card

Upgrading to a better system

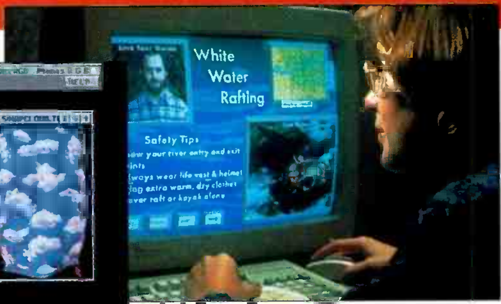
Progressing to a better system takes you from the industrial world to broadcast-quality video production. Better systems provide capabilities including 3-D special effects, frame-accurate editing, on-line and off-line editing, alpha key signal output, rotoscoping, 2-D and 3-D modeling and animations. Typical applications include animated programming, video production, TV news graphics and video messaging.

In the PC world, this system requires upgrading to a full-frame videographics engine that can work in a 32-bit/pixel (red/green/blue/alpha) environment. This solution allows graphics as large as 1,024x1,024 pixels per frame (compared to the 512x512 pixels per frame capabilities of the good system). The higher resolutions require an optional external encoder/decoder box.

Other hardware includes a frame-accurate animation controller, plus high-end S-VHS, 3/4-inch or Hi8 VTRs. The camera should be ENG quality. The Mac system consists of a 68040 Quadra or better, 16-bit, CD-quality audio board, additional RAM, frame-accurate animation controller and a 3-D image editing program.



Screen shot of image compositing on a PC-based desktop system using special effects software. (Photo courtesy of Ron Scott Inc.)



If you own a 486DX or a Macintosh IIci, you're well on your way to setting up a desktop suite. (Photo courtesy of Truevision Inc.)

McDonnell Douglas in Huntington Beach, CA, uses a Macintosh Quadra 900-based system to create Hollywood-styled videos to keep NASA, the U.S. Congress and the media informed about its development work for Space Station Freedom. In Washington, DC, Varnet Communications uses a 486-based video production suite to create everything from animations to business videotapes.

The best system

The jump from better to best takes you to the world of component digital serial (D-1) video. These top-of-the-line desktop video systems allow you to perform full on-line and off-line editing functions, as well as rotoscoping, character generation, 3-D rendering and frame-accurate editing. Applications for the best system include broadcast production, commercial production, high-end animations and network broadcasting.

The users of these high-end desktop video solutions include Markay Enterprises, based in Toronto, who is producing award-winning educational cartoons using a Quadra 950-based desktop video suite. In Moscow, a company called Clip-Makers uses its 486-based desktop video suite to create American-style animations for Russian television.

What should you spend?

Desktop video is becoming increasingly affordable. If you're ready to take the plunge, you'll need to budget between \$3,500 and \$5,000 for a good system. A better system will cost you between \$6,500 and \$12,000, and the best system will range from \$15,000 to \$25,000. These prices are for the platforms and do not include peripherals, such as tape machines and cameras.

Finally, when making decisions on hardware and software, here are a few things to consider:

1. Purchase as much RAM as you can afford. Although 8MB of RAM is adequate for some applications, you'll see a marked improvement in system performance using at least 24MB of RAM.
2. Purchase the largest disk drive you can afford. Graphics files consume huge amounts of disk space and images from 200MB to 300MB in size are common.
3. Purchase a computer that has a full upgrade path to future systems. For the Macintosh, that means stay away from old Mac II series computers, except the IIci. On the PC side, look for a 486 or Pentium-based system.
4. If you can afford a CD-ROM drive, get one. Manufacturers are offering great deals on CD-ROM players and outstanding libraries of public domain clip art and

QuickTime and VFW videos are available.

5. Talk to someone who already is producing videos on his or her PC. Try that person's system and ask about the system integrator or reseller.

6. Free guides are available to help you navigate through the process of selecting a desktop video system. ■

The other platforms

By Steve Epstein, technical editor

So, you're thinking about desktop video, but the computer that happens to be on your desk is not a PC or a Mac. Well, even though the Commodore-64 had an internal NTSC/PAL jumper and a component video output, it and the other computers of that era are not suited for video. On the other hand, Commodore's Amiga, with help from the Video Toaster folks, is the computer behind the revolution. At the other end of the spectrum is Silicon Graphics, whose computers are behind a large percentage of the hi-tech 3-D graphics coming out of Hollywood.

Commodore's Amiga

The Toaster is probably the one accessory for the Amiga platform that everyone thinks of first. However, it's not the only application available. One thing to remember when comparing it with other platforms is that processor tasks are distributed among dedicated processors. Therefore, comparing clock speeds with other computers is not always an accurate indicator of the system's speed and power.

The A4000 is based on the 68040 chip and runs at 25MHz and features the AGA chipset for graphics. The AGA chipset is capable of 262,000 colors in high-resolution graphics. Output is component RGB that can be connected to standard NTSC RGB inputs. For composite video, an external encoder is required. Additional adapter cards are required for video in, genlock and video capture. Also available are 24-bit graphics adapters. Internal audio in the Amiga is 8-bit, but several 16-bit audio cards are available. MIDI cards also are widely available.

Other features of the Amiga line include a parallel port, two mouse ports and an RS-232 port standard. The internal hard drive bus is IDE in the A4000; SCSI in the A3000. A 3½-inch high-density floppy drive is standard and can write PC-compatible disks. Additional software allows Mac-compatible disks to be written as well.

SGI

Silicon Graphics systems start at $4,995 for the Indy. However, unless you have other SGI systems that can be networked to the Indy, plan on spending twice that amount to bring the unit up to a workable stand-alone level. Of course, if you have the budget, there are plenty of RISC-based models in the SGI line from which to choose. In addition to systems, some of the most powerful software available for 3-D graphics is written to run on the SGI platform.

The Indy features a 100MHz, RISC 4000 microprocessor. The standard RAM complement is 16MB, which is expandable to 256MB. Both S-video and composite video input is standard. Video out, however, requires an output card. Indy can handle four stereo channels of audio with line-level stereo analog and serial digital stereo I/O. A microphone input and stereo headphone output round out the complement of audio connectors. Audio sampling rates include 48kHz, 44.1kHz and 32kHz and can be set independently for input and output.

Networking the Indy to other machines increases its out-of-the-box functionality. Network connections include ethernet AUI, ISDN and ethernet 10base-T. As you'll notice, there is no shortage of connectors on the back panel of this computer. Inside are two GIO-32 slots and room for two internal 3½-inch drives. Other models in the SGI line include the IRIS Indigo, Indigo² and the Onyx.

As usual, the question comes down to short-term vs. long-term needs and budgets. The Amiga and SGI platforms have plenty to offer, and each has advantages and disadvantages. The Amiga is an excellent way to get started. As demonstrated by *Seaquest DSV*, it can take you all the way to the networks. SGI, on the other hand, is way out in front in terms of sheer power and capability. Of course, there is a dollar value attached.

One approach is to find the software you need to accomplish your task. Then, determine what is needed to run it and what it will cost. Armed with that information, you'll be able to make the decision a little easier. ❑

➡ For more information on desktop platforms, circle the following numbers on the Reply Card. Also see "Desktop Video Systems" on pp. 60-61 of the 1994 BE Buyers Guide.

NewTek (Amiga) (301)
Silicon Graphics Inc. (302)

For the free guides:

Mac-Desktop (303)
Mac-Professional (304)
PC-Desktop (305)
PC-Professional (306)

WE'VE SOLVED THE KNOTTY PROBLEM OF INTERFACING YOUR AUTOMATION, ROUTERS AND MASTER CONTROL.

Utah Scientific is the *only* source for a completely integrated broadcast automation system. TAS, our Total Automation System, effectively squeezes seconds into the day and makes control effortless. TAS speaks directly to our AVS family of routing switchers and the MC-500 Master Control Line, featured in more stations than any other single master control switcher.

This system is unique in the industry. With it, Utah Scientific has powered working solutions for important customers such as CBS-TV, WGN and Star Television, Hong Kong.

And now, the transition to digital is in your reach with our new DMC-601, the world's *first* Digital Component Master Control Switcher. The DMC-601 is easily upgradable from Utah's famous MC-500 series, smoothing the transition to digital at the important final step before you go on-air.

Let Utah Scientific help you make the right tie. Call 800-453-8782. Knot calling could be costly.

utah scientific

4750 Wiley Post Way, Salt Lake City, UT 84116-2728   United Kingdom FAX: 44-734-892022 PHONE: 44-734-890111   Hong Kong FAX: 852-525-8297 PHONE: 852-868-1993

DYNATECH
VIDEO GROUP
The best professional video in the world

ALPHA IMAGE • ALTA • CABLE PRODUCTS • CALAWAY EDITING • COLORGRAPHICS • D²S² • DA VINCI • NEWSTAR • QUANTA • UTAH SCIENTIFIC

Circle (22) on Reply Card

Desktop radio

The next wave of radio technology is coming to a desktop near you.

By Laurie Rachkus Uttich

The Bottom Line

Although digital cart machines have begun to replace their analog counterparts with high-tech, but essentially similar devices, another class of digital audio storage systems has taken a different tack. Foregoing the tradition of removable, single-cut media, these systems store audio in files on random access, mass-storage, PC-based systems. This so-called "desktop radio" approach offers advantages in control, management and integration, leading some to conclude that it represents the future of radio operations.

Many broadcasters can still remember how cart machines changed their lives. The broadcast cartridge ushered in a new era of radio. It was a revolutionary change, and one that many had not considered necessary before to its emergence. After it happened and broadcasters moved to the new technology (some willingly, others not so willingly), it became hard to imagine radio operating any other way. Until recently, this has remained true.

As cart technology progressed, broadcasters expected—and received—more. The cart machine's abilities were maximized to the point that it could handle multiple functions, making radio operations increasingly easier and radio businesses more efficient.

Today, digital computer systems provide the next wave of audio storage and management technology in the form of what's been called *desktop radio*. It seems about to set off a similar cycle of change in the industry.

The advantages

Like many other emerging technologies, desktop radio promises "faster, better and easier." This implies that there is a need for such improvements or else there would be little market for such a product.

Uttich is communications consultant for International Tapetronics Corporation, ITC, Bloomington, IL. Respond via the *BE* FAXback line at 913-967-1905.

Acknowledgments: The author wishes to thank Charlie Bates and Willem Bakker of ITC for their assistance on this article.

Although broadcasters are often accused of settling for the way things are instead of focusing on the way things could be, a well-crafted desktop radio system may provide desirable new levels of efficiency with a minimum of transitional upheaval. This could qualify the technology as a true breakthrough.

Although desktop radio systems differ dramatically among manufacturers, the systems' basic concepts are fairly consistent. Simply put, a desktop radio system consists of a hardware and software package that operates as a transparent, monolithic audio storage and production device, often allowing a varying number of workstations to be linked via a local area network (LAN). Integration to other station equipment and systems also is typically offered. (See Figure 1.) Such a system can beneficially affect separate areas of a station, comparing favorably to many earlier breakthroughs that focused on a single element of the operation.

With the proper interfaces, all of the basic components of station operations can be linked to a desktop radio system. Ideally, sound quality and playback equipment reliability is enhanced, on-air personalities are assisted, walk-away automation is possible, spots are easily produced and recorded, traffic is preprogrammed directly to the studio, and paper logs are replaced by computerized documentation.

These functions are only possible, however, if the desktop radio system has the

Continued on page 42

Overheard in all the best places.

It's the new **Matrix Plus® II intercom system**. The system that more and more broadcast professionals and system integrators are starting to talk about. Matrix Plus II builds on the remarkable strengths of the original Matrix Plus—the new industry standard for high-performance communications. Matrix Plus II is a truly integrated, **100 x 100 digitally-controlled intercom** with easy-to-use visual display stations, a comprehensive modular interface system, external DTMF system control, and simplified, pull-down menu programming. Exclusive features include **"Intelligent System Linking"** of multiple systems for expansion beyond 100 ports, and global remote control over crosspoint levels. There's also improved station communications for **long-line remote capability**, as well as optional, fully digitized single-pair wiring. Plus much more, including the highest level of service and support in the industry. Want all the details? Call us at **(510) 527-6666**. The Matrix Plus II. You'll be overhearing more about it.

Matrix Plus II

FROM CLEAR-COM INTERCOM SYSTEMS

See Us at NAB! Booth #18015

Circle (23) on Reply Card

945 Camelia Street, Berkeley, CA 94710. Tel. 510-527-6666, Fax 510-527-6699
International: PO Box 302 Walnut Creek, CA 94597. Fax 510-932-2171

Supercam is yet another milestone in the development of Panasonic's S-VHS video recording systems.

MORE CREATIVE CONTROL WITH DSP.

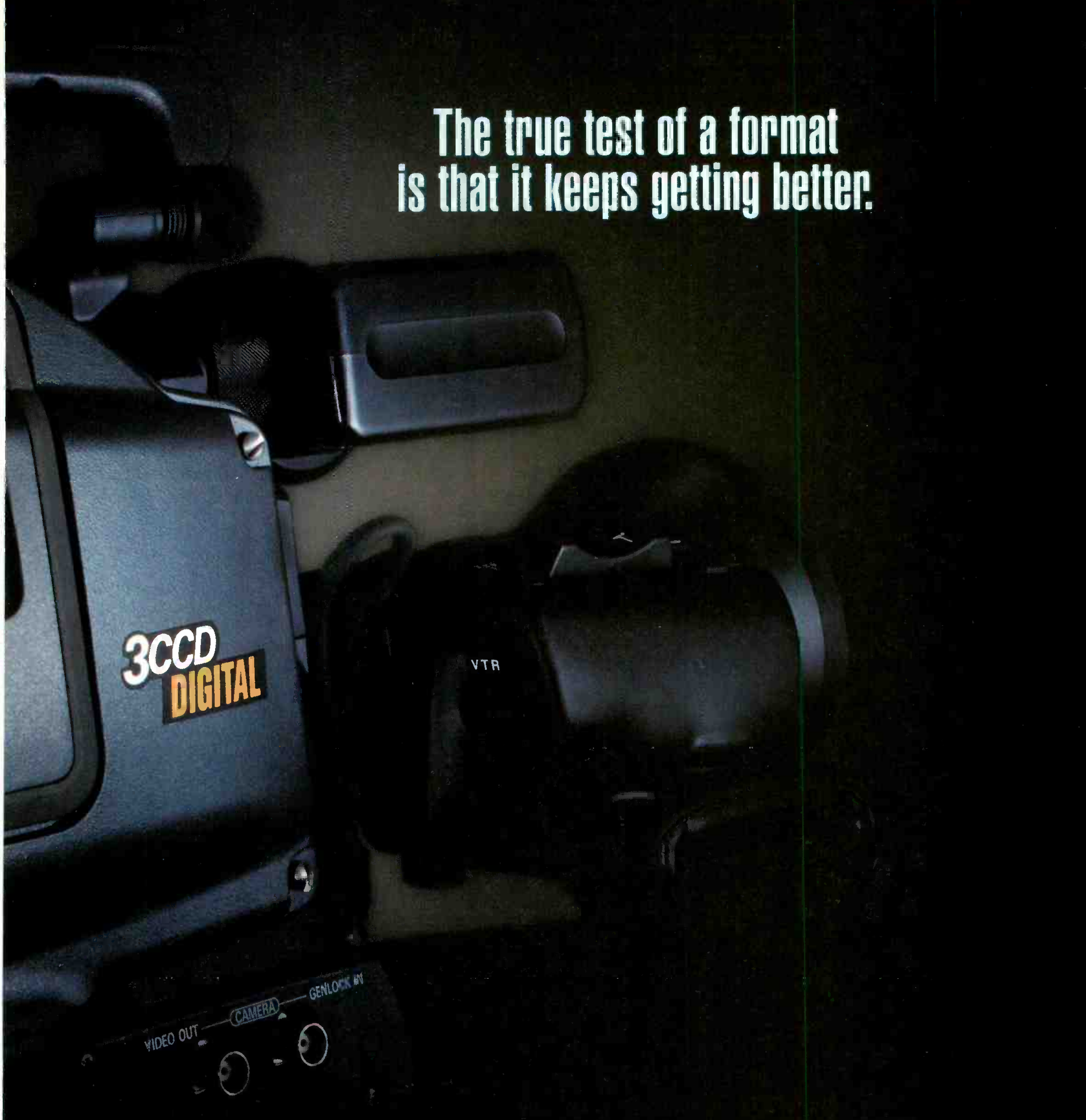
Supercam features Panasonic's EMMY-award winning Digital Signal Processing, 3 CCD camera technology for consistent high quality images with greater reliability.

Supercam means the world's most advanced digital camera technology is now available to users of Panasonic's S-VHS, which is rapidly becoming the world's most widely used professional video recording format.

EXTREME LOW LIGHT PERFORMANCE.

Today, S-VHS provides high quality images—even

For more information call: 1-800-528-8601 (Upon request enter product code 21) One Panasonic Way, Secaucus, NJ 07094.



in extreme low light conditions—for most professional applications including: ENG, sports and event videography, post-production, computer graphics, and on-air operations for broadcast, cable and corporate television.

HIGHER QUALITY AT LOWER COST.

Now, broadcast and professional videographers can get their hands on the most advanced digital camcorder technology for a fraction of the cost of typical broadcast studio and EFP cameras.

Panasonic's Supercam. Further proof that Panasonic's S-VHS keeps looking better all the time.

Panasonic
Broadcast & Television Systems Company

Continued from page 38

appropriate capabilities. These include scheduling and control of multisource audio reproduction (CDs, hard disk audio files, remotes and network feeds), flexible audio production facilities, databridge interfaces to traffic and music scheduling, and accounting systems and hardware interfaces (audio and control) to ancillary broadcast equipment. Furthermore, all scheduled events should be electronically logged as successfully or unsuccessfully completed, and this data should be optionally available for printout.

Hardware configurations (especially the critical user interfaces) span wide ranges among today's desktop radio systems. Terminal hardware is available in compact desktop or expandable rack-mount forms, allowing various mounting configurations. User-interface possibilities include QWERTY keyboard, mouse/trackball, touchscreen and dedicated, specialized control surfaces. Popular among the latter are devices with control hardware that emulate mixing-console faders and/or tape-deck transport controls.

Digital differences

Hardware and software differences separate desktop radio suppliers, making each system unique in its capabilities and operational style. Although nearly all vendors offer a base system that adequately delivers the fundamental desktop radio concept, most configurations are no more than off-the-shelf consumer computer systems adapted to broadcast applications. This setup can keep initial investment costs low and hardware maintenance simple, but advanced digital systems that are designed exclusively for broadcasters' needs also are required. These requirements incorporate interfaces and capabilities that increase a desktop system's utility and efficiency.

Some of these special needs include multitasking ability for performing simultaneous on-air and production work (and/or for multiple program streams from a single system at LMA/duopoly facilities); automated mixdown for production work; high levels of redundancy in powering and storage; fast and flexible tape backup; and comprehensive machine control, external audio and data-bridge interfaces, affording the system a high level of integration into a station's operations.

Another advantage of desktop radio involves its ability to make local spots match the audio quality of CD-originated programming. Digital audio production greatly reduces the likelihood of storage and processor artifacts, such as signal-to-noise, distortion and particularly wow and flutter, while offering nearly unlimited playback iterations without degradation. Powerful and user-friendly production software also will allow creative staff to stretch their skills and productivity, thereby getting more effective spots out of the production room in less time.

Automation

Broadcasters at every market level are now using automation. Many who aren't using it are seriously considering its application. Whether they choose to automate only low-rated dayparts (like overnights) or decide to go completely automated, desktop radio systems can again provide a cost-effective solution.

With appropriate software and adequate audio I/O, switching and mixing capabilities, many desktop radio systems allow simultaneous on-air program management, commercial production and automatic recording of network feeds. Some systems also allow precise time-shifting of network audio, which lets the system respond to all commands from the satellite service while reproducing local liners, legal IDs and jingles in any manner programmed into the playlist — even matching talent-specific content with the network. When properly handled, such a system can provide automated operation without an automated sound.

The amount of local content that may be stored and the amount of time allotted for unattended operation are only limited by the maximum amount of storage with which the system can be outfitted. Stations considering automation of any

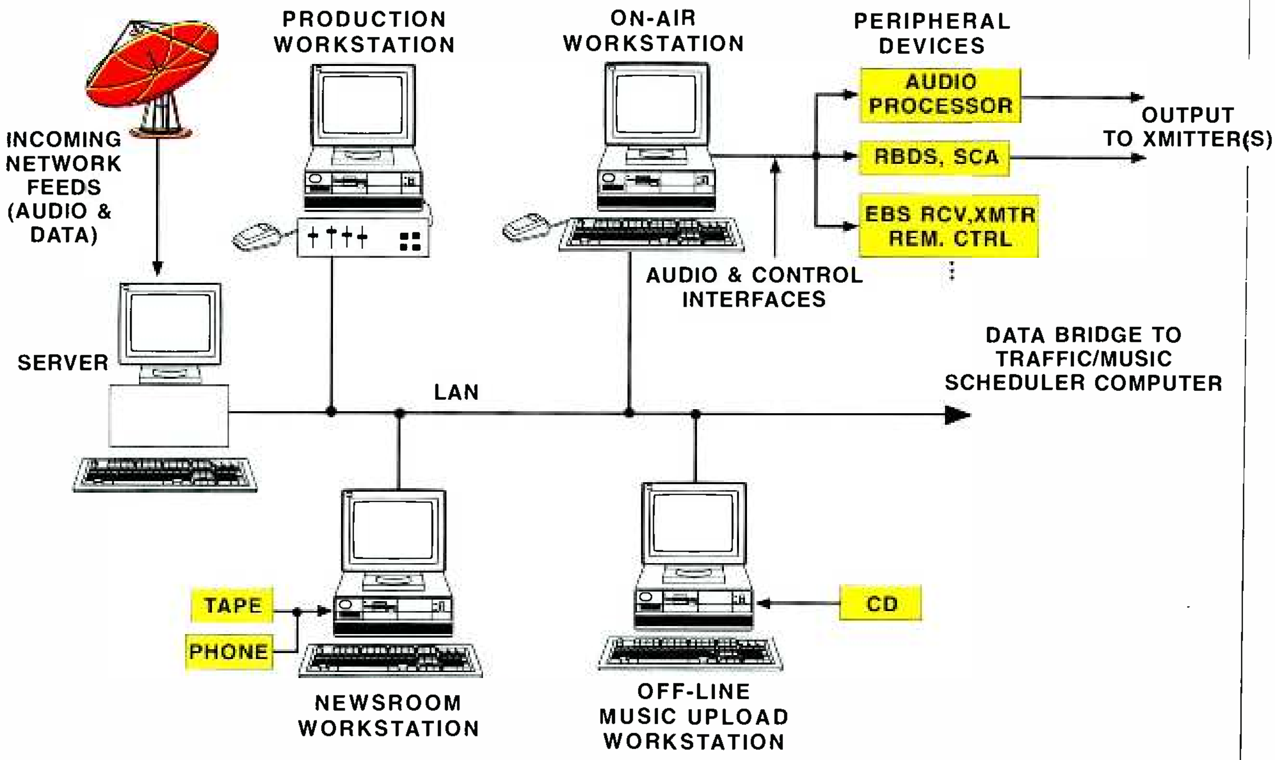


Figure 1. *Conceptual block diagram of a fully developed desktop radio system, incorporating automation, storage, routing, external device control, data-bridging to other computer systems and various levels of audio and text manipulation/production.*

kind should examine each system's range of features and base system configurations before purchasing anything.

Live-assist flexibility

Although digital systems will make automation possible, many broadcasters (especially those in larger markets) will not choose to completely automate their stations, for obvious programming reasons. Naturally, no computer can replace good, live on-air talent. Nevertheless, a desktop radio system can complement the operation of a live announcer/operator, facilitating his or her on-air work just as it does for virtually every other department in the station. Such live-assist operation has been the focus of several desktop radio manufacturers' most recent developments.

Some manufacturers refer to live-assist as *semi-automated* operation, correctly implying that with the system's assistance the on-air personality is free from extensive machine or media manipulation. This allows the "morning zoo" to run even more naturally, for example, without technical headaches and hang-ups complicating the air personalities' acts.

With an advanced digital system, such combo talent/operators can build their program ahead of time, selecting specific music cuts, sets and segues, and adding studio microphone and telephone drop-ins (both live and prerecorded). A common user-interface for quick, easy access to these processes provides easily identifiable on-screen icons and point-and-click selection, eliminating the need for QWERTY keyboards and high computer literacy skills among operators.

In some digital systems, menus of cuts can be set up off-line, before the on-air program, at a terminal in an office area or somewhere else outside the on-air studio. These cut lists can be subdivided into separate on-screen pages to minimize searching for a particular cut when on the air in live-assist mode. When these menus are linked to a traffic and music interface program, the cuts and sets are automatically arranged hour-by-hour and displayed as required in real time. Some systems offer the ability to preselect an entire day's (or week's) programming, either directly or via the traffic computer.

For on-air talent to keep the fast or smooth pace that the station's format requires, a desktop radio system must be minimally capable of playing three simultaneous stereo, uncompressed audio channels in the on-air studio. Each channel also must be brought out on separate audio outputs, allowing for independent downstream control and routing of multiple channels without restrictions.

Production and editing

Desktop radio systems should offer production directors advanced production and editing capabilities. One valuable new feature offered by some systems is time compression/expansion, which allows producers to adjust a spot to fit its required time slot and to end the repetitive process of getting it just right in real time.

A typical desktop radio system includes a rack-mountable CPU/disk drive, a VGA monitor, a trackball or mouse and a QWERTY keyboard.

Other features allow the producer to generate tight cues without depending on a CD's liner note inaccuracies; to trim the heads and tails of audio cuts; to set intro and outro timing marks for tight voice-overs; and to easily add, delete or move cue tones (now control points). These possibilities of desktop radio production will reduce production time and frustration levels, and will allow new levels of quality to in-house productions.

Making the transition — painlessly

Although some have tried, completely reinventing the wheel is rarely a successful approach to refining an existing technological process. Likewise, completely restructuring the radio station could be equally disastrous. For a smooth transition to desktop radio, the system — especially the display screen and control surface — must be familiar to existing operators or broadcaster-friendly.

Other important factors for easy conversions to digital include on-site training and total networking capability. Some digital system suppliers also can access a station's system remotely to diagnose and correct problems quickly.

Meanwhile, technology will keep progressing, and digital systems, like analog systems, will progress with it. Preparing for the future is somewhat easier with digital systems, however. Unlike analog machines, which often had to be replaced or refurbished, many digital systems are expandable and upgradeable, allowing at least some amount of future-proofing and subsequent growth.

One note of caution: Many of today's desktop systems are already heavily taxing their CPUs. Because they involve the processor in moving data from the hard drive to the DSP board for conversion, these systems limit their CPU's capability to perform other tasks. These systems already require expensive, high-speed processors (486-33+) to maintain reasonable performance, so they will be limited in their ability to expand.

To meet tomorrow's needs, broadcasters need a digital structure that allows for high data transfer rates to/from storage devices and DSP or I/O boards, while leaving the CPU available for servicing the mouse, keyboard, display, LAN, serial ports and processing commands from on-air and production personnel. Without these capabilities, this wave of technology will be ultimately unsuccessful.

When to buy?

This debate isn't a new one. With every breakthrough in technology, industry leaders fight with the decision to embrace change or hold out until new technology has been proven by experience. Although many may concede that the change would be beneficial, other factors still hold them back. Some broadcasters struggle with the investment while others become frustrated with poor designs of available systems.

As the industry comes to terms with the spending decision while searching for a system that will maximize investments, you may wonder whether you're ready to join this new world of technology. This question can only be answered after closely researching each system's design and its ability to meet your needs for today and tomorrow. After you discover and select the system that's right for you, once again you'll probably find yourself wondering how your station ever operated without it. ■

➡ *For more information on desktop radio systems, circle (307) on Reply Card. Also see "Recorders, Audio," p. 56 and "Playback Automation," p. 72 of the 1994 BE Buyers Guide.*

NTSC/PAL

Switch Hitters

Model 5212 NTSC/PAL Vectorscope

Model 5222 NTSC/PAL Waveform Monitor

At home in both worlds, Leader's new Model 5212 Vectorscope and Model 5222 Waveform Monitor fill the monitoring needs of facilities that operate in both NTSC and PAL television systems. Switch-hitting is automatic, and system flexibility is extended by universal power supplies that accept power sources from 90 to 250 Vac, 48 to 440 Hz and 11 to 20 Vdc as an option.

Both units are microprocessor controlled. This translates into a wide range of system tailoring to fit individual needs, while keeping front panel controls simple and familiar.

The vectorscope, Model 5212, features three channel operation with overlay display of the three signals. Automatic phase-set places burst from the selected reference precisely on the -(B-Y) axis, and this includes an external reference. Phase accuracy is ±1°, and a digital readout shows the phase of selected vectors with respect to the burst reference. A simple method of measuring differential phase and gain is provided, with digital on-screen readout. X-Y (Lissajous) display of stereo audio is also provided.

The waveform monitor, Model 5222, features eight channel operation. Picture display is included. Line select operation offers readout in both NTSC or PAL (SECAM III) notation. Selected line(s) are highlighted in the picture display and in the combined 1V/1H display. Cursor measurements apply to both time and level and provide 0.5% accuracy.

White phosphor CRTs are options for both units.

Call toll-free

1 800 645-5104

In NY State

516 231-6900

LEADER
FOR PROFESSIONALS WHO KNOW THE DIFFERENCE

Leader Instruments Corporation, 380 Oser Avenue, Hauppauge, New York 11788
Regional Offices: Chicago, Dallas, Los Angeles, Atlanta. In Canada call Omnitronix Ltd., 416 828-6221

Circle (55) on Reply Card

Ergonomics for desktop systems

Don't forget the human engineering when designing desktop facilities.

By Dr. Walter P. Black

The Bottom Line

A desktop production system's good economics can be nullified by its poor ergonomics. Although great emphasis is placed on desktop systems' technical design, little thought is given to their physical layout. The concentration of the operator's focus on fewer devices (compared to the traditional suite) multiplies the problems that improper design can cause. A number of techniques and accessories can minimize user stress/injury and maximize productivity.

$

When desktop video systems (DVS) were first introduced, it seemed a perfect opportunity for manufacturers, integrators and users to overcome the ergonomic difficulties of large-system design. The production workplace would be divesting itself of the 6-foot-long audio mixer with an infinite number of knobs, the huge video switcher, the bulky edit controller, the DVE console, the character generator, the 50-screen monitor wall and the graphics animation system, all to be replaced by a computer screen, digitizer, keyboard and a VCR for input and output.

The ultimate, user-friendly production environment was sure to result. Unfortunately, this is not what has happened. In practically every example of today's desktop video system installation, basic ergonomic principles are violated in multiple ways. (See Figure 1.)

Help stop DVS injuries

Instead of designing new concepts where humans mold machines to their physiques, the industry is creating more examples of machines hurting the physique. It is likely that more cases of Repetitive Motion Injuries (RMIs) will be encountered, which already account for 56% of work-related injuries.

RMIs are not just confined to the Carpal Tunnel Syndrome (CTS) — a painful inflammation of muscles and nerves from the arm passing through the wrist to the hand, which is caused by moving the arm and wrist in unnatural positions. RMIs also include stress in the eyes, neck, shoulders, back, arms, legs and feet. There are many ways to relieve stress and injury by keeping these body areas in more natural positions. The requirements of each of these areas are defined as follows:

•*Eyes*: Eyes are sensitive organs. Extremes in motion, positioning, brightness and contrast can cause undue exertion, which leads to total body fatigue. (See the related article, "Ergonomics and Vision," pg. 67). The top of the video monitor should be level with the eye, while the normal vision center is 15° down from straight ahead, extending to an optimum image-bottom position of 30° down from straight ahead. Optimal distance from eye to monitor is 20 inches. (See Figure 2.)

In today's desktop video system installations, basic ergonomic principles are violated in multiple ways.

•*Neck*: When monitors are placed too high or are two or more across, or if a full-size digitizer with tablet overlay is placed beside the keyboard, the neck must con-

Black is the creator of VidCAD and principal of Video Design Pro, Las Cruces, NM, an engineering software company that specializes in design and documentation of communications systems. Respond via the *BE* FAXback line at 913-967-1905.

TIED TO THE JOB?

But have you ever thought about professional digital audio editing? Too slow? Too expensive? Difficult to understand? SADiE™ Disk Editors have changed all that. For a start SADiE™ runs on a PC, so you get much more computer for far less money. It has a fully functional Windows 3* user interface, non - destructive sample accurate editing, real time cross fades and up to 8 track playback with real time digital mixing, bounce down, overdub, EQ and dynamics control. And real time saving.

SADiE™ Disk Editors have sold worldwide into broadcast, post-production, studios and mastering organisations, so its already been well and truly put to the test out in the field. SADiE™ Version 2 incorporates many of our customers suggestions. Talk to them about our commitment and service, if you don't know a SADiE™ user in your area, we can easily put you in touch.

Tied to the job or just tired of the job - why not free up a couple of minutes today and phone or fax for some more information.

- *Windows 3.1* on 486 host computer*
- *Rapid graphical editing*
- *Clear user interface*
- *Local SCSI drive fast audio access*
- *All crossfades calculated in real-time*
- *Fully non-destructive, sample accurate editing*
- *Up to 8 track playback with real-time mixing*
- *Unique Trim Window allowing real-time adjustment of audio*
- *Jog and shuttle scrub modes*
- *AES/EBU, SPDIF and analog I/O*
- *All standard sample rates*
- *Full SMPTE timecode support with chase and trigger lock*
- *16, 20 and 24 bit digital audio editing*
- *Bounce down*
- *Overdub*
- *Reverse playback*
- *Real-time dynamics control*
- *Real-time EQ*
- *Real-time digital resampling*
- *Real-time duration change*
- *Real-time noise reduction*

BRITISH INNOVATION

MANUFACTURED IN THE EUROPEAN COMMUNITY BY STUDIO AUDIO & VIDEO LTD

Studio Audio & Video Ltd
The Old School, Stretham
Ely, Cambridge
CB6 3LD. UK
TEL: +44 (0)353 648888
FAX: +44 (0)353 648867

USA

Studio Audio Digital Equipment Inc
1808 West End Avenue
Suite 1119
Nashville, Tennessee 37203
USA
TEL: +1 615 327 1140
FAX: +1 615 327 1699

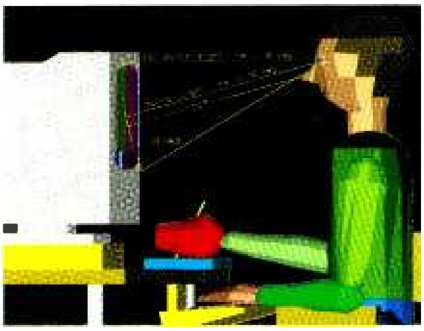
SADiE DISK EDITOR

Circle (25) on Reply Card

SADiE™ DISTRIBUTORS WORLDWIDE

Argentina Kappa T 081 31 0818 F 081 31 1493 • **Asia Pacific** VW Marketing T +44 372 728481 F +44 372 724009 • **Australia** Audio & Recording T 02 316 9935 F 02 666 3752 • **Canada** JSGS Ltd. T 416 751 7907 F 416 751 7975 • **China** Wo Kee Eng. Ltd T +852 774 2628 F +852 363 7808 • **Denmark** SC Sound T 43 99 88 77 F 43 99 80 77 • **Finland** oy HedCom AB T 90 682 866 F 90 682 8489 • **France** Coach Audio T 87 77 00 00 F 87 77 01 21 • **Germany** Stefan Mayer Audio Engineering T 0 6851 6519 F 0 6851 6519 • **Hong Kong** Digital Professions Ltd T 318 0588 F 305 1455 • **Israel** Sontronics Electronic Equipment T 03 5705223 F 03 6199297 • **Korea** Avix Trading Co. Ltd. T 02 565 3565 F 02 565 3561 • **Philippines** Tracks T 2 631 3277 F 2 631 3267 • **Poland** Unico T +44 223 63025 F +44 223 301488 • **Singapore, Malaysia, Indonesia** Team 108 Technical Services T +65 748 9333 F +65 747 7273 • **South Africa** Tru-fi Electronics SA (Pty) Ltd T 011 462 4256 F 011 462 3303 • **Spain** Lexon T 93 203 48 04 F 93 280 40 29 • **Sweden** Tranzicom T 08 730 3710 F 08 730 5125 • **Taiwan** Acesonic T 2 716 8896 F 2 719 2065 • **Thailand** KDM Trading T 2 318 2724 F 2 318 6186 • **USA** SADiE Inc T 615 327 1140 F 615 327 1699 •

Figure 1. *Identify five problems with this DVS. (Answers: 1. Desk too high [34 inches]. 2. Arms in uncomfortable position. 3. Two too many monitors and placed too high. 4. Monitors too small and too far away from eyes. 5. Keyboard is too far away.)*



MONITOR SIZE (diagonal)	OPTIMUM RESOLUTION	MIN. DOT PITCH
14"	800 x 600	0 28
17"	1,024 x 768	0.28
20"	1,280 x 1,024	0 30
21"	1,600 x 1,280	0 30

Figure 2. *Proper position and specifications of monitors for desktop video systems.*

tinually move to keep the eyes comfortable. Severe neck pain is a growing RMI problem. There is evidence that neck compression is related to CTS pain.

•*Back and thighs*: How many teachers told you to sit up straight with your shoulders back? So you did — for about two minutes. This is partly because it is an unnatural, uncomfortable position. The more natural sitting position curves the back slightly, with a 100° to 110° angle between back and thighs. This can be achieved through forward-tilting of the chair seat or reclining of the back.

The back also needs constant support, enhanced by an adjustable lumbar support. Chairs with variable forward tilt, adjustable seat length (for longer/shorter thighs) and variable back angle and tension should be chosen. It is important that the chair back follow and support the back in any position, such as the Back Hugger chair shown in Figure 3, which helps with side-sitting as well as leaning forward or back.

Thighs should fit comfortably into the saddle and be parallel to the floor or have a 10° to 15° tilt down to the knees. (Most ergonomic chair manufacturers have multiple seat options.) Because every physique is different, it is better to try different back and seat styles to find one that fits you. Well-designed chairs cost between $500 and $1,500 but will return great dividends through reduced fatigue.

•*Feet*: The feet must be at a comfortable height to equalize pressure along the thighs. A short person needs a foot rest to accomplish this. A foot rest is normally level for both feet, easily adjustable in height and rake angle without tools or stooping to the floor. (See Figure 4.) For all users, a periodic movement of the foot support keeps back muscles in tone and allows the thighs to equalize pressure.

•*Shoulders*: Multiple keyboards or keyboards combined with digitizers make shoulders work unequally (see Figure 5), causing strain on shoulders, back and neck. All arm motions should be contained within the normal 19-inch shoulder width. If a desktop system uses a digitizer, the 19-inch reference will always be a problem, because the keyboard and the digitizer are each 19 inches wide, and both should be directly in front of the user. The choices for a solution are as follows:

•Put the digitizer up to 45°, which will cause pain in the back, shoulders, arms and wrists.

•Put the keyboard behind the digitizer (see Figure 1), which will cause radical extension of arms and uncomfortable back and thigh angles.

•Place the keyboard under the digitizer on an articulated keyboard holder. (See Figure 6.)

•Use a smaller 6x9 digitizer and smaller keyboard.

•Get a 3-button mouse.

Figure 3. *Grahl "Hugger" chair offers split back support and pivoting elbow rests that give arm and shoulder support and mobility.*

Note that if the desktop/keyboard height is 30 inches or higher, the arms will naturally move outward, causing increased wrist-flex angles, which quickly lead to CTS and shoulder strain.

•*Arms*: Traditional inflexible arm rests bump into desktops and cause shoulder elevation or slumping. Articulated supports move with the arm and offer positive stress relief. The elbow support helps keep shoulders even while arms have full-motion horizontally with partial vertical motion and doesn't bump desktops.

Articulated forearm supports keep the forearm in the same horizontal plane as the keyboard but allow free horizontal movement. (See Figure 7.) Forearm supports force the hand and wrist angles to be at natural angles. Backsaver and Dominion Blueline manufacture wrist supports that mount to the desktop.

•*Hands*: Most keyboards are tilted forward from 10° to 20° and have flip-down rear feet that can add another 10°. This has been done to enhance the readability of the keys (there are few true touch-typists), but it forces the wrist to flex awkwardly, leading to CTS.

Wrist or palm support of proper height (see Figure 8), lower desktop and keyboard height, arm support and negative keyboard tilt can all reduce CTS risk substantially. For desktop video systems, an articulated keyboard drawer below the mouse or digitizer (see Figure 9) could give a better blend of functionality than most current placements.

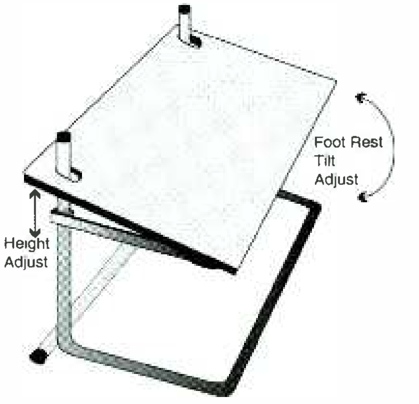


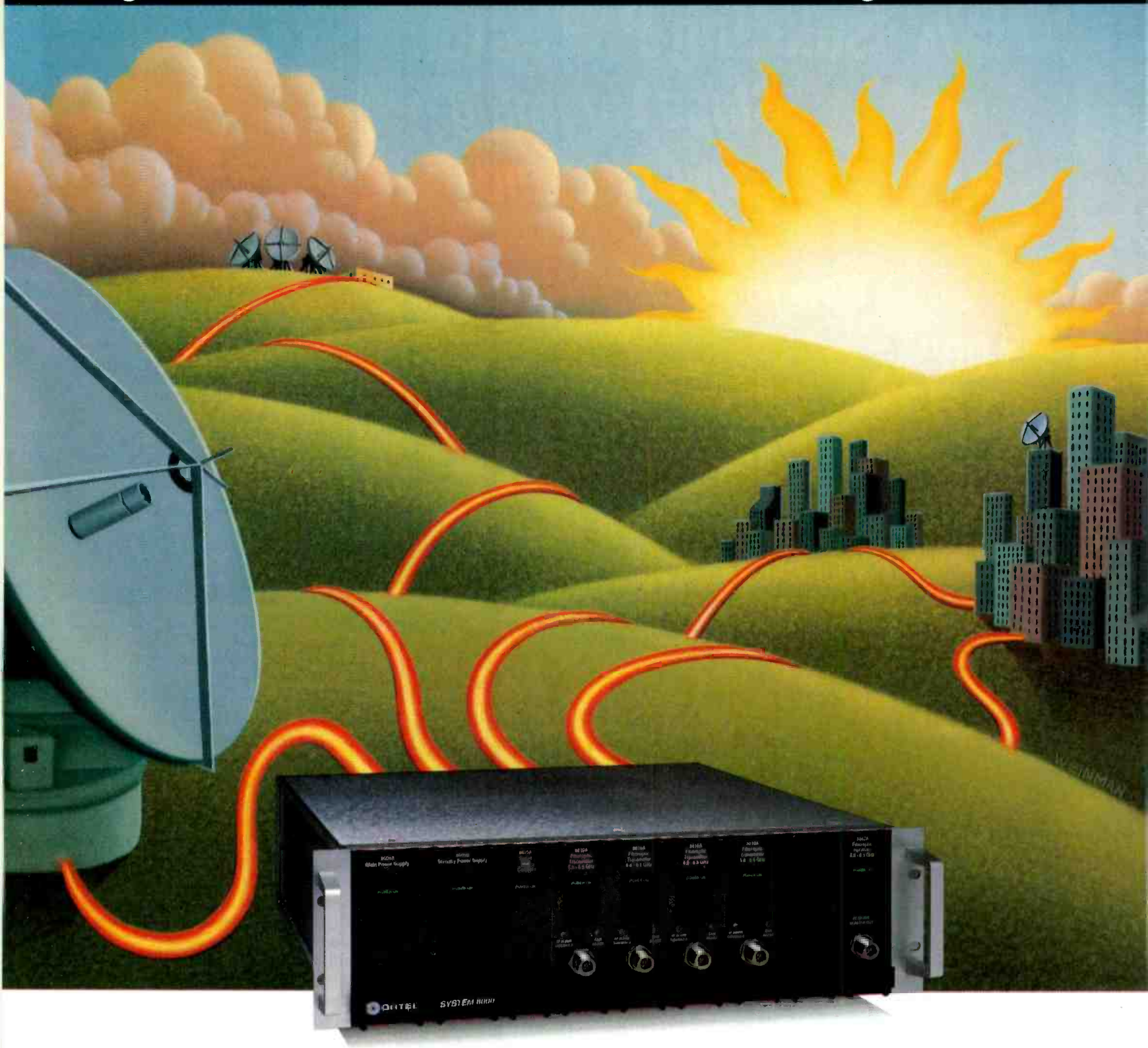
Figure 4. *Adjustable height and tilt footrest maintains correct leg and foot positioning. (Courtesy of Fox Bay Industries.)*

Desktop equipment guidelines

Following are some guidelines regarding desktop video equipment selection:

•*Monitors*: Use one 17- to 20-inch monitor, correctly placed and sized as shown in Figure 2. A large monitor with multiple windows can be viewed closer than Figure 2's guidelines because you are using several smaller (12- to 14-inch) virtual

Light Links™: The new antenna linking solution.



- *Interfacility connectivity for Ku, C, L, IF signals*
- *Saves money on installation, operation and maintenance.*
- *Uplinks and downlinks.*
- *Unprecedented reach.**

This new application of **linear fiber optics** offers you flexibility, performance and convenience simply not available with other technologies. We call it *Microwaves on Fiber*™. With System 8000 Light Links™ you get complete fiberoptic interfacility connectivity for satellite earth stations. With fully redundant paths. On all standard satellite frequency bands.

System 8000 is a complete, intelligent system solution. Connect remote antennas to control centers. Connect site to site. Our 22-page color brochure tells you what it does, how it works, and how you can use it. Full specifications and application information. Call us today for your copy. If you want to discuss your next project, our technical sales staff is ready to help you.

CALL TOLL FREE: 1 (800) 362-3891

* Single span: 65 km for IF bands, 40 km for L band, 30 km for C band, 15 km for Ku band.

Circle (26) on Reply Card

See us at NAB, Booth #18181

Making Light *Work* For You

ORTEL CORPORATION

2015 West Chestnut Street • Alhambra CA 91803 •Telephone: (818) 281-3636 • Facsimile: (818) 281-8231

Figure 5. Keyboard and digitizer produces bad shoulder angles (45°) and constant head and neck movement when moving from monitor to keyboard to pad. (Courtesy of VidCAD.)

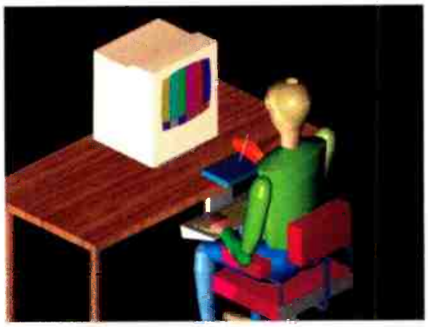


Figure 6. Keyboard on articulated shelf with digitizer on top puts keyboard, small digitizer and monitor in more comfortable position.

monitors. If the large monitor is microprocessor-controlled, set the VGA text mode to fill what would be a half-height, half-width screen display on a 20- or 21-inch monitor.

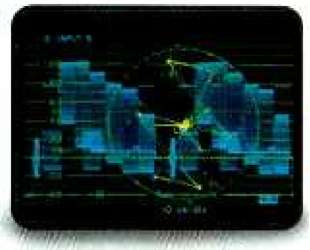
Select monitors with low dot-pitch, high refresh rate (at least 70Hz) and progressive (non-interlaced) scanning. For ultimate flexibility, get an adjustable monitor arm with vertical, horizontal and tilt control, but check the load capacity. Monitor shelves should be avoided — shelves are for books.

•*Keyboards*: Place keyboards flat or at a negative rear tilt. Click keyboards take less effort over long periods of use because they provide audible cues that the key has been pushed. Use an articulated keyboard holder as shown in Figure 9.

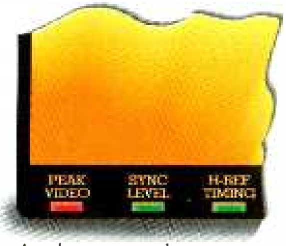
•*Digitizers*: These should be avoided because they take up too much desk space. One exception is the use of a smaller tablet with a pressure-sensitive pen for paint programs.

•*Trackballs*: These devices are difficult to manage because you overuse your thumb for tasks for which it was never intended. On some trackballs the thumb/fingers must continually jump between the ball and the keys, causing imprecise pointing. Standard trackball designs also make it difficult to hold a key down and drag.

•*Mice*: The mouse appears to be the best pointing device for all programs except paint. Newer mice offer more options for



You get the same CRT-type displays you're used to, with 10-bit internal resolution, so they're sharper than any other rasterized monitor available.

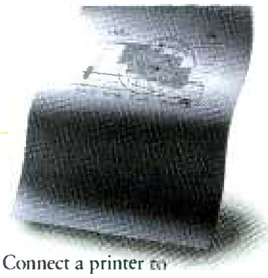


A red prompt on the bottom of the picture shows when your signal goes out of limit.

You can improve overall video signal quality while holding your expenses down.

WHAT IF YOU COULD AUTO-MEASURE VIDEO SIGNALS BY REMOTE, HAD A SYSTEM FOR ADVISING OPERATORS WHEN SOMETHING IS OUT OF LIMIT, HAD AN ASSISTANT TO ISOLATE PROBLEMS AND PRINT STATUS REPORTS, AND YOU COULD AFFORD IT TOO? IMPOSSIBLE? NO.

That's right. Real time auto-measure. You can monitor studio signals constantly, without being there yourself. And since WVM-710 displays on your existing picture monitors, you can centrally route and control signals to and from remote points, even over phone lines.



Connect a printer to the WVM-710, and you can get hard copies of waveforms and auto-measure screens whenever you want. A big help in trouble-shooting.

THE WVM-710 VIDEO MONITORING SYSTEM FROM MAGNI.

See us at NAB. Booth #16684.

MAGNI
MAGNI SYSTEMS, INC.,
9500 S.W. Gemini Drive,
Beaverton, OR 97005 USA
PHONE: (503) 626-8400
1-(800) 237-5964
FACSIMILE: (503) 626-6225

We pay attention to real needs.

Circle (27) on Reply Card

Figure 7. BODYBILT offers articulated forearm support, which reduces wrist strain.

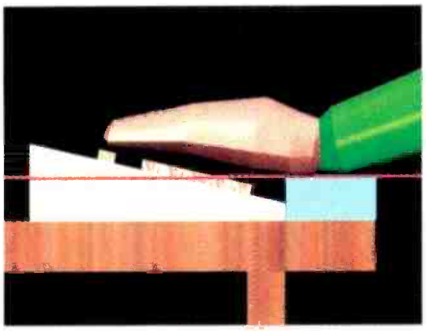


Figure 8. Proper palm pad placement is equal to the height of the first bottom row of keys.

3-button mouse usage in Windows and are often more ergonomically styled.

•*Desks*: The desktop surface for keyboards should be 25 inches to 27 inches above the floor or just high enough to clear your crossed legs comfortably. If you use articulated keyboard holders, try a 27- to 30-inch-high adjustable desk. These adjustable desks are ideal for multiple-operator workstations. You may want to design your desk at counter height (42 inches) and use a tall chair and foot supports. (See Figure 10.) This enables you to work standing or sitting. This concept has worked well for years in the engineering shop, but it's seldom used in the production room.

•*Peripherals*: VCRs, mixers and test equipment should not be placed on the main desktop area. Use software controls wherever possible, and get up to change tapes. You need to get out of the chair every half hour anyway.

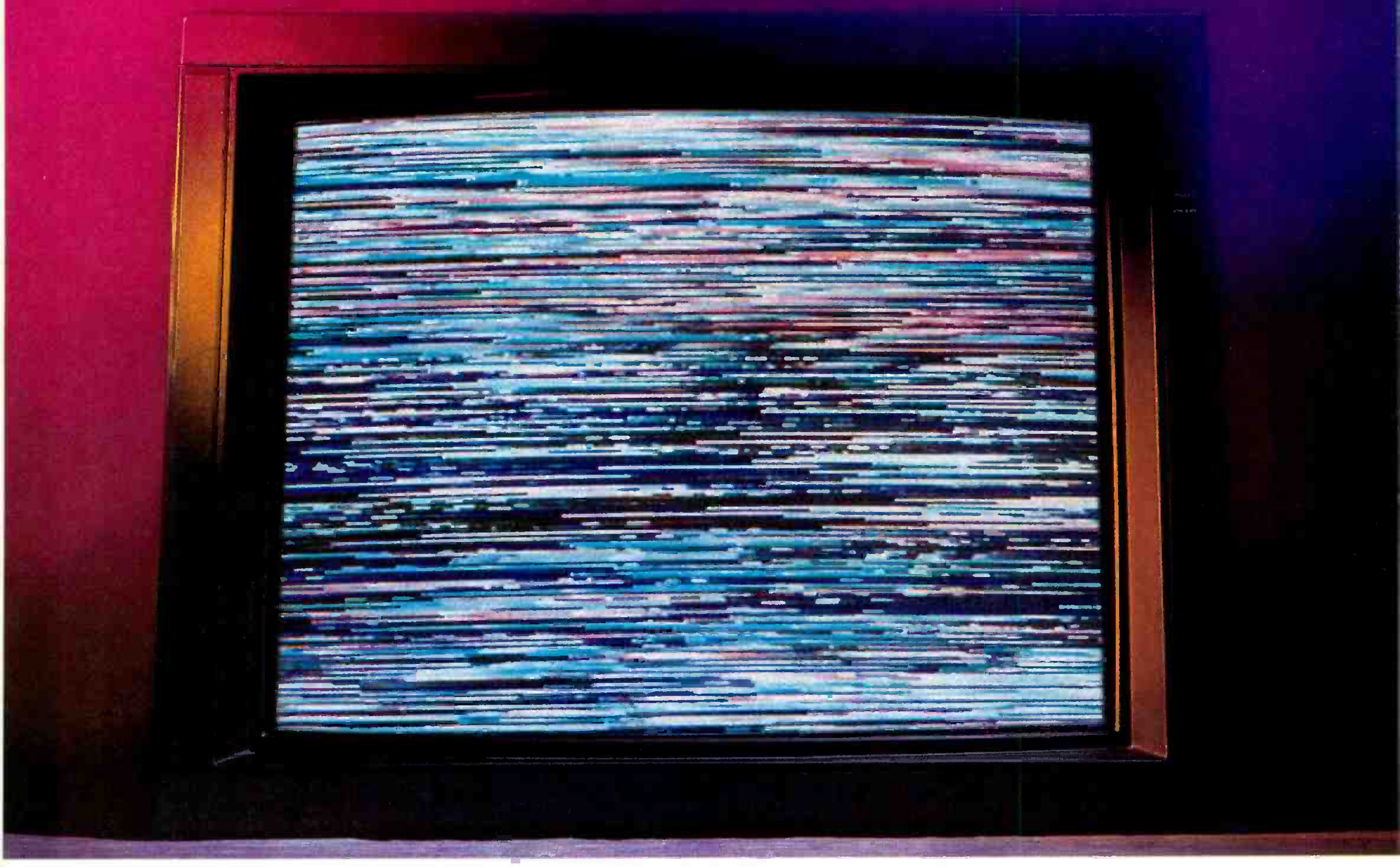
•*Chairs*: Select chairs with fully adjustable seats, backs, lumbar supports and elbow or arm supports. Don't be cheap. Try several before you buy. Adjust your own chair and dare anyone to change it.

Ergonomic planning of a desktop video system can lead to many happy and productive working hours without strain or injury. Poor design and cheap attitudes will bring grief and pain. Design the system so that the user has good freedom of movement, and encourage users to move every half hour or hour. Also remember that no design, chair, mouse or keyboard can fit every user because no two people are alike. Plan, try and change workspaces as needed to reduce aches and fatigue. Your product and your operators' health will benefit.

Figure 9. Proformix articulated keyboard support with negative keyboard tilt and palm support allows comfortable typing and placement of mouse/digitizer so that shoulder or arms need not be extended.

Continued on page 67

Our Customers Love This Picture.



Whether you are in television broadcasting, program distribution, or corporate communications, video pirates cost you a bundle. Protect your video and your business with Macrovision's *VES scrambling systems*. For transmission and recordable security in PAL or NTSC format, Macrovision has a VES product for you.

- VES-TX: **NEW!** Fully addressable, professional transmission system
- StarShaker: **NEW!** Fully addressable, low cost transmission system
- VES-TP: professional transmission
- VES-TS: surveillance transmission
- VES-TD: industrial transmission
- VES-C1: videocassette security

For your total video security needs, call or fax Macrovision for details and distributor contacts.

Macrovision U.S.A.
Tel: +1 (415) 691-2909
Fax: +1 (415) 691-2999

MACROVISION
protecting your image

Macrovision UK, Ltd.
Tel: +44 895 251602
Fax: +44 895 256951

Distributors in: Australia, Canada, Germany, Indonesia, Italy, Japan, Malaysia, Saudi Arabia, Singapore, Spain and Taiwan.

Circle (28) on Reply Card

Squeezing the picture: Video compression

Stuffing five pounds in a 2-pound bag.

By Patrick E. Walker

The Bottom Line

As analog technology gives way to digital, the amount of data handled is increasing rapidly. For uncompressed 24-bit video, typical data rates are more than 200Mb/s. Unfortunately, many desktop systems can only sustain data rates in the 2Mb/s to 5Mb/s range. Hardware advances are increasing sustainable data rates, while simultaneously, data-compression techniques are reducing the amount of data required. Because of the high price attached to high data rates, compression systems offer an economical alternative. In the near future, compression systems may become as common as videotape machines. $

Desktop digital video is available today in two major forms, commonly called *software-only* and *hardware-assisted playback*. Software-only playback uses the computer's CPU to deliver low-quality (less than VHS tape equivalent), windowed (usually 1/16 to 1/4 screen), and less than full-motion (about 15 to 30 frames per second (fps) on a fast i486) video for playback from CD-ROM or over a network. Generally, software-decoded video is employed for multimedia publishing and desktop video conferencing applications, where the developer desires to reach a wide community of users who may not possess dedicated video-decoding hardware in their machines.

Of more interest to the broadcasters is hardware-assisted digital video. To decompress and display better quality digital video, computers use add-on hardware boards with dedicated and extremely fast video DSP chips. Compression algorithms that require hardware-assisted decoding are of two main types:

1. *Interframe*: such as Production Level Video (PLV) and the various MPEG algorithms. These use combinations of key, motion-predicted and interpolated frames to achieve high compression ratios and low data rates.
2. *Intraframe*: such as TrueMotion and the many forms of motion JPEG. These systems compress every frame (and, sometimes, every field) of video individually. These algorithms provide quality video and offer the advantage of frame-accurate editability. The cost, however, is data rates two to 10 times higher than interframe algorithms.

In addition to algorithm types, another issue of compression is the symmetry of the process. With symmetric algorithms, the compression process requires the same amount of clock time as the decompression (playback). On the other hand, the asymmetric compression process requires considerably more clock time than decompression. Because most of the horsepower is required for compression, asymmetric decompression can be done on low-cost computer equipment.

Interframe algorithms

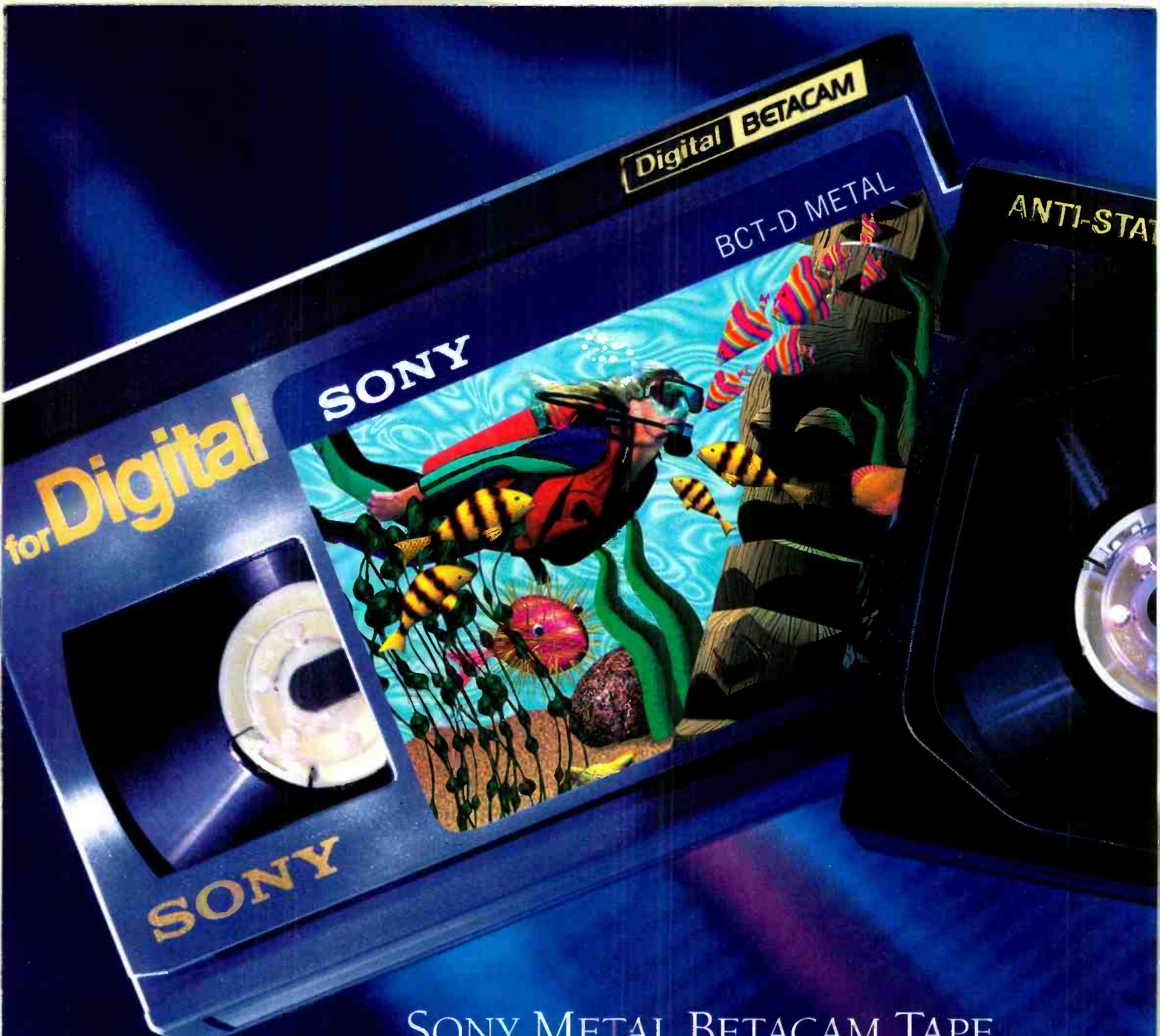
Common interframe algorithms include:

• *Production Level Video*: PLV is a digital video algorithm that was developed as part of Intel's Digital Video Interactive (DVI) technology in 1989. In 1991, an improved version (PLV-2) was released. PLV can provide VHS-quality video at 30fps on a full-screen display. In this mode, the resolution is 256x240 pixels. Horizontal pixel interpolation, a 5:4 pixel aspect ratio and horizontal line doubling are used to achieve a full VGA screen 640x480 pixel display.

A PLV bitstream is generated by using a modified Vector Quantization (VQ) approach and consists of at least one key (or reference) frame every 120 frames, followed by predicted frames every third

Continued on page 58

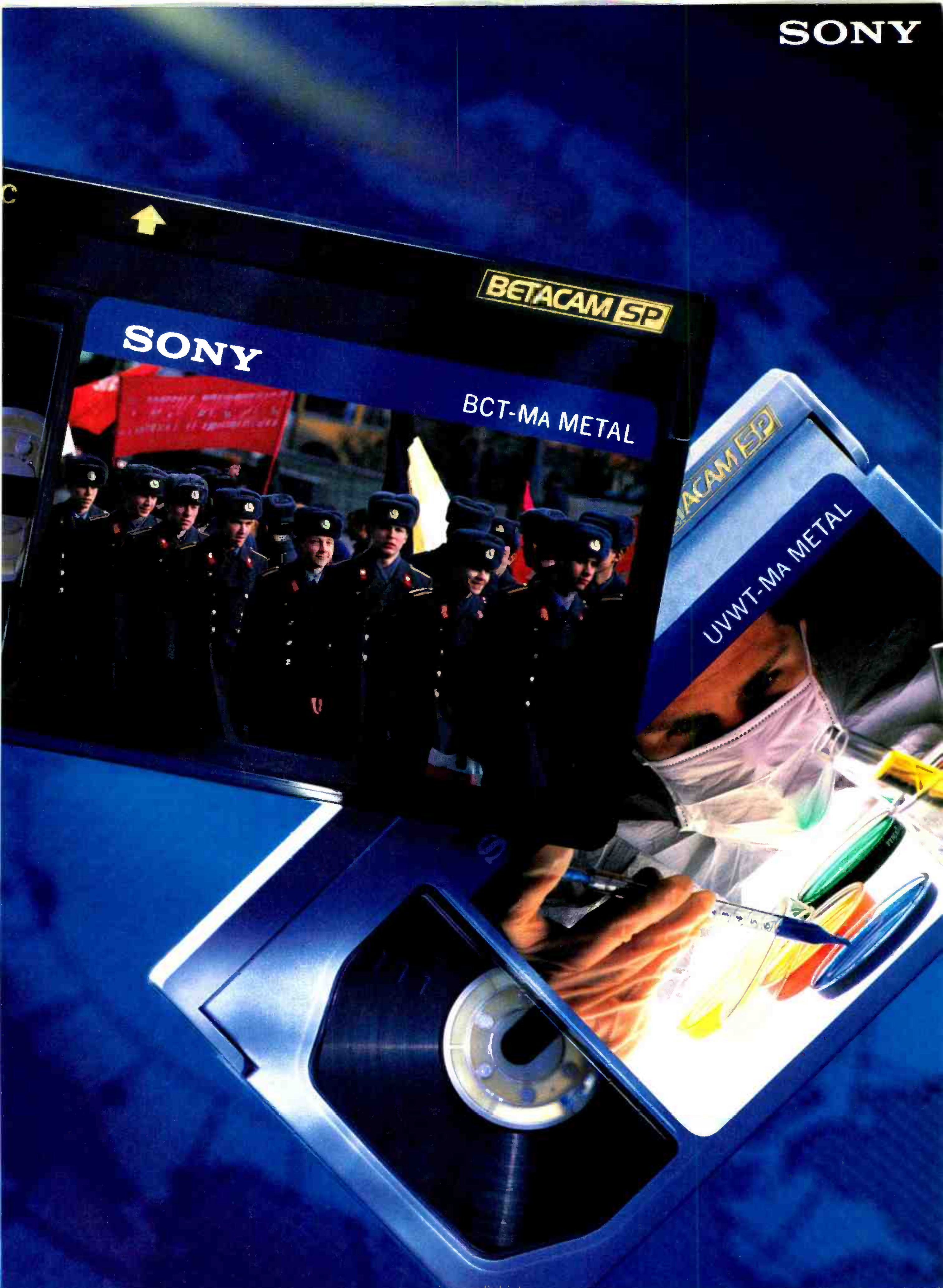
Walker is chief multimedia systems engineer and a product manager for Horizons Technology Inc., San Diego.



SONY METAL BETACAM TAPE. A CLEARER PICTURE OF WHERE THE WORLD IS GOING.

You've never seen so many brilliant reasons for choosing Sony Metal Betacam® tape. The inventor of the format and leader in metal tape technology announces new tapes that are even more advanced. You can step up to the future with Sony's unprecedented Digital Betacam BCT–D Series. For ENG, EFP and post production, choose the broadcast master tape that sets a higher standard, BCT–MA Series. Or discover the tape that's making Betacam SP® recording affordable enough for industrial video, UVWT–MA Series. Whichever way you look, one thing is clear. There's a Sony Metal Betacam tape for wherever your world is going.

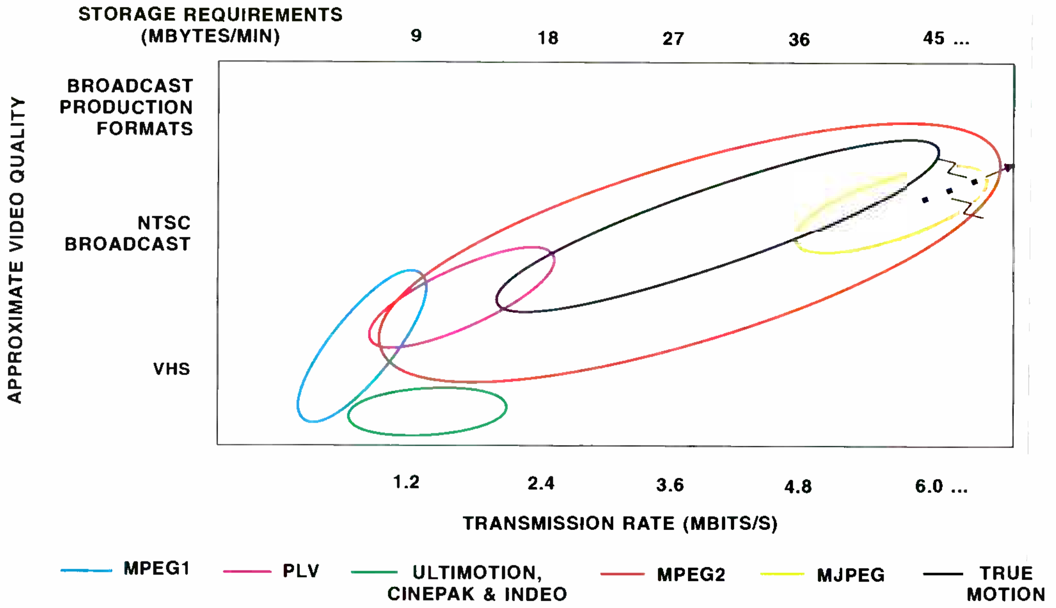
Circle (30) on Reply Card


SONY
BETACAM SP
SONY
BCT-MA METAL
UVWT-MA METAL

Continued from page 54

frame. Between the predicted frames are interpolated frames at the highest compression ratio. PLV is designed to deliver motion video at a data rate of 1.2Mb/s (the normal 1X CD-ROM rate). By doubling the average frame size and data rate, PLV can reduce artifacts and achieve even better motion smoothness.

PLV is compressed on a computer driven by a CCIR-601 frame server. The frame server is loaded from broadcast-quality tape formats. Using an 8-node Intel iPSC-860 machine, it takes about one hour to compress one minute (1,800 frames) of digital video product.



Video quality vs. data rate and storage requirements for various compression schemes.

PLV is in wide use in kiosks, CD-ROM-based interactive learning systems, multimedia databases and video network applications. Playback is accomplished through the IBM/Intel ActionMedia-II playback board or one of the several clones.

•*MPEG-1*: The Motion Pictures Expert Group (MPEG) completed years of committee work in 1991, and MPEG-1 video was approved as an ISO standard in late 1992. MPEG-1, like PLV, is designed to enable full-motion, full-frame video playback from a CD-ROM at 1.2Mb/s. MPEG-1 employs a Source Input Format (SIF) for motion video and associated audio rates up to 1.5Mb/s yielding picture quality comparable to or slightly better than VHS.

•*MPEG-2*: MPEG-2 is being developed as a standard for high-quality video delivery in broadcast and production applications. Final adoption of the committee recommendations is expected this year, including specification for the audio component of the standard. MPEG-2 will operate at full CCIR-601 resolution (or greater) and at data rates from 2Mb/s to 20Mb/s. MPEG-2 is the data compression technique specified for HDTV by the Grand Alliance.

ISO is expected to approve the MPEG-2 standard this year, and chips and systems are presently in development by several major vendors.

Two types of redundancy exist in full-motion video — redundancy within a single frame and redundancy between adjacent frames. MPEG, like PLV, uses three different types of frames: (I)ntra Picture, (P)redicted and (B)idirectional. I-type frames are compressed using only the information in that frame using a Discrete Cosine Transform (DCT). A rolling second of MPEG-1 video will contain at least two I frames. P-type frames are derived from preceding I frames (or from other P frames) by predicting motion forward in time. P frames are compressed to approximately 60:1. Bidirectional (B) interpolated frames are derived from the I and P frames, based on previous and next frame referencing. B frames are required liberally to achieve the low average data per frame and low data rate necessary for CD-ROM delivery.

The number of I, P and B frames constituting an MPEG bitstream is variable, depending on the decoding/encoding chip manufacturer and the type of video being compressed. In some applications, only I and P frames are used, resulting in the 4.7Mb/s video some have called MPEG-1.5.

MPEG-1 generally operates at a resolution of 320x240 pixels, with interpolation and line doubling to achieve full-screen playback. Recently, several companies have introduced real-time compression boardsets for PC class computers. These single-pass systems normally accept composite or Y/C video input. Because of the emerging availability of compression and low-cost playback boards, use of MPEG-1 video is expected to increase rapidly this year.

Intraframe algorithms

Intraframe compression algorithms process every frame of video (sometimes every field) identically. Therefore, intraframe compressed video can be used for frame-accurate applications in the same manner as analog video. The only control over data rates, however, involves varying the resolution or frame rate of the video capture and compression process. For high-quality results, intraframe video data rates can be as high as 20Mb/s (6.8 minutes per gigabyte of storage). Two intraframe approaches include:

1. *TrueMotion*: an intraframe-only extension of the compression algorithms available for the Intel i750 environment. Microcode is used to reprogram the i750 chips just prior to playback of a video file. It operates at a 640x480 playback resolution on a VGA monitor, and uses a non-DCT algorithm to yield video that appears quite similar to video from a laser videodisc. The data rate at the 640x480 pixel resolution is 4.8Mb/s (28.4 min/Gb). The Power!Video compression station has been developed for compressing TrueMotion on a PC-class computer equipped with an ActionMedia II capture and compression board. It can compress a minute of video in about five minutes.

2. *Motion JPEG*: The Joint Photographic Experts Group (JPEG) has established a standard for still image compression that, like MPEG, uses a DCT algorithm. By using fast JPEG compression and decompression chips from various vendors, several board manufacturers have capture and compression systems that can process video in real time at 30fps (or 60 fields per second in recent products). Compression ratios for VHS quality usually run at about 20:1, and data rates normally exceed 1MB/s. Because of the high data rate and storage requirements, motion JPEG puts great demands on drives, buses and processors, and is not used much for distributed multimedia.

In 1986, Comark invented IOT transmission technology. Eight years later, we still set the world's standard.

Despite what you may have heard, IOT technology wasn't born yesterday. We saw its potential to change the transmitter industry quite some time ago.

We showed the first Klystrode amplifier at NAB in 1986, and put the first IOT transmitter into full-time broadcast service in 1988. Since then, we've used more than three million hours of on-the-air experience to lead the way in IOT research & development.

In 1991, our patented aural carrier corrector technology and advanced linearity corrector were developed to meet today's requirements for high efficiency common amplification transmission. And in 1992 we introduced the exclusive DUAL USE™ system that lets you operate with NTSC today and, in the future, convert to D-HDTV.

But we didn't stop there. At NAB 1993, we introduced our third generation IOT system, the IOX. Its ultra linear Class A drivers, optically-isolated solid state control logic, constant impedance output filter, leading-edge crowbar design and IEC-215 implementation make it the most advanced UHF-TV transmitter in the world today.

So if you're looking for the most advanced, proven IOT solution, go with the company that's been pioneering the technology for eight years—not eight months. For more information, or to request a set of our latest **HDTV TECH BRIEFS**,™ call us today at 1-800-688-3669.

COMARK

A THOMSON-CSF COMPANY

1990 Emmy Award for Engineering Excellence

Route 309 & Advance Lane • Colmar, PA 18915
TEL: (800) 688-3669 • FAX: (215) 822-9129

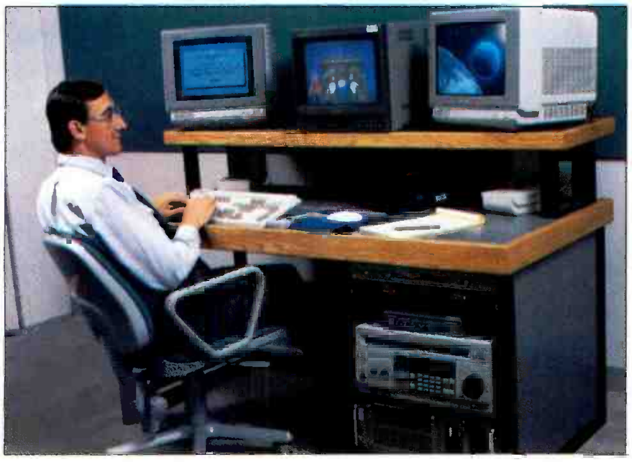
See us at NAB, Booth #16113

Circle (31) on Reply Card

VIDEO COMPRESSION METHODS							
Method	Frame rate frames/s	Data rate Mb/s	Resolution pixels	Synchronized audio	Special hardware	Compression	Quality
Ultimotion	15	1.2	160x120	Y	None	Symmetric	Good
Cinepak (Quicktime 1.5)	15-24	1.2-4	320x240	Y	None	Asymmetric (150:1)	Good
Indeo (VFW)	15-30	1.2-4.8	160x120-320x240	Y	None	Symmetric or Asymmetric	Good
PLV	30	1.2	256x240 (640x480)	Y	i750	Asymmetric (60:1)	Better
MPEG-1	30	1-4.7	320-240 (640x480)	Y	C-cubed CL 450/950	Asymmetric 15:1 on PVS	Better
MPEG-2	30	2-20	720x480	Y	Y-TBD	Asymmetric	Best
Motion JPEG	30	4.8-10	160x120-640x480	N	C-cubed CL 550/560	Symmetric	Good to better
TrueMotion	30	4.8	384x480 (768x480)	Y	i750	Asymmetric (10:1)	Better to best
Laserdisc	30	181.6	640x480 480 H lines	Y	Videodisc Player	N/A	Better
Pixel resolutions indicated in parenthesis are full-screen images obtained through horizontal interpolation and line doubling. Pixels used in PLV have a 5:4 aspect ratio, which accounts for the different number of pixels involved.							

Table 1. *Details of common video compression schemes in use today. Quality level is relative, and dependent on compression ratio used.*

Because JPEG was standardized for still images, there is no associated audio processing standard nor synchronization technique for motion JPEG. Individual board manufacturers have adopted different techniques, resulting in unique bitstreams that are not compatible with those of other vendors. Nevertheless, motion JPEG is widely accepted for closed-environment applications, such as video editing. Most non-linear desktop editing systems today make use of motion JPEG boards.



A desktop video editing system, one of the reasons for the proliferation of compression technologies. (Courtesy of Horizon Technology Inc.)

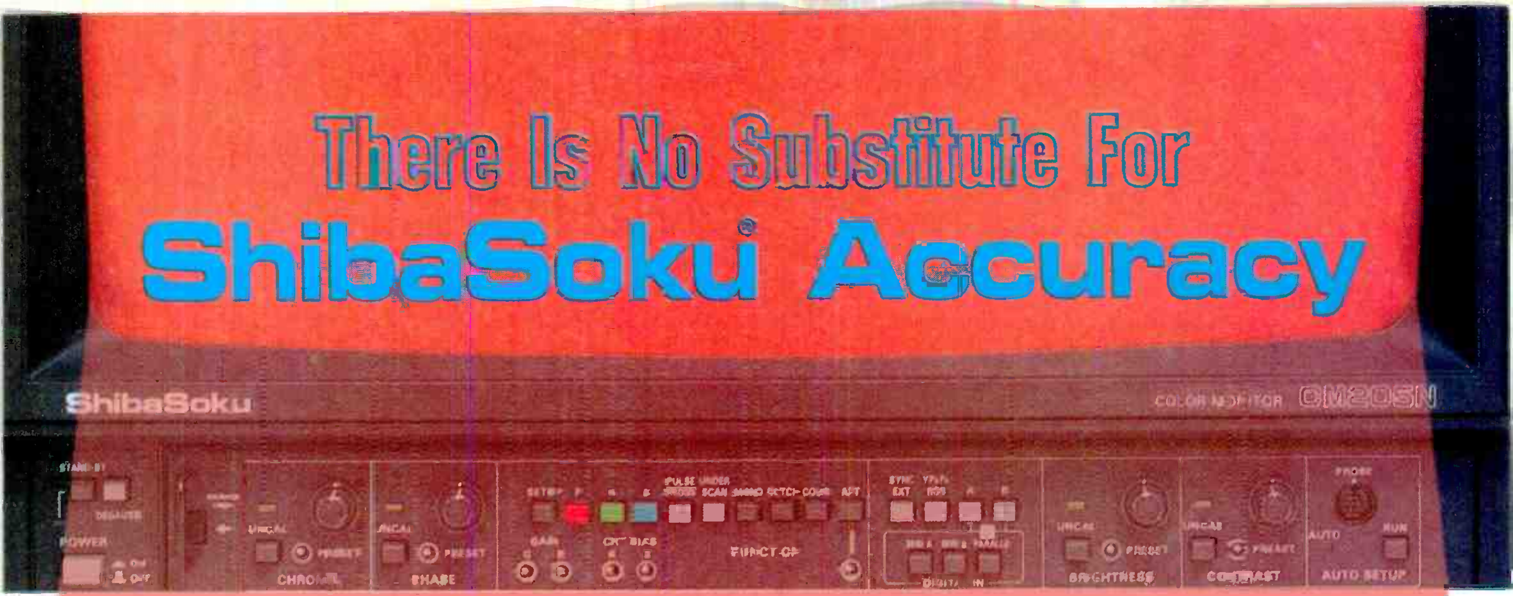
Comparing compression systems

Table 1 shows various methods of compression and how they compare with one another. Although Ultimotion and Quicktime are not mentioned in the text, they fall into the same category as Indeo. All are software-decodable video that play at low-quality rates. Low-quality video is used for applications that are better at one-quarter screen or less because the pixelation and jerkiness are apparent at full screen playback.

One thing to remember when considering compression schemes is the compression ratio. Sony and Ampex use 2:1 ratios in the Digital Betacam and DCT formats. At 2:1, the compression is virtually transparent. Many desktop system manufacturers are saying that ratios of 8:1 are barely noticeable. Compression schemes all look good at low ratios, but as those ratios are increased, the quality decreases. The reasons behind increased ratios are simple: reduced file size and limited system throughput. Both of these factors influence and, to some extent, govern the range used on various systems. In addition, realize that there are two sides to the compression coin. Those on one side are looking at final image quality and accepting compression as a means around technical limitations. However, the other side is quite forgiving of final quality and sees compression as the means of storing large amounts of information in limited space. Today's systems encompass various compromises between these two extremes.

With both hardware-assisted and software-only playback of digital video today, users have a range of compression algorithms from which to choose for their application. Although there is much written about a standard in the digital video compression market, users tend to choose whichever algorithm closely fits their application and satisfies the various factors of data rate, quality and playback costs (such as the hardware, software and platform). However, the issue of video quality is and will always be an important consideration when choosing a digital video compression system.

■



Make no mistake. Superior test instruments are built by the creator of the finest video monitors — ShibaSoku

TG76AX—High Stability, Modular Multi-Format Digital Video Test Generator. Ideal for R&D and Broadcast quality Digital equipment evaluation.

+ Primary oscillator fsc accurate to ±1Hz
+ Standard Analog Formats (12 bit D/A converter) NTSC-M/PAL-B,G,D,I and 525/60 & 625/50 video
+ Provides optional Digital Video/Audio signal outputs (CCIR601, SMPTE 244M & 259M)
+ Optional Digital Video/Audio Generation, 10 bit 4:2:2 Component Digital Signal output, 4fsc NTSC Composite Digital Signal output, AES/EBU Digital Audio output
+ All optional signals can be generated simultaneously

TG21A1—Modular NTSC TV Signal Generator. Perfect in TV or VCR plants and R&D.

+ 12 signal waveforms
+ High stability, 10 bit/word digital signal data
+ Optional PAL module and monoscope pattern, component video, Y/C separate video, and black burst output
+ Each optional signal can be generated simultaneously
+ GENLOCK performance and GP-IB interface is standard

TX20AX—Multi-Standard Video Signal Analyzer affordably accommodates 4 video formats; Composite (VBS) & Component (Y, R-Y, B-Y) video, RGB and a separate Y/C video signal.

+ NTSC/PAL automatic selection
+ 15 measurement functions available — signal level, chroma phase, frequency response, DG/DP, Y/C delay, S/N etc.
+ Measuring points are variable — 36 pattern memory
+ Easily computes sum, average, max/min point output

Building acute accuracy for the true professional in broadcasting, electronics manufacturing and leading production houses worldwide has been our #1 priority through 40 years. ShibaSoku's straightforward, rugged engineering is why so many users keep our instruments On-Line for over a decade.

Know the equipment that gives Lasting Accuracy. Circle the reply card number below.

See You At NAB '94 — Booth #16619

ASACA®

Asaca/ShibaSoku Corporation of America
12509 Beatrice Street, Los Angeles, CA 90066
(310) 827-7144 Fax (310) 306-1382

Circle (32) on Reply Card

Video production switchers

Courtesy of Dynatech

Digital systems dominate as analog fades away.

By Curtis Chan

The Bottom Line

Basic switcher effects have changed little over the years, however, the price of those effects have dropped dramatically. Digital control systems have reduced the size and cost of a basic switcher while simultaneously offering flexibility and the potential for expansion. As the digital future nears, consider a step in that direction by replacing your analog switcher with a smaller more powerful digital unit.

During the last few years, digital-based technologies have made significant inroads into production switcher offerings. At present, the all-in-one workstation-style systems still have a long way to go before they can supplant the venerable production switcher in its many supporting application roles. These roles include live on-air production, production and post-production. Within each application, there are still numerous offerings for the low-, mid- and upper-market tiers. The changes for these various market offerings can be only described as smaller-better-faster for low- to mid-end systems and more versatile, more features, more performance for the high-end systems.

Given the downward spiraling economy of the past five years, market-savvy companies are dividing up the switcher marketplace with strongly differentiated product offerings. Each of the three main broad markets (low, mid, high) have given way to multiple submarkets, with unique application requirements. As a result, switcher offerings have broadened, allowing vertical market differentiation as well as providing a certain amount of expansion capability within each product mix.

Table 1 depicts a broad overview of product offerings with respect to each market tier. From the chart, we can derive two general directions. High-end switchers can either serve a broad application base with a plethora of features or are geared toward a boutique clientele with unique feature sets. The mid- to low-end switcher offerings have benefited from the digital age sporting features that were only available on high-end systems of yesteryear.

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

The low-end market for switchers offers analog and digital alternatives.

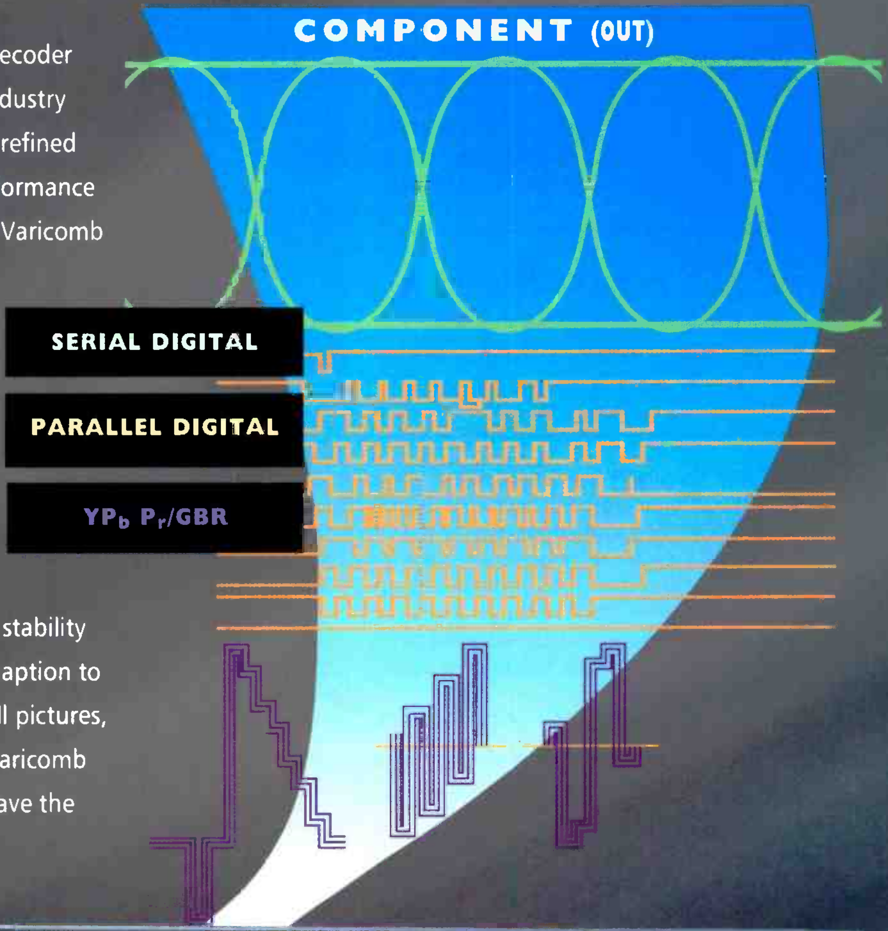
The low-end market

The low-end market for switchers offers analog and digital alternatives. Although composite analog and digital switchers are plentiful, the widespread use of component analog and digital tape formats have given rise to a variety of competitively priced, performance-oriented digital component switchers as well. The majority of these switchers are 4:2:2 based, with 16/32-bit processing and offer 8- to 10-bit resolution paths. Many models offer one or two M/Es with a downstream keyer and up to three key levels.

In this market range, keys have selectable gain from linear to 8X gain or better. The keyers usually have linear and luminance keys, chroma-keys and wipe pattern inserts over background video. Key modes include the basic assortment of key invert, wipe pattern mask, box mask

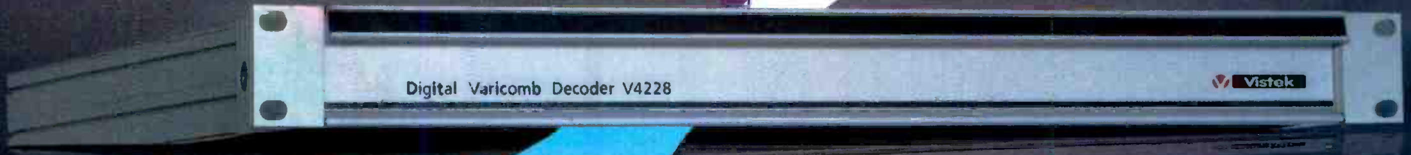
The V4228 Digital Varicomb Decoder

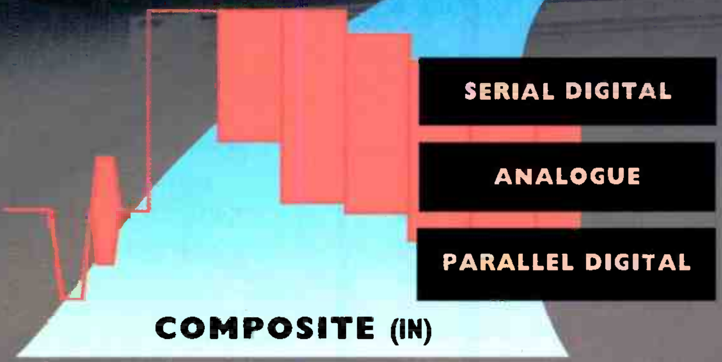
Vistek Electronics is proud to announce the launch of the V4228 Digital Varicomb Decoder.



Designed to be the ultimate composite decoder for the analogue and digital world the industry standard Varicomb technology has been refined and implemented digitally providing performance that actually exceeds that of the existing Varicomb product!

The propriety Varicomb algorithm has long been acknowledged as the most transparent process for transferring from the composite to component domain for real pictures, eliminating the art facts of cross colour and cross luminance without sacrificing resolution. Add to this the accuracy and stability of digital technology and the optional adaption to a frame comb for perfect decoding of still pictures, whilst maintaining all the conventional Varicomb benefits when there is motion and you have the best decoder available.





The flexibility of configuration allows the tailoring of analogue and digital interfaces to suit the requirements of any installation with the easy addition of interfaces as needs change. PAL or NTSC, analogue or digital, two dimensional or three dimensional adaption the V4228 IS the ultimate solution!

SEE US AT NAB STAND No. 13836

Vistek

The World's Standard for all World Standards

Vistek Electronics Ltd., Unit C, Wessex Road, Bourne End, Bucks SL8 5DT, England Telephone: (+44) 0628 531221 Telex: 846077 Facsimile: (+44) 0628 530980

U.S. Sales contact: Preferred Video Products, 4405 Riverside Drive, Burbank, CA 91505 Tel. (818) 562 6544 Fax. (818) 562 3342

Circle (33) on Reply Card

generator and video and matte fill. Wipe patterns usually have controls for adjustable edge softness, borders, pattern reverse, pattern multiplier, aspect, position and preset size. In addition, the keys can automatically or independently be assigned to the program or preset bus.

In many switchers, it's also possible to assign both keys to the same bus with selectable priority. Key source can originate from the key bus, an external source, the chroma-key or one of the pattern generators. On the two keyer-type M/Es, layer priority between the two M/E key-

M/E keyers offer linear, luminance and preset pattern keys, as well as chroma-keys.

ers can be easily switched. Some new switchers also offer an optional third-axis processor for manipulation of the Z-axis.These types of processors take Z-axis data from a DVE to provide keying relative to the position of the picture in 3-D space. Fill video can be selected from the key bus, external video or a color matte generator.

One of the newer innovations for this market category is a full wipe generator for each of the key layers. The wipe generator can be used to create on-box-type masks that can be positioned freely on the screen and be either hard or soft.

Production switchers in this tier sport up to 12 primary inputs, five external key inputs, 20 or more wipe patterns, at least 20 effects memory registers, program, preview, clean feed and wipe-key outputs. Aside from D-1 or D-2 compatibility, switchers also are able to select between NTSC and PAL. Additionally, many switchers on the high end of the scale for this market also tout self-timing inputs (input bus FIFO's automatically adjust the timing of all inputs) and 2-way communication with the edit controller. That is, the edit controller is constantly updated of every switcher move.

Options in this range include framestores to hold a foreground or background frame, widescreen 16:9 capability, color correction, chroma-key and 3-D effects. In many cases, the 3-D effects are canned or users can create their own.

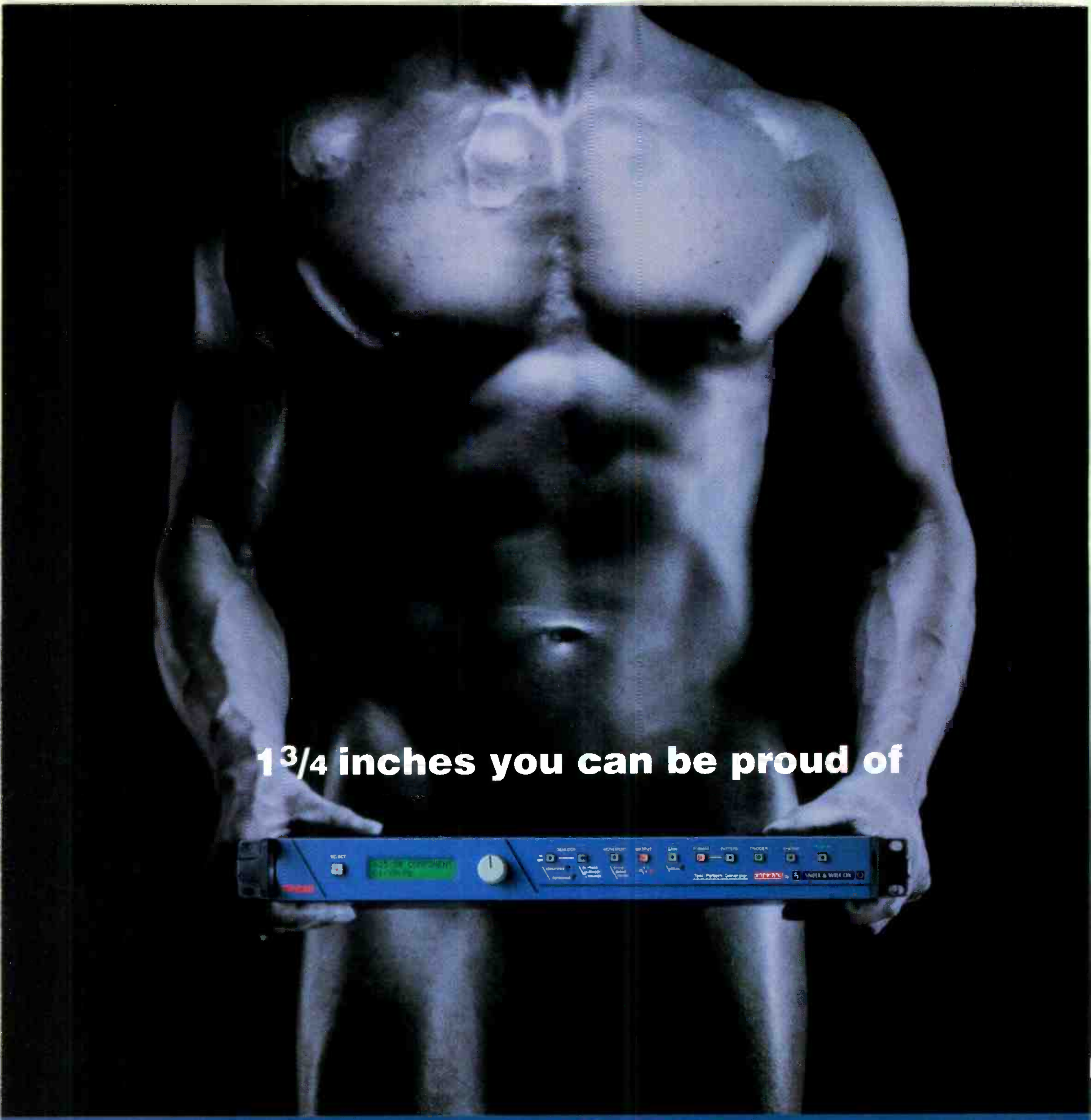
An all-digital suite at North Coast Communications, Pittsburgh. (Photo courtesy of Abekas.)

The middle market

Upping the ante, mid-range switchers include all of the aforementioned plus enhanced features that affect user flexibility, networkability and expansion capability. Switchers in this class fulfill each application category with a myriad of powerful features.

Mid-range switchers include enhanced features that affect user flexibility, networkability and expansion capability.

For instance, a basic switcher might include a single M/E with three keyers, two in the M/E and one downstream. For live applications, a program/preset mixer would be included. M/E keyers offer linear, luminance and preset pattern keys, as well as chroma-keys. The wipe system includes extensive wipe modifiers, such as border width and edge softness, edge softness symmetry, aspect, rate-con-



KUDOS by SNELL & WILCOX

MULTI-FORMAT

WIDE BAND DECODING

MULTI-STANDARD

4:2:2 PROCESSING

- Test Image Generation
- TBC Synchronisation
- Decoding/Encoding
- Noise Reduction
- Standards Conversion
- Colour Correction

The power behind the Kudos range is Snell & Wilcox. Find out how it measures up to your needs.

Snell & Wilcox offices worldwide: UK Tel: +44 (0) 730 821188 Fax: +44 (0) 730 821199 **USA** Tel: +1 (408) 734 1688 Fax: +1 (408) 734 4760 **Japan** Tel: +81 3 34 46 3996 Fax: +81 3 34 46 4454 **France** Tel: +33 1 47 89 8308 Fax: +33 1 47 89 8572 **Italy** Tel: +39 (0) 6908 7557 Fax: +39 (0) 6908 7418 **Germany** Tel: +49 (0) 611 990840 Fax: +49 (0) 611 306004 **Russia** Tel: +7 095 192 69 92

Circle (66) on Reply Card

Evaluating production switchers

Here's a basic checklist for evaluating a switcher. Because analog switcher technology is pretty much old hat, let's add the requirement that the switcher is digital and will be used in a compositing environment.

1. Whether composite or component, the processing resolution should be a minimum of eight or 10 bits. In some cases, 8-bit technology can result in artifacts when performing transitions. For instance, a soft wipe between two sources may cause a staircase or stepping effect in the wipe pattern. However, most switcher companies employ dynamic rounding or dither to control this limitation.
2. The user interface has to be intuitive, friendly and fast. In this arena, there are as many solutions as there are switchers. One approach is to emulate an analog switcher facade. Other solutions center on hard keys for dedicated processing paths or effects, assignable soft keys, software macros and the use of computers. In fact, the latest generation of switchers is using computers (PC and Mac) for control and as input devices. This solution brings about cost-effectiveness, higher productivity and adds to the input peripheral resource pool.
3. The compositing switcher must deal with the problems associated with the integration of multiple elements in a scene. Proper controls that can monitor and adjust each layer are vital. For instance, consideration for sync relationships between elements, maintaining contrast, color values, sizing, X-Y-Z positions and phase. There should be a way to interactively and simultaneously make corrections to any or all layers.
4. In many of today's production situations, real-time or near-real-time compositing would be ideal. The switcher should have provisions for multiple VTRs or disk recorders and have frame memories available as a source.
5. The luminance and chroma-keyers should be good quality and the chroma-keyer should have the ability to suppress the chroma-key color in the foreground (foreground suppression). Without foreground suppression, a clean composite of foreground subjects containing smoke, reflections and/or hair detail is impossible. The keyer should have a certain amount of flexibility added to it, such as the ability to shift, resize and soften the key signal. Today, digital keyers are part of the package for most switchers.
6. Plan on a large amount of memory storage. Registers are crucial in the compositing environment because key levels, wipe adjustments, crops, drop shadows and transition values can change during a session. The ability to recall these configurations and transitions is vital.
7. Check the list of integration tools and system flexibility available. These tools might include digital color correction, masking, looping and layer breakout (the ability to feed a switcher layer to a DVE or VTR for re-entry on another layer).
8. Think network. In larger systems, it's important to know whether a control panel or part of a signal chassis block is available for allocation. Of course, the intelligence of the system might extend to user-assignable setups and memory of acquired and released resources with all of its setups intact when on loan to another edit bay. ❑

trolled positioning and vertical and horizontal multipliers. Higher-end models might include up to three M/Es with up to five full-function keyers per M/E. Either M/E could be used as a background for the downstream keyer.

Most switchers in this range come equipped with a fade-to-black unit and an output blanking processor. Flexibility to expand is paramount in this class and many companies offer expansion in the form of up to eight aux buses for multiple feeds as well as plug-in options including digital color correction, 10-bit I/O, dual framestores, the ability to accept multiple input formats and 4:4:4 chroma-keying.

Additions to this class of switchers might include an enhanced effects controller interface. Such a controller may have the following features:

- *Key frames* — for building sequences of predefined effects based upon key frames.
- *Register attributes* — effects registers for instant recall of effects setups and the ability to record attributes for performing predefined tasks automatically. Tasks might include triggering GPIs, initiating auto transitions, performing effects dissolves and inhibiting recall of background crosspoints. In a related area, switchers of this caliber can copy M/E settings from one to another or swap the two. Lock protection for locking individual or banks of registers against erasure is common.
- *Timeline* — gives the operator a programmed sequence of events that can be used as a mini edit decision list for the switcher.
- *Disk drives* — many of the newer switchers allow switcher data to be dumped to disk. Disks contain information, such as

personality programming, effects memory registers, wipes and matrix pattern information.

• *Custom personality* — using the control interface, the user has the option of reconfiguring the system attributes. Attributes might include key source assignment, linear key clip and gain default values, output blanking, matrix wipe program button assignments, control attributes of external devices, GPI assignment and other system parameters.

Because communication with the outside world is usually via the industry standard RS-422A serial interface, expect better usage from the interface in terms of peripheral recognition and control, status and feedback as well as more than one interface.

Another recent entrant offers a novel approach to combining user flexibility with raw processing power. This type uses a control panel that is similar to conventional switchers except for the space-saving X-Y matrix arrangement of the source and bus rows. A PC or Mac complements the control panel and is used as an input device. Because the computer screen is an extension of the switcher, all screen groups show relevant information pertaining to the selected function. Because of the computer, all configuration information, key memory, panel and timeline memory, switcher operations and diagnostics can be stored to disk.

A benefit of these types of switchers is the ability to route any key and/or video source, including the preview subcomposite, to an external effects device for processing, and then return the processed signal to one of the many keyers in the chain. This allows flying any layer or combination of layers without tying up any portion of the switcher's layering capabilities. Furthermore, newer digital-type switchers incorporate color correction or alteration capability to each layer.

Newer digital-type switchers incorporate color correction or alteration capability to each layer.

Top-of-the-line

As we move to higher ground, switcher manufacturers are either providing powerful digital component or composite systems with analog-type interfaces or trying to revolutionize the industry by creating unique boutique-style interfaces.

In one instance, a company's new switcher line combines an analog facade with all of the advantages of a digital signal processing and routing system for transparent manipulation. Because of the improved housekeeping of this type of switcher and its inherent improvement in picture quality, the editor can concentrate on the creative aspects of on-line editing instead of timing and levels.

In digital component switchers, there are no level changes or shifts to worry about and clients have the opportunity to make decisions on-line, an option they don't have in the traditional analog suite. You also would expect multiple framestores to provide stills that can be used to build graphic layers without having to recall those images from a disc or tape recorder. This, along with multiple keys, means a typical spot can be color corrected in one pass, composed and composited in a fraction of the time it would take in an analog suite.

From another viewpoint, higher-end switchers give more of the features expected from the mid-range plus feature enhancements. One enhanced feature is effects send capability for each M/E. With this, effects devices can be fed with the

MARKET	APPLICATION	FORMAT	PRODUCT HIGHLIGHTS
High-end	Digital post-production Graphics layering, film post	Component digital Component analog Composite analog Comprehensive effects editing	Multiple analog/digital format capability Integrated digital/analog video effects Resource sharing, auto EQ/ timing inputs Large number of I/O and M/Es Up to 4 framestores, large effects memory banks Powerful editor interface, built-in hardware/software diagnostics, color correction within M/E
High-end Mid-end	Medium-to-large post houses broadcast centers, on-line post	Composite digital Composite analog Component digital Component analog	2-3 M/Es, up to 64 inputs, versatile editor I/F, Unlimited M/E re-entry, traditional or compositing type switcher, serial or parallel digital inputs, open M/E architecture allows multi-point effects insertion, good keying operation, communication expansion slots
Mid-end	Medium-to-large post studios and broadcast centers, mobile EFP/ENG applications	Composite analog Component analog	2-3 M/Es, up to 24 inputs, 1-2 keyers per M/E, down-stream keyer, program/preset for live production, timeline effects building, auto select modes, assignable key source inputs, large E-MEM storage banks
Mid-end Low-end	Small-to-medium production, post-production, mobile, film post, graphics layering	Composite analog Component analog Composite digital Component digital	1-2 M/E with down-stream keyer, typical 10 inputs, serial or parallel digital, multiple buses, E-MEM Effects, multiple pattern generators, chroma keyer, 525/625 switchable

Table 1*. Various features available on production switchers based on application, format and market tier.*

Strongest link.

Your satellite receiver is the most important link in your reception chain. And the one thing you can always count on - the signal never gets better than it is at the receiver. It creates the most important link to video and audio technical performance and initial S/N ratio.

Which is a very good reason to specify Standard Communications Corp.'s new rebroadcast *Intercontinental* satellite TV receiver - but it's not the only reason.

It has all the features professional operators need most: total flexibility in both C/Ku-band operation, rebroadcast quality certified video on NTSC, PAL and SECAM signals, and a universal power supply built for the rigorous demands of 24-hour-a-day operation.

Never before has one receiver worked so well from INTELSAT to all DOMSAT formats in C, Ku and S-band frequencies. The 800 MHz or optional 1 GHz input will work with all known LNBs on all worldwide ITU regions. And our synthesized PLL tuning circuit provides direct frequency selection with crystal tolerance - 100 KHz accuracy in a continuous, self-monitoring control loop. The new digital AFC circuit improves performance in low threshold, severe interference, and multiple carrier per transponder operation.

A unique 70 MHz I.F. spectrum inversion circuit allows Ku-band to C-band or vice versa I.F. uplink or downlink turnarounds.

The *Intercontinental* is built for knowledgeable and discriminating engineers and offers proof of performance RS250C and CCIR567 certification. It features six I.F. bandpass filters, from 36 MHz to 16 MHz, five audio filter selections from 880 to 75 KHz, and six audio de-emphasis circuits.

There is much more you should know about the *Intercontinental* - and Standard Communications - than we can tell you in a single ad. Call us or fax us. We'll send you more information showing you how to get the best performance and peace of mind. Link up with our new *Intercontinental.*

Standard Communications®

SATELLITE BROADBAND PRODUCTS DIVISION

P. O. Box 92151
Los Angeles, CA 90009-2151
Phone (310) 532-5300 ext. 217
Toll-Free (800) 745-2445
Fax (800) 722-2329 (Toll-Free)
(310) 532-0397 (CA & Int'l Only)

See the entire Standard line at the NAB March 21-24, Booth #16075.

Circle (34) on Reply Card

same video and key sources that feed the switcher. Outside devices can be spliced or inserted directly into the path of any given keyer for expanded capability.

Also in the high-end are better chroma-keyers and borderline key generators. Attributes include background and foreground suppression to eliminate color fringing. Another feature of these switchers is multiple layer compositing within each M/E. For example, the composited key from an M/E in the layering mode is available as a source on another M/E or the downstream keyer for additional compositing.

Advanced effects memory systems are also the norm with typical switchers, consolidating switcher and DVE by adding key framing to the attribute set. Many of these switchers have at least 100 registers, disk storage, effects dissolve and sequencing capabilities. Framestores are a must to save time in this category and many have video, key and mask stores.

In digital component switchers, there are no level changes or shifts to worry about.

For the wipe generators, expect to find almost unlimited control over wipe patterns and image layering in the program/preset mixer. Of course, having up to 32 inputs is a plus. In some models, you can configure the switcher with an external key input for every video input, giving a virtual 64-input capability for use with video or keying.

Still another company has extended its system enhancements with additional updates. One update offers an expanded SMPTE protocol editor interface. This protocol allows edit controllers complete control over all switcher functions and edit-by-edit switcher status snapshots. Moreover, because the Probel General Remote-Control Communication Protocol is out, the new generation interface allows the switcher control panel to act as an X-Y matrix controller for an associated router. Last, expect to see expanded control over master/slave grouping capabilities. For instance, multiple groups of peripherals, such as DVEs and recorders can be assigned to each given layer. If the timeline describing an individual layer were to change with respect to other layers, the master/slave grouping would automatically resynchronize all the source for that layer group.

The advent of digital switcher technologies paralleled with the growth of digital-based VTRs and peripherals will change present operating methodologies and increase creative freedom. New upcoming standards for signal and control interfaces along with more powerful computing power will greatly enhance production throughput while minimizing interface concerns. As a result, broadcasters and production houses have more incentive to consider equipping their facilities with the latest advances in switcher design and other types of digital-based systems.

For more information on production switchers, circle (325) on Reply Card. Also see "Switchers, Video" on p. 66 of the 1994 Be Buyers Guide.

Continued from page 52

Ergonomics and vision

By Dr. Dana McQuinn, O.D.

By 1997, forecasters predict that there will be more than 70 million computer users in the United States. It is no wonder that more and more people complain of visual problems and physical discomfort from video display terminals (VDTs).

Common complaints include fuzzy and unclear vision, blurred vision at close working distances, or slow change of focus from close to distant. After four or more hours of sitting at a VDT, distance vision may remain blurred for a while. These symptoms often clear up after a time away from the computer.

Others complain of double vision, eyestrain, eye irritation (burning, dryness, itching), headaches, backaches, frequent loss of one's place (on screen), excessive fatigue and irritability, nervousness and frequent errors.

The simplest advice is to get up and take breaks periodically, to look away from the screen toward other items at differing distances, and to blink more frequently. Heavy users should take a 10-minute break every hour; light users should break for 15 minutes every two hours.

Computers in rooms with overhead lights and uncurtained windows are subject to glare problems. If the computer cannot be moved or partitions adjusted, an anti-glare screen can be added to the VDT. Select an anti-glare screen that has been approved by the American Optometric Association.

Computer users who wear general-purpose bifocal or trifocal lenses tilt their heads back and lean forward to focus, adding stress to the neck and back. Wearing single-lens glasses with intermediate focal length as you use the computer can help. Special progressive lenses are another alternative for VDT viewing. A tint or anti-reflection coating also can be added to lenses to reduce the effects of fluorescent light and glare.

Often, there is too much background light in the office, which causes screen contrast problems. The room lighting should not be more than three times brighter than the screen background. If possible, turn off overhead lights to darken the room environment and to reduce light reflection. Use desk lighting instead of overhead lighting for reading printed copy. Position the work area so overhead lighting is directly overhead, rather than in front or behind the VDT operator, to reduce glare.

More and more people complain of visual problems and physical discomfort from VDTs.

Heavy computer users should take a 10-minute break every hour.

The room lighting should not be more than three times brighter than the screen background. ❑

McQuinn, who specializes in visual analysis, is an optometrist in Las Cruces, NM.

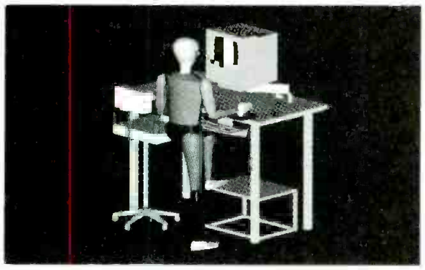


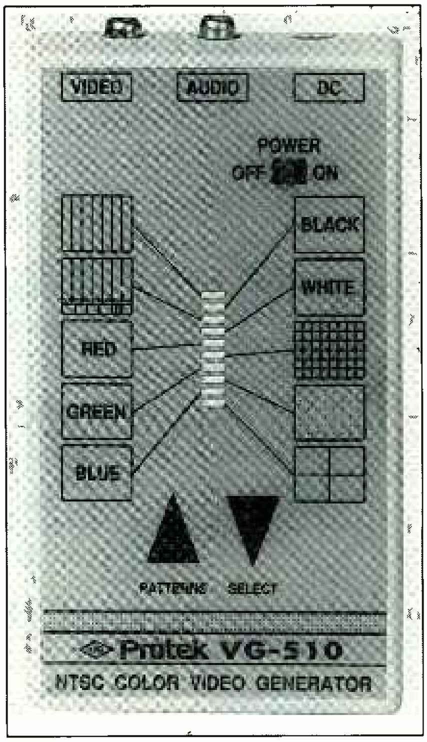
Figure 10. Installing a DVS at counter height (42 inches) allows the user to alternatively sit, stand or recline while producing. Adjustable chair, foot rest, monitor arm and articulated keyboard make this a flexible system.

Editor's note: Because the companies whose products are mentioned in this article may be unfamiliar to *BE* readers, their contact information is listed at right.

- **Backsaver** — 53 Jeffrey Ave., Holliston, MA 01746; 800-251-2225
- **Blueline/Dominion** — 1990 E. Algonquin Road, Suite 208, Schaumburg, IL 60173; 708-397-3330
- **BODYBILT Seating** — 3900 Texas Ave. S, College Station, TX 77845-5831; 409-693-7000
- **Fox Bay Industries** — P.O. Box 4409, Kent, WA 98032; 800-874-8527
- **Grahl** — One Grahl Drive, Coldwater, MI 49036; 517-279-8011
- **Proformix** — P.O. Box 22, Route 22 West, Whitehouse Station, NJ 08889; 908-534-6400 ■

New Products

Hand-held NTSC video test generator
By HC Protek



• **Model VG-510**: offers 10 test patterns including SMPTE, blackburst, full-field color bars, red, green, blue and white fields, center pulse cross, crosshatch and dots; blackburst may be used to lay down black on tapes and record SMPTE color bars with tone at the beginning of the tape; audio output is 1kHz with an adapter included for 120V studio use; measures 5 1/2"x3 1/4"x1 1/2" and weighs 7 1/2 oz; specs include composite video out 1Vpp into 75 ohms; polarity positive and sync negative; 525, 2:1 interlace scanning lines; horizontal line frequency of 15,734kHz; 59.94Hz vertical field frequency; 3.579545MHz+/- 10Hz for color subcarrier frequency.

Circle (352) on Reply Card

Scan converter
By Digital Vision

• **TelevEyes/Pro**: computer-to-TV video scan converter with gen-lock; MacroMedia Action! SE is included; external device connects between the computer's output and monitor; hardware-only video scan converter converts IBM PC VGA or Macintosh video output to clean, flicker-free composite video or S-video; hardware automatically converts almost any computer output, running any mode, any display hardware, and any application; needs no software; on-board hardware image processing eliminates flicker on the composite display while preserving full computer resolution; control of all of the TelevEyes/Pro features is done via a 3-button control panel and on-screen menus; gen-lock overlay is built-in.

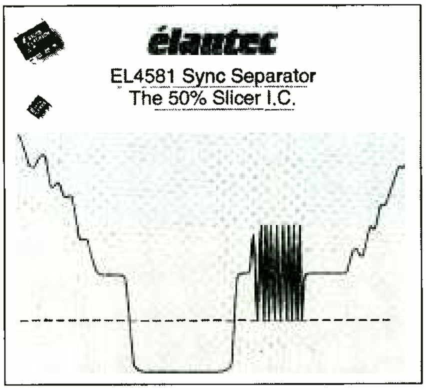
Circle (357) on Reply Card

Power protection products brochure
By EFI

• **"Electrical Network Protection Products"**: full-color, pocket-sized short form brochure describes facility-wide network solution to power and data line protection from transient voltages and other power problems; also described are the company's patented product technologies and value-added warranty programs.

Circle (361) on Reply Card

Video sync separator
By Elantec



• **EL4581C**: highly integrated CMOS video application-specific standard product provides flexible, industry-standard sync separation capabilities for video applications that need rapid and reliable wave shape qualification of incoming signals with no sync problems; extracts timing information, including composite and vertical sync burst/backporch and odd/even field information from negative sync NTSC, PAL, SECAM and non-standard video signals; operates on a single supply, +5V circuit.

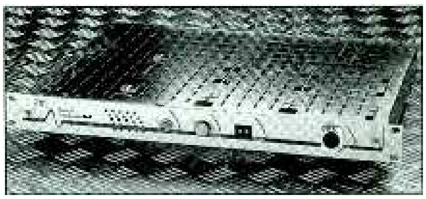
Circle (364) on Reply Card

Satellite calculator
By COMSAT World Systems

• **CTVS satellite calculator**: helps compute earth station look angles to INTELSAT satellites; determine uplink/downlink beam pattern advantages and computes a link budget for video transmissions from a subscriber's personal computer; also provides up-to-date information on international satellite transmissions, earth stations for TV services worldwide and satellite path configuration, as well as the ability to place orders for INTELSAT space segment capacity; service includes a currency conversion table, and at the touch of a key, customers can obtain an estimated calculation of end-to-end space segment charges on any transmission.

Circle (365) on Reply Card

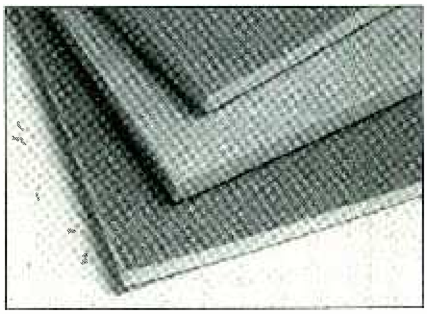
Line identification unit
By Arun Systems Ltd.



• **Line identification unit**: assists in the correct allocation of lines in audio broadcast transmission; equipped with a minimum of four balanced audio output channels, expandable up to 24 channels using additional 4-channel cards; outgoing channels provide a clear and continuous audio message, fed directly to conventional jack plug fields and are disconnected following a successful line proving; channel message recording is via integral microphone while the use of EEPROM memory means messages can be rerecorded more than 100,000 times; message duration can be specified; front-panel-mounted loudspeaker provides channel message monitoring with channel selection by thumbwheel switch.

Circle (366) on Reply Card

Acoustical foam
By illbruck



• **SONEX Fabrix**: created from non-woven, fire-resistant fabric and melamine

Continued on page 73


23 23 23

The new digital multitracks

any size market.

Other features that are not available on analog multitracks include track slipping, copy and cut/paste track-bouncing or editing (without generation loss), cross-

The recorders' cost-effectiveness qualifies them for radio production use in any size market.

fade edits, and headers for storage of tape identification and setup data.

Recording media

The Alesis ADAT and Fostex RD-8 use S-VHS cassettes (recordings are generally interchangeable between them), while the Tascam DA-88 uses Hi8 videocassettes. This produces some differences in terms of recording, shuttle and fast-wind times. The ADAT format runs an S-VHS cassette at approximately three times its nominal video recording speed, whereas the DA-88 format runs a Hi8 cassette just slightly above its nominal video speed. The ADAT format also uses an oversized recording track width, nearly double the S-VHS standard 58 micron width. Table 1 shows the resulting play and wind times.

From another perspective, the ADAT format offers 320 track minutes per tape; the DA-88 provides 864 track minutes per tape. This is a handier way to analyze storage for users who elect not to use all eight tracks on every recording.

These systems all use widely available videocassettes for recording media.

Applications

Adding one of these recorders to a radio production facility will instantly increase its capabilities. A corresponding upgrade to an expensive 8-bus mixing console is not necessarily required. Unlike multitrack music recording applications, lay-up or assembly of the individual audio tracks for radio production is usually done in a "serial fashion," one element at a time.

Therefore, you can distribute a 2-bus console output's left channel to all of the recorder's odd-numbered input channels (1, 3, 5 and 7), and the right channel to all even-numbered inputs (2, 4, 6 and 8). Some units offer internal channel linking so you can connect the stereo mix bus from the mixer to any pair of recorder channel inputs, and assign audio to different tracks in the recorder as you wish.

It is essential, however, that enough inputs be available on the console for simultaneous playback of all recorder tracks during final mixdown to stereo. This might be accommodated on console B inputs. Ideally, each track output

Adding one of these recorders to a radio production facility will instantly increase its capabilities.

should appear on a mono fader rather than a stereo line input module.

For overdubbing, a monitor mix bus is typically required. On a standard radio console, a cue, auxiliary or audition/utility bus can be used for this purpose.

Modular multitracking

A unique feature of these digital multitracks is their ability to be stacked into larger track configurations. For 16 tracks, simply link two of the same model recorders. For 24 tracks, link three recorders, and so on up to 128 tracks with 16 recorders. One deck is established as master, and the other decks slave to its transport.

Beyond accommodating long-term growth, this feature allows some interesting short-term possibilities. For example, two recorders that are normally dedicated to separate uses/rooms can be combined when a major project comes along

A unique feature is their ability to be stacked into larger track configurations.

(assuming the mixing console used can handle 16-track operation.) Alternatively, one or more additional recorders can be rented, enhancing your track capacity on a per-project basis. (When linked-ma-

The Fostex RD-8 recorder.

The Tascam DA-88 recorder.

New Products

Continued from page 68
foam to improve aesthetics and ensure safety; all materials meet Class 1 building requirements and are fiber free; available in a variety of colors.

Circle (358) on Reply Card

Retrieval system
By ASC Audio Video Corporation

• **Virtual recorder**: digital, random access retrieval system that makes recorded material instantly available for any application designed to work with videotape recorders; it records and plays video, 2-channel audio and SMPTE linear time code; any device that interfaces with a professional VTR can take advantage of true random access video via industry standard SMPTE RS-422 serial protocol.

Circle (359) on Reply Card

Prompting system
By Questar Systems

• **Questar AccuPrompt**: designed for all Apple Macintosh systems; comprehensive system for creating scripts, arranging them in run order and scrolling them for live teleprompting; scripts can be viewed on a stand-alone Macintosh or any NTSC monitor to provide complete, state-of-the-art teleprompting; World-Script compatible, the system can create and scroll scripts in any language, even those with complex characters; offers global search and replace and multiple "hot keys" offering instant access to various features while live prompting is in operation.

Circle (367) on Reply Card

SCA cards
By SCS Radio Technology

• **SCSRT1**: high-tech FM SCA decoder card can be used in virtually any FM radio on the market; the company provides cards at a specified frequency; with crosstalk rejection at -60dB with virtually no noise; cards measure 2" square and can sound professional in most any environment without the need of an outside yagi, provided the SCA-adapted radio is within the RF broadcast parameter; cards are easy to install, with only four terminals; voltage to each card is between 6V to 9V at around 25mA and is connected directly to the FM detector of the radio; bypass switch is used to change from AM or FM to SCA.

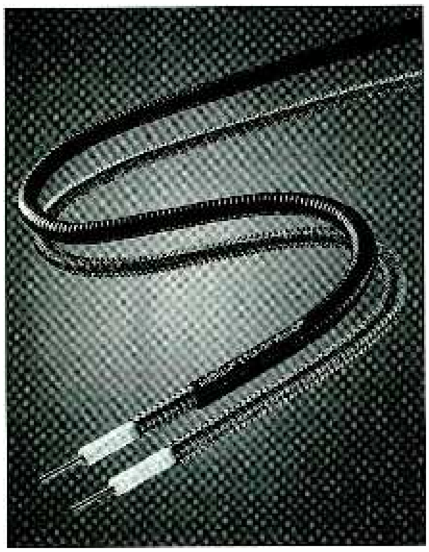
Circle (368) on Reply Card

Test pattern generator
By Tektronix

• **TPG20**: multiformat test signal, pattern and picture generator; supports virtually all non-HDTV analog and digital component and composite video formats; its analog and parallel and serial digital outputs eliminate the need for external format conversion devices; ability to generate complex frame-length patterns and reference pictures with movement on selected areas; features 10-bit digital test signal generation with oversampling; ensuring accurate test signals with minimal artifacts.

Circle (370) on Reply Card

Superflexible coaxial cables
By Andrew



• **Type FSJ2-50**: has a 1" minimum bend radius for easy installation and routing in enclosed areas; has a foam polyethylene dielectric; at 1,000MHz, the cable has an attenuation of 4.09dB/100 feet, and an average power rating of 0.452kW.

• **Types ETS2-50T and ETS2-50**: use a low-loss expanded polytrafluorethylene di-dielectric; can handle about 2.5 times the average power of the foam polyethylene at 1,000MHz; at 1,000MHz, ETS2-50T has an average power rating of 1.15kW while ETS2-50 has a rating of 1.31kW; attenuation of both cables is 4.24dB/100 feet.

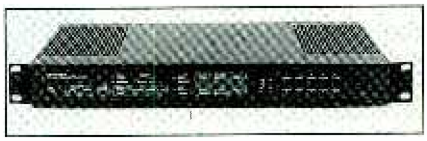
Circle (360) on Reply Card

Indexing software
By SoftWright

• **Map crossing and Indexing module of the Terrain Analysis Package**: software to facilitate plotting of paths for RF paths on USGS topographic maps; calculates the map crossing distances for each map on the path; index of more than 76,000 USGS topographic maps is included; enables user to print out a list of maps necessary for showing the path.

Circle (371) on Reply Card

Video demodulator
By Videotek



• **DM-154**: high-performance agile video demodulator has RS-232 remote-control capabilities; zero carrier chopper, quadrature output for ICPM measurements, synchronous detection, MTS stereo/SAP decoder outputs, 4.5MHz aural output, and technical specifications necessary to do FCC baseband video cable testing.

Circle 372 on Reply Card

Digital interfacing and conversion line
Dynair Electronics

• **Genesis equipment line**: consists of complete line of 8-bit and 10-bit A to D and D to A converters and associated products; will convert the full range of component and encoded analog signals to and from the several digital formats in current use; features full complement of audio conversion equipment, including a serial digital audio multiplexer, which combines asynchronous AES/EBU digital audio with serial digital video signals; fiber-optic transmitters and receivers allow full bandwidth signals to be transmitted distances more than 50km.

Circle (373) on Reply Card

chine recordings are made, all decks' tapes must be labeled with the tracks they contain — 1-8, 9-16, etc.)

Although these small recorders can be placed close to the operator, remote controllers also are available. They are especially helpful for linked-machine sessions. Optional controllers and meter bridges with 24- or 48-track configurations allow multiple decks to be operated like a single machine.

Making choices

When evaluating digital multitrack recorders, consider first which tape format offers the most benefits for your situation. Then compare the hardware, features, optional accessories and prices.

Because these recorders expect to populate a number of different audio marketplaces, they offer flexible control interfacing. Typical protocols supported include RS-422 and MIDI, along with some proprietary/third-party console-automation, VTR and DAW control formats. Control (and synchronization) features may be optional accessories on some decks. (See Table 1.) AES/EBU and S/PDIF digital audio interfaces are optional for all systems.

Parameter	Alesis ADAT	Fostex RD-8	Tascam DA-88
Media/format	S-VHS/ADAT	S-VHS/ADAT	Hi-8/DA-88
Rec. time/cass.	40 min.	40 min.	108 min.
Tape speed	3.75 ips	3.75 ips	0.626 ips
Track width	100 microns	100 microns	20 microns
Fast wind time	120s unwrapped 240s wrapped (T-120)	120s unwrapped 240s wrapped (T-120)	80s (P6-120)
Shuttle speed	3x play speed	3x play speed	0.25x to 8x play speed
Digital I/O	EIA optical (x2) ADAT format	EIA optical (x2) ADAT format	DB25 (x2) TDIF-1 format
Analog I/O +4dBu/bal.: -10dBV/unbal.:	 ELCO 56-pin 1/4" phone	 DB25 (x2) RCA	 DB25 (x2) RCA
Sync/Link I/O	DB9 (x2)	DB9 (x2)	DB15 (x2)
Word sync I/O	(opt.)	BNC (x2)	BNC (x2)
Time code I/O	(opt.)	XLR	(opt.)
Video sync/VITC	(opt.)	BNC	(opt.)
Pitch control	+100/-300 cents	±6%	±6%
Sampling rates	variable (40.36 to 50.85kHz)	44.1/48kHz	44.1/48kHz

Table 1. *Manufacturers' specifications of digital rotary head multitrack recorders compared.*

Digital recording means that basic audio specifications are universally high. Focus instead on operational parameters, such as punch-in and -out, overdubbing, shuttle, multimachine linking, fast-wind and auto-location, plus overall reliability and connector complement. If demo units are available, compare a device's performance in your own facility and environment.

As technology permits, the cost and time required to produce higher-quality audio recordings will continue to decrease. The new crop of digital multitrack recorders has made a major step in this direction, and is one radio production facilities should not ignore. ■

For more information on rotary head digital multitrack recorders, circle the following numbers on the Reply Card:

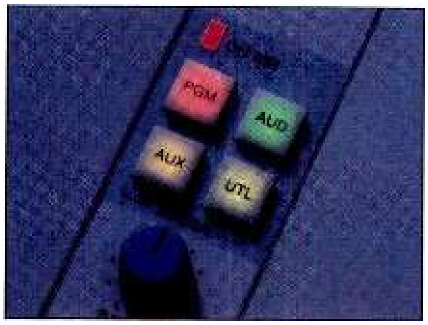
Alesis (330)

Fostex (331)

Tascam (332)


Here's To A Great Broadcast Future!
Now that TTC is part of LARCAN we've got a lot to celebrate, because we've combined the resources of two great transmitter companies. LARCAN is today's market leader with the popular M Series solid-state VHF transmitters and our new cutting-edge solid-state UHF line. LARCAN-TTC excels with the ultra-efficient, high power UHF HDR Series IOT transmitters and our complete low power UHF/VHF lines. On the radio side, we already have more solid state FM transmitters in the field than all other domestic companies. And LARCAN-TTC is definitely HDTV-ready—*right now*. The engineering resources and corporate strength of LARCAN-TTC will insure you a great broadcasting future. Visit us at NAB '94, booths 15758 and 15708 to see products worth celebrating.
LARCAN TTC
LARCAN: 228 Ambassador Drive, Mississauga, Ontario L5T 2J2
TEL: 905-564-9222 FAX: 905-564-9244
LARCAN-TTC: 650 S. Taylor St. Louisville, CO 80027
IN U.S.: 1-800-TTC HDTV TEL: 303-665-8000 FAX: 303-673-9900
High Power U.S. Sales: LDL Communications:
14440 Cherry Lane Court, Laurel, MD 20707
TEL: 301-498-2200 FAX: 301-498-7952
Circle (61) on Reply Card
CHAMPAGNE GRANDE CUVÉE

Re: Radio



Raiders of the lost radial

By John Battison, P.E.

Readers may recall my nagging about the necessity for accurate addresses and location descriptions when making field-strength measurements. A few months ago I came across the epitome of unidentified measuring locations.

This experience points out some important issues to remember when baby-sitting an apparently stable AM DA array.

The symptoms

I was called to check out a 3-tower in-line array that had been operating for approximately 26 years. All of the operating parameters were within the limits, but all of the monitor points (MPs) except one were low — some by a factor of 4. Meanwhile, one radial in the nighttime pattern was 250% high, a problem that had been slowly increasing during the past seven or eight years.

My first step was to ask for the license, MP locations and the latest proof. This is where the problems began. The current license was the usual postcard renewal that gave no operating data. The complete, posted license was dated 1974. That would have been fine if the MPs in use had agreed with it, but many of them did not. The chief engineer's check into the technical file turned up a partial proof made in 1980, which showed some different MPs, and some corrections made thereafter — but no license later than 1974 was on file.

It was apparent from the telegrams in the file that this partial proof had been filed with the FCC, but there was nothing to indicate that the proof had been accepted after correction, and there was no new license to cover the changes.

When searching turned up nothing, I called the AM Section at the FCC. John Sadler located the 1980 license and faxed me a copy. Finally, we had the correct operating parameters and authorized MPs. The parameters were the same as the 1974 license, but until we found the 1980 license, we had not known how the station was supposed to be operating.

Battison, *BE's* consultant on antennas and radiation, owns John H. Battison and Associates, a consulting engineering company in Loudonville, near Columbus, OH.

Searching for clues

An inspection of the array and the associated RF equipment showed no obvious problems. So we went out to the MPs, and here our identification problems began. The routes to the MPs were clear, but the specific addresses and locations were not. The description "0.6 miles from the intersection in the house drive on the south side" is too vague and provides no positive identification of the exact house/property and location of the MP.

I settled on the same locations that had been used for the last eight years by a part-time technician. At least I knew my new measurements would compare to those taken previously at these locations, even though they might not all be at the official MPs.

I also found, to my surprise, that the station always read its night MPs at night. In my experience, most stations switch to night pattern during the daytime for night MP measurements, thereby making measurements safer and easier for their technicians. As if to confirm this logic, the MP for that troublesome night radial was in someone's driveway, close to a busy, unlit road. It did not seem advisable to wander around with a field meter in the dark to look for variances.

I wanted to rock the phaser to see what the point did, but I was told that the station was in the middle of a rating period and that the phaser controls had not been moved for approximately 10 years. They were probably oxidized, and poor contact or arcing would no doubt occur if the sliders were moved. In view of the possible repercussions, we decided to let well enough alone — at least until after the rating period.

In hot pursuit

The next day I looked for potential radiators. I didn't have to look far, but this only produced more confusion. Within the 5kW major lobe were 27 towers of various kinds. Two were suspicious: One was a 250-foot cable tower, about a ½-mile away. It reradiated 7V/m. It hadn't been detuned and was probably in place when the 1980 partial proof was made.

The other suspicious object was a tall water tower in a junkyard approximately 0.4 miles away. This had the remains of a detuning system on it, but no one knew which station(s) it had been affecting. Once again, no one at the station knew anything about it, except that it was in place long before 1980.

Any engineer should know the proper procedure for running a radial.

Two other 3-tower arrays also were partially within the major lobe. One station has been dark for more than a year, but no one knew if it affected my client's station and if anything had been done about it. A theme was developing — keeping good records had apparently not been a high priority for the station's previous chief engineer.

Missing the point

I decided to rerun the radials on which the highest and lowest values currently appeared. The well-marked radial maps were set out, and the 1980 partial proof was opened to the appropriate radials. To my horror, there was not a single measuring point description on any radial in the proof!

Any engineer should know the proper procedure for running a radial: Draw a radial on a map and tentatively pick out a place to measure. Then after going to the point and measuring, describe the point and identify it for future use/comparison, and include that data in the report. In this case, we had nothing. I felt that attempting to make comparative measurements at unknown locations 13 years later would not prove much. Therefore, we had to run a new proof, starting with a non-DA in order to attempt to identify reradiators.

If good records had been established, this extra work and expense could have been avoided. Once again, the moral of the story: Remember to keep adequate records. ■

Television managers come to Odetics looking for on-air systems that are futureproof. Systems that will help them avoid costly errors in light of approaching digital tape and disk technology. That's where we come in.

We're Futureproof

Odetics is the master of futureproof television technology. That's how we got to be the world leader in large on-air library management systems. Since day one, Odetics on-air automation systems have been completely format-independent. This means we can handle any tape format from S-VHS to digital Betacam. It also means we're ready to implement emerging digital technologies in a seamless evolution — not a costly "start over" process.

Automation Is Our Middle Name

And what about automation? It's the technology that made Odetics famous. So we can guide you in the development of phased-in "islands of automation" that let you expand productivity at a cost-effective pace — without forsaking your on-air quality or reliability.

With Odetics there's no need to fear your fate at the hands of an unproven supplier. Odetics is the leader in on-air automation technology for today and tomorrow. Call us to talk about your future.

Odetics Broadcast

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

Director of Sales	Northeast	Southeast	West	North Central	South Central
Bill Keegan	Ray Baldock	Emerson Ray	Chuck Martin	Bill Boyd	David Scally
(714) 774-2200	(201) 305-0549	(813) 960-0853	(818) 999-9796	(612) 894-2121	(404) 917-9506

Circle (60) on Reply Card

See us at NAB, Booth #18932

Transmission Technology

UHF transmission technology

By Nat S. Ostroff

Unlike the conditions faced by its pioneers 30 years ago, today's UHF-TV industry offers its stations more than one choice of transmitter technology. Today's UHF broadcaster must understand the differences between several transmission methods, which will allow technical and economic conditions to be optimized for a station's particular circumstances.

When UHF-TV was just beginning to challenge the VHF establishment, the technology of the day offered few advantages over VHF. The UHF spectrum required considerably higher power levels to achieve the same coverage as the VHF competition. Approximately 10dB more power than VHF was desired, but this was not easily attainable 30 years ago.

Following some early efforts that used tetrode and traveling wave tube (TWT) devices to achieve a few thousand watts of output power, the first real UHF device to gain predominant use was the klystron.

Klystron technology

The klystron is an electron beam device. It uses a beam of fixed power that runs for several feet through a series of resonant cavities that are excited with the driving RF signal. The voltages established by these driven cavities cause the electron beam to accelerate or decelerate in such a way as to form bunches, which occur at the frequency of the RF drive signal. This bunching of the electron beam creates a high-energy replica of the low-power driving signal. The high-energy, modulated beam is coupled to its load through an output cavity.

Ostroff is president and CEO of Comark Communications, Colmar, PA. Respond via the *BE* FAXback line at 913-967-1905.

Because the klystron must start with a steady-state (DC) electron beam that operates at the full peak energy required by the load at all times, it is a Class A amplifier. Early klystrons were good high-power amplifiers with poor energy efficiency. Peak-RF-to-DC efficiencies of 25% were acceptable in that era of low energy costs. By the end of the 1970s, however, energy efficiency had become a critical issue to the UHF industry. Transmitters of more than 120kW output power were being specified, and the economics of such higher power were forbidding if efficiencies could not be improved.

Around that time, RCA (in cooperation with PBS) developed a system for switching the electron beam power in the klystron between peak sync and near-black levels. This system, known as pulsing, represented a major step in moving klystron efficiency to more acceptable levels. Meanwhile, work by such companies as EEV and Varian improved the unpulsed klystron efficiency to almost 50%, and the addition of the pulser moved peak-RF-to-average-DC efficiency to 75% or higher.

> ***Early klystrons were good high-power amplifiers with poor energy efficiency.***

Klystrodes and IOTs

Unfortunately, the pulser technology was complex and somewhat unreliable. A better solution to UHF energy conservation was still needed. In 1986, the Klystrode was introduced by Varian and Comark. This device was related to the klystron and the tetrode, hence its name. Today, the Klystrode is known as one of the family of devices called inductive output tubes (IOTs), which are offered by several manufacturers in various power levels and socket configurations.

The IOT is an electron beam device that uses a grid (like a tetrode) to bunch the beam (like a klystron). The electron beam's energy is directly controlled by the grid, so the IOT is a Class B amplifier — the DC power demand of the tube is a function of the RF drive signal. This is important because a TV signal is at its maximum power level for only 7% of the time (for NTSC), and its average power is only approximately 50% of its peak.

The Class B operation of IOTs produced a doubling of conventional pulsed klystron efficiency. Peak-RF-to-DC efficiencies of more than 100% can be obtained with IOT devices. Therefore, the term *figure of merit* (FOM) was established to avoid expressing efficiency at more than 100%. (Note that most FOMs are cited at a 50% average picture level [APL], but other APLs are sometimes chosen. To avoid misleading values, verify the APL that is used in the FOM calculation.)

Because the IOT modulates its power demand with the requirements of the drive signal, the device does not have to be operated near saturation to be efficient. The IOT also is more linear than a klystron, allowing other capabilities, such as common amplification, in which the visual and aural signals are amplified together.

The first high-power, common amplification UHF systems were introduced in 1989 by Comark. This approach eliminates the aural tube and the RF diplexing system and provides redundancy through simple paralleling. Energy efficiencies are equivalent to those of VHF systems.

Another klystron variant is the Multi-Stage Depressed Collector (MSDC) klystron, which was developed around the same time as the Klystrode. MSDC technology uses a specialized collector system on a conventional klystron body to recover the unused energy left in the electron beam and return it to the power supply. The technique provides FOMs similar to the IOT technology, although it requires a pulsing system to do it. MSDC systems also involve a complex power supply design. These factors have recently steered the industry away from developing any new MSDC designs.

At power levels of 20kW and below, a solid-state option becomes practical.

Power levels make a difference

At power levels of 60kW and above, the industry seems to be leaning toward an IOT approach. For power levels below 60kW, there is a wider range of viable choices, including low-power IOTs, tetrodes and solid-state devices.

Low-power IOTs are becoming available in air-cooled systems. These devices compete with tetrodes at the 10kW-30kW power level. Tetrodes at 20kW-30kW are water-cooled. The advantages of the IOT over the tetrode are higher gain, high output power using air-cooling and longer life. On the other hand, the tetrode offers smaller size and lower unit cost. Both tetrodes and IOTs offer the advantages of Class B operation.

At power levels of 20kW and below, a solid-state option becomes practical. (These power levels are predominant outside the U.S. market.) Solid-state systems achieve 10kW-20kW by combining many low-power (typically 100W) devices in an array. The multiple power supplies and RF amplifiers of solid-state transmitters offer soft-fail and hot-maintenance advantages.

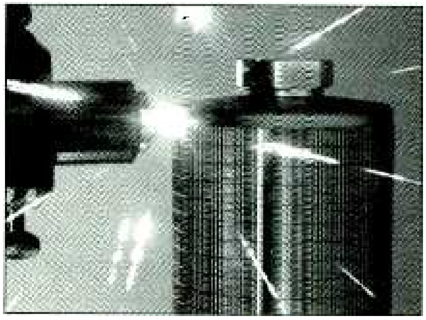
The multiple power supplies and RF amplifiers of solid-state transmitters offer soft-fail and hot-maintenance advantages.

The low gain of the solid-state devices and their combining losses provide poor DC-to-RF efficiency. Yet, at the relatively low power levels where solid-state is feasible, efficiency is not a major concern. At high power levels (60kW and up), however, today's solid-state technology becomes prohibitively inefficient, generally overwhelming the value of its soft-failure attributes.

Transmission technology continues to progress in the UHF-TV world. Improved efficiency and reliability have been the most recent beneficiaries, but the proper choice for a particular application remains a function of a broadcaster's judgment to a large extent. Therefore, it is worthwhile to find out as much as you can about your station's current and future needs and about the transmission technology options available to you. The more you know, the better your choices will be. ■

➡ *For more information on UHF transmitters, circle (326) on Reply Card. Also see "Television Transmitters, UHF" pp. 136-138 of the 1994 BE Buyers Guide.*

Applied Technology



Tektronix 2714 cable TV spectrum analyzer

By Jeff Noah

From the early '70s until 1985 cable operators were subject to technical regulations similar to those in effect today. It wasn't until 1989, when RF signal leakage regulations went into effect, that cable operators once again had to perform tests at the behest of the FCC. Then, in February 1992 technical reregulation came full circle, presenting the cable industry with the need to rediscover the technology, tools and techniques required in the not-too-distant past.

What's the same? What's not?

Many of the most frequently made cable measurements are identical to those made by broadcasters. Others are unique because of distortions caused by the presence of multiple carriers on a single wire. But even for measurements common to both worlds, one significant difference still separates the two: the number of times a measurement must be repeated in each system. A broadcaster using Channel 6 measures only Channel 6. A cable operator measures the same attributes as an over-the-air broadcaster, plus a few more, but for 20 to 60 channels.

Required measurements common to cable and broadcast include carrier frequency and amplitude measurements, carrier-to-noise ratio, chrominance-to-luminance delay and differential gain and phase. Measurements exclusive to cable include 24-hour carrier stability, adjacent visual carrier amplitude, composite triple beat and composite second-order (CTB/CSO), cross modulation, amplitude characteristic (or frequency response or in-channel response), terminal isolation and leakage.

Carrier measurements

Cablecasters make carrier level and frequency measurements more often than any other measurements. They usually call upon a signal level meter (SLM) or spectrum analyzer with a built-in frequency counter to do the job. Like broadcasters, cablecasters must measure visual and aural carrier amplitudes and frequencies. However, cablecasters must repeat the process for all channels to satisfy the 24-hour stability and adjacent-carrier level requirements.

Measuring carrier levels with an SLM requires little more than connecting the meter, selecting a channel and reading the level from the display. On a cable-specific spectrum analyzer, placing the measurement cursor on the peak of the carrier, once properly positioned, supplies a level and frequency readout to complete the measurement. Initiated by pushing just a few buttons, an analyzer's automated mode measures and displays readouts of all visual and aural carrier levels and frequencies.

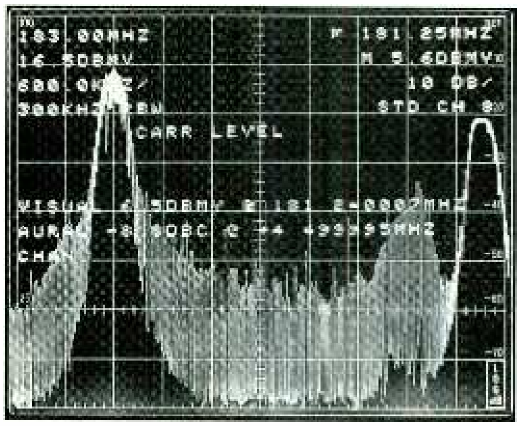


Figure 1. 2714 display of an automated carrier level and frequency measurement.

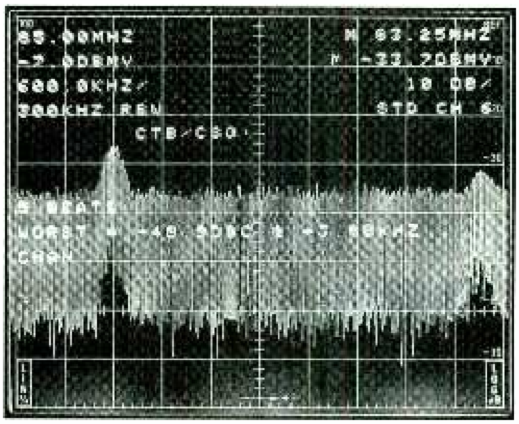


Figure 2. Display of a CTB/CSO measurement on the 2714.

The adjacent carrier level and 24-hour carrier level variation tests require measuring the visual carrier level on every channel. Each carrier can be no more than 3dB above or below the adjacent channels, with the maximum variation of 10dB between any two carriers. The 24-hour requirement states that no carrier may vary by more than 8dB during a 6-month period, specified as July/August and January/February, respectively, the hottest and coldest times of the year. This measurement must be taken every six months and performed once every six hours (four times in one 24-hour period).

The instruments of choice for cable operators make the measurements automatically. After all, who wants to make upward of 1,000 individual carrier measurements in a 24-hour period, manually? Figure 1 shows an analyzer's display after an automatic carrier measurement of one channel.

Coherent disturbances

The coherent disturbances category includes composite triple beat (CTB), composite second-order (CSO) and cross modulation. The FCC requires removing a channel from service when making coherent disturbance measurements.

Composite triple beat, as its name implies, occurs when three carriers combine to form a beat at an algebraic sum of their frequencies. For example, $F_{C1} \pm F_{C2} \pm F_{C3} = F_{CTB}$ or $2F_{C1} \pm F_{C2} = F_{CTB}$. Beats from CTB occur at or near the carrier frequency for non-coherent cable systems. For coherent systems, they occur at the carrier frequency.

CSO occurs when two carriers combine to form a beat at an algebraic sum of their frequencies. For example, $F_{C1} \pm F_{C2} = F_{CSO}$ or $2F_{C1} = F_{CSO}$. For non-

Noah is a technical writer for the Tektronix Television Division, Beaverton, OR.

coherent and Incrementally Related Carriers (IRC) coherent systems, CSO beats are typically found at or near ±0.75MHz and ±1.25MHz from the visual carrier. On Harmonically Related Carriers (HRC) coherent systems, CSO is coincident with the visual carrier. CSO can cause diagonal lines on the picture, whereas CTB can cause a number of random, horizontal streaks across the screen. Cross modulation superimposes a faint image from one channel onto another. CTB is typically stronger in middle frequencies; CSO tends to be more apparent at the upper and lower frequencies.

The system RF power level greatly affects spectrum analyzer measurement accuracy. Most analyzers produce internal beat products that interfere with these measurements if the total

Tektronix 2714 spectrum analyzer.

power at an analyzer's input is too high. Connecting a preselector for the desired channel between the subscriber terminal and the spectrum analyzer prevents this. Fortunately, preselectors are usually needed only when the average visual carrier level on all channels of a 60-channel system is above 10dBmV (non-coherent systems) or 15dBmV (coherent systems).

CTB and CSO beats fall into frequency bands within the channel and are obscured by the presence of the visual carrier. That is why the carrier must be removed, after its amplitude is

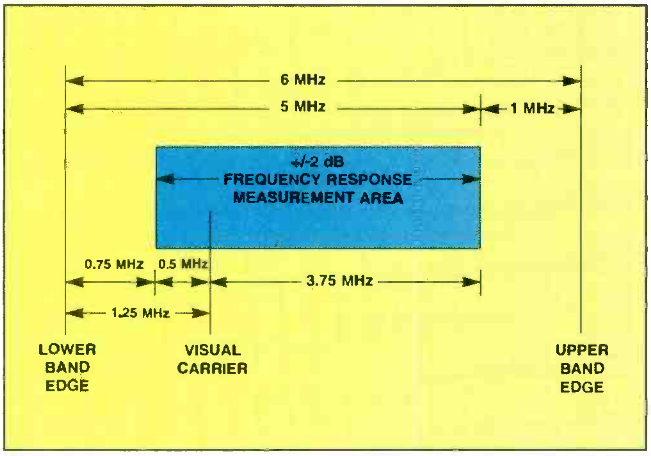


***Figure 3.** Frequency response measurement area for a cable TV channel.*

measured, before measuring the beats. Figure 2 shows an analyzer's display after making a CTB/CSO measurement.

Cross modulation is the last distortion type that falls in the coherent disturbance category. Cross modulation testing doesn't require turning off the carrier while making the measurement, but the modulation for that channel must be shut off after measuring the modulated visual carrier.

The cross modulation measurement is made by measuring and then centering the carrier of interest. After enabling zero span and adjusting the position of the carrier, a 100ms/division sweep is selected. Any modulation present at this point is cross modulation.

Automated analyzers, including the 2714, follow a similar routine, but they acquire and digitize the zero span data. The raw digital data undergoes some processing before the application of a fast Fourier transform (FFT), from which the analyzers extract the 15.75kHz component of the carrier. Using the 15.75kHz component amplitude and modulated visual carrier amplitude, the analyzers calculate and display intermodulation distortion in decibels.

In non-coherent cable sysems, coherent disturbances must be kept at least 51dB down from the visual carrier. The FCC allows a more lenient margin of 47dB for coherent systems (e.g., HRC), because frequency-coincident coherent disturbances have less effect on the picture in coherent systems.

Amplitude characteristic

Although amplitude characteristic, also known as in-channel response or frequency response, is specified for broadcasters, the tolerances listed in the FCC regulations are quite relaxed compared with those that cable operators must meet.

The amplitude characteristic specifications for cable television clearly state the frequency band within a 6MHz channel that must meet the ±2dB limit. Figure 3 shows the location, relative to upper- and lower-channel boundaries and visual carrier, of the frequency band that must meet the ±2dB limit. Because the regulations don't strictly specify how the measurement must be made, they leave room for various measurement techniques.

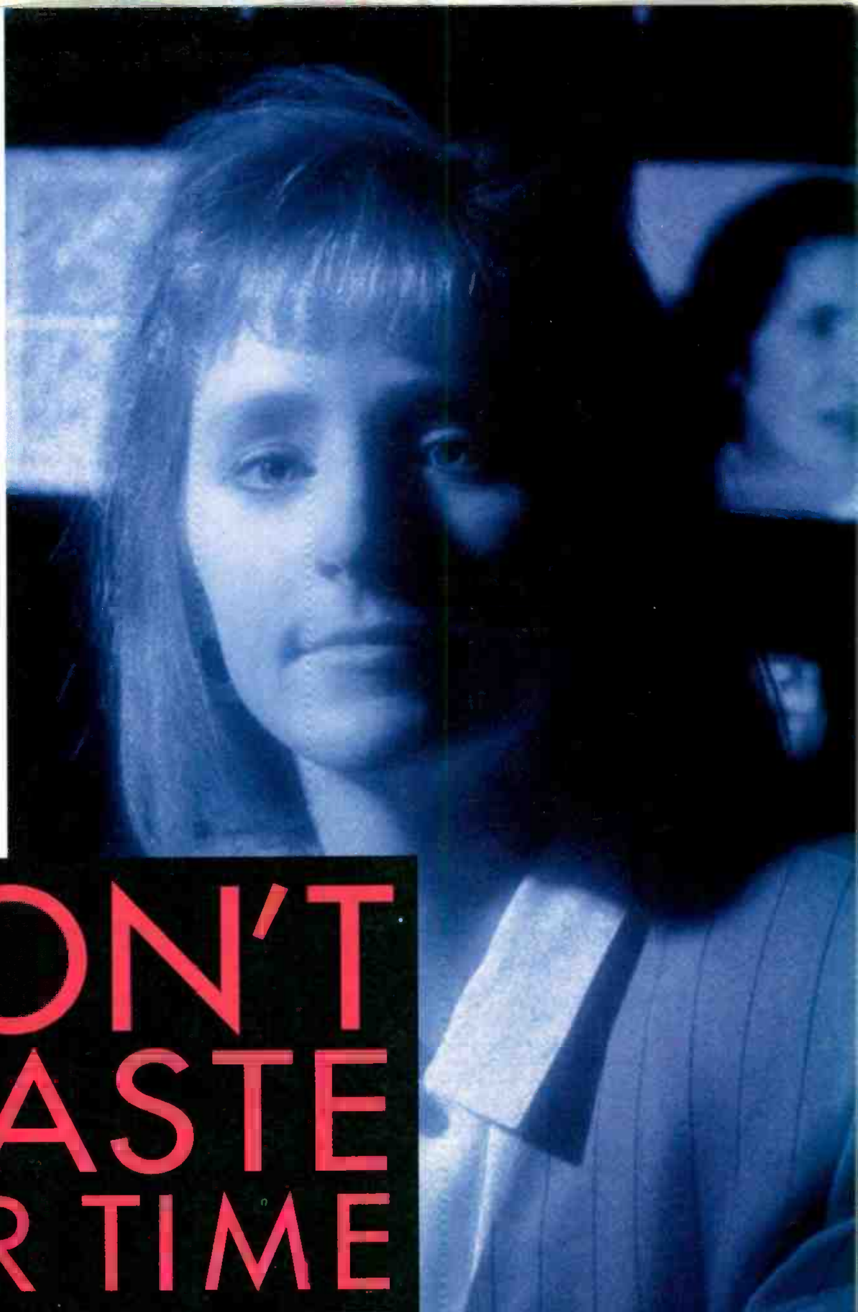
There are two general methods for testing in-channel response. One is to transmit a full-field multiburst or similar test signal over the channel to be measured and monitor that channel with a spectrum analyzer. The other is to include the test signal as a vertical interval test signal (VITS) along with program material, demodulate the RF signal, and measure frequency response at baseband. Both methods require carrying equipment into the field, but the baseband method requires more gear.

The standard broadcast multiburst signal is not optimal for testing cable system response. A special cable multiburst signal was developed with packets at 500kHz, 1.25MHz, 2MHz, 3MHz, 3.75MHz and 4MHz. The 3.75MHz packet falls at the exact upper limit specified by the FCC. The 500kHz packet found on the standard and special cable multiburst signals exercises the lower sideband limit. Changing the last packet's frequency to 4MHz (from 4.2MHz) usually eliminates sound trap-induced roll-off and makes that packet's amplitude a meaningful indicator of response beyond the specified limit.

Making the measurement at RF is really the only way to completely cover the frequency range specified by the FCC, because baseband testing cannot provide any direct indication of lower sideband response. And it can be done automatically by cable-specific spectrum analyzers. Its disadvantage is that regular programming must be replaced with a full field test signal.

The other method of measuring frequency response requires measuring the response of a multiburst or cable sweep signal at baseband frequencies on a waveform monitor or automated video measurement set. The appropriate test signal can be transmitted along with regular programming as a VITS. However, this method does have drawbacks. Channels lacking an appropriate VITS signal require a dedicated VITS inserter. Also, more test gear is needed in the field (tunable downconverter and demodulator). Even though this method has shortcomings, it is the method suggested by the FCC. ■

➡ *For more information on the Tektronix 2714, circle (328) on Reply Card.*



Dana McDaniel can tell you anything you want to know about broadcast automation. But make it quick, ok?

As they say at ChicagoLand TV News, you've got five seconds. Four. Three. Two. Welcome to news when it happens, not when you expect it, or have the staff to handle it. It's broadcast on double espresso. Where any second a producer can override your play list and scream "Let's go live!"

So how *does* an Operations Supervisor keep her sanity at 24 hour news station? Meditation? Primal screaming? Sanka? Try total station automation, by Louth. From the moment it hit the airwaves on January 1, 1993, the entire station has been running on Louth: ADC-100 automation, Autoscreen media management, and the Traffic Interface Manager to tie it all together. All of which gives Dana and her staff absolute flexibility and control under any conditions. From merely frantic to those last second edits to 10,000-event playlists.

If you're considering broadcast automation, talk to the people who use Louth – like Dana. And don't be afraid to get right to the point. After all, air time is money. And she doesn't have a moment to waste.

DON'T WASTE HER TIME

LOUTH
AUTOMATION

545 Middlefield Road, Menlo Park, California 94025
(415) 329-9498 Fax: (415) 329-9530

Circle (62) on Reply Card

Industry Briefs

BUSINESS SCENE

Studer Revox AG, Switzerland, plans to reorganize some of its subsidiaries. The semi-professional products, Revox-Pro, is to be integrated in the Studer professional product range.

The manufacturing operation for semi-professional products will be transferred from Loffingen, Germany to Regensdorf, Switzerland. The Studer sales organization will be responsible for marketing these products.

In the United States, some activities of Studer Revox America Inc. have been taken over by Studer Editech Corporation, located in Menlo Park, CA. The existing branches in Los Angeles, Nashville and New York will remain unchanged.

Studio Audio Digital Equipment Inc. (SADiE) has moved sales and customer support to Nashville. The new U.S. sales headquarters for the SADiE digital audio editor opened for business Feb. 1. The address is 1808 West End Avenue, Suite 1119, Nashville, TN 37203; telephone 615-327-1140; fax 615-327-1699.

Odetics, Anaheim, CA, has installed its 200th large library cart machine. The TCS90 cart machine is being used to automate Asia's first all-business news service, Asian Business News (ABN).

BAL Broadcast Limited's (England) DRX-4600 digital interface system has been selected by Thames Engineering, which is designing and installing a VTR area at Thames' Teddington Studios. Equipment in the BAL DRX4600 family has been ordered in a mix of 1U, 2U and 4U racks to provide A-to-D and D-to-A conversion directly at the VTR locations. Parallel-to-serial and serial-to-parallel converters, YUV and PAL monitoring D-to-A's and digital black and test signal generator cards also have been included in the system.

General Instrument Corporation, San Diego, has announced that the Public Broadcasting Service (PBS) has purchased GI's DigiCipher digital compression system for use in satellite distribution of PBS's audience and instructional programming services to its member stations and educational institutions.

TouchVision Systems, Chicago, and Metro Video Systems, Burbank, CA, have opened an office and training facility in San Francisco. Metro Video Systems will handle sales, training and technical support for northern California.

Denon America, Parsippany, NJ, plans a $100,000 cash infusion to promote Radio Best Data System (RBDS) market by buying RBDS encoders and supplying them free to radio stations in key U.S. markets. Denon is to supply stations with 40 model RE-533 encoders marketed by Cleveland-based RE America in exchange for free advertising. Stations will be selected with an eye toward programming diversity. Before approaching specific stations, Denon will take market-by-market inventory of how many stations subscribing to which programming formats already have installed RBDS equipment.

Industry Briefs

Dynatech Video Group, Madison, WI, has announced that Editing Machines Corporation (EMC), Washington, DC, has joined its group.

Graham-Patten Systems, Hollywood, CA, has supplied 10 D/ESAM series digital edit suite audio mixers to Hollywood Digital. D/ESAM 800 digital edit suite audio mixers have been installed in three telecine rooms, four composite digital D-2/D-3 edit suites, one component D-1 edit suite and a small-format edit suite. Two D/ESAM systems also have been installed at an off-site location.

LBA Technology, Greenville, NC, and Geleco Electronics, Limited, Toronto, Canada, have announced that LBA Technology will acquire the radio frequency (RF) systems and components business of Geleco. All Geleco RF manufacturing assets and inventory will be relocated to Greenville, and its operations consolidated within an expanded LBA Technology manufacturing facility.

Sundance Resources, Inc., Dallas, has formed a wholly owned subsidiary — Lightwave Systems, Inc. (LSI). LSI has been granted a technology license agreement from Lestar Laboratories Inc. LSI will market the Lester Laboratories DAS-500 and DAS-2000 analog-to-digital transmission, routing and distribution systems. LSI also will introduce the Lightwave Systems' 20-bit A/D conversion products. LSI is located at 900 Jackson Street, Suite 700, Dallas, TX 75202.

Hitachi Denshi America Ltd., Woodbury, NY, has announced the sale of Digital SK-2600 studio cameras with ultrawide band triax to CBS TV City, Los Angeles.

PEOPLE

Jeff Boggs has been appointed to head the new U.S. sales headquarters for the SADiE digital audio editor. The headquarters is located in Nashville.

Robert W. Puffer has been appointed vice president of manufacturing for Avid Technology, Tewksbury, MA.

Thor Culverhouse and **Bill Denne** have been appointed to positions with the Television Division of Tektronix, Beaverton, OR. Culverhouse covers the Northwest from the Seattle, WA, field office. Denne covers the six New England states from Tektronix' Boston field office. ■

Professional Services

Classified

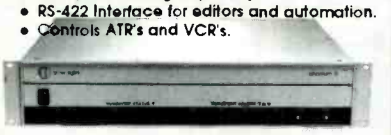
FOR SALE

Classified

FOR SALE

Sony Interface for your VPR-2 or AU-300

- Convert Sony serial to parallel control.
- Complete editing capability.
- RS-422 Interface for editors and automation.
- Controls ATR's and VCR's.



Phantom II VTR Emulator

FOR INFORMATION:
Call 1-800-331-9066
cipher digital — 30 W. PATRICK ST., SUITE 310, FREDERICK, MD 21701

Circle (72) on Reply Card

RS422 VTR REMOTE CONTROL with TIMECODE DISPLAY & JOGWHEEL

SONY, AMPEX, JVC, BTS
PANASONIC, HITACHI
Low Cost — Lots of features
DNF INDUSTRIES
(213) 650-5256 • LA, CA 90069

For Classified Advertising or Professional Services information
Call Renée Hambleton at
(913) 967-1732 FAX (913) 967-1735

****NEW****

MATROX STUDIO

The Ultimate Desktop Video Production Suite

- All Digital Processing (4:2:2)
- Five Layers of Video/Graphic Mix Effects
- Tempra Pro (tm) Paint Software
- Inscriber/CG (tm) Titling Software
- Time Base Correctors
- Wave for Windows (tm) Audio Editing Software
- Matrox: MAT-Studio3 Studio AB Roll/NTSC
- Matrox: MAT-MMP12 Personal Producer/12 CH Audio
- 2-JVC BR-S622U S-VHS Recorder/Players & Time Code Generator/Reader
- 1-JVC BR-S822U S-VHS Recorder/Player & Time Code Generator/Reader
- 1-Pioneer: 486 DX2-66 EISA Motherboard, 256 Cache
- 1-12MB Memory-1M x 9 SIMMs 70ns
- 1-ANTEC: KS010B-Tower Super Server Black Case W/Fans
- 1-PC Power/Cooling: 450W TurboCool-Power Supply
- 1-ADAPTEC: AHA-1742A-SCSI & Floppy Drive
- 1-MICROPOLIS: MC2217-SCSI Disk Drive (1.8 GB)
- 1-TEAC: FD-235 (Black Front)-1.44MB 3.5" Floppy Drive
- 1-BOCA RESEARCH:IOAT55-Serial & Paralle I/O Card
- 1-MATROX: MGA Ultima Pro 2MB SVGA Video Card
- 1-Microsoft:Serial Mouse-OEM Bundle W/MS Dos & MS Windows
- 1-101 Key Keyboard
- 1-MAG: 17" MX17F Multisync Monitor
- 1-JVC: VM-R190SU 19" Broadcast Color Monitor
- 1-AMCO Engineering 4' Equipment Rack W/4-Sliding Shelves & Fans
- 1-Rubbermaid Computer Table
- 1-HON Office Chair

One Complete Matrox Desktop Production Editing System List Price $40,000.00...Our Special Price to You $29,950.00 Plus Shipping and Handling

Contact Jeff Raker
WAAY TV, 1000 Monte Sano Blvd.
Huntsville, AL 35801
or call (205) 534-0482 Ext. 267, Voice Mail Ext. 667

Circle (76) on Reply Card

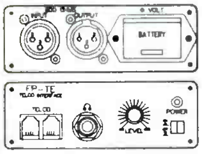
PIG-E-BAK™

New microphone placement system

- Mounts to top, sides, or bottom of another microphone and locks
- Adjusts for height, angle and position
- Clamp pads made of shock absorption material to reduce shock & vibration
- Weighs approx. 4 oz.
- Virtually unbreakable

Ac-cetera Ak'set'ərə
Ac-cetera, Inc.
3120 Banksville Rd.
Pittsburgh, PA 15216
1-800-537-3491, 412-344-8609, FAX 412-344-0818

FOR SPORTS REMOTES USING DIAL-UP TELCO



Line level inputs and outputs; a simple 2W to 4W conversion; can listen, transmit and receive simultaneously; battery powered; small size (4.5" x 1.5" x 6"); comes with a carrying case

MENTION THIS AD AND RECEIVE AN ADDITIONAL 10% DISCOUNT

FP-TE *TELCO INTERFACE* **$185.00**

PREPAID ORDERS RECEIVE A 20% DISCOUNT AND FREE SECOND DAY FREIGHT
(THIS OFFER AVAILABLE ONLY IN CONTINENTAL U.S.)

USA AND CANADA ORDERS (800) 634-3457
FAX ORDERS (800) 551-2749
SESCOM, INC., 2100 WARD DRIVE
HENDERSON, NEVADA 89015 USA
TECHNICAL HELP (702) 565-3400
CALL OR WRITE FOR YOUR FREE 56 PAGE AUDIO CATALOG!

Factory Direct Cases

Our prices can't be beat.

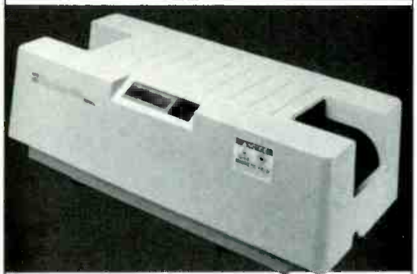
Custom or Stock Sizes

Call for Catalogue or Quote — 800-645-1707
In NY 516-563-1181
Roadie Products, Inc. — Fax: 516-563-1390

CALL US For New and Rebuilt Radio Broadcast Equipment

HALL Electronics
(804) 974-6466
1305-F Seminole Trail • Charlottesville, Va. 22901

TAPE ERASERS



garner

WHEN COST IS IMPORTANT AND QUALITY IS CRITICAL

1-800-228-0275

Erases all formats in quantities of 1 to 1,000,000

garner industries
4200 North 48th Street • Lincoln, NE 68504

Circle (75) on Reply Card

BROADCAST ENGINEERING
9800 Metcalf, Overland Park, KS 66212
(913) 967-1732 Fax (913) 967-1735
Call Renée Hambleton for all your advertising needs

Start the year with quality used gear.

- SONY BVH-2500 1" VTR w/ TBC **$15K**
- SONY BVH-3100 1" VTR w/TBC **$25K**
- GVG 100-N Swticher with RGB Chromakey, Digital Borderline, Pulse Regen, and KEY-MEM. **$10,455**
- SONY BVE-600 A/B Roll Editor with built in switcher optional **starting $3,900**
- HEDCO 16x1 SXR w/ GPI control **$500**
- FOR-A FA-420 TBC **$2,000**
- SONY BVM-1900A 19" Hi-res monitor **$2,000**

MICOR VIDEO EQUIPMENT Sales
CHICAGO 312 334 4300

SONY . AMPEX . BTS . DUBNER
GRASSVALLEY . PANASONIC

If You're Looking For the Best in Used Equipment and You Want the BEST: **. DEAL . VALUE . SERVICE**
CALL MIDWEST: (708) 251-0001 . CANADA (604) 850-7969

midwest
AUDIO/VIDEO EXCHANGE, INC.
1131 Central Ave. Wilmette, Illinois 60091
International Brokers and Appraisers Serving the Audio / Video Industry

Circle (74) on Reply Card

Classified

FOR SALE

BE CLASSIFIEDS

913-967-1732
Ask for
Renée.

STUDIOFOAM
SOUND ABSORBENT WEDGES
TESTS UP TO 40% BETTER THAN SONEX
★COSTS LESS•BETTER COLORS•BETTER CUT★
SONOMATT
4'X8'X2" Sheets•$29.99 Ea. In Pairs•NRC.70•Ships UPS
VENUS 12"x 2'x 4'•NRC 1.30•Flat 10K-125Hz.
BASS TRAPS Then They Really Kick In (125Hz NRC=1.53!)•Charcoal Gray•2 For Just $150!!
USAFoam•Box 20384•Indianapolis IN 46220 (317)251-2992
1-800-95-WEDGE

★☆★ BUY • CONSIGN • SELL & SERVICE ★☆★
Your Full Service Dealer of New & Used
Broadcast & Industrial, Video & Audio Equipment
"Harry with Encore and Paintbox" priced to sell
D1 or D2: DVR-1000, DVR-28... call now
Beta SP: 75 or 65 or 60. In the box.
3/4" SP BVU-950 WITH TBC & TIME CODE.
S-VHS JVC BR-S822U Editor in the box.
S-VHS JVC BR-S525U Player TBC & Slow-Mo
3 Chips camera BVP-5 or 7... ready to go.
DVE: ADO-1000, 2000 or 3000 in demo room.
Toaster: Few configurated differently
And "Much Much More"

BCS BROADCAST STORE, INC.

BCS • BROADCAST STORE, INC.
NY 212-268-8800 LA 818-551-5858 UK 081-810-9055

Circle (71) on Reply Card

FREE

Apply for a **FREE** subscription to the industry's leading information source, *Broadcast Engineering*. Turn to the reader service card in this issue and fill out the subscription application section. Soon you could be receiving monthly issues of *Broadcast Engineering* . . .

FREE!

BROADCAST ENGINEERING®

Note: Sign and date the form to speed processing.

EQUIPMENT WANTED

WANTED: USED VIDEO EQUIPMENT. Systems or components. PRO VIDEO & FILM EQUIPMENT GROUP: the largest USED equipment dealer in the U.S.A. (214) 869-0011.

SERVICES

Freeland Products, Inc.
Serving the world with quality rebuilt tubes since 1940.
CALL TODAY FOR A FREE INFORMATION PACKET
75412 Highway 25 • Covington, LA 70433
800-624-7626 • 504-893-1243
Fax 504-892-7323

TRAINING

FCC GENERAL CLASS LICENSE. Cassette recorded lessons for home study with seminars in Washington, Newark, Los Angeles. Bob Johnson Telecommunications. Phone (310) 379-4461

CLASSIFIED ADVERTISING RATES

CLASSIFIED ADVERTISING NOW AVAILABLE AS CLASSIFIED DISPLAY OR BY-THE-WORD.

Classified Display: $119 per column inch, per insertion, with frequency discounts available. 1 inch minimum, 10 inches maximum per ad. Blind ads $40 additional. Reader Service number $50 additional or free to 4" or larger ads. Spot color available for $95 (color determined by publisher).

By-The-Word: $1.75 per word, per insertion. Initials and abbreviations count as full words. Blind ads $40 additional. Minimum charge $40 per insertion. No agency discounts allowed for classified ads.

Contact Renée Hambleton, at (913)967-1732, for information on frequency and pre-payment discounts. To place your classified ad send your order and materials to Broadcast Engineering, Classified Ad Mgr., P.O. Box 12901, Overland Park, KS 66212-2215.

HELP WANTED

NEW YORK TIMES OWNED UHF CBS AFFILIATE seeking studio engineer. Primary experience with Sony Beta and Betacart desired. Sony Technical School training a plus. Familiar with Grass Valley 100, 300, Abekas A53D, Harris Iris, Chyron 4200 and Scribe. Great benefits package and great city. Resume to: Chief Engineer, WHNT-TV, PO Box 19, Huntsville, AL 35801, EOE.

ATLANTA—CHIEF ENGINEER: Trinity Broadcasting 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, 2442 Michelle Dr., Tustin, CA 92680. M/F EOE.

TOO MANY ENGINEERING OPENINGS!!
We have too many openings in the engineering depts. of broadcast stations & not nearly enough personnel to fill them. Openings from coast to coast from entry level to seasoned chiefs needed in all aspects of broadcasting. Dozens of positions listed each week, all within a 4 week window. $20 for 4 weeks, $35 for 8. Call toll-free for info.
BROADCAST EMPLOYMENT WEEKLY
1125 W. Boone Ave., Nampa, ID 83651
1-800-922-JOBS • BBS 1-208-467-4110

SENIOR MAINTENANCE ENGINEER

(5 to 7 years minimum experience) to work in Washington D.C. News Facilities House. Hands on experience required with state of the art ENG equipment, studios, graphics, transmission equipment and master control. Experience in the field and computer skills are beneficial. Competitive salary and comprehensive benefits. Send resume and salary history in confidence to:
Frank O'Connor
Engineering Manager, Maintenance
Professional Video Services
2030 M Street N.W., Suite 400
Washington D.C. 20036

CHIEF ENGINEER needed to help make a difference. KDOR TV 17 (Tulsa, OK), 2120 N. Yellowood, Broken Arrow, OK 74012

CHIEF ENGINEER — Aggressive television group has openings in Greenville, MS (VHF-ABC), Springfield, IL (UHF-FOX), and Terre-Haute, IN (UHF-ABC). Must be proficient and experienced in maintaining studio and transmitting equipment, employee supervision, and FCC rules. EOE. Send letter and resume to Director of Engineering, Bahakel Communications, LTD, PO Box 32488, Charlotte, NC 28232.

TELEVESION MAINTENANCE TECHNICIANS: Entry level and experience positions available. A.A. in Electronics required. Work on broadcast M-II video tape machines and camera. Some transmitter work. WHAG-TV is a small market NBC affiliate. Comprehensive benefit package, including 401(k) and Section 125 Plans. Send resume and salary requirements to PERSONNEL, WHAG-TV, DEPT. Z, 13 E. WASHINGTON ST., HAGERSTOWN, MD 21740. NO PHONE CALLS. EOE.

Ad Index

Advertiser	Page Number	Reader Service Number	Advertiser Hotline
Abekas Video Systems	3	5	415-369-5111
ADC Telecommunications	55	29	800-726-4266
Asaca/Shibasoku Corporation	61	32	310-827-7144
AT&T	23	14	800-248-3632
Avitel Corporation	34	20	801-977-9553
Austin Company	69	35	216-831-0110
The Broadcast Store, Inc.	87	71	818-551-5858
Broadcast Video Systems Ltd.	74	45	416-764-1584
BTS Broadcast TV Systems	15	11	800-962-4BTS
Canare Cable, Inc.	81	41	818-365-2446
Canon USA Broadcast Lens	64A	65	201-816-2900
Cipher Digital, Inc.	86	72	301-695-0200
Circuit Research Labs Inc.	82	47	602-438-0888
Clear-Com Intercom Systems	39	23	510-527-6666
Comark Communications, Inc.	59	31	215-822-0777
Denon	82	46	201-575-7810
Dynatech Video Group	37		608-273-5828
Enco Systems Inc.	84	37	800-ENCO-SYS
Garner Industries	86	75	800-228-0275
Grass Valley Group	35	21	800-343-1300
Hardigg Industries	64	40	800-JHARDIGG
Harris Allied	1	4	800-622-0022
Horita	36	43	714-489-0240
Immix	16A-16D	100	916-272-0800
Intertec Group 2 Seminars	66	67	800-458-0479
Jem-Fab Corp.	85	70	516-867-8510
JVC Professional Products Co.	33	19	800-JVC-5825
Leader Instruments Corp.	45	55	800-645-5104
Leitch Incorporated	BC	3	800-231-9673
Louth Automation	83	62	415-329-9498
Macrovision	53	28	415-691-2909
Magni Systems, Inc.	51	27	800-237-5964
Matrox Electronic Systems	5	6	800-361-4903
Maxell Corp Of America	11	9	800-533-2836
Midwest Audio/Video Exchange	86	74	708-251-0001
Mission Electronics	32A-32B		913-894-8480
N Vision, Inc.	52	38	916-265-1000
Odetics, Inc.	77	60	800-243-2001
Opamp Labs, Inc.	36	44	213-934-3566
Orban, Div. of AKG Acoustics	7	7	510-351-3500
Ortel	49	26	818-281-3636
Otari Corp.	9	8	415-341-5900
Panasonic Broadcast & TV	81		800-524-0864
Panasonic Broadcast & TV	40-41		800-524-0864
Pioneer New Media Tech	29, 31	18	800-LASER-ON
Polyphaser Corp.	50	49	800-325-7170
Pro-Bel Inc.	IFC	1	404-396-1971
QSI Systems, Inc.	28	16	603-893-7707
Quantel	71	10	203-656-3100
Sachtler AG	21	12	32-909-150
Sanix Corporation	67	48	708-677-3000
Sealevel Systems, Inc.	64	39	803-843-4343
Shure Brothers Inc.	43	24	800-25-SHURE
Snell & Wilcox Ltd.	64B, 64C	66	073-082-1188
Sony Business & Professional Products Group	24-25, 26		800-635-SONY
Sony Recording Media	56-57	30	201-930-7081
Standard Communications	65	34	800-767-6695
Studio Audio & Video Limited	47	25	353-648-888
Tascam/Teac America, Inc.	27	50	213-726-0303
Television Technology Corp.	75	61	303-665-8000
Utah Scientific/Dynatech Video Group	37	22	800-453-8782
Vega, A Mark IV Company	13	36	818-442-0782
Video Design Pro	22	13	800-VID-CAD6
Videotek, Inc.	IBC	2	800-800-5719
Vistek Electronics Limited	63	33	628-531-221
VPS	32A-32B		305-592-5355
WAAY-TV	86	76	205-553-3131
The Winsted Corporation	28	15	612-944-8556

Advertising sales offices

NEW YORK, NEW YORK
Gordon & Associate
Josh Gordon
210 President Street
Brooklyn, NY 11231
Telephone: (718) 802-0488
FAX: (718) 522-4751
Joanne Melton
888 7th Avenue, 38th Floor
New York, NY 10106
Telephone: (212) 332-0628
FAX: (212) 332-0663

OXFORD, ENGLAND
Richard Woolley
Intertec Publishing Corp.
Unit 3, Farm Business Centre,
Clifton Road, Deddington,
Oxford OX15 4TP England
Telephone: (0869) 38794
FAX: (0869) 38040
Telex: 837-469 BES G

AGOURA HILLS, CALIFORNIA
Duane Hefner
5236 Colodny Ave., Suite 108
Agoura Hills, CA 91301
Telephone: (818) 707-6476
FAX: (818) 707-2313

SANTA MONICA, CALIFORNIA
MC² Magazine Communications Marketing Corp.
Jason Perlman
Telephone: (310) 458-9987
FAX: (818) 393-2381
Deborah Kern
Phone: 310-393-2381
FAX: 310-458-8080
501 Santa Monica Blvd., Suite 401
Santa Monica, CA 90401

CHICAGO, ILLINOIS
Vytas Urbonas
55 East Jackson, Suite 1100
Chicago, IL 60604
Telephone: (312) 435-2361
FAX: (312) 922-1408

TOKYO, JAPAN
Orient Echo, Inc.
Mashy Yoshikawa
1101 Grand Maison
Shimomiyabi-Cho 2-18
Shinjuku-ku, Tokyo 162, Japan
Telephone: (3) 3235-5961
FAX: (3) 3235-5852
Telex: J-33376 MYORIENT

FREWVILLE, SOUTH AUSTRALIA
Hastwell, Williamson, Rep. Pty. Ltd
John Willianson
109 Conyngham Street
Frewville 5063, South Australia
Telephone: 799-522, FAX: 08 79 9522
Telex: AA87113 HANDM

CLASSIFIED ADVERTISING
OVERLAND PARK, KANSAS
Renée Hambleton
P.O. Box 12901
Overland Park, KS 66282
(913) 967-1732 FAX: (913) 967-1735

Automatic Choice.

It's the age of automation, a time when you need precise, yet affordable, automatic video measurement to assure compliance with new FCC regulations. This is why Videotek proudly presents our selection of state-of-the-art auto-measurement instruments for the cable and broadcast industries. Call us today to find out more about your Videotek choices.

DM-154 Demodulator. *High performance stereo TV demodulator with remote control capability. The perfect companion to the S-2000 or TVM-730 auto-measure instruments. Now at last you can afford a demodulator that has the features and specifications necessary to test cable and broadcast systems for FCC compliance.*

DM-141A Demodulator. *154 channel cable-ready demodulator with BTSC stereo balanced outputs. Easy operation makes it great for off-air or cable monitoring.*

S-2000 System Auto Measure. *The most affordable auto-measure instrument in the industry is also one of the most advanced. The S-2000 is capable of performing hundreds of NTSC and PAL video measurements with absolute accuracy.*

TVM-730 Video Analyzer. *This acclaimed video analyzer provides all the auto-measure capability of the S-2000 and outstanding waveform/vectorscope features such as three independent line selects, measurement cursors, combination displays and twenty versatile memories.*

VIDEOTEK™
A Zero Defects Company

243 Shoemaker Road, Pottstown, PA 19464 1-800-800-5719 (215) 327-2292 Fax: (215) 327-9295

CERTIFIED ISO-9003 INTERTEK

Accredited by the Dutch Council for Certification for certification and registration activities

Circle (2) on Reply Card