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An INTERTEC[®] Publication

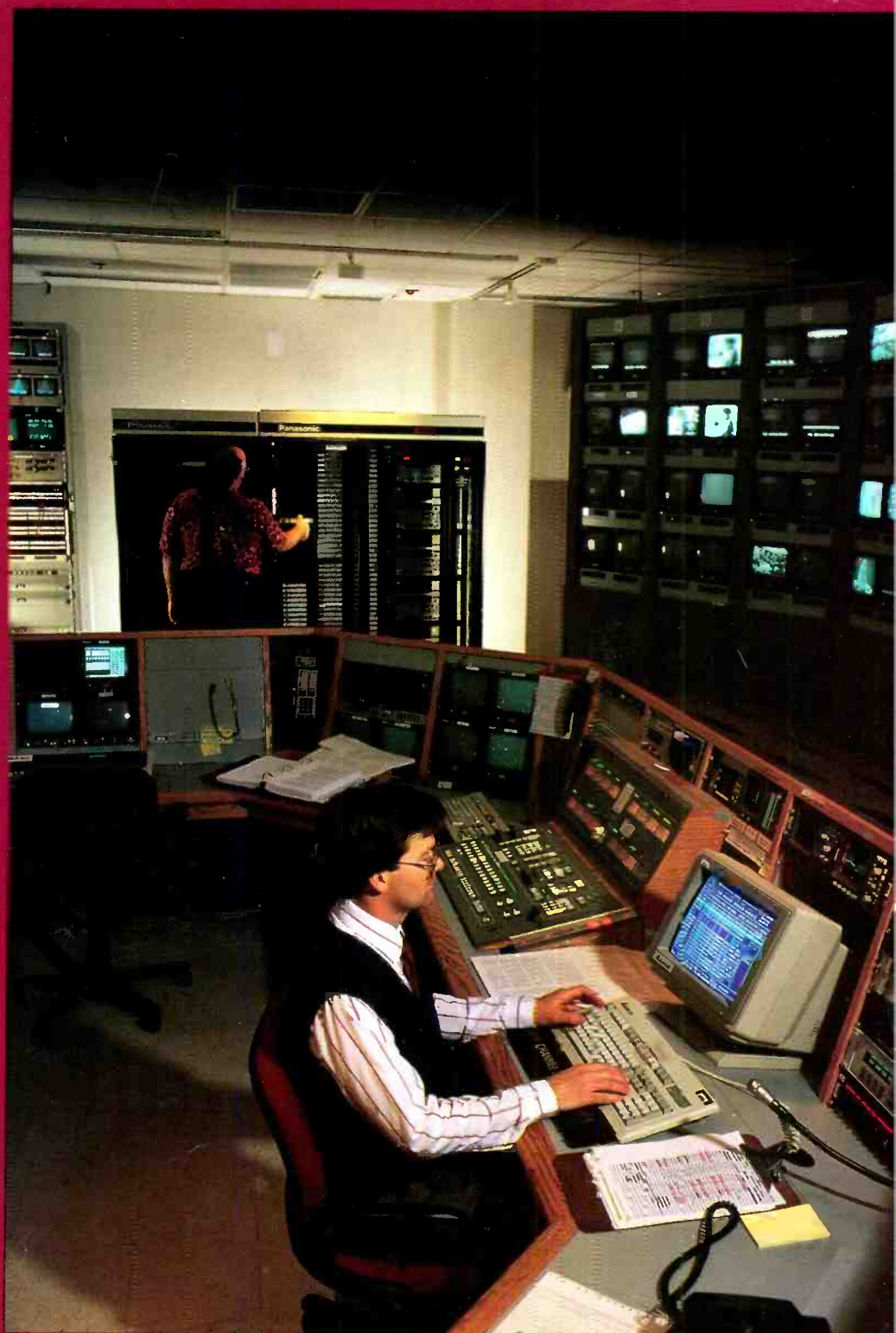
February 1995/\$5.00

Cover Story:

TV automation
systems

Also Featured:

♦ Video
Compression
Selecting PC
video
monitors
Synchronizing
digital audio
video



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THIS MONTH...

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Systems abound but choosing the right one requires research and planning.

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As analog audio and video become another form of digital data, compression will allow these enormous files to be handled cost-effectively.

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Getting out of sync can be even easier with digital audio.

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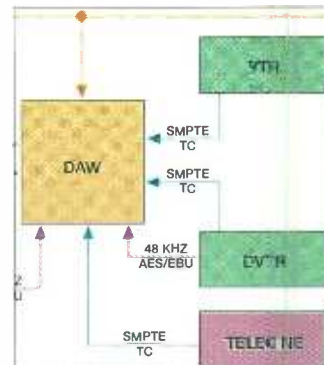
By Gene Koprowski

Monitors may look similar on the surface, but internally there can be major differences.

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By Brett Bilbrey

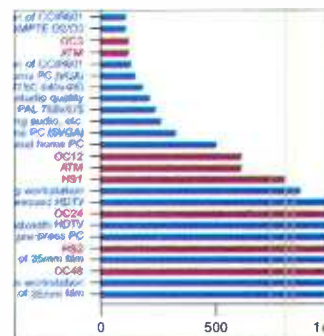
The term "digital video" has been used to describe a variety of image formats.



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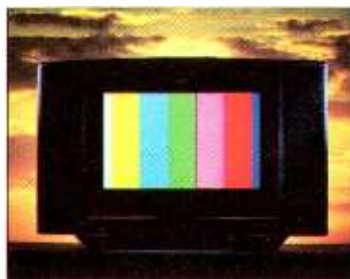
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ON THE COVER: Station KNBC-TV relies on Alamar-based automation technology for both on-air and satellite record operations. The system is based on Alamar equipment and software. Cover photo by Sterling Communications.

What's New At

NAB95?

SUNDAY, APRIL 9-THURSDAY, APRIL 13, 1995
LAS VEGAS CONVENTION CENTER

It's no secret! Digital video equipment will be the key focus at NAB95.

You'll see new digital VTRs, new digital switchers, dazzling digital effect generators, cameras . . . and the latest in digital video test equipment – the state-of-the-art solutions from AAVS – providing test and measurement capabilities that assist the engineering and operations staff in determining the quality of the digital transmission and issuing a warning before a failure occurs. Preventative maintenance answers that ensure your digital video facility will stay up and running – helping you maintain and increase the quality of your final product – digital video quality that your customers expect and deserve.

Visit with us during **NAB95 at Booth #19623** to discover how **AAVS** can help with your digital video testing needs.

The Principles Of Digital Video

The "Principles Of Digital Video" provides the basics of digital video, with an emphasis on digital video system troubleshooting and testing. This tutorial is ideal for system engineers in the process of converting to digital video and those who are presently considering the implementation of digital video in their facilities. For more information on "The Principles Of Digital Video" tutorial call **1-800-769-AAVS(2287)**.

Don't Miss Out! To Set Up A Private One-On-One Demonstration And Find Out About The Latest Techniques In Testing Digital Video Systems, Call **1-800-769-AAVS(2287)**.

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COFDM evaluation project awards contract

The COFDM (coded orthogonal frequency division multiplexing) evaluation project has announced that major TV broadcasting organizations have agreed to contract for a COFDM transmission subsystem suitable for advanced digital TV broadcasting in North America.

The group announced that HD-DIVINE, a consortium of Scandinavian telecommunications and broadcasting organizations based in Stockholm, Sweden, will supply a flexible and configurable COFDM system. The Canadian Communications Research Centre (CRC) will be employed to develop an optimized configuration of COFDM parameters for North American 6MHz TV transmissions, using the flexible HD-DIVINE hardware. The selection of HD-DIVINE and CRC is the result of an international search and evaluation of proposals from COFDM technology developers begun last June. The expected delivery date for an optimized testable system is July 31, 1995, after which it will be submitted to the FCC Advisory Committee on Advanced Television Service (ACATS) for evaluation.

COFDM technology is being considered for adoption in Europe and around the world. If the technology is successful it would be an alternative to the Grand Alliance's 8-VSB transmission technology already approved for testing by ACATS. It also could be integrated with the rest of the Grand Alliance system. COFDM technology has the potential to provide greater multipath immunity (eliminate the effects of ghosting), allow for increased coverage to areas that don't have good reception (through the use of on-channel repeaters) and provide greater flexibility for advanced digital services.

HD-DIVINE's principal members include Teracom, Telia, Swedish Television, Danish Telecom and Finnish Telecom. HD-DIVINE has subcontracted with Sintef Delab, a Norwegian research and development firm, for the development of necessary hardware.

The COFDM evaluation project is a joint effort of NBC, Capital Cities/ABC, Fox Broadcasting, the Association of Independent Television Stations (INTV), the Association for Maximum Service Television (MSTV), the National Broadcasting Company (NBC) and the National Association of Broadcasters (NAB). Additional funding and technical support has been provided by the Canadian Association of Broadcasters (CAB), the Canadian Broadcasting Corporation (CBC), the Brazilian broadcast trade

association (ALBERT) and the Canadian Communications Research Centre (CRC).

SBE call for papers

Abstracts are being accepted for proposed engineering papers for the fall SBE Engineering Conference. The conference will be held from Sept. 6-9 in New Orleans. The event will be held concurrently with the NAB Radio Show, RTNDA and SMPTE and World Media Expo. The technical conference will address hands-on needs of engineers and technical managers at TV and radio stations, post-production facilities and corporate video centers.

If you are interested in preparing a technical paper for presentation, submit an abstract outlining the scope of the paper no later than March 1, 1995. Send your correspondence to SBE Engineering Conference Chair, Society of Broadcast Engineers, 8445

Federal pre-emption of state and local RF regs urged

According to the Electromagnetic Energy Association (EEA), state regulations that are in conflict with FCC radio-frequency (RF) standards should be pre-empted by federal rules because they impede development of communications systems, including new technologies. EEA's position is stated in a petition filed with the FCC. It requests a further notice of proposed rule-making (RPM) for adoption of a rule pre-empting state and local regulation of radio-frequency energy matters.

EEA maintains that pre-emption is warranted when state law or regulation obstructs the intended social, technological and economic benefits of continued service or future advancements in communications. Technologies, such as advanced television, digital audio broadcasting, personal communications services and cellular services cannot be fully realized if FCC-authorized facilities are delayed or blocked by state or local regulations applying RF energy standards that are inconsistent with those adopted by the commission.

Regulatory burdens from multiple state and local RF standards interfere with the FCC's ability to accomplish its Congressional mandate. Specifically, one of the FCC's duties is to make available to everyone in the United States a rapid, efficient, nationwide and worldwide wire and radio communications service with adequate facilities

at a reasonable rate.

Authority to pre-empt state and local regulations that unduly impede the implementation of federal policies is delegated to the FCC under the Communications Act and the National Environmental Policy Act (NEPA).

Philips and Sony propose specs for multimedia CD

Philips Electronics and Sony Corporation have jointly proposed specifications for a 12cm high-density multimedia CD.

The CD will be able to store approximately 3.7GB of data. This storage capacity -- more than five times that of an audio CD -- has been achieved by incorporating a 635 manometer (red) laser. This laser reduces the distances between the tracks and the sizes of the pits and uses highly sophisticated error correction and improved modulation techniques. The specifications would allow discs to be produced at conventional manufacturing facilities with only minor modifications. As a result, production costs of the proposed new discs will be similar to that of conventional CDs.

For further enhanced applications, the specification includes a dual-layer disc that enables a doubling of disc capacity to approximately 7.4GB. This technology is being developed in collaboration with 3M. ■

UPCOMING SHOWS

APRIL 9-13

NAB in Las Vegas
(202)429-5335

MAY 7-10

NCTA in Dallas
(202)775-3629

JUNE 9-13

International Television Symposium
in Montreux, Switzerland
(+41 21 963 32 20)

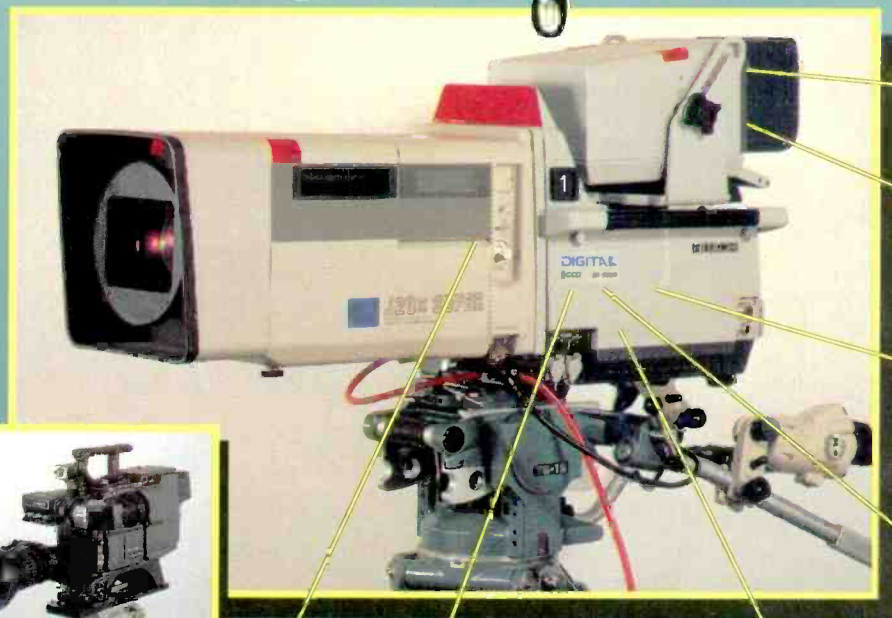
Buy a digital camera or else.....

Or else you may be stuck with a camera left behind by digital technology

As we all know, communications, video, information...everything is going digital. Isn't it time cameras did? Today's digital camera not only outperforms the best analog can offer but sets new benchmarks in video quality, features, stability and reliability. The days of the analog camera are numbered because digital offers too many advantages to be ignored.

With DIGITAL advantages such as a new video transparency, flesh tone detail to soften facial blemishes, precision detail correction, precision transfer of setups between cameras, a plug-in memory card to recreate exact setups weeks or months later and serial digital outputs for D-1 and D-2/D-3 VTR's, now is the time to consider what all cameras will be.....DIGITAL.

Introducing the *Digital SK-2600*



Unique PIP (Picture in Picture) Allows a second video source to be windowed with camera video in any of four quadrants or reversed with camera video

Separate H&V detail generator for viewfinder makes focus "pop" for camera operator

Exclusive single LSI device provides 13-bit (minimum) digital processing for RGB video including detail and masking.

The 600,000 pixel CCD provides 900 TV line resolution and dramatically reduces aliasing. An optional, 520K pixel CCD is available to provide switching between 4:3 and 16:9 aspect ratios at the push of a button.

High performance Ultra-Band triax system (12MHz Green) or Field triax system for long cable lengths or Digital optical fiber system

Plug-in 6 position ND and CC filter wheels allow easy insertion of special effect filters with full remote control capability



SK-2600P Portable Companion

- "No Diascope" internal automatic camera setup
- "Thru-the-Lens" automatic setup with standard grey scale chart

Network Users:
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Call today for more information or a demonstration.

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Let the buyer beware

Don't you hate it when you make the same mistake you've warned others about? I recently fell victim to my own zeal for a good deal without carefully looking beyond the initial purchase price.

As an engineer, I've always been a strong proponent of investigating all the avenues before making a purchase. Careful buyers look at more than just the front panel. Manufacturer integrity, product quality, suitability and technical support are all factors that should be a part of any buying decision.

The genesis for my frustration stems from the recent purchase of a new computer. After many weeks of exploration and comparing prices, I selected a well-known brand. Being the careful consumer, I read the magazine reviews, compared prices, and checked out the industry's impression of the company before I made my selection.

I even went to the trouble to dial in to the company's technical support BBS and its CompuServe forum before I made the purchase. I made that extra effort just to be sure that when I had questions, the company would be there with the answers.

After arriving home with my new toy (I mean *business tool*) I discovered that the speaker amplifier was defective. After calling the store, they said to call the toll-free tech support line for a free replacement. Sounds straightforward right? Wrong.

My calls to tech support reached nothing but a busy tone. I even called at 2:00 in the morning and the phone was still busy! Now, after more than 20 calls to a busy toll-free number over a 3-week period, I've given up. I'll repair the damn thing myself and to hell with the warranty!

This frustrating experience reminded me of a similar situation encountered by a *Broadcast Engineering* reader. It seems he had purchased a well-known brand of desktop editing system. Shortly after he purchased it (well within the warranty period) a board failed.

When he called the manufacturer's tech support line for help (at least he got through), he was told the defective board couldn't be repaired for six weeks. He explained that this wasn't a hobby with him but a business. He had a client waiting for the equipment to

be up and running and a 6-week repair turnaround wouldn't cut it.

The customer asked for a loaner board, but was told the company didn't provide loaners. He then asked if he could be moved to the top of the service list. The technician said that would be possible, but the best turnaround would still be two weeks.

At his wits end, my friend asked what he was supposed to do to get the board repaired more quickly. To which the company's tech support person suggested, "check with a few dealers to see if they will loan you a board."

Professionals like our reader deserve better treatment. Just because he didn't spend \$100,000 for his editing system, doesn't mean that after-the-sale support should resemble my experience. Although he didn't buy a toy, the manufacturer treated the customer like it was. So what if your business will be down while the company gets your board fixed. Your customers will wait won't they?

Unfortunately it may be difficult, as I found out, to get an honest picture of just how well a company meets its promise for technical support. Whether it's on software or hardware issues, professionals are entitled to and should demand top-flight support from the equipment's manufacturer.

Before you buy that next digital wonder, ask around. Has anyone you know called the company's tech support number? Does the company provide loaner boards? Does it provide 24-hour technical support? Don't trust a dealer's answer. Call the support line yourself. Is anyone home? Is it always busy? Will there be someone available to help you when you need it?

For me, I'm mad as hell and not going to take it any more! Got a similar story? Contact me at one of the following e-mail addresses:

be@intertec.com

CompuServe, 74672,3124.

Fax: 913-967-1905

Snail mail also available.

Brad Dick

Brad Dick, editor





Exciting Exciter.

SNG is going digital, and Harris leads the way.

For SNG and other SCPC TV links, upgrading to digital compression and transmission is essential for efficient, cost-effective operation. The Harris DSE 1400 Digital Satellite Exciter and DSR 1400 Studio Grade Receiver will give you a competitive advantage now, and into the 21st century.

With this integrated Digital Satellite News Gathering (DSNG) system, you can access a wider range of transponder channels, achieve lower transponder costs, use less transponder bandwidth and less HPA power, get improved signal quality, and have simpler, more reliable operation. You can also save space and money by using a smaller antenna. The innovative design of the DSE 1400 Satellite Exciter provides the latest MPEG-2 video and audio compression standards with advanced motion compensation and digital coding algorithms in a compact video encoder, combined with QPSK modulation and

frequency conversion in a single, rugged, 6RU high unit. The DSR 1400 Integrated Receiver Decoder (IRD) provides L-band downconversion, demodulation and decoding. These single units require less space than separate 3-unit configurations, and are easily installed or retrofitted in SNG vehicles or fly-away terminals.

Each part of this Harris Digital Satellite TV System is designed for simple, error-free operation. All commands are entered from a single, user-friendly keypad, and are confirmed by colored LEDs. --- Routine set up requires no subsystem adjustment. The MPEG-2 encoder with I, P and B frames, modulator and frequency converter automatically establishes, maintains, and displays the required operating status.

With this system, the cost of upgrading to digital technology is quickly offset by opera-

tional savings, which then continue, year after year.

Other features include variable data rates of 2, 3, 4, 6 or 8 Mbps, compatible with IDR standards; NTSC 525/60 and PAL 625/50 standards; analog composite video, S-VHS component, and Betacam* component inputs; CCIR 601 serial digital video input; standard 2-channel analog or AES/EBU digital audio; 64 kbps auxiliary channel; and 85-265 Vac, 47-63 Hz power supply for operation worldwide.

Contact Harris Allied to learn more about how this exciting digital satellite TV system can give you a competitive edge.



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Florence, KY 41042 USA
Phone: 606 282-4800
Fax: 606 283-2818

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*Betacam is a registered trademark of Sony Corp



The FCC has instituted a proceeding to streamline its antenna structure clearance procedure. It also will revise Part 17 of the rules concerning construction, marking and lighting of antenna structures. The commission's goal is to significantly reduce the number of filings requesting changes to towers; expedite application and notification processing; and increase safety in air navigation.

The FCC proposes to simplify the current antenna structure clearance process with rules requiring registration by tower owners.

The FCC has proposed to simplify the current antenna structure clearance process with rules requiring registration by the owners of towers, rather than by licensees using them. The commission proposed that licensees remain responsible for compliance with all tower rules, but on a secondary basis, in case the tower owner fails to correct any violation.

Currently, the FCC's antenna clearance process requires identifying the location and height of each antenna structure that is either 1) more than 60.96 meters (200 feet) above ground or 2) that may interfere with a nearby airport runway. The applicant must obtain a determination from the Federal Aviation Administration (FAA) as to whether the structure is a potential hazard to air navigation. The FAA may recommend that the tower be permitted but only to a lower height, recommend painting and lighting specifications or recommend both. The FCC then imposes the FAA specifica-

FCC proposes new tower rules

tions as requirements on the authorization of each licensee using the structure.

In 1993, the commission reviewed approximately 17,000 such applications and notifications. Many of these applications and notifications reported changes to the same antenna structure. The FCC believes that the new antenna structure clearance process will significantly reduce the number of repetitive applications filed. Therefore, the burden on the entire communications industry will also be reduced.

In order to simplify the clearance process, the FCC will revise Form 854 requiring a specific registration application to be filed by the tower owner, instead of each licensee or permittee. The registration will set forth coordinates, height, a unique registration number, and painting and/or lighting specifications, where applicable. The revised FCC Form 854 will also be used by the tower owner to: 1) reflect an increase or decrease in the height of the structure; 2) correct coordinates; 3) reflect a change in existing painting and lighting specifications; 4) notify the FCC of the dismantling of the structure; or 5) notify the FCC of a change of ownership.

In revising the form, the commission emphasized that antenna structure registration will not in any

call the Mass Media Bureau, Audio Services Division, FM Branch at 202-418-2720.

TV ownership rules

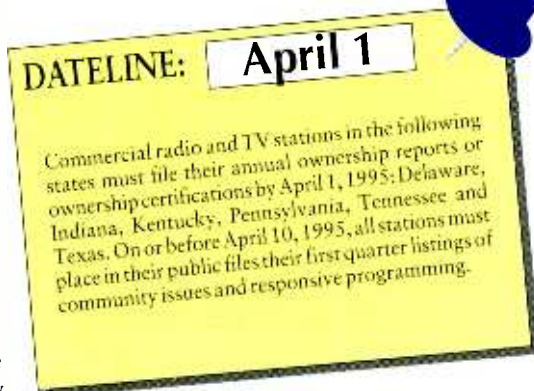
In other FCC news, the FCC has requested further comment on proposals to modify its national and local TV ownership rules.

The current national ownership rules permit an individual or entity to hold attributable ownership interests in no more than 12 TV stations or in TV stations that reach no more than 25% of the country's TV households, whichever limit is reached first. The local ownership rules prohibit a person or entity from having interests in two TV stations whose Grade B contours overlap.

On the national level, the FCC proposed to increase the number of TV stations one owner could hold. It also proposed to raise the permissible audience reach of those stations in which an individual or entity may hold attributable ownership interests. Under one proposal, a single owner would be allowed to hold ownership interests in any number of stations nationally. However, the owner would be subject to an audience-reach limitation that would increase from the current 25% of TV households by 5% every three years until an upper limit of 50% was reached.

The agency also set forth proposals that would relax the duopoly restrictions on the local level. This would include narrowing the geographic scope of the rule by changing the signal contour overlap that triggers the rule from Grade B (which typically ranges from 50 to 70 miles in radius) to Grade A (which typically ranges from 30 to 45 miles in radius). The FCC also requested comment on proposals to permit common ownership of two TV stations in the same market under limited circumstances. This would include when the proposed combination would occur in a large market with a substantial number of other competing voices. Similarly, the FCC requested comment concerning whether to relax or eliminate the one-to-a-market rule, which prohibits ownership of a TV and radio station in the same market.

The FCC also solicited comment on issues of control and attribution with respect to LMAs between TV stations. The FCC adopted a regulatory scheme governing LMA rules for radio in 1992, and is wondering whether it should adopt similar rules for television.



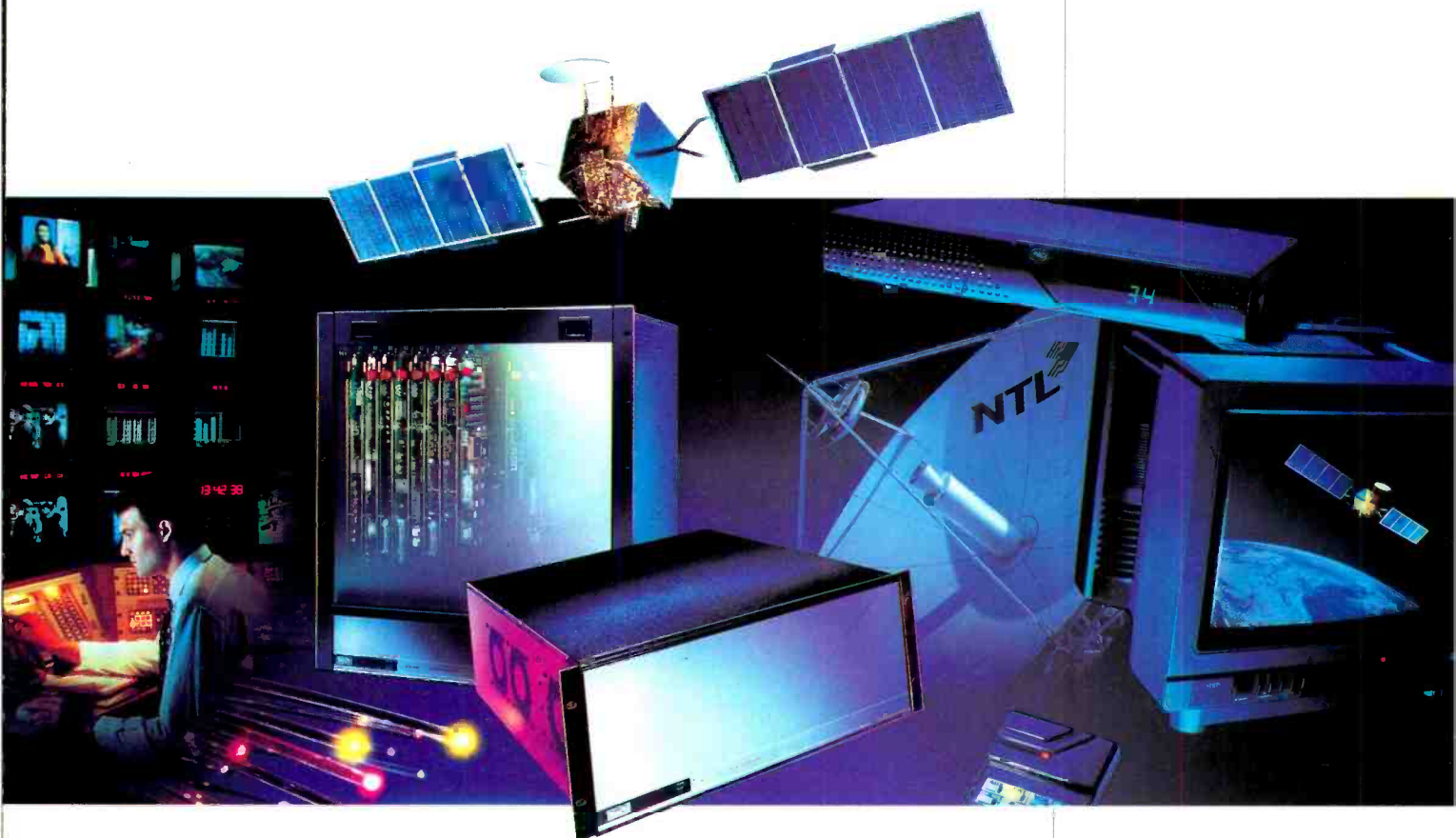
way constitute a commission authorization to transmit radio signals from the structure or relieve the owner of responsibility for compliance with applicable local or state laws.

Additionally, the FCC proposed revising Part 17 of its rules to reflect changes to two FAA Advisory Circulars (AC 70/7460-H, August 1991, and AC 150/5345-43D, July 1988) regarding painting and lighting antenna structures. Also, the commission would implement statutory language holding tower owners primarily responsible for compliance with FCC painting and lighting specifications. For more information,

Harry C. Martin and Andrew S. Kersting are attorneys with Reddy, Begley, Martin & McCormick, Washington, DC. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@interloc.com.

NTL MPEG-2 Video Compression

Tried, Tested and Trusted



Two years ago NTL set the pace for digital broadcasting with the launch of System 2000, the world's first video compression system based on the MPEG standard.

NTL MPEG systems are now widely in use by television broadcasting operators all around the world giving substantial operational benefits in applications that include broadcast contribution links, distribution to cable headends, satellite news gathering networks, business television and even distribution to terrestrial television antennas.

Now, NTL has launched System 3000, based on the tried and tested technology of System 2000 but enhanced to be compliant with the European DVB standard and the MPEG-2 (Main Profile at Main Level) performance specification.

System 3000 also gives broadcasters additional capabilities including the ability to broadcast up to 18 video channels within a single satellite transponder, statistical multiplexing and various telecom networking capabilities.

This diversity of applications using NTL's established technology means that fully compliant MPEG-2 systems are now being shipped to solve broadcasters' networking problems without the uncertainty of how the system will perform.

When you can't afford to take risks, don't settle for anything less.

Contact Barry Crompton for more information.
Telephone +44 1703-498042.

NTL Advanced Products Division 34 A-C Parham Drive Boyatt Wood Ind. Est. Eastleigh
Hampshire SO50 4NU United Kingdom Tel: +44 1703-498000 Fax: +44 1703-498043





Managing your own career, part 3

After you have decided it is time to find a new job and have prepared your resume, references, writing samples, audio or videotape demos and other portfolio items, it is time to get busy locating job opportunities. What type of job are you after or what type of position do you want to create?

Define the type of job you want

Do not waste time bombarding the marketplace with resumes. As an engineering manager you have developed specific skills. You are no longer looking for a wide range of entry-level work. Rather, you should target jobs that fit your skills, training and years of experience. Do you want to work for a TV station? Do you want to work for an equipment manufacturer? How about a cable system or a broadcast network? Do you want to take on another management job? Or do you want to focus on development engineering, operations engineering or maintenance engineering? Is location or market size important to you? Do you want to be responsible for a bigger budget or manage a bigger staff? Is it possible to create a new position in your current job? Narrow your possibilities and focus on those desirable job opportunities.

Network, network, network

Once you have narrowed your job search, you need to make contacts. Talk to people who work in those fields. Put out the word that you are interested.

Don't directly ask for a job when you are networking. Many times you will hear that the company is not hiring. It is better to be indirect. Get information on the company and the position that you are interested in. Make contacts in the company that are one or two levels above the position you are interested in. Let them know that you are interested in working there. The position you desire may not be available now, but sometimes other positions open up or new ones may be created, so keep your options open.

Ask your contacts if they know of anyone

who is hiring or if they can give you names of other contacts. It is important to keep expanding your contact base.

Networking takes time and patience. You have to identify the people you want to approach, and how you want to approach them. They may not have a job for you, but any information you can get will be helpful. You have also planted a seed and your name is out there and in the backs of your contacts' minds when an opportunity arises or when a position becomes available.

The job ads

Subscribe to the major trade magazines and scan the classifieds every month. Weekly publications are a good source for current want ads, and the lead times and turnaround on the ads is much quicker. Daily newspapers also may list positions that you are looking for. Monthly trades, such as *Broadcast Engineering*, also have classifieds, but the lead times are longer. However, these job postings generally are looking for higher-up positions and are willing to take the time to find the right person with the right qualifications.

When you find a job ad you want to

Network, network, network.

respond to, send a cover letter immediately. If you don't subscribe to trades or newspapers, you can always check out the reference and periodical section at the local library. Also, if you have access to the Internet, it is a great place to surf for contacts, job leads and other career-related information.

In-house job postings

Another method of finding a new job lies in many major media companies and broadcasting groups. They frequently post job openings internally and these are good opportunities to find out about jobs within the same company. Sometimes these companies may accept applications from out-of-house applicants. You can find out whether you can apply as a new hire from the personnel department of the company. Your networking may uncover a job that was advertised in-house and is accepting outside applications.

Your college

Take advantage of your alma mater when looking for a new position. Most universi-

ties offer some form of "lifetime" job placement. Many jobs that are posted on college campuses do not receive applications. Undergraduates are notorious for believing that if they do not have every qualification asked for, they are unqualified for the job. Take advantage of this and keep in touch with your college placement department.

Placement exchanges

Many of the membership organizations have job placement assistance for members. For example, the SBE has a bulletin board service, and the NAB is running a placement clearinghouse. Other organizations also help match candidates to jobs. PBS has run a phone line for years that assists PBS stations in attracting good broadcasting talent. Find appropriate placement exchanges that apply to your situation. These are usually free to members.

A word about job ads

Job ads are frequently written broadly to see what kinds of applicants they can bring in. Advertising is an expensive process that companies would rather only do once. It is easier for a company to reject a few more résumés than to get the budget to re-advertise a job. Therefore, do not be bashful about applying for a job that you have the majority, but not all, of the qualifications. As long as you fit the general profile of the ad, you are not wasting the time of the company, and may in fact, be the best applicant for the job (even missing a qualification or two). Remember, it takes only one good job offer. Don't let a reasonable opportunity go by. On the other hand, to avoid annoying companies and receiving lots of letters of rejection that may demoralize you in your job search, avoid answering ads that you are not qualified for.

Good luck

A little luck never hurts. But there is no replacement for experience, good skills and hard work. Keep in constant touch with your resources. Do not let your networking contacts grow stale. Read the job ads every week, check your bulletin boards on the day they post new jobs. And above all, do not get discouraged. A good job search in this industry can take time. But know what you want, be creative and be persistent. ■

Morris is an assistant professor of radio/TV/film at Northwestern University. He is a former chief engineer and a former manager of engineering and maintenance for a major TV network.

MAXELL ON THE MARCH

maxell digital



the intelligent ones.

Maxell Is On The March with the exciting digital performance of our D-2 and D-3 videocassettes. Using advanced magnetic tape technology, featuring Ceramic Armor Metal particles, Maxell has produced the perfect production tapes for every recording application from ENG, EFP to broadcasting. Both D-2 and D-3 feature

unmatched error rate and consistent quality, even under the severe operating conditions. Add an incredibly strong binder system for increased durability and lower error rates, and you'll be using the superior digital videotapes that keep Maxell On The March creating innovative tape technology for demanding professionals.

In Your Hands, Our Science Turns To Art

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Using DAT in the field

expensive. Converted consumer machines typically lack the robustness required in location work.

Pre-compensating for post-production

The main reason that production sound people are clambering to get into digital is to accommodate digital post-production. It is the users of the digital audio workstations and digital non-linear editing systems who demand digital audio. These users have their own peculiarities. One involves their preference to work in NTSC television. This means that the film from the production has to be slowed down 0.1% and the sound has to follow. If we slow down the audio 0.1% the digital audio output is no longer sampled at the standard rates of 44.1kHz or 48kHz, but at 44.056kHz or 47.95kHz instead. Devices that expect standard digital input signals don't react well to these sampling rates. Therefore, some professional DAT machines can record at 44.144kHz and 48.048kHz, so that direct digital transfers are possible when pulled down in the telecine.

Most music is now recorded digitally at 44.1kHz. Audio for playback on the production of a music video (which is to be shot on film) must be sped up by 0.1% so synchronization with the picture is correct after telecine. That requires the DAT machine to be able to play back at 44.144kHz.

TV production, whether for programming or commercials, is time-critical. TV editors typically use drop-frame time code so that the time code on their color videotapes will match actual running time. Once again, the pull-down, to which the sound and picture are subjected in telecine, changes the 30 frames-per-second (fps) time code that was put on the audiotape during production into 29.97fps time code. If post-production requires 29.97fps drop-frame time code, then the production mixer must record 30fps drop-frame time code on the tape during the initial recording (30fps drop-frame is not a SMPTE-standard rate).

Another example is a telecine transfer from film to D-2 digital video. The film goes through its normal pull-down in speed and its conversion to video fields, but when the sound is pulled down, it's no longer at the 48kHz sampling rate that the D-2 machine expects. If the original DAT cassette is recorded at 48.048kHz with 30fps drop-frame time code, however, the D-2 machine will get 48kHz audio and 29.97fps drop-frame time code.

A major advantage of digital over analog recording is the available dynamic range. The production mixer also must know to

what medium the original material will be transferred in order to match its dynamic range to that which can be supported downstream. For example, in a film production where the mixer knows that the tracks will be transferred to magnetic film, dynamic range should be kept smaller than if a digital audio workstation were to be used for post, and the end result released in a digital film sound format. Clearly, professional sound mixers must know what will happen to their tracks in post-production.

On the level

SMPTE has determined that -20dB should be the reference level for digital recording (i.e., 20dB below maximum record level). That means that the familiar 0VU that equates to -8dB on a Nagra modulometer should be set to -20dB on a digital recorder's peak meter. This seems a bit low, but on a machine not equipped with an adequate limiter, lower is better than hotter. (With a good limiter, you can run the level hot without encountering distortion — just a little compression, perhaps. But the next digital device in the chain may not be able to use so hot a signal.)

In fact, recording "hotter" or "down in the mud" in digital is of little consequence to the actual magnetic recording level. In digital recording, that level is constant — and always at maximum or *saturation* level. Changes in audio levels only affect the composition of the data being recorded, not its signal strength. The level meter on the DAT machine is, therefore, not a *recording level* meter, strictly speaking, but simply an indicator of the dynamic range of the signal.

Because post-production staff in the film and TV industries desire to stay in a digital format as long as possible — eventually right to the release-print or air-tape — production sound mixers must have the tools (knowledge and equipment) to do their jobs properly. They have mastered the transition from optical to magnetic recording, then from magnetic film to 1/4-inch tape, then from Neopilotone to time code for synchronization. The transition from analog to digital recording is the next step, albeit a big one. ■

For more information on portable DAT recorders, circle (300) on Reply Card. See also "Recording & Playback Products," p. 58 of the BE Buyers Guide.

Manfred Klemme is vice president of Sonosax USA, North Hollywood, CA. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

Production sound is undergoing a major changeover from analog to digital technology. Although this process is revolutionary in terms of the hardware used, it is really just another part of the continuing evolution of production sound.

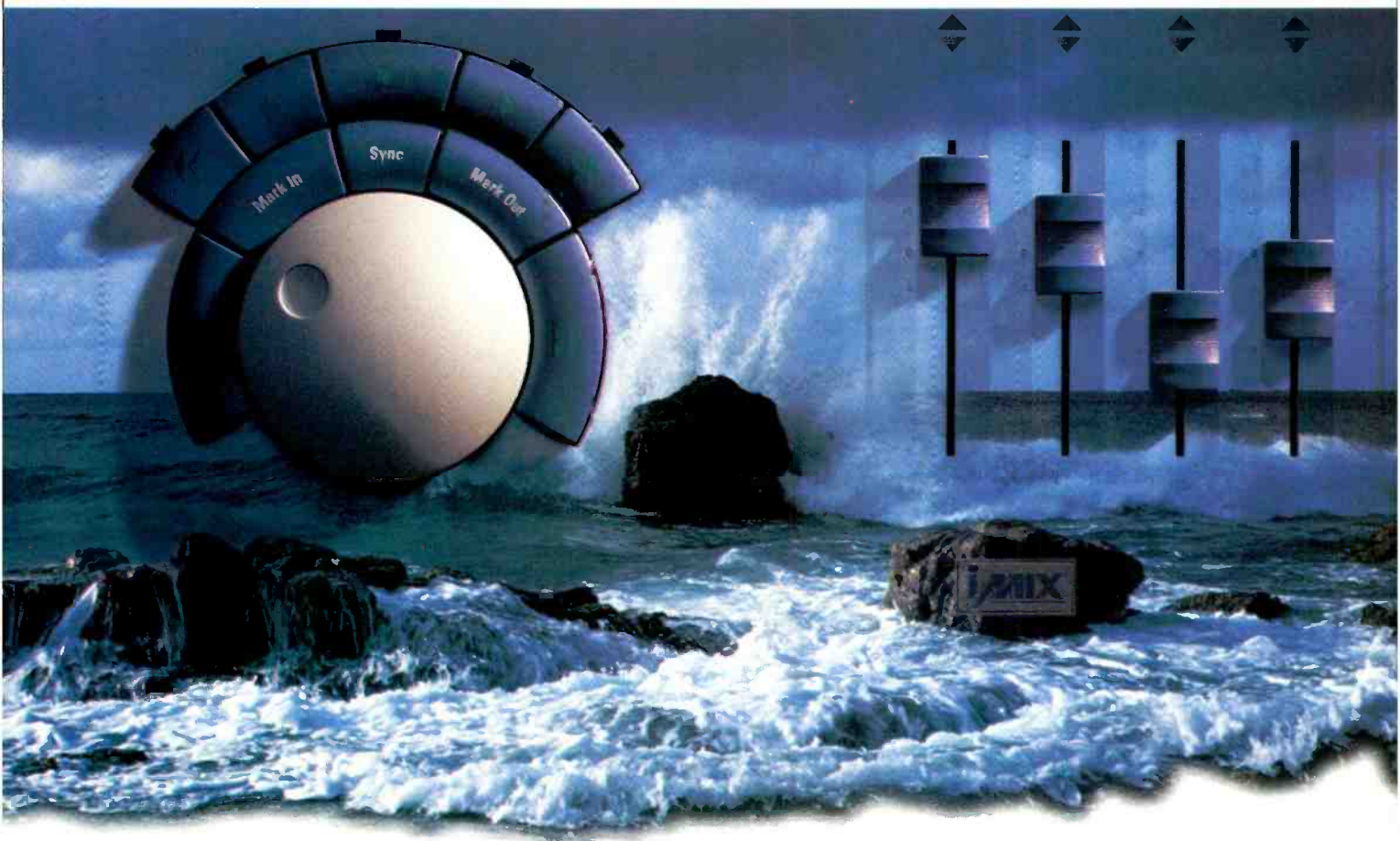
The history of what we call production sound — the recording of live sound during the filming of picture — is a saga of synchronization between picture and audio. *Double system* sound (i.e., the use of separate devices for recording sound and picture) has gone through several major changes, beginning with the introduction of *Neopilotone* by Nagra in the 1960s. Later, *crystal sync* eliminated the pilot cable, and then time code allowed every frame to be discretely identified. The current revolution is from 1/4-inch analog tape to DAT (specifically, R-DAT (*Rotary-head Digital Audio Tape*)).

Professional sound mixers must know what will happen to their tracks in post-production.

The audio for many documentary films and videotapes is recorded on simple consumer DAT machines with the addition of small professional mic pre-amps. The pre-amps make up for these decks' inadequate analog circuitry and their lack of phantom and T-powering for professional microphones. As with any R-DAT machine, these recorders provide the necessary stability for film sound that will be transferred to magnetic film for post-production. But production sound mixers for major motion picture and TV production are increasingly using fully professional DAT machines instead. These decks feature such exotic items as SMPTE time code for synchronization, pull-up and pull-down of the basic 44.1kHz and 48kHz sampling rates, and powering for microphones. The professional DAT machines are built for the job — rugged and

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Getting on-line, part 2

What's available for broadcast professionals in the vast array of cyberspace? The resources that might interest broadcast professionals can be divided into several categories, such as technical support, product information, professional associations, career issues, business concerns and financial information.

Bulletin board services

Many manufacturers offer electronic bulletin board services (BBS) to support their products. Some have forums on CompuServe, and others can be reached via the Internet. Typically, these services have sections for product update information, software drivers for hardware, frequently asked questions, and notes about bugs and workarounds. Equipment users post messages and questions about equipment functions and operations, and request resolutions for problems.

Reading these messages can tell you a lot about how the equipment works under field conditions and the quality of the manufacturer's support. You can find out most of this elsewhere, but the benefit of the Internet is that the information is available 24 hours a day. You can access it when it's convenient for you. The manufacturer's support personnel monitor these forums and can provide rapid responses to your questions and problems.

Broadcast Professionals forum

In places like the Broadcast Professionals (BP) forum on CompuServe or in news groups on the Internet, you'll find a wealth of information about products and services. Rec.radio.broadcasting, rec.video.production, alt.religion.broadcasting, rec.video.cabletv, and rec.video.satellite are a few of the news groups on the Internet. Most of what you'll read in the BP forum or the news groups is personal opinion, often based on experience.

Press release information from the manufacturers can be located in the BP forum library, on the PR services or on the Dow Jones News/Retrieval service.

Columnists and reviewers for the major

trade publications are frequent visitors to cyberspace. When you're about to make a major purchase decision, nothing beats talking to current users or the product developer or the person who just finished a hands-on review before you sign a contract.

AES and SBE are just two of the many professional organizations with on-line outlets. (A discussion of SBE's Fidonet BBS system appeared in *BE*'s October 1994 issue.) Both AES and SBE have sections in the BP forum on CompuServe. Many other relevant associations, such as IEEE and even the unions and guilds, are on-line.

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Networking on-line

Networking is one of the keys to career advancement. The beauty of cyberspace is that it is the great equalizer. If you're on-line, you're available. Write a message. People respond. It's like the fantasy of Hollywood. At any moment, walking around the corner or sitting in a restaurant, you'll spot a star. The difference is, in cyberspace, you can talk to them and even get to know them. Some are famous names like Geffen, Spielberg and Costner. Others are only important to industry professionals like chief engineers, operations, production and promotion personnel at stations, cable nets and post facilities around the world.

Everyday you'll find opportunities on-line. Most of the commercial services offer a classified section for job postings. The Internet has thousands of opportunities if you have the time to look. Most universities have a job board and an office staffed with people dedicated to finding jobs for students and alumni. More consultants and headhunters are also on-line looking for talent.

As you move up the career ladder, business and management skills may become more important than technical or engineering skills. Discussions of the issues facing today's professional is always at the forefront, and the resources a manager needs to make an informed decision can be found faster on-line than off. Thousands of knowledgeable people respond daily to questions about advertising, personnel practices, survey techniques or nearly any topic under the sun. It's

not a substitute for a paid consultant, but it is a good way to find the right person, company or source to meet your needs.

Financial information about businesses also is on-line. Dun & Bradstreet credit reports, biographical information about executives, market trends in an industry, stock prices or anything else you can find in print is on-line. And, the information is often more accurate because it's updated more frequently.

Accessing the Internet

To "surf the Internet" you need access. Commercial providers offer access from the limited — e-mail send and receive only — to limited access — e-mail and news groups — to nearly full access — e-mail, news groups, gopher and Telnet — to complete access — a SLIP/PPP account. The on-line service provider currently offering the fullest access is the Delphi service. America On Line, Prodigy and CompuServe are racing to expand their access to the Internet. But if you want to take full advantage of all the Internet offers, there are several companies that will provide flat-rate local phone access to an Internet host for about \$20 a month. A \$35 to \$50 start-up fee covers the software programs you need to turn your computer into a (SLIP/PPP) peer on the Internet. Recent quotes for flat rate deals included 90 hours of time per month. Additional hours were quoted at \$2 per hour.

Full access lets you log on to World Wide Web (WWW) servers. The "Web" is a multimedia network using hypertext links to find and access files. Some Web servers support audio and video multimedia files. The Web links pieces of information that may be spread over dozens of servers and "publishes" the information much like a chapter in a book. When you click on a heading, the Web sends you to the computer server where the information resides.

Cello and Mosaic are the most popular software packages (both are available as freeware and in commercial versions) used to access this client/server application. The Gopher system works the same way as the Web though it's only text.

Prices have dropped dramatically over the past year for high-speed data/fax modems. It's never been cheaper to buy a 14.4kpbs modem. For less than a \$100 you can make the leap and start traveling on the information superhighway. ■

Robert Goodman is president of Goodman Associates, Inc. Philadelphia, a production company and converging technologies consulting firm. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

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The vision is more fuzzy

Flexibility

The least acceptable choice for broadcasters is to do nothing. Fear that cable or DBS competition might find attractive markets for ATV/HDTV/DATA ensures that broadcasters will continue the full provisional development of HDTV/ATV systems. Technically, the Grand Alliance HDTV system can deliver the flexibility the NAB has lobbied for, i.e., more channels and ancillary data services or higher picture quality (and ancillary data too). To enter the digital transmission era at the right moment economic incentives would prove invaluable to greasing the way. Search as broadcasters have, the "killer apps" haven't yet surfaced. To stimulate thinking on the subject, Abel has given hundreds of elaborate presentations on the NAB's vision of the terrestrial

transport, transmission, and the audio subsystems of the Grand Alliance design have been integrated successfully at the David Sarnoff Research Center. Unfortunately, the integration of the video encoder and decoder hardware at AT&T Jersey lab has proved to be less than a slam dunk. In December, the alliance realized it would not meet its internal deadline so the ATTC could start full-system testing as scheduled on Jan. 31. When advised of the delay in mid-January, frustrated ACATS chairman Dick Wiley rushed an expert group to the Murry Hill, NJ, integration site to assess the situation. After witnessing outstanding interlace pictures (with the I, P and B frames) and receiving assurances that the committee-style management of the alliance had been replaced with a project manager, Bob Rast, the ACATS team left satisfied that all was on track. "It's hard to live up to dates on something that has never been done," said one of the six observers. The result: testing is now scheduled for the end of March, with a more detailed schedule and single-pointed accountability.

COFDM

On a separate parallel course, the controversial COFDM (coded orthogonal frequency division multiplexing) transmission subsystem question was raised this month when the NAB, NBC Capital Cities/ABC, Fox Broadcasting, the AMSTV, the Canadian Association of Broadcasters, the Canadian Corporation, the Brazilian broadcast trade association, and the Canadian Research Centre announced that a million dollar contract had been given to Scandinavian-based HD-DIVINE to build COFDM hardware for testing. (See "News," p. 4). COFDM is believed by some to offer higher transmission efficiency and to produce far better results for mobile receivers. Considering digital broadcasting could mean numerous digital services for onboard computers in future automobiles, this question seems one that needs to be proven. Also, any perceived efficiency or extended "reach" promised by COFDM advocates was thought far too alluring to be forgotten without serious study, which can only be done with actual hardware. Others see COFDM funding as still another strategy for delay as it threatens the 8-VSB subsystem already chosen by the alliance. ■

The broadcasters' role in advanced television (ATV & HDTV) was recently aired in a Sunday edition of the *New York Times*. In the article, FCC Mass Media Bureau's Bill Hassenger said it didn't paint a flattering picture of our public airwave servants. "But," he added understandingly, "the world has changed completely since the HDTV drive began."

The *Times* article criticized the NAB for generally self-serving HDTV tactics and caught one proponent in an unflattering upbraiding of their hoped-for broadcast customers. The NAB placed HDTV on the national agenda in 1987 claiming then that the benefits of HDTV were reason enough to save spectrum from the grasping hands of land mobile and even for getting more of the precious airwaves. Two years later they complained that HDTV was too expensive.

The NAB now doesn't see HDTV as much of a near-term threat. Nor is spectrum under the same kind of pressure as it once was. Not only have high-priced auctions of spectrum shooed away fly-by-nighters, recent bandwidth compression techniques have expanded use of existing allocations.

Dr. John Abel, executive vice president and chief strategist for the NAB, promotes a "flexible use" policy for the new ATV channel. Flexible use would ensure broadcasters' competitive place in the digital infobahn future. He claims government-mandated use of HDTV would be contrary to market indices and be the ruin of broadcasting. Broadcasters need, of course, the digital channel if they are to stay competitive with the digital cable and DBS rivals. Judging from a speech given at the '95 Winter CES in Las Vegas, the pro-competitive FCC chairman Reed Hundt is in general agreement. From the FCC's viewpoint, the market means not just the consumers, but manufacturers and broadcasters as well. Keeping the fires burning during these slow times of delays and testing is crucial to broadcasters having any access to the digital era. Hassenger submitted to chairman Hundt an agenda on ATV issues that is independent of the testing schedule.

Broadcasters need, of course, the digital channel if they are to stay competitive with the digital cable and DBS rivals.

future where "multimedia digital broadcasting" in one channel replaces the broadcast metaphor of one 6MHz channel for one program service. In his view, multimedia broadcasting might be anything from multiple services (in one channel) to a new world where ancillary data is transmitted in great amounts to home and business computers. Abel, an historian in the field of communications, said recently that most new services in broadcasting begin as national ones, later moving to the local levels. DirecTV's Tom Bracken reports that several new national data services for the home will soon roll out on its nationwide digital DBS DirecTV service. If Abel is right, the success or failure of those national DBS data services will, at least in part, influence the future for local terrestrial data broadcasting (and the commercial fate of HDTV). But that influence can take hold only after a standard for terrestrial digital broadcasting is set by the FCC and new RF channels allocated.

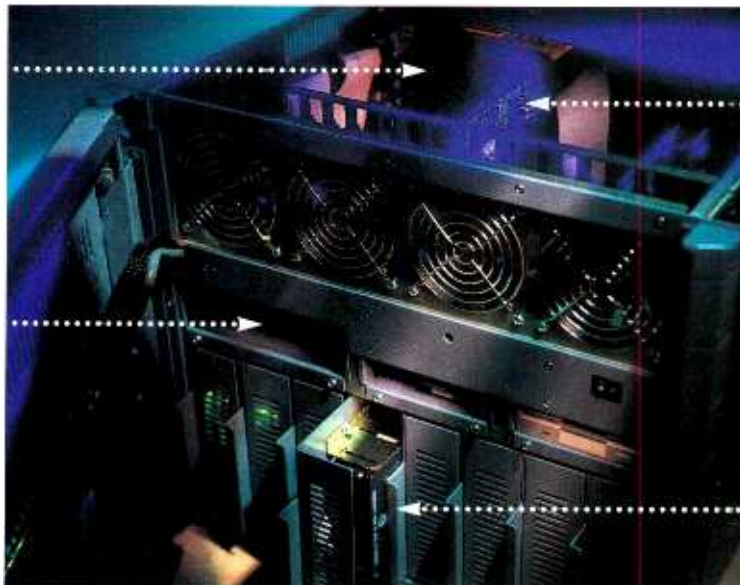
The newest delay

New delays threaten to tarnish the credibility of the entire ACATS process. The

Dale Cripps is publisher and editor of the *HDTV Newsletter*, Advanced Television Publishing, 753 East Fall Creek Rd., Alesca, OR, 97324-9504; phone 503-487-4186; fax 503-487-4187. Respond via the BE FAXback line at 913-967-1905.

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TV automation

Automation systems abound but choosing the right one requires research and planning.

As master control automation becomes more common, and more cost-effective, the problem of integrating manual and automated operations still hinders its acceptance. Among the concerns are the role of the master control operator, the ease with which manual control can be invoked, and the smooth integration of live, taped and network events.

The Bottom Line:

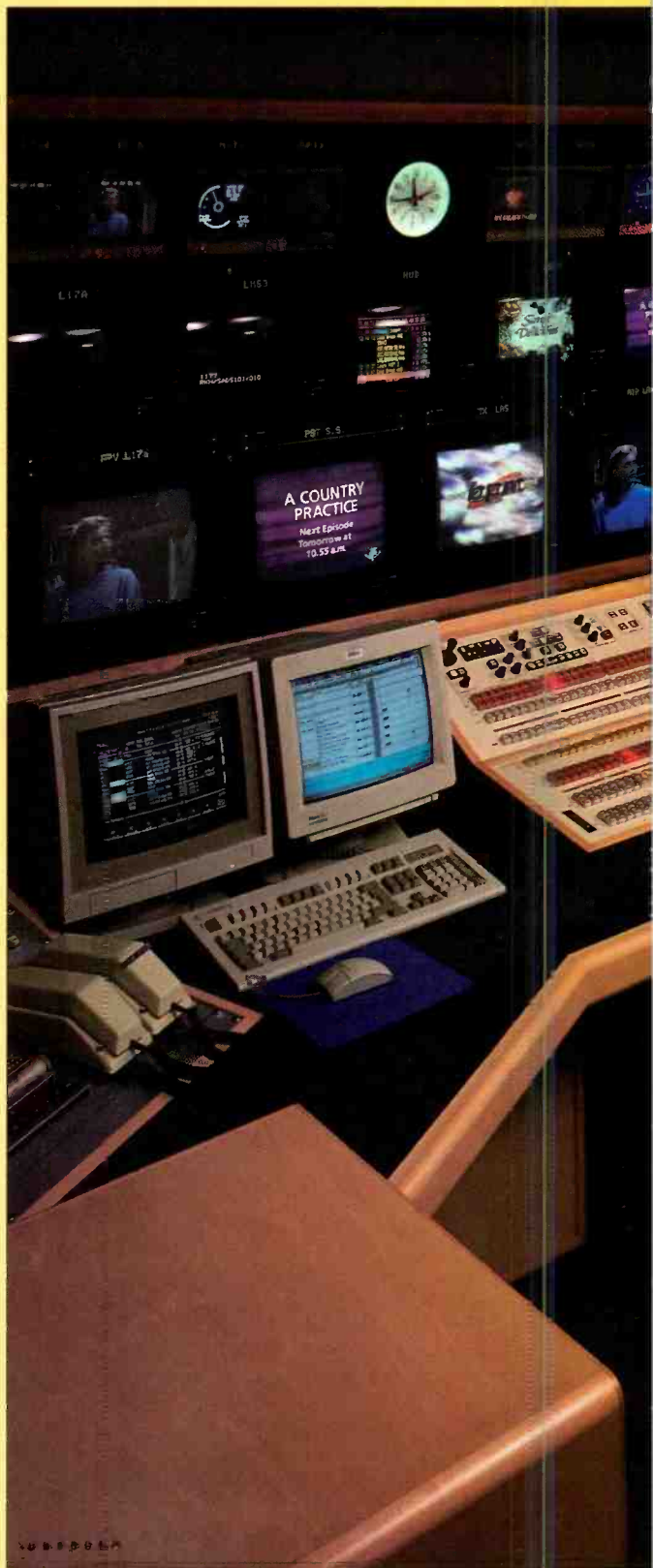
Automation systems support their cost-effectiveness by pointing toward reduced errors and an improved on-air look through tighter switching. However, many times the real cost-effectiveness of an automation system is based more on how well the system can be integrated into the present operation than on the system itself.

This article looks at some of the ways automation can facilitate daily operations, including those events requiring manual intervention. Moreover, we will explore how well-designed automation systems can be more responsive to the dynamic environment of master control.

What should you expect?

Early computer automation systems were hard-pressed to provide the performance required for frame-accurate timing of simultaneous operations in master control. Many early automation systems were capable of simple event stacking and machine control, but often did not deliver an improved on-air product.

Newer systems, combined with the built-in remote-control protocols of modern broadcast equipment, put effective computer control of VTRs, routing switchers, and similar equipment within reach of any competent programmer. Reliable automated control of multiplay cart systems and full-featured master control switchers is also now a reality. Given this, the success of master control automation depends



greatly on how well the technology can be applied to the environment of each station. For example:

- Can the system provide effective automated control of all installed equipment, both old and new?
- Can automation be integrated into current operations — including traffic, media preparation, master control and billing — while still providing all the promised benefits? (For more information, see "Master Control Automation," April 1994.)

Automation's role is to assist the operator by performing most of the routine tasks of normal operation in a consistent and reliable manner. Automation cannot and should not be expected to replace an experienced operator's judgment and ability to handle exceptions and technical problems.

Automated/manual control

Automated operation normally includes control of a cart system and external VTRs for the playback of spots and programs. During periods of local tape programming, all scheduled events can be fully automated. In this mode, the master control operator simply ensures the required tapes are loaded for each event. The automation system can then cue, preroll, and take each event to air at the scheduled time. During network programming, the exact start time of each local break may or may not be known. In this case, the master control operator has the choice of triggering breaks manually, or setting absolute break start times based on information provided by the network. Plans for networks to send embedded break triggers to local stations as part of the broadcast signal may eventually solve this dilemma. At present, stations must decide whether the advance times provided by the network will be accurate enough for use by automation.

Live programming requires that breaks be triggered manually. Here, the master control operator must trigger the event with adequate preroll to allow for a clean transition. Finally, in each of these scenarios, the operator must be prepared to deal with last-minute changes. Replacing or dropping a spot in the next break is error-prone. Making a last-minute change in a manually triggered break is especially hazardous. It requires the operator to determine whether sufficient time remains to make the change safely.

One common requirement for automation systems is providing the master control operator access to manual control. Depending on the circumstances and timing of each situation, different methods of overriding automated operation are required. For example, dropping a spot that is 10 minutes to air is much less hazardous than dropping the spot next to air.

During automated operation, the need for manual control occurs in several situations including triggering of breaks, handling late schedule changes, and recovering from equipment failures. These manual operations fall into three functional categories:

1. *Event control* — either delay or switch to the next event by an immediate function.
2. *Schedule editing* — change the sequence of upcoming events by a schedule editor or pre-programmed function.
3. *Manual override* — override automated control for all events until further notice.

The key to successful integration of automation with the manual operation is providing quick, intuitive access to these functions.

Event control panels

As described above, immediate manual intervention by the operator is sometimes necessary to control the sequence and transition of the current-to-next event to air. Last-minute event control does not allow time for edited changes to the schedule. The automation system must allow the operator to effect the change within seconds, while still maintaining automated control of the continuing schedule.

When triggering a break manually, the master control operator is accustomed to using a take or preroll button on the master switcher control panel. Likewise, when immediate action is required to alter the transition to the next event, these operations should be equally accessible to the operator. By including a set of function-specific event control buttons, the automation system can provide quick access to the most common type of last-minute changes. Most systems accomplish this through dedicated keys, either on a separate control panel or through function keys on the keyboard. On some master control switchers, unused buttons can be assigned these functions. In general, the functions provided by these event control buttons include:

SKIP: Skips the next scheduled event. This is equivalent to dropping the event by editing the schedule in advance.

RECUE: Aborts the preroll of the next event and recues the tape. In many systems the event then requires a manual trigger.

HOLD: Holds the current event on air until the button is released. This is useful for delaying transition to events previously set with absolute times.

MANUAL: Switches the automation system to manual mode.

Continued on page 23



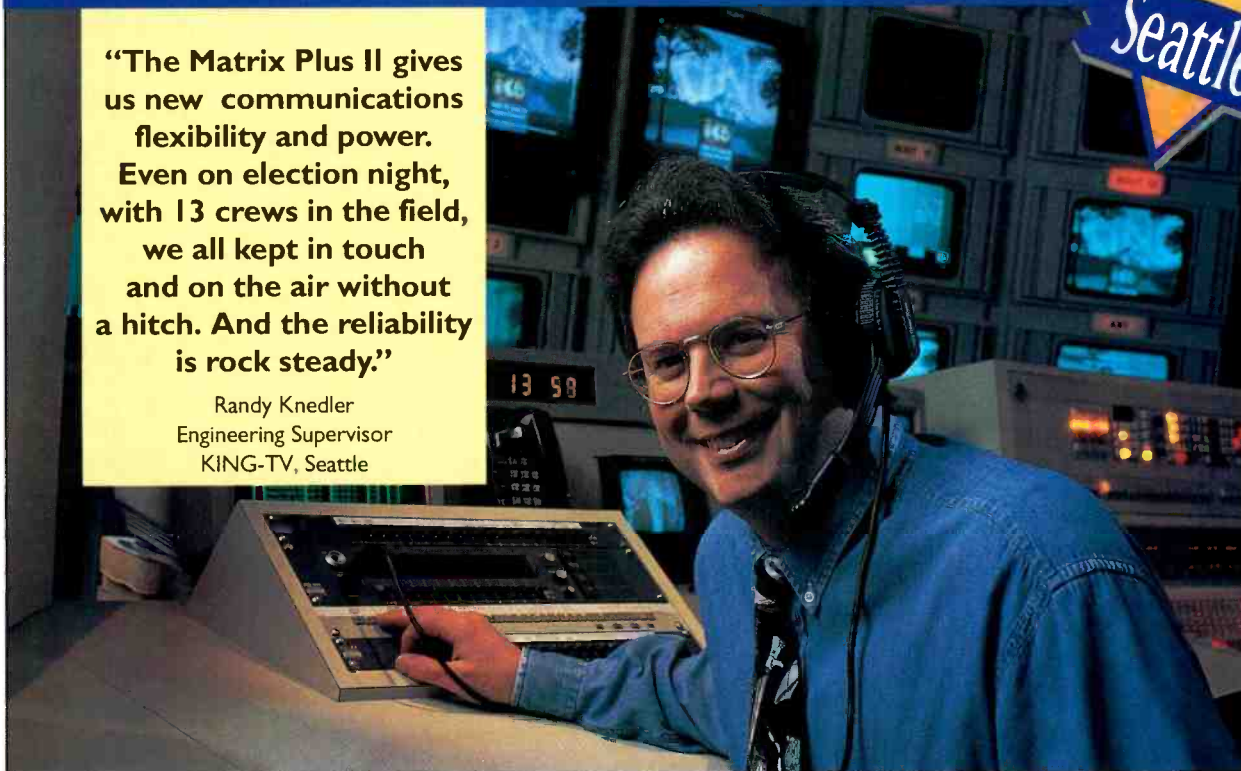
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Building your own PC-based system

By Paul Breneman

Many of today's facilities are filled with complex specialized equipment. Despite the sophistication of the equipment, there are usually several areas creative employees can enhance through improved methods and higher levels of equipment control. Look carefully at areas prone to problems or errors and consider alternate methods of accomplishing the tasks. As a starting point, a promotional disk offered by Cycle-Sat contains several broadcast-type utilities — among them a VTR controller and calculations for positioning satellite dishes.

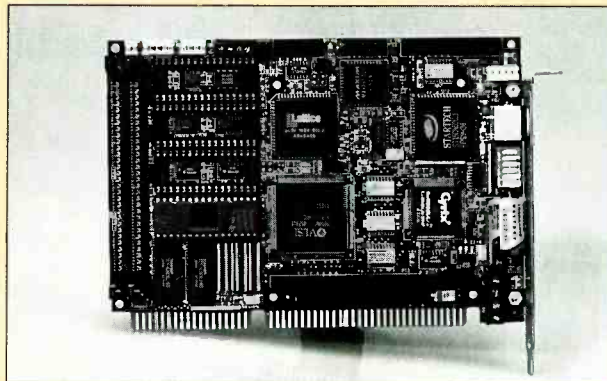
Whatever you come up with, use technology appropriate for your project. Carefully evaluate the factors involved. Can the project be completed using existing in-house resources? Is there a strict deadline, or can the project be developed as time permits? Can the project be used as practical continuing education? The real-life knowledge gained by actually assembling a system is almost always better than simply having someone teach the development process to you. In addition, the system can be customized to satisfy the unique needs of your facility.

Explore the hardware issues

Make a list of the equipment (VTRs, routing switchers, satellite receivers) to be controlled and their interfaces. PCs are popular in the industrial field and a large selection of PC hardware and software products are available from industrial computer suppliers. Also, several traditional video companies are adding PC products to their line. Among the products available are test signal

generators, DAs, switchers, time-code reader/generators and measurement devices. Industrial suppliers offer add-in boards with RS-232 or RS-422 serial control ports, mechanical or solid-state relays, digital I/O and various other interfaces. These boards can be used to interface to your existing equipment.

Pay particular attention to any special requirements, especially timing requirements. What timing accuracy does the project need? The clocks in PCs are notoriously bad at keeping accurate time. Software is available, however, to compensate for the drift in the PC's clock. Options include add-in cards with a more accurate clock, or feeding time-of-day code to a time-code reader in the PC.



One of many slot-card-type motherboards available today. Many of these units also support the stackable PCI/104 bus structure. (Photos courtesy of Industrial Computer Source, San Diego, CA.)

For 35 years, video professionals all over the world have put their reputation on the line by choosing Grass Valley systems.

Software is critical

Although it is certainly nice to be able to get about any hardware interface you need on an add-in card, getting the software to control it is a different matter. Today's PC software is usually more sophisticated than what was running on main-frame computers a decade ago. With many of today's professional products, the software is the most complex part. It can also be the most expensive part of a product, especially for items manufactured in low volume.

Determine the type of user interface needed (if any). It is possible to get by with only a special "hidden" box with no user interface to fix some problems. The PC architecture is now available on small PC/104 cards that support a stackable architecture. Software can be developed in larger systems and then downloaded to the PC/104 card. If the budget is tight and space is available, consider the older PCs. Most have sufficient horsepower to run DOS-based control applications.

Will a text-mode display suffice, or should your software take advantage of graphical user interfaces (GUIs) like Windows? Developing a simple text-mode interface is easier, but a graphical display can provide more information to the user. If designed properly, a graphical display can simplify complex operations.

If you have limited programming experience and your project involves some special hardware interfaces, seriously consider

starting out with a DOS program. Once you have it up and running reliably, you will be in a much better position to evaluate the feasibility of porting the program to Windows.

Use on-line resources

The best reason to build your own automation system may be the education you receive in the process. Don't overlook valuable resources, such as the on-line computer services

accessible with a computer and modem.

Although many forums and services are geared toward general information and entertainment, there are also forums dedicated to the various computer platforms, operating systems, and software programming languages. You will usually find experts in a field on-line, so the advice you can get on the forums is usually far superior to that you would get calling a manufacturer's support line. You may even find some files and programs that will help you develop your own PC-based automation system.

Paul Breneman is with SOS Productions, Columbus, OH, and Directed Path Enterprises, Plain City, OH. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.



A variety of rack-mount PC chassis are available for industrial use.



For more information on automation hardware and software, circle (303) on Reply Card. See also the "Computer and Automation" section on pp. 88-89 of the BE Buyers Guide.

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AUTO: Returns to automated operation.

TAKE: Take (or preroll) the next event.

For last-minute actions, dedicated buttons bridge the gap between editing the schedule and overriding system settings by changing the switcher preset or program sources directly. During the last seconds of an event, these functions provide immediate control, without possible on-air glitches caused by direct source selection or manual VTR operation.

Manual override and failure recovery

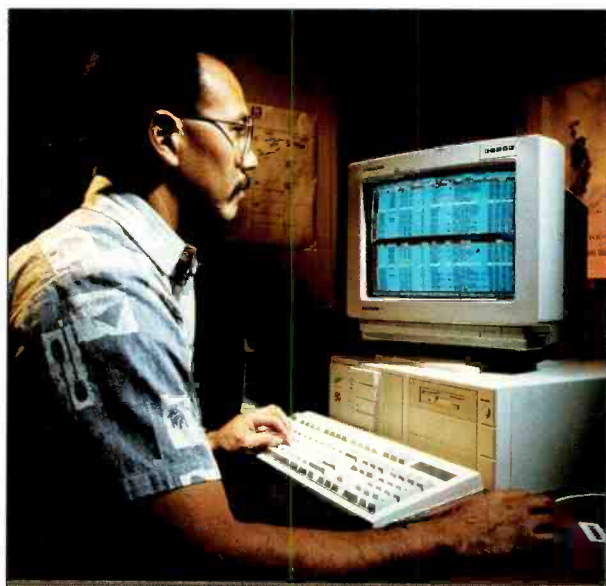
When the normal operation of the automation system is interrupted by a major failure, such as a computer malfunction or power outage, the master control operator's first priority is to take immediate manual control of the switcher and playback sources. Diagnosis of the problem and switchover to a backup system must usually wait for a long duration event, such as a program segment. At that point, the operator has time to correct the problem, switch to backup equipment, or prepare for extended manual operation if the problem cannot be quickly remedied. Simply put, the operator needs to get things stabilized and get some "time to maneuver."

The design of the automation system should

support failure recovery by giving priority control to the operator. Typically, when a major failure occurs, operation will be forced to a manual mode. This transition must occur quickly and with little or no interruption to the on-air signal. In addition, it should occur in a manner that prevents additional problems.

All equipment under automation control should have local control panels active. If a multicart system is used for spot playback, the complete playlist should have already been loaded and be available for manual operation. Likewise, if the master switcher includes an event stacker, this should have been preloaded by the automation system. If the next program segment runs from an external VTR, the tape should have been cued by the automation system and remain cued, ready for playback.

Then, with the automation system in manual mode, the operator need only press the switcher



Many of today's automation systems use standard PCs as part of the user-interface. Some systems run entirely on generic PCs, others require additional proprietary hardware. (Photo courtesy of Louth Automation, Menlo Park, CA.)

TAKE button to use the preloaded cart system playlist and switcher event stack for each subsequent event or break. This process can then be continued until a long-duration event is on-

Continued on page 57

line from which to choose.



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Video compression

By Steven Blumenfeld



As analog audio and video become another form of digital data, compression will allow these enormous files to be handled cost-effectively.

The digital age is here. Today, data is collected, digitized, compressed, processed, analyzed, put on a network or other media and made available, for a price, to the end user. Servicing specific market needs with valuable data across digital networks, via satellite and on storage media is the business of the digital age. Included in this is the digital sourcing, transmission and storage of information, including pictures and sound. As the revolution progresses, it has become obvious that video and audio, specifically digitally compressed video and audio, will have a prominent role.

Motion pictures combined with dynamic audio can have a much greater effect than silent, still images. Video is a sequence of images, usually updated at 30 images (frames) per second or 60 interlaced fields per second. It can be shown that considerable redundancy exists in any given image or sequence of images. In a sequence of images, there are two type of redundancies, inter-frame (temporal) redundancy and intraframe (spatial) redundancy.

Video compression is the art of removing these redundancies and there are various methods of doing this. Some incorporate image decimation, transcoding of the image or representing the image as a series of formulas.

For a typical video scene, the intraframe correlation is between 0.9 and 1. Taking this into account, an image can be represented as the changes from one to another using only 0% to 10% of the image. On the other hand, if a

video signal is completely random, no compression scheme will work.

Why is compression necessary?

To start with, a single digitized video image requires a large amount of storage. An 8-bit,

CCIR 601, 4:2:2 image (Y=720 pixels x 486 lines, Cr=360 x 486, Cb = 360 x 486) is approximately 700kB. At a rate of 30fps, that is approximately 168Mb/s. Multiplied by 60 seconds/minute gives us a whopping 10GB/minute. This unwieldy amount of data cannot be stored on disks cost-effectively in an uncompressed form. (See Table 1.)

Even though compression is still in its infancy, several standards exist. To date, the majority of standardized compression techniques have been based on the *discrete cosine transform* (DCT). Other

The Bottom Line:

Computer systems are gaining acceptance throughout broadcast facilities. Despite major increases in drive capacity, uncompressed video datastreams can still be overwhelming. Storage requirements can be reduced through the use of compression, making disk-based storage of audio and video an alternative to tape in some applications. In addition, compression makes it easier to move the information over computer networks. — \$

	Space per movie	Cost per movie
1984	11M cu in	\$33M
1990	4,700 cu in	\$1M
1994 @ 3Mb/s	22 cu in	\$2,000
1994 @ 1.5Mb/s	11 cu in	\$1,000

Figure 1. The amount of physical disk space required to store a feature-length movie, and the cost for that much space. The 1994 numbers use data compression at indicated bit rates.

forms of video/image compression are being used today. Two of the most promising are *wavelets* and *fractals*.

Wavelet/subband compression uses a transform similar to DCT and has two main advantages over DCT. First, it degrades more gracefully. The wavelet scheme loses detail as the bit rate decreases, but does not show the same kind of blockiness inherent in a low bit-rate MPEG image. Second, and probably most important, it is scalable. This allows the data to be stored at the highest quality/bit rate while only the necessary quality/bit rate needs to be delivered for any given application.

Fractal compression has promise, but it is asymmetrical (encoding requires far more processing

power than decoding). This problem is not specific to fractals and may be alleviated by future Application Specific Integrated Circuits (ASICs). Fractals are inherently scalable, allowing an image to be viewed at varying resolutions without any degradation. In addition, fractals seem to do better with natural images.

Which is best?

The reality is the best compression scheme is the one that gets the job done. Recently, the FBI chose wavelets as a way to store its immense catalog of fingerprints. Fractals have been used to store high-quality still images in consumer CD-ROM encyclopedias. However, for the majority of applications, MPEG is the clear choice. It is a worldwide standard and encoder and decoder prices are falling rapidly.

The Moving Pictures Expert Group (MPEG) issued MPEG-1 in November 1991. MPEG-1 uses a few tricks to compress video data. The first operation in this data-reduction scheme is *frame decimation*. The encoder reduces the data in the vertical and horizontal dimensions by approximately half, by simply throwing away pixels. The images are then converted into a YUV format. The U and V components are further decimated taking into account the human eye's limited color resolution.

The next operation does not involve compression and is virtually lossless. A DCT is used to transcode the image into the frequency domain. Once in the frequency domain, intraframe and interframe redundancies are taken into account to compress the image even further.

MPEG-1 at 1.5Mb/s yields approximately a VHS quality while allowing 72 minutes of compressed audio and video to be pressed onto a compact disc (640MB). MPEG-1 has become relatively cheap to encode and use, but there are some major technical problems. Most relate to the multiplexing of the elementary audio and video streams. Today, a number of decoding solutions will not work with a specific multiplexer. This requires anyone using MPEG-1 to have the tools necessary to analyze a bitstream and make corrections. This can make network distribution a problem — especially if you cannot specify the decoder.

Continued on page 28

Standard	Current Uses	Data Rates
H.261	Video conferencing	64kb/s -384kb/s - 1.5Mb/s
JPEG	Still image coding using DCT	
CCIR - 723	Long distance of transmission of 4:2:2 components	34-45-140 Mb/s
MPEG - 1	Motion compensation, DCT, frame-based VHS-like quality, ratified November 1991	~1.2Mb/s video with 128-334 kb/s audio
MPEG - 2	Motion compensation, DCT, Interlaced video, high-quality images, ratified November 1994	~3.0-8.0 Mb/s

Figure 2. Some of the current compression standards in use today, their uses and data rates.



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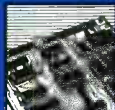
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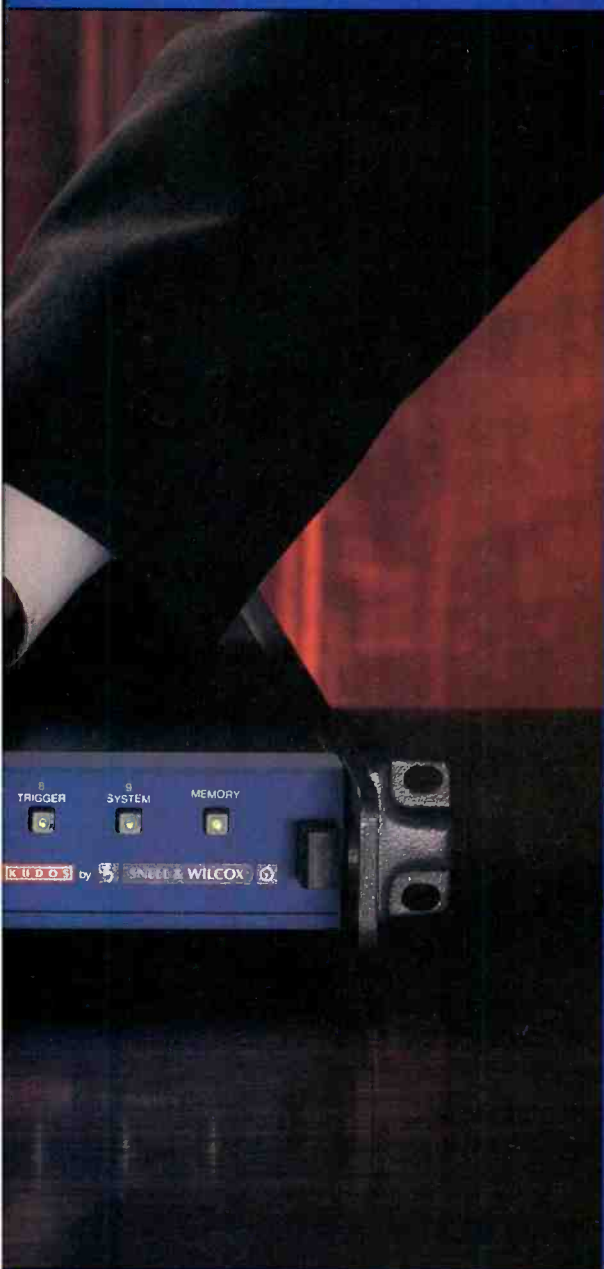
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Levels	Profiles				
	Simple I,P 4:2:0 non-scalable	Main I,P,B 4:2:0 non-scalable	SNR I,P,B 4:2:0 SNR scalable	Spacially I,P,B 4:2:0 spacially scalable	High I,P,B 4:2:2 SNR, spacially scalable
High <1,920x1,152 60 frames/sec		<80Mb/s			<100Mb/s
High - 1,440 <1,440x1,152 60 frames/sec		<60Mb/s		<60Mb/s	<80Mb/s
Main <720x576 30 frames/sec	<15Mb/s	<15Mb/s	<15Mb/s		<20Mb/s
Low <352x288 30 frames/sec		<4Mb/s	<4Mb/s		

Figure 3. The various levels and profiles available in the MPEG-2 "toolbox," some of which have not been defined.

Through identification of various MPEG-1 decoders and cataloging of their characteristics, three specific problem areas have been identified. First, there are multiplexers that are "audio centric," where the audio bit-

stream determines the length of the file, sometimes causing the loss of some video bits. This results in an incomplete last frame, which can be identified by green blocks in the last frame of video. The solution is to always round the

audio bitstream up or to make multiplexers "video centric."

Second, because MPEG-1 is bursty, some multiplexers put the audio streams at indeterminate locations — wherever there is room. This causes a problem with some decoders that have a narrow window for the audio packets. Audio packets outside the window can cause synchronization errors. The audio may unlock from the video until the decoder can correct itself.

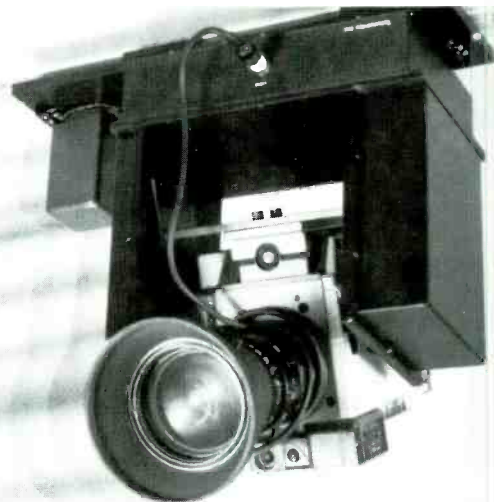
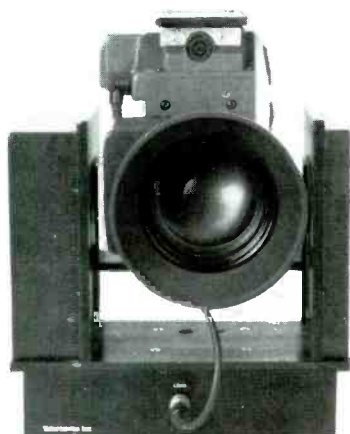
Third, the various multiplexers pack the bits differently. Some are more efficient than others. Less efficient multiplexers can cause problems, especially on CD-ROM drives with marginal data throughput. The drives may not be able to keep up with the continuous data flow, possibly causing errors in the image and sound data.

MPEG-1 vs. MPEG-2

Confusion reigns when people start talking about compression and especially the differences between MPEG-1 and MPEG-2. It has been said that MPEG-2 quality will be so much better, usually it is said without any qualifications or specifics. Will MPEG-2 at 2Mb/s be better than an MPEG-1 stream at 2Mb/s? The answer is probably not. MPEG-2 is made up of various image qualities — pro-

Continued on page 32

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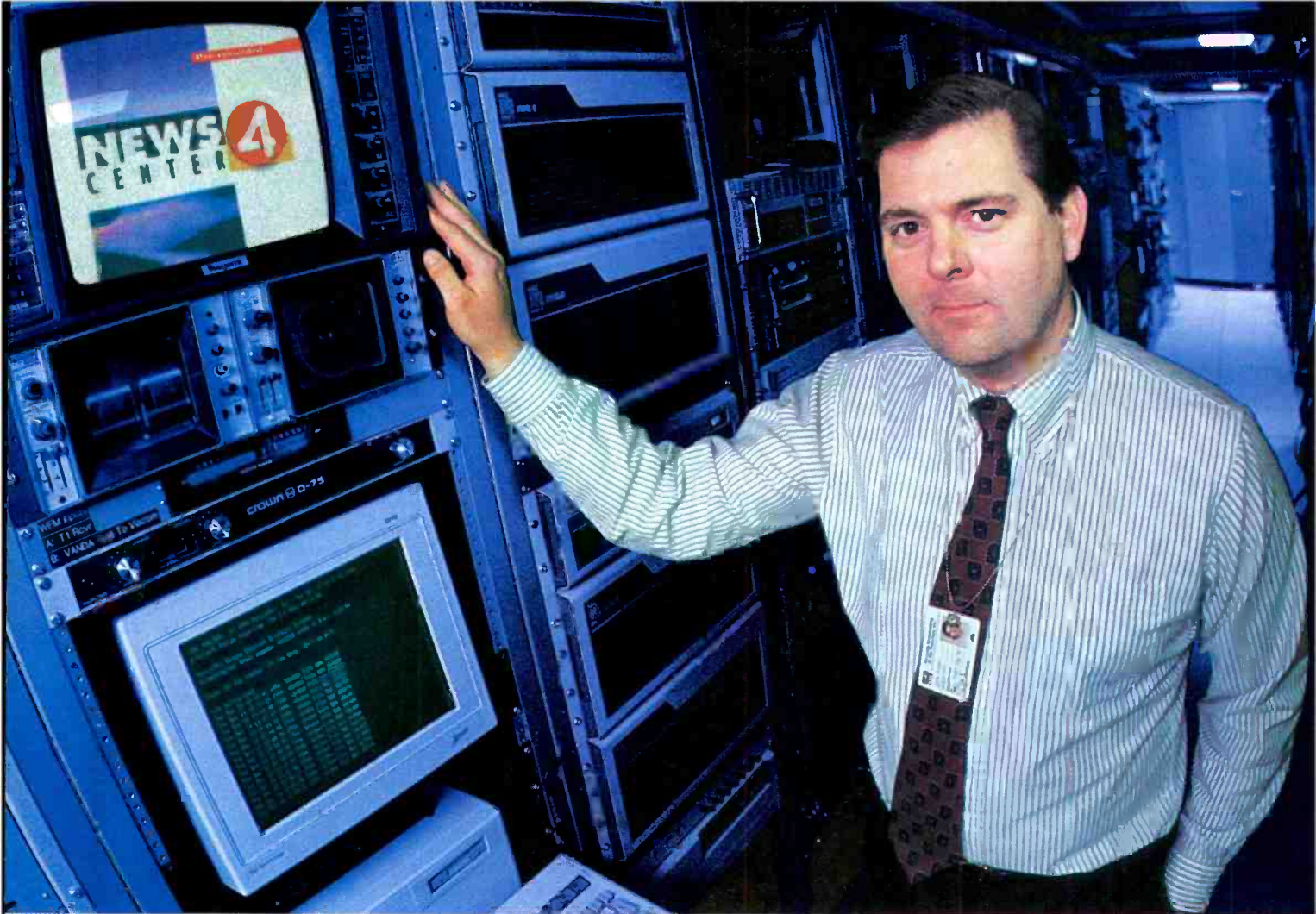
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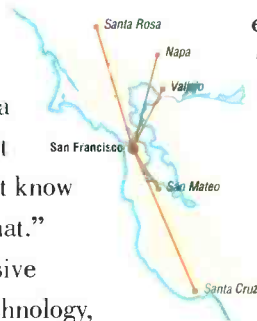


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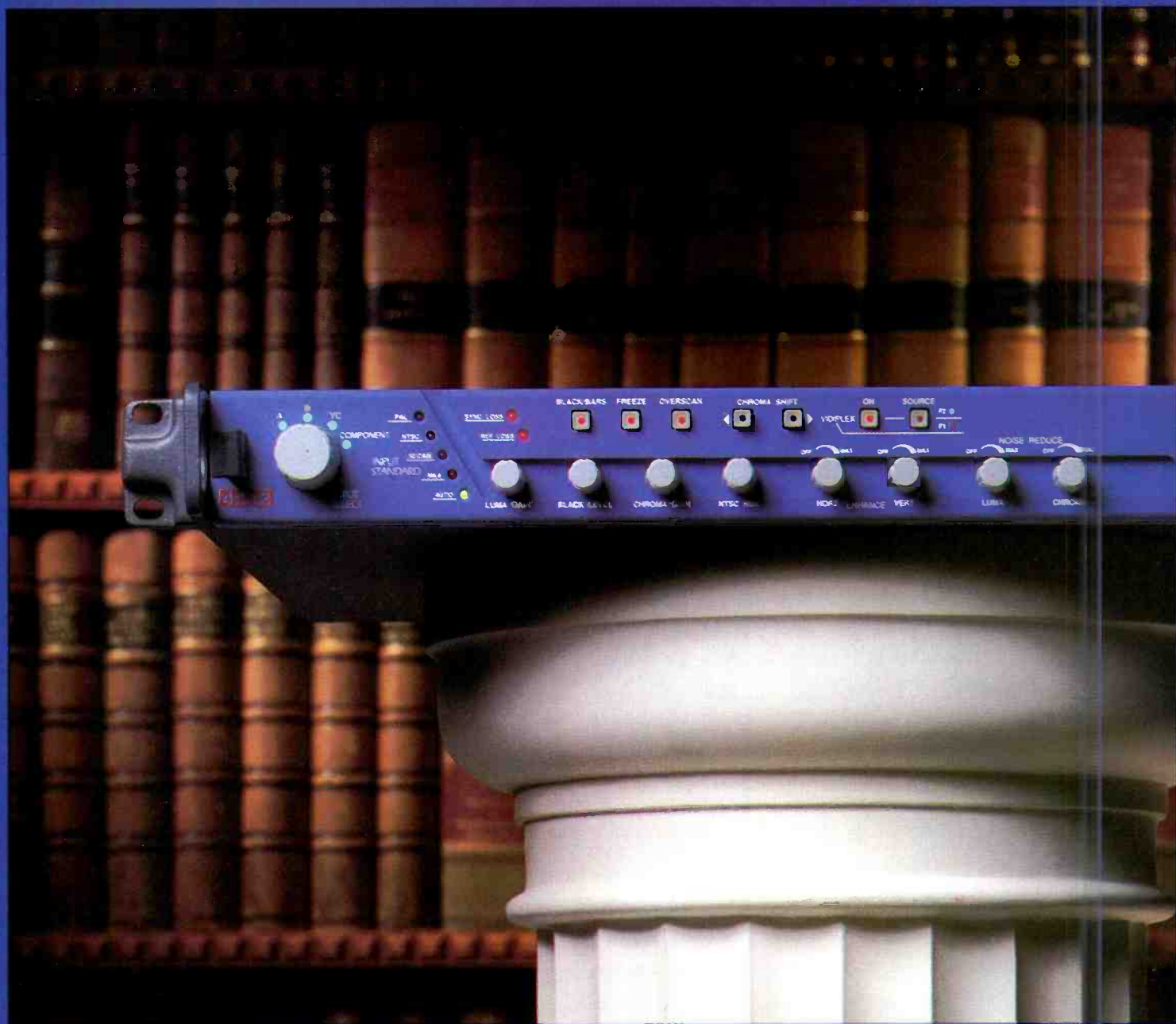
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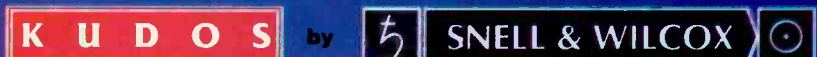
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files and various resolutions — levels. Figure 2 shows all the flavors of MPEG-2. When most people refer to MPEG-2 they are referring to a main profile/main level (MP@ML) bitstream. MPEG-1 is actually much closer to MP@LL (main profile, low level).

MPEG-1, a frame-based system with data rates up to 1.5Mb/s. MPEG-2, on the other hand, is field-based with data rates up to 80Mb/s. MPEG-2 is focused on interlaced pictures at eight bits per pixel. MP@ML at 4Mb/s to 6Mb/s gives an NTSC-like image quality while it takes 8Mb/s to 10Mb/s to achieve a reasonably high quality image.

The MPEG-2 standard is really a "tool-box." It allows users to select different types of compression, profiles, and various levels of processing complexity, resolution and sampling levels. The standard is scalable all the way to HDTV and includes provisions for multichannel audio compression.

MPEG-2 was developed with a media independent system layer for multiplexing and transport. An MPEG-2 decoder is said to be in conformance at a given profile and level if it can properly decode all syntactic elements of the bitstream as specified by that profile at that level. Furthermore, a decoder should be downward compatible with all streams that are lower on the matrix.

Encoding

Today, there are two MPEG-2 encoding camps. The first one advocates a bitstream that is simple profile at main level (SP@ML). They claim that without the B-frames the cost of the decoders can be greatly reduced. Decoding B-frames requires much greater available memory. This is because both previous and future frames must be put into memory to decode the present B frame. The second group is showing MP@ML encoders. These are in the majority and as previously stated when most people talk about MPEG-2 they are usually referring to MP@ML. The quality of the SP and MP encoders have been excellent. Many people are surprised that the SP encoder looks as good if not better in most circumstances at a given bit rate. This could be due to better image manipulation and algorithms.

The problem again is one of compatibility. Will a SP@ML bitstream play on a MP@ML decoder? This should work but I have not seen anyone try it and seeing is believing. The opposite case will probably not hold true. For now, to be safe, make sure that both the decoder and the bitstream to be decoded are at the same profile and level. This will become a sticky issue as MPEG-2 is deployed either within a closed studio environment or to the public.

Sony and Philips Electronics NV have unveiled a new generation of compact disc. The disc uses laser technology that will allow 3.7GB of data per disc. The increased data storage will allow an MPEG-2 main level/main profile, 135-minute movie to be stored on a single disc. Both companies hope the quality will be high enough and the price low enough to make home use of videotape obsolete.

Conclusion

In the next six to eight months these issues and more will become apparent as MPEG-2 is deployed. There will be much finger pointing and bad feelings as the early adopters work through problems. In eight to 12 months many of the compatibility issues will have been identified and solutions will be created.

Technology challenges created by the deployment of compressed video, whether on a video file server or other media, are coming into focus and solutions are forthcoming. But, engineering staffs are just beginning to examine the challenges. The "same old studio" syndrome will not suffice. "Data studios" where new problems, solutions, equipment and job titles will prevail may be on the way and could revolutionize our industry. ■

Steven Blumenfeld is vice president of technology for GTE Interactive Media, Carlsbad, CA. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@interrec.com.

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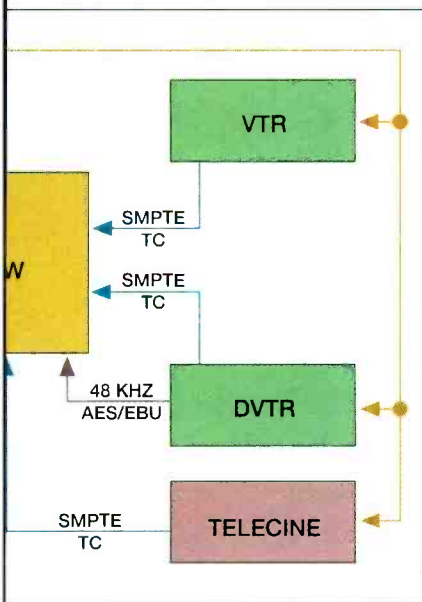
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Synchronizing digital audio to video

Getting out of sync can be even easier with digital audio.

One of the greatest frustrations that a post-production facility deals with is synchronization. At some point, a project's audio and video are likely to get out of sync, and someone will be responsible for putting them back together. In this regard, the advent of the digital audio workstation (DAW) has been both a blessing and a curse. It is a blessing because a DAW can be used to fix sync problems, but it is more often a curse, because most operators don't understand the issues involved in maintaining a synchronous relationship between digital audio and video.

The most important factor in synchronization is the relationship between time-code rates and sync rates. Operators need to realize that the reference sync rates of a post-production house (or *house sync*) may be different from the time-code rate of a source tape. In most video production facilities, the house sync (or *blackburst*) is 59.94Hz when referencing NTSC (two fields per frame). However, time-code rates are often left to the whim of the operator. A non-drop frame 30 frames per second (fps) time-code rate may be striped onto a videotape referenced to 29.97kHz.

Now, recall that digital audio workstations and digital audiotapes (DATs) are synchronized to audio sampling rates of 44.1kHz or 48kHz, but they must also be referenced to video decks to maintain audio-video synchronization. There are many variables and possible permutations here, with plenty of opportunity for problems.

Digital pull-down

For example, consider using a digital au-

dio workstation to edit sound for a motion picture. The film is originally shot at 24fps while the audio is recorded to time-code DAT at 48kHz. The film now goes through the telecine process of creating a video reference tape for further editing. During this

There are many variables here with plenty of opportunity for problems.

process, the film is slowed down. (The NTSC video frame rate of 29.97fps must be synchronized with the 24fps of film, so a compromise must be struck. This is called *pull-down* or slowing in the frame rate of the film, ending with a new effective film rate of 23.976fps, which is derived by dividing 24fps by 1.001.)

How does this happen? In the telecine process, four film frames will equal five video frames. (The conversion scheme alternately copies each film frame to either two or three video fields.) The videotape shows redundant information to make up for the fact that NTSC video runs faster than film.

The tricky part of the telecine process is the audio transfer. In halcyon analog days, audio came in on 1/4-inch analog tape. The tape was then "referenced" to the film rate used in the telecine process and automatically slowed down to match the film. A working videotape was then created with a guide audio track. Today, when audio comes from the field on DAT, special considerations must be made depending on whether the source audio is going to be kept in the digital domain or converted to analog and then back to digital.

The Bottom Line:

"Time is what keeps everything from happening at once," as the saying goes. Typically, this is a good thing. But, sometimes two events that are supposed to happen at once don't. Welcome to the world of synchronization problems — familiar ground to the post-production community. Digital technology has simplified and complicated the problem, but the real culprit is often operator error.

§

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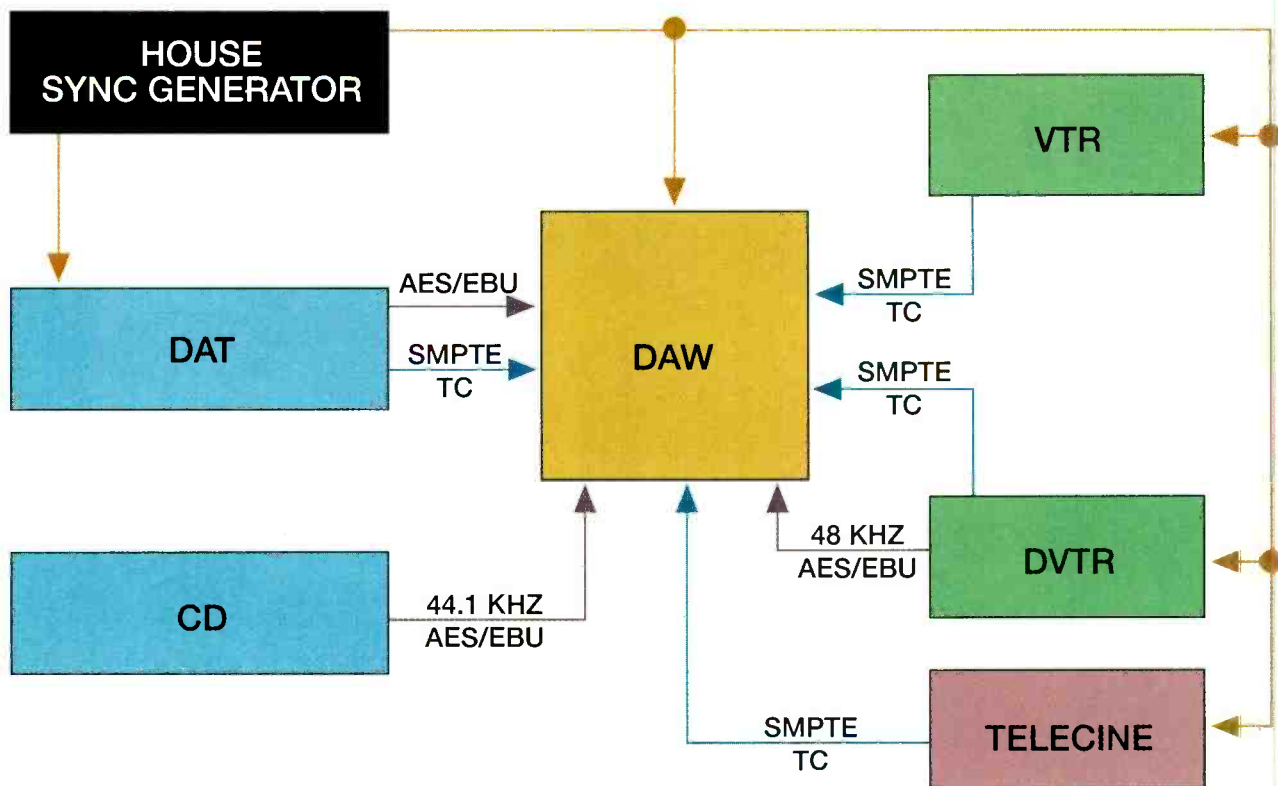


Figure 1. Interconnections required for proper audio/video synchronization in a typical post-production facility.

Ideally, the audio should be kept in the digital domain. To do this, the DAT machine should be able to lock up to house sync via an *external reference* capability. If it cannot do this, then the workstation to which the audio is being transferred must be able to do so. On some workstations, this may result in a pulled-down sample rate of 44.056kHz if the original audio is sampled at 44.1kHz or 47.952kHz if the original is 48kHz. Other workstations can internally generate a 44.056kHz or 47.952kHz sample clock that is locked to house sync. Some of these full-featured workstations include a real-time sample rate converter for changing the sample rate of the source audio "on the fly," as the signal is loaded onto the hard disk. This kind of synchronization flexibility is an important feature because it allows the workstation to be referenced to house sync without altering the pitch of the source audio. (In other words, the digital audio signal is synchronized as it comes *into* the workstation, so any changes to the audio signal's original time-domain nature are avoided.)

What about the *time-code* rate when editing audio against video? Time code also "slows down" when the sample rate is slowed during the telecine pull-down process. It's important to make

sure the original time-code rate is 30fps, so the new rate will be 29.97fps. However, if the original time-code rate was set to 29.97fps, it will slow the time-code down to 29.94fps and the original film rates will have to be reconfigured. A good audio workstation will allow you to check the incoming sample rate of the audio as well as the incoming time-code rate in order to quickly determine if a sync problem will arise later on.

Analog sync problems

As an adjunct, time-code problems can also arise with analog source tapes from the field. In the analog world, there is usually an offset between the play, record and time-code heads. To get around offset problems that arise from the time it takes for tape to pass from the record head to the time-code head, many recorder manufacturers build in time-code delays. The problem is that there is no real standard spacing. This can result in source tapes with multiple frame offsets between the audio and the time code (typically because the playback machine has a different spacing between its play and time-code heads than the record machine's time-code offset expects).

Knowing what that offset is can correct the problem, but it is important to

keep in mind that such problems arise easily. For example, the Nagra IV S-TC time-code field recorder has several published times for the offsets between the audio and time code at varying recording speeds. In the field, the audio person will *jam-sync* the slate with the Nagra. The slate picks up the time code from the Nagra and feeds it to the film camera which then free-runs. If the jam-sync is done correctly, there may not be a problem. However, the Nagra can be in either of two modes — "test" or "record." Test mode is the correct mode for a jam-sync. If the jam-sync is done in record mode, there will be a frame delay introduced as the Nagra is trying to pre-compensate for its record head/time-code head offset. The result is an analog tape that goes to the telecine room with time code that is out of sync from the code printed on the film stock.

Post production

Once the audio is loaded into the workstation, editing may proceed. During this time, the workstation must always be referenced to house sync, resulting in a pulled-down sample rate. Once the audio editing is complete, the final audio must be referenced to the

Continued on page 43

**When you see this name on a post production
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Extended control panel



Standard control panel

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** Off screen shots

film rate in the dub process. Again, a change in sample rate for audio playback may be required.

Working from video rather than film can be less confusing, but equally tedious. A telecine process is not involved, so there is no video slowdown to worry about, but referencing digital

tion of the edits may change as the sample rate of the EDL changed. For example, if a 2-minute sound effect ends at 00:01:00:00 with a sample rate of 44.1kHz, when it's changed to a EDL sample rate of 44.056kHz, the sound effect will now end at 00:01:00:04 (0.1% or 3.6 frames later, to be exact).

Synchronizing with digital video

Today, more and more facilities are using digital VTRs for their source video and audio. The digital VTRs usually have four channels of 48kHz digital audio. When 48kHz is used, workstations and DAT machines are happy. Referencing a workstation to a DVTR at 48kHz is as simple as connecting it. No pull-downs or strange sample rates are needed. Just remember that CDs and some DAT tapes will still come in at 44.1kHz.

Here the sample rate difference becomes much more critical. Instead of a 0.1% difference as encountered in the telecine pull-down process, the error between these two sampling rates jumps an order of magnitude to a full 1%. If sample rate conversion as described above is not performed (or analog transfer used), this error can cause audible pitch shifting. Most engineers and editors should hear this amount of pitch difference immediately, but at the end of a long editing day, some of these shifts can sneak through.

Coping skills

More often than not, synchronization problems come from simple mistakes. One cardinal rule that is easy to institute and follow will help: Make sure that audio and video operators fully and correctly document their digital audio sample rates and sync references all along the way. This will save

a lot of downstream frustration from trying to guess frame rates or having to re-sync improperly referenced tapes.

The best insurance is to know from the outset what rates will be dealt with throughout the project, and what tools will be used in the editing process. In this way, synchronization problems can be avoided — or at least tracked down and corrected with a minimum of lost time and aggravation. ■

Mark Ely is product manager at Sonic Solutions, San Rafael, CA. Respond via BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

Working from video rather than film can be less confusing, but equally tedious.

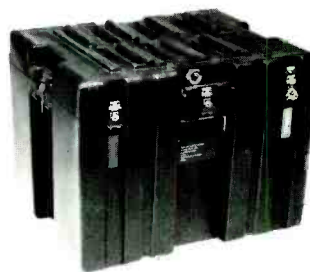
audio to video remains a critical issue. In the editing process, an editor may use dozens of different sound effects and music tracks from CD sources. If the CD player's digital output is connected to your workstation, then the recording is kept entirely within the digital domain — similar to the field DAT example above. However, the sample rate of a CD is always 44.1kHz. When recording into a workstation from a CD player's digital output, the workstation is clocked at 44.1kHz with no regard to the videotape. Once recording is completed and the system reclocked to house sync (44.056kHz sampling), the sound effects and music will be slowed down and the pitch will drop, although typically by an imperceptible amount.

Most editors are not concerned about this because they are usually editing the audio to picture and will make length adjustments as necessary. Nevertheless, ignoring this issue can still get you into trouble on occasion. To get an accurate pitch from a CD source, the workstation must be able to either maintain a 44.1kHz sampling rate referenced to house sync or to sample-rate-convert the audio as it comes in. If neither of these are possible, as a last resort you can use the analog outputs of the CD player and resample the audio into the workstation.

The only time using different sample rates really gets you into trouble is when you begin editing the audio to picture before you remember that the workstation is referenced to the CD player. All the editing done up until this point may be out of sync. Even though time-code values are referenced from a source videotape, the overall length of the EDL and relative posi-

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Selecting video and PC monitors

Monitors may look similar on the surface, but internally there can be major differences.



It has been said that the lines between video and PC monitors are blurring. The hype is that there is a true technological convergence, and a new standard is emerging. But that's not quite true just yet. Although computers and communications technologies are coming together — such as in desktop video — the products needed to monitor the video production process are not.

Sure, some features are becoming common for computer and video monitors. A few years ago, every computer display monitor operated at 9,300K. Meanwhile video monitors operated at 6,500K. Today, a variety of manufacturers make monitors with selectable color temperature. Still, according to manufacturers' estimates, approximately 70% of the computer market consists of monitors with the older 9,300K standard.

Other differences between PC and video monitors include subtle distinctions in aspect ratio, drastic differences in bandwidth capability, and disparities in the frequencies used to scan the display. Engineers need to consider all of these factors — as well as price — when mulling the purchase of a new monitor. This article looks at some of the fundamental differences between today's PC and video monitors, and offers some tips to consider when purchasing monitors for use with computers, video or both.

Signal parameters

Analog video is distributed throughout a facility at a bandwidth of 20MHz or less. Once broadcast, it is reduced to less than 5MHz. Professional color video monitors typically

limit bandwidth to less than 6MHz, although some high-resolution black-and-white monitors are capable of displaying signals with bandwidths of 12-15MHz.

Computer monitors, on the other hand, are designed to display the widest bandwidth signal possible. Most of today's displays are progressively scanned, beginning at the top of the screen and scrolling down to the bottom. However, some older monitors use interlaced scan. This difference between monitor types has led to some confusion. For computers, display memory is output progressively, however, the scanning method used to display the signal can be either progressive or interlace, based on the video card driving the monitor.

The Bottom Line:

Color video monitors are expensive but necessary equipment in broadcast and post-production facilities. Over the last few years, high-quality computer monitors have found their way into most facilities. Despite outward similarities, there are major differences between video and computer monitors. Understanding the differences makes it easier to choose the right monitor for the job.

Screen aspect, pixel aspect and the ratio of horizontal to vertical pixels can all be changed for computer displays.

This is a critical difference between computer and video monitors. For video, the electrical signal, the display format and even the signal bandwidth are all fundamentally intertwined. All of these were laid out when NTSC was specified. Although video monitors are built with some flexibility, offering external sync inputs or composite and component video inputs, in general, they are configured to display the 60 interlaced fields of NTSC at bandwidths of less than 10MHz.

For computers, these parameters are far more

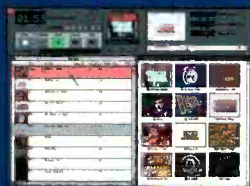
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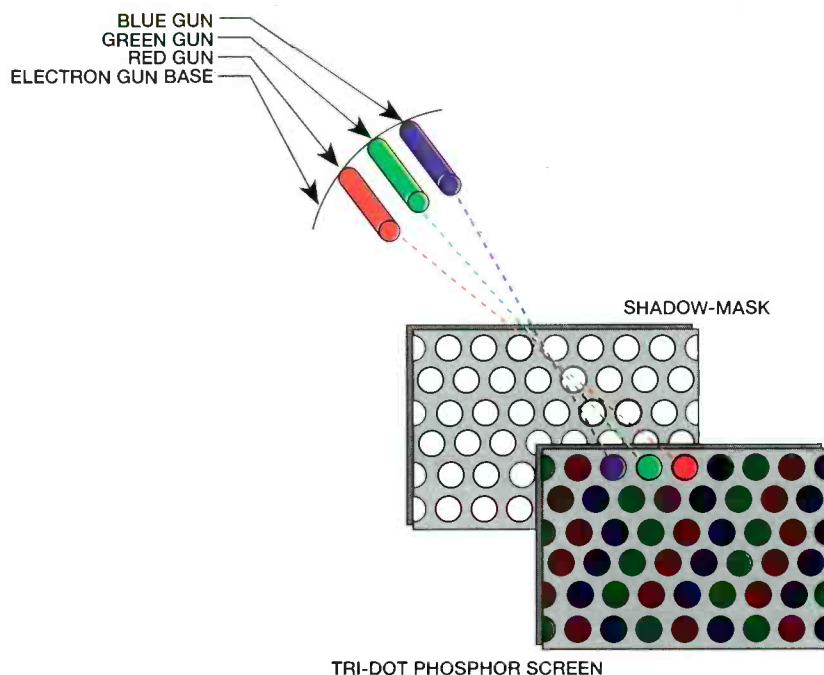


Figure 1. Shadow or dot-mask CRTs use three electron guns and a circular or oblong mask to direct the electron beams to the proper phosphors. Older CRTs used the "triad" as shown, newer CRTs use oblong holes arranged vertically.

flexible. Pixel clocks are used to generate horizontal and vertical sync pulses that are fed to the monitor as separate signals. Screen aspect, pixel aspect and the ratio of horizontal to vertical pixels can all be changed for computer displays. Many of the numbers used to define standards such as VGA are stored in lookup tables on the adapter card. Auto-locking sync circuits in computer monitors are capable of locking to various horizontal and vertical frequencies, including properly decoded video. For ease of operation many of these "multisync" units offer internal video decoders and can display a wide range of signal types.

CRT construction

The CRTs used in both types of monitors are similar. Because of the wide range of applications, computer monitors come in various aspect ratios depending on market needs. Video monitors are available with aspect ratios of 4:3 and 16:9, with new models offering the capability of displaying both formats. Regardless of aspect ratio, CRT construction is basically the same for video and computer monitors.

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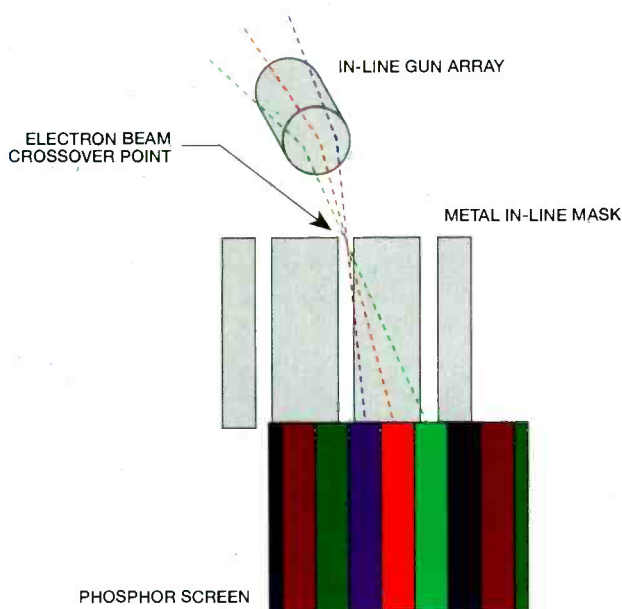


Figure 2. Trinitron technology uses a single gun with three beams and a slitted aperture grill. In general, this technology produces higher resolution and brighter pictures.

In general, two types of CRTs are available, the shadow or dot-mask and the parallel stripe or Trinitron. In the dot-mask CRTs, the electron beams pass

ed by the pitch as well as by the size of the CRT.

Another factor in the overall "look" of the picture is the type of phosphors used.

through a carefully aligned mask with round or oval holes arranged in vertical lines. The guns are arranged in a line, as are the phosphors on the screen. Dot pitch is the distance from the center of one dot to the center of the next dot of the same color. In the Trinitron-style CRTs, fine stripes of phosphors are arranged vertically. An aperture grill composed of parallel slots is used to mask the phosphors. The electron gun emits three beams, each of which is directed to the proper stripe by an internal beam-aiming structure and the grill. Pitch is measured from the center of one stripe to the center of the next same color stripe. In both types of CRTs, screen resolution is limited

by the pitch as well as by the size of the CRT. For the most part, computer monitors used the EBU phosphor specification, while video monitors may use the EBU, SMPTE, NTSC or P-22 phosphor specifications, depending on age and design constraints. NTSC phosphors were specified in the early 1950s unfortunately, and CRTs using those phosphors had little light output. The P-22 phosphors are an uncalibrated phosphor set used by several manufacturers.

Monitor gamma curves also determine how the display will appear. For video applications, gamma curves are part of the NTSC spec, however, in the computer world, gamma information can be stored in lookup tables and adjusted as needed. As the pitch is reduced, so is brightness. In addition, the mask absorbs more energy from the beam and heats up. As its temperature changes, the mask can distort, possibly causing image distortion as well.

Features

Most professional color monitors for video and computer applications offer reasonably high quality images. Some of the features offered include precision alignment capabilities and remote control, both infrared and wired. In broadcast, picture tube alignment includes registration and

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matching the picture on one monitor to another in the same room. An experienced engineer can relate to the problems of trying to get one color monitor to precisely match another. Today's microprocessor technology allows monitors to be precisely aligned in the field. Alignment parameters can be stored and recalled or re-adjusted as needed.

**Today's
microprocessor
technology allows
monitors to be
precisely aligned
in the field.**

In the computer world, color alignment can take on different meanings. Consider working in a pre-press application where colors chosen on a computer need to be output for printing thousands of copies of an ad or a magazine. Monitors used in these applications need to display an accurate picture of what the final product will look like. The same type of problem exists when viewing graphics files that originated as film or will be output onto film. These applications are also one of the reasons for the various aspect ratios available.

Wired remote controls have been standard on many video monitors for years, but lately wireless versions are also becoming common. Wireless remote control of multiple monitors usually means designating one receiver as the control receiver, then running cabling from the receiver monitor to other monitors so that all of the monitors can be controlled using a single transmitter. Other features that are available include glare screens, rack-mount kits and plug-in input modules for displaying various signal formats.

What to buy?

So, knowing that, should you buy monitors on price? On technology? On your particular need, for computer-generated graphics, or desktop video production? The answer is a combination of all of these. Because of the differences in technology, what you create on a computer monitor will not look the same when you view it on a video screen.

Multipurpose displays are fine in

general applications, however, in areas where one or two monitors are to be dedicated to a specific purpose, specific monitors should be purchased for each application. Things to consider include dot pitch and the monitor size, because both will affect overall resolution. The smaller the dot pitch and the larger the screen size, the better the resolution. Another consideration is output brightness. In general, the brighter phosphors do not have the color gamut needed for some applications. Phosphors with a wide col-

or gamut are not all that bright. As monitor applications change, the criteria used to judge what makes a quality monitor will change as well. ■

Gene Koprowski is a freelance writer based in Chicago. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

 For more information, circle (302) on Reply Card. See also "Monitors, Video" on p. 72 of the BE Buyers Guide.

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Transition to digital, part 2

The term "digital video" has been used to describe a variety of image formats.

Last month, part 1 concentrated on traditional media. This month, in part 2, issues specific to the emerging media referred to as "digital video" will be addressed. The goal is to make the reader aware, informed and better prepared to deal with problems as the media we work with is increasingly transformed into digital form.

Digital video

Last month, we reviewed video in general, so now is a good time to ask "What is digital video?" *Digital* implies a numerical representation and the ability to be processed by electronic means. Digital video in this context implies the ability to treat video in the same manner as any other digital data.

This is the common thread that allows video stored in electronic digital form on a VTR and video stored in electronic digital form on a computer hard disk to share the name digital video. This is also a source of confusion because two different markets — video and computing — are being addressed. By understanding how digital video evolved separately in these two markets, we will be better able to understand how they are merging now.

In the broadcast market

Digital video in the broadcast market has typically been incorrectly characterized by its means of storage. People commonly think of composite digital video as D-2 and component digital as D-1. Although digital video does have component and composite forms, it is wrong to think the storage means (D-1, D-2, etc.) defines the video format; in fact, the sampling/interface format correctly defines a video signal.

At present, composite NTSC digital video is defined by:

- *SMPTE 244M* (proposed SMPTE standard for television — system M/NTSC composite video signals — bit-parallel digital interface)

- *SMPTE 259M* (proposed SMPTE standard for television — 10-bit 4:2:2 component and 4fsc NTSC composite digital signals — serial digital interface)

Although the digital process employed by composite digital video signals yields lower losses over multiple generations of processing, all of the detriments of an analog composite signal are still present. Artifacts like contouring also occur due to the quantization of the entire video signal, including sync, as opposed to sampling just the active region of video.

Composite digital video performs the best to extend the life of installed video equipment. Phase-encoded information in the composite digital signal makes it difficult for computers to process the video signal directly without first decoding the phase information. D-2 is simply a composite digital video storage format that uses data conforming to the SMPTE 244M specification.

Component NTSC digital video is defined by:

- *SMPTE 125M* (bit-parallel digital interface component video signal 4:2:2)
- *SMPTE 259M* (proposed SMPTE standard for television — 10-bit 4:2:2 component and 4fsc NTSC composite digital signals — serial digital interface)

There is also an international standard for the interfacing of component digital video signals using 4:2:2 CCIR 601 sampling for both 525 and 625 TV systems called CCIR 656.

Although component digital is ideal for studio or post-production work, the high cost traditionally associated with digital component recording has hampered its acceptance. Component digital offers the advantage of less loss over multiple generations of processing and does not have any of the artifacts associated with phase encoding.

Component digital is still band-limited to video frequencies (typically less than 6MHz), and the chroma is sampled at half the luminance resolution. In fact, this is the historical derivation of where the 4:2:2 term appeared — 4:2:2 once represented the multiplier factor of the subcarrier frequency at which the different components were sampled (4-luminance: 2-chroma red: 2-chroma blue). This works out well because the color space used for video production and distribution is

The Bottom Line:

Despite using similar terms the computer and video industries have attached different meanings to them. Much of the recent confusion has been caused by these different meanings. Understanding the various meanings from the viewpoint of each industry is one of the best ways to get a clear picture of the capabilities of the various technologies involved.

component YUV form for storing pixels; it saves space and matches the color space of the composite signal used for transmitting video signals.

In the computer market

Digital video in the computer market has been defined by the need to reduce the amount of data in a video signal until it fits within the bandwidth constraints of the computer. These constraints may be based upon the CPU speed, bus transfer speed and the speed and size of the disk storage system. This reduction of video data can occur by reducing the size, the number of colors, the frame rate or the quality of the video. The reduction of quality is the most sensitive issue because it relies upon a subjective, as well as qualitative, evaluation to determine the acceptability of the data removed. Artifacts, whether visible or not, introduced by reducing data may produce undesirable effects after undergoing processing or transmission.

Compressed digital video is typically defined by:

- Motion-JPEG (Joint Photographic Experts Group)
- MPEG-1 (Motion Picture Experts Group)
- MPEG-2

Although there are many other compression formats, MPEG-2 seems to be the favorite for future video and computer applications. In gen-

eral, compression schemes must make trade-offs between image quality, data bandwidth and real-time operation.

An issue directly related to compression is how much data is lost. Compressing a "data" file requires that it be reconstructed exactly ("lossless") for it to be usable by a computer. For the most part, video can tolerate a "lossy" compression scheme where image content and data are removed permanently. This is especially true when the quality of the reconstructed image will be judged subjectively by a human eye, which is capable of filling in the missing information.

If this sounds strange, remember that current composite broadcast standards are a form of compression. Only one field at a time is transmitted and our eyes are expected to integrate the even and odd fields to reconstruct the total image.

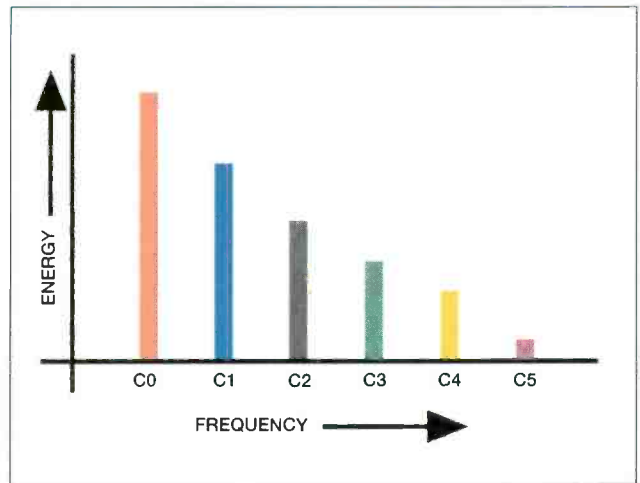
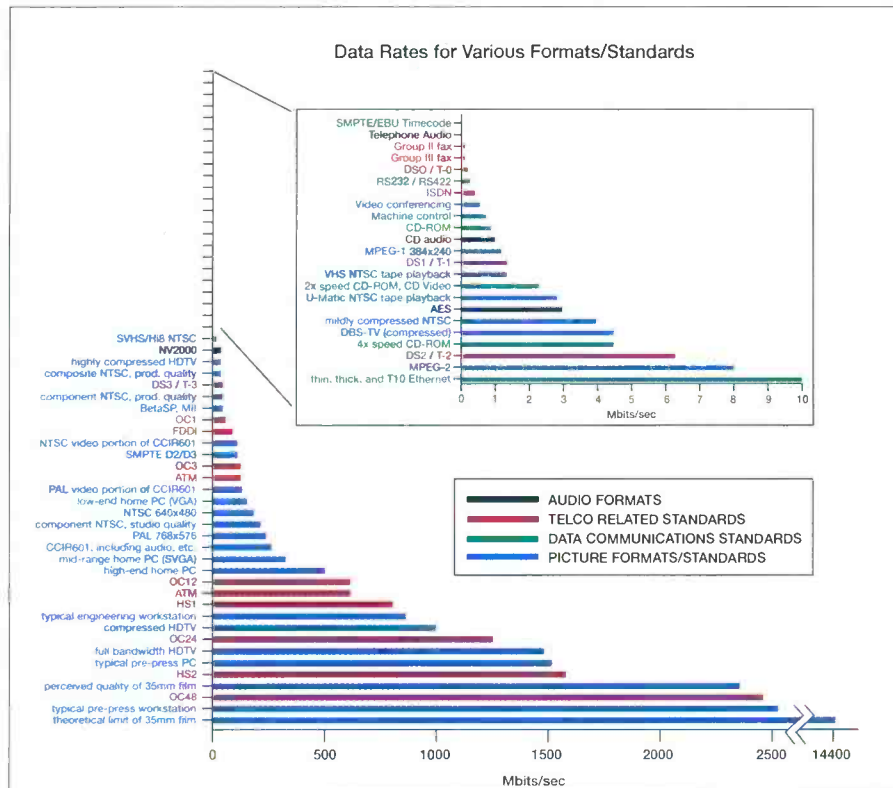


Figure 1. When discrete cosine transform (DCT) is performed on a signal, time domain information is transformed into frequency domain data. In a typical video image, a majority of the frequency components can be described by a single coefficient (C0), harmonics are then described using additional coefficients (C1-5). Each additional coefficient requires extra bandwidth.

JPEG is a compression scheme created to operate on still images. By playing a series of JPEG images in sequence, motion is achieved, hence the creation of Motion-JPEG. JPEG was created with a focus toward image quality, not





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Standard	Example	Mbits/sec
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Telecomm	OC48	2488.000
Picture	perceived quality of 35mm film	2400.000
Telecomm	HS2	1600.000
Picture	typical pre-press PC	1520.000
Picture	full bandwidth HDTV	1500.000
Telecomm	OC24	1244.000
Picture	compressed HDTV	995.000
Picture	typical engineering workstation	843.000
Telecomm	HS1	800.000
Telecomm	ATM	622.000
Telecomm	OC12	622.000
Picture	high-end home PC	506.000
Picture	mid-range home PC (SVGA)	310.000
Picture	CCIR601, including audio, etc.	270.000
Picture	PAL 768x576	265.400
Picture	component NTSC, studio quality	251.000
Picture	NTSC 640x480	220.900
Picture	low-end home PC (VGA)	198.000
Picture	PAL video portion of CCIR601	177.000
Telecomm	ATM	155.000
Telecomm	OC3	155.000
Picture	SMPTE D2/D3	143.000
Picture	NTSC video portion of CCIR601	143.000
Telecomm	FDDI	100.000
Telecomm	OC1	52.000
Picture	BetaSP, MII	45.000
Picture	component NTSC, prod. quality	45.000
Telecomm	DS3 / T-3	44.700
Picture	composite NTSC, prod. quality	23.000
Picture	highly compressed HDTV	20.000
Audio	NV2000	18.400
Picture	SVHS/Hi8 NTSC	12.000
Datacomm	thin, thick, and T10 Ethernet	10.000
Picture	MPEG-2	8.000
Telecomm	DS2 / T-2	6.300
Datacomm	4x speed CD-ROM	4.600
Picture	DBS (compressed)	4.600
Picture	mildly compressed NTSC	4.000
Audio	AES	3.070
Picture	U-Matic NTSC tape playback	3.000
Datacomm	2x speed CD-ROM, CD Video	2.300
Picture	VHS NTSC tape playback	1.544
Telecomm	DS1 / T-1	1.544
Picture	MPEG-1 384x240	1.500
Audio	CD audio	1.411
Datacomm	CD-ROM	1.150
Datacomm	Machine control	1.000
Picture	Video conferencing	0.768
Telecomm	ISDN	0.144
Datacomm	RS232 / RS422	0.115
Telecomm	DS0 / T-0	0.064
Telecomm	Group III fax	0.014
Telecomm	Group II fax	0.010
Audio	Telephone Audio	0.008
Datacomm	SMPTE/EBU timecode	0.002

Table 1. Information is transferred at various rates, determined many times by how much is needed and how long it will take. This table depicts data rates used to move information using today's technology.

most confusing aspects of MPEG-2 is the resolution discrepancies between video CCIR 601 sampled signals (720 x 486 for NTSC and 720 x 576 for PAL) and MPEG (704 x 480 for NTSC and 704 x 576 for PAL).

Compression and spatial sampling

Video has evolved in much the same fashion that yesterday's LPs evolved into today's CDs. Originally, black-and-white televisions displayed images as a series of lines drawn across the screen. As black-and-white gave way to color, triads of color groupings replaced the glow of the monochrome phosphors. To produce a color image, the electron beams were shot through a dot mask, reducing resolution. The reduced resolution of color monitors was an acceptable trade-off for the ability to display color.

Digital video sampling for compression works slightly differently. Unlike broadcast where the signal is displayed as it is received following the scanning pattern across the screen, compression schemes developed for recording computer video rely upon spatial sampling.

Computer compression will look at the entire frame, in blocks typically eight lines high by eight samples wide, trying to represent these blocks with as little information as possible. Taking the 8 x 8 space (64 pixels) as 24-bit color pixels, there would normally be 192B(bytes) (1,536b)(its) used to represent this block. If the computer can represent this area with only 64b, then on average a pixel in this block would be represented by a single bit (1b/pixel storage), and the compression ratio would be 24:1.

The trick to compression

The trick to compression is throwing away the data that we don't perceive or that is redundant. Many compression algorithms take advantage of frame rates or color spaces to increase efficiency. Film, for example, is originally recorded at 24fps, but it is "resampled" to 30fps when shown on television. Some compression systems go back to the original 24fps to avoid having to compress the additional one-fourth extra data created from the conversion to video. The conversion back to 30fps video is done at the decoder box.

In a similar manner, if I have a computer graphic created in an RGB color space and wish to compress it and eventually show it on television, I can take advantage of the fact that human chrominance perception is lower than luminance perception (a factor that television already takes advantage of) and convert the graphic first to a YCrCb color space and then compress the graphic. The result will be in a color space ready for display on television.

One caveat is in the conversion from RGB to YCrCb — something called color legalization may occur. This happens because the YCrCb color space does not support all the colors in the RGB color space and some scaling or truncation may be required. This could be considered a bandwidth constraint for color.

Content dependence

Compression is highly content dependent. Compression artifacts are the visual result of the inability to reconstruct the original image faithfully.

A major factor in this process is noise. Noise is unwanted high-frequency information. High-frequency components require more bandwidth to convey. A screen of solid color will compress well, while a screen of solid color with noise will not.

Filtering is a crucial factor in data compression. The cleaner the source, the better the compression ratio and the better the quality will be.

Frequency domain compression

"Cleaner" in this context refers to removing undesirable high-frequency information. This is important because most compression schemes are based on the frequency domain of a signal, not on the spatial domain. The frequency domain was chosen because coefficients could be chosen to represent frequency harmonics of an image, with most of the energy of a video signal concentrated in the low-frequency components. (See Figure 1.)

Audiophiles will be quick to note that this is just like audio in that it takes more power to drive the bass than it does the high frequencies. But like audio, in the same way it takes the high frequencies to provide crisp, clean sound, the high-frequency components of a video image are necessary to reconstruct

Continued on page 64

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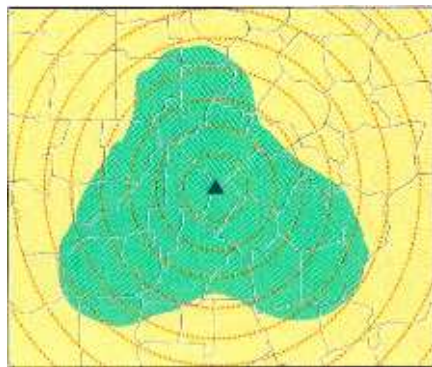
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When confronted with conflicting standards, regulations and rules, which set should be used? In particular, which set of rules applicable to obstruction lighting for skeletal transmission towers should be observed — the FCC's or the FAA's?

The FCC has been issuing numerous citations in recent months. This suggests that considerable attention should be paid to the transmission tower and its obstruction marking and lighting. The primary standards for aircraft warning light systems begin with the FAA Advisory Circular (AC) 70/7460-2D1H, Change 2, dated July 15, 1992. It is the latest publication to date on obstruction lighting. Suffixes -1G, -1F and -1E (November 1976) are effectively obsolete.

Conflicts and confusion

Although many existing skeletal towers for radio and television may not incorporate the latest lighting concepts in accordance with either FAA AC 70/7460-1H or FCC regulations, they might very well pass as grandfathered, but by whom? The commission's Part 17, paragraphs 17.24 through 17.42 includes specifications for the lighting of antenna structures that do not conform with what is stipulated in FAA AC 70/7460-1H or -1G. (The FCC regulation is dated Oct. 1, 1991.)

Here's an example of the disparity. The FAA refers to tower lighting levels in an "A-Number" series (e.g., A-1, A-2, etc.). The FCC also uses an A-number series to classify tower height, but it does not agree with the current FAA series. Sorting out this and other divergences between the two agencies' rules quickly becomes a mind-numbing exercise.

While the FCC is currently working on the disparity, it remains to be seen when the two regulatory organs will get in tune. Meanwhile, the FAA clearly has developed a meaningful lighting standard that is commensurate with today's stringent air traffic requirements. Most tower constructors and purveyors of obstruction lighting systems follow the FAA route.

Federal standards for obstruction lighting

Recent changes

For those who may not be familiar with Change 2 of the AC 70/7460-1H, the most significant change involves the location of two beacon light units at the intermediate levels on structures exceeding 350 feet (107m). Although this may apply to new or forthcoming construction what about existing tower obstruction lighting? First, reference should be made to the original license issued for permission to proceed with the high iron construction. Second, it may surprise some to learn that each tower (whether stand-alone or in a multitower arrangement) must have its flashing-light units in synchronization. No more "flip-flop" or asynchronous lighting is permitted. Such lighting can, in most instances, be altered by changes in the controller to fulfill the synchronous lighting code.

*Sorting out divergences
between the two
agencies' rules quickly
becomes a mind-
numbing experience.*

Hot AM towers with older wiring may present a problem in accommodating this change. The most likely area of difficulty involves the new requirements for lamp failure and flasher "fail-safe" monitoring.

The FAA/FCC codes state that the minimum allowable monitoring method is visual inspection of a tower's lighting. Both agencies emphasize, however, that the structure should be equipped with a properly maintained automatic monitor, preferably with the capacity to remotely detect any lamp failures and provide indication of such failure to the licensee. Immediate reporting to the FAA and in-house documentation of the failure is required. The fines for ignoring these rules are steep. It is also a good idea to review the original license or check with the FCC/FAA whenever you're considering any change in lighting or marking of a tower.

Until revised and updated FCC regulations conforming to the newer FAA standards are issued, it is advisable to obtain a copy of the FCC Field Operations Bureau Bulletin No. 13, entitled *Radio Tower Painting and Lighting*.

A copy of the FAA Advisory Circular 70/7460-1H Change 2 can be obtained

from the Department of Transportation, Utilization & Storage Section (Publications) M443.2, 400 7th Street SW, Washington, DC, 20590.

Wait, there's more

When reviewing individual tower lighting requirements, keep in mind that any obstruction lighting system must not only conform to the lighting units (fixtures) as listed in the FAA AC No. 150/5345-53 (Airport Lighting Equipment Certification Program), but should also include the lighting controls to assure proper operation of the system. Interestingly, both lighting controllers and the companion photoelectric control are not specifically listed in the FAA AC 150/5345-53. The controls selected must simply fulfill the lighting functions for which they are intended: flash rate for beacons, control of steady burning sidelights, lamp failure monitoring, and specifically for red lighting, flash/fail safe monitoring of the beacon(s). Based upon individual requirements, additional features, such as power fail, lighting protection, fusible circuitry, etc., can be specified and included in the controller package. Retrofitting the entire existing obstruction lighting systems to the newer standards may be a wise choice when contemplating newer controllers.

And just when you thought it was safe to put the regulation book back on the shelf, stand by for more changes. Supplement -43E to the FAA's AC 150/5346-43 specification for obstruction lighting equipment is anticipated in early 1995. It includes a number of additional changes that will affect both flashing modes and monitoring systems for tower lighting.

Every licensee and tower owner should obtain copies of the aforementioned FAA and FCC documents for reference purposes. The refinement of obstruction lighting practice has come a long way thanks to the FAA and FCC regulations. Never underestimate their value. Like them or not, they are the proper guidelines. ■

**Next month:
STL systems**

Bob Mosher is an electrical engineer and obstruction lighting consultant for Crouse-Hinds Airport Lighting Products, Chalfont, PA. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

air (normally a program segment). Once it's started, the operator can attempt to diagnose and correct the problem.

Assuming the failure was in the automation computer, a backup computer may need to be brought on-line.

Because the communication between the automation system and most broadcast equipment is via RS-232/422 serial cables, the backup system should be configured for easy connection to these devices in the event the primary system fails. This can be done by using a serial data router or manually switching the cables. If manual recabling is needed, the backup device should be located as close to the primary unit as possible. This requires careful initial planning.

Prior to returning to automated operation, the automation system must be restarted and the schedule reloaded. The reboot needs to occur without affecting any decks currently on-air. Once the system is again active, the operator can then identify the event currently on-air. At this point, the system can be returned to the automatic mode with the next event being manually triggered, as time left on the current event is unknown. When the event ends, the operator "takes" the next event, fully restoring automated operation.

Logging manual procedures

Most automation systems log each event as it airs to fulfill the requirements of the FCC log. Equally important is the logging of all manual actions and equipment errors that affect the schedule. If the logging capabilities of the system are to be used, logging should record the following:

- Use of any event control buttons.
- Changes made to the original traffic schedule.
- Changes to program or preset sources on the switcher.
- Errors reported by the switcher, cart system or VTRs.
- Bypass of the master control switcher.
- Use of the MANUAL or AUTO buttons, including the logging of all scheduled events when switching from manual to automatic mode.

This additional information should be recorded in a detailed as-run log file that can be printed or queried, and archived for future reference. You should also consider what manual logging procedures will be used during equipment failure. For instance, how will a harried operator be able to accurately log events while running in a manual mode? It's important to

consider these type of events because they will certainly happen at some point.

Conclusions

Experience with a variety of automation sites, from small local affiliates to large international networks, has shown that thoughtful design of the manual/automated interface is a key part of the acceptance of master control automation.

Although the use of the latest software, including object-oriented design and graphical user interfaces can enhance the operator's use of the automation computer, technology for its own sake does not always provide the best solution. The automation system must always support and assist the operator, even at times when manual intervention provides the best results. ■

John Wadde, ICA Systems Group, Laurel, MD. Respond via the BE FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

 For more information on automation systems, circle (305) on Reply Card. See also "Business Automation and Commercial Insertion Systems" on p. 88 of the 1995 BE Buyers Guide.

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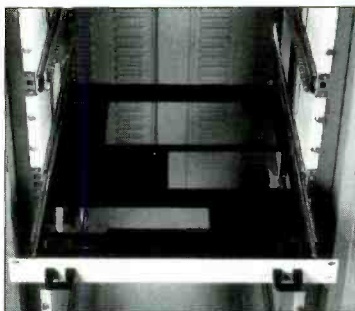
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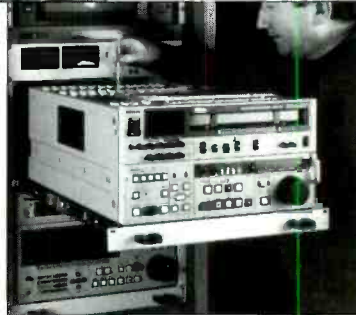
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As one of the leading stations in the country's No. 2 market, KNBC-TV in Los Angeles depends on the smoothest on-air operation possible. Like many other broadcasters, we have found that automating the on-air control room results in smoother transitions, fewer mistakes and a better overall on-air look. Although a highly skilled staff is still required for consistently good results, everyone responsible for on-air operations agrees that it's important to have an automation system that is user-friendly and supports the station's operating style.

The NBC Network has a lot of experience with automation, but it wasn't until 1992 that KNBC-TV had to make a decision about automating its own operations. Prior to that time, all of NBC's West Coast feeds originated from a facility in Burbank. KNBC-TV simply fed information into the automated West Coast operation. When the network decided to close down the Burbank facility in favor of satellite feeds from New York, KNBC-TV took over its own on-air operations and selected an automation system.

The station's decision-making team wanted a system that was user-friendly and easy to move around in. It also had to be adaptable to our mode of doing things, rather than being limited to a rigid set of procedures. We also wanted a system that would work with any equipment we chose to acquire or had on hand already. After

Alamar automation

considering several available systems, the team came to the conclusion that the automation package offered by Alamar USA most closely met our goals.

For us, one of the additional — and unexpected — advantages of such a user-friendly system is the ability to train operations staff in a quick and expedient manner, resulting in fewer on-air outages.

Getting started

I moved to KNBC-TV from the network facility in Burbank just in time to help get the new system established. A number of staff members at the station worked closely with Alamar to customize the automation system, and helped write the traffic conversion program (which converts data from the station's Enterprise traffic system to Alamar nomenclature for airplay).

The system went on-line in September

We now control everything in our on-air room with the automation system.

1992, two weeks ahead of the scheduled launch date, and operations personnel rapidly learned how to make the whole system work smoothly. Naturally, there were a few start-up bugs, but the inherent flexibility of the system worked to our advantage. We now control everything in our on-air room — record and playback tape machines, routing switcher, and two dub stations — with the automation system. In addition, satellite workstations in areas such as programming, on-air promotion and commercial traffic continuously pipe information into the automation database in master control.

Controlling the on-air array

The automation system uses three 486-based PCs: the main computer, a backup, and one for the Media Manager database. The backup is constantly updating itself from the main so that it's never more than two hours behind. If necessary, the database computer can also function as a backup.

The on-air computer runs the "engine" that controls the station's two Panasonic M.A.R.C. 400 tape machines (one for air and the other for backup) with five decks

each, plus an array of outboard MII, 1-inch and D-3 machines. The computer also controls the still-store system and 360 Systems Digicart machines. The automation system communicates directly with the sequencers in the M.A.R.C. 400 machines. This has two advantages: It eliminates the need to translate software languages, and it also results in faster response by the M.A.R.C. 400s.

The BTS master control switcher can also be manually controlled simply by pushing a button that releases the switcher from Alamar control. Outboard tape machines, the still-store system, and the Digicart system also have manual overrides in place, allowing the master control operator to handle emergency programming that differs from the automated playlist.

For recording, the automation system controls two M.A.R.C. 100 machines as well as a number of remote machines that record programs from satellite for time-shifting or from syndication. Because we back up all recordings, a M.A.R.C. 100 machine is loaded with MII tapes with barcodes on them labeled SA and SP, for *show air* and *show protection*, respectively. Prior to the record event, the automation system tells the machine to load one SA tape and its SP mate, so we end up with air and protection tapes with matching barcode numbers. Once the recording is completed, the automation system commands the M.A.R.C. to rewind the tapes and unload them. An operator can then remove the tapes and load them into playback machines. Show numbers and reel numbers are automatically downloaded into the Alamar database.

All facilities in the master control area are interchangeable with relation to record and playback. A M.A.R.C. 100, normally assigned as a record machine, could be used as a playback machine simply by changing the channel assignment from record to playback.

Media Manager

The Media Manager database is really the nerve center of our automation system because it contains all the information needed for accessing programs and commercials. It is constantly updated, and is the only practical way to keep track of everything in our library.

The daily logs are built in the Enterprise traffic system. Once this step is completed, the logs are then run through the Alamar traffic conversion program in which all

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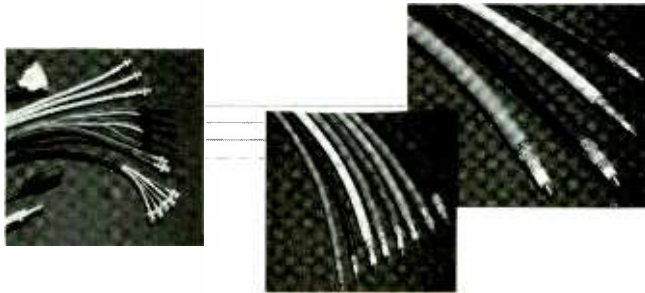
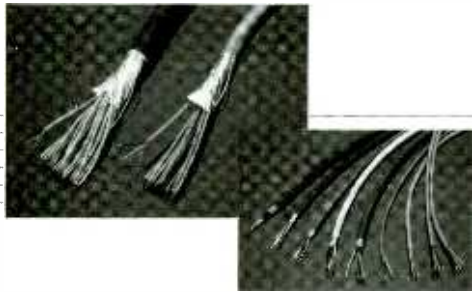
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Enterprise information is translated to Alamar language. The end result is a playlist that comes to master control in the form of a file on the hard disk drives of the main and backup computers. This playlist is a series of events that represents the station's program and commercial schedule for the next 24-hour broadcast day. This list is then loaded into the on-air channel in the main computer making it active and ready for air. Each event-line contains all the necessary information pertaining to that specific event. All of this program and commercial information is accessed from the Media Manager database during the traffic conversion process.

For commercial and promo tape playback events, the Media Manager information is critical, and the ease with which it can be accessed is important. This is because commercials and promos are aired from multicut cassettes. The reels are usually client-driven and may contain as many as 10 spots on one 20-minute MII reel.

When a commercial or promo is to be aired, the playlist event will tell the M.A.R.C. 400 which tape is to be loaded. Alamar knows the location of each tape in both M.A.R.C. 400s through a sophisticated bin map program. If the tape is not in the M.A.R.C., the system will alert the operator with a "no-tape" status on the Alamar screen. Once the tape is located and loaded into one of the five decks in the M.A.R.C. 400, it is cued to the correct time-code start-of-message noted in the playlist. The M.A.R.C. then waits for the automated command to roll and switch at the time specified in the playlist.

Using automation in live events

Commercial breaks in live events such as news and sports are treated somewhat differently within the playlist. During the live program, breaks are loaded as manual or *triggered* events. Each triggered event has a time attached to it for chronological placement in the playlist, but the event will not start until the operator hits the take button.

Once the take is engaged, several things happen at once. The first event in the sequence or break is rolled and switched to air. The automation then continues to activate each subsequent event based on the duration of the current on-air event. This process continues until the next triggered event comes up in preset. While this is happening, the system updates itself and ripples through the list updating the times attached to all triggered events until it comes to the next real-time event. This function keeps the triggered breaks in their correct order within the list. The process is repeated as each triggered event happens.

Thread-up window

The automation system has been programmed with a 5-minute thread-up window for the loading of commercial islands in the M.A.R.C. machines. This window period is adjustable. We chose five minutes because we didn't want tapes loaded in the decks with the heads wearing on the tapes for long periods of time. Five minutes before the break is to air, the system commands the M.A.R.C. to load and cue the elements within that break. This works well for breaks that have real scheduled times attached to them in the playlist.

Triggered breaks are loaded off the duration of the previous event in the list. For example, during a live news program, each studio load in the playlist is given a 2-minute duration. This keeps each subsequent break within the 5-minute thread-up window so that the next commercial island is automatically loaded as the previous one is completed. In this way, we exercise the necessary control over the timing of breaks, while the automation system does the mundane work of cuing, rolling and stopping the tape machines.

With live sports, however, the next local break may not come for

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The QTR-600 beltpack remotes are extremely easy to use and provide operation similar to that of hard-wired intercom beltpacks. They are compatible with popular dynamic or electret headsets, such as Beyer, Clear-Com, and Telex. The cases are welded aircraft aluminum alloy with a high-impact, molded Cycloc (ABS) control panel that will withstand the roughest use.

One QX-600 master station supports up to six QTR-600 remotes with "hands-free" two-way communications, and an unlimited number of PL-2 receivers for listen-only users. Circuitry is provided to interface external line audio with the system or to link two QX-600s into a 12-user system. The master station is directly compatible with all standard wired intercom systems such as Clear-Com, RTS, ROH, Telex, and many others via internal programming switches. A local headset position and extensive

control, adjustment, and monitoring provisions are also included.

The PL-2 VHF mini-receiver provides a high-performance, low-cost solution to providing one-way "listen-only" communications. Very often, individuals need to receive instructions but are not required to speak. Using PL-2 receivers for this application avoids the expense of additional full two-way remotes and can significantly lower the cost of a typical system. The PL-2 is fully compatible with the Q600 system and is designed to provide reliable communications in the most demanding RF environments.

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Some people in this particular line of work tend to live in a world of their own.



a half hour or more, so the operator observes the program and the network breaks, and manually command cues the machines when the local break is only a few minutes away. Again, this saves tape and head wear. Other stations might do it a bit differently, but this procedure works well for us.

Automating routine chores

Our remote machines often do double duty, recording and playing back programs. For example, we air *Extra*, a new Warner Brothers entertainment magazine, at 7:00 p.m. each weekday evening. The satellite feed comes in at 1:00 p.m. The automation system puts a machine into record mode, switches the router so that the input into that machine is the correct feed, and records the show. At the end of the recording, it rewinds the tape and marks it. Then, at 7:00 p.m., the automation system sends a playback command to the machine. We do the same thing with *The Sally Jessy Raphael Show*, which records at 4:00 a.m. and airs at 3:00 p.m. Repetitious events like this are a natural for an automation system, because it never forgets to turn on the tape machines and its timing is always precise. The only human involvement necessary is to occasionally reload the machines with new tape.

At KNBC-TV the automation system is set up to communicate with the still-store system. We recently bought a new Quantel Picture Box and Alamar is developing the protocol so we can talk to that system. It's a central library system, so graphics will create the stills and feed them into the system with a material ID and a home storage number, which is basically a reel number for purposes of automation nomenclature. The system will then call up the still automatically and put it on the air when needed, without any human intervention.

Expandability is important

Our on-air routines are constantly evolving as we find new ways to do things, and more ways for automation to take over some of the manual chores. A recent example is an electronic reconciliation feature that we installed a few months ago. The automation system now sends back information to the traffic system about all the spots that have aired. This allows the station to generate its billing electronically, avoiding a great deal of paperwork.

As opportunities like this arise, it's important to have a flexible and expandable automation system. For example, our database is growing so fast that we soon plan to install a new hardware platform based on a Hewlett-Packard RISC system that will provide faster response and more

data storage.

Other areas under consideration involve the new disk-based systems and video servers. Eventually, when non-tape operations become a reality, we will want our automation system to help us make that transition as easily as possible, while continuing to remain flexible. ■

Editor's note: Field Reports are an exclusive *Broadcast Engineering* feature for *BE* readers. Each report is prepared by well-qualified staff at a TV station, post-production facility or consulting company. These reports are performed by the industry for the industry. Manufacturer's support is limited to providing loan equipment and to aiding the author if requested. It is the responsibility of *Broadcast Engineering* to publish the results of any device tested, positive or negative. No report should be considered an endorsement or disapproval by *Broadcast Engineering* magazine.

Brett Crutcher is manager, on-air operations at KNBC-TV, Los Angeles. Respond via the *BE* FAXback line at 913-967-1905 or via e-mail to be@intertec.com.

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detail and sharpness.

A natural advantage of using frequency domain compression is that television is a band-limited medium. Therefore, it is not necessary to transmit as many high-frequency components to reconstruct a video signal faithfully.

This does not apply to computer playback because computers are able to display images well in excess of video bandwidth. It could be concluded from this that, just as in video, the bandwidth of the media is an important consideration, as it is in compression and computer digital video. Ignoring this fact could result in an

MPEG stream that would look fine on a video display, but look soft on a computer screen. It is interesting to note that despite the wide bandwidth of computer displays, overall computer bandwidth is much lower. Computer screen images are somewhat static. As the images become increasingly dynamic, bottlenecks through the computer system reduce the overall throughput.

In a band-limited channel, it's possible that only the low-frequency coefficients could be sent, and there would be significant artifacts. As the bandwidth is increased, more coefficients

can be transmitted, the original signal can be better approximated and there are fewer differences from the original.

As we get into the higher-frequency components, noise becomes an increasing factor in the process of deriving coefficients. The result? As the compression scheme tries to generate more high-frequency coefficients that represent less signal, more bandwidth is required for transmission until there is as much noise as signal content.

Is all noise bad?

But is all noise bad? Not at all. Some noise is considered useful to help mask the artifacts of compression, but this type of noise is added at the decoding portion of the process. If we added it at the encoding side, we would be adding to the amount of data that has to be compressed.

Noise added in the decoding process is called *dithering*. It helps mask the artifacts created by the loss of high-frequency components due to bandwidth limitations.

To minimize the amount of artifacts introduced in the compression process it is important to minimize the amount of noise contained in the original signal. This is done by starting with the cleanest, highest quality, noise-free signal possible. The best available video signals with the highest signal-to-noise ratios are direct from cameras or component digital recordings.

By having a cleaner source to begin with, the resulting compression will have better quality and higher compression ratios. Composite signals, even composite digital signals, are considered poor choices to compress because of their own artifacts and bandwidth limitations.

Conclusion

I have tried to clarify the meaning of "digital video" as it relates to the merging worlds of broadcast and computer technology and how compression plays a part. Compression is a major factor of digital video. It is an enabling technology that reduces bandwidth requirements. At the same time, however, it can be a source of artifacts that affect color resolution, purity and fidelity, thereby causing problems with hue shifts, saturation and color degradation.

Digital compression, much like analog composite video, must be understood from origination to destination to avoid artifacts. Close attention to the full end-to-end architecture will be the ultimate factor that affects the quality of delivered digital video in systems yet to come.

References

1. C-Cube: "MPEG Overview," Product Catalog.
2. SMPTE: "Annotated Glossary of Essential Terms for Electronic Production."
3. Tektronix: "A Guide to Digital Television Systems and Measurements."
4. Quantel: "The Digital Fact Book," Edition 7.
5. SMPTE Journal (December 1994): "Performance Evaluation: From NTSC to Digitally Compressed Video"

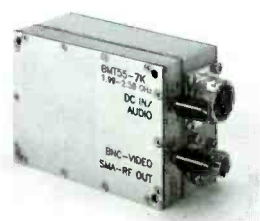
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David Carroll Electronics Inc. has been appointed manufacture's representative for Tektronix, Beaverton, OR, serving northern California and northern Nevada.

Sony, New York, plans to unveil a digital end-to-end television system architecture at the NAB convention in April. Designed to integrate total digital network and production facilities, the system incorporates digital field acquisition, rapid data transfer into a plant's disk-based input server and shared access to audio/video files.

Itelco, Orvieto, Italy, has sold two additional 40 kW IOT transmitter systems to Finnish Broadcasting Corporation

Abekas Video Systems, Redwood City, CA, has delivered its Diskus digital disk recorder to Microsoft, Serious Robots, Videomsmith and Film & Tapeworks.

Hitachi Denshi America, Ltd., Woodbury, NY, has announced the selection of its SK-2600 and SK-2600P cameras for filming CBS' soap opera *The Bold and the Beautiful*.

KNK Seminars, La Jolla, CA, is offering three-day technical seminars in May and August 1995. Participants will receive comprehensive analysis and design information on the MPEG-1 and MPEG-2 standards. For more information, call 619-459-8058.

Cyphertech Systems, Century City, CA, and Toronto, Canada, has announced a joint merger with Effective Engineering, Burbank, CA. Effective Engineering will be responsible for the installation of the Cyphertech decoder stations internationally and the maintenance of all Cyphertech Systems equipment.

Videssence has appointed Professional Productions & Promotions as its sales representative in Hawaii.

PEOPLE

John Palmer has been named chief engineer at Satellite Network Systems, St. Paul, MN.

Mary Pat Ingwell has been appointed as a network coordinator at Satellite Network Systems, St. Paul, MN.

Ronald W. Starcher has been named manager of conversion tube manufacturing at Burle Tube Products Division, Lancaster, PA.

William M. Seiderman has been appointed technical marketing representative at Burle Tube Products Division, Lancaster, PA.

Dean Slagle has been promoted to senior vice president, operations and human resources, at Audio-Technica, Stow, OH.

David Webb has been named chief engineer at Varitel Video, Los Angeles.

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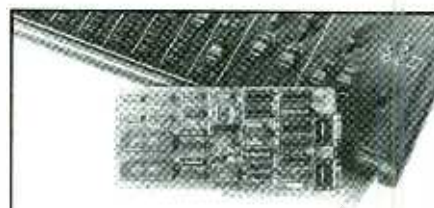
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Circle (356) on Reply Card

Lightweight lens Angenieux

► 15x8.3 AIF $\frac{2}{3}$ -inch lightweight/ENG lens: offers assisted internal focus (AIF) allowing operator to zoom in for focusing with the flip of a switch without having to frame the shot again; offers a focal length of 8.3-250mm, MOD of 0.8m, and 16:9 compatibility; also features zoom speed control, built-in 2x extender and a standard UV filter.

Circle (357) on Reply Card

Video Marker Boeckeler Instruments

► Pointmaker PVI-70 multiple-sync video marker & PVI-40 video marker: markers allow user to draw and direct arrows and other pointers over video images; the marker is connected between the graphics station and the video display (or patch panel); the marker generates the pointers and drawn lines on top of the video image and becomes part of the video signal; lines and pointers may be recorded with the video image for later playback or markers can draw over the image during a live broadcast.

Circle (358) on Reply Card



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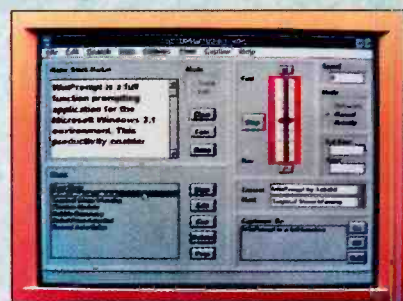
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1711 Dell Avenue
Campbell, Calif. 95008
408 866/9373 Fax 408 370-4861



Circle (50) on Reply Card

Windows-based prompting system Tekstil Industries



► **WinPrompt:** Windows application offers wide variety of fonts and sizing and spacing capabilities; features a built-in closed-captioning output; allows user to easily import text from other word processors; user can also rearrange order of stories or items and estimate reading time for scripts; WinPrompt can be controlled by a mouse or a small handheld thumbwheel-activated remote control to advance/re-tard script roll-by.

Circle (359) on Reply Card

GPIB-to-APIB command translator Audio Precision



► **GAT-1 GPIB-to-APIB command translator:** allows test equipment using the proprietary Audio Precision interface bus (APIB) to operate in response to commands from IEEE-488 general-purpose interface bus (GPIB) controllers; GAT-1 allows owners of existing APIB-based System One units to operate all test and measurement functions using either the existing APIB interface or a GPIB controller; GAT-1 also allows APIB-based Audio Precision modules to be combined with GPIB devices in new configuration for production test systems.

Circle (360) on Reply Card

Cable/transmission auto measure set Magni Systems

► **Measurement set for cable/transmission testing:** measurement set addresses distortions common to modulators, transmitters, and other RF distribution systems; such distortions include differential gain and phase distortions, signal-to-noise ratio, chrominance-to-luminance delay errors, and pulse-to-bar ratio; user can select which measurement set is active through the configuration of menus of the WVM-710 automated video signal monitor.

Circle (361) on Reply Card

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NEW PRODUCTS

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By Multidyne

► VPDA-100 video, pulse, subcarrier distribution amplifier and clamper: includes three on-board equalizers for three cable types; unit equalizes 0-1,500 feet of 8281, RG-59U and another cable of choice; features 20MHz bandwidth and a fast AC/DC feedback clamping circuit that samples error voltage on the video backporch; clamping circuit will extract any hum present in the video picture on a line-by-line basis; additional features include a loopthrough input, six outputs, cancellation and extraction of up to 40V of hum; AC powered with built-in line cord and less than 0.05% differential gain and 0.05° differential phase.

Circle (362) on Reply Card



Isolation rooms

WhisperRoom

► Expandable line of portable sound isolation rooms: available in numerous standard sizes; can be expanded in 2-foot or 4-foot increments by purchasing expansion packages; the Professional series include ventilation systems, electrical service, and adjustable/locking casters (options include door window, wall window, and cable passage); the Residential series offers similar features in a more economical package.

Circle (363) on Reply Card



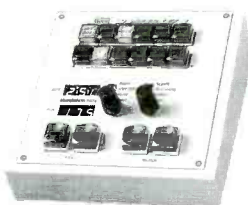
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Circle (45) on Reply Card

Synthesized voice audio signal source

Bicom

► CT-1 Cabletalker: model provides synthesized voice audio signal source for use in testing equipment and for channel, wire pair, or cable identification; each Cabletalker identifies itself with a user-selected, single-digit voice number (up to "nine"); multiple cables or wire pairs can be distinguished by using several CT-1s and identified with a listening device like an audio signal tracer or a high impedance earphone attached to the wire; an internally selected option provides a small bias current that allows the use of telephones or Lineman's Test Sets as receivers.

Circle (364) on Reply Card

A/B roll software

TAO Media Systems

► Editizer 3.0: editing control interface for Videonics MX-1 A/V mixer: a single mouse click allows users to store MX-1 settings through TAO' editing software; different settings are stored in the edit decision list for every event; the software allows storage, automatic recall, and performance of up to 16,000 events; the Editizer controls most VCRs and editing peripherals mixed together within the same system.

Circle (365) on Reply Card

Enhanced software

SoftWright LLC

► Terrain Analysis Package (TAP) 3.0: new version allows the user to check STL or other microwave paths for clearance from terrain and man-made obstructions on a personal computer; displays knife-edge diffraction losses and geographic coordinates at all points down the path; can also determine if proposed antenna heights at both ends of the path are suitable.

Circle (366) on Reply Card



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Circle (20) on Reply Card

EBS equipment modification service By AddieTech

► **Short-Tone Package:** a low-cost EBS equipment modification service available to broadcast stations; service includes tone generator modifications and free return shipping for all brands and models of equipment; Short-Tone package includes modifications to decoder and generator for proper 8-second operation, a generator tone duration switch so stations may operate with the current long tone until July 1, then switch to the short tone and reserve the long tone for actual emergency attention signaling; package also includes a power supply check, unit performance check, documentation, and a 90-day guarantee.

Circle (367) on Reply Card

Digital desks By The Winsted Corporation



► **Digital desk units:** line of five digital desks for multimedia editing and production; designed for linear and non-linear systems; ergonomic design curves around the user and units integrate easily with all multimedia systems; models range from a 48-inch wide workstation to a 94-inch workbench; all models feature black granite laminate work surfaces and riser shelves, wire management system, and optional decorative trim accent inserts.

Circle (368) on Reply Card

Digital imaging system By Viewgraphics

► **Viewstore 6000:** a resolution independent digital imaging system provides computer workstations with access to real time, full motion, super high resolution digital imagery; features superior display quality, image format flexibility, re-time full motion playback, detailed image analysis, and broad array of interface options; video output is programmable to any resolution up to a 360MHz pixel rate including super high resolution 2Kx2K; system can store any resolution RGB or 4:2:2 format digital imagery with support for both eight and 10 bits.

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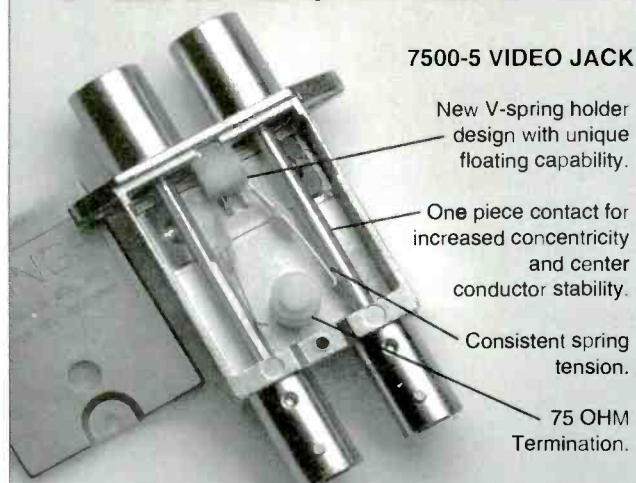
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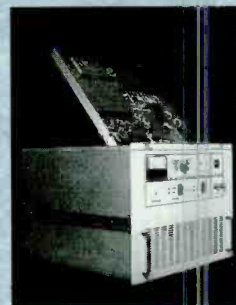
NEW PRODUCTS

UHF TV transmitter

ITS

► ITS-820: a 100W UHF TV transmitter offers high performance in a compact unit; housed in a 14-inch high rack-mount tray assembly with modulator; four transmitters fit in one standard rack for multichannel UHF systems; unit is compatible with most scrambling systems; available in a 100W translator version (ITS-822).

Circle (370) on Reply Card



Batteries

Plainview Batteries

► Expanded line of Hydricell batteries: cylindrical and prismatic nickel-metal-hydrate cells; cylindrical additions include four sizes: AA, 4/5-A and 4/3A; seven prismatic models are 300 to 3,000 mAh capacity.

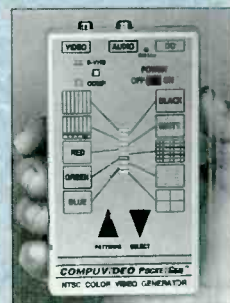
Circle (371) on Reply Card

Video/audio generator

Compuvideo

► PocketGen: a hand-held, battery-operated video/audio generator offered in NTSC or PAL models; operates for more than 40 hours on four "AA" batteries or can be used with AC adapter (included); unit provides 10 patterns including full field bars, SMPTE bars, rasters, red, green, blue, white and black, crosshatch, dots and center cross.

Circle (372) on Reply Card



Lens adapter

Wexler Video Inc.

► Lens adapter: enables user to mount B3 2/3-inch (Ikegami) type lens to a B4 2/3-inch (Sony) type camera; works on all ENG, EFP and studio cameras; proprietary microcircuitry compensates for iris and VTR trigger voltages; proprietary lens compensates for back focus and chromatic distortion.

Circle (373) on Reply Card

Audio and video matrix routing switchers

Nova Systems

► NovaRouter: series is available in 8x8, 16x16, and 32x32 matrices; routers are capable of up to five switching levels to support unlimited combinations of stereo audio, composite video, component video, RGB/S and VGA graphics.

Circle (374) on Reply Card

Continued on page 80

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



EVW-300 with Canon 13:1 Servo Zoom Lens, VCT-12 Tripod Mounting Plate and Thermodyne LC-422TH Shipping/Carrying Case\$5495⁰⁰

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Quick-Draw Professional FOR CAMCORDERS OR STAND ALONE CAMERAS



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

FEATURES:

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

antonbauer

Logic Series DIGITAL Gold Mount Batteries

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



DIGITAL PRO PACS

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

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

DIGITAL COMPAC MAGNUM

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

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

GOLD MOUNT BATTERIES

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

- **PRO PAC 14 NICAD BATTERY** (14.4v 60 Watt -4ours)
- **PRO PAC 13 NICAD BATTERY** (13.2 v 55 Watt -4ours)
- **MAGNUM 14 NICAD BATTERY** (14.4v 72 Watt -4ours)
- **MAGNUM 13 NICAD BATTERY** (13.2 v 66 Watt -4ours)
- **COMPAC MAGNUM 14 NICAD BATTERY** (14.4 43 WH)
- **COMPAC MAGNUM 13 NICAD BATTERY** (13.2v 40 WH)

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

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VIDEO 14/100 FLUID HEAD

- Sachtler Touch and Go System
- Integrated sliding battery plate
- Strengthened dynamic counterbalance in 2 steps
- Frictionless leak proof fluid damping with three levels of drag
- Vibraticless vertical and horizontal brakes
- Built in bubble for horizontal leveling
- Compatible with wide range of tripods series 100

HOT POD TRIPOD SERIES

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



ENG TWO-STAGE TRIPOD SERIES

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

SACHTLER SYSTEM 14 PACKAGES

SYSTEM 14 PRO I - Economic standard with two-stage aluminum tripod video, includes: 14/100 Fluid Head + ENG 2D 2 CF Two-Stage Carbon Fiber Tripod + SP100 spreader + ENG 2 Padded Bag

SYSTEM 14 PRO II - Light standard system with two-stage carbon fiber tripod video, includes: 14/100 Fluid Head + ENG 2 CF Two-Stage Carbon Fiber Tripod + SP100 spreader + ENG 2 padded bag

SYSTEM 14 PRO III - Quickest tripod system, extremely high extension possible by the pneumatic center column, includes: 14/100 Fluid Head + Hot Pod Tripod + Padded Bag 100 II

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Vision SD 12 and SD 22

Pan and Tilt Heads with Serial Drag

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

Features:

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

Vision Two Stage ENG and LT Carbon Fibre ENG Tripods

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

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

Vision 12 Systems

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

SD-12A System

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

SD-12D System

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

SD-12LT System

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

Vision 22 Systems

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

SD-22E System

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

SD-22 LT System

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

SD-22 ELT System

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

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DA-88 Multi-Track Recorder



The first thing you notice about the eight channel DA-88 is the size of the cassette - it's a small 1/8-inch video cassette. You'll also notice the recording time - up to 120 minutes. These are just two of the advantages of the DA-88's innovative use of 8mm technology.

- Intrinsic to the 8mm video format is the Automatic Track Finding (ATF) control system. This approach records the tracking control information, along with the program material, using the helical scan (video) head. Competing S-VHS based system record the tracking data with a linear recording head, independent of the program data. The S-VHS tape must be run at a higher speed (thereby delivering shorter recording time) to deliver control track reliability, and requires some form of automatic or manual tracking adjustment. Synchronization and tracking must be adjusted, either automatically or manually (just like on your home VCR) as the machine ages, or if the tape is played back on another machine.
- On the other hand, the ATF system ensures that there will be no tracking errors or loss of synchronization. The DA-88 doesn't even have (or need) a tracking adjustment. All eight tracks of audio are perfectly synchronized. What's more, this system guarantees perfect tracking and synchronization between all audio tracks on all cascaded decks - whether you have one deck or sixteen (up to 128 tracks!).
- Incoming audio is digitized by the on-board 16-bit D/A at either 44.1 or 48KHz (user selectable). The frequency response is flat from 20Hz to 20KHz while the dynamic range exceeds 92dB. As you would expect from a CD-quality recorder, the wow and flutter is unmeasurable.
- One of the best features of the DA-88 is the ability to execute seamless Punch-ins and Punch-outs. This feature offers programmable digital crossfades, as well as the ability to insert new material accurately into tight spots. You can even delete individual tracks, whether you want to generate special effects or compensate for poor timing. All of this can be performed easily on a deck that is so simple and intuitive to use.

OPTIONS

- **RC-808** - Single Unit Remote Control
- **RC-809** - System Remote Control
- **MU-8824** - 24-Channel Meter 16-bit D/A at either 44.1 or 48KHz (user selectable).
- **SY-88** - Complete SMPTE/EBU Chase Synchronizing and MIDI Machine Control interface

Fostex

RD-8 Multi-Track Recorder



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

- Full transport control is available via the unit's industry-standard RS-422 port, providing full control right from your video bay. The RD-8 records at either 44.1 or 48KHz and will perform Pull-Up and Pull-Down functions for film/video transfers. The Track Slip feature helps maintain perfect sound-to-picture sync and the 8-Channel Optical Digital Interface keeps you in the digital domain.
- All of this contributes to the superb sound quality of the RD-8. The audio itself is processed by 16-bit digital-to-analog (D/A) converters at either 44.1 or 48KHz (user selectable) sampling rates, with 64KHz oversampling. Playback is accomplished with 18-bit analog-to-digital (A/D) and 64KHz oversampling, thus delivering CD-quality audio.
- The S-VHS transport in the RD-8 was selected because of its proven reliability, rugged construction and superb tape handling capabilities. Eight tracks on S-VHS tape allow much wider track widths than is possible on other digital tape recording formats.
- With its LCD and 10-digit display panel, the RD-8 is remarkably easy to control. You can readily access 100 locate points, and cross-fade time is fully controllable in machine to machine editing. Table of Contents data can be recorded on tape. When the next session begins, whether on your RD-8 or another, you just load the set up information from your tape and begin working. Since the RD-8 is fully ADAT compliant, your machine can play tapes made on other compatible machines, and can be controlled by other manufacturers ADAT controllers. Your tapes will also be playable on any other ADAT deck.
- In addition to familiar transport controls, there are a number of logical, user friendly features. The only unit in its class with an on-board, back-light variable contrast LCD display. It provides all of the information you'll need to keep track of offsets, punch points, generator functions and other pertinent data. Three function keys, combined with HOME, NEXT and UP/DOWN buttons, enable you to navigate the edit menu effortlessly. If you need to have access to the front panel controls, the optional model 8312 remote control gives you remote command of the most common functions.

SENNHEISER

RF SERIES CONDENSER MICROPHONES

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

MKH 20 P48U3 Omnidirectional

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

MKH 40 P48U3 Cardioid

Highly versatile, low distortion push-pull element, transformerless RF condenser, high output level, transparent response, switchable proximity effect (4 dB at 50 Hz) and pre-attenuation of 10 dB to prevent overmodulation. In vocal applications excellent results have been achieved with the use of a pop screen. Recommended for most situations, including digital recording, overdubbing vocals, percussive sound, acoustic guitars, piano, brass and string instruments, Mid-Side (M-S) stereo, and conventional X-Y stereo.

MKH 60 P48U3 (Short Shotgun)

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



MKH 70 P48U3 (Shotgun)

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

MKH 416 P48U3 Supercardioid/Lobe (Shotgun)

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

MKH 816 P48U3

Ultra-directional Lobe (Shotgun)

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

CHYRON Graphics

PC-CODI TEXT AND GRAPHICS GENERATOR

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

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

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

SONY COLOR MONITORS

PVM-1350

13" Presentation Monitor

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

There is also a manual degauss switch to demagnetize the screen. Sub control mode allows fine adjustments to be made on the knob control for contrast, brightness, chroma and phase. The desired level can be set to the click position at the center allowing for mut-

PVM-1351Q

13" Production Monitor

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

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

All the features of the PVM-1351Q PLUS

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

SHURE



FP32A PORTABLE STEREO MIXER

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

- High quality-low noise electronics, perfect for digital recording and transmission
- Three balanced inputs, two balanced outputs plus tape out and monitor
- Supports all types of condenser mics with internal phantom supply
- Inputs can be switched between mic and line level
- Each channel has own pan pot
- Each channel has illuminated meter and peak indicator
- Two units can be cascaded to provide six input channels
- Internal 1KHz oscillator for record and send level calibration
- Internal (2x9V alkaline batteries) or external power
- Switchable low cut filters

MACKIE



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

Usually the performance and durability of smaller mixers drops in direct proportion to their price, making lower cost models unacceptable for serious recording and sound reinforcement. Fortunately, Mackie's fanatical approach to pro sound engineering has resulted in the Micro Series 1202, an affordable small mixer with studio specifications and rugged construction. The Micro Series 1202 is a no-compromise, professional quality ultra-compact mixer designed for non-stop 24-hour-a-day professional duty in broadcast studios, permanent PA applications and editing suites where nothing must ever go wrong. So no matter what your application, the Micro Series 1202 is ideal. If price is the prime consideration or you simply want the best possible mixer in the least amount of space, there is only one choice.

CR-1604

16-Channel Audio Mixer

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

TASCAM



688 Midistudio

The 688 MIDISTUDIO is a compact, 20 input audio mixer combined with an 8 track cassette recorder system. Designed for the MIDI-based studio, this unit will work well for both the production facility and the individual artist. In the MIDI environment, sources can be selected, destinations assigned and routing designated, all from the remote MIDI controller. With its wide input range and ability to be remotely synchronized, the 688 can be the heart of a high tech, compact 8 track studio.

- Full featured 20 input mixer (10 balanced XLR inputs)
- 8 x 2 cue monitor mixer
- Built-in dtx noise reduction system (defeatable)
- Unique "Scene Display" system to monitor MIDI-controlled setups
- Gapless auto punch in/out and rehearsal modes
- Serial interface for external synchronization

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HORITA

WG-50 Window Dub Insertor

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

\$269

TG-50 Generator / Insertor

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

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

\$349

BSG-50

Blackburst/Sync/Tone Generator

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

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

\$269



CSG-50

Color Bar/Sync/Tone Generator

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

\$349

TSG-50

NTSC Test Signal Generator

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

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

\$439

WE STOCK THE FULL LINE OF HORITA PRODUCTS INCLUDING:

- WG-50—Window Dub Insertor
- TG-50—Generator/Insertor
- TRO-50—Generator/Insertor/Search Speed Reader
- TRO-50PC—Has all of the above plus RS-232 control
- VG-50—VITC Generator, LTC-VITC Translator
- VLT-50—VITC-to-LTC Translator
- VLTR-50PC—VITC-to-LTC Translator/RS-232 Control
- RLT-50—Hi8 (EVO-9800/9850) TC to LTC translator
- TSO-50—NTSC Test Signal Generator
- SCT-50—Serial Control Title "Industrial" CG, Time-Data Stamp, Time Code Captioning
- SAO-50—Sine Area, Commercials Pattern and Oscilloscope Line Trigger and Generator

SONY

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

SVP-5600 and SVO-5800 features:

- By combining the high resolution (400 horizontal lines) of S-VHS with high quality signal processing techniques like DNR, Digital Field DGC and Chroma Process Improvement, they deliver the consistent picture quality so essential to editing. They also incorporate a wide video head

- gap and track width (58mm) for stable and faithful picture reproduction.

- Each has a built-in TBC plus an advanced Digital Noise Reducer (DNR) for both the chrominance and luminance signals to eliminate noise during playback. At the same time, a field memory incorporated in the noise reducer removes jitter to provide sharp, stable pictures. The field memory also includes a Digital Field DGC (Dropout Compensator), which replaces signal dropout with information from the previous field.
- They also incorporate Chroma Process Improvement circuitry for excellent color picture quality in the playback mode. This advanced circuitry greatly improves the chroma bandwidth, thus enabling sharper and clearer color picture reproduction.

ADVANCED EDITING FUNCTIONS

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

FOUR CHANNEL AUDIO SYSTEM

- They each incorporate four-channels of high quality video. There are two channels with Hi-Fi (AFM) tracks and two with longitudinal (normal) tracks. The Hi-Fi tracks provide a wide frequency response from 20Hz to 20kHz and a superb dynamic range of 90dB. The normal tracks

- incorporate Dolby B noise reduction for high quality sound reproduction. XLR connectors are used for the inputs and outputs for all four channels.

MULTIPLE INPUTS AND OUTPUTS

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

USER FRIENDLY OPERATION

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



REBATES: Buy an SVP-5600 or SVO-5800 Professional S-VHS VCR or UVR-1600, UVR-1800, Betacam SP VCR with:

- Sony PVE-500 A/B Roll Edit Controller and receive \$500 instant rebate!
- Sony FXE-100 A/B Roll Edit Controller/SEG and receive \$1000 instant rebate!

FXE-100 ALL-IN-ONE VIDEO EDITING SYSTEM

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

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

SWITCHER AND SPECIAL EFFECTS GENERATOR

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



ADJUSTABLE TRANSITIONS

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

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

WIPE CONTROL

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

AUDIO MIXING

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

USER FRIENDLY OPERATION

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

VERSATILE SYSTEM INTEGRATION

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

MAGNI



MM-400

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

FEATURES:

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

WVM-710

Automated Video Signal Monitor

The WVM-710 is the first high performance, high resolution waveform monitor/vectorscope with real-time auto-measure capability. Designed for broadcast and cable stations, production and post-production facilities, the WVM-710 allows the engineers to easily set signal measurement limits, while letting suite users monitor signal quality against the pre-set limits. With its auto-measure capability, the WVM-710 provides immediate and visible warnings whenever an out-of-limit condition is detected. This frees producers and editors from interpreting waveforms of graphs and to focus solely on creative content - with the confidence that any signal problem will be flagged immediately.

APPLICATIONS INCLUDE:

- Checking cameras and lighting in video production
- Ensuring multiple-source video signal integrity through routing switches
- Checking FEC compliance in transmission
- Assessing level and color validity in graphics generation

FEATURES:

- Simplifies signal measurement by allowing limit ranges to be set for each parameter. Measurement limits can be set numerically (through menus) for peak video, sync level, H-ret timing, SC/H phase, color frame, etc.
- Once limits are set, you view continuous signal status reports via on-screen prompts.
- Full-function, highly accurate waveform/monitor vectorscope. Provides separate waveform and vector displays, combines displays, separate video, auto-measure displays, and more.
- Unique "venetian blind" picture display which alternates between video and reference every 32 lines. This allows quick setting of timing, luminance, chrominance and color hue. For example, if the video signal timing does not match the reference signal, segments of the display will offset from each other and change color. This error can be easily corrected without consulting a waveform or vector display.
- Like the MM-400, the WVM-710 does not include a CRT, but rather, provides waveform/vector and measurement displays on standard video monitors. In fact, its 10-bit internal resolution produces displays that are sharper than other rasterizing monitors and are as clear and accurate as conventional CRT's.
- Offers supreme flexibility with multi-standard capability (composite, component, S-Video).
- The WVM-710 is also equipped with electronic gauges: an engineer can switch between waveform and vector displays, and the gauges will change accordingly. There are no CRT linearity problems and no etched lines to deal with.
- The WVM-710 can be controlled serially from a PC or modem, with transfer of waveforms or measurements back to the computer. A printer can also be connected to obtain a hard copy of either a questionable signal parameter, or the complete signal waveform for off-line analysis and troubleshooting.
- Its small size and operating characteristics make it ideal for

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PARTS!!! We currently have parts available for
GVG 300, Utah AVS-1B, & BTS TVS/TAS 2000

MICOR VIDEO EQUIPMENT
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New Products continued from page 76

Multichannel audio processor

Panasonic

► MAP: multichannel audio processor multiplies digital audio channels in D-3, D-5 VTRs; MAP is a stand-alone A/D and D/A converter as well as a 4:1 bit rate reduction device for audio applications; acts as a processor between studio audio components and a digital audio/video recorder; the compression scheme has a delay of 4ms maintaining audio/video synchronization.

Circle (375) on Reply Card

Stereo audio switcher

Target Technology Inc.

► AMS-126: 12x1 stereo or dual audio switcher fully self-contained in a 1-rack unit (1.75") frame including control panel; standard features include separate mono-sum output with adjustable mix level controls and unbalanced X-Y outputs on BNC connectors to monitor stereo phase coherency on an X-Y displays.

Circle (376) on Reply Card

Software

Avid Technology

► Media Composer and Film Composer version 5.2: new versions of digital non-linear video and film editing systems; new features, which vary by model, include Avid's Video Resolution (AVR) 27, enhanced real-time 2-D digital video effects, real-time chroma and luma keys, software-based multicamera editing, support for third-party Photoshop-compatible plug-ins, support for Avid's Media Reader option and more.

Circle (377) on Reply Card

Transient/surge protection for tower beacon lighting

MCG

► TLP series: compact 8"x8"x4" weather-resistant protector; designed for shunt installation at the supply service panel or directly at the beacon junction box on the tower; unit features all mode protection (line-neutral, line-ground, neutral-ground) in field replaceable protection modules; protects two single phase 120VAC or one 120VAC or one 120/240VAC split-phase lines; a 3-wire monitoring cable can be connected to alarm relay terminals located within the enclosure for remote status indication; two local green LEDs indicate protection is present.

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BY SEALED BID, 3-complete Harris TC-85 Studio Camera Chains, (less pedestals and heads). Call CE at (314) 882-8888 for more information.

FOR SALE: G.E. Industrial Voltage Regulator. Model GEK-26035. In excellent condition. Recently overhauled by G.E. \$3,500.00 plus shipping. Call Vic (818) 440-1147. Fax (310) 676-1033.

VHF TRANSMITTERS FOR SALE. Two Harris BT18H high band VHF, 18 kW each. Currently on Ch 11. Includes two MCP-2V exciters in hot standby, Alford diplexer, combiner cabinet for parallel 36 kW operation, patch panel, line, test and reject loads, equipment racks, control console, and TFT remote control system. Available late spring '95. \$36,000 FOB Chicago. Contact Jerry Hanna, WTTW-TV, (312) 509-5459.

1" VTR, APMPEX VPR-80, Hitachi Waveform Monitor and Vectorscope V-079 and V-069. Excellent condition. \$18,000 or take over lease. (713) 432-0435, Houston, Tx.

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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.

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HELP WANTED

DISTRICT SALES MANAGER

Continental Electronics Corporation, Dallas, Texas, a leading manufacturer of broadcast and communications equipment, is currently seeking an individual with thorough knowledge of equipment needs of radio stations, to sell in the North East USA. Territory includes the following nine states: NY, NJ, PA, CT, RI, MA, VT, NH and ME.

The successful applicant will be involved with assisting customers in planning new projects, upgrading, compiling equipment lists, closing orders, and attending trade shows and other meetings to present and explain products.

Typically requires a BS degree in engineering or equivalent plus four years of related experience or BS in business administration or equivalent plus six years of technical sales experience. Background as radio station engineer a plus.

CONTINENTAL PROMOTES PROFESSIONAL SATISFACTION THROUGH CHALLENGING WORK, COMPETITIVE SALARIES, AND A COMPREHENSIVE EMPLOYEE BENEFITS PACKAGE.

To apply, send resume with salary history to: **PROFESSIONAL RECRUITER-NDS002, CONTINENTAL ELECTRONICS CORPORATION, P.O. BOX 270879, DALLAS, TEXAS 75227. PRINCIPALS ONLY PLEASE. AN AFFIRMATIVE ACTION EMPLOYER BY CHOICE.**

CHIEF ENGINEER/MAINTENANCE ENGINEER combination for full broadcast station. UHF experience a must. KNAT-TV 23, 1510 Coors Rd NW, Albuquerque, NM 87121. EOE.

ENG ENGINEER, SNG ENGINEER, AND ENGINEERING TECHNICIAN. Experience required. Send application and resume to KSTW-TV, PO Box 11411, Tacoma, WA 98411. Telephone number 206-572-5789 EOE

MAINTENANCE ENGINEER POST PRODUCTION Henninger Video, a full service Post Production facility operating 3D Graphics, Audio, Telecine, and Editing in all formats, has an immediate opening for an individual with 3 to 5 years experience in system and component level maintenance of digital and analog video systems and VTR's. We are a growing facility, looking for an individual with good interpersonal skills who really likes fixing things. Strong VTR knowledge is required. Please send resumes to: Director of Media Services 2601-A Wilson Blvd. Arlington, Va 22201 FAX: 703-243-4023 (No phone calls please)

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Continental Electronics Corporation has established itself as world leader in the design, development and production of high power radio frequency transmitters for communications, radio broadcast, radar and scientific research applications.

Continental is looking for MSEE(s) or equivalent with at least five years experience in designing solid state RF amplifiers. Primary responsibilities will be design and development of high power solid state RF amplifiers (1000 watts and higher) for application in AM and FM radio transmitters capable of producing 50 kW of output power. Must be familiar with PSPICE transient analysis and TOUCHSTONE RF analysis software programs.

CONTINENTAL PROMOTES PROFESSIONAL SATISFACTION THROUGH CHALLENGING WORK, COMPETITIVE SALARIES, AND A COMPREHENSIVE EMPLOYEE BENEFITS PACKAGE.

TO APPLY, SEND RESUME WITH SALARY HISTORY TO: PROFESSIONAL RECRUITER-KSAM001, CONTINENTAL ELECTRONICS CORPORATION, P.O. BOX 270879, DALLAS, TEXAS 75227. PRINCIPALS ONLY PLEASE. WE ARE AN EQUAL OPPORTUNITY EMPLOYER.

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ITS CORPORATION

Visibly Better Technology

ITS Corporation is a leading manufacturer of television transmitter systems located in a suburb of Pittsburgh. Our total workforce has grown from 110 employees in 1992, to 167 employees in 1993 with 268 current employees. Staffing projections for 1995 indicate continued growth. We are seeking candidates for the following position:

FIELD SUPPORT ENGINEERS

- Requirements:
- 2 or 4 year electronics degree
 - CATV or RF experience
 - willingness to travel
 - good communication skills

Interested candidates should forward their resume with salary history to:

ITS CORPORATION
Human Resource Department
375 Valley Brook Road
McMurray, PA 15317-3345
FAX: (412) 941-4603

ITS is an equal opportunity employer and promotes a tobacco-free work environment.

MAINTENANCE ENGINEER Excellent opportunity at the corporate headquarters of a quality minded company, The NEW YORK TIMES Broadcast Group. Fully automated facility with the latest digital equipment. Knowledge of computer & digital electronics required. Must have formal electronics training, SBE certificate a plus. Career opportunity in a newly remodeled studio overlooking the Mississippi River. Females & minorities encouraged to apply. Send resume to James Anhalt WREG-TV 803 Channel 3 Drive, Memphis, TN 38103.

WTXL HAS AN OPENING for Chief or Asst. Chief Engineer - High level Maintenance & Repair Experience needed at the ABC Affiliate in Florida's Capitol City. Must know everything from News & Production, to the UHF transmitter. Please send resumes and salary requirements to: General Manager WTXL-TV Tallahassee News Channel 27 8927 Thomasville Road Tallahassee, Florida 32312

BROADCAST MAINTENANCE TECHNICIAN Regional news channel needs full time technician with five years experience in troubleshooting and repair of audio, video, RF systems and related equipment. Prefer computer literacy including various LANs, AutoCad, Database, MS-DOS, and computer station automation. ENG, master control and studio experience desirable. Must be able to work varying shifts in state of the art facility in suburban Chicago. Excellent benefits. Send resume with salary requirements to CLTV, 2000 York, Suite 114, Oakbrook, IL 60521 attn Human Resources.

MAINTENANCE ENGINEER Top Chicago post house is seeking a senior level maintenance engineer. You will handle maintenance and product support on a wide range of digital and analog equipment. Experience with D1, D2, 1", Betacam, GVG 200 and digital graphics equipment along with minimum 3 years experience preferred. Excellent benefits and a great working environment. Please fax or send resume (no phone calls please), with salary requirements to the attention of: Avenue Edit, Inc. Attn: Claude Ball 625 N. Michigan Ave. Chicago, IL 60611 Fax # 312.943.9760

VIDEO ENGINEER/LOCATION PRODUCTION We are looking for a person with a technical background who has experience in Single/Multiple video camera techniques. Eastern PA based company provides Betacam SP and Digital Betacam production both nationally and internationally. Send resume to Clark Production Associates, Inc. 296 Broadhead Rd. Bethlehem, PA 18017.

TELEVISION MAINTENANCE TECHNICIAN Applicant must have five years recent experience on all facets of broadcast television maintenance and troubleshooting down to component level. Should have FCC license; SBE certification a plus. Send resume to: Jerry Agresti, Director of Engineering, KCRA-TV, 3 Television Circle, Sacramento, CA 95814-0794. NOTE: Any offer of employment is contingent upon passing a medical test for drug and alcohol use. EOE M/F/ADA.



4MC
FOUR MEDIA COMPANY

Opportunity in Singapore for Broadcast Professionals

Four Media Company Asia, a major Los Angeles based satellite broadcast company is expanding to the Asia/Pacific Region and has the need for a Chief Engineer and an Operations Manager for its new satellite earth station in Singapore.

CHIEF ENGINEER

- Must have a minimum of 3 to 5 years experience in the satellite broadcast industry. Areas of technology include RF, audio, video (analog and digital). Facilities include satellite transmission as well as videotape origination. Responsibilities include system design, integration, maintenance, staff supervision, and training.

OPERATIONS MANAGER

- Full responsibility for day to day operation of the satellite earth station including scheduling and supervision of earth station staff. A thorough understanding of the satellite industry in the Asia/Pacific Region is required as well as strong technical and operations background. Asian language skills a plus.

If you fulfill the requirements for either position please submit resume, salary history and availability to:

Fax: (818) 840-7389
2813 W. Alameda Boulevard
Burbank, CA 91505 USA
Attention: Human Resources

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BROADCAST ENGINEERING TECHNICIAN WTVJ, Florida, has an excellent opportunity for a team oriented, hands-on, broadcast engineer. The candidate must have experience in the following areas: VHF/UHF transmitters, MRC Remote control systems, microwave, computers, and studio systems. The position also requires an extensive knowledge of FCC regulations, and a general class FCC license. Strong communication skills, and an ability to manage large projects are required to gain immediate benefits from this terrific opportunity. Send resume to Employee Relations, WTVJ/NBC, 316 N. Miami Ave., Miami, FL 33128. WTVJ/NBC is an equal opportunity.

KRIV FOX TELEVISION HOUSTON is accepting applications for a Maintenance Engineer. Component level experience in 1" video tape equipment; sony betacam; Analog/Digital switchers, graphic generators, etc. Knowledgeable in test & measurement procedures with both video & stereo audio systems is beneficial. Ability to work under pressure of fast pace operations. Min. 5 years experience, and FCC or SBE certification. Send resume with salary history to KRIV, Fox Television, P.O. Box 22810, Houston, Tx., 77227, Attn: Charmaine Williams. EOE.

CHIEF MAINTENANCE ENGINEER: Hoffman Video Systems, a leading distributor/systems integrator of broadcast television systems has an immediate opportunity for an experienced maintenance engineer to work in Seoul, Korea for a minimum of 1 year. The position demands an extensive background maintenance of professional broadcast TV systems, and general TV studio operations. Applicants must possess specific knowledge of digital switchers/routers and electronics, Beta Cam and computers. Minimum 5 years experience and college degree required, E.E. degree preferred, or equivalent work experience required. Korean language a plus but not required. Salary based upon experience and technical skills. We offer competitive benefits and compensation package (\$100K/yr +) to the right individual. To apply either mail or fax a resume, salary history and three reference to: Bob Jablonski, Chairman, Hoffman Video Systems, 1049 Flower Street, P.O. Box 25097, Glendale, CA 91221-5097. Fax: 818-507-7118. An Equal Opportunity Employer.



FOUR MEDIA COMPANY, INC.

Broadcast Positions Available in Singapore

Four Media Company, a leading post-production and satellite distribution company, is seeking qualified applicants to fill the following positions in its all digital facility in Singapore.

TECHNICAL DIRECTOR

- Broadcast cable/news orientation. Must have technical experience in DVE, still store and titling, fast moving environment.

PRODUCTION AUDIO MIXER

- Television audio production mixer. Music/music video background a plus. Seeking professional to provide input.

ON-AIR OPERATIONS MANAGER

- Must have broadcast facility management experience including: traffic, LMS automation and other automated playback systems. Ability to manage and train 24 hour staff. Broadcast or cable orientation.

MASTER CONTROL OPERATORS

- On-air master control experience including: traffic, LMS automation, and other automated playback systems. Broadcast or cable orientation.

PRODUCTION/POST PRODUCTION ENGINEERS

- Hands on experience in the maintenance, trouble shooting and repair of all analog and digital broadcast equipment.

Asian language a plus.

Excellent salary and benefits package will be provided to qualified candidates.

Please forward your resume, salary requirements and availability to:

Human Resources
2813 W. Alameda Avenue
Burbank, CA 91505 USA

SONY

Sony Broadcast Business and Professional Group has several opportunities for Broadcast Professionals in the following areas.

Field Engineers Engineering Specialists Depot Engineers

(San Jose and Cypress, CA;
Chicago, IL; Teaneck, NJ;
Norcross, GA; and Irving, TX)

We have openings for Engineers with a background in installation, maintenance, repair and troubleshooting of audio, video and telecommunications equipment. An AA degree in Electronics or equivalent and 3+ years' broadcast experience are necessary. Customer interface and travel will vary, depending on position. Must be willing to relocate.

Send your resume and salary requirements, along with locations you are interested in to Catherine Borders at the address or fax number listed below.

Sr. Video Systems Design Engineers

Contract/Temporary

We're looking for very seasoned Engineers to start immediately and work on designing large scale digital audio and video facilities. Candidates must be strong in system level engineering design, technical problem solving, team building and communications. Responsibilities will include the design of floor plans, equipment rack elevation layouts, and detailed signal flow construction diagrams. Fluency in Microsoft Excel for Windows is required; AutoCad, MS Word and MS Access software knowledge a plus. The ability to work with minimal supervision and training will also be key.

These contract positions require 5+ years' professional experience in the design, operation, maintenance and testing of large scale state-of-the-art analog and serial digital audio and video production, as well as broadcast facilities.

Contract/temporary positions require full-time presence at Sony's facilities located in San Jose, CA. Some travel will be required during installation and testing of facilities after designs have been completed. **Resumes should be sent to Christine Young at the address or fax number listed below.**

Send responses to: Sony Electronics, Inc., 3300 Zanker Road, MS: SJ-2C2, San Jose, CA 95134; FAX (408) 955-5163.

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Winsted Corporation	60	27	800-447-2257
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Josh Gordon
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Fax: (718) 522-4751

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SPORTS STANDARDS CONVERTER OF THE YEAR

Major Sporting Events Transmitted using Vector VMC



Albertville Winter Olympic Games 1992
CBS, Turner Sports (TNT)



Barcelona Summer Olympic Games 1992
NBC, CTV (Canada)



Lillehammer Winter Olympic Games 1994
CBS, NHK, CTV



World Cup Finals 1994
EBU, RTM (Malaysia), ATV (Hong Kong)



Wimbledon Tennis 1994
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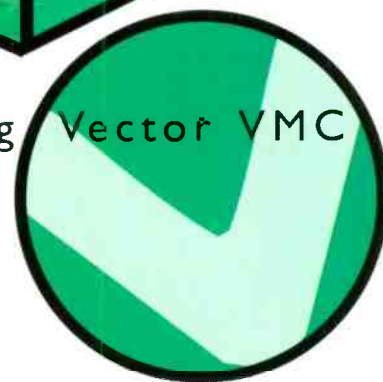
Goodwill Games 1994
Turner Sports



Commonwealth Games 1994
BBC, RTM, ATV

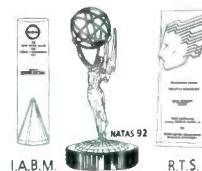


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Glue skies

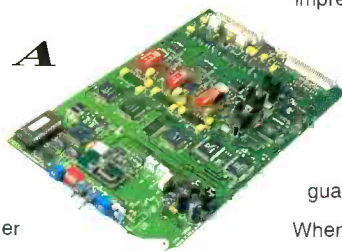


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