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April 1989/$3

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NAB '89

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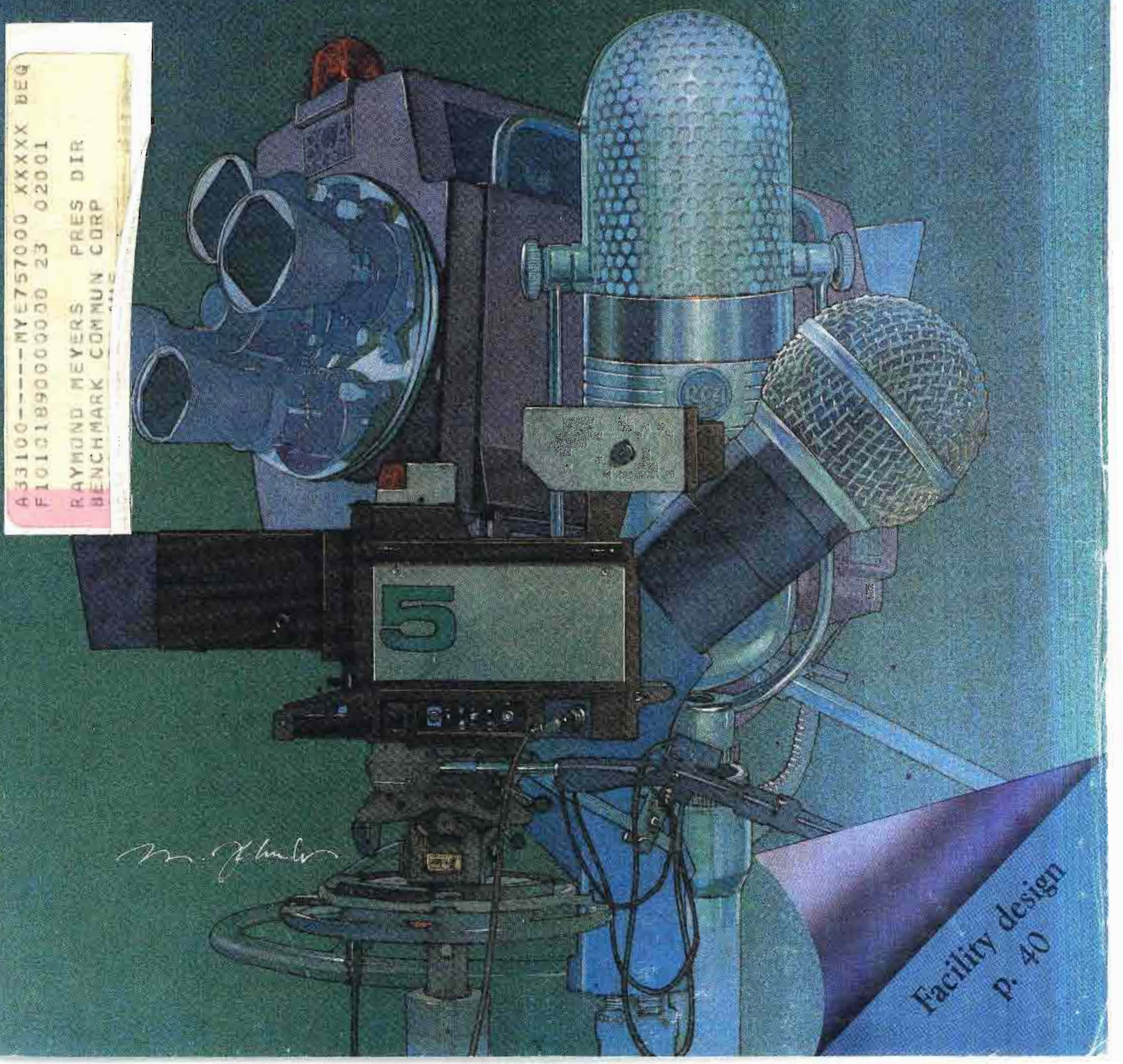

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Facility design
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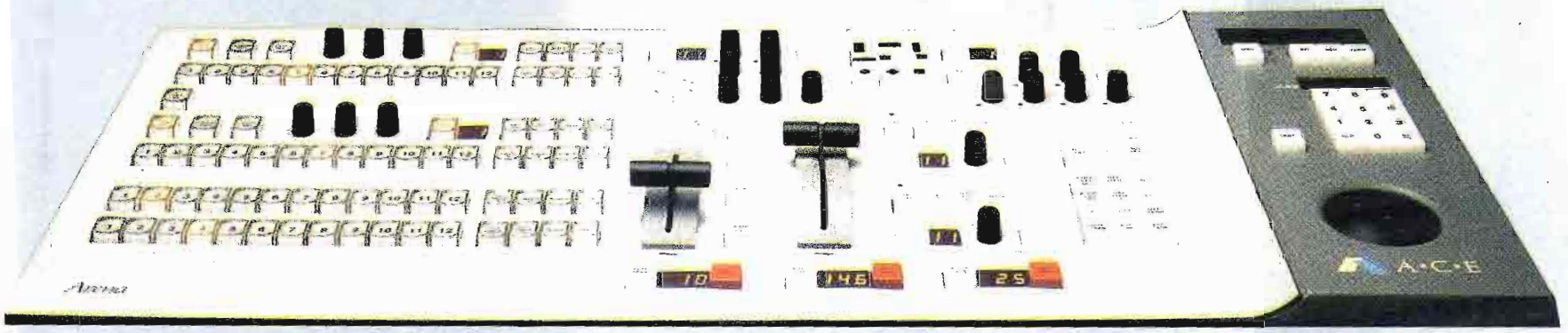

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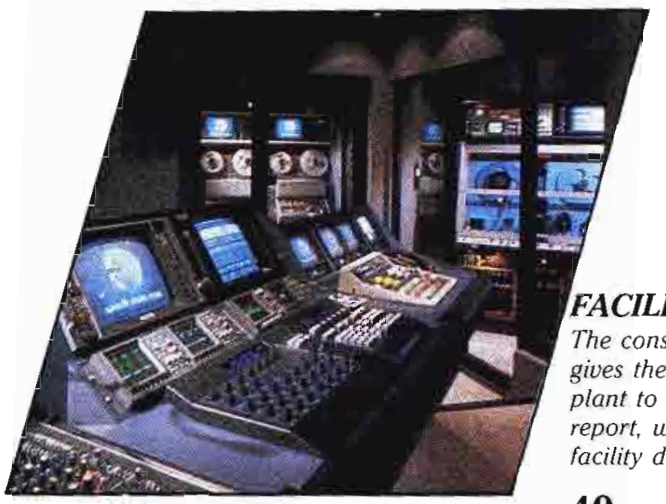

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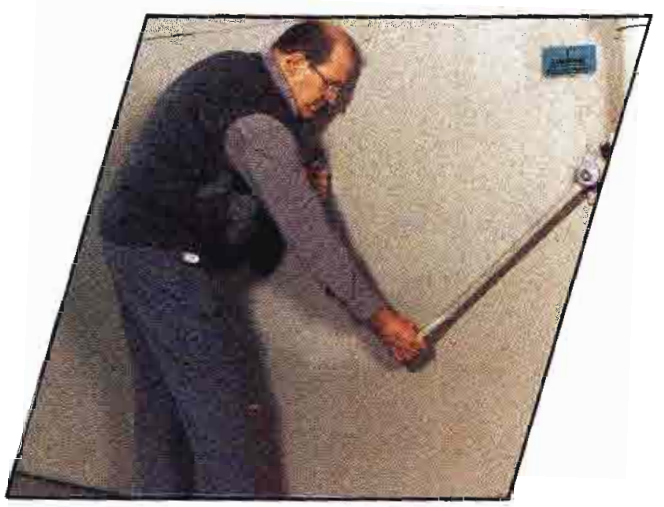

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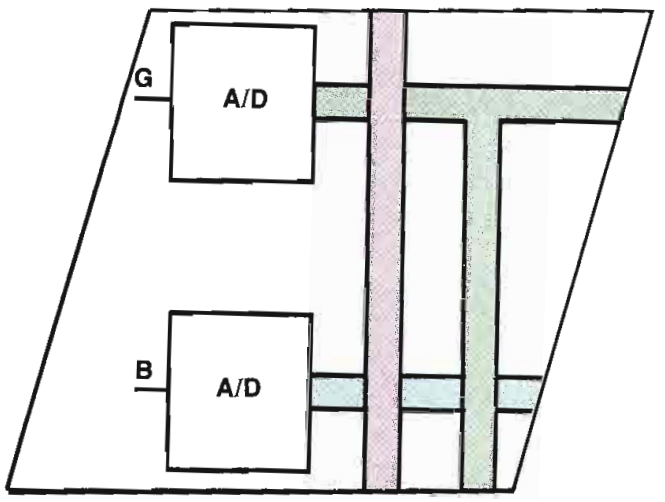

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BROADCAST ENGINEERING

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The stage is set for the annual NAB convention April 29 to May 2 in Las Vegas. Our cover this month illustrates the theme of the convention, "Proud tradition, dynamic future." From the early days of broadcasting, radio and TV stations have been at the forefront of technology. (Cover illustrated by Mark Schuler.)

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Phil Kurz joins *BE/VS* editorial team

Intertec Publishing is pleased to welcome Phil Kurz to the editorial team of **Broadcast Engineering** magazine and its sister publication, "Video Systems." Kurz joins Intertec as a consulting editor after a 3-year affiliation with "Television Broadcast" magazine, where he served as associate editor for two years and editor for a year and a half.

In his previous positions, Kurz covered a variety of today's most pressing technological concerns, such as the development of a transmission system for HDTV, the future role of fiber optics in signal routing and delivery, and the technological promise and potential pitfalls of satellite news gathering. Kurz also

regularly covered the industry's major trade shows.

In addition to directing the daily editorial operation of the magazine, Kurz immersed himself in a number of special industry-related activities. Among these were the launching of a safety-awareness campaign regarding the proper use of telescopic masts on ENG vehicles and the organization of an expedition to provide live TV pictures of Halley's Comet, free of charge, to all TV stations in North America.

Before joining "Television Broadcast," Kurz served as an editor on the international desk of the Yonhap News Agency in Seoul, South Korea. He is a graduate of the University of Missouri School of Journalism. We look forward to his contributions.

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BROADCAST ENGINEERING

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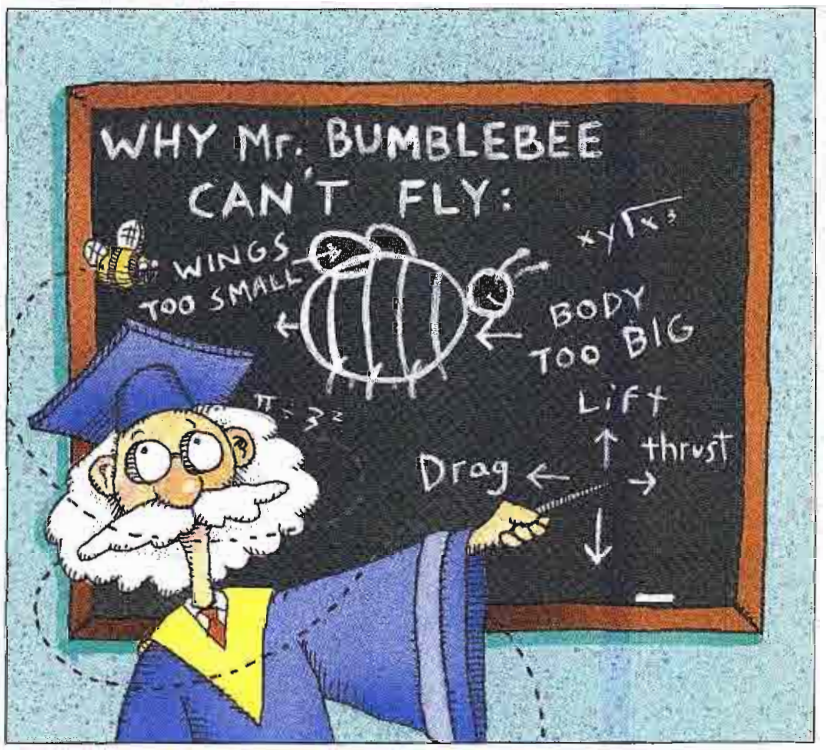
Blinded by theory

Let's face it. We're lazy. Often, it is easier to quickly dismiss a new idea than to hear it out and make an honest decision about it. The risks of change are plentiful. We might "get burned." We might "look bad" if things don't work out. Perhaps the hardest of all is that we might have to admit that we don't know everything.

When someone has a new idea that doesn't align with our pet premises, it is a hard pill to swallow. Worse yet is when someone proposes a radical new idea, *then demonstrates that it works.* At that point we can no longer stroke our learned chins and spout memorized theories as to why the thing can't succeed. Faced with a demonstration that flies in the face of conventional wisdom, we have but two choices: Charge the perpetrator with charlatanism, or go back to square one to figure out what is wrong with our theories.



Recently, a panel of industry experts gathered in Washington, DC, for a 5-day exercise in evaluating proposed HDTV standards. One system, Genesys, proposed by Richard Gerdes of PSI (Production Services Inc.), Tucson, AZ, was notably different than the rest. Instead of quoting line rates and aspect ratios ad infinitum, Gerdes stated simply that Genesys was not really a production standard, but a transmission system capable of multiplexing *any* of the other 14 proposed standards over the top of a standard NTSC signal without degrading the original signal, without requiring additional bandwidth and without generating out-of-band harmonics.

Did our council of wizards embrace Genesys as a simple path through the HDTV forest? Afraid not. Perhaps red-faced before a fresh idea, our gurus pilloried Gerdes. Maybe Gerdes' only defense is that while most compatible HDTV systems are still only chalk marks on laboratory blackboards, he can hook up coaxes to some small boxes filled with common circuitry, and piggyback a 3MHz video signal over NTSC, with full bandwidth coming soon.

Science moves ahead slowly, but inexorably. Hypotheses change gradually into facts, which then become the foundation on which further progress is built. This glacial trek down first one trail, then another, eventually gets us to the goal. True, the common practices of a given day often look like hilarious wrong turns when viewed in the mirror of hindsight, but over time, science's relentless logic sorts everything out.

New ideas, however, without lineage or proper footnotes in the traditional tomes, often choke the system. Rather than bucking the tide of peer opinion, otherwise fine engineers and scientists find it easier to set such ideas aside for other days, and continue with the flow. For this reason, explorers once feared sailing off the edge of the world, years passed before university-educated surgeons started boiling their knives, and pilots only joked about attaining a velocity "faster than that of sound."

An old country doctor — a quiet man with many simple, inexpensive cures that work in spite of what his colleagues say about him — once shared this quotation with me:

"Most people are slaves of habit, followers of custom, believers in the wisdom of the past, and, were it not for brave and splendid souls, the dust of antique time would lie unswept, and mountainous error be too highly heaped for truth to over-peer. Custom is a prison, locked and barred by those who long ago were dust, the keys of which are in the keeping of the dead." —Unknown

Our craft, with all its roots, is scarcely a hundred years old. How dare we presume to have discovered all its secrets? If the Genesys system can realize what it promises, it can inexpensively solve our compatible HDTV quandary. We must not judge this matter before we've heard it.

Rick Lehtinen,
TV technical editor

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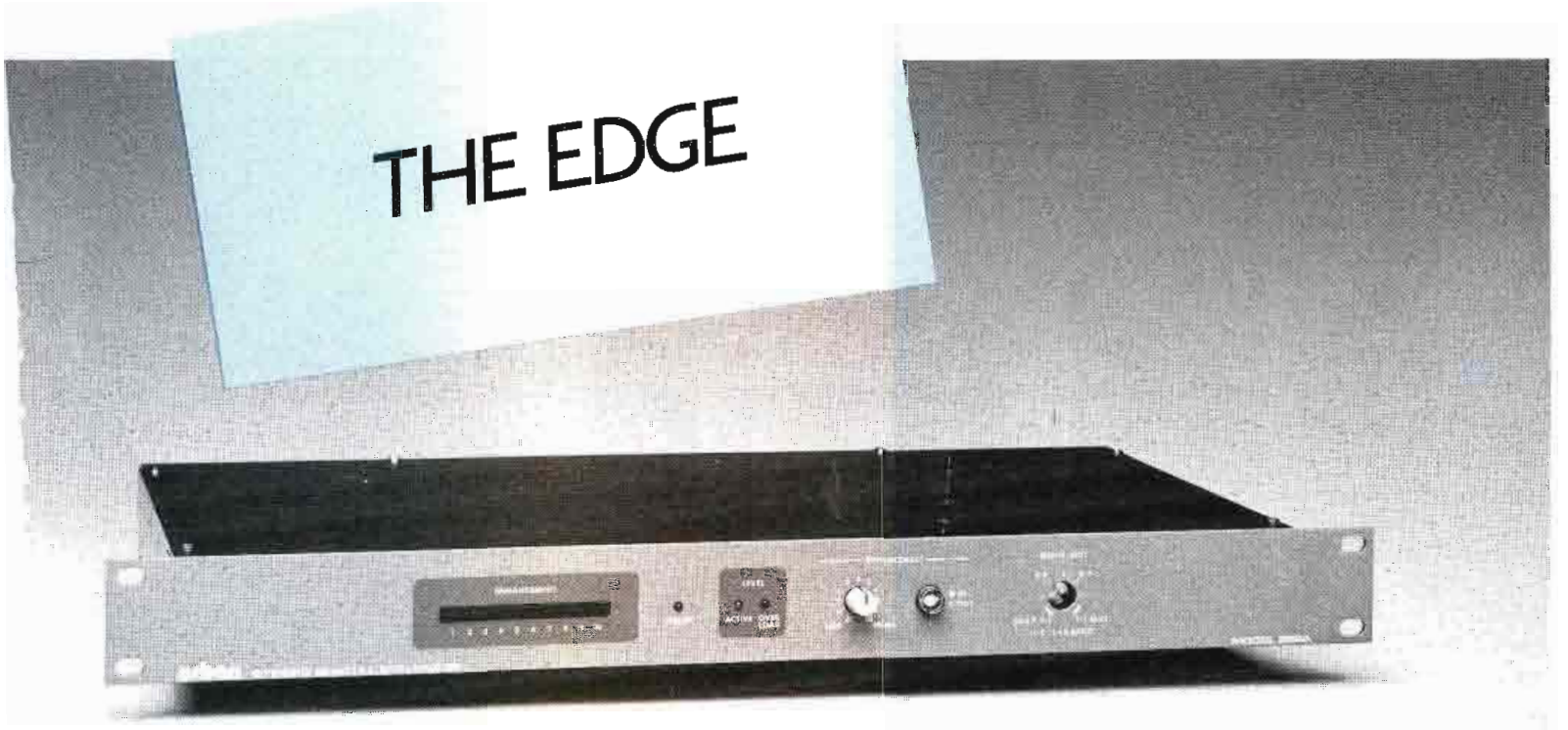

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Egidio Giani, WLR South East Radio, Waterford, Ireland: "Nice overall stereo sound which does not *sound* enhanced when in fact it is."

Unnamed Source (at user's request), Columbus, OH: "Good job at a great price. Subtle intensity!"

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TV rule changes follow requests

By Harry Martin

Certain outdated and unnecessary rules will be eliminated or amended by the FCC in response to requests by the TV industry. The first change will be to remove the restriction on the broadcast of unrelated visual and sound signals. Under the old rule, broadcast services such as video display of news, weather or community information that were unaccompanied by a related audio signal, or audio programming with no visual accompaniment, were restricted to the hours of midnight to 6 a.m. or for only 15 minutes just before a station's regular sign-on time. The commission has determined that there is no need to preclude such programming options at any time during the day, and has repealed the rules.

Also gone is the requirement that the color burst signal in TV programming be omitted throughout the transmission of an extended black-and-white program. Technological changes in broadcast equipment have made it desirable in some cases to retain the information carried in the color burst signal even when black-and-white programming is carried. For instance, many production videotape recorders now use the color burst signal for timing and synchronization functions. Recognizing these technical changes, the commission has chosen to downgrade the current rule from a "requirement" to a "recommended standard." This rule change should provide broadcasters the flexibility they need while continuing to protect reception on NTSC TV sets designed in accordance with the current color burst omission requirement.

In other TV actions, the commission deleted the reference tables used for conversion of the minutes and seconds of geographic coordinates to decimal parts of a degree. These values, used in calculating the distance between two stations, can be more accurately and easily converted with a calculator.

The current rules that specify limits on the extent of permitted directionalization of TV antennas have been retained. The commission concluded that it should maintain the current limits because of controversy over just how much directionalization can be authorized without degrading signal quality. The agency's current waiver process is thought to be sufficient to handle requests for greater degrees of directionalization than the rules permit.

Also eliminated are the rules governing the installation of studio and transmission equipment and related safety standards. Because most TV equipment is now built and installed by manufacturers who design it to meet federal and state safety requirements, the commission determined that its rules are outdated and unnecessary.

The commission removed a redundant provision requiring that the meter used to determine a TV station's visual power be calibrated at least once every six months. However, the rules still require that TV stations calibrate their power meters as often as necessary to ensure compliance with the station authorization.

Standard for reporting EEO efforts clarified

In response to requests by the National Association of Broadcasters, the commission has clarified its position on the EEO recruiting requirements that must be reported by a station at renewal time.

In 1987, the commission modified its EEO rules and renewal reporting form (Form 396) to require stations to identify the number and the sources of minority and female job referrals. The NAB challenged the new requirement by asking the commission to explain how broadcasters could avoid possible violations of state regulations prohibiting the acquisition and retention of information about job applicants. NAB requested that the commission suspend the EEO reporting format in Form 396 for one year to allow stations to collect enough data on recruitment sources to permit them to comply with the new requirements. It also asked the commission to define "referral" as used in the EEO rules and on Form 396.

The agency's response was that the collection and retention of information on job applicants, which is required by the commission, should not conflict with any existing state regulation. States that have laws barring the collection of information on race and gender must recognize the authority of a federal agency to pursue its programs and goals. The commission noted that there have not been any difficulties with state laws reported by licensees so far, but said that if any state law does bar collection of data, the affected licensee should bring such information to the agency's attention.

Because the current EEO reporting program is similar to the one it used in the past, the commission declined to suspend its reporting requirement for recruitment sources as NAB had asked. And, in defining the term "referral," the commission replied that it will mean the same thing it has since the agency instituted EEO regulation in 1976: referrals that can be identified by the licensee as minorities or women.

Repeal of fairness upheld by court

The U.S. Court of Appeals for the District of Columbia Circuit has upheld the commission's 1987 determination that the Fairness Doctrine no longer serves the public interest and should be repealed.

The court fully supported the commission's decision to repeal the doctrine, but declined to comment on the determination that the Fairness Doctrine is unconstitutional. In focusing on the policy facets of the decision, the court supported the commission's findings that a combination of dramatic growth in broadcast outlets and other electronic media, and the significant "chilling effect" of the Doctrine, justified its elimination. The court said the commission's decision-making process was neither arbitrary nor capricious and had been conducted with sufficient notice to fulfill the requirements of administrative process.

In a separate concurring opinion, Judge Kenneth W. Starr noted that he also supported the determination that the Fairness Doctrine is unconstitutional. Judge Starr said that if the Fairness Doctrine eventually is reinstituted or codified, its proponents would have a "substantial" burden trying to defend it on constitutional grounds.

Martin is a partner with the legal firm of Reddy, Begley & Martin, Washington, DC.

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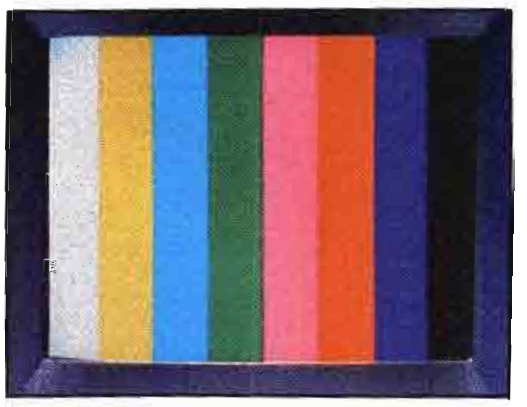
Design may prevent VDT user symptoms



By Mike Berry

The Center for Disease Control, through the National Institute for Occupational Safety & Health (NIOSH), has investigated many serious physical symptoms developed by operators of video display terminals (VDTs) and other devices using cathode ray tubes to display data. Symptoms included eye fatigue and irritation, blurred vision, headaches, dizziness and pain or stiffness in the neck, shoulders, back, arms, wrists and hands.

NIOSH has determined that these medical symptoms are caused, not by the VDTs, but by improper lighting and poor posture and positioning of the operators in relation to their computers. Because the use of terminals in broadcasting is on the rise, particularly in computer graphics applications, let's review some ergonomic considerations for facility design.

Room layout

Several references are available for planning a graphics room. These include the NAB engineering handbook, various lighting and acoustical manuals and publications from the Center for Office Technology, the American National Standards Institute (ANSI), the Human Factor Society and the Occupational Safety and Health Administration (OSHA).

Figure 1 suggests general guidelines for positioning of the operator, monitor, table and chair.

Lighting and glare

Ideal lighting starts with track lighting. Add a rheostat, and this adjustable "task lighting" can be set to the particular needs of each workstation. Side lights, one on each side of the VDT work area (set to adequate and equal intensity), should be used to eliminate both shadows and glare. The change in light levels caused by shadows or glare on a VDT or uneven room light levels force the eye to accommodate several lighting intensities simultaneously, increasing eye strain and fatigue.

Glare — a strong, harsh reflection — can occur on the monitor or on any reflective surface (such as a shiny keyboard). An anti-glare matte finish now is available on some keyboards. In addition, any work surfaces near the monitor (table tops, files, shelves and walls) should be a medium to dark color and have a non-reflective finish.

To stop reflections off the monitor, first try to eliminate the offending light source. Next try treated glass filters, which cut down off-axis light that could reflect from the screen. Anti-reflective aerosol sprays, developed for air traffic controllers' radar screens, seal the glass (actually filling the microscopic pores with a fine coating that dispels static electricity, hence dust) and resist fingerprints while reducing glare.

Avoid windows in work areas. If this is impractical, install venetian blinds or heavy drapes to prevent reflection. The windows should run parallel to the operator's line of sight. Windows behind the operator can cause reflections and shadows, and a window behind the monitor can cause uneven light levels.

Exercise your eyes

If the operator wears corrective lenses, NIOSH suggests they may need to be specifically designed for the exact distance between the monitor and the operator's eye. If a special prescription is required for the work place, many employers will assume the cost, as well as that of an annual eye exam.

Be aware that any prolonged physical or mental task can result in fatigue. Therefore, NIOSH recommends the following: An operator who works at a VDT for an 8-hour workday should be allowed a 10-minute break every hour. An operator who only occasionally uses the VDT during the workday should be given a 15-minute break every two hours. During the break time, operators should leave their terminals, walk around and focus their eyes on distant objects. These recommendations have been determined to be the minimum needed by an average operator to avoid excessive muscle and eye fatigue.

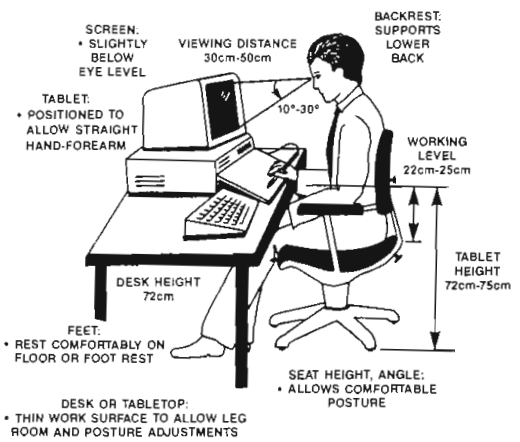


Figure 1. *Suggested heights and angles for comfortable operation of computer graphics equipment.*

One study concluded that most visual fatigue brought on by working at a computer actually was a result of the operator neglecting to blink. The study stated that VDT users tend to stare at the screen "to avoid missing anything." So a conscious effort by the operator to blink more often, which serves to lubricate the eyes, is another method of combating eye fatigue.

Radiation

One common area of operator concern is VDT radiation. Studies by the Food & Drug Administration of the U.S. Department of Health & Human Services, NIOSH and the U.S. Army Environment Hygiene Agency have measured the amount of radiation, X-rays, radio-frequency waves, microwaves and ultraviolet and infrared light emitted by VDTs. These studies have found the levels to be below current allowable standards. In fact, according to NIOSH, some levels of radiation were found to be so low as to be indistinguishable from general, or background, radiation. To date, OSHA has no reliable information linking any birth defects to expectant mothers working at video display terminals.

However, opposing parties are extremely vocal and point to the inconclusive evidence as reason enough not to risk the possible repercussions. Some municipalities have passed regulations aimed at VDT usage. Meanwhile, more major studies are under way.

Berry is a broadcast designer for Dallas Post-Production Center, Dallas.

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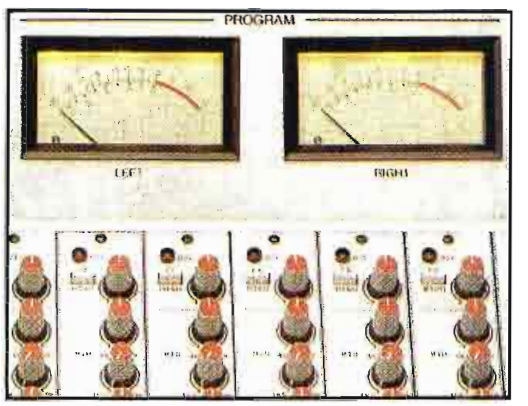
A pirate network strives for legality



By John Battison, P.E.

A milestone in the development of commercial radio — or radio as we know it— occurred in the Republic of Ireland this past winter. The Republic of Ireland, or *Eire*, to give it its preferred name, was the last English-speaking country to hold to the outmoded concept of government-operated radio stations. Until recently, there were no privately owned commercial stations in Ireland.

Birth of pirate stations

The result of the original policy was that the people of Ireland rebelled in the same way the British did. Pirate stations sprung up. Both countries experienced the joys of unbridled commercial broadcasting from European stations such as Radio Luxembourg, Radio Normandy (Fecamp) and the Isle of Mann, in the Irish Channel.

The British pirates took the form of shipborne radio stations such as the well-known *Radio Caroline*. Other pirates used some of the old wartime forts just off the coast of Britain. One of these was the scene of a modern pirate boarding when a rival station tried to take over one of its competitors. In Ireland, the competition was peaceful.

In 1987, I received a phone call from Cork, in southern Ireland. The caller was asking for help with a pirate network. It turns out that the owner of the network — one AM station and three FMs — had read an "re: Radio" column and was soliciting my advice.

My client's stations were a tribute to ingenuity, entrepreneurship and just plain guts. Cork County, including the city of Cork, has a population of more than 400,000. National service is provided by several AM and FM transmitters that neither cover the area adequately nor provide the programming the listeners want.

The WKLR group of stations (West Cork Local Radio) provided MOR, country and western (the most popular format) and Gaelic-language transmissions.

Studios and offices were located in Bandon, in the back of an abandoned pub and a nearby trailer. A homemade STL, operating on an unused FM channel, relayed the signal to the Cashelmoore transmitter located about five miles away. All the equipment was old, salvaged from all kinds of BBC discards or bought from Italy, as was the case with the FM transmitters.

The 350W AM signal was generated by a circa-1945 RCA transmitter, formerly used by the BBC. A flat-top antenna with an unknown base impedance provided service to an area with a radius of about 30 miles. I found no conductivity data on the Irish soil, but estimated it to be approximately 10 in the river valleys, 2 on the rocky rises and less on the mountains. The conductivity rose to approximately 5,000 at the edges of the Atlantic and the Irish Channel.

The FM transmissions from Bandon originated from a 250W Italian transmitter driving a vertical dipole with a gain of about 0.5. Coverage was extended to the western part of the country with two 250W translators, which took the off-air signal and rebroadcast it on a different channel. Without a legal licensing plan, the basic way to choose a channel was to find an unused one.

My job was to advise on extending the network and adding a new FM transmitter to serve the city of Cork. Finances being what they were, the transmitter turned out to be another 250W Italian unit coupled to a vertical homemade dipole with a reflector. These were installed on a 35-foot pole on a 100-foot bluff overlooking the city.

In January of this year, I traveled again to Cork, this time to plan a legal network. The government's concept called for three 5kW ERP FM stations to cover the whole country and the sites to be rented at high prices from RTE (the national radio service). Our opinion was that these three low-power stations could not serve adequately the 402,465 persons in the 2,887-square-mile area.

The application

Our proposal was that we be permitted to serve the area with a system of seven FM stations and be allowed the essential flexibility for local programming. Ten days of intensive work produced a document far heavier than any I've seen provided to the FCC by an applicant. This was due by Jan. 20.

In the hearing process, each applicant has 30 minutes to present the case and 20 more minutes to answer questions. This is the total amount of time you are permitted to argue your case.

The WKLR presentation was powerful. During my 1987 visit, I had explained the public radio philosophy used in America. Essential to this philosophy is the support provided by local listeners. However, because of the pirate nature of the stations, I explained, companies were considerably reluctant to buy commercials. Therefore, the stations' income was not impressive.

Using the idea of local support, Dave Heffernan — the young, driving force behind WKLR — formed 35 WKLR support clubs in the area. These clubs acquired 155,000 signatures on petitions for WKLR and raised money to pay for application costs. They even obtained the government's permission to run a raffle to raise additional money to support the group's effort (shades of the FCC and anti-lottery rules).

An extremely strict admonition contained in the legislation was that any pirate station broadcasting after Dec. 31, 1988 would never receive a license. The last days of WKLR operation as a pirate were hectic. In the final two days of the year, WKLR did almost 40 remote broadcasts to build public support. The effort paid off. More than 100 supporters attended our hearing. No other applicant had any supporters attending.

This hearing process was in stark contrast to a recent FCC hearing in which I was involved. In that case, almost two years had elapsed between filing and hearing, with only two applicants. Three days of hearings in Washington, DC, were to be followed by six months of waiting for a proposed decision. It was possible that the issue would be dragged all the way to the Supreme Court. By contrast, the WKLR decision is expected within two weeks of the hearing, and as far as I know, there is no appeal route for the loser and, therefore, no $1,000-a-day attorney fees.

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

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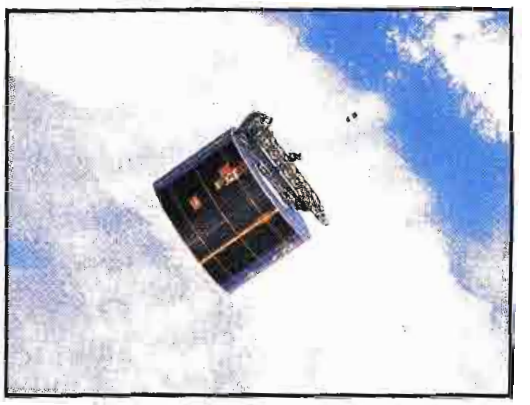
Space robots are at hand



By Elmer E. Smalling III

When NASA sends technicians into space to construct permanent space stations or bases on the moon or Mars, much of the mechanical work will be done with the help of robots. The robotic helpers will act like apprentice human operators, performing low-skill-level tasks such as tightening screws, moving panels, carrying tools and modules, and fetching and finding tools and components that the human space builders have lost or dropped (if you can "drop" something in space!).

This "helper" task of fetching tools is important for many reasons. First, many of the tools used for space construction will be custom-made for the individual projects and will be worth hundreds of thousands of dollars each. Second, NASA is concerned about the problem of "space junk." A 10-pound orbiting wrench could destroy a space station. Third, a robot can go miles in search of a tool or component, using a relatively small amount of fuel. Human "gofers" might use up a great amount of EVA time and materials or become lost or stranded, taxing or exhausting their life-support systems.

Smalling, **BE**'s consultant on cable/satellite systems, is president of Jenel Systems and Design, Dallas.

Getting "handsy"

The first step in designing a robotic helper is developing flexible manipulators, or "hands." Scientists at the Johnson Space Flight Center are working on many types of space hands in their laboratories. Some are basic claw-type devices that will hold material in place or carry heavy equipment.

NASA soon will demonstrate 3-fingered robot hands operated by as many as 12 separate motors, connected by pulleys and cables, that provide the hand with nine degrees of freedom. These manipulators will exhibit more flexibility than a human hand and will be articulated from a universal-type wrist joint.

The agency also is at work on a hand that uses pneumatics, which provides 16 degrees of freedom. This unit is too bulky for space travel at this stage of development.

Smart hands

The most interesting type of manipulator is the "smart hand," which has fingers and an opposable thumb. This hand will be able to do almost any task a human hand can. The smart hands will be attached to a robot body, as shown in the photo, that will contain controllers, computers, radio link and power supplies.

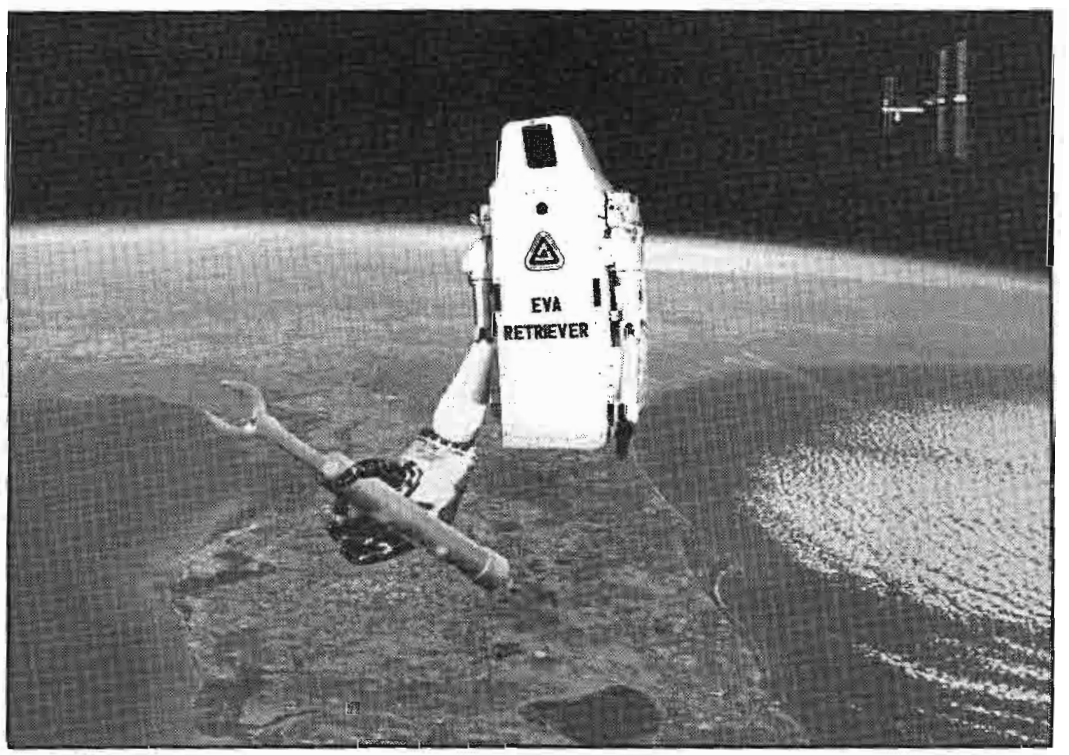
It is possible that future manipulators will use electroconstrictive materials to simulate muscle fiber. This material will contract in response to an applied voltage (nervous signal). However, manufacturing material that can withstand the extreme temperatures and radiation of space will be a challenge.

The human touch?

To retrieve tools and to perform as assistants, robots will have to be able to "see" and "feel" objects by using touch and visual sensors. Hands that look and act like human hands are called "anthropomorphic."

NASA probably will use a language called ADA to operate the robot helpers. ADA is a committee-developed language roughly based on PASCAL. Unlike RISC and assembly coding, this high-level language will require lots of robot program storage and thousands of lines of code for a final program. (The government is attempting to standardize its software operations by requiring most scientific work to be done in ADA. This is certainly a pragmatic, if not ideal, approach!)

The agency's robot "helper" will communicate with astronauts using verbal commands and replies. Years of research already have gone into this command and response-control technology, because of work on devices to aid the disabled. It seems this is one case in which existing technology will contribute to a space project, instead of vice versa.



An artist's depiction of EVA retriever with "smart hands." The robot will fetch tools and components "dropped" by astronauts.

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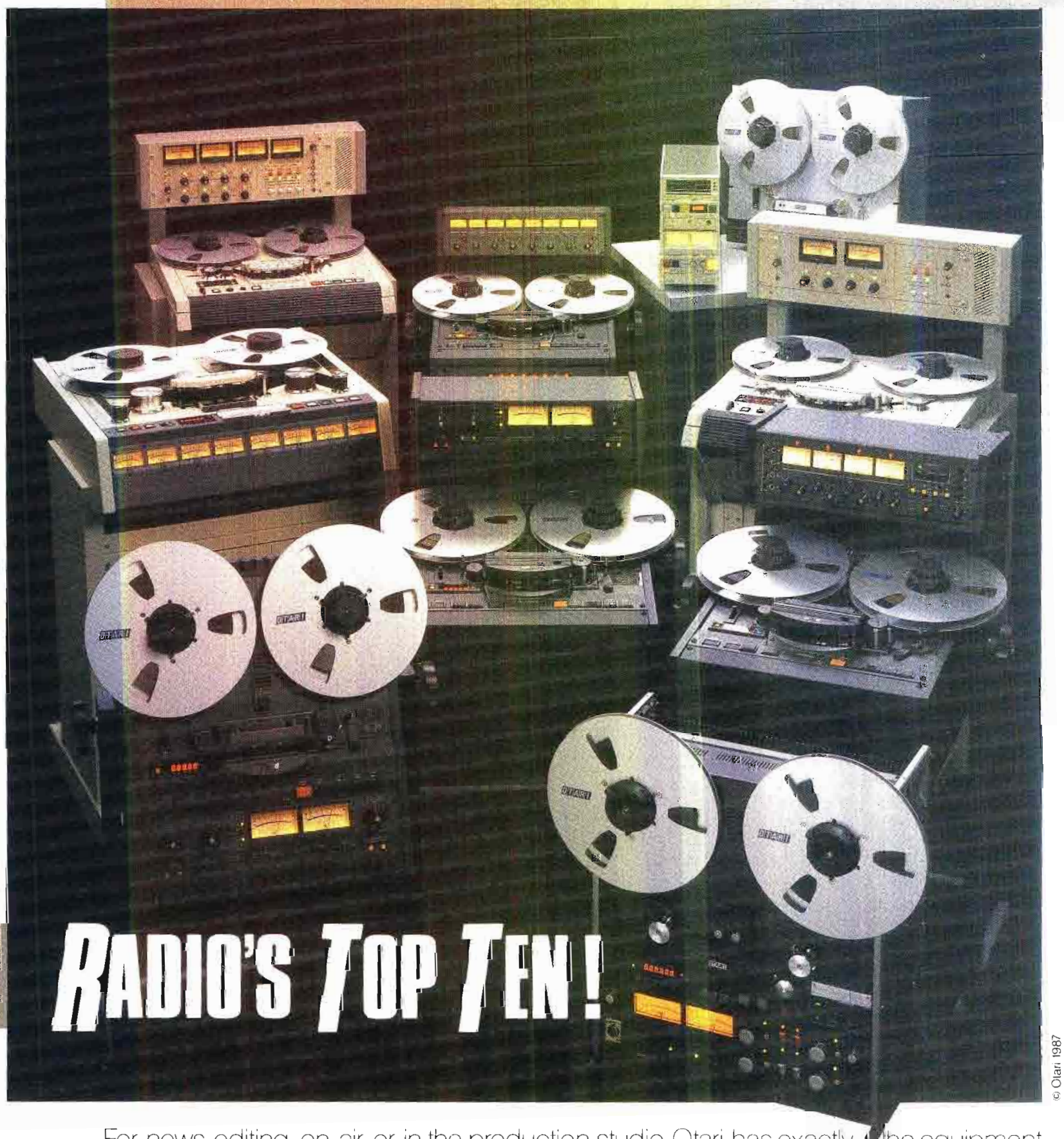

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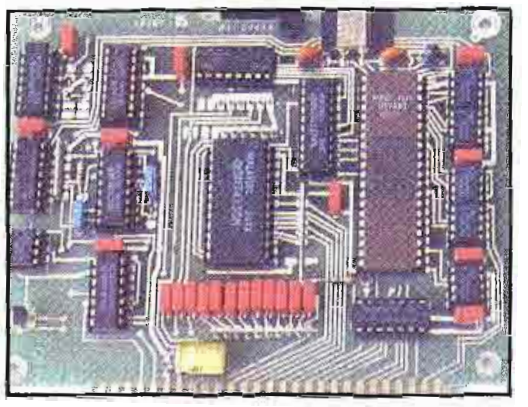
More about modems



By Gerry Kaufhold II

A modem transaction consists of establishing a connection on the PSTN (Public Switched Telephone Network) and passing tones back and forth. Modem users often seek the highest possible throughput, because the faster the information can be exchanged, the shorter the duration of the phone call and the lower the cost.

Taking a byte out of AFSK

The Bell 103 standard defines 300b/s as the maximum amount of digital data that can be transmitted using the 1,170/2,125Hz frequencies for full-duplex operation. This means that there is a duration of approximately 3ms for each bit. The analog filters used to detect the tones must be fast enough to capture a tone in about 1ms for practical operation.

One way to move eight digital bits through a modem would be to use the carrier as the "steady-state" position between the transmission of each bit of information. For example, the receiver might start looking for 1,170Hz as the carrier, decode a digital 1 for 1,270Hz, then wait for 1,170Hz to signal that another bit is on the way. (See Figure 1, top.) This method is known as *return-to-zero* (RZ) binary coding. If the steady-state condition between each bit of information can be eliminated, throughput will almost double.

Non-return to zero

An elegant technique, which uses the relative timing between each bit to eliminate returning to the steady state, is called *non-return to zero* (NRZ) coding. (See Figure 1, bottom.)

Upon making connection, the originating unit sends its 1,170Hz carrier tone. The answering unit responds with its 2,125Hz carrier tone. When the originator is ready to send a byte, it changes frequency to 1,070Hz, digital zero.

The receiver senses the zero and starts a timer that counts a predetermined length of time (about 4.5ms). The originator holds the frequency at 1,070Hz for the 3ms prescribed by Bell 103. This initial zero is called the start bit, and the 3ms duration is the bit time. At the end of the start bit, the transmitter sends the appropriate frequency for the first bit of the byte to be transmitted.

Halfway through the 3ms of the bit time, the receiver's 4.5ms counter times out, and the receiver decodes the binary value of the present bit. The receiver is now synchronized to the mid-point of each bit coming in from the transmitter, and sets its internal timer for 3ms. The rest of the byte is transferred, with the receiver decoding each bit during the middle of its bit time.

After the final bit has been transferred, the transmitter sends a digital one as the stop bit. The receiver verifies that exactly one start bit, eight databits and one stop bit were received, and waits for the next start bit to occur.

Notice that the stop bit is always a digital one (mark), the start bit is always a digital zero (space), and their bit times are slightly longer than data. This assures the receiver that it always will catch the change from stop bit to start bit.

1,200-baud modems

To obtain data throughput rates of 1,200b/s, a modification is made to the full-duplex 300-baud modem protocol. A frequency of 2,100Hz is used as both the initial carrier tone, and to signify digital one. A frequency of 1,300Hz is used for digital zero. The document that defines 1,200-baud modem operation is Bell 212A.

Because of the high rate of modulation, more bandwidth is required for each tone, so the 1,200-baud modems can communicate at the higher data rate in one direction only. The answering modem sends back a continuous low-frequency tone at 390Hz to verify that the modems still are connected. In modern modems this 390Hz tone is AFSK-modulated to provide a 75-baud data path for status information and error-correction schemes.

When the originating modem is finished transmitting, it automatically switches back to a receiver mode, outputting a carrier tone at about 390Hz while listening for the answering modem to transmit its reply.

Because of the number of different communications rates, whenever a modem answers an incoming call, it "listens" for the first frequency and adjusts its internal timing generator to match the communications protocol of the originating modem.

In a future column, we'll discuss modems that operate up to 9,600 baud over the PSTN.

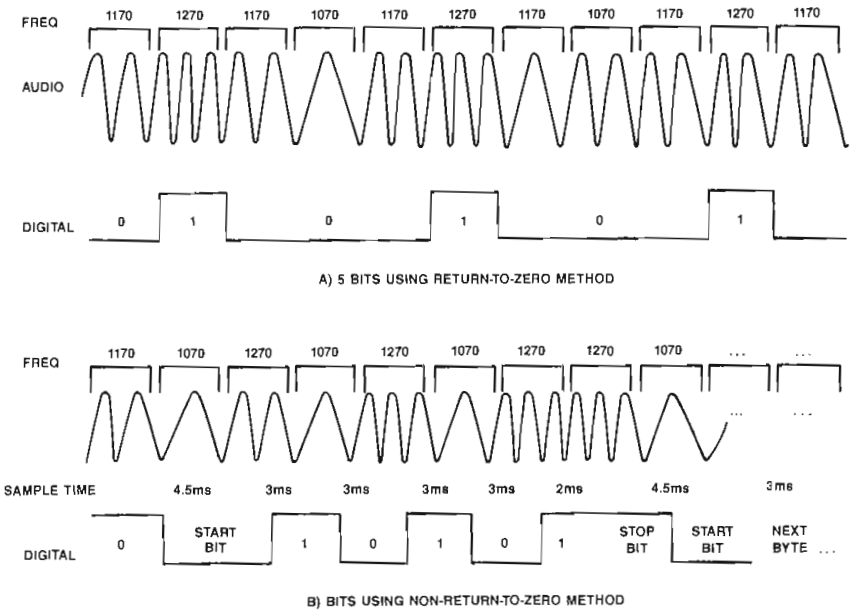


Figure 1. A comparison of RZ and NRZ formats.

Kaufhold is a market development engineer for SGS-Thomson Microelectronics, Phoenix, AZ.

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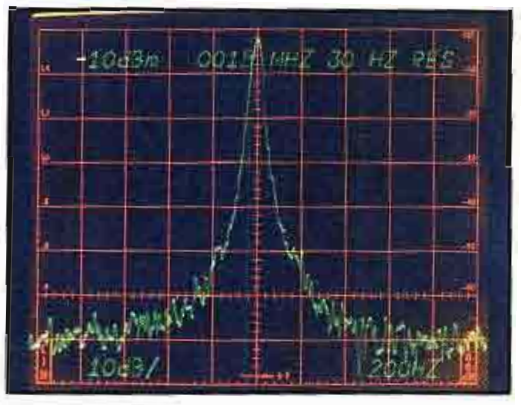
Part 2

Troubleshooting

Maintaining your computer

By Brad Dick,
radio technical editor



Computers continue to expand into new areas within the broadcast station. It's now common to find computers used in almost every department, from traffic to accounting to engineering. Although the machines are basically reliable, there is one computer component where trouble may just be waiting to happen — the hard disk.

Replace or repair

In the strictest sense, hard disk drives don't require preventive maintenance. Hard drives are sealed and have no user-serviceable components. A hard disk may give years of trouble-free service, but when it does fail the results can be disastrous. If you are responsible for your station's computers, implementing some of the following procedures may help prevent such failures.

Repair may run one-third to one-half the cost of a new drive.

If the hard disk does finally quit, the only alternatives are to send it to a repair depot or junk it. Which step you take depends on the drive's age. If the drive is several years old, I recommend it be replaced. There are a couple of reasons for this.

The cost of hard drives today is quite reasonable. A new 20Mbyte drive can cost as little as $200. Repair will typically run from one-third to one-half the cost of a new drive. Although a repaired drive may provide you with several more years of service, its MTBF may not be as great as a new one.

There are other advantages in simply replacing the defective drive. First, a new drive contains factory-fresh components. The mechanical systems are not worn and should last longer than those in a reconditioned drive. Second, replacing the drive allows you to increase the computer's storage capacity. As today's programs get larger, additional disk storage becomes an important factor. Finally, a new drive will most certainly provide faster access times. If a drive is more than four years old, it probably has an access time around 65ms. A new drive may cut that time by half or more. If the staff is using disk-intensive programs, the faster access times will be appreciated greatly.

Early warning signs

Most of today's operators have never encountered hard disk failures. This is due in part to the relatively low number of hours many systems have been used. However, failures will become more common as the equipment ages. Unfortunately, after a problem develops, it may be too late to salvage the data stored on the disk. The best advice for preventing problems is to look for some early warning signals and back up your data often.

Although it's possible for a hard disk to crash without warning, there are often several signs that problems are in the offing. Learning to recognize these indicators may prevent the loss of valuable data.

The computer's disk operating system (DOS) will often tell you when an error has occurred. The error message may be: *Boot failure, Sector not found, Bad sector error, General failure reading drive* and *Abort, Retry, Ignore*. Sometimes you'll be able to repeat the command or boot from a floppy and recover. It's also possible that once these messages appear it's already too late to salvage any data stored on the drive.

Look for early warning signs and back up your data often.

One easy-to-recognize sign of potential problems is a drive that has to read repeatedly a sector or track to get valid data. The drive also may take longer than usual to retrieve information.

Listen to the drive. When a drive is searching for data, you can hear the servo mechanism moving the heads back and forth across the tracks. If the data detected by the heads is invalid, the search-and-read process is repeated many times. The sound made by the servo mechanism is, therefore, repeated every time the search process takes place. If you notice this repeating sound, it's time to take action.

Listen to the drive.

Mechanical wear is a common cause of lost data and hard disk failure. Over time, the mechanics of the read/write heads develop slippage. Parts that were precisely aligned when the disk was new begin to lose alignment. As a result, the sector header IDs and the data begin to drift away from each other. Although the drive is told where to go for the data (header ID), the data may not be precisely located there. The drive interprets any missing or incorrect data as invalid and an error message is sent to DOS. The operating system then tells the servo to try again. The result is that either the head searches repeatedly until it finally skews or slips to just the right spot to recover the data or the error message is triggered.

Software solution

One way to help prevent this type of problem from occurring is to remove and then reload all of your software. If you've ever tried to back up a 20Mbyte drive on to floppy disks, you realize what a time consuming task this is. It's not likely that the typical broadcast station computer user is going to go through the hassle. Although this process updates the data, it does nothing to prevent the failure of the drive's original servo information (low level format).

It's possible to perform a low-level format without destroying all of your data. Software is available that will perform this task along with a variety of other useful chores. We'll discuss the use of software maintenance programs next month.

Acknowledgment: Appreciation is expressed to Gene Senecal, technical support technician at Gibson Research, LaCadena Hill, CA, for his help with this article.

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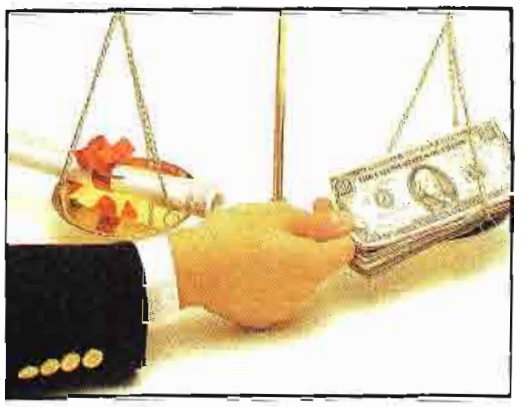
Part 1

Management for engineers

On being a leader



By Brad Dick,
radio technical editor

Jim was elated as he told his wife about his promotion to chief engineer. He had worked hard at the station for several years and saw the new job as his reward. His 5-year-old son was listening to the conversation. After a time, he asked, "Does this mean you don't have to fix things now, Dad?" "Not exactly," his father replied. "Now my problems will be with people, not equipment." Little did Jim realize the significance of his statement.

As a leader of a group of people, he will be faced with resolving software (people) problems rather than hardware (equipment) problems. It goes without saying that he will no longer be able to apply the time-tested repair techniques of hitting, kicking or dropping the defective device.

The jubilation of acquiring a leadership title such as supervisor, chief engineer or manager often turns to disappointment. This is especially the case when someone who has spent years training on technical issues suddenly becomes responsible for people. The most proficient maintenance engineer can make a lousy chief engineer. Technical training alone does not equip you to be a good leader.

Born leaders

The adage, "Leaders are born, not made" is simply not true. Historically, leadership was based on social class. Positions of leadership often were vested within families. Such divisions made it almost impossible for just anyone to become a leader. Although upbringing and environment may affect how easily a person handles the change, there is nothing to prevent you or anyone else from becoming a leader.

Social research verifies that birth characteristics have little to do with whether you become a leader. What does make a difference is whether you can help others satisfy their own needs.

The hierarchy of needs

Figure 1 depicts a hierarchy of the five levels of human needs. A pyramid is used to represent a hierarchical relationship among these needs. This concept was presented by psychologist Abraham Maslow in 1943. Let's look more closely at the basic human needs he identified.

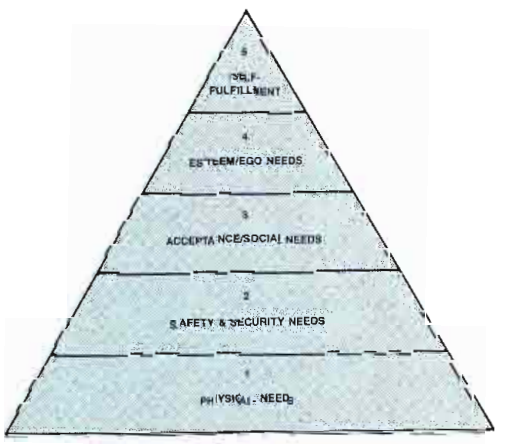


Figure 1. *Maslow's pyramid symbolizes five levels or kinds of human needs. Human behavior is based on efforts to satisfy these needs.*

Level-one needs are the most important because they must be satisfied before a person will be motivated to satisfy the next level. These needs are physical in nature and include food, shelter, water, air, even sex. This level also includes an adequate salary. These needs are satisfied for perhaps 95% of the U.S. population.

Level-two needs concern a person's safety and security. This includes such things as a home, job security, life insurance and tenure. This need level is met for 70% to 75% of the country's population. It's important to recognize that level-one and level-two needs are met primarily through company policy. As such, the leader has little control over these areas.

Today's workers are concerned with satisfying the needs in levels three, four and five. Level-three needs are socially based and include friendship, family, belonging to a group, associations, hobbies and recreation. These needs are satisfied for only 40% to 45% of our population.

Level four, which addresses self esteem or ego needs, embodies the need for achievement, competition, challenge, power, status or prestige and awards. Perhaps 15% to 20% of the work force sees these needs as being met. An effective leader helps the staff meet level-three and level-four needs.

The pyramid's peak, level five, represents needs such as self-fulfillment, a feeling of contentment, of having arrived or being free. A mere 5% of the work force reaches this level.

Outside fulfillment

Unfortunately, the workplace does not always provide opportunities for workers to satisfy the needs of levels three, four and five. This is especially the case in lower-level positions. Rigidly defined or routine jobs and areas in which the tasks are totally controlled restrict the ability of the worker to satisfy these needs.

Workers who are unable to satisfy level-three, -four and -five needs on the job will seek those opportunities outside the workplace. Social interaction (level three), achievement (level four) and self-fulfillment (level five) needs can be met outside the job. Hobbies, sports activities and social clubs provide organized structures that allow a person to satisfy these needs.

You might assume that it would be an advantage for employees to satisfy their needs outside the workplace. However those who do will be underachievers at work, expending just enough energy to keep their jobs and receive their pay which they will use for the things that meet their particular needs.

Most jobs today satisfy the human needs in levels one and two. Minimum-wage laws take care of the money issue (level one) and unions protect workers from being fired (level two). This means that trying to affect employees through the first two levels of needs is seldom effective.

Effective leadership

One problem with the discussion of motivational theories is that it's difficult to visualize them in practice. However, understanding the basic theory is only the first step. Over the next few months, we'll develop some specific tools you can use to become a more effective leader.

For those of you not yet in leadership positions, stay tuned. Career development depends, in part, upon your being prepared for advancement.

If you have some interesting examples of good or bad leadership, why not share them with **BE** readers? :-))

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Part 2

SBE Update

Debate continues on licensing issue

By Bob Van Buhler

The 1989 winter meeting of the Michigan Association of Broadcasters (MAB) in Lansing, MI, was the setting for discussion of industry standards and the professional licensing of broadcast engineers. Vice president, Bob Van Buhler, joined in a panel discussion titled, "Is a Broadcast Engineer Really an Engineer?," which was presented jointly by the Michigan SBE chapters and the MAB.

Other panelists included professional engineers John F.X. Brown and Harry Ball and engineering consultant Harold E. Munn. Brown, who chairs an Association of Federal Communications Consulting Engineers (AFCCE) committee studying the issue, presented a viewpoint similar to that contained in a report by Dane Ericksen, SBE director. (See last month's "SBE Update" for a review of Ericksen's report.)

Ball, Michigan's executive vice president of the National Society of Professional Engineers (NSPE), adopted a hard-line approach. He suggested that NSPE's position was that broadcast engineers are not entitled to use the title of engineer unless licensed by their particular state's board of licensing. Further discussion seemed to indicate that the NSPE's interest is in protecting the title of professional engineer, rather than prohibiting the use of the term broadcast engineer.

Munn suggested that it is time for broadcast engineers to abandon the title of chief engineer for something more descriptive. Such a title might be technician, chief operator or technical director. Because the FCC never licensed engineers, Munn said, it would be inappropriate for it to pre-empt state licensing of engineers in any area. He said it is more important that states not pre-empt federal prerogatives with regard to licensing radio operators, supervisors and technical managers.

Van Buhler reviewed the society's current position. The SBE viewpoint is that broadcast engineers have a right to supply their services to broadcast entities in light of current industry customs. This would apply whether it involves working for a private employer or as an independent contractor. He also confirmed SBE's opinion that broadcast engineers are entitled to use the traditional job titles associated with their work. This position also recognizes the prerogatives of PEs who are consulting engineers, and it discourages ambiguities in titles that infringe upon these areas. Van Buhler noted that the society's adoption of the title of professional broadcast engineer for its 20-year certification appears to have been particularly irritating to the NSPE's membership.

Van Buhler suggested that the issues would more appropriately be addressed by direct discussion between the groups involved, rather than adopting confrontational strategies that harden viewpoints and polarize positions. SBE delegates have addressed the issue of industry standards and professional licensing at several SBE regional conventions and state meetings. Because of clear differences as to what constitutes effective action and appropriate response, the society's efforts are being conducted separately from those of the National Association of Radio and Telecommunications Engineers (NARTE).

Van Buhler is chief engineer for WBAL-AM and WIYY-FM, Baltimore.

Bring your spouse

SBE national convention and **Broadcast Engineering** conference attendees are invited to bring their spouses to help celebrate the society's 25th anniversary. A gala Saturday evening event is planned.

In keeping with the convention's entertainment theme of Kansas City-style jazz, live music will follow the Saturday night dinner. Registration forms will be mailed in July. Payment may be made by check, Visa or MasterCard. Don't miss the exciting 1989 SBE national convention.

Executive committee action

Last month, space did not permit printing all of the executive committee's tentative policy statement on the professional licensing of broadcast engineers. The remainder of that policy follows:

- The ethical broadcast engineer operates with care and recognizes and respects the expertise of the structural, mechanical, electrical engineer and the architect. Broadcast engineers do not imply knowledge or skill in these areas by virtue of their activities as broadcast engineers. They make no such claim of expertise in these areas, directly or indirectly, unless licensed to do so by the proper state agency.
- The SBE does not encourage the use of the term consulting engineer or engineering consultant by personnel other than licensed professional engineers.
- The terms broadcast technologist, broadcast engineer, senior broadcast engineer and professional broadcast engineer are the various levels of certification employed in the SBE-sponsored certification program. These terms are in no way intended to imply competence in other disciplines, and they may not be used by SBE members or other certified personnel to represent themselves as certified or licensed professional engineers.
- There is ample precedent for use of the term broadcast engineer by qualified personnel engaging in the work described. The industry itself has long used the term engineer to describe broadcast operating, maintenance and technical management personnel. This practice is reinforced by the use of the term engineer in other fields, to describe those who are properly versed in the design, construction and use of engines, machines and other technical apparatus.

The SBE's tentative policy statement and Ericksen's conclusions will be discussed at the next meeting of the board of directors, to be held in conjunction with the NAB convention. A final policy statement will be completed at that meeting.

Comments on this issue should be addressed to professional licensing in care of the SBE national office, P.O. Box 20450, Indianapolis, IN 46220. Or contact Dane Ericksen, P.E., Hammett & Edison, P.O. Box 280068, San Francisco, CA 94128-0068, 415-342-5200.

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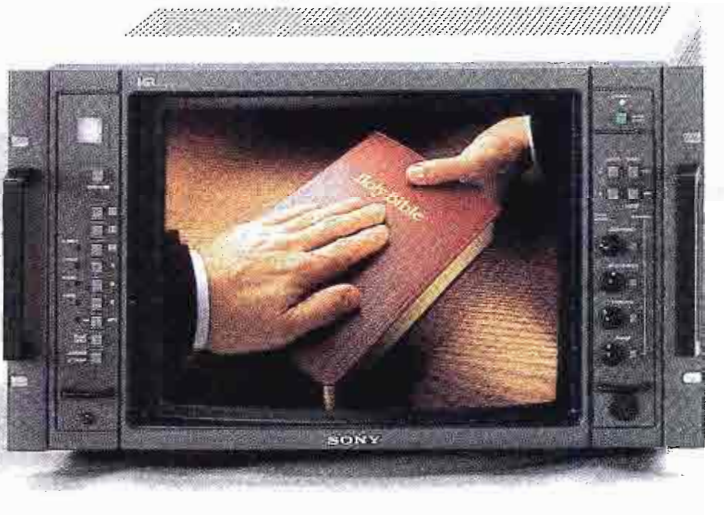

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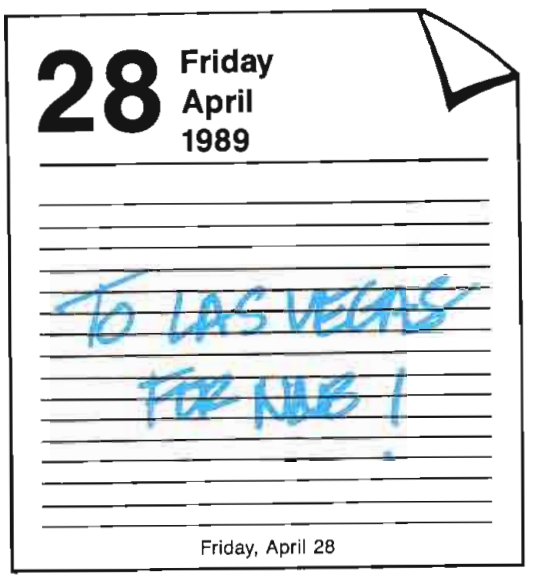
NAB Engineering Conference



The 1989 NAB Engineering Conference and Exhibition opens this month in Las Vegas, NV. As always, the show will be so big that you won't get to see everything. It's a cinch that you won't be able to make it to all the exhibits or to all the engineering sessions in the amount of time available. However, with a bit of advance planning, you can cram a lot more floor and session time into your stay.

To help you allot your time efficiently, **BE** has compiled the following condensed version of the Engineering Conference schedule. Use it to identify the sessions you want to attend. If you find that it will be impossible to make it to all the sessions you'd like to, you may want to use the old schooldays practice of borrowing notes. Ask a friend to work out a plan with you to trade session attendance. You cover one session while your friend attends another. Meet later to compare notes. Cassette tapes and the "NAB Proceedings" also will be available. These can be important tools in the effort to collect as much useful information as possible.

Radio sessions

Digital Audio and Radio Systems

Friday, April 28
8:30 a.m.-12:05 p.m.

1. "Digital Audio Interfacing Standards," Skip Pizzi, National Public Radio.
2. "Digital Audio Measurement System for System One," Dr. Richard Cabot, Audio Precision.
3. "The CD Player in the Broadcast Environment: A Proprietary Cartridge System," Hiroyuki Ukita and Laura J. Tyson, Denon America.
4. "Planning a Digital Production Studio," Frank McCoy, WGCI-AM/FM.
5. "Digital Audio for Links and Subcarriers," Harold R. Walker, Pegasus Data Systems.
6. "Completely Digital FM Broadcast System," Robert Zavrel, Digital RF Solutions.
7. "New Digital Sound Broadcasting Modulation System for Terrestrial and Satellite Use in the 1GHz Range," Dietmar Kopitz, European Broadcasting Union.

FM Improvement

Friday, April 28
1:30 p.m.-4:40 p.m.

1. "FCC FM Regulatory/Technical Actions," James E. McNally, Mass Media Bureau, FCC.
2. "FM Stereo Separation Vs. Receiver Blend," Thomas Keller, Broadcast Technology Partners.
3. "High-Powered Synchronous FM Boosters," Martin Hadford, RF Specialties.
4. "Optimum Bandwidth for FM Transmission," Edward Anthony, Broadcast Electronics.
5. "NRSC FM Subcommittee Report," Wesley Whiddon, Group W Radio.
6. "FM Directional Antennas," John Kean, Moffett, Larson and Johnson.
7. "NTIA Irregular Terrain Propagation Study," Elden Haakinson, NTIA, Department of Commerce.

Radio Engineering

Saturday, April 29
8:45 a.m.-11:55 a.m.

1. "FCC Remote-Control Policy: An Update," James E. McNally, Mass Media Bureau, FCC.
2. "Consolidating AM and FM Transmitter Sites," Ron Nott, Cortana.
3. "Determination of the CP Gain of Sidemount CP-FM Antennas," A.R. Mahnad, Jampro Antennas.
4. "Real World Maintenance," Gary Smith, Sun Mountain Engineering.
5. "NAB Test CD," Stan Salek, NAB.
6. "Diplexing AM Antennas," Tom King, Kintronics Laboratories.
7. "Automated Maintenance Testing," Michael Callaghan, KISS-AM/FM.

AM Systems Engineering

Sunday, April 30
8:30 a.m.-11:50 a.m.

1. "Overview of FCC AM Actions," Alex D. Felker, Mass Media Bureau, FCC.
2. "Progress Report on NAB AM Improvement," Michael Rau, NAB.
3. "Low-Profile AM Antenna System," Dick Adler, Laurence Livermore Laboratories.
4. "Low-Profile Anti-Skywave Antenna," Basil F. Pinzone, Pinzone Communications Products.
5. "Alternate Production of Groundwave by Structures of Inherently Low Skywave Potential," Timothy C. Cutforth, Vir James P.C.
6. "AM Directional Antenna Tuning, New Methodology, New Tools," Edward A. Schober, Radiotechniques Engineering.
7. "AM Diplexer Design: Q-Matching Technique," Jerry M. Westberg, Westberg Consulting.
8. "The Splatter Monitor and Spectrum Analyzer — A Comparison of Field Measurements," John P. Bisset, Delta Electronics.

Radio Production and Audio Processing

Monday, May 1
1:30 p.m.-4:40 p.m.

1. "Broadcast Applications for Voice-Activated Microphones," Michael Pettersen, Shure Brothers.
2. "Acoustic Noise Measurement and Reduction Techniques for Broadcast Studio Equipment," Jeffrey H. Steinkamp, Broadcast Electronics.
3. "A Digital Dynamics Processor for FM Broadcast," Michael Morgan, Valley International.
4. "Operational Features and User-Interface Considerations of a RAM-Based Digital Audio Workstation," Christopher Moore and Jeffrey Stanton, AKG Acoustics, digital products division.
5. "Analog Vs. Digital Technology in Audio Processing, Where to Draw the Line," Chuck Adams, CRL.
6. "Audio Processing for NRSC," James Wood, Inovonics.
7. "Digital Audiotape in the Broadcast Environment," Robert R. Weirather, Harris Broadcast Division.

TV sessions

TV Automation

Friday, April 28
9 a.m.-12:10 p.m.

Continued on page 30

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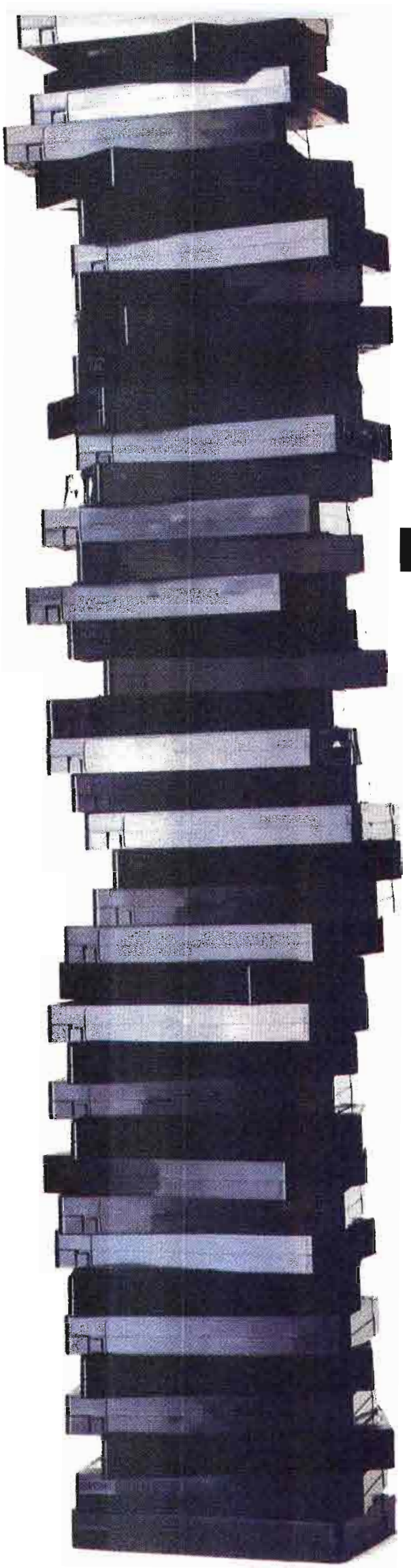

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Continued from page 26

1. "Multiplicity of Videotape and Satellite Delivery Formats," Harold E. Protter and James Hall, WVTW/Gaylord Broadcasting.
2. "The ALS Automated Library System," Edward H. Herlihy, La Kart.
3. "Design, Construction and Implementation of a Three-Camera Studio Remote-Control System," Richard Slenker, WPIX-TV.
4. "Interfacing Newsroom Automation and Station Automation Systems," Tyler North, Dynatech Newstar.
5. "UTECS — A Unified System for Remotely Controlling Television Analog Functions," Merv Graham, Graham-Patten Systems.
6. "The Mouse: A New Approach to Character Generator User Interface," Carl Ketcham, Quanta.
7. "Increased Versatility for the ESbus," Paul H. Jarrett, BBC.

Graphics and Animation
Friday, April 28
1:30 p.m.-5:05 p.m.

1. "Future Directions of Computer Graphics for the Broadcaster," Susan Crouse-Kemp, Broadcast Television Systems.
2. "Distributed Anti-Aliasing Through the Use of Pipeline Architecture in Graphic Systems," Jim Wobermin and Ken Fuhrman, Ampex.
3. "The NBC Olympic Graphics," Steve Bonica, NBC.
4. "Animation and the Broadcaster," Robert Brandel, NBC.
5. "Issues in Electronic Graphic Interface to Newsroom Computers," Steve Davis, WPQI-TV.
6. "Film-Style Creativity and Digital Power in Video Animation," Bill Ailke, Quantel.
7. "New Trends in Weather Graphic Images and Hardware," Dr. Joel Myers, Accu-Weather.
8. "High-Resolution Computer Scan Conversion," Yasushi Yamashita, Yamashita Engineering Manufacture.

Cable TV Systems
Friday, April 28
1:30 p.m.-3 p.m.

1. "Improving Relations Between Cable and Broadcasters," Wendell Bailey, National Cable Television Association.
2. "Cable Television System Architecture and Interface Requirements," Robert Luff, Jones Intercable.
3. "Better Receiver Antenna Systems = Improved CATV Signal Quality," Ellis Feinstein, Scala Electronic.

TV Audio
Friday, April 28
3 p.m.-4:45 p.m.

1. "Work of the BTSC Modulation Monitoring Committee," Randall Hoffner, NBC.
2. "A New Approach to Television and Film Post-Production Audio," Anthony H. Langley, Rupert Neve.
3. "Group Delay Correction for Improving TV Stereo Performance," R.J. Plonka, Harris Broadcast Division.
4. "How to Acoustically Upgrade for Stereo Television," Dr. Peter D'Antonio, RPG Diffusor Systems.

TV Engineering and New Technology
Saturday, April 29
8:20 a.m.-11:55 a.m.

1. "The V-LAN Universal Control Network," William Stickney, Videomedia.
2. "Managing Routing Switcher Growth in a Multiformat World," Dan Mazur, Di-Tech.
3. "Digital Video: Converting Between Digital Standards," Paul Salazar, Ampex.
4. "S-VHS Signal Processing in Time Base Correctors," David E. Acker, For-A.
5. "Interfacing the Tektronix VM700 Video Measurement Set to the Real World," Eric Small, Modulation Sciences.
6. "Recent Developments in Solid-State TV Transmitters," P.C. Turner, Larca Communications Equipment, and Jim Wilson, LDL Communications.
7. "Multichannel RS-250B Short-Haul Video Transmission on Fiber-Optic Systems," Corine Sharp, Catel.
8. "The PBS Technical Evaluation Process," John Prager, Public Broadcasting Service.

UHF Transmission Systems
Sunday, April 30
9 a.m.-12:10 p.m.

1. "Three-Tube Switchless Combiner," Bill DeCormier, Dielectric Communications.
2. "An Improved Circular Waveguide for UHF-TV," Edward Ostertag, Andrew.
3. "Klystrode-Equipped UHF-TV Transmitters — Report on the Initial Full-Service Station Installations," N.W. Ostroff, R.C. Kiesel, A.H. Whiteside and A. See, Comark.
4. "Giving a Renewed Life to an Old UHF Transmitter," David Folsom, WQTV-TV.
5. "I.F. Diplexed Tetrodes Vs. Multiplexed Klystrons/Klystrodes," David A. White, Acrodyne.
6. "High-Power Isolators for Television," E. Pivit, ANT Communications, and Thomas J. Vaughan, Micro Communications.
7. "A 60kW UHF-TV MSDC Klystron Transmitter," Earl McCune and John Wills, Varian Associates.

HDTV Production
Sunday, April 30
1:30 p.m.-4:40 p.m.

1. "Lighting for HDTV," Laural Maurel, LTM Corporation of America.
2. "Harp-High Sensitivity, Hand-Held, HDTV Camera," Fumio Okano, Junji Kumada, Tohru Mochizuki, NHK Science and Technical Research Laboratories.
3. "Post-Production of the CBS Movie of the Week," Rupert Stow, CBS.
4. "HDTV Transcoding, A Versatile Standards Converter," Barry Flannaghan and Roderick Snell, Snell and Wilcox Electronic Consultant.
5. "HDTV Camera Lens Requirements," Joseph A. Martinez, Angenieux Corporation of America.
6. "HDTV Production Systems," Laurence Thorpe, Sony Advanced Systems.
7. "Multistandard HDTV Signal Generation," John L. Judge, Magni Systems.

Advanced TV I
Monday, May 1
8:45 a.m.-12:20 p.m.

1. "FCC Advanced Television Service Advisory Committee Report," Richard Wiley, Wiley, Rein & Fielding.
2. "Development of a Test Facility for Advanced Television Systems," Charles W. Rhodes, Advanced Television Test Center.
3. "Development of a Cable Test Facility for Advanced Television Systems," Walter Ciciora, American Television and Communications.
4. "Conducting Propagation Tests for Advanced Television Systems," Edmund A. Williams, ATTC.
5. "The Cost of Conversion to HDTV," Robert Ross, WJZ-TV.
6. "Zenith's Spectrum-Compatible High-Definition Television System," Wayne C. Luplow, Zenith Electronics.
7. "Advanced Compatible Television — An Update," James E. Carnes, David Sarnoff Research Center.
8. "The Use of Genesys Technology for HDTV," Richard C. Gerdes, Production Services.

Advanced TV II
Monday, May 1
1:30 p.m.-4:40 p.m.

1. "NTSC-Compatible MUSE — 6/9 System," Taiji Nishizawa, NHK Science and Technical Research Laboratories.
2. "Super NTSC: An ATV Proposal," Yves C. Faroudja, Faroudja Research Enterprises.
3. "Title unannounced," William Glenn, New York Institute of Technology.
4. "Compatible Introduction of HDTV in North America," Mikhael Tsinberg, North American Philips.
5. "Extended-Definition Television," Nobuo Katsura, NTV International.
6. "A Status Report on HD-NTSC: Compatible HDTV in a Single Channel," Richard J. Iredale, The Del Rey Group.
7. "NTSC-Compatible Cross-Color and Chroma-Crawl-Free Broadcasting," Denes Ilkovics, High Resolution Sciences.

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...ther sessions

...tional Development

Sunday, April 30
9 a.m.-noon

1. "Engineering Management into the '90s," Sim A. Kolliner, WHIO-TV.
2. "Management Made Simple," Judith E.A. Sheets, Calumet Group.

Computers for Broadcast Engineers

Sunday, April 30
1:30 p.m.-5 p.m.

1. "Title unannounced," NBC paper.
2. "Applications of High-Speed Local Area Networks in the Broadcast Environment," Donald Edvalson, Broadcast Television Systems.
3. "Technical Documentation and the Personal Computer," Dr. Walter Black, Video Design Pro.
4. "Modem Communications: The Use of On-Line Services for the Broadcast Profession," William Tullis, Turner Broadcast System.
5. "In the Vast Wastelands," Chuck Forsberg, Software Developer.
6. "Title unannounced," John Hoffman, New York Management Services, On-Line Communications Division.

...paring for an FCC Technical
...ection

...ay, May 1
...m.-9:40 a.m.

...liance in a Deregulated Environ-
...William McAllison, Radio
...nt/Systems.

...Auxiliary & Satellite

...p.m.

...ncy-Coordination Prob-
...Political Conventions,"
...Overview," Frank D.
...twork Distribution
...ent and Future,"
...mote Pickups."
...ons for Satellite
...le Resources.

...vironmen-

3. "New Tower Structural Standards ANSI/EIA-222D," Ramon D. Upsahl, Skilling Ward Magnusson Barkshire.
4. "Guidelines for Vibration Control of Tower Guy Cables," A.S. Richardson, Research Consulting Associates.
5. "At the Empire State Building Fire," Joseph J. Giardina, PSA Communications.
6. "Electromagnetic Interference to Aviation Receivers — FAA Considerations in the Broadcast Site Selection Process," William P. Suffa, Jules Cohen and Associates.
7. "Dealing with RF Interference Complaints," David M. Marcis, Friendly Broadcasting Company.

New Communications Technology

Tuesday, May 2
8:30 a.m.-12:05 p.m.

1. "The AT&E Receptor System Subcarrier Modulator," Mark R. Gehrin, AT&E Laboratories.
2. "A Distributed Architecture for a Reliable Solid-State VHF Television Transmitter Series," Robert R. Weirather, Harris Broadcast Division.
3. "Digital Fiber Optics for Broadcast Television and Radio Transmission," Ken Regnier, COMLUX.
4. "Design of Analog Fiber-Optic Protection for Video Transmission Systems," Edward B. Olson, Group W Satellite Communications.
5. "Advanced RF System Measurement Techniques," James T. Stenberg and Walter Pries, Micro Communications.
6. "The Broadcasters' Need for Packet Radio," Richard Rudman, KFWB radio.
7. "Eight-City R53 Digital Video Trial — Progress and Networking Features," Robert J. Blackburn, Bell Communications Research.
8. "ISDN," Howard Sherry, Bellcore.

Evening workshops

Acoustics

Sunday, April 30
7 p.m.-8:30 p.m.

1. Dr. Peter D'Antonio, panel moderator, RPG Diffusor Systems.
2. David R. Schwind, Charles M. Salter Associates.
3. William A. McVey Jr., PSA Consulting Engineers.
4. Eric Neil Angevine, Oklahoma State University.

Contract Engineers

Sunday, April 30
7 p.m.-8:30 p.m.

1. James Loupas, panel moderator, James Loupas and Associates.
2. James Stanley, What company?
3. Barry Victor, The Victor Group.
4. Larry Waggoner, broadcast technical consultant.

AM Antenna Systems

Sunday, April 30
7 p.m.-8:30 p.m.

1. Benjamin F. Dawson, moderator, Hatford and Dawson.
2. Thomas King, Kintronic Laboratories.
3. Joseph Mauk, KMJ-AM.
4. Thomas G. Osenkowsky, WLAD radio.

Engineering luncheon

At the 1989 engineering luncheon, which will be held in the Las Vegas Hilton on Saturday, April 29, NAB will present the Engineering Achievement Award to William Connolly, president and CEO of Sony Advanced Systems. Connolly is considered to be one of the major contributors to broadcast technology and will be honored for his many years of work in the industry.

The luncheon speaker will be noted writer and lecturer, Len Feldman. Feldman is an engineer who has been active in the field of high-fidelity audio for more than 35 years. He is an authority in the field of consumer electronics and continues to serve as a consultant to the Electronic Industry Association (EIA). Feldman will offer his views on the technical issues of today and tomorrow.

RF Radiation Regulation Compliance

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Preparing for an FCC Technical Inspection
Monday, May 1
8:45 a.m.-9:40 a.m.

1. "Compliance in a Deregulated Environment," William McAllison, Radio Management/Systems.

Broadcast Auxiliary & Satellite Systems
Monday, May 1
10:05 a.m.-12:10 p.m.

1. "Solving Frequency-Coordination Problems at the 1988 Political Conventions," Louis Libin, NBC.
2. "HPA Technology Overview," Frank D. Morgan, MCL.
3. "CBS Television Network Distribution by Satellite: Past, Present and Future," Richard Streeter, CBS.
4. "Narrow Deviation Remote Pickups."
5. "Operational Considerations for Satellite News Gathering," New Cable Resources.

Safety Interference and Environmental Concerns
Monday, May 1
1:30 p.m.-4:40 p.m.

1. "Broadcaster Environmental Concerns," Warren P. Happel, Scripps-Howard Broadcasting Company.
2. "Personal Safety Considerations with Broadcast Transmitters," Mukunda B. Shrestha, Broadcast Electronics.
3. "New Tower Structural Standards ANSI/EIA-222D," Ramon D. Upsahl, Skilling Ward Magnusson Barkshire.
4. "Guidelines for Vibration Control of Tower Guy Cables," A.S. Richardson, Research Consulting Associates.
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RF Radiation Regulation Compliance
Sunday, April 30
7 p.m.-8:30 p.m.

1. Jules Cohen, panel moderator, Jules Cohen and Associates.
2. Dane Erickson, Hammett & Edison.
3. Richard A. Tell, Richard Tell Associates.
4. Barry Umansky, NAB.

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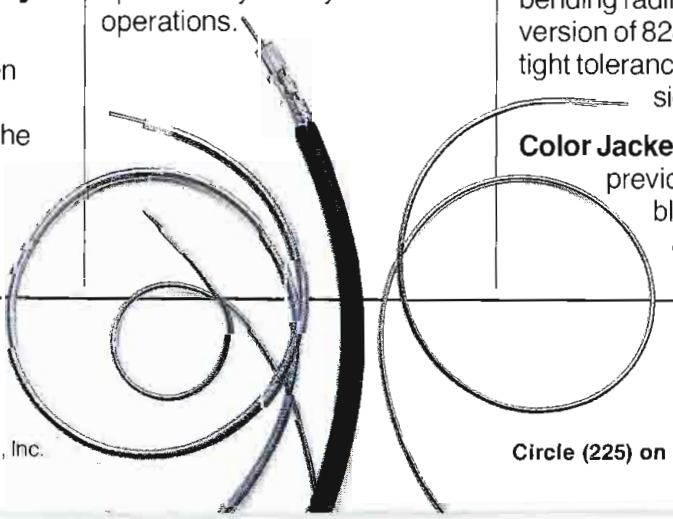


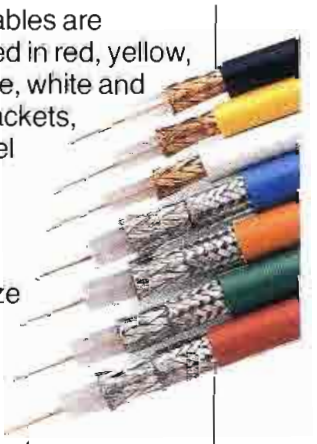
The broadcast industry knows that Belden is accepted worldwide as the standard for reliable, top-quality cable. More importantly, broadcasters know Belden has earned this reputation by designing durability into cables, so users won't have reason to be sorry.

New ways to avoid apologizing.

Dependable Belden performance is now available in six new broadcast cables:

Conformable™ and Flexible Coax—9307, 9308 and 1168A are innovative conformable replacements for semi-rigid coax in applications calling for improved flexibility, high temperature rating or tight bending radii. 1163A, a flexible version of 8281, is designed to tight tolerances for excellent signal return loss.

Color Jacketed Coax—previously available in black only, Belden's 8241, 8281 and 1163A video cables are also now offered in red, yellow, green, light blue, white and orange outer jackets, making channel coding much easier.



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News
Continued from page 4

Varian TVT announces new MSDC transmitter

Varian TVT has introduced the VISTA series of 60kW to 240kW UHF-TV transmitters, incorporating Varian's multistage depressed-collector (MSDC) klystron. Operational test results on the series were presented at an Association of Federal Communications Consulting Engineers (AFCCE) meeting Feb. 16 in Washington, DC.

Performance tests indicate that the annual electrical costs for a 120kW UHF station, which can reach $250,000, could be cut in half with the VISTA transmitter.

The MSDC klystron is the result of a cooperative program supported by NASA, National Association of Broadcasters, Public Broadcasting System, Varian and other transmitter manufacturers.

VISTA transmitters are based on the Varian TVT range of high-efficiency transmitters in production since 1977. With the VISTA, conventional tubes have been replaced with the VKP 7990 MSDC klystron and a multivoltage power supply that is required to drive the new tube.

Bentsen joins NASA's TV development division

Thomas J. Bentsen, former director of satellite systems engineering at CBS, joins NASA as the television development division manager of advanced video system development.

Before joining NASA, Bentsen was director of engineering at WBAL-TV, Baltimore. At CBS, he was responsible for network distribution from the New York Broadcast Center to affiliate stations, and he directed the conversion of the network from terrestrial to satellite distribution.

Acrodyne patents digital TV broadcast signal

Acrodyne Industries, Blue Bell, PA, has received a patent on a new method for RF transmission of a synthesized composite TV broadcast signal.

This state-of-the-art technique employs the technology used to reproduce virtually noise-free audio on compact discs to

broadcast TV video and audio. The transmitted signal is a digital synthesis of the composite analog signal now being broadcast.

The patented method is expected to provide almost 60% from ac mains to average power transmitted without the distortion common to TV transmitters today.

By John Blau,
European correspondent

Spanish commercial TV almost reality

The Spanish government is about to give its final approval for three new private TV channels. Licenses will be announced in June, and broadcasting is expected to start within six months. The first cities to receive the new stations will be Madrid and Barcelona. In the first year, coverage will be limited to 35% of the country, increasing to 80% by 1995. The signals will be beamed by Eutelsat F1.

One company that is already out of the running for a channel is the Milan-based publishing giant Rizzoli-Corriere della Sera SpA. It made a bid to acquire 50% of Italy's TV Internazionale, but Spanish lawmakers have decided to forbid publishing companies from operating TV stations.

Sky orders more transponders aboard Astra

Murdoch's Sky Television has leased two more transponders on Astra, bringing the total to six. The fifth transponder will carry the U.S. Disney Channel, which was wooed across the Atlantic in a 100-million-pound joint venture between News International and the Walt Disney Company.

EBU adopts four standards

The European Broadcasting Union (EBU) recommended four different encryption standards for European broadcasting: Eurocrypt, which is a combination of Euromac and Anglo-Nordic specifications; the Anglo-Nordic specifications; the French CCETT specifications; and Eurocypher, the system proposed by British Satellite Broadcasting and General Instruments, based in the United States.

CNN on the move in Europe

The American news channel CNN intends to set up seven more offices around the world within the next couple of months. New offices are planned in Athens, Brussels, Geneva and Madrid to complement those in Frankfurt, London, Moscow, Paris and Rome. In Europe, CNN currently reaches 2.3 million households.

Europe 2000: What kind of television?

A European film and TV forum is to be launched this spring. This decision was reached by the advisory board of the Manchester-based European media institute following proposals by the European initiative group "Europe 2000: What Kind of Television?" Pierre Desgraupes of the advisory board hopes the forum will become the key to developing a coherent European film and TV policy.

DBS planned in U.K. for the end of year

British Satellite Broadcasting (BSB) plans to launch a direct-reception satellite by the end of this year. It is to carry three channels and use the D2-Mac norm. To attract viewers, the company plans to market low-priced flat antennas manufactured by the Scotland-based Fortel company.

New frequencies for Spanish radio

Policy-makers in Spain are in the final stages of drafting legislation for new Spanish radio frequencies. The country is to receive about 1,200 new frequencies. Presently, almost 700 VHF stations are on the Spanish airwaves.

Continued on page 288

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Whether you're choosing a monitor for its technological advantage, unique features or low price, you can own the monitor of choice: an Ikegami.

Now Ikegami has expanded its monitor line to include a state-of-the-art Auto Setup Color Monitor.

ASP-15 Auto Setup Probe.

Ikegami monitors are available in 3-Series Monochrome, 5-Series Low Cost Monochrome, 9-Series Color (In-line Gun), 10-Series Color (Delta Gun), 15-Series Color (Auto Setup) and 16-Series Color (Low Cost Professional) Models. What distinguishes Ikegami monitors from others is a commitment to research and development, and continued market analysis to meet the broadcasters' needs. The results speak for themselves. Today, Ikegami is proud of its reputation not only for the finest cameras, but the finest monitors. It's a reputation that we strive to maintain.

Consider the latest advancement in monitor technology: Auto Setup. Originally pioneered for Ikegami cameras and now available in the Ikegami 15-Series Broadcast Color Monitors.

With an optional Auto Setup Probe, the 15-Series is menu driven with data shown on the CRT. An optional Remocon Box provides for remote control operation. The CRT features a Fine Dot Pitch Shadow Mask for superior resolution, an In-line Self Converging Electron Gun, Controlled Phosphors and a Black Matrix. The 15-Series is available in 14″ and 20″ and uses a Digital Control System (DCS) to simplify monitor set up. When using the Auto Setup Probe, the following functions can be automatically set, at a reference level, and stored in less than 50 seconds: contrast, brightness, chrome, hue, RGB background and GB gain. Auto Setup is another Ikegami breakthrough.

The Ikegami 16-Series Low Cost Monitors feature an In-line Self Converging Electron Gun, a Black Matrix CRT, a Comb Filter/Trap, and front panel selectable A/B video and RGB video outputs. Specifically designed for a wide range of production and broadcast applications, the 16-Series is available in 14″ and 20″ at surprisingly low costs, making the series extremely competitive. The introduction of the 15-Series and 16-Series monitor comes as the 9-Series and 10-Series continue to enjoy enormous popularity.

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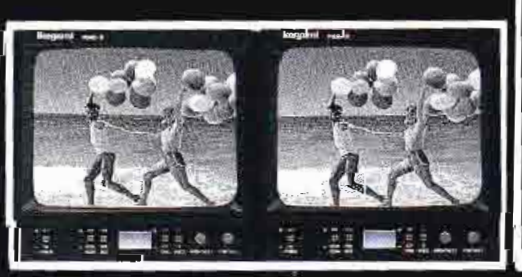

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Our Monitor Line Your Choice.

The 9-Series Broadcast Color Monitors incorporate In-line Gun technology, High Resolution Shadow Mask CRTs and American Standard Matched Phosphors. In a word, the 9-Series provides superb resolution (700 TV Lines), excellent stability, easy maintenance and low power consumption. Standard features include pulse cross; keyed back porch clamp video amplifier; preset contrast, hue, chroma, and brightness controls; on-demand degaussing; aperture correction; remote control capability and more. A 14", 20" and a 10" portable model is available.

The 10-Series Broadcast Color Monitors feature a high resolution (800 TV Lines) Delta Gun CRT, specifically developed for image quality, with nine-sector convergence controls and Feedback System (BFS) that detects and greatly reduces brightness changes due to current deviation in CRT emission. Available in 14" and 20" models, the 10-Series is remarkable for its picture quality. And this quality is equally evident in our 3H-Series Monochrome Monitors.

The 3H-Series of Professional Monochrome Monitors provides the high performance necessary for technical evaluations. 9-inch configurations are available as: bare chassis, cabinet with handle; and for 19-inch rack mounting in an 8¾-inch height for single, single with WFM, single with Vectorscope space, and dual unit uses. 14-inch configurations are for cabinet use or for 19-inch rack mounting in a 10½-inch height.

Sliding panels are featured on all color monitors.

Our monochrome monitor, the PM 9-5, is a low cost product that combines high reliability and superior picture quality. Features include: dual video inputs, pulse cross, keyed back porch clamp amplifier, and tally light. It's available for various rack-mount configurations.

Ikegami monitors fulfill your most demanding expectations, while narrowing your choice for the very best. For further information, call your Regional Ikegami Office for the dealer near you.

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Facility design special report

The construction of a major facility to meet present needs and future requirements demands detailed, long-range planning.

Key elements in the design of any audio-video production facility are flexibility and long-term reliability. Studio and master-control facilities vary considerably from one station or post-production house to the next, and from one market size to the next. However, the thread that ties them all together is the need for adaptability in design.

It is impossible to predict with any accuracy the requirements of a studio in four or five years, let alone for the next 10 to 15 years, which is the life span of a typical studio/control room complex between renovations or major improvements. Planning for future expansion and modification, therefore, is an important part of any construction project. Likewise, design must take into account the plant's maintenance requirements.

To achieve these goals, facility management must commit time and resources. Detailed planning is expensive and demands long lead times, but the result is a plant that serves the needs of the business.

The construction of an audio-video facility is a major event. It gives the design team a rare opportunity to shape the new plant to meet current needs and future goals. In this special report, we look at some of the key elements that go into facility design.

• "Designing a Post-Production Center" . . . . . page 40

Post-production work requires a state-of-the art facility that can expand to meet new demands. The design approach for a new plant may significantly affect the bottom line.

• "Building on the 'Rock'" 66

An update on the plans of NBC-TV to rebuild at 30 Rockefeller Plaza, and how the network will design the new plant to meet its current needs and future growth. It promises to be one of the largest facility construction projects in history.

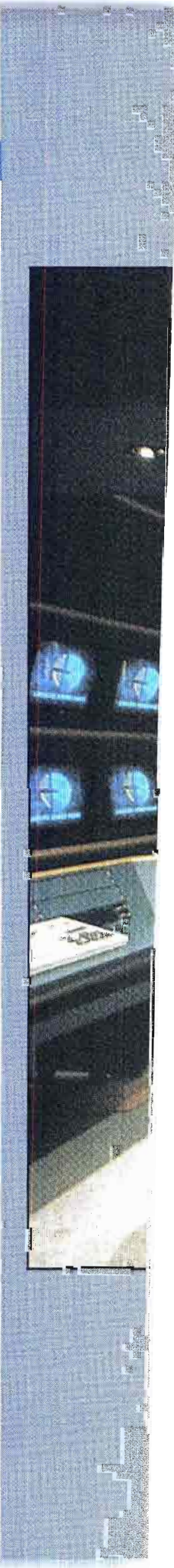
• "Acoustical Design and Monitoring Requirements" 76

How to design and construct control rooms for proper acoustics. The listening environment is a key element in proper stereo mixing.

• "Acoustical Door Design" 98

A door is a door, right? Well, not when a TV or post-production studio is concerned. A door failing to meet the necessary performance levels can compromise the productivity of a facility. This article examines some of the important items to consider when planning a new studio or rebuilding an old one.

Jerry Whitaker,
editorial director



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The main control room for the Groupe André Perry post-production center in Washington, DC. The elaborate facility, which opened about nine months ago, is a case study of the "right way" to build a high-end audio-video complex. (Photo courtesy of Groupe André Perry.)

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Designing a post-production center

By Phil Kurz

With technological changes looming on the horizon, technical managers must rely on proven facility design fundamentals.

Engineers facing a system retrofit or from-the-ground-up construction of a new video facility are in a less-than-enviable position. Quite simply, the industry is at a technological watershed. Some sort of wideband high-resolution video system is on the horizon. Meanwhile, digital videotape recorders promise to eliminate many of the problems, such as multi-generation degradation and the nuisance of working with an open reel, that post-production facilities have faced in the world of 1-inch analog recording.

Beyond digital video recording and HDTV, TV engineers must plan for the sweeping tide of automated and robotic devices as they look to plan their systems of the future.

Which way should you jump? With the price tags of many facilities in the stratosphere (the new production facility built for Gannett Broadcasting's "USA Today" news show cost in excess of $15 million), gambling on the future technological direction of the industry could be disastrous.

Although the path to the future may look cluttered, certain fundamentals exist to serve as guideposts for engineers and systems integrators concerned with the design and construction of a new video facility. Systems designers and engineers who have a clear understanding of these principles should be able to build technically sound facilities that are capable of serving the needs of today.

Kurz is a **BE** consulting editor.

The telecine room of the Groupe André Perry post-production house. (Courtesy of Groupe André.)

What's more, these guidelines should provide them with a solid foundation upon which to build the video facility of the future.

Planning your system

Whether you are responsible for building an editing bay, a film-to-tape house or an audio-sweetening facility, the success of the project hinges, to a great extent, upon the planning that goes into the project. Preliminary planning sessions should include not only the engineers and systems integrators who will put the facility together, but also key management, marketing and operations personnel.

This team approach to system design should help you put aside the personal idiosyncrasies that could affect the design of your facility. Too often, something is done a certain way simply because "we've always done it that way." Input in the planning phase from everyone on the team should strengthen your design because it will help you uncover the true mission of your facility. With a mission in mind, you can design the facility to meet your unique needs.

Before you sit down at your CAD station or put pencil to paper, you and your team of planners must analyze what your system will be used for. The easiest way to do this is to ask yourselves questions

Continued on page 44

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Continued from page 40
such as:

- What market do you intend to serve with your facility?
- Are those clients available in your market?
- What services already exist in your locale?
- How will the facility be staffed?
- What direction will this facility take when it is time to expand?

Once you have answered these questions, match your budget to your want list. This process should result in a clear understanding of what is required from the facility and what you can afford. At this point, you can begin building an equipment list. The choices of equipment will have as much to do with its technical excellence as with the demands of the market you are trying to serve.

If your equipment want list wreaks havoc with the available budget, it will be up to management to seek more financing, redefine the mission of your facility or rethink the timetable for having the ideal system completed. With proper planning, perhaps you can trim back your immediate goals and allow the facility to expand eventually into what is desired.

The next decision is whether to hire a systems integrator who will produce a turnkey facility or whether to build it yourself. You must weigh a great many factors.

First, even if your team of engineers has the technical audio and video expertise, do you have the knowledge of architecture, ergonomics and metal and woodwork necessary to produce your facility?

Second, you must determine *your true value* to the company. For instance, if your company is considering undertaking a retrofit while operations continue in other areas of the plant, will you be able to maintain the technical integrity of the daily operations as well as devote the time needed to complete the retrofit?

In the case of a new facility, you could hire the staff before operations are ready to commence. But weigh that approach against the benefit of staff involvement in the construction and the sense of pride in workmanship and maintenance that is a likely result.

Hiring a systems integrator costs money. But compare that expense with the potential loss of income caused by an overworked staff, leading to the imminent problems of deferred maintenance, downtime in existing facilities and dwindling revenues.

Whether you decide to build the facility yourself or hire a systems integrator, familiarity with the fundamentals of facility design is a must for your own protection and peace of mind.

Site surveys

Once you have determined the goal and the budget for a facility, a preliminary site survey for power integrity and radio-frequency interference can reveal problems before it is too late.

Building a post-production suite in the shadow of New York's Empire State Building or the World Trade Center might pose some serious RFI problems. A quick check of environmental RF before work begins can save you from having to take costly steps to shield the facility from it.

But don't despair if a space already is leased for your site, and it happens to be in a high-RF environment. You can take steps to reduce the likelihood of problems. Walls can be erected using MU metal or copper mesh to shield the facility from outside RFI. Unfortunately, these techniques are expensive, in terms of material and installation.

Before a site is chosen, the building's electrical power source should be checked. Although this may seem like a time-consuming extravagance to the engineer facing a tight deadline, putting

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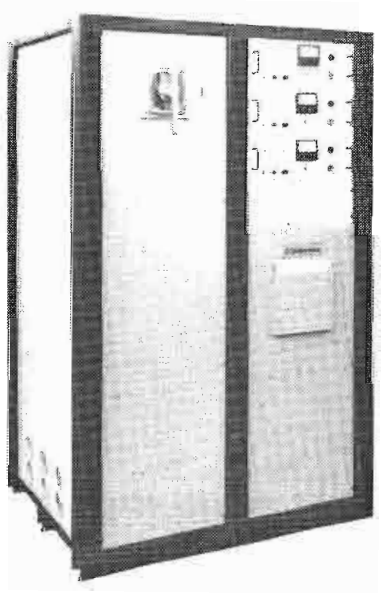

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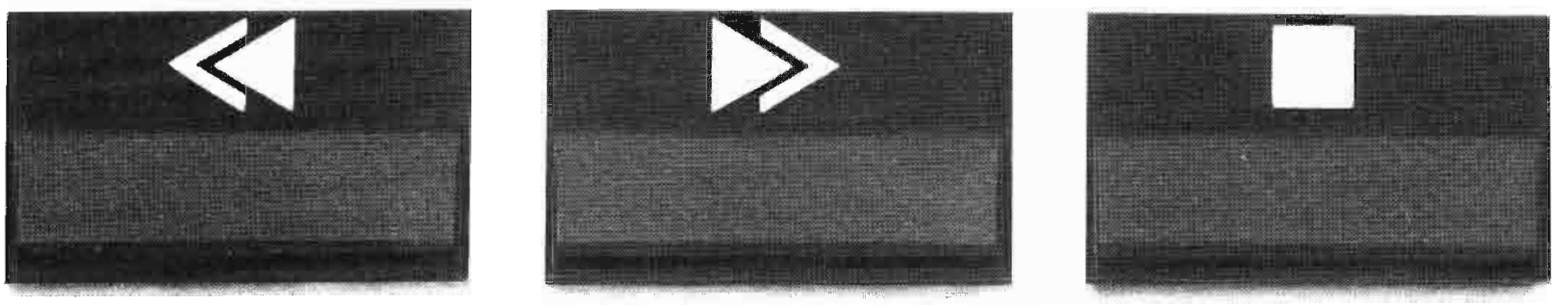

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a meter on the power supply for two weeks to a month will provide you with the information you need about power peaks, dips, transients and brownouts to provide a safe power source for costly audio and video equipment.

Once you find a site that is suitable in terms of RFI, power integrity and real estate cost, you can begin the arduous task of laying out the plant.

There are several approaches to this phase of facility planning, one of which is called the *paper doll* method. It's simple and direct. Begin with basic block shapes that correspond to all the spaces you have identified as necessary. Obviously, these will vary depending upon the facility, but those common to most facilities include a central equipment room, editing suites or bays, film-to-tape transfer rooms, audio mixing room, graphics and animation studios, green rooms and offices. Move the blocks around on a sheet of paper until the layouts fit your particular needs.

Remember to take into account the clientele you will be serving and the way in which the facility will be staffed. For instance, in a non-union shop where one person performs multiple tasks, the proximity of tape machines in a central location to editing suites is an important factor. If, on the other hand, the facility will be more fully staffed, the physical relationship of tape machines to editing bays becomes less critical.

Future growth is another point to keep in mind while going through this exercise. Successful facilities will grow, and there should be some method to the madness. Editing facilities often add film-to-tape rooms. The converse is true for film-to-tape houses. It's not unheard of for successful duplicators to double their capacity in six months. Such expansion should be planned for before the initial installation leaves the drawing board.

You have at your disposal a couple of logical strategies to plan for growth. For example, an editing facility might locate, on the periphery of its editing bays, a cluster of offices and green rooms. When growth demands that additional bays be added, these non-technical rooms can be transformed into editing bays without requiring a major retrofit to existing technical facilities.

Another strategy is to lease or buy more space than is necessary at the outset of your project. Adjacent unused space can be transformed into office space and sublet to tenants with the understanding that you may need to take over the space eventually.

In either case, you should plan to run adequate conduit, wire ways, power and air conditioning to these rooms to accommodate future transformation into technical areas. This paper doll blocking method doesn't have to include doorways, corridors and windows. An architect can draw up plans from this rough layout.

Another approach can be called, for lack of a better term, the *electronic paper doll* method. Room adjacencies can be determined through the use of a CAD system. A number of programs exist for this purpose, ranging from auto CAD to sophisticated architectural CAD programs that actually take you on an electronic 3-D walk through your facility and show you where equipment will be located from various points of view.

A less sophisticated, but comparable, approach is to build a mockup of the system to be installed. This can be as simple as laying out the floor plan (including doorways and corridors) with masking tape on the floor to an elaborate ersatz model with mockups of consoles and equipment racks.

The obvious advantage of this approach is that you will be able to walk through

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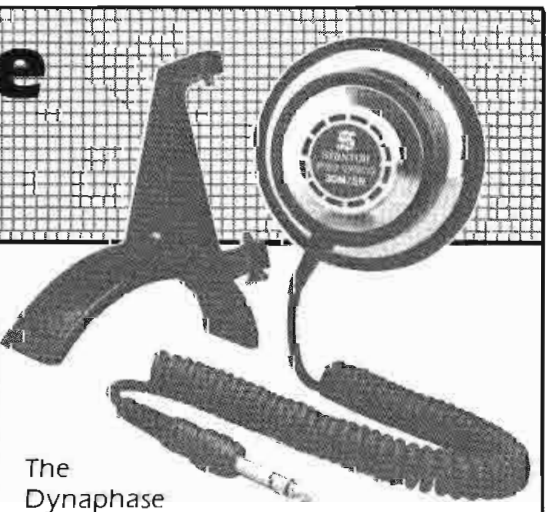

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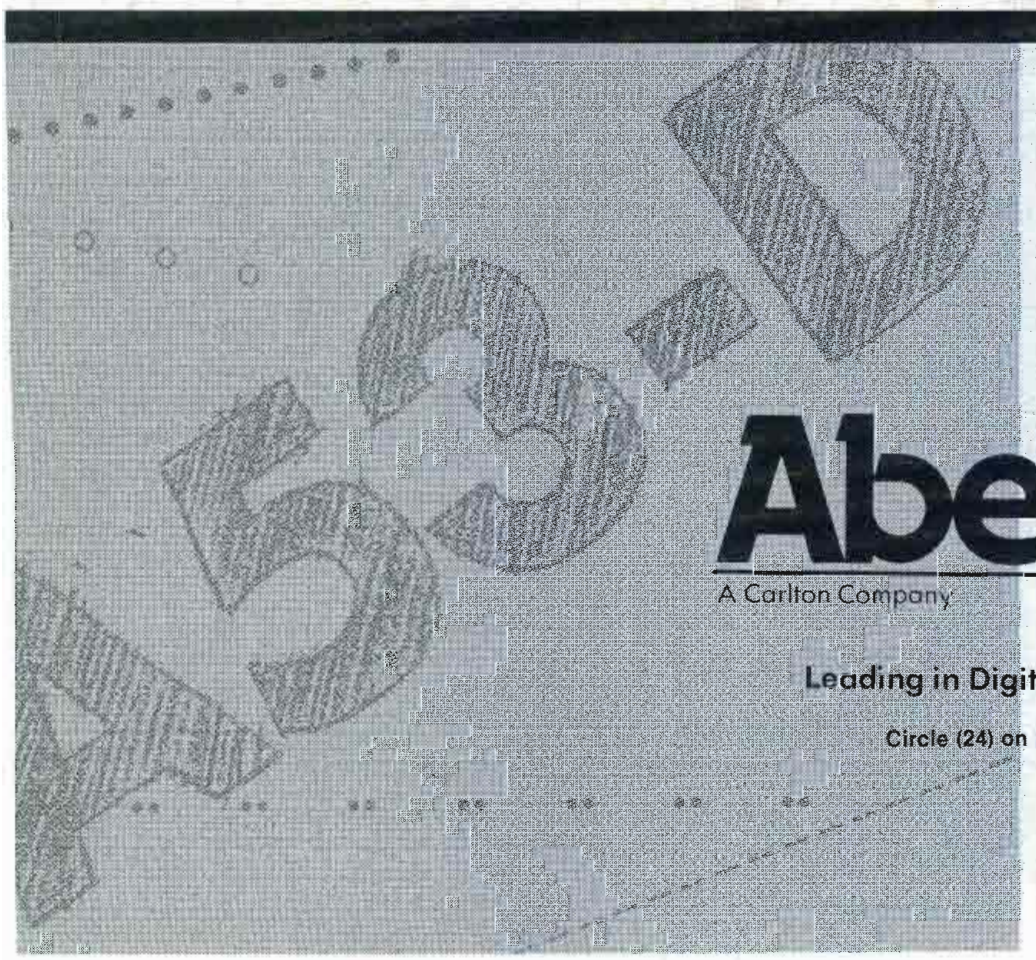

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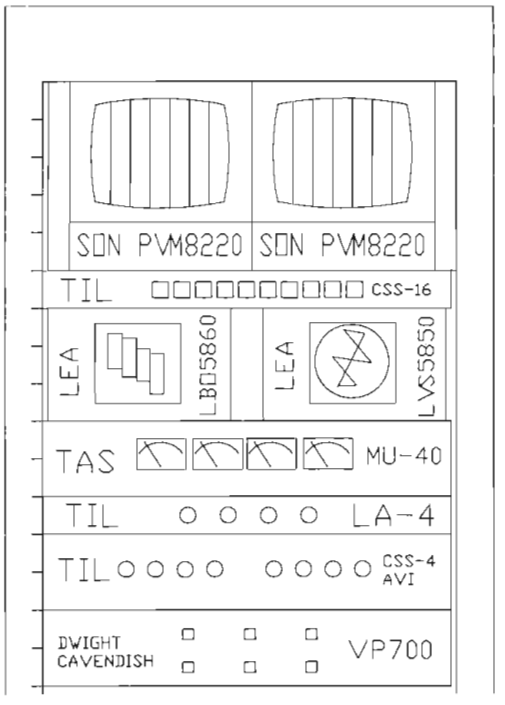

Figure 1. *Computer-aided design programs make facility layout more efficient and revisions easier. Shown is a printout from an AutoCAD system using a library of common audio and video products offering accurate scale model representations of equipment. (Courtesy of Technov Industries, Staten Island, NY.)*

the daily tasks of the facility operators. This allows you to design a system based on the way the operators do their jobs, as opposed to forcing them to mold their methods to the layout of the facility.

Power up

After you have determined your budget, equipment needs and facility layout, begin ordering equipment, racks and consoles. But before the carpenters and electricians get to work with the plans drawn up by the architect, conduct a visual survey of the electrical power source. Begin with a look at the general power source to the site, and determine whether there are any general grounding problems.

Go to the basement or sub-basement of the building. Look for a suitable ground for isolated signal grounds and technical power grounds. You can use a cold-water pipe or the steel structure of the building for this purpose. Remember, however, to keep signal, technical and house power systems separate. This isolation is especially important with respect to grounding because of the need to eliminate ground-loop problems before they begin.

You can further address this problem during the installation of racks, frames and consoles by making sure that they are isolated from electrical grounds. Devices such as hum-stop coils are available when nothing else seems to work. Also, a resistance check can be done to identify any telltale problems resulting from an inadvertent crossover from the building's grounding system. (For further information regarding facility grounding, see "Grounding Procedures for Broadcast Facilities," page 46 of the May 1988 issue.)

Armed with the information you have gathered from your month-long study of the power source to the building, you can begin planning for the facility's technical power and house current needs. If you are locating the facility in a heavily industrialized area, the power-supply survey is not likely to show that your power is clean and consistent.

Surges, brownouts and other anomalies make a power-isolation system a must. Even if your power supply seems to be clean, installing an isolation transformer for technical power may be a small price to pay for the peace of mind that your high-dollar investment in equipment is protected.

On the other hand, if you are building a small off-line bay to do cuts-only editing, you may not wish to take the time or trouble to isolate and regulate technical power.

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DESCRIPTION
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Diff. Gain: 0.1%
Diff. Phase: 0.2 deg.
Tilt & Overshoot: <1%
Hum & Noise: -60 db
Isolation: >40 db at 3.58 MC

PRICE: $400

MODEL A-44
4-Channel Audio Dist. Amplifier

DESCRIPTION
The Model A-44 Audio Distribution Amplifier consists of a Model 520 Power Supply, 4 Model 422B Audio Distribution Amplifiers mounted on a Model H-5/A Panel Chassis. The back panel has four 12-terminal barrier stripe for input-outputs. There is one electronic balanced input and four balanced outputs for each of the 4-channels.

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Again you have to weigh the benefits against the cost.

Determine how much current you will need for the facility by going back to the equipment list and totaling the wattage rating for each item. This will give you the minimum current needed to run the equipment. Add to this the current required for air conditioning, lighting, nontechnical power for reception areas and offices and future expansion. These requirements could add 50% or more to the total current necessary for the facility. Obviously, these figures are approximations, and they should be checked with an electrical contractor for compliance with local building codes.

Cool down

Visualize the facility before you build it. What do you see? Perhaps you see sophisticated electronics operating in an enclosed space with a specific number of clients and staff members performing their daily tasks.

You also should see heat: body heat and equipment heat. In the facility design, take into account the proper amount of cooling necessary for today's needs as well as tomorrow's expansion. You can take a couple of approaches to expansion. One method is to configure air conditioners in a modular fashion so that the addition of new technical space will require only that another unit be added.

A different approach involves the installation of a larger system than current demands require. In either case, be sure that you plan for the future when ducts are being installed. By doing so, you will eliminate the need to tear apart walls to redo ducts when the time comes to expand.

Although your architect or systems integrator will have a method of determining the amount of air conditioning that is needed, you too can come up with a rough estimate using an old rule of thumb:

- Multiply the amount of power that will be consumed in the technical area by 2.5, and round up the result to the next even thousand. This is the BTU size needed to cool the technical space.
- Determine how many cubic feet of space will be required for all technical rooms and for the entire facility. Subtract the cubic feet of the technical facility from the cubic-foot figure for the entire facility. Multiply this number by 2. This gives you the BTU size needed for the rest of the facility.
- Add the technical BTU need to the BTU requirement for the rest of the facility, and you have a rough idea of how big the air-conditioning system must be to cool the facility adequately.

You can use this formula to approximate how much additional air conditioning will be required for future expansion.

Besides size, other air-conditioning-related concerns involve the overall noise produced by the air conditioner and the comfort level of personnel. In general, the smaller the ducts, the greater the air velocity needed to move a given amount of air. The greater the air velocity, the greater the noise produced by the system. Therefore, the size of the ducts installed in a video or audio facility is quite important.

A typical audio room or sweetening studio will have a noise condition (NC) rating of 20. By way of comparison, a typical office will have a rating of 45 NC. If you determine that you want the noise level of the video facility to more closely approximate the conditions typical of an audio studio as opposed to an office, you can specify that silencers be installed in the ductwork to hold down ambient air-conditioner noise. A silencer is nothing more than an oversized piece of duct with a series of baffles designed to reduce the sound of rushing air. Use of oversized ducts throughout the installation is

Continued on page 54

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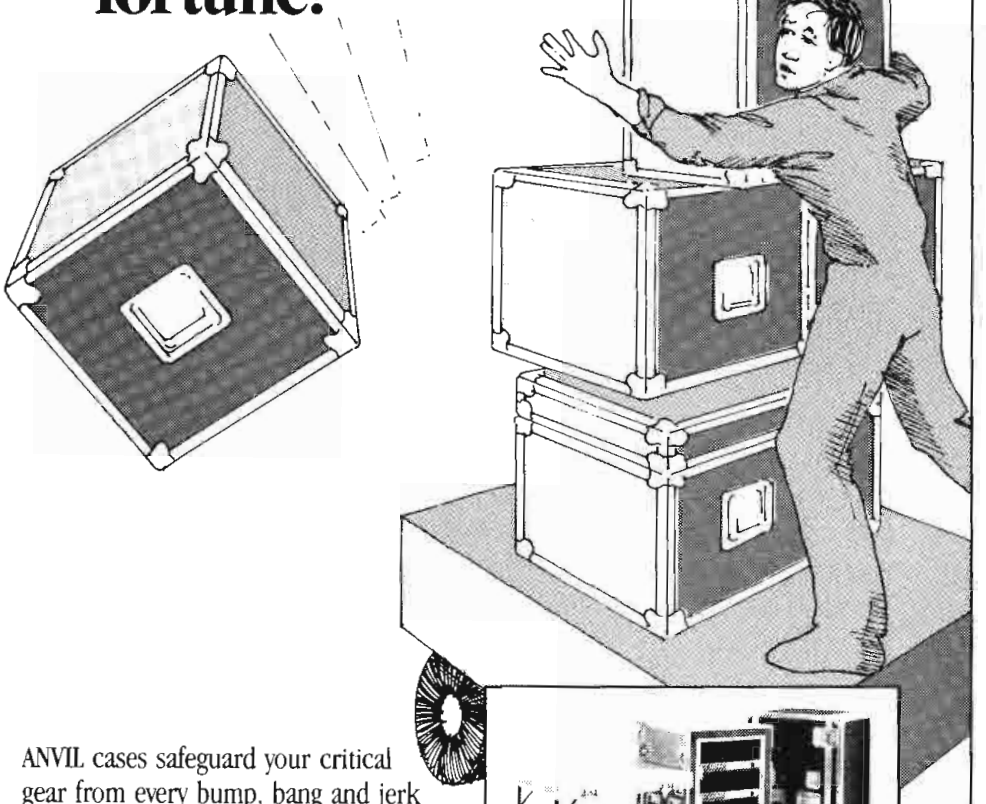

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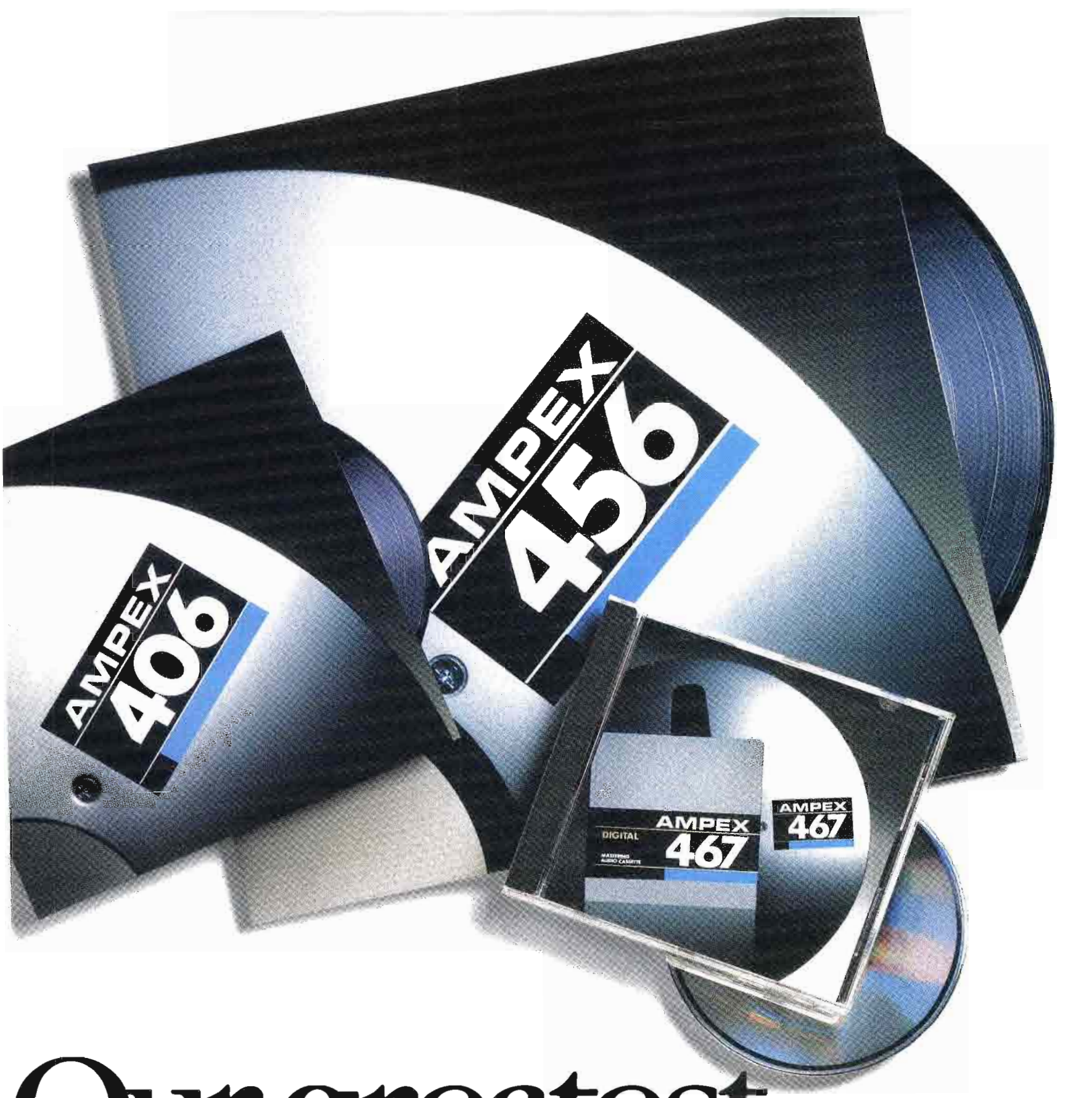

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Continued from page 50

another approach to silencing.

One last guideline about air conditioning: Be conscious of comfort. You don't want vents and cold-air returns located so that clients and staff members have cold air blowing down their backs. Ideally, an air-conditioning system puts cold air into a room, especially a central equipment room, through a floor such as a computer floor, and pulls it out through the top.

Timing and cables

The heart of any video facility is its sync, timing and cabling installation. Although the systems designer isn't confronted with much change in terms of sync and system timing, there are a few points to keep in mind when designing this aspect of your system. The price of RS-170A sync generators is dropping significantly, meaning you can get more features for your dollar. Also, the use of encoded subcarrier is eliminating many of the SC/H problems facility designers and engineers once faced.

As far as cable runs go, high-quality coaxial cable eliminates most RFI problems. However, if long parallel runs of cable carrying different types of signals are designed into the system, shield them with a metal sheath (or place them in metal conduit) to reduce the chance of crosstalk. Where cables must cross each other, make the intersection at a 90° angle to hold down crosstalk. Route video and timing signals separately through a passive switcher and into the two inputs of your waveform monitor/vectorscope.

Documentation

An invaluable part of facility design is documentation. If you need to do a retrofit to the facility some day, you don't want to play Sherlock Holmes just to find blackburst. Today's CAD systems, from MacCAD to sophisticated CAD programs designed expressly for video work, provide a tremendous resource for documentation purposes.

Obviously, the layout of the consoles and racks in any documentation manual is critical. However, it is much more important for you or your systems integrator to identify each audio, video and timing cable run. By identifying signal pathways, you prevent the headache of wading through a spaghettilike maze of coax when the time comes for expansion or modification. These drawings should be quite specific, identifying how each cable gets from one place to another. Cutaway sectional views of cable runs may be helpful.

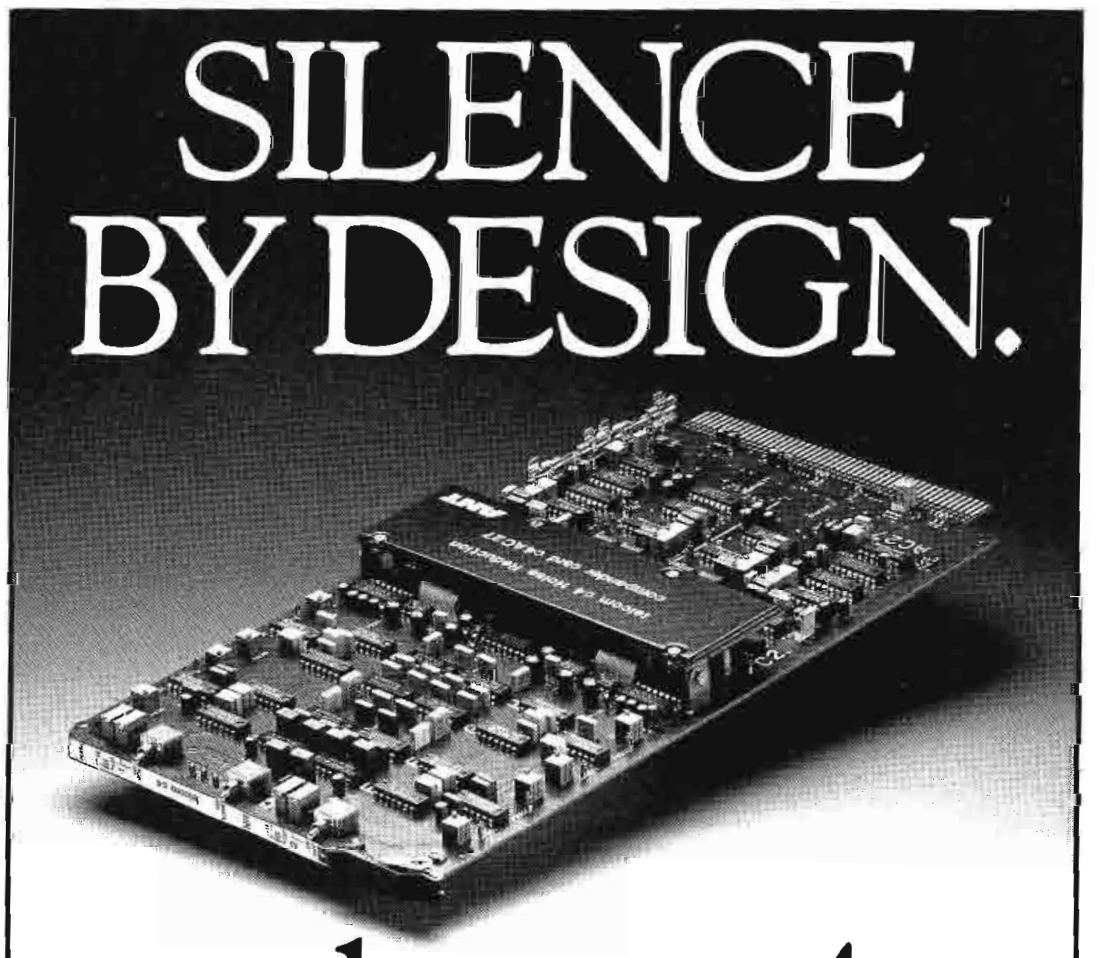
Other items to include are the architectural layout, the placement of racks and consoles (with a numbered index to equipment placement), ac power distribution (including the type, rating and location of power outlets) and cable tray drawings. Keep this system documentation up-to-date so that it doesn't lose its relevance with the addition of new equipment.

Technology trends

For any video facility to succeed in the long run, it must remain open to change in technology. This fact has never been more apparent than it is today, with the industry facing the possibility of a massive overhaul of technology.

The most obvious change is the advent of high-definition television. Already facilities must address the challenge of accommodating today's NTSC world without closing off the possibility of handling wider-bandwidth high-definition signals.

WGBH-TV in Boston successfully met that challenge. The public broadcast station's director of engineering, David McCain, began searching for a new routing system in 1985. Unwilling to in-



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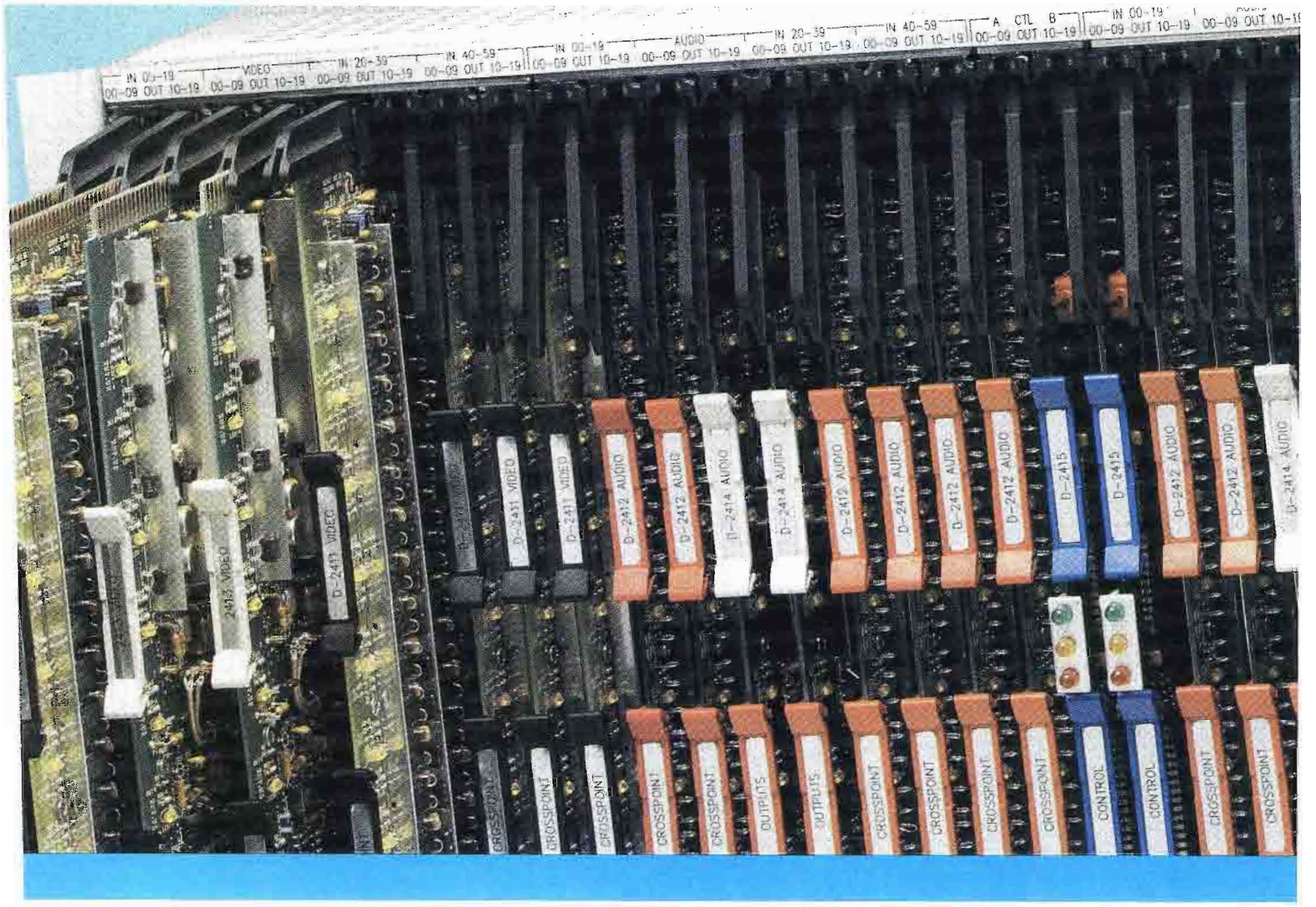

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nore the inevitable, McCain began a search for a routing switcher that would be able to handle the station's current NTSC signal routing requirements, yet have adequate bandwidth to handle whatever form of high-resolution TV system was on the horizon.

McCain settled on a 5-level 200×200 video and 80×80 audio routing switcher that delivers HDTV-compatible performance (−0.5dB at 30MHz and −3dB at 60MHz). The limiting factor of the system is the 23 miles of video cable used to interconnect the equipment. The routing switcher did not add the anticipated extra heat load because of a new FET design that draws no current unless it is active.

WGBH-TV's experience shows that, although today's needs must be met, it is not impossible to plan for the wider-bandwidth systems to come.

System monitoring is another area in which the impact of HDTV will be seen. With an aspect ratio of 5.33:3 as opposed to 4:3, the video facility of the future may require larger monitor walls. The monitor walls also may need to be placed farther away from operators for the sake of easy viewing.

More immediate problems with changing technology exist for video facility designers. The D-1 and D-2 formats provide an interesting set of problems for today's video facilities. Although D-2 composite digital VTRs are designed to be direct replacements for 1-inch type C machines, some accommodation must be made for their digital audio and digital dub capabilities if the full advantage of the D-2 is to be gained. In existing facilities, that may present quite a problem.

D-1 brings its own problems to the video facility designer. Because the system operates in the digital component arena, how does it fit into an existing composite NTSC facility? Many systems integrators are overcoming this problem by treating the D-1 format and its complement of equipment as a digital island unto itself with an analog-to-digital and digital-to-analog link to the rest of the plant.

The introduction of integrated special effects, paint, character-generation, still-store and recording systems is beginning to redefine post-production. Products are now available — aimed at the high-end user, the corporate/industrial user and everybody in between — to provide a one-box-does-all approach. Expect to see an acceleration of this trend toward incorporating multiple functions into a single system as well as a change in the way editing suites and post-production studios are designed, both from a technical and a physical point of view.

The other obvious technical trend is automation. For the broadcast engineer, the trend toward automation has become a fact of life. From remote-control transmitter links to remotely controlled cameras, automation is charting a new course for stations throughout the country.

Fade to the future

Planning a facility to incorporate these technologies brings up an array of concerns for the engineer or systems integrator who launches into a facility design. At the planning stage, the magnitude of these changes becomes apparent. From a change in staffing requirements to exotic robotics, it's not the same ballgame any more.

Acknowledgment: The author wishes to thank Tom Canavan, A.F. Associates; Nigel Redman, Technov; C. Stanley Ellington, Centro; Craig Wall, Centro; Fred Powers, Powers, Wenhardt & Associates; and David McCain, WGHB-TV, for providing information for this article.

(Related articles begin on page 60.)

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TRUTH: A lot of monitors "color" their sound. They don't deliver truly flat response. Their technology is full of compromises. Their components are from a variety of sources, and not designed to precisely integrate with each other.
CONSEQUENCES: Bad mixes. Re-mixes. Having to "trash" an entire session. Or worst of all, no mixes because clients simply don't come back.

TRUTH: JBL eliminates these consequences by achieving a new "truth" in sound: JBL's remarkable new 4400 Series. The design, size, and materials have been specifically tailored to each monitor's function. For example, the 2-way 4406 6" Monitor is ideally designed for console or close-in listening. While the 2-way 8" 4408 is ideal for broadcast applications. The 3-way 10" 4410 Monitor captures maximum spatial detail at greater listening distances. And the 3-way 12" 4412 Monitor is mounted with a tight-cluster arrangement for close-in monitoring.
CONSEQUENCES: "Universal" monitors, those not specifically designed for a precise application or environment, invariably compromise technology, with inferior sound the result.

TRUTH: JBL's 4400 Series Studio Monitors achieve a new "truth" in sound with an extended high frequency response that remains effortlessly smooth through the critical 3,000 to 20,000 Hz range. And even extends beyond audibility to 27 kHz, reducing phase shift within the audible band for a more open and natural sound. The 4400 Series' incomparable high end clarity is the result of JBL's use of pure titanium for its unique ribbed-dome tweeter and diamond surround, capable of withstanding forces surpassing a phenomenal 1000 G's.
CONSEQUENCES: When pushed hard, most tweeters simply fail. Transient detail blurs, and the material itself deforms and breaks down. Other materials can't take the stress, and crack under pressure.

TRUTH: The Frequency Dividing Network in each 4400 Series monitor allows optimum transitions between drivers in both amplitude and phase. The precisely calibrated reference controls let you adjust for personal preferences, room variations, and specific equalization.
CONSEQUENCES: When the interaction between drivers is not carefully orchestrated, the results can be edgy, indistinctive, or simply "false" sound.

TRUTH: All 4400 Studio Monitors feature JBL's exclusive Symmetrical Field Geometry magnetic structure, which dramatically reduces second harmonic distortion, and is key in producing the 4400's deep, powerful, clean bass.
CONSEQUENCES: Conventional magnetic structures utilize non-symmetrical magnetic fields, which add significantly to distortion due to a nonlinear pull on the voice coil.

TRUTH: 4400 Series monitors also feature special low diffraction grill frame designs, which reduce time delay distortion. Extra-large voice coils and ultra-rigid cast frames result in both mechanical and thermal stability under heavy professional use.
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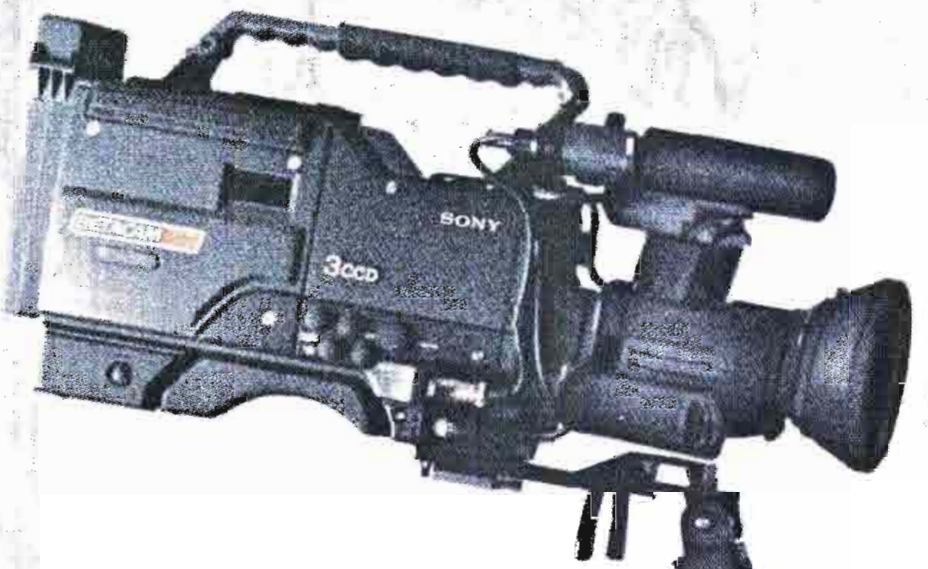

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Case study: "USA Today" production center

By Tom Canavan

When Gannett Broadcasting decided it was time to enter the world of syndicated television with a news show based on its highly successful national newspaper, "USA Today," there was one small problem. To produce the show as envisioned by the producer, the media giant needed to build what would become the country's largest component analog video facility in just six months.

Gannett chose a systems integration company (A.F. Associates) to design, coordinate and assemble the $15 million facility. The company set Sept. 12, 1988 as the target date for the show's launch, and turned the pressure gauge a few notches higher when it was decided that three practice shows had to be taped at the facility in mid-June.

To meet the broadcaster's tight deadlines, the systems integrator took a less-than-conventional approach to the problem. The tight schedule required that priorities be set so that one part of the job didn't have to wait for the completion of another. As a result, some equipment was ordered on the basis of educated guesses by Gannett. Fabrication of racks began before a final facility design was settled on, and cable was cut in anticipation of future needs. Meanwhile, workers cleared two floors in Gannett's Arlington, VA, office tower to house the facility. Work also began on three remote support facilities, in New York, Los Angeles and Chicago.

The main control room of the "USA Today" show. This room is located on the 27th floor of the Gannett tower office building in Arlington, VA. The studio is located on the seventh floor of the building.

Adding to the system's complexity was Gannett's desire to rely chiefly upon component analog video and a sophisticated video graphic network to provide the visual sizzle the show's producers were after.

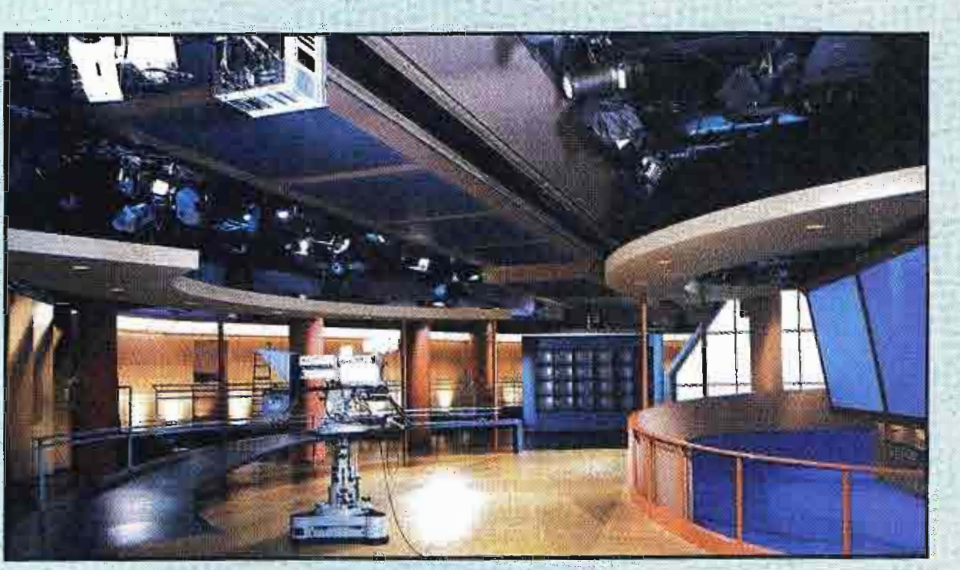
Field acquisition and editing were to be done using ½-inch (Betacam) hardware, with the exception of two 1-inch machines for periodic use. A total of 13 edit bays — five with A/B-roll editing — were designed into the home and remote facilities. Two more are now in the works.

In the studio, manually operated cameras are aided by two ceiling-mounted cameras controlled remotely via a robotic system. A 24-monitor, computerized videowall and two video projectors give the studio a distinctive look.

The "USA Today" TV studio is located on the seventh floor of the Gannett tower, and the technical facility is on the 27th floor. The main control room on the 27th floor is fed by a subcontrol room, which also feeds the video projectors and the computerized videowall.

Despite the tight timetable, all deadlines were met. The pressure was intense. Because of the complexity of the project, and the narrow time frame into which it was condensed, the threat of a major problem loomed throughout the project. Heightening the pressure was the fact that, despite the best efforts of equipment manufacturers, deliveries often were made at the last possible instant. Nevertheless, the project was completed on time, within budget and without major technical problems.

A portion of the subcontrol room showing the transmission and camera-control equipment. The video projectors and videowall also are controlled from this room.



The main studio for "USA Today: The Television Show." The set's high-resolution video projectors and a 24-monitor, computer-controlled videowall give the program a distinctive look.

The "USA Today" show facility includes 13 ½-inch editing bays (Betacam format), eight of which are cuts-only booths. Two more are planned.

Apart from the rush to get the job done in a short time frame, few shortcuts were taken. The product is one of the most advanced facilities in the world, and it is certainly the leader in electronic graphics and digital effects.

Canavan is vice president and general manager of A.F. Associates, Northvale, NJ.

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Case study: Infinity Broadcasting

By Richard Dempsey

Infinity Broadcasting recently was faced with the need to relocate its two New York City stations, WXRK-FM and WJIT-AM, and corporate headquarters. The fast-track project would come up against several difficult hurdles.

Work began with site selection. The process of choosing a site for a radio station in New York is fraught with pitfalls. A number of factors come into play, not the least of which are cost, location and appropriate floor area. Sites were inspected for suitability in terms of acoustics, ac power capacity, air conditioning and plumbing. Structural loading capacity was examined as well.

In the case of Infinity, the site-selection process led to the fourth floor of a building at Madison Avenue and 58th.

After considering several floor schemes, Infinity chose a design using a central core for the studios with offices and ancillary spaces wrapped around on all four sides. The broadcaster was concerned with keeping the identity of both stations separate. Therefore, master control was placed in the center of the rectangular central corridor with news immediately adjacent. The WXRK-FM studios were situated on one side of the master-control area and the WJIT-AM studios on the other.

Dempsey is president of Richard B. Dempsey Architects, New York.

The reception area for Infinity Broadcasting's newly completed New York AM and FM stations and corporate headquarters.

The central core was isolated from unwanted noise by single-wall acoustical partitions and low-noise buffer spaces. Carpeted floors throughout and heavy ceiling and floor slabs provide effective sound control, making *floating-floor* construction unnecessary.

The FM station broadcasts a classic rock format with music, talk, and live and telephone interviews. The AM station has a similar format, but in Spanish. The station also provides strong community-oriented programming. In both stations, the DJ on duty operates the transmitter remote-control system. There are two air studios, three production studios, two news booths, a newsroom and master-control room.

Continued on page 64

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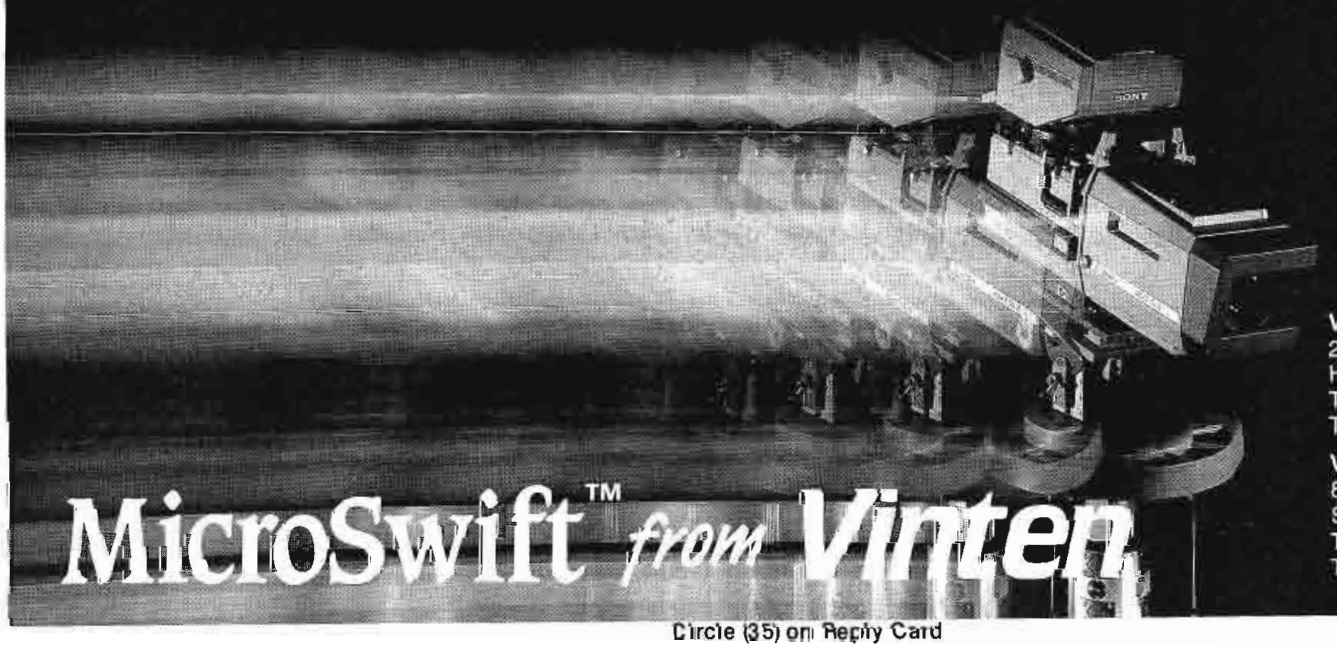

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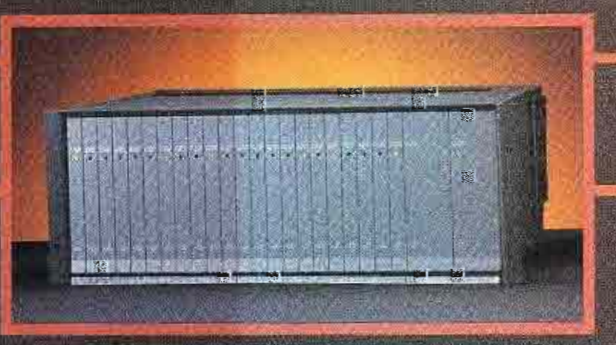

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Continued from page 62

The production studios can be used on-air if necessary. Each studio has a 4-track, 22-input console and two tape machines (except in FM production, which has a 4-track and two 2-track recorders), two turntables and two compact disc players. The consoles were selected for adaptability and ease of maintenance.

The only major acoustical problems came from the building's *wet columns* (columns containing water pipes and drains) and air-conditioning system. To overcome the wet column noise, spaces inside the columns were packed with insulation, and double gypsum board was used to further deaden any sounds. To reduce noise from the air conditioner to acceptable limits, new main distribution ductwork with turning vanes was installed. After the ducts were insulated and lined with sheet lead, a double-sheet gypsum ceiling was installed. That effectively quieted the system.

One of the Infinity Broadcasting production studios. Each is built around a 4-track, 22-input console.

As the construction deadline approached, the normal coordination problems associated with a fast-track project surfaced, together with a few unexpected glitches that required quick solutions. The result was some 11th-hour activity. Nevertheless, Infinity moved in on time, and the project finished well within budget.

Case study: WJLA-TV

Allbritton Communication's flagship TV station, WJLA-TV, wanted a showcase for its new Washington, DC, broadcast center. Following a 10-month fast-track construction project, the station now has its wish. The ABC affiliate moved into the new 86,000-square-foot broadcast complex on Dec. 16, 1988. The center includes a large on-air newsroom, studios, technical center, edit suites, control rooms and office space for 232 employees spread through 11 floors in two adjacent buildings.

The main WJLA-TV studio during construction.

Photos by Alan J. Goldstein

Exterior of the Intelsat building complex in Washington, DC, which houses WJLA-TV.

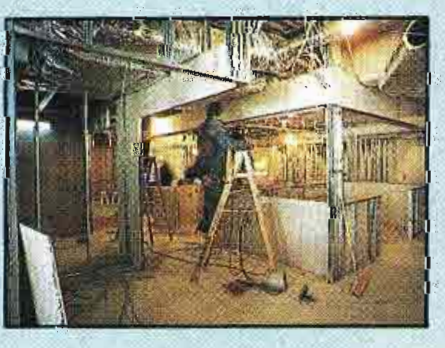
The building complex, owned by Intelsat, is part of a new construction project at the Intelsat complex on Connecticut Avenue in Washington. This afforded WJLA the opportunity to design its new TV facility from the ground up.

The control rooms and technical center are built on depressed slabs for access floors that facilitate cabling and eliminate ramps. Special lighting and HVAC were incorporated into the design. Acoustical isolation of the studios from adjacent mechanical rooms was a primary concern. A noise criteria (NC) of 25 in the studios was achieved. The use of sound-absorbing panels and additional recommendations from acoustical consultants reduced the reverberation time and improved the acoustical performance of the studio space.

Custom millwork was used throughout to house the video, audio and control equipment. Care was taken to consider ergonomics, sight lines and glare in the design of the work environments.

Wires, wires everywhere! A worker wires the audio punchdown blocks.

The WJLA-TV master-control room.



One of the edit booths during construction.

The production control room during system checkout.

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Building on the "Rock"

By C. Robert Paulson

A flexible architectural plan keeps NBC solid as a rock.

Some of us grew up in the '30s and '40s, when our "window on the world" was a huge console radio with a large tuning dial. For those of us with recollective roots in those radio decades, the letters N, B and C still have a special poignance. NBC was the pioneering radio broadcaster that brought us live entertainment, via the Red and Blue Networks, from a marvelous facility known as "30 Rock" — Radio City, 30 Rockefeller Plaza in the city, no ZIP needed. Its main entrance was, and still is, on Sixth Avenue, in spite of the fact that Mayor La Guardia later rechristened it Avenue of the Americas.

"The General" (NBC and parent Radio Corporation of America founder and guiding genius, David Sarnoff) saw a future for visual broadcasting in the early '30s, even before the planning of NBC Radio Network Headquarters. (See the related article, "The House That Radio Built.") Using the primitive progenitors of field cameras and point-to-point microwave systems developed by an RCA/NBC team, the network added pictures to sound beginning with experimental broadcasts from the 1939 New York World's Fair.

By the late 1940s the radio studios on the third through ninth floors of 30 Rock were the sources of the "picture radio" entertainment that glued us to round-tubed, black-and-white sets. We were entertained by Milton Berle on the "Texaco Star Theater" and watched Sid Caesar's "Show of Shows," "The Colgate

Paulson is director of distributive sales, Eastern region, for Artel Communications, Hudson, MA.

Comedy Hour," "Robert Montgomery Presents" and "The Lucky Strike Hit Parade." And five nights a week, John Cameron Swayze read us 15 minutes of world news.

For whom the bells tolled

The memorable sounds of 30 Rock radio included an eerie premonition. The chimes that tolled the hourly station breaks between NBC radio and TV shows were the musical notes G, E, C. Ironically, NBC's decision to extend its 55-year sojourn at 30 Rock probably wouldn't have been made if not for the 1980s takeover by General Electric Company. GEC bought the remaining framework of General Sarnoff's shaky corporate structure, then sold the NBC Radio Network.

Checkerboard moves

The vacant radio network space will make it possible for the TV network to stay in the building, rebuild its facilities and technical plant and continue to operate, causing minimal disturbance to the 3,000 or so employees to whom 30 Rock is a business home. Tentative plans call for a "checkerboard style" shifting of offices and departments to permanent or temporary homes on floors vacated by NBC radio and the disbanded Olympic Planning department. With this approach, the network can keep everyone officed during renovation.

To date, a planning staff led by Henry S. Kanegsberg, vice president of facilities and operations planning, has created an architectural master plan to guide the facility's transformation. The plan is under deliberation by NBC management.

Influential factors

Many influences apparently combined to motivate NBC to build its TV future on the Rock. Of highest import to technical systems planners is the competition that the original TV networks — and their 1,000 or so VHF/UHF station affiliates — are now facing.

Continued on page 67

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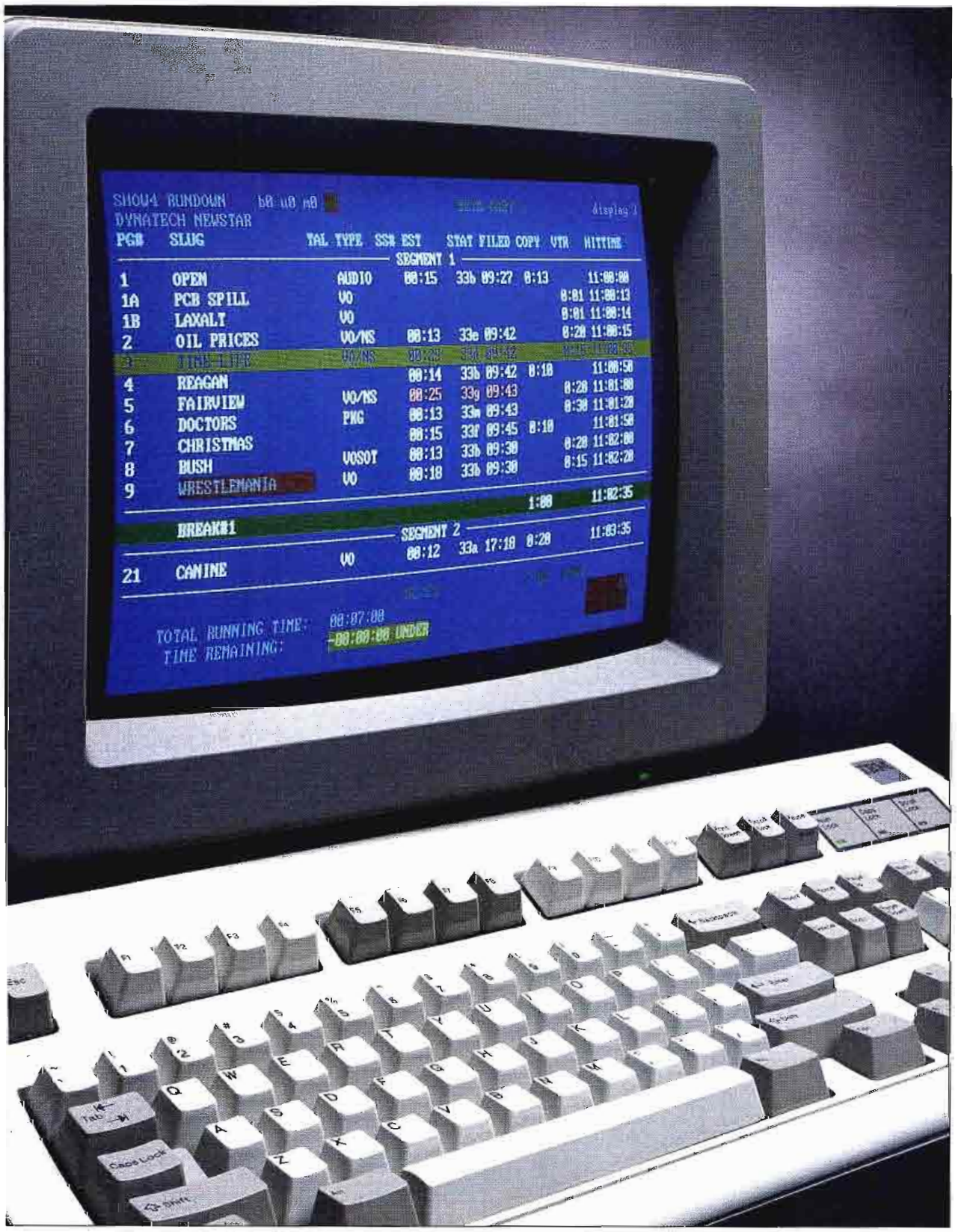

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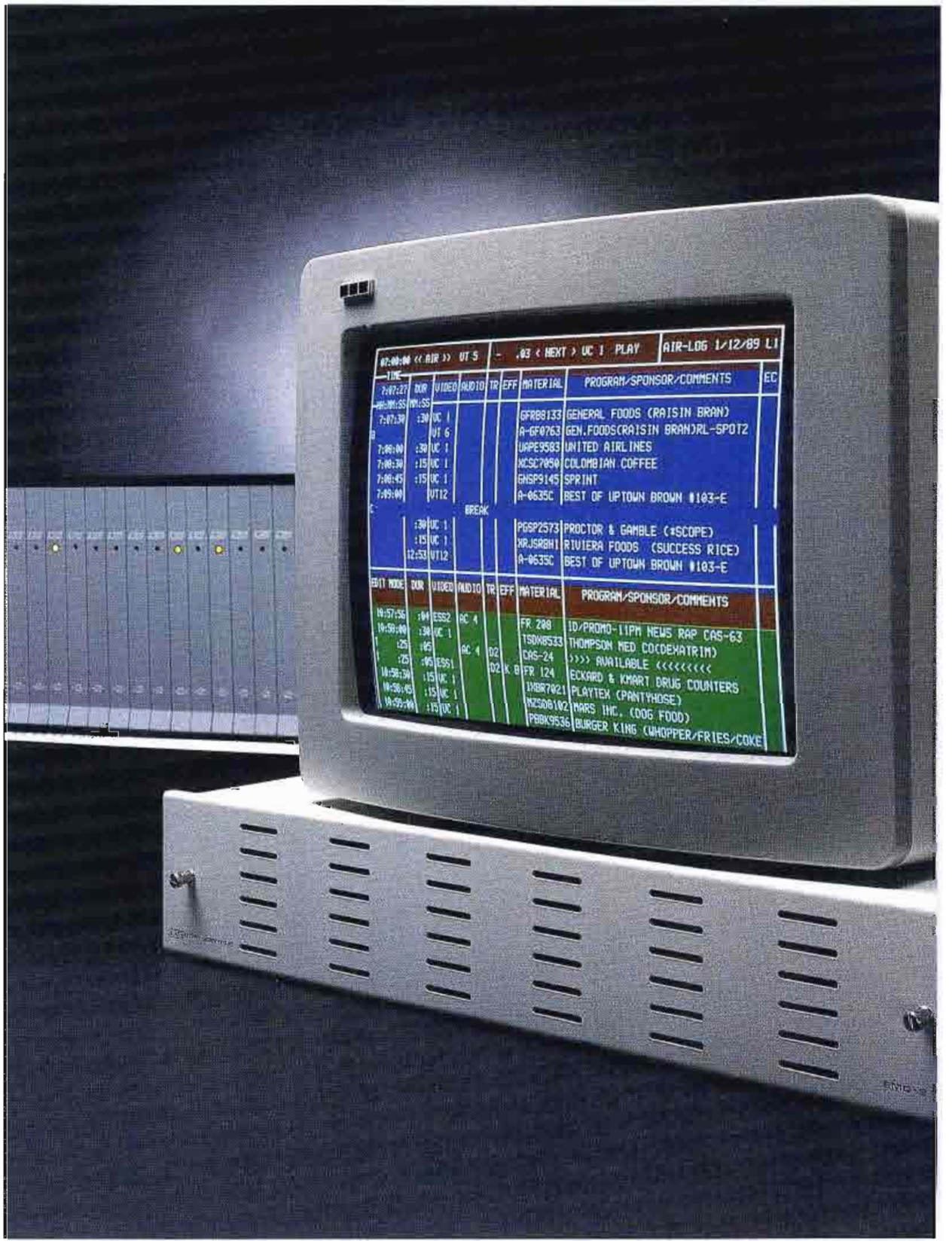

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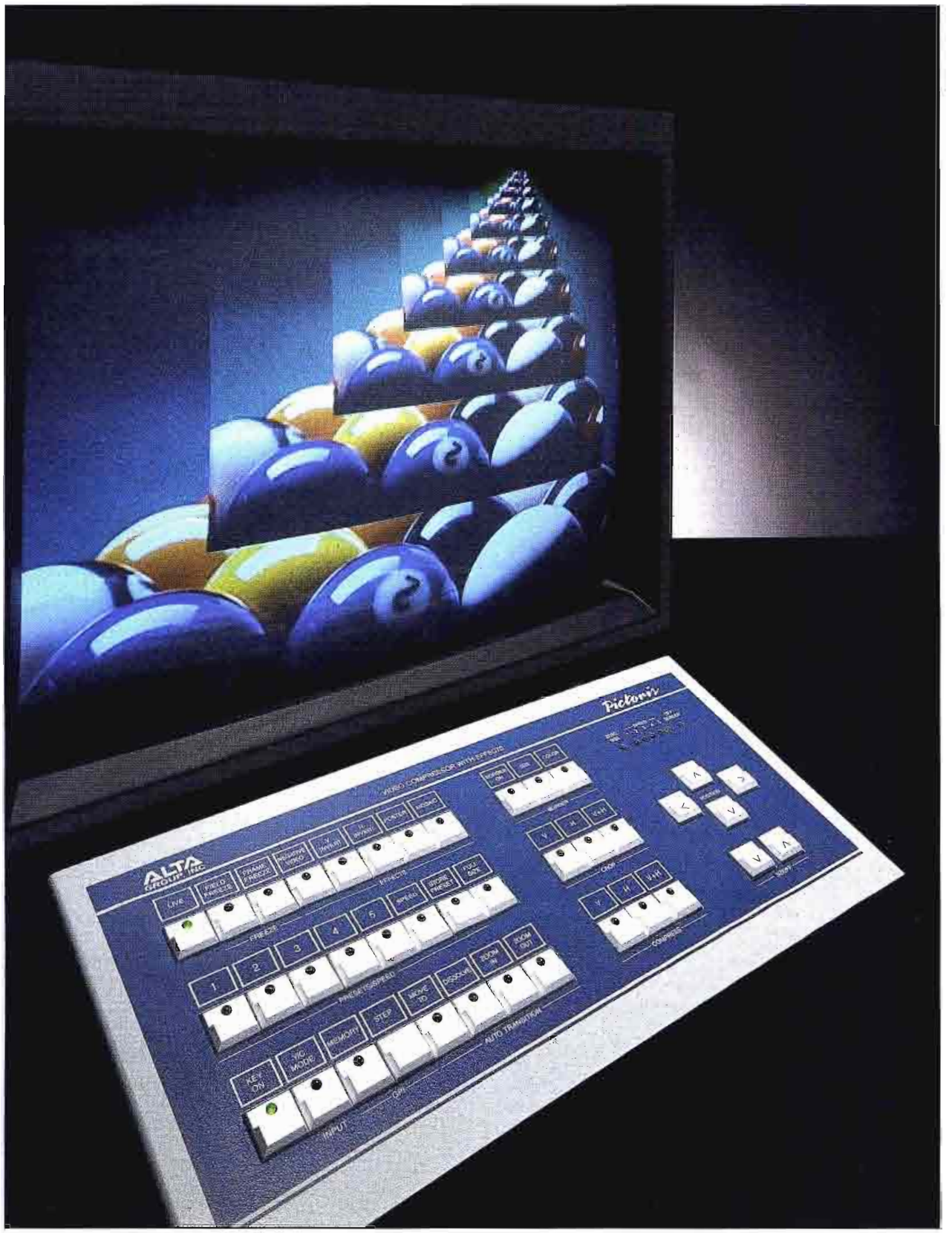

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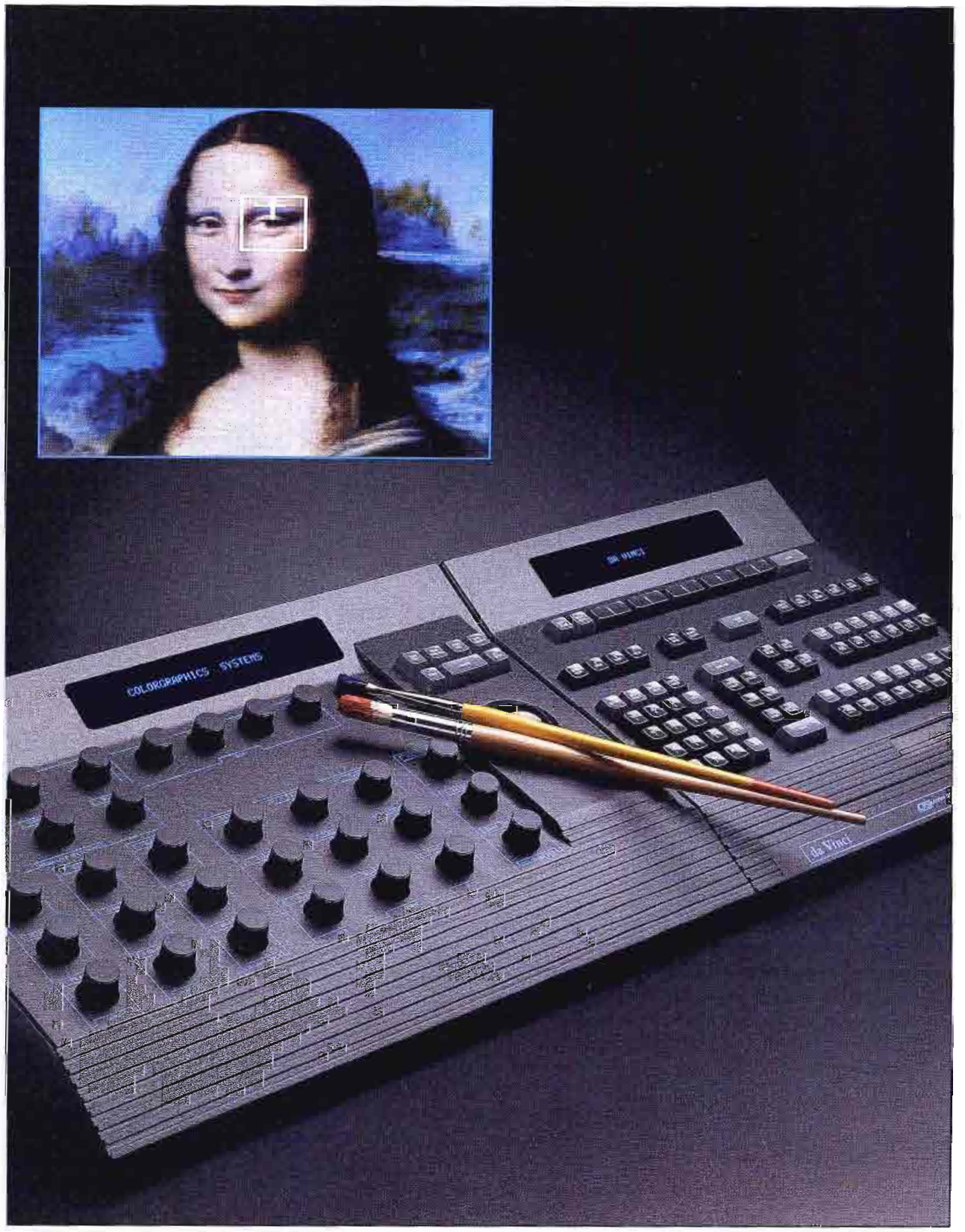

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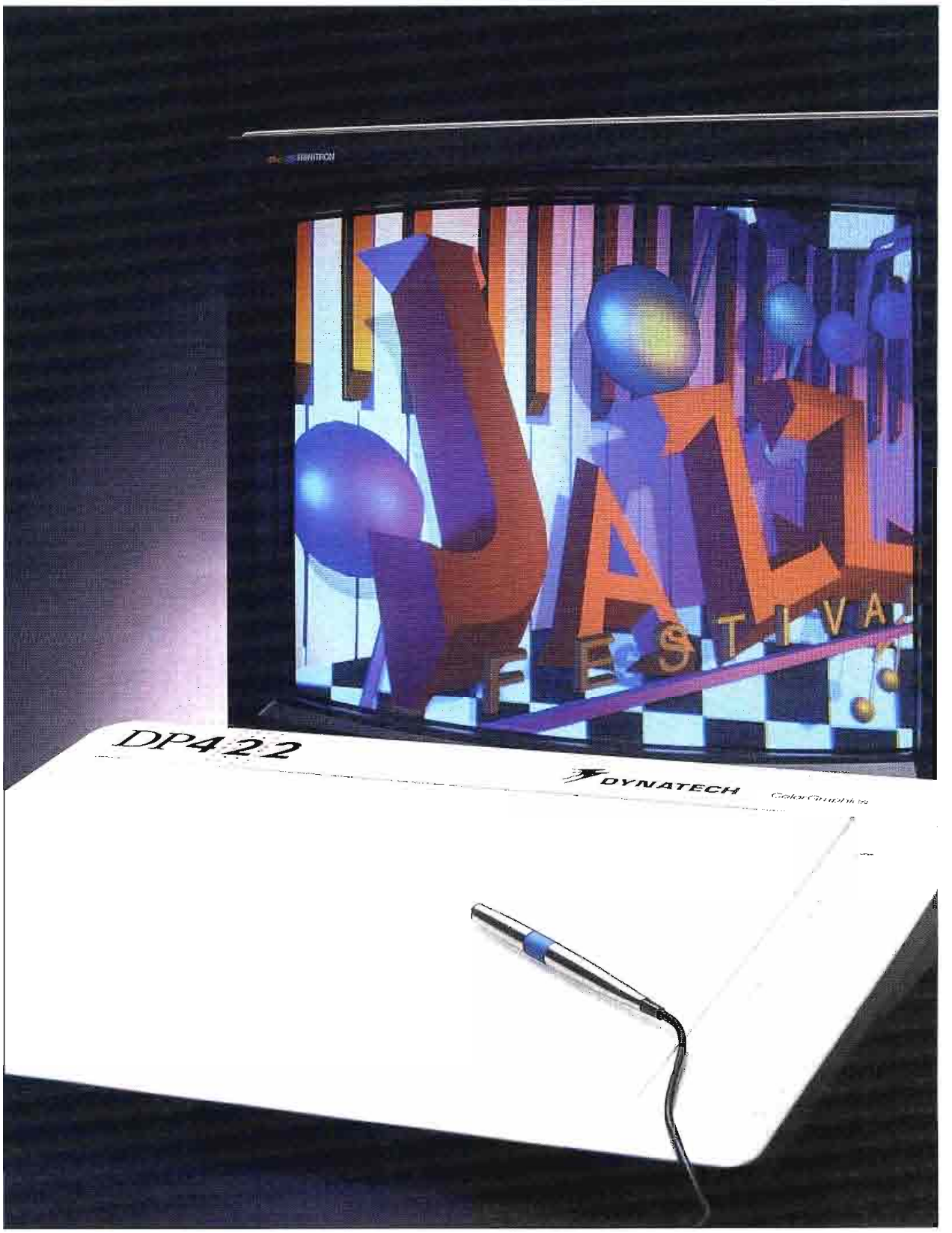

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Continued from page 66

The climate for television is changing. Each month, TV industry business trade magazines carry stories on how much the network and affiliated-station share of the viewing audience has shrunk since the previous measuring period. Home-delivered "programming" is no longer just entertainment. The audience base is splintering into segments with different needs. Prime-time viewers may be seeking specific information about business, personal finance or education. They may prefer to watch movies, which may be homemade or Hollywood-created, bought or rented, on disk or on tape. Or they may want to play video games.

In addition to the changing viewer base, there is increasing competition among the many services vying to serve those viewers. NBC's current competition includes other networks, cable systems and their specialized satellite network program distributors, over-the-air multichannel multipoint distribution system (MMDS) deliverers of the same programming, and a few over-the-air program distributors via direct broadcast satellite (DBS).

By painstakingly reading between the lines of the trade press coverage of the network's current and early 1990s plans, it is easy to envision an NBC that will change to more squarely face this competition. A glimpse into the mid-1990s might reveal a company that will be using DBS, MMDS and cable system delivery of channels to the home, in addition to its network of affiliate stations.

For the 1992 Barcelona Olympics, for instance, it has been reported that NBC-TV will deliver 160 hours of a potential 2,000 hours of programming via the network. Presumably, the remaining 1,800 hours will be styled into alternative channels for people who want to receive in-depth programming, see complete events from beginning to end and view events that are judged not attractive enough for full-network coverage or that are aimed at specific demographic sections of the audience.

Such a scenario presupposes that the network of the future will be as different from the current one as today's network is from the one formed 55 years ago. Technical systems planning requires firm answers to these hard questions:

- How, and from where, will our entertainment and news programming arrive?
- How will we be required to process and time delay these inputs before they are scheduled for retransmission?
- To whom and how and when will we be required to send them?
- How much can we afford to spend on the labor and equipment for program processing to remain competitive with our competitors — cable, DBS, telephone companies, cheap disk and tape movies and movie theaters?

NBC's architectural master plan recognizes that some answers that will be needed in the early 1990s can't be predicted with any reliability in 1989. The plan also recognizes the unpredictability of the advancing technologies on which the 1990s hardware for TV (video, audio and ancillary data) signal creation, transmission, processing, storage and distribution will be based. The architectural master plan now being evaluated, therefore, covers only the first 15 years of a planned 35-year occupancy of the 30 Rockefeller premises.

"Continuum" planning

The network's plans for its future at 30 Rock began with the premise that technological considerations couldn't be placed first. Most important to define were the space and services needs of the people who would be coming to work there over the next 15 years.

The planners acknowledged that the building's occupants had not made any dramatic or unexpected demands for new capabilities. The reason for this is presumed to be the company's investment in technical systems. Capabilities such as Ku-band satellite network program distribution and MTS stereo sound broadcasting, as well as the across-the-board adoption of the M-II videotape format, will keep some parts of the 30 Rock facility technically valid for six to nine years before upgrading or replacement will be needed.

Because there is no urgent need to revitalize the existing plant, modifications to working spaces will be continual, and the least expensive alternatives will be used whenever possible.

The plan specifically addresses the expected trends in operations automation and the operational simplicity and size of 1990s equipment. More operating functions will be possible in the same space. Automation will be substituted for current manual operations only when management is convinced it will provide the dual payoffs of revenue increases and cost reductions. The existing studios will not be added to or changed significantly.

The current practice of using outside-owned and leased facilities for shooting and editing sitcoms and soaps will not change. The M-II-based ARPS (automated record and playback system) already in use accommodates either physical or electronic delivery of this programming into 30 Rock, as well as its on-line storage, retrieval for editing and time-scheduled retrieval for routing and onward electronic transmission.

All the major TV operations groups now in the building will remain: network news, sports, the local station, post-production facilities, network operations, entertainment programming planning and management and the NBC administrative and executive staffs.

All-digital after all?

The master plan allows operations and engineering management the privilege of changing course. Commitments to any existing or promised analog or digital technologies and equipment can be dissolved as mandated by changes in market demand or by competitive pressures.

For instance, based on emerging digital technologies and their predicted capabilities and costs, NBC engineers predicted two years ago that the 1990s plant would be, essentially, all-digital. They predicted the network would commit heavily to the D-1 digital component format as the eventual successor to M-II, which had just been adopted. A technical paper described the distribution facilities within the plant as all-fiber, transporting all video, audio and data signals as packets via digital multiplexer terminals operating at a clock rate in the 2Gb/s range.

A more recent SMPTE paper abstract stated, "The organization of the technical plant will be determined by the number, variety and complexity of workstations contained within it." Workstations and computers work together over bit-serial circuits with throughputs ranging from EIA-232B at 1,200 baud to Ethernet at 10Mb/s. In a digital environment, these signals could be packets of video and audio signals, with header "address" blocks directing them to hardware destinations for further processing, interim storage or outbound transportation.

This suggests that NBC no longer considers recording on D-1 VTRs, a 3-channel parallel digital component format, to be technically viable or cost-effective. In fact, recent, undenied rumors heard in the aisles of trade shows suggest that the network's transition into digital recording will call for a digital cassette/tape-transport combination that is form-factor and interface identical to M-II.

HDTV routing?

NBC has become the most vocal champion of new HDTV formats that don't have any technical commonality with 1125/60 (now issued as ANSI/SMPTE Standard 240 M), a format that evokes admiration from the Japanese and scorn from the Europeans. None of the 1125/60 format proponents state that the initial interface signals between devices will be digital, nor are they spreading rumors about the availability of a digital high-definition VTR in the near future.

Analog bandwidth requirements for HDTV signals range from three parallel 27MHz channels for 1125/60 to a single

Continued on page 70

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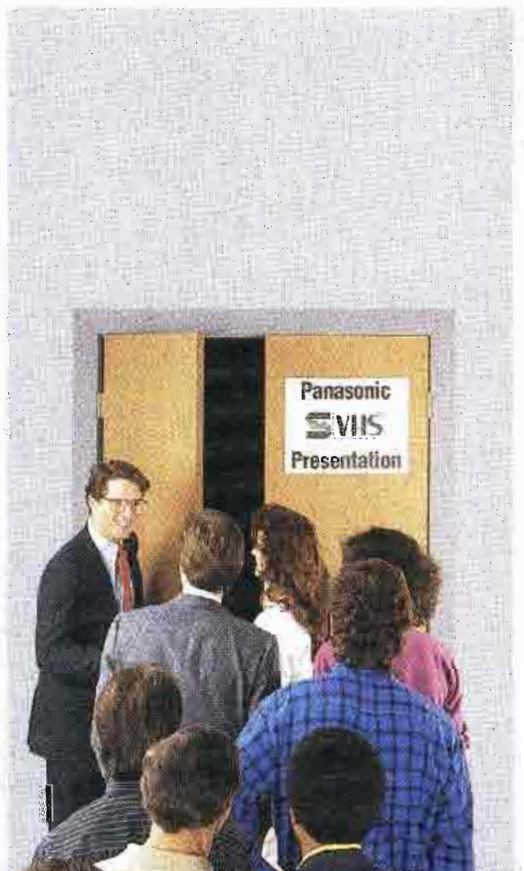

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Continued from page 67

7MHz channel for NBC's 1050/59.94 ACTV I. How would an all-digital/all-fiber transmission plant accommodate these analog signals? A 2Gb/s throughput rate could handle a serially digitized 1125/60 or 1050/59.94 signal and ancillary audio and data, but it would clog the system. Will high-speed, multiplexed, packet-switched digital circuits be NBC's panacea for mid-1990s transmission needs? Or will analog routing and recording be around as long as NTSC is the FCC's required home-delivery system?

Planning pays

The architectural plan allows for these hardware-specific questions to be raised as often as necessary. Each set of answers is well-documented as another option for hardware implementation. All options are available for consideration whenever the marketplace and the competition make it necessary to weigh the hardware capabilities and costs.

Such an approach allows the network to remain on target, but permits flexibility, so that it can react quickly to change. The plan was one of the factors supporting NBC's decision to stay on the Rock through the 2020s.

The house that radio built

NBC was created in 1926 through the acquisition of two early experimental radio stations that had been founded by Westinghouse and AT&T. The network's commercial broadcast operations began in October 1927, at 711 Fifth Ave. The facilities, then viewed as spacious, were designed by venerated chief engineer O. B. Hanson, who would later go on to design 30 Rock.

The first station, WJZ, had been established in 1921 by Westinghouse Electric and Manufacturing Company. A Newark, NJ, factory cloakroom was the original studio, equipped with a rented piano and an acoustic phonograph. After the station was purchased by RCA, the studios and transmitter were moved to Aeolian Hall in New York.

The second station, WEAF, on New York's Walker Street, was put on the air by the American Telephone and Telegraph Company, which was "anxious to study the possibilities of radio broadcasting."

In just six years, the pioneer network outgrew the Fifth Avenue quarters. On Nov. 11, 1933, NBC began network operations at 30 Rock. The 11-story building, just to the west of the 70-story RCA Building Tower, simultaneously fed two networks and the two local stations. The building contained 22 studios and five audition rooms, with associated client's rooms and observation booths, switching booths, a master control and "such other space as is requisite to the functioning of the complicated mechanism that is the modern broadcast plant." The new radio complex occupied almost 280,000 square feet.

And all this only 13 years after the birth of broadcasting in the garage-based studios of Pittsburgh's KDKA.

Hanson's vision

Hanson's master plan for radio broadcasting from 30 Rock evolved from his radio communication operations experience, which began in 1912 with his education in "wireless" at the Marconi Company (later the RCA Institute). He went to sea twice, and between voyages, he worked for Marconi's testing department. He eventually became chief engineer of the department and helped

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S/N Ratio (dB)				
Luminance (Color Mode)	57.2	51.7	52.0	49.0
Chrominance (AM)	51.8	47.5	51.4	44.5
Chrominance (PM)	44.3	40.1	43.8	35.2

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- Signal Source: Shibasoku TG-7/1
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  - Chroma: 50 IRE w/100 IRE p-p
  - Resolution: Monoscope Shibasoku 58A/1
- Noise Meter:
  - Y-S/N: 200 kHz HPF, subcarrier trap on, 4.2 MHz. LPF, weighted
  - C-S N: 100 Hz HPF, 500 kHz LPF, unweighted

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put Newark's WAAM on the air. Hanson moved to WEAF in 1922, becoming the assistant to the plant engineer. When NBC bought the station in 1926, he became the chief engineer.

Hanson's brilliance and vision in broadcast facilities design is implicit in the radio network's 55-year occupancy of 30 Rock, with the continually expanding TV network as a co-occupant since the late 1930s. His accomplishments and his career lend credence to the old saw that experience is the best teacher. His design knowledge was the amalgamation of lessons learned at sea, at Marconi, at the experimental facilities of WAAM and WEAF and, later, in the installation and operation of the network's Fifth Avenue facilities and in the Chicago Merchandise Mart.

It is particularly interesting that Hanson designed 30 Rock for both radio network broadcasting, and for what he described as "elementary visual broadcasting, or television, as it is more popularly known."

His foresight was evident. "Anticipating the advent of television," he wrote, "the entire lighting system in the studio section was designed to operate on direct current to obviate the possibility of stroboscopic interference from alternating current lighting. Five 750kW motor generator sets in the basement (have) a considerable portion of capacity intended for flood lighting, a requirement for television."

The design of a ninth floor, 4-studio group anticipated special needs for complex live radio production as well as live television. (See the floor plan.) The four 30-foot, almost-square studios were arranged around a single central control room. Hanson installed sound-insulated windows from this control room into each of the four studios. The floor of the control room was designed so that it could be converted into a turntable that revolved via an electric motor.

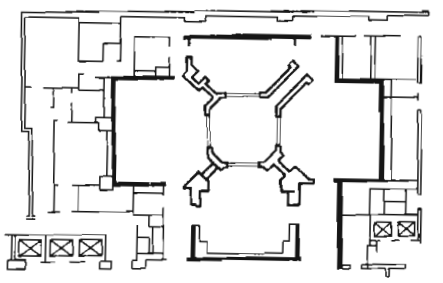
"One purpose of this studio group is to allow, in sound broadcasting, for the separation of various performers," Hanson wrote. "For example, the orchestra might be in one studio, the principal players in another and the remainder of the cast in still another. The outputs from the three studios would then be electrically combined or 'mixed.' The arrangement allows the producer a more accurate control over the 'balances' of the units involved.

"Another purpose of these studios is to allow for rapid scene shifts in television. This would be accomplished by simply revolving the control-room floor so that the scanning equipment, which would be mounted thereon, would face the desired studio," he said. (What was Hanson's 1930 vision as to the form and size of the TV camera?) "Thus, four scene changes could be effected, if necessary, within a very short time."

Centralized design

According to Hanson, "The maximum practicable degree of centralization (is needed) to simplify the problem of routine inspection and maintenance, and to facilitate the location or correction of trouble in the minimum possible time."

All the centralized switching, master control and input/output equipment was situated originally on the fifth floor, along with a power room and battery room (providing 14Vdc filament power at 250A and 400Vdc plate B voltage at 2.5A), and a main equipment room filled with 330 racks including 300 audio amplifiers. On the periphery of this floor (one of two with windows) were operating staff offices, recording rooms (for electrical transcriptions), a laboratory (specific capabilities or purposes not identified) and operating and maintenance shops.



This floor plan of 30 Rock's ninth floor shows a "cloverleaf" of studios with a common control room. This was designed for complex radio productions and early television.

Equipment installation time:	9 months
Audio cable, miscellaneous sizes:	470,000 feet
Other miscellaneous wire:	250,000 feet
Largest cable used:	1,800 conductor
Synchronous clocks (220Vac/60Hz):	275
Conduit, miscellaneous sizes:	660,000 feet
Trench for cable:	2,500 feet
Sound-insulated doors:	296
Microphone outlets in studios:	250
Loudspeakers:	175
Radio receivers:	110
Equipment racks:	330
Audio amplifiers:	300
Vacuum tubes:	2,000
Remote monitoring stations:	120

Table 1. *A list of the equipment roster and materials used in construction of 30 Rock's Red and Blue radio networks and two local stations.*

The next challenge

With the sale of NBC radio last year, the 11-story studio core is to be transformed into an all-TV plant. NBC planners now face two challenges. The first is to design the best TV facility possible. The second is to expand on the craftsmanship of the man who designed the house that radio built.

Acknowledgment: The textual quotations are excerpts from a delightful 1935 NBC publication, "The House That Radio Built," written by the network's first chief engineer, O. B. Hanson. This booklet contains technical information on the facility's planning and construction, including sections on sound insulation; acoustical treatment; studio planning (layout) to minimize noise, confusion and delay; control room windows; and acoustically adjusting studios, some of which still is relevant today. It is regrettable that the publication is out of print.

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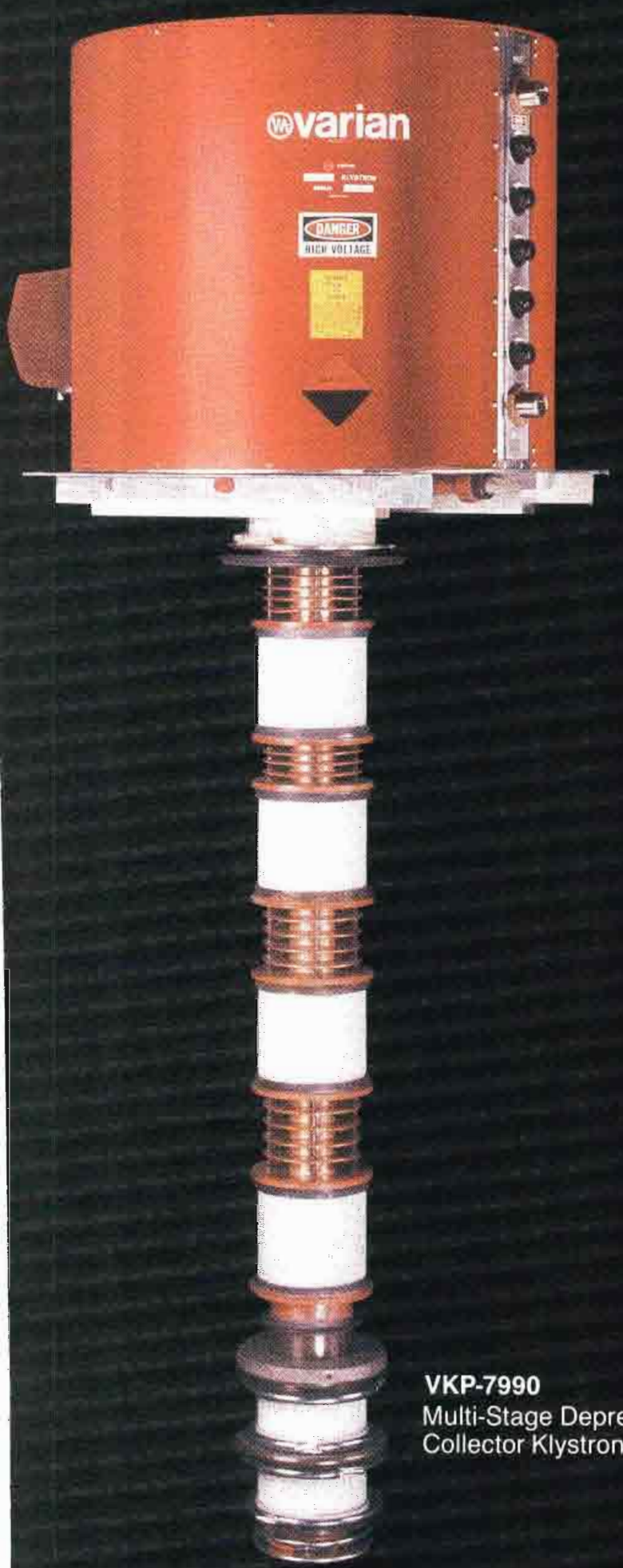
THE SHAPE OF THINGS TO COME...



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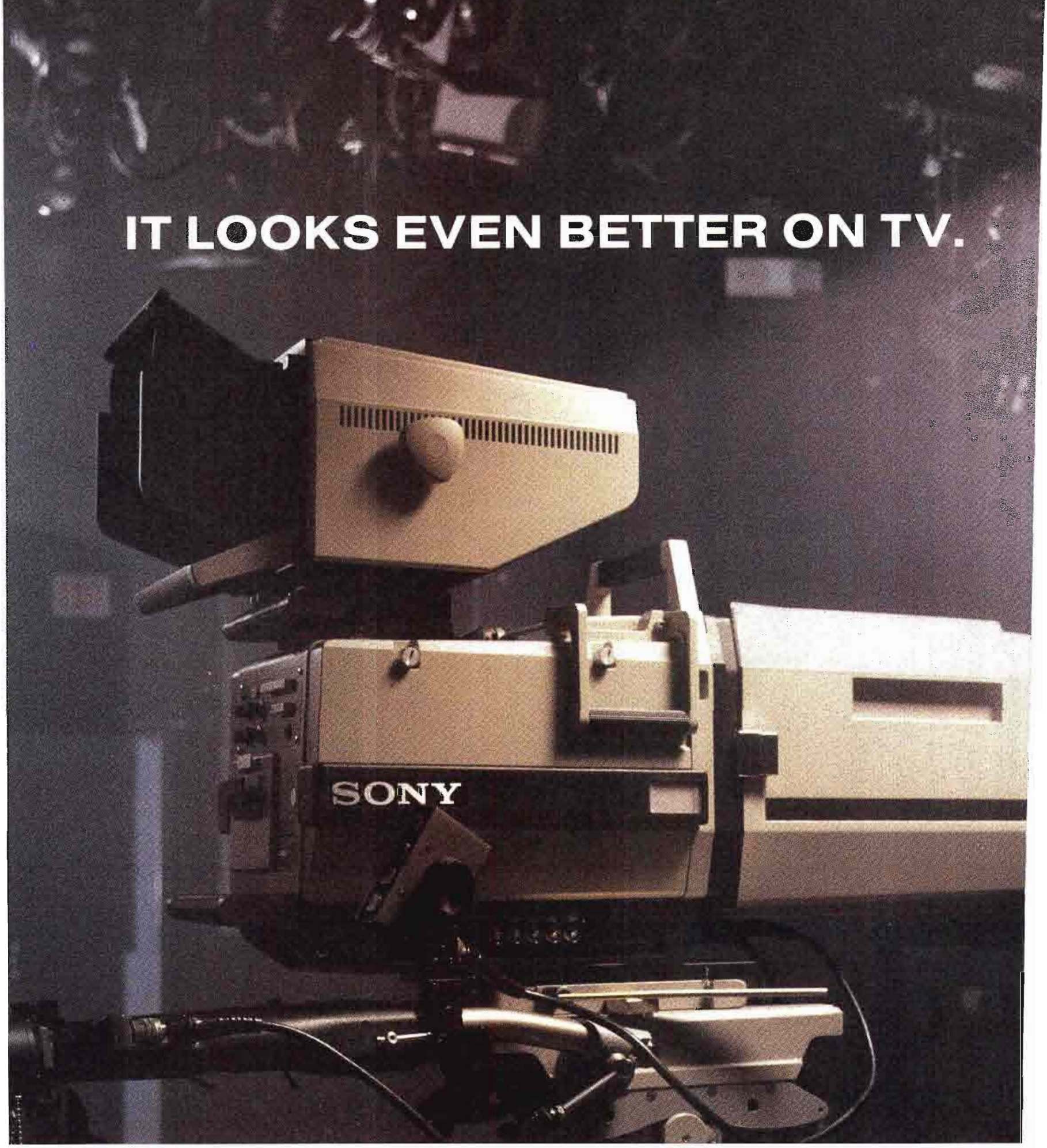

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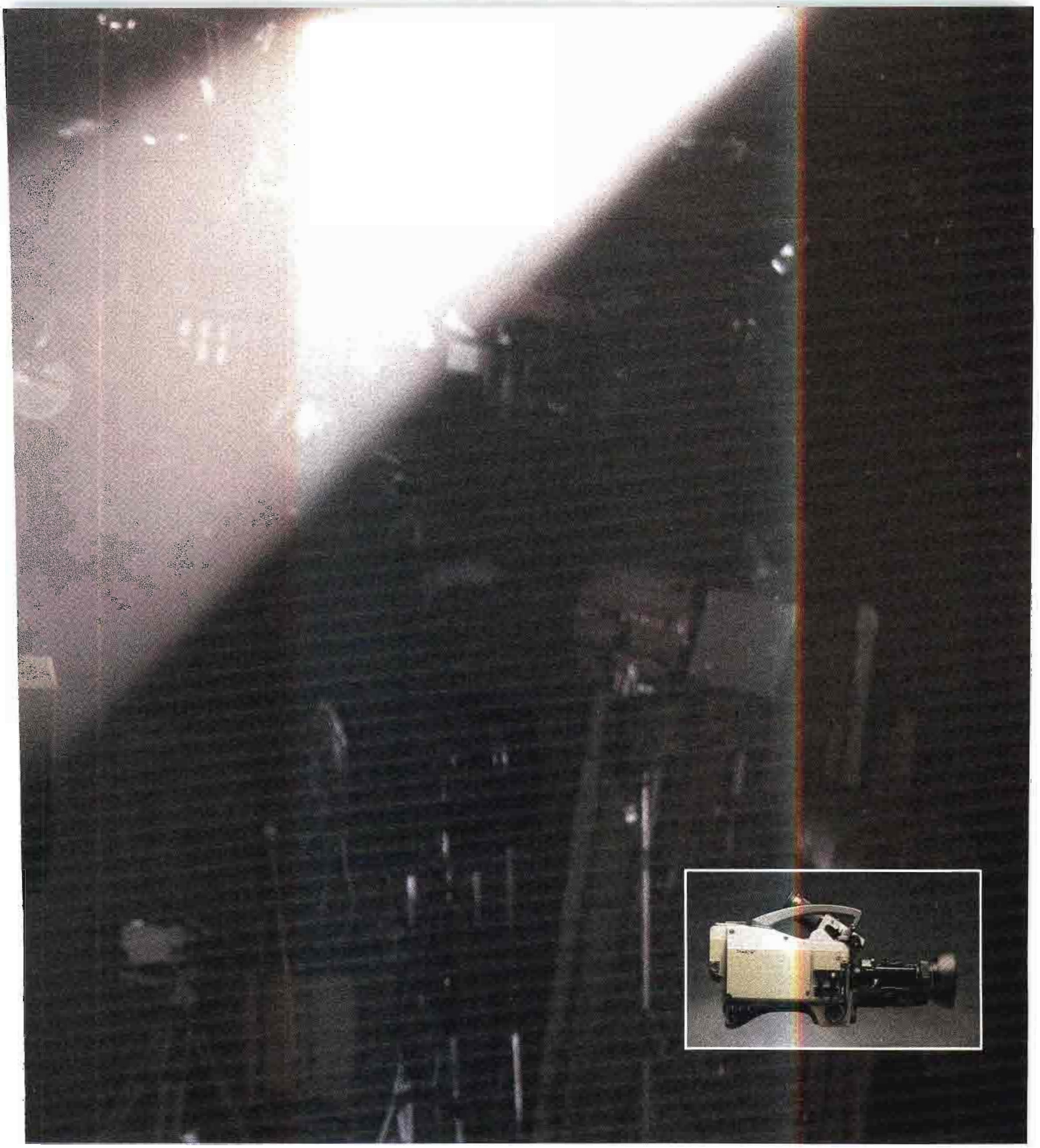

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By Chips Davis

When it comes to building acoustical spaces, you can't fool Mother Nature.

Ever notice that the on-mic sound of some stations is superior to that of other stations? What makes the local production work from your competitor sound better than yours? Is it the equipment, or could it be the studio acoustics? Successful stations recognize that their on-air sound involves more than the type of audio processing, microphone or console used.

Every word spoken by your on-air staff originates in an acoustical environment. If that environment is contaminated with background noises, poor frequency response or an inferior monitoring system, the air product suffers.

Some of these problems have unsuspected causes. The micing problems I see and hear in most facilities are caused by reflections from copy stands, counters and windows. These reflections change the timbre of the natural voice. This effect also occurs with micing of instruments. See Figure 1.

Reflections in the monitoring environment from video monitors and near-field speakers can cause the same comb filtering of the signals. *These types of problems that arise from acoustic cancellation, cannot be corrected with equalization.* See Figure 2.

Modern technology

New technologies and a better understanding of the physics involved in recording and reproducing sound are forcing us to re-examine our studio design practices. As we learn more about how sound operates, we have been able to improve upon studio and control-room design.

Other factors affect a studio's acoustical requirements. Witness the changes brought about by digital technology. As the quality of source material improves, so must the quality of the monitoring systems. In broadcasting, there is no mastering engineer to correct mistakes made in the studio — it's direct-to-home delivery.

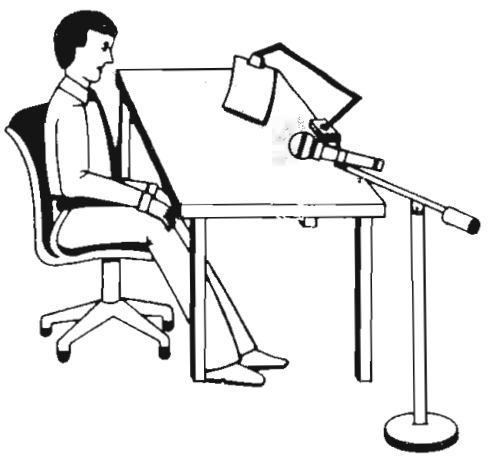

Figure 1. *Many of the acoustics problems broadcasters face begin with copy stands, counters and windows. As the announcer's voice reflects from these surfaces, the timbre is changed, making it sound unnatural.*

Also, the better the technical quality of the equipment you use, the more critical the acoustical environment in which that equipment must live. For instance, quieter electronics, wider dynamic ranges and more sensitive microphones result in a greater need for a quiet, non-fatiguing acoustical environment.

Marketplace constraints

To survive in a competitive broadcast marketplace, you need to evaluate honestly, objectively and realistically your actual needs and available budget. Do you really need to try for the performance of a brand new "world class" (what a misused term) complex built from the ground up?

Will your market pay for that kind of quality? Would a less sophisticated, and less costly, facility be adequate? Perhaps your needs would be better served rebuilding or even just retrofitting your existing facility. Don't be afraid to settle for something less than the ultimate. Monetary restraints simply mean you have to be more creative to achieve the desired acoustical performance.

Get some help

Using all the expertise you can develop, establish a list of criteria and stick to it. If the guy down the street who built his own studios wants to give you advice, listen, but don't take it as gospel. That could be suicide. Before you adopt any of his suggestions, find out whether he is a reputable acoustical engineer or a designer with a successful track record.

Obtain some of the excellent books on basic acoustics and studio design. Do your homework. Armed with this type of infor-

Davis is president of Chips Davis, LEDE Designs, based in Las Vegas, NV, and San Rafael, CA.

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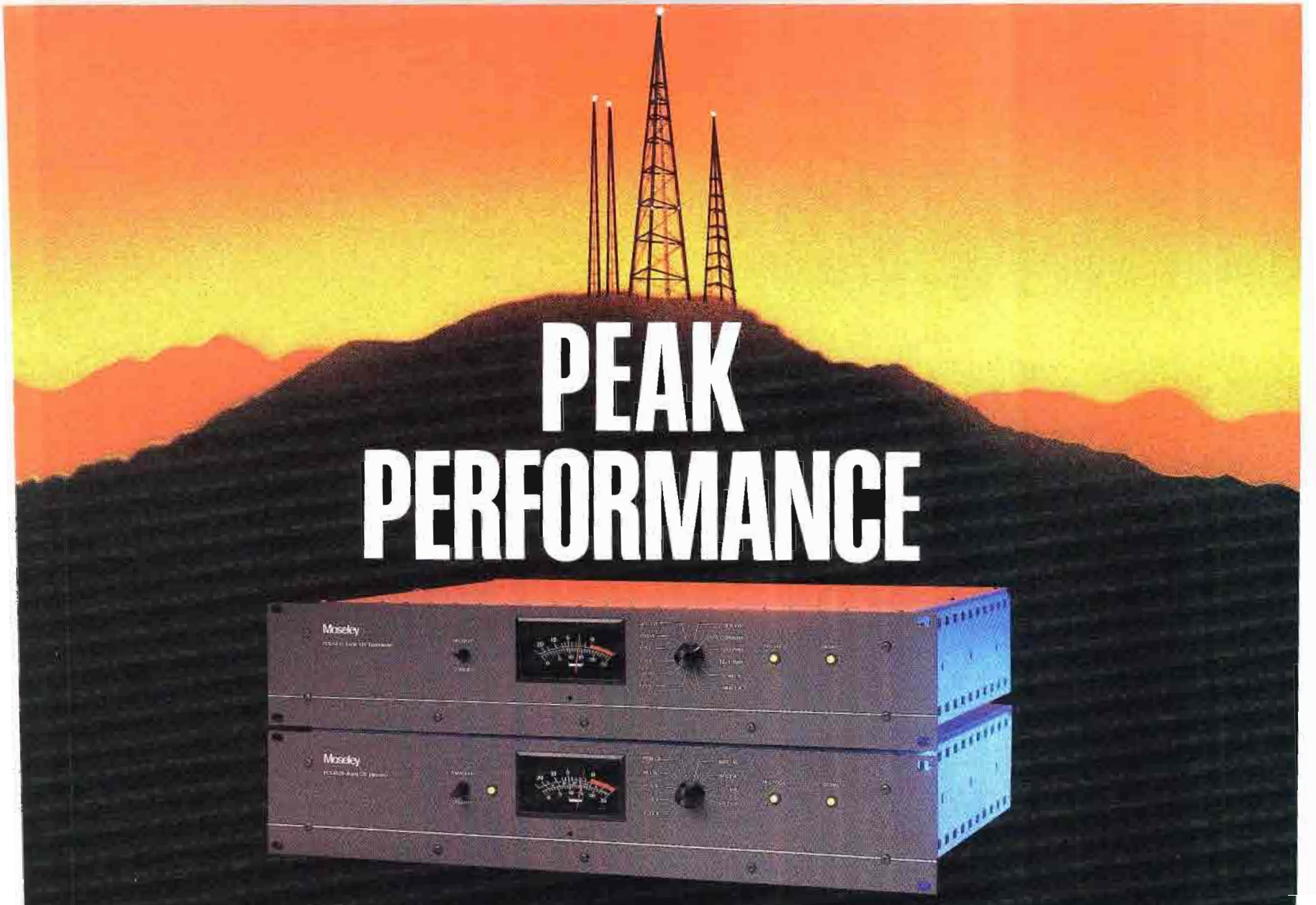

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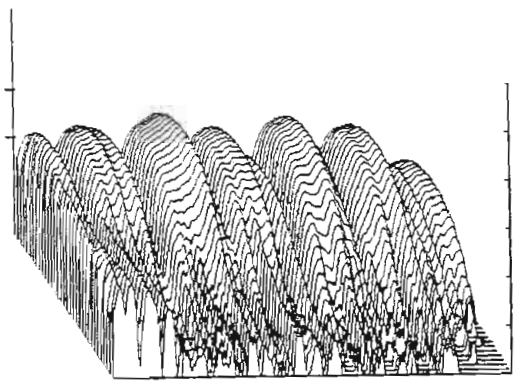

Figure 2. *The result of reflections creates the anomalies shown in this 3-D plot of frequency vs. time. The response plot was measured in a typical broadcast control room.*

mation, you are in a better position to at least ask the right questions. See the recommended reading list on page 96.

You've got to examine your own attitudes about what sound and recording are before you move forward. Your station may have been successful using less than optimum studios. Even so, you've got to temper the "I-can-get-a-good-sound" attitude and start demanding better acoustical technology. Sure, you may be able to get a good sound out of almost any room, but is the cost in effort, uncertainty and ear fatigue worth it?

It costs no more to do it right the first time. As a matter of fact, doing it right the first time usually costs less. A well-conceived design, whether for ground-up construction or a weekend rebuild, can save more than the construction change order fees alone. There is little room for experimentation with a crew of union craftsmen on the job site. Doing it right the first time just takes a little more effort on your part.

The decisions you make about your new studio will be preserved in bricks and mortar. You will have to live with those decisions for a long time. You share a responsibility with the studio designer to make sure that your new dream station won't become a nightmare the day you go on the air.

Noise considerations

The first and foremost aspect to consider is noise. Broadcasting and recording studios require a quiet environment. This isn't something that can be added after the walls are up. You, the designer and the construction crews must pay infinite attention to every detail. An improperly isolated conduit, a coupled-wall system, an air leak or a shorted HVAC isolator can negate hundreds of thousands of dollars worth of construction in a minute.

To get an idea of what I mean, examine Figure 3. The drawing shows how a ceiling hanger should be installed. Take a look at the photo on page 80, and you'll notice that the suspension rod is touching

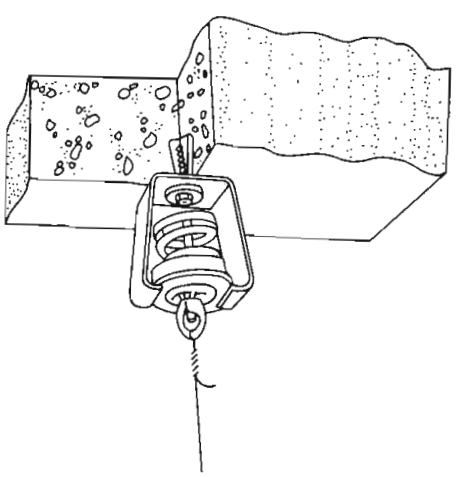

Figure 3. *The correct technique for using spring hangers to isolate air-conditioning ducts and other mechanical systems. Note that the hanger is bolted to an expansion anchor in the ceiling slab. The suspension rod should not connect with the hanger bracket.*

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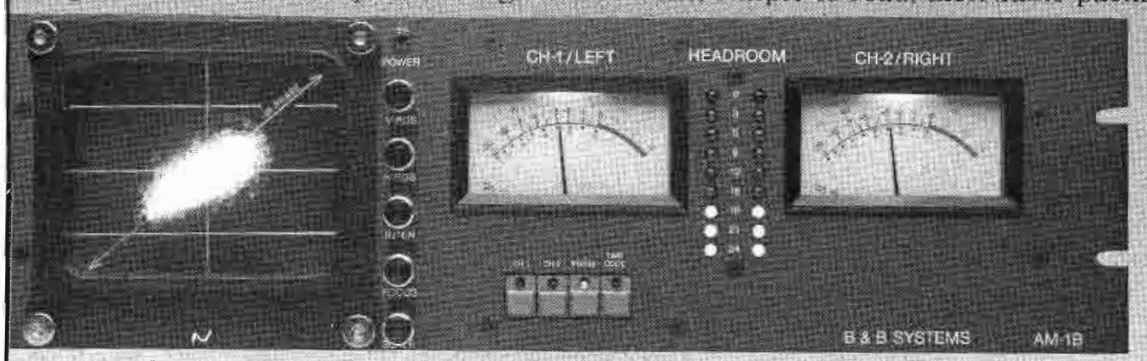

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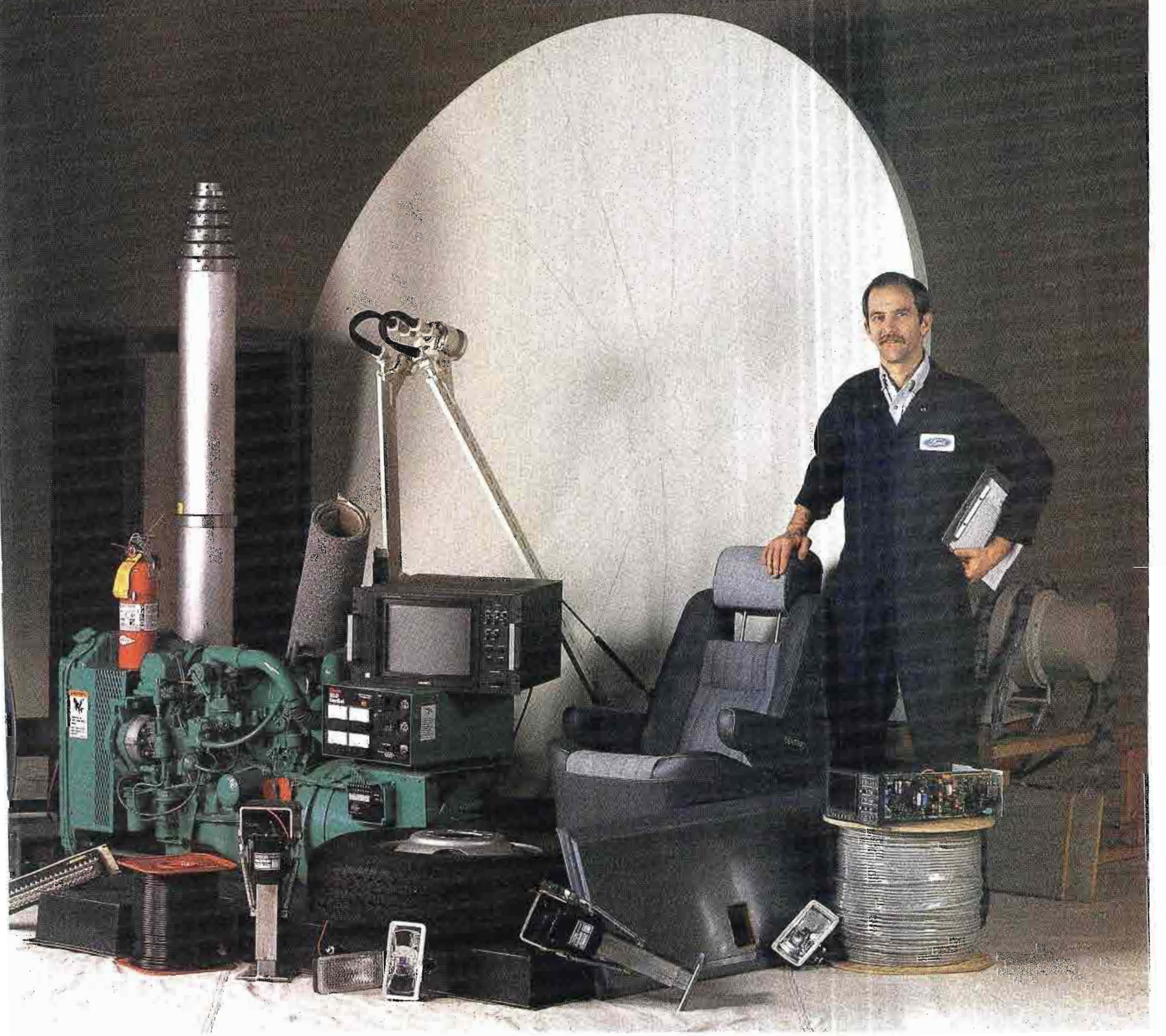

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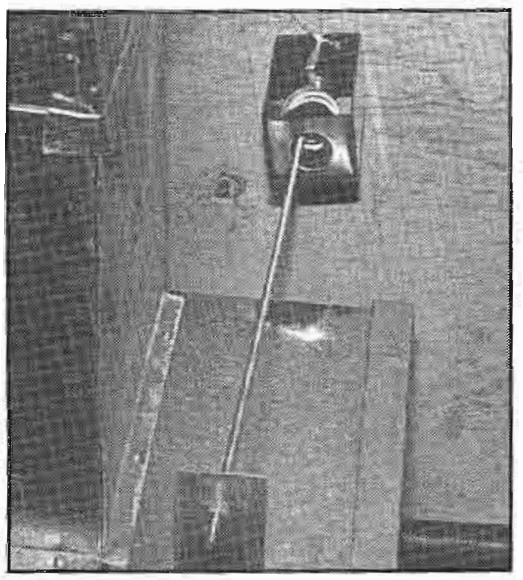
the mounting bracket. The result is that HVAC system noise is now coupled to the studio shell. Such problems are expensive to fix.



A perfect example of how not to mount spring hangers. Note that the suspension rod connected to the suspended air-conditioning ductwork is tilted from perpendicular so that it now touches the ceiling-mounted hanger. Consider the additional expense of having to rehang the entire HVAC systems, as was necessary for this studio, to provide adequate sound isolation.

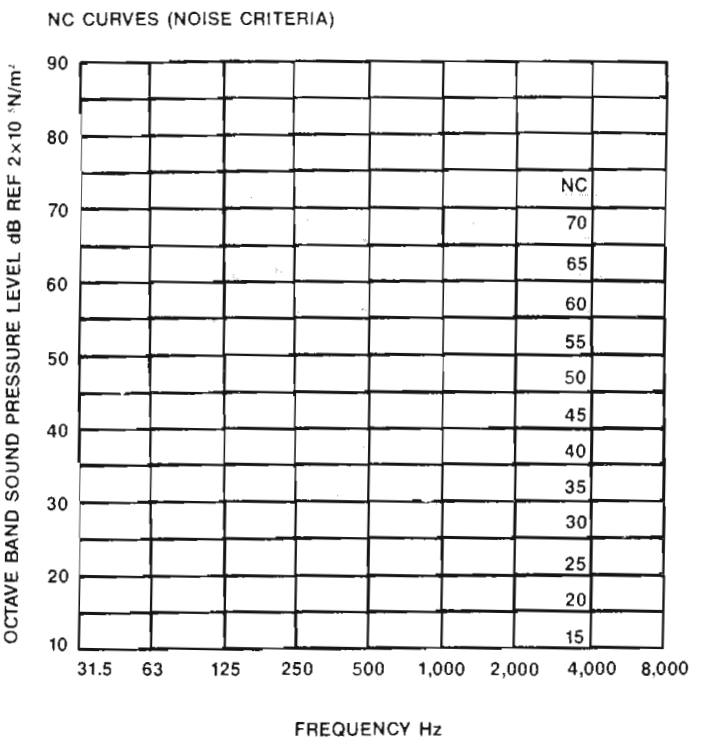
A simple rule is: *Where air goes, sound follows.* Studios and control rooms must be airtight. You're dealing with construction that requires planning, supervision and commitment. No detail is insignificant, and no single item is any less important than any other.

I've measured major-market control rooms where the subaudible air-handler noise alone was more than 100dB at 15Hz. Although you can't hear it, you'll soon know the noise is there. The ear fatigue and physical stress in such a room is debilitating. These kinds of factors must be addressed from the beginning.

It's important also to understand that people like to respond to complex questions with simple answers. Be wary of any designer or consultant who answers your questions with fast, uncalculated, off-the-cuff responses. Acoustics is a science, not magic.

An example

Let's look at an example of where failing to ask the right question might lead to inferior results. If you place a 100dB sound source on one side of a wall system with a sound transmission coefficient (STC) of 56, you'll measure an attenuation of approximately 60dB at 1kHz on the other side. However, shift the frequency of that same 100dB signal down to 125Hz, and the attenuation drops to 35dB. At 63Hz, the attenuation through the same wall is less than 20dB.



FREQUENCY	63	125	250	500	1,000	2,000	4,000	8,000	Hz
NC70	83	79	75	72	71	70	69	68	dB
NC65	80	75	71	68	66	64	63	62	dB
NC60	77	71	67	63	61	59	58	57	dB
NC55	74	67	62	58	56	54	53	52	dB
NC50	71	64	58	54	51	49	48	47	dB
NC45	67	60	54	49	46	44	43	42	dB
NC40	64	57	50	45	41	39	38	37	dB
NC35	60	52	45	40	36	34	33	32	dB
NC30	57	48	41	35	31	29	28	27	dB
NC25	54	44	37	31	27	24	22	21	dB
NC20	51	40	33	26	22	19	17	16	dB
NC15	47	36	29	22	17	14	12	11	dB

Figure 4. *Standard noise curves from NC-15 through NC-70. The change in criteria by frequency is clearly shown in the table below the graph.*

Locating a recording or broadcast space designed for a noise curve (NC) of 15 (extremely quiet) next to a control-room wall with an STC of 56 will result in an actual NC (the ambient noise leaking from one space to the other) of 65 at 63Hz. At 1kHz the NC becomes 40. This is too noisy for most control rooms. Figure 4 illustrates the frequency-dependent nature of the curves.

Frequency-response anomalies

As if all this isn't bad enough, you've got to consider the consequences of the methods used to achieve adequate isolation. The only effective way to achieve efficient isolation is by the use of mass and air space. Mass and air space contain sound without the uncertain, and sometimes negative, side effects of less efficient isolation methods. Table 2 illustrates the typical sound reduction of various construction materials vs. frequency. The table confirms that reducing the transmission of high frequencies is much easier than for low frequencies.

Lightweight wall and window systems absorb sound by *diaphragmatic* action. They resonate at frequencies complementary to their mass, panel size, depth and composition. Resonating panels can act as narrowband, acoustical filters, subtracting their complementary frequencies from the audible signal within the room.

If you place a lightweight wall or window system near a loudspeaker — in a soffit, ceiling or side wall — the speaker can drive the entire wall. The results are attenuation at the resonant frequency of the wall or window and a serious potential for a sustained ringing.

The result is a wall system with the unfortunate potential of acting both as panel absorber and re-resonator, both of which produce a disastrous situation if uniform frequency response is your goal.

What happens if you physically attach or couple your loudspeakers to a resonant lightweight wall? The speaker drives the wall, introducing still another negative effect called *early, early sound.* This turns the entire coupled shell into a gigantic sound board.

Some designers actually use this effect, thinking the result will be bottom-end punch. However, this coupling creates an artificial, inaccurate, exaggerated bass response in the room. Such conditions make mixing decisions extremely difficult.

Designers sometimes compound the error with negative peak (compression) ceil-

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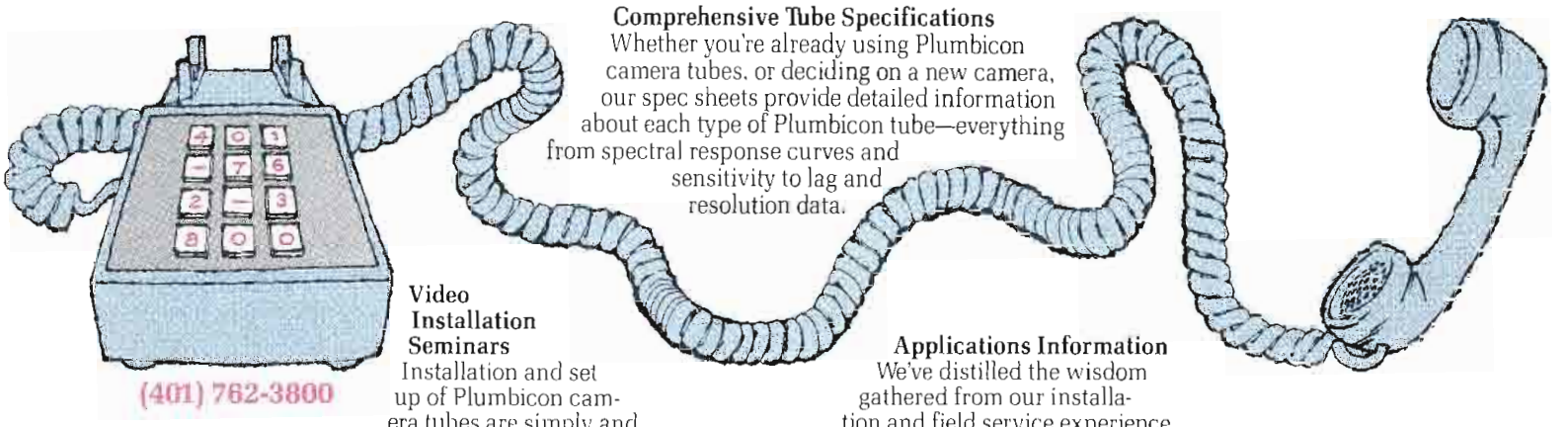

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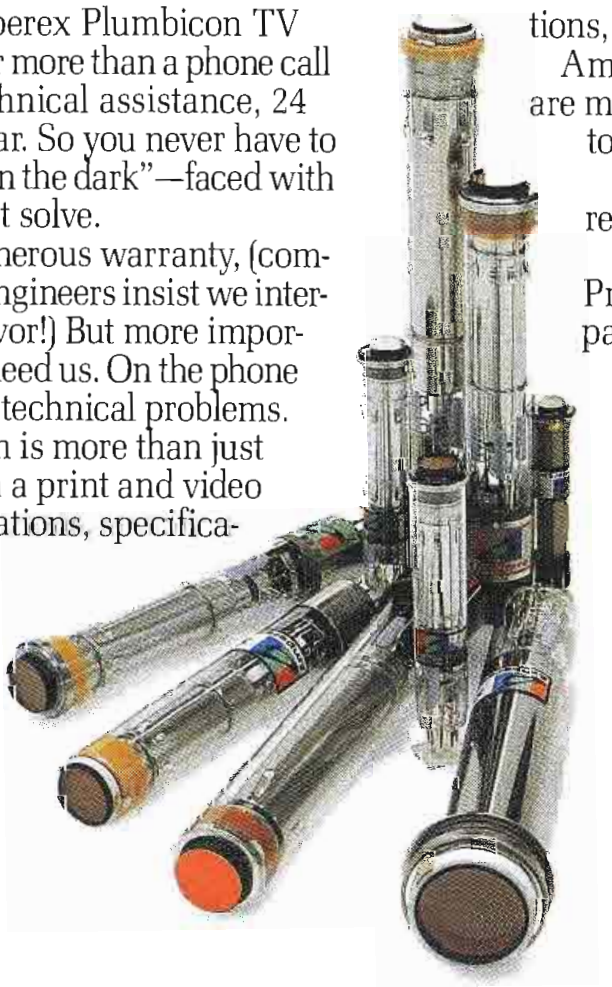

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Trap dimensions (quarter wavelengths of bass notes)

FREQUENCY Bass notes	DEPTH Meters	Feet
30	2.86	11.38
40	2.14	7.04
50	1.72	5.64
60	1.43	4.69
70	1.23	4.03
80	1.07	3.52
90	0.96	3.13
100	0.86	2.82
120	0.72	2.35

Table 1. *Bass traps often are used to control room response. Note, however, that they require large amounts of space.*

ings, which double the bass wave back upon itself. This reinforces the bass wave at some frequencies while canceling it at others. The net result is a booming, inaccurate bottom-end response.

Low-frequency response

In small room acoustics (control rooms are considered small from an acoustical standpoint), the first design consideration for bass is modal spacing. This is the natural resonance of a space defined by its height, width and length ratio. (Just as the length and diameter of an organ pipe determines its natural resonant frequency, the height, width and length ratio of a room determines its resonance modes.)

Think about the last time you sang in the shower. Recall how some notes seemed to fill the space with rich, long-lasting tones while other notes sounded thin and seemed to evaporate quickly? The notes that made you sound like a basso profundo were those that were in natural resonance with the room modes. They were on the nodes and were, therefore, reinforced. The notes that corresponded to the nulls were diminished. These natural resonances or modes are called *Eigenmodes*.

Room dimensions that are multiples of each other cause these Eigenmodes to become additive. This creates a dominant resonance in the room that sustains complementary bass notes at the expense of all others. Figure 5 illustrates Eigenmode frequency vs. room dimensions.

The shaded area in Figure 6 represents acceptable room ratios. There are three sets of ratios, called *golden ratios*, that produce optimum modal spacing:

1.14:1.39:1
1.28:1.54:1
1.60:2.33:1

The most desirable mode distribution of a room is even spacing of the modes without voids or build-ups. *The use of golden ratios can cause trouble with different size rooms. Always plot out modal spacing as a final check.*

Continued on page 86

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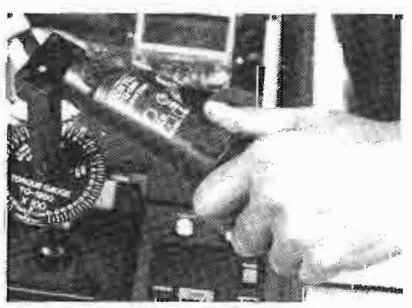

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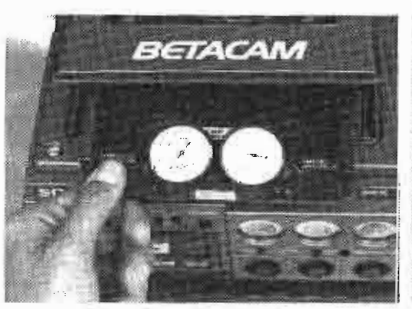

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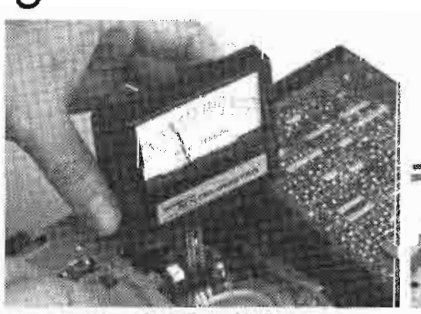

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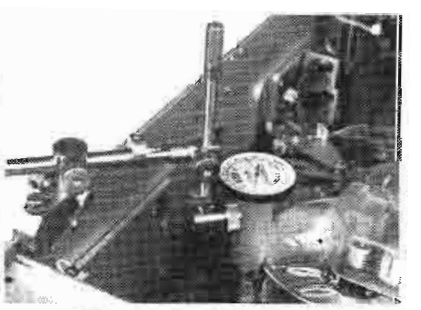

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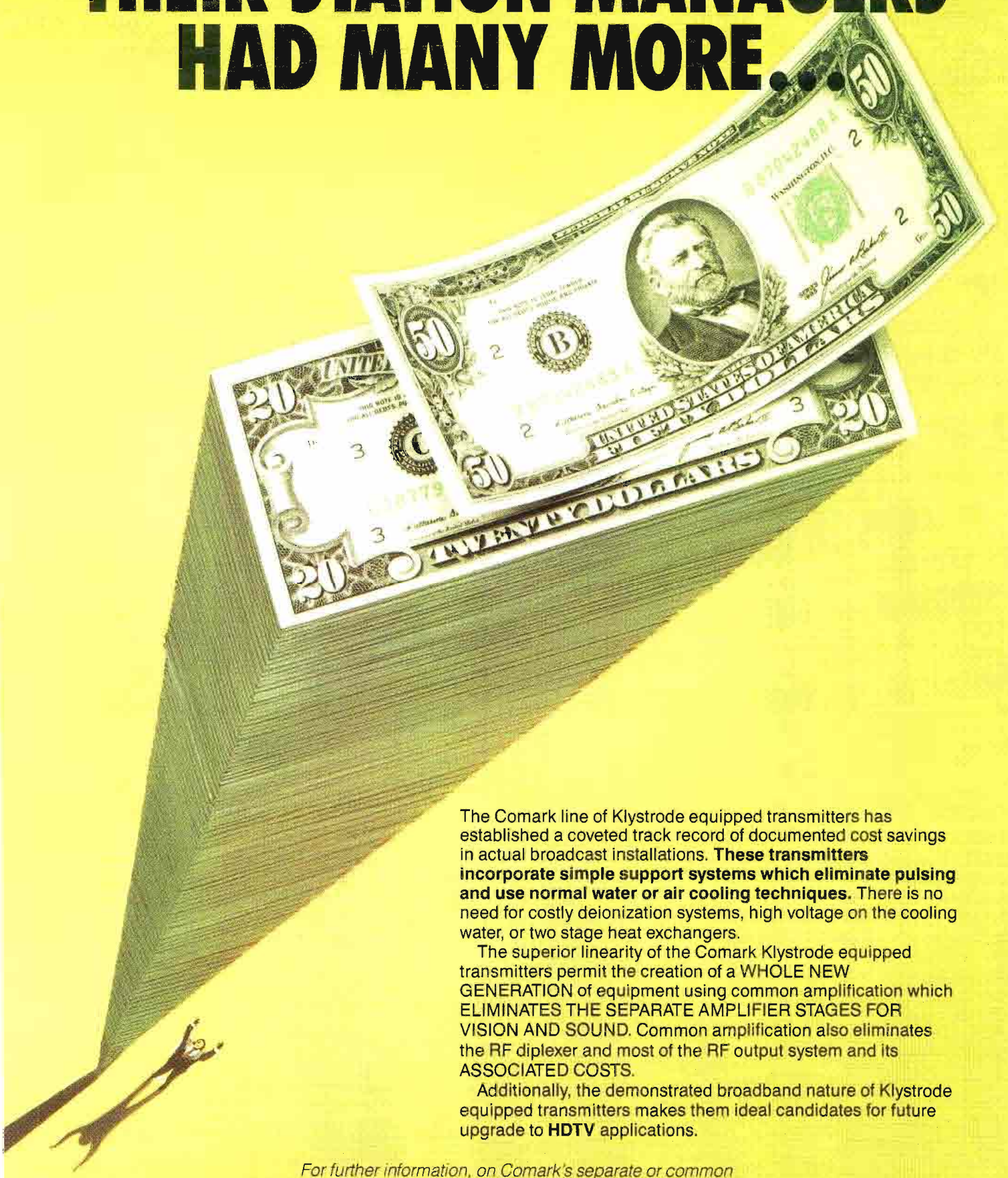

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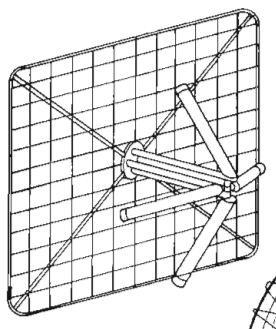

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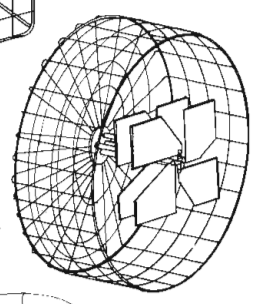

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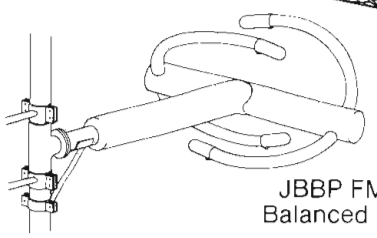

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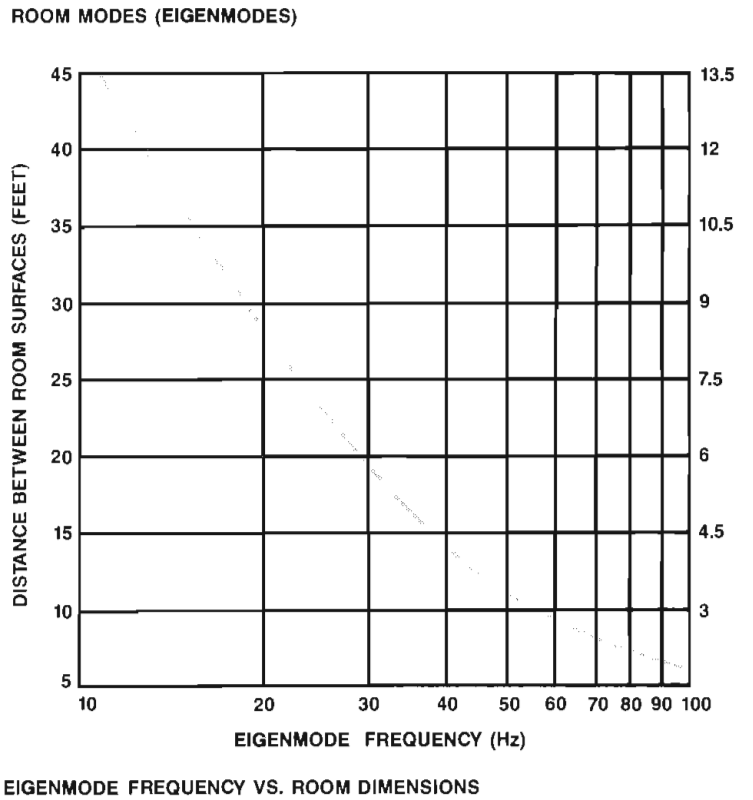
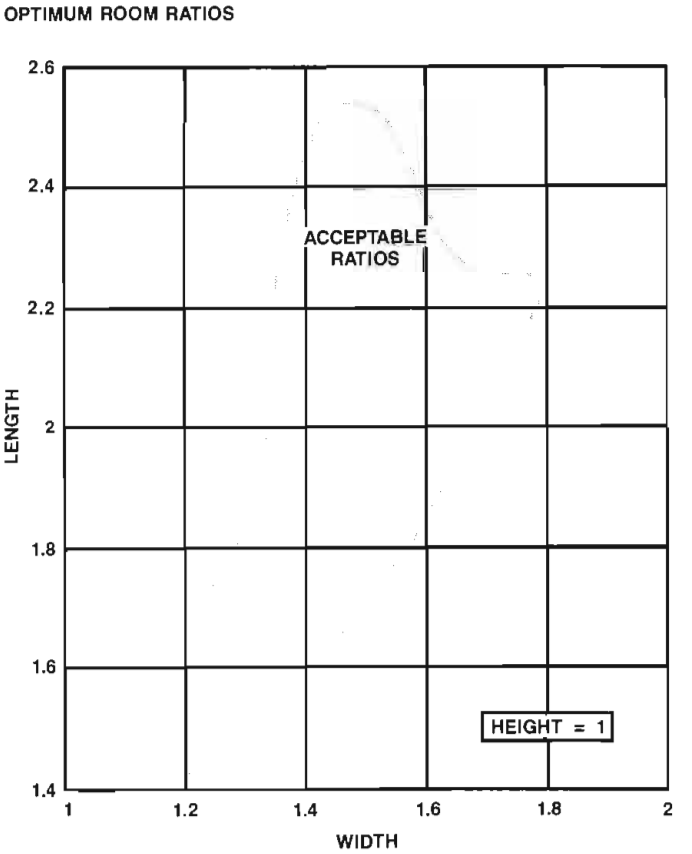


Figure 5. *Room modes (Eigenmodes) determine which frequencies are emphasized and which are attenuated. Note that the Eigenmode frequency is determined by the distance between the room's surfaces.*



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1.60:2.33:1

Figure 6. *It's possible to derive mathematically preferred room dimension ratios. The shaded area represents acceptable ratios. Optimum ratios are called golden ratios, which are listed in the text.*

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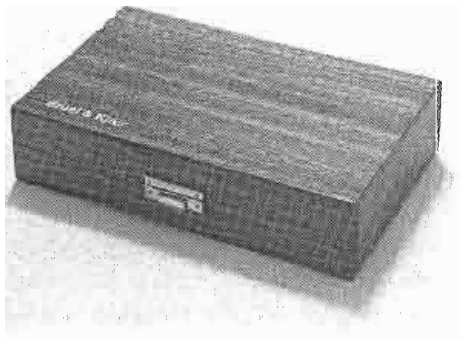

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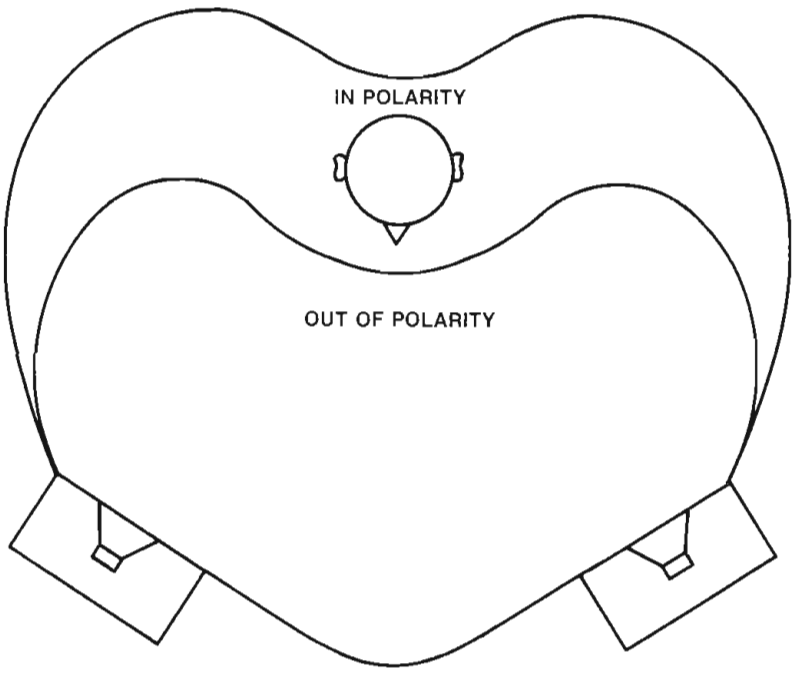

Figure 7. *A subjective technique for detecting absolute polarity on a stereo mix. When all of the various sound elements are in polarity with one another, the image should seem to occur ahead of the monitor speakers, wrapping from a line parallel to your ear to behind your head.*

Traps and EQ

To cure problems of improperly spaced room modes, many designers build traps or use equalizers. Let's first address the use of traps.

For an LF trap to be effective, it must be at least ¼-wavelength deep (see Table 2). For frequencies between 40Hz and 50Hz, that's a depth of about six feet. The cubic volume of the trapping device determines how much energy the trap absorbs.

Traps often occupy 100 square feet or more of valuable room space, yet still produce unpredictable, unacceptable results. The reason is that traps absorb not only the target frequency but those above the target frequency as well. That's a high price to pay for not considering some simple laws of physics when planning the dimensions of the room.

If you size a room correctly and build a massive, rigid shell, the entire room will help you achieve isolation and control of the bottom end without the need for traps. The bottom line in room design is that you can't fool Mother Nature. The laws of physics always apply.

Room equalization

If you attempt to compensate for acoustical design problems with room equalization (EQ) inserted between the amplifiers and speakers, you've already lost the game. Room anomalies caused by early reflections can create notches up to 40dB deep. This kind of problem cannot be solved with an equalizer.

If you absolutely must use outboard monitor EQ, always cut; never boost. Boost EQ causes unpredictable anomalies to occur after the initial signal has passed the device. This may be heard as ringing, coloration and changes in tonality. Such distortion affects the objectivity of your mixing decisions.

Absolute signal polarity

Because mixing decisions are based on what the engineer or announcer hears, speakers play an important role in how your studio sounds. Any anomalies in the path from the speaker to the ear affect the resulting mix. For instance, the way a speaker couples to the environment, how accurately it is aimed, and the horizontal and vertical mounting angles can make audible differences in the accuracy of the produced sound.

Absolute polarity is another important factor. When a sound source generates a positive signal at the microphone output, it should produce a corresponding positive signal from the speaker. This should be the case regardless of the number of elements in the signal chain.

When the mix is in absolute polarity, the image seems to occur ahead of the speaker, wrapping from a line parallel to your ears to behind your head. (See Figure 7.) When the sound is out of absolute polarity, the stereo image occurs more in the plane of the speakers and sometimes above them. An out-of-polarity sound will seem distant and never seems to wrap around your ears.

Practical example

To see what a difference absolute polarity makes, build a simulator and listen to the results. Insert a 4PDT switch in line with the audio feeding the speaker (see Figure 8). It's important to use high-quality audio material. A good audio source for

Continued on page 92

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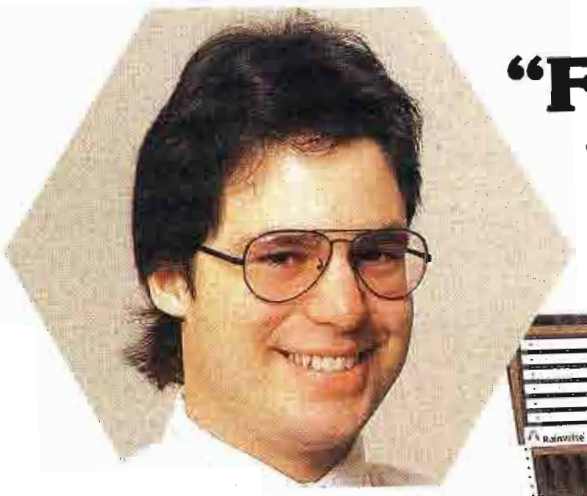
"Features and specs sold us on Auditronics 200 consoles."



Robert Lankton, Chief Engineer
WDUV/WBRD in Bradenton, Florida

"Their performance and reliability keep us sold."

"We wanted a console flexible enough to use in master control, production and news. We shopped for features and specs, but we also looked for ease-of-use and reliability. We got just what we wanted in our four Auditronics 200s."

Features

"I insisted on outboard power supplies and no monitor amps in the console for noise reasons. I was impressed with Auditronics' VCA technology, which at the time was not available elsewhere. We wanted the self-contained clock and timer. We needed the switching logic to interface between the A and B inputs, (a neat concept most other consoles don't offer). And we needed a lot of extra line inputs to support our satellite feeds. We needed a first-rate telephone interface. Auditronics beat its competitor hands-down on this. And, of course, modular design was a must for serviceability. We got it all in the Auditronics 200."

Specifications

"We go for the widest dynamic range we can get because much of our programming originates on CD. So the 200's 3dB better S/N is really important. Everything on the Auditronics 200 tests out better than the specs they publish, and you can't ask for more than that."

Ease of Operation

"I found the 200 logically laid out and very easy to train our people to use. The jocks like them and can easily understand them, which is very important to management."

Reliability

"We're just ecstatic about the Auditronics consoles. They've run 24-hours, 7-days since turn-on without a failure. What's more, they've held their specs, which I check every month to audiophile standards."

"Would I buy Auditronics again?"

"At WDUV/WBRD everybody is happy with both the Auditronics consoles and the support we've received from the company. We look forward to doing business with them again." If you'd like to know more about why Rob Lankton swears by Auditronics consoles, call 1-800-638-0977 or contact

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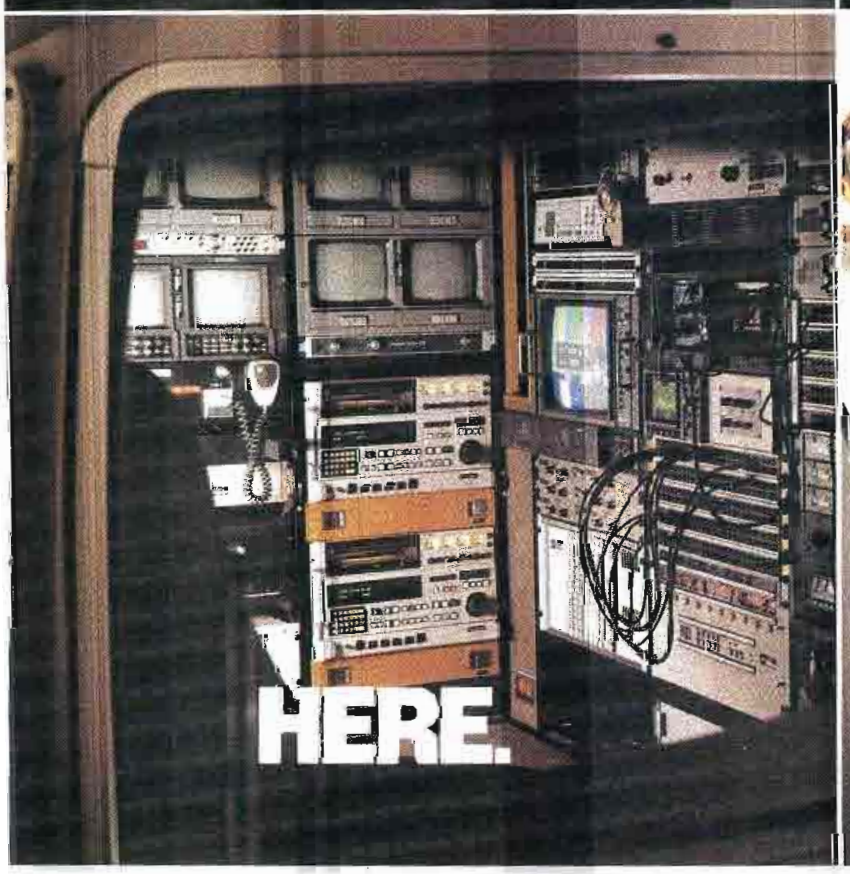

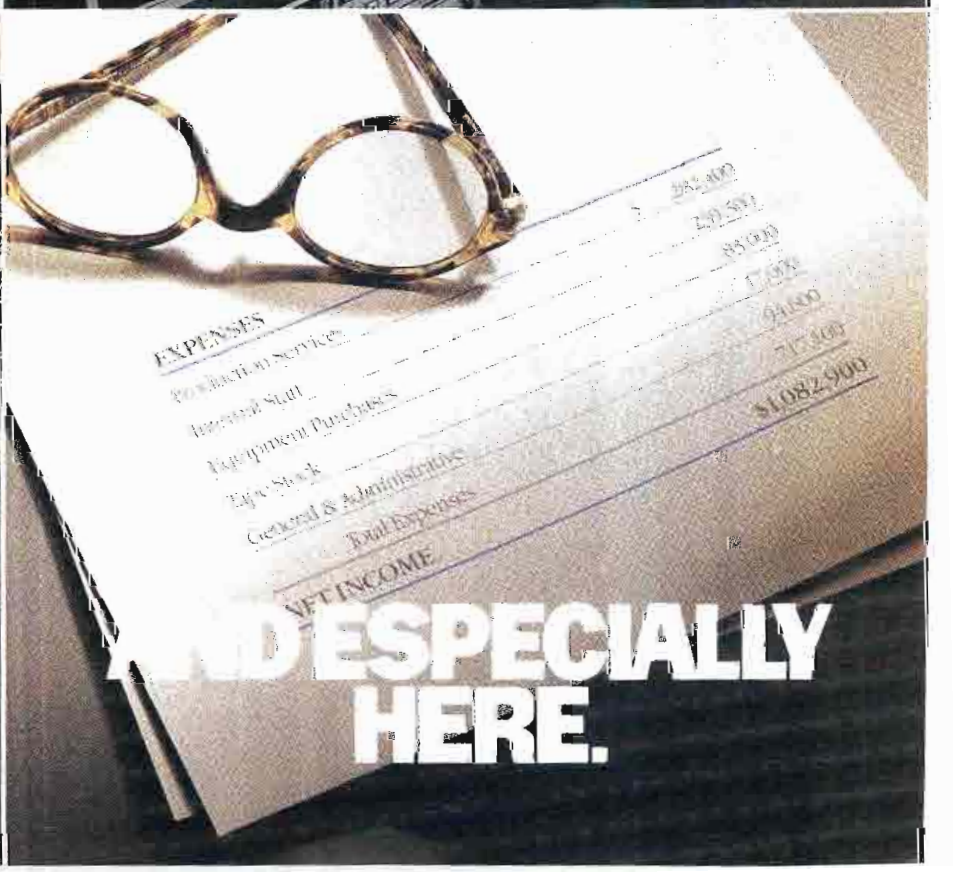

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Continued from page 88

MATERIALS	THICKNESS (mm)	125Hz	250Hz	500Hz	1kHz	2kHz	4kHz
Brickwork (plastered)	110	31	36	41	50	55	61
Brickwork (plastered)	220	41	45	50	56	63	62
Breeze block (plastered)	100	27	33	40	50	57	56
Reinforced concrete	150	37	42	47	51	56	60
Reinforced concrete	200	38	44	49	54	58	62
Reinforced concrete	300	39	46	51	56	60	63
Reinforced concrete	450	40	47	54	59	63	65
Tongue & groove/chipboard floor	21	21	18	22	24	30	33
Tongue & groove/chipboard floor with 12 mm plasterboard ceiling	235	18	25	37	39	45	45
As above but floating on glass wool mat	240	25	33	38	45	56	60
Chipboard sheets onto framework	19	17	18	25	30	26	32
Plasterboard sheets onto framework	9	15	20	24	29	32	35
Wood wool slabs	25	0	2	6	6	8	8
Wood wool slabs (plastered)	50	23	27	30	32	36	39
Wallboard (fiberboard)	12.5	11	15	20	24	29	33
50 x 100 stud partition with 12mm board each side	125	16	22	28	38	50	52
12mm plasterboard each side 75mm airgap	100	25	24	33	41	46	33
2 x 12mm plasterboard sheets 50mm air space with 50mm quilt in cavity	150	28	38	44	49	52	56
Windows (single well sealed)							
• 6mm	6	22	24	28	32	25	35
• 12mm	12	28	30	33	29	32	—
• 12mm laminated	12	30	32	36	36	37	—
• 19mm	19	25	31	30	32	45	47
Windows (double glazed)							
• 6mm + 12 gap + 6mm	24	21	25	29	34	29	35
• 10mm + 12 gap + 8mm	30	24	26	32	33	30	38
• 6mm + 50 gap + 6mm	62	25	28	36	41	46	—
• 12mm + 50 gap + 8mm	70	29	34	37	41	43	52
• 6mm + 100 gap + 6mm	112	28	34	38	42	40	—
• 12mm + 100 gap + 8mm	120	32	37	41	44	46	53
• 6mm + 150 gap + 6mm	162	31	37	43	48	44	—
• 12mm + 150 gap + 8mm	170	33	38	42	46	46	54
• 6mm + 200 gap + 6mm	212	40	42	49	56	43	—
• 10mm + 200 gap + 8mm	218	31	42	50	53	51	—
Doors							
Solid core	40	16	19	24	26	29	31
Lightweight	44	14	16	18	18	22	25
Plywood	9.0	12	17	22	25	26	24
Blockboard	25	18	22	27	29	30	32
Hardboard	6.25	14	19	24	29	34	35
Plaster on lath ceiling	19	22	27	31	36	42	45
Acoustic tile		21	23	27	30	34	38
Steel sheet - 22 gauge	0.71	12	17	22	25	26	25
- 16 gauge	1.65	12	21	27	32	37	43

Table 2. *Typical sound reduction in decibels provided by some common construction materials.*

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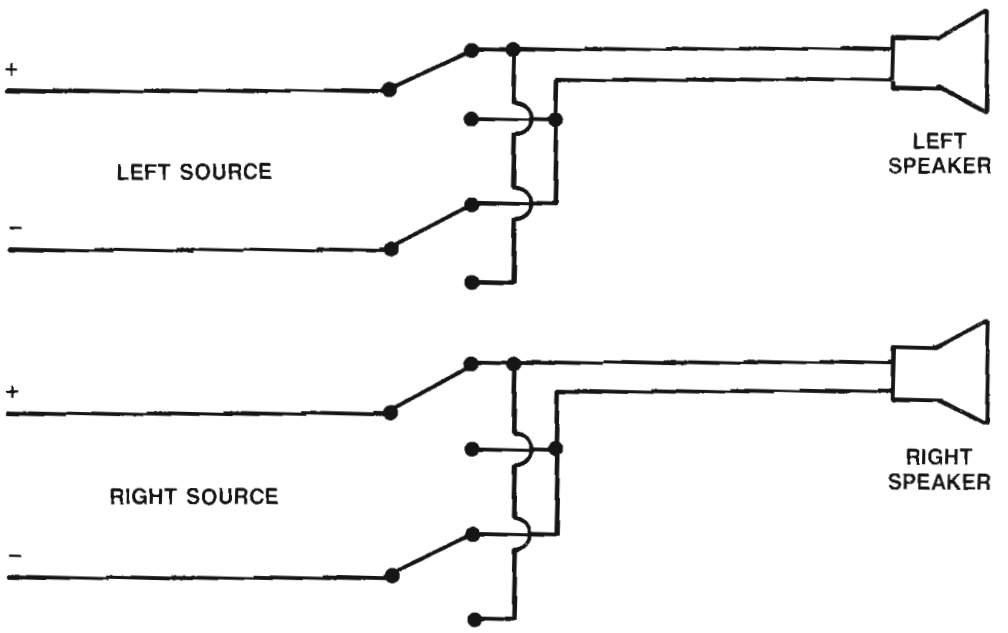

Figure 8. *It's possible to hear absolute polarity. Construct this circuit, and insert it between the audio source and speakers. It's important that a high-quality signal be used for the test.*

this test is the compact disc of Barbra Streisand's "*Broadway*" compact disc. Flip the switch back and forth to simulate an out-of-polarity sound.

The orchestra, effects and vocal echo in this recording all are in one polarity, while the vocal is in another. In one switch position, the orchestra comes forward and the voice is back, creating an effect similar to a live performance. In the other position, the effect reverses, with the vocal forward and the orchestra and vocal echo back. You'll also find that the mix and balance stay relatively the same no matter where the playback is monitored. The results are affected only by limitations of the playback system used. This effect is easier to hear in the far field.

Sound localization

Point-source localization — the ability to judge and control the width and position in space of a voice or instrument — is important. A new production or control room should permit you to localize, within a few degrees of pan, any sound. If you record live with more than one microphone, you should be able to listen to the mix and place each member of the band in the exact spatial relationship they shared in the studio or performance. Your

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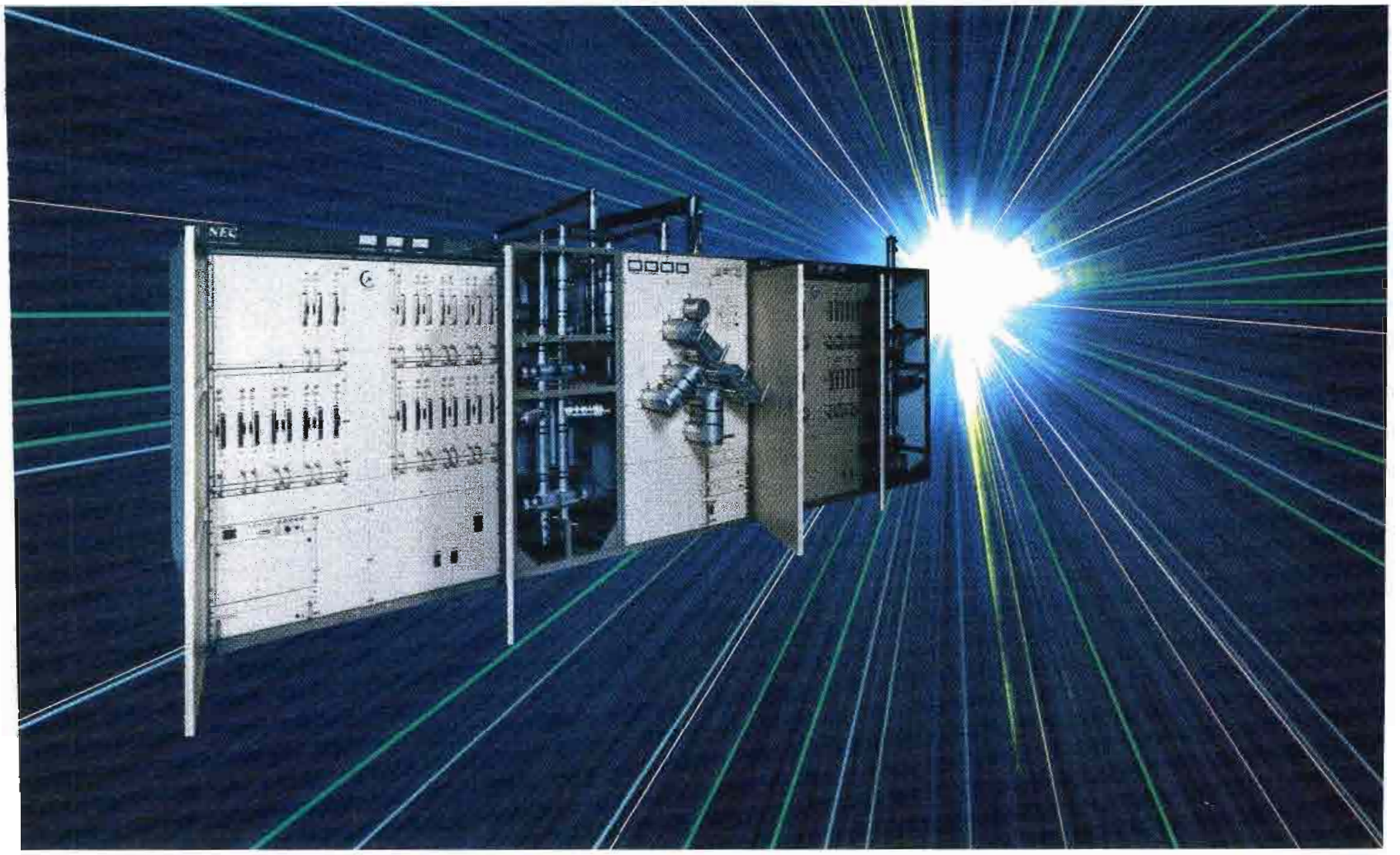

Solid-state transmitters are destined to dominate in UHF and VHF broadcasting. With NEC's new series of fully solid-state TV transmitters, you can move into 21st century technology today.

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- ☐ Greater safety: operate on 28V DC power; PA and power supply modules replaceable without interruption of broadcasting.
- ☐ VHF TV transmitters: NEC also offers 5 models of fully solid-state VHF transmitters – 5/10/15/20/30kW.

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listeners should be able to reconstruct the same setting in their minds.

Artistic license allows you to place any instrument or effect anywhere in the 3-D space that your creative instincts dictate. If your new control room can't provide this 3-D mixing capacity, you have given up some competitive advantage. Strive for a control room in which you can control the sound.

Speaker location

A long list of factors should be considered when locating speakers. Watch the way people listen critically to a sound source coming at them at eye level. They'll duck their heads to the speakers to achieve about a 15° vertical orientation. Human ears are designed to accept stereo sound most easily if it originates from approximately 60° wide and 12°-15° overhead.

Keep these facts in mind as you locate the speakers. Use phase-coherent speakers. You also must control the early reflections and have the proper Eigenmode spacing. Wall and isolation systems and diffusion must be used correctly. We've already discussed the kinds of problems that can result if they are not installed properly.

Begin by controlling the noise and eliminating any early, early sound problems. Pay particular attention to construction details. Your conscientiousness will yield benefits in neutrality, flexibility and sound control that you never thought possible.

Do it right

This kind of control isn't limited to multimillion-dollar facilities. You can get good results by retrofitting a control room over a weekend. It's also possible, using the principles of physics and modern acoustical design technologies, to inexpensively optimize even an existing conventional control room.

No one ever said that building a studio or control room with good acoustics would be easy. It's not. However, it is possible to build a facility that meets today's needs as well as tomorrow's. What you build today must carry you into the 21st century. Stations that pay close attention to design and construction details will be rewarded with better-sounding studios and a competitive air sound.

Editor's note: Several of the graphs and tables for this article were obtained from "The Audio System Designer Technical Reference," by Klark-Teknik.

Reading list

- "How to Build a Small Budget Recording Studio From Scratch." F. Alton Everest.
- "Acoustic Techniques for Home and Studio," 2nd Edition. F. Alton Everest.
- "The Master Handbook of Acoustics." F. Alton Everest.
- "Sound System Engineering," 2nd Edition. Don and Carolyn Davis.
- "Studio Acoustics." Michael Rettinger.
- "Acoustics of Studios and Auditoria." V.S. Mankovsky.
- "The Recording Studio Handbook." John Woram.
- "Room Acoustics." H. Kuttruff.
- "Theoretical Acoustics." P.M. Morse, K.U. Ingram.
- "A New Criterion for the Distribution of Normal Room Modes." Oscar Bonello, *AES Journal*, Vol. 29, No. 9, Sept. 1981.

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By Carroll G. Wright

Close the door on noise in your studio.

A high-performance sound-reduction door can go a long way toward smoothing day-to-day production chores inside the broadcasting studio. Productivity is likely to increase, for example, when a properly designed acoustical door isolates the whir of a power saw or drill press in a set-making area from the fragile quiet of a live TV broadcast.

Case study

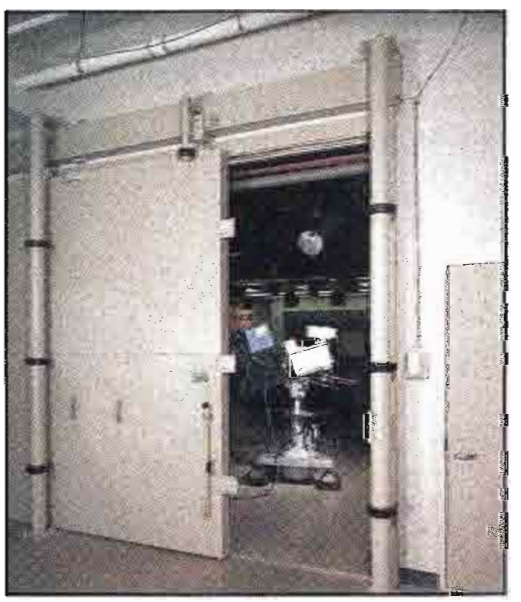
For years, station WIXT-TV in Syracuse, NY, had to halt its construction of sets and props whenever a production was being taped inside an adjacent studio. The studio's door, made of heavy plywood, was built to absorb unwanted noise coming from the scene shop side. However, the door did not prevent objectionable noise from reaching the studio. In order not to disturb broadcasting and taping sessions, construction crews were forced to stop work. Downtime could last hours, costing the station considerable time and money.

The problem was solved when the station moved into a new building. The new facility relied on a 4-inch-thick, all-steel, acoustically rated door to prevent sound leakage. The 2,400-pound acoustical door slides horizontally along one wall of the new building's production studio. Just as in the old facility, the scene shop and delivery area are located on the other side of the door.

The door permits easy access between the production studio and scene shop. It also allows set construction, normal deliveries and other activities to continue while on-air broadcast or commercial production is taking place in the studio. This has eliminated much of the construction crew's downtime.

Specifications are important

There are many kinds of ratings for sound-reduction doors. Therefore, it is imperative that the engineering consultant specify correctly the most suitable one for the application. Although WIXT-TV's old door was intended as a sound-reduction door, it did not attenuate the normal noise generated by the scene shop. This compromised the production studio's acoustical performance.



Partially opened acoustical sliding door shields the studio from the noise of the scene shop and loading areas.

Successful performance of any acoustical door can be attributed, in part, to certain criteria used in specifying the door. In general, specifications are written around the sound transmission loss (STL) between two rooms — one with a noise source (tools and machinery) and an adjacent one requiring a certain level of quiet (for broadcasting).

Walls, ceilings and floors also are designed to attenuate noise. In fact, the entire acoustical envelope, including HVAC equipment, must be considered to achieve low ambient noise levels in the studio. The overall acoustical performance of a room depends, to a large extent, upon the materials used to develop sound barriers. The STLs for some basic building materials are shown in Table I.

STC ratings should be comparable

One of the first steps in selecting the right door is to match the STL values established for the wall design with the STC rating and performance of the door. Wall material suppliers emphasize system performance, which includes doors, wall penetration and construction methods. The type of wall construction used in your building will determine the maximum performance available in the facility.

It isn't necessary to specify a door with a higher STC rating to compensate for a presumed transmission loss at the door seal and gasketing. All performance

Continued on page 102

Wright is chief engineer, Jamison Door Company, Hagerstown, MA.

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Continued from page 98
ratings apply to an operable door, which includes seals and gaskets.

Some applications may require that special consideration be given to the transmission loss required at specific frequencies. If so, then the STC rating of the door may need to be higher or lower than that of the wall.

Current laboratory ratings

It's important that the STC performance rating of the door is certified by an independent and accredited test laboratory. The highest testing standards are maintained by members of the National Voluntary Laboratory Accreditation Program (NVLAP), administered by the U.S. Department of Commerce and specified by the National Bureau of Standards (NBS).

It is equally important that the door be measured against the latest test standards. The standards have been upgraded significantly in recent years. The latest ASTM procedures require that transmission loss values be tabulated at 18 ⅓-octave frequencies in test rooms with carefully controlled temperatures and humidities. Furthermore, improvements in the laboratory, electronic sampling and computerized statistical analysis now provide a more accurate measurement of transmission loss, especially at low and high frequencies.

A specification based on a rating obtained by E90 test procedures before 1981 could yield an unsatisfactory result. For example, a door tested as STC 61 with the older E90-70 test procedures has a value of STC 57 when measured by up-to-date E90-83 test procedures. Example results of a door tested under current procedures are shown in Figure 1.

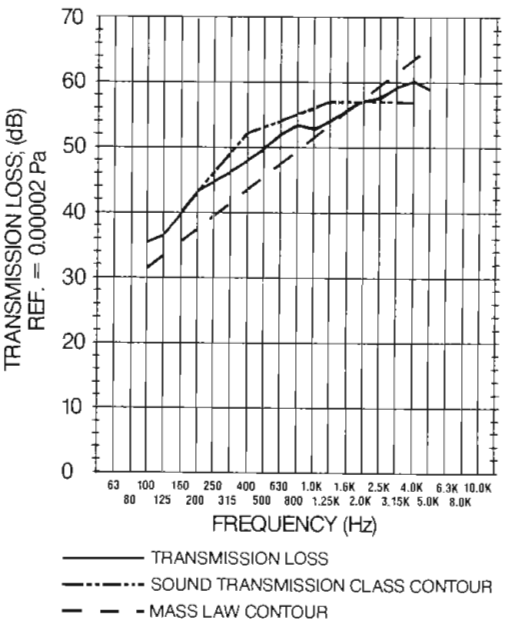

Figure 1. *Typical sound transmission loss report for an acoustical door. The door has an STC rating (53dB at 500Hz) and will provide an STL of 35dB at 125Hz. The STLs at other frequencies are shown by the solid line.*

Three types of doors

Three types of sound doors are available: swing, horizontal sliding and vertical sliding. Most sound doors are the single and double swing types, with STC values in the lower 60s. Swing doors are operated manually and usually cost less than a sliding door of comparable size. Most swing-door installations have factory-built frames, prepared for field-mounted hardware.

Vertical sliding doors are useful for corridors or other areas where horizontal slide space is limited and where a swing door would cost valuable floor space. Sectional overhead doors are seldom used because they often exhibit gasket leakage between the sections and cannot compress the top and side gaskets.

Single and bi-parting horizontal sliding doors are available with tested STC ratings through STC 53. A horizontal sliding door saves floor space and can be supported from overhead rails. This configuration allows flush floors and easy movement of scenery, cameras and equipment through the studio complex.

Doors also must be easy to operate

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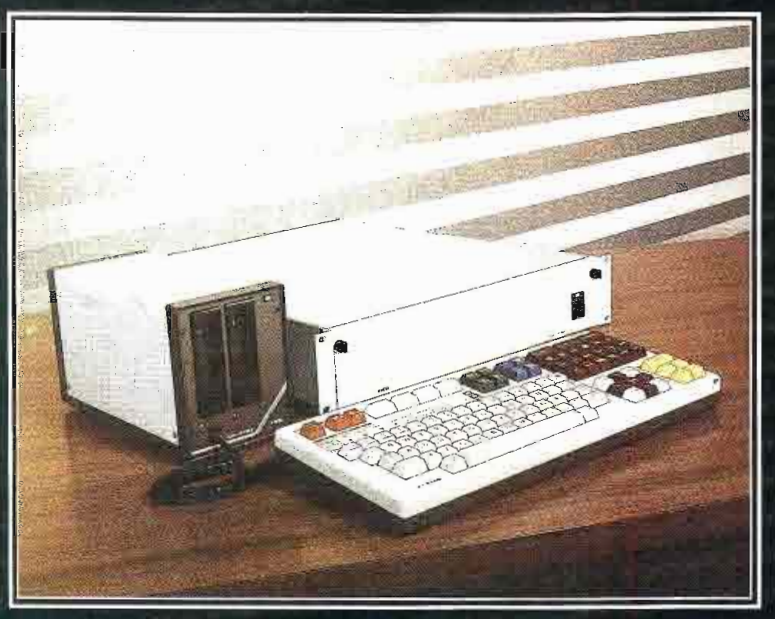

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Although the door at WIXT-TV weighs more than a ton, only a force of between 25 pounds and 40 pounds is required to open and close the door. The door's suspension system is shown in Figure 2. The door travels smoothly, suspended by a low-friction ball bearing trolley from an overhead track. Hard rubber rollers located on columns in front of the door rotate as they come into contact with the door's sealing ramps. Double-row gaskets are compressed by the rollers, providing a tight seal when the door is closed. Larger horizontal sliding doors are sealed with a torque tube sealing system that pivots the door while compressing the gaskets.

The station's door measures 10 feet high and 9 feet wide and requires approximately 10 feet of wall space. Sliding doors as large as 20 feet wide and 25 feet high are practical. Power operators are available, enabling remote operation of the door. When so equipped, the door should have sensitive edges or safety switches.

Sills and frames

It is important to recognize that the door sill represents a significant path for sound leakage. Some doors require a small

Continued on page 108

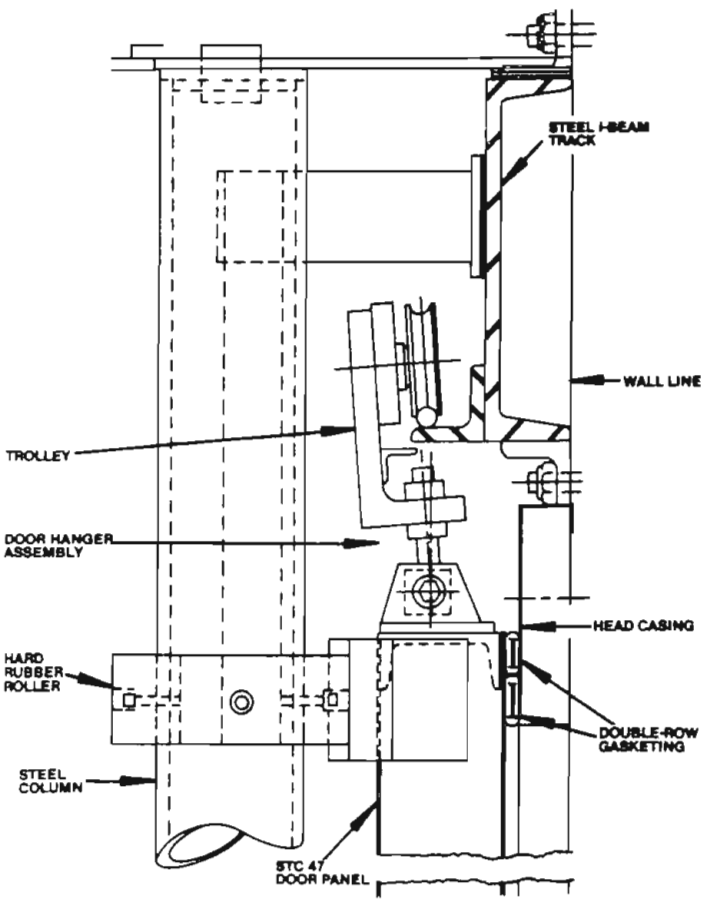

Figure 2. *This acoustical door is suspended from a trolley that glides on a steel I-beam track. Note the double row of gaskets at the door top.*

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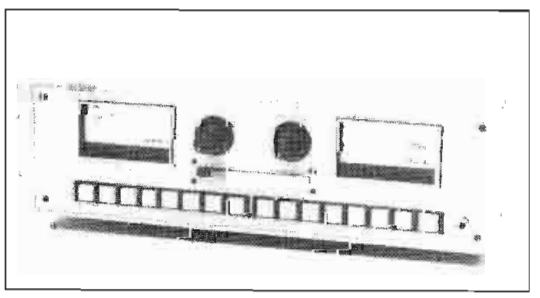

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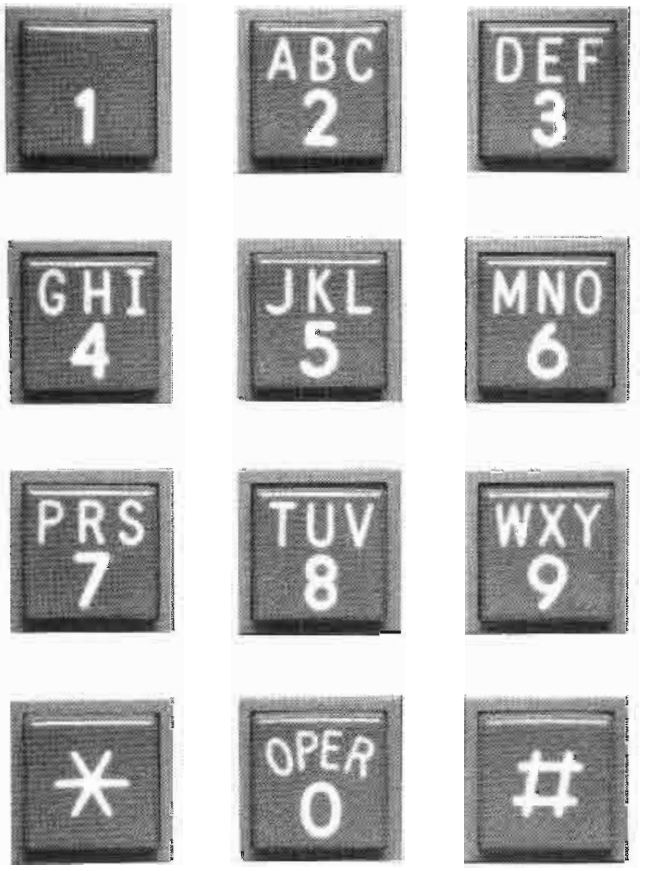

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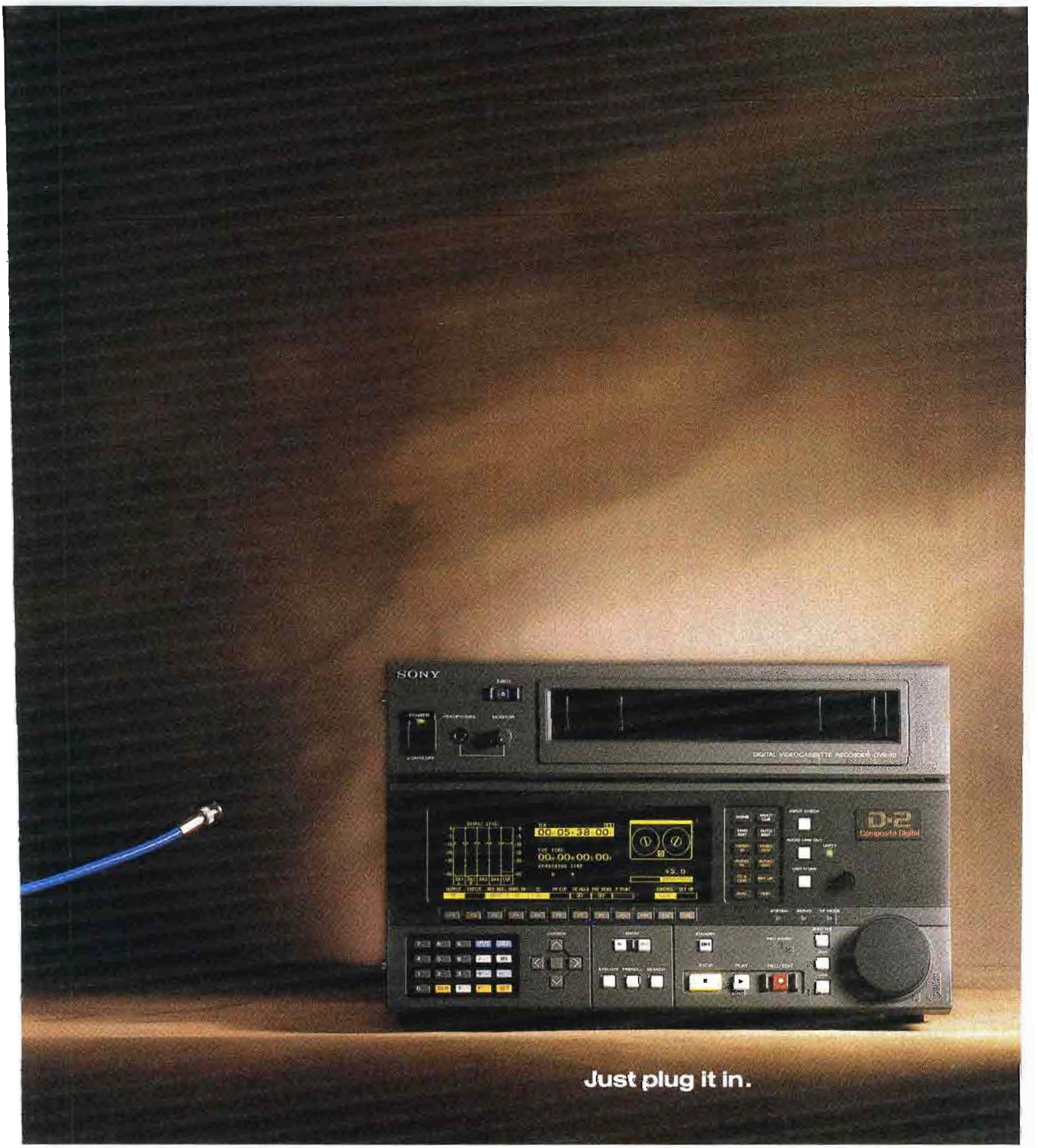

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Continued from page 104
threshold gasket or semi-oval threshold at the sill to achieve a given STC rating, as shown in Figure 3. Doors with sills that are perfectly flush with the adjacent floor may require automatic drop sill gaskets or air-driven gaskets. If your station plans to use a flush sill, be sure the engineering consultant specifies that the door's STC rating is based on a flush sill gasket design.

The door frame, as well as the door, must be matched carefully with the wall. The thickness and construction of the wall will determine the width of the frame, including soffits and rabbets. The door manufacturer must know whether walls are poured concrete or masonry so that proper frame anchorage may be provided.

Care must be taken to ensure proper installation and maintenance. Frames and doors must be true and plumb. Any flanking paths as a result of faulty door frame installation will result in sound transmission leakage.

The door gaskets must be adjusted correctly to obtain a proper compression seal at the sides, head and sill. An opening the size of a pinhole between the gasket and the door frame can decrease STC performance as much as 6dB for high-performance sound doors.

After the door is installed, gasket maintenance is a must. Elastomeric gaskets used with sound-reduction doors are subject to compression set. The gaskets need periodic adjustment. Adjustments usually are made by moving the door stops to maintain adequate compression. Gaskets damaged by moving traffic should either be repaired or replaced.

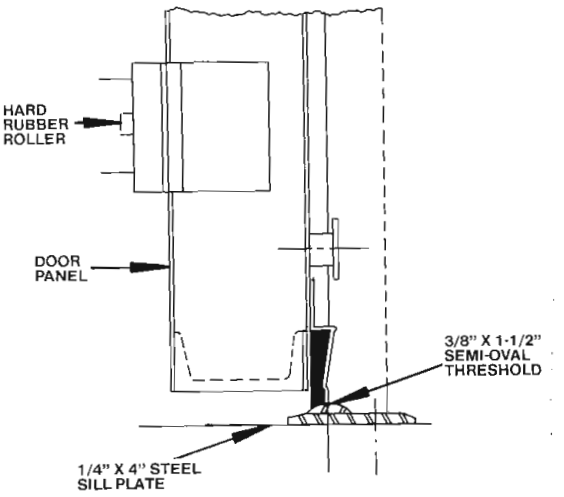
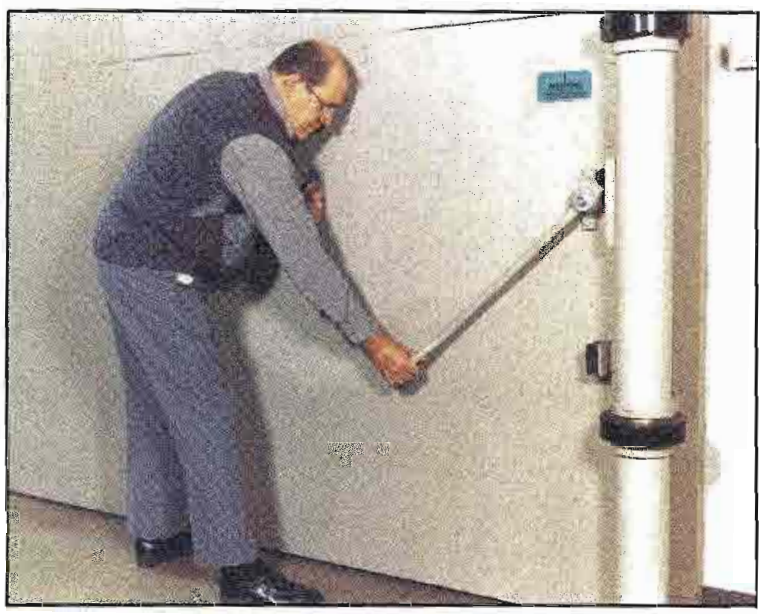


Figure 3. *Cross-section of floor gasket. If cameras must be moved between adjacent studios, a drop-sill or air-driven gasket should be used.*

The objective of any sound-reduction door is to provide the desired barrier between the noise source and the broadcast studio. Careful attention to developing the required specifications will help to ensure the door's successful performance. As WIXT-TV learned, the use of high-performance acoustical doors can go a long way toward enhancing the efficiency of a station's overall production operation.



The 1-ton door opens with a starting pull of 40 pounds and a sliding force of only 25 pounds. The vertical column on the right is the torque tube, which compresses the door gaskets and forms a sound-tight seal.

MATERIAL	STC
Solid concrete	
3" thick (at 39 lb/ft² weight)	47
6" thick (at 72 lb/ft² weight)	54
12" thick (at 144 lb/ft² weight)	60
24" thick (at 288 lb/ft² weight)	66
Brick	
4"-thick wall with ½"-thick plaster each side	42
12"-thick wall with ½"-thick solid brick	54
Concrete block	
6" CMU hollow blocks	43
8" CMU hollow blocks	45
12" CMU hollow blocks	50
Two layers of ½" gypsum wallboard	31
2'×4' wooden stud, gypsum wallboard (½" each side)	38
2'×4' wooden stud, gypsum lath (3/8") and ½" plastic	46
Steel truss rod, gypsum lath (3/8") and ½" plastic	47
3/16"-thick steel plate	36

Table 1. *Typical sound transmission class (STC) ratings of common construction materials.*

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UHF multichannel antenna systems

By Ernest H. Mayberry and James T. Stenberg

A combined antenna system may provide the answer for stations planning to upgrade their transmission facilities.

Regulatory pressure is making it increasingly difficult to find suitable transmitting site locations for high-power UHF-TV stations. The FAA imposes numerous restrictions on placement of tall towers, EPA/FCC RF radiation guidelines make it difficult to use sites near inhabited areas, municipal codes vary widely and unpredictably from city to city, and most of the best transmitting sites in a given market already have been taken by other stations or services. An economical solution may, however, be found in the use of a single, multichannel antenna and transmission line fed by two or more stations at a site.

The advantages of a common site for multiple channels are easily recognizable. Real estate and tower costs are lower; the use of a location already accepted by the FCC, FAA and local governments assures a faster and more predictable approval process; and all broadcasters benefit from the common orientation of receiving antennas.

For most stations, the major consideration is economics. The use of common antenna and transmission-line hardware reduces the cost of the project compared with a multiple-antenna installation. In fact, a multichannel transmission system can reduce tower costs. Figure 1 compares a dual-antenna installation and a multichannel antenna system on one tower. Even with the additional cost of the transmitter combiner, the savings using a broadband, multichannel system are significant. This example looks at a case in which two channels are used; more substantial savings are possible by adding other channels to the system.

For some applications, a broadband antenna system is the only solution. Existing towers often are limited in available aperture and/or windload capacity for antenna-mounting, preventing the use of multiple antennas on the structure.

Mayberry is a systems engineer with LDL Communications, Laurel, MD; Stenberg is an RF design engineer with Micro Communications, Manchester, NH.

Antenna considerations

Radiation of multiple channels from a single antenna requires the antenna to be broadband in both pattern and impedance (VSWR) characteristics. As a result, the antenna design represents a significant departure from the narrowband, single-channel pole antennas commonly used for UHF-TV. The typical single-channel UHF antenna uses a series feed to the individual radiating elements; a broadband antenna has a branch-feed arrangement. The two feed arrangements are shown schematically in Figure 2.

At the design frequency, the series feed provides co-phased currents to its radiating elements. As the frequency varies, the electrical length of the series line feed changes such that the radiating elements are no longer in phase outside the designed channel. This electrical length change causes significant beam tilt out of band and an input VSWR that varies rapidly with frequency.

In contrast, the branch-feed configura-

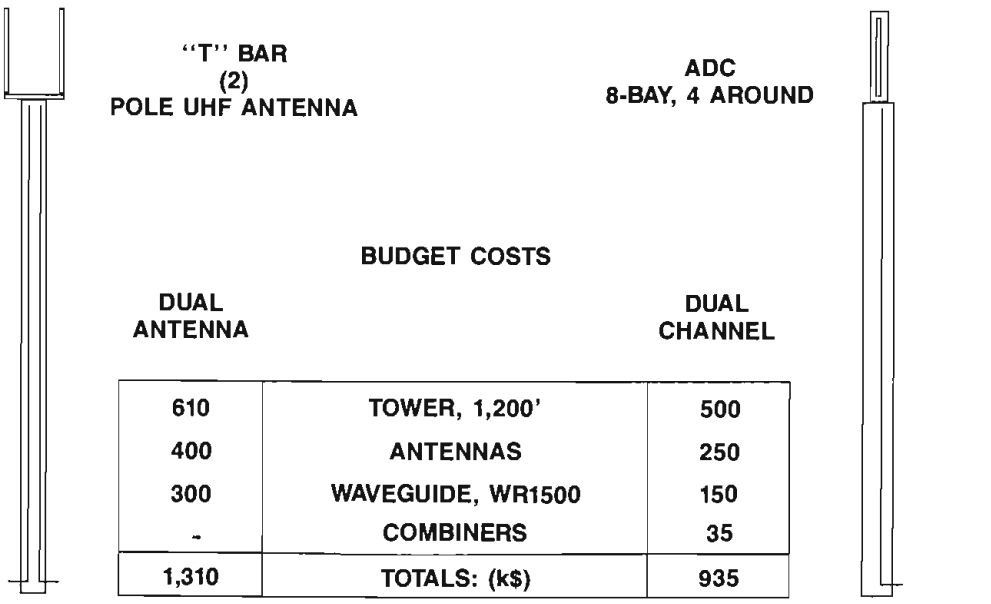

Figure 1. Cost comparison of dual-antenna vs. dual-channel operation for two UHF-TV stations.

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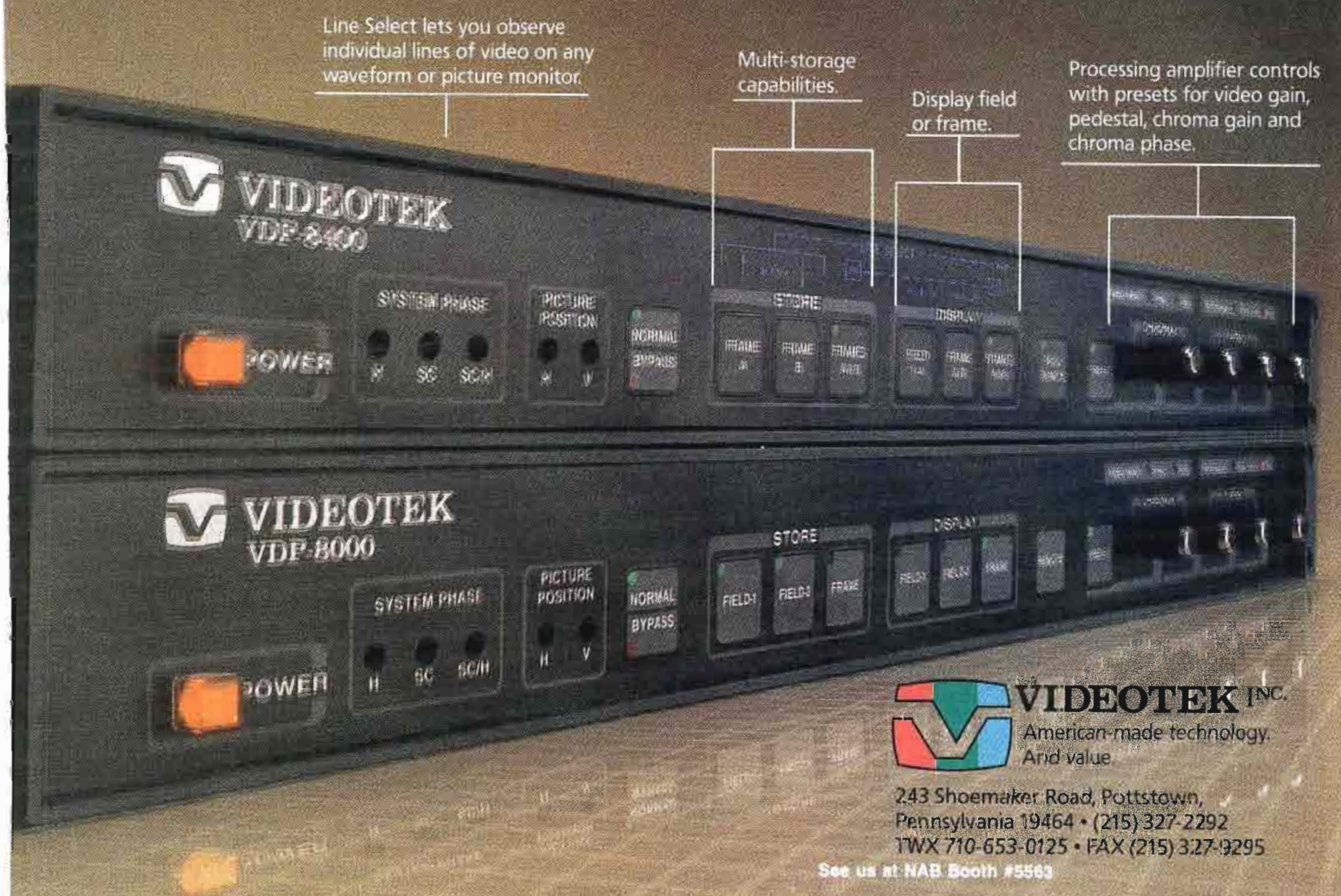

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tion employs feedlines that are nominally of equal length. Therefore, the phase relationships of the radiating elements are maintained over wide frequency spans. This provides vertical patterns with stable beam tilt, required for multichannel applications. Broadband VSWR performance also is possible because the input impedance is essentially the average of all the radiating element impedances.

The basic building block of the multichannel antenna is the broadband panel radiator. The individual radiating elements within a panel are fed by a branch-feeder system that provides the panel with a single input cable connection. These panels then are stacked vertically and arranged around a supporting spine or existing tower to produce the desired vertical and horizontal radiation patterns.

This design provides great flexibility for accommodating the multiple requirements of gain, power handling and horizontal radiation pattern shape. For increased gain, more panels are stacked vertically. If greater power handling is required, more panels are used (either vertically and/or horizontally around the mounting structure). Because of the freedom to vary the phasing, power division and pointing direction of the panels,

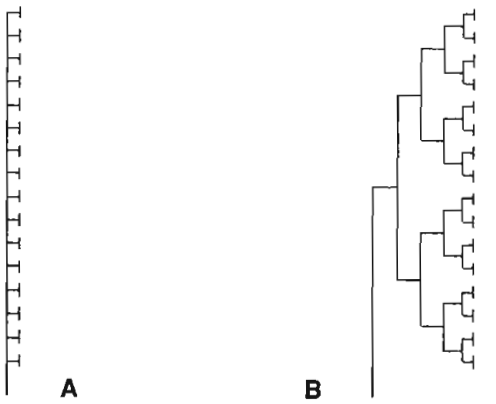


Figure 2. *Antenna feed arrangements. (a) Series-feed or narrowband antenna. (b) Branch-feed or broadband antenna.*

numerous custom horizontal radiation patterns are possible. It is this flexibility that makes it difficult to put absolute limits on the performance capabilities of multichannel antenna systems.

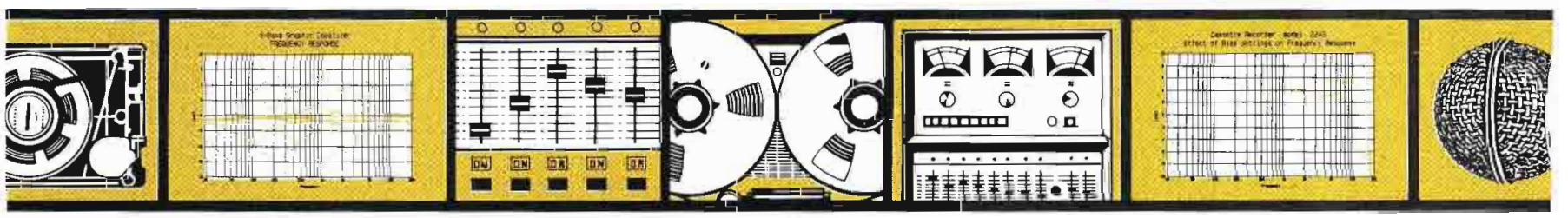
The ability to combine multiple channels in a single transmission system depends upon the bandwidth capabilities of the antenna and waveguide. The antenna must have the necessary bandwidth in both pattern and impedance (VSWR). It is possible to design a UHF antenna system for low-power applications using coaxial transmission line that provides wideband capability. For high-power systems, waveguide bandwidth sets the limits of channel separation. The scope of this discussion is limited to high-power systems that use waveguide for power transmission from transmitter to antenna.

Antenna pattern performance is not a significant limiting factor. As frequency increases, the horizontal pattern circularity deteriorates, but this effect is generally acceptable. Also, the electrical aperture increases with frequency, which narrows the vertical pattern beamwidth. If a high-gain antenna were used over a wide bandwidth, the increase in electrical aperture might make the vertical pattern beamwidth unacceptably narrow. Usually, however, this is not a problem because of the channel limits set by the waveguide.

For the antenna, it is primarily VSWR that limits the operating bandwidth. Broadband VSWR performance is accomplished by use of the following:

- branch-feed system.
- broadband individual panels.
- elements fed with a phase perturbation scheme[1].
- properly located discontinuities in the feed system[1].

Phase perturbation generally occurs as



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Amber 5500: a broadcast-ready, fully programmable audio test system with optional AudioCheck™ PC automation software.

Whether you're testing electronics, tape machines or room acoustics, you want fast, accurate, reliable information — not programming, interfacing or connection headaches.

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a natural by-product of providing null fill and beam-tilt phasing over an antenna's vertical aperture. As a result, the similar impedance characteristics of the panels cancel out at the antenna input. It also is possible to incorporate phase perturbation within individual bays of an antenna to improve the impedance characteristics of the bay. If discontinuities in the feed system are located properly, the impedances of the multiplexed channels are matched, and an improvement in overall bandwidth occurs.

By using these techniques, it is possible to offer an antenna input VSWR specification for each of the combined channels that assures excellent picture performance, comparable to that achieved by single-channel antennas. Typical VSWR specifications for the visual carrier are 1.05:1 (each channel) and 1.10:1 for the visual upper sideband.

Horizontal pattern capabilities

Because of the physical design of a broadband panel antenna, the cross-section is larger than that of the typical narrowband pole antenna. Therefore, as the operating frequencies approach the high end of the band, the circularity (average circle to minimum or maximum ratio) of an omnidirectional broadband antenna generally deteriorates. For example, the economical 4-panel-per-bay antenna configuration has typical circularities of ±2dB at channel 26 and increases to ±3dB at channel 69.

Consider the meaningful effect this has on coverage. Figure 3(a) shows a 4-panel-per-bay horizontal pattern with ±2.5dB circularity and its corresponding rms circle. Because the ERP of an omnidirectional antenna is based on the rms gain, the Grade B coverage distance actually is greater in the maximum directions and less in the minimum directions. For this case, a variation of +2, −4.5 miles relative to the FCC-calculated Grade B distance of 51.5 miles (transmitting 2.5MW ERP from 1,200 feet) is obtained. The total coverage

Continued on page 235

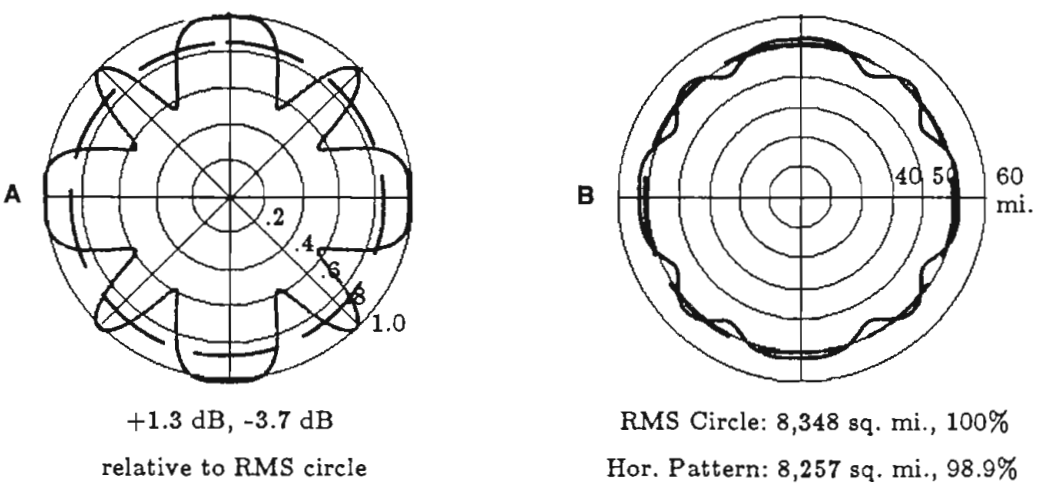

Figure 3. *Comparison of horizontal pattern vs. coverage area for a 4-element-per-bay (square) antenna. (a) Horizontal pattern with ±2.5dB circularity and the corresponding rms circle. (b) Resulting coverage area of each pattern.*

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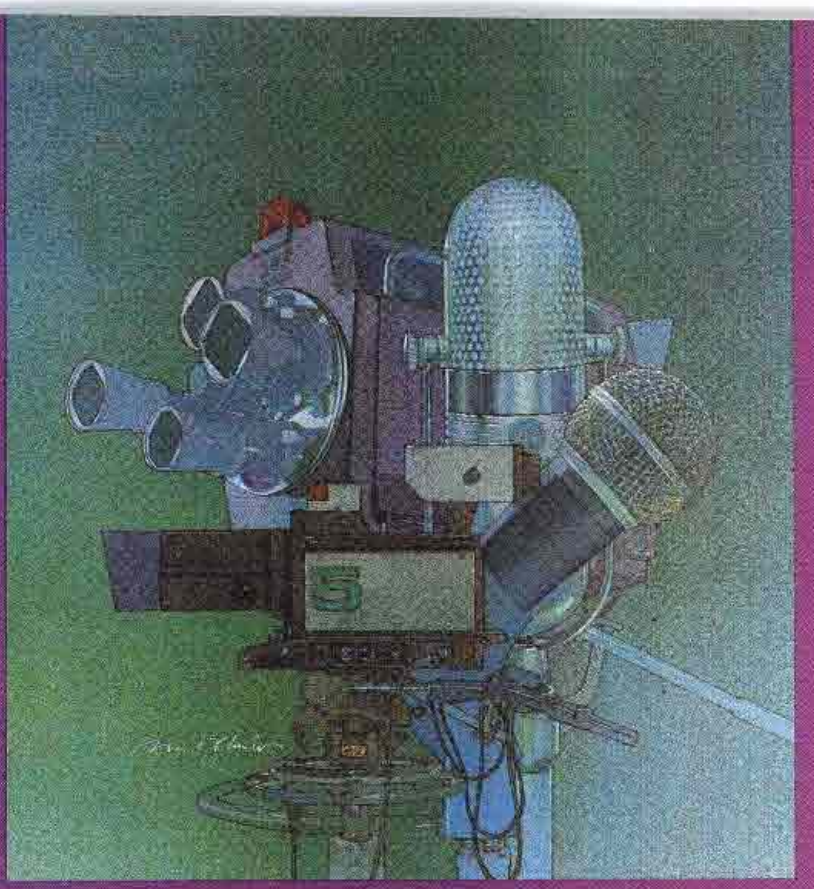

EXHIBITOR LISTINGS

"On the Air: Proud Tradition — Dynamic Future"

The proud tradition of broadcasting is part of the theme of the National Association of Broadcasters' convention in Las Vegas, NV, April 29-May 3. NAB has planned events that will provide a glimpse back into broadcast history, but much of the content of the technical papers and other meetings will look toward the compelling future of broadcasting. Many companies will follow the tradition of introducing dynamic new products in the exhibit halls. And advanced TV systems, which seem to have become a tradition over the past several years, will play a major role in this years' event.

Anyone who is interested in higher-resolution pictures and larger screens will not want to miss two demonstration areas. One is at the convention center, where a large part of the East meeting rooms have been given over to advanced television and will include a complete studio and a home-viewing environment. Exhibits in this area will feature proponents of terrestrial standards for North America.

A second area of interest will be off-site, at the Tropicana Hotel. Billed as "HDTV Production Expo '89," the Tropicana exhibit will include production equipment specifically for HDTV, particularly 1125/60. Tickets will be available at the ATV exhibits desk or at the Tropicana. Plan to set aside approximately two hours for this special excursion trip, which includes a 15-minute theater presentation and a guided tour through the exhibit. Buses will run between the convention center and the Tropicana Hotel. Manufacturers who, at our press deadline, were known to be participating in either of these special exhibits are marked with a dagger (†) in the "Exhibitor Listings."

In the **BE** exhibitor guide in this issue, you will find information on many of those new products. The guide consists of three parts. The first part is a preliminary exhibitor map that is bound into this issue, just before this page. The map shows the floor plan of the Las Vegas Convention Center and the Hilton convention annex. You also will find a small section on the main convention center map that indicates outside exhibitors. Keep in mind that all exhibit numbers 7,000 and higher are in the Hilton. Outside exhibits begin with an *A*. Companies known to be involved only at the Tropicana have *TROP* as an exhibit designation.

Booth numbers will be changing almost up to the opening of the show, but you should be able to tentatively chart trips through the exhibit hall. Just be sure to pick up the latest edition of the **BE** map in the publications area of the convention center so that you can double-check the location of exhibits. It will contain any changes that were made available to us after the completion of the preliminary map.

The second part of the guide is the alphabetical "Exhibitor Listings," beginning on page 136. All companies that told **BE** they planned to attend are included in this list, along with a notation of the generic product types they expect to exhibit. Booth numbers for each manufacturer are included, as are reader service numbers, which you may use to request product information from these companies. A blue *See ad page* line indicates any manufacturer advertising in this issue.

A code number, such as A1 or S6, that appears with an exhibitor's listing is for use as a cross-reference to the third part of the NAB exhibition guide, "New at NAB," which lists the new products to be introduced at this year's show. That section begins on page 186.

Welcome to NAB '89.

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No dropouts in Russia.

Tape dropouts mean trouble for videotape professionals. No wonder so many of them choose to work with Sony Professional Videotape. Including the producers of two recent documentaries shot in Russia, who minimized dropouts by shooting with Sony Videocassettes.

Sony cassettes were never at a loss for picture, whether covering sub-zero, Northern Russia nights or getting impromptu interviews with people on the street in Moscow.

Not that this surprises those of us at Sony Professional Videotape. After all, we've designed all our products around one basic premise: durability. To be frank, the demanding shooting conditions of Russia aren't as tough on our tape as we are.

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No matter which Sony Professional Videotape you're working with, there's one thing you know for sure. Its greatest ability is durability. Whether it's U-matic, Betacam,® 1" or Digital tape. So take on the world. With Sony Videotape. On location in Moscow, Russia or in a studio in Moscow, Idaho, you need a tape that's tough as Sony. After all, there's no better way to lower the dropout rate.

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Circle (70) on Reply Card

Abbott div/Brintec (n.a.)
Power connectors, grounding systems.
Circle (501)

Abekas Video Systems 5582
Videodisc recorders, still stores; digital video effects systems; video production switchers; graphic titlers. (V2, V6)
Circle (502) See ad page 47,248A-D

ACCOM 917
Video processors; noise, grain reducers. (V7)
Circle (503)

Accu-Weather 7416
Weather data services, graphic displays, maps. (V5)
Circle (504)

Accurate Sound 5760
Microphones; reel, cassette audio recorders, duplicators; tape conditioners. (A3, A4, S4)
Circle (505)

A.C.E. 7935
Video encoders, decoders; color correction, video processors; video switchers. (V5, V7)
Circle (506)

Acoustic Systems 5486
Acoustic materials; prefabricated broadcast booths. (S7)
Circle (507)

Acrodyne Industries 3982
VHF, UHF TV transmitters, exciters. (R1)
Circle (508)

Adams-Smith 2505
Time code systems, transport synchronizers, emulators; audio, video editing controllers. (A3, V2)
Circle (509)

ADC Telecommunications 3755
Multipin machine control patching; audio termination, cross-connection systems; patch panels, cords; wiring management. (S2)
Circle (510) See ad page 259

Adelphon A150
Broadcast tower products, accessories. (R1)
Circle (511)

ADM Technology 4951
Audio consoles; mix-minus systems; audio level meters; audio DAs; console-editor interfaces. (A1, A3, S5, S6)
Circle (512) See ad page 327

Adrienne Electronics 7901
Time code products; computer hardware, software; routing, distribution systems. (S1, S5, V2)
Circle (513)

Advanced Designs 5334
Weather radar equipment. (V5)
Circle (514)

Advanced Micro-Dynamics 1563
Transmitter remote control cabling kits; remote control accessories. (R1)
Circle (515)

Advent Communications 7300
Satellite news collection flyaway systems; video exciters, modulators, data converters; communications package systems. (R5, R6)
Circle (516)

ADx 5551
Time code products, synchronizers. (V2)
Circle (1155) See ad page 306

AF Associates 3719
Remote production vehicles, facilities design, construction; distributor; AVS standards converters; test/monitoring equipment; Radamec-EPO robotic camera pedestals and camera control systems. (S6, V1, V7)
Circle (518) See ad page 217, 285

AGFA 5206
Video recording tape.
Circle (519)

Aircraft Digital Music Library 5444
Production music; CD, record, tape formats.
Circle (520)

AKG Acoustics 2043
Microphones, headphones; audio effects, delay equipment; digital audio workstations. (A3)
Circle (521) See ad page 147

Alamar Electronics 4779
Broadcast programming automation equipment; machine controller interfaces. (S1)
Circle (522)

Alan Gordon Enterprises 3855
Animation equipment; distributor, microphones, audio accessories; camera support systems; studio furnishings, effects devices; production equipment rentals. (A1, A4)
Circle (523)

Alden Electronics 5460
Weather graphics, radar displays (V5)
Circle (524) See ad page 137

Alexander Batteries 3914
Batteries, charger/analyzers. (V4)
Circle (525)

Allen Avionics 5222
Fixed, adjustable video delays, timing units; hum eliminators; audio, video processors; distribution systems; wiring, connectors, patching products. (S6)
Circle (526)

Allen-Heath 7434
Audio consoles. (A1)
Circle (527)

Allied Broadcast Equipment 2027
Distributors; Autogram Pacemaker audio consoles; pre-assembled radio station. (A1, S7)
Circle (528)

Allied Broadcast Systems 2215
Facility turnkey engineering services; studio furniture; prewired studio services. (S3, S7)
Circle (529)

Allied Tower 1565
Broadcast towers, construction, services.
Circle (530)

Allsop 5356
Tape cleaning kits, refills; Beta, VHS, U-Matic formats. (S4)
Circle (531)

Alpha Audio 3455
Automated audio editing equipment. (A3)
Circle (532) See ad page 204

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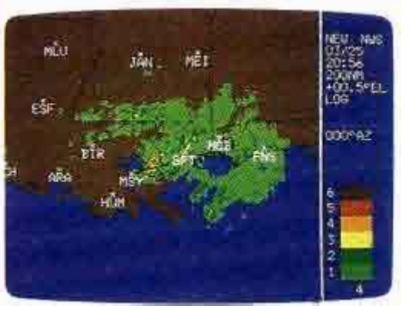
Four Radars

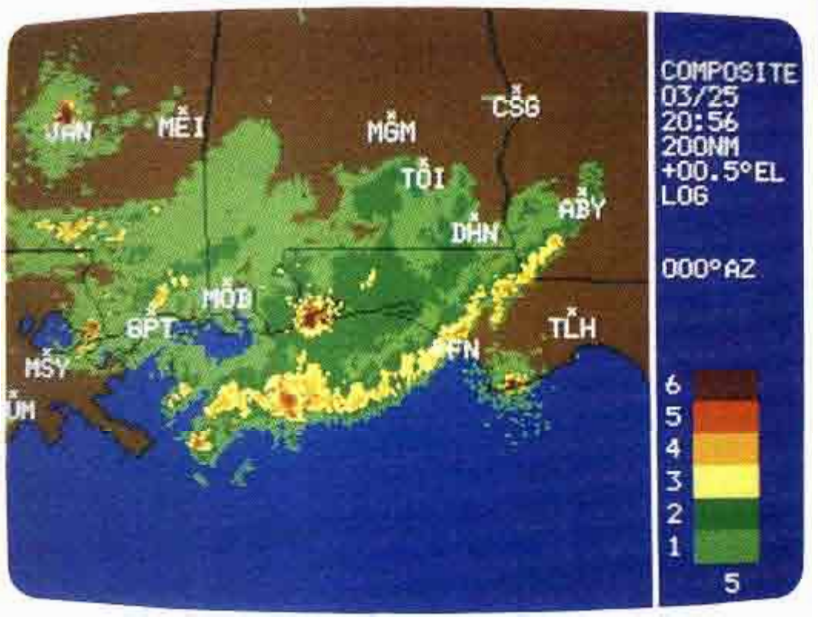
Pensacola, FL

Apalachicola, FL

Jackson, MS



New Orleans, LA



Individual radar displays can only show you part of the picture. This composited image, centered in Pensacola, FL, combines echoes from four different radar sites and shows the true magnitude of the storm.

PLEASE VISIT US AT NAB BOOTH 5460

In One

When the real weather story is outside the range of conventional radar, you need Alden's new radar compositing feature.

Compositing combines the echoes from multiple radar sites and displays them on a single screen. You can specify the radar sites you want, or automatically gather echoes from all the sites in your region–up to 16 in some areas!

The result is a display that's dramatically different from conventional radar. Instead of simply showing the weather that's here, compositing adds the weather that's on its way.

In addition to compositing, Alden's Weather Radar System offers a full range of standard features, including zoom, time-lapse looping, customized backgrounds, and auto-dialer. Yet the cost is thousands less than other systems.

For more information on Alden's Weather Radar System, contact Alden Electronics, 46 Washington Street, Westborough, MA 01581 (508) 366-8851.

ALDEN ELECTRONICS

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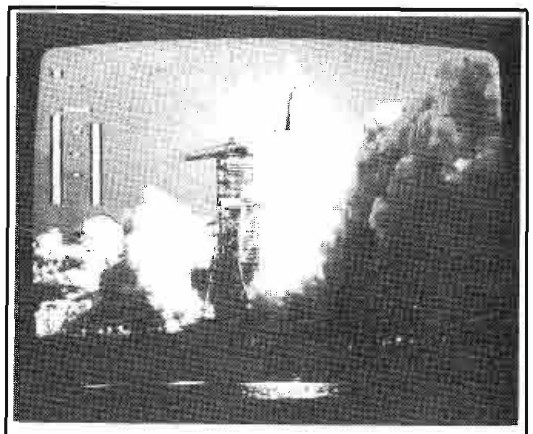

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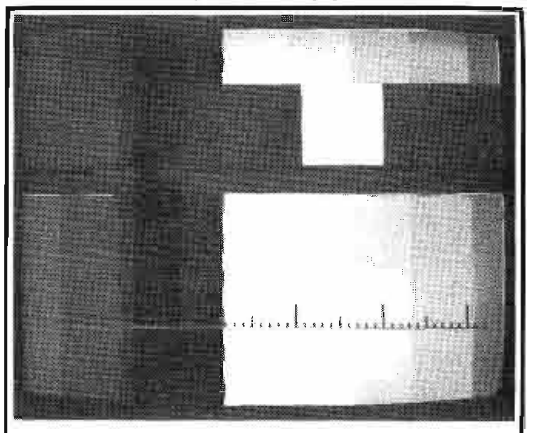

RG341 VIDEO GENERATOR

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- Movable MicroMark 1/10 Microsecond Ruler
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- Exact Center and Minimum Lettering Graticles
- Ideal for Graphics Stations, Master Monitors

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Alpha Video & Electronics/AVEC 5183
Enhanced VTRs/VCRs; IFB systems; ENG antenna mast accessories. (A4, S7)
Circle (533)

ALTA Group 4526
Video production systems; TBCs, synchronizers; digital video effects equipment. (V5, V7)
Circle (534) See ad page 210, 211

Altronic Research 2529
RF dummy loads, water and air cooled. (S6)
Circle (535)

Amber Electro Design 2209
Audio measurement systems, distortion analyzers. (S6)
Circle (536) See ad page 112

AMCO Engineering 3747
Standard, custom equipment enclosure racks, accessories.
Circle (537) See ad page 165

AMEK Consoles/TAC 2008
Audio consoles. (A1)
Circle (538) See ad page 329

American Studio Equipment 2038
Special purpose camera mounts, dollies; studio electrical equipment; grip products.
Circle (539)

Amperex Electronic 5213
Camera tubes, CCDs; RF power tubes, klystrons.
Circle (540) See ad page 231, 81

Ampex Audio-Video Systems 4501
Video cameras, camcorders; analog, digital video recorders; digital effects, graphics systems; editing controllers; still store systems; system design, construction services; digital signal translators. (V1, V2, V5, V6, V7)
Circle (541) See ad page 42-3, 51, 140-1

Ampex Magnetic Tape 4501
Audio, video analog, digital recording media; reel, cassette forms. (S4)
Circle (542) See ad page 183, 207

AMS/Calrec 1134
Digital and digitally assignable analog audio consoles; audio workstations. (A1, A3)
Circle (543) See ad page 343

Amtel Systems 5433
Time code, machine control products; distribution equipment; video processors.
Circle (544)

AMX 7230
Machine, equipment controllers, interfaces; control panels. (S1, S5, V2)
Circle (545)

Andrew 1721
Earth station antennas, receivers, LNA/LNC controls, C-/Ku-band upgrade kits; transmission line, connectors; microwave equipment. (R1, R6)
Circle (546) See ad page 335, 337

Angenieux 4138
TV camera lenses. (V1)
Circle (547)

Anixter Brothers 2436
Microwave antennas.
Circle (548)

Anritsu 7521
RF test equipment.
Circle (549)

Antenna Technology 2036
Earth station antennas, uplink HPAs, RF amplifiers; demods, receivers. (R6)
Circle (550)

Anton-Bauer 5219
Batteries, chargers; battery analyzers. (V4)
Circle (551) See ad page 281

Anvil Cases 5426
Heavy-duty, reusable, custom, standard shipping cases of aluminum, other material, ATA-approved.
Circle (552) See ad page 50

Aphex Systems Ltd 1058
Audio processors, DAs; MIDI equipment; clock systems. (A2, A4, S1, S5)
Circle (553) See ad page 116

Apollo Audio Visual 7535
Slide-to-video transfer systems; mobile, AV/TV furniture; lamps; video presentation systems. (S3, V3, V4, V8)
Circle (554)

Applied Research & Technology (n.a.)
Digital audio delays, reverbs, stereo equalizers; dynamics processors. (A2)
Circle (555)

Arben Design 5763
Studio fixtures; cyc tracks; facility designs.
Circle (556)

Arbitron Ratings 4377
Audience research services.
Circle (557)

Arrakis Systems 2215
On-air, production mixers; audio distribution switchers, DAs.
Circle (558) See ad page 21

Arriflex 4165
Film cameras, lenses, accessories; lighting accessories; time code products; video camera accessories, control systems; studio grid systems; lighting ballasts. (V1, V2, V3, V4)
Circle (559)

Artel Communications 4579
Fiber optic, coaxial transmission products; data transmission systems.
Circle (560)

ASACA ShibaSoku 5533
Video monitors; AF, RF, video test equipment; TV demod; VTR test systems; videotape, videodisc automation; HDTV products; magneto-optical recorders. (S6, V2, V8)
Circle (561)

Associated Computer Services 7033
Circle (562)

Associated Production Music 3377
Production music library, services.
Circle (563) See ad page 326

Aston Electronics 7720
Still stores; digital titling/character generator systems. (V2)
Circle (564) See ad page 133

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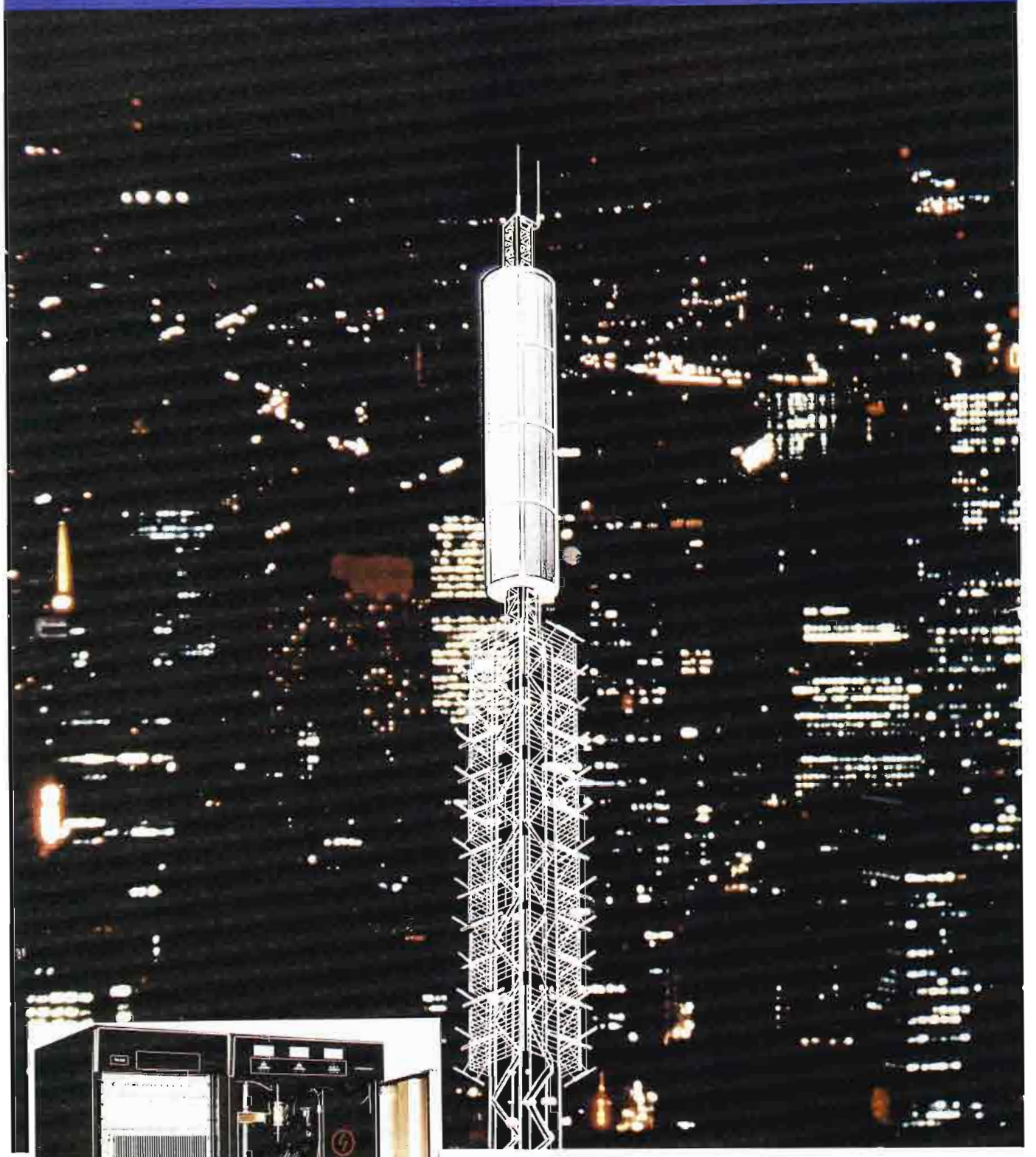
TELEVISION TRANSMITTERS



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With battery, tape and the newly-developed ultralight Nikon lens, this *camcorder* is nearly three pounds lighter than an Ike HL79E *camera!*

It's compact and easy to handle, too. So your crews can move fast and maintain a low profile, even in explosive situations.

Low light is no problem either. Advanced CCD sensors deliver dynamite pictures, even in adverse conditions.

And if those conditions mean hard knocks, don't worry. Its rugged design, magnesium alloy chassis and weatherproof housing help keep the CVR-200 on the streets, and out of the shop.

But as good as it is, the CVR-200 is only part of the story. We can outfit you with a full arsenal of the most advanced Betacam equipment available:

☐ *CVR-35*–the portable VTR with the features news professionals ask for most.

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e business.

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Before the competition does.

AMPEX

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AT&T Communications **3962**
Digital graphics systems; telco services.
Circle (565) See ad page 277

ATI Audio Technologies **2101**
Audio mixers, dynamics processors; microphone, phono, headphone, monitor amplifiers, DAs; monitor, test equipment. (S5)
Circle (566) See ad page 305

Audi-Cord **1113**
Audio cart recorder. (A3)
Circle (567)

Audico **1740**
Videocassette reloaders, rewinders, cyclers, timers, audio/videocassette labels.
Circle (568)

Audio Accessories, Inc. **1529**
Printed circuit board jacks; prewired patch panels, patch cords, jacks. (S2)
Circle (569) See ad page 172

Audio Broadcast Group **2427**
Studio cabinetry; turnkey installations; facilities design; distributor, audio mixers, effects, recording, source, monitoring equipment. (S7)
Circle (570)

Audio Developments **3465**
Audio mixers for ENG, editing; modular mic/line distribution systems. (A4)
Circle (571)

Audio Kinetics **2414**
Audio editing equipment, transport control systems; audio console automation; ADR accessories. (A1, A3, V2)
Circle (572)

Audio Precision **2044**
PC-based audio test/measurement systems. (S6)
Circle (573) See ad page 253

Audio Services **(n.a.)**
Wireless mic, recorder accessories; Sonosax mixers; distributor, rentals for motion picture, video production. (A1, A3, A4)
Circle (574)

Audio-Technica US **1631**
Portable audio mixers; instrument, wired, wireless microphones; headphones. (A4)
Circle (575)

Audio-Video Engineering **1726**
Hum-stop coils.
Circle (576) See ad page 288

Audiopak **1653**
Audio cartridge tape. (S4)
Circle (577)

Auditronics **1363**
Audio DAs; on-air, production consoles, mix-minus systems. (A1, S5)
Circle (578) See ad page 89

Autogram **1026**
Audio on-air, production mixers. (A1)
Circle (579)

Automated Business Concepts **2539**
Station management, business software.
Circle (580)

AVCOM of VA **5114**
RF measurement equipment; satellite, microwave electronics. (R4, S6)
Circle (581)

AVS div/AVESCO **3719**
TV standards converters. (V7)
Circle (582) See ad page 217, 241

BAF Communication **7538**
Satellite uplinks, flyaway units, vehicles.
Circle (583)

BAL Components **5222**
TV timing systems; delays, filters. (V7)
Circle (584)

Barco Industries **5463**
Video monitors; TV modulators, demods. (R4, V8)
Circle (585) See ad page 269

Barrett Associates **1041**
Audio mixers, processors, recorders; mics, monitors; transmitters, microwave, related equipment; wire, cable, connectors; distribution equipment; music/effects, promotional material.
Circle (586)

BASYS **5568**
Newsroom automation; machine controllers; recording systems; prompters, captioning equipment; camera support controls. (S1)
Circle (587)

B&B Systems **3873**
Test, monitoring equipment; facility design, consulting services. (S6)
Circle (588) See ad page 78

BC **7834**
Equipment cases.
Circle (589)

BCS Broadcast Store **7235**
Broadcast equipment brokers
Circle (590)

Beaveronics **1726**
Video production switchers; Favag timers, clocks; A-V Engineering hum-stop coils; titlers. (S1, V2, V5)
Circle (591)

Belar Electronics Lab **1352**
Radio, TV modulation, frequency monitors. (R4)
Circle (592) See ad page 162

Belden Wire & Cable **2431**
Wiring, cables; optical fiber materials. (S2)
Circle (593) See ad page 33

Bencher **4584**
Camera support, lighting, copy stands. (V1)
Circle (594)

Benchmark Media Systems **3780**
Microphone preamps, interfaces; common mode filters; DAs, patching equipment. (A4, S5, S6)
Circle (595) See ad page 162

BEXT **(n.a.)**
FM amplifiers, exciters, generators. (R3)
Circle (596)

beyerdynamic **3738**
Wired, wireless microphones; headphones; infrared headsets. (A4)
Circle (597) See ad page 317, 319

BHP **7517**
Videotape editing systems. (V2)
Circle (598)

Bill Daniels **5277**
Product literature services.
Circle (599)

Bird Electronic **1552**
RF load resistors, attenuators, wattmeters.
Circle (600)

Bogen Photo **5744**
Camera support products.
Circle (601)

Bogner Broadcast Equipment **5174**
TV, MDS, ITFS, MMDS broadcast antennas. (R1)
Circle (602)

Boonton Electronics **2525**
Test, measurement equipment; microwave power meters, sweepers; audio distortion, impedance analyzers; modulation monitors.
Circle (603) See ad page 145

Bowen Broadcast Service **3429**
VTR repair, modification kits for TCR-100; automation equipment; facility design, construction, consulting. (V2)
Circle (604)

Brabury/Porta-Pattern **5177**
Signal distribution products; camera test charts. (S6, V7)
Circle (605)

Bradley Broadcast Sales **2301**
Distributor; audio mixers, processors; recorders; audio sources, monitor; test, monitor, measurement units; Telos digital telephone systems. (A4)
Circle (606)

Bretford Manufacturing **5782**
Video equipment carts, cabinets; video screens; wall-mount brackets, shelves. (S3)
Circle (607)

Broadcast Audio **1053**
On-air, audio production mixers; audio distribution equipment. (A1)
Circle (608)

Broadcast Automation **7226**
Distributor, IGM automation; audio recorders, processors.
Circle (609)

Broadcast Electronics **1205**
FM transmitters; audio mixers; cart recorders; radio program automation; stereo exciters, generators; pre-amp; phono systems; remote control equipment. (A1, A3, R1)
Circle (610)

Broadcast Electronic Services **923**
VCR interface modules. (V2)
Circle (1153)

Broadcast Microwave Service **1718**
ENG transmitters, receivers, antenna pointer; RF power amplifiers, exciters, generators. (R2)
Circle (611) See ad page 158

Broadcast Products **2143**
Larger-than-life "radio" promotional vehicles.
Circle (612)

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And Cablewave's FM Broadcast Antennas ARE PROVEN First Rate Performers!

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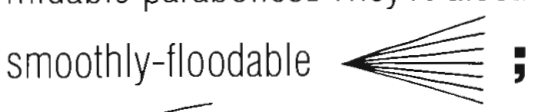

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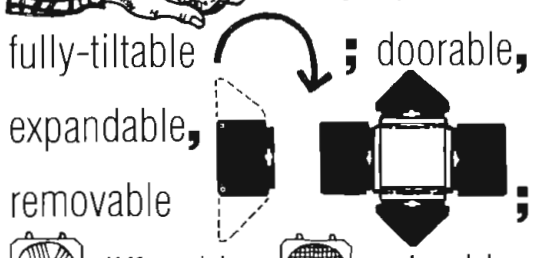

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mountable; tape-upable;

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Circle (613) See ad page 292

Broadcast Video Systems BVS **3426**
Video encoders; safe-area generators; time/date character generators; linear keyers; video, pulse delays; Cox test equipment; RGB signal processors; title assembler; multiple standard decoders. (S5, S6, V5, V7)
Circle (614) See ad page 104

Broadcasters General Store **7327**
Newsroom workstations; audio noise reduction equipment. (A2, S1)
Circle (615)

Bruel & Kjaer Instruments **7431**
Low-noise, high-intensity microphones; recording, measurement simulator. (A4)
Circle (616) See ad page 88

Bryston Limited **2148**
Audio monitor amplifiers.
Circle (617)

BSM Broadcast Systems **2237**
Distribution products, routing switchers.
Circle (618)

BTS† **4119**
Cameras; analog, digital video recorders, editing equipment; telecines; digital graphics systems; production, master control switchers; audio, digital video signal processors, format converters, sync generators; routing, DA, test equipment. (S5, V1, V2, V3, V5, V6, V7, V8)
Circle (619) See ad page 52-3

BURLE INDUSTRIES **4048**
Mixed-field Saticons. (V1)
Circle (620)

Cablewave Systems Div/CELWAVE **5100**
Coaxial, waveguide transmission line; tower, antenna products, services.
Circle (621) See ad page 143

CAL/Cox Associates **3426**
Component video titling, switchers, processors; video test equipment. (S6, V5, V6, V7)
Circle (622)

Calzone Case **3416**
ATA-rated equipment cases.
Circle (623)

Cam-Lok **3481**
Multiconductor control, power connectors, interlocks.
Circle (624)

Camera Mart **5551**
Distributor, audio, video products; cameras, time code equipment, test equipment; rental. (V1, V2)
Circle (625) See ad page 164-5

Canare Cable **5755**
Precision video coaxial cable, video component cable, BNC plugs, jacks, terminations. (S2)
Circle (626)

Canon USA **3955**
TV camera lenses; camera support products; still video cameras, reproducers.
Circle (627) See ad page 320-1

Carpel Video **3848**
Distributor, new, recycled videotape. (S4)
Circle (628)

CASCOM **7727**
Animation services; telecine accessories; camera support systems.
Circle (629)

CBSI Custom Business Systems **1253**
Station business automation software.
Circle (630)

CCA Electronics **1047**
AM, FM radio transmitters.
Circle (631)

CEL Electronics **4177**
Digital video effects; TV standards converters; editing control accessories. (V2, V5, V7)
Circle (632)

Central Dynamics **3944**
Routing, video production, master control switchers; digital encoding, decoding, translator systems. (S5, V7)
Circle (633)

Central Tower **2348**
Tower products; tower maintenance.
Circle (634)

Centro **4956**
Mobile production, news vehicles; equipment racks, consoles; audio, video accessories; facilities design, construction. (S7)
Circle (635) See ad page 79

Century 21 Programming **1621**
Radio programming services.
Circle (636)

Century Precision Optics **3470**
Camera lenses, special purpose prisms; wide-angle, telephoto accessories.
Circle (637)

Channelmatic **5519**
Videocassette automation, commercial insertion; routing, distribution. (S1, S5)
Circle (638)

Chester Cable div/Alcatel **5203**
Component analog wiring, cables. (S2)
Circle (639)

Christie Electric **3441**
Batteries, chargers, analyzers. (V4)
Circle (640) See ad page 170

Chyron Group
See:
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- Chyron
- CMX Systems
- Digital Services/DSC

Chyron† **4538**
Character generators; electronic graphics, paint systems. (V5)
Circle (641) See ad page 213

Cine 60 **4019**
Battery systems; lighting equipment. (V4)
Circle (642) See ad page 96

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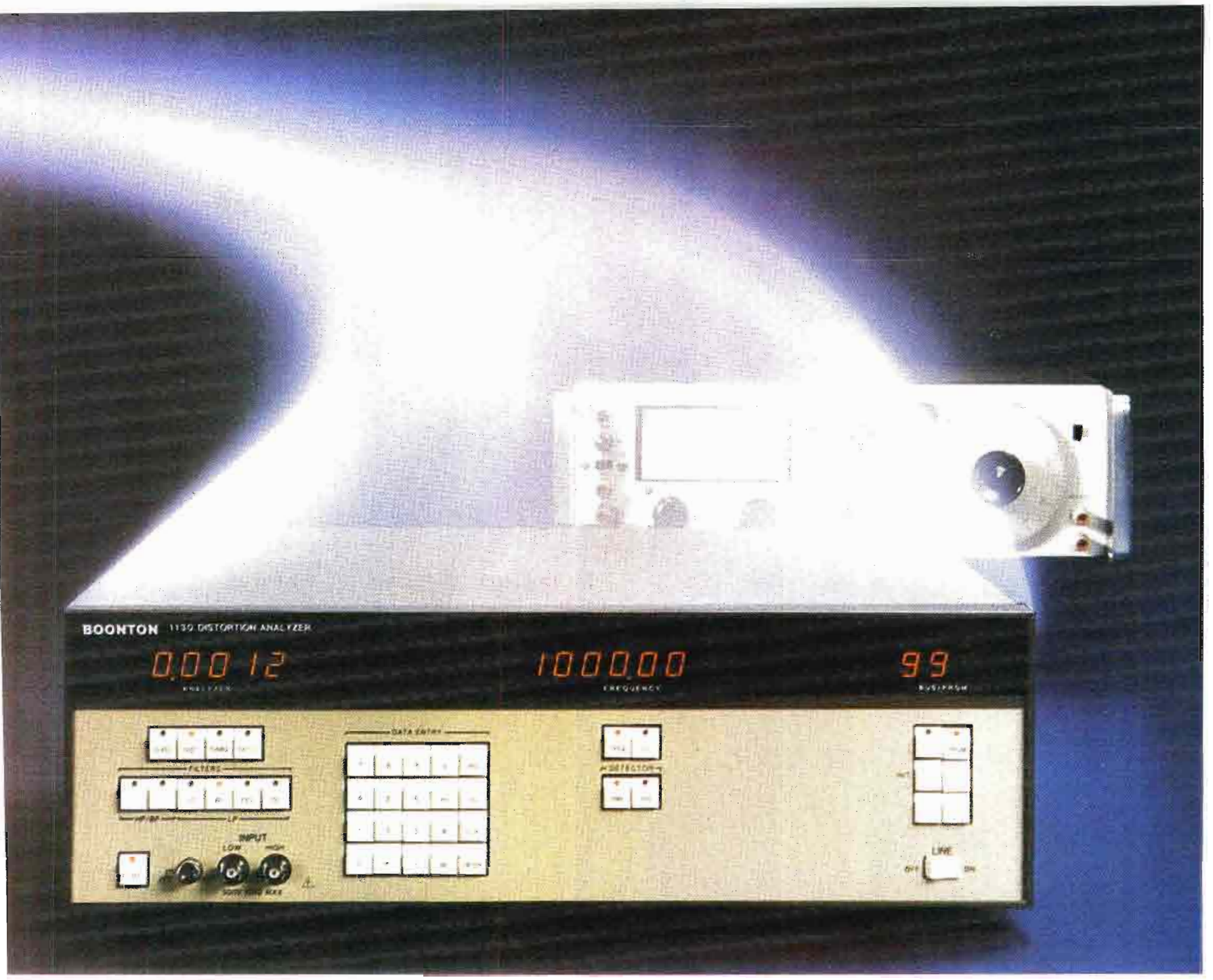

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- With test repeatability. Interdepartment measurements are consistent.
- And with a very attractive price.

Standard Features:

- Distortion fundamental frequency range 10 Hz to 100 kHz.
- 10 mV sensitivity
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- Fully differential or single-ended input.
- Average or RMS detection.
- Non-volatile storage of 99 complete panel setups.
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Good Reasons To Call RTS When You're Talking To Talent.

The time spent talking to on-air talent should be time well spent. We can help improve that critical link.

Since communication with on-air talent is in real-time, an IFB system must not interrupt the talent's concentration. Our Series 4000 IFB System does just that—and more.

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Dialog track and frame video editing systems. (A3, V2)
Circle (643)

Cinema Products **3758**
Cine cameras; camera stabilizers; wireless camera control equipment; video assist units; film-transfer accessories. (V1, V3)
Circle (644)

Cinemills **3181**
Lighting equipment, accessories, gels. (V4)
Circle (645)

Cipher Digital **3574**
Audio, video edit controllers; transport synchronizers, controllers; time code products. (V2)
Circle (646) See ad page 180

Circuit Research Labs **1009**
Audio processors; radio, TV stereo, subcarrier generators, exciters. (A2)
Circle (647)

Circuit Studios **3963**
Electronic graphics, modeling, animation. (V5)
Circle (648)

Clear-Com Intercoms **5346**
Fully digital matrix, analog intercom systems; single, multi-channel wired, wireless headset, speaker, mic operation; IFB, ISO interfaces; self-contained stereo monitor/speaker systems. (A4)
Circle (649) See ad page 223

CMC Technology **4253**
Replacement videotape recorder heads; VPR, BVH upper drum refurbishing.
Circle (650)

CMX **4538**
Videotape editing controller systems. (V2)
Circle (651)

Coaxial Dynamics **2527**
Power terminations, loads; RF test equipment, wattmeters.
Circle (652)

Coherent Communications **7618**
Time code products; wired, wireless mics; audio mixers, supplies.
Circle (653)

Colorado Video **3913**
Slow-scan video transmission systems; still stores; video noise reduction equipment. (V7)
Circle (654)

ColorGraphics Systems **4526**
Electronic graphic art equipment; weather graphics, data services. (V5)
Circle (655)

Columbine Systems **4277**
Music library/programming, newsroom, traffic management software.
Circle (656)

Comad Communications **3177**
FM radio, TV antennas; distributors, SIRA Sistemi Radio antennas, Data Security degaussers. (R1, S4)
Circle (657) See ad page 315

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AKG's DSE 7000. Digital Solutions to Analog Problems.

Creating polished audio tracks with analog equipment while under the gun is a real problem.

Have you ever ruined a track by punching in or out at the wrong moment? AKG's Digital Sound Editor stores your takes in RAM memory, so you can "undo" any mistakes and make adjustments quickly and precisely.

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Have you ever wished for a sound editor that's as powerful and easy-to-use as your word processor with controls as familiar as your mixer and tape deck? With the DSE 7000, you can easily cut, copy, move, slip and adjust sound elements. It's an AT compatible-based, digital sound editor that combines both record and mix functions together in one convenient unit — with ease, speed and flexibility.

Contact AKG to learn how the affordable DSE 7000 will provide digital solutions to your analog problems.

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"I have too much money on the line to gamble on dirty power."

Joseph H. Kelley
CEO "SHOWBOAT" Hotel & Casino, Las Vegas

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Now, the odds of you making the right choice have been further improved by Underwriters Laboratories. The Current Technology products have received outstanding marks in Underwriters new category 1449 testing program.

Joe Kelley is right. There is too much money on the line to gamble with erratic power. The Power Siftor works, you can bet on it.

Don't wait. Failure to act can result in permanent damage to your equipment! Our analysis of your power protection needs is free...and so is the call.

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MP Series

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Comark Communications/Thomson 5141
UHF TV transmitters, solid-state, Klystrode designs. (R1)
Circle (658) See ad page 84-5

Comlux 3086
Fiber optic transmission, terminal equipment; video, audio, data-to-digital processors; Telettra video codecs. (S1, S2)
Circle (659)

Communication Microwave COMWAVE 5777
Microwave transmission equipment. (R2)
Circle (660)

Comprehensive Video Supply 5548
Editing systems; S-VHS compatible titlers, video processors; scripting software; lighting; modular effects, keyer, mixer, DA products. (S1, V2, V4, V5, V6, V7)
Circle (661)

Comprompter 5774
Electronic newsroom, prompting systems. (S1)
Circle (662)

Computer Concepts 1061
Broadcast automation hardware, software; business systems; programming services.
Circle (663)

Computer Prompting 3612
Video prompting equipment, video monitors; automation hardware, software. (V5)
Circle (664)

Comrex 1521
Audio mixers; telephone frequency extender transmit/receive systems; IFB, off-air cuing equipment. (A2)
Circle (665)

Comsat World Systems 4383
Satellite system video codecs, modems. (S1)
Circle (666)

Comtech Antenna 2024
Earth station antennas.
Circle (667)

ComTek 5768
Wireless microphone systems. (A4)
Circle (668)

Concept Productions 1453
Computer-assisted programming for radio; radio formats on DAT. (S1, S8)
Circle (669)

Conifer 3858
ITFS, MMDS antennas, electronics. (R2)
Circle (670) See ad page 336

Connectronics 1571
Multicore audio cable, connectors. (S2)
Circle (671)

Conrac Display Products 1741
Video monitors.
Circle (672)

Continental Electronics/Varian 1125
AM, FM broadcast radio transmitters. (R1)
Circle (673) See ad page 287

Control Concepts 3902
Power line filters, conditioners. (S6)
Circle (674) See ad page 156

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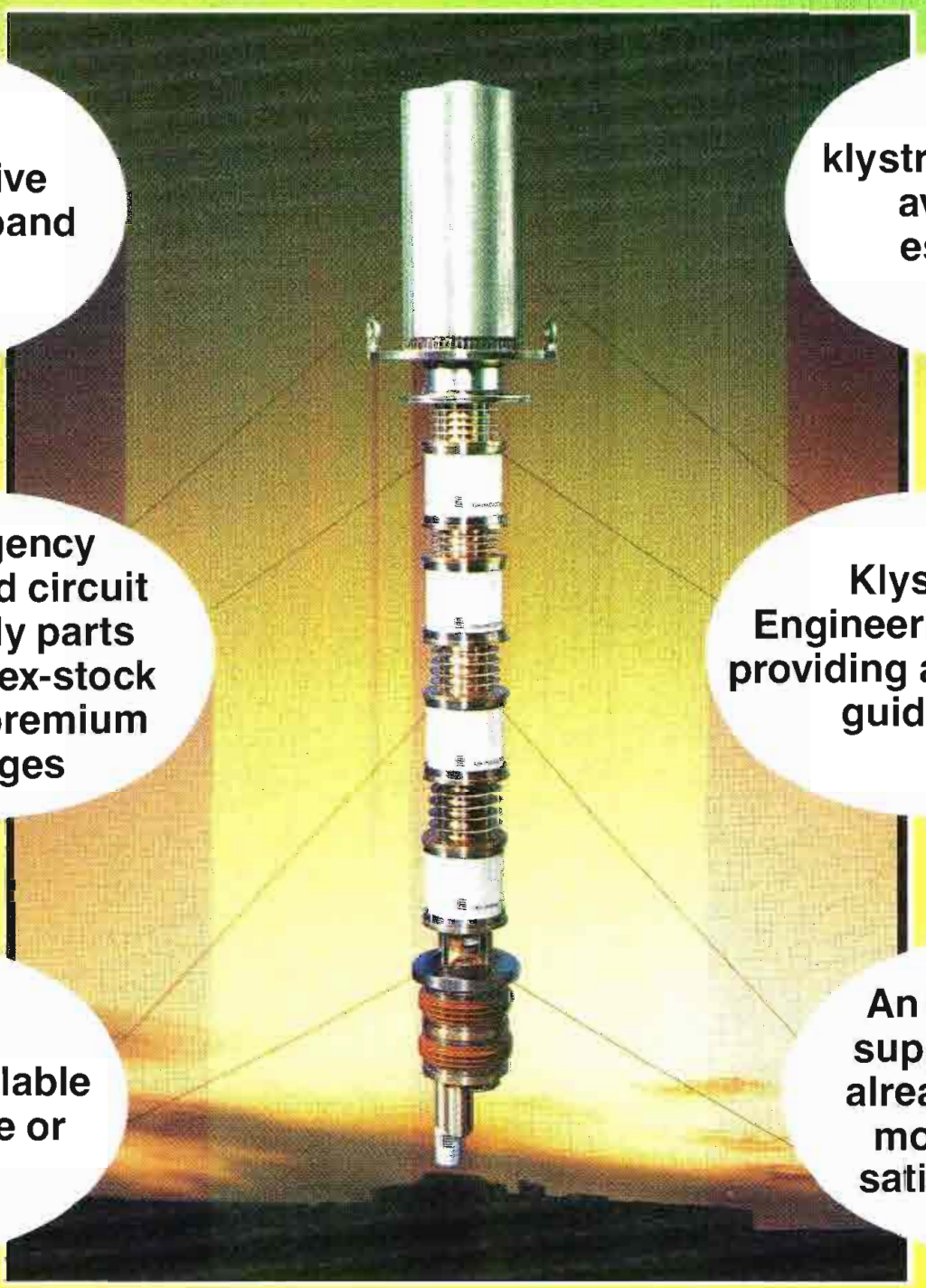

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An established support scheme already servicing more than 200 satisfied clients

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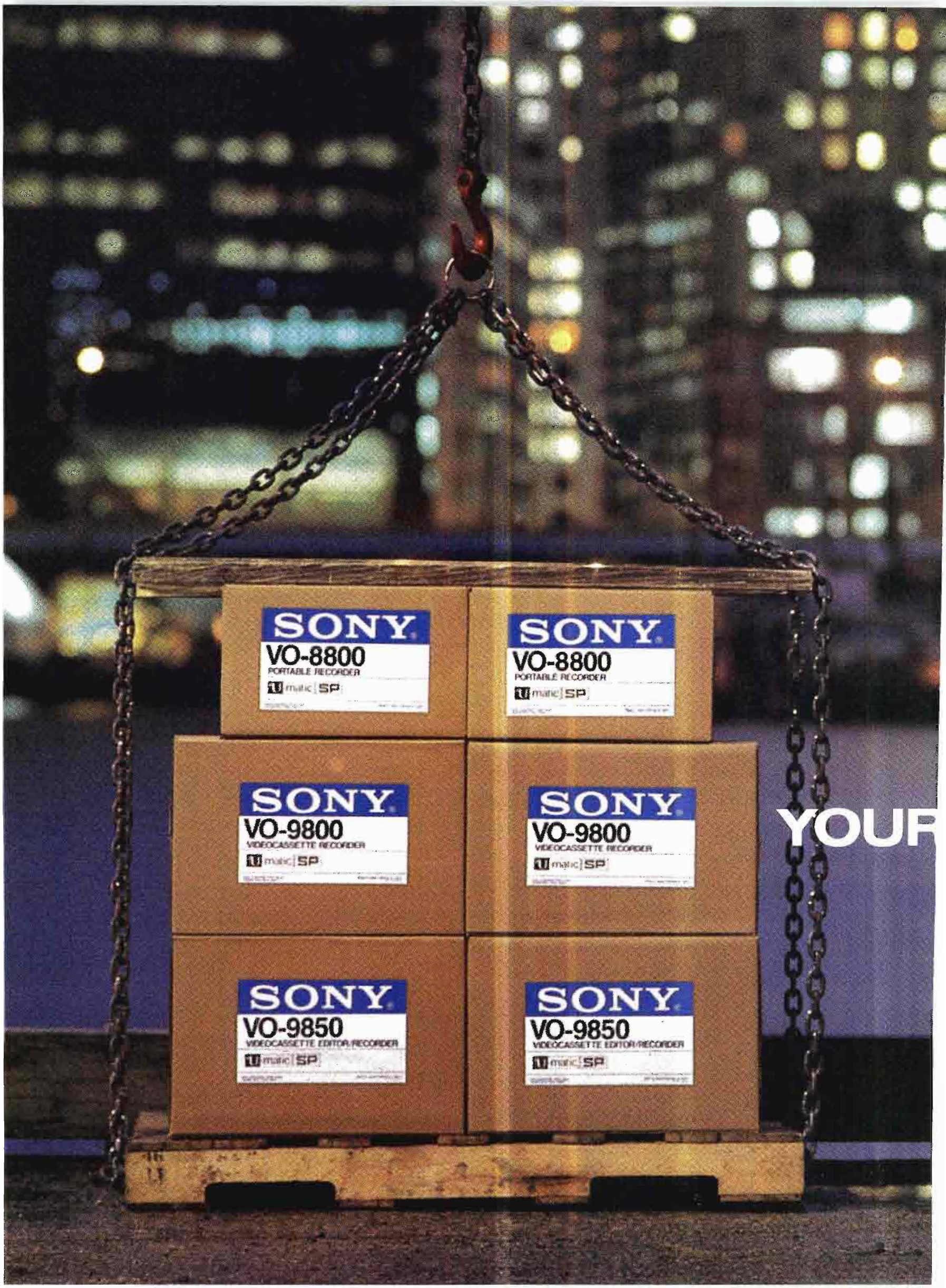

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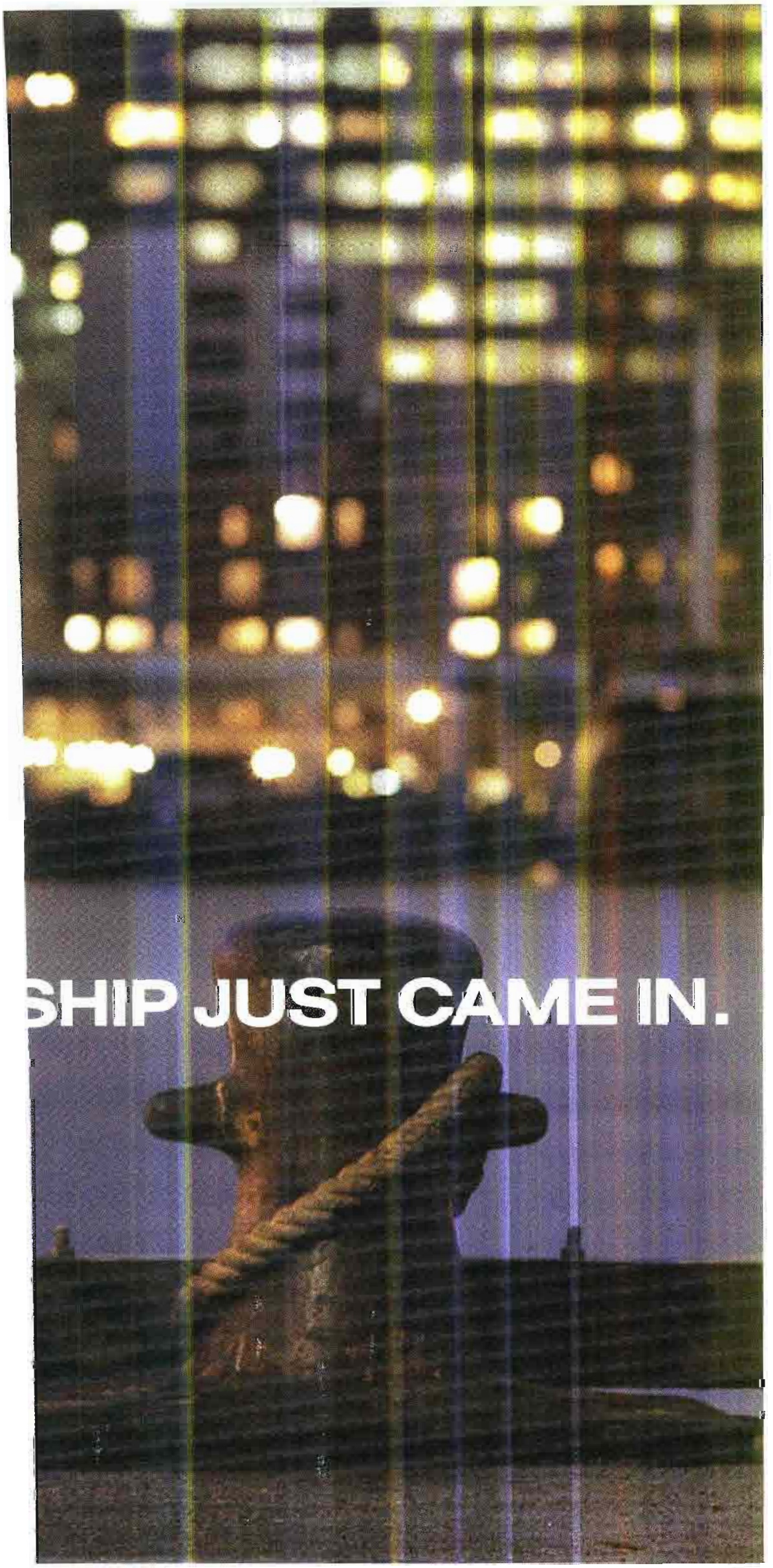

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Cool Lux Lighting 5761
Portable, studio lighting.
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Corporate Communications 3080
Film-to-video transfer, signal correctors.
Circle (676)

Countryman Associates 1463
Microphones, audio accessories.
Circle (677)

Crosspoint Latch 3977
Video production switchers, switcher/TBC production systems. (V6, V7)
Circle (678) See ad page 247, 344

Crown International 1557
Audio monitor amps, test equipment.
Circle (679)

Cubicomp 703
Digital video graphic, art systems. (V5)
Circle (680)

Current Technology 7621
Power line conditioners, surge suppressors. (S6)
Circle (681) See ad page 148

Cycle-Sat/Winnebago Industries 3184
Satellite relay service; addressable decoders.
Circle (682)

Dalsat 7417
Satellite relay, uplink services.
Circle (683)

Data Center Management 5586
Electronic newsroom systems.
Circle (684)

Datacount 2004
Station management software.
Circle (685)

Datatek 3951
Signal routing, distribution equipment. (S5)
Circle (686) See ad page 55

Dataworld 1374
Broadcast industry engineering databases; computation programs; allocation, interference, population studies; subscriber databases.
Circle (687)

dbx 2420
Audio dynamics, stereo TV signal processors.
Circle (688)

DEC/Digital Equipment 7811
Computer hardware.
Circle (689)

Delta Electronics 1159
RF test instruments; remote control systems; coaxial transfer switchers; transmitter power, modulation controllers; AM stereo processors. (R1)
Circle (690) See ad page 70

Denon America 7127
Compact disc player systems. (A4)
Circle (691)

DeSisti Lighting/DESMAR 3583
Studio rigging, fixtures; lighting instruments, mounting, lamps; lighting controllers.
Circle (692)

DeWolfe Music Library 1736
Production music, effects libraries.
Circle (693)

Dielectric Communications 1025
Transmission line, waveguide; CP, panel antennas; RF switching, power combiners; test loads, dehydrators; microwave absorption material.
Circle (695)

Digital Arts 7633
PC graphic software. (V5)
Circle (696)

Digital Audio Research 7921
Digital audio disc-based workstations. (A3)
Circle (697)

Digital Creations 7231
Console automation, moving fader, VCAs.
Circle (698)

Digital F/X 4326
Digital video effects equipment; TBC/effects production systems. (V5)
Circle (699)

Digital Processing Systems 4568
Digital frame synchronizer, TBCs. (V7)
Circle (700)

Digital Services/DSC 4538
Digital video effects, compositing systems, videodisc recorders, still stores. (V5, V7)
Circle (701)

Di-Tech 3716
Distribution, routing switcher systems; tally systems. (S5)
Circle (694) See ad on Inside Back Cover

DKW Systems (n.a.)
Automation systems. (S1)
Circle (702)

Dolby 1457
Audio noise reduction systems; aural spectral enhancement processors. (A2)
Circle (703) See ad page 219

Dorrough Electronics 1035
Audio test equipment; audio mixers, dynamics processors; exciters. (S6)
Circle (704) See ad page 289

Dreamdata 5753
Computer-based video prompter systems.
Circle (705)

DSI Communications 1765
Remote transmitter control systems; site monitoring equipment; engineering design, installation, consulting services. (R1)
Circle (706)

Dubner Computer Systems 4130
Still store; digital graphic art, titlers. (V5)
Circle (707)

Duggan Manufacturing 5328
Case hardware. (S3)
Circle (708)

Dwight Cavendish 5470
Videocassette duplicators, QC equipment. (V2)
Circle (709)

DX Communications 2343
Satellite receivers. (R6)
Circle (710)

Dynair Electronics 1707
Routing switchers; modular distribution equipment. (S5)
Circle (711)

Dynamic Technology 4682
Distribution, routing switchers.
Circle (712)

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See Insert Pages 66A-H

Dynatech NewStar 4526
Newsroom automation; computer software. (S1)
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Eastman Kodak 4551
Videotape products; photographic films.
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Power tube rebuilding.
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Editron USA 7632
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EECO/Convergence 1773
Video editing controllers.
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EEG Enterprises 3438
On-screen text, caption, VBI data encoders, decoders.
Circle (719)

EEV 4262
Lead oxide Leddicon camera tubes; high-efficiency, UHF TV klystrons; RF power devices; satellite electronics. (R3)
Circle (720) See ad page 149

EG&G/Electro-Optics 3922
Tower lighting, controls, beacons.
Circle (721)

Electrohome Digital Video Systems 5116
Video monitors, projectors. (V8)
Circle (724)

Electro Impulse Laboratory 1103
RF loads, calorimeters, attenuators, wattmeters.
Circle (722)

Electronic Research 1017
FM antennas, multichannel diplexer, notch filters.
Circle (725)

Electrosonic Systems (n.a.)
Video display videowalls. (V8)
Circle (1150)

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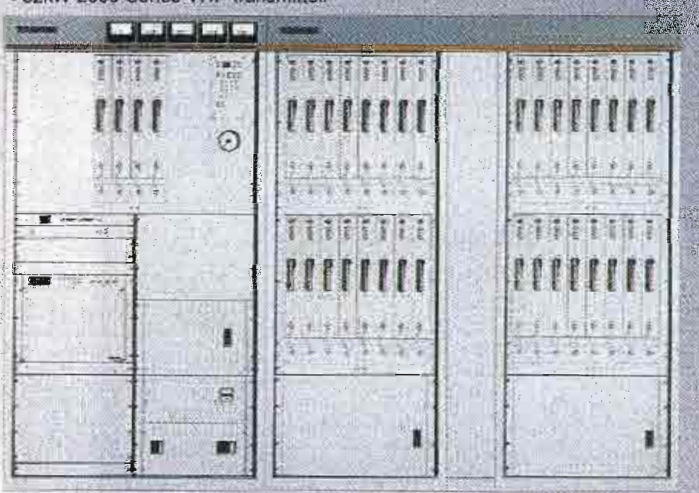

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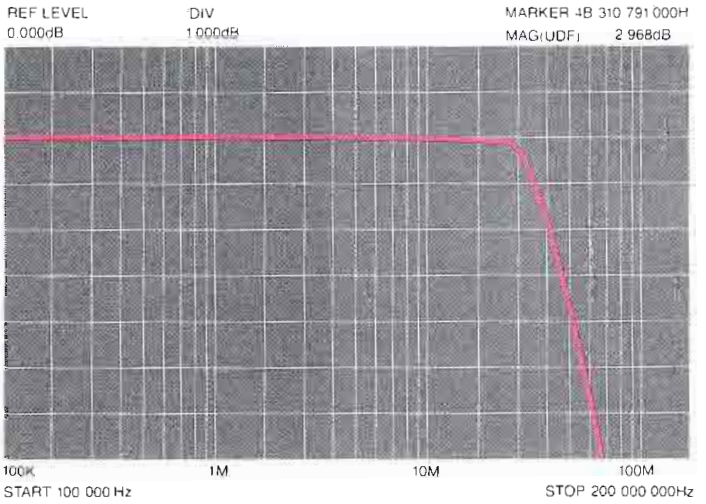

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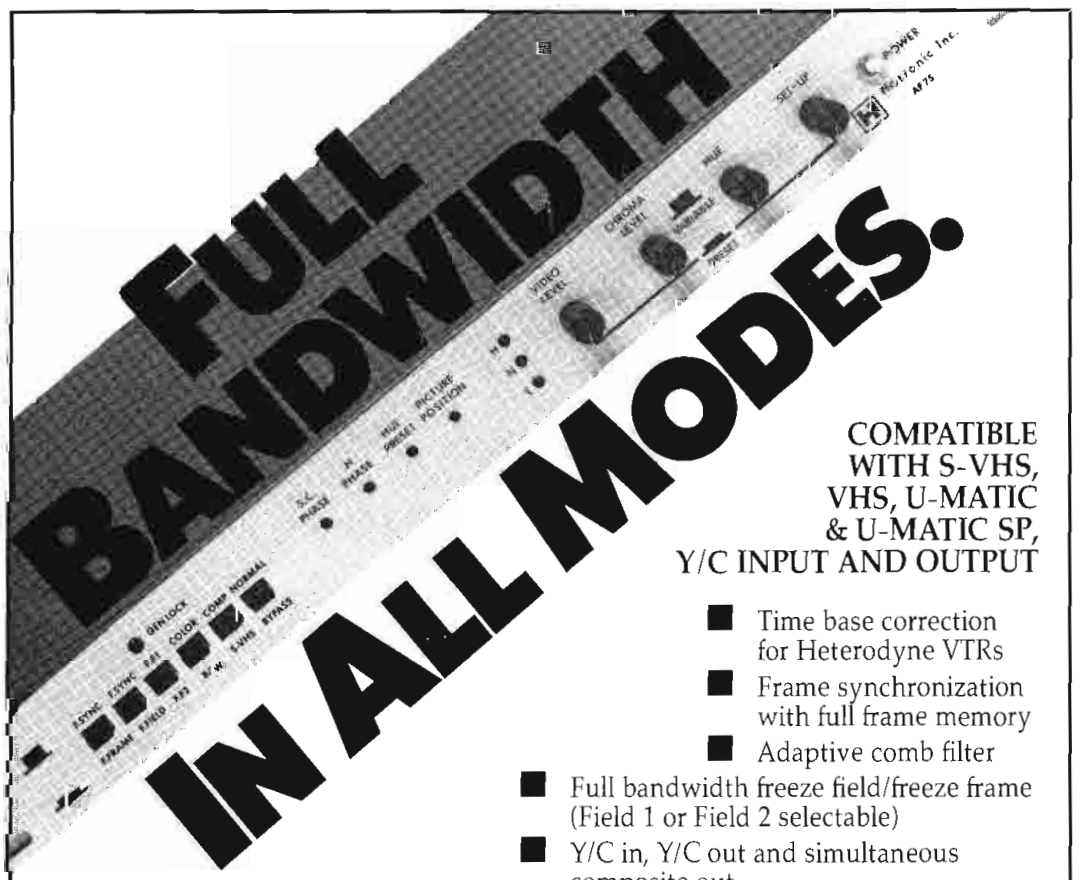

Circle (83) on Reply Card

Electro-Voice **1641**
Audio mixer; microphones, speakers.
Circle (723) See ad page 271

EMCEE **4251**
TV transmitters, ITSF, MMDS equipment; tower products, services. (R1, R2)
Circle (726)

Emcor Products/Crenlo **1573**
Equipment racks, enclosures.
Circle (727) See ad page 323

Emergency Alert Receiver **2248**
EBS receivers; SCA receivers. (R4)
Circle (728)

Energex Systems **(n.a.)**
Replacement NiCad battery cell packs. (V4)
Circle (729)

Energy-Onix **1730**
FM transmitters, exciters, amplifiers; AM NRSC filters. (R1, R3, R5)
Circle (730)

Enterprise Electronics **3870**
Weather radar systems. (V5)
Circle (731)

Ergo Industries **(n.a.)**
Equipment rack, slide kits; lighting, battery products. (S3)
Circle (732)

ESD/Environmental Satellite Data **5461**
Weather graphics imaging, displays, services. (V5)
Circle (733)

ESE **3907**
Time code equipment, clocks; DAs; graphic titlers. (V5)
Circle (734) See ad page 331

Eventide **2535**
Digital audio delay, programmable effects processors; time modification systems. (A2)
Circle (735)

Evertz Microsystems **5379**
Time code equipment; editing controllers. (V2)
Circle (736)

Excalibur Industries **3165**
Equipment transport cases.
Circle (737)

Fairlight Instruments **7717**
Digital video effects, paint systems.
Circle (738)

Faroudja Laboratories† **5733**
Video encoders, decoders; video component transcoders; scan converters. (V7)
Circle (739) See ad page 273

Farrtronics **5448**
Distribution, patching; intercom, studio, IFB systems; punch-down insulation terminal blocks. (A2)
Circle (740)

Ferno Washington **7726**
A/V on-location equipment carts; batteries, lighting accessories.
Circle (741)

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FGV Panther 3838
Studio cranes; HMI lighting. (V1, V4)
Circle (742)

Fiberbilt Cases 5338
Shipping, carrying cases, containers. (S3)
Circle (743)

Fidelipac 1117
Audio cart recorders; audio recording tape; studio furnishings. (A3)
Circle (744)

Field Engineering 3084
Video safe area generators. (V5)
Circle (745)

Film House 1659
TV spots for radio stations.
Circle (746)

Flash Technology 1553
Tower obstruction lighting, beacons.
Circle (747)

FloriCal Systems 5686
Automated videotape record, playback, tape-delay systems; TV automation; video compositing systems. (S1, V2, V7)
Circle (748)

FOR-A 5151
Audio mixers; signal DAs; video processors, TBCs, synchronizers, format convertors; titling systems; digital effects systems; video switchers. (A1, S5, V5, V7)
Circle (749)

Fort Worth Towers 3840
Broadcast, communications towers, services; equipment shelters.
Circle (750)

Fortel 5526
TBCs, frame synchronizers; signal processors, format transcoders. (V7)
Circle (751)

Fostex 5280
Audio recorders, event controllers; headphones, microphones. (A3, A4)
Circle (752)

Frezzolini Electronics 3916
Batteries, chargers, analyzers; portable lighting equipment. (V4)
Circle (753) See ad page 189

Fuji Photo Film 3551
Video tape; standard oxides, metal formulations.
Circle (754)

Fujinon Optics 3555
TV camera lenses.
Circle (755) See ad page 311

Future Productions 5784
Videotape duplicators; camera control units.
Circle (756)

Garner Industries 5112
Tape degaussers. (S4)
Circle (757)

GE American Communications 3419
Satellite program distribution, broadcast TV, syndication, newsgathering, international/occasional TV, digital audio/SCPC network program, business video.
Circle (758)

Gefen Systems 2351
CD players; computer software; sound effects libraries. (S4, S1, S8)
Circle (759)

General Electric/Comband 2243
ITFS, MDS downconverters, receivers.
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General Electric/Lighting 3905
Stage, studio lamps.
Circle (761)

Generic Designs 5352
Machine controllers.
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Gentner Engineering 2127
Transmitter control systems; audio processors; telephone interfaces; recording systems; distribution equipment; patching. (A2, R1)
Circle (763) See ad page 105

Geocam 7003
Video matte boxes, brackets; camera mounting base plates; follow focus modules. (V1, V3)
Circle (764)

GML 7331
Microphones.
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GML America 3849
Digital video effects, TBCs, sychronizers, video production systems.
Circle (517)

Gorman Redlich 1271
EBS encoders, decoders; NOAA weather radios; digital AM directional array monitors.
Circle (766)

Gotham Audio 3538
Neumann microphones; audio noise reduction systems; EMT-Franz processors; CD players; audio recorders; K&H speakers. (A2, A4)
Circle (767)

Graham-Patten Systems 5728
Audio edit mixers; component video keyers.
Circle (768) See ad page 179

Grass Valley Group† 4130
Routing, production, master control switchers; video effects, Dubner graphics systems; analog, digital, component video products; edit controllers; fiber optic products; impedance conversion modules. (S5, V2, V6, V7)
Circle (769) See ad page 9, 56, 224-5

Gray Engineering Labs 3947
Time code systems; safe title generators; video-assisted film editing equipment. (V2)
Circle (770) See ad page 196

Great American Market 3373
Studio, location lighting products; visual effects, pattern projectors; lamps.
Circle (771)

Greenberg Electronic Teleprompting 7543
MS DOS-based teleprompters. (V5)
Circle (772)

Grunder & Associates 4177
Distributor; CEL digital effects, standard converters; edit control accessories. (V2, V5, V7)
Circle (773)

GTE Spacenet 909
Satellite transmission, news, voice, data services; signal-turnaround, bandwidth conversions.
Circle (774)

Hallikainen & Friends 1111
Earth station remote controllers; newswire computer software; audio mixers; automation equipment. (R6, S1)
Circle (775)

Harris Broadcast Group 1305
Audio mixers, audio recorders; AM, FM, TV transmitters; terrestrial microwave; modulation monitors; RF exciters, generators. (R1)
Circle (776) See ad page 265

Harris Video Systems 1305
TBCs, synchonizers; graphics workstations. (V2, V5, V7)
Circle (777) See ad page 27

Harrison Systems 1116
Audio consoles. (A1)
Circle (778) See ad page 176

HEDCO 2231
Audio, video, digital routing switchers. (S5)
Circle (779)

Hipotronics 3379
Voltage regulators, power line conditioners.
Circle (780) See ad page 44

Hitachi Denshi† 4519
TV cameras; video recorders, tape; encoders; HDTV recorders, displays; video monitors; test equipment; microwave systems. (V1, V2, V8)
Circle (781) See ad page 3, 41

HM Electronics 3066
Wireless microphones; intercom power stations. (A4)
Circle (782)

Hoffend & Sons 3365
Stage rigging, drapery systems, manual, motorized, computer control; stage, studio fixtures.
Circle (783)

Holaday Industries 2028
RF radiation, EMF survey meters. (S6)
Circle (784)

Hoodman A125
TV camera accessories, sun shades. (V1)
Circle (785) See ad page 204

Hotronic 3771
TBCs, frame synchronizers. (V7)
Circle (786)

Howe Technologies 1465
Audio consoles, phase correctors. (A1, A2)
Circle (787)

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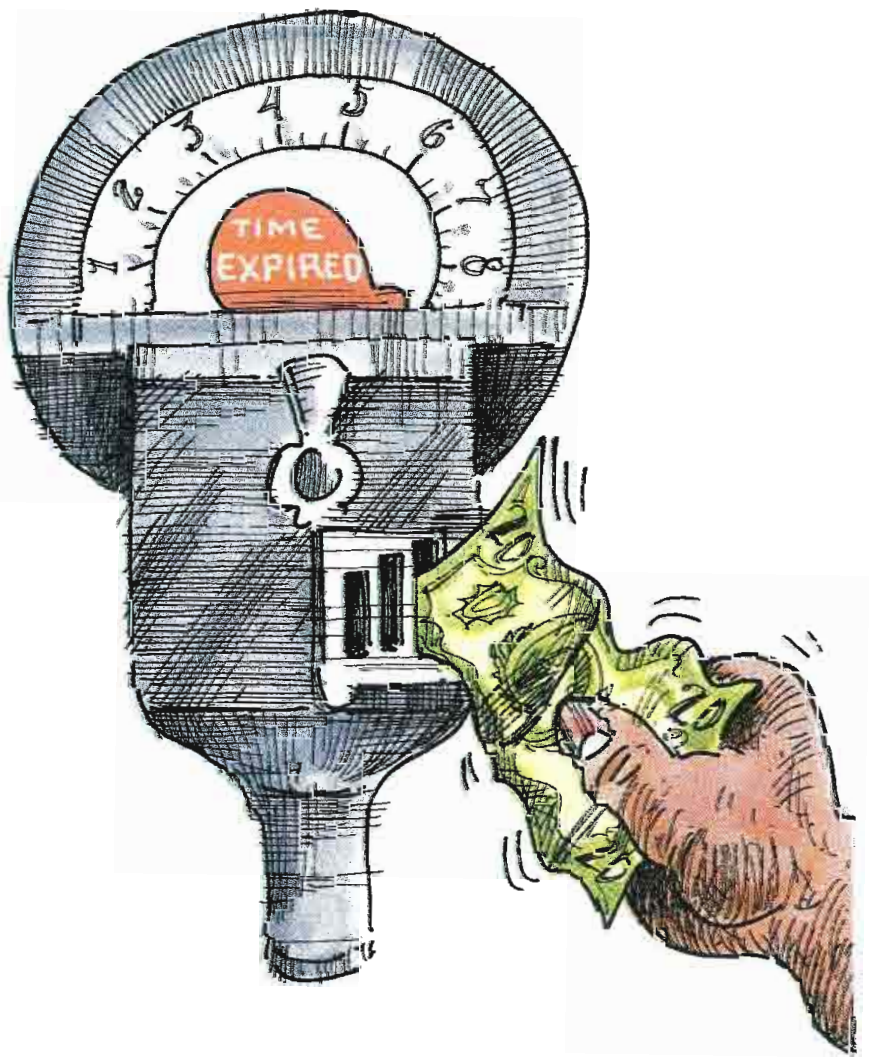

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Hungerford, Aldrin, Nichols, Carter 1056
Certified public accountants.
Circle (788)

IDB Communications A140
Satellite uplink services, equipment.
Circle (789)

I•DEN Videotronics A126
TBCs; component video transcoders. (V5, V7)
Circle (809) See ad page 334

IGM Communications 1141
Radio broadcast automation; multideck audio playback equipment. (S1)
Circle (790) See ad page 316

Ikegami Electronics† 5305
CCD cameras, camera/recorders; monochrome, color monitors; ENG microwave; telecines. (V1)
Circle (791) See ad page 36-7

ILC Technology 3773
TV lighting equipment; Daymax HMI lamps.
Circle (792)

Image Video 5574
Master control, video production, routing switchers; digital audio recorder, editing systems. (S1, S5)
Circle (793)

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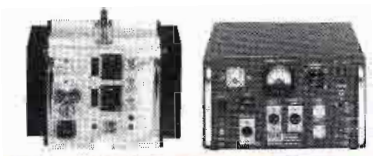

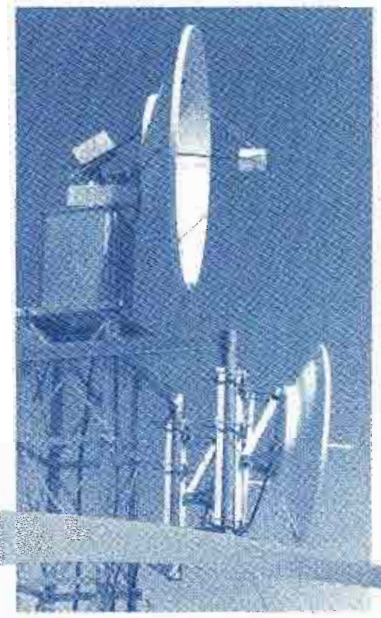

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Circle (795)

Innovative Automation 1603
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Innovative TV Equipment/ITE 3938
Camera support systems, tripods, pedestals, pan/tilt heads. (V1)
Circle (797)

Inovonics 1473
FM generators; audio mag film recorder equipment. (A3, R5)
Circle (798) See ad page 296

Integrated Arts 7821
Circle (799)

Integrated Media Systems 7011
Digital audio recording/editing systems. (A3)
Circle (800)

Integrated Technologies 7334
Weather Network software, hardware, database for high resolution weather graphics.
Circle (801)

Intelligent Light 7105
Graphic system software, workstations.
Circle (802)

Intelvideo† 4478
Video encoders, decoders; video-to-film accessory. (V7)
Circle (803)

Interactive Motion Control/IMC 5477
Camera control systems for animation. (V1)
Circle (804)

Intergroup Video Systems 3526
Video production switcher. (V6)
Circle (805)

International Music Company/IMC 7440
Digital audio recorders, sampling. (A2, A3)
Circle (806)

ITELCO 3459
FM, TV transmitters; microwave systems; RF power amplifiers; receivers, demods; exciters, RF generators. (R1, R2)
Circle (807)

ITS/Information Transmission 5180
VHF TV exciters, modulators; ITFS, MMDS transmitters, amplifiers. (R2, R3, R5)
Circle (808)

J-Lab 3084
Video recorder interfaces.
Circle (810)

Jampro Antennas 1217
FM, TV transmitting antennas; towers, guys, lighting; tower services. (R1)
Circle (811) See ad page 86

JBL Professional 3577
Audio monitor amplifiers, speakers. (A4)
Circle (812) See ad page 57

Jefferson Pilot Data/JDS 1241
Station business, traffic, accounting software.
Circle (813)

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Jensen Tools **1667**
Electronic tool kits, hand tools, tool cases; fiber optic maintenance equipment; VCR alignment tools.
Circle (814)

Johnson Electronics **1527**
SCA, EBS receivers; audio amplifiers.
Circle (815)

JVC **4168**
Tube, CCD cameras; video recorders, edit controllers, duplicators; TBCs, frame synchronizers; video monitors, effects generators, switchers. (V1, V2, V6, V8)
Circle (816)
See ad page 19

K&H Products **5377**
Camera support products. (S3)
Circle (817)
See ad page 300

Kahn Communications **1005**
Audio dynamics processors; telephone bandwidth extenders; AM stereo equipment.
Circle (818)

Kangaroo Video Products **3741**
Equipment transport cases.
Circle (819)

Karl Heitz **3477**
Camera support; pan/tilt heads, tripods. (V1)
Circle (820)

Kavouras **5719**
Weather graphics display systems, map data files. (V5)
Circle (821)

Kay Industries **1647**
Phase converters, power conditioners. (S6)
Circle (822)

Keith Monks Audio **2151**
Audio accessory products.
Circle (823)

Key Video **5102**
Audio, video routing switchers; PC-based video switcher. (S5, V6)
Circle (824)

Kings Electronics **5123**
RF, video, coaxial, triaxial connectors.
Circle (825)

Kintek **1057**
Audio processors, mono-to-stereo converters.
Circle (826)

Kintronic Laboratories **710**
AM antenna phasors, tuners; RF patch, switching panels; HV insulators; tower transformers, lighting chokes, variable inductors; equipment shelters; shortwave antennas. (R1)
Circle (827)

Kliegl Brothers Stage Lighting **3516**
Lighting instruments, lamps; lighting control systems.
Circle (828)

Kline Towers **5446**
Design, fabrication, erection, maintenance, inspection services; guyed, self-supporting, platform, multi-array towers, antenna support structures.
Circle (829)

Knox Video Products **3849**
Digital graphics, titlers; video switchers; video processors. (V5)
Circle (830)

Laird Telemedia **4874**
Distribution equipment; telecines; video processors; character generators. (V5, V7)
Circle (831)

Lake Systems **819**
Facility design, construction; distributors, audio mixers, processors, recorders, audio sources, monitors; cable, patching systems; studio furnishings; video recorders, switchers, monitors; video format converters. (V2)
Circle (832)

Landy Associates **5522**
Distributor; digital video recorder; custom videotape editing systems; CCD, Plumbicon cameras. (V1, V2)
Circle (833)

LDL Communications/Larcan **3562**
FM, TV transmitters, transmitting antennas; multistation power combiners; towers. (R1)
Circle (834)

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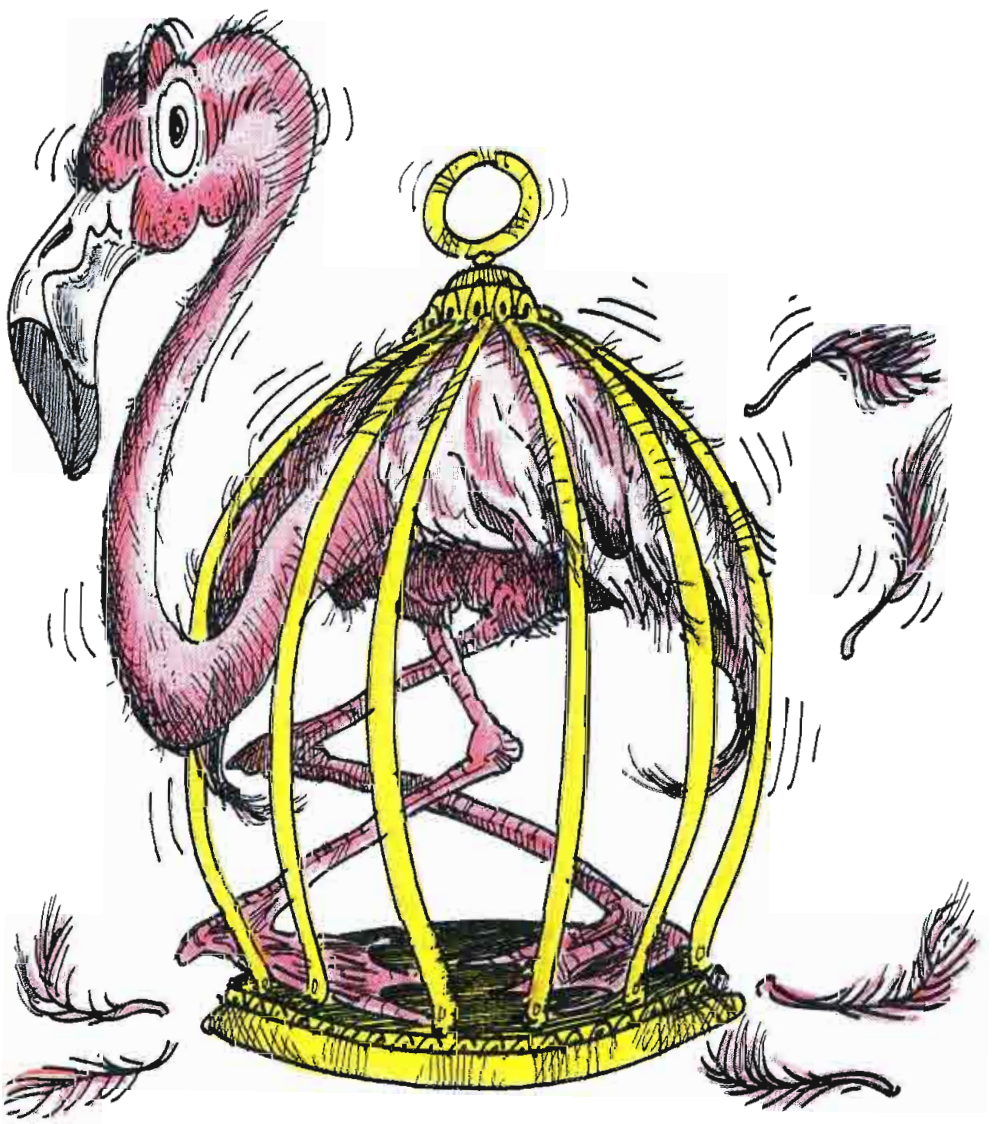

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LEA Dynatech **4526**
Lightning protection, deterrents; surge suppressors.
Circle (835)

Leader Instruments **5371**
Sync, video, test signal generators; waveform, vector monitors; oscilloscopes; video level meters. (S6)
Circle (836) See ad page 5

Lectrosonics **5370**
Wireless microphone systems. (A4)
Circle (837) See ad page 239

Lee Colortran **3533**
Studio lighting instruments, lamps, gels.
Circle (838)

Leitch Video **3568**
Sync, test signal generators; VBI insertors; video processors; DAs, master clock systems; still stores. (S5, S6, V5, V7)
Circle (839) See ad page 49

LEMO USA **5107**
Audio, video coax, triax, multicore, mixed coax-multiple pin connectors. (S2)
Circle (840) See ad page 245

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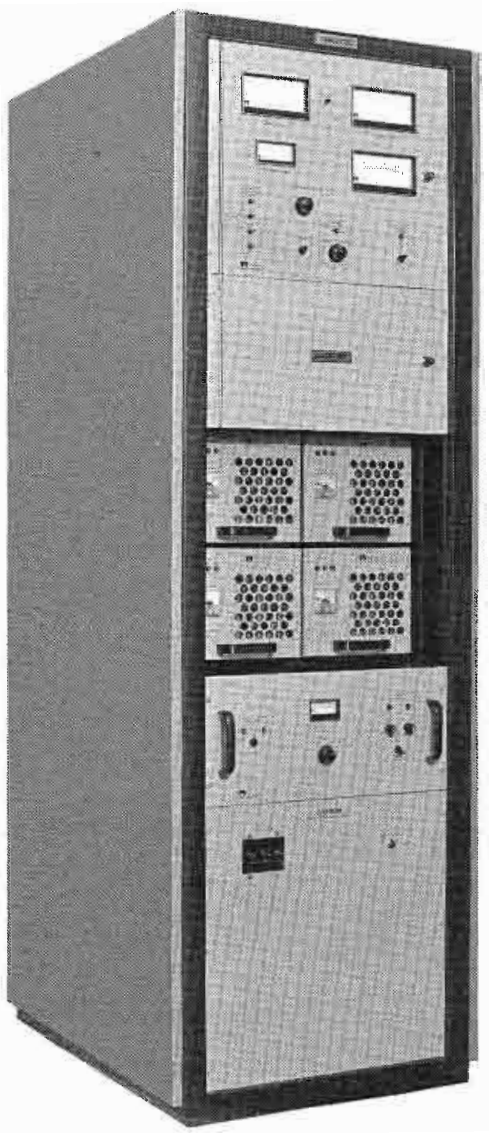
NEW 5 KW SOLID STATE AM TRANSMITTER



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Leonetti Company **A157**
HMI, SunRay lighting products. (V4)
Circle (841)

Lexicon **2327**
Digital audio production systems; time compressers/expanders; audio effects, processors; MIDI equipment. (A2)
Circle (842)

Lighting Methods **4483**
Lighting dimmers, dimmer controllers.
Circle (843)

Lightning Eliminators & Consultants **3919**
Lightning elimination, deterrents; power conditioning consultation; grounding systems.
Circle (844)

Listec Video **3523**
Computer video prompters, prompter displays. (V5)
Circle (845)

Logica **3926**
Still store, graphics library systems. (V5)
Circle (846)

Logitek **1635**
Audio mixers, monitor amps, speakers; impedance interfaces.
Circle (847)

Lowel-Light **3768**
Studio, portable lighting instruments, lamps.
Circle (848) See ad page 144

LPB **1541**
Audio mixers; phono pre-amps; studio furnishings; low power AM transmission. (A1, A4)
Circle (849)

LTM **5358**
Location, portable, studio lighting instruments, ballasts, follow spots; microphone accessories. (A4, V4)
Circle (850)

Lucasey Manufacturing **(n.a.)**
Case hardware, special purpose metal parts. (S3)
Circle (1156)

Luxor **2449**
Satellite receivers.
Circle (851)

LW International **5205**
Telecine equipment.
Circle (852)

Lyon Lamb Video Animation **7111**
Video animation controllers, equipment.
Circle (853)

3M Broadcast/Related Products **3405**
Character generators; video routing switchers.
Circle (854) See ad page 83

3M International Tapetronics **3405**
Audio routing switchers; ITC cart recorders, reproducers; ScotchCart II broadcast tape.
Circle (855)

3M Magnetic Media **3405**
Audio, video recording tape, cassettes, cartridges. (S4
Circle (1154) See ad page 83

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M/A-Com MAC **3933**
ENG microwave, 18GHZ and 23GHz. (R2)
Circle (856) See ad page 97

Magni Systems† **3173**
Video test equipment; waveform, vector monitors; SC/H-phase measurement products. (S6, V5)
Circle (857) See ad page 61

Magnum Tower **1501**
Broadcast towers, accessories; tower services.
Circle (858)

Manhattan Production Music **3064**
Production music, effects libraries. (S8)
Circle (859)

Marconi Communications Systems **4338**
Telecines; frame synchronizers, decoders; UHF, VHF TV transmitters. (R1, V3, V7)
Circle (860) See ad page 249

Mark Antenna Products
Microwave, earth station antennas.
Circle (861) See ad page 300

Marti Electronics **1204**
STL microwave receivers, transmitters; RF exciters, generators. (R2)
Circle (862)

Matco Mfg & Test **5382**
Machine sequencers, routing switchers; DAs; dubbing controllers, commercial insertion.
Circle (863)

Matthews Studio Equipment **4183**
Camera pedestals, cranes, tracks; grip equipment; lighting products.
Circle (864)

Matthey Electronics **5200**
Filters, delay lines. (S6)
Circle (865)

Maze Broadcast **7420**
Pre-owned equipment; equipment brokering, appraisals, liquidation services.
Circle (866)

McCurdy Radio Industries **1755**
Audio consoles, delay systems, intercoms, speakers; automation; signal distribution; audio test equipment; telephone hybrids. (A4)
Circle (867) See ad page 215

MCL **A115**
Power amps for satellite communications. (R6)
Circle (868) See ad page 295

McMartin Industries **2227**
FM exciters, SCA generators; audio monitors, control products.
Circle (869)

Media Computing **5386**
Automated newsroom, machine control software, interfaces. (S1)
Circle (870)

Media Touch Systems **2442**
Touch-screen control for broadcast equipment; automation equipment; audio recording products; distribution systems.
Circle (871)

Merlin Engineering **5530**
Standards converters; HDTV-TV converters; custom VTRs, accessories; video encoders, decoders; time delay equipment. (V2, V7)
Circle (872)

Micro Communications **1547**
RF transmission line, circular waveguide; switchless combiners; computer drafting; field service. (R1, S1, S7)
Circle (873)

Microdyne **5119**
Satellite receivers, programmable satellite terminals. (R6)
Circle (874)

Micron Audio Products **5772**
Wireless microphone systems.
Circle (875)

Microsonics **5362**
Video filters, delay lines.
Circle (876)

Microtime **4126**
TBCs, frame synchronizers; digital graphics, special effects systems; A/B roll, effects production system. (V5, V7)
Circle (877)

Microwave Radio **1731**
ENG electronics, antennas. (R2)
Circle (878)

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Midwest Communications **4568**
TV production facilities, vehicles; distributor, A.C.E. graphics, signal routers, color correcters, scan converters; Digital Processing Systems TBCs; Technalogix, Toshiba TV transmitters; microwave, earth station systems; racks, studio furnishings. (R1, S5, S7, V5, V7)
Circle (879) See ad page 1, 173, 175

Miller Fluid Heads (USA) **5455**
Camera support, tripods, pan/tilt heads. (V1)
Circle (880)

Miralite Communications **7530**
Earth station equipment, electronics, controllers.
Circle (881)

Mitchell Camera **3533**
Camera support, tripods, geared heads; cine cameras; batteries; video-assist systems.
Circle (882)

Mitsubishi Electric Sales† **7101**
Video monitors, printers, projectors. (V8)
Circle (883)

Mobile-Cam Products **7321**
News gathering vehicles; audio/video routers; mobile antenna control systems. (S7)
Circle (884)

Modulation Sciences **5765**
Audio processors; modulation monitors; RF exciters, generators; distribution equipment; test, monitoring products. (S6)
Circle (885)

Modulite/Bardwell-McAlister **3880**
Lighting instruments, control systems.
Circle (886)

Mole-Richardson **3974**
Lighting instruments, lamps. (V4)
Circle (887)

Montage Group **5283**
Non-linear electronic video editing systems. (V2)
Circle (888)

Morton Hi-Tek Furnishing **7800**
Studio furnishings, equipment racks, cases; facility design; consulting services.
Circle (889)

Moseley Associates **1317**
Remote control systems; STLs; RF generators, exciters; audio processors. (A2, S1)
Circle (890) See ad page 77

Motorola C-Quam/AM Stereo **1004**
AM stereo radio exciters, modulation monitors, receivers. (R4, R5)
Circle (891)

Musco Mobile Lighting **A135**
Self-contained, remote production lighting. (V4)
Circle (892)

Mycomp Technologies/MTC **(n.a.)**
Audio, video DAs; A/V monitoring, machine control equipment. (S1, S5, S6)
Circle (893)

MZB/Gray **3432**
Mobile production vehicles; distributor, cameras, video recorders, processors, displays; routing, DA equipment; ENG microwave.
Circle (894)

Nady Systems **3740**
Wireless microphone systems. (A4)
Circle (895)

Nagra Magnetic Recorders **4005**
Audio recorders.
Circle (896)

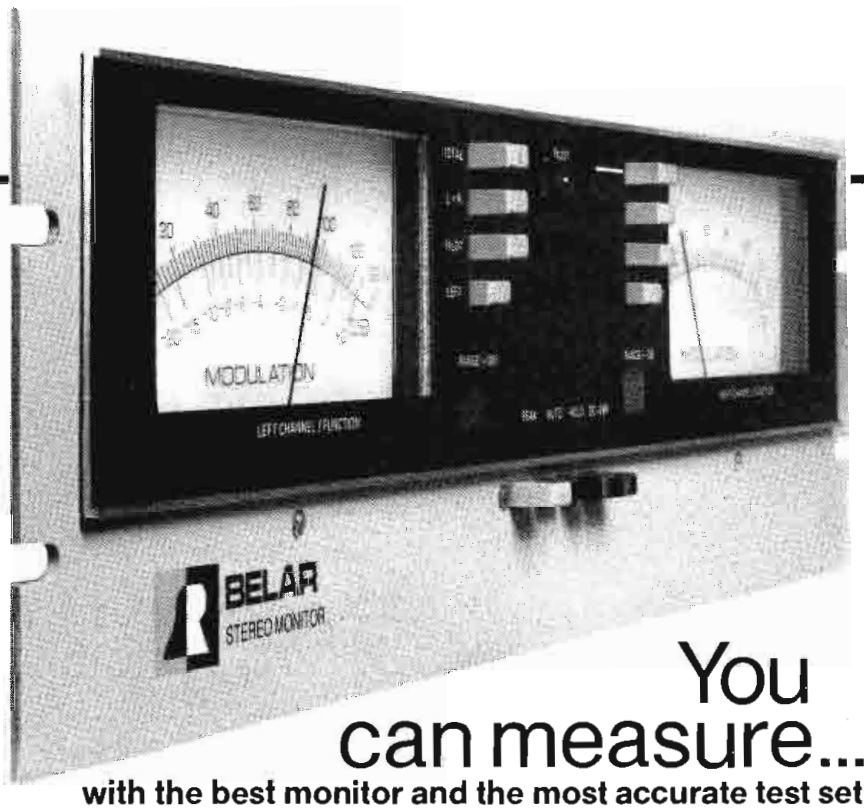
Nalpak Video Sales **3368**
Rack, tripod cases; production vests; lens accessories. (S3, V1)
Circle (897)

Narda Microwave **2349**
STL, ENG electronics.
Circle (898)

National Public Radio **7622**
Program transmission services.
Circle (899)

Nautel **1065**
Solid-state AM radio transmitter systems. (R1)
Circle (900) See ad page 160

NEC America/Broadcast **3444**
Solid-state video recorders; TBCs, frame synchronizers; CCD cameras; VHF, UHF TV transmitters. (R1, V1, V2)
Circle (901) See ad page 95



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Nelson/Thorn EMI Lighting **5365**
Lighting instruments, lamps; accessories.
Circle (902)

Neotek **7430**
Reinforcement, production audio consoles.
Circle (903)

Network Music **1624**
Music, sound effects libraries.
Circle (904)

Neutrik USA **1734**
Connectors; test equipment. (S2)
Circle (905) See ad page 283

New England Digital **2307**
Digital audio disK recorders, effects, edit systems. (A3)
Circle (906)

Nikon Photo/Electronic Imaging **7905**
TV camera lenses.
Circle (907) See ad page 301

Norpak **3783**
Teletext, NABTS data delivery equipment. (V5)
Circle (908)

Nortronics **1537**
Audio recording heads, recorder accessories.
Circle (909)

Nova Systems **5472**
TBCs, frame synchronizers. (V7)
Circle (910) See ad page 263

Numark **7043**
Audio/video mixers; audio mixers, digital samplers. (A1, A2, V6)
Circle (1151)

Nurad **5538**
ENG, STL electronics, antennas.
Circle (911)

Nytone Electronics **5479**
Flying spot slide-to-video telecines; color analyzers, integrated production systems. (V3)
Circle (912)

O'Connor Engineering Lab **4574**
Camera support, tripods, pan/tilt heads.
Circle (913) See ad page 310

Odetics **711**
Automated videocassette player systems, system expanders, control panels. (S1)
Circle (914) See ad page 197

OKI Electric Industry **3087**
TV standards converters. (V7)
Circle (915) See ad page 191

Olesen **3726**
Lighting instruments, accessories.
Circle (916)

Omicron Video **2515**
Utility routing, component video, production switchers; analog, digital component DAs. (V6, V7)
Circle (917) See ad page 290

Omnimusic **1156**
Production music libraries.
Circle (918)

Optical Disc **7525**
Videodisc recorders, playback systems; digital audio processing equipment. (V2)
Circle (919) See ad page 325

Orban Associates **1630**
Audio processors for AM, FM, TV, studio; equalizers; stereo synthesizers; sibilance controllers. (A2)
Circle (920) See ad page 7, 17

Orion Research **3068**
Software-based audio mixers. (A1)
Circle (921)

Osram/Siemens **7427**
Lamps for stage, studio lighting.
Circle (922)

Otari **1353**
Digital, analog audio recorders; video duplicators. (A3, V2)
Circle (923) See ad page 15, 221

Pacific Radio Electronics **7330**
Video cable, connectors; utility lighting devices; test, monitoring equipment. (S2, S3)
Circle (924)

Pacific Recorders/Engineering **1325**
Audio mixers; audio cart recorders,

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High definition. When it comes to quality products,
supporting any format or standard,
video professionals peg Tek.
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reproducers; signal processors, distribution equipment. (A1)
Circle (925)

Paco Electronics USA **3920**
Batteries, charger systems. (V4)
Circle (926)

Paltex **4156**
Videotape editing control systems, VTR interfaces; Quantum/Weircliffe tape degaussers. (S4, V2)
Circle (927) See ad page 189

Panasonic Broadcast Systems† **4142**
Panasonic Pro Industrial Video
TV cameras; digital, analog videotape recorders. (V1, V2)
Circle (928) See ad page 28-9, 68-9, 71, 90-1

Pansophic Systems/Graphics **7917**
Video graphics equipment. (V5)
Circle (929)

Patch Bay Designation **5344**
Designation labels for patch bays.
Circle (930) See ad page 214

Peerless Sales **4086**
Utility equipment carts.
Circle (931)

Penny & Giles **2201**
Audio, video faders; motorized faders; joystick controllers; patch panels, accessories.
Circle (932) See ad page 334

PEP **4000**
Batteries, charger systems.
Circle (933)

Perrott Engineering Labs **3834**
Batteries, chargers; equipment covers; color correction filters.
Circle (934)

PESA Electronica **5712**
Character generators; master control, production switchers; video processors; video monitors, test equipment; TV transmitters, translators; intercom/talkback systems. (A4, R1, S6, V5, V6, V7, V8)
Circle (935) See ad page 103

Peter Dahl **1663**
Audio level, transmitter power transformers, inductors.
Circle (936)

Philadelphia Video Lab **2920**
Video-hardcopy converters for 35mm/color transparency, slide, photographic print forms; production facility. (V8)
Circle (937)

Philips Lighting **7740**
Lamps for stage and studio. (V4)
Circle (938)

Phillip Drake Electronics **7005**
Routing, distribution equipment.
Circle (939) See ad page 314

Photographic Equipment Service **4882**
Motion-controlled animation tables, stands.
Circle (940)

Pinnacle Systems **801**
Digital graphics, effects, video workstations. (V5)
Circle (941)

Pinzone Communications **2315**
Audio transmission systems; videocart refurbishing; satellite receivers, downconverters; AM antennas.
Circle (942)

Polar Video **2315**
Video switchers; safe area generators; keyers, faders.
Circle (943)

Potomac Instruments **1375**
Audio processors; directional array monitors; field strength meters; remote, programmable transmitter controllers; AM monitoring receivers; program audio analyzers; frequency synthesizers, detectors. (R1)
Circle (944)

Pro-Battery **3382**
Batteries, chargers.
Circle (945)

Professional Sound/Sonosax **7618**
Audio mixers; talkback equipment; wireless mic accessories. (A1, A4)
Circle (946) See ad page 178

Progressive Computer Products **3381**
Video information delivery systems; computer-to-video encoders.
Circle (947)

Q-TV **3713**
Video prompting equipment.
Circle (948)

QEI **1147**
FM transmitters; modulation monitors; studio-transmitter T1 links. (R1, S1)
Circle (949) See ad page 31

QSI Systems **3751**
Video SID, message generators; video processors, switch-over equipment. (S5, V7)
Circle (950)

Quality Video Supply **3383**
Monochrome, color video combiners, keyers. (V6, V7)
Circle (951)

Quanta **4526**
Anti-aliased character generators; 2-D, 3-D, paint, titling, animation system; videotape editing controllers. (V2, V5)
Circle (952)

Quantel **5312**
Digital video effects, graphics/paint systems; caption generators; still library systems.
Circle (953) See ad page 34

Quantum Audio Labs **4156**
Weircliffe tape degaussing products. (S4)
Circle (954)

Quickset **3513**
Camera support, tripods, pan/tilt heads, dollies.
Circle (955)

R-Columbia Products **3468**
Headphones, camera operator headsets; intercom systems. (A4)
Circle (956) See ad page 302

R/SCAN **5732**
Lightning detection equipment.
Circle (957)

Radamec-EPO **3719**
Camera support automation equipment. (S1)
Circle (958)

Radiation Systems/SatCom Tech. **3070**
Earth station antennas, controllers; flyaway systems. (R6)
Circle (959) See ad page 300

Radio Systems **2037**
Audio mixers; SCA receivers; audio DAs, preamps, monitor amps; cart machines; studio cabinetry.
Circle (960)

RAM Broadcast **1001**
Distributor, audio, radio, video equipment; audio phase monitors, routing switchers; video monitors; studio furniture, cabinetry; consultant service. (A2)
Circle (961) See ad page 54

Ramsa Audio/Panasonic **4142**
Digital audio DAT recorders; CD players. (A4)
Circle (962) See ad page 87

Rangertone Research **3762**
Audio film recorders; film projection equipment. (A3, V3)
Circle (963)

Rank Cintel† **3926**
Telecines; still stores; disc-based video recorders; graphics systems; weather receiving, display equipment; color correction equipment. (V2, V5)
Circle (964) See ad page 209, 293

Rapid Deployment Towers **A150**
Mobile antenna support structures. (R1)
Circle (965)

Reach Electronics **5751**
Pushbutton switches, components. (S6)
Circle (966)

REBO High Definition Studios† **TROP**
High definition TV products. (S2, V2, V7)
Circle (967)

Recortec **3910**
Videotape conditioners; VHS adaptations.
Circle (968)

Rees Associates **3483**
Studio, production facility design.
Circle (969)

Register Data Systems **2337**
Traffic, accounting business systems. (S1)
Circle (970)

Research Technology Int'l/RTI **1706**
Videotape degausser, evaluators, cleaners; film cleaning equipment. (S4)
Circle (971) See ad page 168

Retex International/PAS **7435**
Professional audio equipment distributor.
Circle (972)

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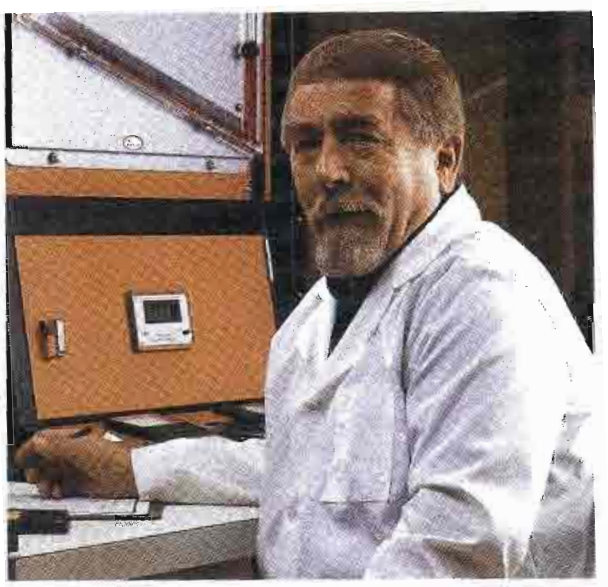
AMCO'S PEOPLE TAKE THE HEAT SO YOUR COMPONENTS DON'T HAVE TO.



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VISTA MSDC UHF TV TRANSMITTERS.

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TVT *division*

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The VISTA line of ultra-high efficiency 60-240 kW UHF television transmitters – the first to use the revolutionary Multi-Stage Depressed Collector (MSDC) klystron from Varian MTD – promises to cut a station's transmitter energy consumption by more than half. This means substantial savings for you.

These state-of-the-art transmitters incorporate the latest exciter technology, featuring precise pre-correction with excellent stability; advanced solid-state control-logic; a field proven, rugged, Annular Control Electrode (ACE) pulser and a new multi-voltage beam power supply designed for enhanced reliability and efficiency.

New to the market, VISTA is founded on proven technology. It uses klystrons similar to the thousands of modern broadband pulsed tubes in use today, which offer high gain, good transmission quality, reliability, and very long life. Based on TVT's series of high efficiency klystron transmitters, which have been in production since 1977, VISTA embodies the experience of over 600 UHF TV transmitters manufactured by Varian TVT.

Varian is the only US company that designs, manufactures and can therefore, effectively support the entire transmitter, including the tubes, exciters, power supplies, circuit assemblies, amplifiers, and control systems. VISTA is not just a collection of assemblies but a fully integrated design offering innovative technology, firmly rooted in a well established engineering heritage. It represents one of the best investments available in broadcasting today.

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VISTA MSDC™

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NEW V-SERIES TAPE DEGAUSSERS

ERASE IT ALL IN ONE PASS

All Signals... Time Code! Control Track! Audio! Video! V-Series Degaussers remove all trace of signal. Return tape to original blank condition.

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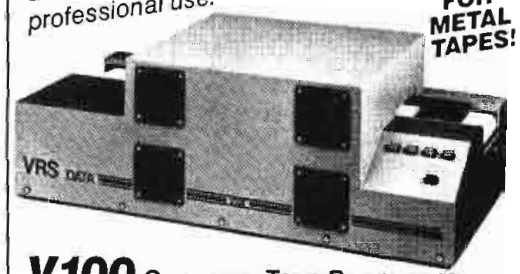
All Day Every Day... V-Series Degaussers are designed for continuous duty professional use.



V100 **Conveyor Tape Degausser.** Erases 22 metal tape cassettes per minute! Provides 75 dB erasure on 1500 Oersted metal tape, up to 80 dB erasure on S-VHS and oxide tape.

V90 **Tape Degausser.** Provides greater than 75 dB erasure on metal tapes, greater than 80 dB on standard oxide tapes. Simple automatic operation.

V93 **Tape Degausser.** Provides better than 80 dB erasure with typical 5 second cycle time. For cassettes, video/audio reels, data cartridges, floppy discs.

NAB Booth #1706

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RF Technology **5451**
ENG transmitters, receivers, power amplifiers, antennas; fiber optic systems; delay lines. (R2, S2, S6)
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Richardson Electronics **3852**
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Circle (974) See ad page 199, 201

Rocktron/RSP Technologies **3946**
Audio dynamics processors, noise reduction equipment.
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Rockwell International **3733**
STL/ICR microwave systems; weather radar, displays.
Circle (976)

ROH/Anchor Audio **3451**
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Circle (977) See ad page 180

Rohde & Schwarz **3813**
Audio, video, RF test systems; signal generators, modulation monitors; FM, TV demods.
Circle (978) See ad page 251

ROHN **4013**
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Circle (979)

Rosco Laboratories **5340**
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Circle (981) See ad page 65

Ross Video **4977**
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RTS Systems **4151**
Multiple-channel, programmable, modular intercom systems; headsets; intercom telephone couplers; wired, wireless systems; audio test tone generators. (A4)
Circle (983) See ad page 146, 282

Rupert Neve **2407**
Audio consoles for radio, TV, production; console automation. (A1)
Circle (984) See ad page 115

Sachtler **2437**
Camera support equipment; lighting instruments for studio, ENG. (V1, V4)
Circle (985) See ad page 193, 195

Saki Magnetics **1673**
Audio heads for audio, video recorders. (A3, V2)
Circle (986)

Samson Products **2308**
Wireless microphones, receiver systems. (A4)
Circle (987)

Sanken/Audio Intervisual Design **7900**
Stereo field microphones. (A4)
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Scala Electronic **(n.a.)**
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Circle (989)

Schafer World Communications **1347**
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Schneider **4162**
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Schwem Technology **5482**
TV camera lenses, stabilizers; wide-angle lenses. (V1)
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Scientific Atlanta† **3423**
Earth station antennas, electronics, controllers.
Circle (993)

SECK **3577**
Production, remote audio mixers. (A1)
Circle (994)

Selco/Sifam **1657**
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Circle (995) See ad page 294

Sennheiser Electric **1052**
Studio, field microphones, dynamic, condenser designs; headphones, headsets. (A4)
Circle (996) See ad page 307

Sentry Systems **2215**
Radio broadcast automation. (S1)
Circle (997)

SESCOM **3413**
Modular audio DAs, mic/phono preamps; line, monitor amps. (A2, A4, S5)
Circle (998)

SG Communications **2405**
Towers, antenna installation, services.
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Shima Seiki USA **3073**
Digital graphics design workstations.
Circle (1000)

Shively Labs **1341**
Transmission line; antenna radomes; directional array consultants. (R1, S7)
Circle (1001)

Shook Electronics USA **A—-**
Mobile TV production vehicles. (S7)
Circle (1002)

Shure Brothers **1517**
Dynamic voice, instrument microphones; audio distribution products. (A4, S5)
Circle (1003) See ad on Inside Front Cover

Sierra Video Systems **7904**
Distribution, routing switchers. (S5, V7)
Circle (1004)

Sigma Electronics **3168**
Distribution equipment; signal generators; videographics devices; sync, video ID generators. (V5, V7)
Circle (1005) See ad page 303

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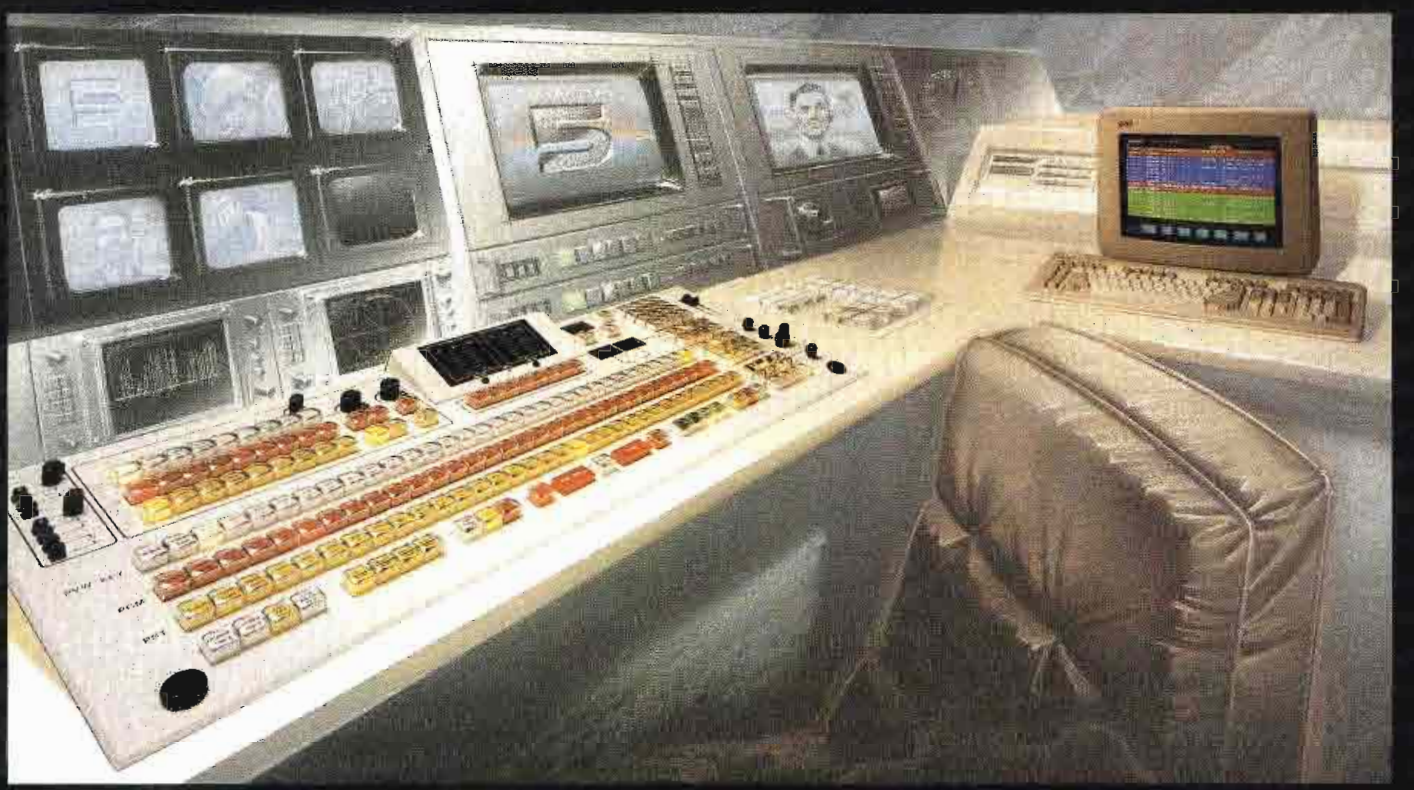
AUTOMATION SYSTEMS



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This wide range of system choices makes Utah Scientific the perfect source for your automation system.

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Skotel 4021
Time code generators, readers, inserters. (V2)
Circle (1006)

Snell & Wilcox 5530
Standards converters. (V7)
Circle (1007) See ad page 257

Solid State Logic 2005
Audio consoles; digital audiodisc recorders. (A3)
Circle (1008) See ad page 182

Solutec 5748
Automation hardware, software; audio, video DAs; audio level monitor equipment. (S1, S5)
Circle (1009)

Sono-Mag 1105
Radio program automation; multicart carousel systems.
Circle (1010)

Sony Communications Products† 4101
Video cameras, camera-recorders; analog, digital video signal conversion products; video signal processors, TBCs; video monitors; videocassette automation. (S1, V1, V2, V8)
Circle (1011) See ad page 24-5, 58-9, 74-5 106-7, 150-1, 205

Sony Magnetic Tape 4101
Video tape, analog, digital in reel, cassette formats; audio tape.
Circle (1012) See ad page 135

Sony Pro Audio 4101
Analog, digital audio recorders; analog-digital signal conversion products; audio mixers; wireless microphones. (A1, A3, A4)
Circle (1013)

Sound Ideas 3826
Production music, sound effects.
Circle (1014)

Sound Technology 4577
Audio test equipment, signal analyzers. (S6)
Circle (1015)

Sound Workshop Pro Audio 7133
Audio consoles.
Circle (1016)

Soundcraft/USA 3577
Audio consoles. (A1)
Circle (1017)

Soundmaster 7340
Integrated audio editing systems; transport synchronizers, controllers.
Circle (1018)

Spectra Image/Spectra Systems 3077
Videodisc recorders, playback equipment. (V2)
Circle (1019)

Sprague Magnetics 1446
Audio heads, head refurbishing service.
Circle (1020)

Stainless 3479
Broadcast towers, accessories, services.
Circle (1021)

Standard Communication 2545
Earth station electronics.
Circle (1022) See ad page 237

Stanton Magnetics 1649
Phono cartridges, headphones. (A4)
Circle (1023) See ad page 46

Stantron Unit/Zero 1712
Modular equipment cabinets, consoles; VTR/VCR dubbing/duplicator racks, accessories. (S3)
Circle (1024) See ad page 93

Star Case 4782
Equipment transport cases.
Circle (1025)

Status Cabinetry 7001
Studio furnishings.
Circle (1026)

Steadi-Film 7927
Camera support equipment; telecine accessories; recording systems.
Circle (1027)

Steenbeck 3877
Film, mag film editing tables, film-to-video transfer equipment. (V3)
Circle (1028)

Storeel 5238
Videotape storage systems. (S3)
Circle (1029)

Strand Lighting 4351
Stage, studio lighting instruments, dimmers, controllers, accessories.
Circle (1030)

WHEN BATTERY LIFE MAY MEAN SOMEONE'S LIFE.

You never know when a life-threatening emergency is coming.

That's why your batteries have to be in top condition. Charged, ready to deliver their rated ampere-hours.

Christie's CASP® Universal Battery Support Systems are insurance against battery failure. These state-of-the-art, microprocessor-based systems recondition degraded batteries, pinpoint potential problems, analyze useful capacity, and charge batteries with precisely the amount and type of current needed for peak performance.

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Streamline Communications 7140
Publisher, "Pulse of Radio" magazine.
Circle (1031)

Studer ReVox 1261
Audio consoles; audio recorders; FM monitor tuners; transport synchronizers; CD players. (A3, R4)
Circle (1032) See ad page 11

Studio Technologies 3828
Microphone preamps; stereo simulation, stereo signal identification products.
Circle (1033)

Sure Shot Satellite Network 3686
Circle (1034)

Swintek Enterprises 2205
Wireless microphones; intercoms; headphones; video accessories.
Circle (1035)

Switchcraft 1042
Audio patching panels, patch cords, jacks. (S2)
Circle (1036)

SWR 4009
FM, TV antennas; transmission line products.
Circle (1037)

Sylvania Lighting 3900
Stage, studio lamps.
Circle (1038)

Symbolics/Graphics Div 7017
Digital graphic systems.
Circle (1039)

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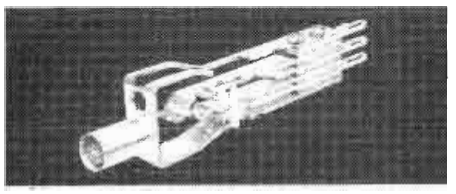
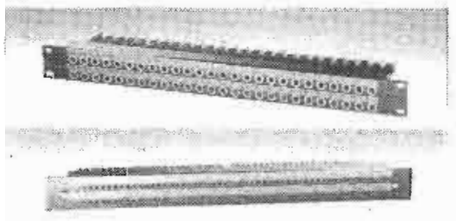
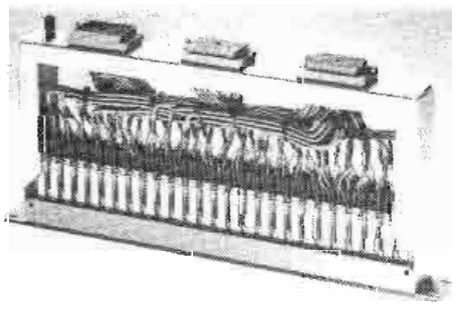
PATCH-BAY PRODUCTS



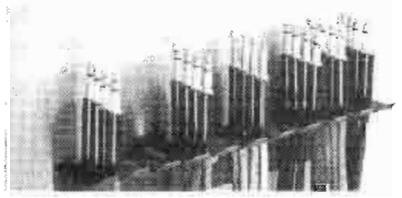
- 1/4″ Long-frame and Mini Telephone Jacks



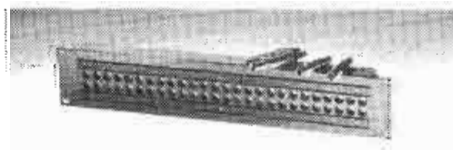
- Jack Panels with Jacks in both sizes
- A variety of Row and Jack Hole Spacings available



- Standard line of Pre-wired Panels
- Custom Wired Panels



- 1/4″ & Mini Patch Cords
- Patch Cord Holders
- Polysand



- Video Panels

audio accessories™ audio line

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Symetrix 2304
Noise reduction, telephone hybrids; digital audio recorders; audio level meters. (A2, A3, S6)
Circle (1040)

System Associates 5355
Used broadcast TV equipment brokers.
Circle (1041)

Systemation 1032
Radio automation hardware, software.
Circle (1042)

Taber/AVSC 4017
Audio recording heads; degaussers, cleaners, conditioners; recording tape.
Circle (1043)

Tamron Industries 3777
Camera lenses; video printers. (V1, V8)
Circle (1044)

Tannoy 7533
Audio reference monitors. (A4)
Circle (1045)

Tape Care/Data Security 2121
Degaussers videotape, metal particle, instrumentation, computer recording media. (S4)
Circle (1046)

Tapscan 1171
Business software systems.
Circle (1047)

Target Tuning 5440
Fixed-tuned radio for radio station promotions.
Circle (1048)

TASCAM 5577
Reel, cassette audio recorders; audio consoles; signal processors; transport synchronizers. (A3, A4)
Circle (1049) See ad page 45

TDK Electronics 4983
Recording media.
Circle (1050)

TEAC 5577
Videodisc recorders, players. (V2)
Circle (1051) See ad page 114

Teatronics/Lighting Innovations 5738
Lighting dimmers, controllers.
Circle (1052)

Teccom 3948
Circle (1053)

TEKNO 7227
Lighting instruments, lamps; cycs, backdrops; studio rail systems; power inverters.
Circle (1054)

Tekskil Industries 3586
Computer prompters.
Circle (1055)

Tektronix 3700
Component/composite video signal generators; transmission test signal generators; video measurement sets; aural modulation monitors with remote monitoring; signal development software. (S6)
Circle (1056) See ad page 157, 159, 161, 163, 181

Telemet 5138
TV demods; routing switchers, DAs; video encoders, decoders; fiber optic products; sync, test signal generators; sideband analyzers, envelope delay test sets; video switchers, keyers; titling generators. (V5)
Circle (1057) See ad page 238

Telemetrics 5105
Triaxial camera control systems; pan/tilt camera support with computer control. (S1, V1)
Circle (1058) See ad page 309

Telepak San Diego 5746
Equipment covers, transport bags. (S3)
Circle (1059)

Telescript 5335
Computer-based prompters. (V5)
Circle (1060)

Telettra USA 3085
Video codec systems. (S1)
Circle (1061)

Television Engineering 1742
Facilities designs, mobile production vehicles; equipment packages, systems.
Circle (1062)

Television Equipment Associates 5200
Matthey video delays, filters; audio anti-aliasing filters; Racal headsets, 2-way radio accessories. (A4, S6)
Circle (1063)

Telex Communications 3541
Wired, wireless microphones; intercoms; headphones, headsets. (A4)
Circle (1064) See ad page 109

Telmak Television 7240
Modular video switcher, distribution products.
Circle (1065)

Telos Systems 2301
Digital telephone hybrids. (A4)
Circle (1066)

Tennaplex Systems 5441
FM, TV antennas; music automation systems. (S1)
Circle (1067) See ad page 296

Tentel 5223
Tools, gauges for VTR/VCR alignment.
Circle (1068) See ad page 82

TFT 2115
AM, FM, TV modulation monitors; STL equipment; remote pickup systems. (R1, R4)
Circle (1069) See ad page 299

Theatre Service & Supply 3865
Theatre, studio lighting instruments, lamps; facility design, construction, consulting.
Circle (1070)

Theatre Vision/TVI 5757
Studio fixtures, lighting dimmers, power distribution systems; cycs, tracks, chroma-key fabrics.
Circle (1071)

Thermodyne International 2415
Equipment transport cases.
Circle (1072)

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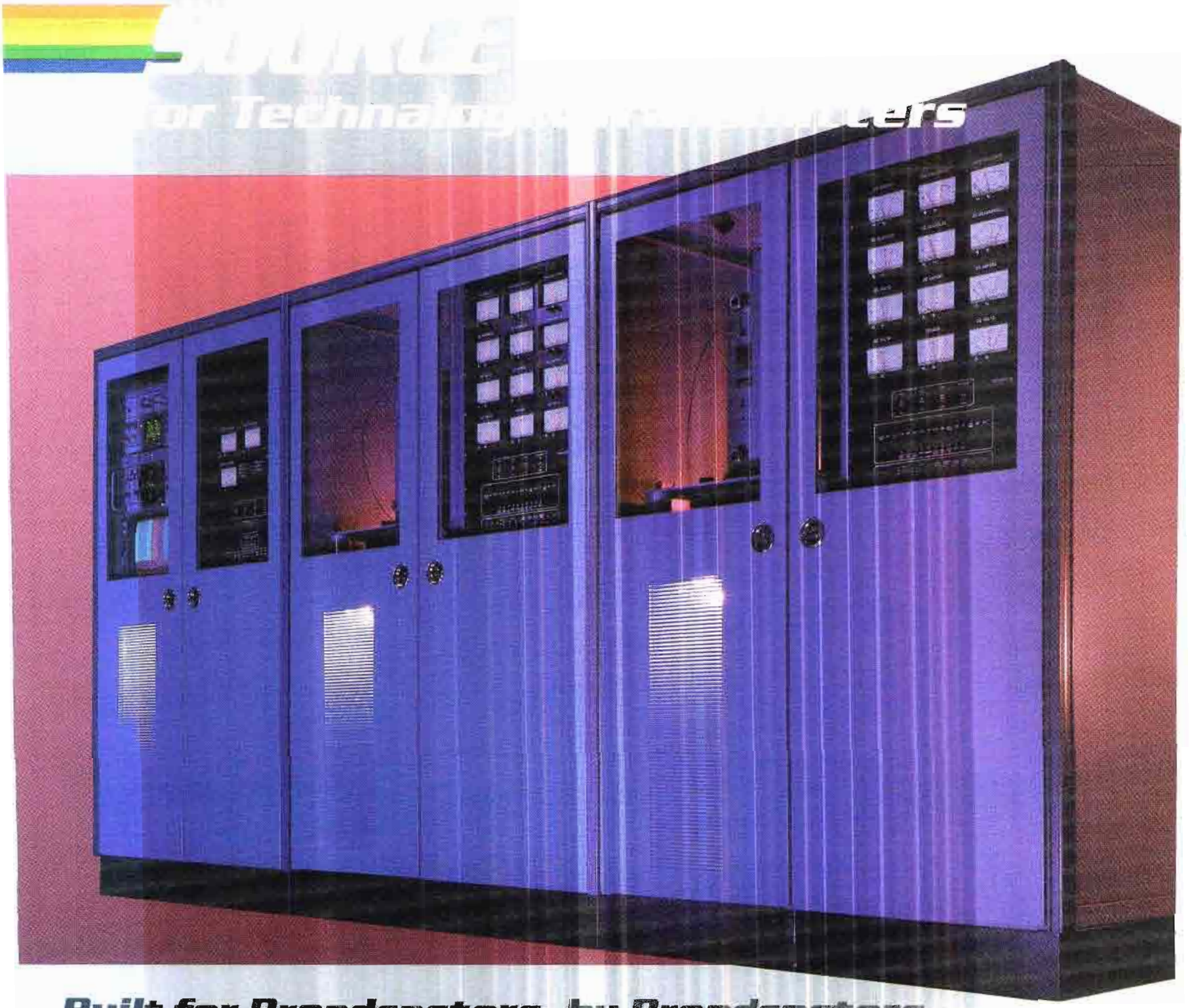

Built for Broadcasters, by Broadcasters

The strength of Technalogix Transmitters owes as much to the people behind them as to the technology within them. LeRoy Wallace, Sr., LeRoy Wallace, Jr., and Don Adams, a design team that possesses over 60 years in the broadcast industry, have created the line of high power UHF transmitters they've always dreamed of building.

Performance, Reliability and Serviceability.

Technalogix and Midwest have teamed up to create a complete line of UHF television transmitters ranging from 30KW to 280KW. Each transmitter is meticulously designed to deliver high performance, reliable operation, ease of service and trouble-free maintenance.

Technical Service and Support.

Midwest has over 50 sales and service centers throughout the country. Plus, the Technalogix Response Team is on-call 24 hours a day to respond quickly to solve your problems.

Replacement Parts Availability.

Technalogix transmitters have been designed using readily accessible "off the shelf" parts, so they can be quickly obtained from numerous third-party sources. By utilizing these parts, your replacement costs are also kept at a minimum.

When it's time to purchase a new transmitter, go with a Technalogix from Midwest. Because your transmitter is the last thing you need to worry about.

MIDWEST
Communications Corp.

One Sperti Drive
Edgewood, KY 41017
606-331-8990

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Thomson-CSF
See:
- Comark Communications
- Thomson-LGT
- Thomson Video Equipement

Thomson Electron Tubes & Devices 1165
RF power tubes, solid-state devices; camera tubes, CCDs.
Circle (1073)

Thomson Video Equipement 5141
Progressive-scan cameras; tube, CCD studio, ENG, EFP cameras; component digital color corrector; analog component, serial, parallel digital video mixers/switchers. (V1, V6, V7)
Circle (1074) See ad page 203, 297

Thomson-LGT 5141
VHF, UHF solid-state TV transmitters, UHF TV translators. (R1)
Circle (1075) See ad page 139

Tiffen Mfg 3744
Optical filters.
Circle (1076)

TimeLine 7901
Time code equipment, transport synchronizers.
Circle (1077)

Times Square Lighting 3286
Audio equipment; lighting instruments. (V4)
Circle (1078)

Titus Technological Laboratories 2027
Audio routing, switching equipment; FM stereo signal analyzers, demodulators. (R4, S5)
Circle (1079)

TMD/Will-Burt 4883
Pneumatically controlled antenna supports. (R7)
Circle (1080)

Toko America 7100
HDTV framestores, image processors; A/D convertors. (V2, V7)
Circle (1081)

Torpey Controls & Engineering 5102
Master clock, central timer, central thermometer systems. (S1)
Circle (1082)

Toshiba/OEM Div† 5168
Miniature and ENG CCD cameras, satellite flyaway systems, VHF transmitter modules, HDTV equipment. (R6, V1)
Circle (1083) See ad page 153

Total Spectrum Mfg 719
Camera mounting systems; remote, automation controllers; ENG accessories.
Circle (1084)

Townsend Broadcast Systems 5555
VHF, UHF TV transmitters, antennas. (R1)
Circle (1085) See ad page 177

Townsend Test & Measuring 5105
Philips Professional Television waveform, vector monitors, TV test equipment. (S6)
Circle (1086) See ad page 255

Transmission Structures 1617
Communications, broadcast towers, services.
Circle (1087)

Trimm 7636
Connectors, patching equipment, terminal blocks.
Circle (1088)

Trompter Electronics 4023
Distribution patch panels, cords, connectors; cable assemblies.
Circle (1089)

True Vision 7627
Computer graphics display equipment. (V5)
Circle (1090) See ad page 277

TTC/Television Technology 3500
FM translators, solid-state transmitters; UHF TV transmitters. (R1)
Circle (1091) See ad page 243

Twentier Systems 7827
Newsroom software, hardware.
Circle (1092)

TWR Lighting 5110
Tower obstruction lights, beacons, controllers.
Circle (1093)

Winsted® THE MATCHMAKERS for the customized approach to videoproduction centers.

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For in-house or on location—a complete production facility in one compact portable unit. Ample 47¼" of rack space puts all your equipment within easy reach. Large selection of modular components offer many variations.

For full-line catalog of editing, production and dubbing consoles, tape and film trucks, film and videotape storage systems, call or write:

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Here is a complete workstation that lets you work at your laptop computer anywhere you need it! Our unique molded case stores, protects, and positions your computer and printer, and it has a built-in storage tray underneath for paper, your cables and supplies. Simply open the lid, plug it in, turn it on and you're all set! Several models are available, starting at just $135.00. Call or write us for more information.

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Telex 83-4763 FAX 215-828-5623

Circle (100) on Reply Card

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Can you locate and lock-on to your target satellite faster than you can read this ad?

Grab a stop watch and time yourself as you read this ad. From the very first word of the headline to the last word in our logo.

And forget about all those incredible speed reading lessons you took. We're talking about your normal reading speed.

If you're currently using the traditional equipment used in locating and locking-on to satellites, your answer is, "No, I can't locate and lock-on to a satellite faster than I can read this ad."

Why?

The reason is simple: on average, it takes ten minutes or so to locate a target satellite and lock a mobile antenna onto it. If you've been around the industry for any amount of time at all, you know it's been that way for years.

And that was fine. Then.

But Midwest's new RC-8097B Satellite Indicator/Controller changes all that.

In about three minutes. Or less.

Because the RC-8097B is based on the time-tested, time-proven Loran C navigational system combined with state-of-the-art microprocessor technology for fast, accurate mobile satellite antenna positioning and control.

The result is an antenna that is correctly positioned. Within ± .2° of elevation and ± 1.5° of azimuth.

In three minutes. Or less.

What's more, the RC-8097B is so easily operated that even non-technical personnel can locate a satellite and position the mobile antenna. Correctly. Within ± .2° of elevation and ± 1.5° of azimuth. In three minutes. Or less.

Better yet, the RC-8097B allows you to set as many as nine satellite positions. As well as nine of the most frequently-used truck locations. And since each truck location is accurate within a 100-mile radius, those presets cover an incredible amount of territory.

Territory in which you can locate and lock-on to any of those nine preset satellites in three minutes. Or less. Within ± .2° of elevation and ± 1.5° of azimuth.

No wonder we say it's an essential on all satellite vehicles.

Are we bragging?

You bet! Because the RC-8097B, designed and developed by Research Concepts, is unique. And only Midwest has it.

So only Midwest can so confidently challenge you to beat our time. From power-on to final antenna positioning in three minutes or less.

With an accuracy of ± .2° of elevation and ± 1.5° of azimuth.

If you can't beat that speed and accuracy with your current equipment, isn't it time you stopped reading and located your Midwest representative for a quick demonstration?

So you can lock-on to Midwest's new RC-8097B Automatic Satellite Indicator/Controller.

MIDWEST
Communications Corp.

One Sperti Drive
Edgewood, KY 41017
606-331-8990

Circle (101) on Reply Card

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Ultimatte† **5165**
Video compositers; computer-controlled camera mounting systems. (V1)
Circle (1094)

Union Connector **4582**
Studio wiring, connectors; power contactors, panels. (S2, V4)
Circle (1095)

UniSet **1752**
Studio fixtures, furniture, set pieces.
Circle (1096)

United Media **5544**
Videotape editing controllers; editing switchers; time code products. (V2)
Circle (1097)

United Ropeworks (USA) **1722**
Tower guy materials, accessories.
Circle (1098) See ad page 102

UREI **3577**
Audio processor; on-air audio mixers. (A2)
Circle (1099)

US Tape & Label **1533**
Cassette labels; promotional materials.
Circle (1100)

Ushio America **7735**
Test equipment, oscilloscopes.
Circle (1101)

Utah Scientific **4526**
Automation equipment; distribution, routing, master control switchers; machine control systems. (S1)
Circle (1102) See ad page 63, 169

Utility Tower **1447**
Tower products; maintenance services.
Circle (1103)

Valentino Production Music **1627**
Music, sound effects library. (S8)
Circle (1104)

Valley International **2030**
Audio processors for on-air, production; audio distribution products. (A2)
Circle (1105)

Valmont Industries **3371**
AM radio antennas, support products.
Circle (1106)

Varian Associates
See:
- Continental Electronics/Varian
- Varian EIMAC Salt Lake City
- Varian EIMAC San Carlos
- Varian Microwave Equipment
- Varian Microwave Power Tubes
- Varian-TVT

See ads, pages 12, 73, 166-7, 187, 233, 285

Varian EIMAC Salt Lake City **5300**
RF power triodes, tetrodes. (R3)
Circle (1107)

Varian EIMAC San Carlos **5300**
RF power amplifiers, devices, Klystrodes. (R3)
Circle (1108)

Varian Microwave Equipment **1125**
RF microwave amplifier assemblies. (R3)
Circle (1109)

Varian Microwave Power Tube Div **5300**
RF power devices, Klystrons, RF circuitry. (R3)
Circle (1110)

Varian TVT **1125**
FM radio, TV transmitters. (R1)
Circle (1111)

VEAM **3611**
Power connectors, fiber optic products.
Circle (1112)

Vector Technology **2137**
TV transmitters, exciters; FM exciters. (R4)
Circle (1113)

Vega/Mark IV **3846**
Bodypac, hand-held wireless microphones; wired, wireless intercoms. (A4)
Circle (1114)

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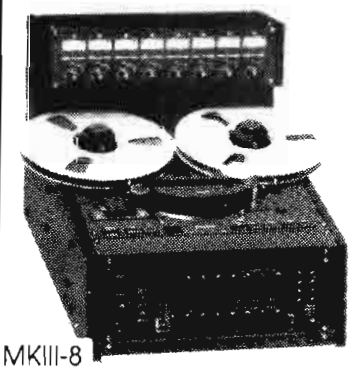
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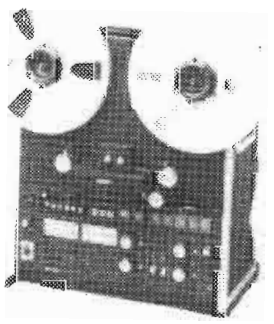
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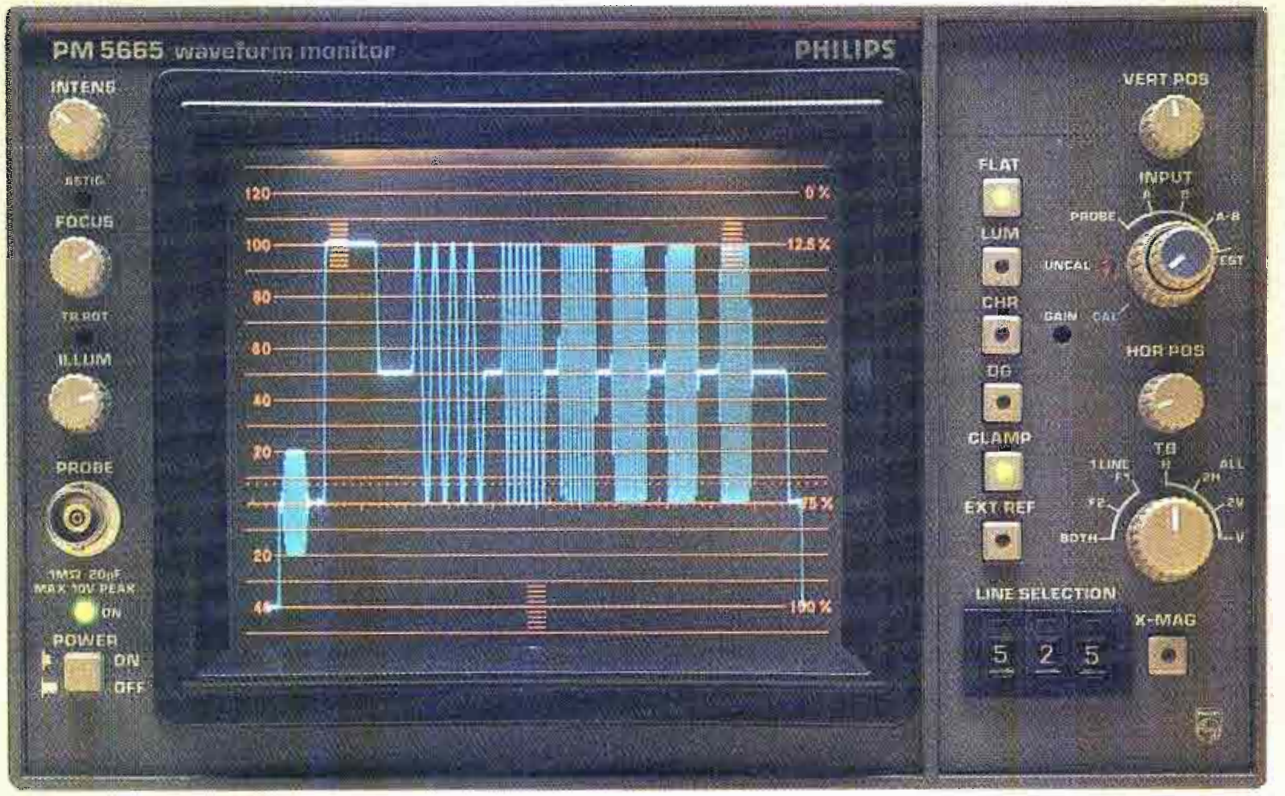
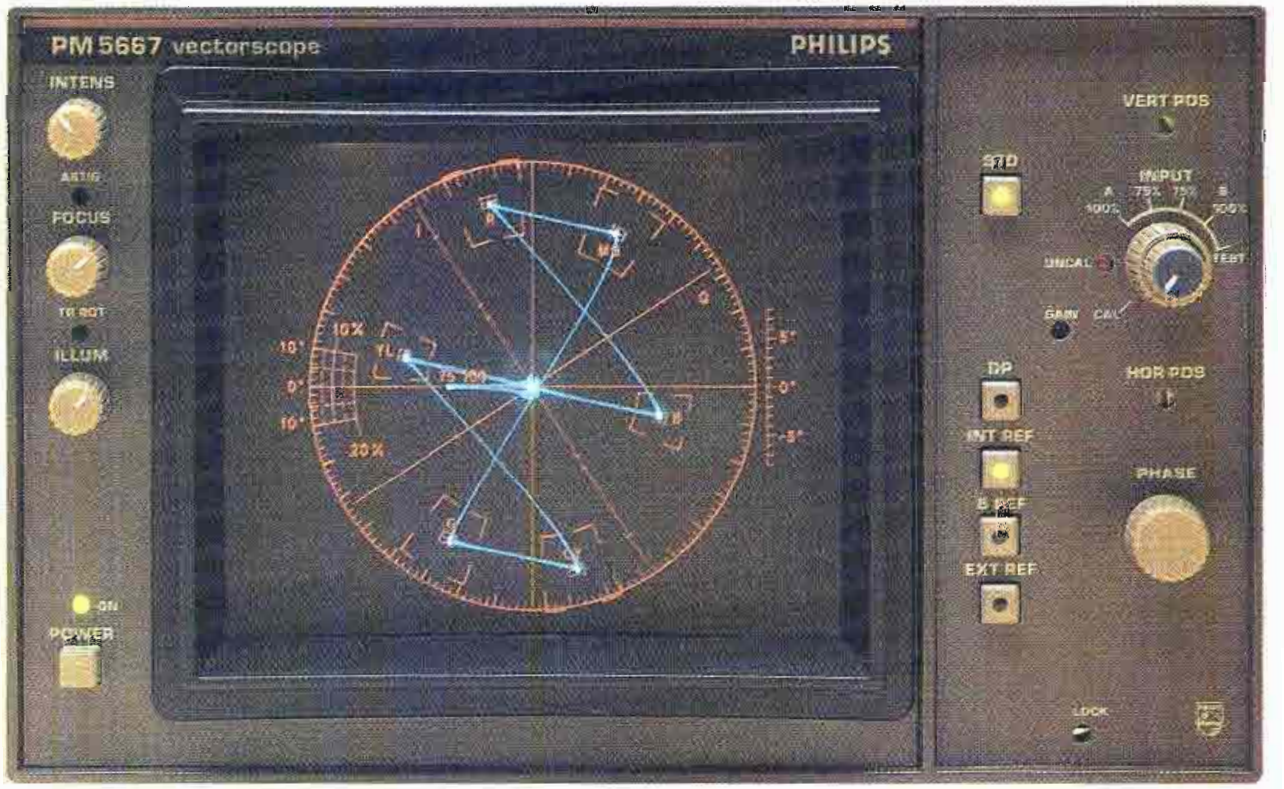


doesn't convince you...



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For a limited time only, you can evaluate your choice of Philips waveform monitors and vectorscopes in your facility for two full weeks at no cost or obligation. Compare the accuracy, versatility and ease-of-use of our instruments against the established brand, or whatever you've been using.

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Video Accessory 5212
Sync, color bar generators, video DAs. (S5)
Circle (1115) See ad page 288

Video Associates Labs 4015
Video, computer titling keyers.
Circle (1116)

Video Communications 7117
Single CPU-based TV business system. (S1)
Circle (1117)

Video Design Pro 7317
Engineering design stations, engineering documentation software. (S1)
Circle (1118)

Video Financial 3884
Financial services. (S7)
Circle (1119)

Video International Development 3486
Video standards converters. (V7)
Circle (1120)

Video Services Unlimited 7228
Camera cranes, booms. (V1)
Circle (1121)

VideoLab 7301
VCR retrofits; shuttle, balanced audio, time code modules.
Circle (1122)

Videomagnetics 5438
Tape degaussers; VPR video head refurbishing services. (S4, V2)
Circle (1123)

Videomedia 3959
Video editing controllers, animation products. (V2)
Circle (1124)

Videotek 5563
Frame-store, synchronizers; video production switchers; color monitors, monitor/receivers, demods; burst distribution systems; waveform, vector monitors. (R4, V7, V8)
Circle (1125) See ad page 111, 113

Viking Cases 5326
Equipment transport cases, enclosures.
Circle (1126)

Vinten Broadcast 809
Camera support, pedestals, pan/tilt heads; camera support automation. (V1)
Circle (1127) See ad page 62

Vistek Electronics 5530
Standards transcoders; distribution matrix amplifiers. (S5, V7)
Circle (1128)

Vital Industries 4326
Video switchers; digital effects systems.
Circle (1129)

Vortex Communications 1521
DAs, routing switchers; test signal generators; time code indicators; comb filters, encoders, decoders; equalizing DAs; video matrix convertors, transcoders. (A2, V5, V7)
Circle (1130)

Walter S Brewer 4777
Studio lighting; studio fixtures.
Circle (1131)

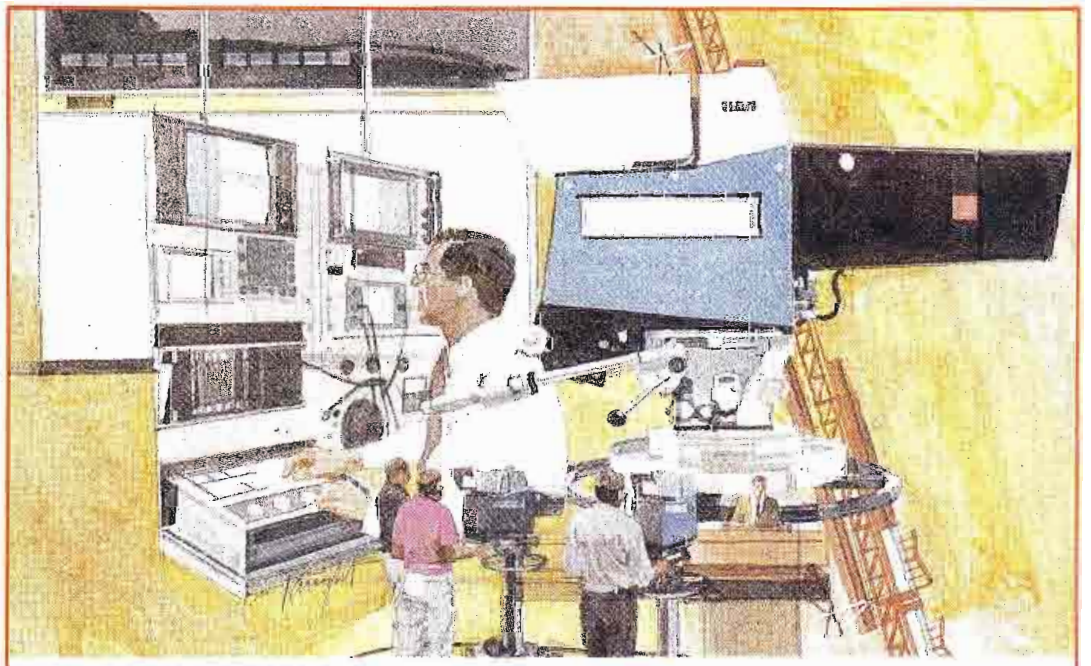
Ward-Beck Systems 5319
Audio consoles; intercom systems. (A1, A4)
Circle (1132) See ad on Back Cover

WaveFrame 7817
Digital audio sampling conversion interface. (A2)
Circle (1133)

Wavefront Technologies 7217
Videographics systems, workstations.
Circle (1134)

Weather Services International 3440
Prepared weather forecasts, data for radio, TV.
Circle (1135)

Wegener Communications 2109
SCPC encoders, decoders; microwave, earth station electronics; digital audio, data, video transmission systems. (R2, R4, R6)
Circle (1136)



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A HIGHER LEVEL OF KEYING

Graham-Patten Systems, the performance leader in high quality video keyers, now takes you to a higher level. The new Model 1241 presents farsighted solutions to on air, remote, and post production demands. This advanced video keying system has functions usually found only in switchers. The Model 1241 is a cost effective choice that will significantly improve your production capabilities.

The Model 1241 is your key to extended video power. It offers six independent self or external key inputs, the cleanest keying edges and borders available, and external control of key and black auto-transitions. Plus, the Model 1241 has these additional advanced features:

Edging Effects

- Borders up to 15 lines wide
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- Border fill from external source
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- Outlining effects
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Additional Features

- Individual clip control for each input
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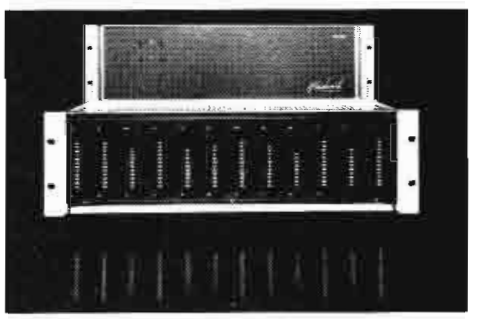

Were it possible to quantify versatility, the question of what to purchase would be easy. The technical performance of the System 1000 is superb, but our primary focus is to give you total flexibility. Our DA-101, for instance, can be a 2 in by 10 out mono DA capable of generating L+R or L-R, a timecode DA with a bandwidth of 200 kHz, a stereo 10 watt headphone amplifier, or a 40 watt bridged mono power amplifier. That's just the beginning. The DA-102 is a stereo 1 in by 5 out DA with a configurable sixth output that may be a 60Ω, direct, or mono mix out. Now add remote control of gain, stereo, mono, L, R, and matrix modes at master control, VTRs, downlinks, etc., to all four System 1000 DAs, and you've got versatility. Call now for full information.

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NAB Booth 3780

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Wheatstone Broadcast Group **1034**
Stereo switching, distribution amplifiers; audio consoles for on-air, production, MTS. (A1, S5)
Circle (1137)

Wheelit **3844**
Utility equipment carts; computer furniture. (S3)
Circle (1138)

Whirlwind **5368**
Production music services.
Circle (1139) See ad page 310, 319

Winsted **4965**
Videotape storage systems; workstation furniture; utility equipment carts. (S3)
Circle (1140) See ad page 174

Wireworks **1760**
Wiring assemblies, cables; connectors.
Circle (1141)

Wohler Technologies **2151**
Stereo audio monitor amps; audio phase indicators. (A4, S6)
Circle (1142)

Wold Communications **1764**
Satellite program distribution services.
Circle (1143)

Wolf Coach **1787**
Mobile production vehicles; mobile unit antenna masts, accessories. (R1)
Circle (1144)

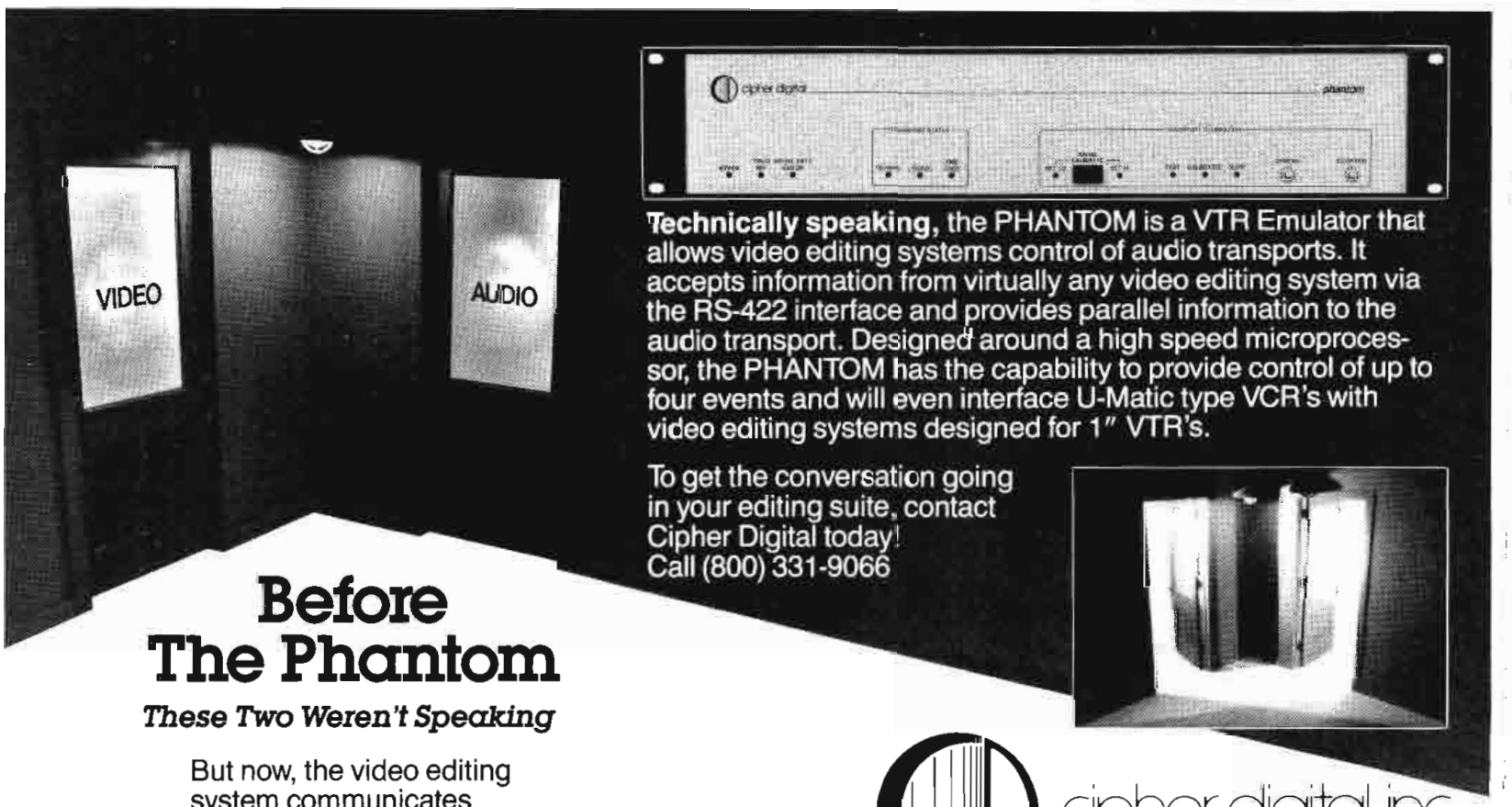
World Tower **1470**
Broadcast towers, services.
Circle (1145)

WSI **3774**
Weather radar imaging, graphics systems. (V5)
Circle (1146)

Yamaha Music **7205**
Audio consoles, digital mixing processors; A/D, D/A converters; powered monitor speakers; effects processors.
Circle (1147)

Yamashita Engineering Mfgr/YEM **3712**
Video scan convertors; video sync generators, encoders. (V7)
Circle (1148)

Zonal **2401**
Audio tape, reel, cassette formats; magnetic sound recording film. (S4)
Circle (1149)



Before The Phantom

These Two Weren't Speaking

But now, the video editing system communicates beautifully with the ATR, thus eliminating the need for an expensive audio suite. And all the credit goes to the unique, new PHANTOM from Cipher Digital.

Technically speaking, the PHANTOM is a VTR Emulator that allows video editing systems control of audio transports. It accepts information from virtually any video editing system via the RS-422 interface and provides parallel information to the audio transport. Designed around a high speed microprocessor, the PHANTOM has the capability to provide control of up to four events and will even interface U-Matic type VCR's with video editing systems designed for 1″ VTR's.

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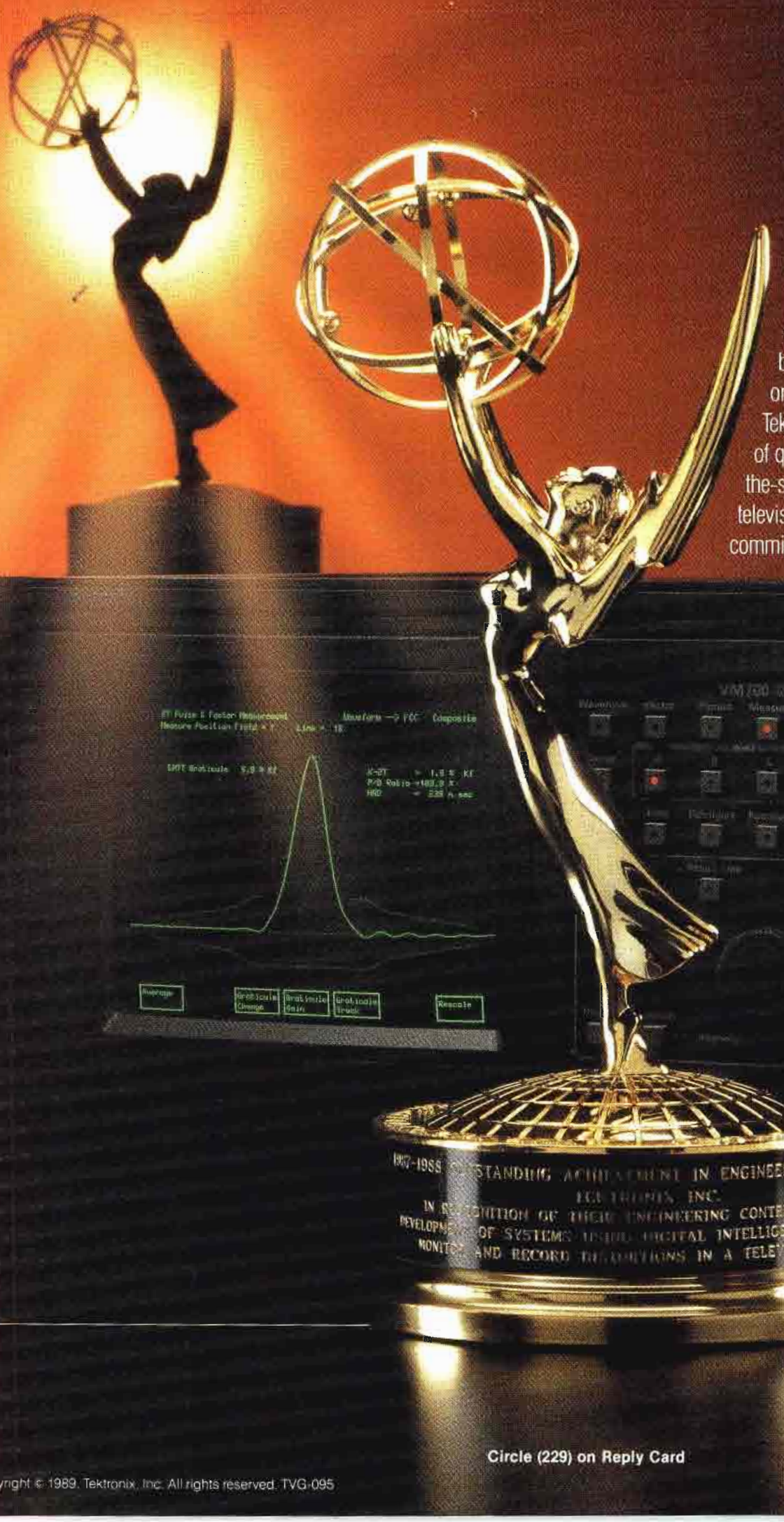

A second Emmy, recognizing our contributions to digital excellence in professional broadcast monitors, is just one more reason to rely on Tektronix for the best measure of quality, value and behind-the-scenes excellence in television technology. We're committed to it.

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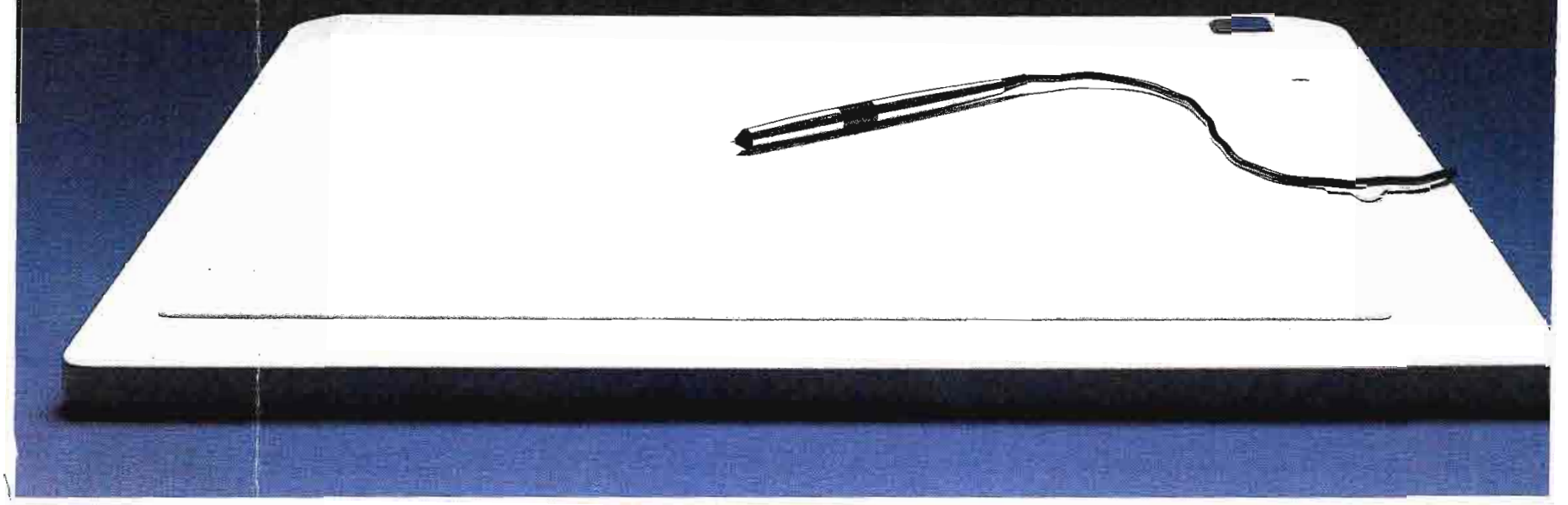
THE AUDIO POST ROOM



DIGITAL AUDIO FOR VIDEO AND FILM

A state of the art audio-for-vision editing suite usually requires considerable investment in equipment, but above all, the patience and dexterity of skilled engineers to manipulate several tape sources to VT and film. Miracles can be performed, but the editor is often constrained from creative experimentation by the limitations of both time and his facilities.

Solid State Logic conceived ScreenSound to put more creative power and time into the hands of the editor by eliminating logistical problems. Instead, we provide an entire editing suite in one integrated unit, with a simple pen and tablet control surface, enabling rapid editing, laying up and track-slipping, all with the digital sound integrity necessary to meet today's broadcast standards.

ScreenSound provides the first working environment built around the editor, not the equipment, leaving him free to use his creative skills on the final soundtrack.

ScreenSound

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a *real* component switcher is here.

AMPEX COMPONENT

Now *all* the advantages of working in the component domain are yours with Ampex's new *component* Vista™ analog switcher.

Its compact size and extraordinary power make it a perfect fit for that elite cadre of professionals dedicated to squeezing the last drop of quality from small-format video, whether it be in broadcast, post, corporate, or mobile applications. And because the Vista was built from the ground up with the newest switcher technology, it's also surprisingly affordable.

Available in either a 10 or 18 input configuration, this new component switcher gives you 6 levels of video with 4 keys and 2 backgrounds. (For the first time in the component world, Vista provides full-capability, linear keyers.)

Via the exclusive Digi-Loop™ system, a variety of switcher video levels may be easily routed in component form to either of two channels of ADO™ digital effects. And for flexibility, transcoding input and output amplifiers let you tailor signals to your specific requirements, allowing any combination of RGB, Betacam, MII, or SMPTE formats.

Vista. An easy-to-use, affordable, powerhouse switcher for component video . . . a *real* component switcher is finally here!

Call 1-800-25AMPEX for more information.

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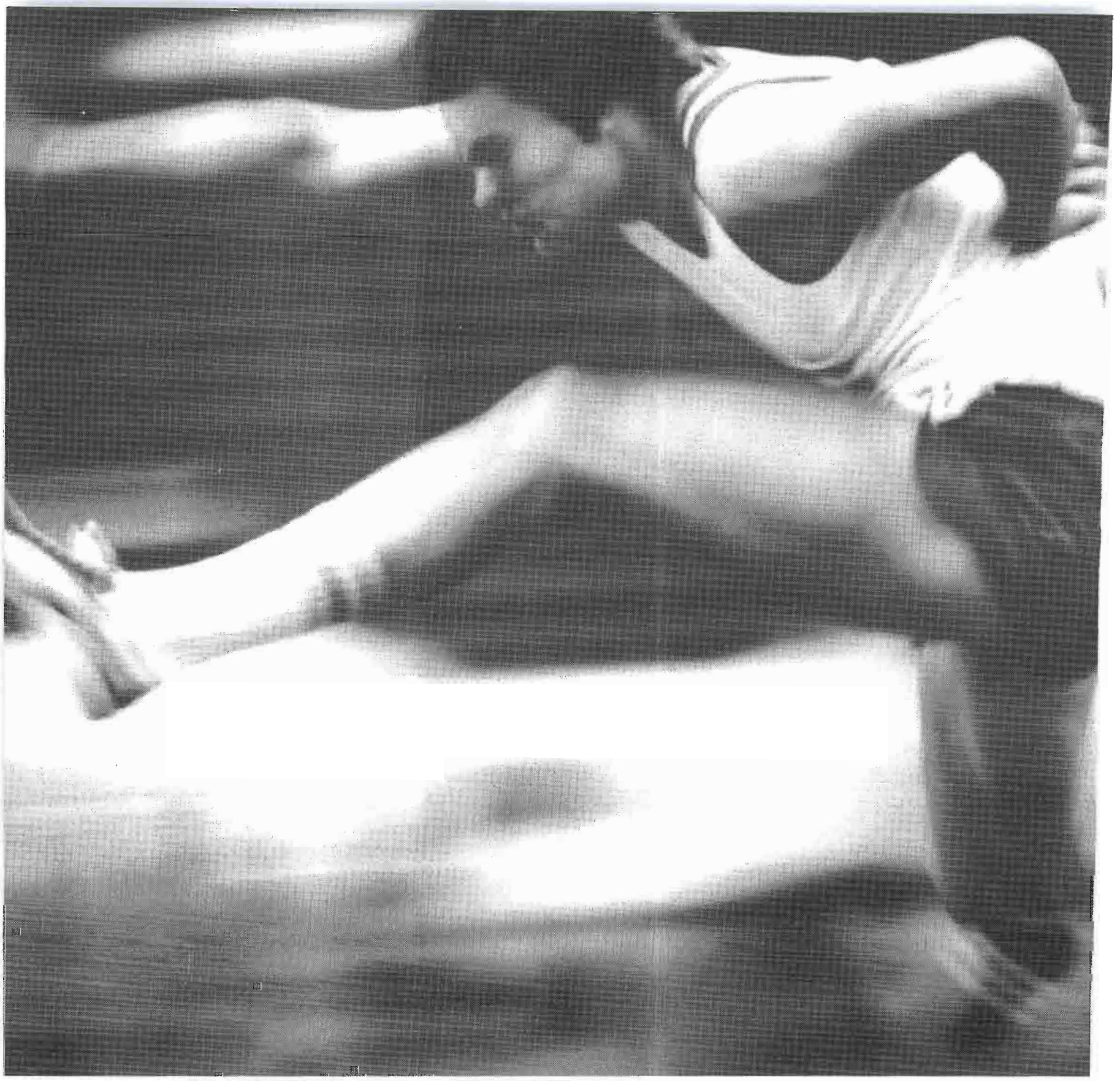

The faster things change, the faster

At Camera Mart, we cover video changes faster than you change lanes.

Our video pros are close to the manufacturers, often evaluating new ideas and testing new products before they're introduced.

So, when you ask us, "What's new?" you know we know what we're talking about.

In over 50 years, we've sold and rented more film and video equipment than anyone.

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In addition, we design, build and install complete video systems. And it all comes with the best service, brightest experts and friendliest rates you'll find anywhere.

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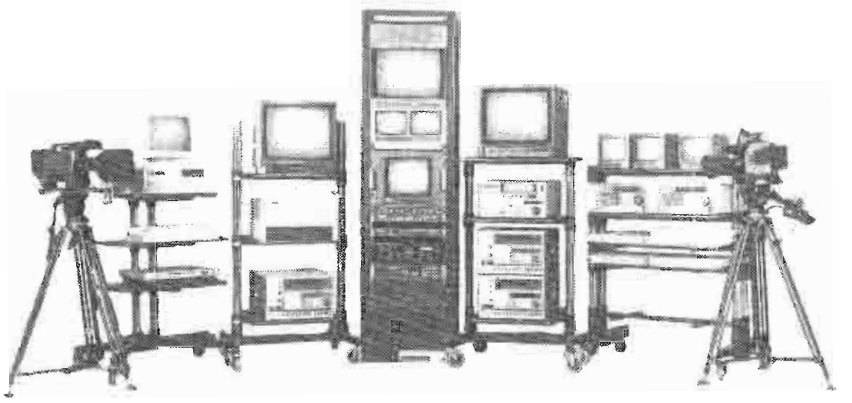

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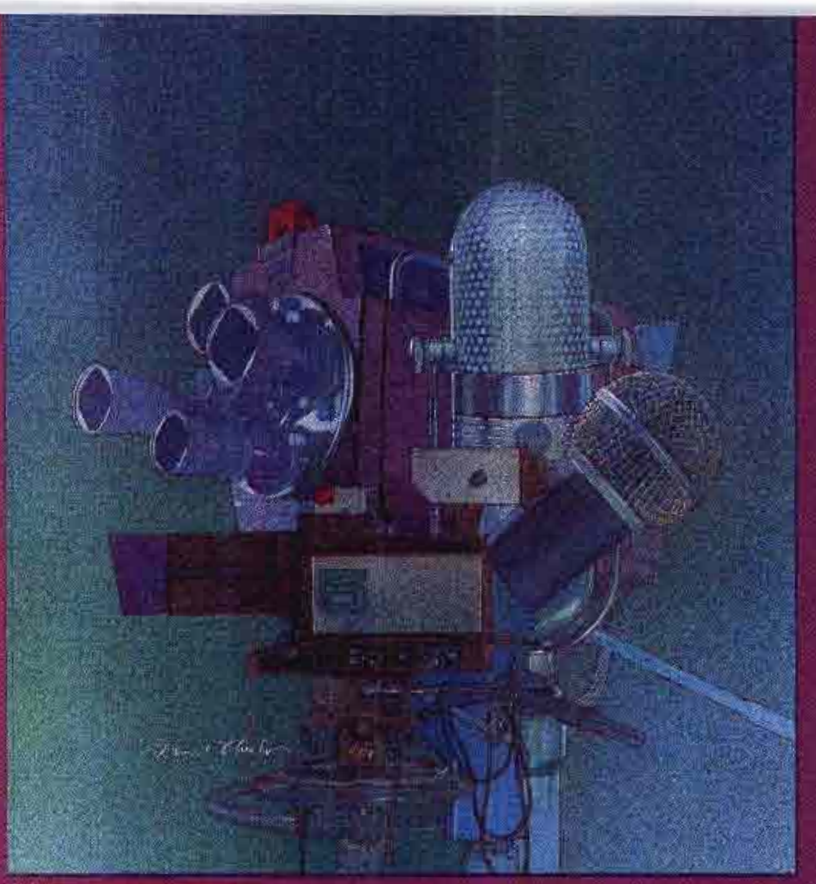

NEW AT NAB

The following pages contain information about new products that manufacturers have told **BE** they plan to debut at NAB '89. These products include items that have been brought to market since the 1988 exhibition, as well as enhanced versions or production models of prototype equipment displayed previously.

"New at NAB" is broken into four general categories: *audio, RF/tower, support* and *video products*. Each category is further subdivided, and each of the subcategories has been assigned a code number, such as A1 or V4. The boldfaced code numbers are cross-referenced in the "Exhibitor Listings," which begins on page 136. For each subcategory, the number in parentheses is the page number where that equipment type begins.

Group A — Audio Products

A1 (188): Audio/mic mixers, consoles, console automation.
A2 (188): Processing systems (delay, effects, dynamics, noise reduction, telephone interface).
A3 (190): Recording systems (cartridge, cassette, disk, reel; analog, digital), audio editor.
A4 (192): Sources, monitors (mic, wireless, amp, RPU, phono, CD player, intercom, headphone, headset, speaker).

Group R — RF/Tower Products

R1 (200): AM, FM, TV transmitters, antennas, transmission line, transmitter remote control; towers, guys, lighting, services.
R2 (200): Terrestrial microwave (ENG, STL, ITFS/MDS; electronics, antennas).
R3 (200): Power amplifiers, cavities, power devices; transmitter power supplies.
R4 (200): Receivers, demodulators, modulation monitors.
R5 (202): Exciters, RF generators (SCA, MTS stereo, SAP, PRO, FM, AM).
R6 (202): Satellite antennas, electronics.

Group S — Support Products

S1 (202): Automation; computer hardware, software (business, programming, newsroom, machine control) timers/clocks, data transmission equipment, services.
S2 (206): Cable, wire, fiber-optic products, connectors, patch panels/cords.
S3 (208): Cases, racks, studio furnishings, acoustic materials, physical effects.
S4 (208): Audio-video recording media, degaussers, tape maintenance products; film, film maintenance products.
S5 (210): Signal-distribution amplifiers, audio-video routing switchers, control panels.
S6 (212): Test, monitoring equipment, RF loads/calorimeters, meters, knobs, signal attenuators; tools; filters, delay lines/units; power-line conditioners.
S7 (214): Production facility, vehicle design, construction; consulting services.
S8 (214): Program services, music/effects libraries; promotional materials.

Group V — Video Products

V1 (218): Video cameras, lenses, tripods, pan/tilt heads, pedestals; camera support/mounting equipment.
V2 (220): Recording systems (tape, disk, solid-state; analog, digital); still-stores; video-editing controllers; transport synchronizers; animation equipment; time-code equipment.
V3 (222): Cine/film cameras, telecines.
V4 (224): Batteries, chargers, analyzers; lighting instruments, lamps; grip equipment.
V5 (226): Digital graphics, titling, effects, weather graphics systems; prompting and caption systems.
V6 (230): Production, master-control switchers.
V7 (230): Video processing, TBC, synchronizer, standard conversion, sync generator, VID generators, keyers, compositors.
V8 (234): Video monitors, projectors, video printers, computer/data CRT displays.

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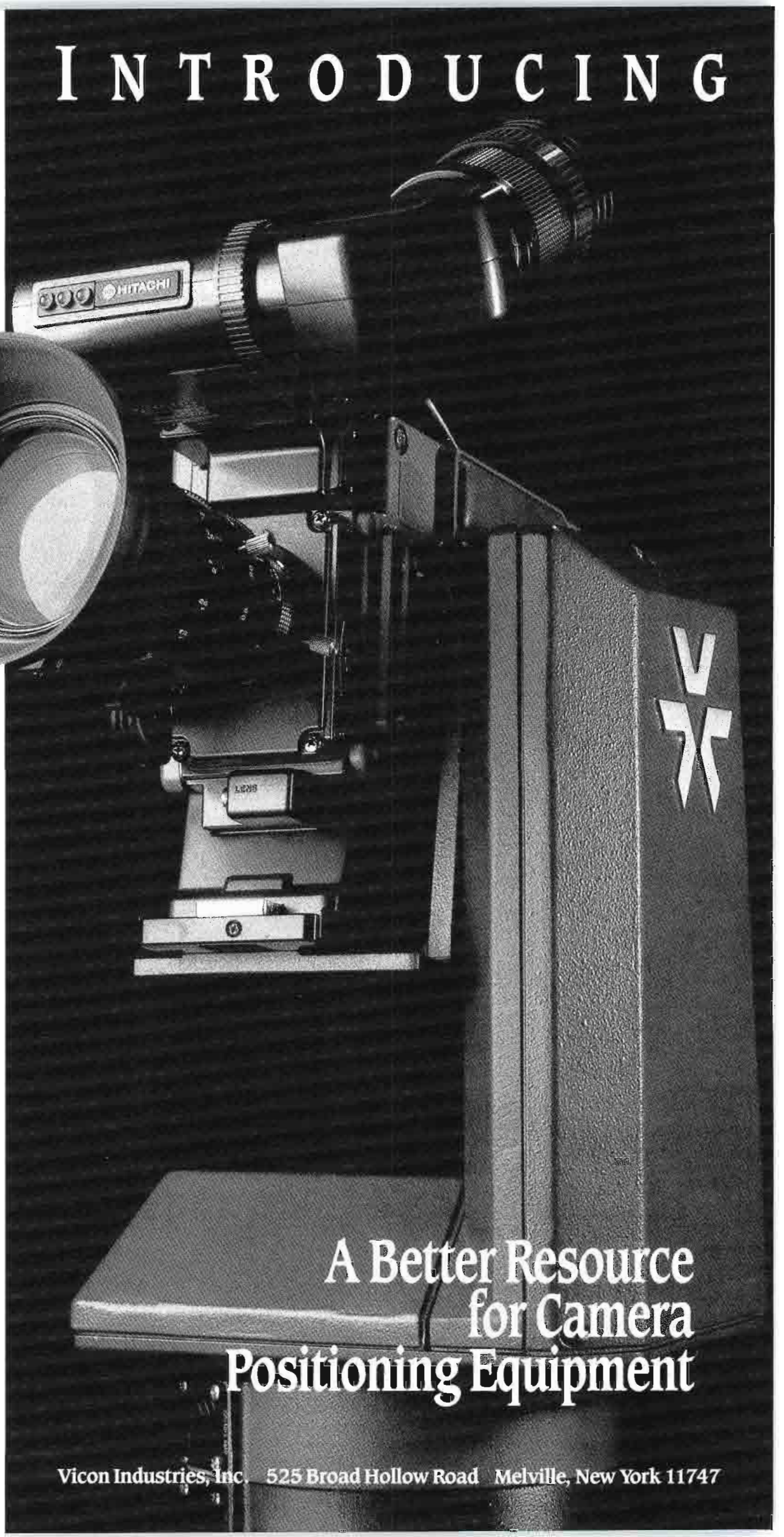
INTRODUCING



Vicon Industries, a leading source of video accessories and systems for more than 25 years, has formed a "Professional Products Division." That's good news for the broadcast as well as the non-broadcast video user.

Quite simply, you now have a better resource for camera positioning equipment...from a company that's committed to the highest quality standards and the best value available.

Take the new Vicon 6000 series. It delivers the most desirable features for all video applications:

High speed
Precise positioning
Silent operation
Compact & rugged

Vicon offers three models, attractively priced, with outstanding performance built on decades of engineering excellence.

For more information on our professional products line, call Mort Russin at 914-638-2805 or 1-800-645-9116. Dealers' inquiries are invited.

Come see us at the NAB Show.
BOOTH #2139

PROFESSIONAL PRODUCTS DIVISION
VICON

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Audio Products A1: Mixers

• Console automation

ADM Technology **4951**
BCS Series II: top-end television broadcast, video production console; select/assign, house router, automated mix-minus PC interface.
Circle (512)

Alan Gordon Enterprises **3855**
Audio-Technica AT4462: stereo field production audio mixer.
Circle (523)

Allen-Heath **7434**
MBI series 16: on-air and production consoles.
SABER: 16-bus recording console.
SCEPTER: rack mixer; 12-input stereo system; rack-mountable.
SIGMA: in-line recording console.
Circle (527)

Allied Broadcast Equipment **2027**
Autogram Pacemaker: on-air, production, news mixing console.
Circle (528)

AMEK Consoles/TAC **2008**
Bullet: compact mixing desk from TAC; free-standing or rack-mount; meter hood contains seven 15-segment LED meters; 10-4-2 configuration with mic/line inputs; 4-band EQ; stereo aux returns.
Circle (538)

AMS/Calrec **1134**
LOGIC 1: digital audio mixer; production models with full dynamic automation.
EDIT 1: digital audio mixer.
ASSIGNABLES: digitally assignable, analog mixers for post production.
Circle (543)

Audio Kinetics **2414**
REFLEX: audio console automation; controls faders, muting, auxiliary switching; snapshots, autofade, soloing, unlimited grouping, programmable off-line mix editing; 64-channel systems.
Circle (572)

Audio Services **(n.a.)**
Sonosax portables: mixing panels; *SX-S* series with 6, 8, 10 inputs; *SX-F2* talkback/communications module; *SX-PR* stereo "shoulder" mixer with six inputs.
Circle (574)

Auditronics **1363**
DMM mix-minus: 8-output system, feeds eight correspondents with separate mix-minus feed.
310TV: on-air/production console integrated to station A/V router; various mainframe sizes.
Circle (578)

Autogram **1026**
Pacemaker series: stereo on-air and production audio consoles; *648* 6-slider, 48-input; *828* 8-slider, 28-input; *1032* 10-slider, 32-input.
Circle (579)

Broadcast Audio **1053**
Series VI: five modular on-air/production consoles; 8-, 12-, 16-, 20-, 24-mixer; LED clock/timer, peak level indicators; headphone EQ; 3-stereo, 1-mono bus; monitor dim.
Circle (608)

Broadcast Electronics **1205**
MixTrak 90: modular audio console for on-air; 8 and 12 mixer designs.
Circle (610)

FOR-A **5151**
Audio-for-Video: 8-input, 2-output audio mixer; EQ options; stand-alone or AFV for PVM/CVM video switchers.
Circle (749)

Harrison Systems **1116**
AP-100: broadcast console series; tabletop, rack-mount versions.
Series TEN: totally automated audio console system; automation system based on Macintosh II, hard disk.
Circle (778)

Howe Technologies **1465**
Model 10K: stereo audio console; 5-stereo bus mixer in 14-, 20-, 24- and 30-channel mainframes; program, audition, utility, monitor and cue buses; utility can be used in dual mono mode.
Circle (787)

LPB **1541**
Citation II: audio mixing console; new generation of Citation design, provides greater flexibility in operation.
Circle (849)

Neotek **7430**
Audio consoles: new frame design; fader options include models for all popular automation systems; GPI triggered, serial editor interfaces.
Circle (903)

Numark **7043**
DM1650, DM1775, DM1975: audio mixers with integral digital sampler.
Circle (1152)

Orion Research **3068**
SoundStar: software-based audio mixer for video-post production; Remem Recall Memory system; 4-channel output for D-2, Beta, M-II; full editor control; 16-input, 8-channels.
Circle (921)

Pacific Recorders/Engineering **1325**
RADIOMIXER: radio on-air mixer.
STX series: stereo television audio consoles.
Circle (925)

Professional Sound/Sonosax **7618**
Sonosax SX-PR: audio mixer for video/TV and digital recording; 2, 4, 6 inputs; ultra lightweight; for ENG/EFP sound requirements with DAT portable recorder.
Circle (946)

Rupert Neve **2407**
Flying Faders: 4th generation console automation system; 12-bit resolution for more than 4,000 digital steps; data stored in 1/10th dB accuracy.
66 series console: for radio/TV broadcast, post-production; features Formant Spectrum Equalization and microprocessor reset system.
Circle (984)

SECK **3577**
Audio mixers: production, remote consoles; 2- and 8-bus configurations to 24 inputs.
Circle (994)

Sony Pro Audio **4101**
MXP-3056VF: 56-input version of MXP-3000 series; targetted for commercial recording studios; hard-disk automation; stereo echo returns, improved cuing; 101-segment vacuum fluorescent metering.
Circle (1013)

Soundcraft/USA **3577**
Model 3200: recording and production audio console.
Circle (1017)

TASCAM **5577**
M-700: mixing console; 20-channel input/output.
Circle (1049)

Ward-Beck Systems **5319**
Model R 6100: 16-channel radio broadcast console.
Circle (1132)

Wheatstone Broadcast Group **1034**
SP-6A: stereo production audio console.
A500as: radio on-air console.
TV500S: master control audio console for MTS.
Circle (1137)

Yamaha Music **7205**
DMP7D, DMP11: digital mixing processors.
MR1642, MR1242, MR842: audio mixing consoles.
PM2800M: professional audio mixing console.
Circle (1147)

A2: Processors, amplifiers

• Compressors, limiters
• Noise reduction
• Delays, effects
• Telephone hybrids

Aphex Systems Ltd **1058**
Model 250: Type-III aural exciter.
Circle (553)

Applied Research & Technology **(n.a.)**
Multiverb II: digital reverb and effects, pitch transposer.
Model SGE: digital reverb and dynamics processor.
Delay System V: studio-quality digital delay.
Model HD-15: high-definition stereo graphic equalizer; filters at 2/3-octave spacing.
HD-31: high definition, 31-band graphic equalizer unit.
Multiverb Ext: digital reverb, sampling delay, pitch transposer.
Delay System VII: sampling, programmable digital delay system.
Circle (555)

Broadcasters General Store **7327**
Dolby 363-SR: 2-channel spectral recording noise reduction system.
Circle (615)

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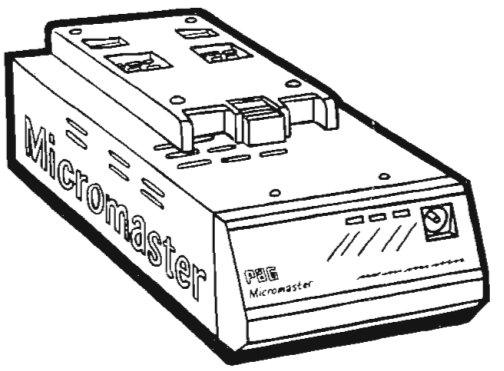

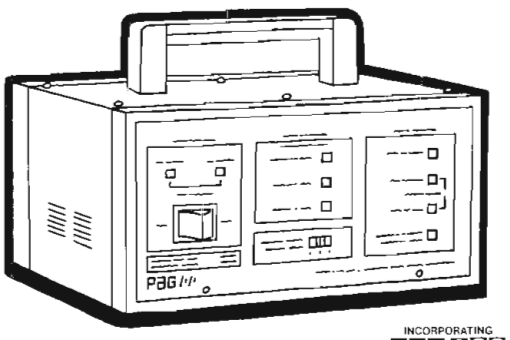

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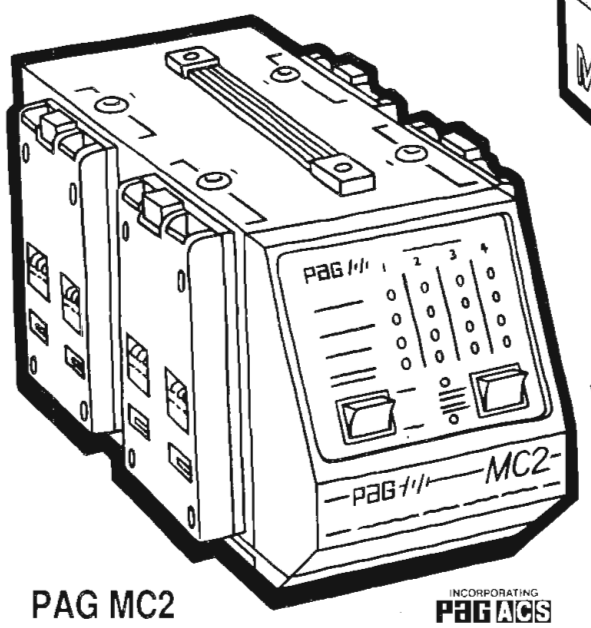

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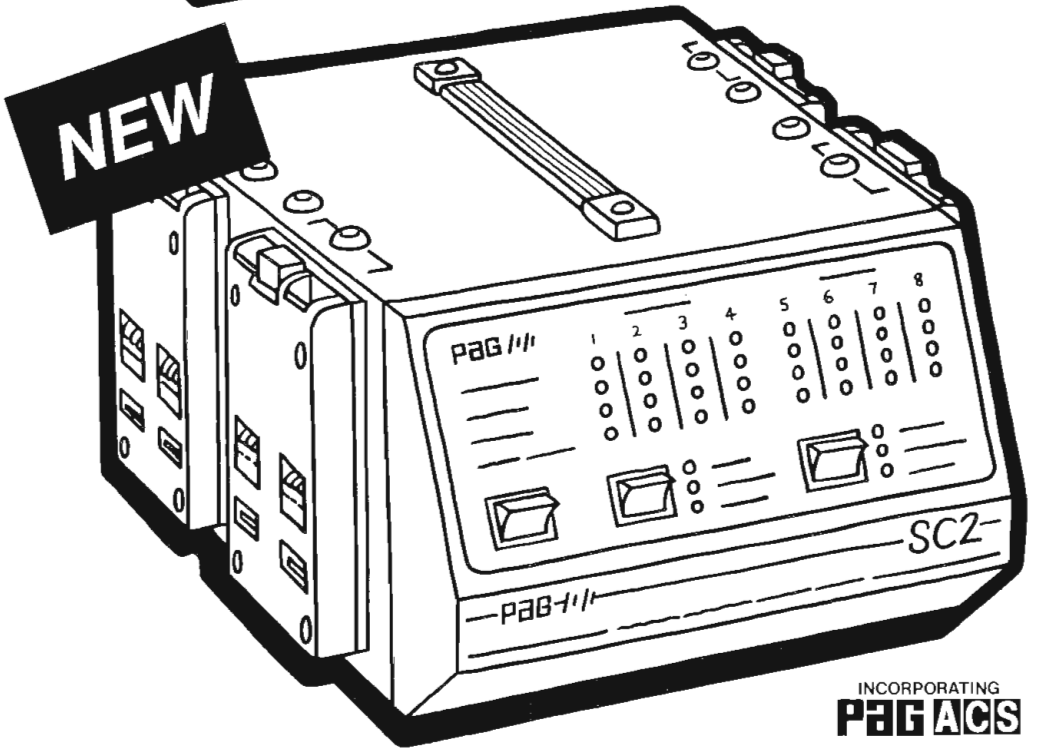

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Circle (110) on Reply Card

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Circuit Research Labs **1009**
IPPI00: programmable microphone processor; integral μP controller enables presets for different on-air talent to be quickly recalled when that talent goes on air.
MBL100: shortwave audio processor; conforms to international bandwidth agreements.
PMC450: upgrade of PMC 400; includes tri-band limiting.
SMP950: upgraded SMP900; includes triband limiting.
Circle (647)

Comrex **1521**
PLX-Micro/Cellular: portable 2-way frequency extender system.
Multi-Line series: frequency extenders, provides 10kHz audio circuit with three standard dial telco lines; modular, upgrades to fully automatic 3-line system.
Circle (665)

Dolby **1457**
Model 363: 2-channel, switchable SR Spectral Recording and Dolby Type A noise reduction unit; auto encode/decode; integral Dolby noise, tone generators; for ATR, VTR, STLs, cart machines.
SDU4 Surround Decoder: for monitoring Stereo/Surround productions for broadcast, audio-for-video, music recording; accepts 2-track matrix-encoded signal; generates left, center, right, surround.
Circle (703)

Eventide **2535**
BD941, BD942: monaural and stereo broadcast delays; 6s and 12s mono or 3s and 6s stereo; full-bandwidth performance; delete button energizes a relay to fill 3s, 6s or 12s, then reverts to normal.
H3000 Ultra Harmonizer: displayed in two software versions; stereo pitch, diatonic pitch changes; reverbs, effects, MIDI implementation; Broadcast version uses presets to operate without setup.
Circle (735)

Gentner Engineering **2127**
Audio Prism: digitally controlled audio processor for FM stations.
Phoenix: digitally controlled audio processor for AM radio; NRSC compliant.
Circle (763)

Gotham Audio **3538**
Model BW 102: Harmonia Mundi digital processor.
Circle (767)

Howe Technologies **1465**
ATC-35 Phase Chaser: audio timebase correction unit; input polarity flip switch; automatic, hold and manual modes; maximum correction ±150 microseconds.
Circle (787)

International Music/IMC **7440**
SI000HD, SI000PB: Akai samplers; *-HD* includes 40Mbyte hard disk, SCSI port; *-PB* unit for playback only.
S950: 12-bit sampler; 750kbyte RAM, expandable; 8-voice; 99-sample memory.
S1000: stereo digital sampler; 16-bit sampling at 44.1kHz or 22.05kHz; 2Mbyte RAM, expandable to 8Mbyte continuous memory; 16-voice; 200 samples maximum; 3.5″ floppy drive; 320 character LCD display.
Circle (806)

Lexicon **2327**
480L V3.0: software for digital effects system; 2-band stereo, 4-band mono parametric EQ, enhanced SME sampling, adjustable-rate reverse playback, two new pitch shift presets.
2400 V3.0: software for time compressor/expander with interfaces for Sony BVH 3000/3100, Ampex VPR-6/80, Panasonic AU-650/660; Time Code Slave available from menu.
Circle (842)

Numark **7043**
DD8000: stand-alone digital sampler with preamplifiers; may be used with various mixers.
Circle (1152)

Orban Associates **1630**
9105A OPTIMOD-HF: audio processor for international shortwave in AM or SSB; increased loudness.
Model 764B: programmable parametric EQ, notch filter; 2-channel; RS-422, -232, MIDI control.
Circle (920)

RAM Broadcast **1001**
telcom c-4 AC-27: audio compander card; designed to improve dynamic range and crosstalk of type C VTR audio channels; direct replacement for AU-27 found in BVH 2000/2500; corrects frequency response errors caused by head bump effects.
Circle (961)

UREI **3577**
Model 7110: audio limiter, compressor system.
Circle (1099)

Valley International **2030**
Model DDP: digital dynamics processor for on-air FM broadcast.
Model DCE: digital compressor, expander; on-air, production applications.
Circle (1105)

Vortex Communications **1521**
Graphic equalizer: modular devices for Vortex Eurogold Broadcast System.
Circle (1130)

WaveFrame **7817**
UDI-4: universal digital interface, 4-channel unit for sample rate and format conversion; emphasis/de-emphasis to D1, D2, BVH-2800, PD, DASH, CD mastering (SDIF), consumer; allows non-sync sources.
Circle (1133)

Yamaha Music **7205**
SPX900, SPX1100: professional multi-effect processors.
AD808: analog-to-digital converter.
DA202: digital-to-analog converter.
Circle (1147)

A3: Recording

- Analog, digital
- Audio editing systems
- Audio duplicators
- Recording accessories
- Transport synchronizers

Accurate Sound **5760**
AS200A: high-speed, reel-to-reel ¼″ audio duplicator.
AS4000: audio cassette slow-speed recorder, logger.
Circle (505)

Adams-Smith **2505**
2600TMS: Track Management System; automatic selection, logging and printing of track sheets.
Transport emulator: controls audio recorder decks from video editing keyboards.
Circle (509)

ADM Technology **4951**
RM 7001: serial and parallel editor-to-console interface.
Circle (512)

AKG Acoustics **2043**
AKG DSE 7000: digital sound editor; RAM-based digital audio workstation; optimized for efficient, rapid operation of high-quality, short recordings.
Circle (521)

Alpha Audio **3455**
BOSS/2: automated audio editing system.
Circle (532)

AMS/Calrec **1134**
AUDIOFILE: digital audio workstation with V8 software; includes vari-speed through digital port, faster lockup, digital de-emphasis, ADR, timecode cut/splice; hardware upgrade options.
Circle (543)

Audi-Cord **1113**
S-series: NAB cartridge record and playback systems.
DL-series: NAB cartridge record and playback systems.
Circle (567)

Audio Kinetics **2414**
ES Penta: ESbus controller/autolocator; controls 5 transports in conjunction to 5 ESbus synchronizers; with AK ES1.11, allows enhanced AK-ESbus operations; offsets, 10 loops or GO-TO points.
Circle (572)

Audio Services **(n.a.)**
Sound Assist: counter/controller for Nagra recorders; monitors tape remaining, duration of last take; locates cue points for playback; pause control.
Circle (574)

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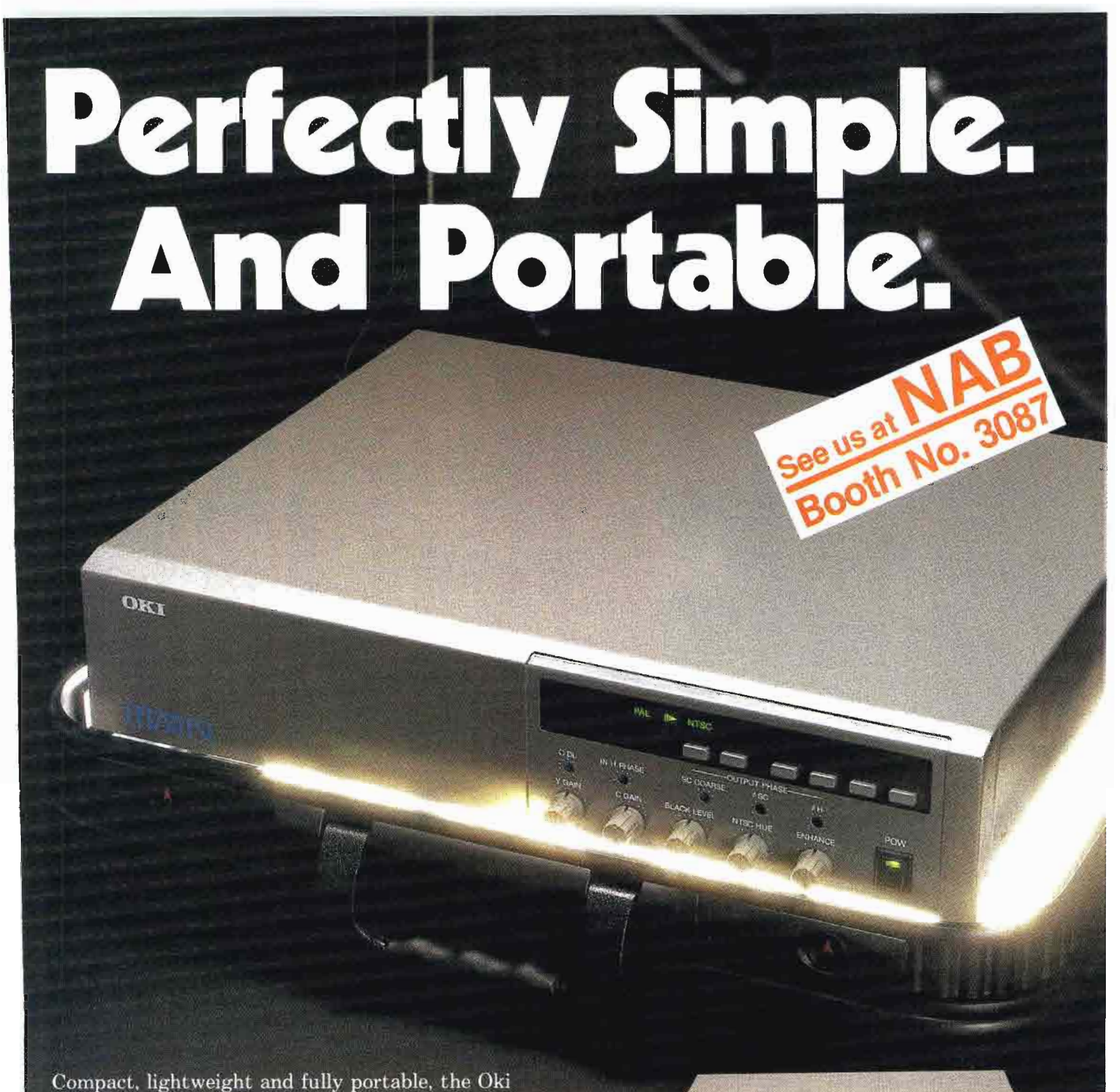

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Broadcast Electronics **1205**
PhaseTrak 90: audio cart machines; *PT90RPS* record/play; *PT-90PS* play only.
Circle (610)

Cinedco **7027**
AUDIFLEX: digital dialog track editing system; for feature films, television applications.
Circle (643)

Digital Audio Research **7921**
SoundStation II: second-generation digital audio recorder, production center; 2-/8-channel, stereo timewarp, animated playback display; full chase synchronization.
Circle (697)

DKW Systems **(n.a.)**
Digital audio storage and playback equipment.
Circle (702)

Fidelipac **1117**
Enhanced CTR30R: a 3-deck cartridge recorder player, now with dc-servo motor operating on 110/220Vac for 50Hz or 60Hz; increased power supply efficiency, improved S/N ratio.
Circle (744)

Fostex **5280**
D-20: DAT recorder; SMPTE timecode and sync capability.
Model 4020: event controller.
R-8: 8-track recorder.
Circle (752)

Inovonics **1473**
Model 397: mag film record/reproduce electronics.
Circle (798)

Integrated Media System **7011**
Model DD-1: hard-disk, digital audio recording, editing system; includes video machine control interfaces.
Circle (800)

International Music/IMC **7440**
DR1200: 12-track digital tape recorder; 8mm videocassette format, 16-bit PCM data; 44.1kHz, 48kHz sampling rates; rotary head ×3; analog track for time code; analog and digital I/O.
Circle (806)

New England Digital **2307**
Synclavier 9600: integrated digital audio workstation; 96Mbyte RAM, 96 stereo output channels; DSP/time compression, optical disk options.
Synclavier 3200: modular sound design, scoring system; multitrack MIDI control center; filtering, mapping, channelization, transposition, routing capability for 128 MIDI devices.
PostPro: 8-track Direct-to-Disk recorder, editor; remote controller, editor, locator interface and maxTrax software to instantly reconfigure system as 16-track.
Circle (906)

Otari **1353**
MX-50: ¼″ 2-channel audio recorder; 7.5/15ips or 3.75/7.5ips; VEM voice editing module option.
DTR-900B: 32-track digital recorder; redesigned auto-locator, remote software, hardware.
DTR-900 modules: accessories for ATRs include *EC-104* chase synchronizer, *CB503* PRODIGI-to-DASH format converter.
Circle (923)

Saki Magnetics **1673**
Long-life Ferrite: replacement heads for audio cart machines in NAB and TOMCAT formats.
Circle (986)

Solid State Logic **2005**
ScreenSound: digital audio editing, mixing, recording system; interfaces with VTRs, film reproducers for off-line editing; for video, film post-production, audio-for-video.
Circle (1008)

Sony Pro Audio **4101**
TCD-D10 PRO: portable DAT recorder; XLR inputs, outputs; AES/EBU ports; twin A-D/D-A conversion.
Software enhancements: to control systems of the DAE-3000 editor and PCM-3402 DASH 2-track.
APR-5003V: center-track time code, 2-channel ATR; interface for post production with 9-pin serial to BVE-900/9000 editors; IEC time code format; LTC/VITC; bit bump; play mode resolves to 60Hz tone.
PCM-3348: 48-track digital audio recorder; DASH format; new LSI devices; oversampled A-D/D-A conversion.
APR-24: 24-track analog recorder with integral synchronizer capabilities.
Circle (1013)

Studer ReVox **1261**
Studer A827-24: multichannel recorder.
Revox C270: enhanced models; 2, 4, 8 channel, very low-speed logging recorders.
Revox C270-TC: professional 2-channel recorder, center track time code.
Circle (1032)

Symetrix **2304**
Model 111: adaptive hybrid telephone interface.
DPR-100: digital processing recorder.
Circle (1040)

TASCAM **5577**
Model 3030: ½″ broadcast audio recorder and reproducer deck.
TSR8: 8-track ½″ multitrack audio recorder and reproducer.
Models 102, 103: stereo cassette decks.
Model 202WR: dual cassette deck.
Circle (1049)

A4: Sources, monitoring

- CD players, phono
- Headphones, headsets
- Intercoms, speakers, RPUs
- Wired, wireless mics

Accurate Sound **5760**
Model 180: Starbird microphone boom, stand.
CR3A: professional condenser studio microphone.
Circle (505)

Alan Gordon Enterprises **3855**
Audio-Technica 40, 800: shotgun microphone series.
Audio-Technica AT803a: omni miniature lavalier condenser microphone.
Audio-Technica AT831: miniature lavalier, cardioid pattern.
Circle (523)

Alpha Video & Electronics/AVEC **5183**
IFB101-B: IFB system.
Circle (533)

AMS/Calrec **1134**
Condenser microphones: enhanced capsule and pre-amp designs.
Circle (543)

Aphex Systems Ltd **1058**
Model 810: impulse analog to MIDI trigger.
Model 850: Feel Factory algorithmic feel composer.
Circle (553)

Audio Developments **3465**
AD-081 Flexi-Link: 3-rack unit housing holds 10 1-in×4-out mic/line input, mixer and summing modules; selector switch on input units selects any of the other 9 inputs for various configurations.
Circle (571)

Audio Services **(n.a.)**
Mini Quad Box: housing for four Vega R33 miniature wireless receivers; central power from 12 C cells or external dc supply; integral multicoupler splits RF from single antenna feed.
Circle (574)

Audio-Technica US **1631**
ATM25: high-intensity instrument microphone.
ATW1031: VHF wireless microphone system.
AT4031: studio condenser microphone.
Circle (575)

Benchmark Media Systems **3780**
MDA-102: dual mic preamp/DA, a System 1000 module.
Circle (595)

beyerdynamic **3738**
DT990 PRO: Semi open-ear, studio, ENG monitoring headphones.
MCE 86: lightweight, shotgun condenser microphone.
S186: wireless handheld mic system.
TS190: wireless lavalier mic system.
DT770 PRO: sealed-ear, studio, ENG, EFP monitoring headphone.
Circle (597)

Broadcast Supply West **2015**
HA-200: Radix headphone amplifier; includes EQ capability.
Circle (613)

Bruel & Kjaer Instruments **7431**
Model 4007: phantom-powered, high-intensity microphone.
Model 401I: first-order cardioid, phantom-powered, transformerless microphone.
Model 4003: line-level, low-noise omni microphone.
Model 4004: line-level, high-intensity microphone; 168dBSPL.
Model 4006: phantom-powered, low-noise mic with changeable acoustic response.
Circle (616)

Clear-Com Intercoms **5346**
Model 1020, 1020M: stereo, bi-amplified monitor speaker systems; full-range sound from self-contained, 19″ rack-mount, 1¾″ high

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package; 6″ low, two 4″ mid/high frequency speakers; 1020M includes peak-reading bargraph meters for input level.
Matrix Plus: point-to-point multiple μP-controlled intercom; digital control of digitized audio; complete operation over single, unshielded twisted pair; immune to hum, buzz, noise pickup, crosstalk; interface cards interconnect to IFB, ISO, wireless beltpacks and other systems or equipment.
Circle (649)

ComTek **5768**
M-182: handheld wireless microphone; full 50mW output, 50-hour operation; all metal package.
MR-180: portable wireless mic receiver; for use with television cameras.
Circle (668)

Denon America **7127**
DN-950FA: CD cart player system.
Circle (691)

Fostex **5280**
T-40: RP ribbon headphones.
F-45: headphones with boom microphone.
Circle (752)

Gefen Systems **2351**
PX-240: compact disc player, configured as 240-CD changer.
Circle (759)

Gotham Audio **3538**
KM 100: Neumann microphone series.
Circle (767)

HM Electronics **3066**
RP735: 2-channel power station with speaker.
RP743: 4-channel power station.
RP753: 4-channel matrix power station.
PD100: power distribution system.
DN100: antenna distribution system.
Systems 515, 525: body-pac and hand-held, low-cost wireless microphone systems.
Circle (782)

JBL Professional **3577**
Control 10: control room monitor system.
Circle (812)

Lectrosonics **5370**
Model T185: handheld wireless mic with Shure SM58 cartridge; machined aluminum, double-tapered body; integral antenna; 20dB compression without distortion.
Model Pro 4-Mini: VHF high-band, 4-channel wireless mic field pack; removable receivers; antenna distribution module; rechargeable supply; aluminum housing; XLR audio output per receiver.
Model CR185: enhanced VHF wireless receiver; mounts on ENG camera; 6-section helical resonator front end; XLR audio output jacks.
H185: enhanced plug-on transmitter makes any mic wireless.
Circle (837)

LPB **1541**
Model TP-1: stereo phono preamplifier for single turntable.
Model TP-2: phono preamplifier for two stereo turntables.
Circle (849)

LTM **5358**
Model 0699-903062: microphone windscreen and muff.
Circle (850)

Marti Electronics **1204**
DR-10 receiver: improved audio performance when used with compatible RPU transmitter and optional audio companding.
RPT-30/CR-10: RPU transmitter, receiver with high performance audio companding.
Circle (862)

McCurdy Radio Industries **1755**
CS9500: digital intercom with 50×50 matrix; compact system includes redundant power supplies; programmable for party lines, IFBs, selective group calls, 2-way radio use, telco interface, beltpacks.
Circle (867)

Moseley Associates **1317**
RPL-4000: remote pickup system; *RPL-4010* transmitter provides 20W output; *RPL-4020* receiver sensitivity 1.2μV for 20dB quieting; audio bandwidth 7.5kHz or 15kHz.
Circle (890)

Nady Systems **3740**
750VHF: 2-channel VHF wireless receiver with integral mixer.
850VHF: frequency-agile VHF wireless receiver; nine synthesized channels.
Circle (895)

PESA Electronica **5712**
Enhanced TB8000: intercom with customer programmable matrices; IBM PC control; 8×8 do-it-yourself matrix.
Circle (935)

Professional Sound/Sonosax **7618**
Mini Quad box: houses 4 Vega R33 miniature receivers; power from 12 C batteries or external 12-24Vdc; single antenna.
SX-F2: communications module for Sonosax audio mixers; slate mic, subtone, PL mic for talkback; two remote roll switches; boom monitor stereo channel select; for SX-S6 to SX-S10.
Circle (946)

Ramsa Audio/Panasonic **4142**
SV-250 Porta-DAT: digital audio recorder.
SV-3500: studio DAT audio recorder.
SL-4700, SL4300: CD players.
Circle (962)

R-Columbia **3468**
Long range wireless FM intercom headphones; range extended to 1-2 miles.
Base station interface: portable or AC operation, allows an interface between any wired intercom system with wireless headphones.
ENG/IFB telephone: includes both tone and pulse dialing.
Sony camera headphone: replaces DR-100, includes 4-circuit miniplug, single or double muff.
Circle (956)

ROH/Anchor Audio **3451**
Model 402: PL master station.
Model 403: PL headset station.
Model 460B: lightweight headset.
Circle (977)

RTS Systems **4151**
#2528: dual-channel, remote-control mic preamp; high performance circuit on card-cage package.
CCD 214: crosstalk canceller; reduces crosstalk between intercom channels.
MCE 325: programmable, 4-channel intercom headset/speaker user station; 4-way modular packaging, permanent-mount, portable use.
ATC 222: automatic telephone line coupler to RTS intercom.
Circle (983)

Samson Products **2310**
Infinity: ENG wireless receiver for video applications; choice of 10 VHF channels; flexible antenna, headphone monitor jack; high, low impedance switch; battery option.
Circle (987)

Sanken/Audio Intervisual Design **1645**
CMS-7S: field stereo M-S microphone.
CU-44X: transformerless, dual-capsule cardioid studio microphone.
CB-485: portable phantom power unit.
Circle (988)

Sennheiser Electric **1052**
MKH70: studio/field condenser microphone.
MKH50: studio/field condenser microphone.
HD25: monitor headset.
HD520: monitor headphones.
Circle (996)

SESCOM **3413**
RK-RACK: rack system chassis, power supply.
RK-MLD: rack system dual mic-line driver module.
RK-ALC: dual-channel ALC line amplifier.
RK-SB: stereo balance box.
RK-PS-1: power supply.
RK-PA: 5-channel monitor amplifier.
RK-SC: stereo phono/line preamplifier.
Circle (998)

Shure Brothers **1517**
Beta 58C, 58M: supercardioid dynamic microphones for vocal applications.
Beta 57: supercardioid dynamic microphone for instrumental use.
Circle (1003)

Sony Pro Audio **4101**
ECM-55: stereo recording microphone; designed for portable digital recording; conforms to various recording patterns.
Circle (1013)

Stanton Magnetics **1649**
890AL: phono cartridge with extra stylus; permits back-cue, tracks 2-7g.
680EL-MP, 500AL-MP: back-cuing cartridges, matched performance, tracks 2-5g.
Circle (1023)

Tannoy **7533**
PBM 6.5, PBM-8: playback reference monitors.
NFM-8 DTM: 8″ dual-concentric near-field monitor for critical mix, reference or broadcast monitoring.
Circle (1045)

TASCAM **5577**
CD-701: professional compact disc player; optional remote control units; for audio production, broadcast applications; with RAM buffer.
CD-401: production/on-air CD player.
Circle (1049)

Television Equipment Associates **5200**
Racal Netset: microphone and speaker located on user's neck; received signal is fed to ear mold; for use with 2-way radio.
Secrette: strap-on earphone with boom mic; for 2-way radio users.
Circle (1063)

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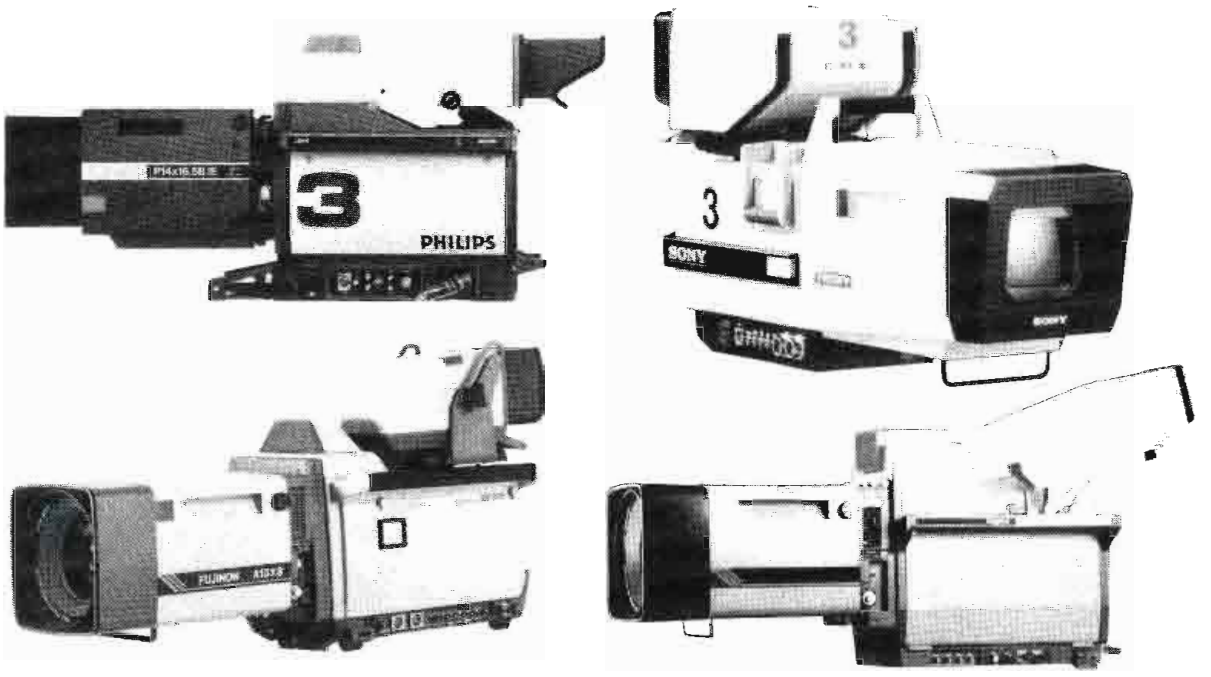
Would you trust these cameras on anything less than a Sachtler?



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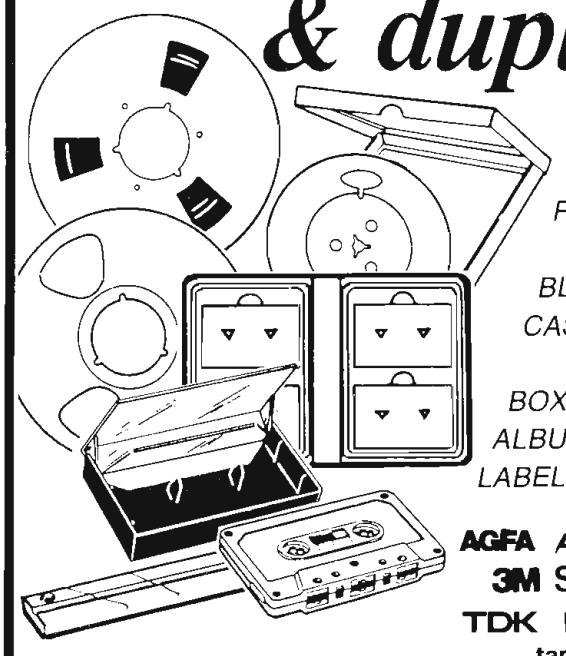

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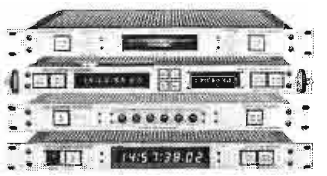

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NAB Booths 3947 & 4046

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Telex Communications **3541**
FMR-25, FMR-25TD: wireless microphone receivers; *-TD* for true diversity.
WT-25: wireless mic beltpack transmitter with attached lapel mic.
HT-100 series: handheld microphones and transmitters.
IC-2SP: 2-line speaker station for intercom systems.
Circle (1064)

Telos Systems **2301**
Telos 10: digital telephone system.
Telos 100: digital telephone system; family of accessory products for radio, TV, teleconferencing.
Circle (1066)

Vega/Mark IV **3846**
T-88 Pro Plus: hand-held, wireless microphone transmitter; Electro-Voice N/DYM 757 element.
T-38 Pro: hand-held wireless microphone transmitter with Electro-Voice N/DYM 457 element.
Circle (1114)

Ward-Beck Systems **5319**
MiniCOM: 24×36 μP-controlled intercom system.
M8220 Interphone: 2-wire intercom system.
Circle (1132)

Wohler Technologies **2151**
AMP-1A: single rack-space powered stereo audio monitor.
AMP-5: tri-output stereo power amplifier.
AMP-2: deluxe two rack-space powered stereo audio monitor.
Circle (1142)

Yamaha Music **7205**
NS10MC: commercial speaker systems.
MS101, MS202: powered monitor speakers.
Circle (1147)

RF Products R1: Transmission

- Antennas, masts, towers
- Radio, TV transmitters
- RF switching
- Transmission line
- Transmitter remote control

Acrodyne Industries **3982**
TRU-25KVC: 25kW UHF TV transmitter.
TRL/10KA: 10kW VHF TV transmitter.
TLU/1KACT: 1kW UHF TV transmitter.
TLU/100T: 100W UHF TV transmitter.
Circle (508)

Adelphon **A150**
Model 700: extra heavy Landmark tower series, from 700 feet to 1000 feet.
Circle (511)

Advanced Micro-Dynamics **1563**
Cable kits for TC-8 and ARC-16 remote control systems; permits rapid installation for most current transmitters.
Accessories for remote control systems.
Circle (515)

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With more than fifty Odetics cart systems installed and operating in markets from #1 to #166, we're way ahead of the competition.

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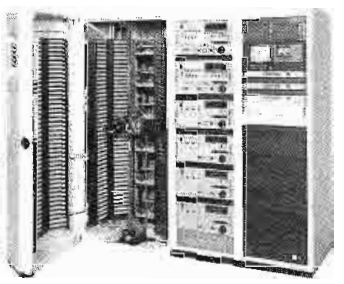

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Andrew **1721**
82RF, 82RG: 3 1/8" EIA flange connectors for 21/4" air dielectric Heliax cable.
GUIDELine: circular waveguide for UHF powers 60kW to more than 240kW; 13.5"-17.5" diameter.
Circle (546)

Bogner Broadcast Equipment **5174**
No Steering: antenna designed for HDTV, stereo, SAP broadcasting; beam steering factor eliminated.
Circle (602)

Broadcast Electronics **1205**
FM-20A: 20kW FM transmitter; single-tube design; with MVDS μP diagnostic system and video display.
MVDS diagnostics: μP-controlled system for 1kW to 35kW FM transmitters; video parameter display.
Circle (610)

Comad Communications **2121**
SIRA FMC-05: broad-band FM antenna.
SIRA UTV-01: broad-band UHF TV panel antenna.
Circle (657)

Comark Communications/Thomson **5141**
CTT-U-ISS: 1kW solid-state, low-power UHF TV transmitter.
CTT-U-10SKA: 10kW Klystrode-equipped, air-cooled UHF TV transmitter.
CTT-U-60SK: 60kW Klystrode-equipped, UHF TV transmitter.
CTT-80SKM: 80kW Klystrode-equipped, UHF TV transmitter; no-diplexer design.
Circle (658)

Continental Electronics/Varian **1125**
XL-310: 10kW AM radio transmitter.
814C: 3.8kW FM radio transmitter.
Circle (673)

Delta Electronics **1159**
High power ammeters, sampling toroids: a series of meters and sampling toroidal coils capable of withstanding the extra voltages of the high power broadcast facility.
Circle (690)

DSI Communications **1765**
STATUSYSTEM remote transmitter site monitoring and control equipment.
Circle (706)

EMCEE **4251**
TTU-100SR: 100W solid-state UHF television transmitter.
TTU10L: 10W solid-state UHF television transmitter.
Circle (726)

Energy-Onix **1730**
MK-50: 50kW FM broadcast transmitter.
Circle (730)

Gentner Engineering **2127**
VRC-2000: remote transmitter controller; full control via telco, radio, data or bidirectional audio links; for AM, FM, TV; VRC antenna monitor reports on AM array; 32-command capability.
Circle (763)

Harris Broadcast Group **1305**
DX-50: 50kW solid-state, digital AM radio transmitter.
HT 30HS: 30kW solid-state, high-band VHF TV transmitter.
HT 35FM: 35kW FM radio transmitter.
HT 20FM: 20kW FM radio transmitter.
HT 10FM: 10kW FM radio transmitter; single-phase power.
Circle (776)

ITELCO **3459**
T234: 30kW FM radio transmitter.
T233: 2kW FM radio transmitter.
T314A: 10kW VHF high-band TV transmitter.
T-134B: 20kW VHF low-band TV transmitter.
Circle (807)

Jampro Antennas **1217**
JBBP: balanced, omni-directional CP FM antenna.
JSL, JSM, JSH: low, medium, high power UHF slot antennas.
JSH/EP: high power, elliptically polarized UHF system.
JCPT: low power CP TV antenna.
Circle (811)

Kintronic Laboratories **710**
Shortwave broadcast antenna display.
Equipment enclosures: weatherproof housing for FM and TV translator equipment.
Circle (827)

LDL Communications/Larcan **3562**
TTS-30M: 30kW VHF television transmitter; all solid-state design for low or high VHF channels; FET output modules for high degree of linearity and reliability; self-contained.
TTS-10MH, TTS-5MH: CCIR-applicable Band III VHF television transmitters; 10kW, 5kW; total solid-state design.
Model Lambda: circularly polarized television transmitting antenna for VHF channels 2-6: low windload; replaces existing batwing types of similar gain; by Alan Dick & Company, Ltd.
Circle (834)

Marconi Communications Systems **4338**
B7548: 60kW UHF TV transmitter.
E1706: 1kW VHF/FM broadcast transmitter system.
E1707: 2kW VHF/FM broadcast transmitter system.
Circle (860)

Micro Communications **1547**
Super Power waveguide and coax circulating isolators.
RF ALL-WAVEGUIDE: rated 280kW; includes switchless combiners.
Switchless combiner: rated 120kW.
Circle (873)

Midwest Communications **4568**
Technalogix TX-60S: 60kW UHF television transmitter.
Toshiba solid-state VHF TV transmitters.
Circle (879)

Nautel **1065**
AMPFET ND5: all solid-state AM transmitter, rated 5kW; integrated modular reserve; built-in duplicate exciter; on-air serviceability.
Circle (900)

NEC America/Broadcast **3444**
PCN 1430SSH: 30kW solid-state VHF television transmitter; high-band.
PCU 960HC: 60kW UHF television transmitter; μP-controlled readouts.
Circle (901)

PESA Electronica **5712**
Solid-state VHF television transmitter; 1kW rating.
Circle (935)

Potomac Instruments **1375**
PC compatible software: for interrogating and commanding the 1500 PC programmable transmitter controller.
Circle (944)

QEI **1147**
RMQ 15/20/25: FM radio transmitter with all solid-state IPAs; 2-cabinet system is field-upgradable from 15kW to 20kW or 25kW with additional IPA modules; grounded-grid final amplifier design.
Circle (949)

Rapid Deployment Towers **A150**
RapUp systems: mobile, antenna support systems; quick setup; *RapUp 100*, 100ft 3-guy level; *RapUp*, 150ft 4-guy level; *RapUp 225*, 225ft 6-guy level; *RapUp 300*, 300ft 8-guy level.
Circle (965)

Shively Labs **1341**
Rigid line: 9-inch rigid coaxial transmission line.
Radomes: cylindrical shape for covering complete FM array.
Circle (1001)

TFT **2115**
FM booster: based on model 8900 IF exciter.
Circle (1069)

Thomson-LGT **5141**
EVH 20000 DD: 20kW dual-drive, VHF high-band, solid-state TV transmitter; broadband; integral regulated power supply, mains-isolating transformer; MTS-BTSC sound system.
EUHF 2000 DD: 2kW, dual-drive UHF band IV/V solid-state TV transmitter; broadband; integral regulated power supply.
RUHF-200 S: 200W UHF TV translator; very linear, very low noise.
RUHF-10 S: 10W low-power UHF TV translator; low-power consumption, designed for solar energy supply; in all input, output bands.
Circle (1075)

TMD/Will-Burt **4883**
Model 6-25-357/367: pneumatic telescoping mast assembly.
Circle (1080)

Townsend Electronics **5555**
CST series: UHF TV transmitters incorporating MSDC (multi-stage depressed collector) klystrons for approximately doubled electrical efficiency.
Circle (1085)

TTC/Television Technology **3500**
UHF-60MA: 60kW Klystrode television transmitter; air-cooled design.
XL10MFM: modulated FM translator for satellite-feed applications.
UHF-10MA: 10kW Klystrode TV transmitter; UHF band.
FM transmitters: new series, solid-state design.
Circle (1091)

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So why would you trust your medical imaging equipment, heart monitors or X-ray machines to rebuilt cathode ray tubes? You need the consistent quality of a new CRT to give you the best resolution. The screen defects found in rebuilt CRTs are more difficult to explain when it comes to such critical matters as a person's health.

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Varian TVT **1125**
1891/90 VISTA: 120kW UHF television transmitter; MSDC multi-stage depressed collector klystron; full waveguide combining system; increased efficiency of standard klystron devices.
Circle (1111)

Wolf Coach **1787**
QD2 portable mast: for news cars.
Self-coiling cable: new concept for ENG masts.
Circle (1144)

R2: Microwave

- Antennas, electronics
- ITFS, OFS, STL
- ENG, MDS, MMDS

Broadcast Microwave Service **1718**
BMT-18GP: 18GHz frequency-agile transmitters.
BMR-18KP: 18GHz frequency-agile receivers.
BMT-40GP: 40GHz transmitter.
BMR-40KP: 40GHz receiver.
AP-1: camera-mounted antenna pointer.
Circle (611)

Cablewave Systems/CELWAVE **5100**
23GHz antennas: 2-, 4-, 6-foot diameter microwave antennas; fine azimuth adjustment of ±5°; elevation adjustment -5°, +50°; meet EIA RS-195B, RS-222C.
Circle (621)

Communication Microwave COMWAVE **5777**
ITFS, MMDS, OFS transmitters and amplifiers.
Circle (660)

Conifer **3858**
Model HLN: ITFS downconverter with Interdigital input bandpass filter.
Model HLN2: high-gain ITFS downconverter with Interdigital input filter.
Model HSLN: high-gain, low-noise ITFS downconvert; Interdigital input bandpass filter.
Model QL-1010: broadband MMDS block downconverter for US or international applications; 31-channel.
QL-30 series: dual-band, broadband MDS block downconverters; 33-channel capability; compatible with scrambling, addressable systems; output at 116-128MHz or 222-408MHz.
Circle (670)

EMCEE **4251**
EMC-4: ITFS/MMDS, low-loss channel combiner.
Circle (726)

ITELCO **3459**
LKFM01: 2GHz microwave transmitter; operates with visual, aural separated.
L771: 2GHz microwave repeater.
LKFM01: 2GHz microwave receiver.
Circle (807)

ITS/Information Transmission **5180**
ITS-1610D: ITFS/MMDS transmitter; compact, integrated design.
Circle (808)

M/A-Com MAC **3933**
MA-18CC: 18GHz microwave communication system.
MA-23CC, MA-23VX: 23GHz microwave communication systems.
Circle (856)

Microwave Radio **1731**
MicroLink I/II: series of 18GHz, 23GHz short-haul microwave links for ENG, teleconferencing; frequency-synthesized units; audio, video connect directly to RF head; simplex, duplex or multiplex.
Circle (878)

RF Technology **5451**
CEO-17/27 Pathfinder: circular polar antenna system.
RF-223B: miniature full-power transmitter.
RF-203GL: wideband portable ENG microwave systems; tunable from 1.4GHz to 15.6GHz.
Circle (973)

Wegener Communications **2109**
Panda II: STL/TSL subcarrier system.
Circle (1136)

R3: Amplifiers, power devices

BEXT **(n.a.)**
T-800, T-1500, T-2000: FM amplifiers for 88-108MHz spectrum; rated for 800W, 1.5kW and 2kW; no neutralization required; 1-tube designs; meets or exceeds FCC, CCIR requirements.
Circle (596)

EEV **4262**
Klystrons: high-efficiency, wide-band, external-cavity devices for UHF television.
Circle (720)

Energy-Onix **1730**
SSA-500: 500W solid-state FM amplifier.
Circle (730)

ITS/Information Transmission **5180**
ITS-1657D: ITFS/MMDS 50W power amplifier.
Circle (808)

Richardson Electronics **3852**
Philips power tube cavities for FM and TV applications.
Circle (974)

Varian EIMAC Salt Lake City **5300**
CV-8075: CW amplifier; can be custom-made between 800MHz and 1200MHz.
YU-121: high-mu, power triode for low-noise single-sideband applications.
YU-181: high-mu triode; thoriated-tungsten, low-inductance grid flange; for HF operation and laser power amplifiers.
YU-157: water-cooled, HF oxide cathode tube; grid flange similar to Varian EIMAC 8938 for laser, RF amplifiers.
YU-106: water-cooled EIMAC 3CX3000A7; improved efficiency.
Circle (1107)

Varian EIMAC San Carlos **5300**
2KDX15LF: air-cooled UHF TV Klystrode amplifier; designed for 15kW visual or 10kW multiplexed visual and aural.
2KDX40LA: air-cooled UHF TV Klystrode amplifier; designed for 40kW visual or 30kW multiplexed visual and aural.
Circle (1108)

Varian Microwave Equipment **1125**
VZC-696701: 10W auto-protected solid-state power amplifier; for SCPC applications.
VZV-6992A5: 125W Ku-band 14.0-14.5GHz power amplifier; 65dB gain minimum; modular design.
Circle (1109)

Varian Microwave Power Tube Div **5300**
VKP-7990: MSDC 60kW multi-stage depressed-collector klystron.
VKP-7984: 60kW high-efficiency, external-cavity klystron (formerly PT-5093).
VYW-7989: continuously tunable circuit (PTE-5095).
Circle (1110)

R4: Reception

- Demodulators
- Modulation monitors
- Receivers

AVCOM of VA **5114**
Model SCPC-3000E: agile demodulator.
Circle (581)

Barco Industries **5466**
200 series: modulators, demodulators; high performance specifications.
Circle (585)

Belar Electronics Lab **1352**
Monitoring equipment for AM, FM, TV.
Circle (592)

Emergency Alert Receiver/EAR **2248**
Model ST: FCC type-approved EBS receiver.
Mocel CT: EBS receivers for schools, hospitals, homes, public service facility tornado warning systems.
SCA receivers: with privacy channel decoders.
Circle (728)

Motorola C-Quam/AM Stereo **1004**
C-Quam AM stereo receivers.
Circle (891)

Studer ReVox **1261**
Studer A764: professional FM monitor tuner.
Circle (1032)

TFT **2115**
Models 886, 887: new generation AM, FM EBS systems; synthesized frequencies; dual clocks count up to 12 days; one shows last signal reception, second shows last signal transmission.
Circle (1069)

Titus Technological Laboratories **2027**
CAD/M: μP-based FM/TV stereo composite signal noise analyzer; includes FM/TV stereo demod, metering and 1×4 DA.
Circle (1079)

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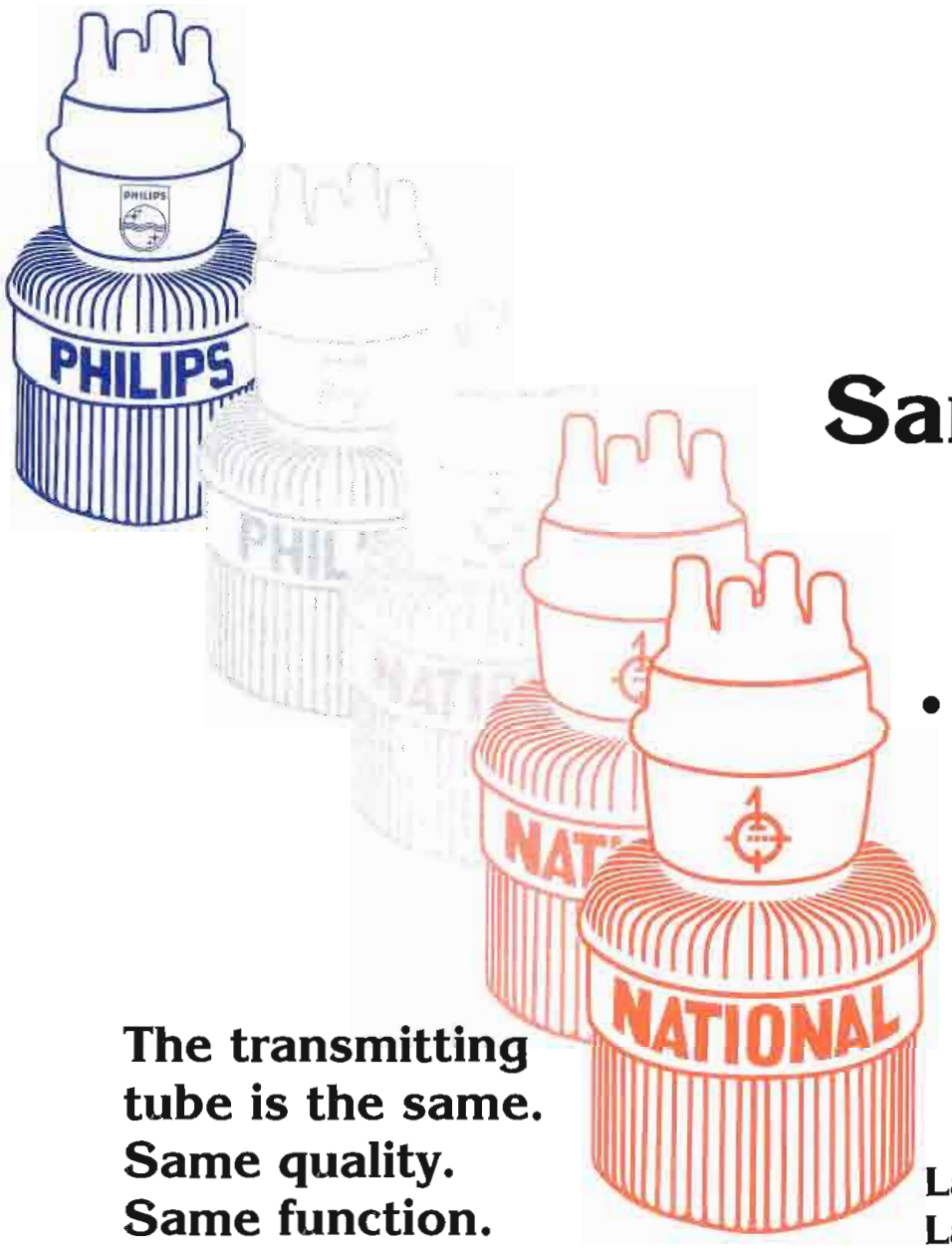

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. . . New Name!

The transmitting tube is the same.
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Same function.
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La même qualité.
La même application.
Nouveau nom.

Die gleiche Senderöhre.
Die gleiche Qualität.
Die gleichen Funktionen.
Neuer Name.

Lo stesso tubo trasmittente.
La stessa qualitá.
La stessa applicazione.
Nuovo nome.

El mismo tubo de transmisión.
La misma calidad.
La misma función.
Nuevo nombre.

同じ送信管
同じ品質
同じ用途
新しい名前

Richardson Electronics recently acquired the Philips Transmitting Tube product lines to ensure an ongoing supply of high-quality tubes worldwide. The National name, Richardson's manufactured brand, will be appearing on the tube. Rest assured your transmitting tube needs will be met with the same quality and the efficient service you have come to expect from Richardson Electronics.

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Vector Technology **2137**
FMT-03: 30W FM exciter.
Circle (1113)

Wegener Communications **2109**
Series 1800: receiver products for broadcast audio, data and video signals.
Circle (1136)

R5: RF exciters, generators

- Stereo, FM, TV
- Subcarrier

Advent Communications **7300**
Video exciter and modulator for satellite systems.
Circle (516)

Energy-Onix **1730**
SST-30: 30W output FM exciter.
PROTECTOR: NRSC AM filter & pre-emphasis unit.
Circle (730)

Inovonics **1473**
Model 706: FM/FMX stereo generator; 2nd generation system.
Circle (798)

ITS/Information Transmission **5180**
ITS-10A: VHF exciter, modulator; retrofit product for VHF TV transmitters.
Circle (808)

Motorola C-Quam/AM Stereo **1004**
Model 1400: C-Quam AM stereo exciter.
Model 1410: C-Quam modulation monitor.
Circle (891)

R6: Satellite

- Antennas
- Controllers
- Electronics

Advent Communications **7300**
Model 1500: flyaway phase-combined satellite news-gathering system.
Model 1900: flyaway, single-thread satellite news-gathering system.
Data up/down converters, communications package systems.
Circle (516)

Andrew **1721**
ASR-series: earth station antenna receivers.
ALC- series panels: LNA/LNC alarm control panels; *ALC100* for LNA/LNC network; *ALC200* for 1:1 LNA/LNC switching network; *ALC300* for 1:2 LNA/LNC switching network; compatible with ASC1000.
C/Ku-band upgrade: kit and electronics for 6-port uplink capability on 4.5m, 7.3m earth station antennas.
Circle (546)

Antenna Technology **2036**
Simulsat antenna: 70° view arc; capable of viewing and reception from 35 satellites simultaneously.
Circle (550)

AVCOM of VA **5114**
LPA-1000: low power antenna.
Circle (581)

DX Communications **2343**
DSA-676: RS-250B broadcast, Ku/C-band earth station receiver; RS-232C remote function control.
DSA-656: Ku/C-band receiver; designed for satellite news gathering applications.
Circle (710)

Hallikainen & Friends **1111**
SAT201: remote control system for multiple satellite antennas, receivers; uses voice-grade telco circuit.
Circle (775)

MCL **A115**
15357: Ku-band test loop translator.
10950: 1:1 redundant 25W C-band solid-state amplifier.
10999: 300W Ku-band TWT amplifier.
10890: VPC redundant 300W Ku-band TWT amplifier; hub-mount system with dual uplink/downlink feature.
Circle (868)

Microdyne **5119**
BKR receiver: C/Ku-band with 1MHz step tuning, two tunable audio subcarriers, selectable IF bandwidths.
MAT II: automated terminal; 200-presets, points antenna, tunes receiver, video AGC.
Circle (874)

Radiation Systems/SatCom Tech. **3070**
240AT: SNV flyaway trailer.
5000 series: PC-based earth station controller.
180KS: 1.8m antenna system.
Circle (959)

Toshiba **5168**
MT-3: fly-away satellite communications package.
Circle (1083)

Wegener Communications **2109**
SDM 200: digital audio equipment.
Circle (1136)

Support Products

S1: Automation

- Hardware, software
- Business, programming
- Newsroom, equipment
- Remote control
- Clocks, timers
- Data transmission

Adrienne Electronics **7901**
PC-207M/BA: ESbus data analyzer hardware, software.
Circle (513)

Alamar Electronics **4779**
MC-2055: 3rd generation sustem; integrates traffic, cart machines, all VTR formats, still stores, titlers and routing/master control switchers; IBM/compatible LAN with ESbus; variable net delay.
LIP-100: GP display with real-time clock, next event count down, in event count down; ES bus.
NDP-100: unattended recording and playback with variable time added in playback for local message insertion.
TD Assistant: production automation support for technical directors; assures news, sports, entertainment productions are frame and content accurate during creation.
Circle (522)

AMX **7230**
SX 232: RS-232C controller.
SX VRG: voltage ramp generator.
SX 8+: 8-relay controller.
SX DCU: infrared control interface.
Circle (545)

Aphex Systems Ltd **1058**
Model 800: studio clock, SMPTE to MIDI converter.
Circle (553)

Artel Communications **4579**
T/R 3601: quad 19.2 digital data transmission link.
C5006: field operations case; 12Vdc, 120Vac operation.
S3501 VideoSnake: coaxial video/audio/data transceiver.
TT/R 3200 series: dual audio modules with 90dB dynamic range; six subcarriers at 7, 9, 11, 14, 17, 19MHz.
Circle (560)

BASYS **5568**
Machine control: production equipment control system interfaced to newsroom automation.
PC Newsroom: automated newsroom operating under PC DOS; wire-handling, assignments, script processing; independent split-screen displays; Rolodex, messaging features, personal files; archiving.
Circle (587)

Beaveronics **1726**
Favag LED50: digital clock operates from Favag-type second or minute impulses or integral time base; 2″, 4″, 8″ numeral options; can be used as UP timer; also day and month display options.
ESE ES180: master clock with WWV receiver producing serial BCD time signals; interconnection to Favag clocks possible.
Circle (591)

Broadcasters General Store **7327**
Sine Systems News Director: μP-controlled radio news editing station.
Circle (615)

BTS **4119**
BTS-2300: television station automation; improved machine control, systems status display, auxiliary scheduling, event recording.
BCS-5000 ICS: integrated control system; central computer with hard disk and set of general-purpose operator panels to control distribution switching, machine control system; soft keys; HP 9000.
Circle (619)

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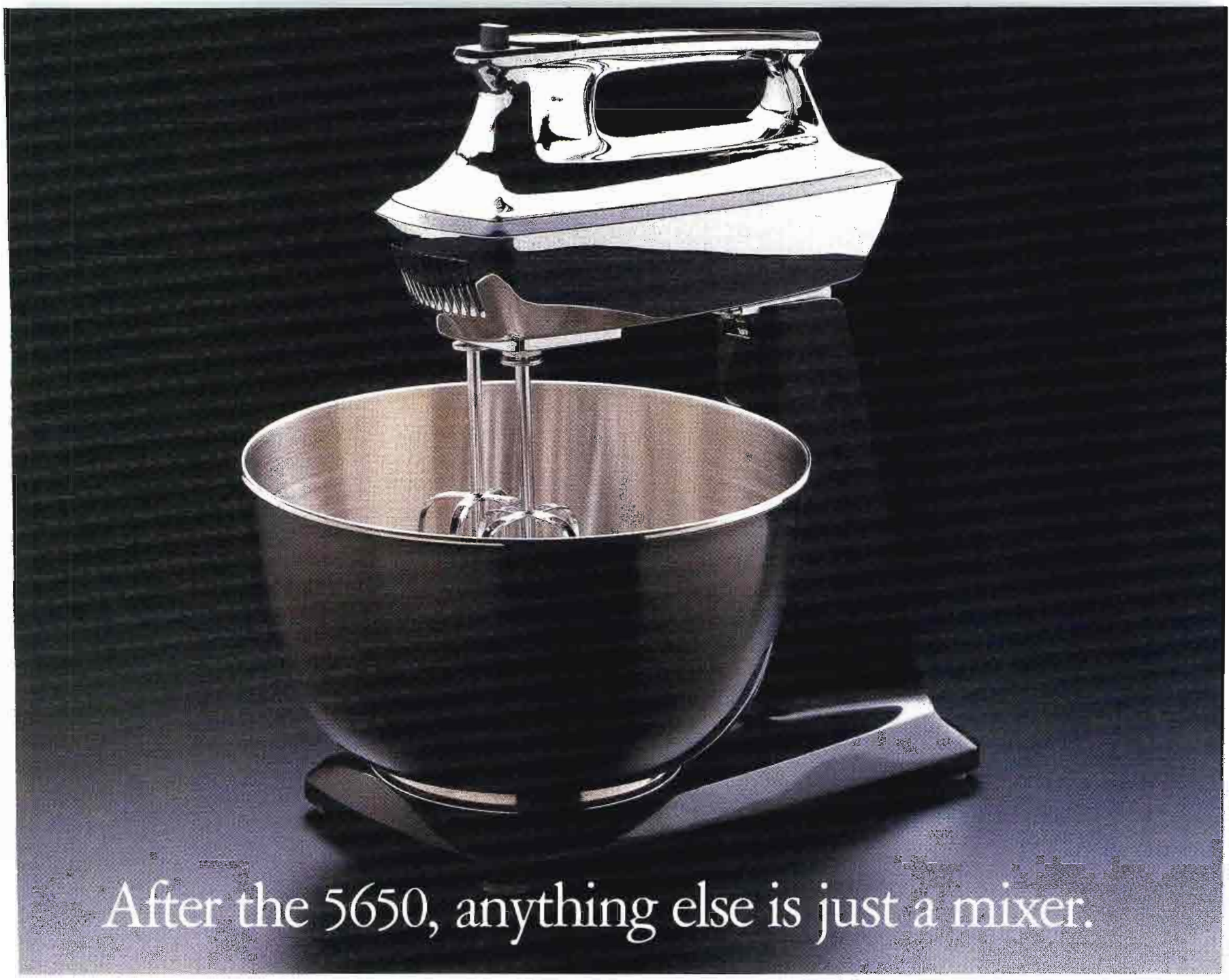


Once you try the 5650 component digital mixer from Thomson, you risk to see your current mixer in a slightly different light. Not just because the 5650 is the first real time, multi-level component digital 4 : 2 : 2 mixer that allows you multi-processing and multi-generations. Nor because it offers you full component digital post production capabilities. The real reason to get really excited about the 5650 is much simpler :

FREEDOM.

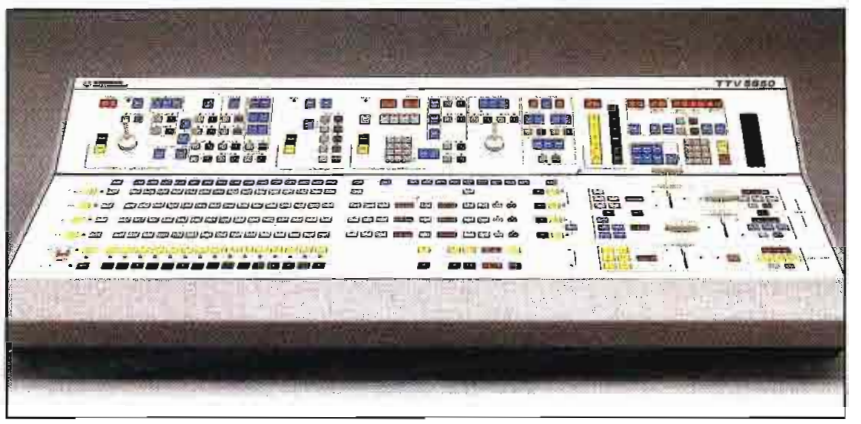
And lots of it. Freedom to create exactly what's in your head, without the headache of lost picture quality. Plus the freedom (and pleasure !) of multi-level mix/effects. And freedom to work with any and all of your current and new generation equipment while taking full advantage of its unique digital architecture.

THE SECRET?

Multi-format input/outputs in both analog and digital standards. And above all, open system to provide full integration in diverse and evolving environments.

What's more, each level of the mix/effect has the same possibilities. That means you'll be free to create without specialized buses and forced integration. Indeed, the only thing you're forced to accept with the 5650 is plenty of wide, open potential !

Chroma Key ? Feel free with three dedicated chroma key buses at your service. And the 5650 keeps you free from maintenance problems with a built-in test bus and automatic diagnostic system. All that at a price that's very reasonable. Take it for a spin !



We think you'll be very impressed with the 5650. But beware : the unlimited freedom you'll experience may make your current mixer seem like, well, just another mixer.

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Circle (119) on Reply Card

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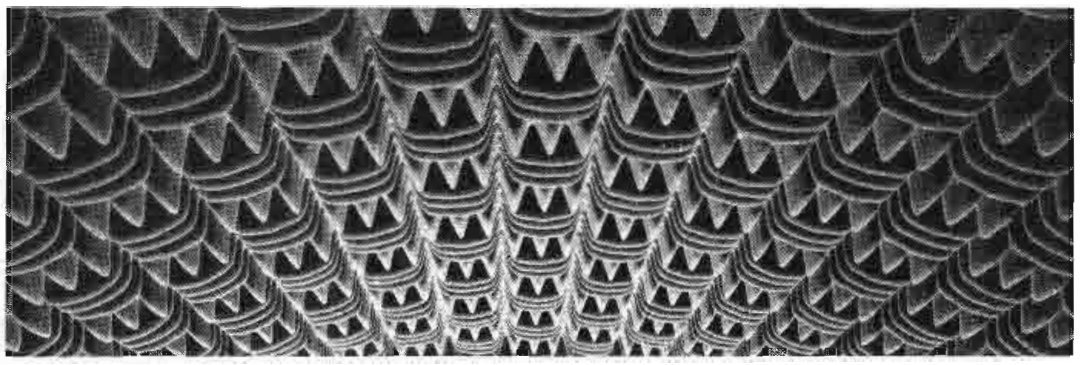

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With its patented anechoic foam wedge, SONEX absorbs and diffuses unwanted sound in your studio. And it can effectively replace traditional acoustic materials at a fraction of the cost. SONEX blends with almost any pro audio decor and looks clean, sharp, professional. Check into this attractive alternative for sound control. Call or write us for all the facts and prices.

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See the entire HOODMAN line at NAB '89, booth A125 outside.

Circle (235) on Reply Card

Channelmatic **5519**
LCC-5A LI'L BEN: clock controller; capability to four systems; provides rewind commands.
LLC-6A LI'L BEN: clock controller; 2×1 stereo A/V switching; two IF/RF switches.
Circle (638)

Comlux **3085**
Telettra DTV-45: 45Mbits/s digital transmission system; for standard NTSC or 4:2:2 digital video; allows two NTSC composite signals on one DS3 circuit.
Circle (659)

Comprehensive Video Supply **5548**
S-MST: script writing software; supports laser printers; imports text; on-screen page, line numbers; underline, boldface character attributes.
Circle (661)

Comprompter **5775**
ENR-MINI: Electronic Newsroom for radio, TV news operations from 1-10 people.
ENR-V2.0: update of ENR software; features greater speed, wordprocessing, transaction tracking, assignment desk.
Circle (662)

Comsat World Systems **4383**
Video codec: digital encoder, decoder from KDD; 45MB/s data rate.
Modem: by Comsat Labs; operates at 140MB/s.
Circle (666)

Concept Productions **1453**
CAPS I, CAPS II: computer-assisted programming systems for radio broadcast.
Circle (669)

DKW Systems **(n.a.)**
CABS: broadcast information, automation system; live assist, programming/scheduling; logging; traffic/commercials; financial applications.
Circle (702)

FloriCal Systems **5686**
MACS: master automation control system; manages interconnects in TV technical and business operations.
Circle (748)

Gefen Systems **2351**
MαE Library: Macintosh version with editor and categories search.
GEF MαE: the MαE Organizer system for Macintosh PCs.
GEFPLN TRACKPLANNER: sound effects cue sheet program.
MULTIMαE: multiple station networking for organizer system.
Circle (759)

Hallikainen & Friends **1111**
TURBO:News software to classify, store stories from two newswires simultaneously; features screen-editing of stories; can be placed before or after wire service selector.
Circle (775)

IGM Communications **1141**
IGM-SC: program automation controller.
IGM-EC: economical program controller.
48PBS Instacart: instant random access multi-deck.
GoCart 24: multicart playback system.
IGM-EN: FSK encoding, decoding units for automation systems.
Circle (790)

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THE RUMORS DON'T EVEN COME CLOSE.

NAB '89
SONY®

SONY COMMUNICATIONS PRODUCTS COMPANY

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Image Video **5574**
PC-40 automation: fully modular master control automation equipment using Ethernet communications; for radio or TV.
7105/E silence detector: enhanced to offer either RS-232 or RS-422 communications.
Circle (793)

Media Computing **5386**
T.E.N.: newsroom software for IBM, compatible PCs.
ANGIS: election/news graphics interface for titling equipment.
TECKIE: software for broadcast equipment automation control from PCs.
Circle (870)

Micro Communications **1547**
Microprocessor controlled systems.
Computer drafting.
Circle (873)

Moseley Associates **1317**
PC Software: TASKMASTER, MASTERCONTROLLER for remote control systems.
Circle (890)

Mycomp Technologies/MTC **(n.a.)**
SPA-344: serial-to-parallel adapter machine-control component.
Circle (893)

Odetics **711**
News Controller Panel: provides individual control of VTRs in Cart Machine to allow last second changes in news stories.
TCS2000 Cart Machine: now available in D-2 and PAL versions.
Expansion Tower: permits 600 or more carts to be available to Cart Machine on-line library.
Circle (914)

QEI **1147**
Digital Stereo Link: links studio and transmitter with telco T1 lines; 16-bit companded encoding/decoding allows stereo generator at the studio; allows transmitter, satellite remote control.
Circle (949)

Register Data Systems **2337**
Traffic Master I: computer-based traffic, billing, accounts receivable system; operates on IBM PC, XT, AT, PS/2, compatibles, most dot-matrix printers; 256kbyte RAM, minimum 5Mbytes of hard disk.
Circle (970)

Sentry Systems **2215**
FS-12C: broadcast radio automation controller; fully automatic, satellite, live assist modes; standard 360k disk holds 50,000+ walk-away event memory.
Circle (997)

Solutec **5748**
SOL-T: "traffic-able" software for SOL-6800 automated broadcast system.
Circle (1009)

Sony Communications Products **4101**
LMS series: expanded range of Library Management Systems, including DVC-1000S with D-2 DVTR; Segment Identification Code (SIC) shows title, start of message, duration.
Circle (1011)

Telettra USA **3086**
DTV-45: video codec; 45Mbits/s digital transmission system; interfaces for analog NTSC, 4:2:2 video; configures to transmit one or two NTSC composite signals over DS3 circuit.
Circle (1061)

Tennaplex Systems **5441**
The Music Manager: PC-based digital audio automation system; can control up to 16 CD or DAT players; playlist storage on floppy disk, print playlists.
Circle (1067)

Torpey Controls & Engineering **5102**
CLK-20: large digital time displays; AM/PM indicators, flicker-free, uses DQSB-6 serial code; 2.25″ digits.
Circle (1082)

Utah Scientific **4526**
TAS-I: production model of total automation system; advanced software design, hardware to fully automate television on-air operation.
Circle (1102)

Video Communications **7117**
VCI software: complete television business management system; operates on one DEC PDP-11 or VAX CPU; order entry, inventory; log production; accounting; EASY-LINK module replaces TWX machine.
Circle (1117)

Video Design Pro **7317**
MasterDOC: software manages complete documentation cycle from system conception to maintenance; drawings, cable lists; equipment changes; drawing functions; networking available.
PEDS Vid386: personal engineering design station; 2Mbyte RAM, expands to 16Mbyte; VidCAD software; 80386 math co-processor; 800×600, 1280×1024 pixel resolutions; 65Mbyte hard disk; 20MHz CPU.
Circle (1118)

S2: Wire, cable

- Connectors, jacks
- Fiber optics
- Patch panels, cables

ADC Telecommunications **3755**
S-9 Patchmate: modular patching matrix operating in conformation with SMPTE 9-pin machine control recommendations; three front-panel jacks, two rear connectors per module for interconnections.
Circle (510)

Audio Accessories, Inc. **1529**
Model 820PCM: printed circuit board mounted mini-jack.
Circle (569)

Belden Wire & Cable **2431**
Improved microphone cables, coaxial cable and broadcast cables.
Circle (593)

Canare Cable **5755**
V-3C: cable supporting 3, 4 or 5 channels of component video.
VJ2-W: 75Ω dual video jack.
BCP-T: 75Ω BNC termination plug.
BCP-77S: 75Ω crimp plug for LV-77S/8281 video cable.
BCJ-RPC: 75Ω BNC jack for direct mounting on PC boards.
Circle (626)

Chester Cable/Alcatel **5203**
Video RGB, Video RGB/SYNC: component analog cables per NEC codes.
Multiple pair audio cables.
Video, sync cable: 75Ω material.
Circle (639)

Comlux **3085**
3000 series: compact fiber optic terminal equipment for digital transmission of video, audio, data; 560Mbit/s fiber optic modules permit multiple video signals on single fiber.
Circle (659)

Connectronics **1571**
J Bay: patch bay system with rear and front options.
X Bay: patch bay system uses any plug configuration.
Bodge Plugs: emergency or service work XLR "easy connect" connectors.
Circle (671)

Farrtronics **5448**
M750-96-PP: 13/4″ panel fitted with 96 bantam jacks; back panel of 14″ deep chassis includes punch-pin connections for external wiring.
Circle (740)

LEMO USA **5107**
Triax: improved 75Ω video triaxial connectors; black chrome, brushed chrome, hardened nickel finish; for cable diameters from 8-15mm; gold-plated contacts.
Circle (840)

Neutrik USA **1734**
NF2C/2 Pro F1: professional RCA plugs.
NL8FC/MPR: 8-contact speaker connectors.
NC3FP-1: panel-mount XLR receptacle, depth is ¾ that of current devices.
NC3FD/MD-L-I: PC-mountable XLR receptacles.
NK guitar cable: high flexibility; 98% shield coverage.
NK2 mic cable: highly flexible; 98% shield coverage.
Circle (905)

Pacific Radio Electronics **7330**
RGB-809-0: RGB cable; single outer sheath contains three miniature coax cables.
RGBS-809-0: four coax cables for RGB+sync.
RGBSC-809-0: RGB+sync+composite; 5-coax cable in a single jacket.
Circle (924)

REBO High Definition Studio **TROP**
Fiber optic system: single-fiber, bidirectional video transmission system; greater bandwidth, lower noise, no ground loops, 12-mile range; joint project with Meret.
Circle (967)

RF Technology **5451**
FOM-13L: fiber optic system.
Circle (973)

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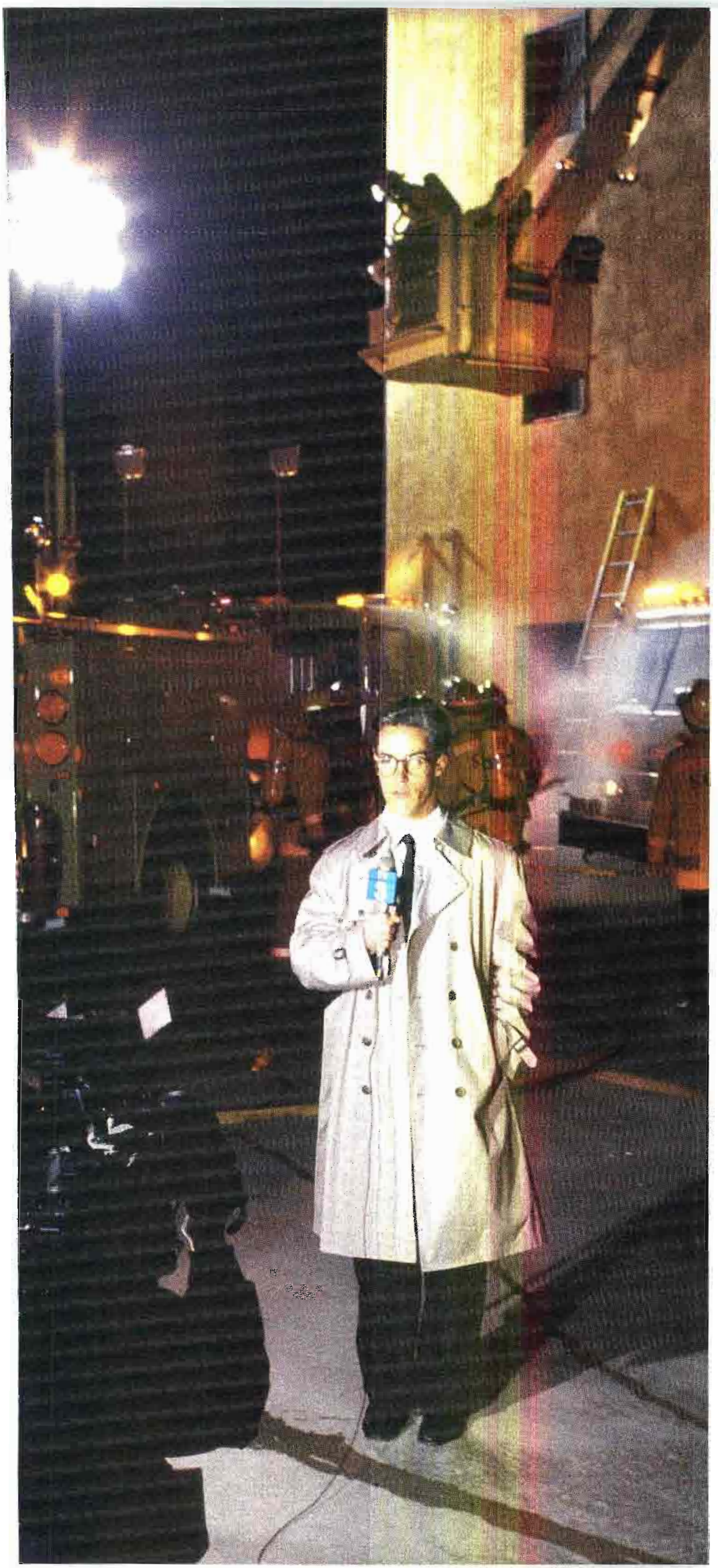

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It's the tape professionals rely on to cover everything from four-alarm fires to world class sporting events.

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Switchcraft **1042**
E111L: ¼" E series locking jack.
Z15J: high-power speaker jack.
Z15P: high-power speaker plugs.
APP334BNO: complete audio patch panel; *APPBK* rear panel; *APPMS334BNO* front & rear panels connected with 4 foot cabling.
Circle (1036)

Union Connector **4582**
Fused 2-fer, 3-fer: cartridge-type fuse systems, meet code requirements for branch circuit distribution; 20A-50/60A and 50A-100A ranges.
EIA panels: inlet/outlet panels; 2P&G, NEMA receptacles.
SINE multipin devices: 19-, 37-pin connectors; cable assemblies, tooling accessories.
Emergency transfer contactors: auto voltage sensing unit transfers lighting loads to emergency power.
Circle (1095)

S3: Cases, racks

- Studio furnishings
- Acoustic materials

Apollo Audio Visual **7535**
Furniture: various mobile, metal A/V, TV tables.
Circle (554)

Bretford Manufacturing **5782**
BB44, BBC48E, MP48E Wide-Body: mobile equipment tables; for monitors, VCRs, TVs; some with electrical unit; pneumatic casters.
TVM series: video wall mount brackets.
A2642E, TVA3654E: adjustable tables for TVs, video equipment; TVA unit includes lockable security cabinet.
VTRC30E, 70E: TV VCR cabinet stand and video security cabinet; both lockable.
Circle (607)

Duggan Manufacturing **5328**
D06-0113ZE: removable caster plate assembly.
D06-0112ZE: flush-mount, spring-loaded handle (case hardware).
Circle (708)

Ergo Industries **(n.a.)**
Custom consoles, equipment racks.
Circle (732)

Fiberbilt Cases **5338**
Model 909: heavy-duty molded shipping cases.
Models 624, 725: medium-duty carrying cases.
Circle (743)

K&H Products **5377**
Camera case: sized to fit under airline seat or in overhead bin, 1" padding to protect camera; leather handles, over the top zipper; suede leather carry strap.
Circle (817)

Lucasey Manufacturing **(n.a.)**
S-2 swivel: monitor slide mount plate; device attaches to shelf of video cabinet to allow monitor to slide out and swivel for best viewing angle; accepts all Lucasey holding plates; supports 60 lbs; key lock.
Circle (1156)

Nalpak Video Sales **3368**
RP-series Rack Pod: light-weight mobile rack cases; four sizes.
TP-0742 Tuffpak: 71/2" OD tubular tripod case.
PV-1: production vest for camera operators.
Circle (897)

Pacific Radio Electronics **7330**
NSRL-1: rack-mountable utility light.
Circle (924)

Stantron Unit/Zero **1712**
VC AS 5030: vertical cabinet assembly.
VC AS 5020: sloping front consoles.
Circle (1024)

Storeel **5238**
Mobile track system: allows moving of longer lengths of storage units with less exertion.
Circle (1029)

Telepak San Diego **5746**
T-1M: metalized raincovers for Betacam.
T-1, T-2: equipment raincovers.
T-GAFF: gaffer bag for accessories.
Circle (1059)

Wheelit **3844**
Projector stand: accommodates most 3-tube video projector systems with loads to 250 lbs; adjustable shelf and restraint straps for projector; top shelf for VCR and control equipment.
Circle (1138)

Winsted **4965**
TAPECAP, CASECLIP: videotape storage systems.
Furniture: computer graphic workstations.
PREMIER: videocart for large screen monitors.
Circle (1140)

S4: Recording media

- Audio, video
- Cassettes, reel tape
- Cleaners, conditioners
- Degaussers

Accurate Sound **5760**
AS6000: tape conditioner for 0.15", ½", ¾", 1"; to 16½" diameter reels.
Circle (505)

Allsop **5356**
67000/67500: cleaning kit and refill for U-Matic.
62000/60210: cleaning kit and refill for VHS.
63000/68010: cleaning kit and refill for Beta.
Circle (531)

Ampex Magnetic Tape **4501**
Ampex 319: D-2 digital video tape; 3 cassette sizes with play times from 3 minutes to more than 3 hours.
#298: Betacam SP cassettes.
#198: Betacam videotape cassettes.
Circle (542)

Audiopak **1653**
AA-4: audio broadcast cartridge; extended frequency response for digital sources at levels to 250nWb/m.
Circle (577)

Carpel Video **3848**
Recycled video tape: ½" Betacam and VHS media; all media is evaluated, physically inspected, cleaned, relabeled; significantly reduced cost.
Circle (628)

Comad Communications **2121**
Tape degaussers by Data Security; *TC-14* videotape, cassettes; *MP-14* D-1, D-2 cassettes; *MP-7* metal particle cassettes; *Type II* instrumentation, computer, metal tape.
Circle (657)

Garner Industries **5112**
Model 400: degausser for metal particle tape.
Model 680: degausser for Super-VHS cassettes.
Circle (757)

3M Magnetic Media **3405**
Digital D-1, D-2 tape.
Type #480XST: videotape for 1" helical type C.
1" Tape Care library box.
Circle (1153)

Quantum Audio Labs **4156**
Special projects: custom-designed high-speed, high-volume, high-coercivity degausser systems.
Circle (954)

Research Technology Int'l/RTI **1706**
Model D11: dropout analyzer for all video formats.
Model V90: bulk tape degausser for metal or oxide.
TapeChek: videotape evaluator, cleaner.
Lipsner-Smith: ultrasonic film cleaners.
Circle (971)

Sony Magnetic Tape **4101**
DAU-series ¾": digital master audio cassettes; VIVAX formulation.
D-¼, D-½: open-reel digital audio tape.
DAT tape: for PCM-2500 DAT deck; *Crystal Art* formulation.
D-2 tape.
Circle (1012)

Tape Care/Data Security **2121**
Model TC-14: bulk degausser for videotape, cassettes.
Model MP-14: degausser for D-1, D-2 cassettes.
MP-7: degausser specifically for metal particle cassettes.
Type II: degausser for instrumentation, computer and metal tape media.
Circle (1046)

Videomagnetics **5438**
Model VM9500M: degausser for higher coercivity tapes; reels to 16" diameter, 2" width; audio, video cartridges, cassettes; erasure level 60-80dB below recording level; optional foot switch.
Circle (1123)

Zonal **2401**
920/960: magnetic sound recording film, 75/125 polyester.
830 series: broadcast tape, improved distortion, noise, HF characteristics.
Logging tape for most brands of communications recorders.
Circle (1149)

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NAB Booth #3926

Circle (124) on Reply Card

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S5: Distribution

- Distribution amps
- Routing switchers

A.C.E. **7935**
ARRAY routing: video, audio, control signal routing system, configurations to 128×128.
Circle (506)

ADM Technology **4951**
Model CH 26: 2-card distribution amplifier rack.
Circle (512)

Adrienne Electronics **7901**
AEC-1SVHS: 10×1 S-VHS routing switcher; Y/C/A/A inputs, outputs.
AEC-2: 10×2 video, stereo audio routing switcher.
Circle (513)

AMX **7230**
SX EL: touch-sensitive control panel.
Circle (545)

Aphex Systems Ltd **1058**
Model 120: audio DA.
Circle (553)

ATI Audio Technologies **2101**
MLA-400, MLA-800: multiple line amplifiers; interconnect as sum/difference amps or distribution amps; active balanced in, active or transformer balanced out; single rack height.
MMA-400, MMA-800: multiple microphone amplifiers; interconnect as sum/difference amps or high-gain distribution amps; active balanced in, active or transformer balanced out; single rack height.
Circle (566)

Auditronics **1363**
Model 1200: stereo DA; 1-in, 6-out with one mono sum output or configure for 1 mono input, 13 mono outputs.
Circle (578)

Benchmark Media Systems **3780**
IFA series: interface amplifiers; eight different modules with power supply.
Circle (595)

Broadcast Video Systems BVS **3426**
Minibox series: lumped, pinnable, switched video, pulse delays and video filters, constructed in small rackmountable boxes.
Circle (614)

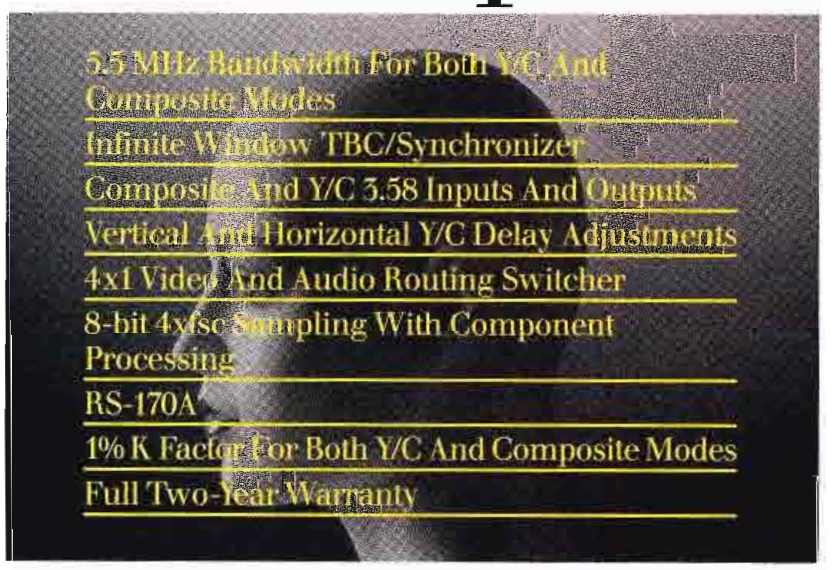
BTS **4119**
D RS 7: Serie 7 4:2:2 digital routing switcher; 8,9, 10-bit processing; ESbus; 525/625 auto standards selection; autophasing option; 8×8/×12/×16 expansion under software control; menu control.
TVS/TAS-3000: wideband A/V distribution switcher; matrix sizes to 250×250; 30MHz; surface mount technology; output monitoring of all out-going signals.
DVA 7: 4:2:2 video DA; 10-bit processing; clock regeneration; 12 sockets for various I/O configurations.
BVA-351, BPA-351, BAA-351: video, pulse, audio distribution amplifiers; fits *RF-351* rack frame.
CP-1401A control panel: for on-site programming of all major TVS/TAS router functions.
Audio Switchbox: solves mono, stereo problems; replaces larger routing system; allows swapping of L/R/mono/time code signals, if required, at a tape machine; mix-to-mono, split-to-stereo, fix out-of-phase; 10 memories with two 4×4 switch matrices; complete matrix, crosspoint control.
Circle (619)

Central Dynamics **3944**
SDS-2+: routing switcher system.
Circle (633)

Channelmatic **5519**
ACS-4A Cricket: automatic A/V changeover switch.
NSS-4B Network Share Switcher: includes disable function.
Circle (638)

Datatek **3951**
D-2400: production models, audio/video routing switcher; cost-effective stereo audio system.
D-804, D-851: dual-channel audio, video DAs, fit D-800 series 10×1 A/V switching rack-frames.
D-861: 10×1 relay switching module; 4 Form-A contacts per crosspoint; for machine control, RS-422 applications.
Circle (686)

Left
Brain Specs.



Introducing ALTA's New Wideband TBC/Synchronizer. An Engineering Masterpiece.

The left brain. Analytical. Technological. Ever in search of order, intelligence, proof. It's the side that puts up with creativity, but quickly gets down to "checking the specs."

ALTA's new Cygnus 5.5 wideband TBC/Synchronizer is a left-minded braintrust. Granted, its impressive repertoire of special effects will delight the right brainers. And that is why we did the ad that logic dictated we put on the right page. But on this side, we want you to evaluate the Cygnus 5.5 set of better than broadcast quality specifications.

Call us. Because, whether you're left-mindedly seeking great specsmanship or right-mindedly seeking great showmanship, the Cygnus 5.5, for just $5950, means your ship just came in.

ALTA GROUP, INC
Dynatech Broadcast Group

ALTA Group, Inc., 535 Race Street, San Jose, CA 95126
TEL 408/297-2582 FAX 408/297-1206

Visit Us at NAB Booth #4526

ALTA Cygnus 5.5
THE TECHNOLOGY OF VALUE

Circle (125) on Reply Card

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Di-Tech **3716**
5615: 16×16 stereo audio switcher.
5864: 32×24 video switcher.
5865: 32×24 stereo audio switcher.
5856: wideband video switcher.
6701: 64×16 tally system.
9100: virtual tally system.
Circle (694)

Dynair Electronics **1707**
Series 1200: modular distribution equipment.
DYNASTY PS: routing switcher system.
Circle (711)

FOR-A **3968**
VDA-206S: video DAs for S-VHS, Y/C-358 signals.
Circle (749)

HEDCO **3855**
HD1600D: true 4-wire operationally transparent regenerative digital routing system; 16×16, expandable to 64×64; pinout for digital control per SMPTE/ANSI 207M-1984; RS-422/485, RW-232 control.
HD1600A: 16×16 audio routing switcher; expandable to 64×64; manual or stereo in one rack frame; RS-422/485, RS-232 control available; 8-level control with numerous matrices per level.
HD1600V: 16×16 video routing switcher; 30MHz bandwidth; unit requires one rack unit; RS-422/485, RS-232 control; 8-level control with numerous matrices per level; expands to 64×64.
Circle (779)

Grass Valley Group **4310**
Control panels for TEN-20, 20-TEN routing switchers.
Digital modules: A/D, D/A converters and DAs, may be used in association with *DHX-532* digital routing switcher conforming to CCIR-601.
Circle (769)

I•DEN Videotronics **A126**
IVD-10: S-VHS distribution amplifier.
Circle (809)

Image Video **5574**
VEA-900 series: video equalizing amplifier modules.
Circle (793)

Key Video **5102**
SRS-1000: serial-controlled audio-video routing switcher system.
AVS-101: 10×1 stereo audio-follow-video passive switcher.
Circle (824)

Leitch Video **3568**
DDA-7100: DIGITEE digital distribution amplifier; 1-input with two reclocked outputs; compatible with CCIR-601 and D-1 or D-2 VTRs.
Circle (839)

Midwest Communications **4568**
ARRAY routing: A.C.E. video, audio, control signal routing system, configurations to 128×128.
Circle (879)

Mycomp Technologies/MTC **(n.a.)**
DA-410: Y-C and stereo audio DAs for S-VHS systems.
Circle (893)

QSI Systems **3751**
Model 5700: video auto-switchover; automatically switches to secondary video source when primary source fails; ideal for STL system at transmitter site.
Circle (950)

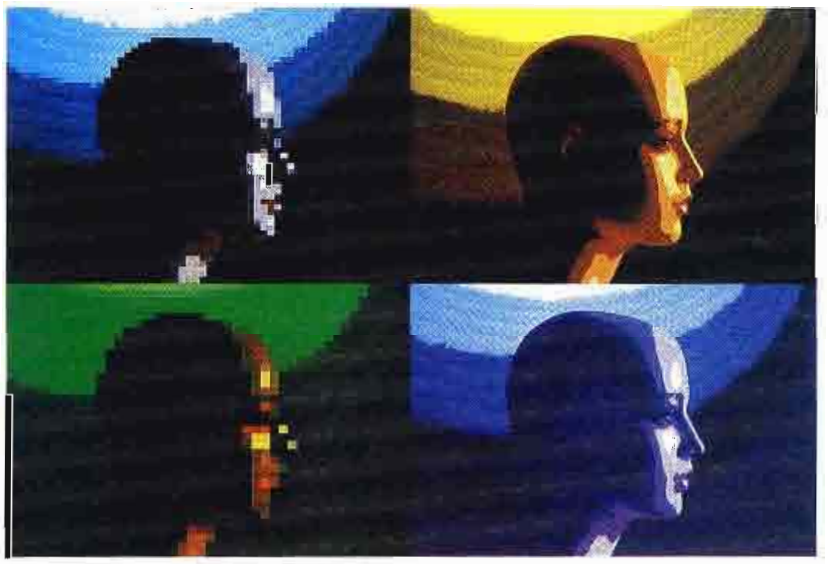
ROH/Anchor Audio **3451**
Model ARMS7000: audio routing + mixing switcher system.
Circle (977)

SESCOM **3413**
Rack series: audio DA modules; *RK-DAADJ* 6-channel with adjustable gain; *RK-AGDA* 6-channel with automatic control; *RK-LA* single channel; *RK-DA* 6-channel, fixed gain; *RK-VCADA* 5-channel VCA.
Circle (998)

Shure Brothers **1517**
Model FP-16A: upgraded audio DA.
Circle (1003)

Sierra Video Systems **7904**
MAXIN: high input, X-Y output routing switcher for any format.
16×4P, 8×8P: sync router modules for 8/16

Right Brain Effects.



Introducing ALTA's New Wideband TBC/Synchronizer. A Special Effects Showstopper.

The right brain. Colorful. Playful. The creative side that sees great specs only as a means to great effects.

ALTA's new Cygnus 5.5 wideband TBC/Synchronizer is a right brain delight. With better than broadcast quality specs and special effects that transform the merely necessary into the simply spectacular. Picture freeze. Variable colorization, variable strobe, and variable mosaic size. And continuously variable posterization.

The Cygnus 5.5. Right brain magic and left brain specs, together in one powerful package for only $5950. Which, right brain or left, should make you of a single mind about your next call.

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Dynatech Broadcast Group

ALTA Group, Inc., 535 Race Street, San Jose, CA 95126
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series.
RS-422: bidirectional data routing in 16, 32, 64, port 8 versions.
Medium size: routing series; 32 input, 8 expandable output configurations.
Circle (1004)

Solutec **5748**
SOL-333: stereo audio DA and video DA.
Circle (1009)

Titus Technological Laboratories **2027**
MLW-1: emergency, automatic audio routing system and audio switcher; three stereo inputs, one stereo output.
Circle (1079)

Video Accessory **5212**
VL-1PC: improved video line isolater.
ADA-2PC: improved audio distribution amplifier.
VDA-2PC: improved video distribution amplifier.
VA1-PC: video power switch; recognizes end of recorded video on tape; initiates desired switching action.
Circle (1115)

Vistek Electronics **5530**
Model V1000: matrix distribution amplifiers.
Circle (1128)

Vortex Communications **1521**
Distribution products: distribution modules for Eurogold Modular Broadcast System; component video and broadband equalizing DAs.
Circle (1130)

Wheatstone Broadcast Group **1034**
Model 822: stereo selector.
Circle (1137)

S6: Test equipment

ADM Technology **4951**
Model RM 1040: dual stereo VU/PPM bargraph meter package.
Circle (512)

AF Associates **3719**
WATCHDOG: automatic video measurement unit.
Circle (518)

Allen Avionics **5222**
HEC-1000: hum eliminators.
VNE-75: hum eliminators for HDTV.
ZL series: zero-loss delay lines.
Bal Components FASTIME: automatic video timing system.
Circle (526)

Altronic Research **2529**
OMEGALINE dummy loads: water-cooled *57100B* 100kW, *57200B* 200kW; air-cooled *6705* 5kW, *6710* 10kW, *6715* 15kW.
Circle (535)

Amber Electro Design **2209**
AudioCheck 2: PC-based software program controls 5500-series instruments for measurements, sweeps, comparison to pre-defined limits, data storage, control of other instruments.
Circle (536)

ASACA ShibaSoku **5533**
TG5601: NTSC TV test signal generator; programmable ID code.
TG57AX: component television signal generator.
TG91E6: high definition television test signal generator.
VN30A: color video noise meter with line/point capability.
VS10B: video sweep generator.
Circle (561)

Audio Precision **2044**
System One Dual Domain: integrated digital, analog audio test system; direct tests in and between domains; DSP enhanced analog measurements; FFT capability; AES/EBU digital I/O.
Circle (573)

AVCOM of VA **5114**
Model PSA-65A: portable spectrum analyzer; 2MHz-1000MHz.
Model PSA-370: portable spectrum analyzer; 10-1750MHZ, 3.7-42GHz.
Circle (581)

B&B Systems **3873**
Model AM-2HR: phase monitor.
Model IM-1HR: phase monitor.
Circle (588)

Benchmark Media Systems **3780**
CFM-1: common mode input filter, an installation accessory.
Circle (595)

Brabury/Porta-Pattern **5177**
HVI 203: multistandard video scope; SC-H phase monitor option; 1U, portable versions; keys waveforms, vectors into NTSC, PAL or NTSC/PAL-M signal being measured or reference input; large individual or combined dual small displays; by Hamlet Video.
HVI 204: component/composite dual standard video scope; SC/H option; displays in color; rack or portable packaging; sum, parade, overlay, individual YUV, vectorial displays in color; full screen or waveform/vector small screens; 3H filter parade display of composite.
HVI 2020: visual stereo PPM & VU metering with color video displays; PPM, VU, peak indications; select L-R or M-S; size and position are adjustable; key or mix into picture display.
Circle (605)

Broadcast Video Systems BVS **3426**
COX5054/30: video sweep generator; operates to 30MHz.
Circle (614)

Bruel & Kjaer Instruments **7431**
Model 4128: head/torso for recording and audio measurements.
Circle (616)

BTS **4119**
Test H-1000: HDTV test pattern, sync generator; tri-level, standard sync; zone plate, color areas; programmable user setups; variable motion control; 16 additional patterns; RGB, Y/R-Y/B-Y outputs.
Circle (619)

CAL/Cox Associates **3426**
COX5054/30: video sweep generator; frequencies to 30MHz.
Circle (622)

Control Concepts **3902**
Isolatron: expanded line of power protection systems; applications for studios, transmitters, remote control systems, computer-based products and surge/transient sensitive electronics.
Circle (674)

Current Technology **7621**
MP240ERF: extended range filtering for power conditioner systems.
Circle (681)

Dorrough Electronics **1035**
Model 1200: stereo signal test set; measures stereo program signals in left/right or sum/difference formats to -75dB; for maximum level set, cross-talk check, balance.
Circle (704)

Holaday Industries **2028**
HI-5000-SX: complete RF radiation exposure measurement system.
HI-3600-02: ELF/power frequency EMF survey meter.
Circle (784)

Kay Industries **1647**
T-series phase converters: changes single-phase utility power to 3-phase; performs power line conditioning, eliminates transients.
Circle (822)

Leader Instruments **5371**
Model 5872: waveform, vector monitor.
Model 430: video sweep generator.
Model 408: video test signal generator.
Model 1602: RGB multiscan video generator.
Circle (836)

Leitch Video **3568**
2600FG: frame generator for SPG-1300 or MTG-2600N test generators; EPROM storage for one color frame for use in test signals.
DIG-2200: D1 and CCIR-601 digital component generator; eight test signals.
DSM-7150: DIGIPEEK digital signal monitor; 75Ω composite luminance signal output for monitoring of CCIR-601 signals.
Circle (839)

Magni Systems **3173**
VS530, VS531: SC-H phase measurement feature.
Waveform/vector enhancements: multistandard models.
Circle (857)

Matthey Electronics **5200**
DIP filters: additional models; six cut-off rates, many with (sin x)/x correction.
Brickwall filter: available in *zero-loss* version.
Audio filter: for customer-defined specifications.
Delay lines: in DIP format for HDTV.
Delay modules: programmable and fixed; to 50ns delay, 30MHz bandwidth.
Circle (865)

Modulation Sciences **5765**
VMate-I: interfaces TEK VM700 video measurement set to remote control systems or other equipment by RS-232; 16 relays mapped to 0-5Vdc voltages for remote control readout; programmed from VM700.
Circle (885)

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Mycomp Technologies/MTC **(n.a.)**
AVM-300: audio/video monitoring unit.
Circle (893)

Reach Electronics **5751**
Pushbutton switch: low-profile, illuminated; 0.65″ square, 0.5″ height; in Form A, AA, latching, momentary; 100ma; mounts to PC board, panel mount available.
Circle (966)

RF Technology **5451**
Faraday Technology: range of delay lines.
Circle (973)

Sound Technology **4577**
3100B: programmable audio generator; numerous software revisions over 3100A.
3200B: programmable transmission/audio analyzer; now includes wow/flutter; designed for 16-bit digital audio tests.
Circle (1015)

Symetrix **2304**
SX 205: micro VU precision level meter.
Circle (1040)

Tektronix **3700**
TEK 751: BTSC aural modulation monitor, decoder; Weighted Peak Mode provides choice of true peak or weight peak readings.
751 PC remote: software for PC to display 751 aural monitor screen.
1780R/1781R: NTSC and PAL video measurement sets; multifunction, wideband, 4-input analog measurements; touch-screen control; interactively combines vector and waveform monitor functions.
HDTV test signal generator systems.
Component/composite test signal generator.
TSG-100: test signal generator; includes transmission test signals.
SPD-300: signal development program; software program allows creation of special test waveforms or modification of existing TSG-300 waveforms; for engineering, evaluation or manufacturing facility.
Circle (1056)

Television Equipment Associates **5200**
Audio anti-aliasing filters: for assorted sampling frequencies; hybrid circuits combine lowpass elliptical; stopband attenuation over 60dB.
HDTV delays: 30MHz bandwidths; BNC connectors.
MBW420B Brickwall: filters in battery-powered, no-loss package; eliminates sync buzz for ENG applications when audio subcarrier is located at 4.5MHz or 4.8MHz.
Circle (1063)

Townsend Test & Measuring **5555**
Philips PM5664: component video waveform monitor.
Circle (1086)

Wohler Technologies **2151**
IPI-1: instantaneous phase indicator; for monitoring stereo audio signals.
Circle (1142)

S7: Facility design

- Studio, mobile
- Construction,
- Consultants

Acoustic Systems **5486**
BB-440: prefabricated, acoustically engineered voice-over booth.
Circle (507)

Allied Broadcast Equipment **2027**
Showcase Studios: complete, pre-assembled radio station building; includes all technical and office equipment.
Circle (528)

Alpha Video & Electronics/AVEC **5183**
E350R: ENG microwave repeater van.
Circle (533)

Audio Broadcast Group **2427**
Turnkey Multi-Track: audio production system with SMPTE timecode option; 24×8 mixing console; effects equipment; 2-, 8-track recorders; installed in human-engineered cabinetry.
Circle (570)

Centro **4956**
ENG-S-200: electronic news gathering vehicle; GMC Suburban.
ENG-SV-200: electronic news gathering vehicle in Ford E-350 Super Van.
Circle (635)

Micro Communications **1547**
Field service department, services.
Circle (873)

Midwest Communications **4568**
Model M-11: Midwest 4-wheel drive ENG mobile unit.
Circle (879)

Mobile-Cam Products **(n.a.)**
Ramcharger One: 1989 Dodge Ramcharger 4-wheel drive, Mini news gathering truck.
Circle (884)

MZB/Gray **3432**
On-site proposals: computer available to produce system proposals from your specifications.
Circle (894)

Shively Labs **1341**
FCC directional pattern work: for Class A stations.
Circle (1001)

Video Financial **3884**
Factoring: business improvement plan to increase cash flow; purchase accounts receivable to provide liquid working capital.
Circle (1119)

S8: Programming

Concept Productions **1453**
Radio Formats: A/C, CHR, Gold, Country and Contemporary MOR programming on DAT or 10.5″ reel media.
Circle (669)

Gefen Systems **2351**
BBC Effects: 18-CD library of sound effects from the BBC.
Circle (759)

Manhattan Production Music **3064**
MPM production music on CD: network news themes; new age music; holiday, patriotic themes; mellow acoustic ballads; spirited heavy metal; ambiance sound effects and station ID logos.
Circle (859)

Valentino Production Music **1627**
Production music, sound effects: CD libraries with 35 discs of music in 60s, 30s, 15s organized by tempo, themes, industrial, specialty categories; 30 discs of sound effects.
Circle (1104)

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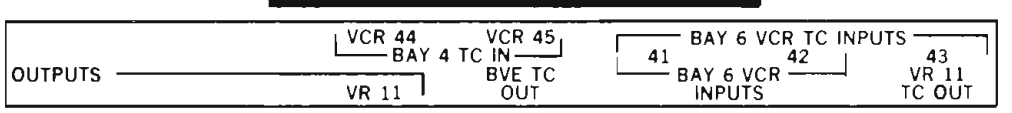

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- Completely modular and field expandable
- 3-pair telco wire between matrix and control panels
- Wide choice of control panels
- Bright, easy to read 4 character alpha-numeric displays
- Easy to program
- All keys universally programmable locally or at central terminal
- System configuration can be changed by user at any time
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Milestones are for celebrating. So celebrate with us, not only Broadcast Engineering's 30th anniversary of service to the broadcast industry; but the evolution our dynamic industry has seen . . . is seeing.

We've gone from equipment racks to ICs; vacuum tubes to super-conductors. And through it all, Broadcast Engineering has been there. Our technical editors bring 63 years of combined industry experience to deliver the information you need to keep your station up and running 24 hours a day.

Thirty years ago we were the first publication designed to meet your needs. Today, we're still the industry's most relied upon magazine.

So let's celebrate our 30-year partnership. BE couldn't have continued its leading position without your devoted readership month after month. And most broadcast professionals agree that they couldn't have performed their jobs quite as well without Broadcast Engineering.

Here's to another thirty . . .

30 Years of Service

Watch for our exclusive 30th Anniversary retrospective in May!

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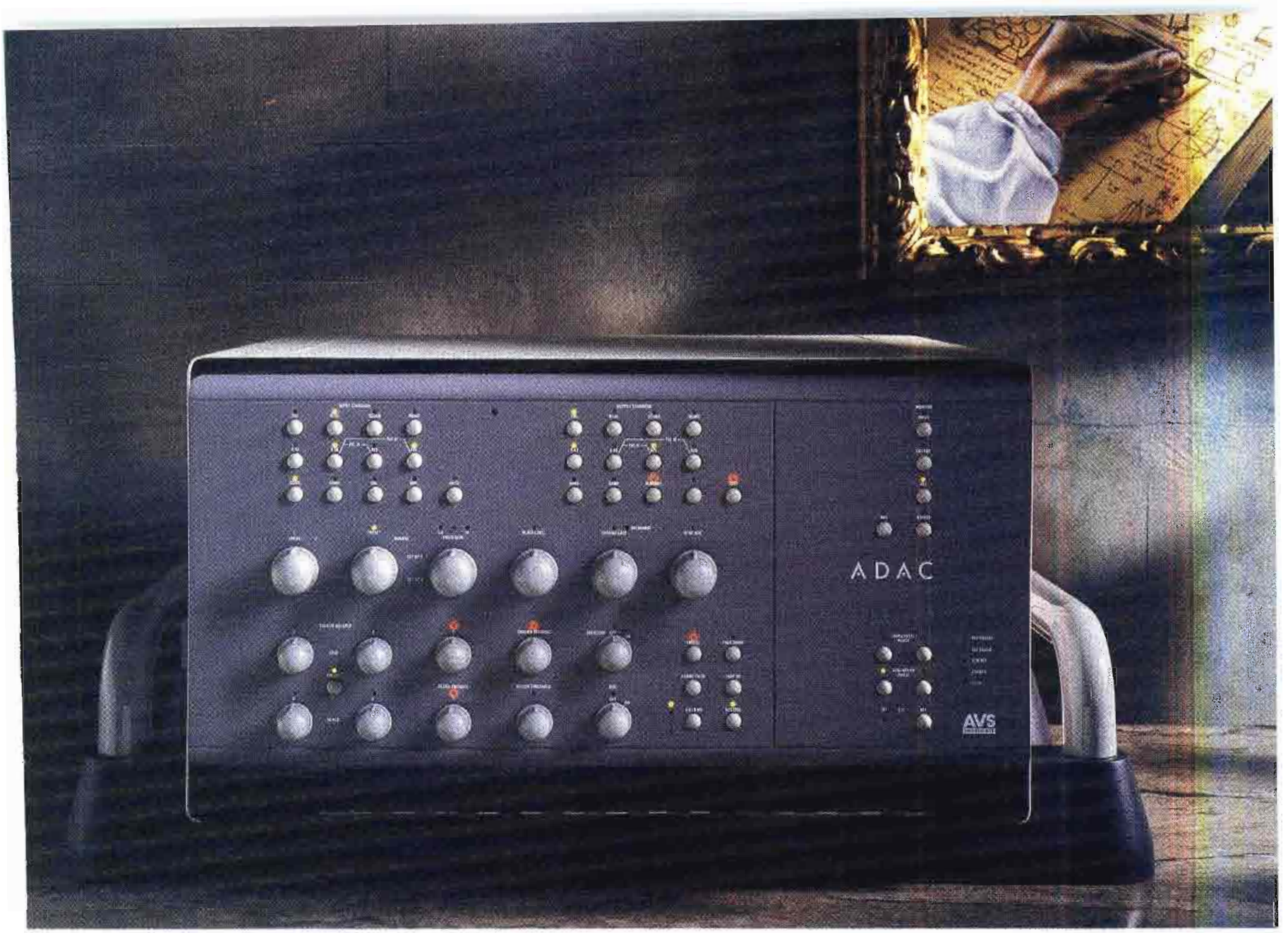

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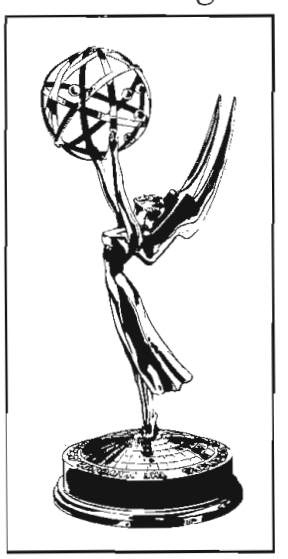

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Video Products V1: Cameras

- ENG, studio cameras
- Camera tubes, CCDs
- Control systems
- Lens systems
- Pan/tilt heads
- Pedestals, tripods

AF Associates **3719**
RoboPed: production models of full-function camera pedestal system; requires no tracks, floor tape or any mechanical guidance mechanisms.
ARC: robotic camera control system.
Circle (518)

Ampex Audio-Video Systems **4501**
CVR-300: single-piece CCD camcorder for ENG/EFP; 700-line resolution; operational weight 15 lbs.
CVC-70: CCD camera for studio, camcorder applications; 700-line resolution frame interline device.
Circle (541)

Angenieux **4138**
14×7: ½″ f/1.6 ENG lens.
14×8: ⅔″ f/1.6-f/2 ENG/EFP lens.
14×9: ⅔″ f/1.6-f/2 ENG/EFP lens.
20×8.5: ⅔″ f/1.3 lens.
40×9.5: ⅔″ f/1.3 lens.
Circle (547)

Arriflex **4165**
ARRI geared head: full swing/tilt geared head for film, video cameras.
ARRI Matte B: for video camera use; includes follow focus.
Varicon on-camera contrast control system.
Circle (559)

Bencher **4584**
Model 430-11: M3 Copy Outfit copy stand for 30-lb cameras.
Model 132-13: M2 Copy Outfit copy stand; holds 15-lb camera; gray baseboard, grid system; quartz illumination.
Circle (594)

BURLE INDUSTRIES **4048**
BC4925, BC4926: ⅔″ mixed-field Saticon camera tubes.
Circle (620)

Camera Mart **5551**
Ikegami cameras: CCD types *CCD770, HC230* and *HL791* Plumbicon type.
Circle (625)

Cinema Products **3758**
WRC-4: 4-channel wireless focus, iris, zoom lens control; 3 lens functions with camera ON/OFF.
Telescoping balance kit: for Steadicam III; support post, camera base plate, balance control.
Steadicam III-A: film/video camera stabilizer; adjustable telescoping support post, side-to-side balance base plate; fore/aft/rotate balance control; 5A external fuse holder kit.
Circle (644)

FGV Panther **3838**
Super Jib-a-Round: rotatable, electronically controlled crane.
Circle (742)

Geocam **7003**
Geocam 4/4.2: 4×4 universal production matte box.
ENG/BH: ENG bracket for hand-holding matte box.
SLIDE: adjustable balance base plate.
FOCUS: universal follow-focus module.
Circle (764)

Hitachi Denshi **4519**
SK-F1, SK-F3: dockable 3-chip CCD ENG/EFP cameras.
SK-F700: CCD studio camera.
Circle (781)

Hoodman **A125**
Sun Shades: accessories for TV cameras; for outdoor operation; *H200* 2″, *H450* 4″, *H500* 5″, *H789* 7-9″, *H1214* 12-14″, *H1721* 17-21″.
Circle (785)

Ikegami Electronics (USA) **5305**
HL-55: FIT, CCD portable camera/recorder.
HC-230: economic camera/recorder with three ½″ CCDs.
HL-950: camera/recorder based on ⅔″ Sta-Sta Plumbicons.
HL-791: top-of-line EFP 79-series camera.
HK-327: studio camera based on 30mm Mag-Sta Plumbicon tubes.
Circle (791)

Innovative TV Equipment/ITE **3938**
TP 100 ultra-light Hot Pod type tripod.
T47/H48 tripod-head combination for CCD cameras.
P-8 light-weight pneumatic studio pedestal.
Circle (797)

Interactive Motion Control/IMC **5477**
Model 3025 control console: for IMC 2-D, 3-D and Camera Mover systems; IMC serial communication to console 4,000 feet from motion control device; QWERTY keyboard, jog knobs, EL display; 3.5″ drives.
Circle (804)

JVC **4168**
KY-15C1: 3-CCD pickup camera for image capture with graphics systems; connects directly to Targa, Vista, RasterOps image capture boards; 668×485 pixel, one-line scanning for greater vertical resolution; *HZ-410U* 10:1 zoom macro lens.
Circle (816)

Karl Heitz **3477**
#280: Gitzo fluid head.
#345B, 345BR, 345BC: Gitzo Inter Pro Studex compact tripods; with leveling balls, optional rapid or gearlift column.
Black extensions, columns; wingnuts for extensions.
Gitzo Giant Ball 5: 2.5″ diameter steel ball allows adjustment knob to change friction; easy-lock positive tightening level; for extra heavy cameras; head weighs 1¾ lbs.
Circle (820)

Landy Associates **5522**
Ikegami HL-55: CCD broadcast camera.
Ikegami HL-79I: 3-Plumbicon tube camera.
Circle (833)

Miller Fluid Heads (USA) **5455**
Model 355: Miller System 80 for EFP applications; supports prompter, long lenses, to 80 lbs.
Circle (880)

Nalpak Video Sales **3368**
LC-I: universal replacement lens cover.
Circle (897)

NEC America/Broadcast **3444**
SP-30: CCD color ENG camera; 700-line resolution; shuttered.
SP-30EX: CCD color camera; barrel-housing; special purpose; with 700-line resolution and shutter.
NC-120: 3-CCD television camera; 700-line resolution; RGB outputs.
NC-15: single-CCD color television camera; shuttered for increased resolution.
Circle (901)

Panasonic Industrial/Broadcast **4142**
AK-450: portable 3-CCD camera; 800 TVL resolution.
Digital camera: high resolution CCD devices.
Circle (928)

Sachtler **2437**
Two-in-One Tripods: for ENG, EFP; accept fluid heads with 100mm, 150mm bowl interface; available in Carbonfiber, Duraluminum.
Model 1000 Video 10: complete support system with dolly, tripod, integrated spreader and elevation column; compact head for CCD cameras.
Circle (985)

Schneider **4162**
TV-71: 20× wide-angle studio zoom lens; for ½″ CCD cameras (8mm image diagonal).
TV-81: 20× wide-angle studio zoom lens; for ⅔″ CCD (11mm diagonal) cameras.
Circle (991)

Schwem Technology **5482**
GX-3: production models of integrated mini camera with stabilizer; complete package is 4″ diameter, 10″ long cylinder; includes camera with remote controllable lens.
Circle (992)

Sony Communications Products **4101**
DXC-325: 3-CCD MULTICAM; docking unit with adapters for RGB, composite sync, Y/C outputs; ½″ type CCD with shutter.
DXC-3000IR: infrared sensitive 3-CCD camera; 560-line, 58dB S/N.
PAC-2CCD: 2-CCD camera; 520-line resolution with 52dB S/N; ⅔″ CCD expands range of available lenses; Y/C outputs for ED-Beta, S-VHS and other recording formats.
Circle (1011)

Tamron Industries **3777**
High resolution lenses: C- and standard video camera mount lens systems for ⅔″ cameras.
Circle (1044)

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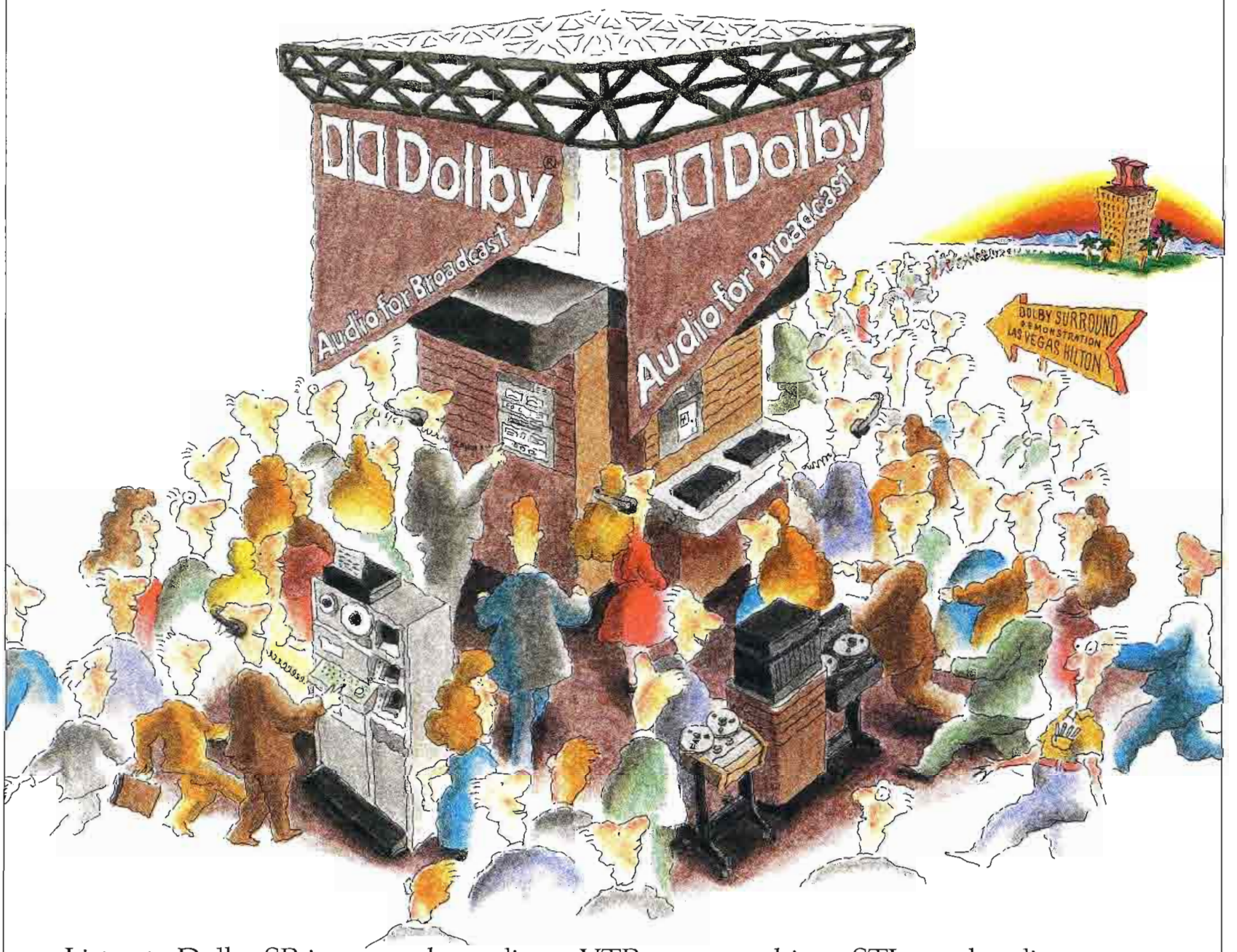
At this year's NAB, don't just look. Listen.



Listen to Dolby SR improve the audio on VTRs, cart machines, STLs, and audio tape machines. And in our suite at the Hilton, participate in a behind the scenes demonstration of a Dolby Surround production—how to use it, when to use it and why to use it. Stop by Dolby and listen.

On display at Booth 1457: Model 363 2-channel unit with switchable Dolby SR and A-type noise reduction; XP series multi-track Dolby SR unit; Model SDU4 Professional Surround Decoder Unit.

Dolby Laboratories, Inc. 100 Potrero, Avenue, San Francisco, CA 94103-4813, Phone 415-558-0200, Telex 34409, Facsimile 415-863-1373. 346 Clapham Road, London SW9 9AP, Phone 01-720-1111, Telex 919109, Facsimile 01-720-4118. Dolby and the Double-D symbol are trademarks of Dolby Laboratories Licensing Corporation.
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Dolby®

Circle (129) on Reply Card

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Telemetrics **5105**
TM8800: pan/tilt systems with presets and computer interface.
TM8650 series: triaxial camera control systems; *M7* for Sony M7; *300CLE* for Panasonic CLE; *BVP-7* for Sony BVP-7; *FPC* for Hitachi FPC series.
Circle (1058)

Thomson Video Equipement **5141**
PROSCAN: EDTV studio camera; progressive-scan system.
SPORTCAM: 3-CCD studio, EFP camera for OB applications.
TTV-1647: 3-CCD ENG/EFP broadcast camera.
TTV-1532: top-of-line studio OB camera.
Circle (1074)

Toshiba/OEM **5168**
IK-M30A, IK-C30A: miniature ½" CCD cameras; -M with integral lens, -C for C mount; 360TVL resolution, 1/1000s electronic shutter; 120Vac, 12Vdc.
Circle (1083)

Ultimatte **5165**
Ultimatte Memory Head: computer-controlled tripod head; portable unit operates from 120V/60Hz or 220V/50Hz or dc; all moves recorded on 3½" discs; for use in video compositing.
Circle (1094)

Video Services Unlimited **7228**
Stanton Jimmy Jib-2.
Stanton Jimmy Jib Jr.
Giant extension: for Jimmy Jib systems.
Remote control: improved controller provides camera iris and VTR start-stop functions.
Circle (1121)

Vinten Broadcast **809**
3277 Mark 7A: pan/tilt head; for studio or remote; ±60° tilt range; 11" fore/aft adjustment for balance; capacity 200 lbs; captive pan bar; improved fluid drag system; wide cam track.
Vision Pedestal: for lightweight cameras; 16.5" column movement with 44lb capacity; self-charging system for easy adjustment; castoring wheels, independent brakes, cable guards; two configurations.
Package system: for the studio; *Vision 20* ENG/EFP fluid pan/tilt head, single pan bar, clamp, 100/150mm ball base; options—2nd pan bar/clamp, 2-stage tripod; Vision folding/castering dolly.
Enhanced MicroSwift: total control over *Tracking Pedestal*, compatible to *Mark 4* and previous pan/tilt heads; integral circuitry eliminates studio clutter; extends to all equipment in studio.
Circle (1127)

V2: Recording

- Analog, digital
- Editing, animation
- Time code equipment
- Transport synchronizers

Abekas Video Systems **2436**
A60: digital disk recorder with Touch-Up feature.
Circle (502)

Adams-Smith **2505**
Motion controller: for use with VTRs, biphase dubbers and Adam-Smith C:Sound displays.
Circle (509)

Adrienne Electronics **7901**
PC-VITC: VITC reader board for IBM PCs.
PC-LTC/CHK: LTC error-checking software for PC-LTC boards.
Circle (513)

ADx **5551**
Time code analyzers, machine controllers, audio synchronizers and emulators.
Circle (1155)

Ampex Audio-Video Systems **4501**
ACR-225 upgrade: software for multiple events per cassette and automatic break tape generation.
VPR-300 enhancements.
ACE 25 software: enhancements for Sony SloMo, complete list management; CMX 340 input/output; 4-machine system, optional internal audio, video switching and EDL storage, management.
SMC-200: slow motion controller; usable with all Ampex VTRs.
Circle (541)

AMX **7230**
DX 8: video duplication control component.
Circle (545)

Arriflex **4165**
ARRI Time Code: reader and generator systems.
Circle (559)

ASACA ShibaSoku **5533**
Optical Disk Systems: advanced products using erasable disk technology.
ADS-200B: floppy, hard disk still-store.
Circle (561)

Aston Electronics **7720**
Wallet: general purpose still store; 35-image capacity with key signals on removable hard disk; 2s access; CCIR-601 compatible sampling; NTSC, PAL; disk directory, stack facility.
Circle (564)

Audio Kinetics **2414**
WIPER: video wipe and countdown system as visual cue for automatic dialogue replacement.
Circle (572)

BHP **7517**
Model 8100N: TouchVision videotape editing system; non-linear film-style system; accommodates 24 VHS or U-Matic VCRs.
Circle (598)

Bowen Broadcast Service **3429**
TCR-100 kits, parts: dynamic magazine brake kit; mechanical parts not available from other sources.
Circle (604)

Broadcast Electronic Services **(923)**
BetaBox: interformat module to use between Beta, M-II, U-Matic VCRs.
GPI router: expands general purpose interface capabilities of editor controllers.
GigaBox: 2.3Gbyte 8mm computer backup tape drive.
Circle (1153)

BTS **4119**
BBE-600: VTR editing system; combines capabilities of BBE-900 editor with self-contained video switcher for dissolves and wipes.
BSB-2001: audio/timecode switcher, stereo phase inverter accessory for VTRs; combine, re-arrange 5 audio, timecode signals from playback deck to lines to routing switcher.
Circle (619)

Camera Mart **5551**
ADx products: a range of time code analyzers, machine controllers, audio synchronizers and emulators.
Circle (625)

Cinedco **7027**
CINEFLEX: 24-frame video editing system; for feature film applications; insures accurate negative cut list.
Circle (643)

Cipher Digital **3574**
Phantom 4810: VTR emulator, transport synchronizer.
Circle (646)

CMX Systems **4538**
CMX 3600 enhancement: hard disk option, available for all existing 3600 systems.
CMX 3100B: replacement for 3100A and 3400 edit controller systems; incorporates all features of 3400A.
Circle (651)

Comprehensive Video Supply **5548**
EDIT MASTER: multiple source editing controller.
Circle (661)

Dwight Cavendish **5470**
CM-250 Copymaster: videocassette duplicator.
CM-7000QC: automated quality-control station for video duplicator system.
Circle (709)

Evertz Microsystems **5379**
Model 7210 e²: provides serial control of VHS, S-VHS, U-Matic VCRs from video editing controller.
Model 4500: time code generator, mounts to camcorders.
Circle (736)

FloriCal Systems **5686**
ShowTimer: fully automated recording, rundown listing and playback from satellite feeds and film-to-tape transfers.
TimeShifter II: low-cost version of established TV tape delay system.
Circle (748)

Grass Valley Group **4310**
D-2 interface: interconnects D-2 signals to the GVG Kadenza.
Circle (769)

Gray Engineering Labs **3947**
VR-221: dual standard reticle generator; available in composite or component signal formats.
Circle (770)

Grunder & Associates **4177**
Model P158: editing shuttle panel; 40×2 character display; by CEL Electronics.
Circle (773)

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Feature Shock!

A built-in tape timer displays current tape position in hours, minutes, and seconds, and includes a search-to-cue locator with cue point and zero location memories.

Otari's new MX-50. Built around the premise that you can have everything you ever wanted in a two-track tape machine, and still stay within your budget. For example:

The Transport

—DC quartz PLL capstan motor with front panel selection of operating speeds (from either a 15/7.5 or 7.5/3.75 ips speed pair).

—Capstan speed variable by ± 7% from the front panel, and by ± 50% from SMPTE time-code external controllers via an Otari-standard 37-pin connector.

—Optional remote control.

The Electronics

—Lighted VU meters with peak-reading LED indicators.

—Transformerless active balanced inputs with XL-type connectors.

—Optional Voice Editing Module (VEM) for twice normal play speed with normal pitch.

Otari's MX-50. For whenever or wherever you need a *professional* audio machine at an affordable price.

For more information, call your nearest Otari professional audio dealer, or Otari Corporation at (415) 341-5900.

OTARI®

10.5" reel size capacity with self-centering NAB hub locks.

± 7% vari-speed.

Capstan speed controllable ± 50% via SMPTE time-code external controllers.

Optional Voice Editing Mode (VEM) for twice normal play speed with audio pitch shifted down one octave for normal pitch.

Cast alloy deckplate.

Lighted VU meters with peak-reading LED indicators.

Headphone amplifier with front-panel headphone jack and level control.

Optimized record and reproduce heads.

Switch-selectable NAB/IEC EQ with front panel indicator.

Lifter defeat with momentary or locked operation.

Tape drive tachometer for accurate tape time display, and for external synchronizer or controller interface via Otari-standard 37-pin connector.

DC quartz PLL capstan motor with front panel selection of operating speeds.

Independent reel size selectors for supply and take-up motors.

Built-in tape timer display.

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Harris Video Systems **1305**
IRIS II Plus: digital still store.
Circle (777)

Hitachi Denshi **4519**
VL-D500: D-2 recorder.
HDTV recorder: 1″ tape design.
HF-5200: HDTV videodisk recorder.
Circle (781)

JVC **4168**
BR-S600U: S-VHS Hi-Fi professional recorder; more than 400 line horizontal resolution, 85dB audio dynamic range; *Time Go-To, VHS Index Search, Intro Search* features; variable, shuttle, still speed modes; wired remote.
BR-7030 Hi-Fi VHS 3-in-1 duplicator: a single housing and electronics for three slide-in, removable record-only transports; QC output; 5,000-hour meter per transport; integrated diagnostics system shows malfunction as digital code on front panel; Dolby noise reduction.
RM-G80U: remote control unit for any JVC 45-pin connector VCRs, including VHS, S-VHS, U-Matic and M-II; counter display, pre-roll, dial search, jog.
Circle (816)

Lake Systems **819**
Interformat Betacam to digital editing suite.
Digital Mix-to-Pix: features Waveframe digital audio production system.
Circle (832)

Landy Associates **5522**
Ampex D-2: digital videotape recorder.
Editing system: custom-designed, multi-format composite videotape system.
Circle (833)

Merlin Engineering **5530**
Custom VTRs and VTR accessories.
Type C: long-play kits.
Time zone delay system.
Circle (872)

Montage Group **5283**
System II: Montage Picture Processor; random-access, non-linear electronic editing system; multiple VCR decks; for theatrical, television projects originating on film or NTSC/HDTV videotape.
Circle (888)

NEC America/Broadcast **3444**
VSR-10: sports version of solid-state recording unit.
Circle (901)

Optical Disc **7525**
Model 610A: videodisc recording system.
MK II: recordable laser videodisc.
Model 534: digital audio converter, encodes, decodes for optical disc.
Broadcast videodisc playback system.
Circle (919)

Otari **1353**
T-700II: high-speed video duplicator; operates 135× NTSC SP mode, 405× NTSC EP mode, 198× PAL mode; laser-based DuPont thermal magnetic duplication TMD process.
Circle (923)

Paltex **4156**
E-series: building block series from 3-machine to 8-machine system; VTR interfaces for any mix of ½″, ¾″, and 1″; EDL from 250 events to 700 events.
Circle (927)

Panasonic Industrial/Broadcast **4142**
Prototype: D3 digital videocassette VTR.
M-II VTR: for industrial applications.
Circle (928)

Quanta **4526**
SCED MK I: 4-machine edit controller.
SCED MK II: full-featured, 8-deck edit controller.
Circle (952)

Rank Cintel **3926**
Gallery Photocall: image management system; single user; 4:2:2 with 5¼″, 12″ optical storage; 30-polyphoto display.
Slide File II: dual-user stills workstation; high resolution.
Circle (964)

REBO High Definition Studio **TROP**
HDTV framestore: designed for operation with Macintosh II; captures and displays single frames from live or recorded HDTV source; 1/30s required; stores multiple frames.
Circle (967)

Saki Magnetics **1673**
Long-life Ferrite: 1″ audio post for BVH series recorder.
Circle (986)

Skotel **4021**
TCG-311: time code generator, reader; half-rack package complements established reader products.
AVTC-20VI: portable VITC, LTC time code reader, character inserter.
Circle (1006)

Sony Communications Products **4101**
Type IX U-Matic SP: editor/feeder package *VO-9850/9800* and portable *VO-8800*; 330 line resolution, 46dB S/N or greater; integral time code; audio S/N to 72dB with Dolby C noise reduction.
BVU-920 player: U-matic SP play-only; dynamic tracking with modular BKU-901A TBC for ±10× play speed; 340-line resolution; reduced Y/C ringing effects; 72dB audio S/N and Dolby C noise reduction.
D-2 videorecorders: expanded product range.
CVRdisc: write-once type optical disc recorder; for interactive video, off-line editing, video database, archival applications.
Circle (1011)

Spectra Image/Spectra Systems **3077**
Model D-160: system-optimized videodisc player.
Circle (1019)

TEAC **5577**
Auto-Turn LV220P: laser videodisc player; plays both sides of videodisc without turning the disc over; use as computer peripheral or one hour of video with 2-channel audio; 108,000 still frames; RS-232C port; compatible with all previous LV-series videodisc players, recorders.
Circle (1051)

Toko America **7100**
Model VT-500E: HDTV frame store.
Circle (1081)

United Media **5544**
UMI-500: A/B roll, time code videotape editing system; full feature, incorporates audio/video dissolve unit with independent dissolve rate for audio and video; 500-event EDL, 3½″ MS-DOS drive; time code generator; expandable for A/B/C roll; list management with ripple; on-line or off-line editing.
Circle (1097)

Videomagnetics **5438**
Refurbishing of VPR I″ heads: AST, R/P, flying erase, sync, dummy and non-sync.
Circle (1123)

Videomedia **3959**
V-MAX I: 2-machine cuts editor; rack-mountable keyboard control; 500-event memory, printer port, GPSI interface; 2-channel video dissolve, stereo AFV mixer; distributed intelligence; ADR, SloMo.
V-MAX II: 3-machine A/B roll edit controller; upgrade of V-MAX I with three VSIO-M distributed intelligence interface modules for serial control VTRs; like V-MAX I includes animation control.
V-MAX III: upgrade of V-MAX II with A/B roll software and full control of external switcher; multi-level transitions, keys, 16 GPSI contacts.
PCE option: multifunction option for control, database archiving of settings for external machines in post-production process, including switchers, titling and graphics generators.
Circle (1124)

V3: Film, cine

- Video-for-film equipment
- Telecine systems
- Film-tape transfer
- Film editing systems

Apollo Audio Visual **7535**
SV-7000: 35mm slide-to-video transfer system.
AY-4000A, AY-5000A: video transfer units.
Circle (554)

Arriflex **4165**
Zeiss prime lenses: 10-100mm, 12mm, 40mm, 60mm Macro, 300/600mm focal lengths.
ARRI video assist: flicker free system.
ARRI video door: pivoting unit for 35-3 film camera.
ARRI Grip: film and video grip equipment, accessories.
Circle (559)

BTS **4119**
Film-to-tape transfer 4:2:2 digital system.
FRP-60 upgrades: dual master mode; auto insert; master, black sensitivity; PC event listing; interfaces to digital video recorders.
Circle (619)

Cinema Products **3758**
CP-16R update: electronic 30FPS conversion for existing cameras; electronic crystal 30FPS via toggle switch on panel.
Showscan CP-65: high-speed, variable frame rate 65mm camera; for Showscan process and 65mm cinematography features, matte, projection work.
Cinevid CCD: video-assist unit for CP-16R camera.
CP Keycode Reader: for Rank Cintel telecine; reads Kodak KeyCode to automate transfer of film frame ID information to video tape; essential for conforming video edits back to film.
Circle (644)

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Geocam **7003**
ARRI/DOOR: adapter allows mounting of Geocam 4/4.2 matte box onto Arriflex bridge plate rods and 16SR camera.
Circle (764)

Marconi Communications Systems **4338**
B3410: digital line array telecine system.
Circle (860)

Nytone Electronics **5479**
New Vision System 1000: combined digital color analyzer, video production unit; analyze 35mm-8×10 film formats, VHS editing; effects, color correction; 6000-frame memory.
Circle (912)

Rangertone Research **3762**
Model 109: high-speed, film dual-audio recorder/reproducer.
Projector: studio projection system, high-speed transport for 16mm, 35mm; carbo light source.
Circle (963)

Steenbeck **3877**
ST-701: 35mm flatbed editing table, beamsplitter allows transfer from film to video without flicker.
ST-721: 35mm film flatbed editing table.
ST-660IV: 35mm, 16mm MAG editing table with videocassette player to synchronize.
Circle (1028)

Tamron Industries **3777**
Fotovix Slide-Feeder L: provides continuous feeding of slides to Fotovix processors; uses standard LKM or Kinderman type 35mm magazines.
Fotovix II-X, Fotovix III: film/video processors allows viewing of negative or positive film images to video; *III* for 35mm; *II-X* for 35mm, 2¼", and 8×11 formats, including prints.
Circle (1044)

V4: Batteries, lighting

- Batteries, packs, belts
- Chargers, analyzers
- Lighting instruments
- Lamps, lighting accessories

Alexander Batteries **3914**
Charger/analyzer: ability to select charge or analyze mode; display shows battery voltage, capacity; printer option for hardcopy of battery voltage, capacity, date.
7700-12 battery: replaces Anton/Bauer ride-behind, upgraded to 4.5Ah.
BPIA-11 battery: increased capacity over BPI-11; 1.8Ah with 11 cells for longer use between recharges.
Circle (525)

Anton-Bauer **5219**
Portable power systems.
Circle (551)

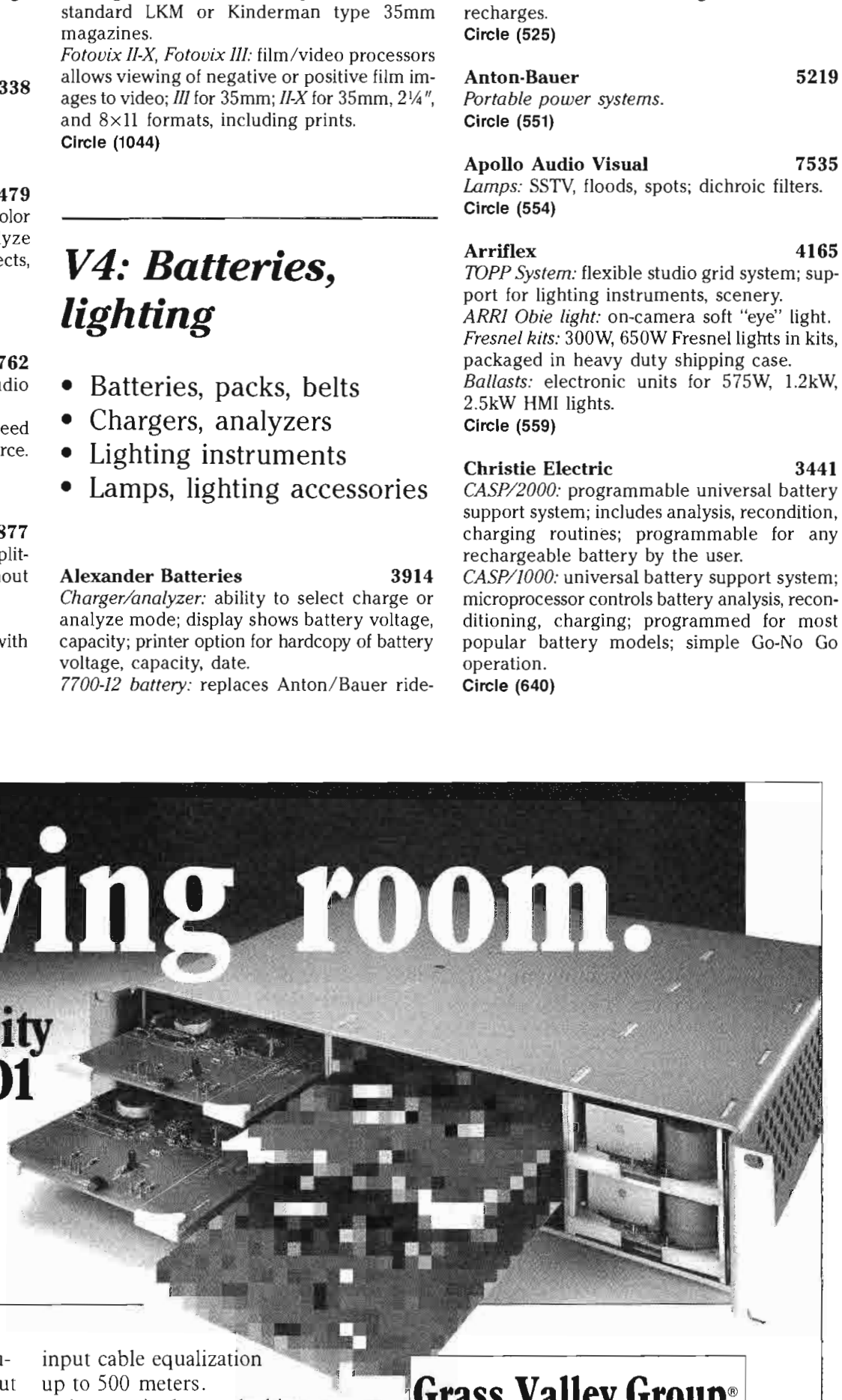
Apollo Audio Visual **7535**
Lamps: SSTV, floods, spots; dichroic filters.
Circle (554)

Arriflex **4165**
TOPP System: flexible studio grid system; support for lighting instruments, scenery.
ARRI Obie light: on-camera soft "eye" light.
Fresnel kits: 300W, 650W Fresnel lights in kits, packaged in heavy duty shipping case.
Ballasts: electronic units for 575W, 1.2kW, 2.5kW HMI lights.
Circle (559)

Christie Electric **3441**
CASP/2000: programmable universal battery support system; includes analysis, recondition, charging routines; programmable for any rechargeable battery by the user.
CASP/1000: universal battery support system; microprocessor controls battery analysis, reconditioning, charging; programmed for most popular battery models; simple Go-No Go operation.
Circle (640)

Growing room.

Flexible capacity to meet your D1 distribution needs.



Our Digital Component Distribution Amplifier lets you grow without taking up extra rack space. The DDA-101 is a 1 input by 4 output module that lives in a 2RU frame. Not enough? Just pop in another module ...same frame, same power supply. Up to a maximum of 4 inputs by 16 outputs.

Long cable run? The DDA-101 can handle it with standard automatic input cable equalization up to 500 meters.

Automatic data reclocking, a full 10 bit data path, and a valid-video LED presence indicator...standard.

So if you're buying now with future expansion in mind, the DDA-101 will give you that growing room and save you money.

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Cine 60 **4019**
B/P 234: supplies 12V, 13.2V, 14.4V simultaneously or selectively; three 5-pin XLR connectors, one for each voltage; in standard and fast-charge configurations for battery belts, packs 4-14Ah.
Circle (642)

Cinemills **3181**
Pargel: 10×10″ pre-cut sheets of gel; fit all standard Par light gel frames; full spectrum of colors available.
Circle (645)

Comprehensive Video Supply **5548**
DLK-999: demo lighting kit.
Circle (661)

Energex Systems **(n.a.)**
XCP13, XCP14: 13.2V, 14.4V 4Ah replacement cell pack for camera-mounted batteries; 3-wire, multipin mount; no soldering required; 1-hour fast-charge cells.
Circle (729)

FGV Panther **3838**
FLIP 575: HMI lighting fixture, flicker-free operation without ballast.
*STIB 575:*HMI Fresnel fixture, flicker-free operation without ballast.
Circle (742)

Frezzolini Electronics **3916**
Frezzi Portable Power Case: all of the portable power products packed into a water-proof, rugged case to run an ENG/EFP camera system.
MBI0/90: 12-channel multicharger/balancer for BP-90 batteries; ac, dc input models.
FBP-14/3 Frezzi-Max: high energy density On-Board NiCad pack.
SC-2 battery management system: 8-channel, two-at-a-time fast charge, multiple battery charger; for ac, dc inputs; 2-wire sensing of any NiCad; charges, revitalizes sequentially.
Circle (753)

Leonetti Company **A157**
SunRay PAR HMI: 200W, 575W, 1200W; magnetic or solid-state Ignitors and Arc Quick Start; color temperature correction control; 180° lens rotation; compact footprint.
Sunray 270W Sungun: handheld.
SunRay 18K, 12K Fresnels: HMI lighting; lightweight instruments; long lamp life; magnetic ballast with Arc Quick Start; globe shock mount; improved reflector design for higher light output.
SunRay Ignitors: solid-state; 200W to 24kW for HMI lighting; uses 10× less current; compatible with all major models of professional HMI lights.
SunRay Ballasts: solid-state, flicker-free, electronic; 200W to 12kW; Art Quick Start and electronic ignitors; flicker-free at any film speed.
Circle (841)

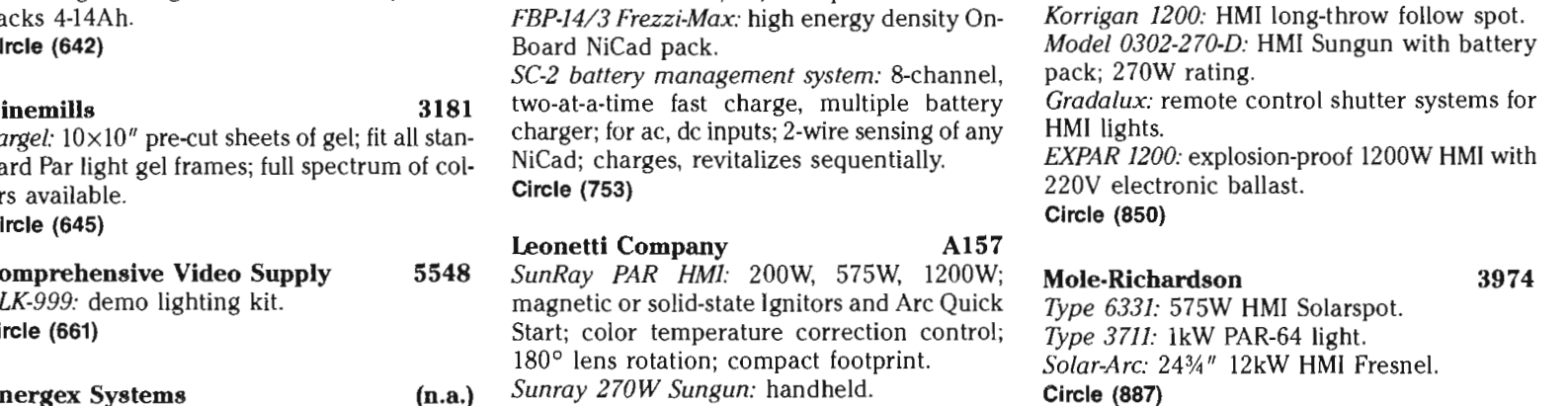
LTM **5358**
Hobbit 1200: HMI short-throw follow spot.
Location lighting: Pepper Soft paks.
Model CGV: high-speed CINEPAR 1200 with 220V electronic ballast.
AQUAPAR 1200: underwater HMI 1200W with 220V electronic ballast.
Korrigan 1200: HMI long-throw follow spot.
Model 0302-270-D: HMI Sungun with battery pack; 270W rating.
Gradalux: remote control shutter systems for HMI lights.
EXPAR 1200: explosion-proof 1200W HMI with 220V electronic ballast.
Circle (850)

Mole-Richardson **3974**
Type 6331: 575W HMI Solarspot.
Type 3711: 1kW PAR-64 light.
Solar-Arc: 24¾″ 12kW HMI Fresnel.
Circle (887)

Musco Mobile Lighting **OUTD**
LIGHT BAR: 4-fixture unit on pre-wired, pre-assembled bar, versatile for sports arenas, stage, conventions, concerts, parades, news events or other large area lighting needs.
Circle (892)

Paco Electronics USA **3920**
NiCad batteries: OEM replacements for DP-10, DP-11, DP-1240, DP-1340S.
KD-120AII charger: includes dememorizer, discharge-before-charge routine, thermal protector circuit.
Circle (926)

Who said you can't have D1 and D2 in the same box?



Grass Valley Group already did it! Digital Component and Digital Composite Distribution Amplifiers. The economical solution to having the best of both worlds...in the same box.

The modular construction of the DDA allows you to build to a maximum capacity configuration of 4 inputs by 16 outputs. Both DDA-101 and DDA-202 will handle a full ten bit data path. Each DA has 4 independent output drivers for added robustness. Cable equalization up to 500 meters, automatic data reclocking, and a valid-video LED presence indicator. All standard!

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Philips Lighting **7740**
MSR 400, 700, 1200: HMI discharge lamps; single-ended, 5,600°K; rated 400W, 700W and 1,200W.
MSR 1200/HR, 2500/HR: single-ended, medium-source, rare-earth discharge HMI lamps; 1,200W, 2,500W ratings; hot-restrike versions; 5,600°K.
Circle (938)

Sachtler **2437**
Reporter 650H 600-1000W tungsten lights; hand-held or stand-mount; 220- or 240Vac lamp.
Reporter 270D: handheld or tripod-mount HMI open-face lights for studio or on-location.
Reporter 100H: 12Vdc tungsten light for CCD camera use or as eye light.
Reporter 250H: 30Vdc tungsten light for film, video camera use.
Production 575D: lightweight, compact for 2-sided HMI burners; oval shape reduces volume, weight.
Production 1200D: open-faced HMI flood; wide focus range greater than 1:5.
Reporter 125D: compact HMI Daylight fixture for news team; flicker free; ac/dc.
Reporter 300H: ac-powered tungsten light; available in set case with three lamps, tripod; accessories.
Lighting accessories: ballast units, batteries, devices for light modeling, instrument mounting.
Circle (985)

Times Square Lighting **3386**
Tratto F-1200: 1.2kW Fresnel instrument.
Acuto F-2000: 2kW Fresnel.
Tratto 22/40: 1kW ellipsoidal spotlight.
Acuto 9/15: 2kW ellipsoidal spotlight.
Talento 575: follow spot.
Circle (1078)

Union Connector **4582**
Unitrol Dimtrak: 6-foot wireway with integral Unitrol dimmers; Unistrut for spotlight mounting in various environments; control signals transmitted via the power line.
Dimmer bypass contactor: manual transfer switch for lighting control; bypasses dimmer console, for maintenance, stage manager or others not at the dimmer console.
HMI remote control contactors: modular unit for remote control of HMI lights; silent mercury contactors and control station.
Circle (1095)

V5: Digital effects, graphics, titling

- Character generators
- Effects, graphics systems
- Prompting systems
- Video production systems
- Weather graphics systems

Accu-Weather **7416**
High Resolution: weather graphics with RADARPLUS and NEWRAD graphics, showing precipitation types and intensity.
Amiga Graphics: advanced version of weather display system.
Lightning Data: ready-for-air graphics through *Accu-Data* weather database.
European/World forecast model.
Circle (504)

A.C.E. **7935**
DMG-1000 Pierrot: tablet, stylus matte drawing system.
Circle (506)

Advanced Designs **5334**
DOPRAD II: deltra-frame animation with V2.01 software enhancements.
WDDS-1000: Weather Data Display System; RRWDS, lightning, graphics paint.
Circle (514)

Alden Electronics **5460**
Model C2000R: remote color weather radar display.
Circle (524)

ALTA Group **4526**
CYGNUS 5.5: wideband TBC/synchronizer; 5.5MHz bandwidth, 450-line resolution; Y/C-3.58 and composite; picture freeze, colorize, strobe; 4×1 video/audio routing switcher.
PICTORIS: infinite video compressor; variable crop, position, effects; compress image with color borders over live video; composite, S-VHS with 5.5MHz bandwidth; dissolves, zooms, inverts; mosaic.
Circle (534)

Ampex Audio-Video Systems **4501**
ALEX: anti-aliased character generator; 256 levels of transparency; manipulation, animation of characters, symbols; additional typefaces from library of 1,500; 16.7 million colors.
Circle (541)

Beaveronics **1726**
ESE ES-CG89: character generator.
Circle (591)

Broadcast Video Systems BVS **3426**
COX2036: component title assembler, by Cox Associates.
SA-103: 4-channel safe-area generator; programmable boxes, countdown clock, slate generator.
TDI-200: time, date, user-programmable ID generator; 2-row, 28-character display; nonvolatile memory.
Circle (614)

BTS **4119**
Alias/2 animation: 3-D computer graphics with interactive software on Silicon Graphics workstation; interface to *Pixelerator* rendering engine.
Vidifex-3D: font/logo compose feature; extrudes, rotates captured image around any axis in 3-D space; tiling onto characters for display, real-time animation; 2-channel videographic workstation.
Vidifont Bitstream Foundry Fonts: 50 typeface masters, resized with font/logo compose feature.
LAN option: RS-232/-422 interfaces to NewStar, BASYS, SISCOM and other newsroom computers.
PIX recorder: machine control system for recording Alias animation files; upgrades to full Pixelerator render engine; digital video I/O.
Vidifont Standard fonts: anti-aliased with light-trapping techniques for smooth edges; 400 fonts in different sizes edge, border treatments.
Circle (619)

CAL/Cox Associates **3426**
COX2036: component video title assembler.
Circle (622)

Chyron **4526**
AU/250: videographic system by Aurora; full-color paint, animation, 3-D capabilities; 80386 processor, SCSI peripheral interface.
Scribe Jr.: compact version of Scribe titling/graphics equipment; 5¼" chassis, keyboard with 2Mbyte 3.5" disc drive; multicolored characters, logos, 32-colors on screen.
SuperScribe: print-quality, anti-aliased resolution; on-line font conversion allows interactive editing of character, graphic attributes; multitasking; logo compose; advanced font utilities.
ACG system: combines character generator, graphics, animation and digital effects into single unit with open-end architecture; real-time operation; Bitstream fonts; NTSC/PAL; linear keyer/fader.
Circle (641)

Circuit Studios **3963**
SuperComputer Velocity System: AT&T Pixel Machine Graphics; with Sun 3/260 workstation; real-time texture mapping, multiple lighting, smooth shading; ray-tracing with HDTV quality.
Velocity 3-D: modeling, video animation; turnkey graphics workstation; 80386-based system.
Circle (648)

ColorGraphics Systems **4526**
LiveLine 5 features: 2-D object-based real-time animation; expanded image transition effects with Digital Video Mixing; Enterprise Electronics, R-Scan interfaces; request list editor.
DP 4:2:2 enhancements: graphics, animation; 3-D modeling, control of object attributes, light, camera movement; 2-D Morph the Animator; VTR/DTR control; History macro; multiplane motion; rotoscoping.
da Vinci upgrades: expanded vector processing with geographic isolation; 16, 32, 64 vector secondary processing for hue, saturation, gray values; tape-to-tape color correction; editing control.
ArtStar 3-D enhancements: true 3-D cut/paste; true perspective; blend brush; dynamic text rotation, curves; luminance-, chrominance--based stenciling, mattes; RGB Phong shading model.
Circle (655)

Comprehensive Video Supply **5548**
PC-2/S-VHS: S-VHS compatible character generator.
Circle (661)

Computer Prompting **3612**
Model CPC-1000: teleprompter software for use on IBM PC and compatible laptop computers.
Circle (664)

Cubicomp **703**
Autopaint: graphics software that makes any frame look handpainted.
Circle (680)

Digital Arts **7633**
DGS system: PC-based software for 3-D modeling, animation and rendering.
Circle (696)

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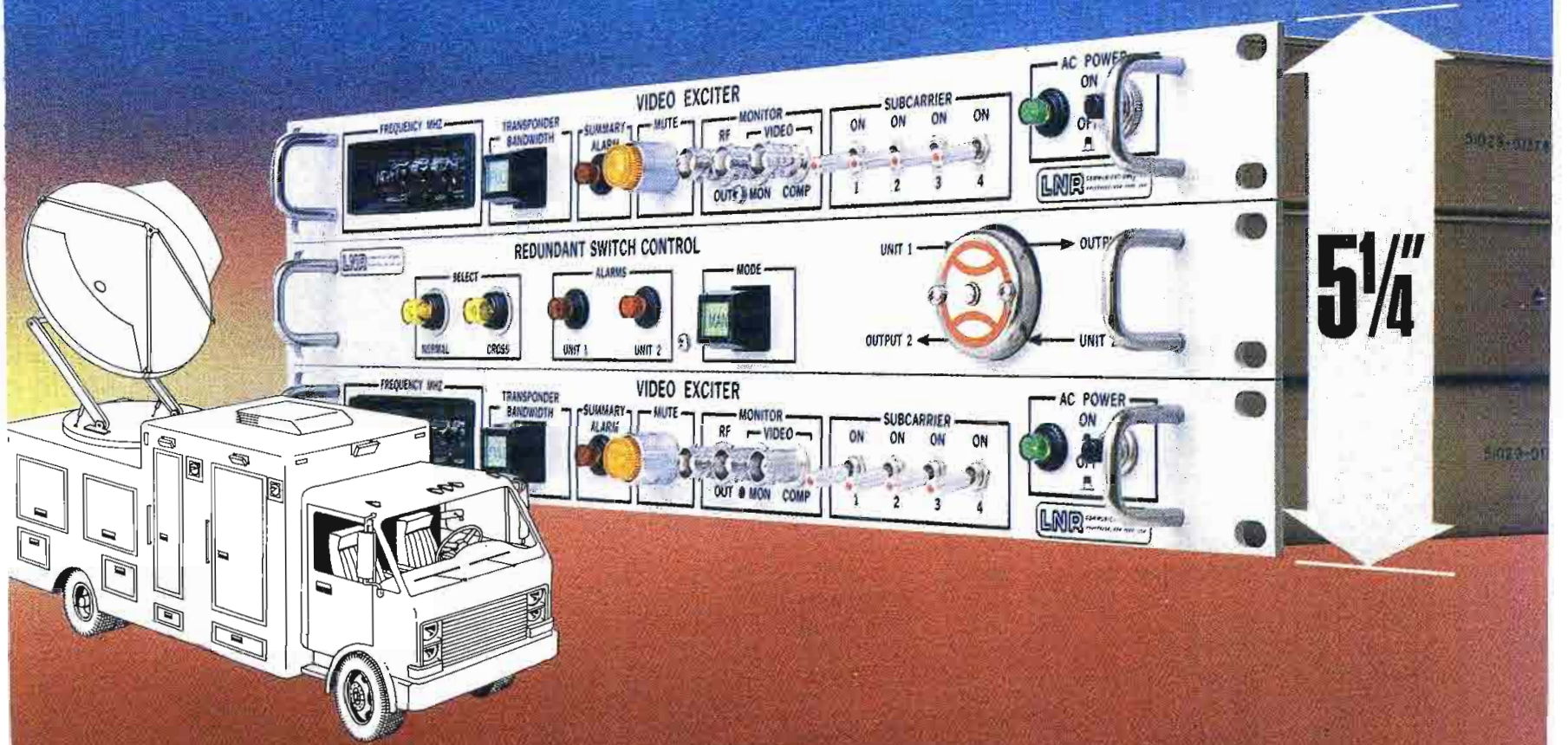
TWO for the Road.



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That's right! LNR's new Video Exciter is only 1¾" high. Together with an automatic redundancy switch and a backup Video Exciter, the entire package fits into a 5½" slot. So you can eliminate worry about down time—even uplink two simultaneous video signals if you wish.

LNR hasn't sacrificed quality in bringing you a compact video exciter. The model LVE-14 uses a highly integrated Ku-Band RF section, together with proven, reliable video circuitry to provide RS250B performance. And, for the first time, you can go from full to half transponder operation at the press of a button.

Here are a few of the special features of the new LVE-14 Video Exciter: • Reduced size and weight • Up to 4 synthesized audio subcarriers • Full or half transponder operation • High power output: 0 dBm standard, +6 dBm optional • Compatibility with all video standards and scrambling techniques • Optional PTT and MCPC voice channels • 6 GHz version also available.

A new low package price is now available. For information on the LVE-14 or other new LNR slimline products for compact mobile applications, call LNR marketing today, or write for detailed literature.

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Digital F/X **4326**
Digital composing studio: 4×4 digital video system integrating real-time compositing, keyframe editing, real-time effects, advanced paint capabilities.
Circle (699)

Digital Services/DSC **4538**
Paragon: digital video effects system; proprietary video processing techniques for improved level of performance.
Circle (701)

Dubner Computer Systems **4130**
GF-50: Graphics Factory system with 3-D.
Model 30-K: dual-channel, dual-user character generator system.
Model 20-KW: animated color weather display system.
Circle (707)

Echolab **1770**
Digital Effects unit: provides zooms, keys, page turns; operates as stand-alone or option to ECHOlab DV-5 video production switcher.
Circle (715)

Enterprise Electronics **3870**
Complete radar packages: narrow beamwidth antenna, pedestal with radome, transmitter-receiver, servo amplifier and radar control/display console with RGB monitor, NTSC colorizer; Doppler subsystem upgrade for WSR-7rC, WR-100-2/77 EEC radars; 250kW peak power, six calibrated rainfall rates, nine Doppler velocity levels; remote, colocated systems, high resolution graphics.
Circle (731)

ESD/Environmental Satellite Data **5461**
Advanced WeatherGraphix: OS/2, 80386-based, weather image, data and graphics processing system, includes advanced art, animation and looping.
True View: dimensional perspective weather imagery.
EasyData 9600: weather data and imagery dial-up service; operates at 9600 baud.
EasyData Imagery: phone availability of TrueView, Full Spectrum and High Resolution weather images.
Circle (733)

ESE **3907**
CG-89: color digital effects character generator.
Circle (734)

Field Engineering **3084**
SAST-1084: SMPTE portable safe-action, safe-title generator.
Circle (745)

FOR-A **5151**
VTW-120: video typewriter; economically priced, color titler.
MF-2000: digital effects system, includes upgrade to dual channel memory.
MF-1000: digital effects system; includes TBC and dual channel capability.
VTW-800: titling unit with effects.
VTW-240S: character generator for S-VHS video.
Circle (749)

Greenberg Electronic Teleprompting7543
Telescroll PC: MS-DOS PC-based teleprompter; enhanced color graphics, full word processing editor; multiple fonts; adjustable margins, text location.
LG-300: camera package for film, tape use.
Circle (772)

Grunder & Associates **4177**
MS-831, MS-851: new generation of 8-bit 4:2:2 digital effects systems; by CEL Electronics.
Circle (773)

Harris Video Systems **1305**
Harris VWS 1000: video graphics workstation.
Software: 2-D and 3-D software options for Harris VWS systems.
Circle (777)

Kavouras **5721**
RADAC 2100: color weather radar display system; includes NEXRAD compatibility, high resolution backgrounds.
Triton A/P: weather, production graphics system.
Composite regional radar summaries.
4-Dimensional weather satellite imagery.
Circle (821)

Knox Video Products **3849**
IMAGR I: integrated MAP graphics system; combines high resolution character generator with complex dynamic motion, picture capture, full paint, 16 million colors with 4ns resolution.
Circle (830)

Laird Telemedia **4874**
Character generator: features font auto-sizing, anti-aliasing; pixel-by-pixel colorizing.
Circle (831)

Leitch Video **3568**
Still File 3100NW option: networking for still store system; enhanced software; GPI interface; protocol serial drivers, enhanced effects; second simultaneous user.
Circle (839)

Listec Video **3523**
A-5000-PC: prompter display running live on personal computer.
A-5000-B: live, on-line prompter display for BASYS newsroom systems; remote control box; prompts from a terminal; continuous output to EEG encoder for closed captioning.
Circle (845)

Logica **3926**
Gallery PhotoCall: single-user, stills and graphics library system.
Circle (846)

Magni Systems **3173**
Model 4004S: genlocking video graphics encoder; enhanced to include separate Y/C channel outputs for S-VHS compatibility.
Circle (857)

Microtime **4126**
Genesis ACT 3: 3-D digital effects; low-cost system with simultaneous rotation, perspective; composite, component inputs/outputs; available in NTSC, PAL, PAL-M.
RP-1 3-D Dual: dual-channel video effects; features compositor cards for linear digital mixing of two channels with assignable priority, variable transparency; optional Post-Effects framestore.
IP-25 ImagePlus Graphics: V5.1 operates on 25MHz clock PC; operates with TARGA and VISTA frame buffers; auto-page effects; 2-D reflectance; generated shadows; grid transformations; 3-D graphs.
Circle (877)

Midwest Communications **4568**
DMG-1000 Pierrot: A.C.E tablet, stylus matte drawing system.
Circle (879)

Norpak **3783**
TTX650: data receiver for decoding of data broadcast with TDS3 data broadcast system; serial, parallel interfaces for PCs, printers; non-volatile memory, RGB, composite outputs, keypad; NABTS data.
Circle (908)

Pansophic Systems **7917**
StudioWorks V3.1: produces 35mm slides, video animation, hard copy and color prepress; supports TrueVision ATVista graphics with TI 34010 coprocessor; includes ScanWork interface for color, tone, resolution, gamma correction; Bezier, B-spline options.
Circle (929)

PESA Electronica **5712**
CG4700 series: upgrades for *CG4711*, additional fonts, 2nd disk drive, remote keyboard; for *CG4722*, off-line subtitle control from IBM PC.
Circle (935)

Pinnacle Systems **801**
3000R: stand-alone 3-D rendering system; receives models, textures, animation scripts on digital network; when completed, frames transferred back to 3000E design workstation for output to tape.
2100 series: production video workstation; digital adaptive comb filter decoder; H/V digital filtering; improved control system.
PRIZM 601: Digital Optical Workstation; digital effects with perspective, rotation, warp, curvilinear effects; 1/32 sub-pixel motion; 15-point filtering; meets CCIR 601 spec.
2120 w/PRIZM: broadcast still-store with digital effects; for stills and live images.
Circle (941)

Quanta **4526**
QVP-3000/3300: full-featured paint and 3-D/animation system.
QCG 500 with QVP-2502: titling system with paint and 2-D.
Delta I: anti-aliased, high-resolution text/graphics generator; production models.
Orion: production models; anti-aliased, high resolution titling generator.
QCG38: real-time titling system.
Circle (952)

Quantel **5312**
Harry E-Motion: latest version to enhance Harry Suite with full VTR control.
Cypher Sprint: digital character generator; multichannel capability; instant graphics, text; compose, generate captions; displays images from Paint Box; compatible with Cypher Sports.
Harry Encore HUD: combines Harry and Encore HeadUp Display from single menu control; editing and effects composition operated from one control station; all features of both devices are included.
Circle (953)

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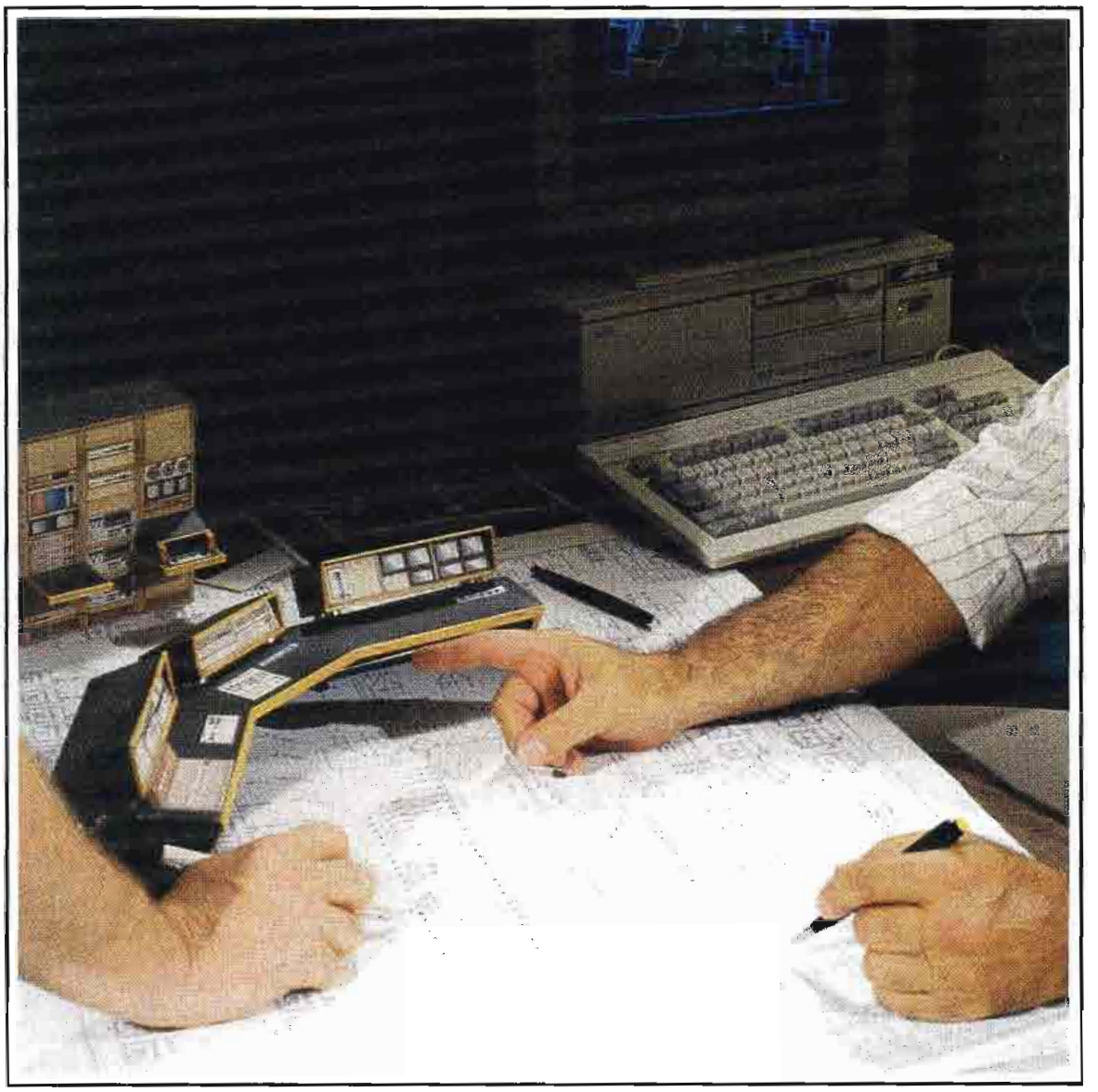
WHETHER IT'S NEW CONSTRUCTION OR RENOVATION . . .



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Rank Cintel **3926**
Cloud File: weather satellite receiving station; receives PDUS digital, WEFAX analog formats.
Circle (964)

Sigma Electronics **3168**
SAG-100A: safe area generator; stand-alone unit.
IGM-2.0: integrated graphics module.
Circle (1005)

Telemet **5138**
Character generator: low-cost character generator with optional paint module; 60-page internal storage; digital matrix display effects; GPI port for external control.
Circle (1057)

Telescript **5335**
IBM/compatibles prompter: prompting system software with instant reformatting of four pushbutton fonts, global search/replace, 100+ individual scripts; direct ASCII loads, smooth scroll; full print menus, international character set, 35mm slide change, 10 hot keys.
Circle (1060)

Toko America **7100**
A/D convertor: high-speed module; applications include computer graphics, animation; weather systems; 3-D animation systems; composite, component, RGBx, monochrome, non-standard video inputs.
Circle (1081)

True Vision **7627**
NuVista: graphics products for Macintosh computers.
Circle (1090)

WSI **3774**
NOWrad: weather radar service for TV with ground clutter suppression, simultaneous multi-image compositing; for 2km, high resolution single-site, regional images and 8km national composites.
Circle (1146)

V6: Switchers

- Master control
- Production

Abekas Video Systems **2436**
A84: digital post production video switcher.
Circle (502)

Ampex Audio-Video Systems **4501**
AVC Vista series: expanded display, additional functions; extended memory system; off-load effects to MS-DOS 3.5″ diskettes.
AVC Vista component analog switcher.
AVC production switchers: 24-register Panel STAR Memory upgrade kit; faster operation and additional features.
AVC Century enhancements: key matrix for switching large numbers of key signals, auto or manual; frame accurate transitions on all AVC Century keyers; Bus Keyer with border modify, key invert.
Circle (541)

Broadcast Video Systems BVS **3426**
COX 2037-1: component video switching system.
Circle (614)

CAL/Cox Associates **3426**
Model 2037/1: component video switching system.
Circle (622)

Comprehensive Video Supply **5548**
Primebridge Micro-series: video effects; keyer, wiper; video mixer, switcher; distribution amplifiers; individually housed in small boxes; for remote, studio applications.
Circle (661)

Crosspoint Latch **3977**
6129BHK: 16-input production switcher; 2 mix/effects systems; fully computerized; 800-event memory.
6119YC: 5-input S-VHS or composite switcher; 2 keying levels, auto transitions, integral genlock sync generator.
8200X: updated version of 8200 switcher with dual TBCs; improved stability, increased solution.
Circle (678)

Dubner Computer Systems **4130**
MCA-14: TV master control.
Circle (707)

Echolab **1770**
DV-4: 6-input video production switcher.
Circle (715)

Grass Valley Group **4130**
Model 200CV: all component video switcher with 2ME units.
Model 100 HDTV: wideband production switcher; fiber optic links to outside world (at Tropicana exhibit).
Circle (769)

Intergroup Video Systems **3526**
Model 9524: 24-input video production switcher; 2-ME with triple level effects in each; 4 linear keyers; effects memory of 250 events; 42 patterns.
Circle (805)

JVC **4168**
KM-2500: video effects generator; wide selection of wipe, transition, color borders; GPI control, auto transitions; 8-input with title, chroma, DSK keys; switches between program, preset buses.
Circle (816)

Key Video **5102**
VXP-4×1: video switcher in a personal computer.
Circle (824)

Numark **7043**
VAM 2000: audio/video mixer.
Circle (1151)

Omicron Video **2515**
Model 546: IGA (independently input gain adjustable) video switcher.
Circle (917)

Quality Video Supply **3383**
Image Lab video switcher.
Circle (951)

Ross Video **4977**
RVS-416: production switcher with multi-keyer; 4 primary levels of keys; multi-keyer offers 8 additional keys, each with a mask generator.
Downstream Multi-KEYER: optional unit for 416 production switcher; places eight keys from six sources on screen simultaneously; all keys are linear with independent border controls.
Circle (982)

Thomson Video Equipment
TTV-5645: analog component video mixer with digital (4:2:2) processing.
TTV-5650: serial component, digital video mixer (4:2:2).
TTV-5655: parallel component, digital video mixer (4:2:2).
Circle (1074)

V7: Processing

- Compositors, keyers
- Signal correctors
- Standard, format converters
- Sync generators, VBI IDs
- TBC/frame synchronizers

ACCOM **917**
DIE-125: noise, film-grain reduction system; aperture compensation; 15dB of noise reduction possible.
Circle (503)

A.C.E. **7935**
HARLEQUIN: automated color corrector; memory storage for 128 grades.
Model CVC: computer video scan conversion unit; raster outputs to 525-line NTSC.
Circle (506)

AF Associates **3719**
AVS ISIS: television standards converter system; 3-field, 2-line system; upgradable to 4-field, 2-line.
Circle (518)

Ampex Audio-Video Systems **4501**
Digital translators: converts between composite digital and CCIR-601 4:2:2 component digital signals for D-1, D-2 conversions, or 4:2:2 telecine output to D-2 videotape.
Circle (541)

AVS div/AVESCO **3719**
ISIS: 3-field, 2-line standards converter; upgrades to 4-field, 2-line system for broadcast bandwidth applications.
Circle (582)

Brabury/Porta-Pattern **5177**
T567/9 encoders: NTSC, PAL systems; switch between dual inputs of RGB, Y/R-Y/B-Y, Beta components; integral sync generator with genlock; S-VHS (Y/C) output capable.
Circle (605)

Broadcast Video Systems BVS **3426**
DE-500: NTSC decoder, YC, Y/R-Y/B-Y, RGB outputs.
MasterKey II: downstream linear keyer, compsite and RGB inputs.
Multi-standard decoder: NTSC, PAL, SECAM to RGB by Video & Interactive Products
EN-300: low-cost NTSC encoder.
EN-350: multiformat encoder; RGB to Y/R-Y/B-Y, YC and NTSC.

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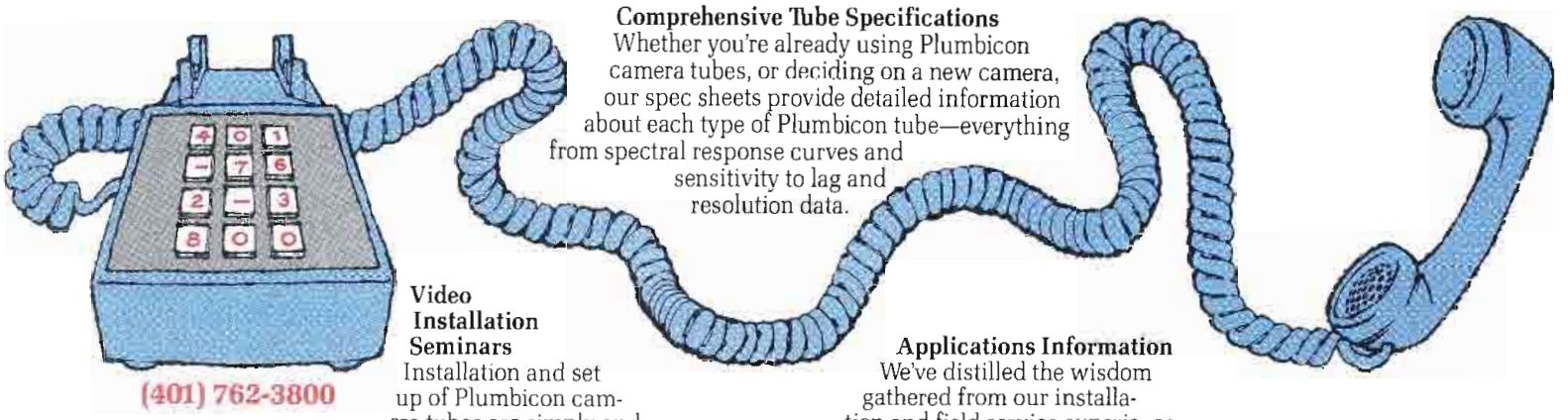

Comprehensive Tube Specifications
Whether you're already using Plumbicon camera tubes, or deciding on a new camera, our spec sheets provide detailed information about each type of Plumbicon tube—everything from spectral response curves and sensitivity to lag and resolution data.

Video Installation Seminars
Installation and set up of Plumbicon camera tubes are simply and graphically explained in our series of Video Seminars for training and quick review.

Applications Information
We've distilled the wisdom gathered from our installation and field service experience into a series of concise "Optical Perceptions" written by and for TV professionals.

ONE TELEPHONE NUMBER GIVES YOU ALL THIS INFORMATION ABOUT AMPEREX PLUMBICON® TV CAMERA TUBES.

When you specify Amperex Plumbicon TV Camera Tubes: you're never more than a phone call away from competent technical assistance, 24 hours a day, 365 days a year. So you never have to worry about winding up "in the dark"—faced with a technical riddle you can't solve.

Of course, we have a generous warranty, (company policy and our own engineers insist we interpret it in the customer's favor!) But more important, we're here when you need us. On the phone to talk you through minor technical problems. On a plane if your problem is more than just routine. At your desk with a print and video library of technical applications, specifications, training and troubleshooting seminars.

Amperex Plumbicon TV Camera Tubes are made in Rhode Island, U.S.A. Delivered to you in twenty-four hours or less.

One telephone number is all you have to remember.

For more information call or write Imaging Products Group, Amperex Electronic Company, Slatersville, Rhode Island 02876. (401) 762-3800. A Division of North American Philips Corporation. Outside the U.S.A. contact: Philips Electronic Components and Materials Division, 5600 MD Eindhoven, The Netherlands.

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EN-450: broadcast NTSC encoder, RGB, YRGB, Y/R-Y/B-Y inputs.
COX2045: RGB component processor.
Circle (614)

BTS **4119**
D SY 7: 4:2:2 synchronizer; variable delay to 1-frame in 10ns steps; selectable 8, 9, 10-bit processing; dynamic rounding.
FNR 7: CCTV field noise reducer.
Circle (619)

CAL/Cox Associates **3426**
Model 2045: component video processing amplifier.
Circle (622)

Central Dynamics **3944**
Stage★1: family of digital encoders, decoders, format translators.
Circle (633)

Colorado Video **3913**
Model 286C: digital color still-frame transceiver brief case; for narrow-band communications links.
Circle (654)

Comprehensive Video Supply **5548**
CCD-35V, CCP-45V: S-VHS color decoder and processor.
Circle (661)

Digital Processing Systems **4568**
DPS-275: multiple format TBC/frame synchronizer; integrated test signal generator; freezes either of 2 fields or any of four fields; strobe, chroma noise reduction and edge enhancement.
Circle (700)

Digital Services/DSC **4538**
Collage: D-2 format compositor; interfaces directly with D-2 VTR for production within digital domain; five video, three key inputs; multichannel compositing of multi-layered effects.
Circle (701)

Faroudja Laboratories **5733**
CTE-2, CFD-N: comb-filter encoder, decoder.
CTC-2: bi-directional video component transcoder unit.
DSC-N: digital scan converter, line doubler; features luminance spectrum expansion.
Circle (739)

FloriCal Systems **5686**
ChroMatte: RGB matte and compositing system; production models.
Circle (748)

FOR-A **5151**
FA-800A: frame synchronizer.
ENC-200: encoder for RGB or Y/Pr/Pb video components.
FA-740S: dual effects TBC; upgrade includes S-VHS interfaces.
Circle (749)

Fortel **5526**
SP150: time base corrector.
CC-3: color correction system.
Interpreter: multiple format transcoding system.
Circle (751)

Grass Valley Group **4130**
SCB 200N: professional sync, color bar generator; genlock with adjustment of outputs for 2 line advance, 1 line delay; maintains correct SC/H phase during adjustment.
DSK 101: down stream keyer.
Circle (769)

Grunder & Associates **4177**
Model P165: 8-bit broadcast, bi-directional television standards converter.
Circle (773)

Harris Video Systems **1305**
Model 642: frame synchronizer.
VW-3: frame synchronizer.
Circle (777)

Hotronic **3771**
AF72: wide bandwidth frame synchronizer.
AF71S: TBC, frame synchronizer, operates sideband in all modes.
AH91: dual-channel TBC with digital effects.
AF71: TBC, frame synchronizer with freeze frame/field.
AE61: time base corrector.
Circle (786)

I•DEN Videotronics **A126**
IVT-12: portable dc-operated timebase corrector for satellite news gathering applications.
IP-10: image path.
IVS10: multi-format transcoder with VHS distribution amplifier.
IVT-9, IVT-9B: timebase correctors for composite and component video.
IVT-9PLUS: inputs/outputs for all formats except 1"; dynamic tracking, dropout compensation.
Circle (809)

Intelvideo **4478**
Model IV-4: advanced NTSC color decoder; digital I/Q demodulation; antialias filters; multiple outputs include R, G, B, Y, C, I, Q, R-Y, B-Y, sync.
Video Flasher: video gate; when triggers, flashes NTSC or PC video on monitor for preselected number (1-8) of fields; simplifies taking photographs of monitor screen.
Model IV-3: enhanced NTSC encoder; extended performance for dynamic enhancement to 18dB of color details based on hue/saturation; digital I/Q modulation; D-2 output option; advanced sync output.
Circle (803)

Laird Telemedia **4874**
Model 1035: keyer fader.
Circle (831)

Leitch Video **3568**
PAL Module: composite and component test signal generator unit for SPG-1510P sync pulse generator.
Circle (839)

Marconi Communications Systems **4338**
B2022: digital PAL frame synchronizer.
B4002: NTSC comb-filter decoder.
Circle (860)

Merlin Engineering **5530**
ME 2001: high definition down-converter; produces low-definition viewing copies of HDTV productions; operates with all current HDTV formats to any output standard; pan, squeeze functions.
ME-9900: 4-field multiple standard broadcast converter; advanced motion processing; supports all standards as well as component, Y-C and RGB.
9800FX4 upgrade: for converters sold since 1984; extends machines to 4-field operation with advanced motion processing.
ME 8800: universal standards converter; supports all component and composite standards; wide range of picture controls, noise reduction and color balance.
Circle (872)

Microtime **4126**
T×3 FIT: format interchange TBC; full frame memory for extended bandwidth VTRs, with production effects.
T×4: low-cost TBC; extended bandwith processing; with optional production effects.
A/B Roll Effects: Composite, U-Matic dub, S-VHS, component inputs; composite, component, S-VHS outputs; framestore memory per channel; extensive range of transitional effects; can use as two TBCs.
Circle (877)

Midwest Communications **4568**
HARLEQUIN: A.C.E. automated color corrector; memory storage for 128 grades.
Model CVC: A.C.E. computer video scan conversion unit; raster outputs to 525-line NTSC.
DPS-275: Digital Processing Systems multiformat TBC/frame synchronizer; integral test signal generator.
Circle (879)

Nova Systems **5472**
NOVA 502: EFP TBC; field portable direct TBC for remote playback of broadcast VCRs.
NOVA 900S Super TBC: S-VHS and heterodyne processing, effects; component outputs.
Nova 710S: wideband TBC, S-VHS, direct and heterodyne processing.
Circle (910)

OKI Electric Industry **3087**
LT 2000: TV standards converter; uses motion-vector technique for precision smooth movement; NTSC, PAL, PAL-M conversions.
Circle (915)

Omicron Video **2515**
Omni-Gen 701, 702: genlocking system for Amiga computer for NTSC, PAL.
Models 416N, 416P: NTSC, PAL sync generators.
Models 451N, 451P: NTSC, PAL video encoders.
Circle (917)

PESA Electronica **5712**
Digital SPG: sync generator with component analog, component digital and PAL analog outputs; full field test patterns.
Video format transcoders: RGB/YUV-to-601 and 601 to YUV/RGB.
Circle (935)

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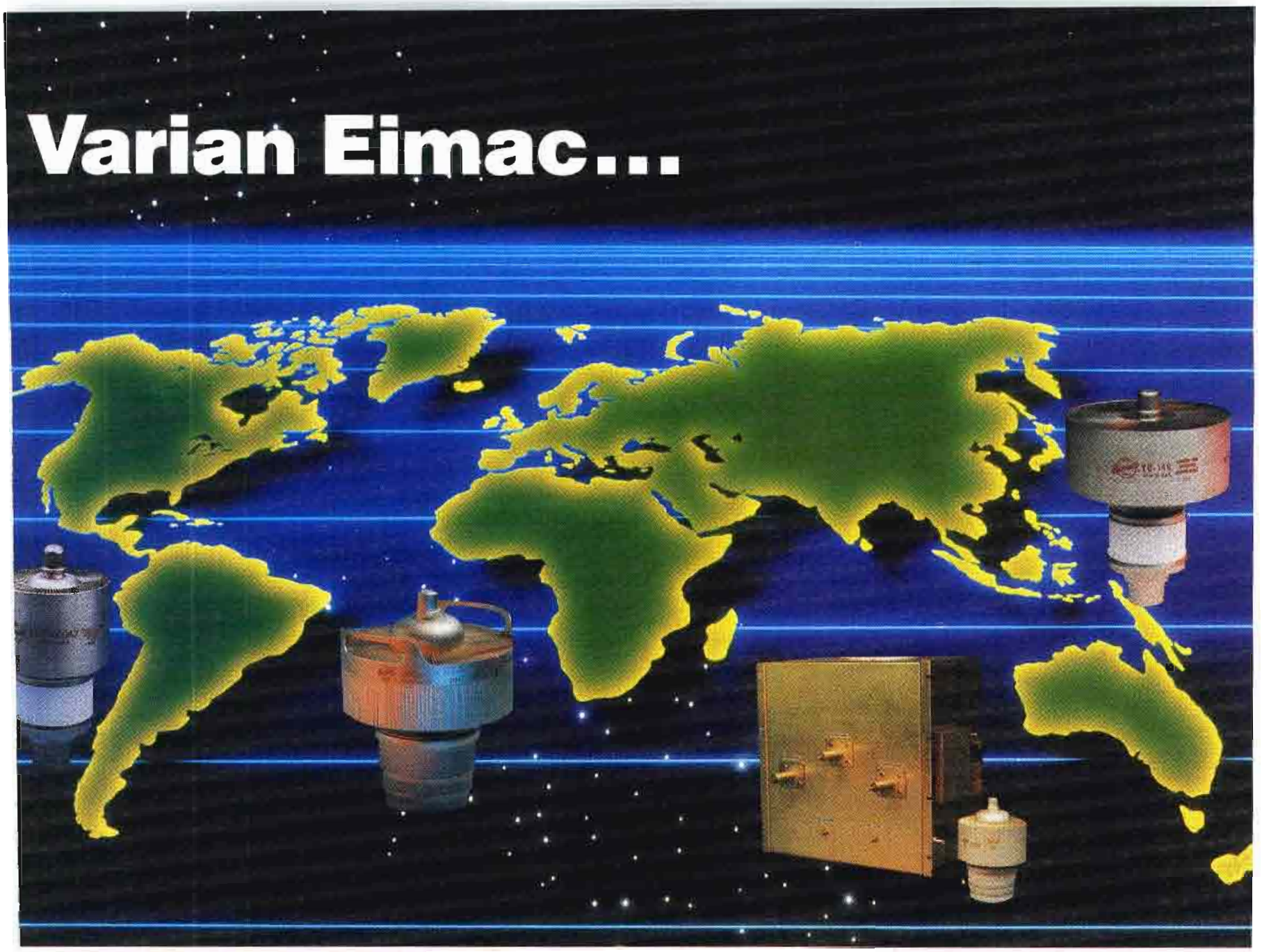

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QSI Systems **3751**
Models 5400, 5500: video processing amplifiers.
VSID-24: video source ID system.
Model 2048: message generator for use with video SID systems.
Circle (950)

Quality Video Supply **3383**
Cramer products: enhancers, correctors, encoders.
Circle (951)

REBO High Definition Studio **TROP**
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Circle (967)

Shook Electronics USA **A—**
48-63: mobile television production trailers.
Circle (1002)

Sierra Video Systems **7904**
S-VHS: Delta series transcoder modules.
Circle (1004)

Sigma Electronics **3168**
TSG-440: test, sync, countdown, ID generator system.
Circle (1005)

Snell & Wilcox **5530**
ME-9900: 4-field multiple standard broadcast converter; *advanced motion processing*; supports all standards as well as component, Y-C and RGB; front panel control of all picture parameters.
9800FX4 upgrade: for converters placed in service since 1984; extends machines to 4-field operation with *advanced motion* processing.
ME 8800: universal standards converter; supports all component and composite standards; wide range of picture controls, noise reduction and color balance.
ME 2001: high definition down-converter; for low-definition viewing copies of HDTV material; for all current HDTV formats to any output standard; pan, squeeze functions; aspect ratio, letterbox.
Circle (1007)

Thomson Video Equipement **5141**
COLORADO: component digital (4:2:2) color corrector.
Circle (1074)

Toko America **7100**
MP-5000: HDTV image processing system.
Circle (1081)

Video International Development **3486**
Standard convertor upgrades: improved noise reduction, motion interpolation software.
Circle (1120)

Videotek **5563**
VDP-8400: 4-field frame-store, synchronizer.
Circle (1125)

Vistek Electronics **5530**
V4002: NTSC to PAL-M TV signal transcoders.
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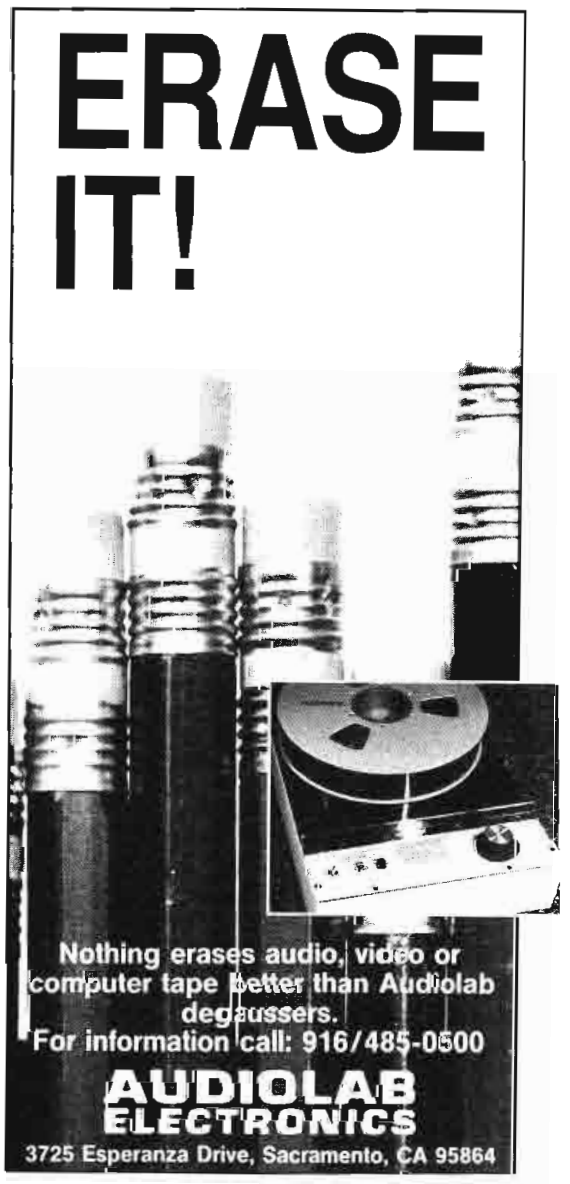
Yamashita Engineering Mfgr/YEM **3712**
CVS-950A, CVS-900: scan converters.
RS1702RB: rubidium dual sync generator.
SG-3000B: sync generator with genlock.
ENC-3000: color encoder with genlock.
Circle (1148)



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V8: Displays

- Video monitors
- Projection systems

Apollo Audio Visual **7535**
CVP-8000: Apollo compact video presenter.
Circle (554)

ASACA ShibaSoku **5533**
CM26A, CM46A: 20″ and 14″ Grade 1 auto setup monitors.
CM65B6: high definition monitor; 26″ CRT using 16:9 aspect ratio.
Circle (561)

Barco Industries **5466**
CVM series: high quality monitors, 14″ and 20″ diagonal screens.
CVS series: high quality broadcast monitors, 14″ and 20″ diagonals; auto-alignment, μP-based control.
Circle (585)

Electrohome Digital Video Systems **5116**
ECP 4000: 3-lens color data graphics, video projection system; for video to CAD; scans from 15kHz to 80kHz; 1280×1024 pixel resolution with maximum focus brightness of 500 lumens.
Circle (724)

Electrosonic Systems **(n.a.)**
PICBLOC: videowall system; an electronic control system presentable on any monitor format in any configuration.
Circle (1150)

Hitachi Denshi **4519**
HDTV displays: large screen systems.
Circle (781)

Information Display Systems **7135**
ESP HDTV projection system.
Circle (795)

JVC **4168**
VM-R140SU: 14″ color monitor; BNC, 8-pin composite inputs; Y/R-Y/B-Y 12-pin M-II input; BNC, 12-pin Betacam input; Y/C S-VHS 7-pin input; RGB analog through BNC; cross-pulse display; 500 line resolution.
Circle (816)

Mitsubishi Electric Sales **7200**
Autoscan: 27″ color monitor.
Color video printer: large format prints.
Circle (883)

Philadelphia Video Lab **2920**
ED Hardcopy: enhanced definition hardcopy; prepares color transparencies, 35mm slides, photographic prints from NTSC videotape source.
Circle (937)

Sony Communications Products **4101**
PVM-5310 system: three 5″ Trinitron monitors; side-by-side mount for mobile field units.
VID-P10: single-CCD camera incorporated in overhead projector system; folds to brief-case package.
BVM-1315: broadcast monitor; RGB response from 100Hz to 10MHz.
VPS-700R: rear screen projector; typically installs in a wall; image viewable through 100° angle; 56¼×41½″ screen with 5.2× gain.
GVM-2000: 20-inch Trinitron monitor for high resolution graphics displays; inputs for 3/4″, 1/2″, ED-Beta, S-VHS, compute RGB from IBM/compatible; multiscan system.
PVM-1340 series: 13 video monitors; *1340, 1341* with 450 TVL resolution with RGB inputs; 640×200 pixel; *1342Q, 1344Q* 600TVL high resolution; RGB inputs; all use 13″ Trinitron tubes.
Circle (1011)

Videotek **5563**
Model RM-8: portable color receiver/monitor; 8″ CRT; ac/dc operation.
Circle (1125)

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Continued from page 114
area calculates to within 1.1% of the rms circle coverage on a square-mile basis, as shown in Figure 3(b). In essence, the area of service is nearly the same as a perfectly omnidirectional antenna. If an area of higher population exists in a given direction, the pattern maxima could be oriented in that direction.

Improved circularity may be achieved by arranging additional panels around the supporting structure. Installations in Canada and England have used 5, 6 and 8 panels per bay. These are illustrated in Figure 4, along with measured patterns at different operating channels. These approaches often are required for power-handling considerations, especially when three or four transmitting channels are involved.

The flexibility of the panel antenna allows directional patterns of unlimited variety. Two of the more common applications are shown in Figure 5. The peanut and cardioid types often are constructed on square support spines (as indicated). A cardioid pattern also may be produced by side-mounting on a triangular tower. Different horizontal radiation patterns for each channel also may be provided, as indicated in Figure 6. This is accomplished by changing the power to and/or relative phase of some of the panels in the antenna with frequency.

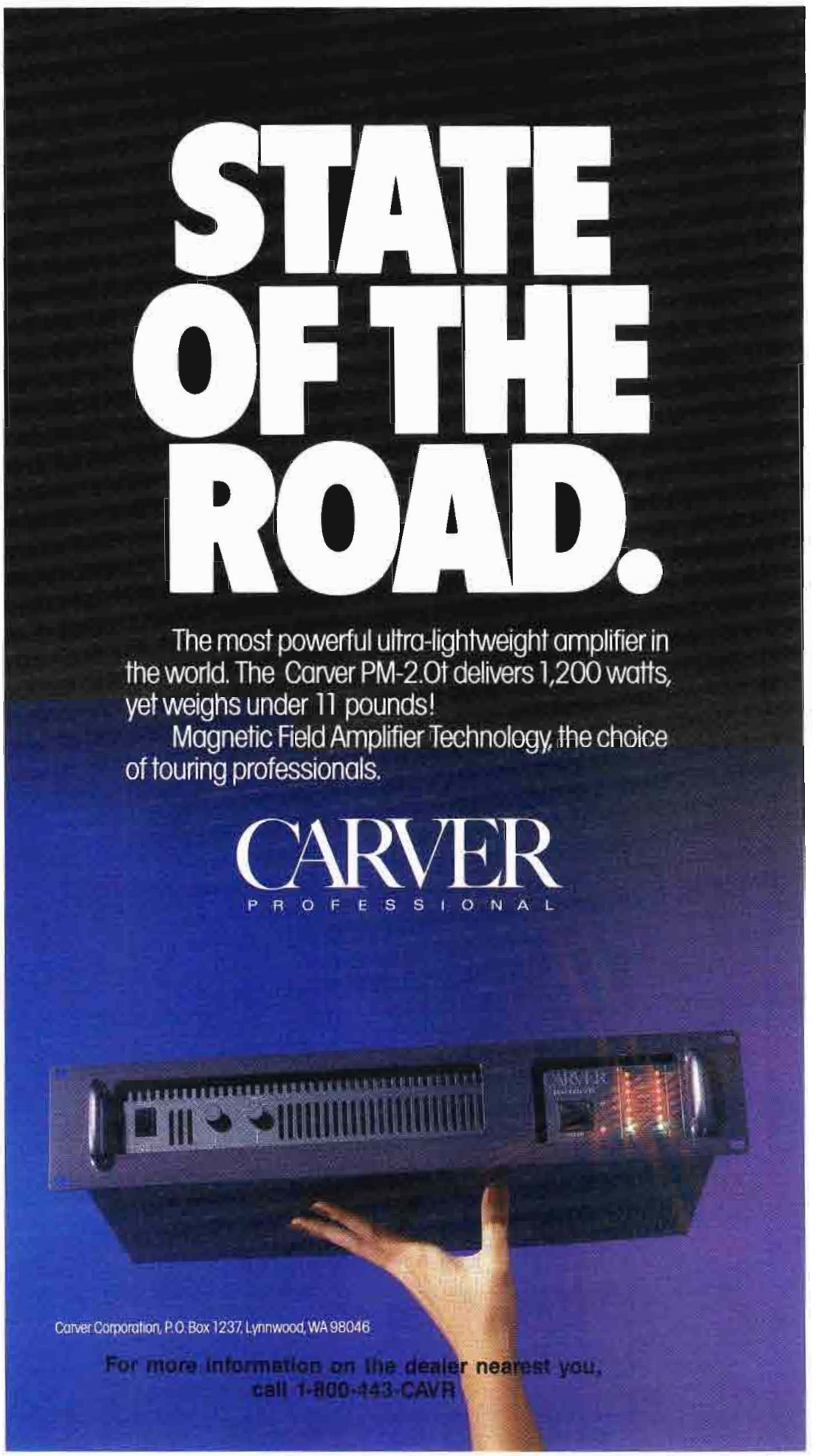
Most of these antenna configurations also are possible with a circularly polarized panel. If desired, the panel can be adjusted for elliptical polarization with the vertical elements receiving less than 50% of the power. Using a circularly polarized panel will reduce the horizontally polarized ERP by half.

A summary of common antenna configurations is given in Table 1, with the pertinent performance characteristics for multichannel applications indicated. These characteristics include circularity (for omnidirectional designs), gain, input power and total available ERP. The latter characteristic refers to the ERP available for division among the channels operating on the antenna if maximum input power and gain were applied. If circular or elliptical polarization is involved, the ERP allotted to one channel represents the sum of the horizontally and vertically polarized ERPs. Desired channel combinations outside the recommended spacings are possible with non-standard designs.

Operational parameters

The first parameters to consider when defining a multichannel UHF-TV antenna system are the frequencies to be combined and the VSWR and insertion loss specifications required. There are two basic limitations on the allowable frequencies of a multichannel operation:

- the minimum allowable channel separa-



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OMNIDIRECTIONAL PATTERN

ANTENNA/ WAVEGUIDE	RECOMMENDED CHANNELS	TYPICAL CIRCUL (±dB)	MAXIMUM RMS GAIN (PWR)	MAXIMUM POWER (kW)	AVAILABLE ERP (kW)
4 PANELS/BAY					
WR-1800	14-39	2.0	31	230	7,130
WR-1500	30-56	2.5	31	210	6,510
WR-1150	52-69	3.0	31	195	6,045
5 PANELS/BAY					
WR-1800	14-39	1.0	31	285	8,835
WR-1500	30-56	1.5	31	265	8,215
WR-1150	52-69	2.0	31	245	7,595
6 PANELS/BAY					
WR-1800	14-39	1.5	31	345	10,695
WR-1500	30-56	2.0	31	315	9,765
WR-1150	52-69	2.5	31	290	8,990
8 PANELS/BAY					
WR-1800	14-39	1.0	31	460	14,260
WR-1500	30-56	1.5	31	420	13,020
WR-1150	52-69	2.0	31	390	12,090

DIRECTIONAL PATTERN

ANTENNA/ WAVEGUIDE	RECOMMENDED CHANNELS	TYPICAL HORIZ GAIN (PWR)	MAXIMUM PEAK GAIN (PWR)	MAXIMUM POWER (kW)	AVAILABLE ERP (kW)
PEANUT PATTERN:					
4 PANELS/BAY					
WR-1800	14-39	2.4	74	125	9,250
WR-1500	30-56	2.4	74	115	8,510
WR-1150	52-69	2.4	74	110	8,140
CARDIOID PATTERN:					
3 PANELS/BAY					
WR-1800	14-39	1.8	56	170	9,520
WR-1500	30-56	1.8	56	160	8,960
WR-1150	52-69	1.8	56	145	8,120
4 PANELS/BAY					
WR-1800	14-39	1.8	56	230	12,880
WR-1500	30-56	1.8	56	210	11,760
WR-1150	52-69	1.8	56	195	10,920

NOTES:
1. *Maximum gain* is the highest gain typically offered for stable performance.
2. *Available ERP* is the total ERP for division among channels if maximum input power and gain are applied.
3. For CP or elliptical polarization, the allotted ERP is the sum of the horizontal and vertical polarization components.

Table 1. *UHF-TV multichannel antenna configuration and performance options.*

tion needed for proper transmitter isolation from the combiner (−36dB minimum).

• the greatest channel separation at which the desired maximum VSWR and insertion loss for each channel can be obtained in the transmission line and antenna.

The first restriction, minimum spacing, is relatively constant across the UHF band for particular types of combiners. Systems with only one channel spacing have been combined successfully with the bandpass combiner design that will be discussed in this article. Other types of combiners require greater channel spacing. The second, and more severe, limitation on the frequencies to be combined in a multichannel system is the maximum VSWR and insertion loss allowable for each channel. VSWR performance of the transmission line is highly dependent on the physical system layout, including the number of elbows, transitions and other components needed to carry the signal to the antenna. The maximum bandwidth and minimum residual VSWR associated with different components vary widely with their design and configuration in the system.

Figure 7 shows the channels over which three standard rectangular waveguide sizes can propagate effectively, as well as the channels that usually are specified for single-channel operation. These waveguide sizes are standard; custom sizes are available for systems whose frequencies might fall between standard sizes. From this figure, the range of allowable channel combinations for each waveguide size can be determined. In the figure the total range does not consider any other component bandwidth restrictions and assumes a straight waveguide with no elbows or transitions.

The question, then, is: *What performance can we expect for elbows, transitions and other components?* A complete analysis of the bandwidth of each compo-

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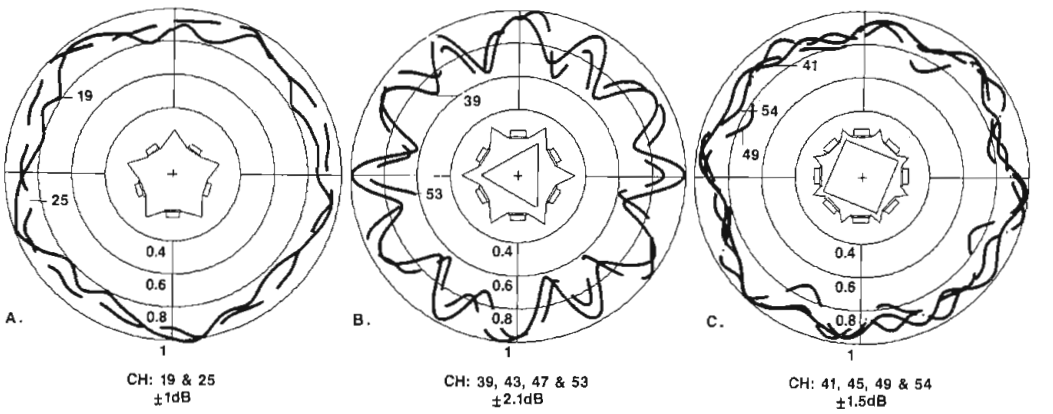

Figure 4. *Measured antenna patterns for three types of panel configurations at various operating frequencies. (a) Five panels per bay. (b) Six panels per bay. (c) Eight panels per bay.*

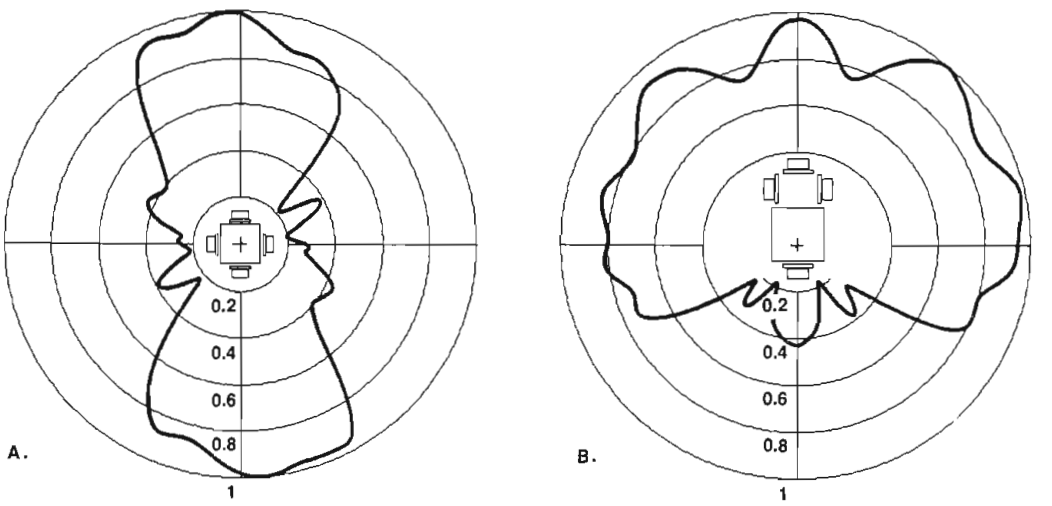

Figure 5. *Common directional antenna patterns. (a) Peanut. (b) Cardioid.*

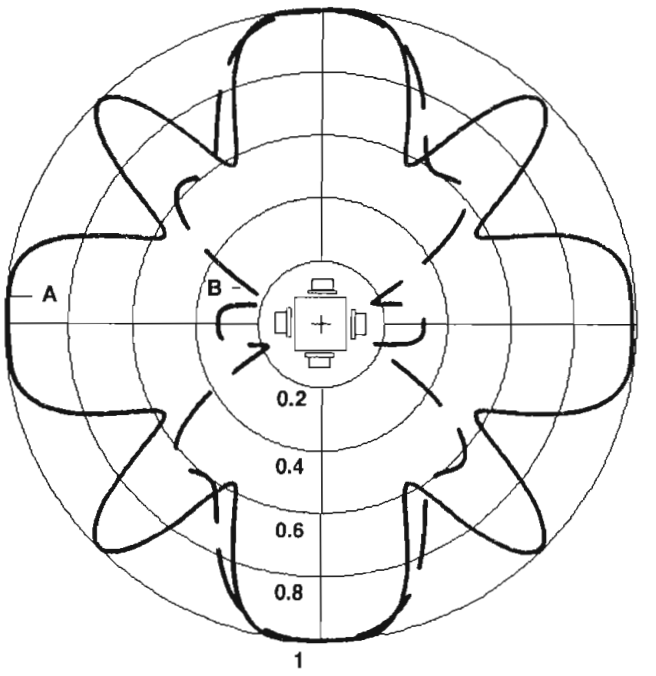

Figure 6. *Use of a single antenna to produce two different radiation patterns, omnidirectional (trace "A") and peanut (trace "B").*

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nent in a prospective system is beyond the scope of this presentation. Generalizations can be made, however, with regard to several important components. For the purposes of this discussion, the standard definition of bandwidth does not apply. Instead, bandwidth is considered the band over which satisfactory, separate fixed tuning of each channel is possible. The channels in between are ignored.

Obviously, this type of tuning becomes difficult when significant residual VSWR must be tuned out on each channel. Standard waveguide transitions have been made that cover more than an entire waveguide band but have fairly large residual VSWR (1.3:1) or do not handle large amounts of power. Optimized transitions have been designed to cover most of the waveguide band (30% bandwidth) with good performance (<1.08:1 VSWR) at high power levels.

Elbows present the other main restriction to VSWR performance. Standard single-mitered elbows have untuned bandwidths (<1.08:1) of approximately 5% to 10%. Optimized, double-mitered elbows can operate over a 30% bandwidth with similar performance.

The total VSWR of a system can be determined by choosing the frequencies that can propagate in the waveguide and examining the number of elbows, transitions and other components that increase system VSWR and lower the maximum available bandwidth. If a system is designed with only one transition and one elbow, a wider frequency range, nearing that of the waveguide, is available. If there are several transitions, elbows and bends, the range must be more restricted.

Figure 8 gives the attenuation or insertion loss of three standard waveguide types over their frequencies of propagation. Although insertion loss always should be as low as possible, the restrictions placed on the choice of the waveguide size limit the optimization of a system for insertion loss. If it is found that all channels can propagate in two different-sized waveguides, choose the size that offers lower insertion loss. This would occur when the combined channels are spaced close together and are near the end of the operating range of one size and in the middle range of another.

The system must be able to handle the combined total power of both channels. Current waveguide and components have theoretical power-handling capabilities approaching one megawatt, and they have been tested up to 240kW (the current maximum transmitter power for a single UHF station). Higher combined power levels may be accommodated, depending on the transmission-line components needed for the installation and the frequencies involved.

The lengths of waveguide sections in a

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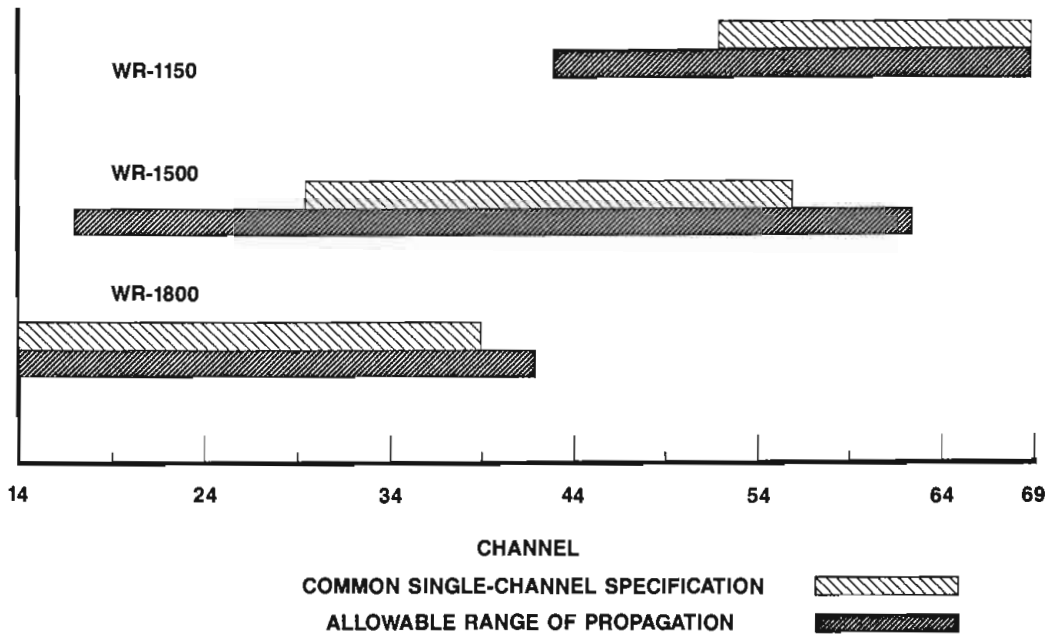

Figure 7. *Bands of operation for three common types of waveguide.*

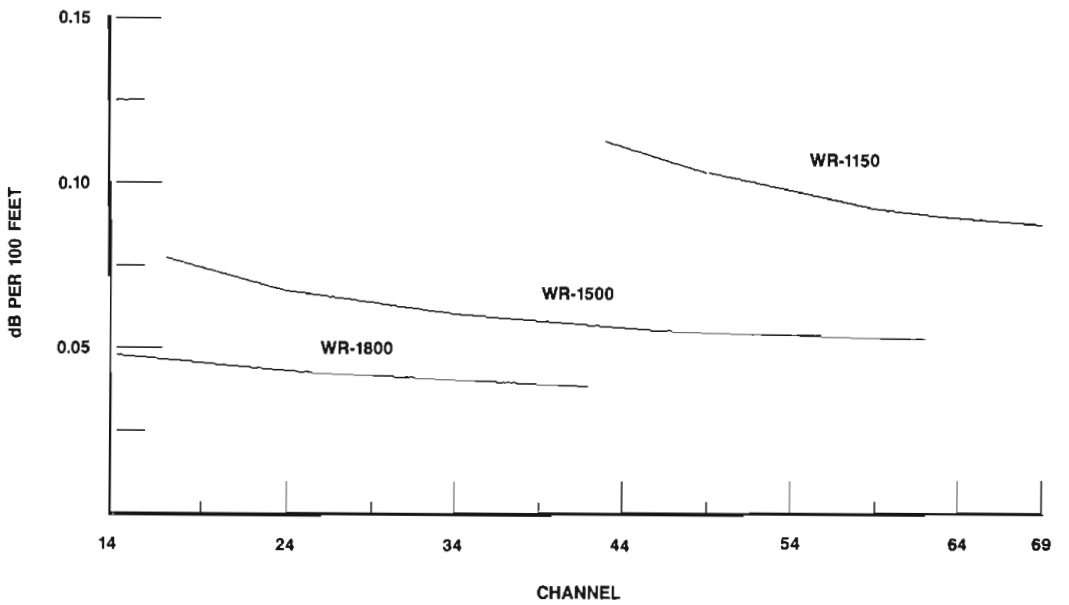

Figure 8. *Attenuation curves for the waveguide types shown in Figure 7.*

long waveguide run must be calculated so that reflections due to flange mismatches do not sum in phase, causing high VSWR within the desired channels. This standard practice for waveguide installations becomes more complicated when more than one channel must be considered and may result in non-standard lengths. Mathematical formulas have been derived to aid in selection of the proper lengths. The objective is to optimize the lengths to provide maximum spacing of flange reflections away from the desired channels. Lengths of about 12 feet are generally desirable for mechanical and economical reasons. As an example, Figure 9 shows the frequencies of flange reflections for 11-foot, 9.75-inch sections of WR-1500 waveguide.

Combiner types

The combiner for a multichannel UHF-TV site must provide high isolation, low VSWR and low insertion loss for each transmitter in the system. Two basic types of combiners currently are used for multichannel operation:

• The *branch type* (or *star point*), by which a separate filter is used for each input, and combining occurs at a tee or common point. The branch-type combiner has the disadvantage of offering relatively low isolation between inputs and is more sensitive to impedance changes of the source and load. This type of combiner often is used for low-power systems.

• The *constant-impedance type*, which uses two hybrids and bandpass or band-reject filters tuned to one of the input frequencies. Constant-impedance combiners offer high isolation, excellent impedance characteristics and relatively low loss. Isolation for one input of the system consists of rejection provided by the hybrid plus the filter; isolation for the other input consists of rejection provided by the hybrid alone. Figure 10 shows schematic diagrams for band-reject and bandpass constant-impedance combiner systems. The choice of filtering in the combiner is dictated by the bandwidth needed (6MHz for television), the spacing of the input channels and the insertion loss desired.

In the constant-impedance band-reject (CIBR) combiner, signals fed into the *injected port* are reflected by the apparent short circuit of the filter at a narrow or notch frequency (Fi) and appear at the output port. See Figure 10(a). Signals fed into the *through port* are split and allowed to pass unimpeded through the filters and also appear at the output port. This type, used in standard constant impedance visual/aural TV diplexers, performs well when the frequencies to be combined are closely spaced and of narrow bandwidth. To obtain high isolation over a full 6MHz bandwidth, a band-reject filter consisting of several cavity sections must be used. High insertion loss results for the through frequency.

In the constant-impedance bandpass (CIBP) combiner, Figure 10(b), signals fed into the injected port are reflected by the apparent short circuit of the filter and appear at the output port. Signals fed into the through port are split and pass through the narrow passband of the filter and appear at the output port. Hence the narrow ports of the two types of combiners are reversed; the injected port of the band-reject and the through port of the bandpass are narrow. Bandpass filtering offers lower insertion loss and higher isolation, along with better thermal stability, than the band-reject design. The benefits of bandpass combiners make their use attractive for multistation applications.

Combiner performance

The performance of the CIBP combiner can be predicted once the frequencies and minimum isolation have been established. An isolation value of −35dB minimum is satisfactory to avoid problems of intermodulation. As stated previously, one channel spacing is required to ensure this isolation with current designs. A VSWR of less than 1.1:1 is obtainable from the CIBP combiner on both channels. Insertion loss for the through port is somewhat higher

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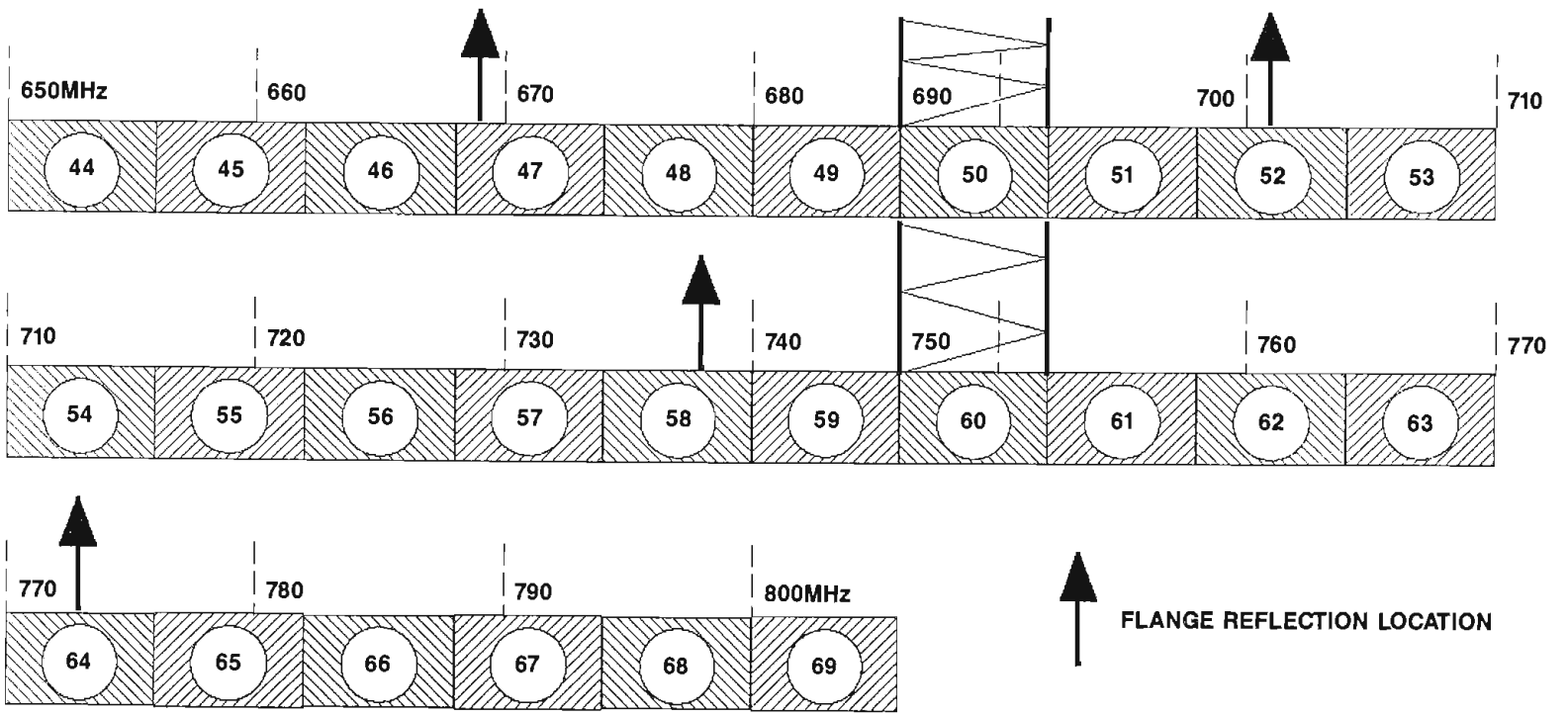

Figure 9. The calculated frequencies of flange reflections for sections of WR-1500 waveguide measuring 11 feet, 9.75 inches.

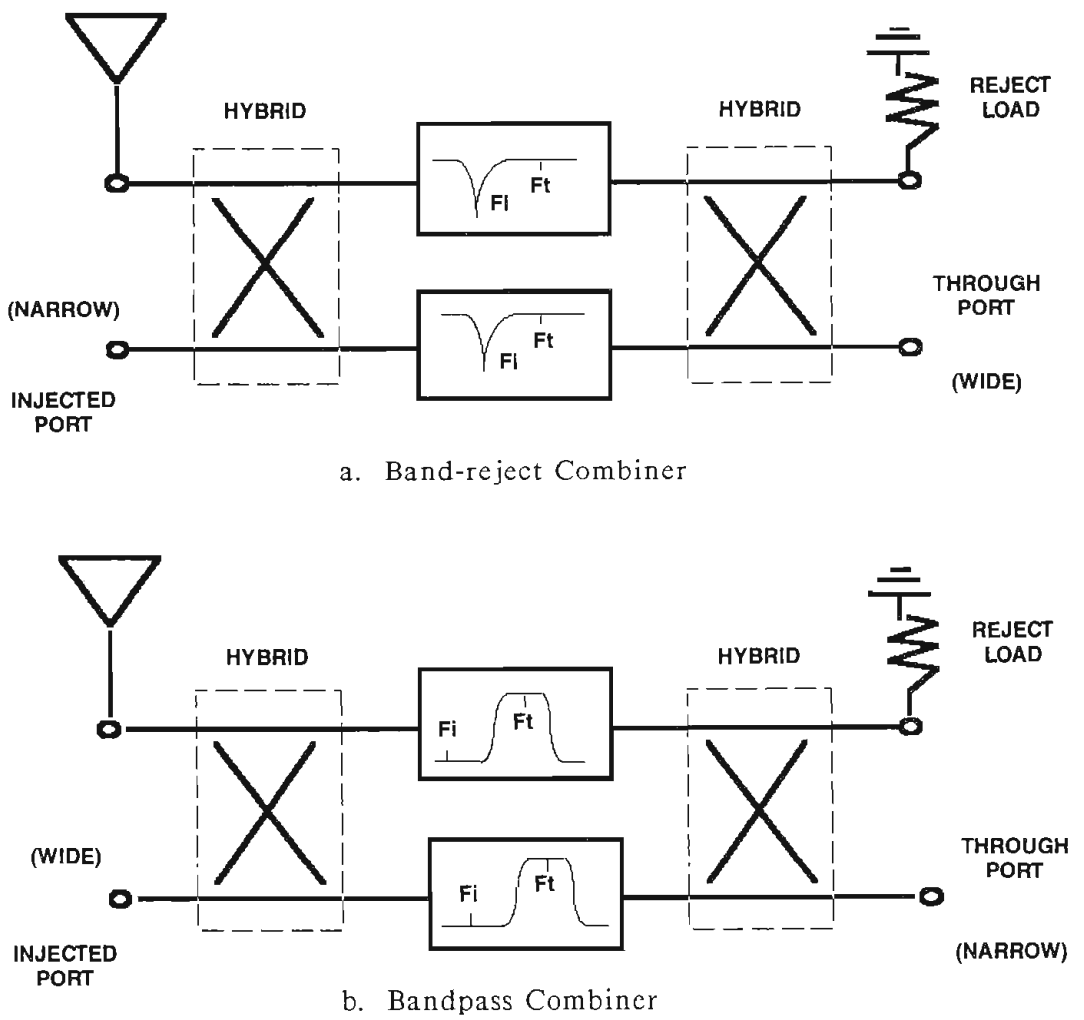

Figure 10. Constant-impedance combiner networks. (a) Band-reject combiner. (b) Bandpass combiner. Filter frequency Fi = frequency of the injected port transmitter; Ft = frequency of the through port transmitter.

than the injected port because of travel through the filter. This difference is minimized by design optimization of the bandpass filters for the frequencies involved. Insertion loss of less than 0.2dB for the through channel and 0.1dB for the injected channel generally are obtainable.

Multichannel installations have been common for FM and VHF-TV for many years with excellent results. Multichannel operation has now been introduced to high-power UHF-TV with similar results. Operation using waveguide is possible with current designs for stations that fall within approximately a 30% frequency bandwidth and are operating on non-adjacent channels.

Acknowledgment: The authors wish to thank M. B. Anders and his staff at the Alan Dick & Company, Ltd., for information pertaining to broadband panel antenna performance.

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1. Anders, M. B. "A Case for the Use of Multichannel Broadband Antenna Systems." *NAB Proceedings*, 1985.

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Enhancing NTSC

By Rick Lehtinen, TV technical editor

Improved encoders give HDTV a run for its money.

The eyes have it.

While broadcasters have been endlessly debating how many lines and frames HDTV will have, receiver manufacturers have found ways to improve pictures at the viewer's end. Improved-definition "smart" televisions soon will take the broadcaster's signal, digitally process it, and present it to viewers in a large-screen, line-doubled, high-resolution format.

Unfortunately, poor-quality TV signals are not likely to look any better when viewed line-doubled on a 5-foot screen, so broadcasters must now work even harder to provide the best picture possible. At the heart of any effort to improve NTSC quality will be talk about the encoding system. This article overviews some recent research in this field.

One wire

The beauty of composite TV systems such as NTSC and PAL is that they fit down one wire. This means luminance, color and sync can be squeezed into one TV channel and ripple through the ether to our homes.

The method by which NTSC added color to the signal was ingenious and ambitious. It was also ahead of its time, outstripping the technology available to implement it. NTSC quickly became known as "never twice the same color." The nickname stuck, but the reputation is no longer deserved. Recent advances in encoding technology have proved NTSC to be robust and serviceable. In fact, with some enhancements and innovative processing techniques, NTSC may be able to give HDTV a run for its money.

Before we go on to discuss improved encoding, a review of traditional techniques is in order.

Y matrixing

One requirement imposed on the NTSC color system was that it be compatible with the existing monochrome service. Monochrome, or black-and-white, television works by varying the brightness of a flying dot on the CRT's face. The dot's intensity-control signal is called *luminance* (Y).

Color television uses three primary colors: red, green and blue (RGB). The first job of the encoder matrix is to synthesize luminance from the three primary colors. This is easily achieved by a simple resistive voltage divider, although other means are generally used. The formula is 59% green, 30% red and 11% blue. See Figure 1(a).

With a little algebra, the three color signals can be represented by artful combinations of Y, R and B. This produces two *color-difference* signals, R–Y and B–Y. These are familiar names in the component analog world.

Mod quad

The goal of the NTSC system was to compatibly add color information to the luminance signal, and have it all fit down

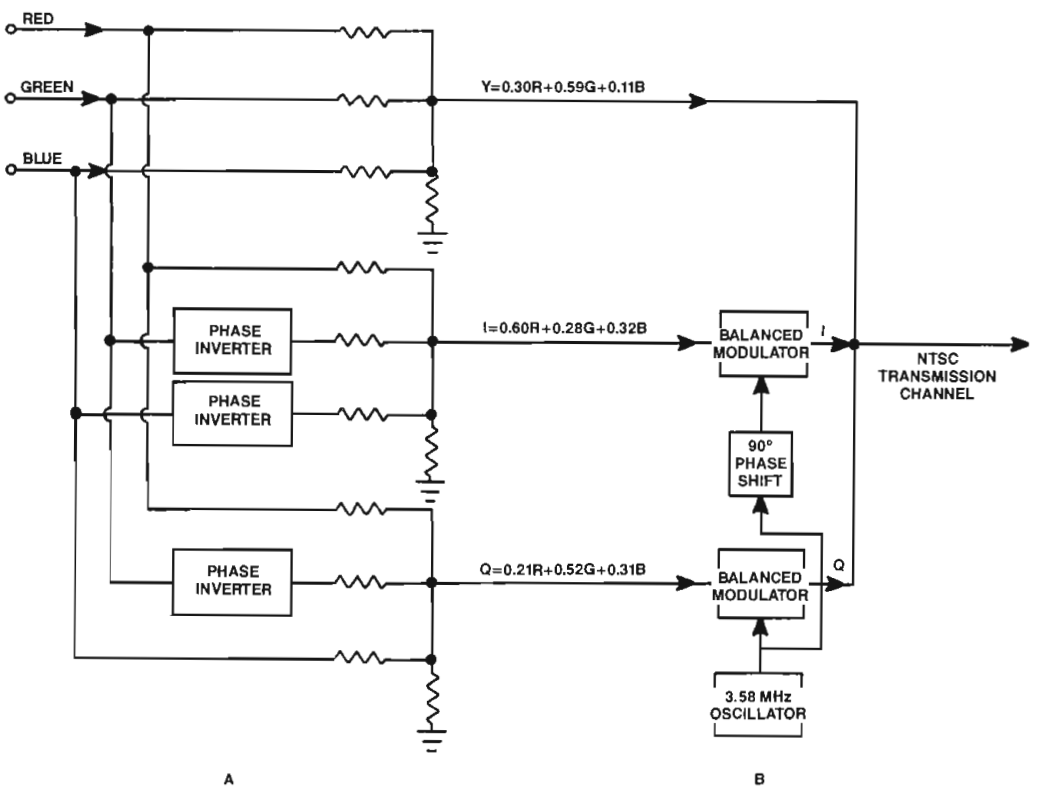

Figure 1(a). *An NTSC matrix can be designed using a simple resistive voltage divider.*

Figure 1(b). *In conventional encoders, balanced modulators transform color-difference signals from matrix into quadrature-modulated double-sideband, suppressed-carrier I and Q signals.*

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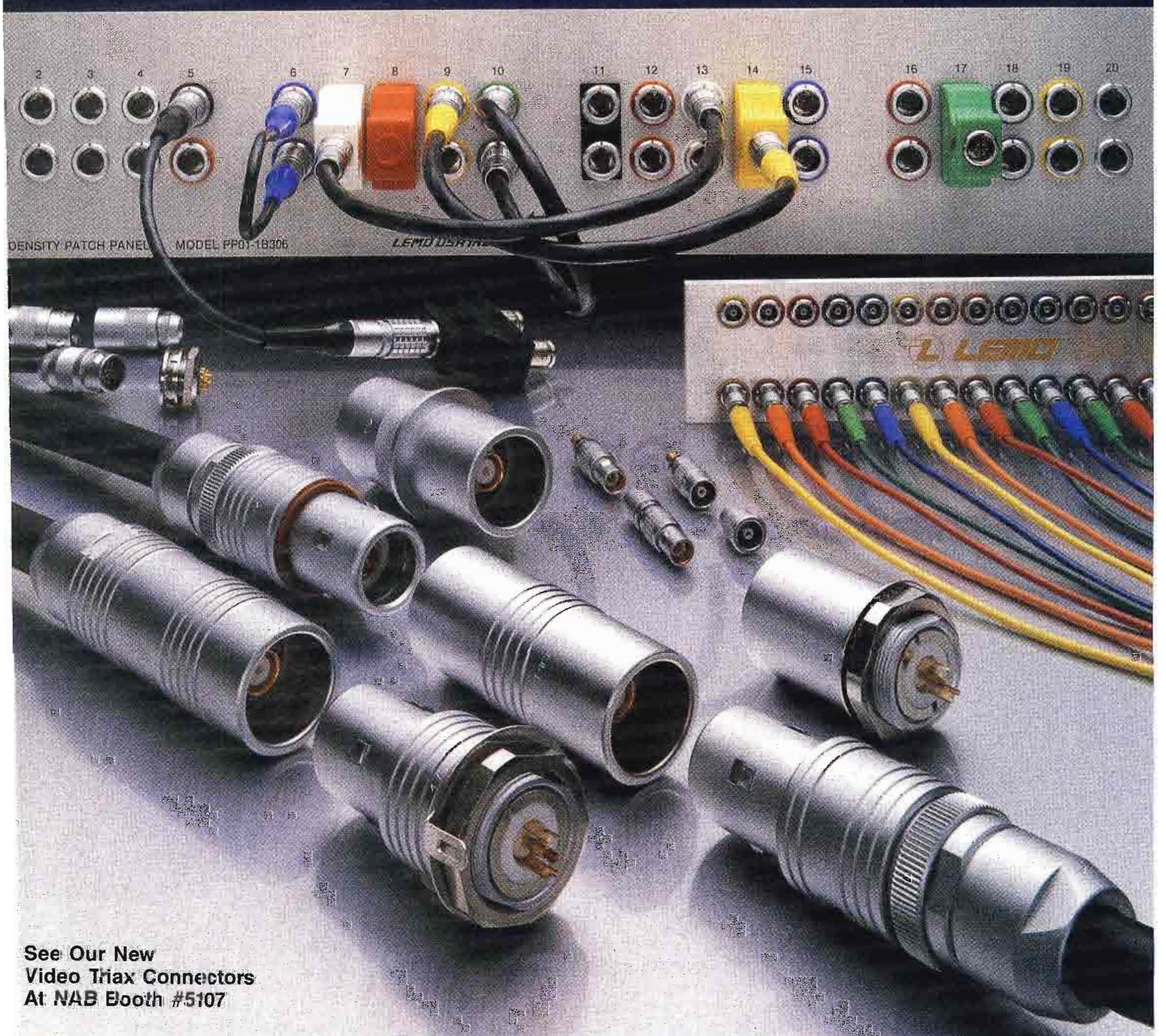

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one wire or channel. The frequencies (number of light-to-dark transitions per unit time) of the color-difference signals are approximately the same as the luminance frequency. This means you can't simply mix Y with the color-difference signals — you'd create a ghastly mess. Instead, you multiplex the color-difference signals into the luminance signal by modulating them onto a subcarrier (3.579545MHz, hereafter referred to as 3.58MHz).

So that both color-difference signals can use the same subcarrier, one is phase-shifted by 90° before modulation. This technique is called quadrature (from the 90° phase shift) modulation. See Figure 1(b). Because it's the modulation — not 3.58MHz subcarrier — that we require, the subcarrier frequency is dropped by using double-sideband, suppressed-carrier modulation.

NTSC designers wanted to be sure that the most important colors, as far as human visual perception is concerned, enjoyed the greatest bandwidth. To accomplish this, they shifted everything 33° with respect to R–Y and B–Y. This put the modulation energy along a path representing flesh tones and other colors to which viewers showed the greatest visual acuity. The new quadrature-modulated, phase-shifted signals were dubbed I and Q (for in-phase and quadrature). I conveys color-difference information in the orange-to-cyan direction. Q is used for information in the green-to-purple direction.

I and Q together can be called *chrominance* (C), or colloquially, *chroma*. Combining Y and C yields NTSC color video. The process is similar for Europe's PAL system, except that the frequencies are different; PAL's axes of color modulation, called U and V, correspond directly to R–Y, B–Y without NTSC's 33° shift. Although boosting the chroma frequencies by 3.58MHz keeps the bulk of Y out of C, and vice versa, there is more to the story.

You take the high road...

Combining Y and C involves one of the most important composite TV technologies: frequency interleaving.

Sidebands from Y and C each would trespass far into the other's domain if the color subcarrier frequency hadn't been carefully chosen. Feed a spectrum analyzer a monochrome video signal, and you will see that energy falls mainly at harmonics of the horizontal line rate. The color subcarrier frequency, 3.58MHz, is an odd multiple of one-half the horizontal line rate:

$$[f_{sc} = (455/2)\ f_h].$$

This means it will throw its harmonics neatly between the clusters of luminance energy — sort of.

Figure 2. *Cross-color artifacts introduce spurious colors into detailed scenes. (Photo courtesy of High Resolution Sciences.)*

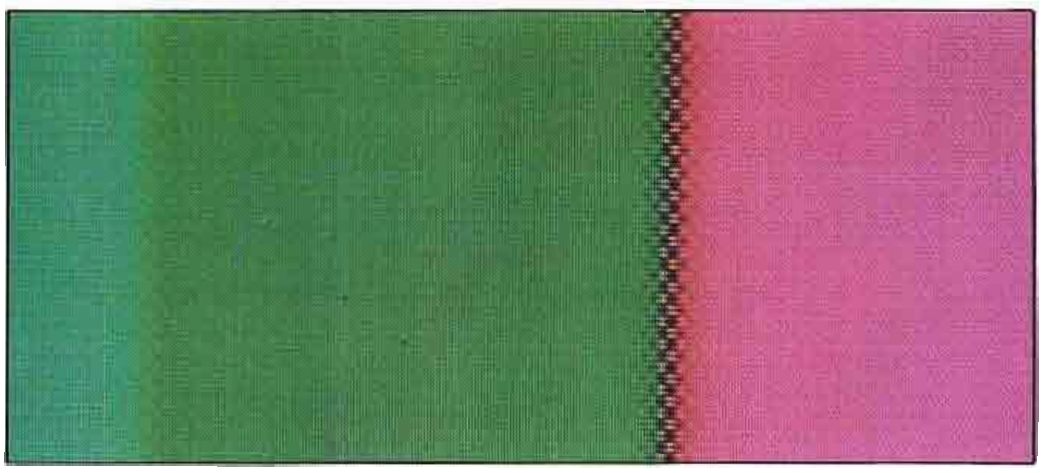

Figure 3. *Cross-luminance and reduced chroma bandwidth show up as the dot crawl and large transition between the green and magenta bar, viewed on a monitor with comb filtering. (Photo courtesy of High Resolution Sciences.)*

Crossed wires

The biggest problem with NTSC is that in spite of all its designer's precautions, there is still interaction of luminance and chrominance. This is particularly true of scenes involving motion or diagonal lines, both of which increase the spectrum of Y and C, leading to frequency overlap. The main artifacts from the interaction are as follows:

- *Cross-color.* This shows up as spurious colors that appear around sharp edges or fine details. It occurs when high-frequency luminance information is interpreted as chrominance by the receiver or monitor. When a newscaster's seersucker suit turns into rainbows, blame cross-color. (See Figure 2.)

Because of NTSC's 4-field sequence, the phase of this disturbance switches every other frame. Some researches claim that this flicker, seen on stationary images, contributes subliminally to long-term viewer fatigue.

As cameras have improved, and sharp-edged computer graphics have become commonplace, the severity of cross-color disturbances has increased in recent years.

- *Cross-luminance.* The phase of the color subcarrier signal reverses each field. This is to allow the subcarrier to cancel itself out on older high-bandwidth black-and-white receivers. Unfortunately, CRT non-linearities and the eye's imperfect integration at this frequency make this cancellation imperfect. As a result, spurious luminance can be seen as a strong moving pattern, called "dot crawl" or "hanging dots," on the edges of brightly colored patterns. (See Figure 3.)
- *Reduced chroma bandwidth.* The bandwidth of the I and Q signals are greater than the room left between 3.58MHz carrier frequency and the 4.2MHz "brick wall" rolloff point, where video is stopped to make room for audio in transmitted TV channels. Bandwidth filters limit the I signal to about 1.3MHz and the Q to about 0.6MHz, and the upper sideband of I is lopped off to make it fit. (See Figure 4.)

Unfortunately, limiting I and Q bandwidth to the frequencies available created a non-linear transfer from one "packet" of chroma to the next. One signal decays faster than the succeeding one can rise.

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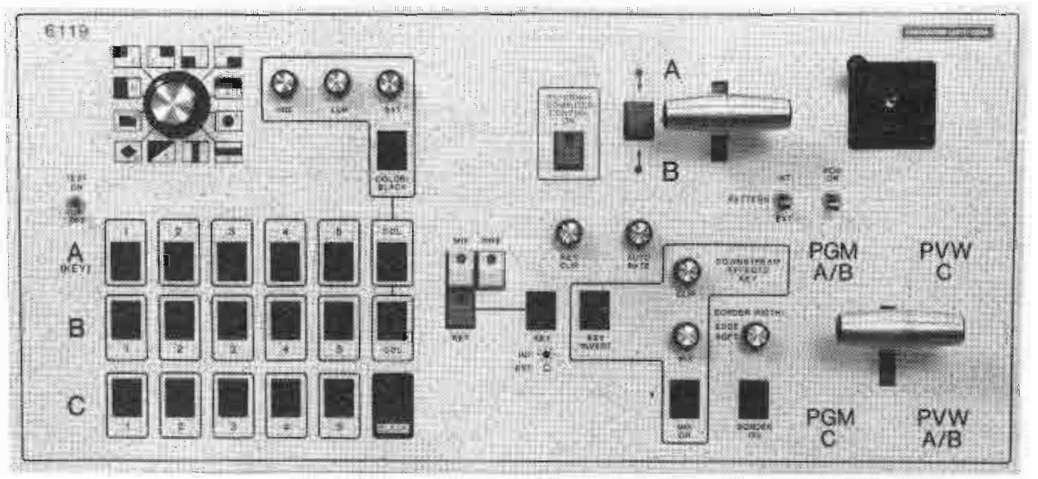

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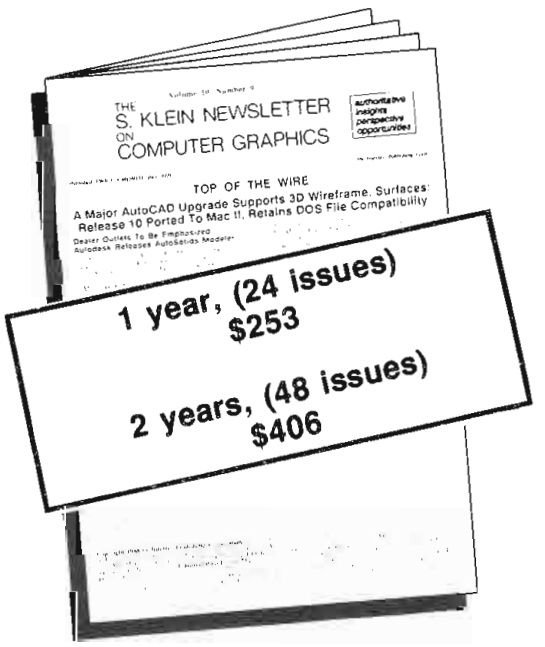

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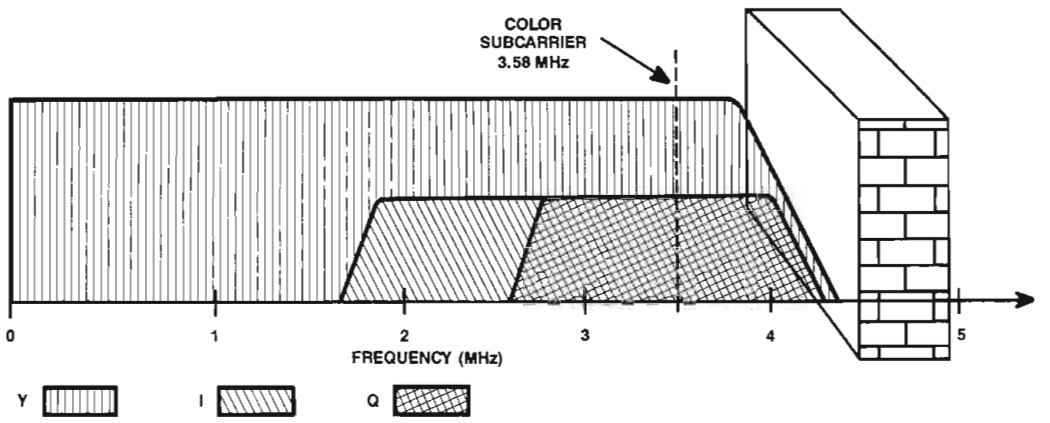

Figure 4. *One-dimensional brick-wall filter prevents video signal, with multiplexed I and Q, from interfering with audio portion of transmitted NTSC.*

That the NTSC signal is stretched too thin can be evidenced by comparing one NTSC image to a similar image with expanded chroma bandwidth. Some manufacturers claim that advanced filtering techniques now allow such wideband chroma without introducing cross-color problems.

• *Chrominance noise.* The chrominance signal-to-noise ratio is greatly improved by advanced encoders. In conventional encoders, what appears as chroma noise is sometimes high-frequency luminance information that has somehow been injected into the chrominance channel. The benefit of removing this noise is most noticeable in dark scenes.

• *Flicker, twitter, and other aliases.* Whenever a camera is pointed at a scene with a lot of horizontal or diagonal lines, it is likely that one of those lines will show up in one field of a frame, but not both. The result is "flicker" or "twitter." This is not a new problem — such effects occurred even in black-and-white days. However, the increased modulation transfer function of current equipment doesn't soften the image across several lines, as might have happened previously. This problem is especially troublesome in computer-generated graphics, where thin lines can be placed exactly where they cause the most trouble.

Graphics systems get around this problem by *anti-aliasing* —softening the edges of hard lines with intermediate colors that don't scream so loudly on an interfield basis. Unfortunately, an equivalent softening effect in cameras would lead to a loss of vertical resolution.

• *Constant luminance principle.* NTSC founders established this because the public's existing black-and-white receivers could decode only the Y portion of an NTSC signal. Briefly stated, it is that Y must not be influenced by C. Let the chrominance signal do what it may; the decoded luminance signal will remain constant to the matrix Y output.

However, the light output of CRTs is not linear. To compensate for the CRT's nonlinear transfer curve, early NTSC users introduced "gamma-law" corrections. To avoid introducing noise, gamma correction usually is done on the prematrixed signals. Gamma causes a violation of the constant luminance principle. In high-frequency, saturated blue details, for instance, gamma is said to violate the constant luminance principle by more than 10dB. The result is a softening of detail information in highly saturated, low-luminance scenes.

It probably would be a good idea to return to the constant luminance principle, but millions of televisions are calibrated to the existing gamma practice. (There is no "standard" for gamma correction. Any industry agreement on the practice has been largely informal.) Eliminating the gamma curve might degrade the performance of those receivers.

• *Gamma.* Gamma correction tends to rob detail from low-level, highly saturated scenes. This is because gamma correction forces the blacks into a non-linear portion of the transfer curve.

Recall that I and Q, the chroma signals, are bandwidth-limited. This implies that most detail information is carried in the Y channel. This is usually not a problem, because the eye's response to high-frequency information is thought to be monochromatic. The human eye also tends to roll off higher frequencies in lower-brightness portions of the screen. But remember that the Y channel is generated by a matrix that is fed RGB *after* gamma-correction. Consequently, gamma correction dooms saturated color details in low-luminance portions of a video signal.

• *Stolen resolution.* Another drawback of NTSC is that it stole some resolution. NTSC color didn't come for free. The area where the I and Q sit used to be occupied by detail information. Formerly, the TV video bandwidth occupied 4.2MHz. Today, depending on the encoding system, serious rolloffs may occur beginning at about 3.2MHz. In fact, many portable VTRs spend little time fooling with Y/C separation. Bandstop filters simply cut out all detail in the vicinity of subcarrier.

Now it's the same color

NTSC was said to stand for "never twice the same color" because of drift occurring in tube circuitry. Engineers in early color days literally had to stand by encoding

Figure 5. *Scene viewed with conventional encoders and decoders, left, and advanced multidimensional encoders and decoders, center. At right, the same scene viewed in component, for a benchmark. (Photos courtesy of INRS.)*

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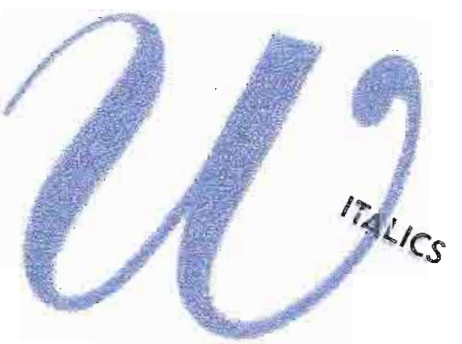

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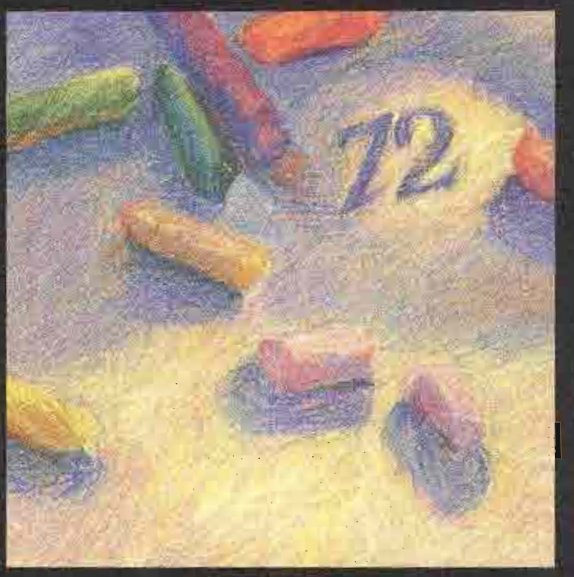

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equipment to keep it "tweaked in." Those days are past, but NTSC's problems still can be objectionable. Subjective proof of this is readily obtained by switching a suitable monitor between RGB and NTSC versions of the same scene. New encoding technology, coupled with parallel improvements in newer receivers and monitors, can make the difference indistinguishable. See Figure 5.

The new encoders

Using electronic circuitry to increase the apparent detail of images is not new technology. Modern receivers do this by use of the "sharpness" control. For encoders, the traditional method is to apply some sort of aperture correction or a high-frequency boost to the luminance signal. For several reasons, including noise, this may be inadequate.

One source of many NTSC resolution problems is the matrixing formula itself. Details that occur in the blue channel, for instance, will contribute little to the overall detail of the signal because blue supplies only 11% of the Y signal. The problem is exaggerated by the aforementioned problems with gamma. Some advanced encoders overcome these low-intensity resolution problems by reinjecting detail information developed from the raw (pre-gamma) primary color channels back into the luminance signal. This helps restore the color signal to its proper resolution.

Another new approach is to apply detail processing only to small luminance changes, leaving the major transitions undisturbed. This gives the appearance of increasing the bandwidth of the transmitted signal, although the 4.2MHz final rolloff is undisturbed. This can be coupled with a new receiver technique of sharpening the edges of large transitions, but avoiding the overshoots of conventional sharpness circuitry. Some advocates claim that these receiver/encoder practices, applied in tandem, give the appearance of nearly doubling transmitted bandwidth.

One resolution-improvement system provides dynamic enhancement of high-frequency details as a function of color and saturation. (See Figure 6.)

R, G and B signals are high-pass-filtered to derive detail signals. The Y signal out of the matrix is filtered into high- and low-frequency components. The high Y information goes to a dynamic mixer, which creates a detail-enhancement signal based on the instantaneous levels of high-frequency R, G, B and Y. Some combinations of these signals, such as high blue detail in the presence of low Y, indicate a situation in which color detail may be lost, and the mixer generates a correction signal. When no color detail is missing, no correction is generated, thereby avoiding the creation of noise. The correction signal and the high-frequency Y signal are non-

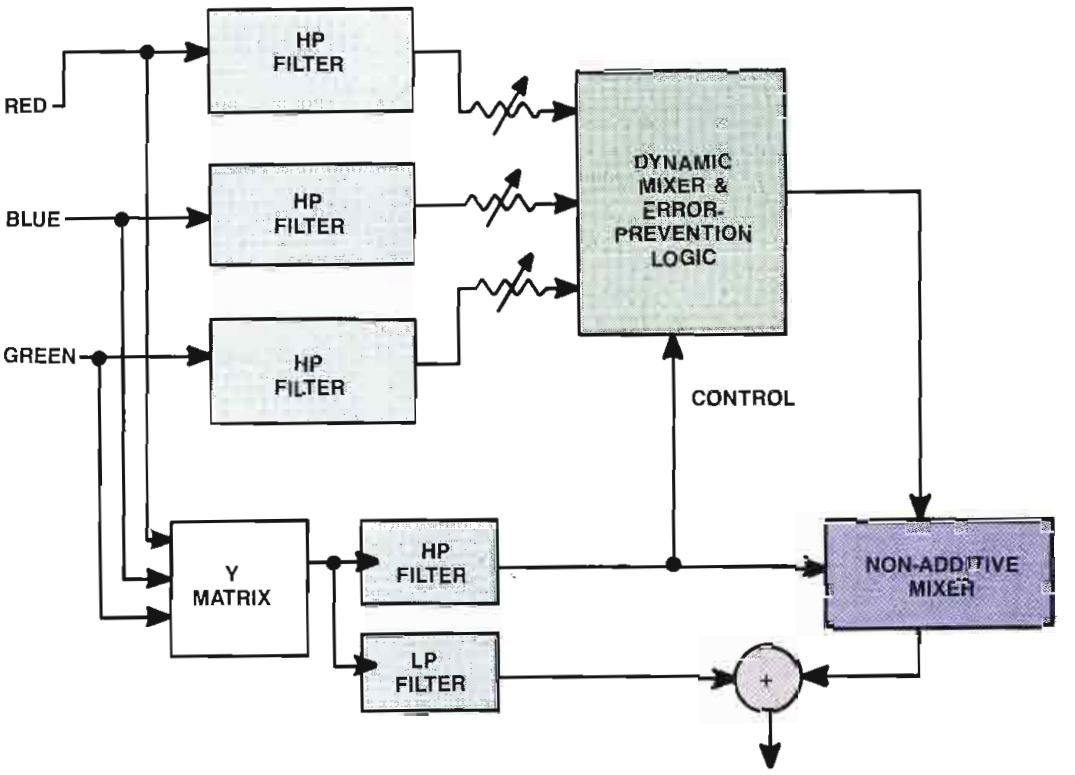

Figure 6. *Circuit to improve NTSC resolution by dynamically injecting detail information, when needed, into the Y channel.*

additively mixed, then summed to the low Y signal. The result is a detail-enriched luminance signal, which advocates claim greatly improves picture clarity. (See Figure 7.)

Digital matrixes

Research has shown that the matrixing operation is probably the least troublesome part of an NTSC encoder. Nevertheless, the matrix is the first item changed in most new encoding processes. This is because it is a convenient spot to develop enhancement signals, or to begin digitization in all-digital encoders.

Some of the new encoders are all-digital devices. In one system, the RGB is digitized, then converted to serial form for

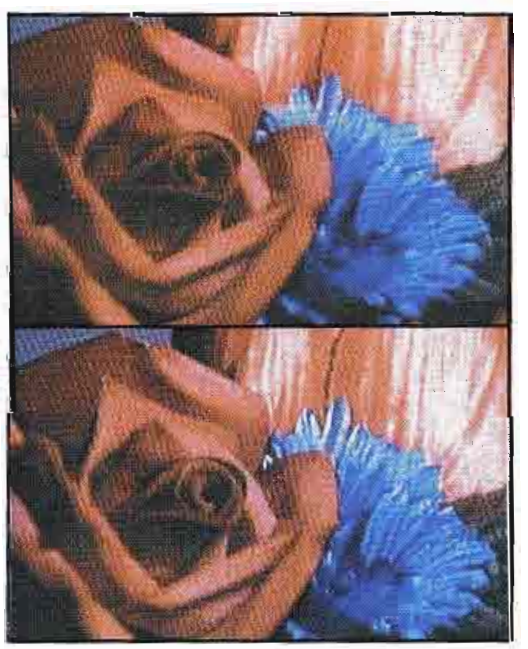

Figure 7. *Resolution improvement obtained by dynamic enhancement (shown in Figure 6) and other encoder advancements. (Photo courtesy of Intelvideo.)*

processing. During the conversion, the following transformation is accomplished using matrix algebra:

$$\begin{bmatrix} Y \\ I \\ Q \end{bmatrix} = \begin{bmatrix} a_{yr}a_{yg}a_{yb} \\ a_{ir}a_{ig}a_{ib} \\ a_{qr}a_{qg}a_{qb} \end{bmatrix} \begin{bmatrix} R \\ G \\ B \end{bmatrix}$$

Where the values for the coefficients are obtained from look-up tables.

The actual processing is divided over three chains to keep the circuit speed requirements reasonable. The three processing channels are summed and returned to a parallel form.

Another digital matrix circuit uses PROMs instead of voltage dividers. (See Figure 8.) Incoming RGB is converted from analog to digital, and the digital values become addresses for a series of PROMs. The data word stored at each PROM address corresponds to the incoming value, multiplied by the matrix coefficient required. (For example, the blue-channel Y PROM will output 11% of its address/input value.) The required PROM outputs are summed, yielding the desired matrix output. A handy feature of such circuitry is that the many PROMs have enough memory to provide either YIQ or Y, R–Y, B–Y, simply by setting a high-order address line high or low.

Prefiltering

As stated, most of NTSC's problems occur when luminance and chrominance cross swords, resulting in a raft of multihued effects, crawling dot patterns and visual worm tracks on receiver and monitor screens.

Keeping the chrominance and luminance out of each other's way has

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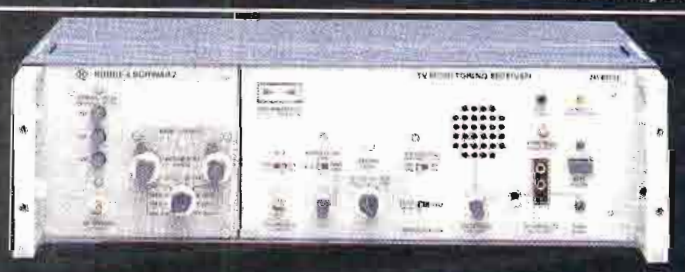

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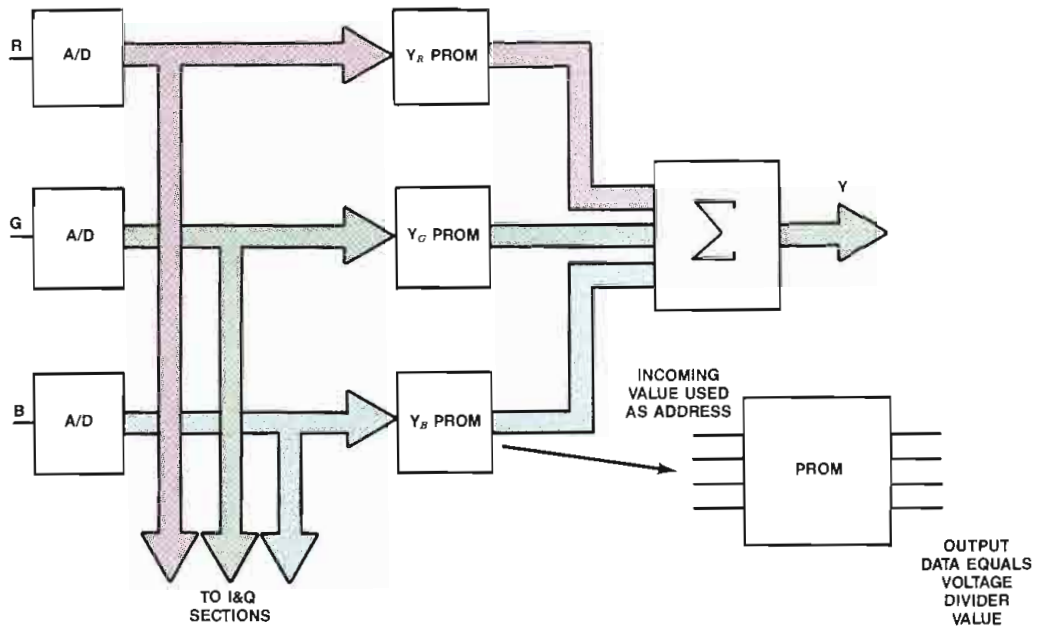

Figure 8. *All-digital matrix uses PROMs. Input value used as address fetches pre-stored data word, coded for correct output level.*

been one of the major thrusts of recent encoder research. One of the most effective techniques is prefiltering — spectral shaping of the Y and C signals before mixing — to avoid as much cross-contamination as possible. Prefiltering is performed in most advanced NTSC encoders.

One-dimensional filtering in the video domain is filtering along a horizontal line. In analog, the whole signal is subjected to the spectral shaping action of the filter (such as high-pass, low-pass, bandpass and bandstop) on a continuous basis. In digital, the same effect can be brought about by multiplying several neighboring samples by weighting factors, and summing the weighted samples to obtain a weighted average, which becomes the filtered pixel's new value.

Two-dimensional filtering usually refers to filtering in both the horizontal and vertical directions. It usually combines a horizontal line filter with some way of looking at corresponding pixels in preceding lines, as in a comb filter. Such filters can be implemented in either analog or digital form. (See the related article, "Video's New Math," page 258.)

Three-dimensional filtering usually involves looking at corresponding pixels in succeeding frames. This requires a frame buffer.

2-D best filter?

One-dimensional filters (bandpass, bandstop and high- and low-pass) often are considered inadequate for keeping luminance and chrominance separate. This is evident in that some conventional encoders use this technology.

Two-dimensional filters, on the other hand, work well. One successful system prefilters both the Y and C. (See Figure 9.) The Y is split with a complementary filter into processed and non-processed segments. This not only avoids disturbing video that is not intermingled with subcarrier, but allows the comb filter to operate over a comfortable 1-octave passband.

Some manufacturers claim that filtering the Y and C after the chrominance has been modulated may lead to impairments and distortions introduced by the nonlinear phase characteristics of chrominance bandpass filters. At least one manufacturer claims to avoid this problem by operating on baseband I and Q.

Three-dimensional filters that use framestores to sample a pixel across several frames of video are possible, but would be expensive to implement (they might be more effective if built into home receivers, not encoders). Also, some research has indicated that 3-D filtering may cause blurring if used in the encoding process.

Modulation

After RGB is converted to YIQ, the next step is to modulate the 3.58MHz subcarrier, as shown in Figure 1(b). In conventional encoders, this takes place in a balanced modulator, which drops out the carrier frequency, leaving a double-sideband, suppressed-carrier signal, which is then bandpass-limited to conform to the available spectrum.

One hybrid encoder system performs an A/D conversion on the color-difference signal outputs from the matrix, clamped to zero on the blanking pulse. (See Figure 10.) The I and Q are multiplexed together and digitally comb-filtered to protect against aliasing. Through an "exclusive-OR" gate, the instantaneous I and Q values are inverted continuously at the subcarrier frequency, using the two's complement. The results are modulated chrominance, free of quadrature error, and the prevention of any group delay that may be introduced by analog filtering.

The modulator in one all-digital encoder works on the principle that modulation can be achieved mathematically. (See Figure 11.) The frequency of the subcarrier is known, the state of the I and Q signals can be determined at any moment,

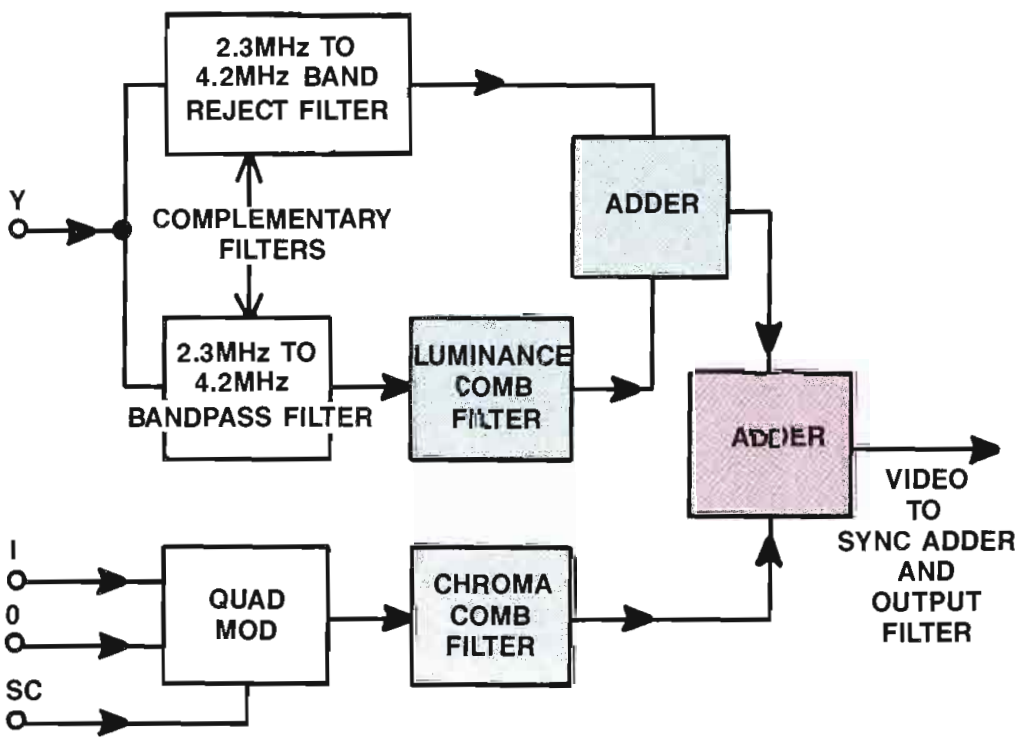

Figure 9. *Two-dimensional encoder uses comb filters to pre-shape Y and C to avoid interaction and resulting NTSC artifacts.*

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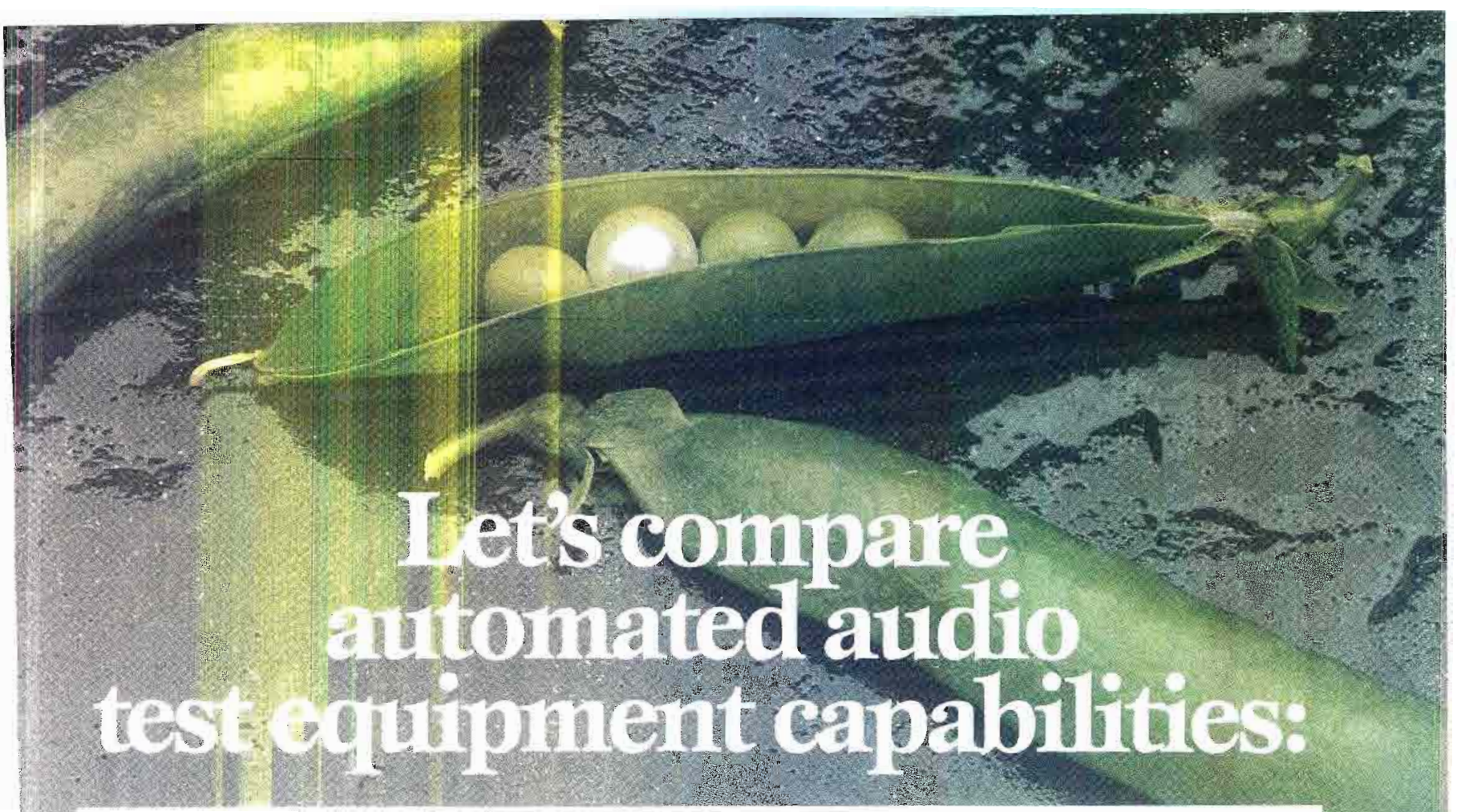

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THD + N	YES	YES	YES	YES
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Software package	included	none available	$575-$1220	system
Typical controller	$600-$3000[2]	$5750[3]	$1000-$3400[4]	$16490[5]

[1] *Announced, no specifications available*
[2] *Personal computer. Interface card included in instrument price.*
[3] *H-P Model 310M IEEE-488 compatible*
[4] *Personal computer plus IEEE-488 interface card*
[5] *Tektronix MP2902 system consisting of instruments, software, Tek 4041/4205 IEEE-488 controller*
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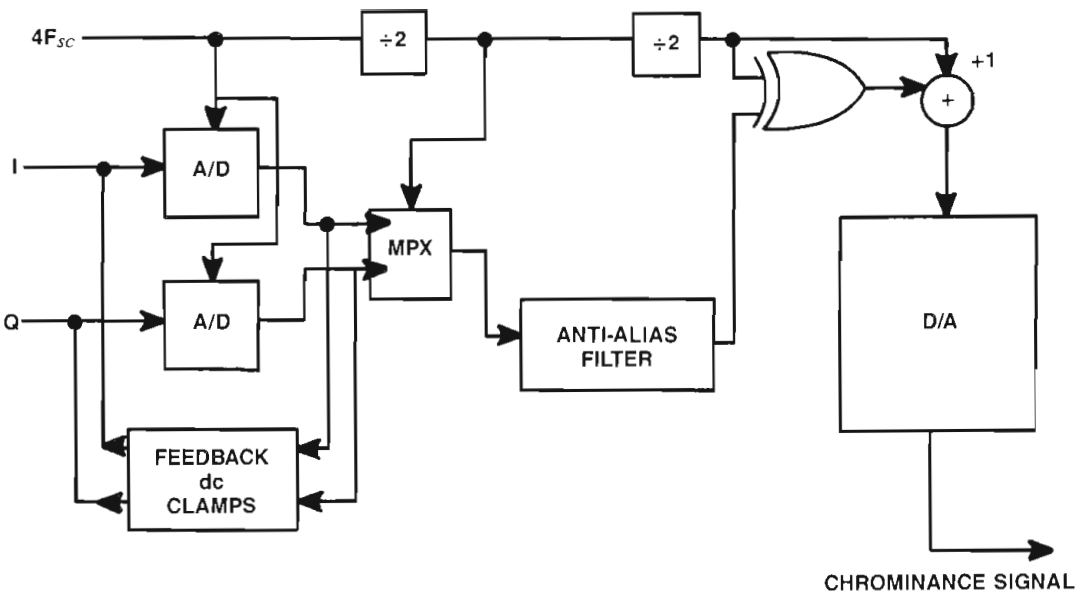

Figure 10. *Digital chrominance modulator circuit uses exclusive OR function and two's complement mathematics to produce modulated I and Q signals.*

and the resultant wave will subscribe to the formula:

$$V'(t) = Yf'(t) + If'(t)X\cos\beta + Qf'(t)X\sin\beta$$

Where $\beta = (2\pi Ft + 33°)$ and F = 3.575945MHz.

Where ′ represents gamma correction, f represents filtering, and t represents time.

High-speed processors crunch the numbers to find the result that would be obtained in a perfect analog system. Those values are then applied to the D/A converter.

What's next?

Even after the encoding process is cleaned up, there's still more. There are several other promising avenues to improving the received signal.

Noise reduction, for instance, has great potential. Instead of traditional "aperture and coring" techniques, new noise-reduction systems use adaptive temporal-recursive filters. Part of the video of a given line is summed with video from the

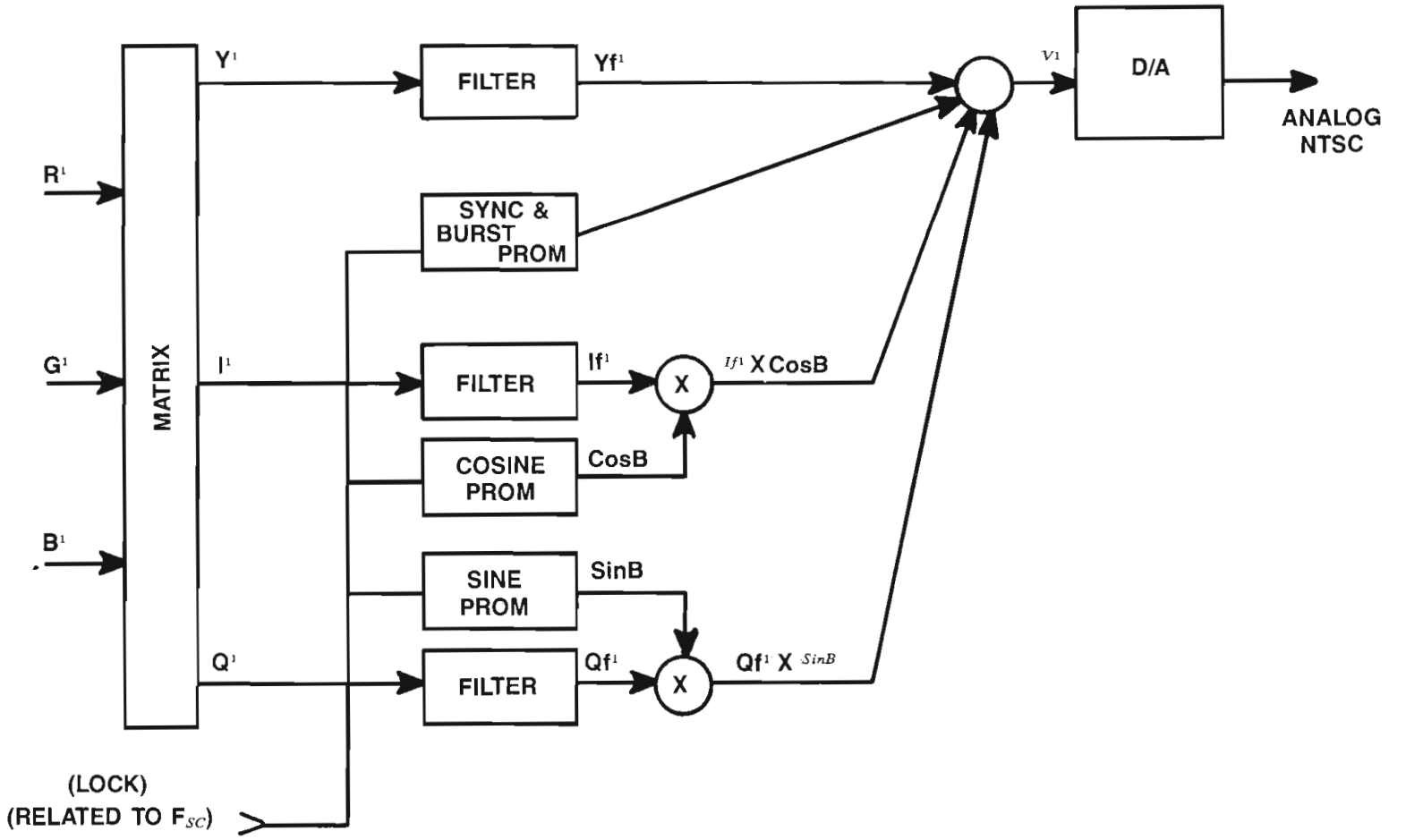

Figure 11. *Digital chrominance modulator mathematically combines Y, I and Q with sine and cosine data from PROMs, to create a signal that follows the modulation equation.*

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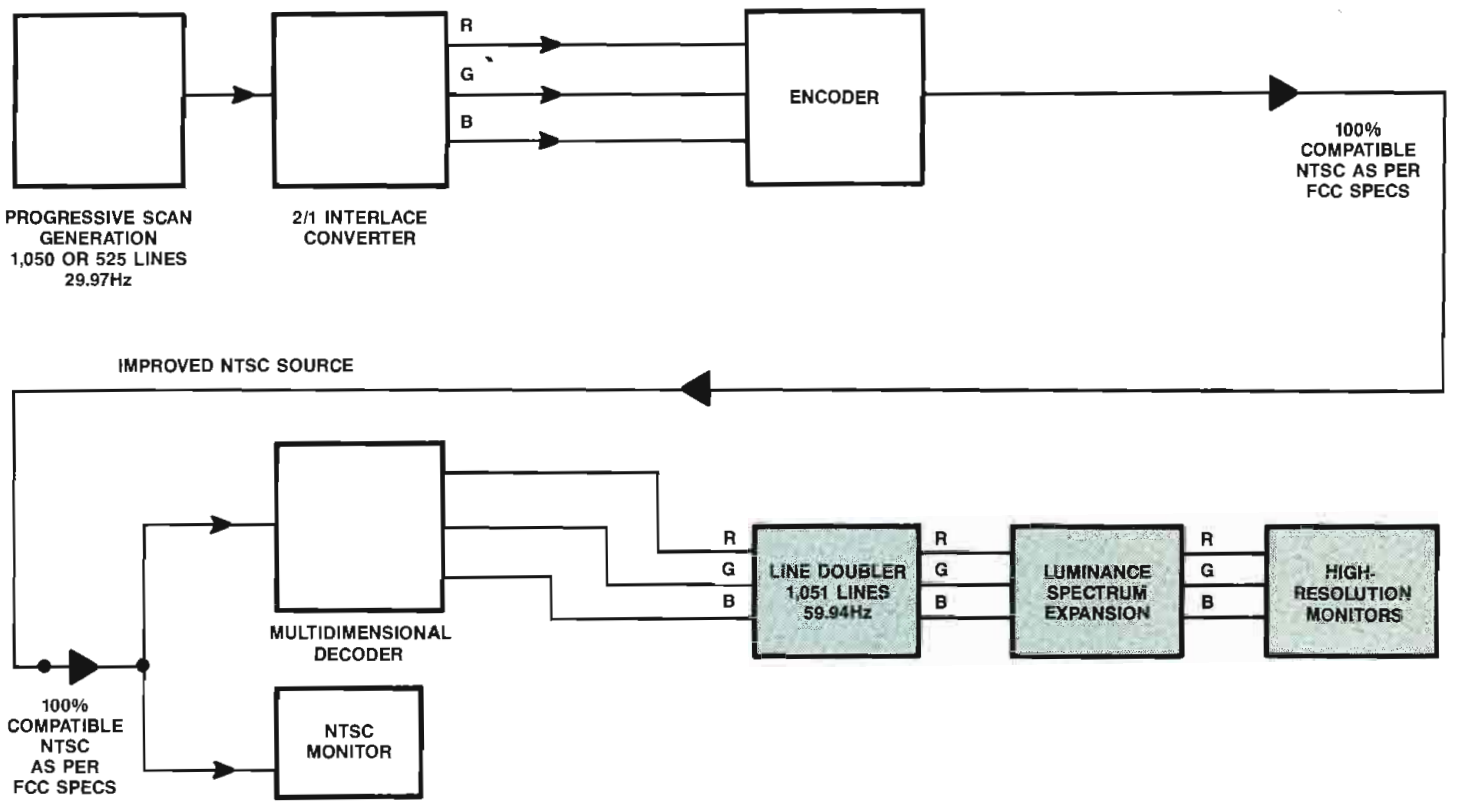

Figure 12. *The NTSC system of the future may incorporate progressive scan, line doublers and spectrum expansion to produce high-resolution signals that compare favorably with HDTV systems.*

corresponding line in the previous frame. The constant part of the signal (the picture) adds geometrically. The random portion (noise) cancels out.

Video purists may argue that the least processing is the best processing, but now that digital television sets incorporate extensive signal-processing and manipulation techniques, it might be time for telecasters to do some processing of their own.

Ghost rejection is another promising technology, particularly important to terrestrial broadcasters. Some systems use special markers in the transmitted video signal, which aid receivers in sorting out the "true" signal from the echoes.

Another direction of study involves cameras that use progressive, instead of interlaced, scanning. One Japanese study surmises that progressive scan at the camera with subsequent 2:1 interlace conversion would, by itself, yield an improvement in picture quality equal to what could be obtained through advanced encoding.

A block diagram of a system incorporating some of these elements is shown in Figure 12.

Staying competitive

Any of the new encoders yields excellent results. Determining which one is right for your station is a matter of comparing price, specifications and the manufacturer's reputation for customer service.

Integration of advanced encoders into a TV plant is a matter of some skill. Determining when to operate in composite, and when to operate in some analog component or digital format, will be the subject of much engineering discussion in future days. However, putting forth the effort to deliver a technically superior signal to the viewer may be one of the surest ways to keep broadcast television competitive with HDTV and other emerging services.

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Video's new math

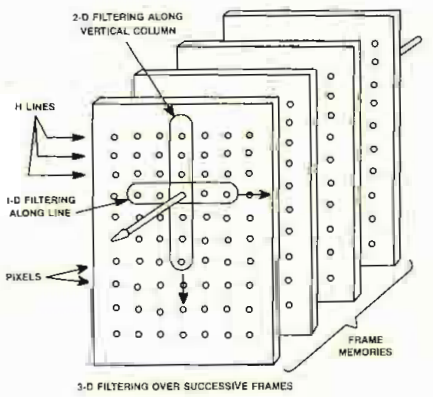
Advertising literature for modern encoding equipment often mentions "multidimensional filtering." But what is really meant by a 1-D, 2-D or 3-D filter?

Megahertz is megahertz

When broadcast engineers think of filters, they probably imagine what can be called "1-dimensional" filters. These work because of the time constants of inductances or capacitances. This type of filter comes in four basic types: low-pass, high-pass, bandpass and notch. For the most part, they are known by the difficult-to-pronounce surnames of their inventors. These 1-D filters work on the principle that megahertz is megahertz; if an incoming signal, say a line of video, has components that are beyond the passband for which the filter is tuned, too bad.

Modern electronic circuitry is more subtle. The video signal, if observed on a spectrum analyzer, will be seen to have energy distributed at multiples of the horizontal line frequency (H), and also at multiples of the vertical rate (V). Two-dimensional filters can shape the energy of both spectra. Vertical domain filters delay lines to compare the pixel at a given spot with the pixel above it. This is done with specialized techniques, comb filters among them.

Of course, not much happens "instantly." Generally, observations must be taken over time. If that time becomes significant, it can serve as a third dimension for filtering. A 3-D filter for video usually takes the form of a large memory that stores several video frames. Processing compares what a given is doing from one frame to the next.



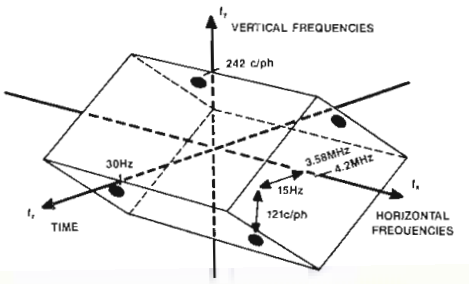
A 3-D filter operates over not just H and V rate information (dimensions one and two), but over time as well.

Mathspeak

Whereas algebra and trigonometry go a long way toward describing the action of 1-D filters, higher tools are helpful when it comes to multidimensional filters. The new nomenclature that has sprung up can be confusing at first, if not introduced properly.

In the first place, forget about megahertz. Many of the basic concepts of multidimensional filters come from non-radio backgrounds. Some way is needed to describe frequency in terms that won't vary between systems with differing scan rates or picture-aspect ratios.

When mathematicians use such invariant, general terms to describe horizontal-luminance frequencies, they might use language such as "the number of cycles counted, divided by the distance over which you counted them" — or "cycles/picture width." In this mathspeak, vertical-luminance frequencies could be referred to as "cycles/picture height."

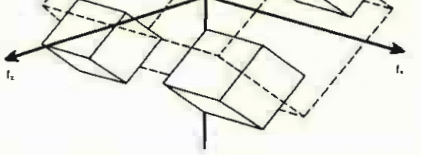


Spatial plot of video in both invariant (cycles/picture height) and conventional notation.

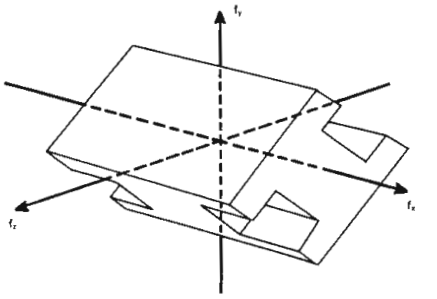
Time, mercifully, is just time.

These vectors can be set into a coordinate system. The H, V and time become the X, Y and Z axes, respectively. The energy found at a frequency is plotted by "growing" it out orthogonally away from the line, a method used to plot the results of Fourier transforms.

This nomenclature allows a different viewpoint on the problem of luminance/chrominance overlap. Rather than thinking of a signal as a function over time, it can be thought of as a function of space and time. In this way, the energy found in a TV picture can be plotted as if it were a chunk of something physical, floating in space. If you were to plot the chrominance frequencies in a similar manner, you'd find that they "orbit" the luminance, centered on the subcarrier frequency.



The "chrominance satellites" are formed by harmonics of the subcarrier frequency. They "orbit" near F_{sc}.



Advanced, non-separable, multidimensional filters allow a precise separation of Y and C, destroying no unnecessary luminance detail information.

To radically simplify a highly complex process, you could filter luminance from chrominance by observing where their respective frequency chunks overlap and by devising filters that keep the Y out of C's way.

Separable and non-separable filters

One important component of multidimensional filtering is "separability." A system that follows an H filter with a V filter uses two separable filters; the functions are separate. The horizontal filter makes its swath, followed by the V, and the intersection of the two swaths (the response of the filter) is, more or less, rectangular.

Some advanced encoders use special "non-separable" filters. In these, the H and V sections are intertwined mathematically, and the H and V pass is done simultaneously. In this way, the response can be more tightly controlled. Such filters can be designed to have tight circular or diamond-shaped responses, preserving portions of the signal that needn't be disturbed.

In fact, this is one reason that advocates of certain encoders claim their systems are superior. They say traditional separable filters "cut out" too much luminance spectra while trying to clear a path for the chrominance. Non-separable filters, proponents say, cut out just enough, preserving luminance detail.

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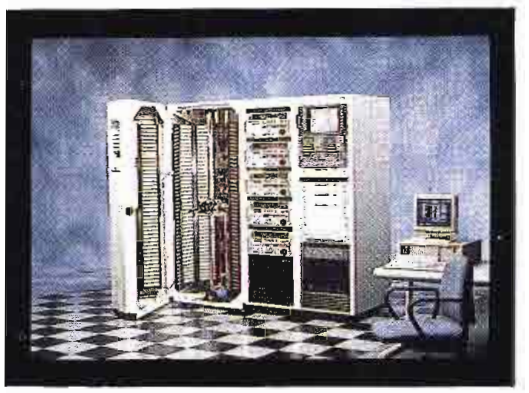
Odetics TCS2000 video cart machine



By Buck Evans

The video cart machine is proving to be a boon to many TV stations. For the first time, a multitude of video material is readily available from one device. With the attendant automatic cuing, playing and logging they provide, these devices are proving to be of major benefit to stations trying to reduce overhead and improve the on-air product.

Examine the options

Our station, KHJ-TV in Los Angeles, was operating with two 15-year-old ACR-25 tape machines. Because of the amount of maintenance they required, the machines simply had to be retired. We conducted a 3-year search for replacements, knowing that our decision would affect the station's operation into the next decade.

We chose the Odetics TCS2000 video cart machine in the M-II format. This combination allows us to efficiently store our carts and to play program-length material. Just as important in our selection was the system's sophisticated library management software.

The basic system

This cart machine is capable of automatically playing to air as well as recording cassettes. Because we wanted to keep the play and record functions separate, we also purchased the Odetics cart workstation, which acts as the primary cart recording vehicle.

Though physically separate, the controlling computers for both the cart system and the record station are completely interactive (see Figure 1). All work done on the record station is reflected immediately in the cart system's database.

The two computers are linked together via a LAN and, in turn, to the traffic department's Bias system. This allows the traffic schedule to be dumped electronically into the cart machine. No manual re-entry of data is necessary.

The cart machine is configured as an enclosed octagonal tower holding 280 carts and six tape decks. Four of these decks are used for playing to air. The other two decks are used primarily to back up our external record capability.

Evans is chief engineer for KHJ-TV, Los Angeles.

Performance at a glance

- *Number of transports: four, six optional*
- *On-line capability: 280 carts*
- *Recycle time:*
  1-3 events: 5s
  1-7 events: 10s
  Continuous: 12s
- *Database can contain more than 65,000 records*
- *Automatically assembles cart playlist from most traffic systems*
- *Automatically tests each playlist for safe operation within time constraints*
- *Prints required cart list*
- *Prints as-run log*
- *Tracks cart usage*

The on-line library and tape decks surround a 4-armed robotic manipulator assembly. The manipulator picks up designated carts and delivers them to a tape deck for play or record. Because of the storage system's octagonal configuration, the manipulator always has equal access to both carts and tape decks.

Automated playback

All carts are identified through bar codes. The cart's bar code is read as each cart is loaded into the system. From this point on, the machine knows the exact location for every cart.

Before playing a series of spots, the system automatically preloads all available decks. In addition, three of the four manipulator arms then are loaded with

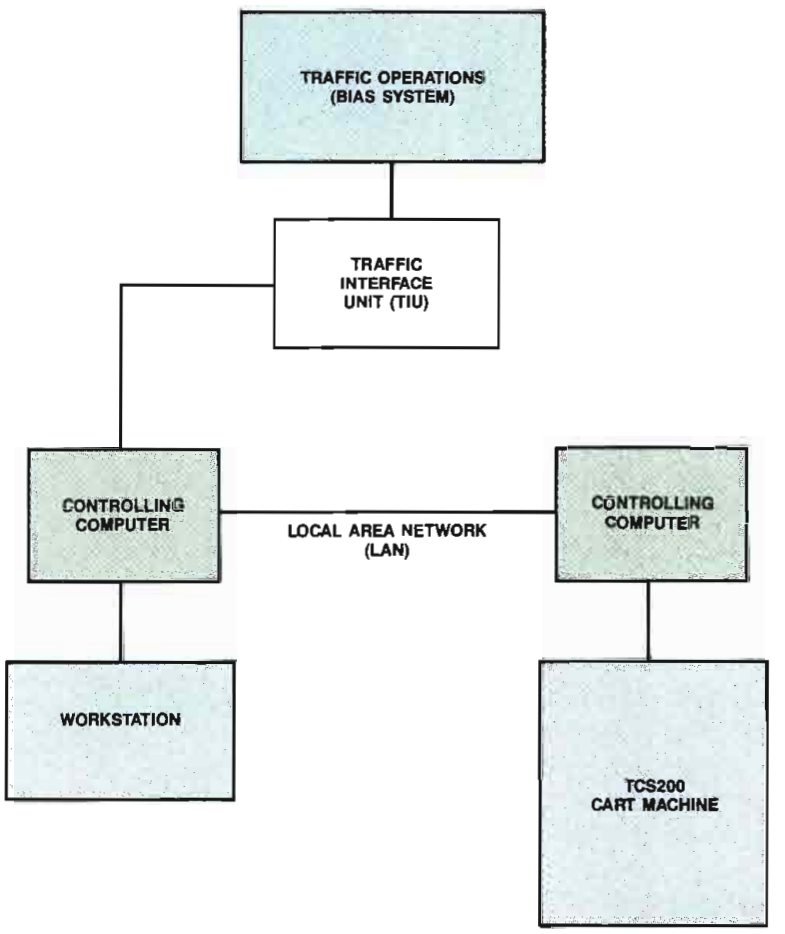


Figure 1. *Station operating block diagram. The traffic log is electronically dumped into the cart machine. No manual re-entry of data is required. A LAN connects the two controlling computers together, providing fully automated playback and record capability.*

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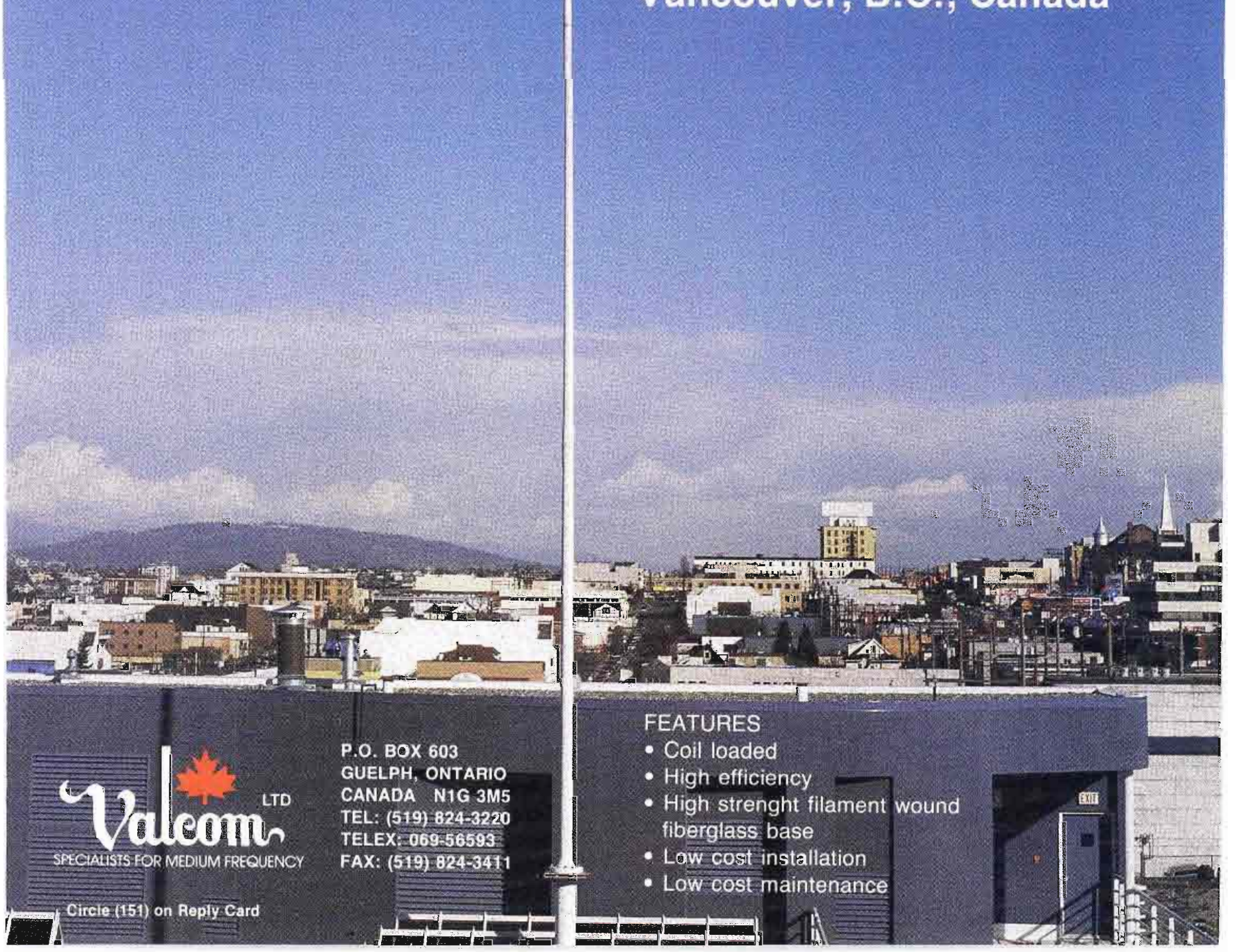

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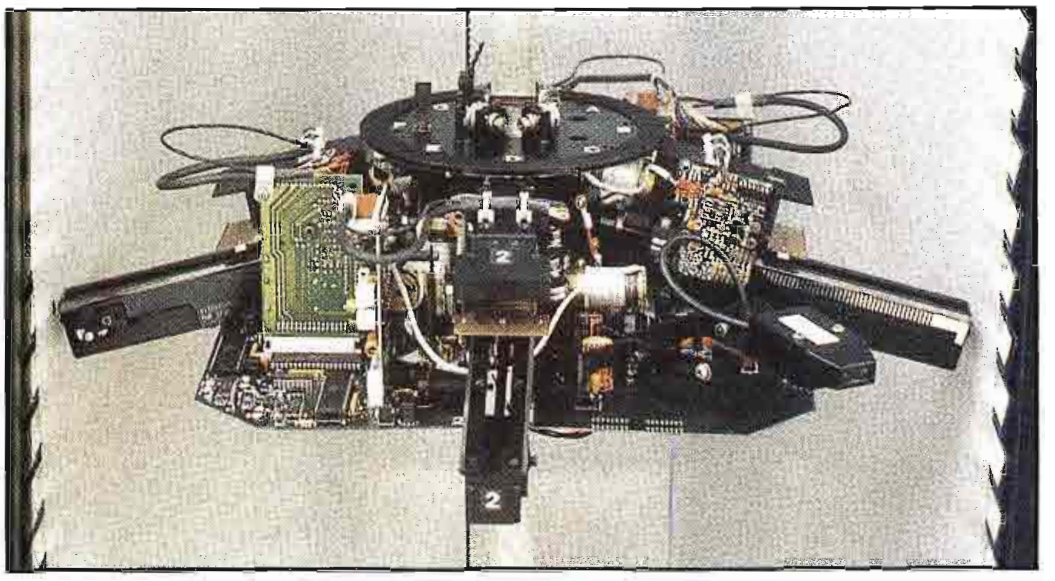
carts that will follow those already loaded in the tape decks.

When a play sequence begins, the empty manipulator arm is parked in front of the on-air deck. As soon as the spot ends and is rewound, the arm removes the cart, rotates and inserts the next cart for that deck.

As the other tape decks complete their play sequence and the cart recues, the arm repeats the process. If none of the decks require servicing, then any unneeded carts held in the manipulator arms are placed back in their storage locations. The next batch of required carts is then loaded into the arms for future use.

Because the manipulator has four arms, it is highly redundant. It can continue to deliver carts into the tape decks with just one of its four arms in operation. The cart system can continue to function even if the manipulator is totally disabled by operating in the manual mode. For the engineer who is not yet convinced that robots work, this is a comforting feature.



The robot arm manipulator contains four cart-handling arms and bar-code readers. Once a cart is introduced into the system, the bar code is read, and the machine tracks its location. The cart system can continue to operate automatically even if only one of the robot's arms is functioning.

System use

The day-to-day supervision of our station's cart system and personnel is conducted by assistant chief engineer Bob Morrison. We run about 600 spots per day on the cart system. An additional 60-80 new spots per day are recorded by the system.

There is quite a bit of changeover in the contents of the cart system's on-line library because of the difference between daytime and nighttime advertisers. Only about 10% of the carts stay within the tower for 24 hours. The tower typically is loaded four times per day, at 2 a.m., 6 a.m., 6 p.m. and 10 p.m.

We try to load the carts into the on-line library at least eight hours ahead of their scheduled airing. With our previous unit, we had to enter new carts at almost every break. This reduction in cart handling allows our operators the freedom to review all upcoming needs and devote more time to quality control.

Intelligent assistant

The transfer of play schedules from the traffic department to the cart system is a simple procedure. The cart system's traffic interface unit (TIU) accepts the schedule from the Bias computer system. The TIU then extracts and organizes the schedule data for transfer into the cart system's playlist. Once the playlist is loaded, it can be edited or automatically played to air.

The cart system is constantly looking 1,600 spots into the future. When carts on the playlist are missing, the spot is highlighted on the computer screen. An *Exception Report* of needed carts can be requested by the operator and printed on the system's printer.

The cart system provides us with the flexibility to make changes to the playlist at a moment's notice. A newly produced promo can play to air less than 15 minutes after the 1-inch master leaves the edit bay.

Carts are inserted easily into the on-line library through the load and unload ports located on the access door of the tower. The door of that tower does not need to be opened except for servicing. There are no hardware constraints on the length of spots aired. It is conceivable that we could run 12-second spots back-to-back for as long as desired.

Information database

The TCS2000 cart machine has the ability to store up to 65,000 carts in its electronic database. Preprinted bar codes are used to identify and track all carts. The number represented by the bar code is used as the primary ID for the database. The database uses this number to reference a wealth of information about each particular cart including number of plays, date recorded, date last played, house and ID numbers, title and SMPTE time-code designations for start of message and duration of each event. This type of information could never be tracked in a manual system.

The wealth of information that is instantly available is one of the most convenient aspects of the new cart machine. For instance, if somebody from the sales department wants to know how often a particular spot has run, it is a simple matter of looking at the computer screen. Such a request used to require a tedious accounting procedure of going through individual billings.

We use the cart system's as-run log to clarify traffic discrepancy reports on the official legal log compiled by the cart system operator. If the operator has written "Pepsi commercial" on the legal log, the billing department no longer has to track down that operator to determine which Pepsi commercial was aired. The cart used can be looked up by referring to the computer-generated as-run log.

Going on-line

Morrison led the installation program for the cart system, which proceeded smoothly. We first received a set of drawings showing space requirements and the location of electrical and video cable outlets. It took almost a week to prepare the engineering control room. When the machine arrived, two Odetics engineers

The library tower and robot arm manipulator open for inspection. The octagonal design and 4-arm manipulator make short work of loading and unloading carts.

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came in and had it operating within half a day. Tests were run, and minor adjustments were made during the remainder of the afternoon.

The next day, our maintenance people began familiarizing themselves with the machine. The rest of the week was spent in technical training on all aspects of the system. An entire week was devoted to training our 22 cart-system operators.

The operator training focused mainly on becoming accustomed to using a computer. The amount of training required depends primarily upon the staff's familiarity with computer technology.

The company provided what turned out to be an extremely helpful feature, a simulator. Using Odetics-provided software and one of our computers, our operators were able to practice operating a system without tying up the entire cart machine. The simulator was instrumental in getting everyone up to speed quickly.

To avoid on-air mistakes, we used parallel learning. During a shift, we would have one computer-proficient person working with a less-experienced person. We often relied on two of our maintenance engineers as the experts because they were more familiar with the system and were already computer-literate.

It's possible for operators to become complacent in operating a reliable automation system such as this. Because the cart machine operates dependably with little human intervention, operators tend to stop performing the normal operational checks that should occur regularly during a shift.

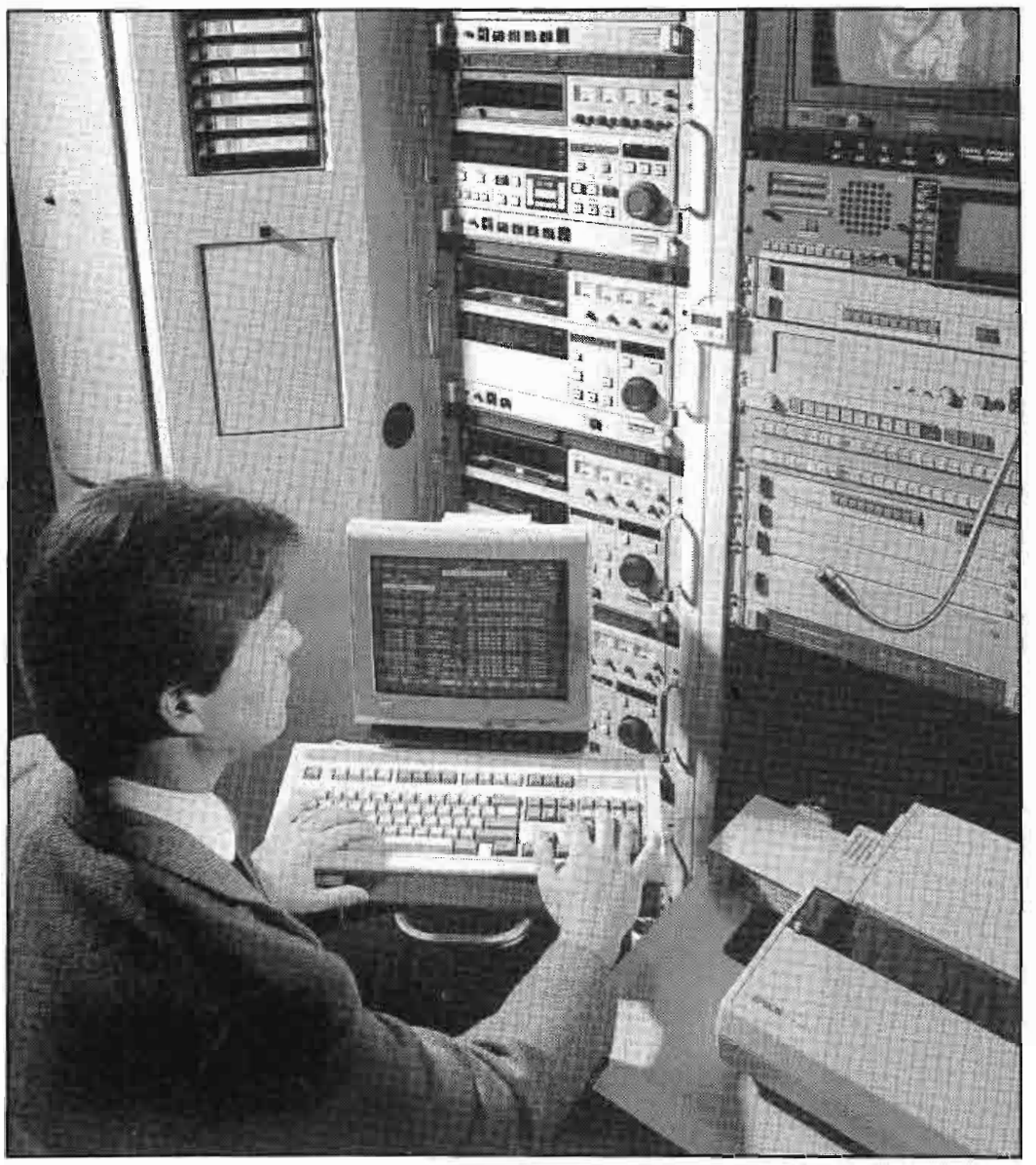
Service from the manufacturer has been consistently helpful. It has been our experience that all requests have been immediately attended to. When parts were needed, they were promptly shipped. The few software-related glitches were duplicated in the company's lab. Within an hour we received an answer to our question.

Future expansion

The system is capable of providing up to four audio channels. We currently use two of these channels for stereophonic broadcasting. We plan to add a third audio channel to the cart machine to carry Spanish-language programming for our SAP channel. Because of the large Spanish-speaking population in Southern California, it should provide us with an effective advertising service.

Ultimately, we plan to use the system to play back spots and program-length tapes. We also expect the cart system, the record station and the Bias traffic system to work together, forming a complete station automation system. This full-scale automation system may be implemented sometime this year.

The Odetics TCS2000 cart machine has had a major positive impact on the station's operations. We've been able to improve our operational efficiency as well as enhance the quality of our on-air product. A side benefit is that our operations staff members now are free to apply their talents in more creative areas. We believe this machine will play an important role in our station's operation in the coming years.



Bob Morrison, assistant chief engineer, checks the system's operation with the controlling computer.

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Ampex ACE 25 editing system

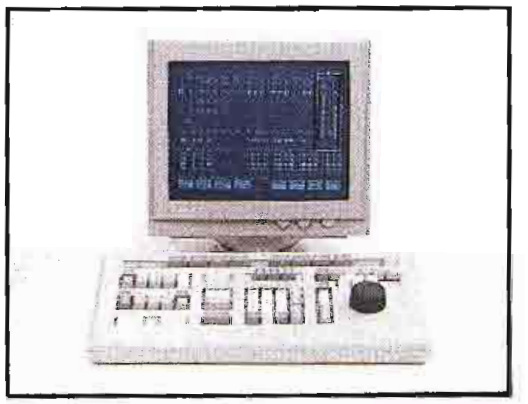
By Roy Moore

The introduction of the Ampex ACE 25 editing system at the 1988 NAB convention provided more than a streamlined complement to the company's line of editors. With this system, sophisticated editing capabilities — many of which were found previously only in far more expensive systems — were made available to news and features editors.

The ACE 25 editing system can create a 1,000-line edit decision list (EDL) and store it to disk. In addition, with its optional internal audio mixer, it is able to write the audio's VU levels and equalization (EQ) values to that same EDL along with each event.

We selected the optional component video switcher, shown in Figure 1, for our system. This allows us to preserve the quality of our Betacam component video through the multiple generations often encountered. In fact, the video is encoded to composite format only when it goes to air from KPIX-TV's new production control room. This arrangement has helped us make the first step toward expanded use of component video technology in other areas of the station.

Moore is engineering manager at KPIX-TV, San Francisco.



Performance at a glance

- *NTSC, PAL and PAL-M computer-based editor*
- *Controls up to four VTRs*
- *Optional internal audio-video switchers*
- *80286 CPU*
- *1,000-line SMPTE EDL with battery backup*
- *Two 3.5-inch disk drives*
- *Four GPI output ports*
- *Auto-assembly and list management*
- *Eight SMPTE serial ports*
- *Two RS-232C serial ports*
- *One parallel printer port*

Interfacing the system

The basic ACE 25 system (see Figure 2) consists of a keyboard, a high-resolution data monitor and an edit controller chassis, which contains two 3.5-inch floppy disk drives. The left disk holds the system operating software, and the right disk stores up to three 1,000-line EDLs.

The system is designed to control four tape transports with serial-controlled RS-422 interformat capability, four GPI ports (each capable of firing multiple triggers per event) and a standard parallel printer port. As shown in Figure 3, we are using the editor with 2-inch Beta SP machines and one ¾-inch BVU 850. These decks feed a BVW 70 Betacam record VCR. We also have 16×4 outboard audio mixer for more complex sound layering. The internal component switcher provides access to any of the station's 90 sources.

Construction

The system power supply is mounted above the editing electronics for easy access. The chassis includes an IBM AT-compatible 80286 CPU, the data display board, the 8-channel ILC (intelligent line

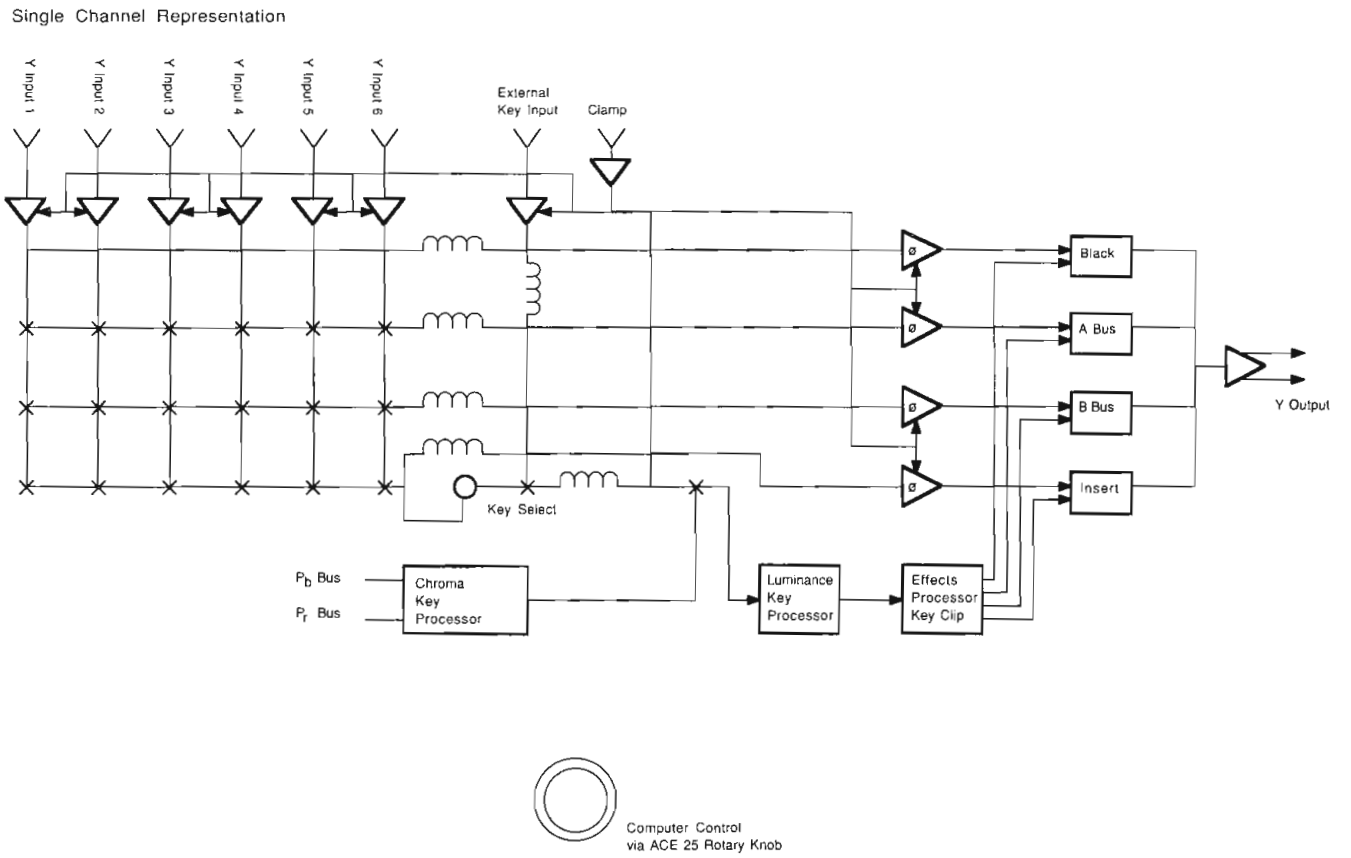


Figure 1. *The optional, 6-input, A/B bus component video switcher provides cut, mix and key capability.*

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controller), the color field identifier board and the switcher and computer interfaces. All circuit boards use standard PC board extenders for troubleshooting. The operating software is MS-DOS.

The component video switcher accesses six sources: three VTRs and three auxiliary inputs. Black, internal component chroma-key and one external luminance key also are available through the switcher.

The internal audio mixer supports six sources of two channels each. In our installation, this includes the three VTRs, three auxiliary inputs, a slate tone and silent. The editor also can interface to a variety of external switchers.

Operator's interface

The keyboard layout is similar to other ACE systems, with the keys grouped according to their use. Across the top of the keyboard are the eight soft keys, whose labels change according to the function that has been accessed. A multifunctional rotary knob, located on the right side, controls the basic editing procedures.

This knob not only serves to shuttle/jog the transports, but also replaces the internal video switcher's fader arms. This makes it easy to adjust video and key levels as well as preview effects. The knob also can adjust audio and EQ levels.

Upon command, two VU meters or a 3-band equalizer can be displayed on the data monitor along with the current EDL.

Audio levels can be displayed on the data monitor and adjusted with the shuttle/jog knob.

A 2-channel, 3-band equalizer is available on the optional internal audio switcher. Once displayed on the monitor, each equalizer channel can be adjusted individually with the shuttle/jog knob.

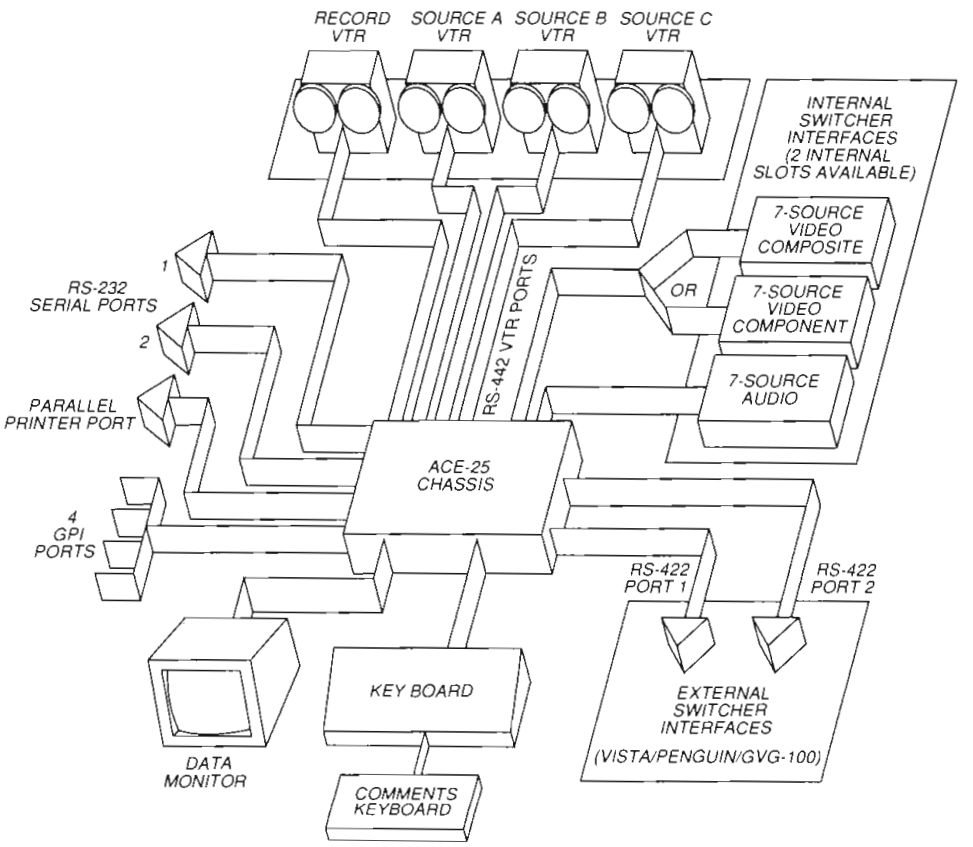
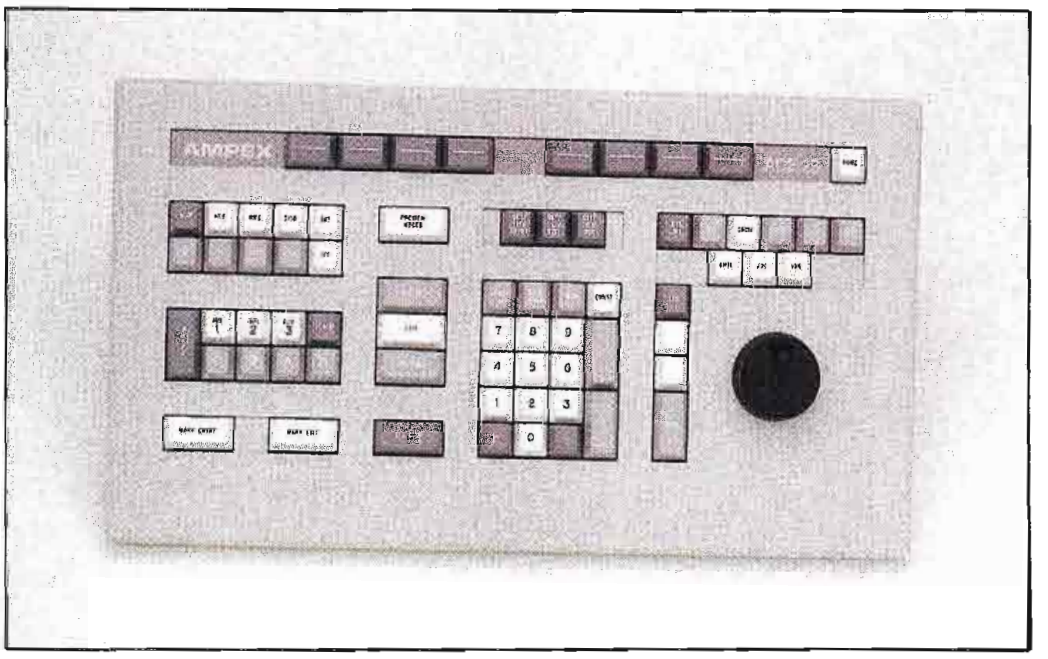


Figure 2. *System block diagram.*



The front panel resembles other Ampex editing products. This makes operator training much easier.

The rotary knob then can be used to set the audio, EQ and audio monitor gain. The same control lets the operator scroll through various on-screen displays, including system setup and hardware configuration screens.

The monitor highlights whatever information is being addressed, providing the operator with an excellent sense of system feedback. The screen is divided into three sections. The top third contains transport status information and, for dynamic tracking decks, the selected tape speed. The center area of the main edit screen contains the edit construction list, displaying the information entered for the edit that is being created. The bottom third of the screen displays five lines of the cumulative EDL, showing events that already have been performed.

Important features

The Ace 25's soft-key-propelled operating software provides many tools essential for sophisticated EDL-enhanced editing, including four features:

- *EDL tag* allows you to retrieve source

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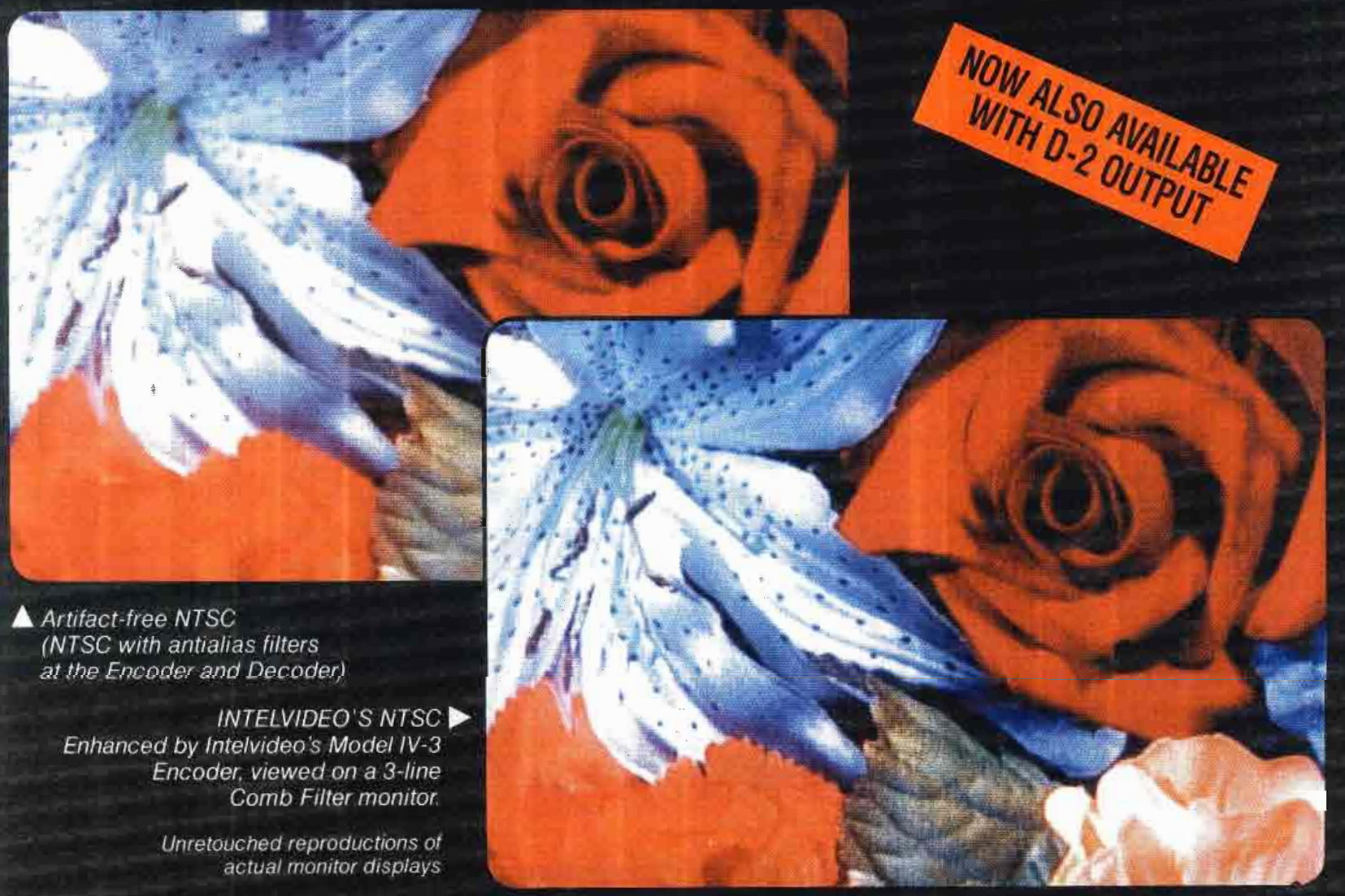

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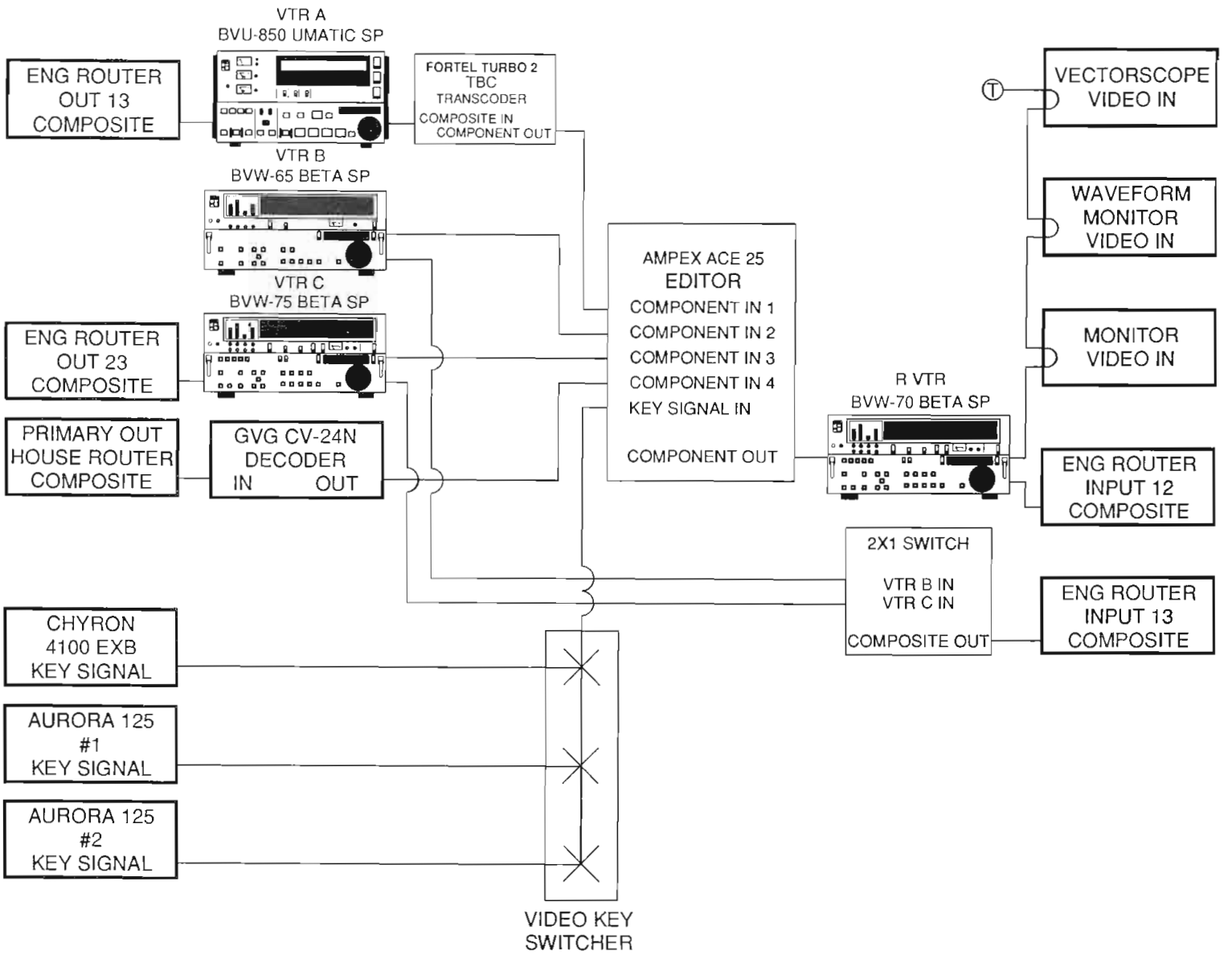


Figure 3. *System diagram. The editor is interfaced through its own internal component video switcher.*

and record side out points from any edit in the EDL.

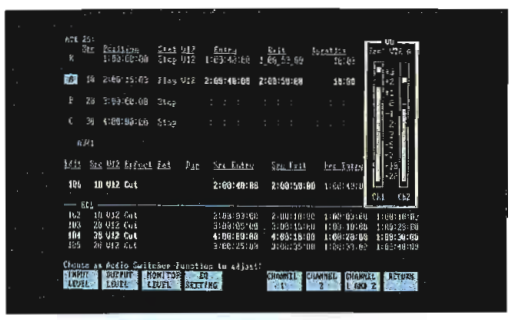
- *Reel tag* picks up match points from previously used reels. This mode tags the "to" source in a from/to transition.
- *Source tag* computes a new match point for a "from" source in a from/to transition based on the new record side's location.
- *Sync tag* permits picking up a sync point within an edit. This is especially useful for backtiming sound bites.

The system provides extensive list-management capabilities, including defining, moving, copying or deleting single edits or blocks of edits, auto clean, auto sort, auto print, auto assemble and a variety of preview modes.

Split edits are flexible and are displayed through additional time lines in the EDL. A split at both the in and out points is permitted on all channels with no restrictions. For example, you can dissolve the video and perform a separate split audio cut within the same event.

The editing system supports interformat editing. New software upgrades will include EDL translating capability to create lists compatible with other systems.

The Ampex ACE 25 has been in use for more than a year at our station. With more than 100 news and feature story projects completed, we've found that the system exceeded our original expectations. In fact, we're thinking of buying an additional unit.



Main menu display. Parts of both the current edit construction list and previous events from the EDL are displayed.

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Field report

Sony PCM-2500 R-DAT recorder

By Chriss Scherer

Digital audio is a nightmare to some and a dream to others. With the release of the compact disc format, engineers realized that digital-for-audio was finally a reality. Although a vast selection of music is available on CDs, they do not offer user recordability. Enter R-DAT — rotary head digital audiotape. This format provides several important features: long recording times, compact size and the purity of digital recording. To take advantage of this technology you need an R-DAT recorder. Sony has introduced the PCM-2500 R-DAT machine, which was tested for this report.

Basic machine

The Sony PCM-2500 is a 2-unit device, consisting of the PCM-2500A digital tape recorder and the PCM-2500B interface unit. The machine provides fast spooling times at up to 180 times normal speed and direct audio interface to both analog and digital audio equipment.

The recorder uses rotary head technology originally developed for video recorders. The small cassette (73mm × 54mm × 10.5mm) provides up to 120 minutes of 2-channel, 16-bit digital audio data.

Controls and connectors

Like the machine, operation also is broken down into two units. The recorder unit is equipped with operational controls, display window, record level adjust, digital/analog input select, error-correction indicator and tape-loading drawer. The interface unit contains the record and playback calibration controls, the receiver for remote control (wired and wireless both are supplied) and five record switches. The switches select type of input, sampling rate, emphasis, master safe and copy prohibit. The machine can sample at both 44.1kHz and 48kHz rates for analog inputs and at 32kHz for digital inputs.

The rear panels have the power cord connectors and the connectors for interfacing the two units: four RCA jacks for the analog connections, one 25-pin D-subminiature connector for digital connections and one BNC connector for the clock. The interface unit contains the input and output audio connectors. To get an idea of the versatile input/output connections, see Table 1.

The display window has peak-reading fluorescent meters with several operating modes. It can display tape running time, elapsed section and remaining-to-end time. It doubles as a display for emphasis, sampling rate and subcode ID code selection.

The front-panel keypad allows the user to perform a quick search of desired cuts by address. Searching is a simple task and can be directed to one specific cut, or a quick listen using the music scan. This mode sequentially plays the first 8s of each selection, then skips to the next start ID.

It is possible to search for blank sections on a tape. If you tell the recorder to locate track zero, it searches for blank space. When a blank section of tape is played, the sampling-frequency indicator blinks to show the tape is previously unrecorded.

The meter display is easy to read and understand. The various indicators keep you informed on the machine's status through sampling rate, emphasis, track number and other indicators.

A front-panel caution indicator informs the user if moisture has formed inside the unit. The machine then shuts off the recorder to prevent equipment damage.

The error-correction indicator has two

Performance at a glance

- *Frequency response: 2Hz-22kHz, +0.5dB*
- *Sampling frequency: 48kHz, 44.1kHz, 32kHz*
- *D/A conversion: 16-bit linear*
- *Dynamic range: >90dB*
- *THD: <0.05% at 1kHz*
- *Wow and flutter: below measurable limit*
- *Recording time: 120m*
- *Tape speed: 8.15mm/s*

ANALOG:

CONNECTOR	TYPE	RATED LEVEL	MAX. INPUT LEVEL
Input (1dBs=0.775Vrms)	XLR-3-31	+4dBs	+24dBs

CONNECTOR	TYPE	RATED LEVEL	MAX. OUTPUT LEVEL
Output	XLR-3-32	+4dBs	+24dBs (600Ω)

DIGITAL INPUT:

CONNECTOR	TYPE	IMPEDANCE	RATED INPUT LEVEL
S/P DIF IN	phono jack	75Ω	0.5Vp-p
AES/EBU IN	XLR-3-31	110Ω	RS-422
SDIF-2 IN	BNC, ×2	75Ω	TTL level

DIGITAL OUTPUT:

CONNECTOR	TYPE	IMPEDANCE	RATED OUTPUT LEVEL
S/P DIF OUT	phono jack	75Ω	0.5Vp-p
AES/EBU OUT	XLR-3-32	110Ω	RS-422
SDIF-2 OUT	BNC, ×2	75Ω	TTL level

SYNC OUTPUT FOR SDIF-2:

CONNECTOR	TYPE	RATED OUTPUT LEVEL	LOAD IMPEDANCE	ACCURACY
Word Sync Out	BNC	TTL level	75Ω	+30ppm (25±2°C) +60ppm (−10°C-60°C)

NOTES:
Maximum cable length for AES/EBU format is 300m.
XLR connectors use pin 2 as high (+), and pin 3 as low (−).

Table 1. *The interface unit offers versatile input/output connections.*

Scherer prepared this report while he was a contract audio and broadcast engineer in Miami. He is currently chief engineer of WEBE-FM, Bridgeport, CT.

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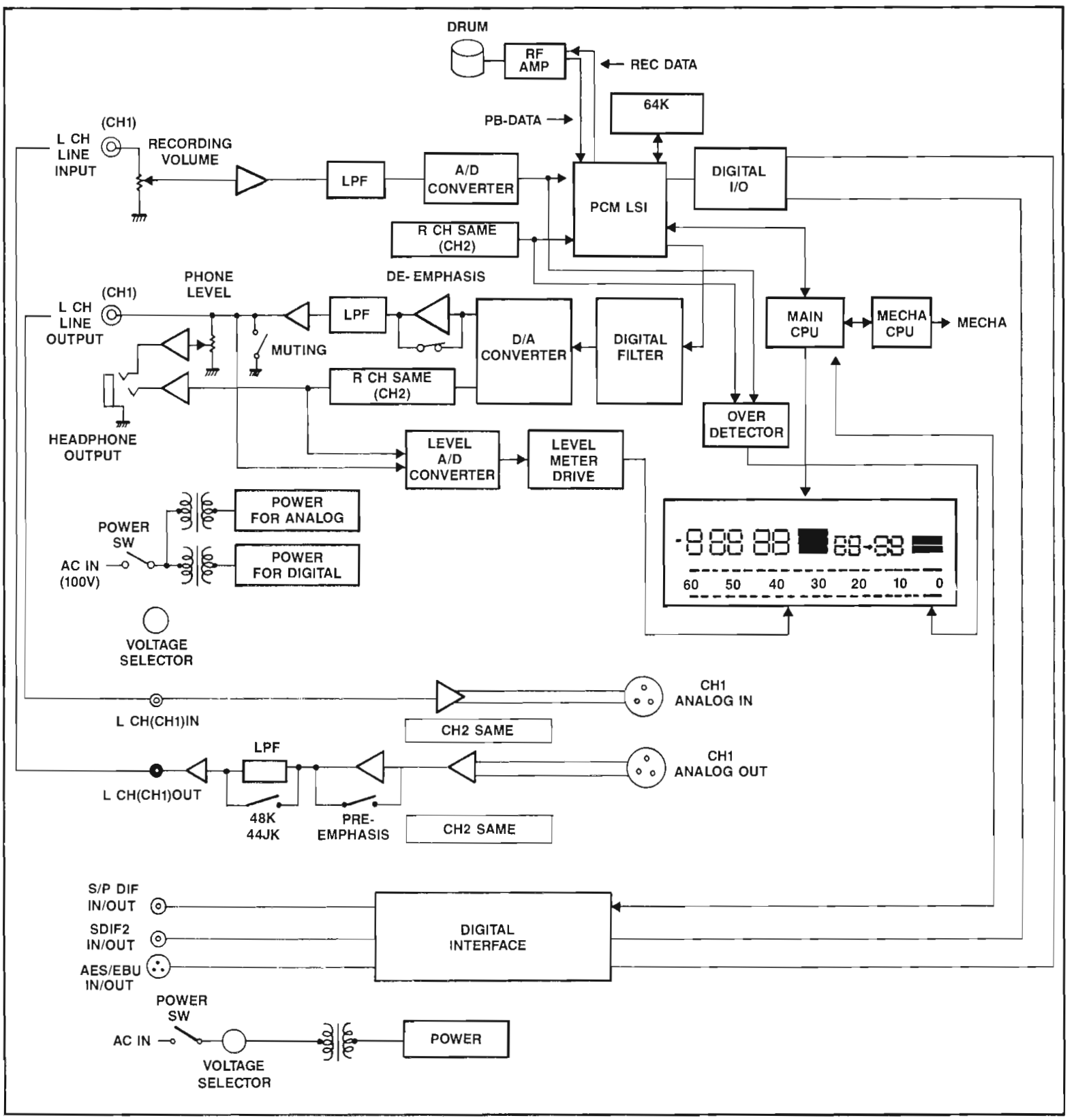

Figure 1. *Basic block diagram. Note that the A/D and D/A processing takes place in the interface unit, not the recorder.*

LEDs to show error-correction status. The green LED indicates an error correction by interpolation, and its occasional flashing is no problem. More serious errors are indicated by the orange LED. It shows that the error was concealed.

Operation and maintenance manuals

The owner's manual covers all the operating functions of the recorder. Its 44 pages are divided logically into specific sections. It is written in such a way that even non-technical users should be able to operate the device.

The service manual also is thorough in its description and instructions. All the schematics are labeled clearly, and in some cases, they are color-coded for easier component and signal-path location. There are foldout pages (some up to five pages) that permit viewing entire circuits or sections at one time. This is a lot easier than flipping through a book or photocopying pages to allow viewing of an entire system.

Because the recorder is composed of two separate units, troubleshooting should be easier. If the recorder unit fails, a new recorder can be substituted without having to remove the interface unit. If the machine is used primarily for playback, the two units could be separated to optimize rack space.

A look inside

At a quick glance, the interior of the recorder looks similar to the interior of a VCR. All the components are laid out in an orderly fashion with an emphasis on

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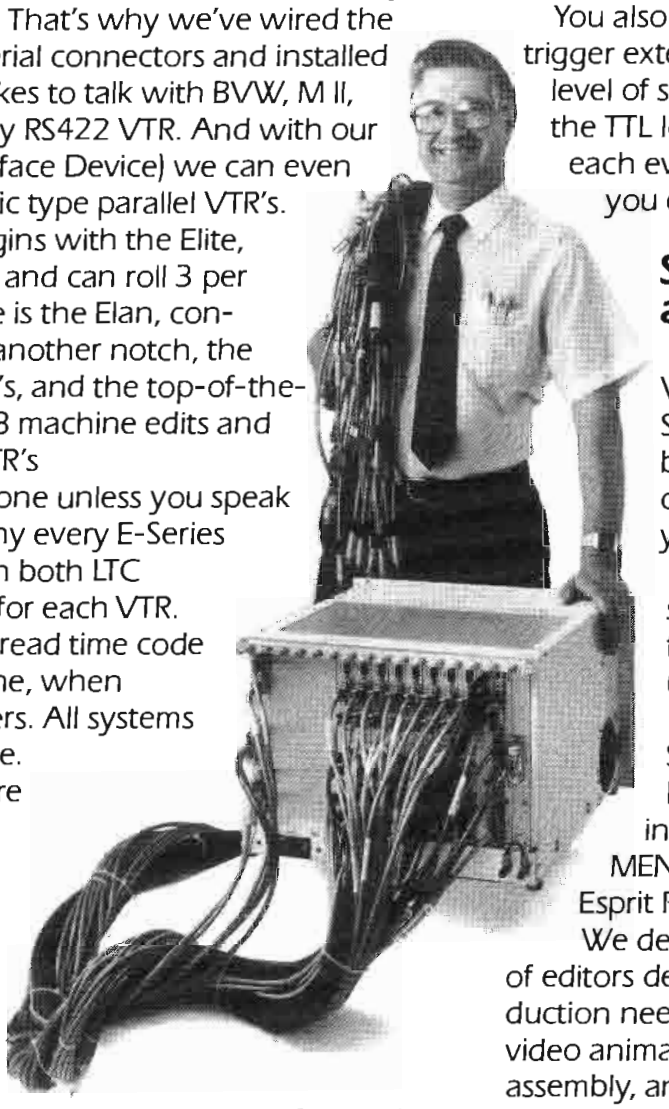

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The front display of the R-DAT recorder looks much like that of a cassette machine.

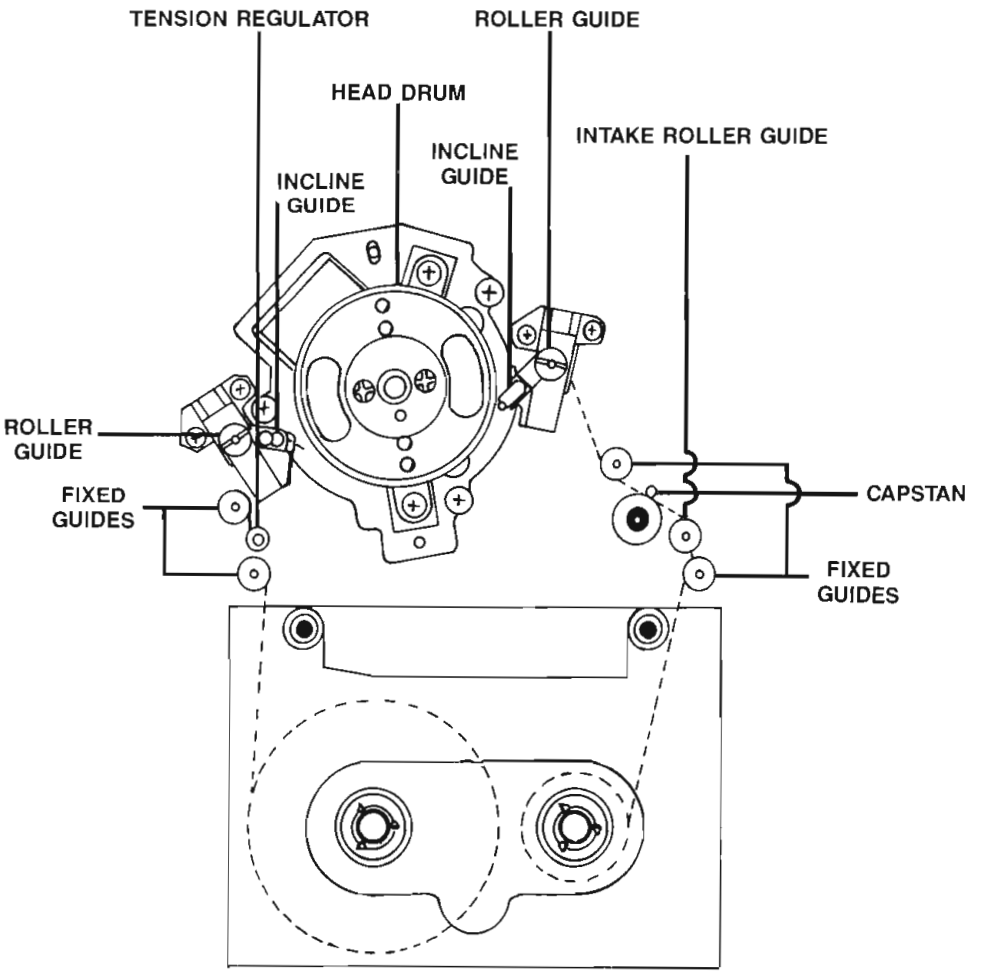

Figure 2. *The key to high-density recording is the use of helical-scanning rotary heads. The combination of the 8.16mm/s tape speed and the 2,000rpm rotating head produces an equivalent tape speed of 3m/s. One cassette can contain two hours of digital audio, representing 2.2Gbytes of information.*

compactness. All the boards are labeled with component numbers. Each major section also is labeled by function.

One of the larger circuits, the analog board, is easily accessible from the top and the bottom of the recorder. The area around the tape transport and loading drawer is more compact with up to three layers of PC boards. These boards can be removed to provide access to the inner circuits.

All the analog boards are separate from the digital boards to reduce any possible interference back into the analog signals. The chassis areas surrounding the analog sections are copper-plated to further enhance the shielding. Each channel has its own A/D and D/A converters, with separate 4X digital oversampling filters. The analog circuits are powered separately to prevent fluctuations caused by the digital systems.

Broadcast applications

The PCM-2500 provides long, continuous recording times with outstanding audio quality. The compact size of the cassettes and straightforward operation make tape handling a breeze. You'll never again have the problem of someone threading the tape backwards.

I recommend that the recorder be used as a mastering deck. In addition to some cuing limitations, it has no sync input. This makes it difficult to sync it to another source. Remote recording could be accomplished easily using analog line-level inputs. Microphone applications would require a mixer.

Editing on the machine is difficult because the tape cannot be easily moved. Instead, the tape must be positioned with the ID codes. Even though the start ID can be changed in 0.3s increments, playback cuing still is dependent on the start ID being in the precise location. Although the electronic tape counter can be used as a cuing aid, rocking or scrubbing the tape is not possible. Remember, the transport is more like a VCR than a typical audio recorder transport.

The wired remote control uses the standard 3-conductor, ¼-inch phone jack, which is mounted on the front panel. This input connects into the same control circuits as the infrared control unit. This prevents the deck from being controlled by the typical contact closure provided in consoles. This makes it almost impossible to wire the motion controls to a typical remote-control panel. A modification probably could be made to interface the device with other equipment, but do you really want to open up and modify a brand new piece of gear? In any case, I prefer a rear-mounted, remote-control connector for permanent installations. This prevents the connector from being damaged or accidentally removed.

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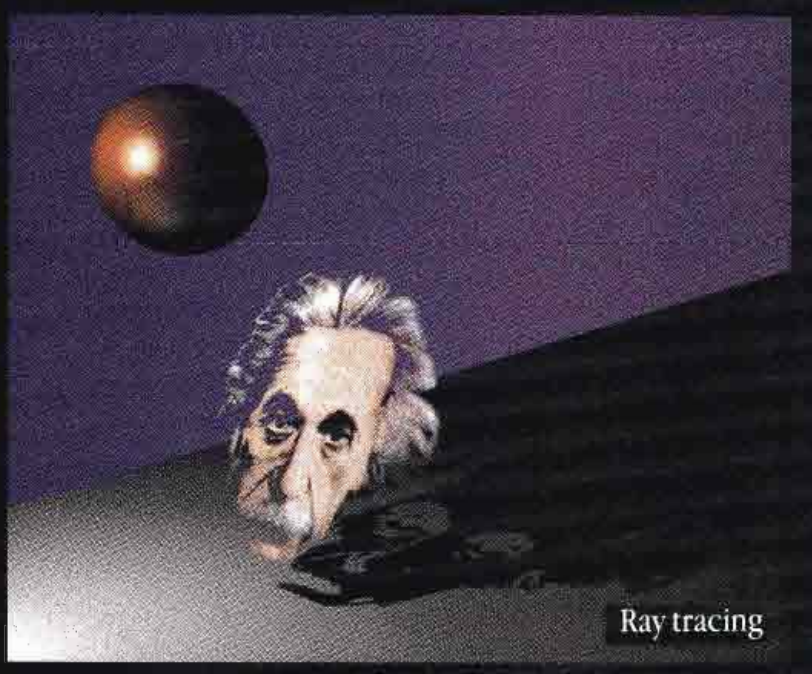
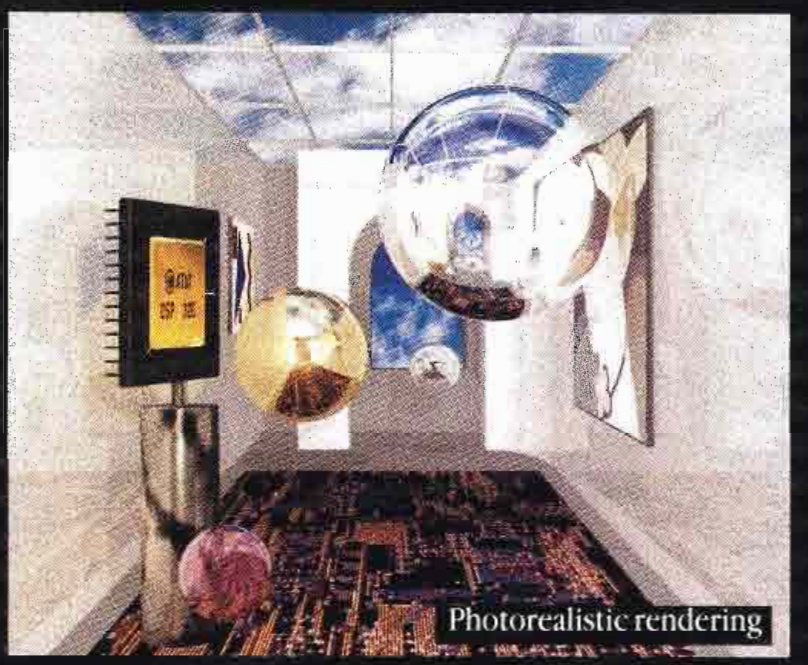
Simulation


Ray tracing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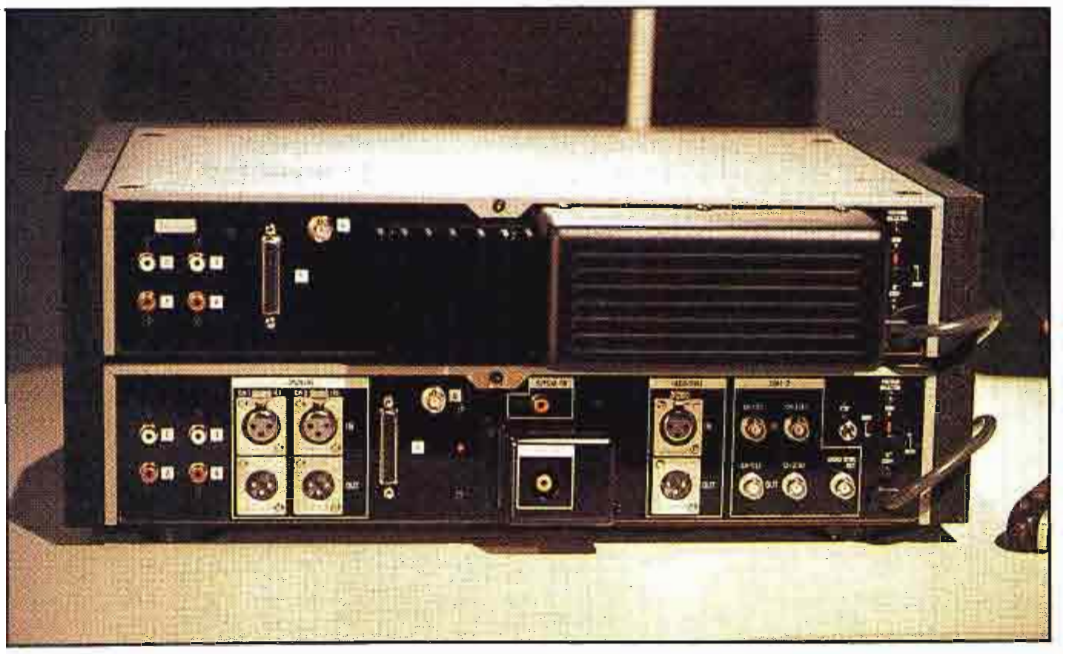
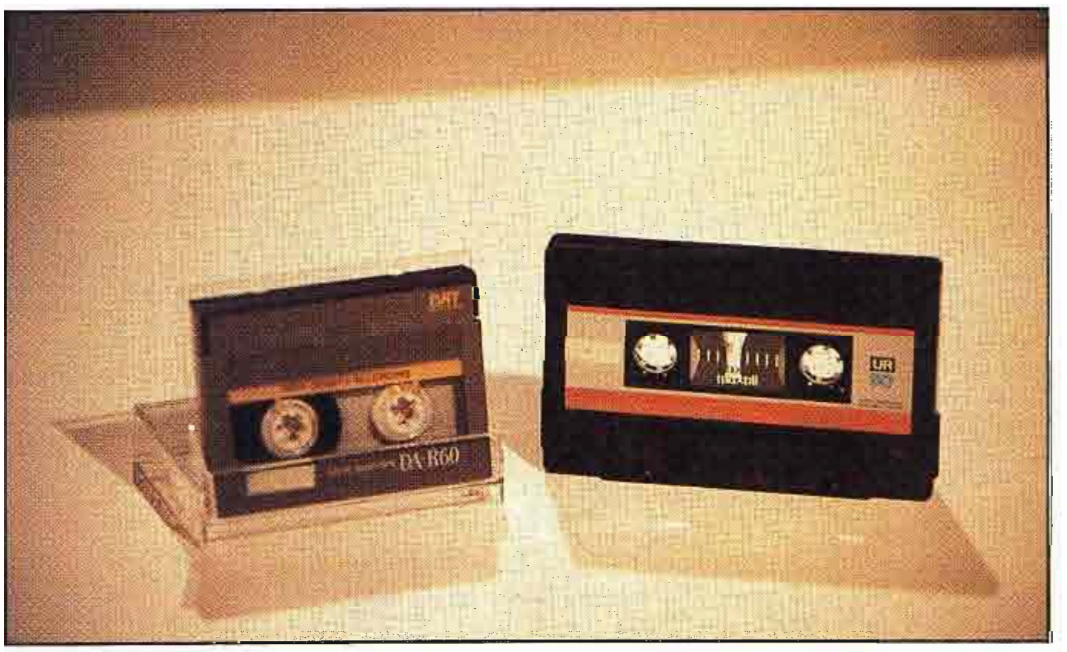
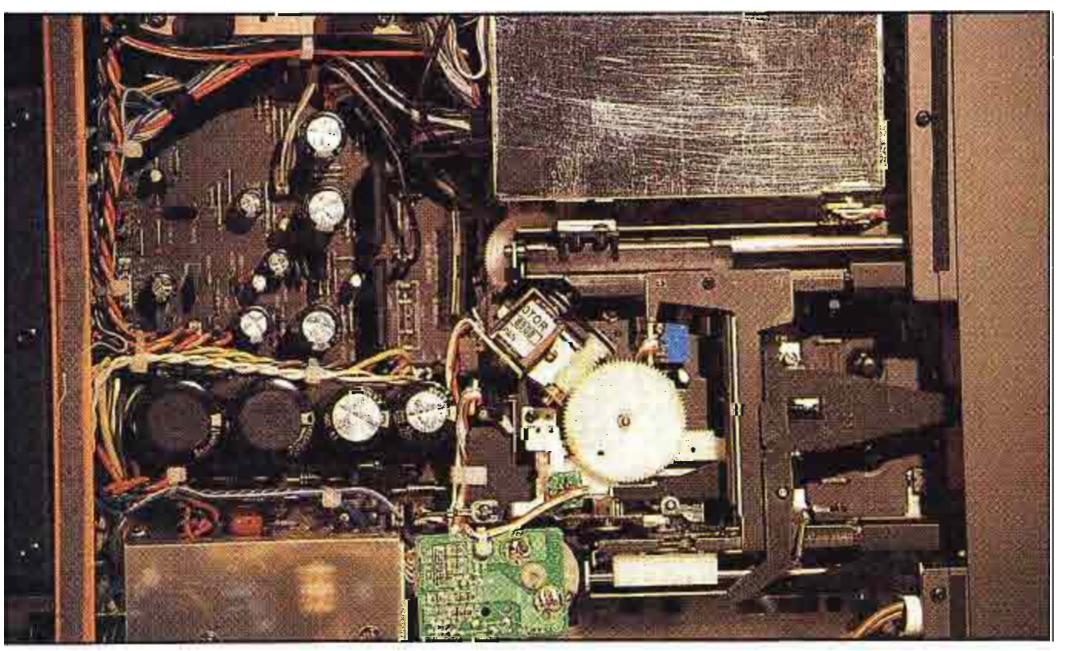


The rear panel has many more input/output options than audio engineers are used to seeing. The recorder accepts both analog and digital inputs. Outputs also are available in both domains.



The smaller cassette size is deceiving. Each R-DAT cassette is capable of providing two hours of stereo recording.



Opening up the recorder gives you the impression that you're looking at a video recorder, not an audio recorder.

Unless your format relies on music that's longer than three minutes (such as classical), the PCM-2500 may not be practical as an on-air music source. Carts, records and CDs offer simpler cuing, which is critical for shorter materials. Longer programs present different constraints, and this is where the recorder would really shine. Syndicated program feeds, recorded with the timer feature, are especially well-suited to this deck.

The digital recorder is a real step toward an all-digital audio path. Top-quality audio, when combined with compact cassettes, makes the device attractive for mastering and archival applications. The major shortcoming for broadcast applications is the cuing limitation. Rapid start-up is possible, but precise location cuing is not always easy. Even so, if digital audio recording is a concern for your station, the Sony PCM 2500 may be the bridge that lets you cross into the digital domain.

Editor's note: The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm.

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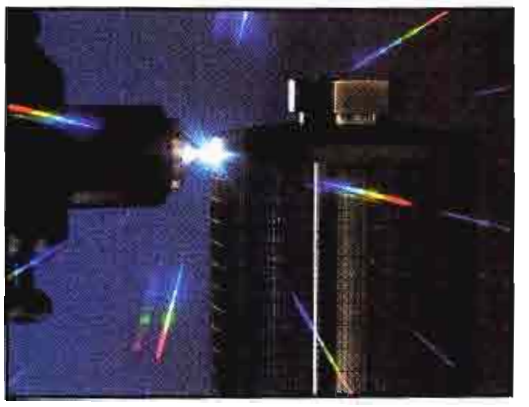
Modulation monitoring for BTSC sound



By Adolfo Rodriguez

Monitoring BTSC (Broadcast Television Standards Committee) TV stereo modulation has been a subject of debate since the system was implemented. The aim of this article is to shed some light on the source of the controversy.

A substantial difference in the indications of different BTSC modulation monitors has created some confusion and concern among broadcasters. In fact, the situation has prompted the EIA (Electronic Industries Association) to form a modulation working group with the task of defining certain characteristics for BTSC modulation monitors. These characteristics were undefined in EIA Television Systems Bulletin No. 5, Multichannel Television Sound, BTSC System Recommended Practices. Although it did not specifically define procedures for BTSC stereo TV sound, the document suggested measurement procedures for FM radio broadcasting.

At the heart of the problem are high-amplitude, short-duration peaks inherent to the BTSC system and the differences in the peak-response characteristics of the modulation monitors available. (Note that the peaks exist in FM multiplexed stereo.)

BTSC system

Let's look at the basics. The BTSC stereo system is much like commercial broadcast FM stereo. The differences lie in stereo subcarrier frequencies and modulation levels, the pilot frequency and the companding in the L–R channel. Like FM stereo, the BTSC system consists of a baseband signal, the sum of the left and right audio channels (L+R) and an AM double-sideband suppressed carrier (DSB-SC), which is modulated with the difference between the left and right channels (L–R). The baseband signal occupies the same spectrum space of a monaural audio signal and provides compatibility of the system with existing monaural receivers.

The L–R subcarrier with center frequency of 31.468kHz, twice the NTSC color line rate of 15.734kHz (fh), is also twice the frequency of the pilot carrier. Additionally, provisions are made for optional transmissions of a secondary audio program (SAP) channel located at 5fh and a professional channel at 6.5fh. Suggested SAP channel applications are dual-language broadcasts and distribution of commercials or other information to local FM stations. The pro channel is intended for non-program applications of voice or data transmissions. Figure 1 illustrates the allocated audio spectrum of the BTSC system.

Each of these carriers contributes to an overall modulation of the FM aural carrier for a total peak deviation of 73kHz. Figure 2 illustrates different parameters of the BTSC system spectrum, including the contributions of each subcarrier to the overall peak deviation. The peak deviation allowed for the L–R channel is twice that specified for L+R (50kHz vs. 25kHz). This

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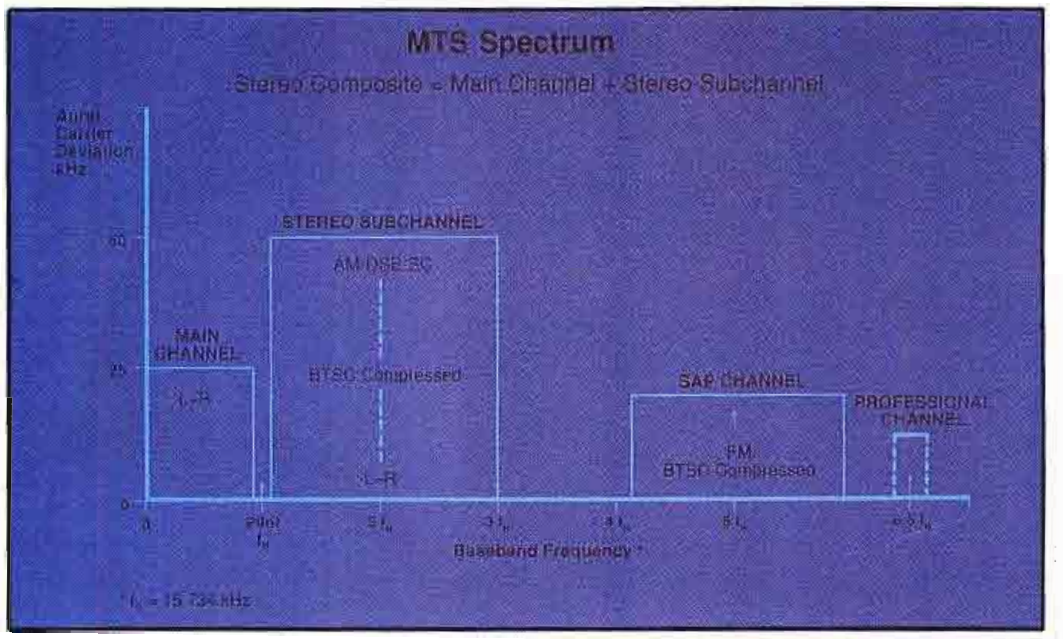
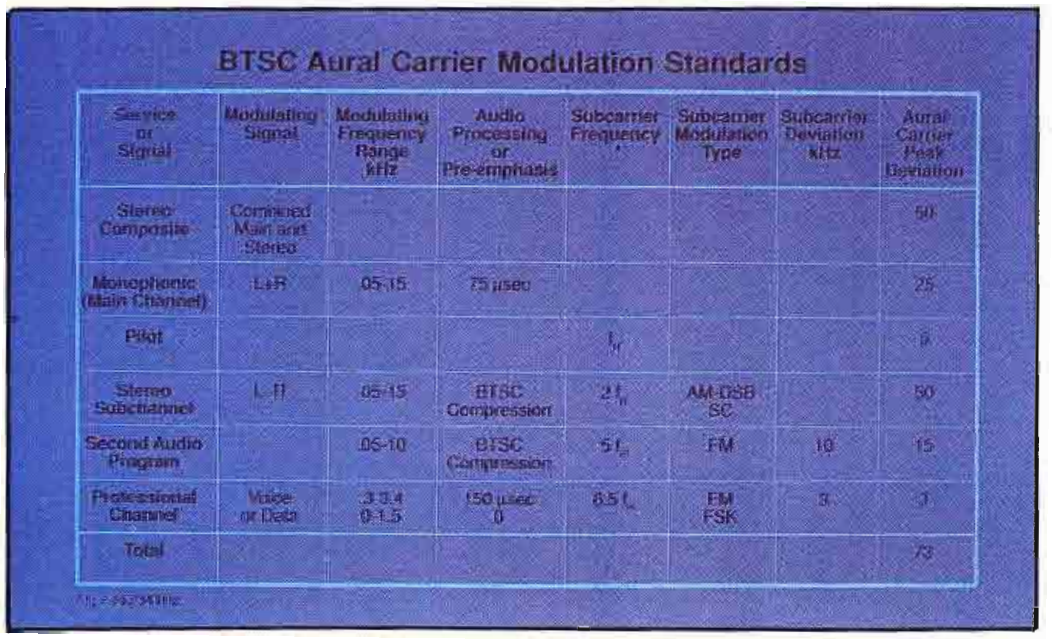


Figure 1. *The MTS spectrum.*



BTSC Aural Carrier Modulation Standards

Service or Signal	Modulating Signal	Modulating Frequency Range kHz	Audio Processing or Pre-emphasis	Subcarrier Frequency	Subcarrier Modulation Type	Subcarrier Deviation kHz	Aural Carrier Peak Deviation
Stereo Composite	Combined Main and Stereo						50
Monophonic (Main Channel)	L+R	05-15	75 µsec				25
Pilot				f_h			5
Stereo Subchannel	L–R	05-15	BTSC Compression	$2f_h$	AM-DSB SC		50
Second Audio Program		05-10	BTSC Compression	$5f_h$	FM	10	15
Professional Channel	Voice or Data	3.3-4 0-1.5	150 µsec 0	$6.5f_h$	FM FSK	3	3
Total							73

Figure 2. *BTSC aural carrier modulation standards.*

Rodriguez is marketing manager for TV measurement systems, Tektronix, Beaverton, OR.

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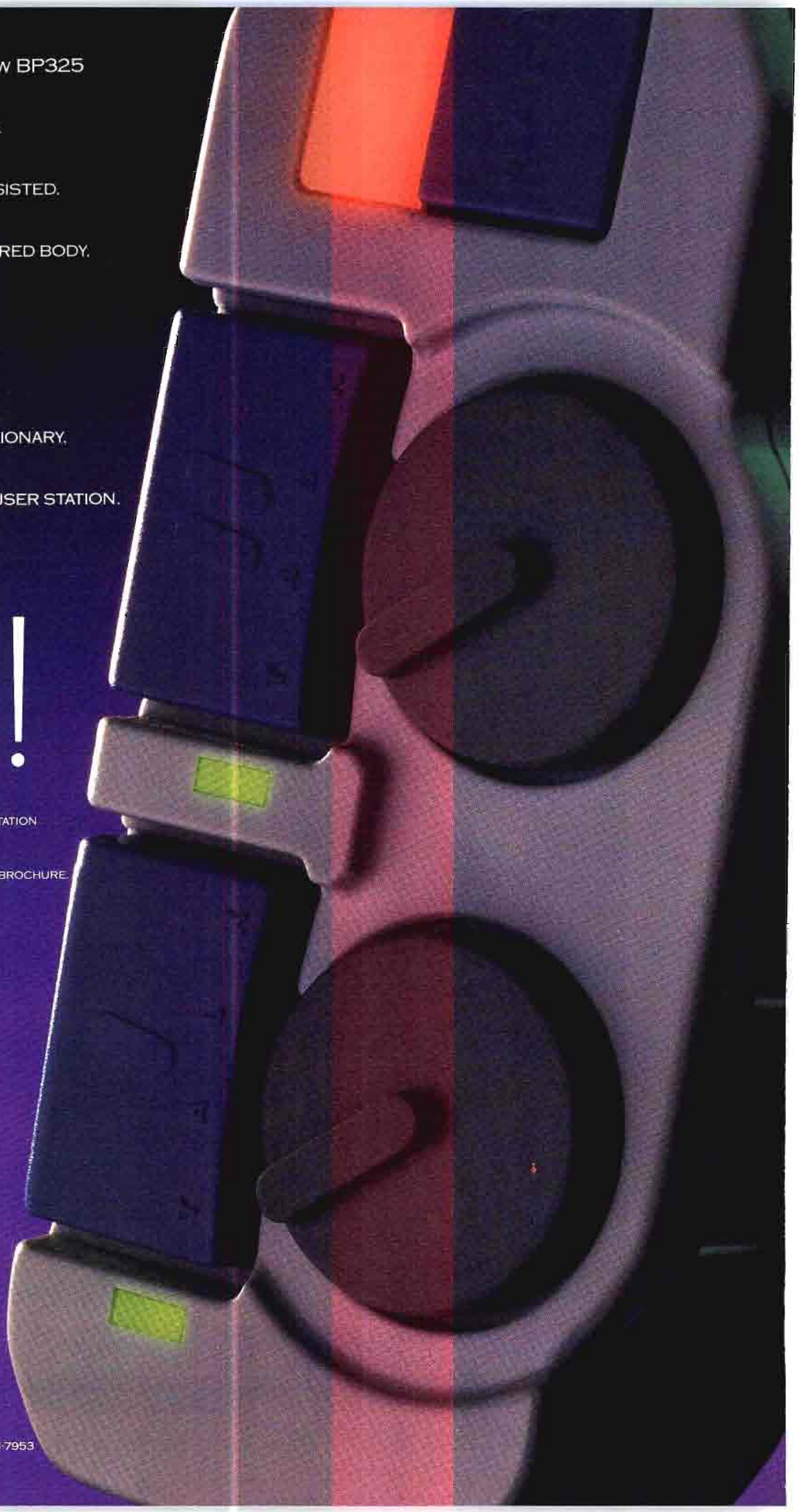

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Continued from page 280
reduces the effects of parabolic noise characteristics inherent in FM transmission systems. However, the combined peak deviation of the main and subcarrier channel still is limited to 50kHz. In normal stereo transmission this presents no problem because of the interleaving properties of L+R and L−R.

Noise reduction in both the L−R and SAP subchannels helps to achieve good signal-to-noise ratios. The noise-reduction system uses both wideband and spectral compression at the encoder and complementary wideband and spectral expansion at the decoder.

The complementary action between encoding and decoding places critical tolerances on the total modulation or composite level in BTSC for good stereo separation. A wrong composite level will cause the expander to mistrack in amplitude and phase, thus feeding an incorrect L−R signal to the receiving stereo matrix and reducing separation. As an example, the best achievable separation with a composite level error of 0.28dB is 30dB, assuming an otherwise ideal system.

The preferred method for adjusting composite level is the Bessel null technique. For a deviation of 25kHz, the Bessel null occurs at a modulating frequency of 10.395kHz in the L+R channel. Alternately, a modulation monitor can be used to measure the deviation of the L+R channel, provided the monitor is accurate. If the monitor measures the pilot injection level, it can be used for an approximate check of the modulation level. The BTSC standard specifies an injection-level accuracy of 5kHz ±0.5kHz (−0.9, +0.8dB). This level of uncertainty could cause separation as low as 25dB.

The compressor in the encoder is the source of the short-duration peaks, which are inherent in the BTSC system. They exist because a finite time is necessary for a compressor to reduce its gain in response to a sudden increase in input level. See Figure 3.

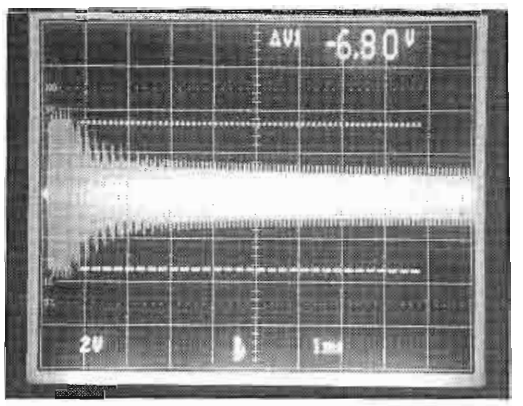

Figure 3. *A short-duration peak results because compressor action is not instantaneous.*

The compressor overshoots, and other overshoots caused by low-pass filters intended to keep the bandwidth of L+R and L−R channels within 15kHz (for pilot protection), cause instantaneous deviations of L+R and L−R that exceed the combined limit of 50kHz for short periods of time.

Indicating modulation

EIA TV Systems Bulletin No. 5 recommends that monitoring and measuring equipment should include indicators for aural carrier deviation of each of the following parameters:

- the main channel (L+R).
- the main channel combined with the stereophonic subchannel (L+R and L−R), but without pilot.
- the pilot.
- the SAP subchannel.
- the pro subchannel.
- all channels combined.

Peak flashers are required for signals on the main channel, the main channel combined with the stereophonic subchannel and the SAP subcarrier; they also are recommended for the professional subcar-

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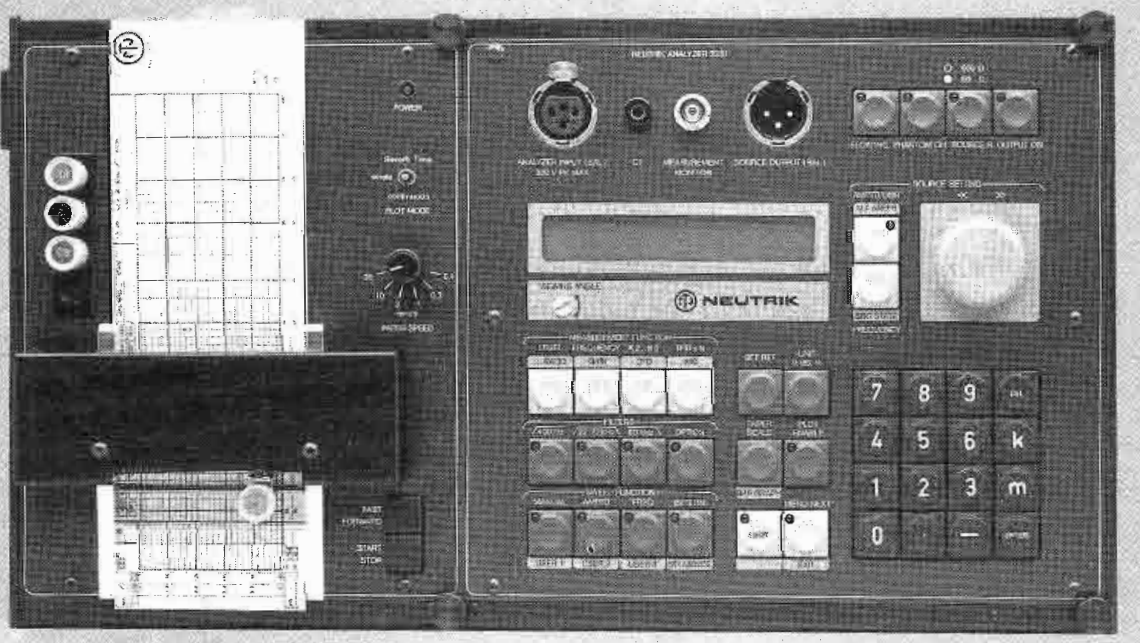

*Vademecum (Lat.) "Go with me"

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rier. The SAP and pro subcarrier deviation also should be indicated. In the past, analog meter movements have served as indicators on modulation monitors. However, the number of parameters involved with BTSC suggests a need for a display that is easier to interpret for comparisons. One possibility is to use an array of linear indicators, such as the peak-deviation screen illustrated in Figure 4.

In general, all modulation monitors perform the same basic functions — to separate the individual signal components from the composite for modulation measurements and to decode and process the signal for audio measurements.

One approach to measurement

Monitors differ in the methods they use to separate and detect the individual signal components. In one approach, each of the time-varying signals is full-wave rectified, then peak-detected. A separate peak detector for each parameter holds the highest peak value it sees, until it is reset. A scanner, looking at each detector output in turn, displays the levels on the screen. The detectors are reset after scanning and return to monitor their respective parameters.

Conventional filtering for component separation would introduce overshoot and alter the true peak value of a complex waveform by delaying some of the signal components more than others. As a result, extraction of signal components from the total signal must follow designs that avoid excessive use of filters.

The main (L+R) channel is the hardest to separate without sharp cutoff filters because of its proximity to the stereo subchannel and the 15.734kHz pilot carrier. SAP and pro components are removed by phase-compensated filtering above 50kHz, and the pilot is removed by cancellation (not filtering). The remaining composite stereo signal (main channel plus stereo subchannel) is fed to its peak detector and to the main-channel sampler.

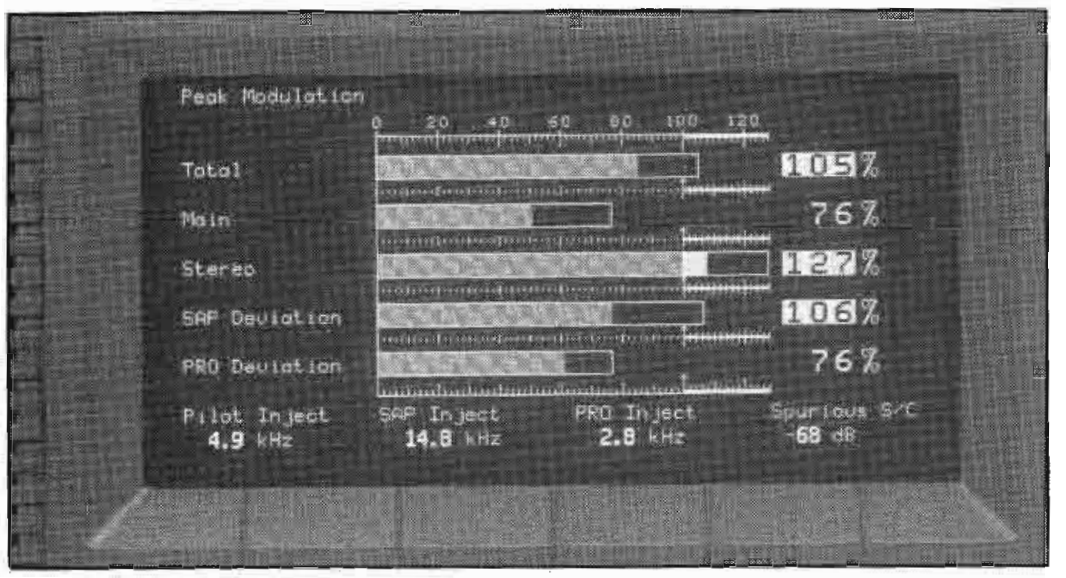

Figure 4. *Various methods can be used to indicate several modulation values simultaneously, including this electrofluorescent panel display approach.*

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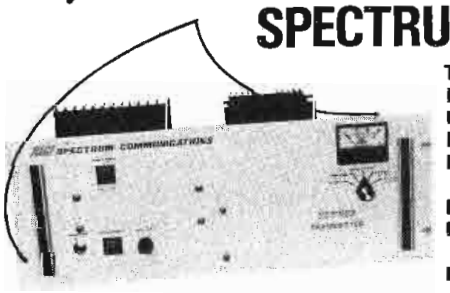

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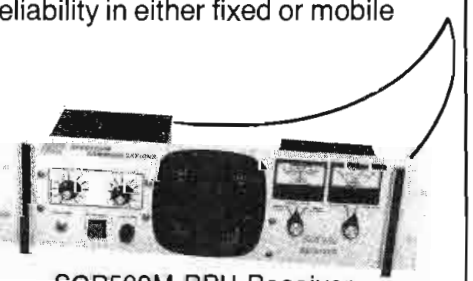

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Sampling of the composite stereo signal occurs at zero crossings of the stereo subcarrier with a frequency four times the pilot frequency. The samples are fed through a reconstruction filter with a cutoff of 20kHz and a high degree of phase linearity to 15kHz. The result is the main channel with minimum alteration of the true waveform. This signal is fed to its respective peak detector.

In defense of peaks

In the method outlined previously, the choice of true peak measurement was influenced by FCC rules for TV broadcasting, by an interest in technical accuracy and by a lack of any other standard. The technical definitions of rule 73.681 for TV broadcasting defines frequency deviation as the peak difference between the instantaneous frequency of the modulated wave and the carrier frequency. Frequency swing is the peak difference between the maximum and the minimum values of the instantaneous frequency deviation of the carrier wave during modulation. Percentage modulation, as it applies to frequency modulation, is the ratio of the actual frequency deviation to the frequency deviation defined as 100%. These statements can be interpreted to favor the true peak method of modulation metering.

FCC rule 73.332, now deleted from Part 73, specified certain characteristics to be met by type-approved modulation monitors. There were separate specifications for meters and for peak flashers. The flasher was required to respond correctly to tone bursts from one to 10 bursts per second, with each burst consisting of either 10 cycles of 10kHz or five cycles of 1kHz. This specifies a maximum allowable time to respond with no stated minimum.

Bypassing the peaks

Broadcasters have indicated an interest in the capability to measure true peak deviation, but they also have asked for additional capability. Particularly, they want an operational monitor for daily, general use, which ignores extremely short transients of little or no audible consequence. This can be accomplished by slowing down the peak-metering circuit but, depending on the approach, other problems could result.

If the attack time of the metering circuit is simply slowed down, as with an R-C integrator, one requirement of rule 73.332(d)(4) may not be met. The rule reads, in part, "The accuracy of the modulation percentage reading must hold when the modulation consists of complete composite stereophonic signals (main channel, pilot subcarrier and stereophonic subchannel)."

The application of an R-C integrator to slow the response may not meet this requirement, even on steady-state tones. If you could see inside the signal, you would see more energy available to charge the capacitor from a main-channel sine wave of a given frequency and amplitude than for the same frequency and amplitude if it forms the envelope of the modulated subcarrier. As a result, discrimination against the stereo subchannel exists, even with steady L and R tones.

If the total meter is calibrated to read correctly on main-channel sine waves, it may not correctly read the peak deviation of the stereo subchannel or of any composite that includes the subchannel. The L=R and the L=−R conditions are illustrated in Figures 5 and 6. The L=R condition clearly reaches the 100% condition with a steady-state signal. The L=−R condition, on the other hand, never reaches the 100% level, even though the peak value is 100%.

There are methods to circumvent this situation that would treat subchannel

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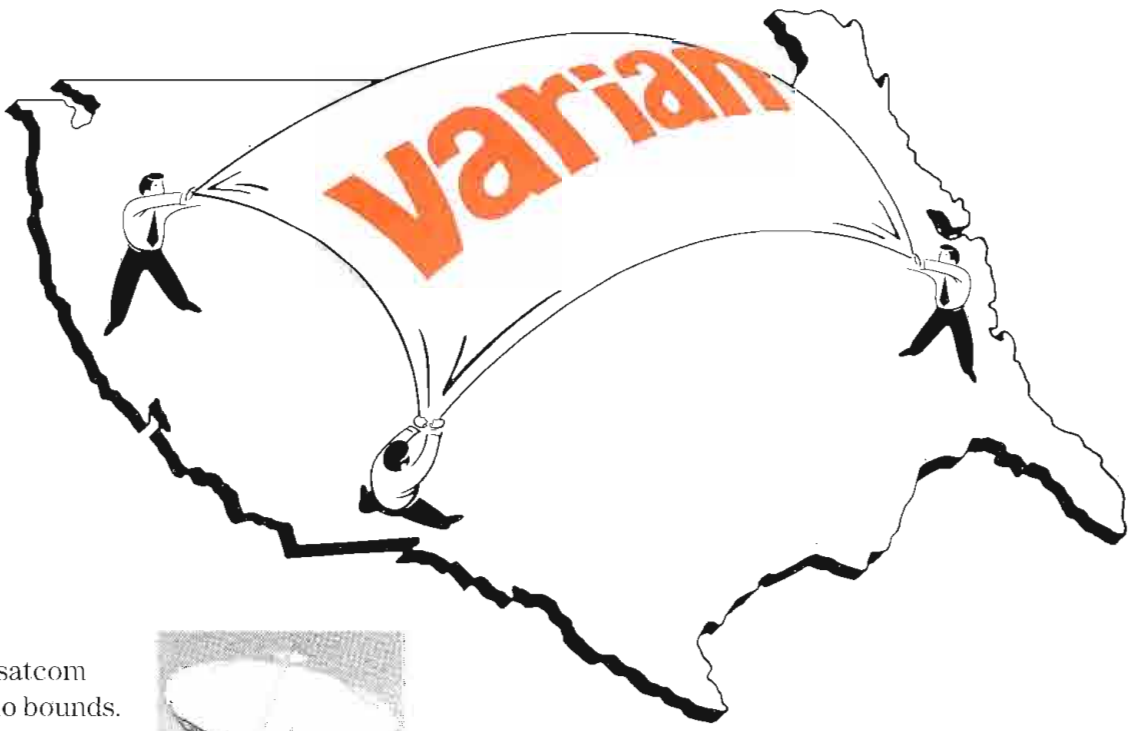

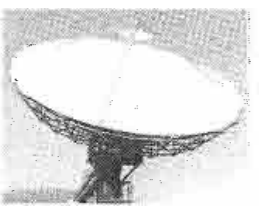

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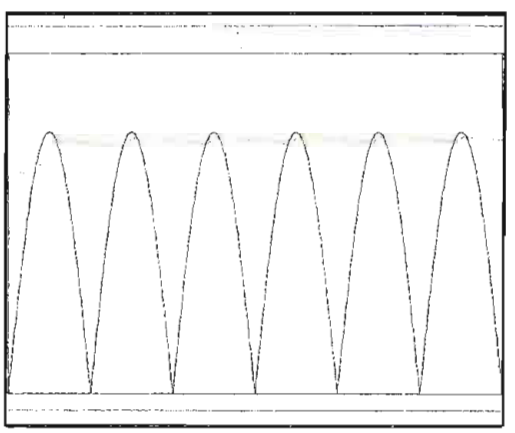
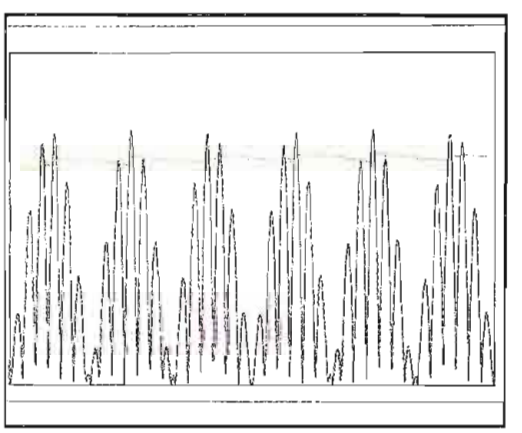
envelope peaks essentially the same as main-channel peaks. In addition, the measurement would apply a weighting factor to a peak, based on its duration. The shorter the duration, the less its effect on the measurement. This weighted peak mode may be available through switch selection with the existing true peak mode. Where the weighted peak mode offers measurements less affected by short transients of limited aural consequence for general day-to-day modulation monitoring purposes, a true peak mode with significant transparency to the signal wave shape is available for such purposes as checking operation and setting of peak-limiter circuits.

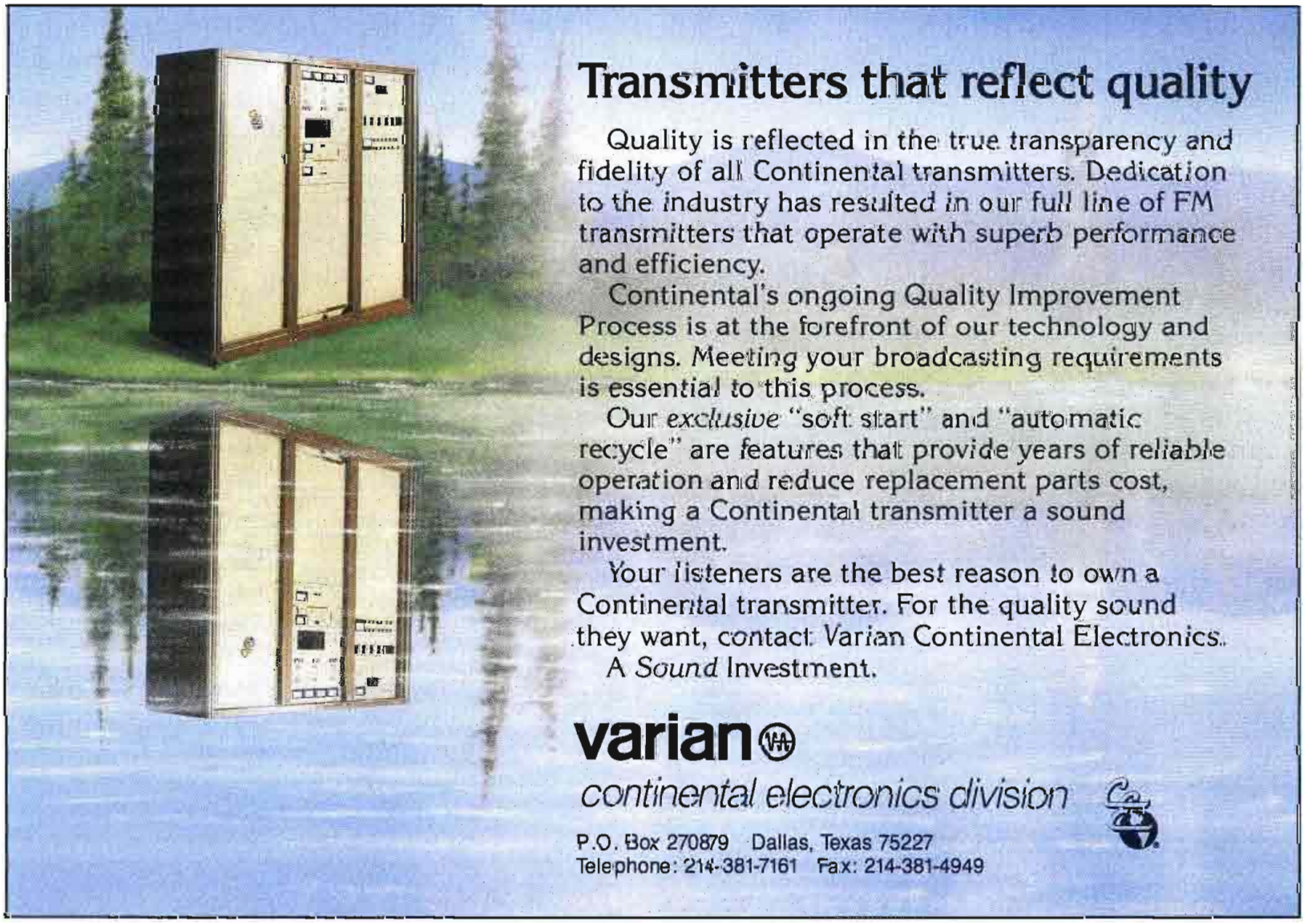
Practical compromises

Documentation for BTSC aural modulation monitoring awaits some statement of the monitoring procedure to be followed. Until the EIA working group completes its work in defining a procedure, it is worth noting that both the true and weighted peak measurements provide valuable information to the broadcaster. However, as with any measurement, the methods must be understood before serious data interpretation can begin.





Figures 5, 6. *The response of metering calibrated for main-channel sine waves (5), may not correctly read peaks of composites, including the subchannel (6).*



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Voice of America in Paris

Voice of America, a service of the United States Information Agency, has been broadcasting from Paris since late 1988. Twelve-minute local slots are produced hourly. The other programs are relayed via satellite from the United States. Local coverage was the condition for granting Voice of America a French frequency.

Maxwell pulls out of British cable TV

In a surprising move to many media experts in Europe, publishing tycoon Robert Maxwell has decided to pull out of the British cable TV network. A Florida bank has been commissioned to sell his shares by the end of the year. One of the reasons for the divestment, experts say, is Maxwell's urgent need to raise capital since his takeover of the Macmillan publishing company for $2.6 billion. But a complete withdrawal from TV is highly unlikely. Maxwell still holds interest in the private French TF1 channel and Britain's MTV.

Radio network formed in Switzerland

Twelve local commercial radio stations in Switzerland have formed the Radio Network Schweiz (RNS). The new company, located in Basel, will coordinate programming among individual stations.

TDF 1 on successful path

The French TDF 1 (identical to the failed German TV-Sat 1) has successfully beamed digital pictures to receivers in France and Germany. The French direct-reception satellite was launched in October 1988. Tests on the D2-Mac decoder were conducted in November. European vendors, however, have been slow to push the D2-Mac norm, pending the outcome of the launch and demand for DBS programming.

New German satellite stations to be used by NBC

The German Bundespost has commissioned Siemens, a West German electronics manufacturer, to build two relay stations for satellite television in Frankfurt and Usingen. Construction is to be completed in May. The station in Frankfurt will transmit programs for NBC and Brightstar via satellite into the United States. The station in Usingen will feed programs from a leased transponder aboard the European ECS-F5 satellite into cable networks. Both antenna systems have been designed to send and to receive one or two modulated TV carriers. Transmission and reception frequencies will range between 14GHz and 11GHz.

German satellite for television?

Germany's Kopernikus telecommunications satellite is scheduled for launch this month. The satellite will be used for TV programming by the country's public serv-

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ice networks. Ideally, the German Bundespost would like to concentrate all German-language programs aboard Kopernikus. Not surprisingly, however, the country's commercial channels have shown little interest in the state-financed venture. The satellite was designed to facilitate voice and data communications between Berlin and the rest of West Germany, at a time when few thought an optical-fiber connection would link the two.

Satellite dish and decoder shortage may hurt Astra

There is growing concern that British retailers will not be able to meet customer demands for satellite dishes and decoders when Sky Television goes into operation. Critics blame the shortage on manufacturers delaying production until the successful launch of Astra. Retailers throughout Europe are concerned that the shortage could result in poor quality or inappropriate dishes flooding the market (60cm dishes reportedly have been sold where 75cm is the minimum requirement). They also are worried that many of the low-budget receivers already on the market will not have been adapted to meet Sky decoder specifications.

Sky Channel retreats from the continent

Britain's Sky Channel is expected to withdraw from cable networks in Scandinavia and the Benelux countries by the end of the year following an earlier decision to withdraw from Germany, France and Austria. Like several other English-language satellite channels, it failed to make an impact against national public and private stations. With this decision, Sky Channel has put an end to its role as a pan-European channel and will concentrate on the United Kingdom and Ireland instead.

EEC directives will be delayed

Directives stemming from the EEC's telecommunications Green Paper concerning satellite services have been delayed. Action had been expected by the end of last year but was pushed back pending the arrival of a new group of EEC commissioners responsible for telecommunications. One new appointee is Jean Dondelinger, who has been put in charge of audio-visual affairs. His appointment has been accompanied by the establishment of a fifth division within the EEC directorate, which will be responsible for the interface between broadcasting and telecommunications. In effect, Dondelinger will be in charge of HDTV policy. Well-known in European cable and satellite circles, the Luxembourg minister headed his country's delegation to last year's WARC conference on the allocation of orbital slots for telecommunications satellites.

Belgium gives go-ahead to foreign channels

The French-speaking region of Belgium, Walonia, finally has adopted the legal framework for the distribution of foreign channels on cable in the southern part of the country. Under the new law, foreign

Continued on page 298

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Supplemental system handles remote control

By Russell Brown

As TV facilities change, so must the remote-control systems that operate within them. Whether it's a new building, a new control room, or even the addition of new equipment, machine control is always changing. Historically, machine control required large rack panels covered with push-buttons. Even larger frames were required to house the control relays. If a station used more than two control rooms, the relay frame became even larger.

Expanding an existing system is time-consuming. The laborious task of adding wiring sockets, frames and relays cannot be avoided. In addition, the changes often have to be performed when the station is off the air. Because many stations now operate 24 hours a day, any interruption of the remote system becomes a major headache.

Alternative approach

With the advent of the SMPTE/EBU ESbus comes the promise of a fully digital machine-control system that is easy to use and install. Although the ESbus is a good idea when constructing new facilities, it is not practical in every situation. When a partial renovation or addition is all that's needed, there is no need to install a whole new remote system. A supplemental system may be just what is needed.

This was the situation at KTSF-TV when two VTR-2s were added. The new VTRs were needed because of increased production and air usage. The previous remote-control system handled three quads, two film islands and three 1-inch VTRs. Adding two more VTRs meant the system had to be expanded or supplemented. Because of the increased demand being placed on the 1-inch machines, we wanted to use more features in the machine-control system than the basic stop, play and ready.

New remote requirements

The production department also wanted more functions, including record, to be available on the new remote-control system. An accurate shuttle control was needed to remotely cue tapes for both production and air operations. Meanwhile, the engineering department was considering a computerized satellite downlink control system for 1-inch recording. In addition, we wanted to be able to control all the machines from two control rooms and a future computer. Combining all these requirements resulted in a system with shuttle and preroll capabilities, record and a tally lockout to prevent mishaps on air.

An important design consideration was the limited available rack space in both master and studio control. There was no rack space for a new control panel. This meant that any new remote-control panel for six VTRs had to be installed in a box designed to handle four VTRs.

Functional design

The control panel size was restricted to about 6"×5". This meant using as few buttons and knobs as possible to control all the functions while providing for play, stop, ready, cue, record and shuttle modes on six VTRs.

The solution was to use only one set of VTR motion controls on each remote panel to control all six VTRs (see Figure 1). Six push-buttons, one for each VTR, select the machine to be controlled. Each of these buttons has a bicolor LED to indicate the availability of the VTR. The LED is red when the VTR is delegated to this control panel and the VTR is in remote. If the VTR heads also are spinning, then the red LED blinks on and off. This permits the operators to know quickly whether they have control of a VTR and whether it is ready to roll.

We wanted to make VTR selection as easy as possible for the master-control operator. This required the use of an interface circuit connected to the preset bus to get a tally output. The result was a time-saving feature. As the air operator presets a 1-inch VTR, that same VTR is selected automatically on the remote panel. This eliminates the need for the operator to preset a VTR, then select it again on the remote panel.

To save on panel space, the detent position of the shuttle knob is used to enter the shuttle mode. When the knob is in the detent position, an LED lights up to show the VTR is in shuttle. As a safety precau-

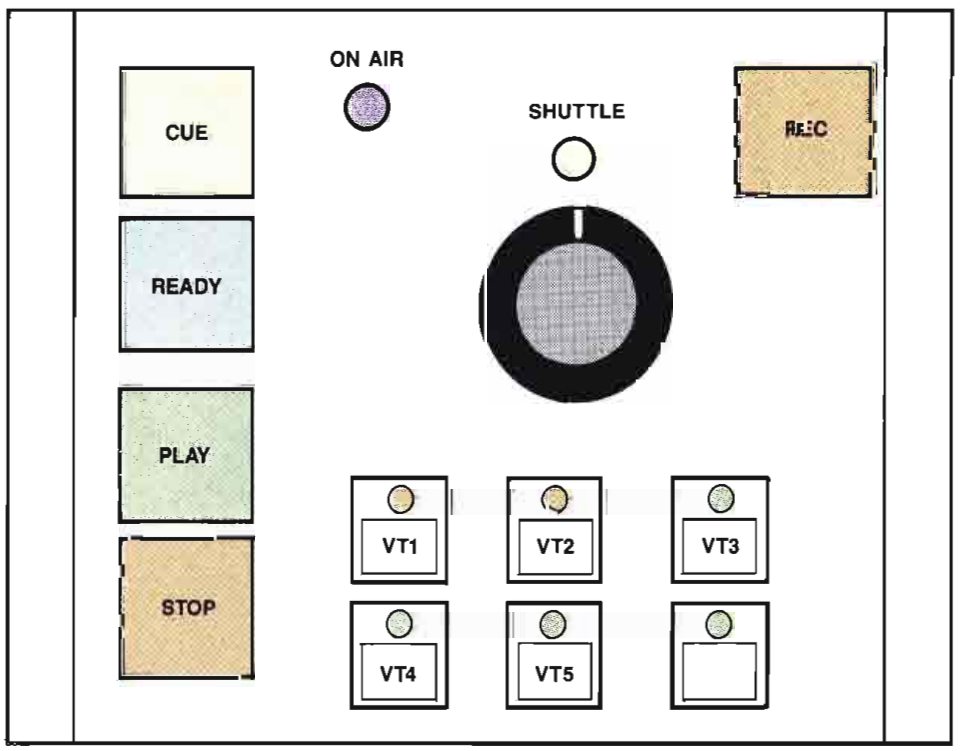

Figure 1. The remote-control panel handles six VTRs with a minimum of switches and panel space.

Brown is design engineer at KTSF-TV, San Francisco.

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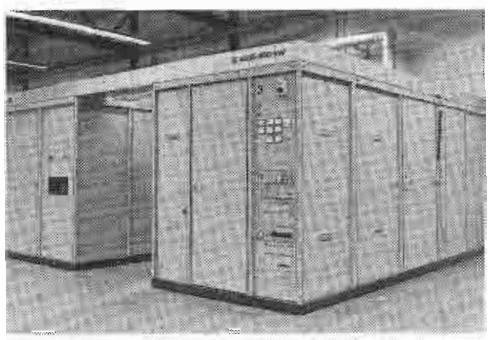

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tion, when the VTR is in shuttle and is then unselected (meaning you have selected a different VTR to control), the shuttling VTR is placed automatically in the stop mode. This keeps the tape from running off the end of the reel without the operator knowing.

The cue control is a single button on the remote panel. When the shuttle knob is in detent and the VTR is in the stop or shuttle mode, pressing the cue button places the machine in the enter-and-search mode. This causes the tape to roll back 5s for preroll. However, if the knob is not in detent when the VTR is in play or shuttle and the cue button is pressed, then only the search function is activated. Now the tape rolls back to the last entered preroll point. This provides quick and accurate tape cuing.

The tape can be prerolled easily with the cue button. If it is rolled too soon it can be recued with another press of the cue button. Also, an operator who is checking a tape before airing it can simply hit cue while the tape is in shuttle or play, and the tape will recue itself. Because the cue-button lamp is tied to the search lamp on the VTR, it indicates whether the tape is at its cue point.

When a VTR is on the air, the only active controls on the remote panels are the play and ready buttons. All other functions are locked out for that VTR. This prevents the stopping or shuttling of a tape while it's on the air.

Because the remote panels have recording capabilities, it is important to indicate when the VTR is not in record lockout. This mode is indicated when the record button's lamp flashes on and off.

Physical design

A card cage is used to house the control circuitry, which simplifies construction and maintenance. This also allows for some expansion if needed. Two remote panels are wired to the system, MCR and studio. The computer port consists of an empty card slot wired to a back-panel connector for future use.

Nine circuit cards are needed for this system (see Figure 2). Each VTR requires one interface card. This minimizes the card's complexity and limits the downtime of a VTR if a problem develops in the remote control. All VTR input and output interfacing, station tally and control selection are handled on this card.

Two remote-panel interface cards contain the indicator lamp drivers, buffers for the push-buttons and a small shuttle voltage interface circuit.

The select card manages what panel is controlling what VTR. It receives information from a machine-delegate control panel located next to master control and from the two remote-control panels. The card has another input, an arming switch,

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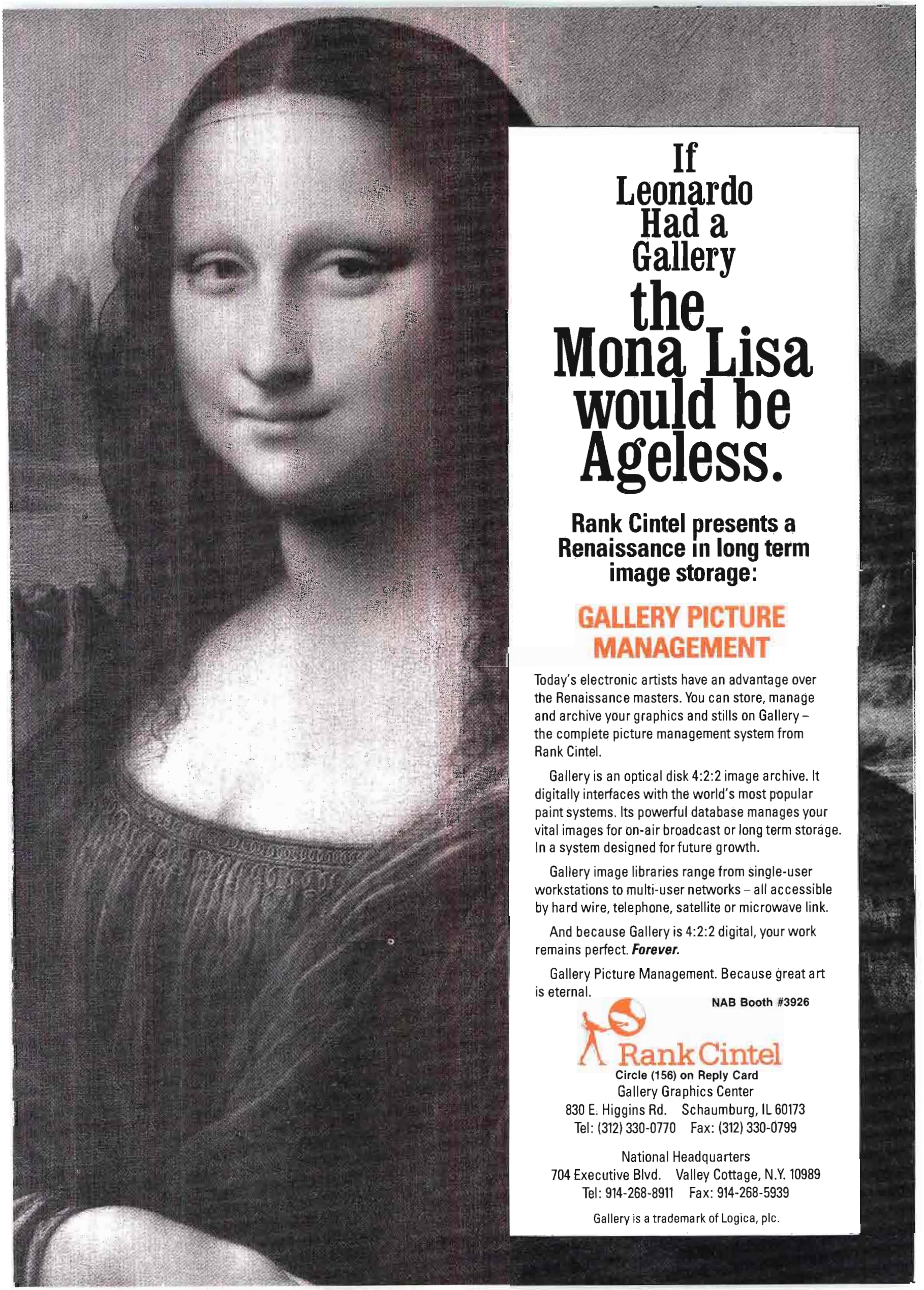

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that selects computer control of a VTR. The arming switches would be mounted at the VTR and wired to a connector on the back panel of the remote.

The control-panel functions include: play, stop, ready, cue, record and shuttle. The panels also have six bicolored LED push-buttons labeled VTR 1 to VTR 6. These buttons select the VTR that is to be controlled.

Electronic design

We used CMOS logic for all digital circuits. This lowered power consumption and reduced the need for bypass caps. Also, some special chips are available in CMOS that are not found in TTL. The higher impedance of CMOS inputs proved to be advantageous because the 1-shots required smaller caps.

The three different control points are master control, studio control and the computer interface. Each control point can control only one VTR at a time. This scheme permits the use of a bused architecture for control and status (see Figure 3). It also meant a large reduction in the amount of wiring.

The three buses have different functions. When VTR 1 is assigned to MCR by the select card, and MCR control panel selects VTR 1, the VTR 1 interface card switches to the MCR bus. That machine receives its commands and places its status onto the MCR bus. If MCR then selects, say, VTR 3, then VTR 1 disconnects from the MCR bus, and VTR 3 is connected to it.

The MCR bus is connected to the MCR remote-panel interface card. The status lines trigger the lamp drivers, and the control lines are driven from the control-panel push-button buffers.

Data-selector chips on the VTR interface cards select from among four different control inputs. These are the three buses and ground. Ground is selected when the VTR is not under the control of a control panel. Status from the VTR cards is placed on the buses with tristate drivers when the VTR is selected.

A master reset circuit on the select card resets all the boards at power up. Also, whenever a VTR card is not selected by a control panel, the card is held in reset until it is selected. This prevents any commands being issued to the VTR when it's not selected.

Construction

The rack-mounted card cage is 5¼ inches high. It holds up to 10 wire-wrap cards and two power supplies. The front panel is hinged on the left side to provide access to the cards.

The original cage was not deep enough to hold all the wires going to the back panel. This was because of the use of wire-wrap edge card connectors, which are pretty deep, and the depth of the IDC- and DB-type connectors on the back panel. A back-panel extension was built to provide the needed depth.

All back-panel connectors are IDC type for ease of construction. The other end of the ribbon cable was soldered to the wire-wrap pins on the edge connectors. All wiring between cards was wire-wrapped.

Three different sizes of DB connectors were used: 25-pin for VTR interconnection and computer interface, 37-pin for the remote panels and 9-pin for tally connection and delegate switchers.

The cards are 6"×4" with a power bus and a ground plane on top. The design relies on a 72-finger edge-card connector, where all 72 connections are used. Each VTR card has 25 ICs plus two resistor networks and two component networks. The component networks hold caps, resistors and diodes on headers. The headers then are plugged into wire-wrap sockets. Mounting these components on headers makes changing parts much easier.

Wire wrapping was the only way this system could have been built at a reasonable cost. Even with the large number of ICs on the VTR cards, the wiring was completed quickly. The wire wrapping was done with a motorized hand tool. Changes were much easier to make with the wire-wrap method. The only problem was that we couldn't fit as many cards into a frame because of the length of the wire-wrap pins.

Problems

The first wire-wrapping method did not work well. This method relied on the hand tool for slitting the wire insulation and wrapping it around the post. This method caused intermittent connections when using 30-gauge wire. Most of the cards had to be rebuilt. However, when 28-gauge wire was used on the back plane and above, the method worked fine. Unfortunately, this wire was too thick to be used on the boards themselves. The solution was to pre-stripe all the wires before wrapping. Once this was done, everything worked as planned.

The original idea was to rely on a single +12Vdc supply, then regulate it down to +5Vdc for the CMOS logic circuits. However, we discovered quickly that the peripheral drivers, which were used as lamp and output drivers, each drew 45mA. As many as 32 of these drivers could be on at once. This meant a total potential load of 1.44A. The solution was to add a separate 5Vdc, 3A power supply.

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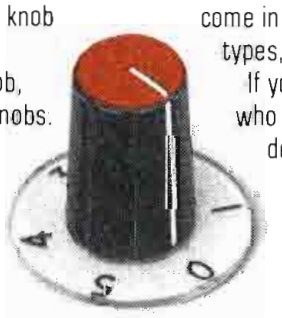

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Installation and training

The new remote system went into operation without a hitch. Cables were run, and panels were installed. For the try-out period, the remote panels were mounted in small cardboard boxes. In case there was a problem with the system, the old remote easily could be placed back into service. Because the studios are in the

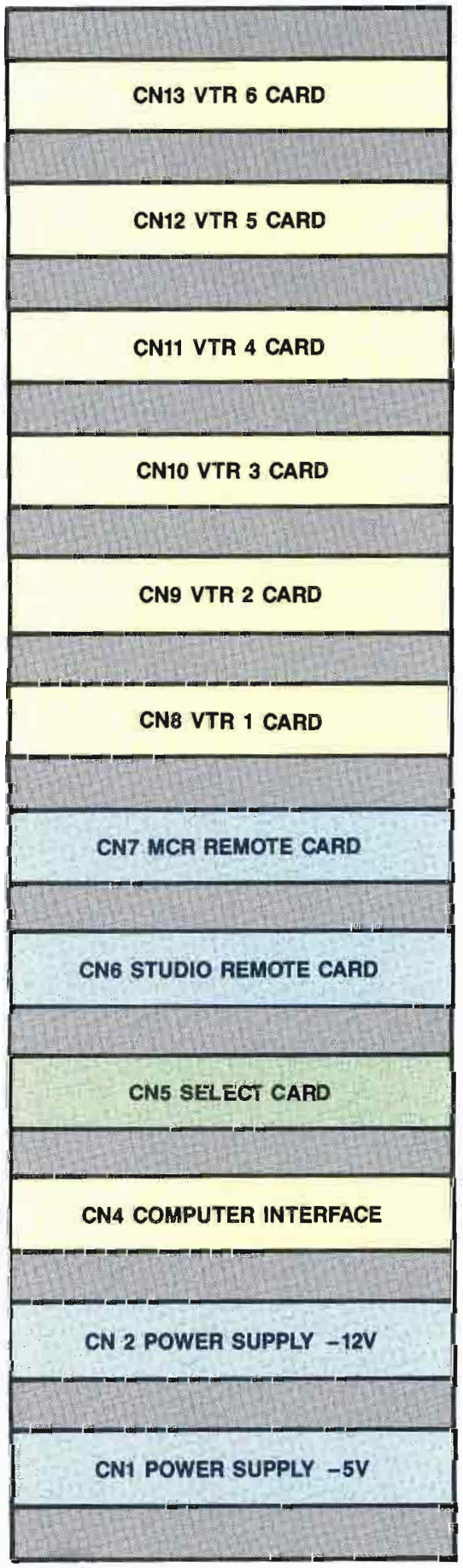

Figure 2. *Card cage layout. In this configuration, there is no room for expansion. A larger cage would permit future expansion.*

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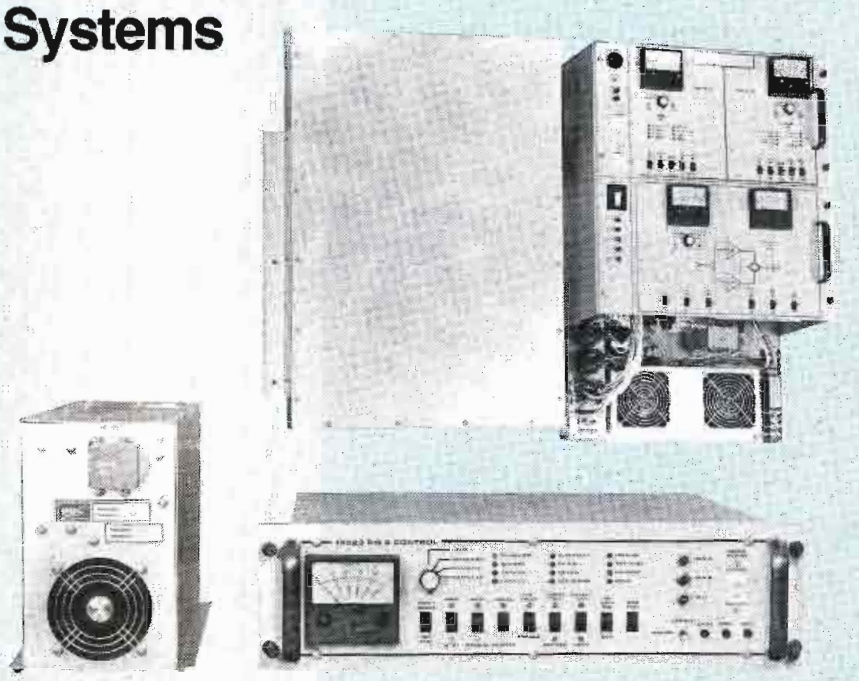

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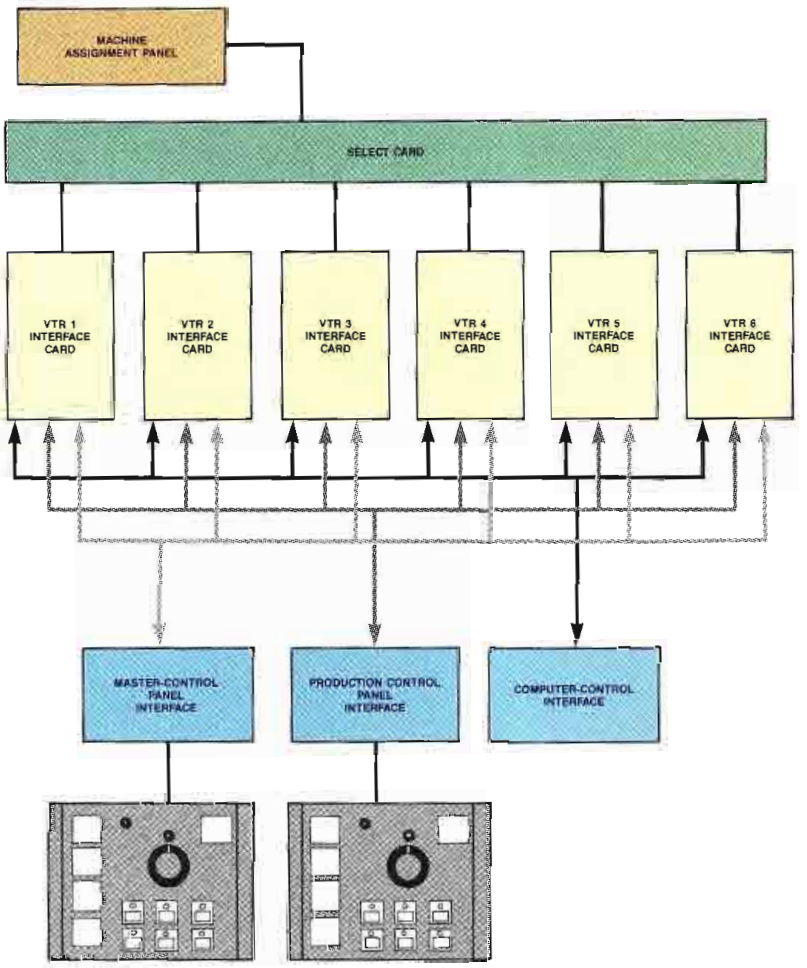

Figure 3. *Basic block diagram. The three buses are connected to each interface card. The select card places the desired machine under the control of the proper remote panel.*

same building as the transmitter, RF interference was a concern. Fortunately, there were no problems.

Cuing of tapes is much faster now that no one has to run back to the 1-inch tape room. Operators can, instead, use the remote shuttle and cuing controls. Production also appreciates the record and cuing capabilities of the new remote-control system. The system has been working well for more than two and a half years.

Things learned

As with any design, several improvements could be made. When shuttling tape, it would be helpful to know how fast the tape is moving. When you are not in the room with the VTR, it is hard to tell how fast the tape is shuttling, especially when it is in black. Bringing out the control track to a speaker would permit the operator to hear the clicks. As the tape speed changed, so would the pitch of the clicks.

It would be nice if the system were more expandable to allow for additional control panels and machine interfaces. This would require multiplexing the control/status bus instead of using discrete buses. It also would be valuable to provide for the addition of another chassis that could control even more VTRs. |:-)))|

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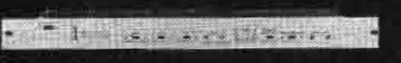

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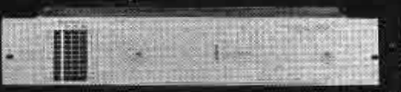

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Continued from page 289

private channels will have to make a financial commitment to the audio-visual industry, as satellite channels already do on a provisional basis. Those that receive more than 75% of their financing from advertising or sponsorship, or that are pay channels, will have to promote audio-visual production through financial investment. This investment will be determined on the basis of an average annual audience share. A minimum level of 10 million Belgian francs has been set. Pay channels will be expected to invest 10 million francs per 3,650 subscribers.

Protectionism not foreign to the French

There has been much talk in recent months about the new technology in Europe. Most observers agree that it will establish the plurality in television that exists in the press. But much more is at stake. The sensitivity of European governments to HDTV and the aerospace sector is proof of this.

A central question is "Who should run the new technology?" Under the British model (patterned after the United States), new technology has allowed private enterprise to enter a domain otherwise reserved for public-service institutions. The launch of Astra marks a high point in this development. BSB is to follow.

The new technology in Germany, by contrast, is driven by the Bundespost, which will be investing another 1.5 billion marks in cable and satellites. The German government has a big say, for instance, in how commercial television will develop in the country.

Until recently, the French have viewed new technology as a natural spin-off of their satellite industry. They are proud of their high technology, and they want to protect it. TDF 1 is a case in point.

France's first direct-reception satellite appears to be a technological success, but whether it will be successful commercially remains to be seen. Considering that Telecom 1 could have reached the same number of homes outside the reach of terrestrial signals, TDF 1 appears to be a huge waste of technology.

So why have the French even bothered with DBS technology? Because it definitely has a future in Europe, experts argue, and the French don't want to miss out on any hidden opportunities.

Yet, protecting the best technology will not help if the programming doesn't come through. Billions of francs are at stake in the satellite alone, followed by billions more in decoders. The French PTT has done a respectable job of providing the infrastructure. Now it wants to see some returns on its investment. And that could take a while.

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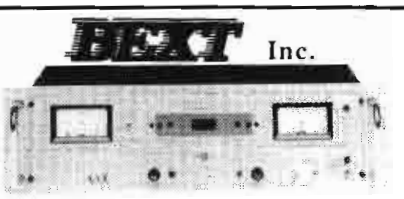

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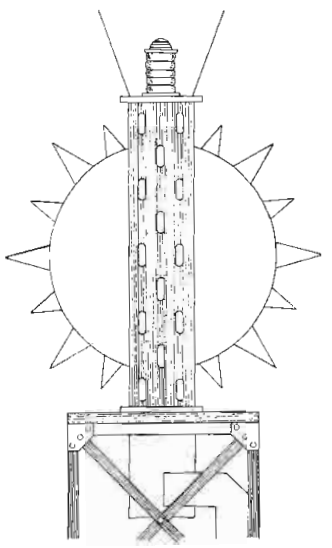

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BARCO Industries and BARCO Electronic agree to merger

Agreement of intent to merge *BARCO Industries* and *BARCO Electronic* into a single corporate entity was announced in Belgium by the boards of directors of BARCO Industries, BARCO Electronic and GIMV, which holds controlling interest in both BARCO companies.

The merger, expected to be approved by June 30, will consolidate the two companies, and will mean a significantly stronger international presence for the company.

Neve names Full Sail Center as its official training center

Neve, Bethel, CT, in a commitment to the education and training of recording engineers, has named Full Sail Center for the Recording Arts, Altamonte Springs, FL, as its official training center. Full Sail will offer specialized training on Neve products.

As part of the agreement between Neve and Full Sail, Platinum Post, Full Sail's professional video company, will produce educational and promotional videos for Neve.

Full Sail will be moving into a new 30,000-square-foot, 7-studio facility in Winterpark, FL. The center will include the Neve V series console with Flying Faders in a room designed for 48-track analog recording and four full New England Digital tapeless studios, each with a Synclavier, recording console, outboard gear, video equipment and a separate isolation booth. The tapeless studio will be able to access two stand-alone 8-track direct-to-disk digital recorders, which can be linked for 16-track digital recording.

Other rooms will include a 1-inch and a ¾-inch video production and post-production suite, a full MIDI recording studio and an 8-track analog recording console. In addition, a 48-track mobile facility with an adjoining studio will offer mix-to-picture capabilities. All the rooms, which float within the main structure, can be patched through a central machine room.

In another move, Neve has relocated its Nashville office to the heart of Music Row. The new office houses sales, service and parts support as well as a demonstration facility. The address is 1221 16th Ave. South, Nashville, TN 37212; telephone 615-329-9584; fax 615-329-1473.

Gentner merges RF division into Salt Lake operations

Gentner Electronics, Salt Lake City, will consolidate its San Jose RF Products Division into its Salt Lake City operations. Sales and marketing of the RF product line will be handled in Salt Lake City by Gary Crowder, director of marketing and sales, broadcast. Manufacturing and customer service of RF products will continue from Salt Lake City.

Electro-Voice Canadian division has new name

Electro-Voice, Buchanan, MI, has changed the name of its professional audio division in Canada from Gulton Industries to Mark IV Audio Canada. The company, which is a wholly owned subsidiary of Electro-Voice and Mark IV Industries, markets Electro-Voice, University Sound, Altec Lansing, Vega, Ivie and Gauss products in Canada.

Mark IV Audio Canada is responsible for sales and marketing of all Mark IV audio

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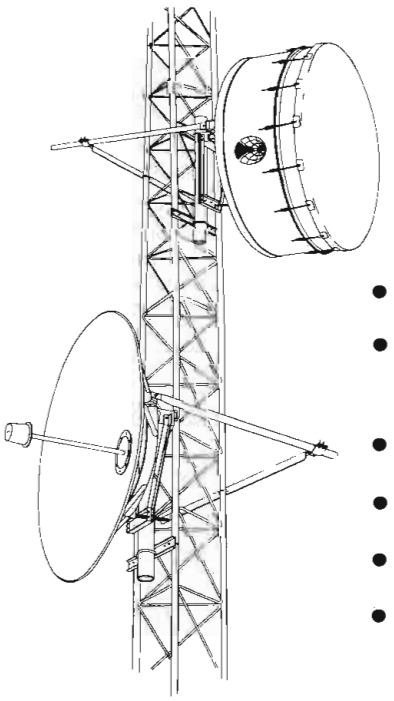

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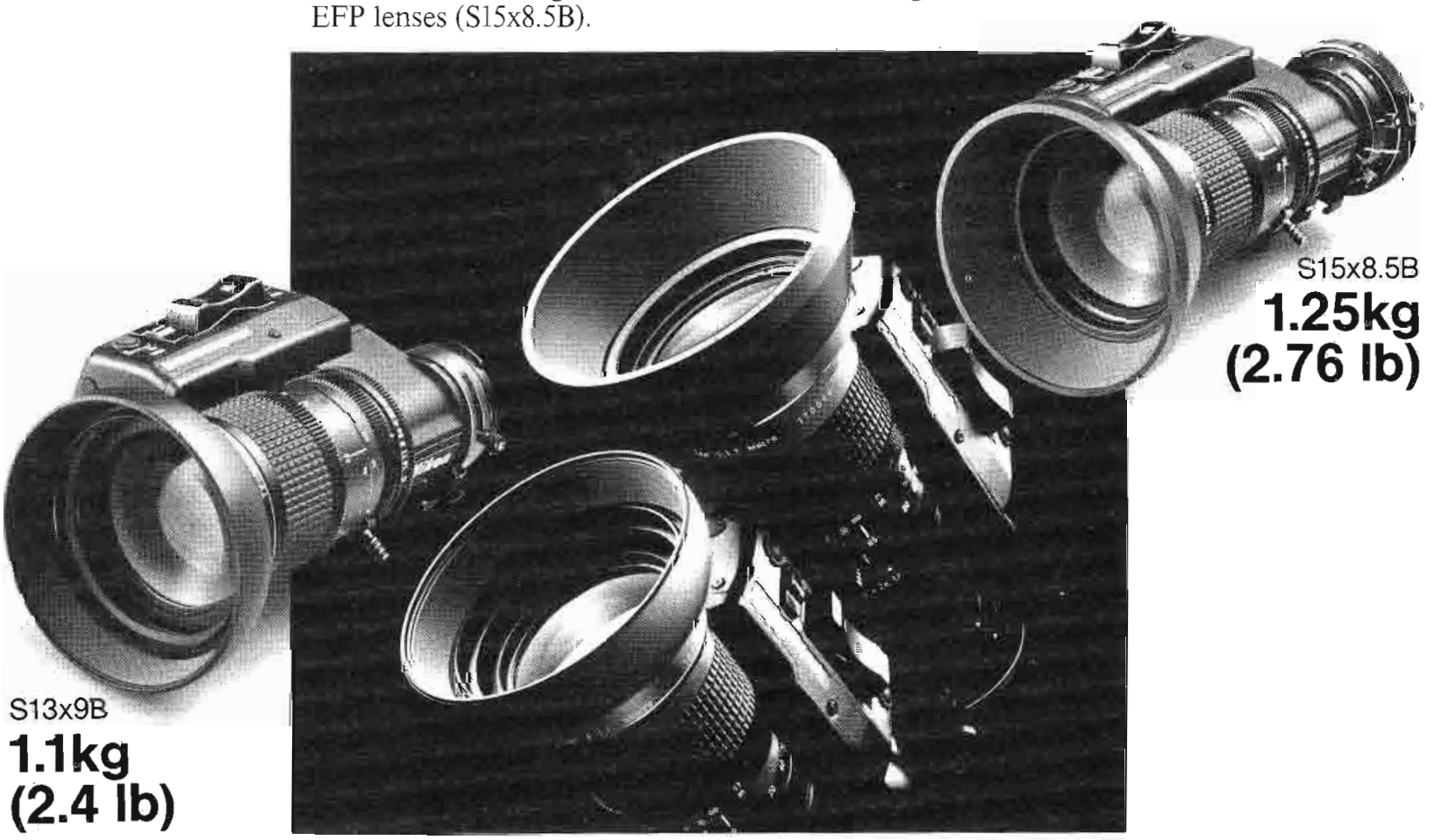

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companies. The executive offices and production facilities are located in Gananoque, Ontario. The company's regional sales offices are located in Vancouver, Toronto and Montreal.

Bonneville Satellite and Wold Communications form company

Bonneville Satellite Communications and *Wold Communications*, Los Angeles, have signed an agreement to combine the facilities, personnel and operations of the two companies.

The agreement is subject to regulatory approval by the FCC. The companies will continue to operate independently during the approval process.

The companies own and operate a total of 17 C-band and Ku-band uplinks in Southern California, New York and Washington, DC, in addition to numerous microwave networks in each city.

Under the terms of the agreement, the assets and certain liabilities of Bonneville Satellite and Wold Company will be combined into a new company, whose trade name has not yet been determined. Bonneville Satellite will own 60% of the new company, with the remaining 40% owned by Wold and the new company's management.

Celco creates new division

Celco, Farmingdale, NY, a Klark-Teknik company, has launched a new division to expand its efforts in the professional entertainment, lighting and design market. The division is headquartered at Klark-Teknik Electronics, Farmingdale, NY.

Allen Avionics and Bal form joint marketing venture

Allen Avionics, Mineola, NY, will market and provide complete technical support in North and South America for the entire video products line from Bal Components, Nuneaton, England. The agreement also covers the marketing of Allen Avionics' products in Europe by Bal.

In addition to marketing Bal's line of video filters and delay lines, Allen Avionics also will handle marketing of Bal's automatic video timing systems (Fastime), as well as its video broadcast and test instrumentation products used for color-camera calibration, NTSC signal enhancement and decoding, and its line of digital interfaces (DIGISTREAM System 601).

Pesa expands its facilities in Spain

Pesa, England, has enlarged its facilities in Madrid to include two laboratories for the studio and RF divisions, a demonstration studio and a training center. It also has expanded the factory capacity, particularly for RF products including transmitters and transposers.

Pesa Electronica, in conjunction with Spanish Television (RTVE), has commenced a joint development program. The project, partially sponsored by the Spanish government, includes research and development in digital television, HDTV and other high-technology products.

Philips increases interest in BTS

Philips and Bosch officially have agreed to adjust their participation in their subsidiary, BTS Broadcast Television Systems GmbH, of Darmstadt, West Germany, to make it a 50-50 joint venture. Presently, Bosch has a 70% and Philips has a 30% interest in BTS.

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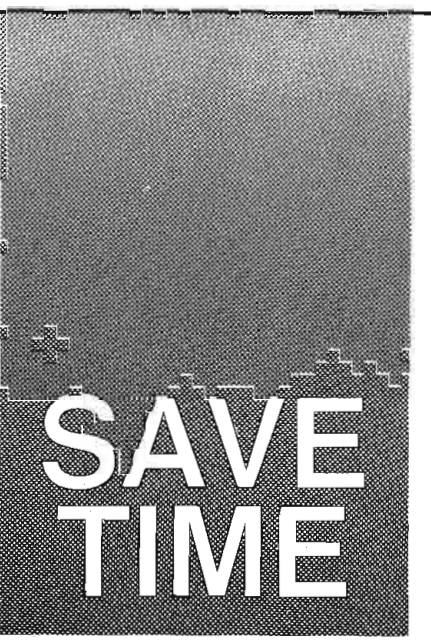

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Comprehensive Video announces new division

Comprehensive Video Supply, Northvale, NJ, has formed a corporate division, CV Technologies, designed to enlarge the scope of its PC-based products for video professionals. This is due to the company's latest development in the growth of its computer-based product line.

Richardson completes purchase of Philips transmitting tube line

Richardson Electronics, LaFox, IL, which completed the purchase of the assets and worldwide marketing rights of the Philips (Amperex) transmitting tube line in August 1988, is now fully integrating this acquisition into its operating structure.

During a transitional period, transmitting tubes will continue to be marketed under the Philips label while the Richardson brand name "National" is being phased in.

Panasonic revamps its national sales force

Panasonic Broadcast Systems Company, Secaucus, NJ, has restructured its national sales organization into three regions. It has combined its sales representative organization, responsible for sales to businesses, industries and teleproduction facilities, with its direct sales manager force, responsible for sales to broadcasters. There are now three sales regions: East, Midwest and West.

SuperTech Field Service moves to North Hollywood

SuperTech Field Services, North Hollywood, CA, has moved to a larger facility. The office is located at 4605 Lankershim Blvd., Suite 209, North Hollywood, CA 91602.

Waveframe relocates

Waveframe, Boulder, CO, has moved to a new office. The address is 2511 55th St., Boulder, CO 80301. The telephone and fax numbers remain the same (telephone 303-447-1572; fax 303-447-2351).

Leitch creates software subsidiary

Leitch Video, Toronto, Ontario, Canada, has announced the creation of its software subsidiary, Softcast Systems, which serves broadcasters and related industries by developing solutions to software systems needs.

Trident enters agreement with Digital Creations

Trident Audio Developments, Torrance, CA, has entered into an agreement with Digital Creations, Plainview, NY. Trident will use Digital Creation's moving fader automation system in all its other consoles that require fader automation. All newly ordered Trident automated consoles will feature the Digital Creations moving fader automation, or they may be retrofitted to any existing Trident consoles.

The address given for McCurdy Radio Industries in the 1988 Buyers' Guide/Spec Book was incorrect. The correct address is: McCurdy Radio Industries, 108 Carnforth Road, Toronto, Ontario M4A 2L4 CANADA; telephone 416-751-6262; fax 416-751-6455; telex 06-963533.

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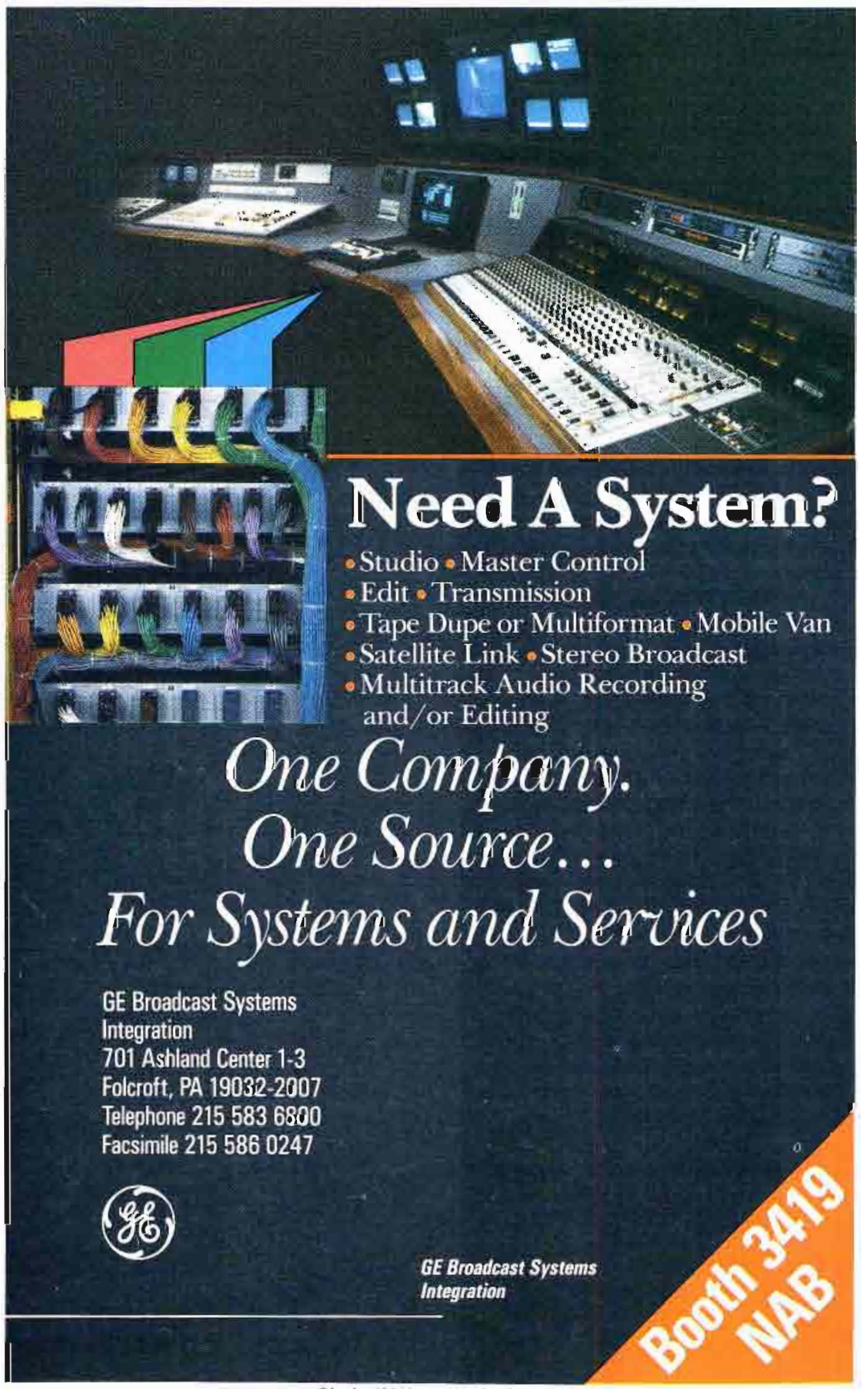
People

Kevin Dauphinee has been named senior product manager of Betacam products for Ampex, Redwood City, CA. He is responsible for worldwide marketing and customer sales support of Betacam systems.

Dan Desmet has been appointed product manager, broadcast division, for Barco Industries, Nashua, NH. He is responsible for sales of broadcast monitors and providing support services to the national dealer network.

Terry Hoffmann has been named president of Centro, Salt Lake City.

Loren A. Swenson and **Theodore L. Henry** have been appointed to positions with Cycle-SAT, Forest City, IA. Swenson is chief operating officer. He will oversee the operations of the Forest City earth stations, including management information systems, video production/post-production, tape duplication and satellite news vehicles. He also is responsible for the company's operations in Los Angeles, New York, Chicago and Minneapolis. Henry is vice president of sales, Western region. He is based in Los Angeles and will oversee the sales and marketing of the company's network to advertising agencies and act as a liaison between those agencies and affiliated TV stations throughout major cities in the West.



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Osamu Inoue and **Sedate Holland Kohler** have been named to positions with Fuji Photo Film U.S.A., Elmsford, NY. Inoue is executive vice president. Kohler is account representative, professional products, magnetic products division, Midwest region. She is responsible for sales of videotape in the Midwest region.

Hugh F. Gillogly, Douglas Sorensen, Arthur Franz and **Tom Greaves** have been appointed to sales positions with Microtime, Bloomfield, CT. Gillogly is the Western district sales manager. He is responsible for the supervision of sales in the Southwest and Western regions. Sorensen is Eastern district sales manager. He is responsible for the supervision of sales in the Northeast and Southeast regions. Franz is direct sales manager for the Northeast region. Greaves is Southeast regional sales manager.

David Roudebush has been appointed marketing and sales manager for professional products, Orban, San Francisco. He is responsible for worldwide marketing and distribution of existing and upcoming products.

Paul Caramagna has been promoted to vice president, photo optic lighting division for OSRAM, Montgomery, NY. He is responsible for the sales, marketing and overall performance of lighting products for specialty markets.

Arthur Chadwick has been appointed vice president of finance and administration and chief financial officer at Pinnacle Systems, Santa Clara, CA.

Dave Collie, Chris David and **Piers Plaskitt** have been appointed to positions with Solid State Logic, Oxford, England. Collie is product development manager. Based at the Oxford headquarters, he is responsible for coordinating the development of analog and digital audio products and overseeing the evolution and enhancement of the console automation systems. David is film products manager

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and has relocated from the Oxford headquarters to the Western region office in Los Angeles. Plaskitt is chief executive officer. He will be in charge of the U.S. operations and will oversee the establishment of a central U.S. administration based at the East Coast office.

Barry Honel is national systemation representative for Systemation, Decatur, IL. He is based in Atlanta and is responsible for developing domestic and foreign markets.

Kinsley D. Jones is Western district sales manager for the product sales group of Townsend Electronics, Raleigh, NC. He is responsible for sales of the VHF and UHF CST products throughout the Western states. He will operate out of the Mission Viejo, CA, office.

Mike Buffington, Craig Damon, Arthur Sloatman, Gus Skinas and **Dave Frederick** have been appointed to positions with WaveFrame, Boulder, CO. Buffington is director of field engineering. Damon, who is European support manger, will relocate to Copenhagen, and is responsible for distributor support, training field service and marketing communications throughout Europe. Sloatman is a systems engineer located in Boulder, CO. Skinas has been promoted to senior product manager, professional audio. He will focus on development of products for professional audio applications, especially recording and editing. Frederick is product manager, music applications. He will focus on development of AudioFrame applications for music composers and editors.

Lindsey Allen has been promoted to manager of professional audiotape products at Ampex Magnetic Tape Division, Redwood City, CA. He is responsible for developing marketing programs and product support programs for the company's line of professional audiotape.

Kelly Daniels has been promoted to product manager for the 3-D Graphics and EPIC product lines at BTS Broadcast Television Systems, Salt Lake City.

Gary L. Montgomery has been appointed national dealer sales manager for Centro, Salt Lake City. He is responsible for establishing and maintaining a worldwide dealer and representative organization.

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New products

MIDI-controlled router

360 Systems has introduced the Audio Matrix 16, a 2-unit rack-mount audio-routing switcher with MIDI control. The system directs any of 16 inputs to any one or more of 16 outputs. One hundred system setups may be programmed and controlled from front-panel switching. MIDI control signals also can be used for selection of source-destination links, for studio or live performance use.

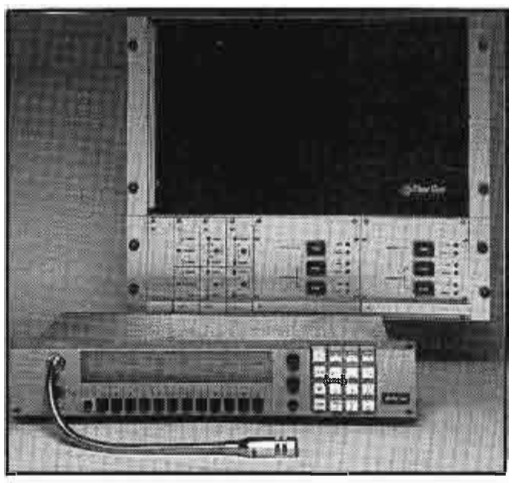
Circle (451) on Reply Card

Amplified stereo speakers and digital intercom

Clear-Com Intercom Systems has announced the following products:

• The 1020 and 1020M amplified speaker systems each occupy one 19-inch-rack unit. They are self-contained, 2-channel systems that cover a frequency range from 80Hz to 12kHz. Both XL-3-balanced and RCA-phono-unbalanced inputs are provided. The 1020M includes an LED bar-type input level meter. Bi-amplification combines low frequencies from both channels into a single amplifier, while the baffled speaker produces an extended bass response.

• The Matrix Plus combines features of point-to-point and conference line systems in a fully digital matrix intercom. Various plug-in interface cards provide connections to 2-way radio, telephone 4-wire equipment and other 2-wire intercom equipment. Routing of fully digitized audio is displayed on an 8-line×80-column LCD screen. Direct connection is possible to Clear-Com IFB and ISO systems. Redundant power supplies and non-volatile system configuration memory increase reliability.



Circle (452) on Reply Card

CAD libraries

Network Communications Consultants has introduced the CADalog symbol libraries. The library contains prepared drawings of broadcast equipment ready to be imported into CAD layout drawings for PC-based, computer-aided design (CAD) stations running AutoSketch. You may resize and interconnect signal paths as needed for your system design. Current libraries include all products from the TEK 1988-1989 TV product catalog as well as a variety of camera CCUs, video switchers, audio mixers, telecines and videotape systems.

Circle (453) on Reply Card

Microwave transmitter

Loma Scientific has introduced the LSI25ST transmitter for use in ITFS, MMDS or OFS operations. The unit is type-accepted under FCC Parts 21, 71 and 94 and provides an output peak visual power ranging from 10W to 20W. Separate aural and visual amplifiers and diplexer performance conform to FCC Part 73 for broadcast television.

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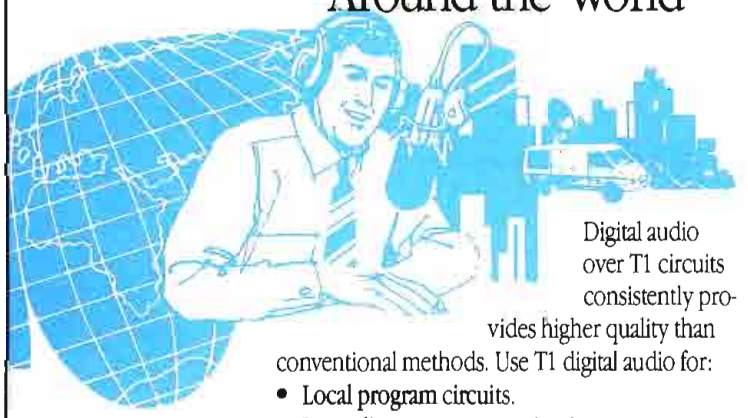

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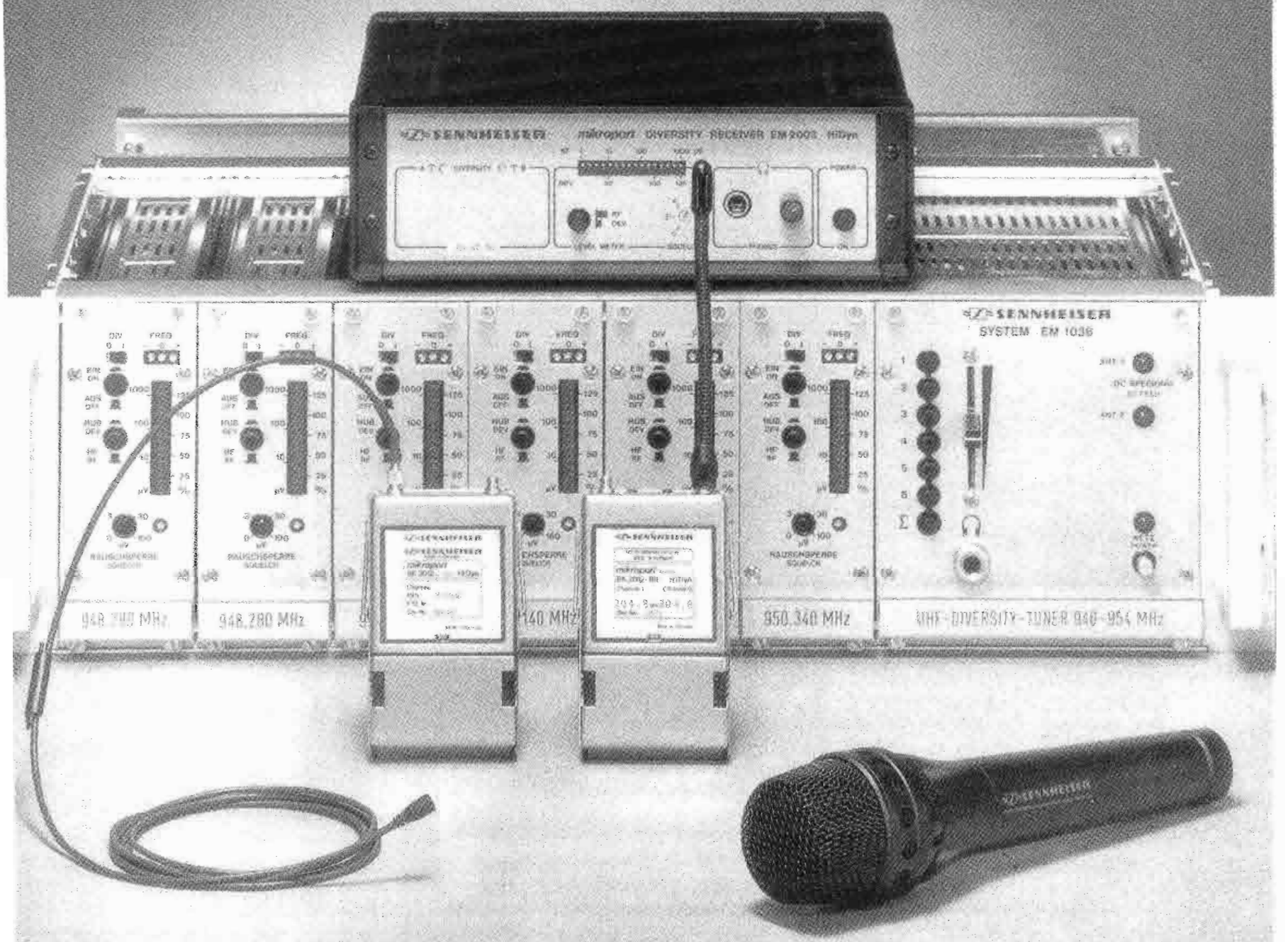

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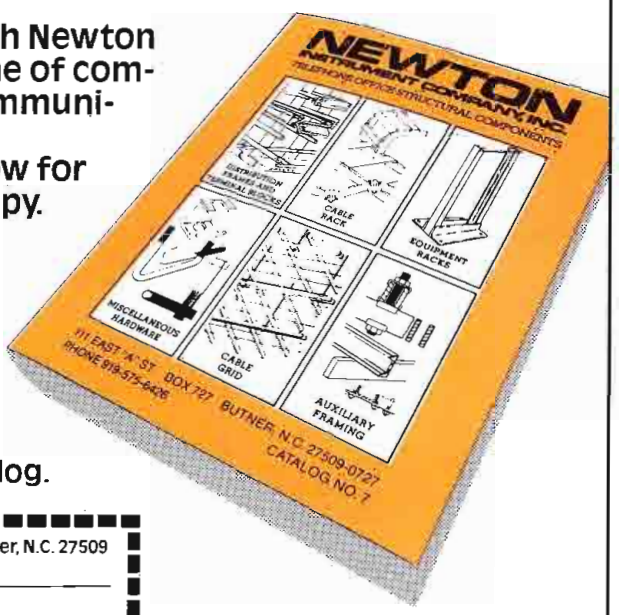

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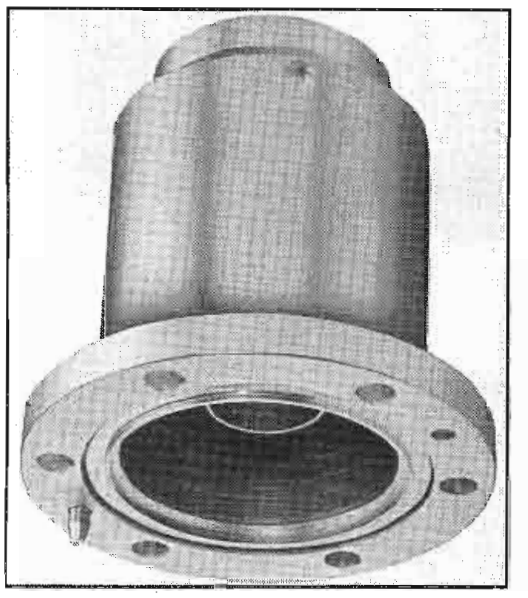
Video-level measurement

FM Systems has introduced the VVM digital video voltmeter. The hand-held, battery-operated unit measures sync pulse amplitude, white level and overall composite video level in volts peak-to-peak or IRE units. The line being measured can be terminated or looped through. The maximum reading is 1.99V or 199IRE.

Circle (455) on Reply Card

Coaxial connectors

Andrew has announced two 3 1/8-inch EIA flange connectors for 2¼-inch HELIAX air-dielectric coaxial cable. The 82RF provides connections between antennas and cable where pressurized gas must pass through the interface. The 82RG includes a gas barrier for applications using non-pressurized components. These components are rated for 20.6kW at 100MHz.



Circle (456) on Reply Card

Electronic paint system

AVS has introduced ARTMASTER, a menu-driven graphics paint system with a variety of software packages. PRESENT software provides for lists of sequenced images and symbols with special effects for on-air presentations. NEWS software is helpful in preparation of video documentary work with statistics and business graphics. Three-D animation software also is available for the system.

Circle (457) on Reply Card

Equalizers, mic pre-amps

API Audio Products has introduced the 550B equalizer and the 512B microphone pre-amplifier. Both are configured to fit a standard API console slot. The 550B includes a fourth midrange band and 13 frequencies. The pre-amplifier features mic-in, line-out from a rear connector, as well as mic-in and a high-Z ¼-inch input on the

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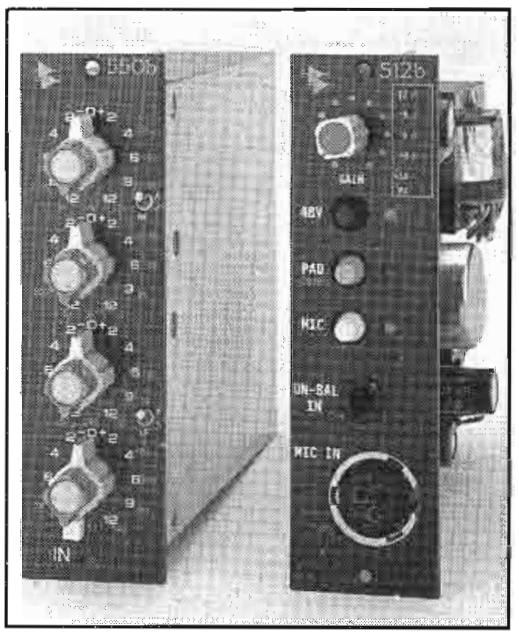
front panel. Controls include gain, mic pad, 48V switch and mic/line switch.



Circle (458) on Reply Card

Modular buildings

Bally Engineered Structures has announced a variety of modular equipment shelters. Speed-Lok construction is used for rapid assembly. R-34 insulation, bullet-resistant panels and a variety of colors and finishes are available for structures that can be expanded or relocated easily.

Circle (459) on Reply Card

Video projection

Barco Electronics has introduced the Barcographics 1001 projector. Nine-inch CRTs are liquid-coupled with a high-resolution optical system and operate at scanning frequencies from 15kHz to 72kHz. The system includes a quad switcher, two video input modules and three RGB analog input modules, allowing configurations to selections from multiple video, data and graphic sources.

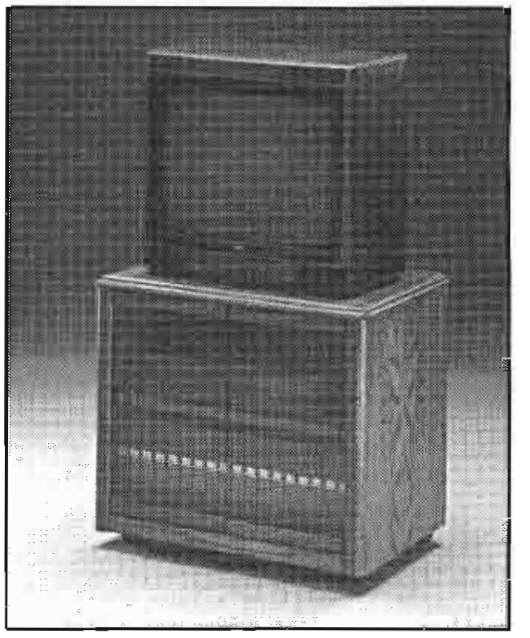
Circle (460) on Reply Card

Three-way amplifier

BGW Systems has introduced the Tri-Amp Grand Touring amplifier, a system designed to power a 3-way speaker setup from a package that is two rack units high. Three separate amplifiers have a total capability of 1kW with 24dB/octave Linkwitz-Riley crossovers and a 12dB/octave high-pass filter. Dual outputs use Cannon P-type or Neutrik high-current Speakon multiconductor connectors. Linkset jumpers are used instead of potentiometers for internal adjustment of signal levels to compensate for differences in speaker sensitivity.

Circle (461) on Reply Card

TV/VCR and video cabinets



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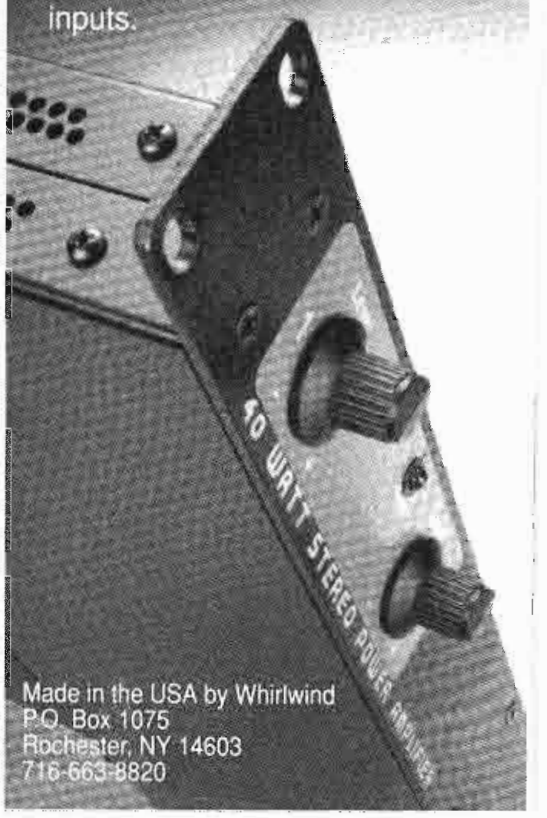

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Before all the chips were down, FUJINON solved the lens problems for CCD cameras.

WITH A CCD CAMERA, WHAT YOU GET IS WHAT YOU SEE.

With CCD cameras, everything changes because you can't change anything. CCD chips are bonded to the prisms by the camera manufacturers. All the usual R-G-B channel adjustments for camera/lens set up are eliminated. To compensate for that, lens performance criteria must be far higher. FUJINON did all that, and in the process made up for the fact that there is no industry standardization in the vitally important selection of glass materials used for lenses and prism blocks.

A18×8.5ERM extra wide and long

A44×9.5ESM the super field zoom

So, FUJINON engineers came up with a new standard.

The results:

Every FUJINON 2/3-inch lens meets the highest CCD performance requirements, offers total interchangeability, brings higher performance to tube cameras, and is compatible with every manufacturer's CCD cameras

A8.5×5.5ERM the ultra-wide zoom

. . . a statement no other lens company can make.

A15×8ESM lightweight, compact, constant F1.5

Incidentally, FUJINON also helped camera makers by devising a unique pattern projector. Used with a high resolution monitor, it permits chips to be placed within a 3 micron tolerance that reduces errors to invisibility.

When you have to select lenses for your new CCD cameras, test several FUJINON lenses against the competition. You'll see the difference. And so will your viewers.

To learn more about the 19 lenses that offer you maximum performance and total compatibility, you'll get more information or a demonstration by calling the FUJINON location nearest you.

A14×9ERM the industry standard

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Bretford Manufacturing has introduced models 5575 and 5576 TV/VCR cabinets and 5578 deluxe video cabinets. The cabinets are part of the Americana collection, and are constructed of solid oak and veneer with a hand-rubbed lacquer finish. Quick assembly uses metal-to-metal hidden fasteners. All three are designed for a TV or monitor on top and a rollout shelf accommodates VCRs or other video equipment. Additional space is available for tape or accessory storage.

Circle (462) on Reply Card

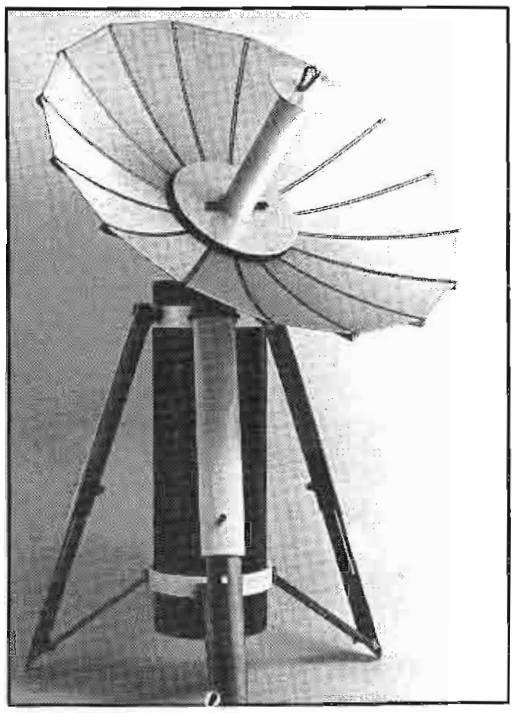
S-VHS monitors

Dotronix has introduced the DOT-X series 96 10-inch and 20-inch S-VHS video monitors. Both the DSV10 and DSV20 accept S-VHS Y/C, standard NTSC and analog RGB inputs, displaying more than 500 lines of resolution.

Circle (463) on Reply Card

Transportable antenna

Comtech Antenna has introduced the AS33-15 C/U transportable INMARSAT transportable antenna system, which weighs 40 pounds when packed in its travel case. The 33-inch-diameter collapsible antenna is designed for L-band operation for telephone, facsimile, computer and radio-repeater applications and complies with INMATSAT SES sidelobe requirements. One-man deployment takes one minute.



Circle (464) on Reply Card

Power/demand analyzer

Dranetz Technologies has introduced the series 806 remote power/demand analyzer to monitor volts, amperes, watts, volt-amps, kilowatt-hours, power factor, demand and projected demand. PowerStar software allows auto-polling capability of 96 remote analyzers. Monitored data is stored in a buffer memory until retrieved by a centrally located PC through an RS-232 port or modem. Data can be presented graphically or in a spreadsheet format with Lotus 1-2-3.

Circle (465) on Reply Card

Audio mixer/router

Intelix has announced the Psychologist Series microprocessor-controlled matrix mixer and router systems for headphone audio control. Remote control of the matrix is accomplished from belt-pack or stand-mounted control through lightweight digital cables. Mixing is performed with digital ladder attenuators. The modular design allows configurations from 4-32×4-16. Control of the matrix also can be accomplished through a standard RS-232 interface.

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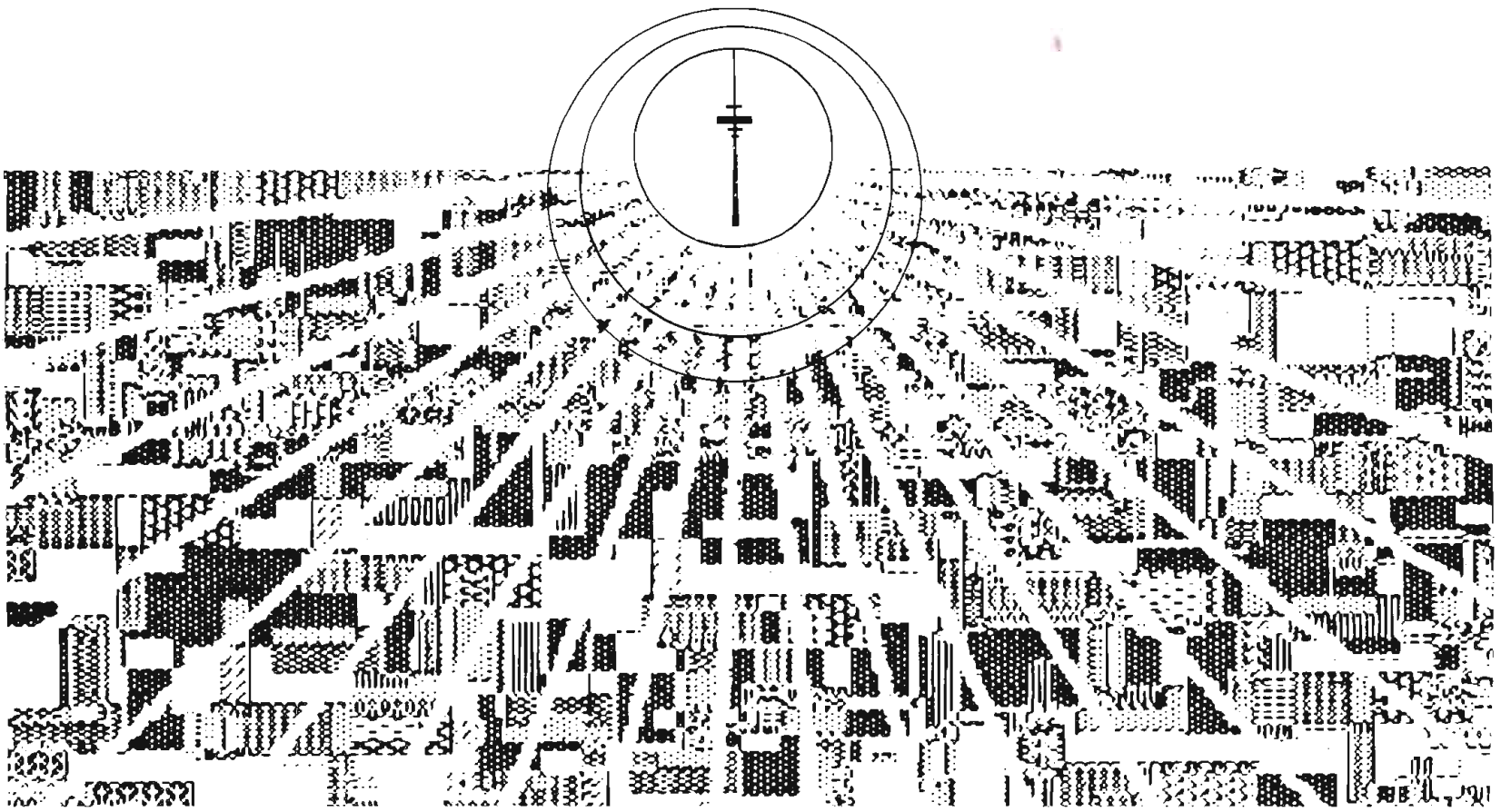

Circle (197) on Reply Card

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Off-line editing systems

Editing Machines has announced the availability of the Emc2 random-access editing system. Eight hours of source material can be transferred into the system for digital storage in low-resolution color images. An editor can view scenes in any order, scanning material at speeds to 16× normal. Changes to the beginning of any sequence can be made without losing subsequent edit points. No searching or rewinding of tapes is necessary.

Circle (467) on Reply Card

Computer-to-video converter

Electro Communication Systems has introduced a series of Photron scan converters. The FSC 64000 converts 1,280×1,024 computer images to composite video and RGB, as well as S-VHS, Betacam or M-II. The FCS 48000 converts computer graphics from 1,024×768 to 1,280×1,024 (47-65kHz) to composite, RGB and the ½-inch recording formats. The FSC 51000 converts the 47-65kHz scanned computer images to 31.5kHz RGB video for video projector systems. A window mode on the FSC 64000 allows a user-selected quarter frame to be converted to standard video.

Circle (468) on Reply Card

Weather radar systems

Ellason Avionics has introduced the E250 color weather radar system. Included in the package are the control cabinet, video monitor, receiver/transmitter antenna and cabling. Radomes and larger antennas are available as options. With three receiver sensitivity settings and five range settings, the unit displays precipitation intensity in four levels based upon measured reflectivity. An AT-style computer cabinet includes one 1.2Mbyte disk drive for program and storage. The RGB output offers 640×480 pixel resolution.

Circle (469) on Reply Card

List management software

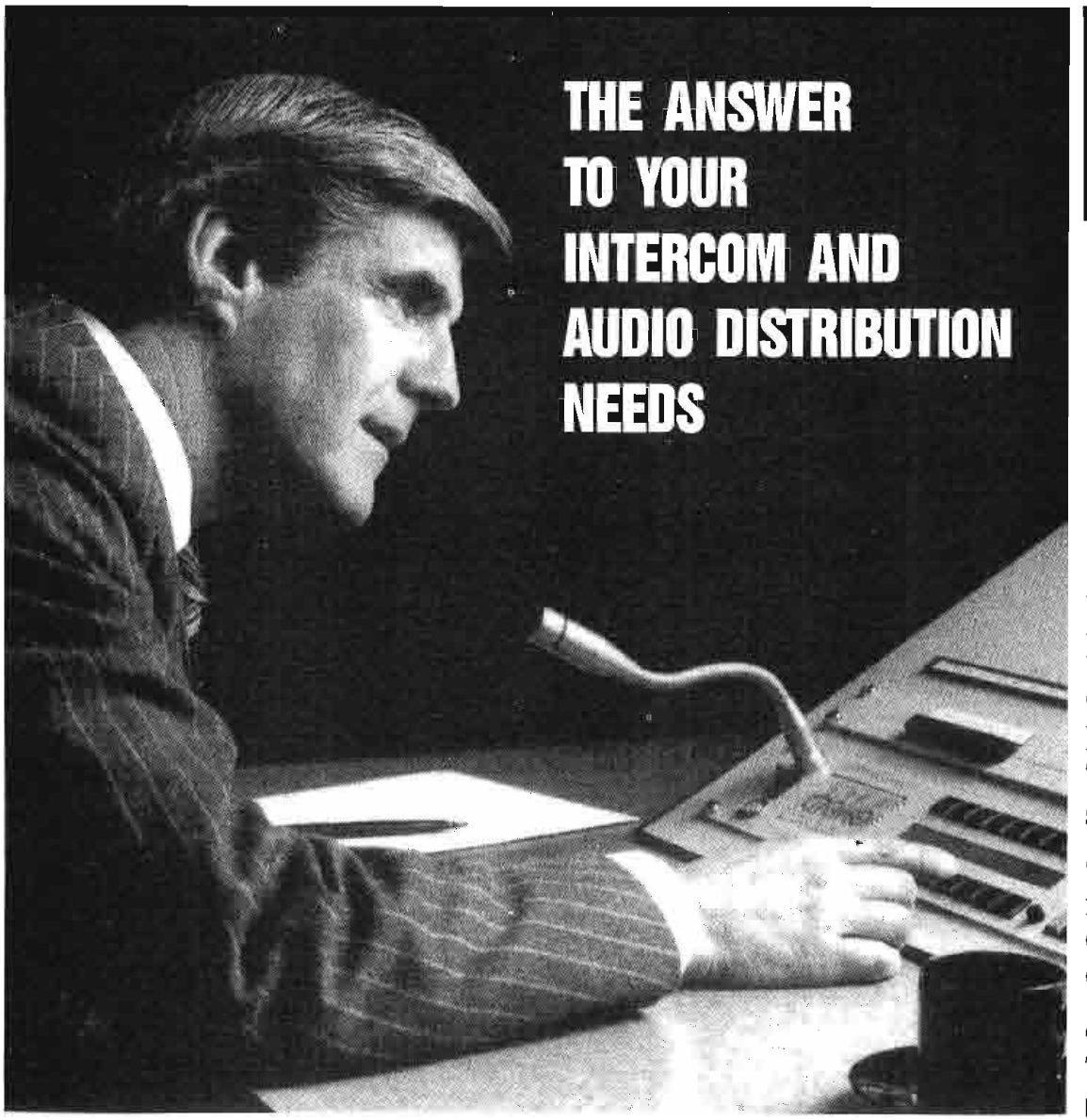
F&B Software has announced TURBOTRACE software to clean, trace, translate and optimize edit decision lists. For IBM PCs and compatibles with at least 512kbytes of memory, the package may be used with CMX-340, CMX-3400, Convergence, Grass Valley and Calaway edit formats. Five sorting formats are supported. Flags are generated for video holes, and lists are created for video or audio-only edits.

Circle (470) on Reply Card

Digital multimeter and digital storage scope

John Fluke Manufacturing Company has introduced the following products:

- The model 45 multimeter features a multifunction dual display, allowing two different measurements from the same



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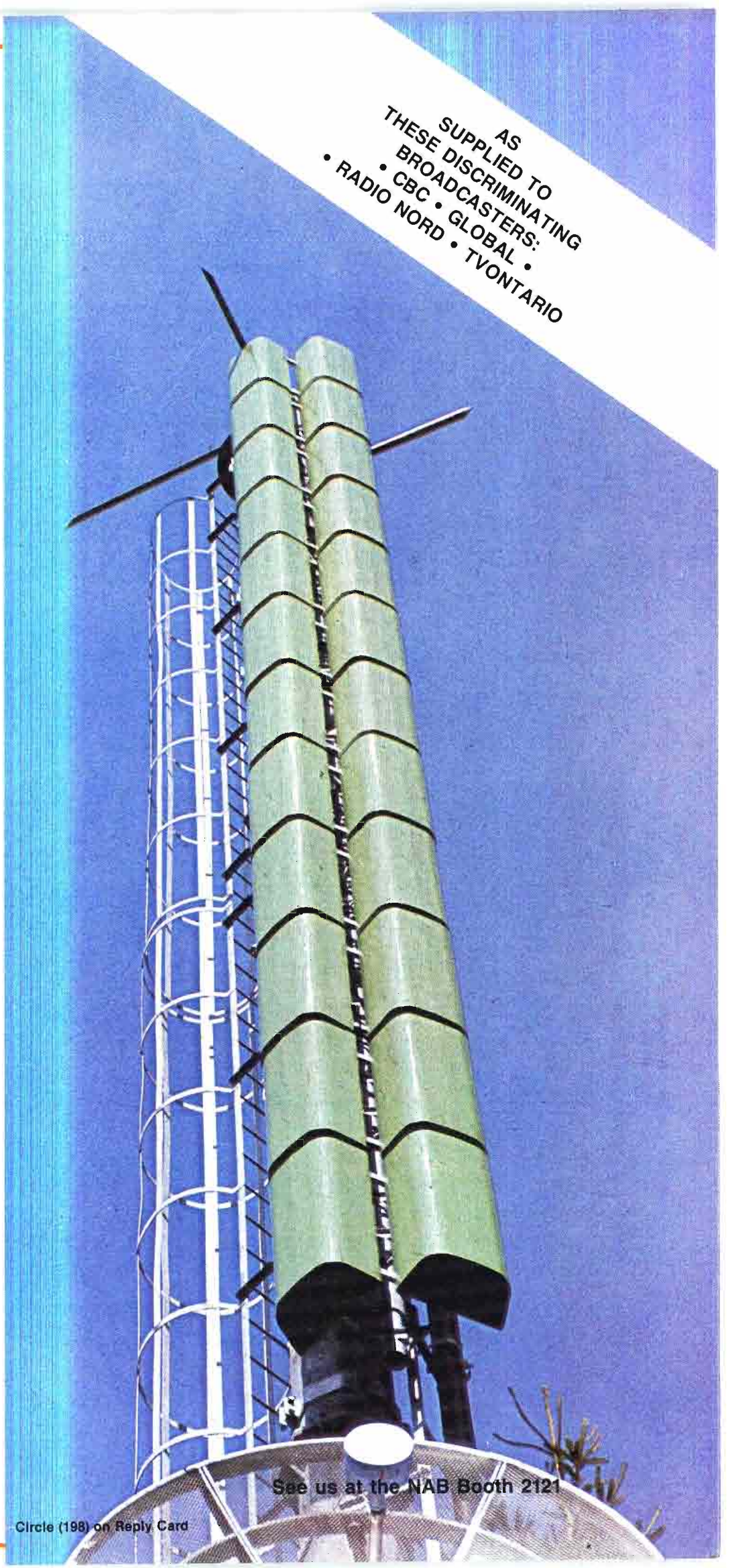

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signal to be taken simultaneously. The display is 5-digit with resolutions of 3,000, 30,000 or 100,000 counts. An integral RS-232 port interfaces to PC-instrument applications.

• The Philips PM 3308 digital storage oscilloscope is a portable package with a 100MHz bandwidth that features an electroluminescent screen, extensive arithmetic and analysis functions as well as a 180kbyte RAM disk for storage of 100 waveforms or setup menus and is nonvolatile with battery backup. The scope weighs 14.5 pounds and displays four traces simultaneously, including channels A and B with two mathematically calculated traces.

Circle (471) on Reply Card

Sound-effects planning

Gefen Systems has announced the TRACKPLANNER software and hardware programs to manage tracking and planning of sound effects. The program logs effects used for a given reel of tape or film in both off-line edit and on-line playback modes. The software package operates on IBM and compatible PCs.

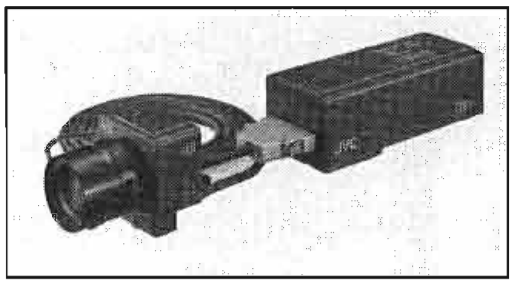
Circle (472) on Reply Card

Tool kits

Hand Tool Industries has announced the soft-side zipper-type tool kits. The kits are lightweight and are manufactured of heavy-duty, padded, brown leather-grain vinyl. Individual pockets are provided for each of the service tools, some with Velcro closures to spare parts or other small items and Velcro snug-straps to secure a meter and its leads.

Circle (473) on Reply Card

CCD security camera



JVC Professional Products has introduced the TK-900U CCD color video camera. The ½-inch CCD sensor produces a resolution of 330TVL without trails or burns. A 1/1,200s electronic shutter provides clear detail in light levels to 10lux. The camera has an S/N ratio of 47dB and includes automatic gain control and TTL auto-tracking white-balance adjustments.

Circle (474) on Reply Card

Voice digitizer

LNR Communications has introduced the DVU-960 single-channel, full-duplex voice digitizer. The stand-alone unit operates over a range of 16-64kb/s, processing audio-signal bandwidths from 50Hz to 5.6kHz for application to synchronous digital links for satellite or terrestrial transmission. Continuous variable-slope delta modulation (CVSD) provides natural voice quality.

Circle (475) on Reply Card

Computer projector

Macro Data has introduced the model MD36 monochrome data projector. A CRT projects the computer display on screens of up to 10-foot widths in a high-contrast, monochrome green image. The 24-pound unit can be set up in less than five minutes and operates with composite, RGB analog or digital and multiscan signals with scan rates from 15kHz to 36kHz.

Circle (476) on Reply Card

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Location lighting cases

LTM has introduced the Pepper Light cases. Constructed of lightweight canvas in silver and blue, the cases use a heavy-duty 2-way zipper closure with a rain flap. Reinforced hand grips and a snap-on adjustable strap are provided. The padded cases have six adjustable compartments for lights, stands and cords with see-through pockets for barndoors, scrims, gel frames and expendable items.

Circle (477) on Reply Card

Animation stand controller

Mark Roberts Film Services has introduced the MRC 4 computer system used for controlling motion of animation stands for film or video, aerial image projectors, optical printers or model shooting systems. As many as 80 moves per hour can be programmed into the system through specially designed data-entry software. Various modes of continuous or single-frame shooting are available.

Circle (478) on Reply Card

TNG network

MCL has announced the MCL 10880 TNG network, composed of a 15351 switching-mode power supply, 15327 test-loop translator, 15330 transmit-receive coaxial switch assembly, 15360 transmit-receive coaxial assembly, 15360 transmit-receive coax switching drawer and the 15359 and 15331 system control and monitor unit.

Circle (479) on Reply Card

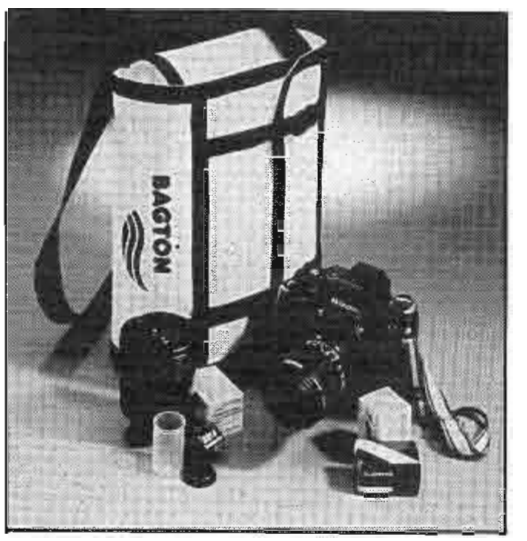
Video-effects systems

Microtime has introduced the Genesis ACT 3 effects system and enhancements to its 3-D RP-1 effects system. The system provides a means to simultaneous rotation, perspective and a full range of other digital effects for composite and component signals, in NTSC, PAL-625 and PAL-525. The RP-1 is available in a dual-channel configuration with the use of compositor cards that plug into the system mainframe. An optional post-effects framestore also is available.

Circle (480) on Reply Card

Equipment bags

Né has introduced the Reporter survival bag by Bagton of Switzerland. The waterproof, tear-resistant, unsinkable bags use touch-fastener and quick-release buckle closures. The bags are resistant to salt water and ultraviolet rays and are bright yellow. Effective protection has been proved by various exploration missions.



Circle (481) on Reply Card

Digital video codec

The NEC America Radio and Transmission Systems Group has introduced VisuaLink 3000, a video codec operating at user-selectable data rates from 384kb/s to 2.048Mb/s. The unit is software-

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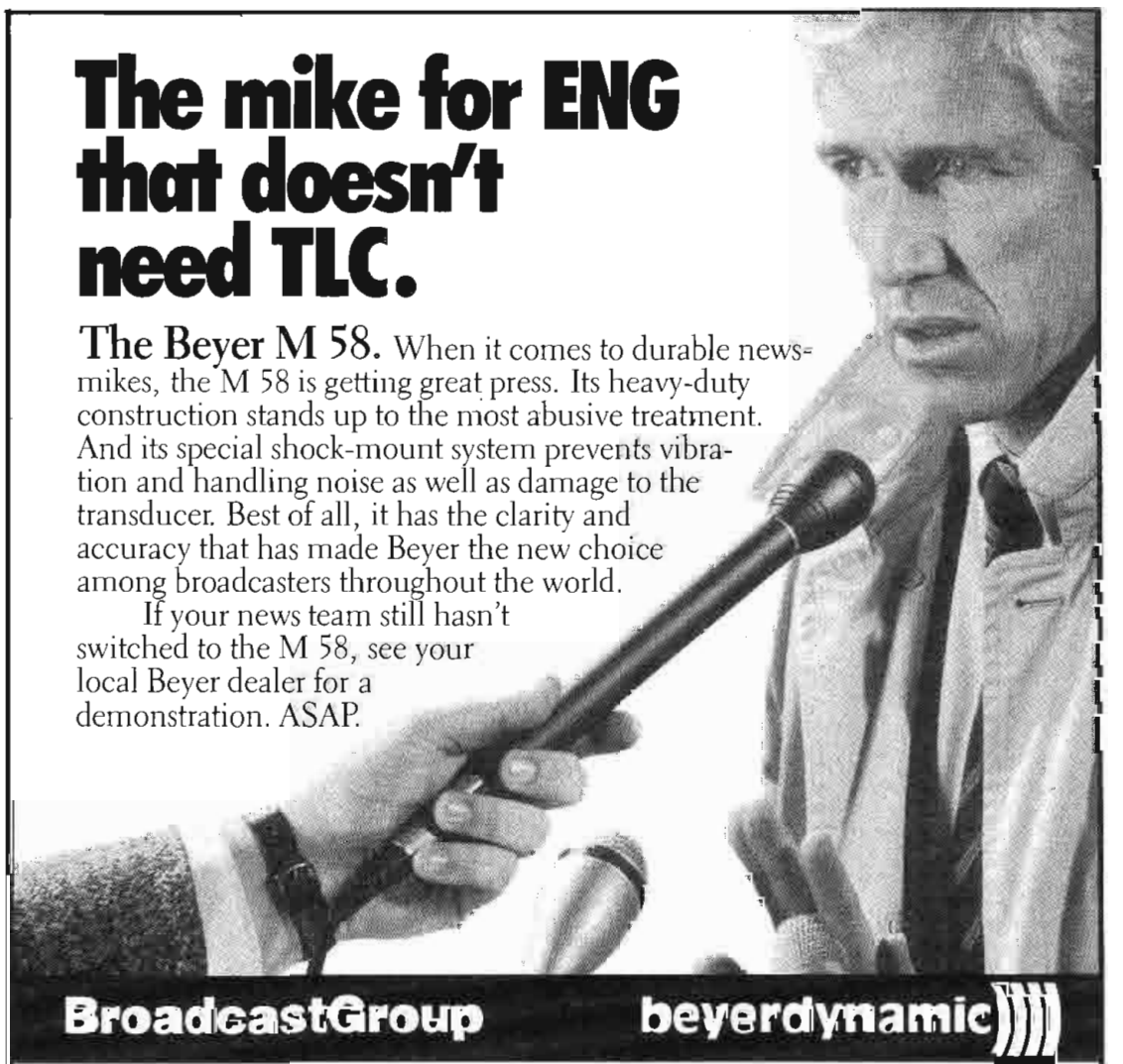
If your news team still hasn't switched to the M 58, see your local Beyer dealer for a demonstration. ASAP.



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upgradable to conform to T1 codec CCITT standards in the future. For transmission of audio and video signals as well as other digital data, features include local and remote loopback for use in equipment troubleshooting. Forward error-correction maintains signal quality in poor transmission conditions. A blackburst source is available to synchronize up to three cameras or video-source inputs.

Circle (482) on Reply Card

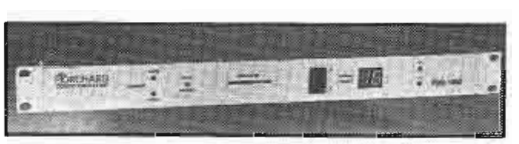
Audio/mic/video distribution

Opamp Labs has introduced the mic/audio and audio-video Press Box series. The A-18/2ML and A-24/2ML units provide two audio inputs with 18 and 24 outputs. Audio inputs are transformer isolated for mic or line inputs. Each output includes XLR, phone, RCA and 3.5mm jacks with mic/line-level switch selection. Both run from 105-125Vac and provide 50dB of isolation between outputs. The VA-16, like the A-/2ML units, is housed in a Halliburton aluminum case and includes one input with 16 outputs for audio and video. XL-type connectors are used for audio.

Circle (483) on Reply Card

Fiber-optics modulators

Orchard Communications has introduced the 1000 series of FM-modulation equipment for fiber-optic transmissions of audio and video. Sixteen channels per fiber include video channels between 100-700MHz and audio between 15-75MHz. The units are frequency-agile and can accept NTSC or composite video inputs from cameras, VCRs or computers. The product is part of a multimedia network of intelligent, switched, microprocessor-controlled video, audio and data.



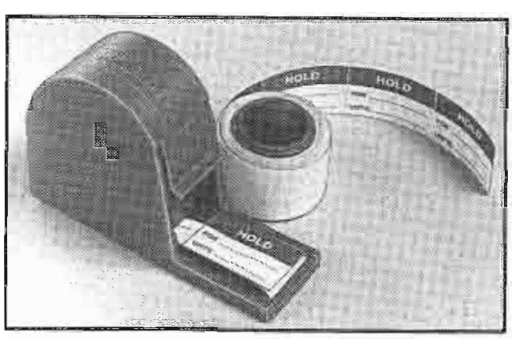
Circle (484) on Reply Card

Portable audio workstation

Pacific Digital has announced the DM-1 portable digital audio workstation for film and video post-production. The unit uses 16-bit audio in applications such as effects editing, background looping, dialogue fill or electronic Foley. The storage capacity of more than 760Mbytes allows effects to be stored with single keystroke access to individual items. MIDI control is possible as well as an AES/EBU digital interface and direct-to-disc capability for CR-DAT editing.

Circle (485) on Reply Card

Label dispenser



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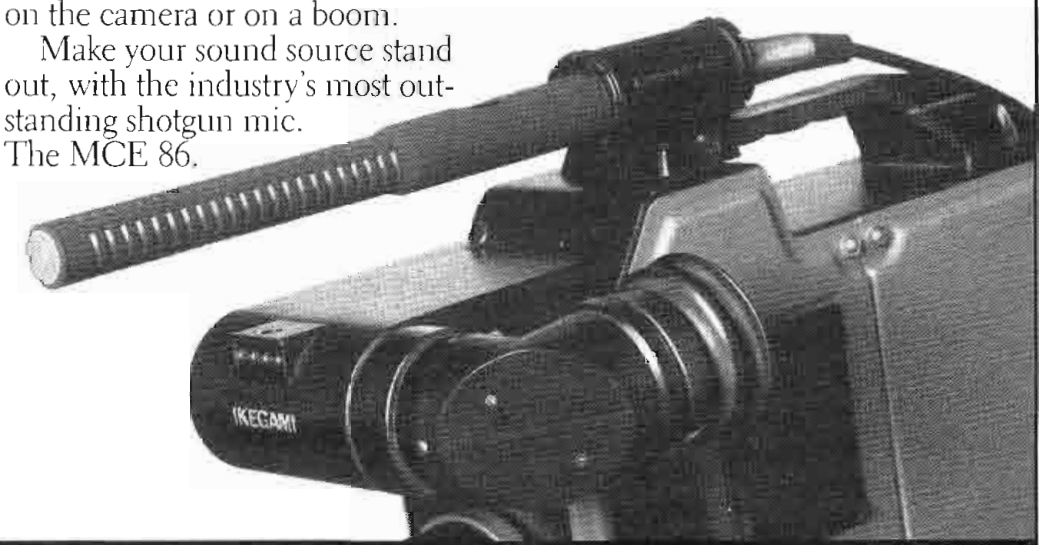
The MCE 86. Whether shooting on-location interviews or industrial videos, the MCE 86 shotgun mic lets you hear your spokesperson loud and clear. Its remarkable reach and accuracy give you crisp, clear response and articulation. No background chatter, no extraneous noises. And its lightweight design makes it easy to handle, whether mounted on the camera or on a boom.

Make your sound source stand out, with the industry's most outstanding shotgun mic. The MCE 86.



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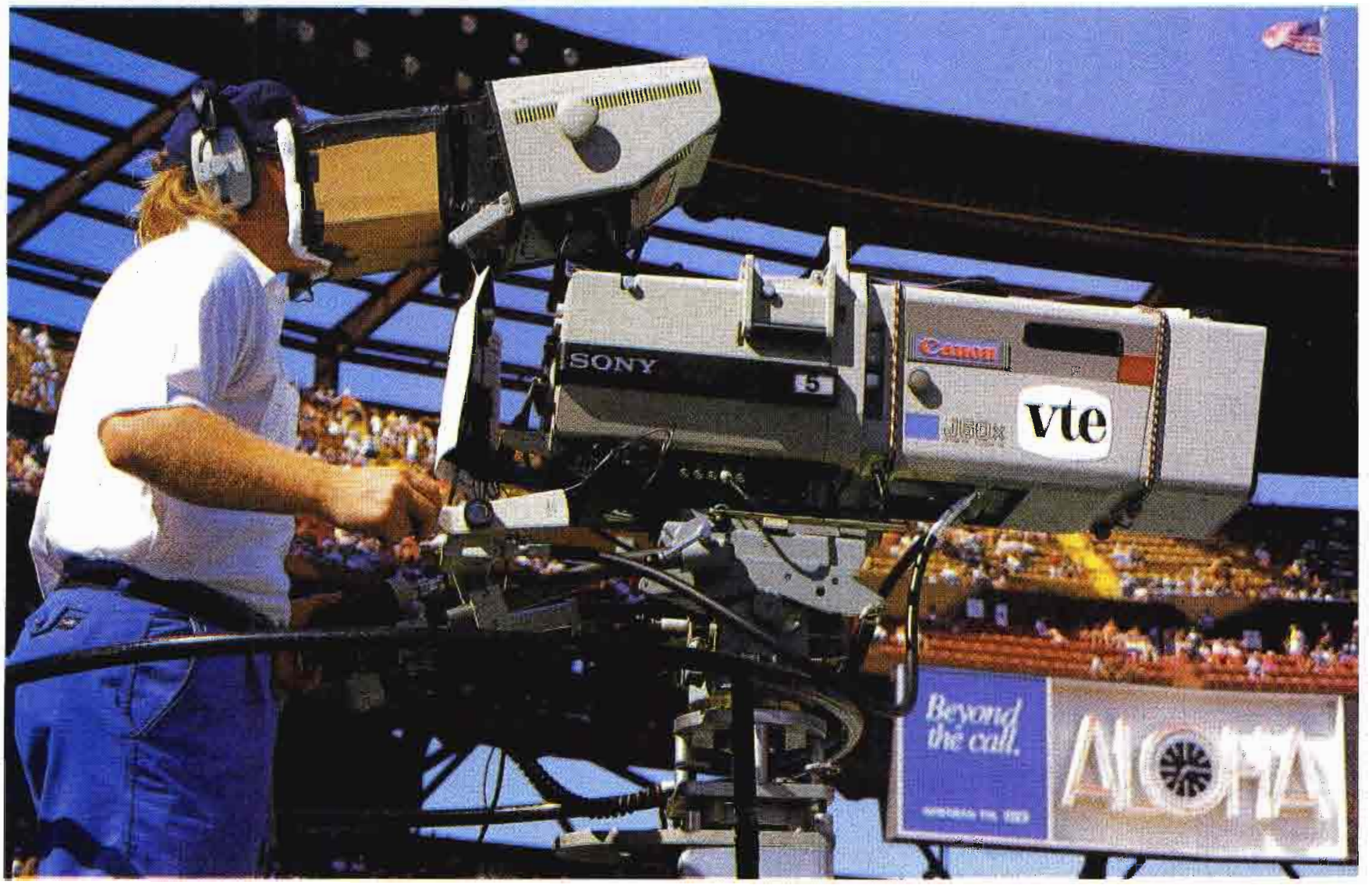

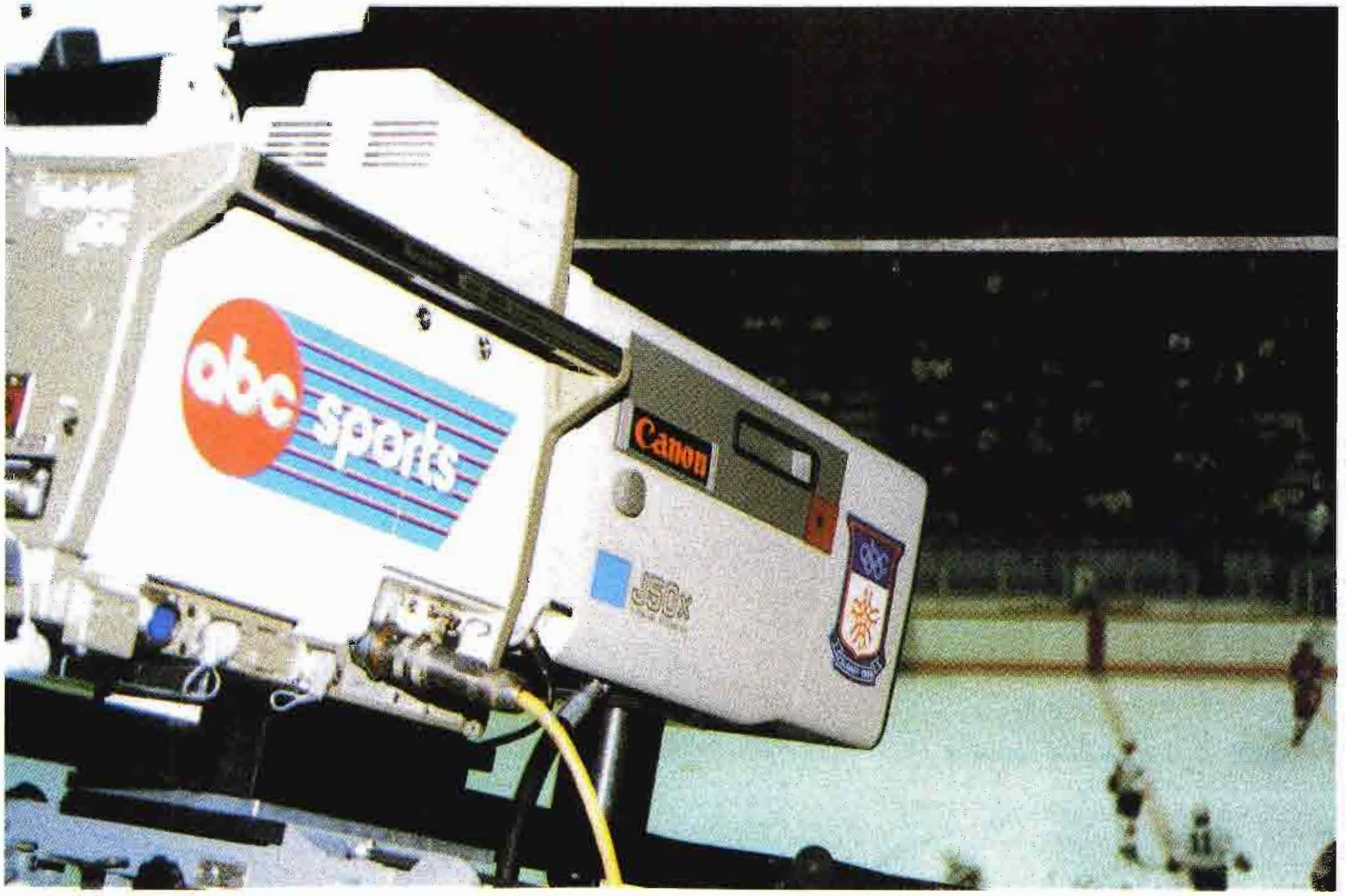

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vinyl, write-on, peel-off labels. The dispenser comes with rolls of 200 bright-colored, pretitled labels, 1"×1". Blank labels in 1"×1" and 1"×3" sizes with a self-laminating protective layer are available for use with the refillable dispensers.

Circle (486) on Reply Card

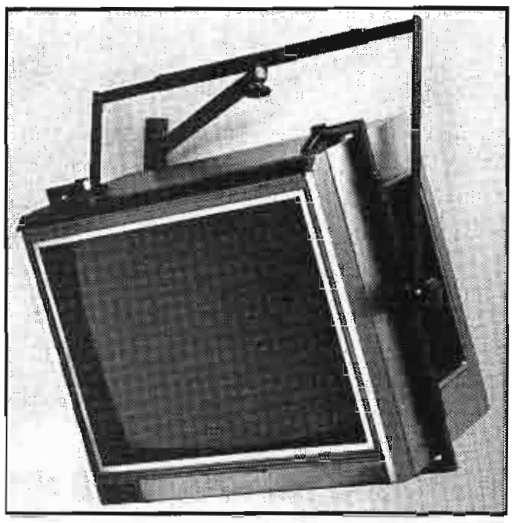
Fiber-optic transmission

PCO has introduced the PCO-5050 miniature, portable fiber-optic, audio-video transmitter. BNC and XLR input connectors link video and audio to the battery-operated unit. The 1,300nm multimode fiber carries FM signals to distances of 8km with a quality that meets or exceeds EIA RS-250B. Dual audio subcarriers are set at the factory for 6.2MHz, 6.4MHz or 6.8MHz. Video response is ±0.15dB, 10Hz-5MHz; audio response ranges from 50Hz to 15kHz.

Circle (487) on Reply Card

Monitor supports

Pivotelli/USA has announced a series of mounting supports for monitors. The Triple Pivotelli is a yoke-type bracket that clamps equipment from top to bottom on both sides. Wall- and ceiling-mounted versions are available for cabinet sizes from 11 inches to 33 inches wide, 11 inches to 30 inches high and weights to 176 pounds.



Circle (488) on Reply Card

Wire service software

Porter Communications & Publishing Systems has announced an enhanced version of PADCOM.TSR and SLOWIRE.TSR software. These programs allow an IBM or compatible PC to receive high- or low-speed newswire files while the computer is running other software under DOS 3.2. Files are sorted by category or service levels and written to designated directories

Circle (489) on Reply Card

Component distribution

Pro-Bel has introduced a series of distribution amplifiers designed for use with color-difference video components. Type 6167 for YUV and RGB applications provide clamping to sync pulses from the Y channel, and RGB models are clamped to the G signal. Type 6168, for non-composite RGB components, may use clamping to an external reference. Bandwidth for these units is specified at 30MHz. Three of the units, each with five outputs, mount in a 1-rack-unit frame with integral power supply.

Circle (490) on Reply Card

Earth-station calculations

Theta Scientific has announced the availability of LOOK 2.10, a software program to calculate azimuth, elevation and declination angles for satellite earth stations. The antenna-pointing parameters can be determined for any location on Earth by this shareware program.

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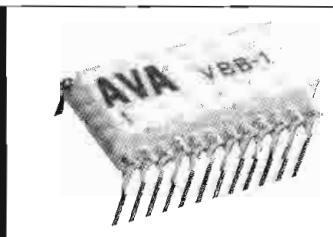

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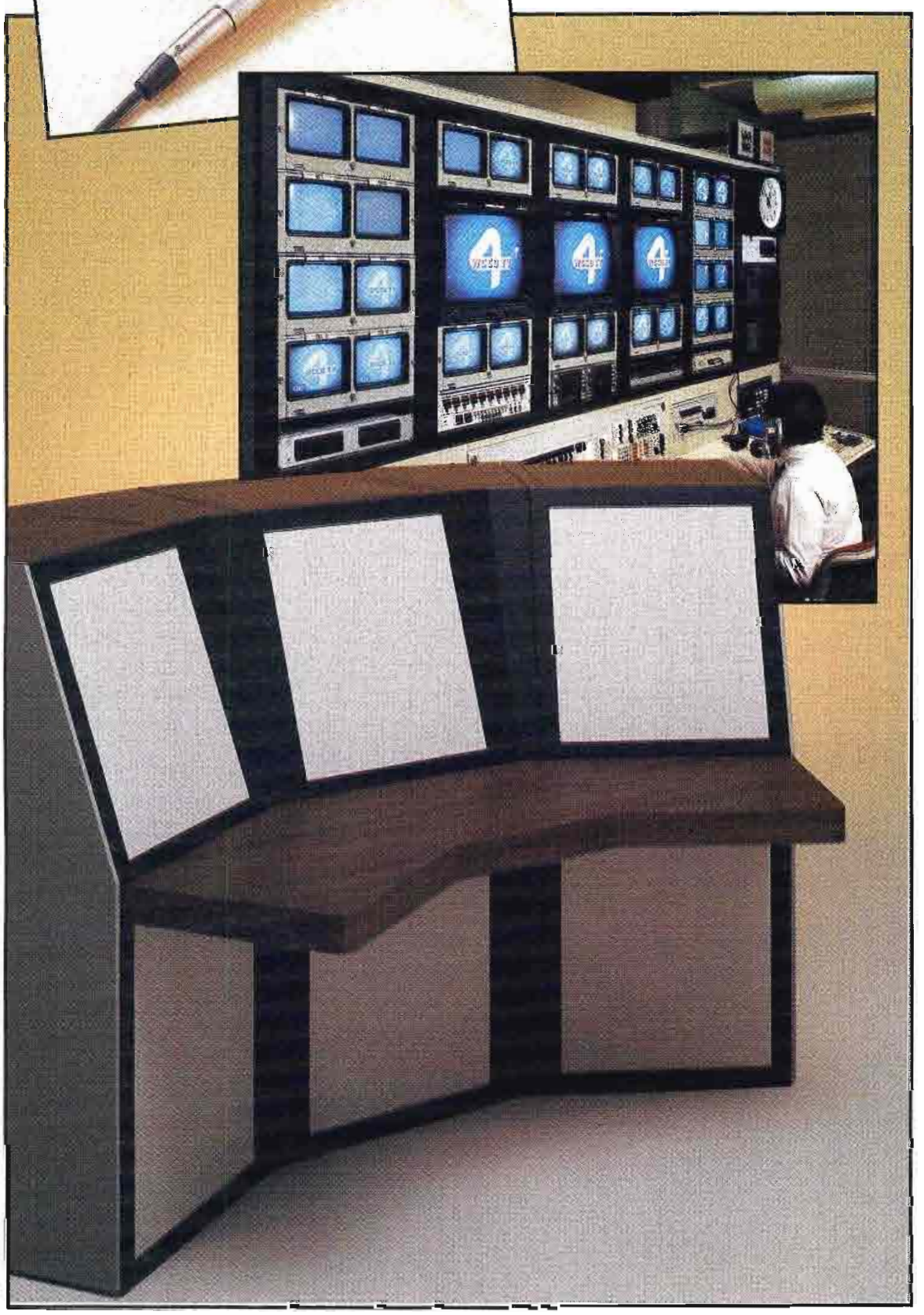

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Label-printing software

Professional Label Service has introduced VIDLABEL software allowing dot-matrix printers to produce videotape labels on tractor-feed adhesive labels. Menu control allows selection of large- or regular-size bold type on VHS top and spine combo labels, as well as other label formats.

Circle (492) on Reply Card

CD test source

PROSONUS has introduced the Studio Reference Disc (SRD). With your CD player, this compact disc of 70 minutes of audio test tones and references provides many of the special test signals needed for audio maintenance. Sine-wave calibration tones, sine-wave sweeps, pink and white noise, left/right polarity checks and musical pitch references are only a portion of the contents.

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Protective audio processor

Renkus-Heinz has introduced the RH-23 2-channel processor, which combines equalization and protection for low- and high-frequency drivers with automatic level-dependent loudness compensation. Designed for Renkus-Heinz Dyna-Gard FRS and SMS series speaker systems, the unit displays signal and protection status with color-coded LEDs and provides protection for the speaker systems if an amplifier or sensing line has failed.

Circle (494) on Reply Card

LCD projection systems

Sharp Electronics has introduced two types of LCD-based projection systems. The TFT LCD panels, combined with a high-power light source and magnifying lens, project images to 100 inches in diameter with good resolution, high contrast and color brightness. The QA-50 panel attaches to a personal computer and offers double-supertwist LCD devices for a 15:1 contrast range and extensive shading capabilities. A wireless remote control is included for use with IBM PC and PS/2 computers.

Circle (495) on Reply Card

Color-correction processor

Sierra Video Systems has introduced a color-corrector system for component video. The unit allows the adjustment of gains and dc levels of component video signals through the use of 2×1 linear multipliers. RGB, Y/R–Y/B–Y or HDTV configurations include single-rack-unit electronics with remote control. Four outputs per channel include sync and blanking control options.

Circle (496) on Reply Card

Studio monitors

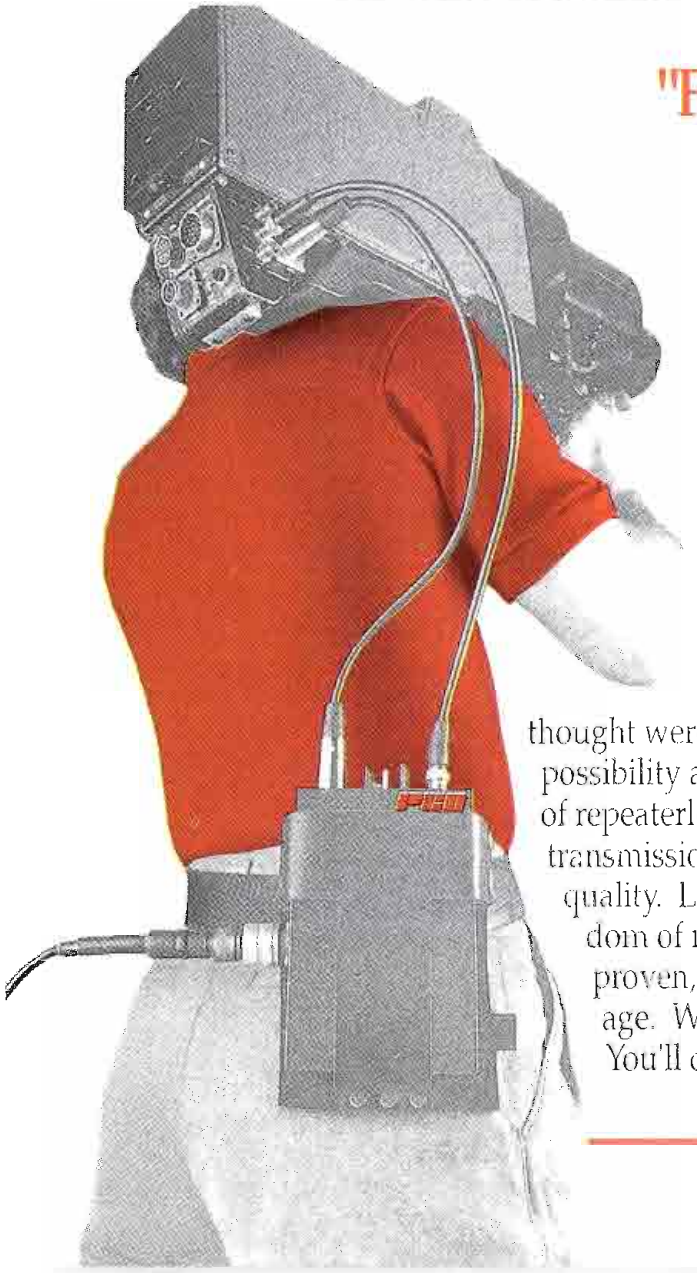
Studio Equipment Distribution has introduced the Court Signature series of studio monitors, ranging from 150W to 400W systems. Audio response covers 25Hz to 20kHz overall. The three models of the series include soft-dome speakers and passive crossovers. The sound field features a wide dispersion angle and may be used as floor-, wall- or flush-mounted systems.

Circle (497) on Reply Card

Serial port synchronizer and audio recorders

TASCAM has introduced the following products:

• The MT-1000 MIDiizer is a 3-function synchronizer that includes an autolocator, MIDI synchronizer to sync MIDI machines



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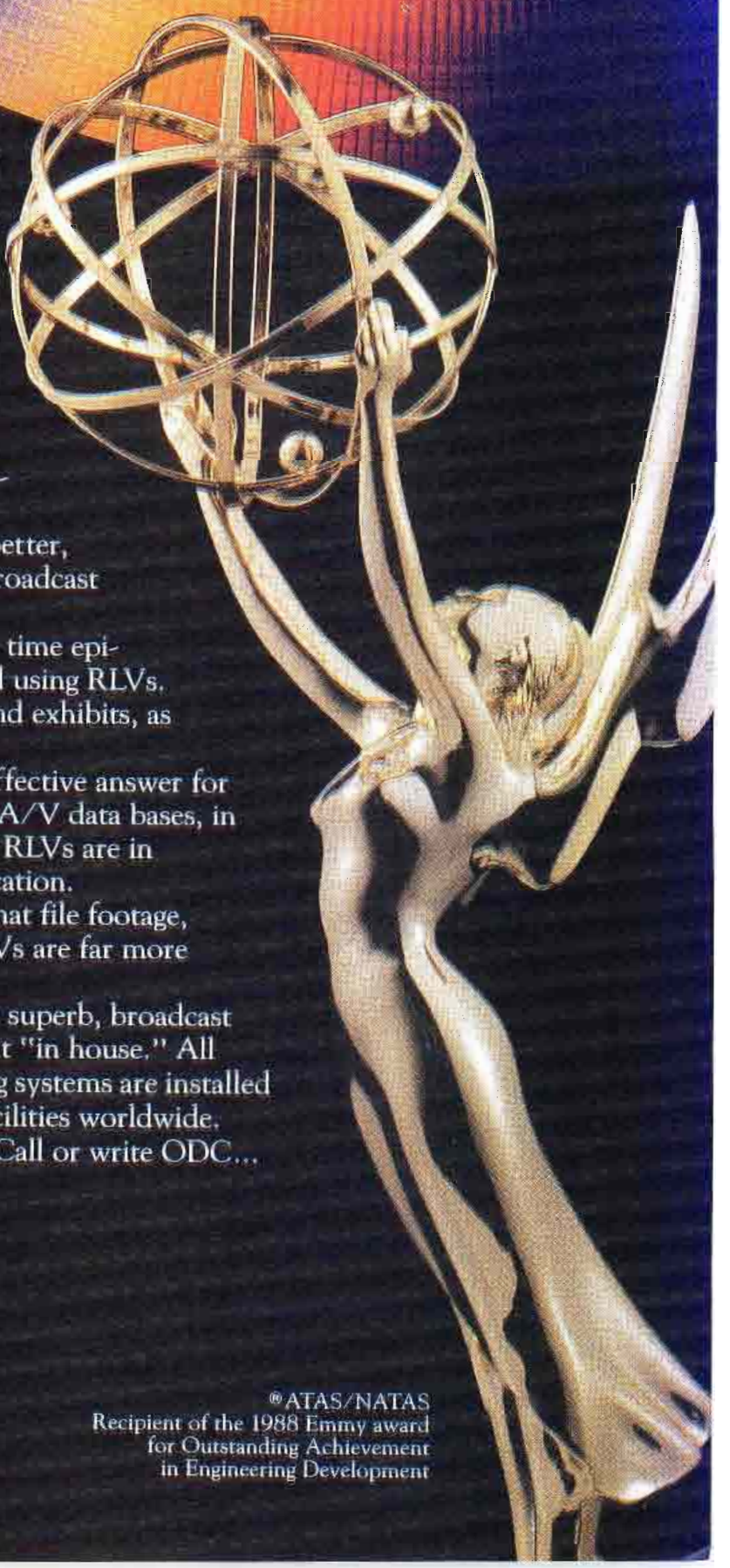

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to transports and a transport synchronizer for two transport chases. In addition to MIDI code, the unit reads and generates 24/25 drop-/non-drop-frame time codes.

• The MSR-16 ½-inch, 16-track audio recorder features integral dbx type-1 noise reduction; noiseless, gapless punch-in/punch-out; a serial port for external computer or MIDiiZER control and parallel port for a synchronizer.

• The ATR-80/32 2-inch, 32-track recorder features an independent sync and repro head; seamless, noiseless punch in-out; dual-spot erase forward and reverse; and accommodates 14-inch reels with samarium cobalt technology motors.

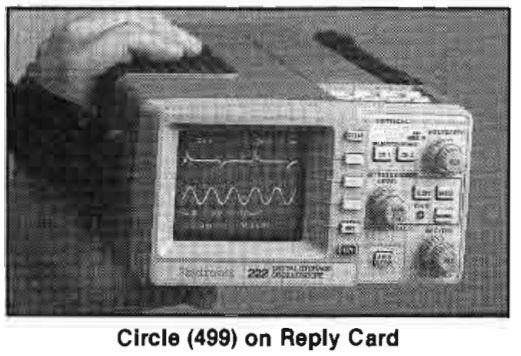
• The DA 800/24 DASH format digital multitrack recorder includes zero-distortion electronics with opto-isolated A/D and D/A conversion and 2× oversampling in record and play modes.

Other features include remote control, local and remote meter bridges and AES/EBU I/O interfaces.

Circle (498) on Reply Card

Digital oscilloscopes

Tektronix Portable Test Instruments Division has introduced the TEK 222 and 336A digital storage oscilloscopes. The TEK 222 dual-channel, hand-held instrument weighs 4.5 pounds with built-in battery. The "tool box DSO" features automatic setup and digital save/recall of front-panel settings and captured waveforms. The model 336A portable storage oscilloscope, designed in cooperation with Sony, is a 50MHz unit with 20MS/s sampling, 8-bit vertical resolution and an expanded memory to 16kbytes. Features include auto setup, cursors, on-screen readout, GPIB and storage of waveforms with eight front-panel setups.



Circle (499) on Reply Card

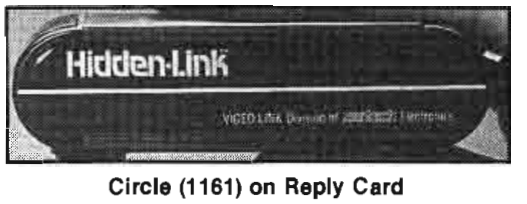
Graphics software

Time Arts has introduced Lumena/Vista, a version of the Lumena graphics software for the ATVista videographics adapter. Operation in 16-bit or 32-bit modes supports 8-bit color mapping, including 2-D animation through color cycling. A total of 16.7 million colors are available for use in 1,024×1,024 resolution images for NTSC, PAL or film.

Circle (500) on Reply Card

Infrared remote control

Xantech has introduced Hidden Link, an infrared control device that can be used for remote operation of various A-V equipment designed for reception of infrared-control signaling. The small device is aimed toward the user's position, and the controlled equipment may remain unseen in a closed cabinet. When an infrared signal is received by the unit, the command is relayed to two infrared LEDs placed inside the front section of the cabinet housing the A-V equipment. The system allows full remote-control functions.



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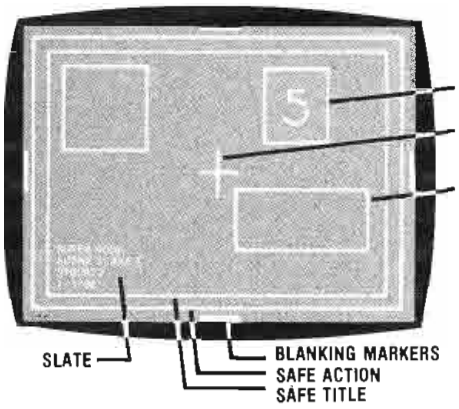

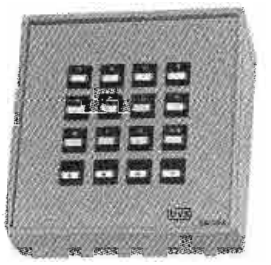

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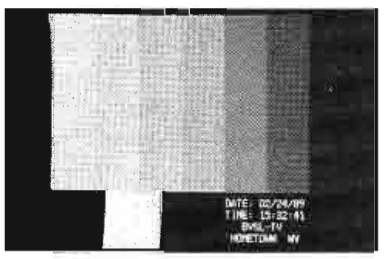

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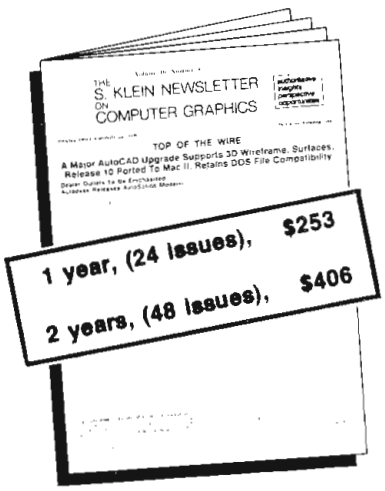

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Computer video processor

VidTech has introduced Scanlock VSL-1, a signal-processing system that gen-locks the output of a Commodore Amiga computer to an NTSC or PAL reference or S-VHS video signal. Supers, fades and keys can be performed to combine live or taped footage with computer-generated graphics and titles. The computer interface is a 23-pin connector to the Amiga RGB connector. With no external video source connected, the unit displays computer video only.

Circle (1162) on Reply Card

Digital annunciator

Time Domain Systems has introduced the VOICE-ID digital voice annunciator. The device uses all-solid-state technology and stores a 15- to 25-second message in a programmable EPROM. The memory is non-volatile. The audio output from the circuit board is 0.5W, 8Ω with a bandwidth of 2-4kHz. Five separate messages can be individually triggered with various programmable delays.

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CCVS quad splitter

Vicon Industries has introduced the V2100QS quad splitter, which digitizes, stores and displays four non-synchronous monochrome images on one monitor screen. Separate brightness and contrast controls are provided for each input. Individual quadrants may be frozen or a quadrant expanded for full-screen viewing. Resolution is 512 lines.

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Now there's a brand new report to help you sort through the mind-boggling number of graphics cards available. It's called **High Resolution Graphics Cards for the IBM PC/AT and PS/2.** The authors, Jon Peddie Associates, produced a similar report last year. This year's report is a total update of the 1987 version and contains *three times the information.* For only $260.

You'll welcome the organized way that comparative data is presented in the report. You'll gain an understanding of the technical jargon, and learn all about the technical and economic trade-offs to be made when buying these products.

More than just a buyers' guide, the report succinctly explains how the different classes of graphics cards relate to actual applications. You'll understand what to look for in refresh rate and vectors per second that are important to CAD projects. As well as understand aspect ratios, software drivers, pixblt, and other factors that are more important in desktop publishing.

You'll appreciate the wealth of competitve data on the graphics card market contained in this report. With numerous charts and figures, the report will help you find profitable opportunities and survival strategies in this volatile market.

In short, whether you're a buyer of high resolution graphics cards or someone who wants to understand the market better, this report will save you days of research and analysis and take you quickly through the maze of products available.

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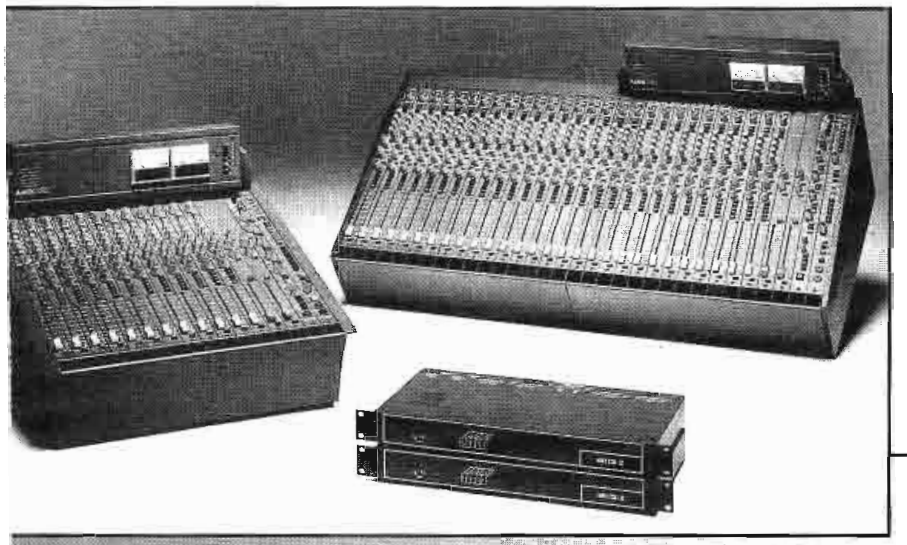

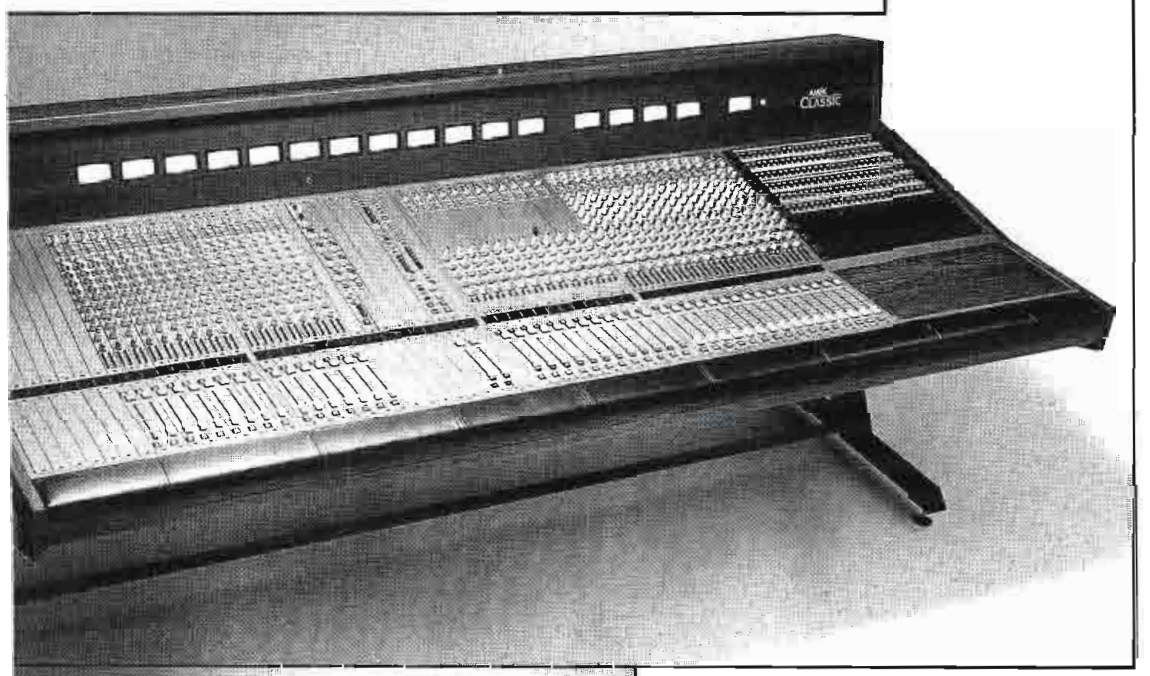

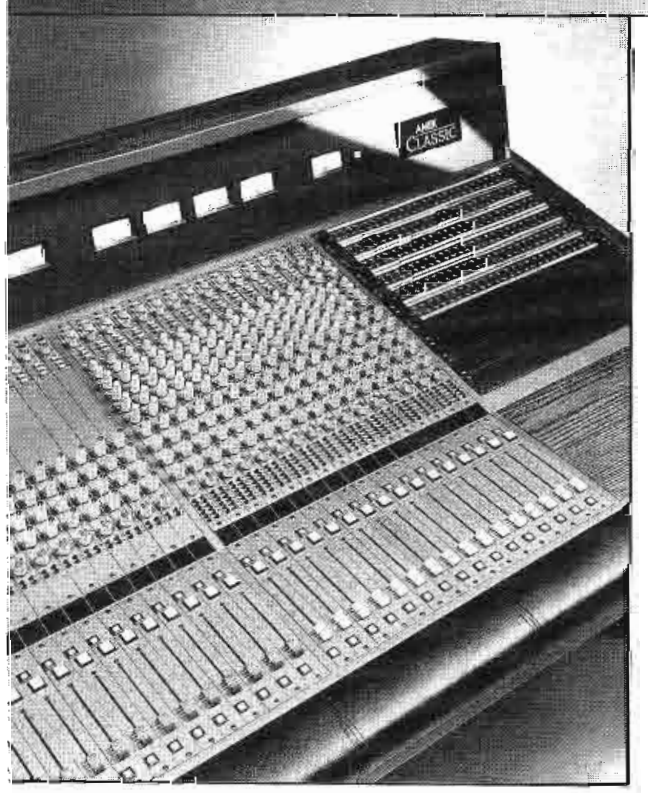

AMEK

Head Office, Factory and Sales:
Amek Systems and Controls Ltd. New Islington Mill,
Regent Trading Estate, Oldfield Road,
Salford M5 4SX, England. Telephone: 061-834 6747.
Telex: 668127 Fax: 061-834 0593

AMEK/TAC US Operations:
10815 Burbank Blvd, North Hollywood, CA 91601.
Telephone: 818/508 9788. Telex: 662526 AMEK USA
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1985 1987

AMEK's large range of advanced audio consoles offers an unequalled choice to Broadcast and Video Post facilities.

For situations where compactness and simplicity of operation count, AMEK BCII has many desirable features. The BCII equipped with our ESM32 AFV (Audio Follow Video) interface provides a simple package solution to problems of integrating a complete audio control system into a Video Edit environment. BCII/ESM32 provides quality audio - not 'video' audio - with monitoring and preview of audio sources. Audio can follow or be independant, and various cross-fade patterns are allowed for. The protocols support a vast range of equipment from major editor suppliers such as AMPEX, CMX, GRASS VALLEY and PALTEX. Standard AMEK-specified packages of desk and interface are readily available, but custom flexibility is catered for.

Beyond the package stage, AMEK BCII offers a wide range of options. CONFIGURATIONS as diverse as a simple 6-in, 1-out through to 24-in, 4-subgroup, 2-out can be provided with ease.

MODULES include Mono and Stereo inputs, Mono and Stereo subgroups and outputs - with or without Dynamics - and several monitor sections for all control room, studio and production gallery requirements.

CHASSIS not only include 16, 24 and 32-position frames in table top, drop through and portable formats but also a complete free-standing studio desk which can include jackfields and extra racking space.

METERING is moving coil-type and options include VU,BBC and DIN-spec PPM.

AMEK CLASSIC is built on a much larger scale and is eminently suited for use not only in Broadcast and Video production but also in Film Post, with or without multitrack Buss/Tape monitoring facilities.

Many configurations are possible. Standard features include 4-band fully-swept equalization, 8 auxiliary send busses, 8 mono or 8 stereo subgroups, and two seperate stereo busses.

Stereo input modules are fully M/S capable and Image Width control as well as Pan is provided. DYNAMICS modules which include compressor-limiters and expander-gates can be fitted.

CLASSIC is also available with the GML Moving Fader automation system for up to 96 faders, or with various VCA-based systems if less sophistication is required.

Beyond this, various multitrack and video-post production console exist in the general range, including AMEK G2520 and the fully-digitally-controlled APC1000 which features Recall, Reset and Assignable system.

AMEK consoles are used in many of the world's major production facilities, such as the BBC, ITN, MOLINARE, NBC and THAMES TV. We have a complete capability and without doubt are counted as one of the world's leaders in audio mixing technology.

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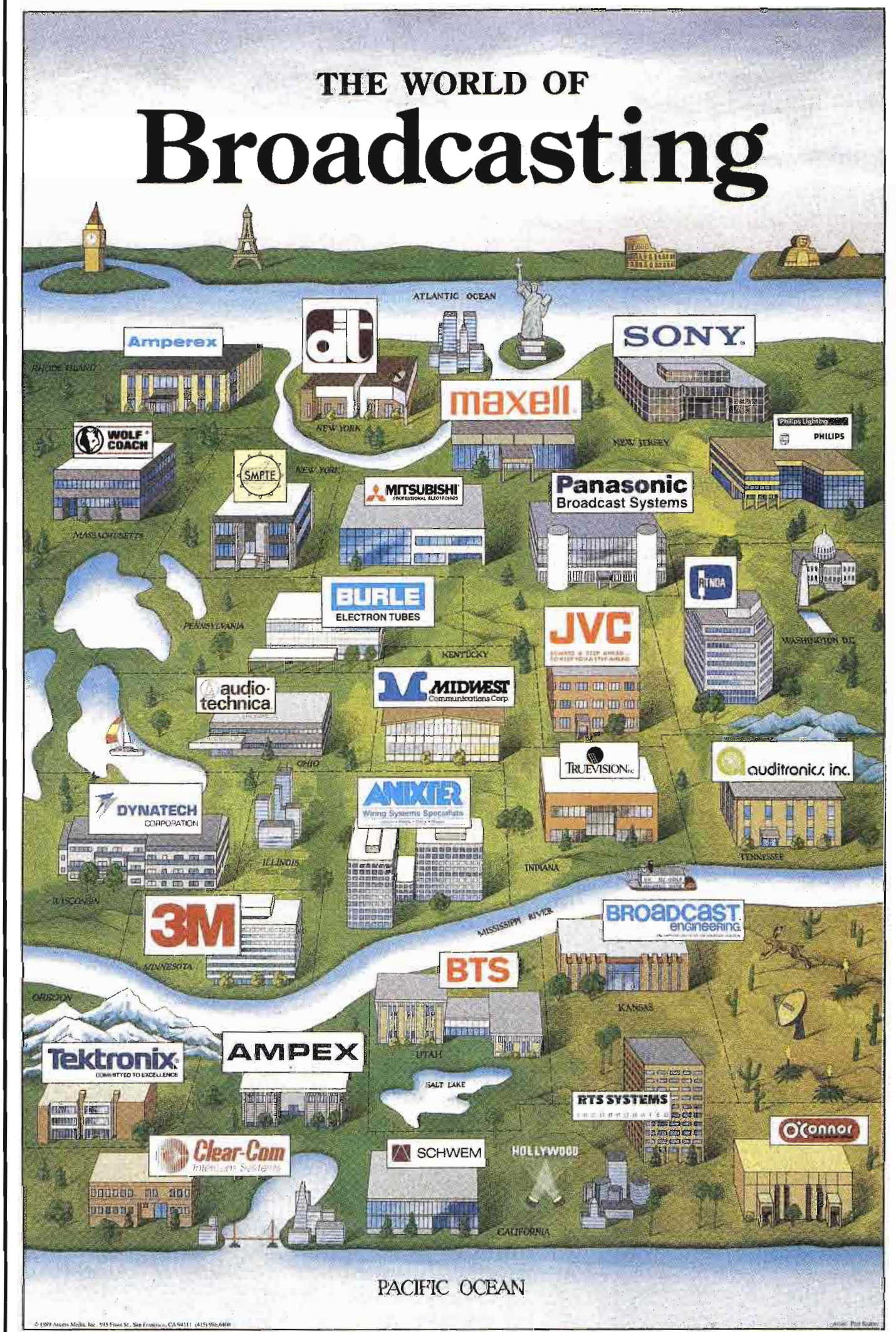

The World of Broadcasting Print will be introduced and distributed at the NAB '89 Show in Las Vegas, April 29 - May 2, 1989. The 24"x36" poster, suitable for framing, was sponsored by the participating companies and produced by Access Media, Inc.

To order your copy of the Print, send $10.00 each plus $2.50 for shipping and handling to:
Access Media, Inc., 945 Front Street, Suite 106, San Francisco, CA 94111.

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Electronic paint system

AVS has introduced the ARTMASTER, a menu-driven graphics paint system with a variety of software packages. PRESENT software provides for lists of sequenced images and symbols with special effects for on-air presentations. NEWS software is helpful in preparation of video documentary work with statistics and business graphics. D animation software also is available for the system.

Circle (1165) on Reply Card

Close-field studio monitors

Digital Designs, a division of Audix, has introduced a series of close-field studio monitors. The model LS-161 is a 2-way acoustic-suspension loudspeaker system that features a 6-inch polypropylene woofer and a 1-inch phase-corrected ferrofluid-cooled polymer dome tweeter. The woofer features a textured semi-hyperbolic cone, a ventilated nomex voice coil former, 4-layer high-temp wire and a closed-cell polyurethane foam surround with precise edge termination properties. The tweeter has ultralight moving mass and liquid cooling. The tweeter and woofer are time-corrected and produce a point source for image localization. The monitor is magnetically shielded for post-production applications.

Other models include the LS6 and the LS-261.

Circle (1166) on Reply Card

Custom PC systems

Leitch Video has introduced the RacPac AT, a reconfigured AT-compatible PC for mounting in a 19-inch equipment rack. The standard system is 80286-based with 1MByte RAM, multifunction card with one serial and one parallel port, sockets for 1.5MBytes of additional RAM and disk driver card with 20MByte hard and 5-inch 1.2MByte floppy drives. The display adapter includes EGA, CGA, MDA, Hercules or composite monochrome. Options include a 80386 CPU, SCSI controller and RS-422 adapter.

Circle (1167) on Reply Card

Wireless amplifier

TOA Electronics has introduced the WA-640 high-band VHF portable wireless amplifier for sound-reinforcement uses. One wired and two wireless microphones can use the amplifier simultaneously. The wireless hand-held or lavalier units operate 35 hours on one AA battery. An optional receiver module is necessary for each wireless mic. Companding and a tone-key circuit design offer a wide dynamic range, good S/N ratio and reduced interference. With the amplifier is an 8-inch, 2-way speaker system rated 15W per channel.

Circle (1168) on Reply Card

Audio monitors

JBL Professional has introduced the following products:

- The Control 10 monitor combines a 1-inch titanium dome tweeter, 5-inch cone midrange and 12-inch low-frequency transducer in a molded enclosure. The 12-inch unit uses JBL symmetrical field geometry (SFG) magnetic structure for low harmonic distortion.
- The Control 12SR sound reinforcement speaker system incorporates a 12-inch SFG transducer with a 3-inch edgewound aluminum voice coil and a 1-inch exit compression driver on a flat-front bi-radial horn. The injection-molded enclosure of polypropylene foam includes fittings for mounting and provides a paintable surface.

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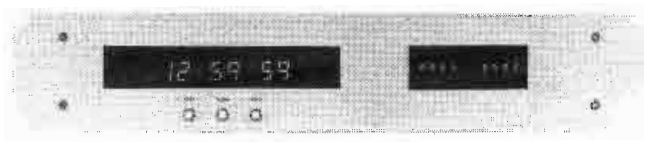

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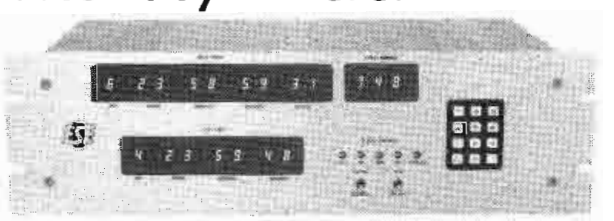

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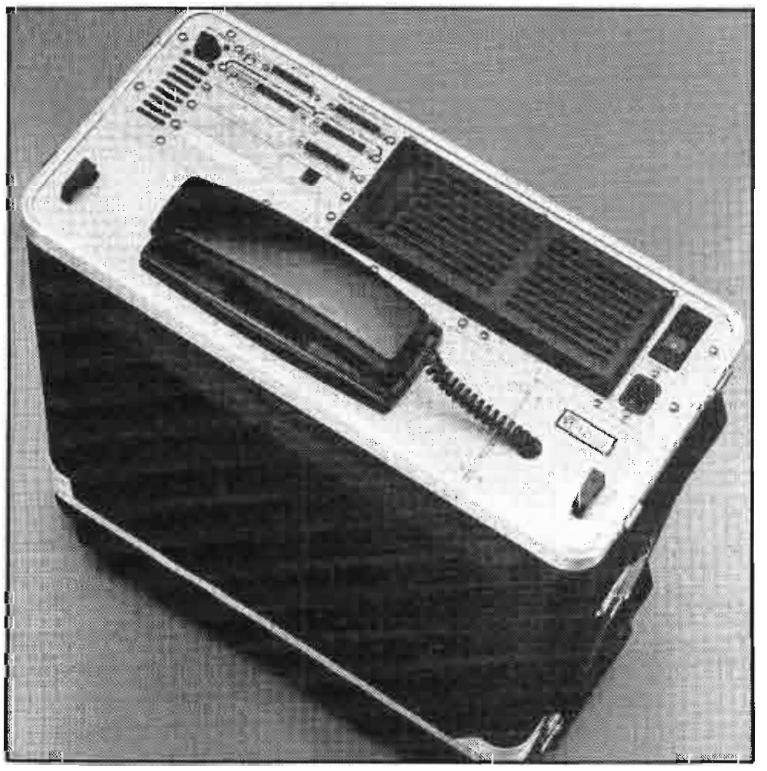
Monitors, enclosures

Turbosound has introduced the TMW-210 floor monitor and TSE-112 modular enclosure. The monitor includes two 10-inch speakers and a high-frequency driver, yet has dimensions making it suitable in studios where sightlines must be preserved. The TSE-112 separated enclosures include a 1"×10" TurboMid device and a V-2 high-frequency device. These enclosures are suggested for installations in which additional high-frequency power is required.

Circle (1170) on Reply Card

Flyaway satellite system

ViaSat Technology has introduced the PSAT portable satellite terminal, which combines a digital interface, Ku-band transceiver and 1.2m-sectioned antenna with mount. All components pack into four carrying cases, which may be checked as baggage on airlines. Setup time for one person is approximately 30 minutes. The system is intended for reliable private network voice and data communications to remote locations covered by a satellite footprint where other forms of communications are unavailable.



Circle (1171) on Reply Card

Audio processor and interface

Aphex Systems has introduced the following products:

- The model 612 expander/gate features downward expansion with a variable ratio, a level ducker and a VCA 1000 voltage-controlled amplifier device.
- The model 124 audio level interface simplifies interconnection of −10dBV consumer lHF equipment with +4dBm and +8dBm professional audio products.
- The model 120 audio DA features electronic servo balancing of a high-impedance input and four low-impedance outputs, transformerless circuitry and a flat frequency response suitable for distribution of audio and SMPTE time code.

Circle (1172) on Reply Card

See us at NAB Booth 1721

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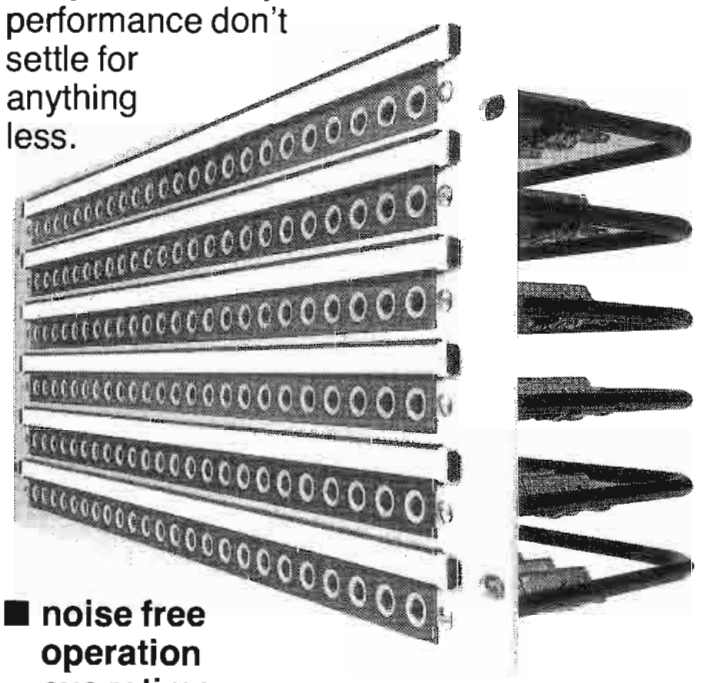

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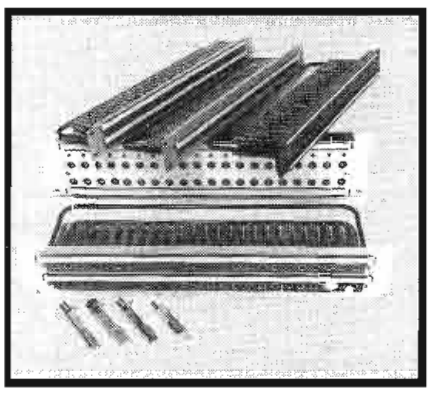

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Circle (214) on Reply Card

Microphones and stereophones

Audio-Technica has announced the following products:

- The TriPoint RD303 incorporates three miniature, permanently polarized condenser cartridges into a single case with separate feeds from each unit. The phantom-powered microphone features a 30Hz to 20kHz response.
- The AT4051 cardioid microphone is an externally polarized, transformerless microphone, which offers interchangeable head capsules for various applications with a response of 20Hz to 20kHz.
- The ATH900 series of stereo earphones includes the ATH909 and ATH911 open-back and ATH910 closed-back stereophones, which have soft foam earpads for an effective element-to-ear seal with adjustable headbands. Matching 4Ω to 24Ω connections, ATH909 and 910 have a 20Hz to 20kHz response; ATH911 extends the range to 25kHz.

Circle (1173) on Reply Card

Cable jackets

The Zippertubing Company has introduced four types of high-temperature jackets for protection of wire and cable in extremely hot applications. The types include Teflon (FEP), aluminized fiberglass (ALFG), aluminized-silicone rubber-coated (ALSR) and high-temperature glass (HTG). These materials cover a thermal range from −400°F to 1,800°F and protect against radiant heat and exposure to flame or sparks. A mesh shielding can be included for protection against EMI, magnetic and other electronic interference.

Circle (1174) on Reply Card

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The above statement could have been made by anyone who has ever been to an NAB convention. And it's true, NAB is the place to discover more than the latest products from the industry giants; it's the place where smaller, more product specific companies such as I.DEN have showcased their equipment.

The backbone of this industry is the small manufacturer, the entrepreneur/engineer who has figured out a way to make a better product, because he focuses on a single product or tight group of products. And this too is I.DEN. IDEN is not a giant, but has been in business for over three years manufacturing OEM equipment until IDEN recently introduced its own brand to the US market. IDEN makes the finest Time Base Correctors, Frame Synchs, Video/Computer Interfaces and Y/C D.A.s in the industry. This year, while you're on your way to one of the booths of the giants, stop by and see IDEN at booth number A126. It's the FIRST OUTDOOR BOOTH YOU WILL COME TO WHEN YOU LEAVE THE HILTON ON THE WAY TO THE CONVENTION CENTER. Or if you do not have a chance to visit the NAB this year, you can get further details on IDEN and its products by contacting:

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Circle (202) on Reply Card

www.americanradiohistory.com

Data patch panel

Jem-Fab has introduced the D-Patch self-normaling data patch panel for use in data signal path switching. The 4-wire interface data signals can be used for VTR to editor machine control, character generator keyboard delegation, DVE, still-store, switcher control, telephone circuits, modems, current loop circuits, modular networking, remote control, data networks and printers. Signal connections are made through a 9-pin "D" connector. The normal signal path does not require patching. When a patch cord is plugged in, the normal signal path is broken and rerouted to follow the patch panel.

Circle (1175) on Reply Card

Routing system and encoders

Midwest Communications has become the distributor for the A.C.E. VX164 routing switcher and 204N/205N color encoders. The VX164 is a 16×4 video-routing system with local and various remote-control options for composite or component video. Software-configured serial panels, a joystick override and multiple audio levels are optional features. The 204N RGB-to-NTSC encoder provides six composite outputs from RGB or Y/R–Y/B–Y inputs with test pattern generator. The 205N includes Y/R–Y/B–Y outputs for simultaneous component analog recording from character generators and includes a TTL input option for use with PC-generated graphics.

Circle (1176) on Reply Card

Wireless microphone

Nady Systems has announced the 501 VR wireless microphone system for ENG and EFP applications. Standard systems operate from 170MHz to 216MHz with five channels. A dynamic range of 120dB is specified over a frequency range of 25Hz to 20kHz. The portable receiver includes double-heterodyne circuitry with a 16-pole IF filter. Transmitters for use with the receiver include a miniature lavalier with bodypack or lightweight hand-held unit.

Circle (1177) on Reply Card

Professional VHS videotape

Sony Professional Tape Division has introduced a line of professional VHS videotape. The videotape features high-power VIVAX magnetic particles. The tape also features a coercivity of 720 Oe and a retentivity of 1,350G. The tape uses the DDL binder system, which enables smooth tape runnability during high-speed fast-forward and rewind operations.

Circle (1178) on Reply Card

Cross key manipulator

Automation Associates has introduced the CKM-4, a 4-input video keyer designed to add 1-pass multilayering power to existing video switchers. In a user-organized stack of up to four key sources, the foreground layers will cut holes and refill over the background layers. Combinations in the stack can be selected by remote control. Separate clip controls are provided for each input. The take button also is paralleled by a GPI. The keyer is the height of one rack unit.

Circle (1179) on Reply Card

Broadcast console

Harrison Systems has introduced the AP-100 series of on-air broadcast consoles.

Circle (1180) on Reply Card

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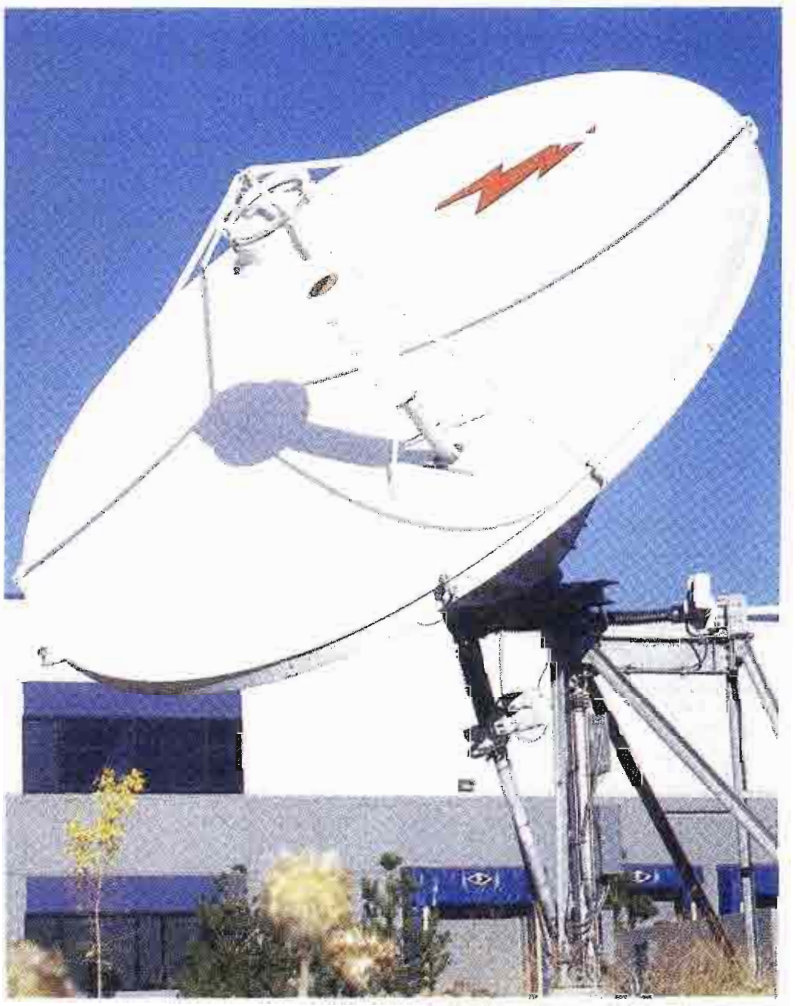

Andrew offers a complete line of satellite communication systems, including the 4.5 metre and 7.3 metre "cherry picker" TVRO antenna systems that can pick and choose programming from any domestic satellite.

And now, Andrew offers its newest "cherry picker," the 7.3 metre R/T antenna system with 6-port feed system. It's a **two-in-one** antenna because it is dual banded as well as transmit (at Ku band) and receive. Andrew also offers its brand new Tri-fold 4.5 and 4.6 metre transportable antenna systems.

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Samplers and software

AKAI Professional has introduced the S950 studio sampler and interface software for the S900 sampler. With a sampling rate of 44.1kHz, the S950 includes an expanded memory to 2.25Mbytes and a high-density disk drive. An optional hard disk interface for connection to a cascade of eight hard drives also provides a CD/DAT interface with 32kHz or 48kHz sampling for DAT applications. Interfaces for the S900 sampler include version V3.1, allowing the use of four Atari hard disk units, and version V3.2 for eight Supra disk drives, which expands the memory capabilities of the IB101A and IB101S interfaces.

Circle (1181) on Reply Card

Video-processing amplifier

Grass Valley Group has introduced the 7510 processing amplifier. It is tailor-made for multichannel operations in areas containing multiple satellite or microwave receivers.

Regenerated sync and burst and all the normal processing amplifier adjustments are provided. Video AGC, hard and soft clips, relay bypass and input cable equalization are standard. Both a 1-rack-unit frame, holding two processing amplifiers, and a 2-rack-unit frame, holding up to four processing amplifiers, are available.

The amplifiers are available in NTSC and PAL models.

Circle (1182) on Reply Card

Test generators, monitor unit and digital audio equipment

Tektronix has introduced the following products:

- The TPG-625 and TSG-422 signal generators. The TPG-625 PAL 10-bit generator produces all elements needed for monochrome and color monitor and receiver performance checks with two areas for text insertion of source IDs. The TSG-422 generates all signals needed for operation, maintenance and evaluation of 4:2:2 equipment, conforming to CCIR-601, EBU 3246-E and SMPTE RP-125 with selection of outputs for 625/50 and 525/60 operation.
- The 1781R video measurement set combines waveform and vector monitoring in separate or simultaneous displays with full-function RS-232/422 remote control, polar SC/H display and calibration, tangential noise measurement and stereo audio phase and amplitude measurement features.
- The NICAM-728 encoder/modulator and decoder for European I, B and G TV standard stereo transmissions. The 728-E encodes a stereo analog source into a datastream for DQPSK modulation. Program audio levels applied to the encoder are displayed on a front-panel LED display with decibel calibration. The 728-D decoder demodulates the digital carrier into left and right analog channels with LED readouts for eye height (%) or parity errors per second.

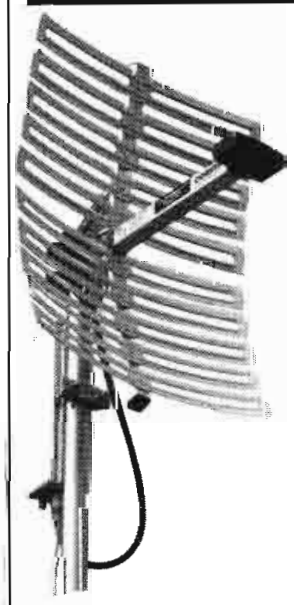
Circle (1183) on Reply Card

Low-print audiotape

Ampex Magnetic Tape Division has announced the Ampex 478 audio-mastering tape for film and video post-production and recording studios. An improved low-print performance provides minimum audible print signals. Other features include a high-speed backcoating process to reduce edge damage and allow high-speed rewinding of the tape.

Circle (1184) on Reply Card

ITFS MMDS WIRELESS CABLE RECEPTION PRODUCTS



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Circle (272) on Reply Card

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Audio-processing products, audio consoles

Klark-Teknik has introduced the following products:

• The DN500 dual compressor, expander, limiter; the DN510 dual noise gate; DN514 quad auto gate and two stereo delays.

The two channels of the DN500 provide a distortion level less than 0.05% and S/N greater than 94dB from 20Hz to 20kHz. The DN510 operates as a stereo or dual mono unit with a range of 0dB to −90dB and provides front-panel control of all attack, delay, hold and release parameter. THD is less than 0.5% with noise at −104dBm. The DN514 includes two auto attack settings for each channel with hold time scaled to the release value.

The DN726 delay provides stereo, in-phase outputs with a delay range of 0s to 1.3s in 20ms increments and 16-bit linear processing. The DN775 stereo mastering preview delay offers 5.55s delay in 16ms increments.

• The MIDAS XL2 console line with frame sizes of 24, 32 and 40 inputs. A 16-input channel expander connects to existing frames with a single, multipin connector. A submix from any or all of the eight subgroups can be routed to two matrix outputs. An 8-scene automute programming capability includes LED indicators of all essential status buttons. An extensive talkback system includes an interface to standard intercom systems. Four-band EQ with 2-band mid-frequency parametric and bass and treble shelving controls are standard, as are Penny & Giles faders.

Circle (1185) on Reply Card

Framestore, decoder and test unit

GML has introduced the TIM dual TBC, PCD-500 PAL decoder and MTG 205 signal generator. TIM provides two independent channels of infinite-window digital time base correction with field- and frame-freeze capability for PAL 625/50 color signals. The PCD-500 PAL-to-component decoder provides simultaneous outputs of YUV components, RGB plus sync and S-VHS with a digital interface conforming to CCIR-601 as a plug-in option. The MTG-205 generator produces CCIR-601 digital component, YUV component and composite outputs selected from an LCD menu display and function keys. The unit includes gen-locking to an external sync source.

Circle (1186) on Reply Card

Headsets and shotgun microphone

beyerdynamic has introduced the DT770/990 studio headsets, which feature a frequency response of 5Hz to 35kHz for accurate reproduction of complex waveforms and extended harmonics. The lightweight designs include a large, low-mass diaphragm. In the DT770, the diaphragm is embedded in a bass-reflex system, and the 990 is a circumaural semi-open air design.

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Time base corrector enhancements

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HELP WANTED: Assistant Chief Engineer. PBS TV and FM operation seeks qualified engineer with minimum six years hands-on experience in the following areas: Harris UHF TV and FM transmitters, Ampex one inch VTRs and digital systems, SBE certification preferred, Some supervisory experience a must. This person will be Chief of FM. Salary commensurate with experience. Position must be filled ASAP. Sed resume to: Engineering, P.O. Box 416, Corpus Christi, TX 78403-0416. 4-89-1t

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OPERATOR/MAINTENANCE ENGINEER for UHF Network Affiliate. Ampex ACR-25 and VPR-6 VTR Experience necessary. FCC General or SBE Certification Required. Send resume to Chief Engineer, WAND-TV, 904 Southside Dr., Decatur, IL 62521. EOE. 3-89-1t

TELEVISION MAINTENANCE ENGINEER: Three years experience in television broadcast equipment maintenance. Thorough understanding of analog and digital electronics. FCC General Class License helpful. Excellent benefits. Salary commensurate with experience. Send resume to F. Bibeau, KOB-TV, P.O. Box 1351, Albuquerque, NM 87103. EOE/MF. 4-89-1t

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ATTENTION: WOMEN WHO SOUGHT EMPLOYMENT WITH THE VOICE OF AMERICA (VOA), THE UNITED STATES INFORMATION AGENCY (USIA), OR THE UNITED STATES INTERNATIONAL COMMUNICATION AGENCY (USICA) BETWEEN OCTOBER 8, 1974 AND NOVEMBER 16, 1984.

YOU MAY BE A VICTIM OF SEX DISCRIMINATION ENTITLED TO A MONETARY AWARD AND A POSITION WITH THE AGENCY.

UNITED STATES DISTRICT COURT FOR THE DISTRICT OF COLUMBIA

CAROLEE BRADY HARTMAN, et al.,
Plaintiffs,
v.
CHARLES Z. WICK,
Defendant

Civil Action No. 77-2019
Judge Charles R. Richey

PUBLIC NOTICE

On November 16, 1984, the United States District Court for the District of Columbia found in this class action lawsuit that the United States Information Agency (USIA or the Agency), including the Voice of America (VOA), is liable for sex discrimination against female applicants for the following positions at the Agency. The USIA was also formerly known as the United States International Communication Agency (USICA). On January 19, 1988, the Court issued its opinion ordering relief in a variety of forms to potential class members. Accordingly, this case is now in the remedial phase.

JOBS COVERED

Specifically, the Court has found that the Agency has discriminated against women in hiring in the following jobs:

- Electronic Technician (Occupational Series 856)
- Foreign Language Broadcaster (Occupational Series 1048)
- International Radio Broadcaster (Other) (Occupational Series 1001)
- International Radio Broadcaster (English) (Occupational Series 1001)
- Production Specialist (Occupational Series 1071)
- Writer/Editor (Occupational Series 1082)
- Foreign Information Specialist/Foreign Affairs Specialist/Foreign Service Information Officer/Foreign Service Officer (Occupational Series 1085 and 130)
- Radio Broadcast Technician (Occupational Series 3940)

WHO IS INCLUDED

All women who sought employment with the Agency in any of the jobs listed above between October 8, 1974 and November 16, 1984 and were not hired may be eligible for relief. Also included are those women who were discouraged from applying for these positions during that time period. Even those women subsequently hired by the Agency in some capacity may be entitled to participate in the remedial phase of this case.

Women who sought employment with the Agency as Foreign Service Officers or Foreign Service Information Officers may be eligible for different kinds of relief depending upon the date of application and whether they sought employment at the entry level or mid-level. Women who sought employment with the Agency as **entry** level Foreign Service Officers or Foreign Service Information Officers in the years 1974-1977 must use the procedure outlined below. Women who sought employment with the Agency as **mid-level** Foreign Service Officers or Foreign Service Information Officers in the years 1974-1984 must also use the procedure outlined below. However, women who sought employment with the Agency as **entry** level Foreign Service Officers or Foreign Service Information Officers in the years 1978-1984 cannot use the procedure outlined below, since the Court has ordered an alternative form of relief for them and selected women in this group will be notified individually as to their rights.

RELIEF AVAILABLE AND HOW TO OBTAIN IT

Relief available to class members may include a monetary award and/or priority consideration for a current position with the Agency. If you think you may be entitled to relief, you **must** obtain a claim form, complete it fully, and return it to counsel for the plaintiff class, Bruce A. Fredrickson, Esq., Webster & Fredrickson, 1819 H Street, N.W., Suite 300, Washington, D.C. 20006 (202/659-8515), postmarked no later than July 15, 1989.

You may obtain a claim form in person and/or in writing from several sources: counsel for the plaintiff class, whose address is listed above; in person from USIA, Front Lobby, 301-4th Street, S.W., Washington, D.C. (8:15am-5:00pm), Office of Personnel Management (OPM), Federal Job Information Center (First Floor, Room 1425), 1900 E Street, N.W., Washington, D.C. (8:30am-2:30pm), or from area OPM offices throughout the country; in writing, VOA-Hartman, P.O. Box 400, Washington, D.C. 20044. You should carefully consider all questions on the claim form, **sign** it, and return it to counsel for the plaintiffs. **Do not, under any circumstances**, return the claim form to the Judge, the Court or the Clerk of the Court. The Judge, the Court and the Clerk of the Court **will not accept** the claim forms and **will not forward** claim forms to plaintiffs' counsel.

PROCESSING OF CLAIMS

The process for handling claims has not been finally decided. Thus far, the Court has ordered that responding class members demonstrate their potential entitlement to relief at an individual hearing to be scheduled at a later date. However, the Court has reserved the right to reconsider this procedure in the event the number of claims filed makes this approach unmanageable.

Should individual hearings be used, you will be fully informed as to the date and time of your hearing. Moreover, you will be entitled to legal representation by counsel for the plaintiff class or his designee at no cost to you. Legal counsel will discuss your claim with you prior to your hearing, help you prepare your case and represent you at your hearing. You may, of course, retain your own attorney to represent you, if you so desire.

At the individual hearing, you will be asked to demonstrate your potential entitlement to relief by showing that you applied for one or more of the covered positions during the period October 8, 1974 and November 16, 1984 and that you were rejected, or that you were discouraged from applying. Evidence may be required in the form of testimony, documents, or both. Once you have demonstrated these facts, USIA is required to prove, by clear and convincing evidence, that you were not hired (for **each** position for which you applied) for a legitimate, non-discriminatory reason, such as failure to possess requisite qualifications. Should USIA make such a showing, you would then be entitled to demonstrate that the Agency's reason is merely a cover for sex discrimination or unworthy of belief.

Following the hearing, the Presiding Official will decide whether you are entitled to relief and, if so, what relief is appropriate. You may be entitled to wages and benefits you would have earned if you had been hired (back pay) from the date of your rejection until the date relief is approved. Under the law, back pay is offset by earnings you may have had during the period. In addition, you may be found to be entitled to front pay (that is, compensation into the future until an appropriate position is afforded you). Similarly, you may be found to be entitled to priority consideration for employment with the Agency. If hired, you may further be entitled to retroactive seniority with the associated benefits and the value of any promotions you would likely have had if you had not suffered discrimination.

REQUIRED STEPS TO FILE YOUR CLAIM

To participate in the remedial phase, **you must fully complete the claim form** and return it, POSTMARKED NO LATER THAN July 15, 1989, to counsel for the plaintiff class. Your failure to do so will result in your losing all rights you may have in this lawsuit. If you have questions about your rights or procedures available to you, you may contact counsel for the plaintiff class:

Bruce A. Fredrickson
Webster & Fredrickson
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Washington, D.C. 20006
(202/659-8515)

October 4, 1988
Date

/s/ Judge Charles R. Richey
United States District Court
Judge Charles R. Richey

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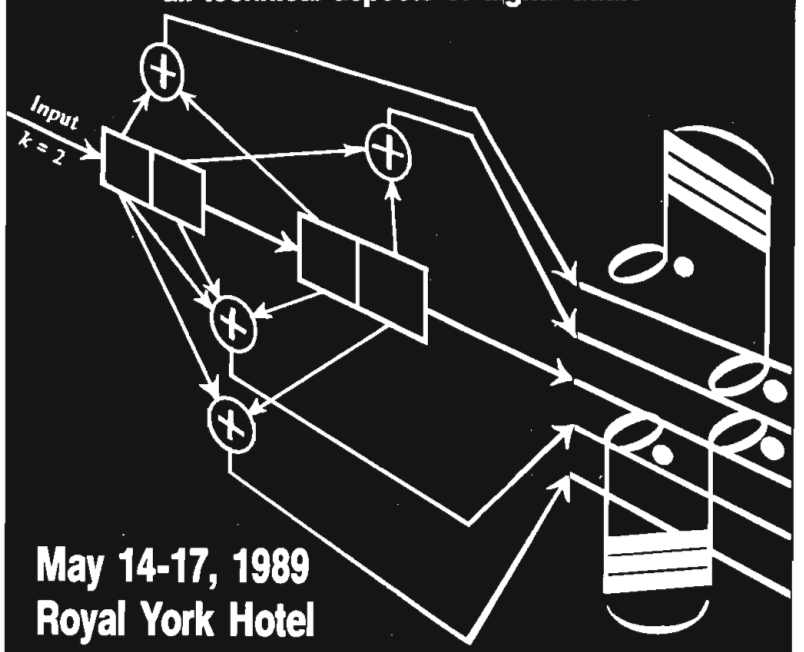

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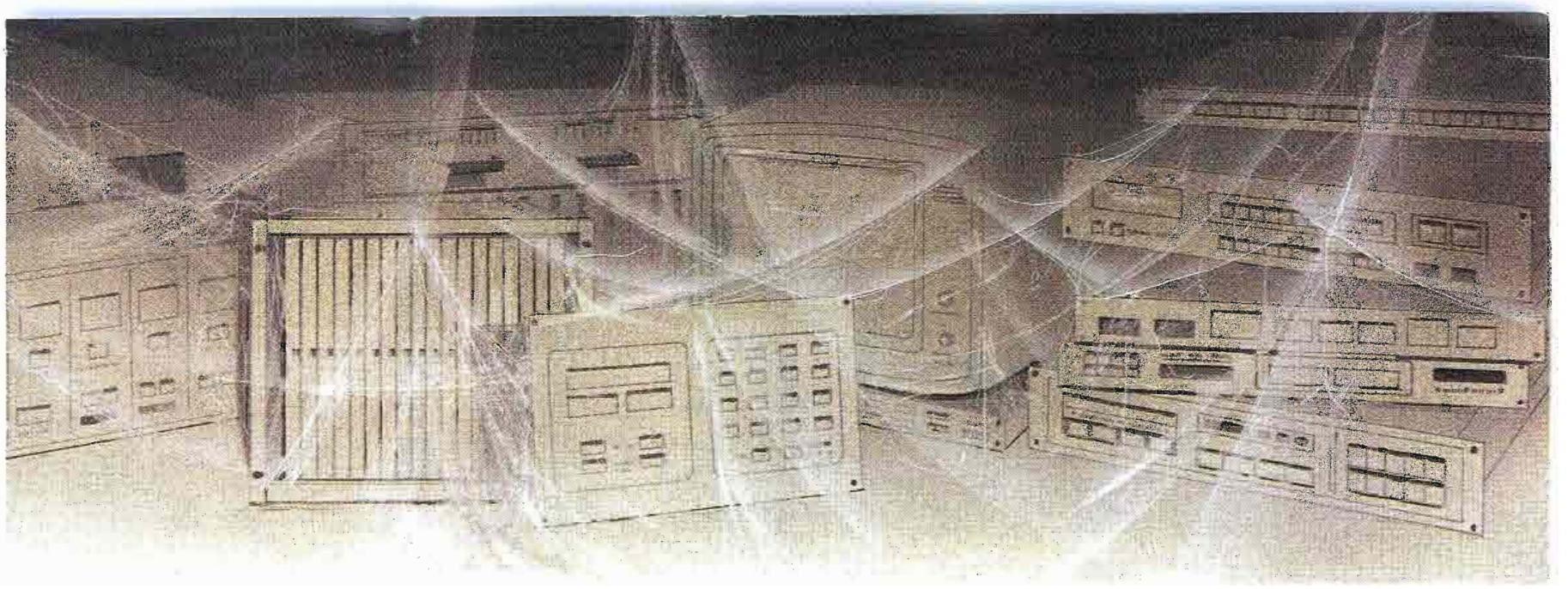

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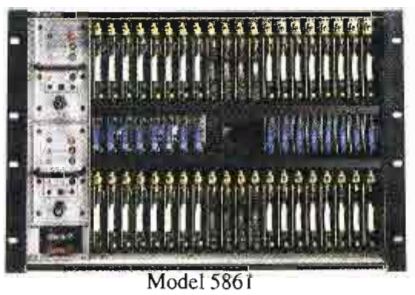

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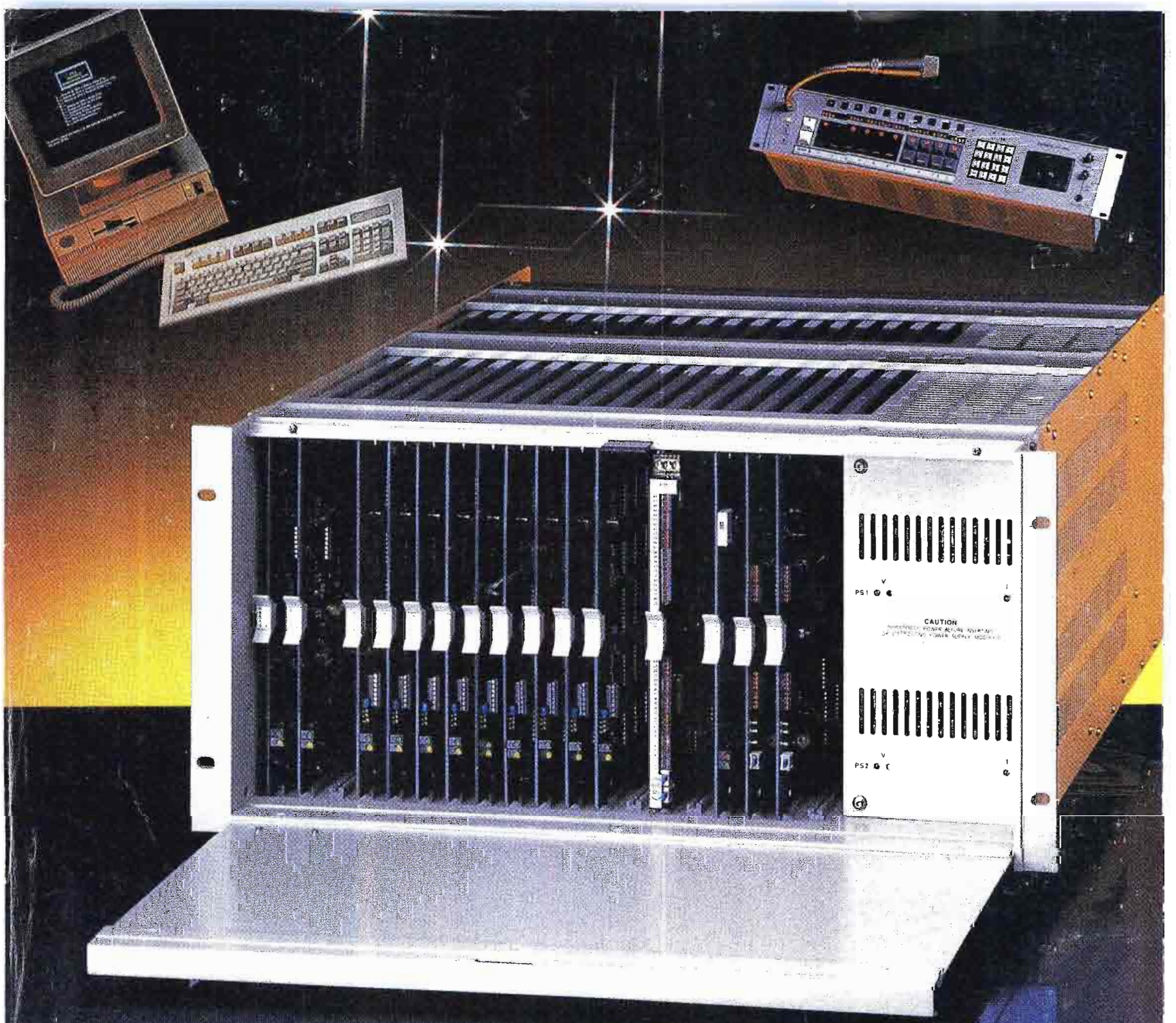

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