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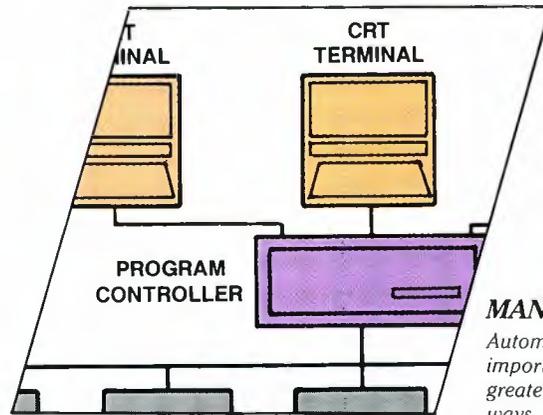


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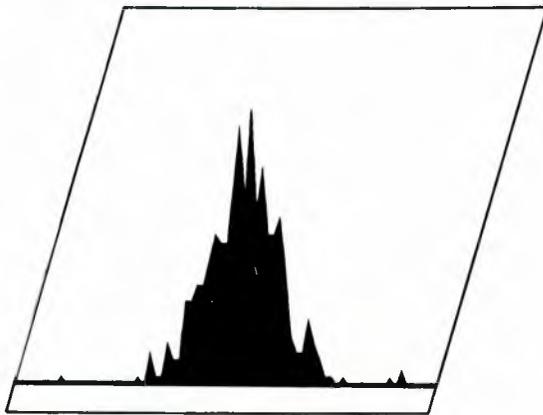
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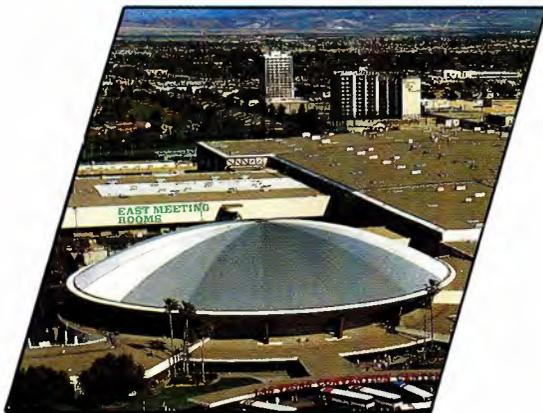
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BROADCAST engineering

MANAGING AUTOMATION IN BROADCASTING:

Automation of radio and TV station operations has become an important tool for increasing the productivity of a facility. With greater competition in the marketplace, stations are looking for ways to reduce overhead and improve on-air performance. Automation is one way to accomplish both objectives. This month, we examine the state of automation and where it is likely to lead the industry. Our editorial package includes the following articles:

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By Brad Dick, technical editor, and Karl Renwanz, WNEV-TV, Boston

That noise behind you is automation, and it's getting closer each day.

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Does anybody really know what time it is?

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Reducing transmitter power is no small task.

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By Carl Bentz, technical and special projects editor

This year, you have the luxury of a little more lead time.

ON THE COVER

Automation has been around for a long time in the broadcast industry, but the full benefits are just beginning to be realized. The key element is *connectivity*, the ability to interconnect various computer-based systems into one operating unit. (Photo courtesy of AMP.)

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Harris Broadcast to develop line of UHF transmitters

The Broadcast Division of Harris has begun development of a series of UHF TV transmitters, which will use the multistage depressed collector (MSDC) klystron developed by Varian Associates.

According to Thomas E. Yingst, vice president and general manager for Harris Broadcast Division, the company decided to develop the MSDC klystron UHF TV transmitters after an extensive study and evaluation of all available UHF amplifier technologies. Company officials expect the Harris transmitter to use less than half the power of similar transmitters.

Harris has sold its first 120kW MSDC klystron transmitter to WNVF-TV, Falls Church, VA. The transmitter is expected to be on the air in early September.

Varian began research and development for the MSDC klystron in June 1984.

Groups supporting the program were the National Association of Broadcasters (NAB), the Public Broadcast System (PBS) and the National Aeronautics and Space Administration (NASA). The 60kW wide-band external-cavity MSDC klystron selected for the Harris UHF transmitter uses the same RF section and electron gun employed in a standard wideband unit.

The MSDC klystron reduces dc input power requirements for each 60kW visual socket from a typical 95kW for newer pulsed transmitters to about 45kW. Harris officials predict the new klystrons to have a mean time between failure of 51,000 hours in the transmitter.

Sarnoff Research sets deal with Faroudja Labs

The David Sarnoff Research Center has agreed to acquire advanced video equipment developed by Faroudja Laboratories

for use at industry demonstrations this year. The equipment includes versions of the Faroudja NTSC encoder and decoder, plus a developmental model of an advanced line doubler, which was created as part of Faroudja's SuperNTSC system for 1,050-line display of NTSC images.

Sarnoff staff members and NBC engineers, who are developing advanced compatible television (ACTV), determined that the Faroudja equipment would meet their needs, and purchasing agreements were established in late October 1988.

Williams assumes post as NAB staff engineer

Kelly T. Williams joins the National Association of Broadcasters as a staff engineer in the science and technology department.

Williams assumes his duties after eight years with WHMM-TV, Washington, DC. He joined the station as maintenance/

Continued on page 110

BROADCAST engineering

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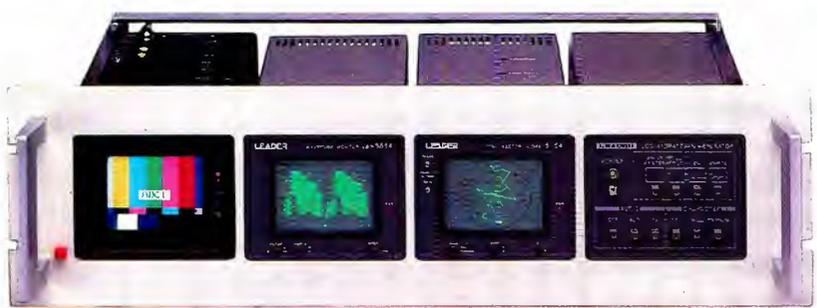
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Lottery considered for AM, FM and TV

By Harry C. Martin

The FCC is proposing to scrap its comparative hearing process and, instead, use random lottery procedures to select from competing applications for new AM, FM and TV facilities. The commission is concerned that the hearing process is too complex, lengthy and expensive and does not necessarily produce the best-qualified licensees.

Under the present system, mutually exclusive applications go through hearings before administrative law judges to determine which would best promote the agency's goals of maximizing diversification of media ownership and providing the "best practicable service" to the community. Under the diversification criterion, applicants having no other media interests are preferred. Under the best practicable service criterion, the primary consideration is the degree to which the owners of the application will be integrated into full-time management. Other factors, such as minority ownership, local residence, broadcast experience, female ownership and participation in civic activities also are considered. Under the proposed lottery system, the only preferences that would be available would be for diversification and minority ownership.

Many of the problems with the comparative process are the result of deregulatory actions during the 1980s. In 1983, the commission removed all restrictions on the amount of settlement payments that can be made to parties who agree to dismiss their applications. Later, the commission eliminated the requirement that applicants make a full showing of their financial qualifications in their initial applications. These and other relaxations in FCC standards spawned a gold rush of speculative proposals by unqualified applicants. The result was that many of the new FM allocations made through Docket 80-90 attracted 10, 20 or 30 competing proposals. Processing these applications has severely taxed the commission's resources and delayed the institution of new services.

The hearing process itself, however, has been effective in weeding out sham pro-



posals. Moreover, once cases have been assigned to administrative law judges, they have tended to move fairly quickly through the system. The major bottleneck is at the commission level, where it is not uncommon for appeals to remain pending and undecided for a year or more.

Under the lottery procedure the commission is proposing, applications would be screened for completeness prior to the lottery. Petitions to deny would be entertained against the lottery winner. This system has been used in the LPTV service and, according to the commission, it has had favorable results in terms of meeting the policy goals of promoting minority ownership and diversification of media control.

Settlement policies further relaxed

In a comparative contest for a new FM station in Florida, the commission has, for the first time, permitted a party who was not an applicant in the proceeding to step in and obtain the construction permit by buying out all the applicants who filed timely applications.

The administrative law judge who heard the case originally denied the settlement. He found that the agreement could not be approved under Section 311 of the Communications Act and Section 73.3525 of the commission's rules, because those provisions contemplate settlement agreements only between the competing applicants.

The commission disagreed, saying that providing a new broadcast service to the public in an expeditious manner is the overriding concern. Moreover, the commission said, neither the Communications Act nor the agency's rules explicitly preclude third-party participation in a settlement.

According to the commission, this case was different from a previous one in which a settlement was rejected because the buying party said it would resell to a third party after approval of the settlement. In that case, the commission would not grant the buying party's application because that party had no bona fide intention to construct the proposed facility. Here, all the applicants who had been competing for

the facility announced their intentions to abandon their proposals. Because the third-party buyer, in contrast, was willing and able to put the station on the air expeditiously, its proposal could be approved.

Unfortunately, the new decision may encourage sham proposals by parties who have more interest in achieving lucrative settlements than in operating a station.

LPTV window

The commission opened a universal filing "window" from March 6 to 10, 1989, for applications for new construction permits and for major changes in existing facilities in the LPTV and TV translator services. It specified that no individual could have an ownership interest in more than five applications for new stations tendered in the window.

Applicants were encouraged to take advantage of the commission's April 1988 policy statement providing for limited consideration of terrain shielding in the evaluation of LPTV proposals. Waiver requests based upon terrain shielding in some instances allow LPTV stations to be spaced closer to co-channel and adjacent-channel facilities than would otherwise be permitted under the commission's interference rules for the LPTV service.

FM downgrading rules streamlined

The commission has adopted new rules that eliminate the requirement of a rulemaking proceeding to downgrade the class of an FM allotment.

Under the new rules, downgrading can be accomplished in a 1-step process by merely filing an application proposing facilities of a class lower than that specified in the Table of Allotments. The table would be amended upon grant of a license for the downgraded facility.

Under previous rules, a petition for rulemaking was required to amend the table. This unduly restricted licensees from changing facilities. Such changes might be necessitated by economic considerations or in order to permit relocation to a more desirable transmitter site. The 1-step procedure the commission has adopted will eliminate approximately one year of waiting time for downgrades. [:-(-)]

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

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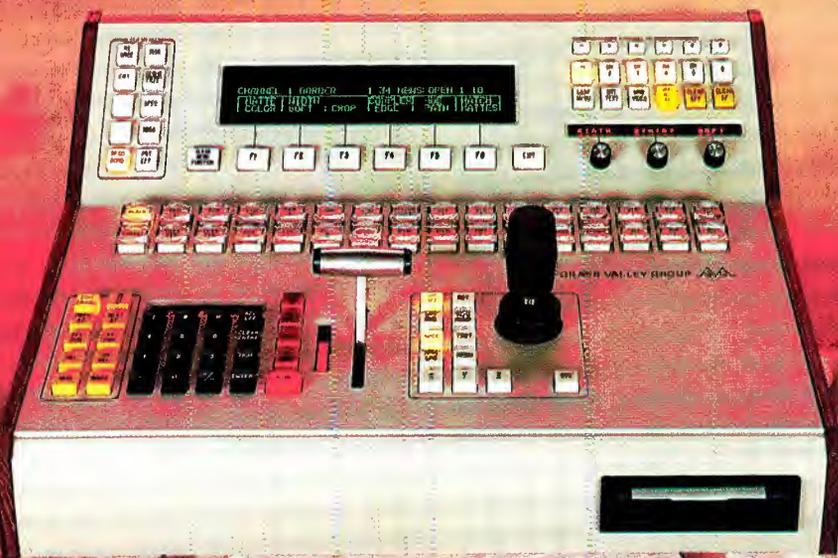
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Circle (8) on Reply Card

The modem is a great communicator

By Gerry Kaufhold II

The Public Switched Telephone Network (PSTN) and plain old telephone service (POTS) form the foundation for all telecommunications equipment. Any new device designed to interconnect to the PSTN must take into account operating considerations that were developed almost a century ago. Imaginative ways have been devised to implement modern services using technology that was installed by our grandparents.

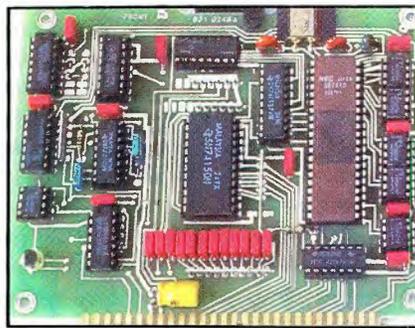
A popular add-on device for personal computers is the *modem* (an acronym for modulator/demodulator), which permits computers to exchange information via dial-up telephone lines. In fact, the text for this article was transported from Arizona to BE using the PSTN and modem-equipped computers. Modems also are used extensively in broadcast remote-control systems.

Tones on phones

Modems communicate by the use of *audio frequency shift keyed* (AFSK) tones. Phase shift and group delay response of audio signals passing through the PSTN are not predictable. In addition, most telephone circuits use audio compression and expansion techniques to improve the apparent signal-to-noise ratio for voice communications. This means that tone levels at the receiver may not track volume levels coming out of the transmitter. The only characteristic of an audio tone that is easily recoverable after transport through the PSTN is frequency, hence modems use audio tones to pass information back and forth. Typically, the originator of the call uses a carrier frequency of 1,170Hz. AFSK is used to provide discrete information values. 1,270Hz is digital 1, and 1,070Hz is digital 0. The answering modem transmits a carrier of 2,125Hz back to the originator. 2,225Hz is digital 1, and 2,025Hz is digital 0. (See Figure 1.)

The definition of these frequencies has been established as a de facto standard for low-end modems, and is referred to as the Bell 103 standard.

If these two different ranges of audio



tones are used, both modems can talk at the same time over a single pair of telephone wires (full duplex). Notice that 1,170Hz is not harmonically related to 2,125Hz. The harmonic distortion products of 1,170Hz will not interfere with the frequency reception of 2,125Hz, and vice versa.

directly to the earpiece is called the sidetone. To accomplish the mixing of outgoing speech with incoming signals, a hybrid circuit was developed. Because the components used in the passive hybrid never are matched perfectly, some portion (about -40dBm) of the send signal appears across the receiver's earpiece.

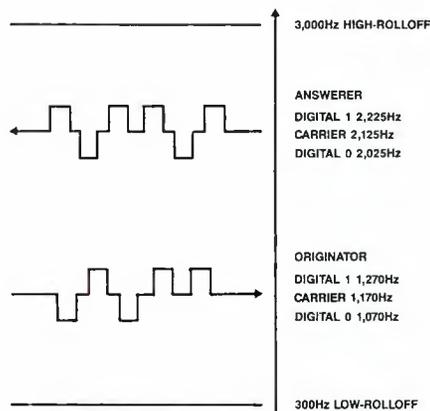


Figure 1. Bell 103 standard modem frequencies.

Notice that 1,170Hz is about 800Hz above the bottom of the PSTN frequency-response cutoff, and that 2,125Hz is about 1,200Hz below the PSTN upper-frequency limit. This provides some tolerance for poor frequency response on older telephone systems. However, even with this conservative choice of frequencies, there are still a few areas of North America where modems will not operate reliably because of shortcomings of the local PSTN.

Faster and faster

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. A related standard is Bell 212A, which operates at 1,200 baud.

For human voice communications, it was discovered that people must be able to hear some audible portion of their speech in the telephone earpiece. This portion of the microphone input that is fed

Early modems were coupled acoustically to telephone headsets. The sidetone signals caused high error rates in the digital signals, keeping speeds low. Now that modems can be connected directly to the phone line, there is no need for the hybrid, and data throughput rates are going up from 300 to 1,200 to 2,400 baud — even up to 9,600 baud — over twisted-pair telephone lines. High-speed circuits require digital signal processing to recover the information.

Because of the dynamic method that the Central Office uses to make line-to-line connections, it is impossible to predict the quality and bandwidth capacity of any given connection. However, once a connection is made on a voice line, that circuit probably will remain consistent for the length of the conversation. This is an important fact that will crop up again in the discussion of high-speed modems.

!:-:)))

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

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Maintaining your computer

By Brad Dick,
radio technical editor

As computers become commonplace in the broadcast station, engineers often find themselves charged with system maintenance. Computer maintenance is not something to be taken lightly. Broadcast engineers are often more comfortable working in the analog domain than in the digital domain. And even if you consider yourself a competent digital troubleshooter, servicing a computer can be a difficult task.

System analysis

The first task faced when servicing a computer is identifying the defective system. Computers can be broken down into several systems: CRT, keyboard, motherboard, hard/floppy disk controller, video card/printer port and serial ports. The exact configuration varies widely.

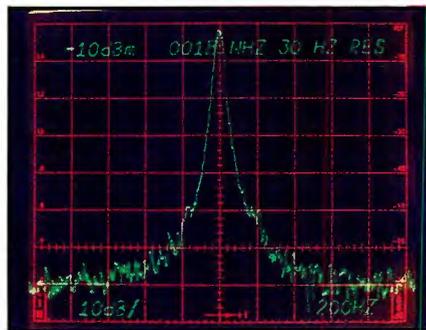
Even if you can't repair the defective card or system, being able to identify the faulty system may reduce the service costs. In addition, if the problem can be isolated to a plug-in board, you may be able to swap boards with a less critical machine, keep the staff happy and keep your station operating.

Some systems on a personal computer must be repaired by service depots or specialized companies. Floppy and hard disk drives are two examples. Leave the repair and adjustment of these devices to those equipped to handle such problems. Other circuits, such as power supplies, CRTs and keyboards, often can be handled in-house.

Locating the problem

Identifying the problem may not be as difficult as you think. Many computers come equipped with diagnostic software. If the system works at all, this software may lead you to the defective circuit. If the computer appears dead or the CRT is blank, the power supply is immediately suspect. Most computers rely on switching supplies, so you should be able to make needed repairs. If not, the entire module can be replaced inexpensively.

Often, a problem with the system will be accompanied with the screen display of an error code. For example, the code 48 301 indicates a problem with the cursor "up" key. If you don't often need that



key, repairs may be delayed. On the other hand, if an error code such as 1790 fixed disk failure appears, immediate attention is required.

Keyboards

Most people think that computers don't require preventive maintenance. That's only partially true. Although it is not necessary to disassemble them on a regular basis, some tasks can help extend the useful life of your computers. One of these tasks involves the keyboard.

Use a soft-bristle paintbrush to remove dust build-up between the keys. A small vacuum cleaner also can be used. Remember that motors produce magnetic fields, so keep floppy disks away from the vacuum.

It's not unusual for an operator to spill coffee or soft drinks onto a keyboard. Some operators may notify you of the problem. Others will hope no one noticed and try to hide it. In any case, the sooner you address the problem, the better.

Turn off the computer, and take the keyboard to your repair shop. Open the keyboard housing, and determine how much of the PC board was affected. Remove the keys in the area of the spill, and wash them in soapy water. (Some keys rely on non-captive springs for return pressure. Be sure you don't loosen them.) While the keys are drying, clean the PC board with denatured alcohol or approved PC board cleaning solution. Unless the beverage was acidic enough to damage the board, there should be no lasting effects.

There are vast differences in the quality of components used on keyboards. Although keyboards all may look alike, many distinctions lie underneath those gray or white plastic caps. The first telltale sign of a key failing is that it won't close properly. A skillful operator or technician may notice the deterioration. Typical indicators are a difference in the sound or a change in the feel of the key.

Often, the key will exhibit the failure only when pressed in a particular way. This accounts for some operators complaining about a problem and others not noticing it.

Once you've identified the defective key, replace it with one identical to the other

keys. Don't use generic replacements. Each type of key feels different. Unmatched keys will encourage data-entry errors by operators and will most certainly result in complaints. Because there are usually some keys that are seldom or never used, it may be possible to swap the unused key with the defective one. If you use this approach, order several spare keys from the keyboard manufacturer as soon as possible. It's a sure bet that as soon as one key fails, others will follow.

Floppy drives

Like the heads on your tape recorders, floppy drive heads need occasional cleaning. The first sign of trouble may be the following message:

*Not ready error reading drive A
Abort, Retry, Ignore?*

Another indication may be that some files contain errors or are incomplete when read. If this happens, it's time to clean the heads.

It is not necessary to remove the drive when cleaning the heads. Special head-cleaning diskettes are available for the task. They come in two basic forms: those that require the addition of cleaning fluid and use-once, pre-moistened disks.

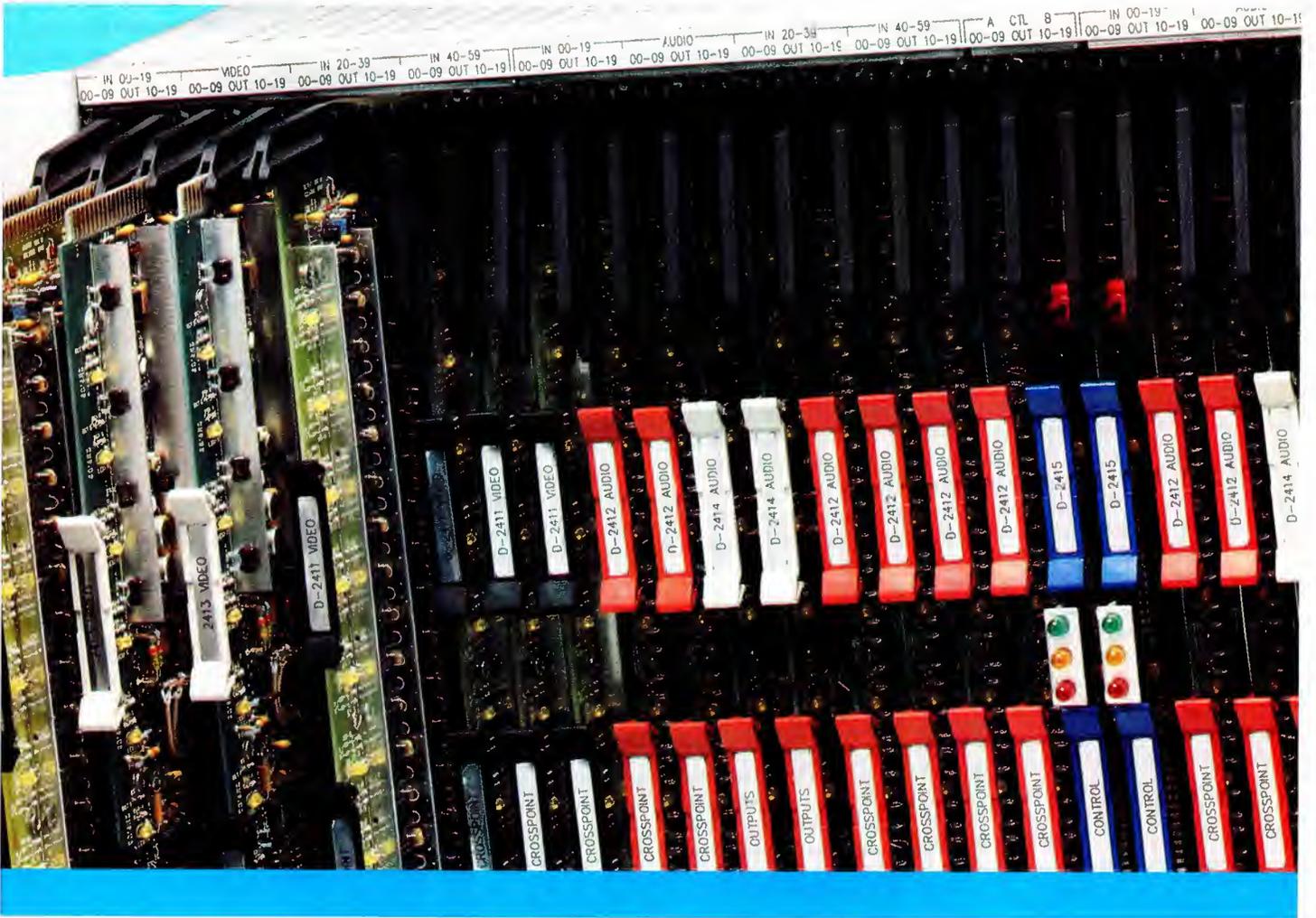
You need to know whether your floppy drives are single- or double-sided. A single-sided cleaning disk can be used in a double-sided drive, but the reverse is not true. If a moistened cleaning-disk surface contacts the head pressure pads, they will be clogged and may hasten future head problems.

Place a few drops of cleaning solution on the cleaning disk, and insert it in the drive. Issue a *dir* command, and wait. As the computer attempts to read the drive, the head(s) will search back and forth across the disk. Repeat the process until the heads have been cleaned for approximately 30s.

After you've cleaned the heads, wait a couple of minutes before placing a standard disk into the drive. Sufficient time must be given for the cleaning solution to evaporate from the heads. If you don't wait, the oxide from the floppy disk may be lifted and deposited on the head. If that happens, having to reclean the heads will be the least of your problems. [:=?=:))]]

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Management for engineers



And you thought you sold airtime

By Chip Behal

Step back from your daily duties for a moment, and examine your station in its entirety as a business. Now answer this question: What is your station's target market? This is not a geography question. If you answered by saying, "Women 25 to 49," for example, you're only partly correct.

Target marketing

The station's customers, in a business sense, comprise the target market. Who is going to buy what the station has to offer? For the most part, income originates from the advertisers. It's the advertiser who pays for your product. The people your station is really trying to appeal to are the agency reps and the local business owners.

Consider the following questions: How does your station appeal to the advertisers, and what is it selling? Let's first assess what the station is selling. Time, of course — airtime in blocks of 10s, 15s, 30s or 60s. But what makes your station's airtime worth more than another's? The answer is the audience.

Market vs. audience

In the first paragraph, the category of women 25 to 49 was suggested as a target market. That demographic group could be the station's target *audience*, but it is not the target *market* because women 25 to 49 years old do not provide the station's revenue. Women 25 to 49 are, in fact, the station's *product*. They are what the station is selling to its customers, the advertisers. The station is selling people, or more precisely, access to people. Not soap, music, information or time.

Each department must work toward the creation of the same product. If not, the process won't work. Unless everyone is trying to build an audience of men 18 to 34, women 25 to 49 or whatever, the station ends up with a poorly made product that won't work and won't sell.

Designing the product

How does a station decide what prod-

uct to manufacture? According to the laws of marketing, you find or create a perceived need among your customers, then meet it. The station has to discover what kind of an audience advertisers want to reach, then build that audience (or audiences — lots of companies make more than one product).

Michael Porter, author of "Competitive Strategy and Competitive Advantage," contends that success in the marketplace is achieved by being either the cost leader or a product differentiator. Cost leadership does not necessarily imply offering the product at the lowest price. It means that the company incurs the lowest expenses in the process of creating the product. As a result, the company can maintain profit margins while offering the product at a lower price.

This approach may allow the company to acquire a greater market share by offering its customers an equivalent product less expensively. The station could offer the product at a higher price and achieve a greater profit margin than its competitors. Unfortunately, that plan of action requires a sacrifice of market share; it is a strategy that, in the long run, tends to be less profitable and more difficult to maintain.

Product differentiation involves carving out a particular market niche by creating a representative product that is different from the products of your competitors. That differentiation is embodied in an audience with demographics or psychographics that are distinguishable from competing stations.

By definition, there can be only one cost leader in the market, but there can be many levels of differentiation. Porter asserts, however, that a company must be either the cost leader or a differentiator. A firm that tries to be both is assured of failure.

Engineering's contribution

Success depends on the engineering department making a contribution to the audience-building effort. Reliability is always important. The product has to be available to customers whenever they want it. Off-air conditions mean no prod-

uct and disappointed, discontented customers. The engineering staff is responsible for ensuring the proper operation of the transmission and studio equipment.

Manufacturers have come to understand that quality cannot be inspected into a product after it comes off the line. It's too late to spot problems then, because the product is finished and would have to be scrapped. The resources invested in it would be wasted.

Quality has to be designed and engineered into the product on the drawing board and during the manufacturing process. Defects must be analyzed immediately and the causes determined so that a new design can be implemented to prevent a recurrence. Engineers can change the design at their facilities by revising and posting procedures, by replacing damaged components with heftier devices, and by making sure that the equipment chosen for the job is up to the task in the first place.

The engineering department must take some responsibility for the station's sound. However, this aspect in the creation of the product is not a 1-person task. Creating a sound signature requires input from a number of sources: the programming department, the corporate consultants, the general manager. The station can't just sound clean or loud or dynamic. It has to sound right. In other words, the station's sound must have all the characteristics necessary to create the intended product.

To be sure that your work meets specifications, ask your general manager to define the station's goals. Ask how the other departments are contributing to the effort. Then, analyze how your efforts will interact with those of others. Through a cooperative approach, your station will attract the desired audience and, as a result, capture the desired market.

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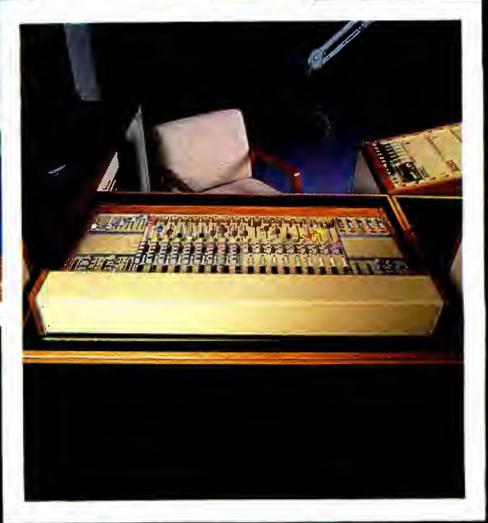
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Behal, a former chief engineer, has a master's degree from Hofstra University, Hempstead, NY.



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Managing automation in broadcasting

The past five years have been a time of upheaval for radio and TV stations. Stations have been bought and sold so fast that the staffs sometimes didn't even know who they worked for. Unfortunately, these sales often were accompanied by wholesale staff reductions as new owners tried to service the newly acquired debt. Competition from alternative delivery systems merely added to the pressure to perform better on a smaller budget.

Coping with these changes has been especially difficult for engineering managers. Reduced staffing and increasingly complex technical systems place the engineering manager between a rock and a hard place. The issue often boils down to doing more with less.

For many stations, automation is being seen as a possible answer. Plant automation originally was implemented as a method of staff reduction. Now, for stations where the staffs are already cut to the bone, plant automation may afford the opportunity to improve the station's image by reducing the number of on-air errors.

Newsroom automation systems were installed to make the news preparation more efficient and to result in a higher-quality product. Now these same systems are reaching into the operational areas.

Plans are being laid to permit newsroom computers to control the entire technical sequence of events in a newscast.

Both applications are based on two criteria: Do more with less, and do it better. However, the effective use of automation requires detailed planning and, most important, a fresh approach to the way broadcasters do their jobs.

The most successful stations will examine automation technology and, as soon as possible, implement it as applicable. These technological leaders will continue to reap the benefits of the systems long after the initial investment.

Automation can't do everything, but what it does, it does extremely well. The question facing many engineering managers may not be whether to use automation, but how to use it most effectively.

- "The Bottom Line in Automation" 26
- "Timing is Everything" 36
- "Planning for Standby ac Power" 46

Brad Dick

**Brad Dick,
issue editor**



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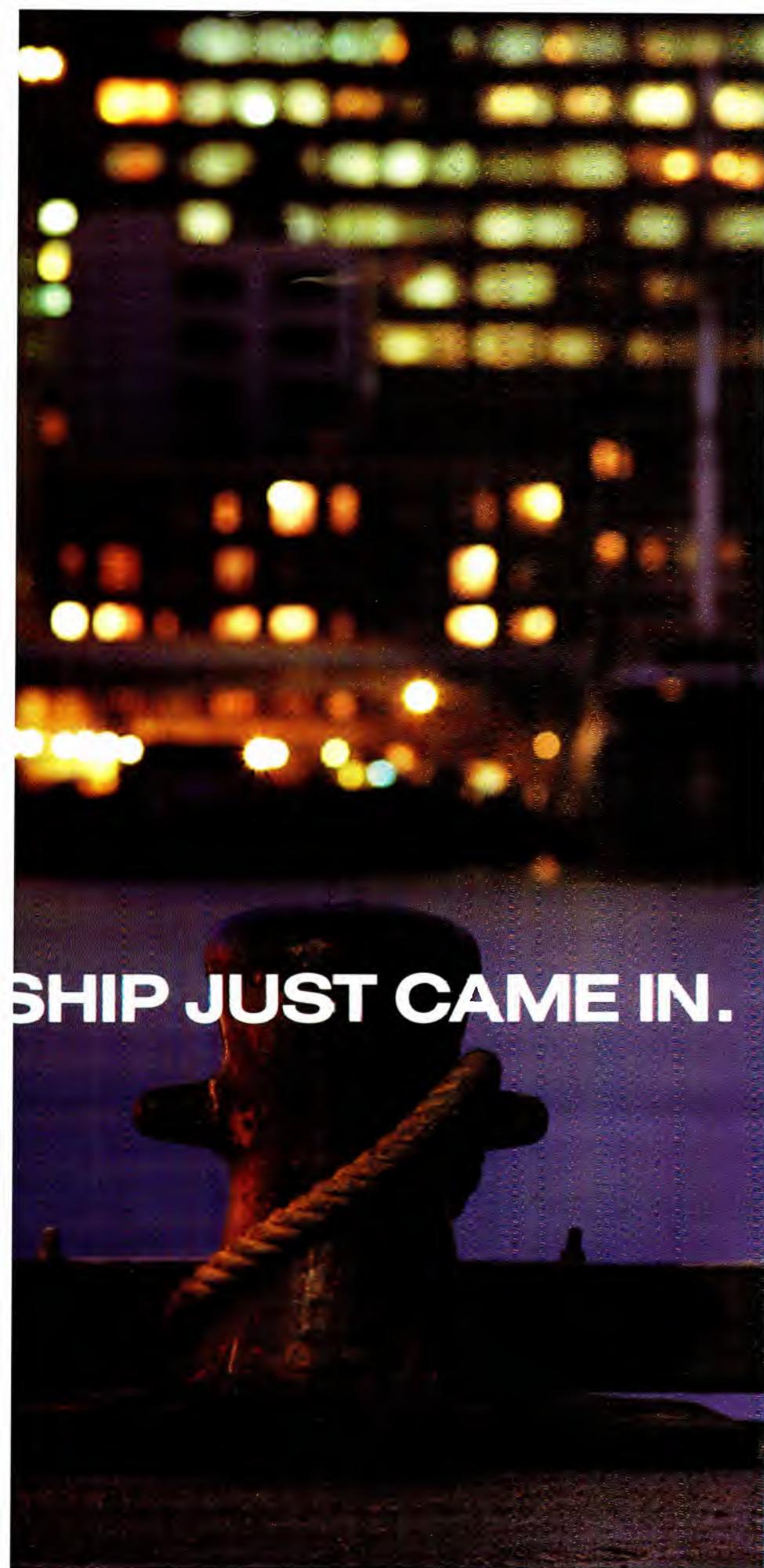
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PROFESSIONAL VIDEO

The bottom line in automation

By Brad Dick, technical editor, and Karl Renwanz

That noise behind you is automation, and it's getting closer each day.

"In business, the competitor will bite you if you keep running; stand still, and they will swallow you."

Broadcasters are coming to the realization that it's no longer business as usual. Increased competition, lowered advertising revenue and slower growth all are combining to sharpen bottom-line pressures on stations. In addition, many of today's owners might not have the personal fondness for broadcasting that the original owner did. Today's owners are often banks or major corporations used to judging a business strictly on profitability. Either you make a profit or you don't. If you don't, changes are made.

Television is especially hard hit by today's economics. Revenue no longer increases at comfortable double-digit rates. The growth broadcasters enjoyed over the past 40 years has ended. It will not happen again.

Other changes are in store. Revenue from the networks will fall, placing stronger emphasis on local production and sales. Changing demographics may force stations to use narrowcasting techniques to boost their economic growth.

Good news, bad news

This kind of business environment contains both good and bad news for engineering managers. The bad news is summed up by the financial pressures. Ask

any station department head about fiscal restrictions, and you'll probably get an earful about cutbacks and reduced budgets.

The good news is that these problems have solutions, more appropriately termed opportunities. One of the areas that offers hope to engineering managers faced with streamlining their operations is automation.

First-generation systems

The term automation carried a bad connotation 10 years ago. Equipment manufacturers, using the versatility and low-cost power provided by computer technology, offered broadcasters a range of new automation systems. Unfortunately, many of these first-generation products promised more than they could deliver.

Once in the field, the products often were unable to perform all the desired tasks. In some cases, broadcasters had to baby-sit systems that were supposed to operate unattended. On-air automation systems in the early days simply didn't work as everyone had hoped. A major reason was that some of the key devices needed were not yet developed.

However, computers did perform successfully in the business area of the station. Accounting, general ledger and payroll computer systems were relatively easy to implement. Traffic systems soon were incorporated into the business computer system. However, making the transition from typing the log to getting the material aired and documented still required a great deal of human intervention.

A true on-air station automation system was not yet available.

Second-generation solutions

Today's broadcast automation systems are far more sophisticated than those early devices. In part, this is because the state of computer technology has improved. But an even more important aspect of successfully integrating automation technology into the broadcast station is that manufacturers and broadcasters more fully understand the complexity of automating the broadcast station and the issues that must be addressed.

Broadcast automation need not encompass every area of the on-air operation or the newsroom. It is possible to rely on stand-alone cart machines to provide fully automated playback for periods of time. Sequencers can be used for automated switching of commercial breaks and even some local program origination. Providing intelligent remote controls, especially for production assist, can go a long way toward reducing operational errors and lowering costs.

The real advantage of automated systems lies in the integration of intelligent subsystems into a working on-air automation system. A large automation system interconnected with a network is shown in Figure 1. Under this scenario, everything works together — from accounting, billing and payroll to the teleprompter, character generator, still-store and video cart machine. The goal of automation is twofold: to streamline operations and to

Renwanz is vice president of engineering and operations, WNEV-TV, Boston.

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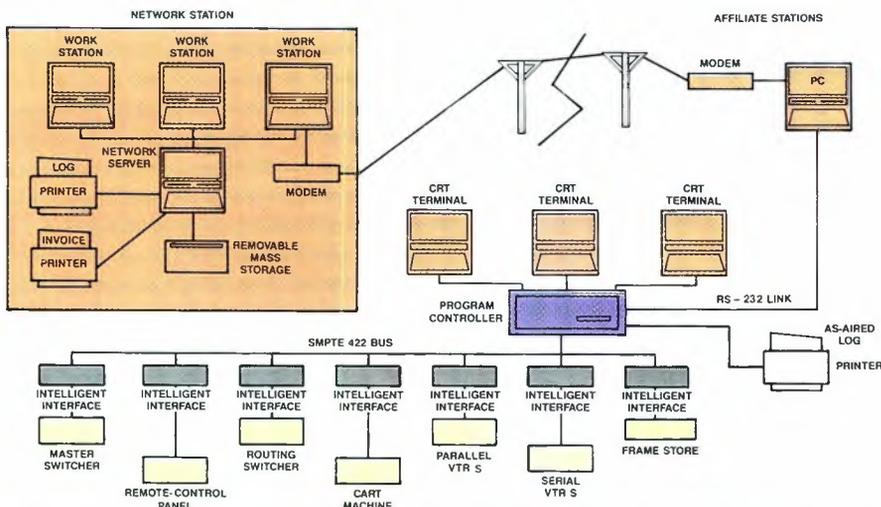


Figure 1. It's conceivable that an entire station's operation could be controlled from a remote location, such as a network. Intelligent interfaces connect between each source or control device and the LAN. This distributed intelligence offers a great deal of flexibility because sources can be exchanged without greatly changing the remainder of the network.

reduce the number of errors. Properly implemented, automation can improve a station's image and profitability.

Change your thinking

Deciding what tasks can be enhanced through the use of automation requires a new approach to the way you think about your facility. Instead of looking at your station in terms of how tasks are completed today, consider how the station could operate. Start with a clean slate, without any preconceived notions of how tasks should be accomplished. Forget that some people don't want to change. Begin thinking of how the product — commercials and programs — can be most efficiently generated, sold and aired.

For many of you, this kind of thought process will be difficult. Broadcasters, especially engineers, often avoid change because it makes them uncomfortable. However, if you don't re-examine tasks to determine which ones really need to be done and how they might best be performed, the efficiency offered by automation will never be fully realized.

Where to automate

What areas should you automate? Only you can answer the question. One station may have a problem of high costs for camera operation. For another station, the problem may not be cost, but a lack of qualified talent to operate the equipment. Whether the issue is cameras, lighting or videotape operators, the basic goal is the same: maximum performance at the least expense.

The underlying emphasis should be on applying automation techniques to any area that will produce a return on the hardware investment while reducing operational errors.

Two areas now receiving widespread at-

tention in terms of automation are newsroom systems (along with cameras and other newscast equipment) and on-air, or plant, automation systems. The newsroom systems generally emphasize automating the production of newscasts. Plant or day-of-air automation concentrates on the tasks needed to maintain on-air operation.

Plant automation was tried several years ago without great success. One reason for the lack of success was that the source materials were not available in archival form. Video cart machines have solved that problem. Plant automation provides the same advantages as newsroom automation: an improved on-air look and a reduced operational staff.

These automation systems typically incorporate control of the switcher, tape decks, cart machines, still-stores and character generators. They also may interface with the traffic computer. The automation system may be as simple as remote machine control for both on-air

and production equipment, or it may be sophisticated enough to run entire blocks of air time. (See Figure 2.)

Let's look at an example. One station in a major market staffed the master-control area with four people: a technical director, two videotape operators — one to load tapes and one to record network feeds — and a master-control switcher. Automation could reduce the needed personnel by 50% or more. The automation system could perform the delayed recordings, cue them for air, switch breaks and transmit the as-run logs back to the traffic computer. This would permit the station to operate with a technical director and one videotape operator. Some stations could eliminate the tape operator.

Newsroom computer systems approach the same issue, but with a different emphasis. Newsroom computers originally were installed to improve the way material was prepared for the newscasts. As the word-processing systems become more powerful, stations began to consider allowing them control over some technical aspects of the newscasts.

Today's newsroom systems now are being directed toward integrating newscast preparation with the tasks required to actually air the newscast. Under this scenario, the news director or producer flags the script with the desired camera shots, still-stores, CG inserts and video/audio feeds. Closed-captioning for the hearing impaired is a natural byproduct. The computer verifies that the required resources are present and triggers each at the appropriate time.

At present, this level of automation seldom is implemented. Newscasts must remain flexible enough to accommodate late news feeds, script changes and mistakes by anchors. This usually means that the events are triggered by an operator rather than by the computer. Even so, the use of computers allows many details to be handled error-free. For example, it's not likely that the computer would

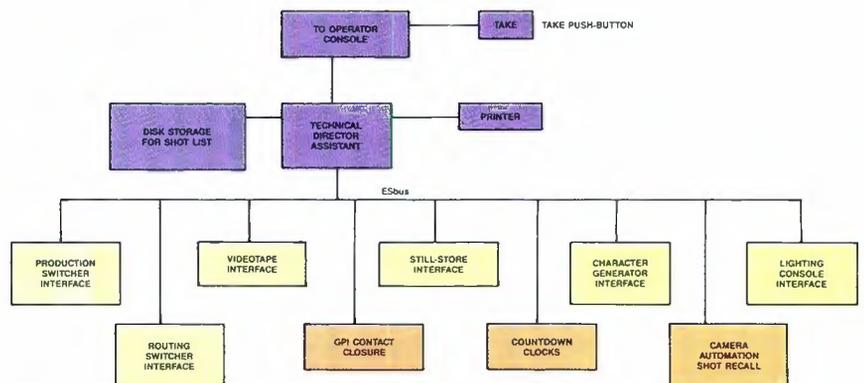


Figure 2. Using automation to cue events for air, which are triggered by a technical director, often works well for stations. It offers the flexibility of events taking place on an as-needed rather than timed basis, but details and sources still are managed by the computer.

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misspell the governor's name or permit a GM spot to run when a Ford commercial was scheduled.

Return on investment

Let's briefly examine the potential return on investment (ROI) of one area of automation: robotic cameras. For purposes of discussion, assume that the station employs four full-time and three part-time camera operators. The salaries are as follows:

- Full-time camera operator: \$40,000.
- Benefit package: \$16,000.
- Total salary cost: \$56,000.
- Part-time camera operator: \$20,000.

In a typical work week, a total of 20 hours of time-and-a-half overtime is paid to the full-time staff of four. This brings the yearly floor crew cost to \$314,000. This is a continuing cost. If production increases, it goes up too. And as contracts are renewed, costs go up.

Let's assume that a robotic camera system, perhaps just a partial system, could be installed for approximately the same cost. Using Table 1 as an example, where's the cost advantage in using automation?

Within 60 days you should begin recovering your investment operation with one or two less camera operators. This depends on the level of robotics and show complexity. Someone still is needed to supervise the camera robotic system. Financially, the bottom line is that with such automation, payback can occur quickly.

There are other reasons to seek equipment solutions to operational problems, not the least of which is that you can depreciate the hardware over its useful life. The tax consequences of even straight-line depreciation can be significant. Also, equipment doesn't get sick or go on vacation, and it handles boring and repetitive tasks without error. If a camera failed, simply rolling in another robotic unit would solve the problem.

The same cost-analysis technique can be applied to the use of a video cart machine or other automation device. Using your station's salary costs and equipment expenses, calculate how soon automated equipment could pay for itself. A more accurate analysis will be possible if you can obtain projected maintenance costs from the manufacturer. In any case, don't forget to allow some additional maintenance costs. Equipment does break, and it takes parts and human resources to repair it.

It's difficult to place a value on a station's image. However, if you've ever been responsible for a major on-air goof-up, the station manager may have offered you a clue as to what it's worth. A station's image is like good will — hard to define, but painfully obvious when absent.

YEAR	EQUIPMENT COST	PERSONNEL COST (WITH ROBOTICS)	PERSONNEL COST (WITHOUT ROBOTICS)
1	\$300,000	\$200,000	\$314,000
2	0	100,000	330,000
3	0	66,000	347,000
4	0	69,000	364,000
5	0	72,000	382,000
First five years:	\$300,000	\$507,000	\$1,737,000
Total 5-year robotic and personnel:		\$807,000	
Possible savings:		\$930,000	

Table 1. A sample calculation of ROI for a robotic camera system. An accurate analysis must include all factors that apply to your station, such as wages, equipment cost, installation, training and additional maintenance.

The perception of automation

One of your most difficult tasks will be convincing other departments of the advantages of automation. Many of the department directors remember the early days of automation and don't realize that things have changed. These people may have less appreciation of your concern for operational costs than maintaining the traditional production methods. Be prepared to explain and even demonstrate how automation can improve the quality of the station's product. Automation can't do everything, but it does offer a high level of reliability. Having programming and news executives accompany you on a factory visit may well be worth the investment.

At the same time, be open and honest with those who will be most affected by automation. Operators don't want to lose their jobs. Assure them that automation will be implemented over time, not all at once.

Although automation may reduce the number of operators needed, it also will create the need for a few highly trained operators. Make every effort to afford

them opportunities to advance and to be trained for the new positions that will be created. In addition, automation will open the door to new maintenance opportunities. Sophisticated electronic and mechanical systems always will require skilled maintenance people. Encourage your current staff to begin training for those jobs as soon as possible.

Begin planning now

Implementing automation will be difficult for most stations, but there may be no alternative. Begin by understanding exactly what needs to be done. Avoid looking at automation as simply a machine-replacing-operator technique. Instead, re-examine how your entire station operates. Start at the beginning, with the selling of airtime. Follow that process through the entire station until the program or commercial is finally aired. An example of an automation functional block diagram is shown in Figure 3. Note that the process begins and ends with the traffic system.

Look for areas where tasks can be combined. Seek ways to perform the needed

Main article continued on page 110

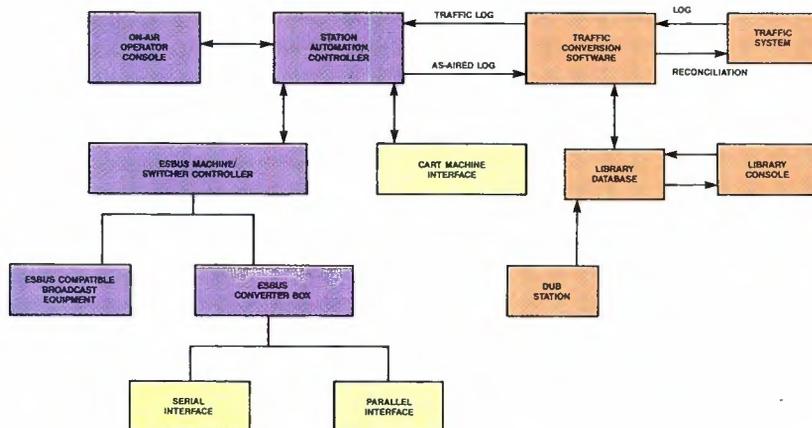


Figure 3. Maximum efficiency occurs when human intervention is kept to a minimum. Here, the traffic system prepares the log using the station's database. The as-aired log is electronically transmitted back to the traffic system for reconciliation and billing.

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CBS looks at library systems management

By Bebe F. McClain

The following comments by Chris Cookson, CBS vice president, are from an interview with the author in which he discussed his views on videotape library management systems. Although

McClain is president of B.F. McClain, Asheville, NC, and a technical marketing consultant.

Cookson's perspective is based on a network's needs, the same principles may be applicable at your station.

CBS is actively re-examining plans for the development of a new CBS New York Broadcast Origination Center. This facility will incorporate some of the

newer library management technology that is now becoming available. It's also important that whatever equipment is purchased be compatible with improvements we expect in the future.

Briefly, the problem we are facing is this: In our New York library, we presently house between 12,000 and 14,000 individual ACR 25 cassettes containing commercials, promos and other program elements. From this library, each day we play between 800 and 1,000 elements into the CBS network, and an additional 400 to 500 for WCBS-TV in New York.

Modern networking requires that we be able to feed different commercials, promos or even programs to several regions simultaneously. The new origination center will be capable of providing up to 10 different feeds. This means that any one of those 14,000 library elements may be needed in several different places, several times a day.

At present, the only way to deal with this demand is by manually pulling, handling, loading, unloading, filing and rehandling the same elements over and over, hour after hour, day after day. This is labor-intensive, repetitive and tedious work that requires constant checking and rechecking to prevent the costly errors that are possible with every action.

With a library management system, we expect to minimize the number of times the same materials must be handled, to minimize the number of chances for error, and to free our staff to do the kind of work where human creativity is more important.

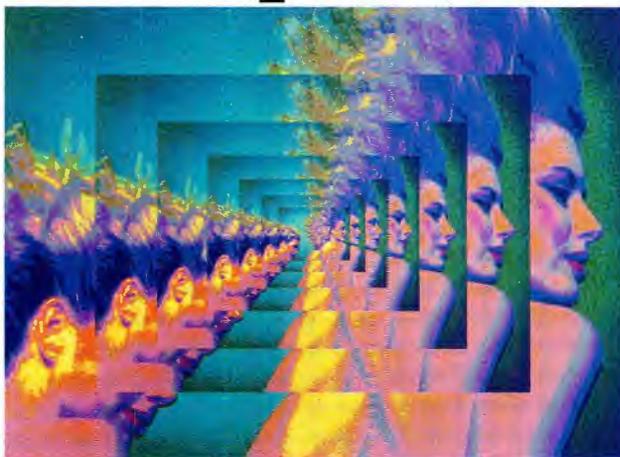
In the near term, we expect to continue handling cassettes, but to a lesser degree. Modern systems will be able to carry a full day's program load, reducing the number of times repeating elements must be reloaded throughout the day, or from one day to the next. Automatic verification and sequencing also will be part of the new system.

Our main interest is in the longer term, where we see great possibilities for an integrated library management system. That technology should allow storage of our entire commercial base in digital form — as one large database that can be maintained off-line.

Each program channel will have its own program log or playlist and a buffer for the temporary storage of elements to be played. Commercials and promos needed for airplay will be ordered automatically from the library database, downloaded to the buffer and inserted into the program stream as needed.

The advantage of using a digital recording system over an analog one in this application is the possibility of automatic verification of the transfer

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from the database to the buffer. In an analog system, the only way to accomplish this would be to dub from the master library and visually check the quality of the dub. Such a process would eliminate many of the advantages of an automatic system.

Essentially, the new system will have the same work flow that is accomplished manually today. The problem in developing a mechanical system is to provide the flexibility that will allow the same

spot to appear in several places at the same, or nearly the same, time without carrying an excessive number of copies of the spot in inventory. This, in turn, would lead to an unmanageably large mechanical storage system of bins, belts and robots.

CBS is looking for a system that will be flexible enough to expand and cope with the network's changing needs. We are trying to look 10 years or more down the line. Digital library management

systems are still in their infancy. Even so, we must examine this new technology and decide whether it can be used now, because our present system can no longer cope with our growing demands.

We have been discussing our philosophy and requirements for such a system with the major library management system suppliers in the hope that a technology will evolve that will be of benefit to us and other users.

Automated test equipment

By David Miller

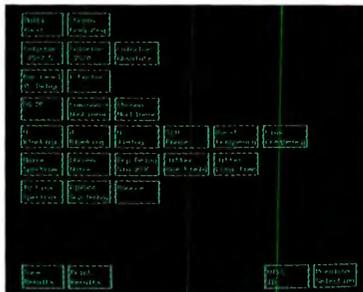
Recent innovations in automated TV test equipment offer many advantages over slower, manually operated equipment. One important benefit is greater accuracy. Because manual measurements depend on the expertise of the technician performing the test, the results often vary. Another advantage is the speed with which tests can be completed. And, for stations short on personnel, automated test equipment permits efficient scheduling so that technicians are free to perform more critical work.

New hardware

Early automated test equipment, although not dependent on operator expertise, still was relatively slow in measuring test signals. The newer equipment enables even inexperienced operators to make consistent and accurate measurements quickly and with minimum effort. Some measurements can be made with the push of a single button.

Automated test equipment allows the user to select from a variety of pre-programmed measurements. The test equipment typically provides both the test signal and the analyzer. This eliminates the problem of locating, connecting and calibrating several different pieces of equipment.

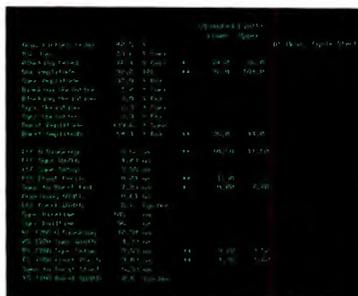
Some models provide as many as 24 different measurements based on FCC, EIA-250C or RS-170A specifications.



This touch-screen display is used to select desired measurements.

Miller is a technical writer for Tektronix, Beaverton, OR.

Operating modes may include waveform, vector, picture, measure and automatic. Automated audio test equipment usually provides a similarly wide range of standard audio tests.



Results of automated measurements displayed along with user-selected limits.

Documentation of the results is almost as important as the test itself. The required hard copy often is provided through printer ports, which can connect to standard computer printers.

Software-driven equipment also permits the operator to set caution or alarm limits for each parameter. A typical display can show measured data and violated limits. Another advantage of automated test equipment is the visual display of the signals being measured. Such displays help eliminate misinterpretation or "number fudging" by the operators.

Practical application

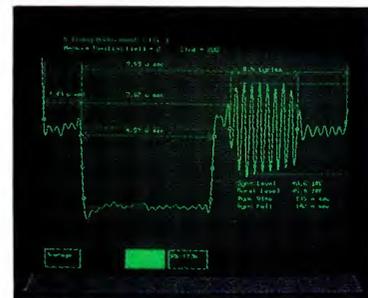
The test equipment need not be confined to the studio. Capital Cities/ABC, Philadelphia, has installed automated test equipment in a mobile van. The van is taken to each of the company's eight stations for tests. Using the same test configuration helps ensure that each station is measured in the same way. The automated test equipment greatly increases efficiency. Printed copies of the waveforms and results are made as the tests are performed. This allows the technical staff of each station to identify potential problems for early correction.

A pioneer in the use of automated test measurements is the Nebraska Educational Television network (NETV).

Because nine stations are located throughout the state, performing the desired tests was a problem. Automated test equipment proved to be the answer. Its use allowed the network to reduce the time required to make the tests and to quickly recover the initial cost of the equipment. The network found that the tasks, which formerly required five operators, now could be accomplished by one.

Remote control

Another plus of automated equipment is that tests can be performed by remote control. Monitoring a station off-air is not always effective or possible. Problems ranging from signal degradation to loss of telemetry and RF interference can affect the accuracy of the results.



Displaying the measured waveform along with values eliminates misinterpretation by operators.

Remotely controlled automated test equipment allows the sampling to take place at the transmitter site. The results then are relayed via data lines to the monitoring station.

NETV is now working on plans that would permit satellites to be used for monitoring. By combining automated test equipment and control systems, the network could continually monitor each station's performance on an unstaffed basis and perform real-time corrections as needed.

The use of automated test equipment is spreading. And, as technical advances continue, new levels of automation will become possible.



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Timing is everything

By William F. Baker, Ph.D.

Does anybody really know what time it is?

An abiding interest of the author is precise time and timekeeping. Perhaps it stems from the many long hours spent at radio stations as a technician, backtiming records or meeting network cues. I vividly recall watching the huge Western Union clock on the wall as it strained to meet its pre-ordained hourly time sync with the Naval Observatory. Often, those old electromechanical clocks would drift seconds off time, creating real production problems for the people at the controls.

Those old clocks appeared at broadcast stations in 1935. They were connected to a master clock at the local Western Union office by telegraph lines feeding the hourly correcting pulse. Western Union ceased its clock operations on Dec. 31, 1973, principally because of the availability of lower-cost, reliable clocks synchronized to the 60Hz local power grid. Also, WWV, the National Bureau of Standards station, was providing precise time — coordinated to astronomical standards in the earlier years, and later to the current atomic standard.

Nevertheless, keeping accurate time at broadcast stations has continued to be a headache in an industry that measures its income in seconds sold. With the reliance on network/station synchronization and increased automation in the master-control area, the tiny station master clock remains the electronic "heart" of the station. Many broadcasters still are close to



Photo by John C. Chasson

the old Western Union days of clock operation, tuning in WWV on scratchy short-wave radios (unreliable in urban areas at certain times of the day). Others, although somewhat more sophisticated in appearance, have their clocks interfaced to a WWV receiver and are subject to all the attendant reception problems, remote antennas and other sources of grief.

A new advancement in horology, the science of timekeeping, is the use of a clock that contacts a master time source directly. It uses the reliable telephone network and measures time path delays in that network to assure local accuracy.

Telephone-based time dissemination

Telephone-based time-dissemination systems skirt the problems of radio-based systems. Time-dissemination networks employing standard asynchronous telecommunications signals (Bell 103-compatible at 300 baud) already are in place or are being implemented across the country. They use a public-domain protocol to

transmit date and time information, and to measure the loop delay of the telephone link. This protocol, using ASCII characters, transmitted by shift-keying techniques, is designed for the transfer of correct time from a master to a submaster or slave clock. The submaster then can pass on this correct time to other clocks in a hierarchical system. Three hundred baud, although considered plodding to some, can travel through most phone systems. Because the average connect time to receive a time update is about 30s, little would be gained by going faster.

The originating, or in-house, clock calls the master clock, located in a precise time laboratory. The local clock emanates tones with frequencies of 1,070Hz and 1,270Hz. After a fixed delay, the master "echoes back" with tones of frequencies 2,025Hz and 2,225Hz. A software comparator in the originating clock looks at the information received to determine whether it falls within an acceptable window of time (see Figure 1).

If the information is valid, the clock accepts it and calculates the loop delay of the telephone line. The clock then requests a time or date feed. The master responds by sending a short string containing either "year-month-day" (such as 880203) or "hour-minute-second" once each second for three seconds. In the case of the date signal, the three strings are compared to test for transmission errors. In the case of the time signal, the string is loaded into the transmitting computer, and the carriage return occurs precisely

Baker is president of WNET-TV, New York.

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on the second. The three words are compared to see whether the seconds are incrementing properly, and the carriage return's time of arrival is offset by the calculated delay of the line (from the echo signal) to synchronize the local clock with the master.

Try, try again

If the information falls outside the acceptable window of time, it is rejected by the originating clock, which can automatically redial the master unit. One manufacturer's equipment redials up to seven times, randomly, in a 1-hour period.

Calls aborted for other reasons, such as busy signals or poor connections, will initiate the same redialing sequence. If the originating clock fails to make contact with the master after multiple attempts, some prompt to the operator is issued. Typically, the front panel will flash, indicating that the clock has not been able to update its time information.

In some cases, the in-house master clock system can be programmed not to accept incoming calls. This obviates the need for a dedicated telephone line for the clock system and allows it to use shared lines, decreasing costs.

Some systems also include a password-protected "system mode" wherein a precise time laboratory can telephone a remote system and command it to have leap seconds or standard/daylight saving-time changes armed to occur at a particular time. This type of system mode normally allows full remote control of the in-house clock system, including time adjustments with millisecond resolution, and adjustments to its telephoning program.

Delay reciprocity

For any system attempting accurate time dissemination by telephone, a major concern is the reciprocity of telephone line delay. It is easy to measure the loop delay; it is the sum of the two line delays. If you could assume reciprocity, that is both of the line delays being equal, you could readily deduce from the loop delay the line delay from the master clock to the slave clock.

Strictly speaking, reciprocity is not always present. For short distances, telephone companies use "2-wire" connections, but for longer distances they generally will use a "4-wire" connection — a separate voice channel operating in

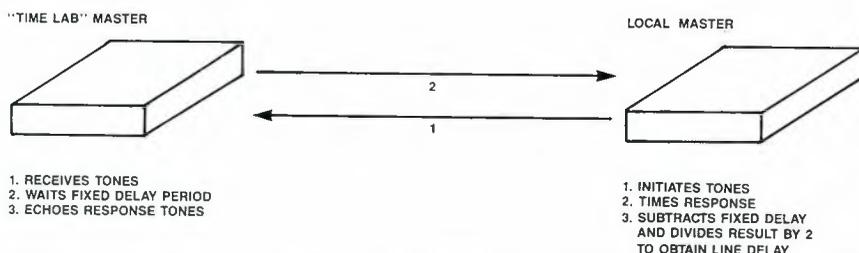
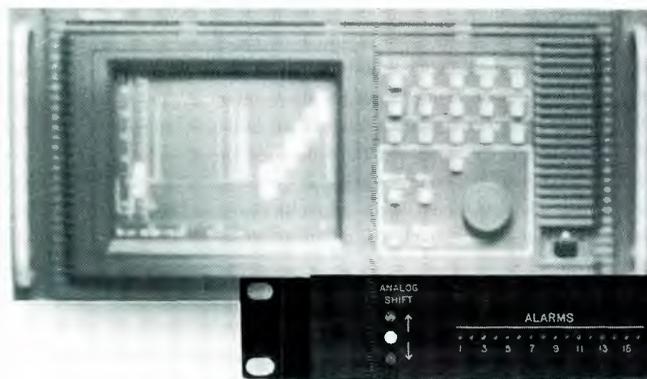


Figure 1. The delay of the telephone system can be calculated and compensated for by sending a test tone and monitoring the return tone. Algorithms can detect asymmetries in the transmit/receive loop.

Continued on page 42



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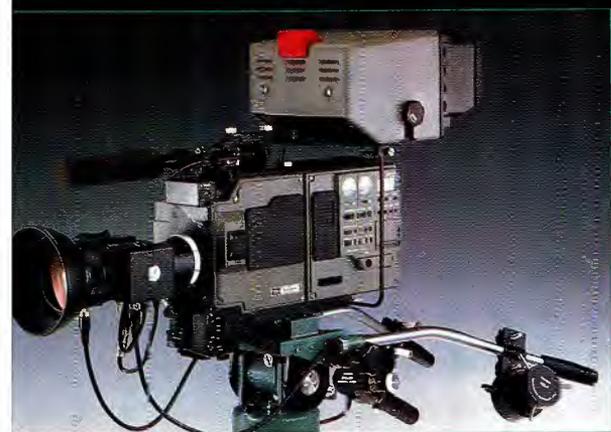
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Continued from page 38

each direction. Some degree of non-reciprocity also will be introduced by any dispersion (such as variation in group velocity with audio frequency), but because this dispersion degrades speech clarity, it is quite well-controlled by the telephone companies.

Experiments conducted by the National Research Council (NRC) of Canada about 10 years ago showed that the loop delay could be measured and corrected to permit millisecond accuracy in time transfer. Even in extreme cases, this type of time-dissemination system easily obtained accuracy within milliseconds, whether public access or leased lines were used. (See Figures 2 through 5.)

The latest generation of telephone-based time-dissemination systems appears to be capable of detecting cases of non-reciprocity, hence avoiding the associated problems. The worst possible situation for reciprocity is where there is a satellite link one way (approximately 0.25s delay), and a ground link the other way (with an uncertain line delay of tens of milliseconds). This condition occurs rarely and randomly on repeated calls between the same two points, and because it is identified easily by a range of loop delay times not otherwise encountered (approximately 200ms to 300ms), it is possible to consider any such call to be a failure, and to abort it.

Broadcast operation and applications

The present technology for telephone-based time-dissemination systems uses an ovenized crystal oscillator as its time base reference. This type of crystal oscillator may be used free-running for stand-alone operation or may be locked to an external 5MHz or 10MHz reference from a cesium or rubidium standard. The oscillator has a stability of ± 3 ms per day, based upon a unit starting out at 0°C and going up to 50°C. Because this situation does not normally occur in practice, the master oscillator is actually quite stable and does not require frequent telephone updates. Telephone calls can be programmed for any time of day, and at any date interval, as specified by the owner of the unit.

Some systems output time information in up to four different formats. Three of these formats (SMPTE time code, RS-232 and BCD — both serial and parallel time) already have proved their value in broadcast facilities. With these formats, the master-clock system can communicate with such external devices as computers, machine automation systems, automated radio stations and remote-production vans and trucks.

The fourth format, a 5MHz sine wave, is directly related to the crystal time base.

This output signal can be used as the master oscillator for a high-quality master sync generator system in any TV studio. With the aid of this output, sync pulse generation, video time code and real time can be directly related to one another to form a cohesive video system.

Advantages of telephone-based time dissemination

The new generation of master clocks is available in desk-, wall- and rack-mount analog and digital models. As an added bonus, you may not even have to change

over your entire existing clock system. Some systems are capable of directly driving the existing impulse clocks in a building that has been so equipped. For these older building clock systems, the hands of each clock face must initially be set manually, but thereafter, the time would be controlled by the new clock-driver system. Leap seconds can be corrected for quickly, and changes back and forth from standard to daylight-saving time can be completed within an hour, eliminating the tedious and time-consuming chore of resetting all the clocks manually

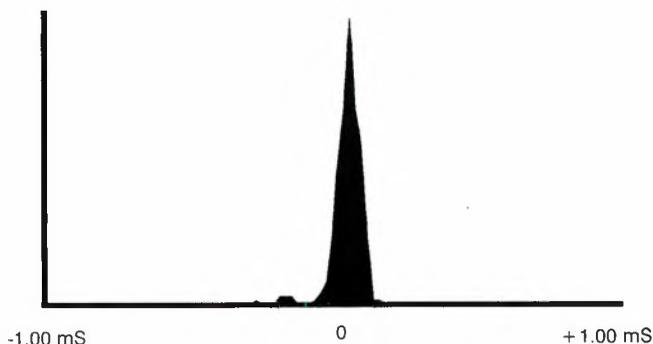


Figure 2. Histogram showing the precision of one slave clock setting its time from a remote master clock. Five hundred calls were made for each histogram. This one shows calls from the NRC time laboratory to NRC time laboratory ($\sigma = 34\mu\text{s}$).

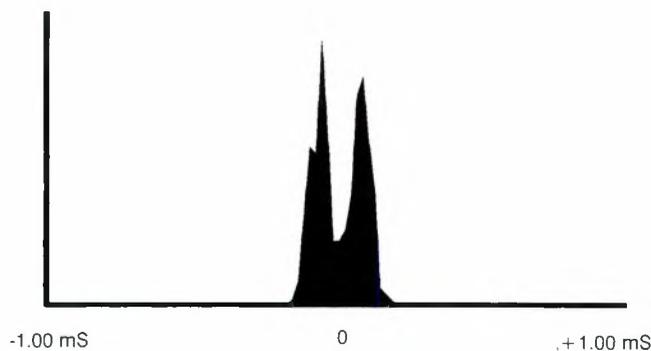


Figure 3. Calls from NRC time laboratory to a station 15km away ($\sigma = 45\mu\text{s}$).

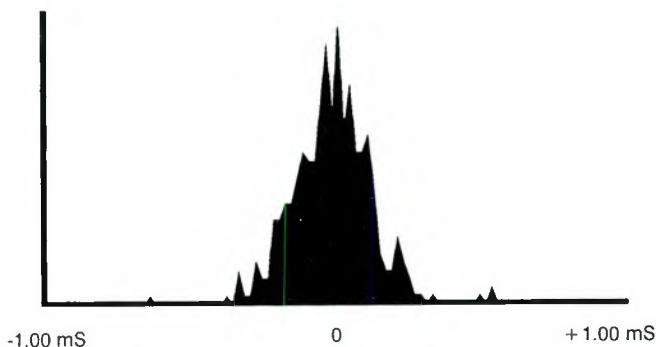


Figure 4. Calls from NRC time laboratory to a station 350km away by leased line ($\sigma = 135\mu\text{s}$).

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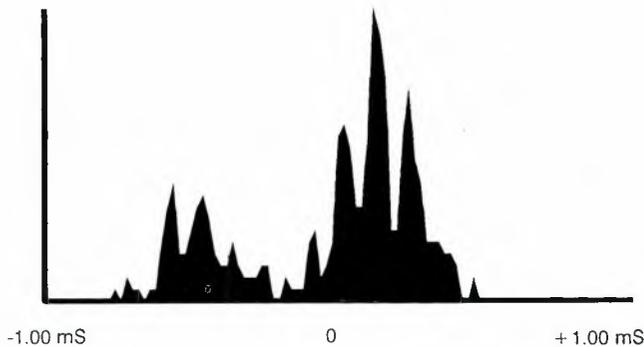


Figure 5. Calls from NRC time laboratory to a station 350km away by public access lines ($\sigma=307\mu\text{s}$).

twice a year.

This new telephone-based time-dissemination technology makes it convenient and economical to reliably maintain time accuracy within milliseconds. Precision timekeeping equipment at broadcast stations has come a long way from those Western Union electromechanical slaves to the present-day systems. In many ways, the modern version maintains the spirit of the old system, but it takes advantage of the latest electronic circuits and some reliable networking provided by telephone circuits to keep us all together and on time.

Time warps

By Rick Lehtinen,
TV technical editor

One fallout of automation in broadcasting is the dramatically increased importance of keeping time. Automated equipment, such as a system designed to capture incoming satellite feeds, cannot rely on an ear- and eye-equipped human to know when to push the record button.

One method of ensuring that all necessary tasks are completed is to pace all activities with a master clock. The clock operates similar to a counter circuit. When the clock gets to a number that corresponds to the time an event is to occur, the signals are given and the machinery goes to work.

Sometimes, however, as in the case of the aforementioned satellite feeds, the receiving station is physically distant from the transmission point. In such situations, it is important for both facilities to have synchronized their clocks to the same time reference.

Micro-timing

Another timing bugbear occurs when individual pieces of equipment each march to a different clock. An example of this is a computer-controlled newsroom. The newsroom computer system, for instance, has a list of times and events. It constantly must reconcile what has occurred with its master schedule and adjust the start and cue times for various pieces of controlled equipment. However, the master-control automation system may have its own notion of when it should initiate station breaks, and the cart machine may have its own agenda as to when it should play tapes. Clearly, one computer has to have precedence, and the others must be flexible enough to accept new instructions quickly if the need develops.

Human time

A newscast generally consists of one

or more humans who read to the audience, with electronic pictures or production effects mixed in to increase appeal, authenticity and interest. The human, however, is not a reliable element, and may cough, stammer, even crack a joke. This may obviate timing schemes based strictly on the clock on the wall. Some way to tie the flow of program events back to the human's delivery may be desirable.

Several schemes for this are based on the prompter feed. Advanced systems actually can sense the speed with which the human is reading by monitoring the prompter scroll rate. They can further pinpoint the reader's position by asking for input about which part of the screen the human is reading from. This allows the computer to keep track of the human to within a few dozen words, which might be close enough. Future schemes might actually listen to the human, and determine the reader's position in the script by voice recognition.

One of the attractions of newsroom automation systems is their flexibility. The newsroom computer is quite good at reordering all the events that are associated with a page of script. If the rundown order must be changed, the computer instantly tracks these changes and orders the various devices, still-stores and cart machines to alter their playlists.

However, no matter how sophisticated it is, the computer has no power to overcome limits of time and space. If a proposed change contains an impossibility — a cart that can't be loaded in time or a robotic camera move that can't be executed soon enough — the computer can only alert the human to the difficulty. Whether the change is made or rescinded quickly enough is not within the scope of the computer's capabilities.

One method to overcome these problems is the use of "pre-cues." In pre-cuing systems, the time required to prepare for a given effect is calculated. Then the time is entered in the script of the required interval before the time mark for the execution of the effect or event.

Automated cameras

Vision-robots are particularly prone to problems in script timing. This is because they have no place to hide. The camera is the viewer's eye, and cameras don't just sit in black until they are needed.

Suppose a script page requires a camera to move from one location to another. In most cases, camera moves are forbidden if the camera in question is on the air. Conceivably, a rundown change could force a camera to air from two positions back to back, without leaving it off-air long enough to change positions. A good camera operator would spot the impossibility, alert the director, and suggest changes or await further instructions. Whether camera-control systems will have an easy interface to the human show-controllers remains to be seen. Manufacturers labor to overcome these types of problems as soon as they are uncovered.

Human touch

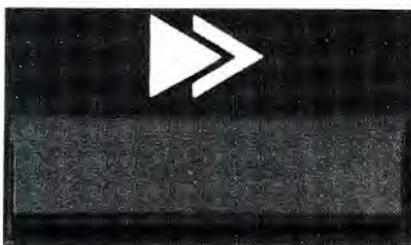
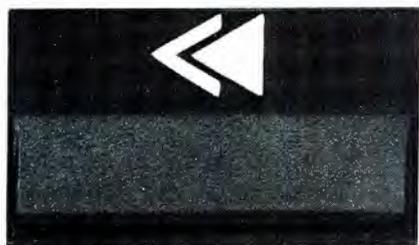
A final timing difficulty is intra-event timing. Assume that a complicated story requires a camera move from a straight-on shot to a key position, in which a still-store slide is to be inserted to the left of the talent. If the talent races or drags, the automated devices must advance or delay the start of their moves.

However, assume the still-store becomes disabled. If the camera cranks over to the key position on cue or the switcher executes the key, and the still isn't available, it would appear as a "goof" on the air. Most newsroom systems probably should include a quick and convenient way to selectively inhibit individually scripted effects within the same story.

This problem may be solved by the various computer automation specialists as they determine, once and for all, which computer is in charge, then cook up a simple-to-use terminal that can sit near the control surface of the switcher.

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Planning for standby ac power

By Morgan Smith

Creative use of generators can cut power costs.

The need for a station backup power source usually goes without question. Time off the air sabotages advertising revenues. Furthermore, EBS stations must have backup power sources. In the event of a catastrophe, they must be on the air to provide information vital to safety and to the public interest.

In addition to protecting revenue and providing public service, there are other good reasons for broadcasters to consider the use of a backup power system. Depending on your utility company and local statutes, it may be possible to use backup power to help reduce your monthly power bill.

A simple scheme for backup power is to have separate feeds available from two different substations. With the ability to switch the power feeds from different substations, a facility can take advantage of whatever portion of the grid is operating at the moment. If a general blackout occurs, however, the high voltage being fed to the substations may be interrupted. That's when the facility must provide the means to make its own power.

A backup power system in a broadcast station usually consists of a generator set and auxiliary equipment. The generator set may be one of several suitable types. The auxiliary equipment is a special power-distribution system, with a transfer switch (see Figure 1).

During normal operations the power is

supplied by the utility. Upon interruption of utility power, the generator will start. After a few seconds to allow the generator to come up to speed and stabilize, the transfer switch will change from the utility source to the generator source and again provide power to the emergency system.

Emergency equipment

How do you decide which equipment is to be powered by the emergency system? The answer probably will be determined by the engineering staff, but here are a few guidelines:

- **Lighting.** Plan on lighting essential areas on a limited basis. Include enough lighting so that employees can move safely about the facility, to staff news-gathering operations and answer viewer and listener calls for information. Don't forget about tower

lighting. Some TV facilities allocate a special circuit for lighting the studio most likely to be operating during an emergency. With this circuit, studio personnel endanger only their own service as they plug in more and more lights to adjust the set lighting. They can't pull down the entire facility by overloading the generator.

- **Broadcast equipment.** Provide power to transmitters, microwave systems, radio communications systems, the routing switcher, master control, cameras, selected tape machines and essential studio equipment. Generally, provide power only to equipment that is essential to keeping the station on the air.

- **HVAC (heating, ventilation and air conditioning).** Air conditioning must be a consideration for emergency operations. Most modern broadcast equipment is heat-sensitive. Personnel comfort is a considera-

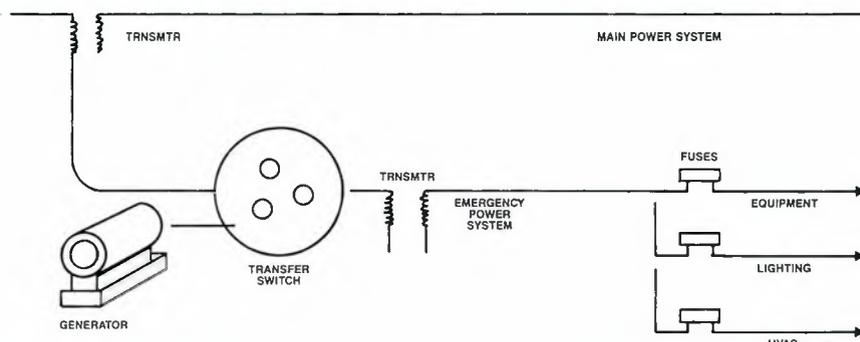


Figure 1. A typical backup power system routes emergency power through a transfer switch. If the main power fails, the generator starts and the transfer switch closes.

Smith is a chief building engineer with experience in broadcast properties. He works for the Salt Lake City division of a major development company based in Houston.

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tion as well. Emergency ac systems may range from a fan in the window to a full-blown system including a small chiller and emergency air-handling units.

Equipment to be left on regular power systems would include non-critical production equipment, the office equipment and items that are not essential to remaining on the air.

Sizing

The emergency equipment has been selected. Next comes the task of sizing the power system. First, calculate and total the various loads, taking into account future additions and expansion. Equipment loads never seem to diminish, but rather to increase. Go over the list again, and include those loads that were overlooked or

forgotten. Then try to add in a surplus. Don't forget the air conditioning. The generator should not run fully loaded in an operating mode. A good rule of thumb is 50% to 70%.

After you have set up your emergency power system, make it a standing policy to police it. Extra, unplanned loads have

Continued on page 52

Controlling generator and UPS noise

By Eric Neil Angevine, P.E.

The existence of a dependable source of electrical power has become a necessity in the broadcast industry. Gone are the days when a broadcaster could go off the air for several minutes, then resume broadcasting with a mere apology. In addition, our high-tech world's use of computers and microprocessor-controlled equipment has made the need for continuous power a consideration in nearly every industry.

To provide themselves with suitably protected power, stations can acquire generators, UPS systems or both. Generators and UPS systems are inherently noisy, and care must be taken to prevent this noise from disturbing building occupants or affecting the broadcast signal.

The noise associated with electrical generation is usually that of the drive mechanism, most commonly an internal combustion engine. The amplitude of the noise produced, and therefore the magnitude of the noise problem, is directly associated with the size of the engine-generator set. It is no surprise that large engines make more noise than small ones.

The UPS inverter that converts battery energy into ac also is an inherently noisy device. In producing 60Hz alternating current, it produces noise with a fundamental frequency component of 120Hz, because it must change polarity twice each cycle, or 120 times per second. Like the engine-generator set, a UPS generates noise in proportion to its size.

Engine-generator noise

A question that must be addressed before deciding how to control the noise of an engine-generator set is whether noise reduction actually is required. Many building owners have elected to tolerate the noise produced by standby power generators because their use is limited to emergency situations.

To use an analogy, most people do not mind the water damage associated with sprinkler systems if they put out a fire. Many think that the noise associated with standby generators is acceptable

during a crisis when the normal source of power is unavailable.

Environmental noise

If it is decided that building occupants can (or must) live with the noise of the generator, some care must be taken in scheduling the required testing and "exercising" of the unit. Whether testing occurs monthly or weekly, it should be done on a regular schedule, so that building occupants (and neighbors) recognize the disturbance as a test.

This is particularly important if the unit is located outside, and there are residential neighbors who may be bothered by the noise. Neighbors should be advised of the necessity and timing of the testing. A time should be selected that will minimize their distraction, and the schedule should be followed faithfully. Even when lengthy exercising is required, most residents will accept a testing schedule for a weekday after 10 a.m. If there are no residential neighbors, it may be better to exercise equipment in the evening, when the business office is closed.

Building noise

Once it has been determined that the noise should be controlled, or at least minimized, the first step is to locate the generator set away from spaces that could be disturbed by its noise. It is not necessary to locate the generator adjacent to areas where standby power is needed.

Often, however, particularly in small facilities, it is not possible to sufficiently reduce the sound produced by an engine-generator set by locating it away from studios or other critical spaces. In these cases, it is necessary to provide an equipment enclosure that is adequate to contain the engine noise.

Because engine noise is predominantly low-frequency in character, walls and floor/ceiling construction used to contain this noise must be massive. Lightweight constructions, even those with several layers of resiliently mounted drywall, are not really effective in reducing low-frequency noise.

A major component of engine noise is exhaust noise. When selecting an engine-generator set, select the highest-quality exhaust muffler available. This often is identified as a "hospital" muffler.

An exciting emerging technology for

noise control is that of active cancellation. It works on the same principle that muffles the sound of out-of-phase loudspeakers. A sound or vibration sensor samples the sound field. The noise is analyzed, and an out-of-phase copy is projected by a transducer, leading to attenuation of the offending noise by cancellation.

Engine-generator sets also produce significant vibration. Except when generators are mounted securely to a slab-on-grade or isolated basement floor, they should be installed on vibration isolation mounts. Such mounts usually are specified by the manufacturer, or they can be selected by your acoustical consultant.

UPS noise

Because a UPS is a source of continuous power, it must run continuously. There is no question about tolerating the noise produced. It is most important, therefore, to locate the unit away from spaces that will be disturbed most by its noise. As with generator sets, UPS equipment does not need to be immediately adjacent to the areas where power is consumed. Consider locations adjacent to mechanical rooms, basement spaces and even detached outbuildings, if available. If both a standby generator and a UPS are to be provided, do not overlook the opportunity to locate them in a common space or enclosure.

Enclosure of UPS equipment often is required, but is not as difficult as that for a generator set, because the inverter does not produce sound levels as great as those of an internal combustion engine. Nevertheless, the low-frequency 120Hz fundamental is equally difficult to contain adequately, and massive constructions are necessary.

Vibration control also is required for most UPS gear, if not provided by the manufacturer. It may be available as an option or it can be specified by your acoustical consultant.

Noise produced by backup power systems can be a serious problem if not addressed properly. Both engine-generator sets and UPS systems produce noise that can disturb building occupants, interfere with the broadcast product and concern residential neighbors. Even the decision not to provide noise control for these systems must be made consciously.

Angevine, BE's broadcast acoustics technical consultant, is an associate professor at the Oklahoma State University School of Architecture, Stillwater, OK.

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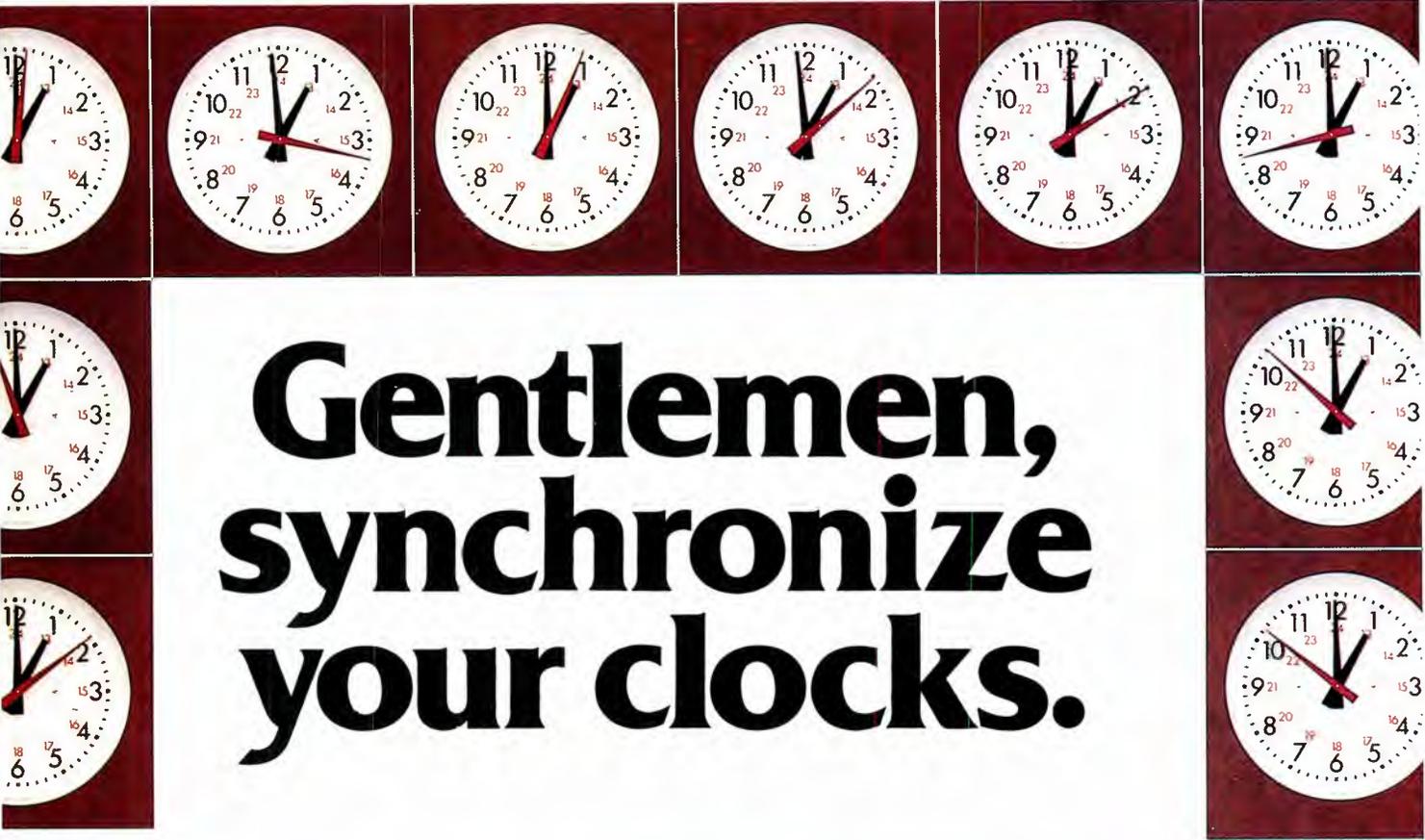
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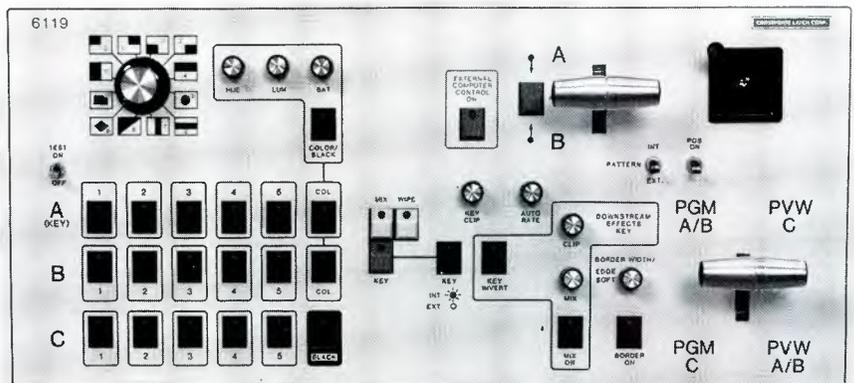
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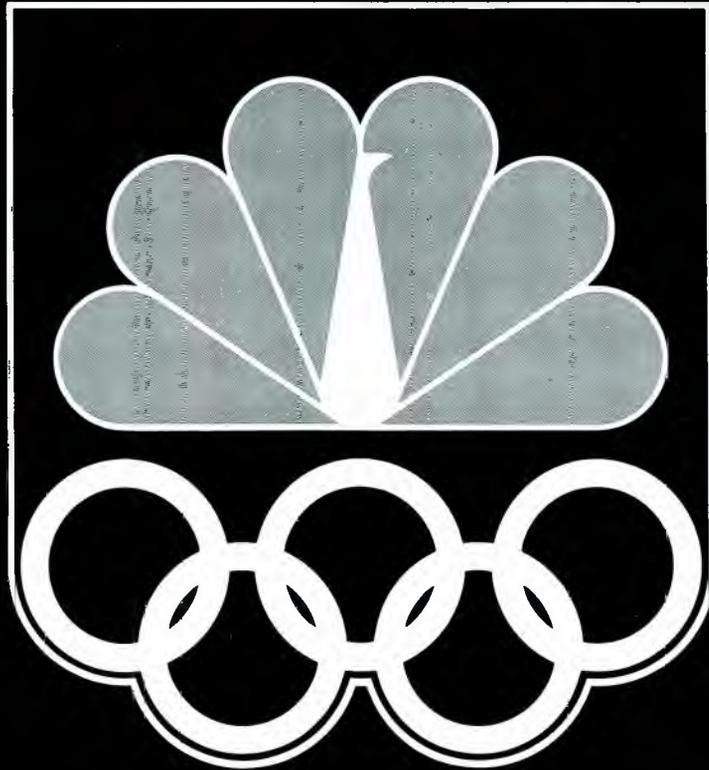
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Judge Charles R. Richey

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
1819 H Street, N.W., Suite 300
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October 4, 1988

Date

/s/ Judge Charles R. Richey

United States District Court
Judge Charles R. Richey

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allows any of its 40-plus standard test signals to be produced in D-2 formats simultaneously with the analog output of the generator. Option -05K is a second connection that takes the digital signal from the D-2 VTR and converts it to the composite analog equivalent. This process allows the original test signal and the D-2 output to be compared directly on a waveform monitor or vectorscope.

- The model 1515SP composite/component test signal generator provides both component and composite signals. It is designed for use with the Betacam SP and similar machines. The unit provides commonly used NTSC signals plus special multiburst; pulse and bar; VITS and VIR signals; field sweep; and signals with markers and indicators as specified by the manufacturers. It provides RGB signals with and without sync, including RGB-SMPTE bars and high-frequency/high-resolution "Bow-Tie" signals.
- The model 2030 HDTV test signal generator operates through interconnection with a personal computer. It allows for the generation of library or custom HDTV signals. The unit has six output channels; three channels can be used to provide synchronizing information, and the other three channels can be used for test signal outputs.

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1:7(=)))

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Adapters and amplifier chart

MCL has introduced the following communications products:

- The models M/N 20075 and M/N 20076 Satcom voice communications adapters are designed to combine video and voice communications uplinks. The adapters provide low-power satellite telephone/communication links from the transmitter through the satellite to the earth station prior to high-power video transmission. The adapters perform under weather conditions from -20°C to $+50^{\circ}\text{C}$, with a temperature-controlled 5W SSA. The adapters come with their own power supply and filter diplexer.

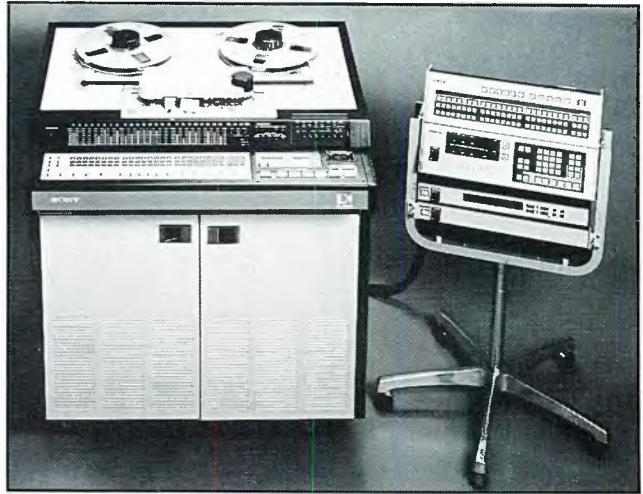
- The model 8703 communications amplifier reference chart describes the various uses, amplifier options, microprocessor logic and pertinent information for redundant and phase-combined "1 for 1" systems and "1 for 1" options. An MCL performance table describes uses and technical information concerning Ku-band split hub-mount systems, with many options.

Circle (440) on Reply Card

Digital and analog multitracks

Sony Professional Audio has introduced the PCM-3324A and PCM-3348 DASH format digital and APR-24 and APR-5003 series analog recorders. Both PCM multitrack recorders feature improved LSI circuitry with 2X oversampled digital A/D and D/A conversion and linear phase digital filtering. The PCM-3348 48-track recorder maintains compatibility with the PCM-3324A by accommodating 24-track tapes. The 24-track APR-24 uses 16-bit microprocessor technology to integrate control of the

transport, audio and synchronization and features a jog-shuttle wheel common to video recorders. Amorphous heads extend frequency response and head life.



Circle (441) on Reply Card

Test signal generators and HDTV signal generator

Magni Systems has released the following products:

- The option -05 for the 1510A NTSC test signal generator



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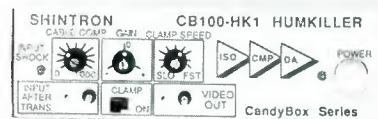
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gapless punch-in/punch-out; a serial port for external computer or MIDIiZER control and parallel port for a synchronizer. The ATR-80/32 2-inch 32-track recorder features an independent sync and repro head; seamless, noiseless punch in-out; and dual spot erase forward and reverse. It accommodates 14-inch reels with samarium cobalt technology motors. The DA 800/24 DASH format digital multitrack includes zero-distortion electronics with opto-isolated A/D and D/A conversion and 2X oversampling in record and play modes. Other features include remote control, local and remote meter bridges and AES/EBU I/O interfaces.

- A serial port, 3-function synchronizer, the MT-1000 MIDIiZER. Functions include an autolocator; MIDI synchronizer to sync MIDI machines 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.

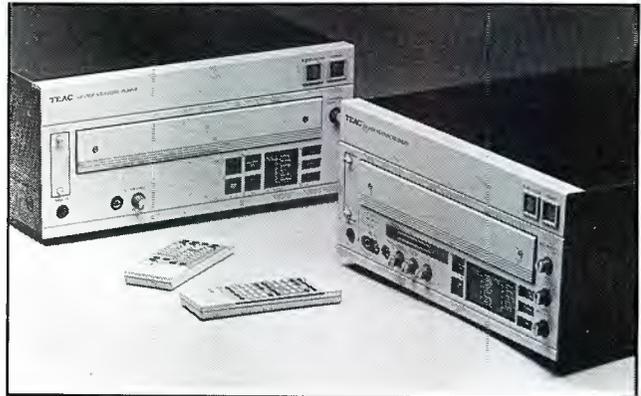
- A multitrack console, the M-700 40-channel audio in-line configuration console. Dual paths through each input/output module have separate fader controls. Each module includes 4-band EQ assignable to either path. Features include group output, quad-mix bus and a hard-wired patchbay.

Circle (437) on Reply Card

Videodisc recorder/player

TEAC has introduced the LV210A videodisc recorder and LV210P player. Targeted for interactive operation in educational, medical, corporate and library operations, the LV210 systems do not include long-play CLV mode, but are otherwise com-

patible with the previous LV200 equipment for 12-inch, 2-sided laser videodisc recording and playback.



Circle (438) on Reply Card

Video overlay board

Processor Sciences has introduced the VGAVISION board. In conjunction with a VGA board and monitor, the board allows full NTSC video to be added to computer-generated text or graphics for a non-interlaced VGA video output. The full-sized board requires one PC slot and two I/O ports; it uses no PC memory or internal connections.

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Audio recorders, serial port synchronizer,
multitrack console



TASCAM has introduced the following products:

- Three multitrack recorders. The MSR-16 1/2-inch 16-track system features integral dbx type 1 noise reduction; noiseless,

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Circle (97) on Reply Card

Work station, still-store upgrades

Pinnacle Systems has released the following product upgrades:

- The Sculptor 3.0 software upgrade offers enhanced modeling and animation including animation time-line editor, optional page turn/roll, scripting in reverse, individual object keyframing, variable perspective controls, high-resolution modes, sunlight modes, cast shadows and metallic, plastics and other materials menus. The software offers enlarged lighting icons, optional 3-D camera cursor, revamped cross-sectional modeling interface and numerical input for grid, scale, spiral and def mesh. The software upgrade is for use with work station models 2033, 2040 and 3000E in both NTSC and PAL standards.
- One-second access time for retrieval of stored images has been added to the 2000 series production video work station equipped with still storage. The increased speed is an improvement of more than three times. One-second access time is available on models 2020, 2030 and 2040 and is optional on the 2010.

Circle (435) on Reply Card

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.

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Wattmeter



Bird Electronic has released the model 43P wattmeter that allows users to measure true peak power of single side-band and AM-modulated RF, in addition to certain rectangular limited pulse signals. The 43P includes peak-reading circuitry that provides a true peak power measurement mode. This capability allows users to measure peak power to an 8% F.S. accuracy without affecting the CW measurement capabilities. The wattmeter uses standard company plug-in elements and does not require special elements for peak measurements. Two 9V NEDA type 1604 batteries drive the peak power-measuring circuitry and have a 48-hour life expectancy in the peak mode.

Circle (433) on Reply Card

Audio recorders, digital editor

Studer ReVox America has introduced three models of the ReVox line. The PR99 MKIII features a die-cast aluminum transport and headblock with servo capstan drive, modular electronics, an autolocator, integral variable speed and balanced inputs and outputs.

The company also has introduced the

Studer DE4003 digital audio editor with control capabilities for one or two players and one recorder. The Motorola 68000 microprocessor, VME-bus structure and large memory provide high-speed sampling. A cue wheel is used to simulate back-and-forth motion of tape reels in cuing.



The PR99 MKII

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Joseph H. Kelley
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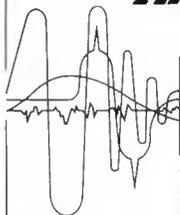


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MP Series

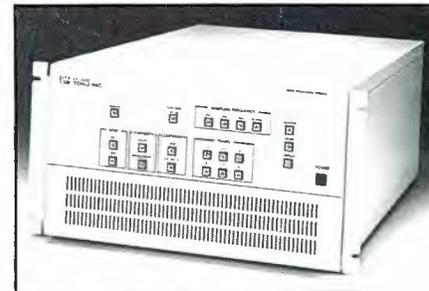
Circle (93) on Reply Card

Storage systems

Toko America has introduced the following HDTV storage systems:

- The model VT-500 is designed for digitizing and storing HDTV signals. It features RGB or Y, P_b, P_r 30MHz component signals for input/output; a bipolar, tri-level sync signal; an interleaved, dual-port memory that allows simultaneous display and computer access of the image data; and a parallel interface to the host computer for image-data access and remote control of the front-panel operations. External sync or sync separation from the Y or G channel can be used. The system has sampling rates of 74.25MHz, 64.25MHz and 48.6MHz.

- The MFS-64H is a multiframe synchronizer and storage device. The system receives HDTV video signals, then digitizes and delays for up to 30 frames. System expansion of up to 90 frames is available. The synchronizer meets the 1125/60 input/output signals of the BTA S-001 studio standard. It has a sampling frequency of 74.25MHz and a signal-to-noise ratio of 50dB minimum.



VT-500 video frame store

Circle (430) on Reply Card

Video furniture

Winsted has introduced the Montreux Suite video editing furniture. The editing console work surface is positioned at a comfortable height and allows operator legroom and an integral footrest. A raked monitor panel permits easy viewing. Cable trays and wells are integrated into the welded steel structure. Wood-trim laminated panels are offered in studio gray, grained black ash or light oak.

Circle (431) on Reply Card

Graphics rendering machine

Symbolics Graphics Division has announced the 3653 computer add-on rendering system. Enhancing the system with three CPUs allows three separate black/white workstations for modeling and animation in addition to rendering duties, making the 3653 a dual-purpose graphics computer.

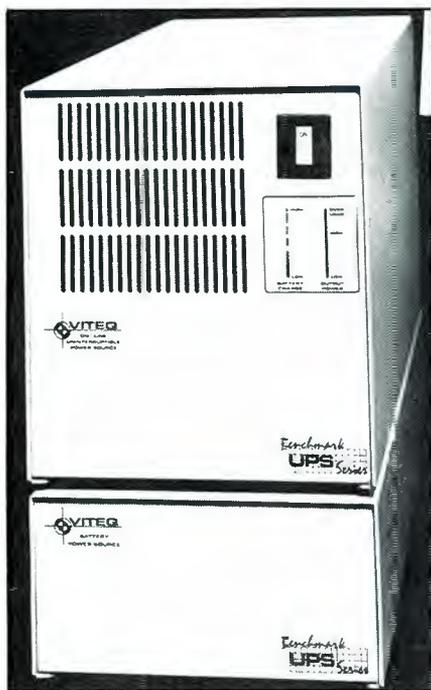
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*perspective, rotation, warp
cleanest edges, smoothest moves*

AM

Digital Optics from Pinnacle Systems.

UPS family



VITEQ has announced the Benchmark UPS family, a series of uninterruptible power supplies for 750VA to 1.5kVA on-line applications. A thermal breaker

guards against surge capacity to 10 times the nominal rating with input fluctuations from 90VA to 140VA accommodated. The UPS 386/LAN is targeted for IBM or 80286/386-based microcomputer file servers; the UPS 15A is for minicomputer equipment.

Circle (427) on Reply Card

U-matic SP recorders



VO-9800 U-matic feeder/recorder

Sony Communications Products has introduced the VO-8800 portable recorder, the VO-9850/9800 editor and feeder/recorder and BVU-920 player. All these type IX VCRs provide 330-line resolution with an S/N of 46dB with Dolby type C audio for an S/N of 72dB. The VO-8800 includes a Y/C interface through a 14-pin

camera cable and offers an optional time-code generator. The BVU-920 features dynamic tracking and accepts the BKU-901A plug-in TBC and BKU-902 digital noise reducer. The VO-9850/9800 editor and feeder recorder offer a variety of options for incorporation into systems using 33-pin or RS-422 9-pin remote control or 2-VCR editing, including optional time-code readers and generators.

Circle (428) on Reply Card

Amplifiers

Models 750F and 750G professional power amplifiers have been introduced by BGW Systems. They offer an IHF output power of 2,000W and an overall dynamic range of 113dB. The amplifiers include high-performance active-balanced inputs with more than 70dB of common-mode rejection. Model 750G includes a dynamic-range LED level display and LED status indicators for heat sink and transformer over temperature and for power-supply failure. Model 750F includes LED modulation and true clip indicators. Both amplifiers include switchable subsonic filters, input mode switching, internal crossover card capability, high-speed Ultracase transistors, solid-state amplifier and speaker protection and a welded steel chassis.

Circle (429) on Reply Card

ARRI

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TBC, freeze-frame

Prime Image has announced the HR600+ high-resolution freeze-frame and TBC system. With 600-line resolution, the unit provides transcoding between all component and composite VCR formats. The full-frame synchronizer stabilizes images from non-capstan, non-V-lock VCRs, microwave or satellite feeds and off-air sources. Selectable chroma and luminance noise reduction and enhancement are featured.

Circle (421) on Reply Card

Communications transceiver

Trycomm has introduced the TR-105 miniature communications transceiver with a range to six miles. The 6W-output radio operates in the 150MHz-174MHz range for voice and data messages with 5MHz deviation. The pocket-sized radio operates to eight hours from a single battery charge. Suggested applications include construction sites, business, industrial and public safety communications.

Circle (422) on Reply Card

Desktop audio system

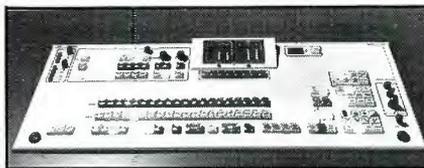
Sonic Solutions has introduced the Sonic System desktop workstation based on a Macintosh II CPU with hard disk storage

of digital audio data and a signal-processor circuit card. A software package provides editing, mixing, dynamics, EQ and project management functions as well as NoNOISE software to remove clicks, pops, hum, tape hiss and surface noise from recordings.

Circle (423) on Reply Card

Master-control switcher

Utah Scientific has introduced the MC-501C master-control switcher. Twenty source selectors can be associated with video only or video plus audio; audio can be stereo, mono or stereo with SAP. An audio-only section includes sources for voice-overs and tags. A full-function machine-control system includes preroll times for each source machine, including film chain multiplexer and audio cart controls. Integration with Dynabus and SAS-2 automation is available.



Circle (424) on Reply Card

Sequencer software and interface

WaveFrame has announced Texture, a MIDI music-sequencer software application for the AudioFrame digital audio workstation. Providing a graphic environment, the software operates as a modular recording architecture of songs, patterns and tracks. Each pattern contains 32 tracks with 96 patterns linkable for a complete song. The UDI-4 universal digital interface module allows interconnection of the AudioFrame to a variety of digital sources with different sample rates and formats, including AES/EBU, Sony/Philips SDIF-1/SDIF-2 and Mitsubishi PD and DUE

Circle (425) on Reply Card

Airflow sensors

Warren G-V has introduced the SAI series solid-state airflow sensors in standard, fail-safe and hermetically sealed units. Using a heated thermistor to sense air streams, the sensors are used to detect equipment overheating caused by fan failures, dirty filters or screens, obstructed air inlets or outlets or other circumstance that disrupt a designed cooling airflow through the equipment.

Circle (426) on Reply Card

THE NEW RPU



Designed by its users.

TFT has responded to the needs of today's broadcasters by introducing the Model 8888 RPU System that offers unprecedented flexibility, versatility and reliability.

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The RPU transmitter and receiver are frequency-synthesized for maximum versatility in the N1, N2 and S frequency bands. Two operating frequencies are programmed by internal DIP switches and are front panel selectable.

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The Model 8888 system allows you to select $\pm 5\text{kHz}$, $\pm 10\text{kHz}$ or $\pm 25\text{kHz}$ frequency deviation depending on frequency band or occasion.



In addition, selection of receiver bandwidths is possible via a front panel switch or DTMF signal. The 8888 also gives you full audio frequency response.

DTMF CONTROL

Versatile DTMF control is provided for receiver activation, bandwidth and deviation selection, and security. All these plus more via a touchtone telephone handset.

RF POWER OUTPUT VERSATILITY

The Model 8888 enables you to change the RF power output via a rear panel switch to suit your needs. It also features a switching power supply for lightweight, cool operation.

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www.americanradiohistory.com

Random-access audio editor

Real World Research has announced the Audio Tablet, a 2-channel random-access editing system. Linear 16-bit sampling is available at 32kHz, 44.1kHz or 48kHz. A/D circuits are self-calibrating, and the D/A circuitry features 4X oversampling. A SMPTE interface reads and generates time code. A MIDI interface also can be used. Standard memory is one hour, stereo, expandable to six hours. The control inter-

face uses a pressure-sensitive touch-screen and incrementer wheel.

Circle (417) on Reply Card

PC-board converters

RO Associates has introduced the RO dc-dc power converters, a series of PC-board-mounted modules. Input range is 36Vdc-66Vdc (RO-48) or 200Vdc-400Vdc (RO-300) with overvoltage protection. Out-

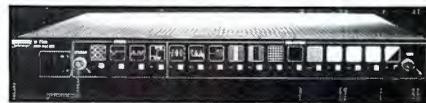
puts are 5V/25A; 12V/12A; 15V/10A; 24V/6A and 28V/5A. These 125W-150W converters require no heat sink or cooling fan.



Circle (418) on Reply Card

MAC signal generator

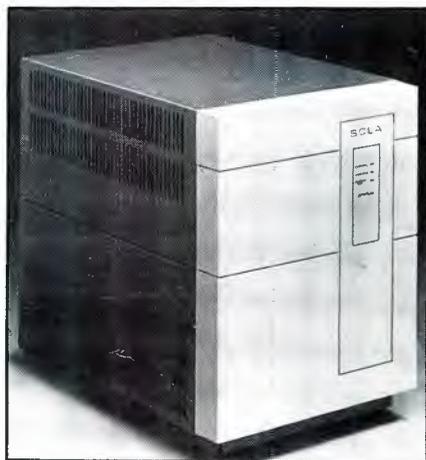
Schlumberger Instruments has introduced the 7765 D-MAC and D2-MAC packet test signal generator, designed to EBU specifications for installation and maintenance of direct broadcast satellite systems. All signals are digitally synthesized from 10 bits at the D2-MAC clock frequency. Signals include patterns for MAC convergence, color bars, static convergence, gray scales and black/white tests.



Circle (419) on Reply Card

Power conditioners

Sola has introduced additional models in the EPC electronic power-conditioner series with ratings of 5kVA, 10kVA and 15kVA. The microprocessor-based products offer 96% efficiency at full load with increased crest-factor load-handling capability and high-inrush overload capacity, eliminating the need to specify oversized power-protection units for computer-based equipment using switch mode power supplies.



Circle (420) on Reply Card

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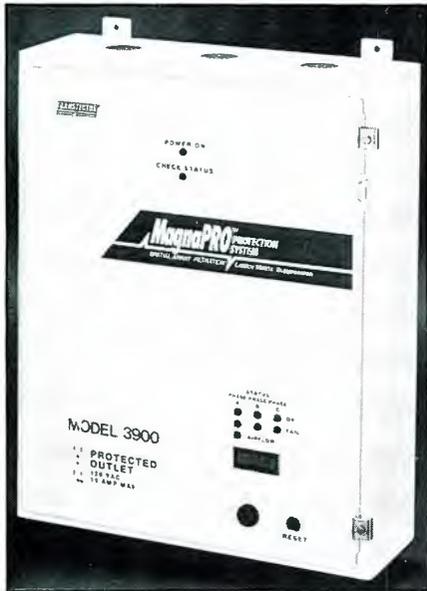
North Hills Electronics, Inc.

1 Alexander Place Glen Cove NY 11542-3796 (516) 671-5700 Telex: 46-6886 FAX 516-759-3327

Circle (37) on Reply Card

Power-line protection

Transtector Systems has introduced *MagnaPro*, a series of power protectors using "spatial array" filtration for noise attenuation over a broad frequency spectrum from 2kHz to 100MHz. The series of power-line conditioners includes bipolar transient overvoltage suppression. Six models cover service voltages from 208Y/120Vac to 480Vac, 50Hz/60Hz.



Circle (413) on Reply Card

Cable tools

Paladin has announced the CST PA 1241 coaxial stripping tool and PA 1820 round cable splitter. The stripping tool can be used on cables of 0.1- to 0.315-inch diameters. Rotating the tool around the cable cuts the dielectric without nicking the center conductor. The cable splitter slits, splits and removes insulation on single- or multiple-conductor cable as large as 1.5 inches.



Circle (414) on Reply Card

Oscilloscope probes

Pomona Electronics has announced two

series of oscilloscope probe kits. One is a low-cost standard replacement series. The other is modular, with threaded connections for convenient field repair. Both series include switchable $\times 1/\times 10$ attenuation, bandwidths to 20MHz and gold-plated tips on some standard models. Those to be used with instruments featuring readouts may include an optional actuator pin.

Circle (415) on Reply Card

Distribution amplifiers

Wheatstone has announced the SDA-82 stereo 8-channel audio distribution amplifier. The unit may be configured as a single input, 16-output or stereo input, 8-output. All inputs and outputs use 3-pin gold connectors. Each output is actively balanced and capable of delivering +26dBm. Distortion is typically 0.002% over a dynamic range of 115dB.

Circle (416) on Reply Card

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Circle (77) on Reply Card

Stereo amplifier

QSC Audio has introduced the model 1100 professional stereo amplifier to its Series One line. The amplifier occupies one rack space and delivers 65W per channel at 4, and 50W per channel at 8. Passive cooling and toroidal transformers allow for ultraquiet operation. The amplifier features two headphone jacks and independent level control. It also features 5-way binding posts for speaker outputs and octal sockets.

Circle (410) on Reply Card

Signal transcoder, editing controller

Panasonic Audio-Video Systems Group has introduced the following products:

- The UTP-1 universal signal transcoder. Multiple inputs and outputs provide transcoding of any existing video component signal format to any other. An NTSC output also is included. Video bandwidth is 5.5MHz with a 60dB S/N.
- The AG-A800 editing controller features SMPTE or control-track timing as well as a 128-event memory. Nine-pin and 34-pin remote-control capabilities are available

through interface adapters. For multisource editing, two source VTRs can be alternated with the unit. A single search dial serves shuttle/jog functions of all attached VTRs, and a data I/O terminal connects to a personal computer to store and retrieve edit data.



Circle (411) on Reply Card

Digital audio equipment, test generators, monitor unit

Tektronix has introduced the following products:

- 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.

- The TPG-625 and TSG-422 signal generators and 1781R video measurement set. 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-232C/422 remote control, polar SC/H display and calibration, tangential noise measurement and stereo audio phase and amplitude-measurement features.

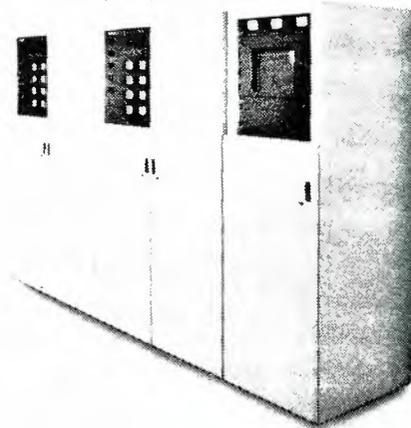


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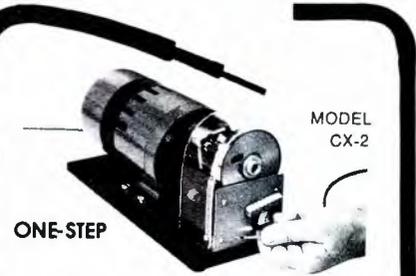


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Circle (90) on Reply Card

Optical fiber link

Ortel has announced System 6000, a TVRO fiber-optic link designed to transmit the low-noise block downconverter (LNB) output of a satellite earth station antenna to a remote receiver or headend as far as 15 miles away. The link consists of the 6300A fiber-optic laser transmitter and 6400A photodiode receiver. Twelve channels from one polarization can be carried on the link. The system RF input also provides current-limited dc power for the LNB.



Circle (405) on Reply Card

Videographics system

Genigraphics has introduced two Infinity Graphics systems. Model 3025 uses an Intel 302 CPU operating at 25MHz in a workstation with 150Mbyte ESDI hard disk and 20Mbyte Bernoulli disk storage, a 19-inch RGB monitor and MetaGraph software for charts, graphs and diagrams. Model 3016 workstation includes a 19-inch monitor, 70Mbyte hard disk storage and MetaGraph software. Both units offer input/output compatibility with CGM computer vector graphics. MetaGraph software features chART graphic, Gallery paint, Model Shop 3-D rendering, Animator motion and DynaMagic 2-D animation.

Circle (406) on Reply Card

Editing switcher controller

NTSC Productions has introduced Risetime, a controller capable of upgrading many small production switchers for frame-accurate, editor-triggered cuts, wipes and dissolves. Triggered by any editing controller's GPI pulse, the unit provides smooth wipe or dissolve transitions ranging from one field to 1,000 frames. Operation with this unit requires a simple (reversible) modification to the switcher.

Circle (407) on Reply Card

LED waveform monitor

Nu-Tronics has introduced the Bug Catcher TC-10, a pocket-sized, battery-operated video signal monitor. Seven of the eight LED indicators on the device are assigned to a video signal parameter and are illuminated when their specific functions are present. The eighth indicates power on and provides a battery-check function. Parameters sensed include four video levels, 4V sync, composite sync and

color burst. An ac adapter is available for use with this battery-operated test unit.

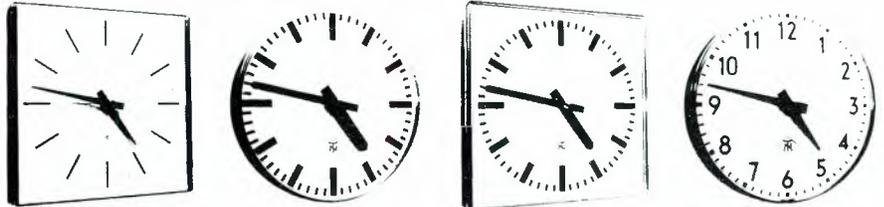
Circle (408) on Reply Card

Serial interface and MIDI computer

Soundcraft USA has introduced the VSA24 interface and series 6000 MIDI computer. The VSA24 enables a direct interface between video editors and the Soundcraft 200B/VE 8-input console. The

serial connection allows crossfades of audio to match video edits for audio-follow-video effects. The series 6000 MIDI computer contains non-volatile RAM for eight songs with 100 patches of complete mute setting for each as well as additional MIDI effects patches. The computer is an optional module for the 6000 series recording mixers.

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Condenser microphone

Gotham Audio has introduced the Neumann KM100 modular microphone system. The KM100 system includes an active capsule that connects to the output stage, forming an axially addressed microphone. Four interchangeable capsules for the system are the AK30 omni, AK40 cardioid, AK45 cardioid with low-frequency rolloff and AK50 hypercardioid. Various mounting accessories also are

available.

Circle (400) on Reply Card

Touch-screen distribution system

Iris Technologies has introduced the Video Commander MX-3200 video routing and distribution system. The switching matrices control 32 video and 64 audio inputs to 32 video or audio outputs. Expansion to 256 elements is possible. Touch-

screen and mouse control systems work from color graphic displays of input and output selections. The screens may be customized, and macro instructions can be used. Video response is ± 0.1 dB to 30MHz. The smart switch technology includes a learn mode.

Circle (401) on Reply Card

Digital multimeters

HUB Material Company has announced the availability of the Beckman HD151, HD152 and HD153 digital multimeters. Three models include auto-off function and auto-ranging with a shock- and contamination-resistant case. The HD152 offers 0.5% Vdc accuracy with 10A ac/dc range. The HD153 includes an audible readout with a 0.25% accuracy and signals the presence of TTL or CMOS logic pulses.



Circle (402) on Reply Card

Audio mixers, audio monitors

JBL Professional has announced the following products:

- Seck audio-mixing consoles have been added to its line. Various configurations include frame sizes to 24 inputs with two and eight subgroups, balanced mic and line inputs, 3-band mid-sweep EQ, monitoring and talkback features. An 8-bus version for multitrack recording features an aux stereo send, four effects returns with EQ and 8-bus routing.

Circle (403) on Reply Card

CD scratch remover

JBF Laboratories has announced the CD Saver, a compact disc scratch remover and cleaning product.

Circle (404) on Reply Card

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Circle (76) on Reply Card

Routing-switcher systems and time-code equipment

Brabury International has introduced the following products:

- The SDR-101/2 RS-422 router provides RS-422 protocol control over routing of remote-control signals from a range of TV products. The standard format is a 12x6 matrix.
- The ARS-100 series audio and video monitoring router serves applications in which the signals are not expected to pass to the final program output. The audio system matrix switches 12 or 24 sources to one destination. The video unit is 12x1.
- The ARS-200 series routing switchers provide an 8x1 matrix for program audio signals with 1RU (remotely controlled) or 3RU (local panel control) configurations.

Circle (395) on Reply Card

Storage oscilloscopes

Fluke and *Philips* have announced the PM3335, PM3350 and PM3365 analog/digital storage oscilloscopes. The three instruments cover an analog bandwidth from 50MHz to 100MHz with sampling rates from 20MS/s to 100MS/s for each channel to an 8K RAM memory. Features include cursor facilities, AUTOSET and an optional GPBI/IEEE-488 interface.



Circle (396) on Reply Card

Audio console enhancements

DDA has announced modular enhancements to the D and Q series consoles and fader automation for the DCM 232 mixer system. The D-series module set includes VCA input and master modules, which offer advantages in global audio control with the use of VCA and mute groups. The input modules include separate mic and line trim with 4-stage, quasi-parametric EQ, eight aux sends and eight group assigns. The Q-series mute group modules enhance audio control in various sound-reinforcement applications. For the DCM 232 in-line console, fader automation provides recording and replay of fader and mute information. Three levels of operation include VCA only, channel switch only and a combination of those two functions.

Circle (397) on Reply Card

Microwave attenuators

Narda Microwave has announced the model 6768 series attenuators for use from dc to 50GHz. The devices feature a thin-film substrate for improved frequency response and a low SWR. Standard values of 3dB, 6dB, 10dB and 20dB attenuation are provided with 2.4mm stainless steel connectors. Other values are available by special order.

Circle (398) on Reply Card

Audio power amplifier

Ortofon has introduced the PPA600 2-channel audio power amplifier, which provides 225W continuous output into 8 or 350W to 4; a mono bridge mode delivers 650W to 8. Protective circuitry is integrated into the system to disconnect the speakers if a dc voltage appears on the output terminals. Sixteen MOSFET metal power transistors are used.

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Circle (75) on Reply Card

Intercom systems

Diless has introduced ProCom, a full-duplex intercommunication system. Each station is equipped with a push-button dial, allowing the user to establish the desired connection at the touch of one button. Any station may be used as beltpack or table-mounted units with interconnection through a standard 3-core microphone cable.

Circle (391) on Reply Card

Zoom video light, compressed-air container

Hamaphot has introduced the following products:

- **Magnum 300** zoom video lights, which feature computer-controlled light output for both wide-angle and telephoto positions. A light sensor measures overall reflected light from the scene and electronically regulates the light output from the instrument for correct illumination,

even in indirect lighting applications. The 300W quartz lamp provides soft lighting, while barndoors assist in light framing.

- The **Biomat** is an environmentally safe, compressed-air container. No propellants are necessary in this air-spray can for cleaning items such as lenses and front surface mirrors. The container includes a hand-operated pump, which allows it to be refilled at any time. The can provides a nozzle or detachable wand for directing air into tight spaces

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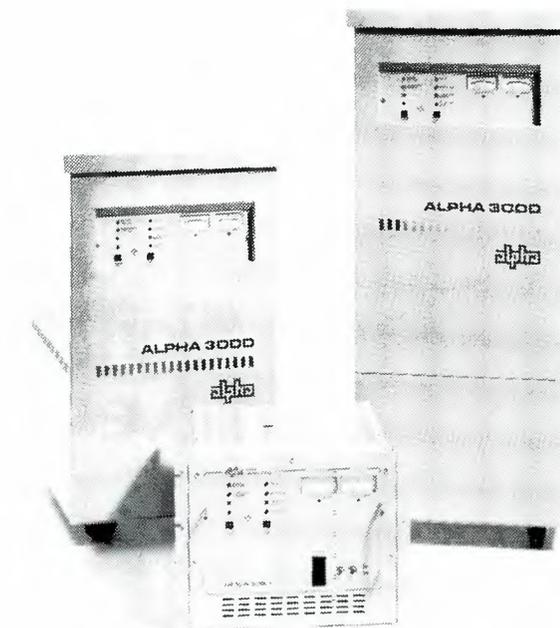
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Circle (74) on Reply Card



Magnum 300 video lights

Circle (392) on Reply Card

Audio mastering tape

Agfa-Gevaert has introduced improved versions of PEM 469 improved audio mastering tape and PEM 291D digital audio mastering tape. The improvements to PEM 469 include more durable oxide surface, backcoating and base film to withstand multiple tape passes common in multitrack recording sessions. The PEM 291D formulation for DASH and PD format recorders has been altered for greater durability in long-term storage and the capability to better withstand razor-blade editing techniques. The digital tape is available in 1/4-inch to 5,000 feet, 1/2-inch to 5,000 feet and 7,500 feet and 1-inch to 5,000- and 10,000-foot lengths.

Circle (393) on Reply Card

Video encoder

Optical Electronics has introduced the model 67136/R RGB-to-NTSC video encoders. An integral crystal-controlled master sync generator provides all drive outputs necessary for the RGB sources used with the encoder. An integral color-bar generator can be used for calibrating monitors or other external equipment.

Circle (394) on Reply Card

TBC enhancements

For-A has announced the FA-740S parallel effects time base corrector for use in A/B roll editing with S-VHS VCRs. The unit can be used to integrate 1/2- and 3/4-inch material with studio camera video through its dual, full-frame correction range. It also can be used with other members of the 740 family for editing and audio switching and includes multiple special effects with independent mixing and wipe functions.

Circle (387) on Reply Card

Grounding system

Lyncole XIT Grounding has announced the XIT electrolytic grounding system. Through exothermic connections and an ion-rich backfill, the system maintains low earth-resistance levels in any type of soil or weather conditions.

Circle (388) on Reply Card

Character-generator systems

Dubner Computer Systems has introduced the 20-KEL election computer and Name Dropper II ID system. The 20-KEL

computer combines an anti-aliased, real-time character-generator system with special software written for election data presentations. Tabulations can be kept for 2,000 races, 6,000 candidates and 1,000 locations. Individual screens use 256 colors from the 16.7 million-color palette.

The Name Dropper II system includes options for complete character generation, special ID graphics packages and time/temperature displays. For affiliate/network ID insertions, the system is triggered from code embedded in the vertical interval. The standard package includes the VBI decoder, a graphics generator and video keyer.

Circle (389) on Reply Card

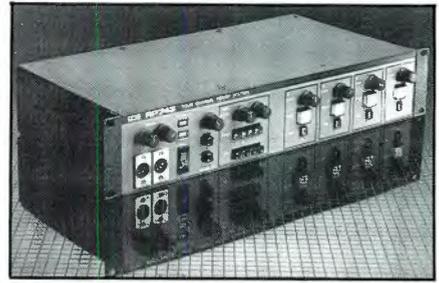
Wireless mic, intercom systems

HM Electronics has introduced the following products:

- The System 515 bodypack and 525 hand-held wireless microphone systems are designed for budget-conscious professional applications. Both systems use the RX-522 receiver, which features NRX 11 noise reduction with operation from ac or dc power. Both transmitters include a mic-

mute switch and low-battery LED indicator. The bodypack unit includes mic gain adjustment and a reversible belt clip. The hand-held system offers an integral antenna housed in rugged ABS material.

- The RP743 and RP753 rack-mount power stations are additions to the HME 700 series cabled intercom family. The RP743 is a 4-channel power station with two headset connections that can access any of the four independent channels. The unit features IFB capability. The RP753 unit is a 4-channel matrix power station with a switch panel to assign 12 stations or groups to one of four independent intercom channels or to two private lines.



Circle (390) on Reply Card

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Circle (73) on Reply Card

Audio-level controller

FM Systems has announced the ALM673 audio-level master. For six mono or three stereo audio channels, the system uses split spectrum control with program-dependent time constants and independent noise gating. A switch converts from 2-mono-channel to 1-stereo-channel operation. 30dB of automatic level control prevents the waveform distortion typical with compression or limiting.



Circle (383) on Reply Card

Machine control and prompting

BASYS has introduced the following products:

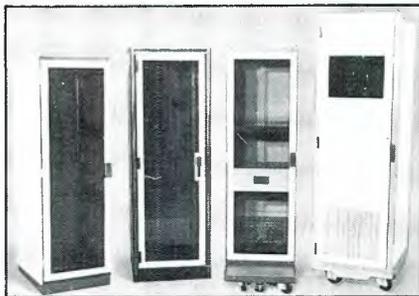
- The MCS One machine-control system allows pneumatic commands to be placed in scripts for operation of character generators, still-stores or video cart systems. MCserver software creates separate command lists for each piece of production equipment, showing com-

mands and order of occurrence in the rundown.

- The A-5000B prompter/closed-captioning device, co-developed with Listec, is plug-compatible with BASYS DT-80 prompters. It features multiple font selection, international characters, closed-captioning and prompter background color selection. In closed-captioning applications, an upgrade feeds the prompter output to an EEG encoder/decoder.

Circle (384) on Reply Card

Sloping-front cabinets



Equipto Electronics has announced a

series of sloping-front cabinets in 10 styles. The cabinets are available in 19-, 24- and 30-inch widths and five depths. Slopes range from 15° to 45° with single and double slopes and low profile designs. Laminate and steel writing shelves are available.

Circle (385) 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 16x4 video-routing system with local and various remote-control options for composite or component video.

- 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 (386) on Reply Card

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Circle (87) on Reply Card

Digital audio production center

Digital Audio Research has introduced 2- and 8-channel configurations of Sound-Station II, a second-generation digital audio recorder and production center. Features of the system include stereo time warp, an animated playback display, punch-in record, long crossfades and full chase synchronization. Inputs and outputs can be analog or digital with optional 18-bit A/D and D/A, AES/EBU digital interfacing and 1610/30 digital interface. Winchester or optical WORM disk drives may be used.

Circle (379) on Reply Card

dc/dc converter

CALEX has introduced the model 12S5.5000UW, a dc-to-dc power converter. Accepting battery inputs from 7Vdc to 40Vdc, the unit produces 5Vdc at 5A with 80% efficiency with a $\pm 15\%$ adjustment of the output voltage. Protection against voltage spikes is included on input and output circuits.



Circle (380) on Reply Card

Weather computer graphics

Environmental Satellite Data has announced WeatherGraphix, a high-resolution computer graphics system designed for TV weathercasters. Based on an 80386 PC, displays use 256 colors from a palette of 16.7 million. Time-lapse loops of satellite imagery extend to 64 frames; graphic features include map-building, font generation, color cycling, cel animation, blob animation and air brush. The system provides multitasking capabilities and acquires satellite and radar data and images through ESD Easy Data dial-up or Express Data satellite delivery service.

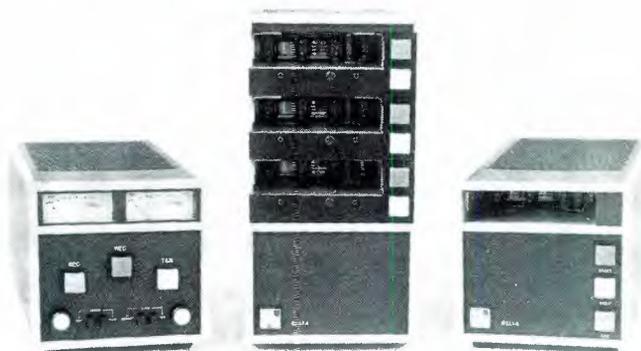
Circle (381) on Reply Card

Slot-array antenna option

Bogner Broadcast Equipment has introduced the NS (no steering) option for its range of standard slot-array broadcast antennas. The option reduces beam steering, which in turn, reduces deterioration in bandwidth, chrominance and aural levels of received TV signals. The NS option is targeted at broadcasters interested in BTSC stereo, SAP and HDTV transmissions.

Circle (382) on Reply Card

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Circle (85) on Reply Card

Continued from page 122

Monitor setup device, options, paint system enhancements

Barco Industries has introduced the following products:

- The BI light probe, an optional unit for use with CVS series broadcast monitors. The integral memory of the probe permits copying of setup information from one CVS monitor to another to simplify the task of color-matching a group of video monitors. In addition to standard calibration settings, memory slots are available for three custom monitor settings. Other options available for CVS monitors include a high-resolution dot-in-line CRT with a 0.31mm pitch, PAL/simple-PAL/delay decoder, audio module and input modules for digital or component format video.
- Three additions to its Producer computer graphics equipment. The Creator 2600 links a paint station to Wavefront 3-D animation software for video, film or high-resolution print outputs. The Frame Grabber works off-line through an Ethernet connection with analog and digital EBU-standard video to import images into the

system. The Vectoriser analyzes scanned images to obtain geometric information for creation of 3-D imaging of logos and other objects.

Circle (376) on Reply Card

Audio recording processor



Dolby Laboratories has announced the model 363 switchable SR spectral recording and type A noise-reduction unit. Two channels in the single-rack-unit package include integral record/playback changeover switching, allowing one 363 to serve for stereo recording applications. Front-panel switching selects SR, type A or no processing with independent controls for each channel. Interfacing to other equipment is accomplished through

transformerless, electronically balanced inputs and outputs.

Circle (377) on Reply Card

VHF TV transmitters and video/graphics workstation

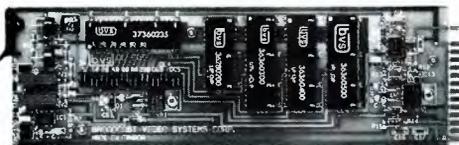
Harris has introduced the following products:

- The Platinum series of solid-state VHF TV transmitters comes in power levels from 1kW through 60kW. The transmitters feature solid-state power-amplifier modules, multiple power supplies and visual PA cabinets, distributed cooling system, transmitter control, visual/aural exciter and user display.
- The Vws 1000 video/graphics workstation provides image management, processing, storage and retrieval of still images in a single, integrated video system. The digital system offers a relational database with a high-speed 32-bit processor that can identify, catalog, manipulate and retrieve images from any on-line sequence.

Circle (378) on Reply Card

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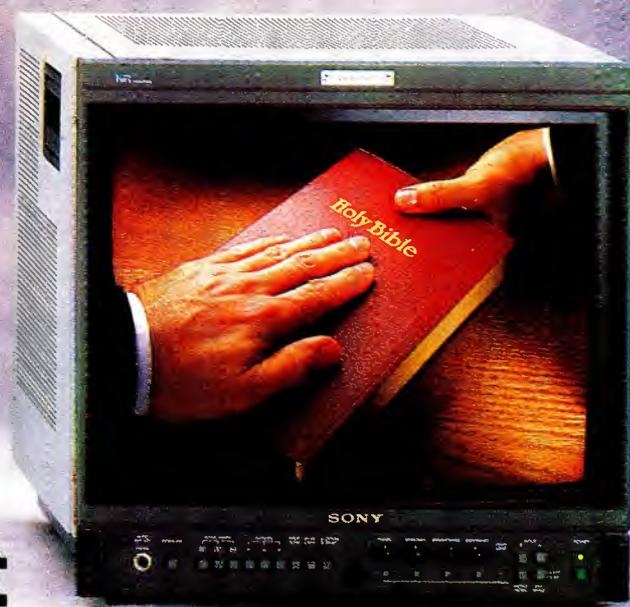
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BROADCAST PRODUCTS

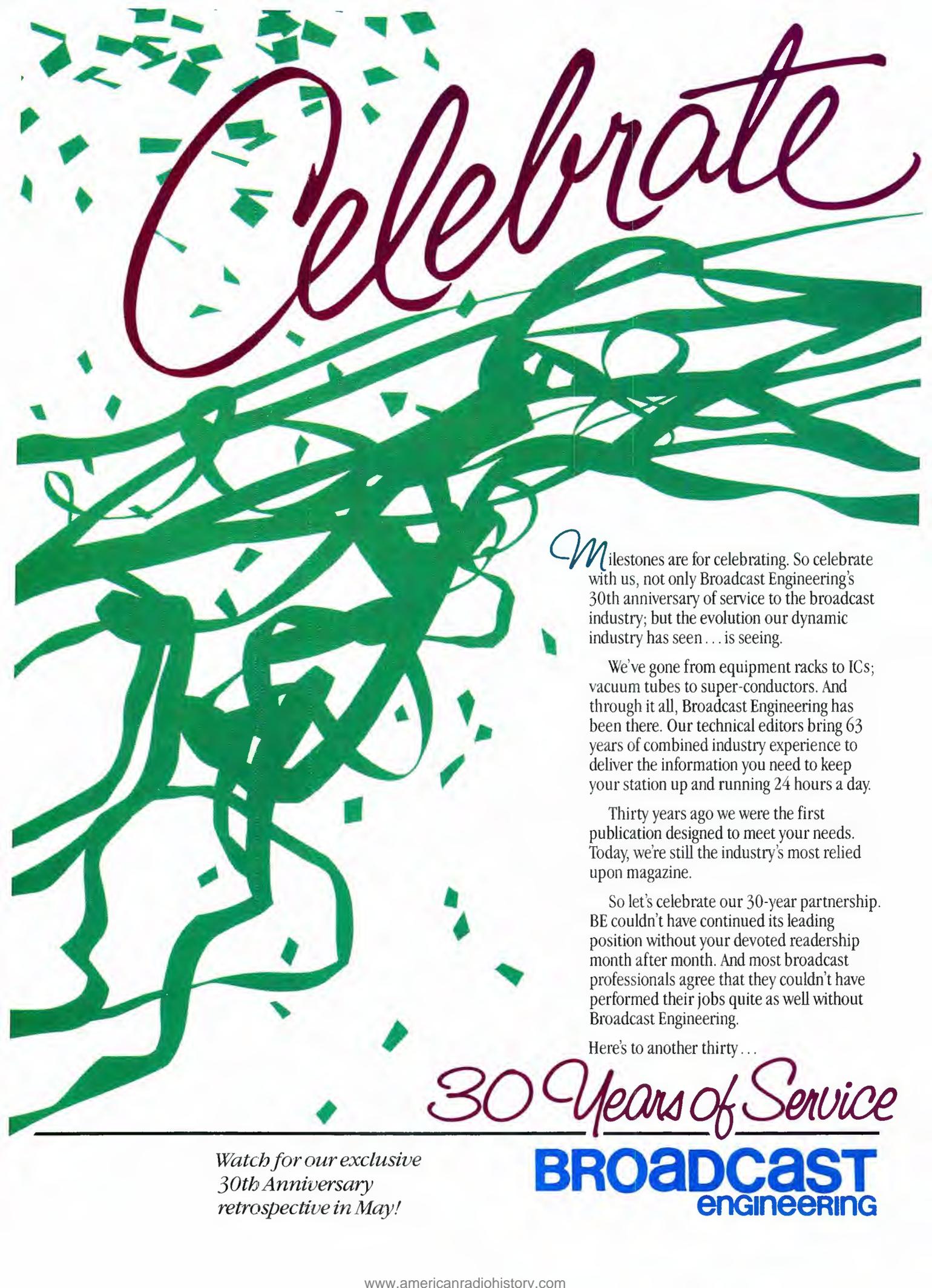


When it comes to evaluating your picture, you need the whole truth and nothing but. Monitors that show you just what you're producing. With all its beauty and all its flaws — down to the tiniest bit of noise or artifact.

You need SONY broadcast monitors. The 19-inch BVM-1910, or a 13-inch monitor, the BVM-1310 or the BVM-1315. They bring you the best possible reproduction of the actual signal. The most faithful and detailed.

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Add to that the best convergence and geometry you can



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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 . . .

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Circle (83) on Reply Card

ENG audio cables

Audio Services has introduced the ENG Duplex audio cable in standard lengths of 15 or 25 feet and custom lengths. The assembly includes two individually shielded audio lines, each with XLR-3F and XLR-3M connectors, plus a monitor return line with stereo mini-connectors. The cable connects the stereo output of an audio mixing panel with the audio inputs of a camcorder and returns a headphone feed, permitting the sound operator to listen to the confidence head of the VTR.

Circle (372) on Reply Card

Audio power amplifier

Carver Corporation has introduced the PM-100 Magnetic Field power amplifier for broadcast and sound-reinforcement applications. The system features high-efficiency linear tracking, fully complementary output stage and clipping eliminator circuits, front-panel metering, series/parallel mono capability and a stereo headphone jack.



Circle (373) on Reply Card

CD cart player

Denon America has introduced the DN-950FA CD cart player for radio station applications. Compact discs played in the machine are enclosed in plastic cartridges that protect the discs from scuffing, dust, dirt and fingerprints. A shutter on the data side of the cart is opened automatically as the cart is inserted into the player. The system's transport mechanism is more rugged than those in previous models to better withstand the wear and tear of radio station environments.

Circle (374) on Reply Card

Ku-band TWTs

EEV has introduced the type N4290 traveling-wave tube amplifier for satellite news-gathering applications. Operating in the 14GHz-14.5GHz spectrum, the amplifier produces an output of 270W from a single cabinet that measures 7"×19"×24" and weighs 66 pounds. Options include a weatherproof case, remote-control and monitoring equipment, a computer interface and phase combiner for applications using two units.

Circle (375) on Reply Card

Continued on page 126

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Circle (84) on Reply Card

Close-up zoom lens

Audio Video Supply has introduced a zoom lens for close-up video using a C-mount. The lens mounts directly to any 2/3-inch tube or CCD camera, allowing a working distance range between 4.5 inches and 12.75 inches. At a 5-inch distance, maximum magnification covers a 5/16-inch square, and the wide-angle coverage is 1 3/4-inch square.

Circle (368) on Reply Card

Multipair audio cable

Belden Wire and Cable has announced a range of multipair audio snake cables for interconnection of audio components in broadcast and recording facilities. Individually jacketed and shielded pairs protect against signal loss in configurations from 4- to 32-conductor pairs. Each pair includes 100% coverage with Beldfoil, PVC jacketing and polypropylene insulation. Conductors are 22AWG (7x30) stranded, tinned copper. A loose-tube construction increases cable flexibility, and inner jacketed pairs include numbers for easy identification.



Circle (369) on Reply Card

UPS systems

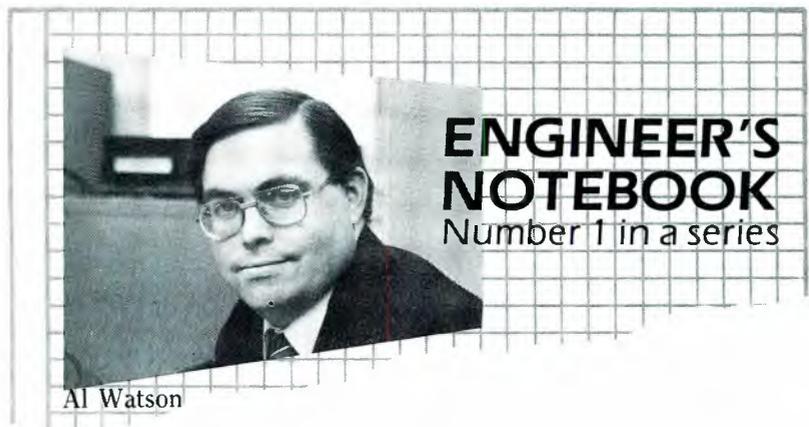
Best Power Technology has announced the 350VA and 750VA units to the MICRO-FERRUPS series of uninterruptible power-supply systems. The units provide intelligent and automatic communications between the UPS unit and the load being supported through an integral microprocessor and RS-232 port. PowerWatch software in the supported computer enhances interactive communications.

Circle (370) on Reply Card

Time base corrector

Fortel has announced the Super-Pro 110 time base corrector with compatibility for S-VHS applications. 5.5MHz bandwidth Y/C processing is available for PAL S-VHS signals as well as high- and low-band U-matic and HET processing for PAL composite signals. Format transcoding can be accomplished simultaneously with signal time base correction.

Circle (371) on Reply Card



N/DYM™ Technology Comes to Broadcast Microphones

By Alan Watson, Director of Engineering
Electro-Voice, Inc.

Those familiar with the benefits enjoyed by musicians through the new neodymium-magnet microphones have no doubt predicted that the new technology would soon be available in broadcast microphones. And now, with the advent of the Electro-Voice RE45N/D hand-held shotgun microphone, the prediction has come true.

The advantages N/DYM™ technology brings to broadcasting are significant. Above all, it gives us a microphone with the high output previously available only from condenser mics—but without the problems of dead batteries, noises caused by poor ground connections in phantom-powering, humidity damage, static electricity, and poor rf rejection.

The Alnico magnets used in most dynamic mics yield a sensitivity of 6 dB less than would be possible if the steel parts of the magnetic structure could be completely saturated with the field. Increasing the Alnico magnet size does not work since the added size interferes with the acoustic design of the mic. Neodymium magnets, however, are so powerful that the magnet can be far smaller and still provide the "lost" 6 dB of sensitivity.

N/DYM Technology extends far beyond a mere substitution of magnetic material. To maximize the new opportunities, Electro-Voice engineers found that the ideal neodymium magnet shape is one with a thin, wafer-like configuration.

This permitted using a voice coil and attached dome of far larger diameter while reducing the surround—yielding important added advantages for broadcast engineers: a smoother, more evenly contoured pickup pattern with extended high- and low-frequency response and better rejection of unwanted noise from the sides.

For more information, please write to us for the specification sheet and brochure on the RE45N/D—the broadcast industry's first N/DYM dynamic shotgun microphone.

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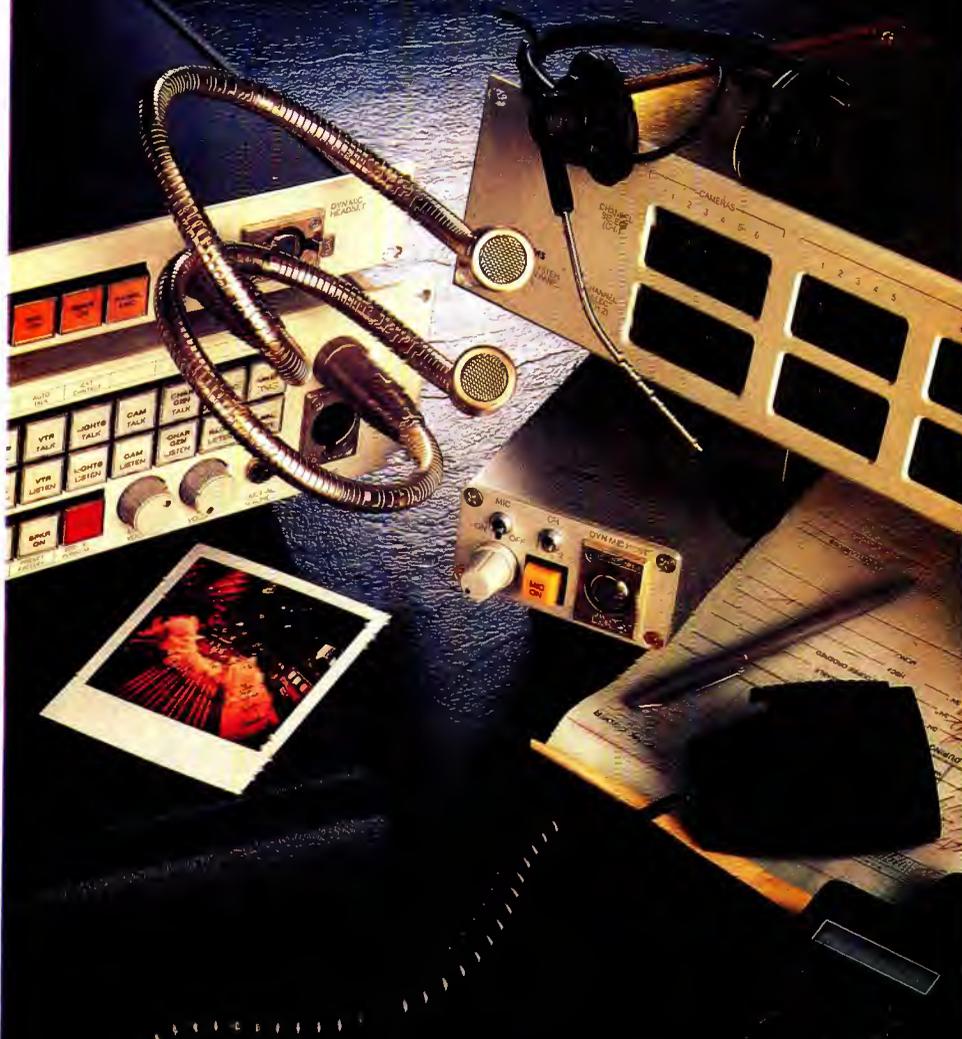
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Circle (371) on Reply Card

High-power load

Altronic Research has introduced the OMEGALINE 75100B dummy load. The unit is designed for continuous duty at 100kW of RF power with a reflective power ratio less than 1.5:1 up to 800MHz. Water cooling requires a flow of 12 gallons per minute.

Circle (364) on Reply Card

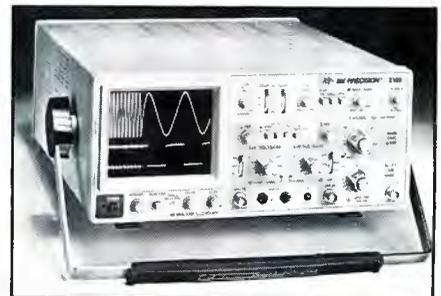
Digital audio test system

Audio Precision has announced the DSP-1 digital signal processor enhancement for its System One test system. The enhancement provides digital waveform generation and a programmable digital analyzer, allowing tests and measurements to be accomplished in either the analog or digital domain. The analyzer is capable of numerous functions through downloadable software. Used with System One, the unit expands measurement capabilities to include FFT-spectrum analysis, individual harmonic distortion and total harmonic distortion without noise.

Circle (365) on Reply Card

Wideband oscilloscope

B&K-Precision has introduced the model 2160 portable oscilloscope that offers a 60MHz bandwidth with 1mV/div sensitivity. Viewing of two signals that are unrelated in frequency is possible with V-mode, and a dual time base offers calibrated sweep times and 19 delayed sweeps. A 10X magnifier allows closer examination of waveforms while maintaining display calibration. Other features include a curve-tracing component tester for out-of-circuit tests, front-panel X-Y operation, a Z-axis input and an output to drive a frequency counter.



Circle (366) on Reply Card

Dynamic microphone

Milab and *Klark-Teknik* have introduced the Milab D-37 dynamic cardioid microphone. Constructed of solid brass, the mic includes a shock-mounted, moving-coil element and integral pop protection.

Circle (367) on Reply Card

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DELTA-GUN, THE TOP OF THE LINE.

Asaca's delta-gun/shadow mask monitors, 20" CMM20-11 and 14" CMM14-11 provide the most accurate reference for color imagery with superior horizontal resolution. The geometric structure of the delta-gun configuration backed by precise convergence circuitry gives you ultra-sharp dynamic focus, adjustable from the front, across the total CRT surface.

The delta-gun monitors include switchable high performance comb filter and aperture correction. And, with digital sync circuitry, no adjustments are required.

Optional extras include NTSC, PAL and SECAM capabilities, switchable from the front (20" model) and RGB, YIQ, BETA and M-II plug-in modules.

Asaca delta-gun/shadow mask monitors, the true measure of performance.



\$7,695⁰⁰ *The delta-gun/shadow mask CMM11 series is the standard in professional broadcast monitoring. The delta-gun CRT provides the most accurate reference for color imagery with superior horizontal resolution.*

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\$6,500⁰⁰ *Exceptional picture quality and low price tag make the in-line CMM26-7 ideal as a broadcast master monitor, test signal monitor or in fixed or mobile teleproduction facilities.*

Asaca's 26" CMM26-7, 20" CMM20-7 and 14" CMM14-7 are designed for use in Master Control, teleproduction facilities and post suites as well as quality assurance. These in-line monitors incorporate many of the design and engineering features of our delta-gun monitors. You can switch between video input signals, internal or external sync, picture size or HDL/VDL with the touch of a single button.

Free *To receive your free copy of the Asaca/Shibasoku full line catalog simply circle the appropriate number on this publications reader response card.*

LAST, BUT NOT LEAST.

Just what you've been looking for, our 9" CM99A high resolution CRT. Compact and side-by-side rack mountable, the CM99A is perfect for mobile applications or plugging into those tight quarters where high quality signal monitoring is essential.

The CM99A standard features include two NTSC and one RGB input, plus audio input and loudspeaker.



\$3,145⁰⁰ *The lightweight compact 9" CMM99A is ideal for mobile use or applications where you need to rack up a lot of monitoring in very little space.*



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BECAUSE YOU BROADCAST MORE THAN BELLS

If there's one thing Asaca/Shibasoku is known for, it's building the finest video monitors, bar none. Asaca's reputation has been earned by producing real world monitors that give you a full range of features to meet real needs. Though Asaca/Shibasoku monitors continually incorporate the latest technology, it is always appropriate technology and not bells and whistles. From the compact 9" CM99A to the new 16:9 Delta Gun HDTV monitors, you always get what you paid for: flawless high resolution, brilliant color imagery and rugged performance.

OUR NEWEST HIGH RESOLUTION MONITORS.

The new 15" CM43 and its larger counterpart, the 21" CM23, in-line dot matrix monitors is equally at home in a broadcast or production facility as it is in a manufacturer's test line or computer graphics system.

You get a variety of input selections: including NTSC, RGB and Y/C. The flat square CRT has a semi-tint glass offering you wider contrast range and black levels that are truly black.

You get high quality comb filters, high stability feedback clamp circuits, H/V delays, pulse cross and scanning size selections. The CM43 and CM23 neatly put Asaca's high performance into a very economical package.



\$4,200⁰⁰

The new CM43 (15") and CM23 (21") flat screen monitors incorporate legendary Asaca/Shibasoku quality and performance into a very economical package.

Contact treatment

D. W. Electrochemicals has introduced Stabilant 22, a polymeric, non-conductive material that becomes conductive under the force of an electrical field or when used in a narrow gap between metallic conductors. The material also possesses lubricant properties. Suggested uses are on switch contacts, connectors, IC sockets and card-edge connectors to produce more secure electrical contacts.

Circle (360) on Reply Card

Logging, switching system

Radio New Zealand Engineering has announced CLASS, a PC-based logging and audio-switching system. An RS-232 connection controls a 64x64 audio matrix as well as additional relays and control circuits. With a parallel printer attached, the system monitors and logs security, fire and transmitter status.

Circle (361) on Reply Card

Playback monitors

Tannoy has introduced the PBM 6.5 and PBM 8 reference studio monitors for mix-down, dubbing, editing or quality-control listening. Both units include a polyamide dome tweeter for a response to 20kHz and a rear-tuned port enhanced low response to 57Hz (6.5) and 47Hz (8).



Circle (362) on Reply Card

Routing switcher

Broadcasters General Store has announced the Sine Systems News Director, a microprocessor-controlled program audio and monitor routing switcher for the central control unit of a radio news workstation. The 16x2 format uses analog CMOS switching and incorporates automatic level control, speaker and headphone amplifiers, clock and event timer, a recorder start function and automatic dub function. It can be used as a tabletop system or mounted in a 19-inch rack.

Circle (363) on Reply Card

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Circle (69) on Reply Card

March 1989 *Broadcast Engineering* 117

New products

Digital audio automation

Tennaplex Systems has introduced the Music Manager, a digital audio automation system that controls up to 16 (per computer card) multisc compact disc players or DAT machines. The system lets you categorize and keyword your entire music library, protect any of the menu items or playlists, store playlists of floppy disk, print

playlists or any part of your database.
Circle (500) on Reply Card

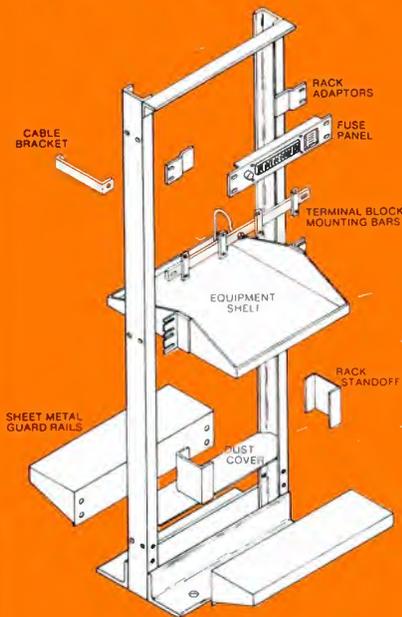
Lighting fixtures

DEDOTEK has introduced the DEDOCOOOL high-intensity lighting fixture for high-speed filming or high-speed video of small objects. The light has enormous light concentration with very little heat

development. This is achieved by two heat-reflecting filters and a lamp with a heat transmitting mirror. The reflected heat is then deflected by two ventilators. The fixture is a low-voltage system (24V). It features a transformer/control unit with two outputs for two light heads. There is a switch to regulate three steps of light intensity.

Circle (501) on Reply Card

NEWTON Equipment Racks



For versatility and ease of installation, Newton Equipment Racks are the first choice of many Central Office designers. They are backed up by a complete selection of accessories. And, Newton will custom tailor racks and components to meet your unusual needs. Here are some more reasons why you should specify Newton Racks in your design.

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Circle (80) on Reply Card

Camera-mounting and support equipment

Vinten Broadcast has introduced the following products:

- Additions to its MICROSWIFT remote camera control system include the Tracking Pedestal, compatible with the Mark 4 and Mark 1, Mark 2 and Mark 3 pan and tilt heads. Self-contained internal circuitry eliminates studio clutter and operational limitations.
- The Mark 7A fluid cam pan and tilt head is designed for studio and remote applications, with a counterbalance system that ensures perfect balance throughout a tilt range of $\pm 60^\circ$. Other features include 11 inches of fore and aft adjustment of platform for simple horizontal balance, wide cam track, improved fluid drag system, new adjustment knobs, new captive pan bar and a 200-pound capacity. The system includes a 3/8-inch bolt fixing to camera, single full size pan bar and clamp assembly and base fitting to pedestal and/or tripod.
- The Vision Pedestal is a pneumatic pedestal for lightweight cameras. It features a 16.5-inch column movement that allows an operable height range anywhere within 25 inches to 58 inches, a 44-pound carrying capacity and a self-charging system for easy payload adjustment. The telescopic column detaches from the base, which is easily folded and features a carrying handle, castoring wheels with fixed tracking facility, independent brakes and cable guards.

AS-101 AUDIO SWITCHER

- Illuminated and legendable control buttons
- Instant or overlap switching
- Front panel accessible level controls
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- Plug-in screw-clamp terminals

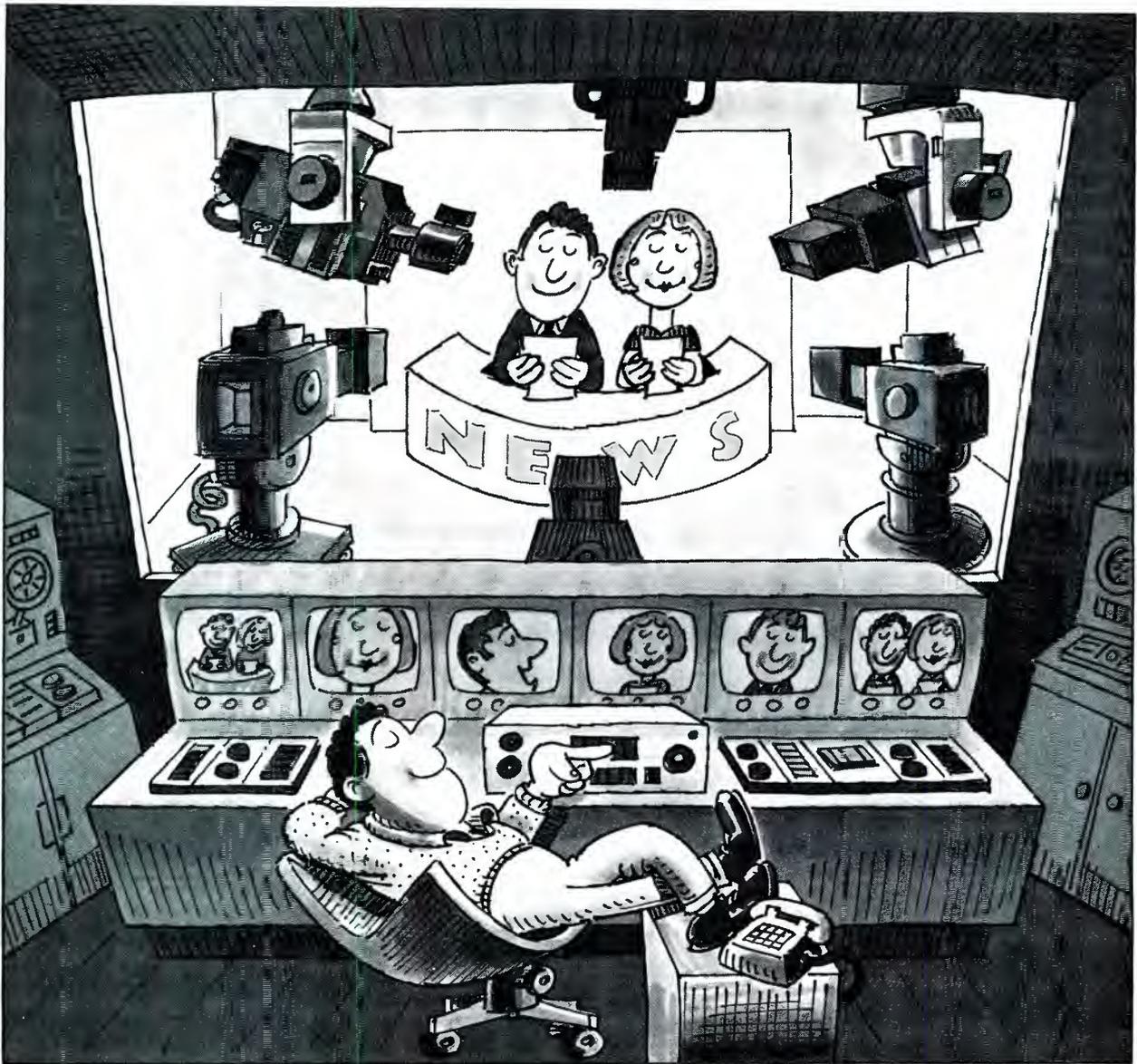
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Circle (502) on Reply Card



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- Ability to zoom and focus
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- Wide range of control options, from panels with multiple-shot memories to simple joy stick remote controls.

It's flexible, affordable—and it's sold and serviced exclusively in the U.S.A. by A.F. Associates.

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Circle (79) on Reply Card

Turner expands capabilities

Turner Broadcasting/WTBS, Atlanta, has made a further commitment to live stereo production and satellite distribution with the purchase of a 48-channel digitally controlled virtual console system from AMS/Calrec. The primary application of the console system will be for complex live stereo production, such as major sporting events, and for distribution via multilocation satellite links while perform-

ing simultaneous multiple mixes. Turner also has ordered an AMS AudioFile hard disk recording/storage/editing system for use in a new post-production suite.

Revox selects Ampex audiotape for recorders

Ampex, Redwood City, CA, has been chosen by REVOX ELA AG, a European tape recorder manufacturer, to be the supplier of tape for its new generation of

audio and instrumentation tape recorders.

Under a joint agreement between the companies, Ampex is supplying REVOX with the tape it will market alongside its audio and instrumentation recorders.

Ariel moves to new headquarters

Ariel has moved its headquarters from New York City's SoHo district to Highland Park, NJ. The address is 433 River Road, Highland Park, NJ 09804; telephone 201-249-2900; fax 201-249-2123.

Bogner sells land-mobile antenna line

Bogner Broadcast Equipment, Westbury, NY, has sold its line of high-performance land-mobile base station antennas to Celwave, Marlboro, NJ. Bogner will concentrate solely on its line of TV broadcast antennas.

Equipto offers simplified order form

Equipto Electronics, Aurora, IL, is offering a simplified quote/order form to be used with its Challenger and solid-system vertical and sloped-front cabinets.

The engineer can check boxes on the form to designate standard sizes and options needed or write in special sizes and custom requirements. Cabinet colors and laminates also are easily selected.

The form was developed to be helpful to engineers who are not familiar with all the available accessory or assembly options, but who need to specify an electronic enclosure.

FM Acoustics acquires Precision Cable Technology

FM Acoustics, Waedenswil, Switzerland, has acquired Precision Cable Technology, Switzerland. Precision Cable Technology is the supplier of Forcelines precision signal-transfer cables. The company will operate under the FM Acoustics brand name.

LPB announces its sale

LPB, Frazer, PA, manufacturer of audio consoles, studio furniture and low-power AM transmitters, has been purchased by Edward W. Devecka Jr.

Lowel-Light moves

Lowel-Light Manufacturing has doubled its office and factory space with a move to the Brooklyn Army Terminal, a renovated national landmark building in New York. The address is 140 58th St., Brooklyn, NY 11220-2516; telephone 718-921-0600; fax 718-921-0303.



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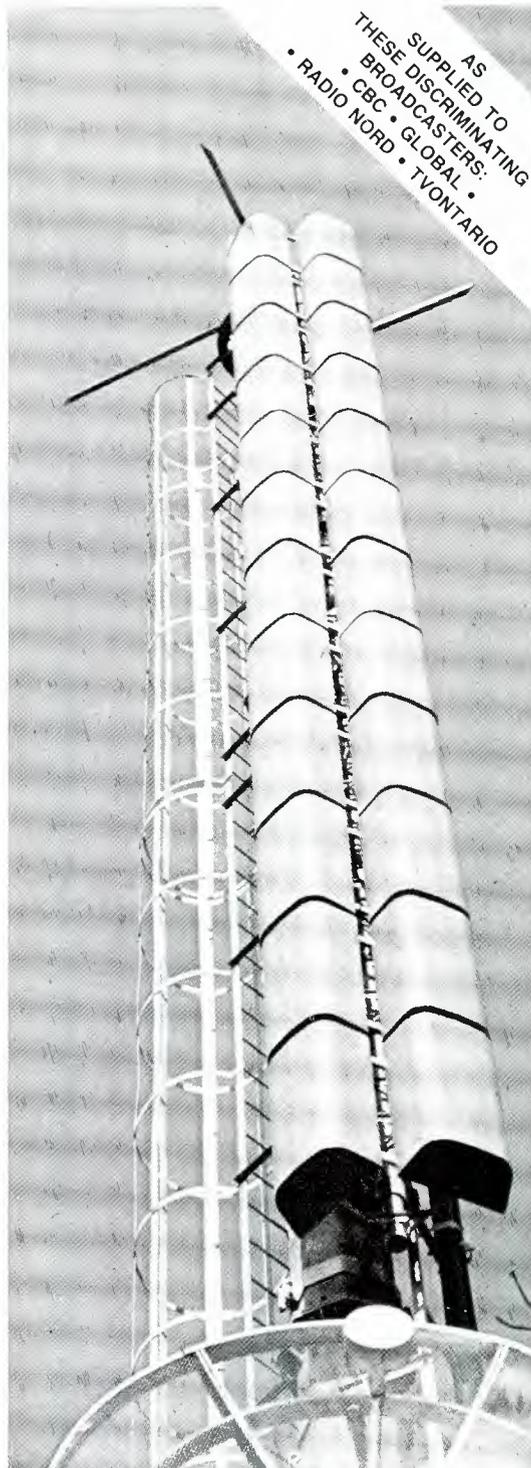
Cables, connectors for any power rating and any EIA standard.

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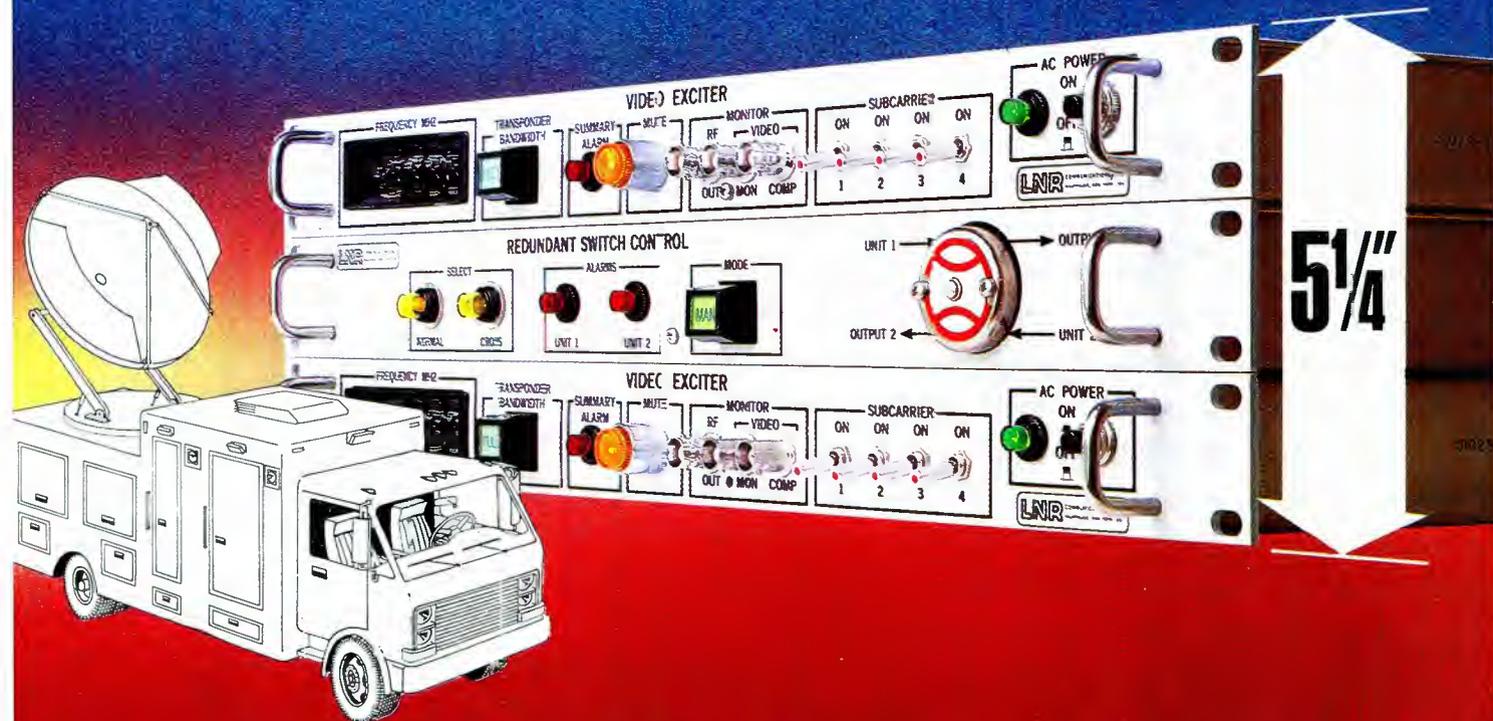


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LNR hasn't sacrificed quality in bringing you a compact video exciter. The model LVE-14 uses a highly integrated Ku-Band RF section, together with proven, reliable video circuitry to provide RS250B performance. And, for the first time, you can go from full to half transponder operation at the press of a button.

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Bernard L. Freeman has been named national customer service manager at Agfa-Gevaert, Ridgefield Park, NJ. He is responsible for the company's regional distribution centers.

Dr. Per V. Bruel, co-founder and director of Bruel & Kjaer Industri A/S, Naerum, Denmark, has been presented with the Silver Medal Award from the Audio Engineering Society (AES). The award was presented in recognition of outstanding development or achievement in the field of audio engineering. Bruel was recognized for his contributions to and continued refinement of microphones used for acoustical measurements.

Don Livinghouse has been named product manager at Pinnacle Systems, Santa Clara, CA.

Forrest Rees has been appointed president and CEO of Sound Technology, Campbell, CA.

Steve Kerman has been named managing director of all international sales in the Americas Pacific Area for Tektronix,

Beaverton, OR. He is responsible for all sales and service activities in the Pacific Rim, Central and South America, South Africa, India, Israel and Canada. He also is responsible for international sales and marketing operations in the United States.

Barry Samuels has joined DYMA Engineering, Albuquerque, NM, as a technical sales specialist. He is responsible for the sale and integration of Sony video equipment.

George R. Swetland has been appointed marketing manager for EECO/Convergence, Santa Ana, CA. He is responsible for direct sales development and support for all national marketing of the company's post-production editing systems.

George Stage has been appointed director of engineering for Orion Research, Cleveland, OH.

Daniel D. Roberts and **Barbara A. Koalkin** have been appointed to positions with Digital F/X, Mountain View, CA. Roberts is vice president of sales opera-

tions worldwide. He is responsible for sales and service of the company's digital post-production system. Koalkin is director of marketing. She is responsible for developing markets for the company's video technology.

John L. Barker has been appointed U.S. sales and marketing manager for Ross Video, Ontario, Canada. He is responsible for the marketing of products in the United States. This includes liaison with existing dealers, as well as the appointment of new dealers and the establishment of OEM agreements with broadcast and teleproduction system houses.

Osamu Tamura has been named vice president of Sony Professional Audio Division. He will operate out of the Teaneck, NJ, office. He is responsible for the strategic growth and direction of the division and will coordinate sales, marketing and product development activities.

David L. Orr has been appointed general manager of Quanta Editing Products, a wholly owned subsidiary of Quanta, Salt Lake City.

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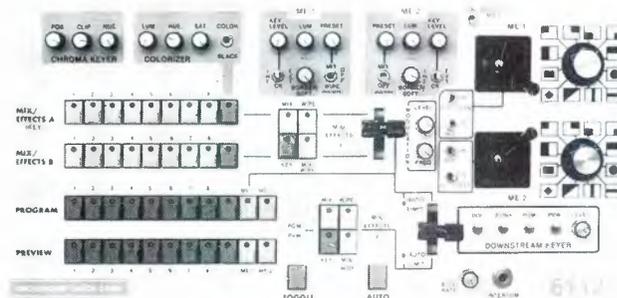
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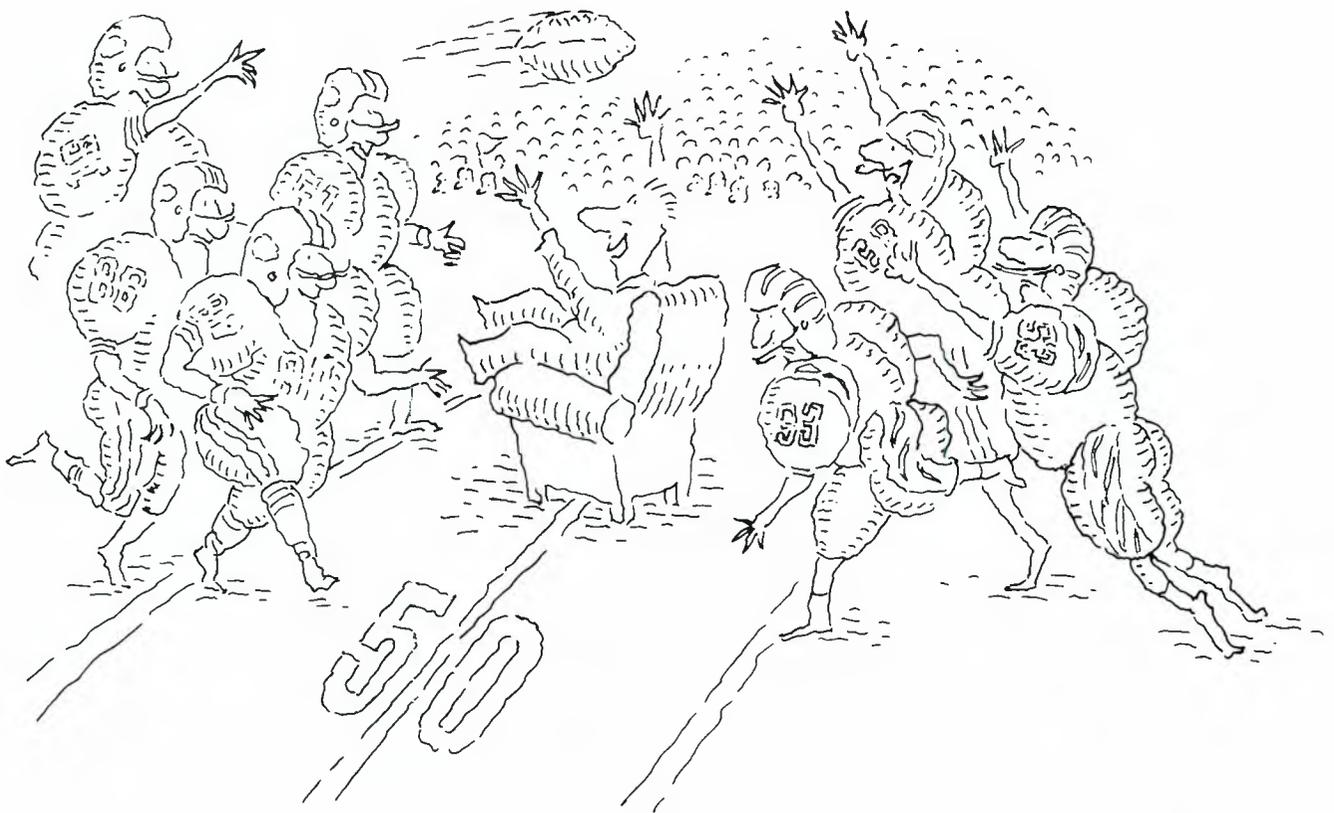
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March 1989 *Broadcast Engineering* 111

News

Continued from page 4

operations technician in 1980 and was named broadcast engineer in 1983, a position he held until 1986, when he was named engineer in charge.

A former engineering intern at Hewlett-Packard, Colorado Springs, CO, and a junior engineer at the Naval Sea Systems Command and the Federal Aviation Administration, Williams has a bachelor's degree in Electrical Engineering from Howard University, Washington, and is a member of the Institute of Electrical and Electronics Engineers and the Society of Broadcast Engineers.

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Spec Book update correction

An error appeared in the "1989 Buyer's Guide/Spec Book Update," on page 145 of the January issue. Under the heading, "Video Processing Systems," the manufacturer name should have been *Grass Valley Group*. We apologize for any confusion this may have caused.

Main article continued from page 30

tasks better, more efficiently, and with fewer errors. Don't let today's operational practices, which are based on tube technology and low labor costs, direct your thought process. Instead, pretend that departments, unions and entrenched people and practices don't exist, and determine whether there is a better way to operate your facility. Ask yourself whether any of these changes could be incorporated into the present structure. New technical facilities often can provide the needed vehicle for major administrative changes.

Don't try to hide the planning process from the staff. Be open about it, and discuss the necessity and advantages of changing practices. If you don't, you run the risk of creating a morale problem. People often perceive automation as a threat to their jobs. This doesn't have to be the case if you begin planning now and implement on a controlled basis. You might find the most creative ideas coming from crew members. After all, they know their job best.

A computer can't yet run the entire station. The tasks are complex, and the software and hardware do not exist. Some of the issues are only now being addressed. Even so, the basic building blocks already are available. And it's probably safe to

assume that purchasing these devices now will enable you to interconnect them to a plant or newsroom automation system later. Meanwhile, your station will enjoy the advantages of improved efficiency, reliability and reduced costs.

The automation process is much easier when initiated by the engineering manager, especially when you consider the alternatives, such as hearing the general manager or finance folks say it's time to cut — now.

Editor's note: Appreciation is expressed to Doug Hurrell of Alamar and Bill Keegan of Odetics for their help in the preparation of this article.

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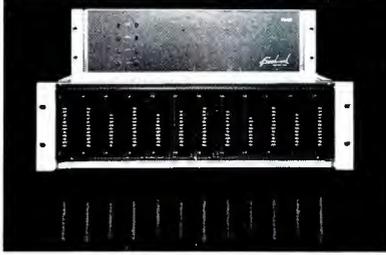
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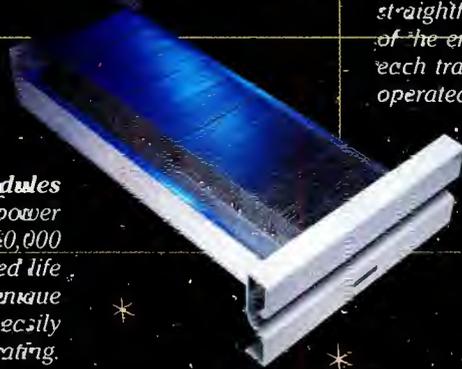
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Conservatively-rated, 1 kW visual and aural power amplifier modules with individual MTBFs of 250,000 hours are identical and interchangeable. For extended life and reliability, each high-stress module features a unique heat sink. "Hot-pluggable" modules can be changed easily and safely while the transmitter is operating.



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The transmitter shown is Harris' HT 30LS 30 kW low band solid-state model, configured with the optional spare exciter and 20% aural option.

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Creativity with camcorders

Of course, most images you will be presenting will not be stills. Some of the advanced consumer recorders displayed at CES have professional applications. The features and quality level of the new S-VHS camcorders and edit decks make them suitable as backups to your component 1/2-inch machines; they also serve as low-cost production systems.

On the home deck side, a number of manufacturers now offer S-VHS decks with jog/shuttle-type search knobs, flying erase

heads and internal or external edit controllers in addition to hi-fi sound and high-quality video. New in models shown at the CES was the inclusion of insert edit and preroll capability. Toshiba now offers such a model in the United States. Sharp and JVC demonstrated Japanese market models with these capabilities that are expected to be seen in the U.S. market before the leaves turn. With list prices of less than \$2,000, you'll pay a reasonable price for features you're used to as a professional.

When it comes to creating the material played back on these machines, you'll want to look into the new range of S-VHS

camcorders. Compact and inexpensive, they offer a quick way to provide footage when the Betacam or M-II is tied up, or when the situation is too dangerous to risk damage to a \$25,000-plus component recorder.

Consumer camcorders shown for the first time at the CES included full-sized VHS and S-VHS models with on-board edit interface, programmable insert edit capability and built-in narration mics that let you record commentary over existing audio tracks. A new, low-profile S-VHS-C camcorder was shown that is perfect for news stories that preclude the use of a visible camera. More consumer camcorders offer 8X lenses as standard equipment, and light requirements are getting lower and lower.

During the past year, the consumer camcorder market has seen substantial growth in the popularity of the compact 8mm format, and its fortunes are due for a further boost with the pending introduction of the high-band 8mm format. This format extension will give 8mm the quality of S-VHS and beyond, making it suitable for use by non-news-department members, by stringers and in hidden camera applications. At this show, however, the format was limited to carefully staged "by invitation only" demonstrations off the convention floor. It was not seen in actual operation.

The new format is, however, expected to be on extremely public display at the summer show. This is one with definite potential for tight budget applications, and you might want to wait to give it a look.

Great expectations

The equipment on display at the Winter CES reflected two facts related to the increasing quality of consumer electronics gear. First, many items that were once "consumer only" are now decent enough to be used in professional applications if you shop carefully and understand the limitations of the equipment.

Second, consumers now have the ability to receive your broadcasts on devices that are better than many that were considered studio-quality only a few years ago. That leads to ever-increasing pressure on your facility to maintain and improve the quality of the signals you broadcast. Keep your signal quality up and consumers will keep on watching, but let it slip and you may find your ratings slipping too.

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Debate continues on licensing issue

By Bob Van Buhler

The SBE continues to address the issue of state licensing or control over broadcast engineers. SBE director, Dane E. Ericksen, P.E., is the contact person with other licensed professional engineers. Both he and Chris Imlay, counsel, represented the society on a panel discussion at the Seattle chapter's regional convention. The session was titled, "Ramifications of Doing Telecommunications Engineering Without a Washington State Registered Professional Engineer's License."

Conflicting viewpoints

The central issue was the validity of requiring a professional engineer's license to perform telecommunications engineering work. As most such spirited discussions are inclined to go, this one resulted in little agreement.

The panel reviewed the situation of J. Milton Scovill, a career telecommunications engineer. Scovill retired from a Northwestern telephone company and began working as a telecommunications consultant. He was essentially doing the same work on a contract basis that he once did for salary while employed by the public utility.

He was challenged by the Washington State Board of Registration, which questioned his right to perform these duties without being licensed as a professional engineer in Washington state. Scovill cited a Washington state civil action, *Martin vs. TX Engineering* (Court of Appeals of Washington, June 2, 1986), which appeared to draw a legal distinction between electrical engineering and electronic engineering. Scovill denied the evidence of clear legislative intent to regulate electronic engineering. Washington state registrar of engineers, Alan Rathbun, also a panelist, disagreed on the applicability of the *Martin vs. TX Engineering* case.

Ericksen report

Ericksen developed a report that contains the following conclusions:

- There is no crisis situation. There is no interest in regulating radio or TV operators

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



or contract chief operators.

- Most SBE members performing engineering duties are exempt from registration based upon the exemption provided for employers and manufacturers.
- The National Society of Professional Engineers has applied concerted pressure to enforce state registration requirements. Ericksen sees nothing wrong with this stepped-up enforcement.
- It is not necessary to hold an engineering degree from an accredited institution to become a professional engineer. Qualifying experience may be substituted when accompanied by successful completion of an engineering fundamentals examination and a professional engineer's test. The tests are available in approximately 19 fields of specialization. Successful completion of these tests will allow registration as a professional engineer.
- The FCC's elements III to IV are not comparable to the engineering fundamentals or professional engineering examinations.
- There is no evidence of abuse by state registration boards.
- New Mexico's Senate Bill No. 8 does appear to warrant SBE action. The bill contains the traditional exemption for employers, but the exemption expires in 1993. This could mean chief operators and other broadcast engineers would be required to become professional engineers to work in New Mexico.
- Ericksen thinks there is a need to add a telecommunications engineer category to the professional engineering exams.
- Despite the lack of hard evidence, Erickson recommends the safe approach, which includes requesting that the commission file a declaratory ruling regarding federal pre-emption of radio operator licensing. Furthermore, a declaratory ruling from the Texas Board of Regulation should be sought regarding the use of the term engineer in job titles and on business cards.

Executive committee action

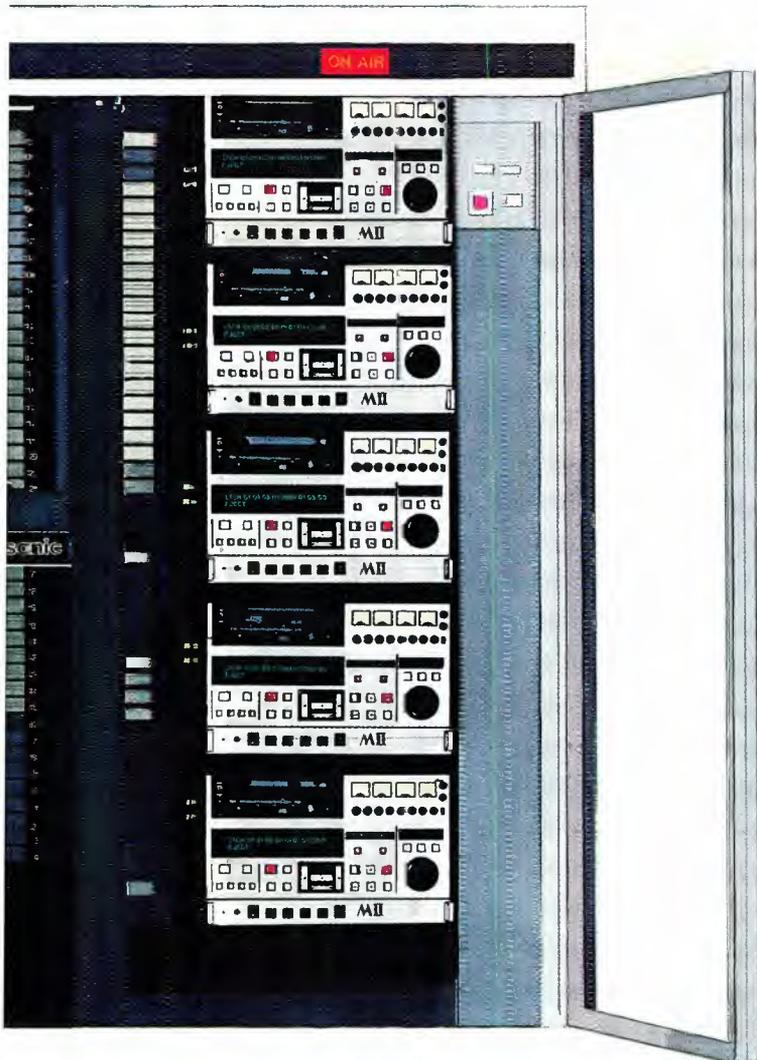
The SBE executive committee met Jan. 12, and developed a tentative policy statement on the professional licensing of broadcast engineers. The policy includes the following elements:

- Federal laws, including the Communications Act of 1934, assign authority to license all aspects of the broadcast engineer's normally accepted duties to the FCC. Even though the commission no longer licenses radio and TV operators, it has never implied that the authority to do so has been surrendered to the states or to any other jurisdiction.
- Licensees of broadcast radio, TV or cable entities are responsible for the proper legal, safe and interference-free operation of their respective facilities. As such, these companies are responsible for evaluating and accepting or rejecting the credentials of personnel who install, service and operate their equipment.
- Generally accepted industrial certification programs, such as SBE certification, are a useful means of determining the quality of training and experience of broadcast technical personnel.
- The SBE recognizes that certain areas of professional activity related to the broadcast industry are separate from the discipline of broadcast engineering. Among these are electrical, mechanical and structural engineering, which rightfully remain the province of the professional engineer.
- In accordance with the custom and practice of the broadcast and cable industry, the installation, maintenance and operation of broadcast-related electronic equipment is the proper domain of the broadcast engineer and technician. This includes audio and video design, acoustical specification and the preparation of technical statements for submission to federal agencies. The work may include manufacturer engineering and design processes and field testing. It also may include the engineering work involved in siting and application for remote pickup facilities and point-to-point Part 74 facilities.

See next month's "SBE Update" for further details of this tentative policy statement.

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BY 500kHz, FILLED UP	BY SEGMENTS, ADD ONE MONAURAL STL	BY SEGMENTS ADD ONE COMPOSITE STL			

Table 1. Under the segment-allocation scheme, more stations can obtain access to the needed STL frequencies.

new allocation scheme. The monaural STL is moved from 947MHz down to 946.875MHz. The required bandwidth remains the same. This now frees sufficient spectrum to install a stereo composite STL at 947.1750MHz.

The example is fictitious, but it illustrates the advantage of the new allocation method. Depending on local use, the segment allocation method has the potential for increasing the number of STL systems by 25% or more. Such an allocation scheme also helps new users and those stations desiring to upgrade equipment or add stereo to identify usable frequencies.

Special permission

Unfortunately, because the order implementing this frequency-assignment method has yet to be activated, the old method of STL frequency assignment remains in effect. However, the Auxiliary Services Branch, on a case-by-case basis, can issue waivers permitting allocation under the new method.

If you want a frequency under the segment-allocation method, a waiver request must be submitted along with form 313. The request must carefully explain and justify the use of the 25kHz segment method. Simply submitting a form 313 that

shows the desired frequency is not acceptable, and it will only delay your license approval. When filing form 313, remember to submit an original and two copies, along with \$75. Call the FCC Auxiliary Services Branch at 202-634-6307 for information.

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The Art of Image Control

Living by the rules

By Ron Balonis

Broadcasters live by the rules — the FCC rules. Although we may not agree with all of the regulations, most of us recognize the importance of having a set of rules by which to operate our stations. It is the only way to maintain an orderly, efficient and fair broadcasting environment.

In some cases, however, the rules are not what they appear to be. As an example, let's examine some rules that are published, but not yet in effect. This is the case with the ones in section 74.502, which concern STL frequency assignments.

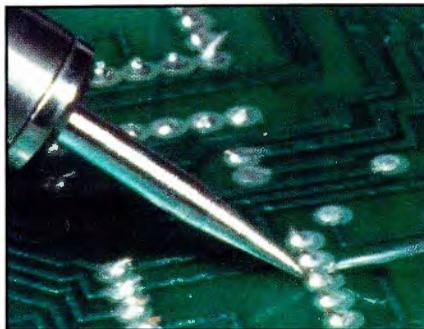
Read the fine print

The 1987 Code of Federal Regulations (CFR), section 74.502, outlines the new method for STL frequency assignment. There's nothing to indicate, fine print or otherwise, that this rule is not now in effect. But it isn't. To know that this rule is not yet operative, however, you'd have to either hear about it directly from the FCC or read it in the Federal Register (FR Vol. 50, No. 228 11/26/85, page 48598, paragraph 29) or the FCC Reports (102 FCC 2d 940, 1985).

The report and order that culminated in the STL inquiry is contained in MM Docket 85-36; FCC 85-588. Appendix B of the report details a new method of STL frequency assignment for section 74.502. Unfortunately, there is a small caveat relating to the full implementation of the rule changes.

Paragraph 29 of this report and order states: "It is further ordered that Part 74 of the commission's rules is amended as set forth in the attached Appendix B, to be effective on the date specified in a future order to be issued by the chief, Mass Media Bureau, indicating that appropriate computer programs are available for implementing the new rules." What that 53-word sentence means is that the new allocation method is in place, but it cannot generally be used. The 1988 edition of the CFR is supposed to set out the existing version of section 74.502, as well as the not-yet-in-effect revised section.

Let's review exactly what the new rules are and how they can be used to help relieve congestion in the STL band. To



help make the most of this information, refer to "Planning an STL System," page 116 of the October 1988 issue.

The new rules

With more than 3,000 STLs in operation, the biggest problem usually is finding a clear, non-interfering frequency. Currently, the STL band extends from 944MHz to 952MHz. The current STL frequency-allocation scheme divides the band into 15 500kHz channels. Section 74.502 was amended, after much debate, on Dec. 16, but it is not yet in effect. It divides the band into 320 25kHz segments. The idea behind this new allocation method is to stack the 25kHz segments to form channels with an as-needed authorized bandwidth. The result is an increase in spectrum efficiency and room for more STL systems.

The revised rules state, "A single broadcast station may be authorized up to a maximum of 20 segments (500kHz total bandwidth) for transmission of program material between a single origin and one or more designations. The station may lease excess capacity for broadcast and other uses on a secondary basis, subject to availability of spectrum for broadcast use. However, an FM station licensed for 12 or fewer segments (300kHz total bandwidth) or an AM station licensed for eight or fewer segments (200kHz total bandwidth) may lease excess capacity for broadcast and other uses on a primary basis."

The rules continue, "An applicant (new or modification of existing license) may assume the cost of replacement of one or more existing licensees' equipment with narrowband equipment of comparable capabilities and quality in order to make available spectrum for its facilities. Existing licensees must accept such replacement without cost to them except upon a showing that the replacement equipment does not meet the capability or quality requirements." In other words, use only as much spectrum as needed for your STL.

New equipment capability

The bandwidth required by an STL system depends upon two main factors:

the design technology of the equipment and the type of STL system being configured — monaural, dual-channel or composite. Because of the sensitivity and selectivity of today's STLs, less bandwidth is needed for a given configuration and capability.

The new rules increase STL spectrum efficiency through two avenues. First, stations are encouraged to use new STL equipment. Second, stations are encouraged to cooperate at the local level through cooperative spectrum-coordination efforts.

Even with these changes, the search for a non-interfering STL frequency can be a difficult task. Even frequency reuse with different polarizations and highly directional antennas sometimes is impossible. In many locations, the number of users simply exceeds the number of available frequencies. Some relief is possible under the new allocation method.

Allocation scheme

Table 1 illustrates an allocation map for a portion of the 950MHz STL band under both the current and proposed ways. Let's examine how the new allocation method could provide additional capability.

A dual-channel STL for an AM stereo station is located on 946.5MHz. The system consists of two transmitters offset from channel center by ± 125 kHz. The entire channel, therefore, occupies 500kHz, or 20 segments. A single-channel STL is located on 947MHz. It occupies 200kHz or eight segments. Finally, a composite STL for a stereo FM station is located on 947.5MHz, which occupies 300kHz or 12 segments.

The left side of the table shows spectrum use under the old (but currently enforced) 500kHz-per-channel allocation method. The middle column, using the segment-allocation method, shows the addition of another monaural STL system (200kHz, eight segments) at 947.2250MHz. The other licensees were not affected. Note, however, that under this scheme, it was not possible to add a composite stereo STL. The band could accommodate only the monaural STL.

The right column shows how a stereo composite STL could be added using the

Balonis is chief engineer at WILK-AM, Wilkes-Barre, PA.



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- Weather/news printing systems, EBS alert systems.
- Satellite receiver site.
- Dedicated tower light beacon, emergency lights.
- In conjunction with a generator to make transfer to auxiliary power transparent to equipment and staff.

Table 1. Typical broadcast applications.

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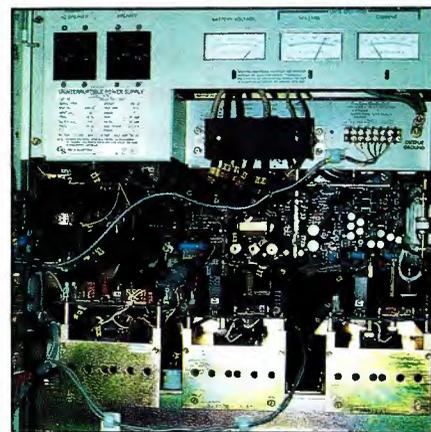


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UPS for our Phoenix station. The unit was used to power a computer that was on the air counting down to a new format for a week. The supply worked flawlessly. For testing purposes, we disconnected the computer's ac power many times to see how it would react. It was a great feeling to know that the computer never glitched.

Other options for backup power include generators, which can be temperamental at times but run much longer, and the less expensive SPS (standby power system). The SPS type of supply operates with batteries, but only comes on-line with the loss of power. Unfortunately, the switch time (2ms to 10ms) can be long enough to create problems for some equipment. In addition, an off-line SPS may not regulate or condition the power as well as a true UPS does.



The front-panel metering provides immediate status indication. The battery compartment is shown mounted below the control cabinet.

Could your station effectively use a UPS? It may be easier to justify the purchase of one than you think. Could power problems cause you to lose data that would be difficult to recover? Have you replaced or repaired equipment because of voltage spikes, sags or surges? Does your station lose listeners or viewers because you cannot broadcast during an outage? What about lost revenue from missed commercials? All these factors must be considered to justify the cost of backup power systems.

We were glad to have the chance to review this product. It was loaned to us for evaluation and for this report. After using it, we decided to buy it and install it permanently.

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.

In essence, these reports are prepared by the industry and for the industry. Manufacturer support is limited to providing loan equipment and to aiding the author if support is requested in some area.

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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.



XBR U-matic[®] cassettes, for instance, feature a molded-in anti-static cassette shell and components to reduce transient dropout potential by neutralizing static charges. Combine this with base film that's been given Sony's exclusive Carbonmirror[™] back coating and dropout potential is reduced even further.

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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Buchanan-style terminal strip that is easy to access. The UPS cabinet is designed to rest on top of the battery compartment, but the cabinets may be separated, if necessary.

Power the load

One of the first questions to ask when looking at a UPS system is, "How long can the device power my equipment?" The chart in Figure 2 illustrates the amount of time the batteries can provide power under different load conditions. The 3kVA UPS will supply 1kW of power for a minimum of 70 minutes. Under a 2.5kW load, the UPS will supply slightly more than 20 minutes of power.

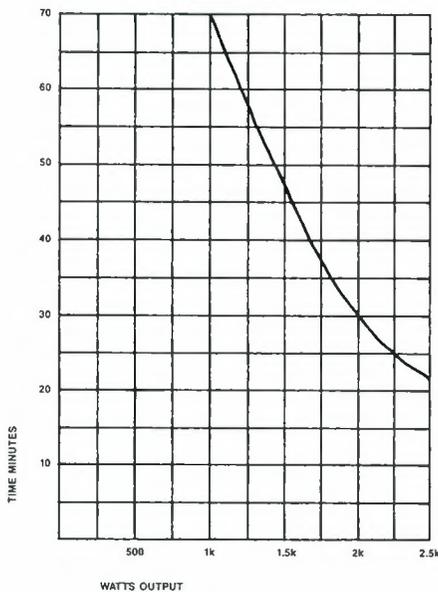


Figure 2. The length of time the UPS can supply power to the load depends upon the battery capacity and load requirements.

Because the typical power outage is brief, the type of protection provided by the UPS should be adequate. It definitely helps out with the short interruptions produced by lightning strikes, storms, heavy usage brownouts or when the power company switches grids.

A UPS system is not inexpensive. In addition to the purchase cost, there is the operational cost. When you total all these factors, you probably will decide that not every device in the station has to be powered by a UPS.

Determine what equipment within your station must be supplied with continuous power. This essential equipment should be separated from less important equipment and placed on dedicated ac circuits. These circuits then can be fed by the UPS. Table 1 lists some areas in which a UPS might prove useful.

Installation considerations

Several things should be considered before installing a UPS system. The first

stumbling block is local fire and electrical codes. Because batteries can explode, and require ventilation, consult your local fire department and building codes office regarding applicable regulations. The batteries used in the Sola UPS are sealed and should not create problems, but it is possible that one may leak gases.

It also is a good idea to involve an electrical contractor with these plans. The contractor will be aware of codes and can recommend the best way to interface the UPS with your electrical system. A licensed electrician also can help ensure that your installation is safe and meets all local building codes.

When planning for the installation of a UPS, consider providing a maintenance bypass switch. This switch should take the UPS completely out of the ac circuit so it can be maintained or checked without causing a loss of power to the equipment connected downstream.

Also consider the heat and noise that a UPS generates. Not only is ventilation needed for the batteries, but also for the heat generated by the SCRs. Although a great amount of heat is not generated, the UPS should not be mounted in a tightly closed closet.

UPS systems can be noisy when the SCRs are working. It's a good idea, therefore, to install the device away from locations where people must work. The dangerous voltages inside the cabinet are another good reason to locate the UPS where untrained personnel cannot obtain access.

Service and documentation

Everything inside the Sola UPS is quite accessible, and the circuits are straightforward. The device has extensive sensing and control logic circuitry, which adds to the accuracy and reliability of this equipment.

All the unit's circuit boards are interconnected by Molex-type connectors. This makes it easy to remove a section of the circuit for repair. Many of the components, such as capacitors, transistors and SCRs, are off-the-shelf items, which makes replacement easier.

The UPS provides two front-panel meters that indicate inverter output voltage and current. These meters are operational when either the power company or the batteries are supplying power. A third meter shows how much voltage the battery charger is supplying to the batteries. It normally should read 135Vdc. The batteries are rated at 120Vdc with 28Ah capacity. Two meters on the battery enclosure display the battery voltage and the charge-discharge current. The meters provide an immediate report of the device's operational status.

A protective feature of this UPS is a static transfer switch. The switch can

manually or automatically transfer the incoming power around the rectifier/inverter circuit if it fails. It can also transfer power for maintenance purposes. (This switch does not, however, completely bypass the UPS for servicing.)

Three boxer fans are used to cool the unit, and an air filter protects the internal components from dust and dirt. The air filter should be checked as often as a transmitter filter.

The Sola UPS has large doors in the front and back that open wide, making it easy to work inside. The doors have keyed locks to keep out unauthorized personnel. The manual provided with the UPS and battery assemblies is written more for an electrical than a broadcast engineer. Even so, the schematics and parts lists are complete and easy to follow.

Practical application

A unique situation at our facility warrants the use of a UPS. The AM/FM studios are located two blocks away from our backup FM transmitter site, which also acts as our STL transmit point. Both the main FM and our AM transmitter sites are fed from this point. The satellite and RPU receivers also are located at this site. (See Figure 3.)

The total amount of current drawn by the equipment is approximately 600W. Installing a 3kVA UPS provides us with two important features. First, adequate provision is made for additional loading in the

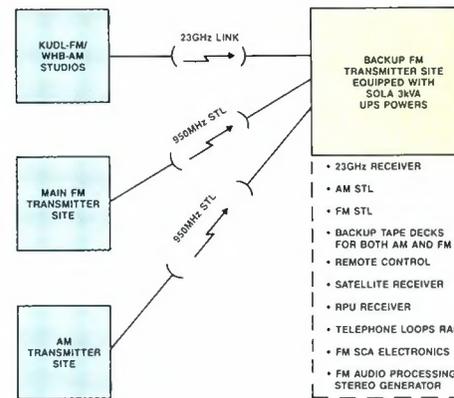


Figure 3. The KUDL-FM/WHB-AM installation relies on a UPS-equipped relay point.

future. Second, by drawing only 600W, we can expect our battery reserve power to last for at least 90 minutes. Although this site has regular power interruptions, we've never been without service for hours. This makes the UPS ideal for our installation.

Plans call for additional backup power systems. The combination of a generator and 15kVA UPS for the studio will take place in the next couple of years. That system will power the critical equipment located there.

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Sola 3kVA UPS

By Chris Ostrander

Every broadcaster fears the loss of ac power. Whether for a moment or for several hours, loss of ac power can cripple a broadcast operation. Unfortunately, this is one element we can't control. A way to minimize power-loss problems, however, is to use an uninterruptible power supply (UPS) system.

A true UPS system is designed to supply power to critical equipment by use of batteries during an outage. A UPS also conditions the incoming power source against voltage fluctuations, line noise and voltage spikes. Note that a UPS system can supply backup power only for a relatively short period because of the limited capacity of the batteries.

The UPS is not a replacement for a fuel-powered generator, which can provide power for hours or days. For many applications, however, it is the perfect solution to power outages. For our tests, we examined a Sola 3kVA UPS under actual operating conditions.

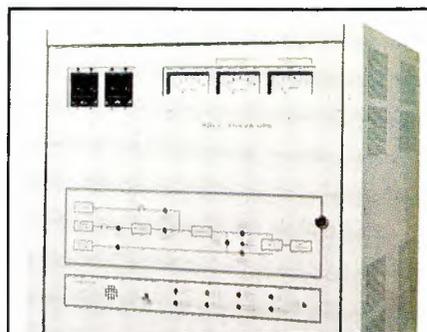
Power conversion

A double-conversion UPS takes the raw ac power source, converts it into regulated dc, then inverts it back to ac, which feeds the critical load. As shown in Figure 1, the primary ac line feeds the rectifier/battery charger. This technique, through the use of SCRs, accomplishes two things. First, it provides regulated dc power simultaneously to the dc/ac inverter. And second, it charges the batteries.

If the primary ac source fails, the batteries take over the job of feeding the inverter. Because the batteries always are connected to the dc bus, the transfer is totally transparent. The equipment powered by the UPS is unaffected by the change. This is extremely important to many devices such as computers and other microprocessor-based equipment. A few milliseconds of power loss is like a lifetime to a computer.

Another piece of equipment affected by short outages are RF amplifiers. Once their circuitry senses a brief interruption of power, many of them begin a power-up sequence, which looks for exact frequency lock (AFC). This process on a 950MHz STL

Ostrander is chief engineer at KUDL-FM/WHB-AM in Kansas City, MO.



Performance at a glance

- True double-conversion uninterruptible power supply (UPS)
- Zero switch time from ac power to battery
- 120Vac, 60Hz, 25A output
- 20+ minutes reserve time at full load, 90+ minutes at one-fourth load
- Inverter provides sine wave with maximum 3% single harmonic distortion, maximum 5% total distortion
- Regulated output voltage $\pm 2\%$
- Operational status provided by front-panel meters and LED indicators
- Nine remote alarm and battery-condition indicators

transmitter may take up to 10s or more — plenty of time for your listeners to find another station. The whole point of using a UPS is to eliminate the possibility of computers crashing or equipment failing through the loss of ac power, which might take you off the air.

System configuration

At first glance, the Sola UPS system might look a bit large to do what it does. However, upon further inspection, its quality construction and design are impressive. The basic supply is available in many configurations such as 120Vac or 240Vac for either 50Hz or 60Hz operation. The unit we're using is configured for 120Vac, 60Hz. It draws a maximum of 38A. Maximum load current is 25A.

The UPS is a bit inefficient because of the power loss from the rectifier, battery and control circuits and through the heat dissipated by the SCRs. Just remember that the small additional monthly power bill may well be worth the protection the UPS provides.

The Sola UPS system has several features, one of which is its MIL-spec construction. It is well-designed and built with quality parts. An LED flow chart is located on the front panel, which is similar to charts provided on many transmitters. The display indicates the status of the internal circuits, including nine alarm/fault indicators that help with troubleshooting.

Alarm and battery-supplying power-relay contacts are brought out so they may be interfaced with a remote-control system. The input, output and battery terminations are connected with a

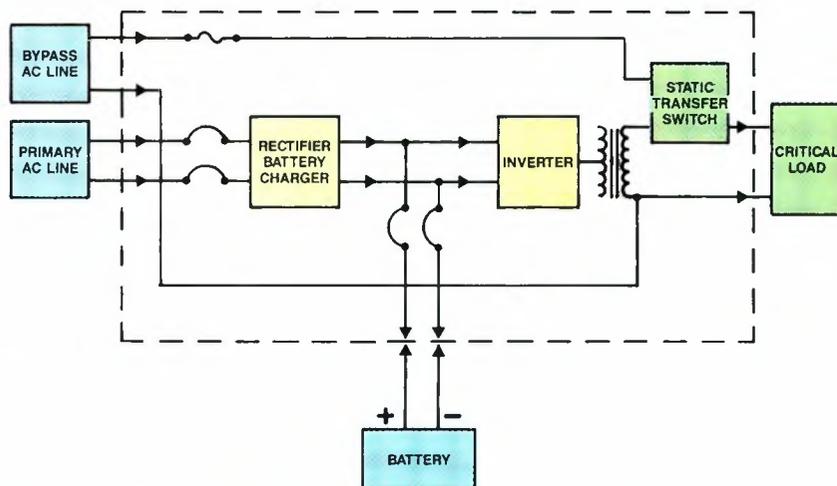


Figure 1. Basic UPS block diagram. This design has the advantage of continuous power-line conditioning.



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FA-420 TBC with Frame/Field Picture Freeze. Synchronizer TBC with DOC and VTR subcarrier. Show stopping performer.

FA-450 Transcoding TBC. Full frame transcoding, decoding and encoding component TBC. Gets the signs straight.

FA-440 Digital TBC with Video Effects. Full frame TBC for remote signal correction and synchronization plus digital effects. Throws a dazzling assortment of curves.

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Continued from page 86

Another advantage is that the digital STL could be inserted in any of three different places within the digital modulation scheme. Figure 5 shows where the STL could be inserted within the broadcast chain.

Also, because NCMO synthesizers can generate FSK, PSK, QAM, or any data communications signals, they can be employed in an STL system with excellent performance. Relay systems could be used without the inherent noise problems encountered with multihop analog systems.

Digital advantages

A completely digitized FM broadcast transmission system now can be con-

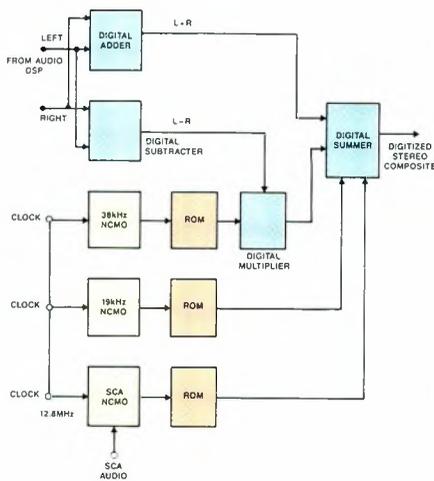


Figure 3. Block diagram of a DDS stereo generator. All signals are phase-locked to within 0.1°. Linearity is comparable to a 16-bit CD player.

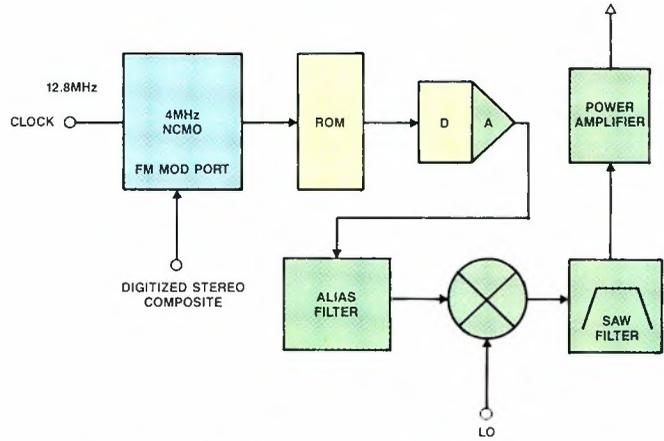


Figure 4. The final section of the FM exciter uses a fourth NCMO synthesizer operating at approximately 4MHz. Conventional power-amplification techniques are used after the SAW filter.

figured using DDS systems built around the NCMO. Because the final RF waveform parameters — amplitude, phase and frequency — are strictly defined with multibit resolution, the product will be as good as the defining digitized bits. Spurious signals within the bandpass typically will be -75dBc. System linearity typically is 0.003% THD. In addition, linearity will be independent of deviation, because the modulating waveform is adding or subtracting hertz deviation directly, not indirectly through a change in reactance.

The various phase relationships among the signals will be controlled within the constraints of the system's 16-bit resolution. The phase error will be so small that it would be difficult to measure with existing test equipment.

The NCMO modulation technique in DDS systems can produce highly accurate modulation waveforms. For the broadcaster, this means that the transmitted

analog signal can be as good as the digital audio source.

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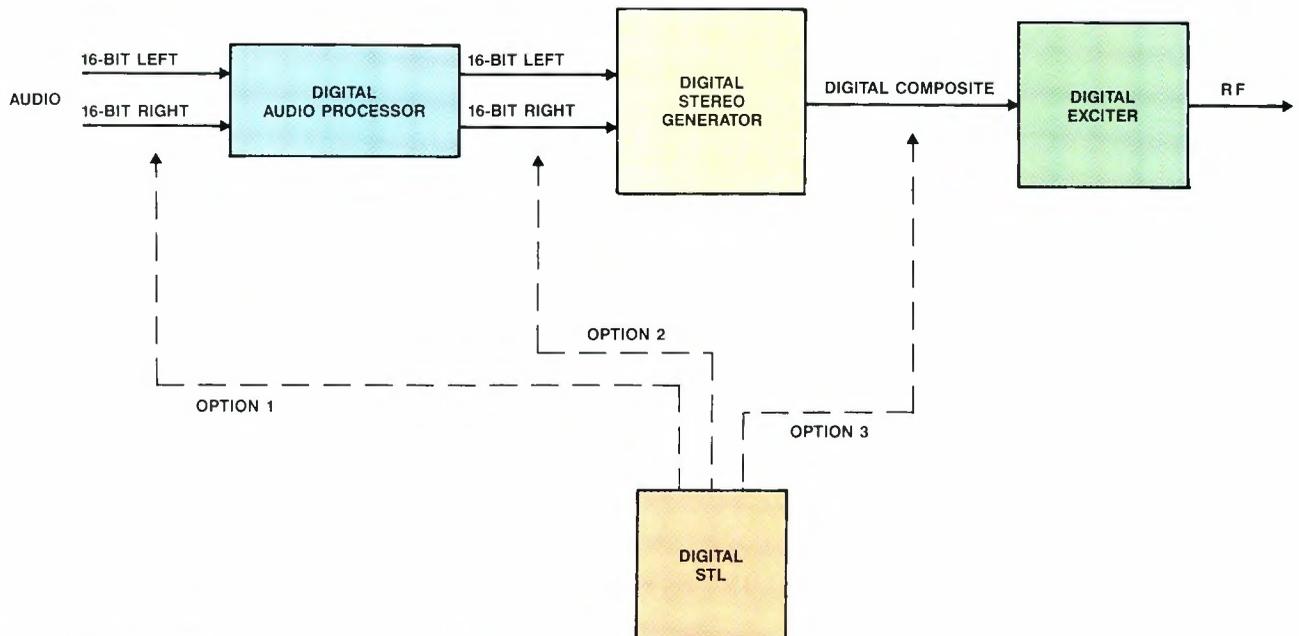
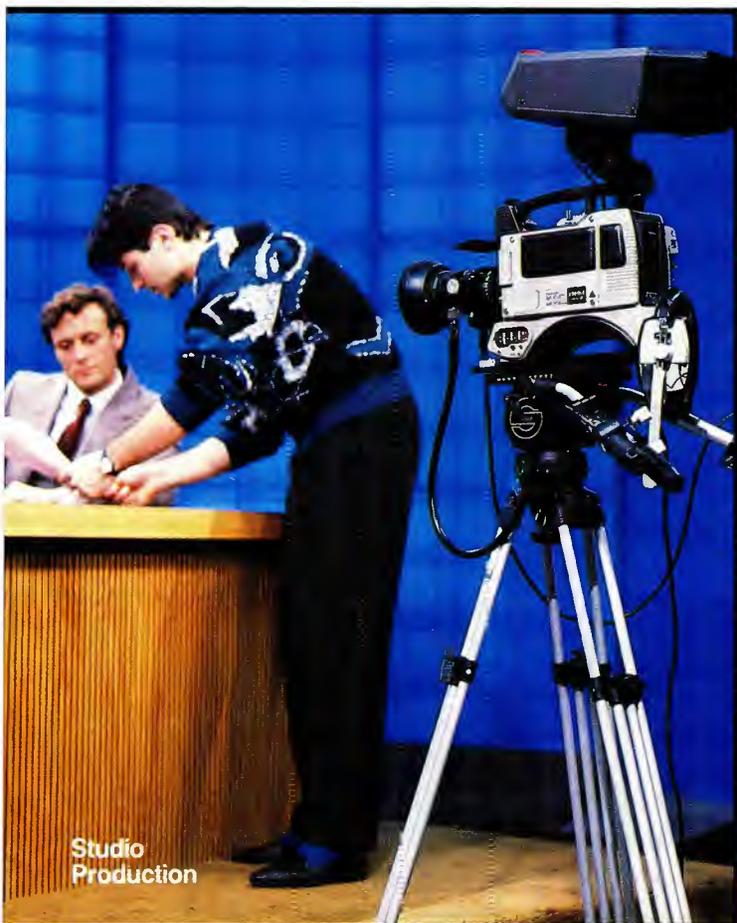


Figure 5. A digital STL could be used in any of three places within the broadcast chain.

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For video network applications, the Pro Series produces high quality images on both large projection systems and small screen monitors. With features like auto repeat playback for unsupervised presentations. And the system is upwardly compatible with standard VHS. So you can continue to use your existing library of recordings without any type of conversion.

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For editing and post-production applications, the Pro Series takes full advantage of the SVHS format as well. With easy to use features and high performance capabilities. Such as digital framing servo circuitry to provide highly stable edits. And time code input/output facilities for frame accurate editing. The Pro Series edit-

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For duplication, Pro Series monitors and VCRs provide you with the convenience and versatility of half-inch cassettes. And the performance of SVHS. When duplicating, you can maintain excellent picture quality thru component or composite signal transfer. And dub Hi-Fi audio simultaneously with the video signal. There's even a Pro Series cassette changer to help increase the efficiency of your duplicating system.

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phase of either signal is adjustable to 12-bit resolution (0.1°).

A third NCMO (or more, if desired) can be added as SCA generators. All subcarrier frequencies can be programmed to within 1Hz of resolution. The SCA program material also is digitized. The four digitized signals — L+R, L-R subcarrier, pilot and SCA — then are fed to a digital summer. The output of this summer is a digitized FM stereo composite signal.

Direct digital FM stereo exciter

Figure 4 illustrates the final stage of the DDS FM broadcast system. The digitized

FM stereo signal is fed to a fourth NCMO synthesizer operating at approximately 4MHz. A 2-pole alias low-pass filter with a 5MHz cutoff frequency precedes an up-conversion mixer.

The local oscillator frequency is chosen so the IF falls on the desired FM channel frequency. The desired FM frequency is defined by a SAW filter with a 500kHz bandpass. The SAW filter provides the needed image rejection and additional alias filtering. The wideband width of the filter reduces phase distortions to a minimum.

The filter is narrow enough, however, to

act as a frequency alias filter. This serves to smooth the discrete frequency jumps inherent in a sampled FM system. The effect is comparable to smoothing discrete amplitude steps in a sampled amplitude waveform. Aliasing works in both the frequency and time domains.

The digital input to the FM modulation port on the NCMO adds frequency deviation in an exactly linear manner. The peak frequency deviation (modulation) is, therefore, precisely defined by the digital modulating word. This design precludes the need for peak limiters. Power amplification and transmission stages follow and use conventional techniques.

Multiformat generator

The NCMO DDS system allows simultaneous AM, FM and PM of the carrier frequency. This permits a completely digital system to be configured for any of the stereo AM systems as well as for standard FM broadcasting. Indeed, any imaginable broadcast format (within Nyquist limitations) can be realized with the NCMO system. Multiple AM formats even could be programmed into a controlling ROM, and the desired AM stereo format could be selected by a single switch.

Using the NCMO with a digital STL would result in a noiseless program relay.

Continued on page 90

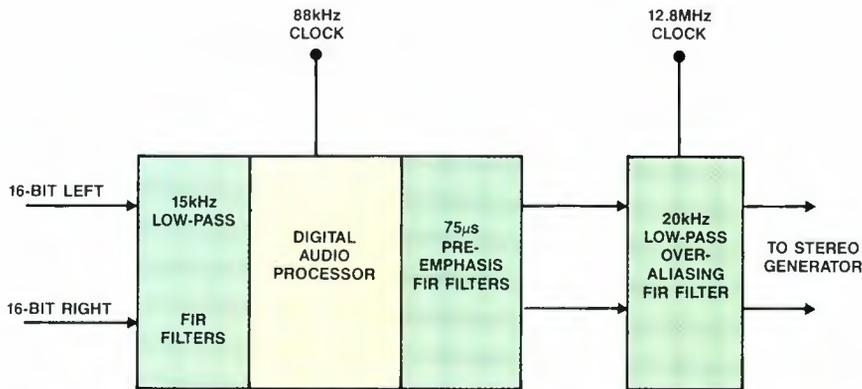


Figure 2. The audio-processing section of a digital exciter can be as complex as desired. The advantage is that both input and output signals remain in the digital domain.

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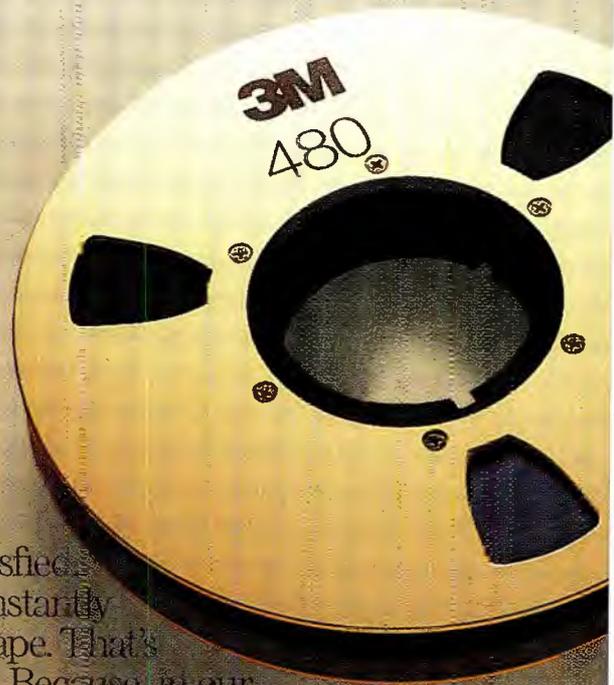
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Digital modulation using the NCMO

By Robert Zavrel

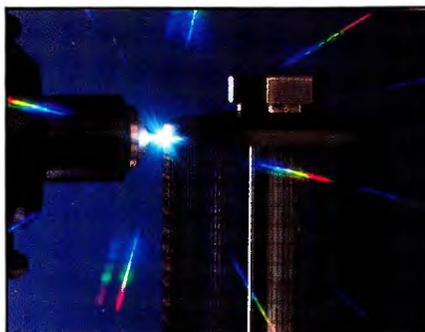
Broadcasters, for the most part, live in an analog world. Delivery systems, for now and the near future, will remain analog. Yet, much of the audio source material used in both radio and TV now originates from digital sources. So, although radio and TV engineers easily can obtain highly accurate audio sources, these signals must be processed with analog techniques before transmission. The analog modulation schemes used may limit the quality of the broadcast material.

Now, however, a method is available for developing compatible analog transmission signals while retaining the advantages of digital origination and processing. This technique is called *direct digital synthesis* (DDS). With advances in digital-to-analog converters (DACs) and large-scale-integration techniques, it's now possible to develop the basic equipment for digital AM and FM transmission systems.

Digital oscillator

The key to digitally produced broadcast signals is a *number-controlled modulated oscillator* (NCMO). The NCMO approach to DDS offers a range of applications possibilities.

Zavrel is a senior RF engineer with Digital RF Solutions, Santa Clara, CA.



The NCMO represents a highly integrated CMOS approach to the design of digital synthesizers. Only two other circuits — a waveform map ROM and a DAC — are required to produce direct digital synthesis. A major benefit is the high level of integration afforded by the NCMO, which simplifies the design of a completely digital stereo radio broadcast system.

Direct digital stereo generator

Recent advances in the DDS technology now permit digital techniques to be used up to RF frequencies. This allows digital techniques to be applied to the two remaining analog blocks in the FM broadcast chain: the stereo generator and the RF exciter.

An FM stereo exciter block diagram is shown in Figure 1. The circuit produces an analog signal consisting of the main-channel audio, subchannel audio, pilot signal and SCA signal at approximately 4MHz. This RF signal then is upconverted to the FM channel frequency, filtered, amplified and transmitted in the conventional manner.

An all-digital system can develop the same signals using NCMO techniques. The audio section of a digital stereo exciter is shown in Figure 2. *Finite impulse response*

(FIR) filters are used for the 15kHz low-pass and 75 μ s pre-emphasis circuits. Digital audio processing can take place after the low-pass filters and before the pre-emphasis filters, if desired. The details of digital compressor design within such a circuit is not within the scope of this article. However, it's important to note that peak limiting is not required. The final maximum frequency deviation will be controlled precisely by the numeric modulation technique.

Figure 3 illustrates the stereo generator portion of the exciter. The L+R and L-R digital signals are created with a digital adder and subtracter. The three digitized subcarriers (19kHz, 38kHz, 67kHz) are synthesized by three separate DDS circuits employing the NCMO technique.

The 38kHz subcarrier is digitally amplitude-modulated by the L-R signal. If a 16 \times 16-bit 4-quadrant multiplier is used, a digitized double-sideband, suppressed-carrier signal will be generated. The carrier rejection will exceed 80dB, and L-R subcarrier linearity will be comparable to a 16-bit CD player.

A second NCMO-ROM generates the 19kHz CW pilot. If the 38kHz and 19kHz DDS synthesizers are controlled by the same clock, they will be phase-locked. The

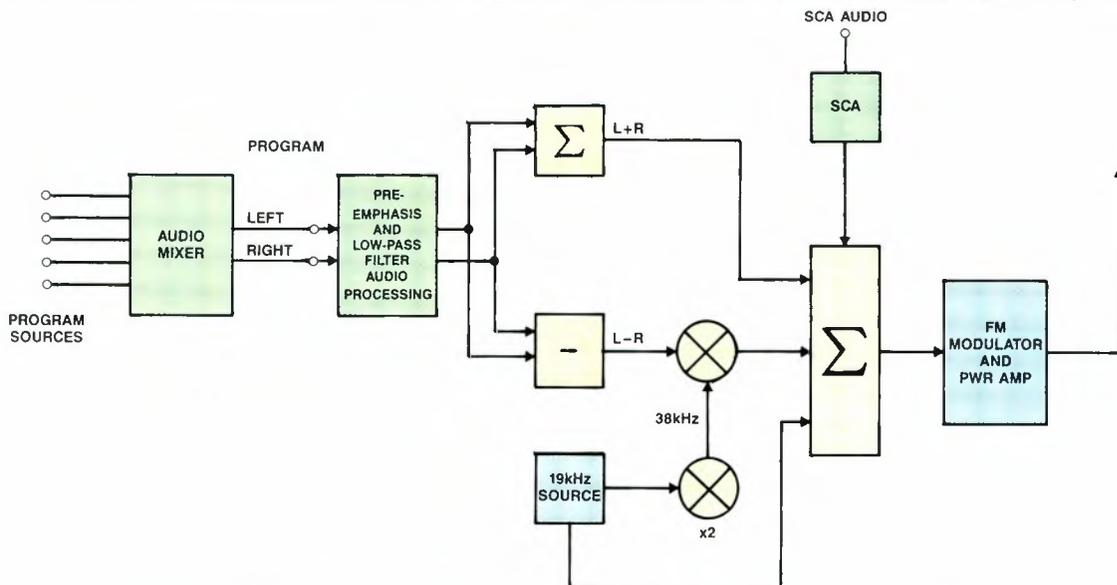


Figure 1. Today's broadcast exciters rely on analog techniques for the generation of stereo, SCA and RF signals. Shown is a block diagram of a typical FM exciter.

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If you can't wait for LCD sets, another encroaching technology is beam index display tubes. The construction of these display devices lets you fold them flat for thin, compact set design while affording a high-brightness display. Sony is using a version of this type of tube in a consumer clock radio, but has demonstrated it as a high-brightness field monitor. Sanyo also has shown this technology, but seems to have shifted its emphasis to LCDs for small sets.

The latest to use beam index tubes is Panasonic, who displayed color sets with

6-inch diagonal screens that are thin enough to be used as seat-back monitors in airline applications. Watch this one for interesting professional applications. Color view finders anyone?

Joint efforts

Another trend to be aware of in consumer television is one that should give you a reason to upgrade the audio side of your video facility. That is the growing number of tie-ins between major audio equipment brands and TV set manufacturers for the inclusion of high-end audio

systems in consumer TV sets. Previous pairings have been Zenith/Bose and Toshiba/Carver. Winter CES witnessed a new addition to the ranks, Aphex, which will see its "aural exciter" processing techniques built into Proton sets. Fosgate also displayed its wares alongside Barco's projection sets, although no joint marketing plan was announced. By the time the Summer CES rolls around in June, there probably will be a few more links between major audio firms and high-line video brands.

This trend brings consumers more than an underpowered amp and a 3-inch speaker for listening to broadcasts; it brings them, on the aural side, what improved video circuits and IDTV give them in video. Now, poor audio production will not only be noticeable, but also may cause viewers to complain or, even worse, tune out. This can work to your facility's advantage as well, if you provide clean signals. There also is an increased emphasis on surround-sound encoding for VCR and LV programs. If you take the time to put surround to work for your original productions, you'll be using technology to give high-demographic viewers a reason to tune in, not out.

The video still camera

Of course, the CES also is about products that consumers use to create programs, as well as the ones they use to view them. For the most part, that means VCRs, but at this show a new product line really came into its own: the video still camera.

Kodak, Sony, Canon and others have been showing this type of device at professional shows for a year or two, but this show saw the video still camera come into its own as a consumer device. Olympus, Canon and Sony all showed these devices. The increased quality available through a new high-band recording system, the built-in flash and user-friendly design merit your attention.

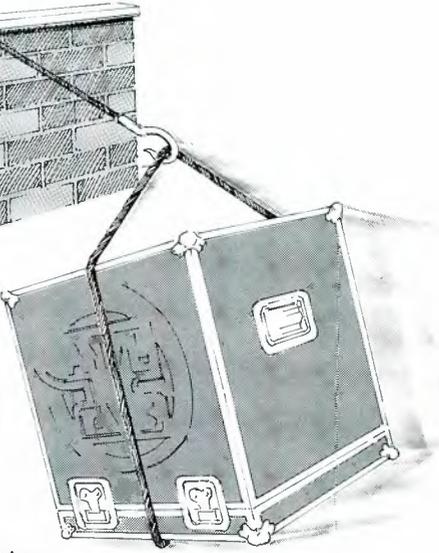
Although consumer 1/2-inch and 8mm camcorders often have been discussed as field recording devices for stringers, these compact units provide an even smaller way to record video images. For a starting cost of less than \$800, you can get still, quality video images of news events. Perhaps a reporter can use them while on location to take shots for use in the graphics box over the anchor's shoulder. They also provide a great substitute for instant film cameras when you are scouting locations.

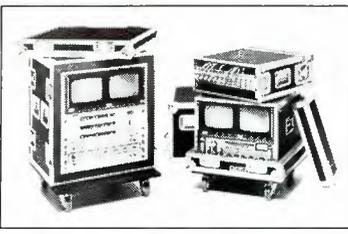
Interestingly, none of the consumer cameras is being sold with a hard-copy image printer, as seen in applications such as Pro Mavica. Cost may be a factor, but perhaps the marketing geniuses think that you no longer need printed copies — that video images alone are enough.

Continued on page 108

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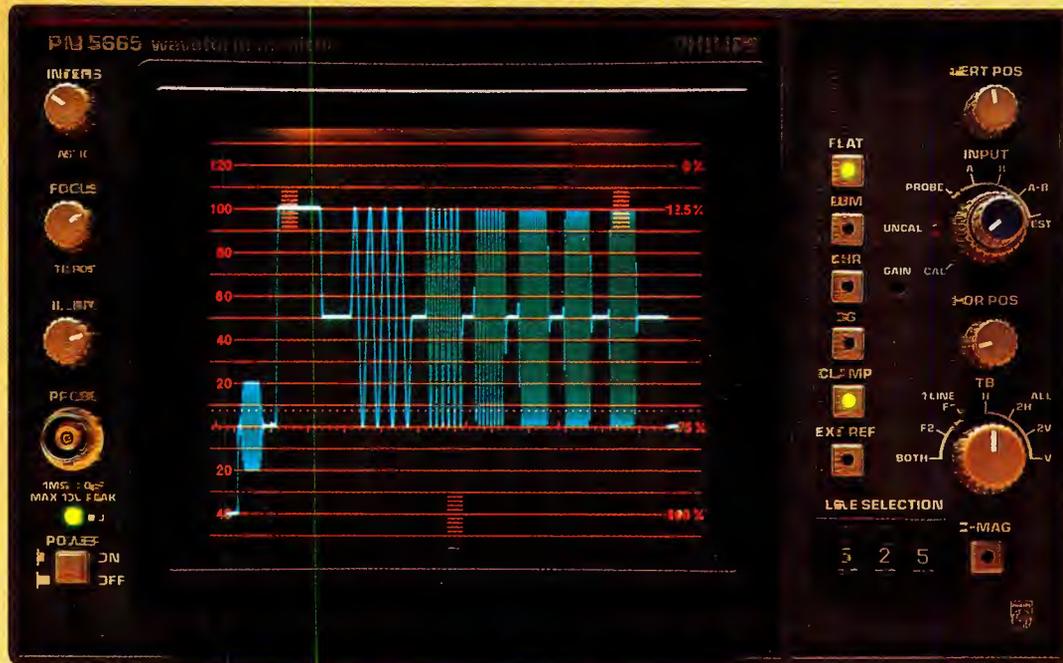
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Winter CES: On the other side of the tube

By Michael Heiss



In the "good old days" it was almost a given that any equipment used by broadcasters would far exceed the quality of anything consumers would use in their living rooms. The notion of slight defects being viewable at home was about as unthinkable as using consumer equipment in a professional environment.

All that is changing. As the 1990s approach, the quality of consumer equipment gets better and better, and cost pressures are being felt throughout the broadcast industry. It is important, therefore, for broadcast professionals to know what their "end-users" are using to receive and process signals at the other end of the tube. One of the best ways to obtain that information is to attend the semi-annual Consumer Electronics Shows.

The most recent edition was the Winter CES, held in January in Las Vegas. Although the mid-season winter show traditionally includes fewer new product introductions than the summer show, there was quite a bit of interest in products that were on display as well as some that weren't.

The R-DAT burnout

R-DAT, for example, made news by not being shown. Although R-DAT is becoming a common tool for professional audio recording, it seems close to a burnout as far as the consumer world is concerned. It seems that almost everyone, from Sony to Samsung, has displayed R-DAT machines at recent CES shows. Except for gray-market importers and Nakamichi's \$10,000 version, R-DAT machines were in the distant background this time as far as the consumer electronics buyers were concerned.

Usually, technology moves from the pro world to the consumer arena. R-DAT seems to be doing the opposite. It may share the fate of U-matic, turning out to be a failed consumer product that becomes a useful tool for the professional.

Now you see it, now you don't

In the case of HDTV, it was sort of there, and sort of not. Numerous seminars and

panel discussions were held on the topic, but no conclusions were reached. Demonstrations were limited, with Sanyo, Barco and Philips all using the show to display different aspects of their technological prowess.

Most interesting in the Sanyo display was the ½-inch HDTV VCR used to play back the demo material. The machine was right out in front and, unlike those in previous demonstrations, seemed to be a full-production model. Not much taller than a BVU U-matic or a D-2 machine, this latest version of the NHK "Hi-Vision" system easily could become a tool for remote production as well as for the HDTV theater playback it was designed for. No price or delivery was listed, but it would most likely be cheaper than the 1-inch HDTV recorders now in use.

Also part of the Sanyo display was an HDTV LV system using the MUSE encoding technique. The significance of this showing is that the laser videodisc, currently experiencing a renaissance in the conventional NTSC world, may prove to be a practical delivery system for home HDTV signals.

On the display side of HDTV were the first public exhibitions of the Philips 1,050-line transmission system and Barco's 1125/60 projector. The HDTV scene at the Winter CES, however, was a calm one. HDTV was used more as a means of attracting people to booths than as a display of techniques and formats.

Many pundits point to line-doubling IDTV sets as the interim answer while we wait for the HDTV wars to settle and a single standard to emerge. This type of receiver requires no change to the broadcaster's transmission standards, because it achieves its display improvement through double scanning and field memory. This makes for a better TV set, but it also means that viewers will be much more critical of the quality of your station's signal.

As with many other products, IDTV was notable at this show, both for where you saw it and for where you didn't. Conspicuously absent from the IDTV ranks was Toshiba, the originator of consumer double-scan sets. On the other hand, Philips displayed production models of its

set, first shown to rave reviews in June. The set uses more than 2.5Mb of memory for storage and processing, and the result is spectacular.

Getting there, however, is not half the fun any more. Deliveries of this set are reported to be running behind schedule; the technology is obviously not as easy to harness as many might think. Perhaps for that reason, most of the other IDTV sets seen in June have disappeared into backroom displays or the labs. Some prototypes were on display, however, as an indication of the TV set industry's commitment to IDTV. Panasonic was showing a 72-inch rear-screen projection set, Hitachi had a 52-inch rear projector in its booth, and Proton displayed an early prototype of a 27-inch direct-view set. Proton's sets are made in Taiwan, an indication that IDTV technology will be forthcoming from manufacturers outside Europe, Japan and the United States.

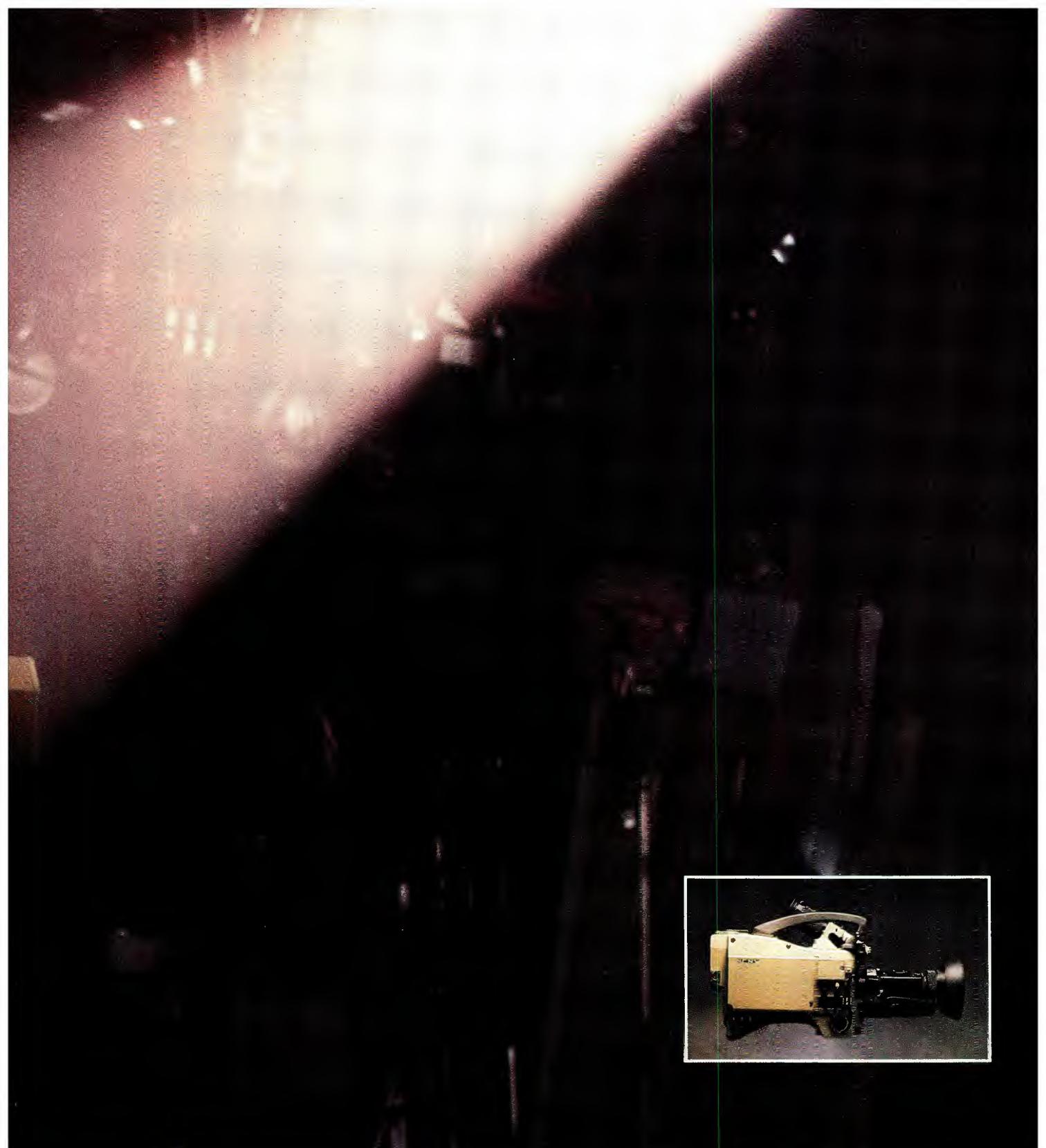
Don't be misled by the slim showings, however. As the HDTV standards battle drags out, semiconductor progress and design experience will make second-generation IDTV sets practical, if not more affordable, this year. Tune up your video signal paths, because IDTV sets, expected to be shown this summer by most of the major TV manufacturers, will be on the U.S. market in the fall.

Return of the LCD

Another note about display technology is the resurgence of LCD technology. Tariff and technical problems have kept color LCD sets off the U.S. market for about 18 months, but it looks as though they are returning. Screen sizes up to six inches soon will be available, with practical sizes of more than 12 inches getting closer and closer. For field and ENG applications in which weight, size, power consumption and mechanical problems must be kept to a minimum, LCD is like manna from heaven.

Particularly suited to vehicle mounting is Hitachi's new 5-inch LCD set, specifically designed for 12V use in cars. LCD sets soon will be widely available in 4- to 6-inch sizes from a number of major manufacturers. They will be useful as a means of viewing and cuing in the field.

Heiss is a BE consulting editor based in Los Angeles.



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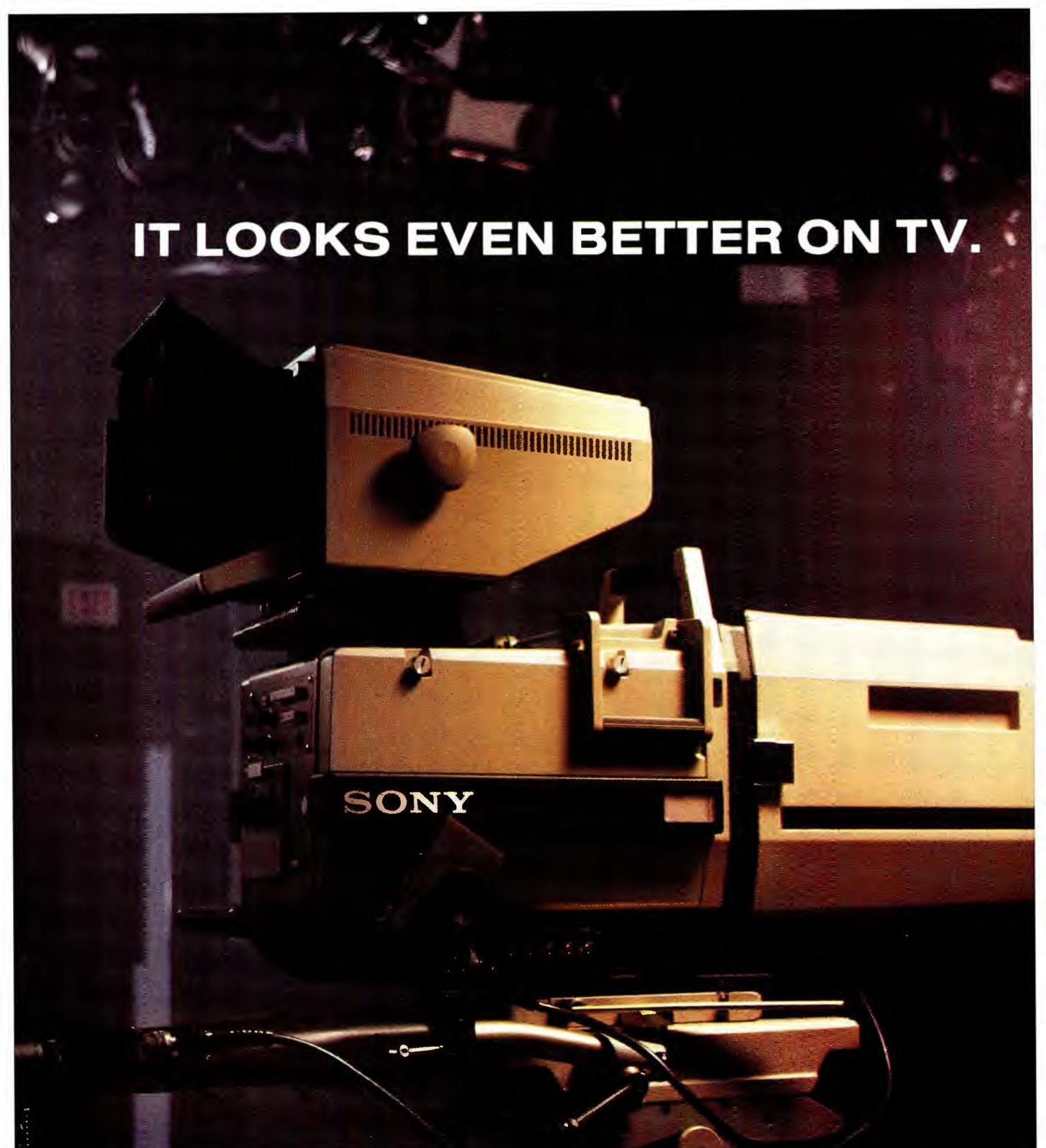
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Half of doing a quality job is having the proper tools.

But when your craft is video, the tool box can get pretty heavy, and pretty expensive, before you're through. You're probably working in two or three formats at once — maybe experimenting with digital or HDTV — and they all seem to need their own separate sets of test generators. It would sure lighten the load if just one box could do it all.

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Continued from page 70



In 1988, attendees reminisced with President Ronald Reagan about broadcasting.

day equipment and personalities. Broadcasters are part of a proud tradition that is worth celebrating. And, although tough times have made their mark on almost everyone in the business in the past few years, there is still a lot of excitement left in this industry. Get in on the ground floor, and attend the 67th annual NAB convention.

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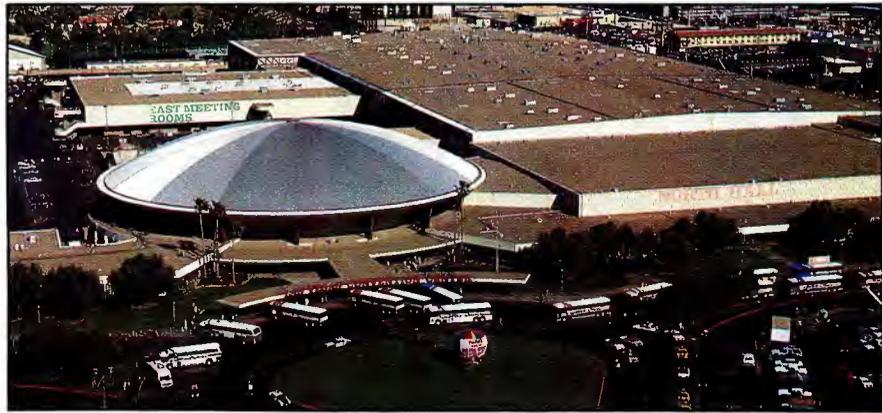
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be offered daily at a convenient location. NAB attorneys, FCC officials, communications engineers and members of the communications bar will be on hand to answer questions on regulatory and legal matters.

A total of 21 technical sessions and workshops, with more than 100 technical papers scheduled, should provide something for just about everyone. The radio sessions begin with "Digital Radio Systems" and "FM Improvement." Television first-day sessions include "Cable Systems," "TV Automation," "Graphics & Animation" and "Television Audio." But it doesn't stop there!

Information on advanced television, HDTV, TV engineering, new technologies and UHF transmission systems will pique your interest. NAB has added several new technical sessions this year, including "New Communications Technology" and "Professional Development for Engineers," as well as discussions on time management, stress management and improvement of communications skills. One session, "The FCC Audit," will help you prepare for visits from the commission.

If you're a radio person, plan to stop in for sessions on AM engineering, radio production and audio production. Also, more than 40 sessions are directed at radio management, promotion and programming. For everyone, there's "Computers



More than 400,000 square feet of space has been allotted for exhibits in the Las Vegas Convention Center, Hilton Center and parking lot.

for Broadcast Engineers" and "Environmental Compliance." And note that the evening workshop program on Sunday, April 30, will offer sessions in RF radiation compliance, acoustics, discussions with contract engineers and digital equipment diagnostics.

Now, in case you still have some time left to spend, a record 400,000 square feet of floor space will be delegated to the equipment exhibit. At press time, there were more than 700 exhibitor contracts. As in the past, the convention center will house the majority of exhibits, but don't

forget to walk through the outdoor exhibit area on your way to the Hilton Convention Center.

There's also the Engineering Luncheon, scheduled for Saturday, April 29, crowned with the presentation of the Engineering Achievement Award, followed by the opening ceremonies. The Radio Leadership Luncheon will take you on a trip through time. A series of audio-visual vignettes will take you into radio's past, from the days of vintage microphones, old-time music and disc jockeys to modern-

Continued on page 74

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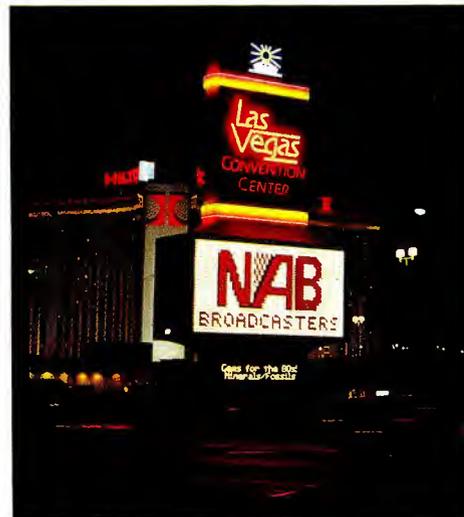


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Getting ready for NAB

By Carl Bentz, technical and special projects editor



This year, you have the luxury of a little more lead time.

It's March already! Can NAB be far away? Actually, it is a little farther over the horizon than many NAB veterans are used to. The show still will be in Las Vegas, NV, but it will span April 29-May 2, reflecting unusually late scheduling for the 67th Annual Convention and International Exhibition and 43rd Annual Broadcast Engineering Conference.

Because of the belated show dates, the traditional **BE** NAB pre-show information, which usually runs in the March issue, will be presented in April. In it you will find the exhibitor listing, new product information and exhibit floor maps that you have come to expect. As always, companies will be making changes — in their booth numbers and the list of products they wish to exhibit — right up to the opening of the show, and the April issue will not reflect these last-minute changes. However, an updated exhibitor map will be distributed by **BE** at the Las Vegas Convention Center.

Although pre-show coverage will be provided in detail in next month's issue, we'd like to give you some hints of what to expect at this year's NAB event. Promising to be bigger than ever, this year's convention is expected to attract more than 40,000 attendees from around the world. That means that hotel accommodations will become scarce soon. If you have not received a pre-registration package from NAB, you may wish to get in touch soon for information. Call NAB at 202-429-5300 or write:

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Attendees must pay an admission fee. If you're eligible for the member rate, pay \$190 before April 7 (or \$215 after that date). The non-member rate is \$425 before April 7 (or \$450 afterward). After March 17, hotel accommodations must be made through the Las Vegas Hotel/Motel Association. It would be a good idea to get your airline reservations lined up soon as well. As you may remember from past years, flights into Vegas are not always as conveniently scheduled as those to other



Registration for the show will be held at the Las Vegas Convention Center and at Bally's (formerly the MGM Grand).

major cities.

The theme of this year's convention, "On the Air: Proud Tradition — Dynamic Future," was selected in celebration of the broadcast industry's past, present and future, from yesteryear when AM radio was king, until tomorrow, when HDTV may predominate and carry most of our communications needs. Yes, there has been a great deal of change, and it's not over yet. That's what NAB is all about: ideas, discussions, hardware, software — the stuff of broadcasting.

You'll want to hear about proposals to help boost AM. And if you're interested in legislative issues, you'll want to catch some of the governmental relations sessions:

- Competition in the '90s — The End of Free Over-the-Air Broadcasting?
- Radio — The New Regulatory Environment.
- Campaigns and Elections — The Broadcaster's Role.
- Taxes and the Economy — Their Impact on Broadcasting and Advertising.

The NAB Legal Department program, "The Lawyer is In, the Meter is Off," will

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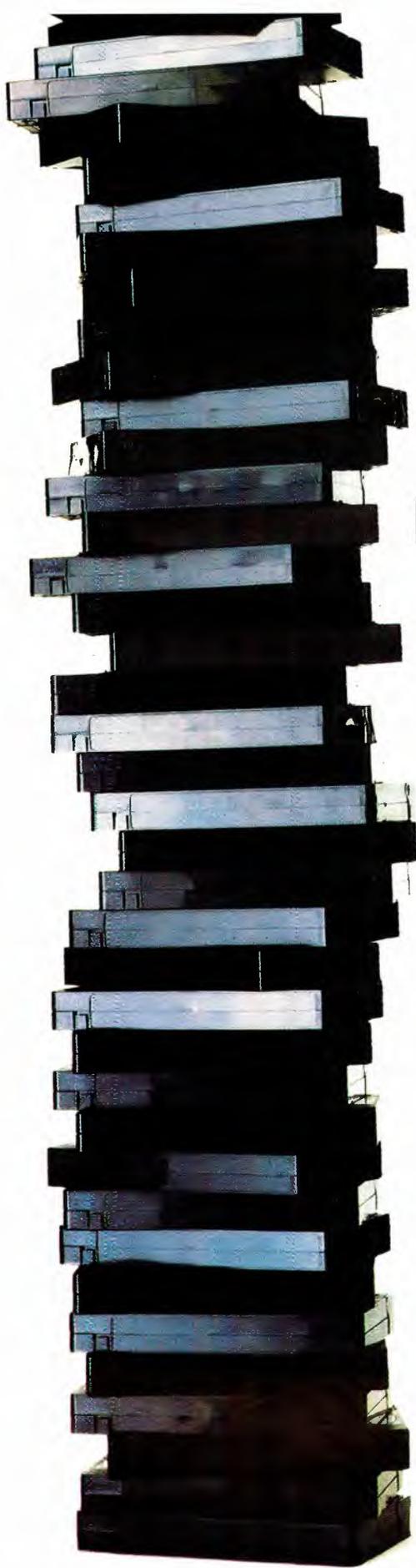
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transmitter is operating. Be sure there is sufficient clearance between the sampled coil and sampling windings.

The transmission line from the sampling inductor must be routed safely to prevent contact with operating personnel. Use an RF contactor to terminate the line during low-power operation and unterminate the line during high-power operation. This also prevents any reactance from being coupled back to the sampled coil during normal operation.

Inductive sampling may be an accept-

able power-reduction method if extremely low power levels are required. It is not as elegant as operating point shift or quadrature power division, but it can be used without significant repercussions because it is quick and inexpensive. For stations with limited financial resources or for temporary tests to evaluate low-power coverage, this method is extremely useful.

These techniques can be helpful for stations that are still trying to determine how to convert their equipment to low-power operation. Consider carefully all the

ramifications before deciding what technique to use. Over time, it will become obvious that the extra time spent designing and installing a quality circuit is a shrewd investment.

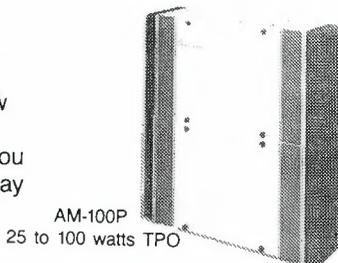
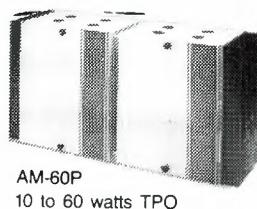
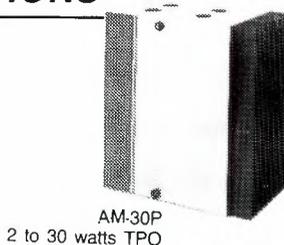
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False economies

Unfortunately, not every broadcaster is concerned with using an elegant solution to the problem of low-power operation. Let me provide an example. Four years ago I installed a quadrature power divider that enabled a small daytime AM station to operate PSRA. A nearby daytime AM competitor also installed a power-reduction circuit and spent the next several days calling other station owners to brag about how inexpensive the conversion was.

I discovered later why the conversion cost was so low. The station's power-reduction method consisted of several incandescent light bulbs and an 8-pin octal socketed relay to switch the transmitter's RF output. The station soon discovered that frequent replacement of the relay and incandescent lamps was necessary. Of course, each time a light bulb burned out or the relay disintegrated under power, the whole power-reduction scheme failed. The result was either 100% of the transmitter's power to the antenna or none at all.

The quadrature power divider installed at the other station was much more expensive, but it has functioned flawlessly for the past four years. I had to verbally defend the quadrature power divider when it was installed, but it's been a long time since I've had to justify the divider's expense to my client.

This doesn't mean that I don't look for the shortcuts too. I once installed an inductive sampling power-reduction circuit and used a manually operated transfer switch instead of the preferred RF contactor. The manual switch was one-fifth the cost of the contactor. I knew that this small station wouldn't spend the extra funds for power reduction if the price of a contactor was included. I had to install the manual switch in such a manner that the transmitter wouldn't be damaged if the operators made a mistake.

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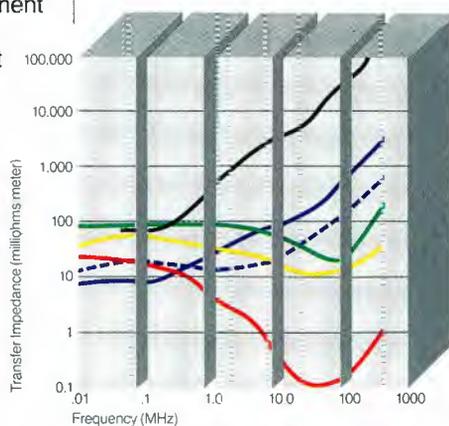
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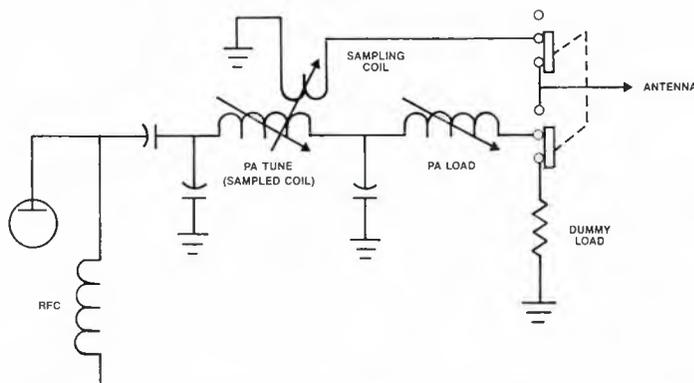


Figure 3. Inductive sampling of the transmitter's output is useful when extremely low antenna power is desired.

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of coupling between these two inductors. Four to 10 turns of insulated No. 12 or No. 14 wire around the sampled inductor usually is sufficient.

On some transmitters, the sampling winding can be wound around the plate tank coil's existing form or near one end of the coil. Avoid using a high number of turns on the sampling coil because it will affect the inductance of the sampled inductor and the bandwidth of the transmitter's output network. Loose coupling (with coupling coefficients on the order of 0.1 to 0.3) is preferred and, in fact, difficult to avoid.

Also, some means of adjustment is necessary. It's possible to wind the sampling coil's windings loosely enough to slide the entire sampling coil back and forth across the active portion of the sampled coil's form. This allows the coupling coefficient to be adjusted as needed at the time of installation.

If the current in the transmitter's loading coil is sufficient, energy can be inductively sampled there. This location often has the advantage of being downstream from harmonic traps. Precise calculations are unnecessary with this method, and trial-and-error adjustments are just as efficient.

This method requires no attenuation of the audio and no switching of the modulation monitor taps and results in no deterioration in S/N performance. In fact, if coupling is sufficiently loose, the transmitter's plate current and voltage may indicate the same as if the transmitter were delivering full power to the transmission line.

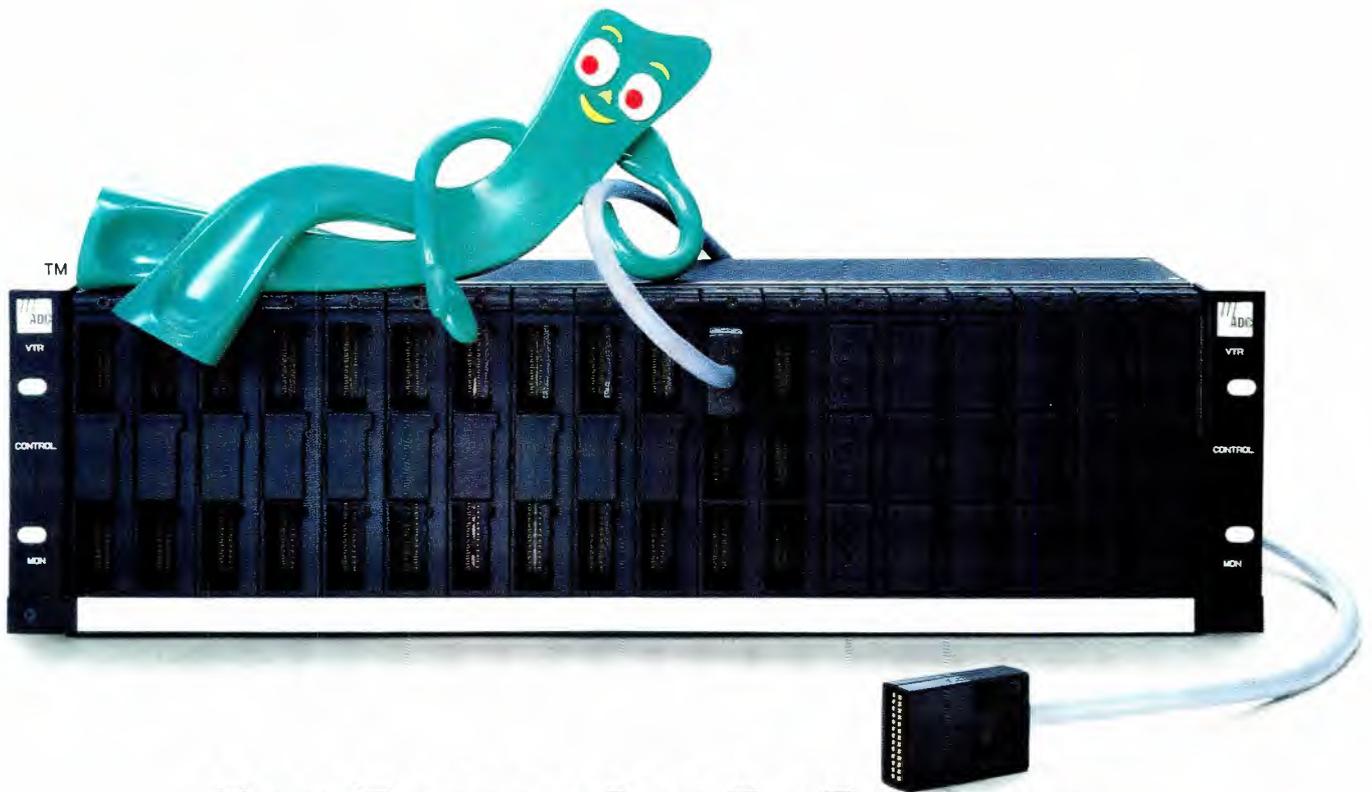
Inductive sampling, like the quadrature power divider, can make the transmitter's efficiency appear quite low. Remember that the antenna current represents only a small part of the power produced because the majority of power is dissipated in the dummy load.

A 250W transmitter that uses inductive sampling to produce 10W at the antenna may have a calculated efficiency of 3%, if the antenna power is used as the measure of transmitter output power. This may seem to be a terrible waste of energy unless PSSA or PSRA operation is used for only a few hours each day.

Safety considerations

It is also necessary to switch the transmitter's output into a dummy load and switch the sampled line port into the transmission line. This requires an RF contactor. Because heat will be generated near the transmitter's output network, be sure there is sufficient clearance between the windings of the two coils. Heat can cause the sampling coil's windings to sag and eventually contact the windings of the sampled coil. Remember also that there may be some high voltages and currents near the sampled inductor when the

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Because the transmitter's output power has been reduced, a corresponding reduction in audio input level also is necessary. Because less audio power is required from the modulator to reach 100% modulation, the audio input level must be correspondingly reduced. The audio input level must be attenuated by a factor of $10 \times \log(P1/P2)$ in decibels. A second relay can be used to insert a fixed resistive pad at the audio input to the transmitter.

Reduction in signal-to-noise

This power-reduction method seems to least affect the transmitter's sideband performance because the transmitter is looking into the same RF load as when operating on high power. However, one measurement — the S/N — will tend to show deterioration with the reduction to lower powers.

The noise produced by the modulator stage is approximately the same in the low-power mode as when the transmitter is operating at high power. However, the audio voltage swing is decreased by $10 \times \log(P1/P2)$. This means that the hum and noise become a larger percentage of the total voltage swing. The resulting S/N tends to decrease by the same amount. The amount of degradation that can be tolerated depends on how clean the incoming audio is and on the transmitter's S/N performance at high power.

In this example, to maintain a 45dB S/N at 175W operation (assuming the audio chain is absolutely clean), the transmitter must have an S/N of at least 52.6dB. A 5,000W transmitter operating at 100W must have an S/N of 62dB at high power. Some plate-modulated AM transmitters may require extra work to obtain the necessary S/N performance. In some cases, other power-reduction methods may be more appropriate.

Quadrature power divider

The quadrature power divider or splitter divides RF power into two (or more)

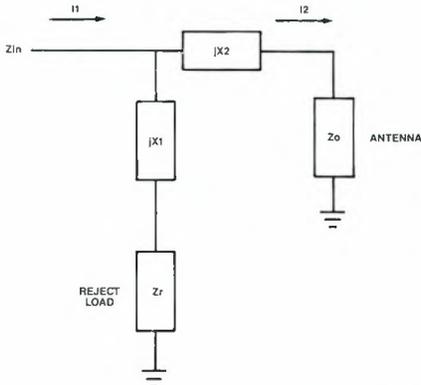


Figure 2. Quadrature power division directs partial transmitter power to the antenna. The total output power is divided between the antenna and reject load.

loads. Figure 2 illustrates this device where X1 and X2 are both reactive and of opposite sign, but not necessarily equal in magnitude. The general equations that characterize the quadrature power divider are:

$$Z_{in} = [(Z_r + jX_1) \times (Z_o + jX_2)] / (Z_r + Z_o + jX_1 + jX_2)$$

and

$$I_2/I_1 = (Z_r + jX_1) / (Z_r + Z_o + jX_1 + jX_2) \text{ magnitude only}$$

However, by making the simplifying assumption that the quadrature divider input, load and rejected power load impedance are all equal and resistive ($Z_{in} = Z_o = Z_r = R$), these two relationships yield simpler forms, which are solved easily for X1 and X2:

$$X_1 = \pm R \times \sqrt{(P_o/P_r)}$$

and

$$X_2 = \pm R \times \sqrt{(P_r/P_o)}$$

where X1 and X2 are of opposite sign

P_r = power to reject load

P_o = power to antenna

For example, consider reducing a 500W transmitter to low-power operation of 75W. If the input to the transmission line and the reject power load (which could be a dummy load) are both 50Ω resistive, as would be likely to occur if the quadrature power divider were inserted at the input to the transmission line, then:

$$X_1 = 19.4\Omega \text{ and } X_2 = -129.1\Omega$$

or

$$X_1 = -19.4\Omega \text{ and } X_2 = 129.1\Omega$$

Either set of values will produce a quadrature power divider input impedance of 50Ω resistive. In operation, 75W is delivered into the transmission line, and the remaining 425W is dissipated in the reject power load. The advantages of this method are that no attenuation of transmitter audio drive level or switching modulation monitor taps is required, and there is no S/N penalty.

Incorporating a quadrature power divider actually can improve the sideband performance of the low-power transmission system. Examine the following non-ideal load, as seen looking into the transmission line, and the resulting input impedance looking into the power divider. This test case uses the same components calculated earlier for a 500W to 75W power reduction.

Frequency (kHz)	Line Input Z	Divider Input
990	54 + j11.2Ω	50.6 - j1.4Ω
1,000	51 + j5.9Ω	50.4 - j0.7Ω
1,010	52 + j0.9Ω	49.9 - j0.3Ω

In this case, the quadrature power divider has improved the sideband performance of the transmission system because the divider network provides some isolation between the transmission line and the transmitter. It's often practical to use the same quadrature power divider for several transmitters because it can be installed at the transmission line input. This would circumvent the necessity for separate power-reduction circuitry in each transmitter.

Lowered apparent efficiency

If the antenna base current is used to calculate radiated power, the efficiency of the transmitter will appear to be less than normal. This is because a portion of the transmitter's power is being dissipated in the rejected power load.

A transmitter producing 500W and having an efficiency of 75% will appear to have an efficiency of 11.25% when operated into the quadrature power divider discussed, if the antenna base current is used to calculate true output power. The transmitter's efficiency is actually 75%, just as before, but a significant portion of the 500W now is being dissipated in the reject power load.

A quadrature power divider must be inserted into the RF system either at the antenna, antenna tuning unit, phaser input or transmission line because it splits RF power into several loads. This means that an RF contactor is required to switch RF ports at these power levels. In addition, the reactances X1 and X2 must be derived with capacitors and inductors that can handle the RF currents and voltages encountered in the network. It is not unusual for the installed price of a quadrature power divider to be more than twice the conversion cost of the operating point shift method.

In cases in which operating point shifts are not practical, the quadrature power divider may be the solution. However, for a station that has a 10W PSSA, the quadrature power divider method may seem like a lot of trouble just to obtain 10W. For these low-power operations, there is another technique that inductively couples small amounts of power from the transmitter.

Inductive sampling

Inductive sampling power reduction is useful for achieving antenna powers in the range of 10W to 25W. Figure 3 illustrates the principle in a typical plate-modulated transmitter. In this method, the transmitter is operated into a dummy load.

A sample of RF energy is coupled from the plate tank or loading coil into the antenna. The percentage of sampled power is determined by the number of turns on the sampling coil, the current in the sampled inductor and the coefficient

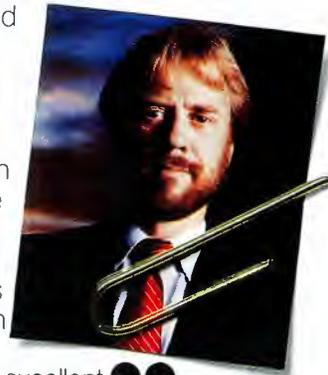
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AM power-reduction techniques

By Tim Walker

Reducing transmitter power is no small task.

More AM stations than ever before are eligible for low-power nighttime, pre-sunrise authorization (PSRA) or post-sunset authorization (PSSA) operation. As station engineer, you may be called upon to assess the technical implications of low-power operation. Although the decision to implement low-power operation generally rests with station management, two questions will almost certainly be directed to you: *How much is this going to cost?* and *What has to be done to convert our equipment to low power?* This article describes three techniques for modifying existing transmitting equipment for low-power operation.

Low-power operation usually is defined as a transmitter output power ranging from a few watts to several hundred watts. Each of the techniques — *operating point shift*, *quadrature power division* and *inductive sampling* — are applicable to overlapping power ranges.

It's important to recognize that each power-reduction method has some limitations. Failure to assess each circuit's shortcomings may invite problems. Degradation of signal-to-noise performance, sensitivity to transmitter load variations and deterioration of sideband performance are areas that must be considered before selecting one of the methods.

Operation point shift

Shifting the operating point (sometimes called the *quiescent point*) of the final RF stage frequently works well for conventional plate-modulated transmitters. Transmitter manufacturers have used this

method of reducing output power for years. For most plate-modulated transmitters, a reduction in plate voltage (and a corresponding decrease in plate current) are all that's necessary to shift the operating point of the final RF stage.

This could be achieved by reducing the primary voltage to the high-voltage power supply. Unfortunately, this technique also reduces the plate voltage on the modulator finals, resulting in insufficient static bias current and increased distortion.

A separate bias circuit for low-power operation could be installed. However, a simpler solution, shown in Figure 1,

reduces the RF final plate voltage without disturbing the modulator circuit. You can calculate the value of resistor R required to achieve a power reduction by using the following formula:

$$R = (E2 - E1)/I1 \text{ where}$$

$$I1 = I2 \times \sqrt{(P1/P2)}$$

$$E1 = E2 \times \sqrt{(P1/P2)}$$

P1 = low power in watts
P2 = normal power in watts
E2 = HV supply voltage in volts
I2 = normal power-level plate current in amperes

For example, consider a 1,000W transmitter with a high-voltage supply of 2,500V and a PA plate current of 0.53A. The transmitter output power needs to be reduced to 175W. Dropping resistors totaling 6,558Ω result in a plate voltage of 1,046V and a plate current of 0.222A. These dropping resistors need to dissipate more than 300W, so several are required to dissipate the extra power. At least one adjustable resistor should be included in the string, so the operating parameters can be adjusted at the time of installation.

Relay K1, shown in Figure 1, is energized for low-power operation. It's convenient to use a DPDT high-voltage relay with one side inserting the dropping resistor and the other side switching taps on the modulation monitor sample coil. Notice that no RF switching is required. All power changes are accomplished in the high-voltage dc power supply. Inserting the dropping resistor in the B+ supply of the RF finals leaves the modulator stage unchanged, so there is no shift in static bias currents.

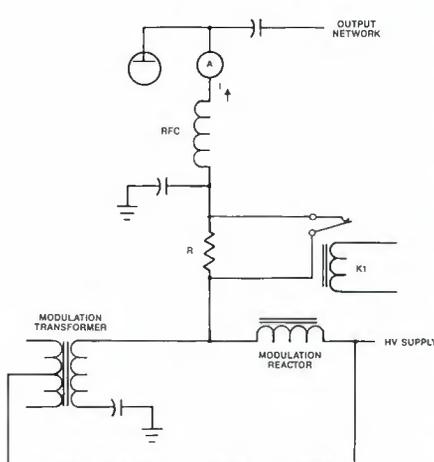


Figure 1. Resistance in the B+ circuit shifts the operating point of the RF stage to accommodate low-power operation. This technique requires good performance from the transmitter's audio section if optimum S/N is to be obtained. The circuit is shown in the high-power mode.

Walker is a broadcast consultant in Ruffin, NC.



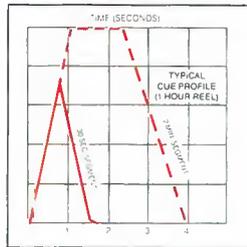
production, and post-production business), thinks it's important to be able to update easily as his business changes. "The hardware and software upgrades Ampex makes in their equipment allow me to keep my facility current, and to always give my customers the newest look. I like that, and my customers demand it."

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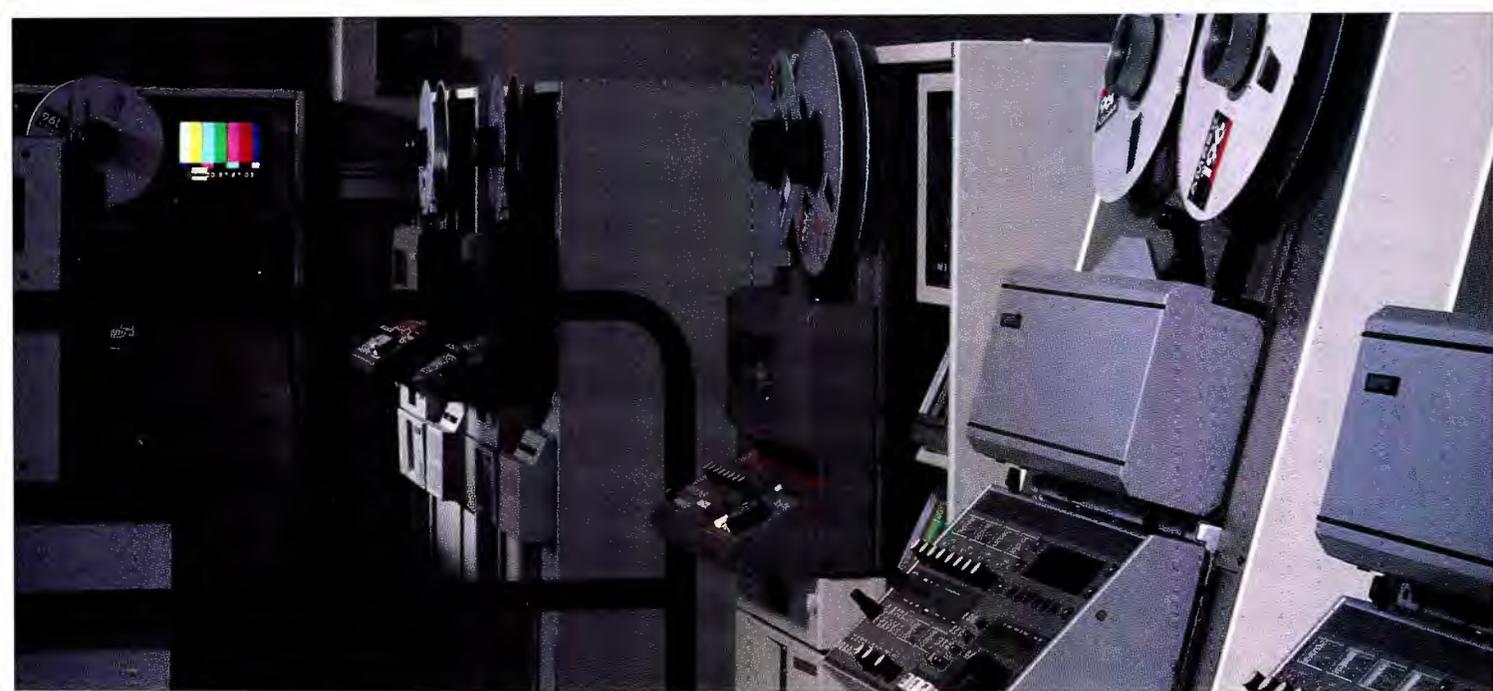
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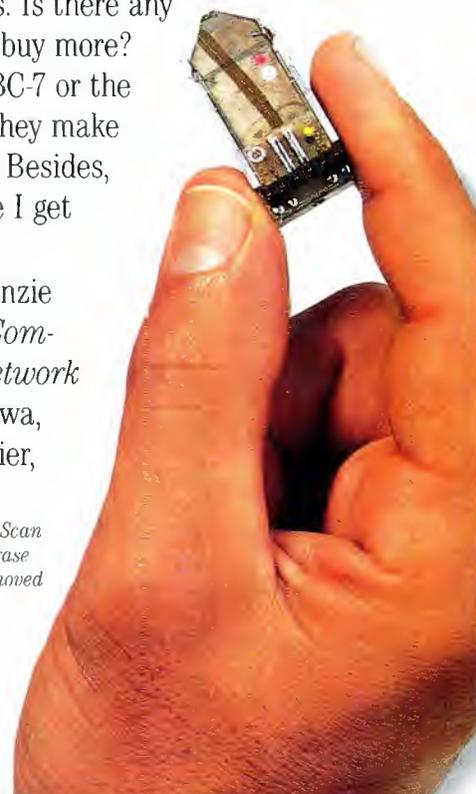
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Jerry McKinzie with *Cycle-Sat Communications Network* in Forest City, Iowa, (a satellite courier,

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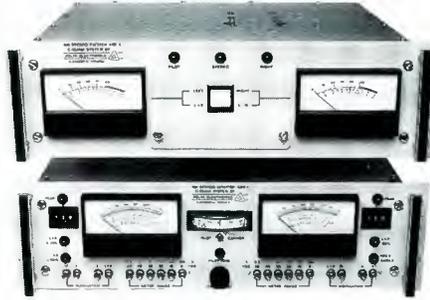


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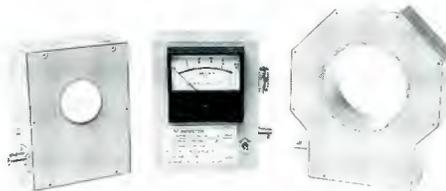
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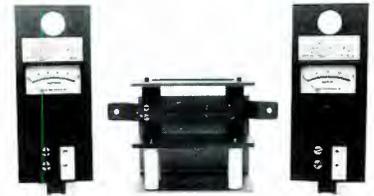
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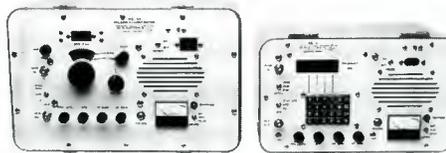
RF Ammeters and Sampling Toroids—Precision toroidal current transformers (TCTs) provide stable antenna monitor sampling while eliminating the problems associated with loops. TCTs also work well in supplying additional modulation monitor or test sample RF outputs. The transformer coupled ammeter (TCA) offers stable base or common point current readings, independent of modulation. The dual and single scale meters also provide remote DC outputs.



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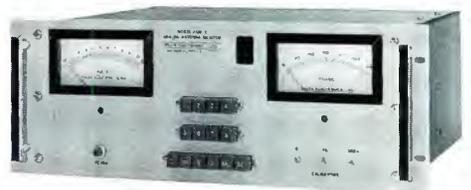
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printout of a customer's usage record. This can be a valuable tool in determining whether usage is higher during a certain time of the day.

Demand limiting is likely to be more helpful to a TV station than to a radio station because of the large periodic demand placed on the power company by TV studio lighting.

Your own utility?

Some broadcasters have reduced their power bills by selling power back to the utility company. A few even have gone so far as to place generator control in the hands of the power company, using the same 8kHz telemetry tones the utility uses to switch its own equipment. This is not universally possible, however. Some regions do not allow the reselling of power generated by burning fossil fuels. Some utilities will buy back power, but at a lower rate than they charge for delivered power.

Your success in selling power back to the utility will depend on the local environment. The process is generally not feasible with an emergency generator set. Nevertheless, some broadcasters who have managed to work out the necessary agreements report considerable savings. Broadcasters also have employed wind- and solar-powered systems in an effort to

augment local utilities.

Switch gear

For demand limiting, reselling of power or merely staying on the air, you will require good switch gear. Making the transition from main to backup power can cause annoying power bumps, which can be as disturbing as a loss of power.

The solution is phase-detection hardware. The generator must be in phase or sync with the power company before it drops out and returns the load to the mains. Special transfer devices, called closed transition switches, will make the new connection before breaking the old. Although it is expensive, this type of switch gear will eliminate power bumps.

UPS

In this era of pervasive microprocessors, interrupting power for one-half cycle can be as troublesome as losing it for several minutes. A device that can take the bump out of switching power sources is the uninterruptible power supply (UPS). Basically, the UPS consists of a series of batteries that are held charged by the ac lines. Inverters convert energy stored in the batteries into ac for the load. If the ac input fails, the batteries carry the load for a short period, typically 10 to 30 minutes,

until the ac is restored.

This is usually long enough to get the equipment through most power outages. It is certainly long enough to get the generator started or to gracefully power down the system until power is restored.

Most UPS systems also provide a degree of filtering or line conditioning to the ac that passes through them. These filters can be of benefit in suppressing transients or other voltage spikes or sags that might damage sensitive electronic equipment.

Backing up into higher reliability

At least one TV station has begun using its meteorological capabilities to increase the facility's reliability in times of inclement weather. Instead of waiting for the power to fail, the station weather staff informs the engineering department when severe weather is likely. The engineers then power up the generator, transferring to it if the storm cells get close.

Granted, backup power systems are expensive to install and somewhat time-consuming to maintain. But a well-planned emergency system can be a powerful tool for keeping your facility on the air, for protecting revenue and for upholding the public safety.

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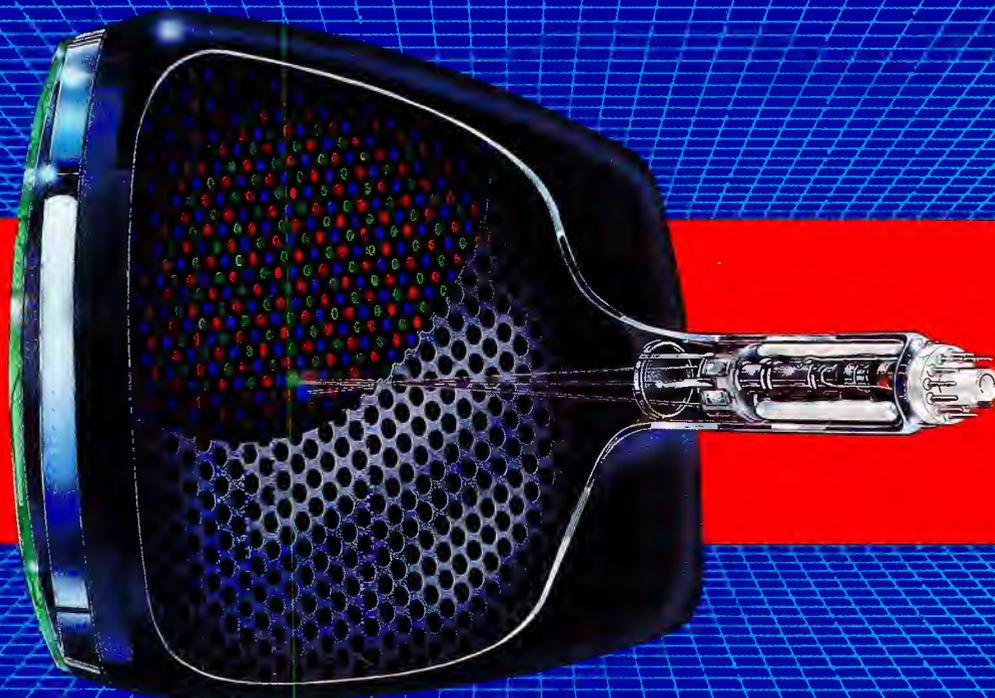
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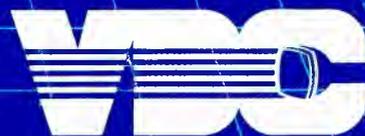
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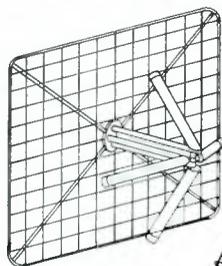
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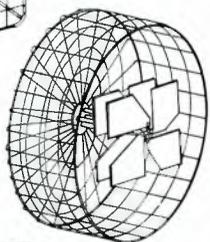


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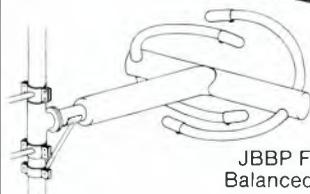
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Continued from page 48
a way of mysteriously appearing, as various employees decide for themselves that the facility can't live without certain equipment.

Power factor

A serious consideration is the type of load that broadcast equipment presents to the power system. It is generally quite reactive. Much of today's equipment is powered from dc power supplies, and these supplies use capacitors. The capacitors charge from approximately the 60° to 120° points and the 150° to 210° points on the power sine wave, causing high current peaks 120 times a second. (See Figure 2.)

These high currents at the peak of the sine wave may cause problems with emergency power systems. The sine wave may end up suppressed in the peaks and squared off. The average current as read by a clamp-on amp meter may seem acceptable, but an oscilloscope makes the problem apparent. Broadcast equipment, particularly if it uses synchronous motors or sensitive computers, may have a hard time using such distorted power.

The first step in overcoming this problem is to size generators and power-distribution transformers to adequately handle the current peaks. Remember to allow for growth and type of load.

The next step may be to install some kind of power-factor correction equipment. The highly reactive loads presented by the dc power supplies in station equipment generally result in disadvantageous power factors, which cause unnecessary equipment heating and, perhaps, power-factor surcharges from the utility. A carefully chosen power-factor correction system is likely to quickly pay for itself.

What fuel?

Generator selection is another important consideration. The prominent types of engines used today are diesel, propane and gasoline. Each has advantages and disadvantages. Diesel is the most widely

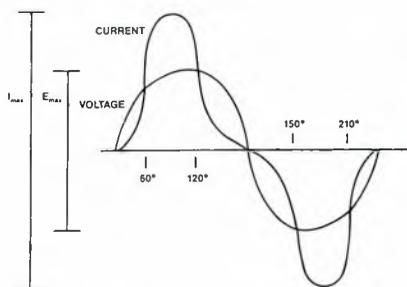


Figure 2. The current curve in a power source feeding dc power supplies may have large spikes caused by capacitor charging. This can distort the voltage waveform, causing equipment problems. The solution is adequately sized power systems.

used fuel for stationary emergency power sources. Diesels are economical to operate and are highly reliable, but the engine block must be kept heated if you expect instant starting and loading.

Gasoline and propane also are popular. Newer units usually are fuel-injected, which increases their reliability. Gas and propane cost more to operate per kilowatt-hour output because of lower engine efficiency.

Not the least of your concerns in selecting an emergency power plant is local fire regulations covering the bunkering of fuel. In this regard, diesel is once again a winner, because its fumes are much less volatile than those of gasoline or propane.

A stitch in time

Regardless of the fuel selected, the generator must be covered by an adequate program of preventive maintenance to ensure that it will perform when needed. This may be provided by station personnel or through a service contract with a local dealer.

The generator should be exercised on a regular schedule. The operation may be on a time clock or it may be handled by a maintenance person. The unit should be observed during exercising to ensure that it is operating properly.

Backup power pluses

In addition to protecting the station against blackout, generators can help the station's bottom line. One way to do this is "load shedding" or "demand limiting."

Load shedding is the practice of using the station's generator to limit the peak amount of power the station draws from the utility. Most utilities have a 2-tiered method of charging. The first part is the usage charge, the rate charged per kilowatt-hour. It typically uses a sliding scale, with later kilowatt-hours costing less than earlier ones.

The second part is the demand charge. This is a surcharge that the utility uses to compensate itself for having enough hardware on hand to service the user's peak request. In many cases, the demand charge is calculated by measuring power in 15-minute increments, then basing the charge on the highest reading taken. One short period of high power usage — perhaps having lights on in several studios at once — can set the demand charge for the next month or several months, depending on the utility's billing cycle.

Careful use of the backup generator can trim demand charges. This can be done either by paralleling the generator with the incoming utility, to share the load and lower demand, or by delegating certain loads (such as the studio lights from 11 a.m. to 2 p.m.) to the emergency generator.

Most power companies will provide a



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BTS is Broadcast Television Systems, a joint company of Bosch and Philips. For more information, please call 1-800-562-1136 or write BTS, P.O. Box 30816, Salt Lake City, UT 84130-0816.

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3-Way Lounger

One of these revolutionary ideas the world looks at TV

BTS did not invent the three-way lounge chair. Barcalounger® did.

But you'd be surprised at how many of the most revolutionary ideas in the history of video did come from BTS. In fact, because we look at things differently, the whole world looks at things differently.

We introduced the first CCD film scanner, for instance. The first Plumbicon camera tube. The first software-based character generator. The B format for videotape recording. The modular routing switcher. And of course, the first 3-D computer animation system, for which we won one of our three Emmies.

BTS has been a technological innovator in the video industry for six decades. Our cameras,



20 gets you 40. 40 inputs plus 8 subs for tracking, overdubbing or mix down means flexibility and control without re-patching at every step. Thanks to the flexibility of the WR-T820B, you can use the monitor section during mixdown to gain 20 extra inputs—over and above the WR-T820B's 20 input modules. So 20 really does get you 40!

The WR-T820B's performance and construction quality are every bit as remarkable as its design. Premium, high-speed IC's in the gain stages give it an open sound that does full justice to all those incoming signals. And our faders are rated at 300,000 operations—20 times the life of a typical carbon fader. Just *two* examples of RAMSA's integrity in design and component selection.

See your RAMSA dealer for a complete demo. Or contact us for further information at: 6550 Katella Ave., Cypress, CA 90630, 714/895-7200.

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