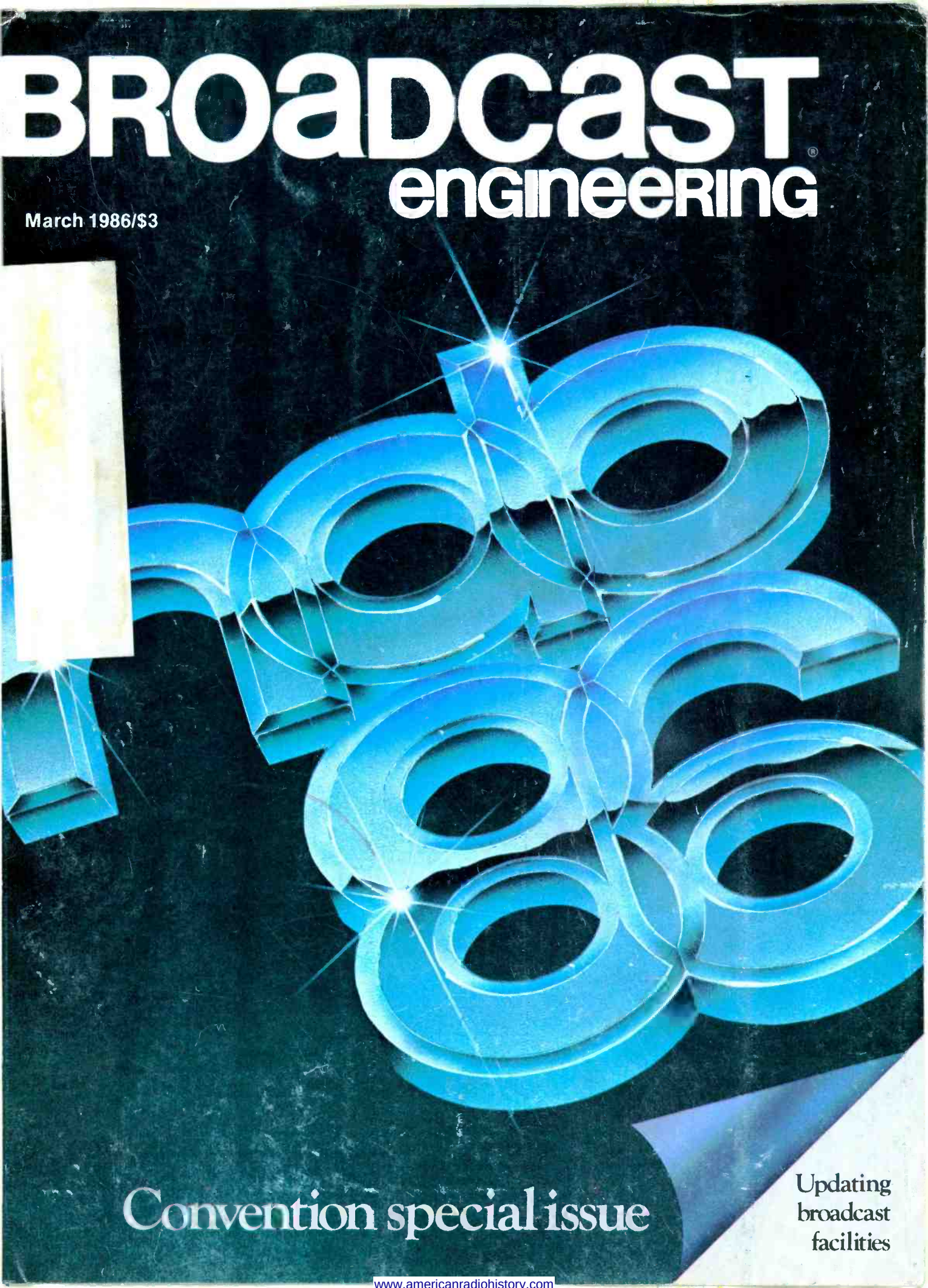
BROADCAST ENGINEERING

March 1986/$3



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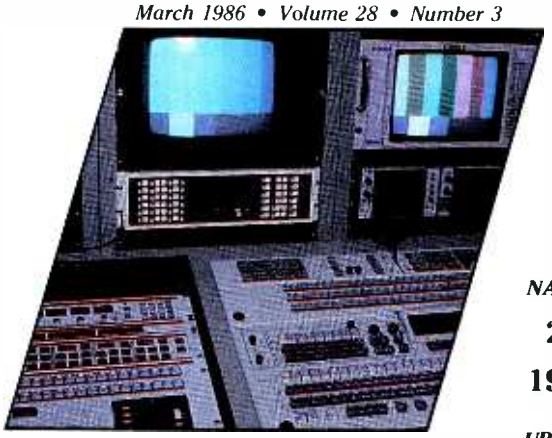
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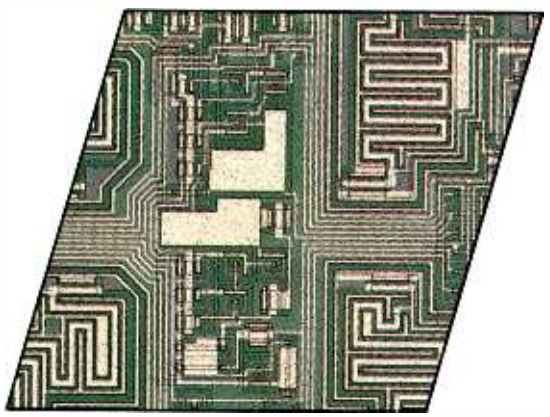
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ON THE COVER
Our cover this month proclaims the upcoming NAB convention in Dallas. The annual gathering is the *main event* for the broadcast industry. In this issue, we present a comprehensive preview of the show. (Cover illustration by Todd Meyers of the **BE** staff.)

BROADCAST engineering

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News

Setup procedures to be upset

The 30-year reign of 7.5% ±2.5% setup in video signals will be brought to an end, at least for facilities involved in production with mixed component and NTSC composite video equipment. Transmitted signals will continue to require the 7.5% lift of black level from blanking, however.

A joint agreement by members of the SMPTE component analog and digital video standards working groups has been reached on the requirements for a recommended practice for video techniques in mixed NTSC/component signal production facilities. A draft of recommended practices is being prepared for consideration by the two working groups.

Agreement on the handling of setup in the mixed signal system will spur an increased use of component technology in existing NTSC systems. The simplified interface of the two technologies answers an issue that was addressed during discussions of the CCIR 601 compatible digital and analog component systems.

It has been noted that for many years, TV cameras and telecines have provided RGB components with zero setup. In 1982, a set of digital component signals, based upon Y, R−Y and B−Y with zero setup, were adopted worldwide. Standards for serial and parallel analog component color difference signals were drafted during 1985. The proposed HDTV signal format is also based upon zero setup for compatibility with previously adopted digital standards.

The recommended practices being prepared must meet certain demands. The NTSC signal, as it exists today, must be preserved. Operations with component signals will provide zero setup at points of interconnection. Any translation between the two signal formats must preserve the maximum image quality.

Setup shall be removed during NTSC signal decoding to components and will be re-added during encoding of the components to the NTSC composite format. The removal of setup may be through fixed, manual adjustment or automatically controlled means. If fixed methods are used, the resulting system errors must be fewer than those of current practices.

It is recognized that setup and/or level errors in NTSC signals may result in headroom and footroom problems when they are decoded to digital domain components. To avoid such errors, care must be used to maintain a tight tolerance around the 7.5% level during NTSC operations. Furthermore, material that does not meet the tolerance should be corrected either automatically or manually to 7.5% setup and proper peak white levels.

Finally, no restriction is to be imposed on signal handling within equipment designs with respect to setup and video levels. The critical areas will be points of interface between the two signal systems.

Plans finalized for SBE convention

The Society of Broadcast Engineers and **Broadcast Engineering** have finalized plans for the first SBE National Convention and **Broadcast Engineering** Conference, to be held Oct. 14 to 16 at the St. Louis convention center. The event will be a showcase for society activities and will raise the SBE to a new level of visibility in the broadcast community. The popular SBE regional conventions will continue to be an important element of society activities, but the October gathering will provide the central focus for the national organization. **BE** is cooperating with the SBE in the effort,

Continued on page 330

BROADCAST ENGINEERING

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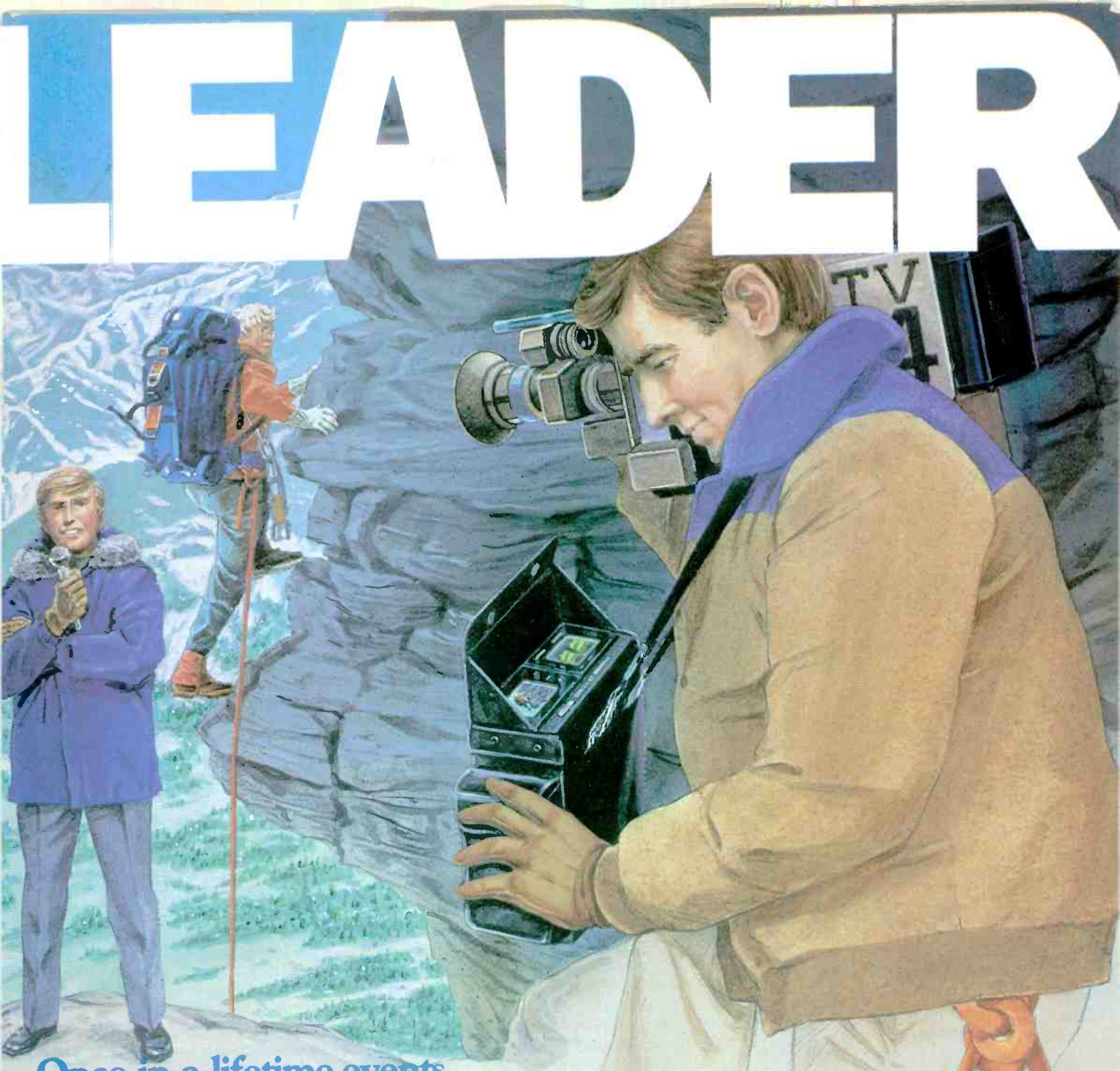
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Editorial

Life is just a bowl of bits

Old-timers as well as newcomers to the broadcast engineering profession will be going to the NAB convention next month with plans to look at TV products by specific functional categories. They will grab up the handy-dandy aisle guides and then dash into the exhibit hall to be engulfed by the latest generations of *SOTA* (state-of-the-art) hardware. They will be dazzled, bedazzled and redazzled by the new digital video signal processing (DVSP) and DASP (audio) products on display.

But to what avail? Will they leave the exhibit floor four days later knowing *exactly* what they are going to put into their next budget, or how to spend the money already in their hands? Of course not.

Here are the real facts about every major new product you'll encounter at the big show in Dallas. You may go to the convention looking for the latest hot stuff about cameras, or VTRs, or editors, or digital special effects black boxes, or transmitters or whatever. But, what you will find is not what you were looking for. The *TV products* are actually all computers! You'll find DDP (distributed data processing) computer networks, specifically, with user-friendly human control terminals; SOTA software; RS-232, RS-422 and IEEE-488 ports; constantly evolving protocols for communication via industry-standard modems; and a laundry list of other specifications.

Some of these computers make pictures; they're called cameras. Some take the output of a camera or VTR and do incredible things to the pictures; they're called special effects boxes. Regardless of what they do, however, inside they're actually sophisticated, but almost always incompatible, computers. And that's the problem! If you're a manufacturer, you can't win the battle to design truly user-friendly ENG, ESP (electronic studio production), EFP and EPP systems until you recognize that your *real challenge* is to design an all-purpose computer network that is instantly reconfigurable, features multiple-channel operation for video, audio and time code, and supports multiterminal, multitask control. Plus, you need a system whose operations can be both manually and automatically controlled from external computers with names like *traffic, sales, scheduling, accounting* and *network*, which often communicate with your computer at varying data rates and in differing formats.

If you're an old-fashioned TV engineer, and not as enthusiastically *into computers* as networking YUMPs (young upwardly mobile professionals) and UPSAILS (upscale pacesetters and innovation leaders), the conventional wisdom is *you're out of it.* Don't prepare yourself to jump off a bridge, if you take this gloom and doom pronouncement to heart. Even those of us who started life as well-trained analog vacuum tube engineers have managed to survive so far.

Digital data-processing system hardware design principles aren't hard to understand. And, once you understand them, planning and managing the evolution of your TV plant from its present analog/digital hybrid mix will be easier (but never simple).

A combination of the microprocessor selected, its MIPS (millions of instructions per second) rating, the size of on-line memory, and the complexity of the software determines what kind of *TV product* a bowl of bits can become. As you consider a purchase, however, remember that every one of those DVSP products in your TV plant—mainly in your EPP suites—is a digital island in an analog universe. Your 1986 challenge is to begin the orderly, cost-justifiable elimination of the analog storage and transmission subsystems existing between those islands.

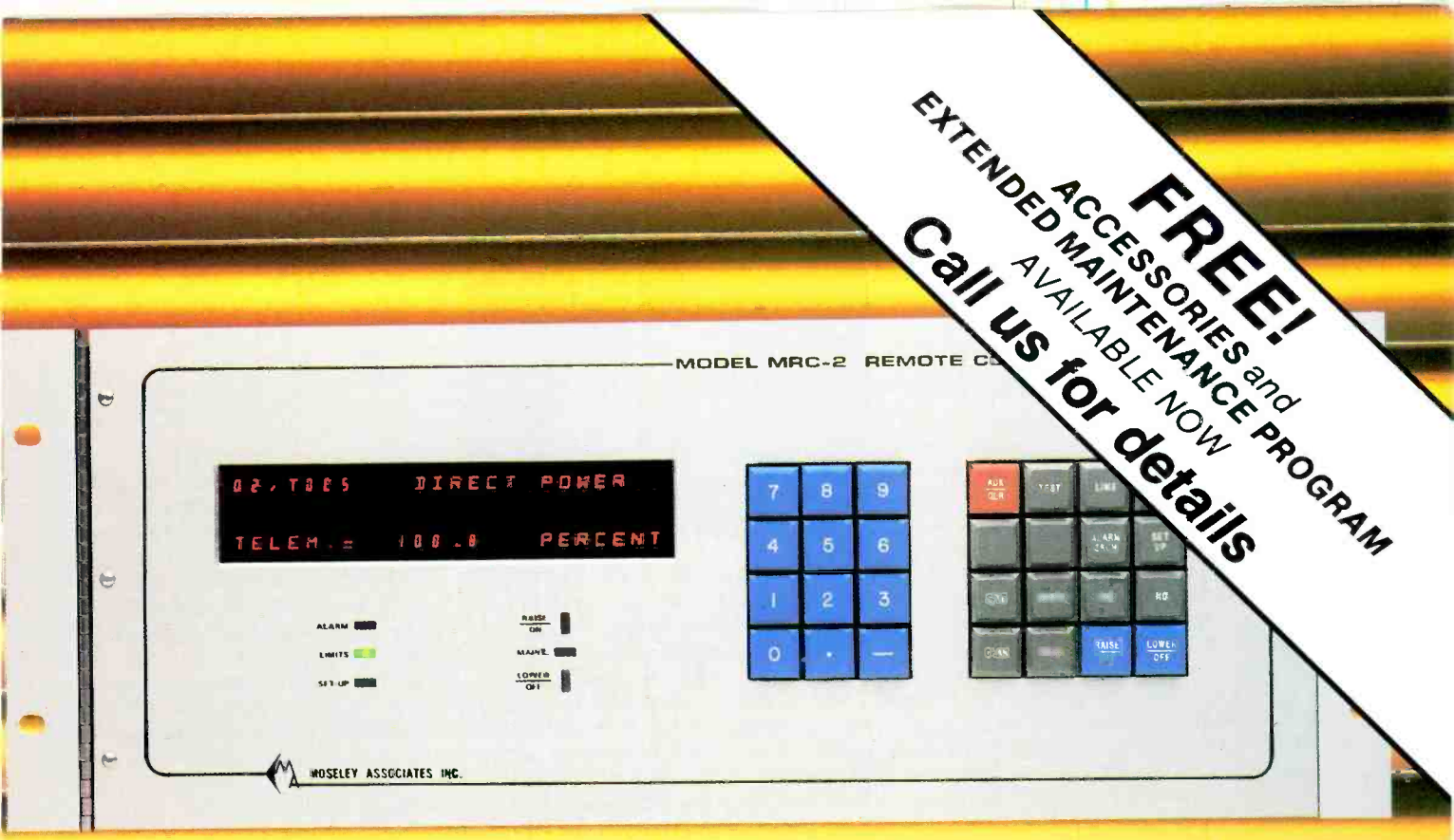
Don't forget that you're dealing with computers, not *TV products*, as you begin to evaluate the next generation of equipment debuting at NAB. Your first criterion for vendor and product choice must, therefore, be the computer interface compatibility of new products to those already working in your system. (Elaborating on those criteria would, unfortunately, push the length of this editorial to the back cover.)

Use your upcoming NAB trip to educate yourself on the variations in computer power descriptions that you'll find in the product brochures: resolution, processing speed, input/output rates, serial-parallel port availability, bus architecture, device expandability, machine-level and high-level programming languages, open vs. closed system architecture and applications software availability. Documenting answers to questions about those variations will point you to the best vendor choices for the *TV products* you plan to acquire.

Take heart. There is hope for the future, if you plan for it now. Remember that in television *these days*, life is just a bowl of bits. |:[=)))|

This editorial was prepared for **BE** by Bob Paulson, managing partner for AVP Communication, Westborough, MA.

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AM gets go-ahead for synchronous operation

By Harry C. Martin

The FCC has granted experimental authority to an AM station in Laughlin, NV, to operate a synchronous transmitter in East Las Vegas.

A synchronous transmitter broadcasts identical programming and is precisely synchronized in frequency with a distant primary transmitter. Today's sophisticated control circuits and highly stable frequency elements permit the use of two or more transmitters locked on the same frequency and can compensate for the program propagation delay between primary and synchronous *slave* transmitters.

A synchronous transmitter might be used either to fill coverage gaps within a station's authorized service area or to extend a station's service area. Synchronous facilities must fully comply with all allocation protection standards for traditional stand-alone stations.

The East Las Vegas facility will be located approximately 60 miles from the primary transmitter in Laughlin and will operate on a frequency of 870kHz with a power of 300W non-directional daytime, and 500W directional nighttime. The primary station at Laughlin is authorized to operate on the same frequency with a power of 10kW directional daytime, and 1kW directional nighttime.

During the experimental period, the permittee will provide the commission with regular reports on its operation. This data will be used to determine the potential benefits and practicality of synchronous operations. The commission's interest in synchronous transmissions stems from a broader policy initiative looking toward the revitalization of AM broadcasting.

FCC pre-empts some local zoning laws

The commission has pre-empted certain state and local zoning regulations that differentiate between satellite receive-only antennas and other types of antenna facilities. Under the commission's ruling, local zoning laws dealing with satellite receive antennas would be invalid unless they have a reasonable and clearly defined health, safety or aesthetic objective and do not impose unreasonable limitations or prevent reception of satellite-delivered signals. Regulations that impose excessive costs on the users of earth stations also are subject to pre-emption.

Under the commission's new rules, local authorities remain free to regulate earth stations as long as the same regulations are applied to all types of antennas. For example, a community may ban external antennas of certain sizes as long as satellite facilities are not singled out for different treatment. If an ordinance does differentiate in the treatment of antennas, the local government must show that its regulation has a reasonable and clearly defined health, safety or aesthetic objective.

The commission does not plan to involve itself in enforcing the new regulations. Rather, earth station users who are adversely affected by local zoning laws may use the standards as the basis for court arguments. Any party requesting FCC review of a controversy will be expected to show that all other available remedies have been exhausted.

Comparative criteria

The FM applications now being tendered for Docket 80-90 allocations, if mutually exclusive with other acceptable applications, will be processed through comparative hearings. The criteria for deciding among competing applicants was adopted in 1965 and has been refined through case law over the past 20 years. The principal comparative criteria are "diversification of control" and "best practicable service" to the public.

Under the diversification criterion, applicants whose principals have no other broadcast interests are preferred to competitors who have such interests. Except for a qualifying daytimer applying for an FM in the same community, owners of other media interests in the area applied for, or even in the same state or region, are at a serious disadvantage compared to applicants whose principals have no other media interests.

Under the best practicable service criterion, the commission looks primarily to the extent of integration of ownership into management. Thus, an applicant whose stockholders all agree to work full time at the proposed facility would receive 100% *quantitative* integration credit and, all other factors being equal, would prevail over an applicant whose owners do not plan to participate in station operations.

After integration proposals are *quantified* in this manner, *qualitative* enhancement credits are awarded. Local residence, minority status, participation in local civic affairs and broadcast experience are the principal enhancement categories. Between two 100% integrated applicants, for example, a local, civically active group with broadcast experience would have a good chance to prevail over a non-local but minority-controlled applicant with no broadcast experience.

Enhancement credits are available only when the persons with the right attributes are proposed to be integrated into management. Thus, no qualitative enhancement credit would be awarded to an all-local, all-minority applicant whose stockholders do not propose to be involved in day-to-day management.

Various means are employed to achieve 100% quantitative integration credit in hearing cases. For example, the organizers of a venture may assign non-voting stock or limited partnership interests to investors who do not plan to work at the station. The commission looks only to the controlling, voting interests in evaluating the degree of integration credit to be awarded, and will not count truly passive interests in assessing quantitative integration credit.

Another important comparative factor is the degree to which the applicants propose service to underserved areas. Thus, if applicant A would provide 1mV/m service to an area and population that receives fewer than five aural services, it would receive an advantage compared with applicant B whose signal would not reach such underserved areas.

The comparative hearing process is long, arduous and expensive. As in any hotly contested legal proceeding, there are many pitfalls and uncertainties. However, the opportunity to pick up a valuable facility for relatively minimal costs continues to attract large numbers of applicants.

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

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Part 3

Strictly TV

By the book

By Carl Bentz, TV technical editor

Would your station pass an inspection today by the FCC?

Perhaps the logs are in order and you know all the meters are OK, because you just finished replacing one. But while you were working on the transmitter, did you disable any protection circuits?

Safety first

FCC rule 73.687(d) is specific regarding interlock and safety features of the transmitting system, and for good reason. Electricity, when handled with respect, is beneficial, but if mishandled, only milliamperes of high voltage electrical current may be fatal.

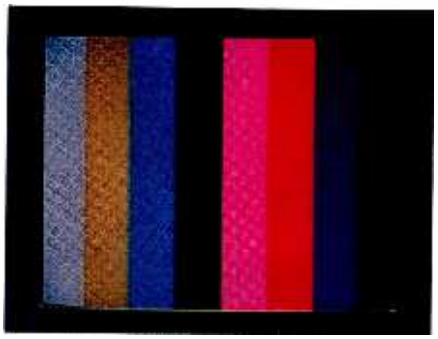
We've all been in situations where the show must go on, even if clip leads and tape are necessary to keep the transmitter on the air. But if the maintenance project will not be completed before sign-on, steps should be taken to ensure that any circuit with a potential of more than 350V is inaccessible to an unsuspecting individual. You could be held responsible if someone—even an unauthorized intruder—were injured or killed by electrical shock as a result of faulty or defeated interlocks.

An occasional check of safety bleeder resistors should also be made. Any part of the system that might retain high voltages should include a method of reducing voltages to less than 350V within two seconds after an access door is opened.

For the sake of other staff members, make certain that the meters you replaced do not carry a hazardous potential. In certain conditions, protective guards around meters may be required.

Correct carriers

In a properly operating system, AFC circuitry maintains the visual and aural carrier frequencies within the ±1kHz tolerance from the authorized frequencies. Do not depend completely upon the AFC circuit, however. Rely on a frequency measurement service with instrument specs conforming to the National Bureau of Standards. Monthly frequency measurements should be made and the resulting reports kept with other operational log information. If any major maintenance project is performed that might affect the frequency of operation, additional interim measurements are strongly suggested.



As designed by the manufacturer, the transmission system also has a functional power control mechanism. Make sure that the mechanism continues to operate properly. Tell your operators to maintain a close watch on the output power and use the controller to keep the visual power within the 80% to 110% tolerance range of the authorized power. Report any apparent malfunction of the power level control system to the maintenance staff and note it in the technical log.

The FM aural carrier power is equally important and should be maintained within the 80% to 110% range. However, the 110% aural power level must not exceed a maximum of 22% of the authorized visual carrier level.

Be aware of any tendencies toward system overheating. Equipment designers plan for normal operation to occur within a specified temperature range. If thermal faults cause your transmitter to shut down, the outage may be a sign of imminent failures. Although the problem might be within the cooling equipment, overheating also points to changes in efficiency, tuning and other aspects of the system.

Don't overmodulate

Once the video path between the studio and the transmitter is set up, keeping the proper levels of video and audio should be relatively easy. Official monitoring of the carriers should be done with reliable, accurate modulation monitors. If a modulation monitor fails, a spectrum analyzer can provide the interim information you need until the monitor is repaired.

Overmodulation of the aural carrier is the easiest to detect in the absence of proper monitoring. If the deviation of the main (or L+R) channel FM aural carrier exceeds ±25kHz, you will probably be able to hear the fault and you may also see it as interference patterns in the picture. Aural modulation of other portions of a multichannel sound system is even more critical.

Peak modulation of the visual carrier occurs during the peak of sync interval, while minimum modulation takes place at the white level. Normally, the peak modulation would be set at the time of transmitter maintenance, particularly when power meters are being calibrated with a calorimeter. An increase in the level of sync will cause an increase in the average power output. Poor control of peak white on the video signal, however, can cause overmodulation of the visual carrier.

Recalling that negative transmission characteristics are used with NTSC signals, an excessive white level (more than 100IRE units or less than 12.5% modulation) results in a reduction of contrast in the picture. If you have exceeded the 100IRE level more than occasionally, you may expect comment from the FCC. Similarly, keeping the video level and peak whites below the 100IRE level can result in a notice.

Do not depend upon a network VITS or VIRS signal as a reference for setting the video level. On numerous occasions, station operators, expecting the network test signal to be at the correct level, have been cited for high or low levels.

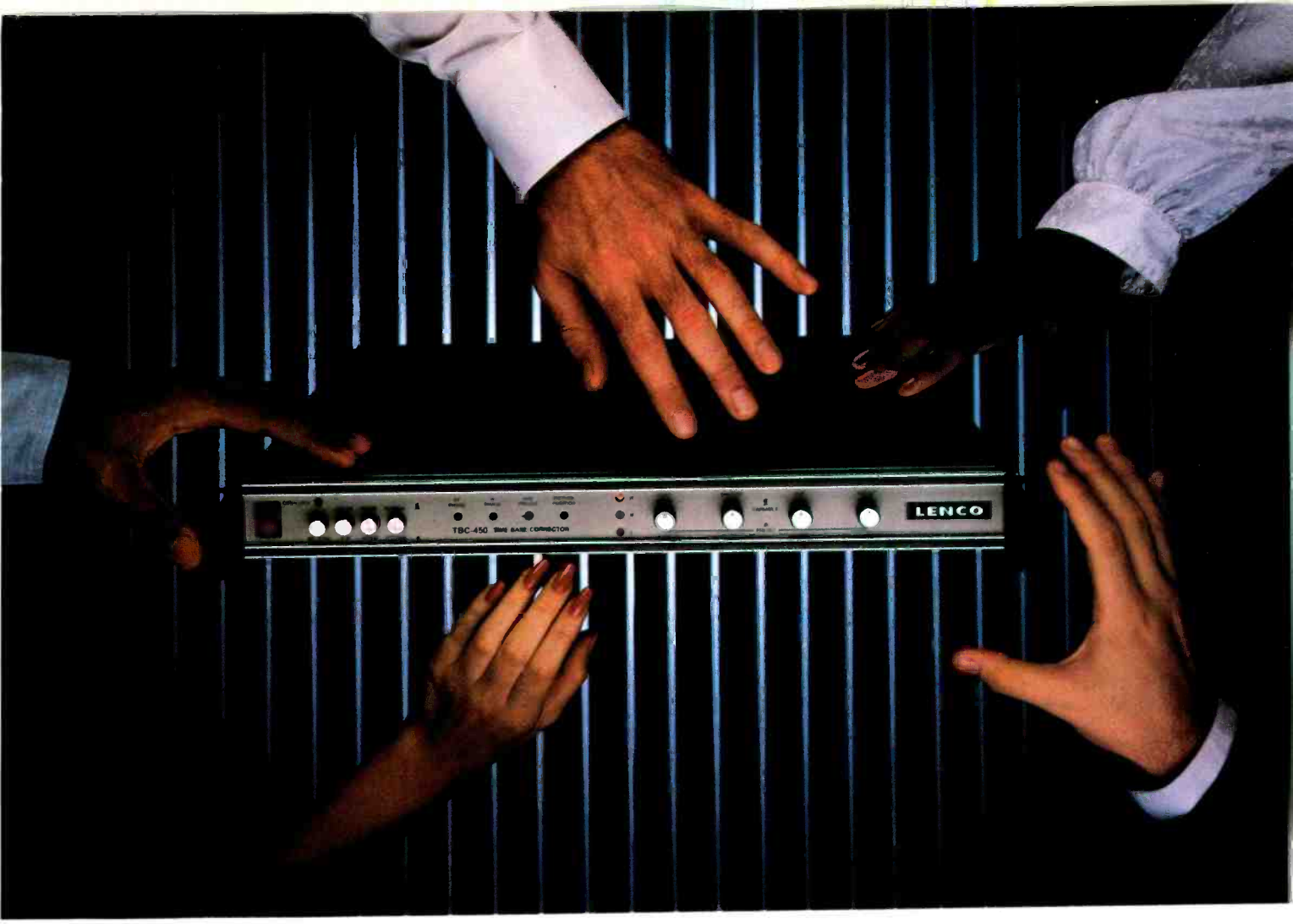
The only solution is for the operator to observe the demodulated signal and maintain sync and white levels at the −40IRE and 100IRE markings, respectively, on the waveform monitor graticule. A reference or zero-carrier trace, produced by the demodulator, should fall on the 120IRE line of the waveform monitor and should be the guideline to proper levels.

Responsibilities

The transmitter operator is charged with complete and proper control of the transmitting system within the bounds of the FCC rules. Furthermore, that operator's prime responsibility is to oversee the transmission system. The operator must be able to observe all transmitter and monitor metering to determine if deviations from normal indications are occurring. In addition, all necessary system adjustments must be available to the operator at the normal duty position.

Any member of the operating staff who is unfamiliar with proper signal levels and adjustments should be thoroughly instructed in the appearance of proper signals. Reading and interpreting the waveform monitor is not difficult, if the operator knows what is to be expected. |:-)))|

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Directional antenna field strength

By John Battison, P.E.

Last month we discussed non-directional antenna system efficiency and overall antenna and ground systems. This month we'll take a look at directional antenna efficiency.

When working on a directional antenna system for the first time, it's valuable to perform a power study. This process involves measuring the station RF power at various places in the antenna system. The study also requires an in-line impedance bridge for most measurements.

A nominal 5kW station is allowed 400W of system power loss. In the example shown in Figure 1, we will assume a total system power of 5,400W. This power should be measured at the common point of the antenna system. To calculate this parameter, square the common point current (I_{cp}) and multiply by the common point resistance R_{cp}. If R_{cp} is 70Ω, what is the common point current?

$$5.4\text{kW} = I^2 \times 70\Omega$$

$$I^2 = \frac{5{,}400}{70}$$

$$I_{cp} = \sqrt{77.14}$$

$$I_{cp} = 8.78\text{A}$$

The common point resistance is about the only resistance (impedance) that can be easily measured without using an in-line bridge. The older technique of using a bridge and oscillator will work here because the common point resistance reflects the combined effect of all the antenna impedances. At this point, we should be confident that we are putting 5,400W into the antenna. Or are we?

Calibrate the meters

Have you calibrated the common point ammeter? If not, now is a good time to do so, and to calibrate all of your other RF meters as well.

The first step in checking the calibration of the RF meters is to obtain an accurate standard. Then, connect the standard meter in series with all of the other meters. A variac can be used to supply the current necessary to check the



meters. Be sure that the variac can drop the output current down to zero before you connect the meters.

Now, increase the variac output slowly in suitable increments for your particular meter scales. As a current increases, compare the readings of each meter with the standard meter.

Measure the power

In order to measure the power at each of the important points in the system, you have to check each stage separately. Insert the bridge at the output of the phaser at the point where it connects to each transmission line. Measure the impedance. Repeat the process at the input to the antenna tuning units (ATUs). Measure the antenna base operating impedance at each tower base with the system operating normally. You now have the necessary data to calculate the actual RF power at each of these points.

The nominal power of the station should equal the sum of the powers from each tower. If the sum of the powers calculated from the towers is far above the station's nominal power, there may be an inaccurate resistance or current reading involved. If the sum of the powers is appreciably lower than nominal and the output stage efficiency is normal, you may have a loss somewhere in the system. The beauty of using an in-line bridge is that you can measure the actual operating power at each link in the system. This process will generally identify the defective area without a lot of work.

The impedance you see looking into the line from the phaser should be the same as that found when you look into the ATU input. The line currents should also be the same, or reasonably close when measured at each end of the lines. If you find that conditions vary considerably, you will need to check the ATU match and the line itself.

Plot the pattern

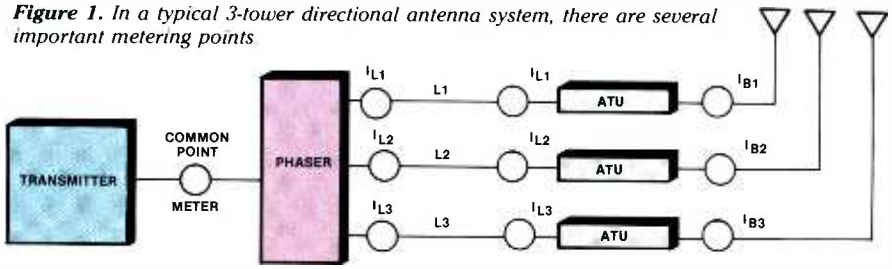
The FCC is concerned about the rms value of your antenna's radiation. You can calculate this value graphically or mathematically. To do so graphically, use a polar planimeter or the square method. Because most of us do not have access to a polar planimeter, we will use the square method for an example.

Plot the antenna pattern on squared paper. The smaller the squares, the more accurate the results. Count the number of squares contained within the pattern's outline. Be as accurate as possible. Add the number of squares and determine the area to be represented by each square. Having determined the number of squares that represent the area covered by the antenna pattern, convert the irregular pattern area to a circle, using the same scale as you used for the antenna pattern. The radius of the circle is the rms voltage for the antenna system at one mile or kilometer.

The mathematical method is time-consuming, but is worth explanation. The inverse field value for every 5° is squared and added together. The total is then divided by the number of entries (72). The answer represents the rms value of the antenna system.

If you have recently run a proof, you can compare this rms value with the original proof value. The numbers should be close to each other. If not, and the new one is lower (which is usually the case) something is reducing your power. The ground system is a likely candidate for causing this type of problem. We will look further into this phenomenon next month.

Figure 1. In a typical 3-tower directional antenna system, there are several important metering points



Battison, BE's consultant on antennas and radiation, owns a radio engineering consulting company in Columbus, OH.

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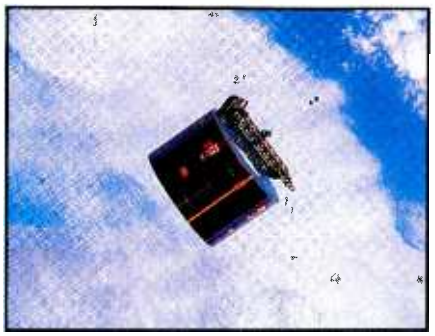
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Part 1

Satellite technology



Transmitting data

By Elmer Smalling III

Because of the growth in digital satellite communications and the requirement for full participation of many users on a single transponder, multiple-access schemes must be employed. Starting in this month's column, three basic types of multiple-access schemes will be discussed—FDMA (frequency division multiple access), TDMA (time division multiple access) and CDMA (code division multiple access).

How they work

FDMA is the least complicated and most popular of the three types of multiple access schemes. Because each user is assigned to a discrete channel, FDMA requires more hardware than either TDMA or CDMA. User channels may be handled as SCPC (single channel per carrier), where each channel is transmitted on a discrete frequency or multiplexed as a subcarrier of a main carrier.

Each user channel or carrier must be separated from one another by a guard band to prevent the possibility of crosstalk. The use of guard bands is rather inefficient because it reduces the total usable bandwidth for communications data.

A slightly more efficient transmission scheme used with FDMA is DAMA, or demand assignment multiple access. This system assigns frequencies to users only when required, freeing up bandwidth for others when a frequency is idle. DAMA may be controlled with a polling system or random-access control.

A master polling computer polls each earth station on the system. When it receives a request to transmit, it assigns a frequency. As the number of stations on the network grows, the polling time becomes greater and eventually limits the operation of the system.

Using a random-access DAMA system, a computer at the primary sending earth station scans the bandwidth for an open channel. When one is found, the computer assigns it to the network. Variations of this scheme, using processors at each earth station site, search for data by decoding the received data then latch onto that frequency until the transmission is complete. DAMA is normally used only where there is low traffic volume.

FDMA modulation schemes usually divide a 36MHz-wide transponder among the users up to the point at which noise due to intermodulation products reduces the effectiveness of the transponder's non-linear amplifier. The amplifier is usually operated at the near-linear portion of its operating curve so that the power obtained from the transponder for each user (accessee) is proportional to the user's uplink power.

Data transmission

Let's look at the types of data signals that may be used with multiple-access schemes.

The simplest type of data modulation is FSK (frequency shift keying), by which two frequencies are used—one frequency for a 1 value and another frequency for a 0 value. A NRZ (non-return to zero) data signal is used to control a modulator to shift a carrier between two frequencies representing a 1 or 0, depending on the input data waveform. Because the square shape of bitstreams or data waveforms produces a wider carrier modulation envelope than would be caused by *rounded* signals, which have smaller phase changes, the data signal is usually rounded at the corners before being fed to the modulator. This process is known as *spectral shaping*.

Another form of coding is PSK (phase shift keying). Binary signals are used to modulate a carrier so that 1s and 0s are 180° apart in phase but at the same frequency. This is referred to as BPSK, or binary phase shift keying. There is a type of BPSK called *relative phase shift keying* in which a 1 is represented by sending a burst with the same phase of the burst preceding it. A 0 is represented by a burst with opposite phase than that preceding it (±180°).

QPSK (quadrature phase shift keying) is similar to BPSK except that two bits of data may be sent with each burst—00,01, 11 or 10. Each of these bit-pair values is determined by the signal phase relationships (0°, 90°, 180° and 270°). Bandwidth may be saved by using QPSK over BPSK, but QPSK requires much more complex equipment.

One extension of QPSK that reduces errors because of reduced phase shifting requirements is OQPSK or *offset quadrature phase shift keying*. Here, the amount of phase difference between bursts is reduced, thereby limiting the amount of spectral interference during the non-linear transmission of a satellite transponder. 8psk allows for octal data transmission (000, 001, 010, 011, 100, 101, 110, 111). This type of coding requires much more complex equipment and is more error prone because of the eight levels of decision required of the receiver circuitry.

Error detection/correction

Error correction must play a large part in any decoding scheme. Satellite data is prone to two types of errors: those that map to a Gaussian noise curve for the earth-space-earth link and those that are burst type noise between terrestrial links.

One type of error correction, called FEC (forward error correction), lends itself to the correction of distributed (Gaussian distribution) errors. This type of correction code adds an error-correcting bit at given intervals. These bits are counted at the receiver and, if errors are detected, an automatic request to repeat transmission triggers a *replay* of that portion of data. FEC coding requires additional bandwidth because of the extra error-sensing bits.

A second method of error sensing is called *parity checking*. Algorithms, which parity-check blocks of data, add up the bits in a given block and check that sum with a parity bit. If a parity-check scheme also checks data in preceding blocks, it is called *convolutional coding*.

The earth-space-earth path is quite noisy, especially when there are many users sharing a transponder and each is employing high-power, high-speed data transmissions. For this reason, it is important to choose the best mode of modulation and error checking. Next month, we'll look at TDMA systems.

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

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Part 5

Circuits

Thyristor servo systems

By Jerry Whitaker, editor

A key ingredient in any ac power control system using thyristors is proper suppression of transient voltages on the utility company power lines. A secondary requirement is suppression of transient disturbances generated by the control circuit itself or the inductive load. Last month, we began to examine the methods that can be used to suppress such disturbances. This aspect of power control is important to long-term reliability of the system.

Voltage-clamping devices include components such as selenium cells and varistors of various types. These devices, although different in construction, act on a circuit exposed to a transient overvoltage in similar ways. Figure 1 illustrates a typical voltage vs. current curve for a voltage-clamping device. When exposed to a high-voltage transient, the impedance of the component changes from a high-standby value to a low-conduction value, thereby clamping the voltage at a specified level. Such components are designed to be essentially invisible in the circuit until the applied positive or negative potential reaches or exceeds the *conduction knee* of the device. The component then effectively clamps the voltage excursion at a level specified by the designer.

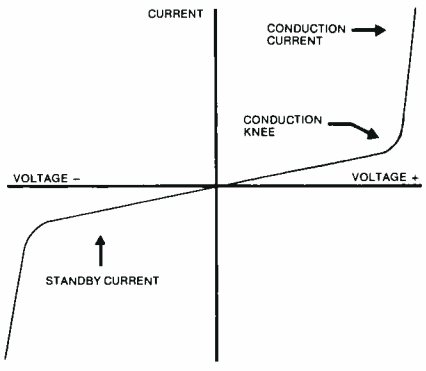
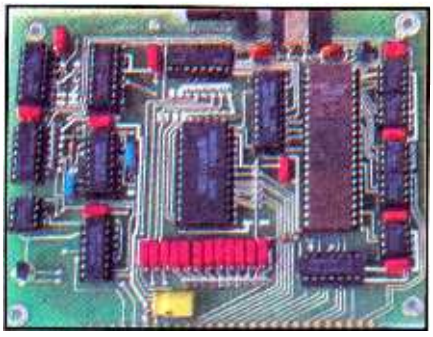


Figure 1. *The voltage vs. current curve for a typical bipolar voltage-clamping device used in transient suppression applications.*

Selecting a protection device

The selection of a transient suppressor for a particular application is a complicated procedure that must take into account the following items:

- the steady-state working voltage, including normal tolerances;
- the voltage-clamping characteristics required in the application;
- circuit-protection devices such as fuses or circuit breakers present in the system;



- the consequences of protection device failure in a short circuit or open circuit mode; and
- the sensitivity of the load to transient disturbances.

The selection process is one that requires careful study and consideration of equipment operation under all operating modes. It is a process that should be left up to the equipment manufacturer. The specifications and ratings of suppression components are not necessarily interchangeable from one manufacturer to another.

The use of transient suppression devices in a transmitter is a necessity today because of the power quality problems that exist—and in all likelihood will continue to exist—in most areas of the country.

Protector staging

Transient suppression for a major piece of equipment such as a transmitter is not accomplished by simply placing a couple of surge suppressors across the ac input lines. There's more to line protection than that. The manufacturer must consider the effects of transients generated through external means, such as the utility company ac input power source, and transients that may be generated through operation of the system. It is possible, for example, to generate damaging voltages in some designs through the normal operation of fault circuits.

Staging is a simple technique that is effective in controlling disturbances entering the transmitter from the utility company line. Consider the ac power distribution system shown in Figure 2. The protection components located at the input point of the transmitter (the *primary suppressors*) will carry most of the suppressed-surge current in the event of a lightning strike or major transient disturbance. The varistors and thyrectors downstream (the *secondary* and *supplementary suppressors*) are rated for clamp voltages lower than the primary protection devices and, with the assistance of the ac circuit series resistance and impedance, exercise tight control over voltage excursions. R-C networks are used in the circuit to aid in transient suppression.

A staged arrangement also protects the system from exposure because of a transient suppression device that may, for whatever reason, become effective. The performance of an individual suppression component is more critical in a system that is protected at only one point than in a system that is protected at several different points. The use of staged suppression also helps prevent transients generated by load equipment from being distributed to other unit sections.

Suppressors generally are not placed in parallel to gain additional power-handling capability. Even suppressors that are identical in type number have specified tolerances, and consequently, devices placed in parallel will not evenly share the surge current.

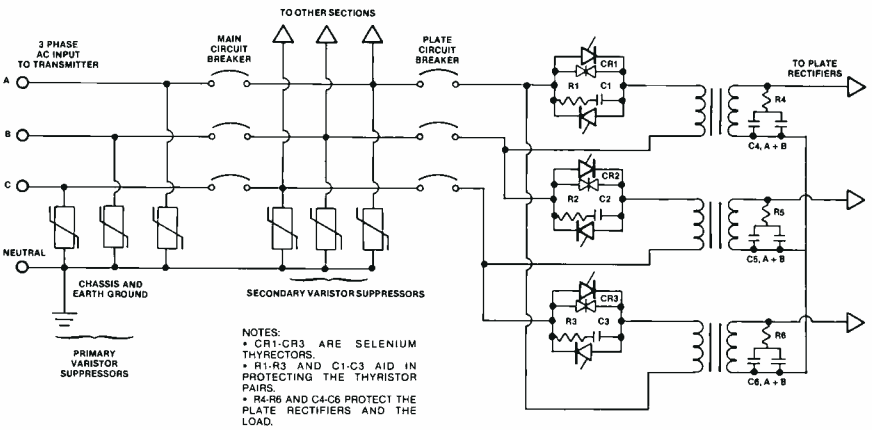


Figure 2. *The use of ac system series inductance and resistance to aid transient suppressors in controlling line disturbances. This technique is known as staging.*

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Part 7

Troubleshooting

Power supply failures

By Jerry Whitaker, editor

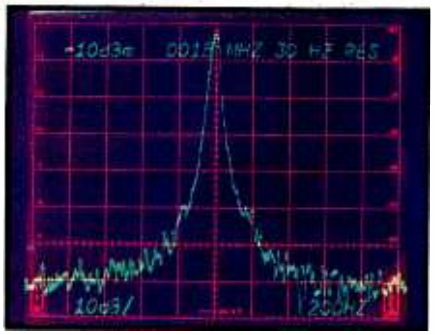
Last month we began to discuss the process of troubleshooting failures in the transmitter interlock circuit. If your transmitter control ladder operates on a low dc voltage, such as 24V, the process of finding the problem can be fairly easy. If, however, the control circuit operates on 120Vac or 208Vac, the fault must be found through continuity checks, usually requiring substantially more work.

The ohmmeter method of troubleshooting is conventional and straightforward. It is also time-consuming. For transmitters operating with a low-voltage control ladder and constructed so that no dangerous high-potential circuits are exposed when making interlock voltage checks, shortcuts are possible.

A methodical approach

When searching for a break in the interlock system, use a methodical approach to solving the problem. Consider the circuit configuration shown in Figure 1. The most logical approach to finding a break in the control ladder is to begin at the source of the 24Vdc input and, step by step, work your way to the input of the power controller. Although this approach may be logical, it can also be slow. Instead, eliminate stages of the interlock circuit. For example, make your first test at terminal A. A correct voltage reading at this point in the circuit will confirm that all of the interlock door switches are operating properly. (Needless to say, you will have to manually close any interlocks for doors that must be opened to gain access to the test terminals.)

With the knowledge that the problem is after terminal A, move on to terminal



B. If your 24V supply voltage disappears, check the fault circuit overload relays to find where the control signal is lost. Often, such interlock problems can be attributed to dirty contacts in one of the overload relays. If a problem is found with one set of relay contacts, clean all of the other contacts in the overload interlock string for good measure. Be sure to use the proper relay-contact cleaning tools.

Finding a problem such as an open control circuit interlock is basically a simple procedure. It is, however, usually time-consuming. Do not rush through such troubleshooting work. In the long run, you will save time by taking a careful, methodical approach.

Step-start faults

The high-voltage power supply of any medium- or high-power transmitter must include provisions for in-rush current-limiting upon the application of a plate-on command. The filter capacitor(s) in the power supply will appear as a virtual short circuit during a sudden increase in voltage from the rectifier stacks. To avoid excessive current surges through the rectifiers, capacitor(s), choke and power transformer, nearly all transmitters use some form of *step-start* arrangement. Such circuits are designed to limit the in-rush current to a predictable level. This can be accomplished in various ways.

For transmitters using thyristor power control systems, the step-start function can be easily designed into the gate firing circuits. An R-C network at the input point of the gating cards can be used to ramp the thyristor pairs from a zero conduction angle to full conduction (or a conduction angle preset by the user). This system provides an elegant solution to the step-start requirement, allowing plate voltage to be increased from zero to full value within a period of about five seconds.

Transmitters employing a conventional ac power control system usually incorporate a step-start circuit using two sets of contactors: the *start contactor* and the *run contactor*. Surge-limiting resistors provide sufficient voltage drop upon application of a plate-on command to limit the surge current to a safe level. Auxiliary contacts on the start contactor cause the run contactor to close as soon as the start contacts have seated.

A fault in the step-start circuit of a transmitter is often evidenced—initially at least—by random tripping of the plate supply circuit breaker upon high-voltage turn-on. If left uncorrected, it can lead to problems such as failed power rectifiers or filter capacitors.

Troubleshooting a step-start fault in a system employing thyristor power control should begin at the R-C ramp network. Check the capacitor to see if it has opened. Monitor the control voltage to the thyristor gating cards to confirm that the output voltage of the controller slowly increases to full value. If it does and the turn-on problem persists, the failure involves one or more of the gating cards.

Troubleshooting a step-start fault in a transmitter employing the dual contactor arrangement should begin with a close inspection of all contact points on both contactors. Pay careful attention to the auxiliary relay contacts. If these contacts fail to properly close, the full load of the high-voltage power supply will be carried through the resistors and start contactor. These devices are normally sized only for intermittent duty. They are not intended to carry the full load current for any length of time.

Look for signs of arcing or overheating of the contact pairs and current-carrying connector bars. Check the current-limiting resistors for excessive dissipation and continuity.

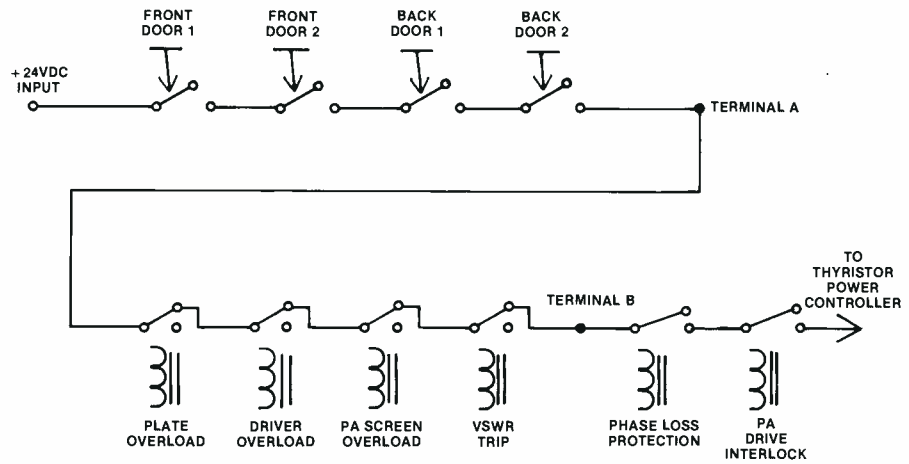


Figure 1. *A typical transmitter interlock circuit. Terminals A and B are test points used for troubleshooting the system in the event of an interlock system failure.*

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Management for engineers

Some pros and cons on tower leasing

By the *BE* staff



Most broadcasters have given at least a passing thought to leasing space on their towers. After all, if you have to maintain a tower several hundred feet tall, you might as well see if some additional financial return is possible. But wait. Before you run an advertisement in the local paper, there are several important items to consider.

Know your tower

The first step in leasing tower space is to obtain the structural specifications for the tower. If you know the manufacturer, and if the company is still in business, you are in luck. Simply contact the company and explain what you want to do. It is likely that the manufacturer is in the best position to assist you in determining what additional (if any) loads can be added to your tower. Even if you have copies of the plans and specifications of the tower, you will need more information before you can determine what additional loads can be applied. For instance, typical tower plans do not contain the rating of the steel used or calculations of the structural design.

Many tower manufacturers rely on computer modeling for tower design. Once a basic tower design is defined, it is easy to make additions to the structure on a test basis with the computer. In a matter of minutes, the computer will tell the structural engineer whether the tower can support the proposed load.

If the tower is several years old, a computer model may not exist for it. In most cases, it is possible to have one made. It is, however, somewhat costly and requires a high degree of expertise. The work requires that a trained engineer physically climb and inspect the tower. The engineer will measure the sizes of the various members, bolts and guy wires. Soil samples may need to be taken along with other tests. From the information obtained in the inspection, a reliable computer model can usually be constructed. The advantage of going through this complicated and expensive process is that any proposed additions or changes can be easily checked on the computer.

Managing your tower

Once you are sure of the structural capacity of your tower, you can begin to consider what type of additions can be made. Some broadcasters will lease space to anyone who has the money. Other broadcasters use tower leasing in political ways, choosing to lease only to certain companies. Whatever the case, the second question that must now be answered is how much to charge.

You may want to charge $100 per foot plus $1,000 per month, but unless you are in a truly unique location, it may be difficult to obtain a rate that high. Tower leasing rates are somewhat competitive. There are usually several locations available to those who want to rent space. Although each location has its advantage, some balancing of costs usually exists within the market. Certain factors affect the fees that can be charged. They are:

- the desirability of the site in terms of elevation, location, accessibility and utilities as compared to other sites;
- the current rates for comparable sites in your area;
- the wind loading on the tower of the proposed antenna, transmission line, mounting brackets and other devices;
- the type of service, and its income potential to the tenant (an example being that FM and TV broadcasters would be likely to pay more for space than would a 1-way paging service or educational broadcaster); and
- interference possibilities between the new tenant and current tenants.

In order to set comparable rates for your tower, it may be necessary to talk to other tower owners. The problem is that they sometimes don't want to reveal what they charge for space. One possible way around this problem is to talk to the companies that lease tower space. It may be that they would be willing to discuss moving their antennas in trade for favorable leasing rates.

Insurance

There are two categories of insurance that a broadcaster should consider with respect to tower leasing. The first is the standard insurance that the broadcaster carries. The second is the insurance that may be required of those companies that lease space or service equipment on your tower.

Many broadcasters carry some form of *all-risk* coverage on the tower, the equipment on the tower, the transmitter building and equipment associated with the transmitting facilities. All-risk insurance is, basically, property insurance. The tower itself is probably the most expensive item to replace.

Pay particular attention to the wording on the insurance policy. For instance, an *agreed amount* clause available from some companies says that in case of loss, the amount specified in the contract will be paid, regardless of replacement cost. If the policy specified an amount of $750,000 and a new tower cost is $1.25 million, you will make up the difference of $500,000.

Because the cost of replacing tall towers (or any tower) is increasing rapidly, get a replacement appraisal at least every two years. Based on the appraisal, the insurance policy may need to be updated. After your tower falls is not the time to discover that the insurance policy will not cover the costs of getting you back in business.

In addition to all-risk coverage, some form of public liability is also suggested. Stations typically carry a liability policy and it may cover situations associated with the tower. If you are in doubt, check with your insurance company.

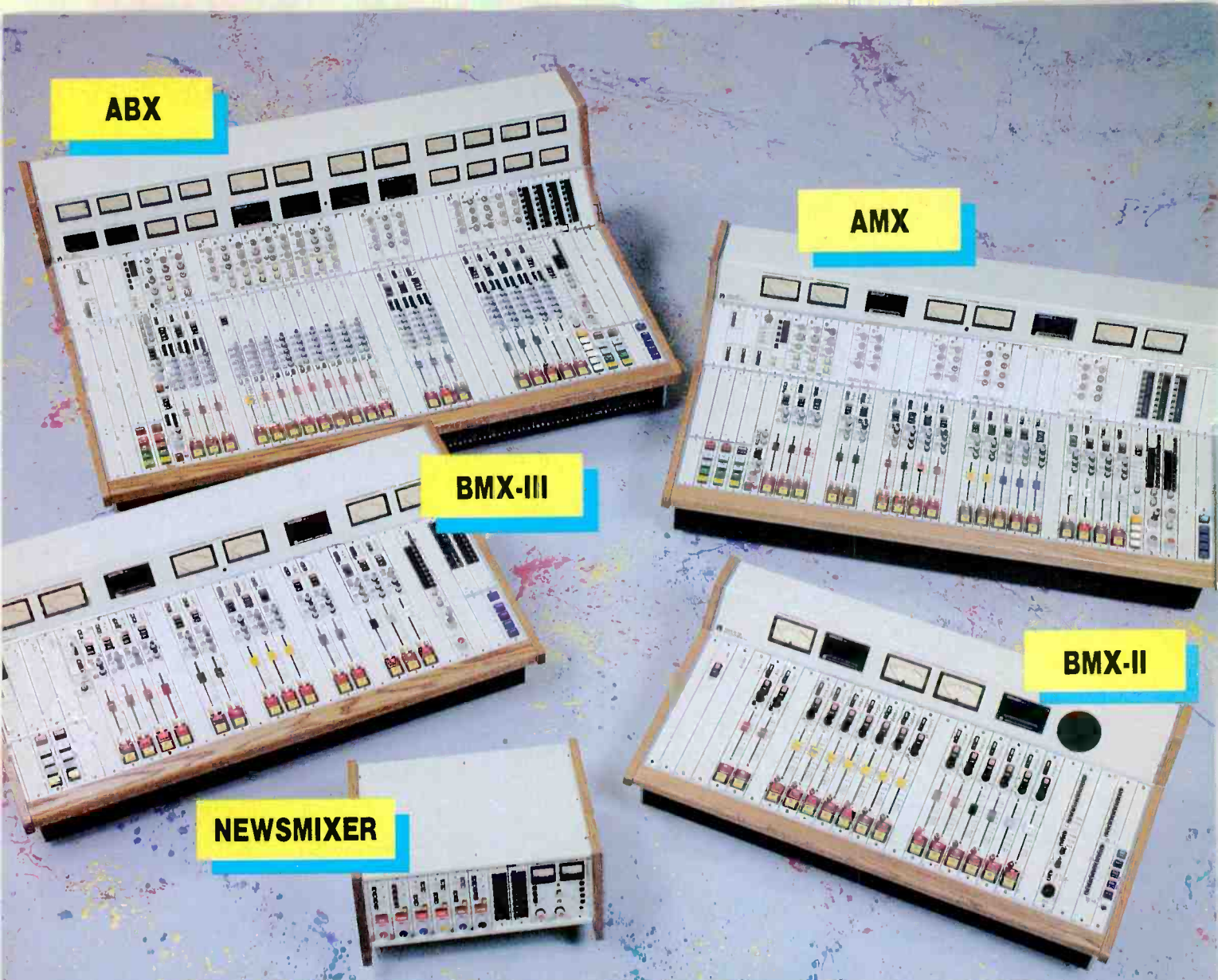
Some stations carry business interruption insurance. Although it is expensive, it can be important if the station suffers major damage in a tower collapse. When you prepare your leasing contracts, be sure to include a clause to protect your station from any claims of business interruption from the tower tenants.

Finally, all tenants on the tower should be required to carry sufficient insurance to cover property damage or injury to a tenant, employees and contractors working for the tenant, as well as damage to automobiles and damage to the owner's or tenants' equipment.

Tower leasing can be profitable. Before you decide to pursue it, however, give it careful consideration. Although leasing a tower can bring in additional profits for the station, it can also result in a number of headaches for the station engineer and manager.

Editor's note: The information in this column was obtained from *Radio and Television Towers: Maintaining, Modifying and Managing.* Copies of the publication are available from the NAB, 1771 N Street, NW, Washington, DC 20036.

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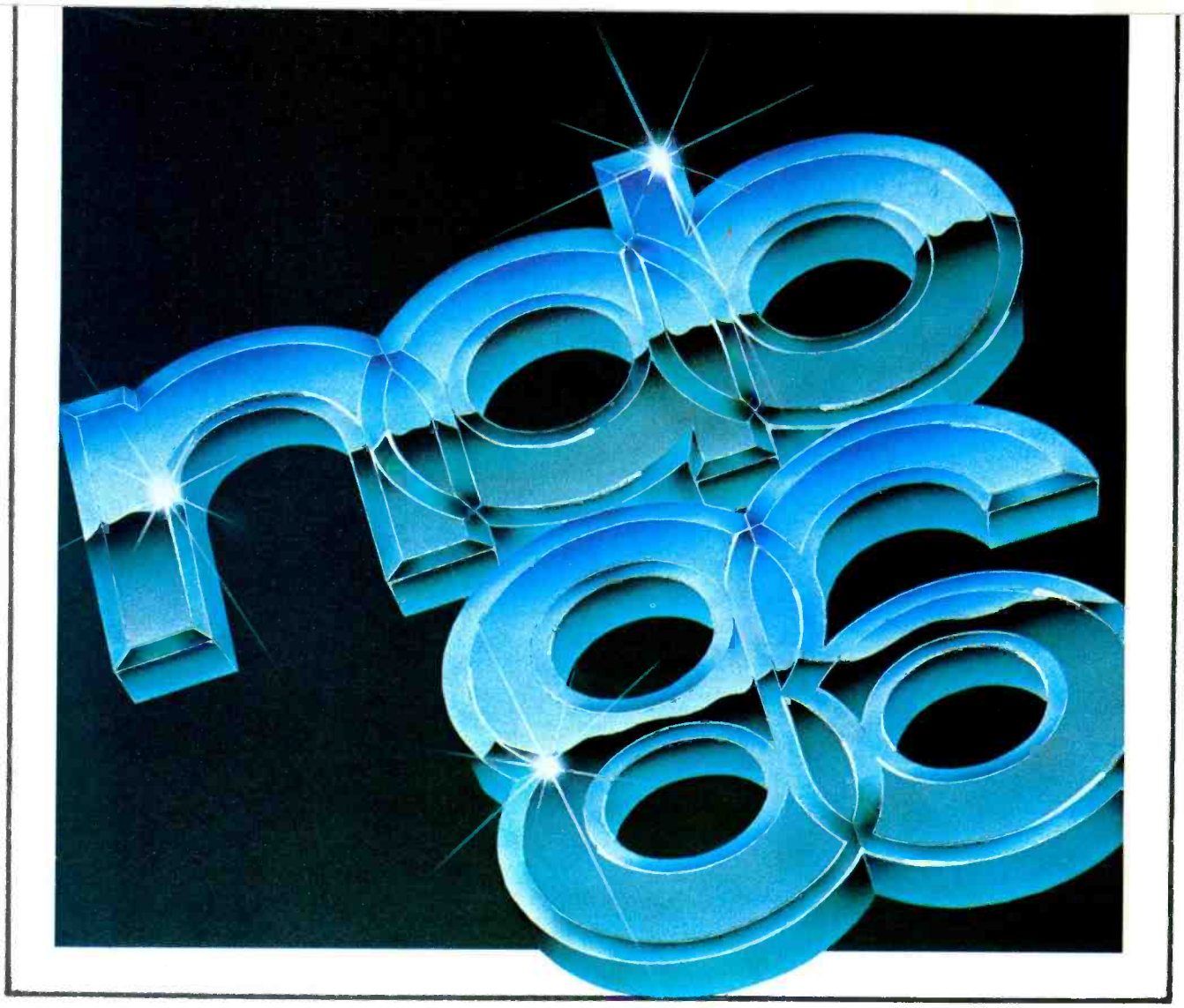
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Tuning in America

By Ed Williams

Another full slate of engineering sessions is planned for NAB '86.

The 1986 NAB Broadcast Engineering Conference will provide a broad range of technical sessions designed to educate and challenge the attending engineer. Under the NAB's convention theme of *Tuning in America*, the sessions will help broadcast engineers tune up their radio or TV stations to provide a quality signal for an increasingly demanding audience.

This year's sessions will cover such topics as HDTV, companded FM broadcasting and improved AM broadcasting techniques. Of special interest to the TV engineer will be sessions on new technology and satellite news gathering (SNG) systems.

The engineering conference begins Saturday, April 12, at the Dallas Convention Center. Additional engineering workshops will be on Tuesday at 7 p.m. in the Hyatt Regency. These evening sessions provide an additional opportunity to participate in one-on-one discussions with experts in the field. The conference features 19 technical topic sessions, with seven panel discussions and more than 90 papers and presentations.

Williams is a staff engineer at the NAB.

Radio sessions

• *AM Technical Improvement* (Saturday, April 12 at 9 a.m.)

During the past year, considerable momentum has developed in the effort to improve AM broadcasting as a system. With the FCC supporting far-reaching changes, the National Radio Systems Committee (NRSC) ready to help design better receivers and the NAB's own AM improvement project, the presentations in this session will provide important new technical information for all AM stations. The session will report on the work of the industry committees, new antenna designs, broadbanding techniques for antennas, synchronous transmitters and electrical noise reduction. This is a must-attend session for all AM station engineers.

• *Radio Broadcast Engineering* (Saturday at 1:15 p.m.)

Topics of general interest to broadcast engineers in this session include: modifying FM antennas for lower downward radiation, combining several FM stations into a common antenna, determining short-spacing interference, analyzing sideband response of AM antennas and solving power-line reradiation problems. A special feature will be a paper on the design considerations for Voice of America antenna arrays.

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• *Radio Maintenance Session* (Sunday, April 13 at 9:30 a.m.)

Because of the success of last year's maintenance panels, they will be repeated this year. Presentations will address the subjects of making the best use of your talents and time and improving transmitter reliability. The panel will include experts on studio equipment, transmitters, tubes and towers. Bring your toughest questions on broadcast equipment maintenance.

• *AM-FM Allocations* (Monday, April 14 at 8:30 a.m.)

With reports on AM band expansion, FM 80-90 activity, FM/aeronautical interference problems and the results of international meetings, engineers from the FCC, NAB and consultants will provide a look into the future of radio broadcasting in the U.S. Coffee and doughnuts will be provided for this early morning session.

• *Radio Subcarriers* (Monday at 10:15 a.m.)

Because stations are becoming more interested in transmitting data on subcarriers as a means to increase revenue, broadcast engineers need to know how to install and maintain the equipment. This session features presentations on improvements and tune-ups you can make to your AM or FM transmitter to permit full use of aural and data subcarriers without harming your main channel programming. The European Radio Data System (RDS) will be described and suggestions will be offered as to how this technology might be used in the United States.

• *New Radio Technology* (Tuesday, April 15 at 9 a.m.)

A series of presentations on novel remote control and automatic transmission systems will highlight this session. The session will feature the latest computer technology for remote control applications, present a method of using dial-up and pocket radio systems, and report on current FCC rules. The panel following the papers will concentrate on remote control and ATS applications. An FCC engineer will be on the panel.

A presentation on the FMX companded FM transmission system will round out the session. This new transmission method can greatly extend the stereo range of an FM signal. The presentation will cover the latest field test results and performance measurements of the FMX system.

• *Radio Production* (Tuesday at 2:30 p.m.)

Have you ever wondered how you might go about setting up a regional sports network, design a remote radio van or improve the acoustics of a production studio? This session will answer these and other questions on radio production. There will also be reports on the construction of the new radio network facilities at ABC and NBC and a description of a new computerized telephone interface system.

• *AM Stereo* (Tuesday at 4 p.m.)

As AM stereo continues to grow stronger, AM engineers need to keep up to date on the latest developments. This session will offer suggestions about the conversion from monaural to stereo and point out some of the problems to be expected. Specific solutions will be discussed. If your station is not stereo yet, it may be soon. Find out how to complete the conversion process at the transmitter and studio as painlessly as possible.

TV sessions

• *TV Recording and Tape Technology* (Saturday, April 12 at 9 a.m.)

At a glance: NAB '86 Engineering Conference:

Saturday, April 12

Radio	*Television*
9 a.m.	9 a.m.
AM Technical Improvement	**TV Recording and Tape Technology**
1:15 p.m.	11:15 a.m.
Radio Broadcast Engineering	**TV Multichannel Sound**
	3:45 p.m.
	TV Graphics

Sunday, April 13

Radio	*Television*
9:30 a.m.	9 a.m.
Radio Maintenance	**TV System Maintenance**

Monday, April 14

Radio	*Television*
8:30 a.m.	8:30 a.m.
AM-FM Allocations	**TV Engineering and New Technology**
10:15 a.m.	2 p.m.
Radio Subcarriers	**Advanced TV Systems**
	2 p.m.
	UHF TV Systems

2:30 p.m.
Special Radio-TV Session: Broadcast Auxiliary

6:30 p.m.
Ham Radio Reception

Tuesday, April 15

Radio	*Television*
9 a.m.	8:15 a.m.
New Radio Technology	**TV Satellite Systems**

Noon
Engineering Luncheon

2:30 p.m.
Radio Production

3 p.m.
Special Radio-TV Session: Non-Ionizing Radiation

4 p.m.
AM Stereo

7 p.m.
Special Radio-TV Sessions: Acoustics, AM Antenna Tuning, TV Measurements and other topics

Wednesday, April 16

9 a.m.
FCC Engineers Forum

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There are a number of important changes taking place in the use of TV digital and small format TV recording. Papers presented in this session will highlight the SMPTE D1 digital video recording standard, the broadcaster's need for digital TV recording, the use of small format broadcast video recording and new formula tape performance requirements for digital TV recording. If you are involved in video recording, this is a *must attend* session.

• *TV Multichannel Sound* (Saturday at 11:15 a.m.)

It is estimated that nearly 300 TV stations will be transmitting in stereo by midyear. Nearly 25% of all full-power TV stations will have made the conversion to stereo operation within a span of only two years. The maturing of TV stereo sound will be reflected in presentations on testing of the BTSC system, maintaining monaural compatibility, production and post-production problems and acoustic design considerations for stereo.

There will also be reports on the use of TV aural subcarriers for data and use of the vertical interval for recording stereo or transmitting stereo audio over microwave systems. FCC type acceptance information and rule compliance will also be discussed. If you're transmitting stereo now or plan to be, you should attend this session.

Engineering award

Dr. George H. Brown, retired RCA engineering executive, will receive the NAB 1986 Engineering Achievement Award. It will be presented at the 40th annual Broadcast Engineering Conference luncheon on Tuesday, April 15.

Joining RCA in 1933, Brown was executive vice president of patents and licensing, a position in which he directed research, engineering, patents and licensing for the company. He was active in the research and development of the National Television Systems Committee's (NTSC) color TV system. He also was instrumental in the design of the batwing antenna, used by most early TV stations.

Brown holds more than 80 U.S. patents, has authored more than 100 technical papers, and is the co-author of a text on radio-frequency heating. He has received numerous honors and awards, including the DeForest Audion Award of the Veteran Wireless Operators Association, the prestigious Edison Medal and the David Sarnoff Award for Outstanding Achievement in Radio and Television.

He received bachelor's, master's and doctorate degrees from the University of Wisconsin, and received an honorary degree of doctor of engineering from the University of Rhode Island. Brown retired from RCA in 1974.

• *TV Graphics* (Saturday at 3:45 p.m.)

Imaginative graphics have become a way of life at most TV stations. The next area of improvement will be increased efficiency and quality in the actual creation process. This topic was well received last year, so don't be late to this year's update on TV graphics technology.

• *TV System Maintenance* (Sunday, April 13 at 9 a.m.)

TV station maintenance requires a wide range of skills. Engineers must be able to work on systems ranging from signal generation and storage to distribution and transmission. Because the session was so well attended last year, a whole new series of presentations will be offered this year. The session will cover such topics as maintaining quality control of programming, video cart machine maintenance and tower maintenance. Following a special report on the problems of tower icing will be an audience participation panel with experts to discuss and solve your maintenance problems. Don't miss this important TV engineering session.

• *TV Engineering and New Technology* (Monday, April 14 at 8:30 a.m.)

New technology and engineering developments never stop unfolding. This session will provide you with the latest reports on component video, all-digital video studios, lighting, automation, a description of CCIR-recommended practice 601 for digital video, the latest news from the world of fiber optics, the SMPTE remote control standard and ENG batteries.

• *Advanced TV Systems* (Monday at 2 p.m.)

A single worldwide standard for high-definition TV production is important to the advancement of HDTV work. This panel will report on how the universal standard is being developed. Other reports will include status updates on the work of technical groups of the Advanced Television System Committee, three reports on spectrum-conservative HDTV terrestrial transmission systems and a comparison of audio systems proposed for use with HDTV transmission.

• *UHF Television Systems* (Monday at 2 p.m.)

There are now more than 550 UHF TV stations operating in the United States. These stations have unique technical characteristics, which will be discussed in this session. Multiple-depressed-collector klystron tubes, Klystrodes, near-field UHF antenna measurements and circular UHF antennas are topics to be covered in this session. If you are involved in UHF broadcasting, you should attend.

• *TV Satellite Systems* (Tuesday, April 15 at 8:15 a.m.)

One of the major problems with satellite news gathering (SNG) has been the inadequacy of the communications systems. Recent work by GTE and Wegener has resulted in solutions to these problems. This session will report on the solutions and what the future of satellites might hold for broadcast applications. ABC and CBS will report on news gathering systems and a second-generation fly-away SNG system. The panel will invite the audience to discuss such *hot* topics as satellite interference and uplink operator training.

More NAB coverage in this issue:

- *Exhibitor listing, page 189*
- *Exhibitor map, page 191*
- *Product directory, page 291*

Related sessions

• *Broadcast Auxiliary* (Monday at 2:30 p.m.)

The broadcast auxiliary bands have made live outside broadcast programming possible. Until recently, broadcasters have had exclusive use of these bands of frequencies. Now, however, the FCC wants stations to share the channels with a variety of other users who may not share broadcasters' concerns about how the bands should be used. In this session, a panel of broadcasters and FCC representatives will discuss these problems and the development of a national policy for frequency coordination in congested areas. The session will include reports on new technological developments in ENG antenna design and spectrum-conservative STL systems.

• *Non-Ionizing Radiation* (Tuesday at 3 p.m.)

The first of the year brought about a new set of regulations for broadcasters in regard to non-ionizing radiation levels at transmission sites. Some stations may need to make changes in their facilities in order to comply with the new regulations. This session will provide reports from the FCC and the EPA on how to measure RF energy, how to modify FM transmitting antennas to reduce downward radiation and how the Mt. Sutro Tower in San Francisco copes with the problem. You will have the chance to question the experts about how to solve your station's particular problems. If you can't attend this session, send your manager. Better yet, try to attend *with* your manager.

• *FCC Engineers Forum* (Wednesday at 9 a.m.)

Engineers from the FCC will be on hand to discuss recent technical rule changes and to answer questions from the audience. This is *the* session to attend to get your questions answered by the people who make and enforce the rules. One of the FCC field-measuring vans will be on display in the parking lot, operating and available for inspection.

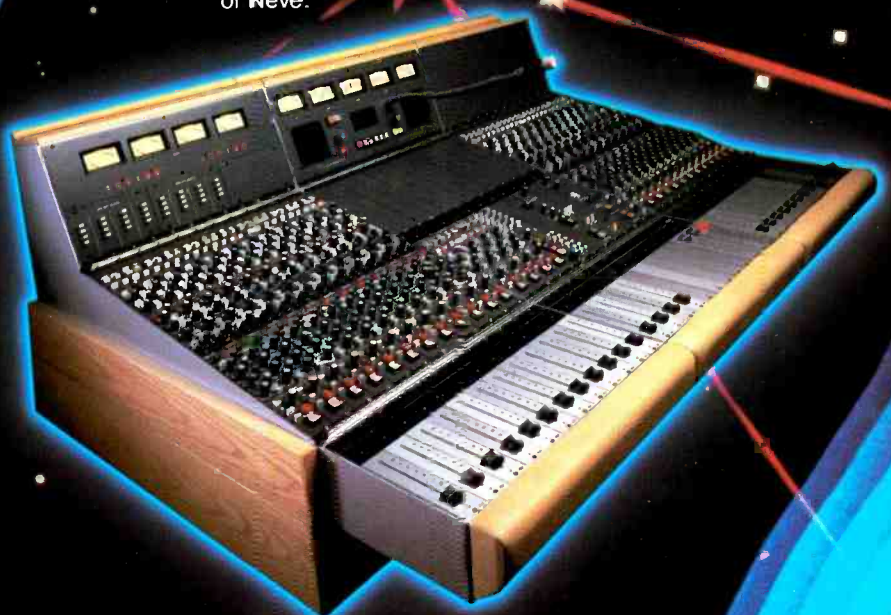
Editor's note: The program listings shown here are subject to change. Check your convention brochure for the latest schedule changes. The *proceedings* will contain most of the papers presented. Copies will be available for sale at the convention.

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Updating broadcast facilities

New technology and tougher-than-ever competition are causing many radio and TV stations to examine their technical plants for ways to improve efficiency and to increase flexibility. This special emphasis section of *BE* looks at the process of building, or rebuilding, a technical center.

WOR-TV has just completed a major relocation project to Secaucus, NJ. The station's new studios and technical center give new meaning to the phrase state-of-the-art. *See page 30.*

Only 134 days from shovel to switch. Impossible? Not so. WYMT-TV in Hazard, KY, completed a studio construction project that can only be described as fast-track. *See page 52.*

High-tech ITFS. That's how the Access Network of Edmonton, Alberta, describes its new broadcast operations center. This is no small operation. *See page 56.*





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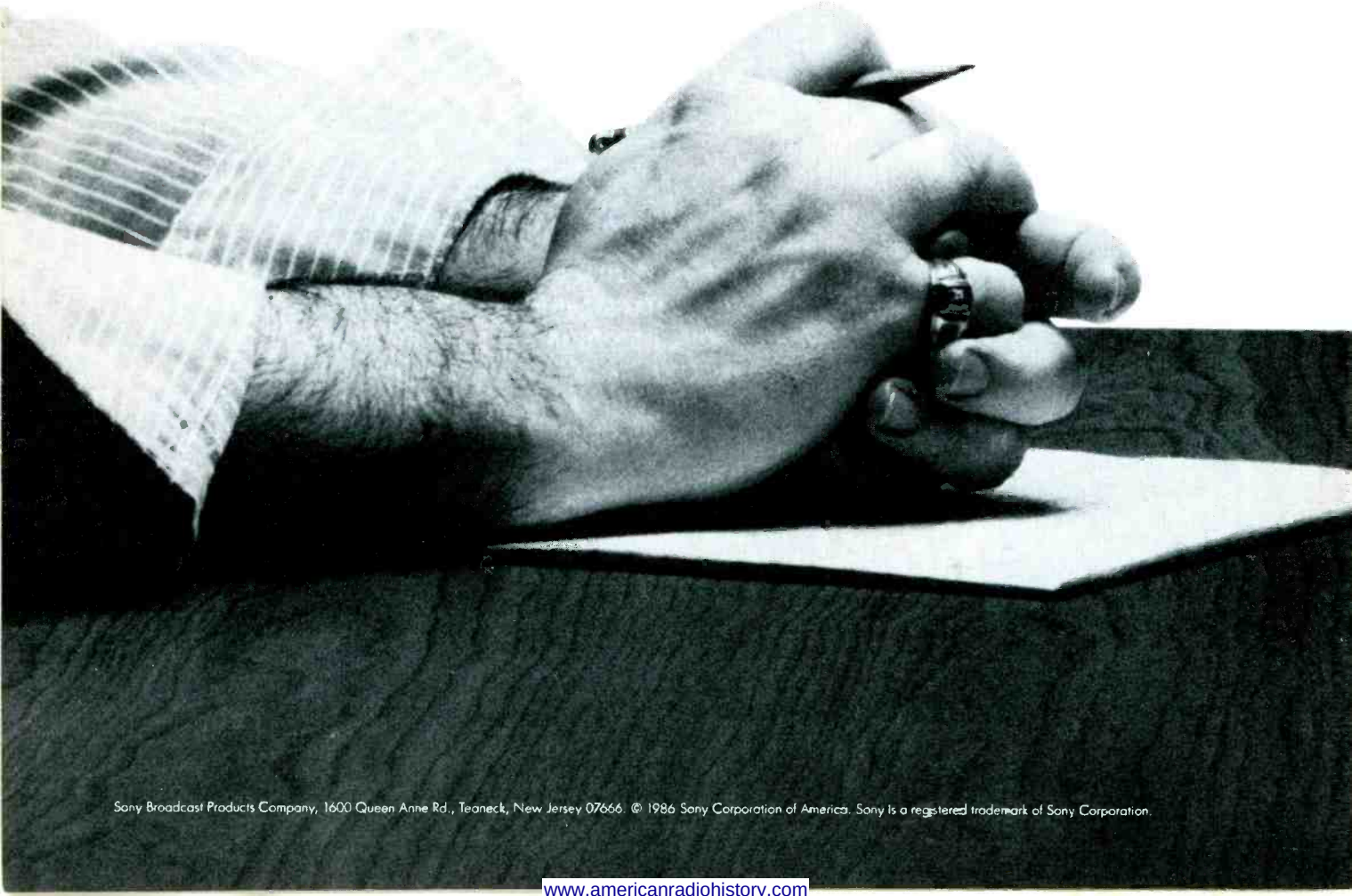
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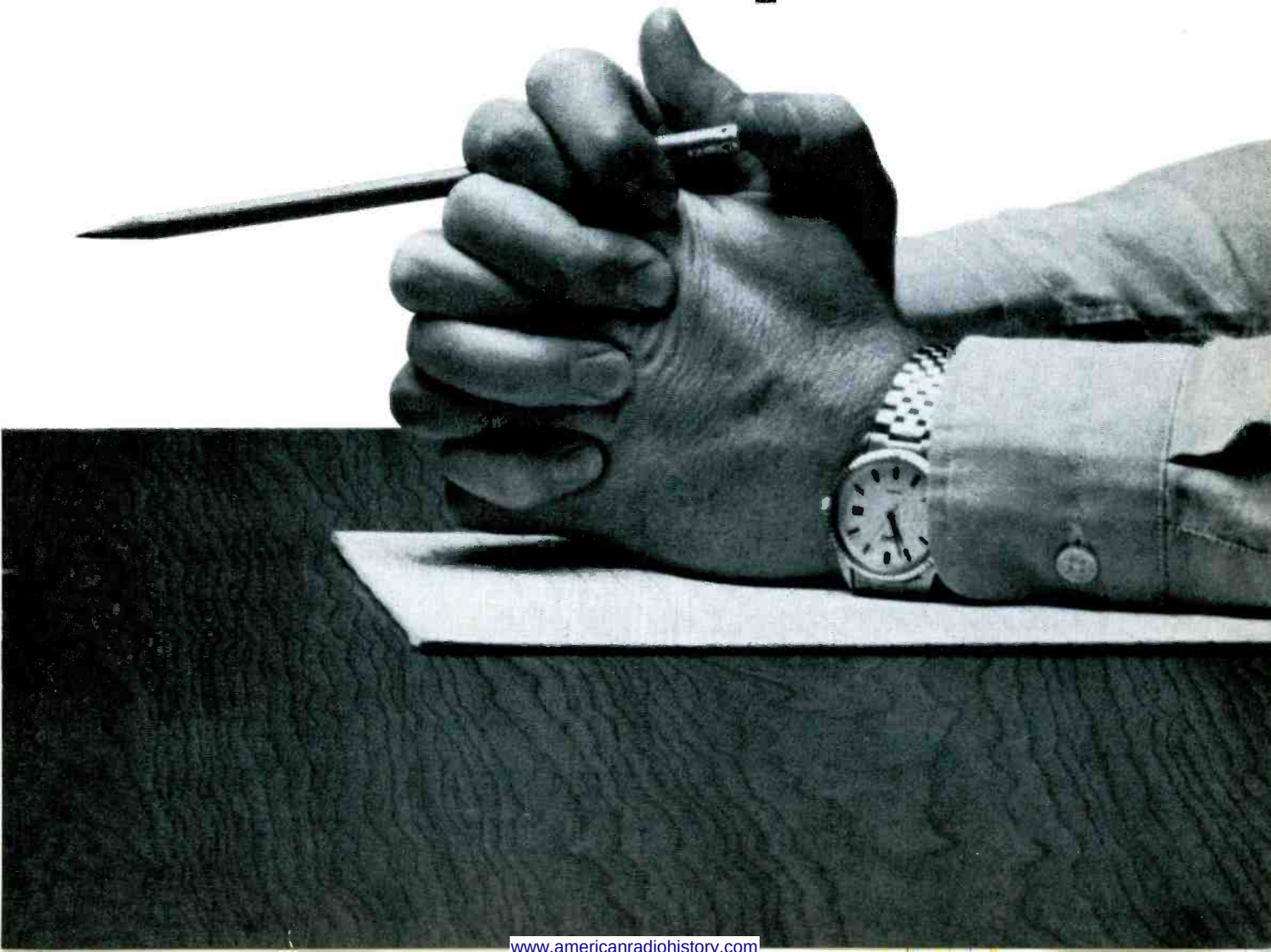
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Building for the future

By Ken McGowan

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

Key elements in the design of any TV plant are flexibility and long-term reliability. TV studio and master control facilities vary considerably from one station to the next, and from one market size to the next. However, the thread that ties them all together is the need for adaptability in design.

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

To achieve these goals, the station must commit time and resources. Detailed planning is expensive and demands long lead times, but the result is a plant that serves the needs of all operating departments at the station. These key ingredients provided the basis for WOR-TV's recent move from New York to a new facility in Secaucus, NJ.

Team effort

When the decision is made by a large corporation to build a new TV facility, a team effort is required to complete construction of the project. Like RKO General (which owns WOR), most large corporations have on their management team experts in various specialty areas, such as communications, security and maintenance. The chief engineer can use these experts as resources for consultation during the design and construction phases of the project.

Because of the number of contractors typically involved in such a project, an in-house arbitrator should be selected to ensure that everyone on the team is working toward the same goals and deadlines. The in-house coordinator might be the chief engineer or another person selected by the company. The criteria for selection should be familiarity with the project and corporate organization, good management and budgeting skills, and freedom from other tasks at the existing facility.

McGowan is director of engineering for WOR-TV 9, Secaucus, NJ.

The driving force behind our successful move to New Jersey was the president of RKO Television, Pat Servodidio. The project management team included:

- From RKO General: Peter A. Leone, vice president and general manager of WOR; Lad Hlavaty, vice president of engineering; staff managers Art Siegel (HVAC systems), Gene Caser (property planning and management) and Bill Malloy (security systems); and Ken McGowan's engineering staff.
- Building architect: Sidney Philip Gilbert and Associates.
- Acoustical treatment: Robert A. Hansen Associates.
- Facility documentation, equipment installation and checkout: Al Bjornson, Telemeasurements.

When WOR was relicensed to New Jersey, it was given the option to relocate. This was a mixed blessing for the engineering department.

We would be given the opportunity to construct a new, state-of-the-art facility from the ground up, but on a timetable that could only be described as *fast track*. Fortunately, the move from the existing studio center on Times Square in Manhattan—which we had occupied for 22 years—would not involve relocation of the transmission facilities on the World Trade Center. With our marching orders in hand, we went to work.

Site selection

Site selection for a new facility involves many trade-offs that must be considered on an individual basis. Before you run out and start searching for that *perfect site*, carefully define your needs. Consider the following:

- *Building space requirements.* How much square footage must be allowed for office areas, technical rooms and studio facilities? Include in the space assessment the required height of each type of room.
- *RF relay requirements.* Can you reach the transmitter through a single STL hop or will an additional relay link be required? What about intercity relay links and ENG equipment? Can the proposed site support the operations you currently have in place, or that you plan for the future?
- *Satellite requirements.* Can the proposed site support the needed satellite downlink and uplink dishes? Will interference with terrestrial microwave services be a problem?
- *Power requirements.* Is satisfactory ac utility company power available at the proposed site, or will additional lines have to be installed (at your expense)? What is the typical power reliability at the site? Do outages occur frequently, and if so, what is the typical duration?
- *Environmental requirements.* Is water available at the site? Does flooding occur over portions of the property during periods of heavy rain?
- *Acoustic requirements.* Is the site near an airport or along a heavily traveled street? If it is, inside acoustic suppression of noise transmission through walls, slabs, windows, doors and particularly the roof could be a difficult and expensive challenge.

There are many other questions that must be asked before an intelligent choice of a proposed site can be made. You may, in fact, find that the legal and financial steps involved in site selection are more formidable than the technical criteria.

Early in our relocation study, a 3.5-acre site in Secaucus was selected from a number of possible locations. The Meadowlands area proved to be ideal for our operations. The WOR transmitter at the World Trade Center is only a 6-mile STL carry from the studio. We found we could establish a line-of-sight path free of any EMI and aircraft landing/takeoff interference with only an 85-foot-tall microwave tower. The site contained an existing structure, which was taken down to the bare walls for reconstruction to our needs. Outside the building there were one and a half acres available for employee and visitor parking, the microwave tower, and earth station antenna pads.

The building was also ideal from the standpoint of transportation. It's minutes from the Lincoln Tunnel on Route 3, the

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The master control room of WOR-TV, Secaucus, N.J. Shown at the switcher is master control operator Clemet Florio. (Photos by Jim Curry, New York.)

turnpike is right behind us, Newark Airport is 15 minutes away and the Meadowlands Sports Complex is only a mile away. Site selection of any new studio should take into account accessibility to freeways, airports and activity centers.

Making it happen

Funding for a new facility can be (and usually is) a difficult task. What we learned may help you in a similar project. Determine your costs for studio and office space per square foot, and be realistic. It is easier to explain why you are under budget than it is to explain why you are over.

Budgeting for a brand new state-of-the-art facility requires deep pockets. One way to keep the initial costs down is long-range planning. If you can't afford to purchase everything you want by the time you have the ribbon-cutting ceremony, plan for growth for several years. But, don't go out and buy the newest equipment on the market if it doesn't make business sense or satisfy your current and future needs. Be realistic with your equipment wish lists. Remember the ball is in your court when it comes to buying equipment. Learn the art of *negotiable buying*.

Set project milestones for members of the project team. Make the deadlines realistic and make them stick. Consider putting late penalties into your contractor agreements to ensure that the required deadlines are met.

Whether you are renovating an existing building or starting construction from an empty lot, consider the acoustic requirements of the facility. Establish acceptable noise criteria numbers for each type of workspace (studio, master control or office area). Hiring a reputable acoustic engineer to assist the general contractor in designing room configurations and selecting construction materials is a wise investment.

The first phase of major equipment installation usually involves the heating, ventilation and air-conditioning system (HVAC). Plan the air-handling equipment with the requirements of the facility in mind. Technical areas (such as master control) present a relatively constant cooling load for the HVAC system. Studio areas, on the other hand, present widely varying cooling load requirements, depending upon studio use and size.

Airflow and acoustic isolation must be considered for all studios. Sound from other parts of the building must not be allowed to leak into studio areas. This requirement dictates the use of separate HVAC systems for certain areas of the plant and/or sound-baffling ducts to reduce sound transfer from noisy areas to quiet areas. In order to keep ambient HVAC noise at a minimum, airflow must be kept low, but at high volume.

When you are ready to plan the technical areas of the new facility, the best input usually comes from an examination of the present plant. Examine its floor space allotments for studio, technical and office use. In what areas are they inadequate? This assessment should include electronic equipment as well as floor space allotments. List the equipment used in each studio or control room of the present facility. Decide how that equipment mix should be changed, if at all. Talk with the engineers and producers who use the current facilities to determine what they would like to see in the new plant.

Cabling can be handled in a number of ways, including wiring troughs, computer floors and ceiling raceways.

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Whatever method you choose, make sure it will provide easy access to equipment and will allow future additions and/or modifications to the system. Give careful thought to the number of audio, video and control cables that must run between studios, editing suites/control rooms and master control. Consider also the in-plant feeds that may be required for monitoring, program feedback and data/control communications.

Plan the emergency power requirements of the facility to provide for continued operation during utility company power failures. A wide selection of options are available for stations considering standby power equipment. Choose the one that meets your needs and budget. Consider establishing a *critical power bus* that is fed from an uninterruptable power system (UPS).

Design your studio lighting system to meet your current and projected production needs. Determine the amount of lighting required, the mix of lamp ratings and styles, and the control system (manual or computerized) that best suits your needs. It is far less expensive to install a lighting system that exceeds your production requirements (initially, at least) than it is to modify, or even replace, an inadequate system after only a few years of operation.

Plan your internal communications systems for current and projected operations. Design the plant intercom to allow easy communications with all areas of the facility involved in production or on-air operations. Study the feasibility of integrating the building telephone system into the intercom and data communications lines. Design an integrated communications system for the plant that ties together all parts of the operation.

Planning for building security should begin long before any walls go up. Security is becoming an increasingly important aspect of plant design. Build natural barriers into the facility to protect sensitive areas such as master control and on-air studios. A card access system can provide station management with an easy way to establish and maintain secure areas of the station, and to change them as needed.

Another part of security planning involves creation of easy-to-follow emergency building evacuation routes. Fire detection and control systems conforming to local building codes must be a primary consideration, whether the station is moving into an existing structure or a new building.

After the general parameters of the plant have been set, develop a project timeline that outlines the stages of construction and deadlines. The planning and construction work flow for WOR is diagrammed in Figure 1.

The WOR project

By following the general steps outlined previously, WOR was able to construct a facility that is one of the largest and finest in the country. The building includes more than 110,000 square feet of floor space. A high atrium welcomes visitors to the building and provides a view into the 7,000-square-foot newsroom. General and administrative offices are on the second floor, accessible by a dramatic stairway and passenger and freight elevators.

On the first floor, three broad front-to-back corridors provide access to separate areas for production, engineering, operations, news, personnel and security offices. Two lateral corridors provide production, engineering and news employees interaccess within these work areas without passing through visitor areas or disturbing other business operations. (See Figure 2.)

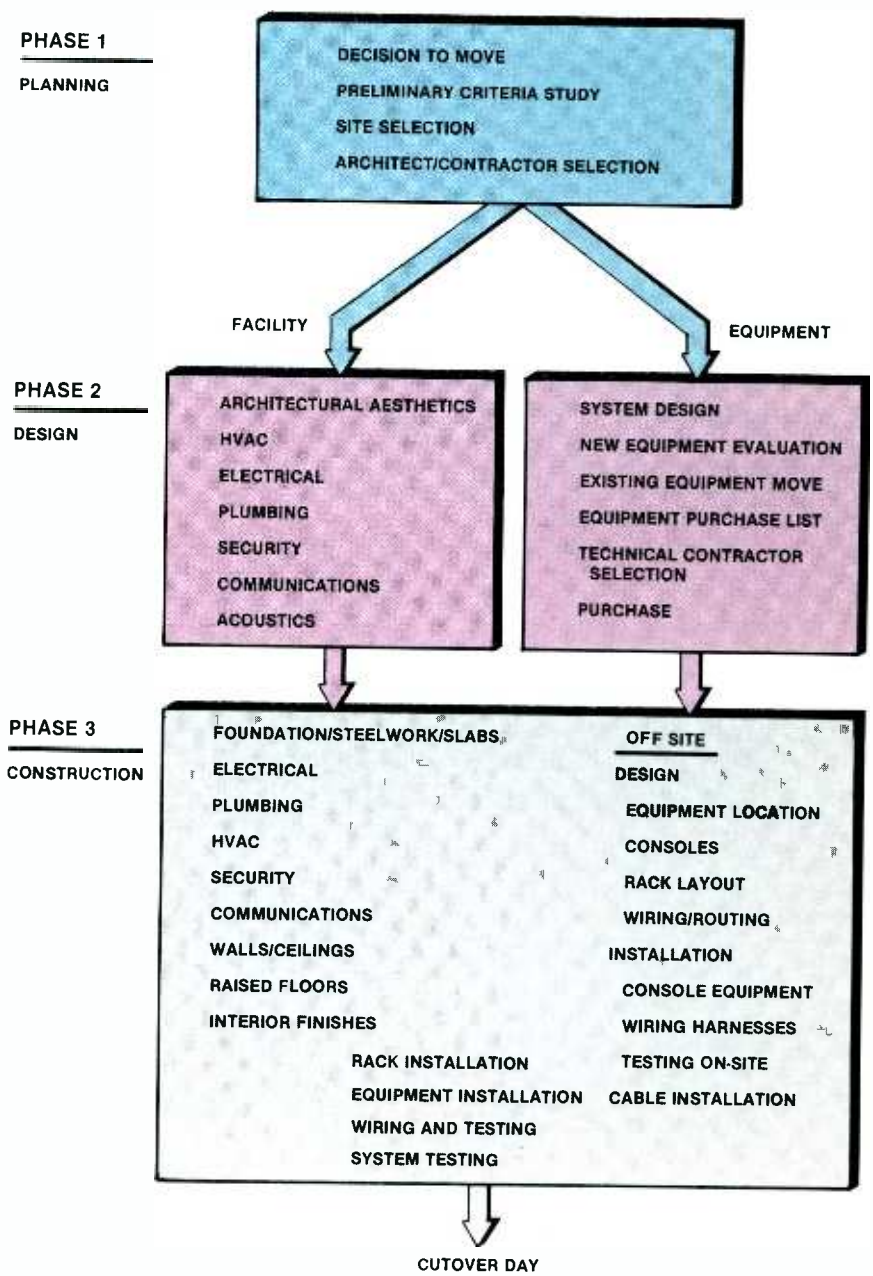
Traffic and security

Visitors enter the station via the atrium, which faces the street. Two other entrances on opposite sides of the building provide employee access from two parking lots. The north side entrance was provided primarily to facilitate news staffers' rapid in-and-out movement around the clock. A loading dock on the same side provides access for supplies, equipment, props, scenery and vehicles for any of three studios opening off the back lateral corridor.

Controlling traffic through these multiple entrances with a security force would have cost a fortune in guard salaries and overhead. We, therefore, opted for a versatile, triple-level electronic security system. For two of the levels, video surveillance cameras and a 2-way intercom provide sight and sound links between all the entrances and the security office located adjacent to the atrium.

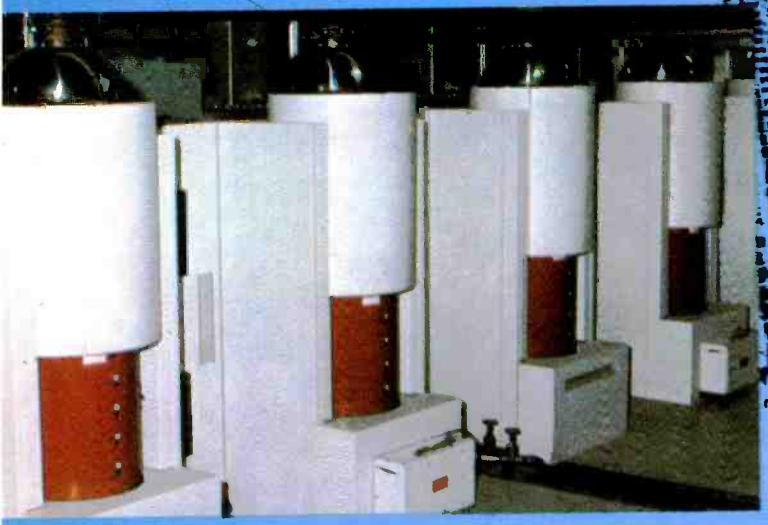
The third level is a computer-based ID-card access system. It can easily adapt to

Figure 1. *Secaucus facility planning, design and construction flow chart.*



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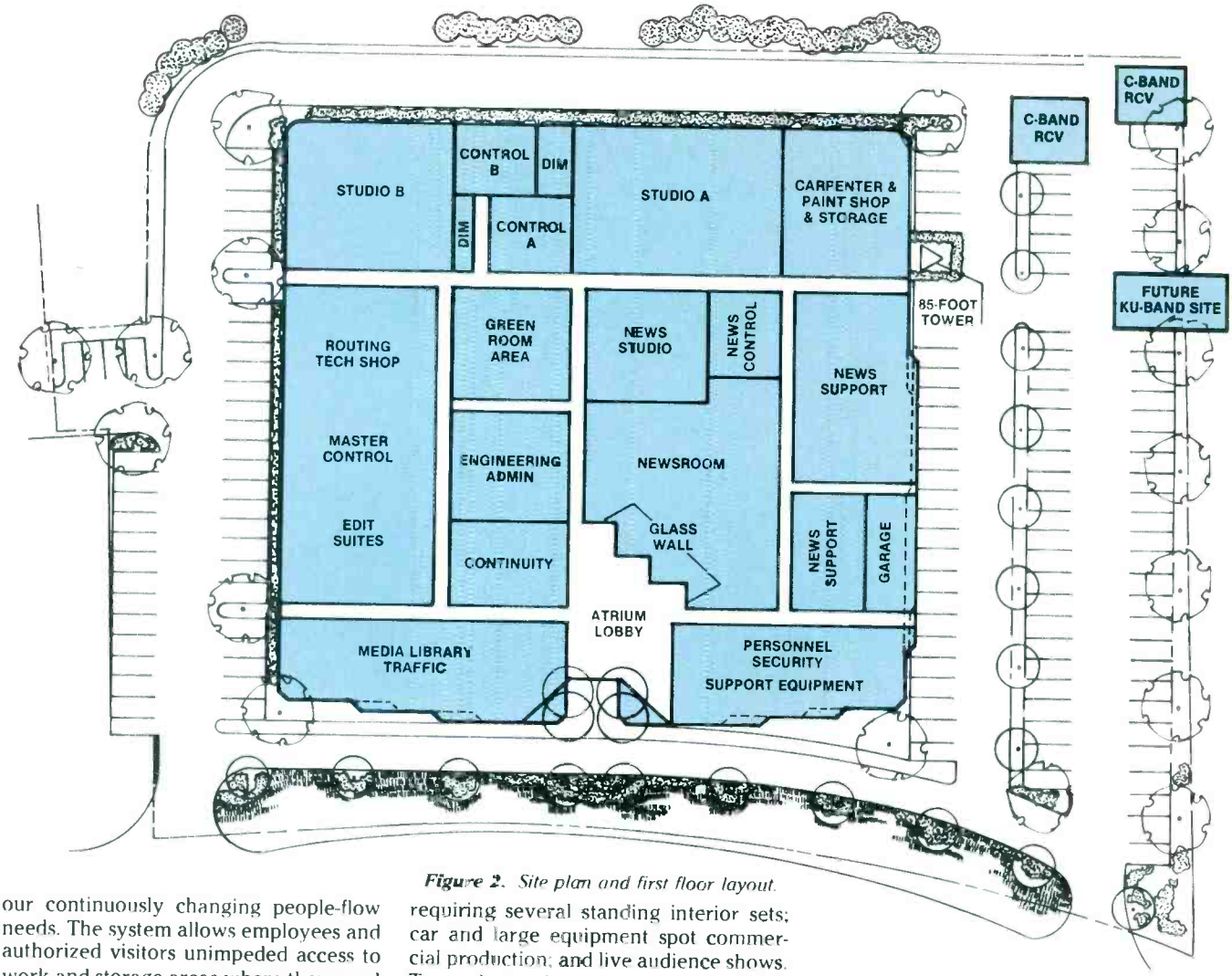


Figure 2. *Site plan and first floor layout.*

our continuously changing people-flow needs. The system allows employees and authorized visitors unimpeded access to work and storage areas where they need to be at specific times. Each card is coded with information about the holder and the areas that person can access. The control computer can be programmed to established authorized access lists for every secured area or room by time of day, day of week or frequency, as well as for specific people.

On-duty guards monitoring people flow can communicate with anyone in the facility seeking access to a specific area. They can open any room to a properly identified employee as necessary.

Production operations

Two production studios, 59' x 89' and 59' x 70', both offering more than 20 feet of headroom to their lighting grids, are located at the back of the building. They are available for in-house and outside producer spot commercial and syndicated program production. Each production control room has its own announce booth and audio booth. Adjacent to studio A are a scene dock and a carpenter shop. A spacious *green room*, dressing rooms, showers and a make-up room open off the corridor leading from the atrium to studio A.

The size and accessibility of studio A make it useful for a number of functions, including: production of a program series requiring several standing interior sets; car and large equipment spot commercial production; and live audience shows. Two electronic post-production (EPP) rooms and an audio-sweetening room round out the spot and program production facilities.

On the second floor we have expansion space to house a program syndication client's entire staff, plus additional screening and editing facilities.

A view of the WOR master control room showing the station automation equipment and video switcher.



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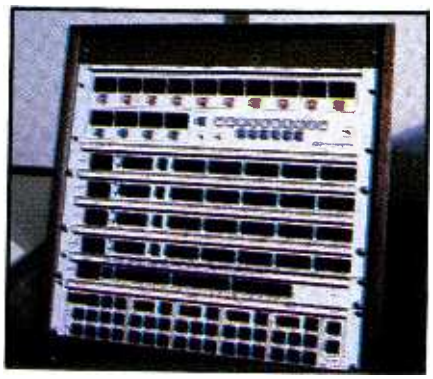
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Engineering operations

The technical facilities used to support production and post-production work and on-air broadcast operations are an engineering manager's dream. We occupy 11,500 square feet, essentially one-third of the first floor. Directly off the atrium are the management and technical operation supervisors' offices and engineering lab, plus a technical conference and training room for the exclusive use of our 75 full-time staff technicians and supervisors.

All of the first-floor work areas in engineering are traditional in grouping and function. The microwave equipment room is adjacent to the microwave tower on the second floor. We've tried to make the plant highly adaptable to accommodate innovations in equipment and applications that are on the horizon.

There are no ramps or stairs to negotiate when passing from equipment rooms and control rooms that have raised computer room floors to the concrete-floored studios, access corridors, office and shop areas. Reference-zero elevation for the entire first floor was established as the height of the studios' concrete slab floors. To install the raised computer floors at the reference height, their concrete subfloors were placed from 12 to as many as 30 inches below reference-zero elevation. Our production control rooms have two *minus levels*, to give both the technical and production people an unobstructed view of the monitor banks. This design innovation keeps monitors at comfortable vertical heights for viewing from both desks.



One of the custom-built routing switcher control panels. Each unit provides the user at the remote location with the capability to select the required feeds and lines in and out of each studio or equipment bay.

News operations

Our news programs are the focus and showplace of the new Channel 9. News 9 has become the primary news source for New Jersey residents and those who work or spend time in the Garden State. In all, the news department occupies about 12,500 square feet. It is actually a building within the building, a business venture on its own.

The operations area, which can be seen through the atrium windows, is built on raised computer flooring. It includes the 7,000-square-foot newsroom with its elevated control bridge, offices, conference room, reception area, news studio C (50' x 60'), production control room (800 square feet), seven edit rooms, and a feed room, which actually serves as news operations master control. Upstairs, directly over the newsroom, is a fully equipped film, print and electronic graphics department.

On the right side of the news department access corridor, a 3,600-square-foot area on the building slab houses two more edit rooms; an audio room; investigative reporter's office; ENG shop; storage space for tape, equipment and personal effects; and a garage for two news vans and four of the fleet of 12 news cars. The separate side entrance adjacent to the garage and news parking lot makes it easy to quickly team up news people and their equipment without involving engineering operations people. News has its own staff of 26 operations technicians.

Tying it all together

When our planning team began work in 1983, we knew that "WOR-TV Secaucus" would actually describe a 4-function TV plant: program/spot production, post-production, news/public affairs and on-air broadcast operations. Three internal departments—news, production and engineering—would provide creative, operations, technical and on-air personnel to make the facility come alive. Two or more outside producers might also be in the plant and using its facilities at any given time. Furthermore, our summertime baseball coverage operations requires 16 temporary engineers plus vacation relief to fill out our field and studio crews.

As mentioned previously, news/public affairs is a physically separate facility, with permanently assigned equipment and people to run it. An integrated computer-automated routing, machine control and source identification system was determined to be an economical alternative to dedicating an expensive array of recording, storage and playback equipment to each of the two spot/program production studios, two 1-inch editing suites and on-air operations center. To service the station's needs, we have on-line a total of 12 type C VTRs (and will add three more this year), three quad VTRs, three quad cart systems and four telecines (each with 16mm and slide inputs). A 2,000-frame still store has been installed and will be expanded by 1,000 frames this year.

The physically separate news/public affairs facility includes a production control room, nine edit rooms, an audio room and a feed room. They are connected into the main plant distribution system via master control for access to shared equipment (such as graphics production and still stores), to receive and process incoming feeds and to put live newscasts on the air. We're staying with ¾-inch as the news format because of our present equipment inventory. A separate 50x25 router that we brought over handles the internal equipment switching and control needs for the news department.

To operate this facility efficiently and accurately against the clock, provisions had to be made to:

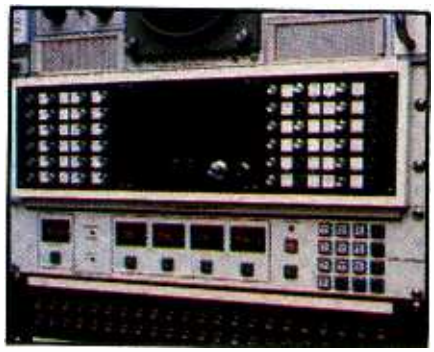
- interconnect the equipment and the five control rooms plus the news department rooms in any one of a literally infinite number of configurations;
- instantly change setups as needed (often by vertical interval switches at times specified down to frames);
- provide *user-friendly* operation; and
- create a system that was *future-proof.*

Routing and control

In mid-1984 we began discussions of our system requirements with several routing switcher and master control automation vendors serving the broadcast industry. After meetings with Lyle Keys and Dale Buzan of Utah Scientific, we gave the company an order in March 1985 for a custom-designed SAS-1 station automation system (see Figure 3). Included are a 4-level, expandable AVS-1B router, an MC 502 master control switcher that controls a PLMC-1 party line machine control system, and a 32-channel source-identification system, which provides positive identification of all video feeds on the production and editing control console input monitors.

The machine control system is fully integrated with the routing switcher, even to the point of sharing the same coax party lines that tie the 60 router remote-control panels together. The system incorporates a *virtual switching matrix* that allows the assignment of any machine to any control point.

Control of machines from the master control switcher is also accomplished via connection to the routing switcher party line. This virtual matrix connection scheme eliminates the separate hard-wired connections otherwise required, while permitting machines to be randomly assigned to, and controlled by, the master control/station automation system.



A small remote-control panel for the WOR routing system.

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The Threat Abnormal voltage surges that occur on AC power lines, communications lines and data lines are a major cause of misinformation and equipment failure for the broadcaster. Broadcasting equipment is especially vulnerable, with tall antennas reaching up into the skies and with electronic units of unusual sensitivity.



Difficulties manifest themselves in two ways: (1) as physical *damage*...this is obvious damage that occurs directly as the result of an electrical storm, or less obvious failures that seem to occur almost at random; (2) as *misinformation*... where the power surge is coupled into the equipment causing improper events to occur or incorrect data to be presented.

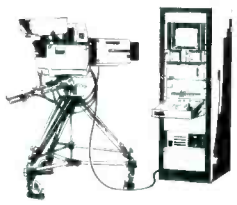
These problems are familiar ones to broadcasters. And now, with the ever-expanding dependance on computer control and the corresponding increase in the susceptibility of these sensitive devices to damage from voltage surges, overvoltages must be controlled and eliminated.

*Allen & Segall/IBM, 1974

The Causes Transient power problems originate outside buildings from lightning, ground faults, and public utility switching, and inside buildings from inductive loads, transmitters, air conditioners, fluorescent lights, etc. A study at IBM* identified transients as the cause of 88.5% of all line disturbances. Transients, sudden and extreme "spikes" in voltage, can be as short as a few nanoseconds or as long as several milliseconds. Their effect can range from total failure to the gradual degradation and breakdown of electronic components or systems.

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Routing switcher description

Signal	Inputs	Outputs
Video	110	110
Audio 1	90	100
Audio 2	80	90
Time Code	20	20

The video matrix was prewired for expansion to 150x150; both audio matrices were prewired for a maximum size of 110x110.

There are 50 router control panels of various configurations and capacities located throughout the plant. They are all reprogrammable while on-line by entering change commands into the system via a standard computer terminal. Access is via one of four user ports available in the AVS-1B mainframe (two are RS-232C, one is RS-422 and one of the ports is switchable).

Perfect timing was the primary goal of our new routing system. For video distribution, we wanted signal timing from any input to any output to be within ±0.5° at 3.58MHz. Utah Scientific engineers said they could meet ±1° at 3.58MHz. Their spec sheets, however, said they could also provide ±1° timing at 4.43MHz, and that's what we held them to. That translates to ±0.8° at 3.58MHz. At the proof of performance tests in Salt Lake City, all the router components checked out to less than ±0.7° at 3.58MHz.

In response to our requirement that all video sources feeding production switchers be in phase whether they were accessed via the router or directly, Utah Scientific designed a new model VDA-9D video distribution amplifier. A total of 110 of these DAs are in the system, each configured with four direct outputs feeding each of the four video router bays with an additional five outputs delayed to match the router path lengths for feeding studio switchers, edit suites and other portions of the plant (see Figure 4). Because of the numerous advantages of this method of handling system delays, we expect that it will be adopted by other engineers in the design of large studio facilities.

To bring incoming video signals into *zero timing* with in-plant video, there are six frame stores available on buses, which re-enter the router. Lexicon audio synchronizers are located on three of the audio buses.

Machine control versatility

The router and its 50 remote control panels solve the problem of making video, stereo audio and time-code signals available where they're needed in our new plant. The task of providing them precisely *when* they're needed by machine remote identification is accomplished in two other systems.

Simultaneous machine control capabilities built into the master control switcher station automation system include: rolling backup spots in breaks during important programming periods; and

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Our VPR-80 type "C" is just about the lowest cost VTR you can buy without making quality compromises. That's why top level broadcasters, post-production facilities and corporate teleproduction studios depend on it for "workhorse" reliability and virtually transparent video quality. And why smaller, but quality conscious facilities use the VPR-80 for their most important video productions.

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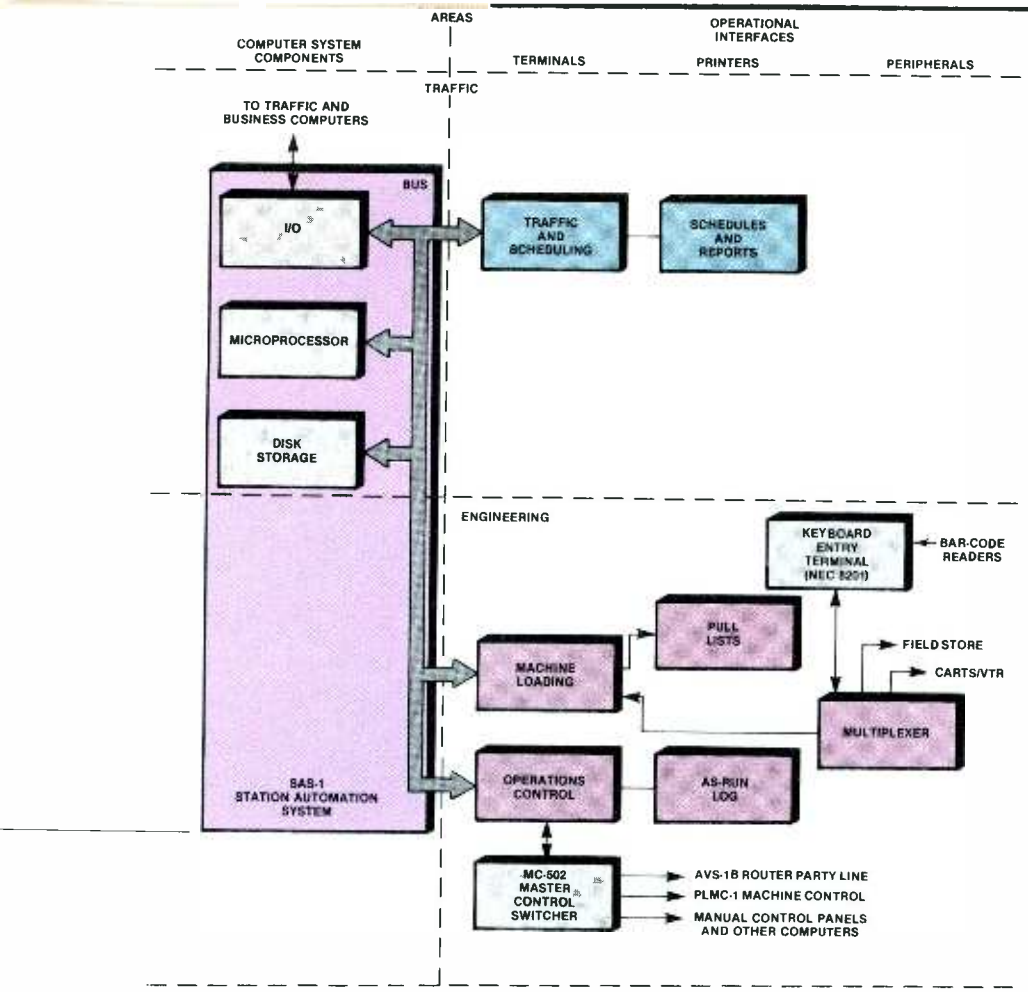


Figure 3. *Automation system block diagram and interfaces.*

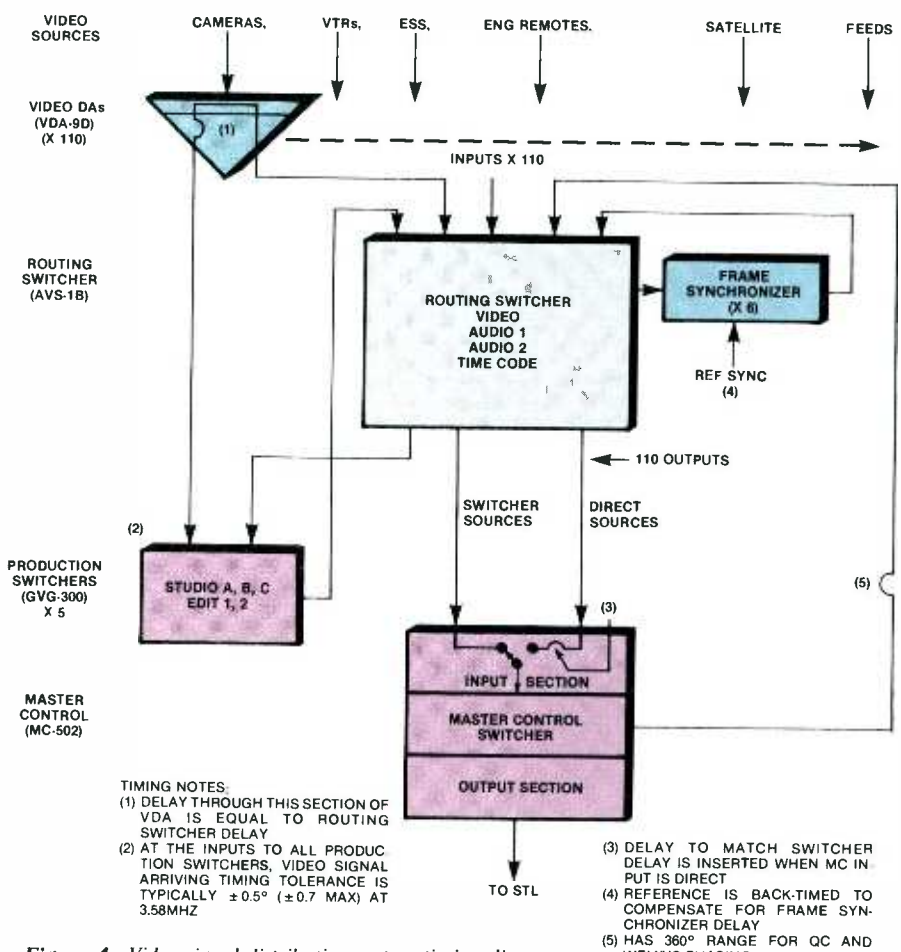


Figure 4. *Video signal distribution system timing diagram.*

acquiring and automatically recording satellite feeds from our two C-band satellite terminals.

Source identification

Our total of 32 source-identification character generators are a vitally important part of the plant signal-distribution system. These devices connect to the routing switcher party line, deriving current assignment information from the party line refresh data. Outputs from VDAs feeding the production and editing switcher are looped through the source identifiers to pick up the names of the currently selected sources for display on the studio and edit suite monitor bank.

These displays eliminate unending verbal communication between master control and the people using the feeds. On any given day, we have more than 30 active video sources including remotes, and up to 1,000 recorded spots and programs being readied for post-production or airing. The possibility for an expensive error is, therefore, always present unless there's efficient communication associated with remote-controllable routing system setup. Our automated source ID arrangement is as foolproof as you can get.

On-air scheduling and execution

The automation system we've installed has two separate functional capabilities: entering the advanced schedule for future days' activities and executing today's real time schedule. Automation for calculation or entry of event duration preroll times, transitions types, single or multichannel/multimachine control commands and other organizational functions are all carried out in a microcomputer that is the heart of the master control switcher.

Future days' schedules are entered into the system from computer terminals located in the traffic department. Software checks verify all entries for completeness and accuracy, and plain-language displays identify unacceptable items. A printer provides reference documentation, and prints out an *as run* log of the previous day's events. That printout is the unofficial source document for billing and accounting.

Terminals and a printer in the machine room are used by our engineers to translate the *future events* log into printed *pull lists* that detail what to load (tapes, films, slides, graphics or audio carts), when to load them, and on what machines. As loading operations are completed, operators report their activities through keyboard entry of house reference numbers for the material. Loading reports can also be entered through bar-code word reading of machine and cassette labels or automated interrogation of tape/cart recorders equipped with tape sensors and ID readers.

Safeguards in the system detect and

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warn master control of system problems such as machines left on *local control*, or not capable of remote start for other technical reasons.

Event execution against the station master clock is synchronized to 1/60 second parts, and held to a precise offset. For instance, if a multiple-spot break is taken 0.5 seconds between 1-second ticks, that offset is held throughout the break to eliminate chopping or upcutting. When the next ID appears, its on-air time will be trimmed or stretched to put the plant back on 1-second tick timing.

The machine control system provides for rolls and simultaneous feeds to air of up to six video and audio sources on any one programming channel, and can control up to six channels at one time. We've programmed the automation system to know the exact preroll *personalities* of every video and audio source in the plant. Therefore, regardless of the complexity of the next event feed to air, all the signals from up to six sources arrive at the STL input in dead sync.

A 6-machine roll could include:

- video only (tape to air);
- audio only (tape to air);
- backup tape (ready for air);
- videotape feed as key source;
- audiotape over primary source; and
- audio cart ID to air.

Backup machines can be prerolled manually if an operator suddenly suspects that a primary feed may be in trouble and a backup roll has not been preprogrammed. We're initially relying on operators to monitor video and audio feed quality and switch backup machines to air manually, if necessary. However, the system is capable of control from video/audio absence and pulse-sensing equipment, and we'll probably install that automated trouble-spotting capability in the future.

We feel confident that our new automation system meets the three current operations design criteria listed earlier under "Tying it all together." We have implemented:

- practically unrestricted equipment and operating location interconnection via the routing switcher;
- field-accurate vertical interval switching of up to six video and audio feeds simultaneously on each of up to six independent program channels; and
- user-friendly operation, with system interface panels and intercommunication protocols that are easy to learn and use.

The fourth design criterion was to "create a future-proof system." Only time will tell if we have been successful, but we're pretty optimistic.

Editor's note: After this article was completed, GenCorp announced that its board of directors and the board of directors of its subsidiary, RKO General, have approved an agreement by which MCA would acquire RKO's WOR-TV in Secaucus.

Acknowledgement: Assisting McGowan in preparation of this article were Cindy Rakowitz, publicity director for RKO General, and Bob Paulson, managing partner of AVP Communication, Westborough, MA.

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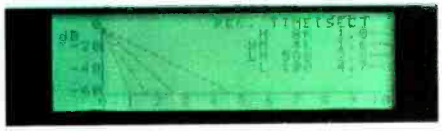
So getting just the right reverb sound is no longer a question of trial and error.



"EARLY REFLECTION" display mode showing room size and relative level and time of discrete reflections.



"REVERB DENSITY" display mode showing level and relative time of subsequent reverberation.



"REVERB TIME" display mode showing difference in reverb time in each of four frequency bands.



"MEMORY TITLE" display showing the titles of internal ROM memories.

The logical grouping of the parameter controls on the remote also makes it easy to create any effect you like. Then store it in any of 60 memories for instant recall.

The remote also contains 9 additional RAMs so you can store programs and carry them with you to use anywhere there's an REV-1.

And there are 30 additional ROMs with factory preset sounds. Many of which can be completely edited (as can the user-programmed sounds) by using the LEDs to tell you the set value or indicate in which direction to move the control so you can easily and precisely match the value of the originally programmed sound.

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We could go on about the REV-1. Tell you about its 44.1 kHz sampling rate that provides a full 18 kHz bandwidth to prevent the natural frequency content of the input signal from being degraded.

How it has a dynamic range of more than 90 dB for the delay circuitry and more than 85 dB for the reverb circuitry.

But why not take a closer look at the REV-1 at your authorized Yamaha Professional Audio Products dealer. Or for a complete brochure, write: Yamaha International Corporation, Professional Products Division, P.O. Box 6600, Buena Park, CA 90622. In Canada, Yamaha Canada Music Ltd., 135 Milner Ave., Scarborough, Ont. M1S 3R1.

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SIN: Designed to fit

By Bebe F. McClain

When space is limited, the design of a new TV production and transmission plant must be a model of efficiency.

When the Spanish International Network (SIN) decided to concentrate its network news and production operations at one site, the organization selected Miami. The city is a hub of the Spanish-speaking population in the United States and a perfect hopping-off point for the South and Central American countries where SIN news bureaus and reporters are located. As in other urban areas, land and building costs were high. With careful planning, however, the SIN engineering department built a center that was efficient and able to accommodate the needs of the network within a limited space.

Site selection

When the search began for the site of the new SIN news and production center, it was soon discovered that the greatest value could be obtained by renovating an existing structure. Not only did SIN need a central location but also a building with an adjacent unobstructed area large enough to accommodate a 10m steerable dish and two 4.6m dishes.

Luckily, a pair of older 2-story structures were found in the heart of Miami's Spanish district, halfway between the airport and downtown. The smaller of the two buildings was targeted for business offices; the larger building, offering 4,600 square feet, was selected for the production center. SIN totally gutted the inside of the larger building, formerly a restaurant, and renovated it according to their needs. An adjoining lot was set aside to hold the 10m dish and a second adjoining lot was allocated for parking and the smaller 4.6m dishes.

Facility layout

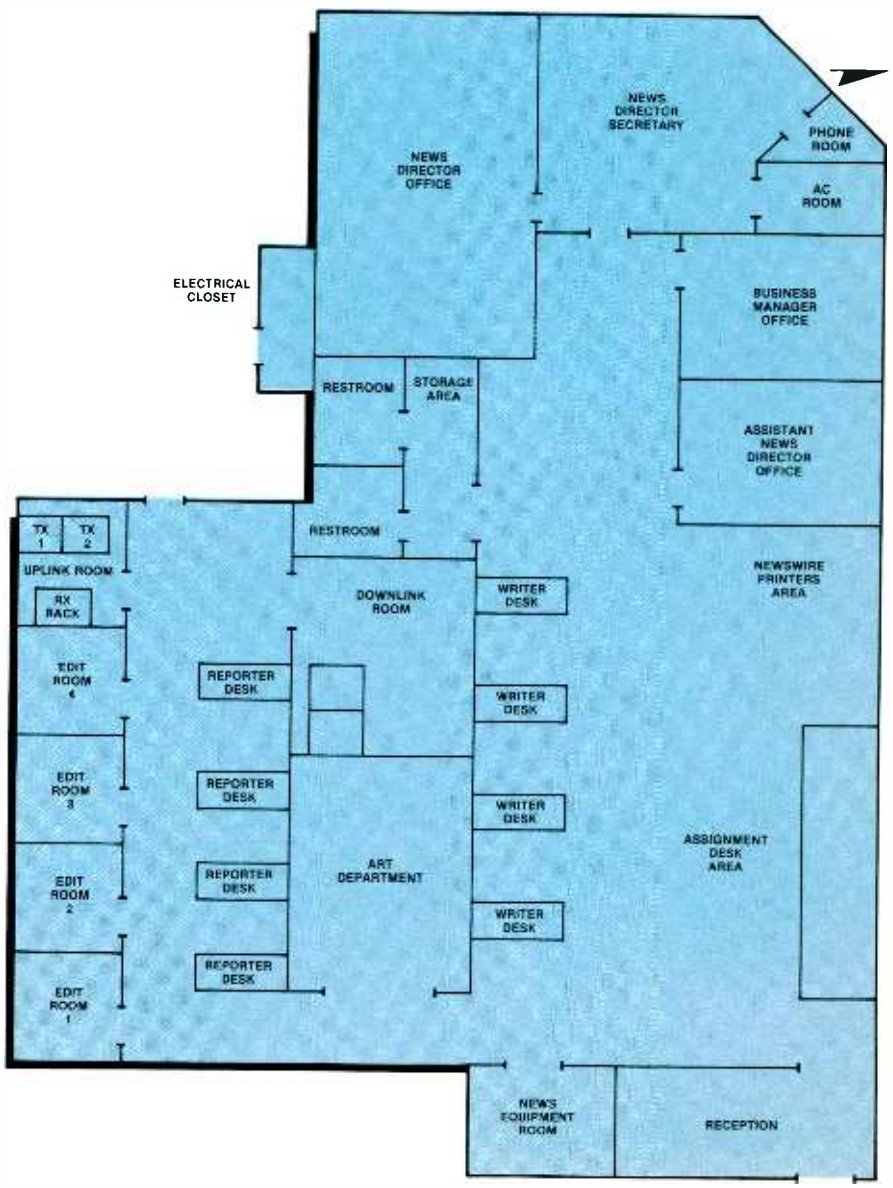
The first floor of the main building is dedicated primarily to non-technical functions, containing a reception area, writers' and reporters' desks, news director's office and art composing. Four complete ENG editing suites and satellite uplink/downlink rooms with monitoring equipment are also located on the first floor. (See Figure 1.)

McClain is president of B F McClain Productions, Asheville, NC.

Every inch of the facility has been planned from a technical and traffic standpoint. For example, the reporters' desks are situated on the back side of the first floor, near the back door and parking lot. A wall of editing booths is located beside the row of desks. A reporter can dash in the back door with tapes, write the story and step into an edit booth a few feet away without encountering another soul, except perhaps a fellow reporter.

Each of the four edit rooms has acoustically insulated walls. The edit suites are only large enough for the equipment and two people. Two ¾-inch

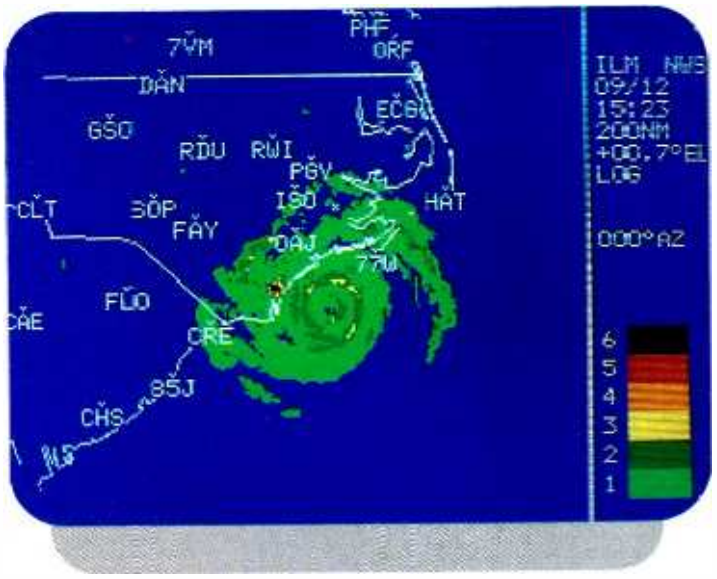
Figure 1. *First-floor layout of the SIN News and Production Center in Miami.*



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The SIN control room showing the production switcher and monitor banks.

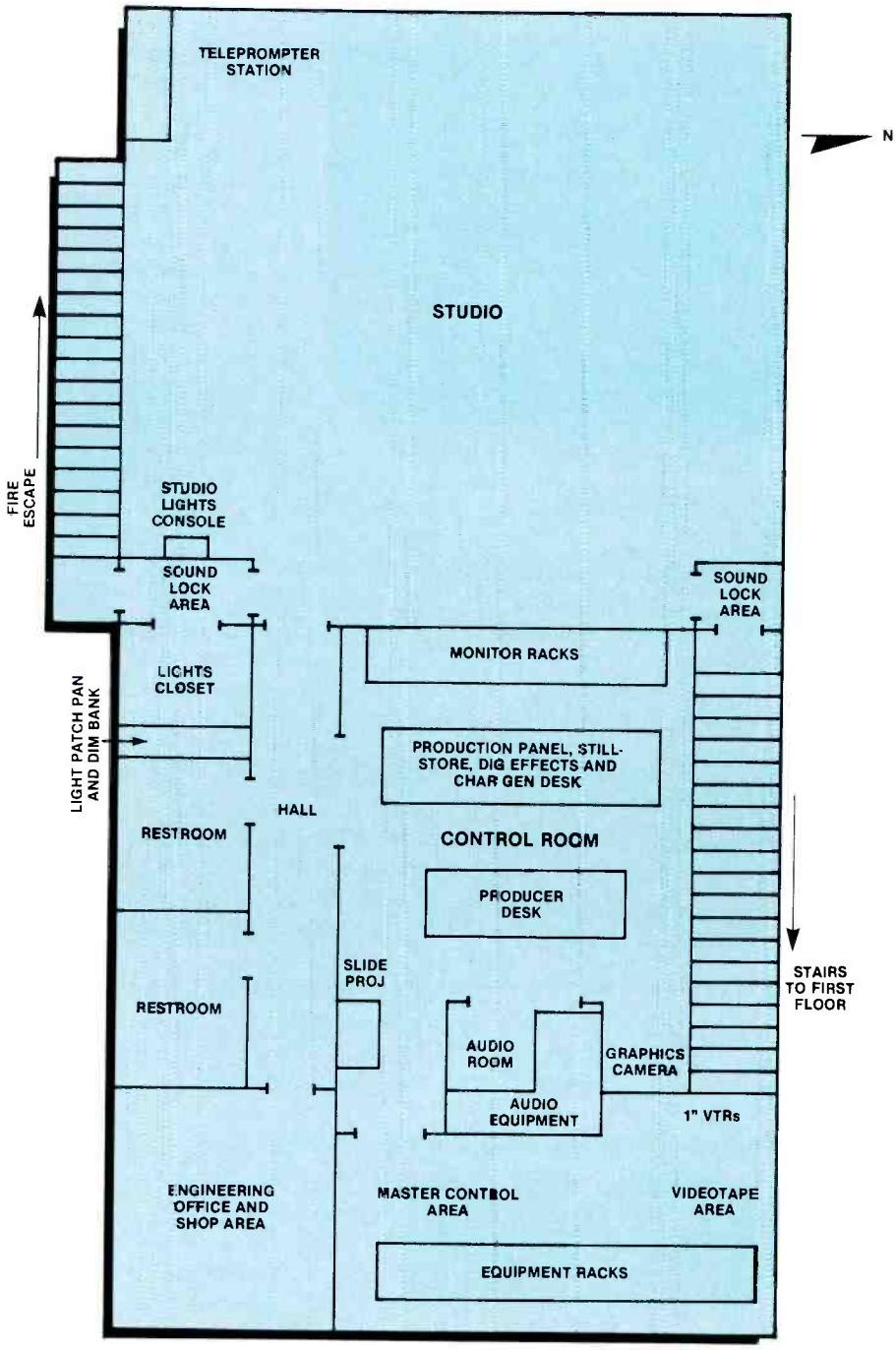


Figure 2. *Layout of the second-floor SIN production/technical center.*

VTRs with edit controllers, an audio mixer, monitor and microphone are installed in each suite.

The second floor is dedicated to production. Within the 2,100-square-foot area, SIN placed a 30' x 30' studio, equipment room with combined master control and videotape recording area, control room with switcher, producer's desk, character generator and digital graphics system, audio production center, and engineering office. (See Figure 2.)

The production control room is well thought-out, and takes into consideration the space needed for equipment and people. A small area is allocated for the audio booth because only one person is usually involved in mixing. Audio production is located in a room at the back of the main control room. The booth houses a 16-input audio console, professional cassette deck, ¼-inch reel-to-reel deck, cart machine, stereo synthesizer, limiter/compressor and reverb system. Double glass doors isolate the audio operator from control room noise. The entire audio system at the SIN production center is stereo, using discrete left and right channels for distribution and transmission.

Nine 19-inch racks house three computer camera remote control units, a frame sync for outside feeds, a clock system gen-locked to WWV reference time, a routing switcher and sync system. The SIN routing switcher is configured as a 30x20 system that can be expanded to 50x20.

Planning for the SIN plant encompassed the obvious requirements to the smallest details. For example, all monitors are installed at eye level. And, the VTR area also functions as a tape evaluation recording center using three 1-inch VTRs and two ¾-inch broadcast VTRs. The two systems face each other on opposite racks. An operator can stand between the two rows and have access to all units and support equipment.

Two TBC racks are provided for the ¾-inch VTRs. The enclosures include color monitors, waveform monitors and vectorscopes. The additional equipment was installed because SIN uses a lot of ¾-inch tape on the air. A convenient

The main equipment and VTR room.



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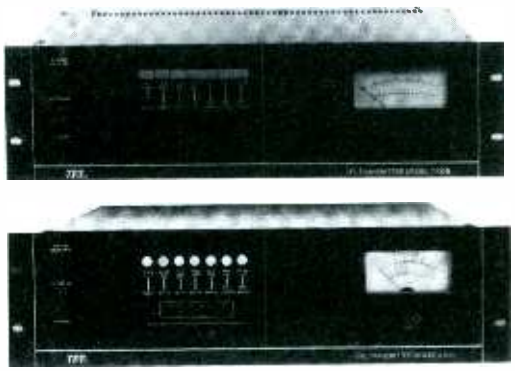


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The audio-mixing booth adjacent to the control room.

layout and high-quality monitoring equipment allows tape corrections to be made quickly.

SIN produces a nightly national 30-minute news program that is uplinked for simultaneous distribution to more than 300 affiliates across the United States. Receiving and transmitting equipment for the 10m uplink/downlink C-band system is located in a small room within sight of the dish outside. There are two satellite transmitters. One is active and the other is configured as a *hot standby*. The room also houses three satellite receivers, monitoring and test equipment, and an antenna position controller for automatic dish alignment.

The nightly national news is anchored from the 30'x30' studio outfitted with three auto setup computer-controlled cameras and prompters. Within this area is a news set and another set used for commentary.

SIN used a tightly designed lighting grid of 4'x4' instead of the more common 6'x6' grid. This allows operators to more easily locate lights among the two sets and evenly illuminate either one. The dimmer bank and patch panel is located outside the studio, with a remote control panel inside.

The air-conditioning system was designed to distribute a large volume of air at low velocity. Three separate air-conditioning systems were installed: a 5-ton unit for the studio on the second floor; a 10-ton unit for the first floor; and a special air-conditioning unit for the satellite transmission room.

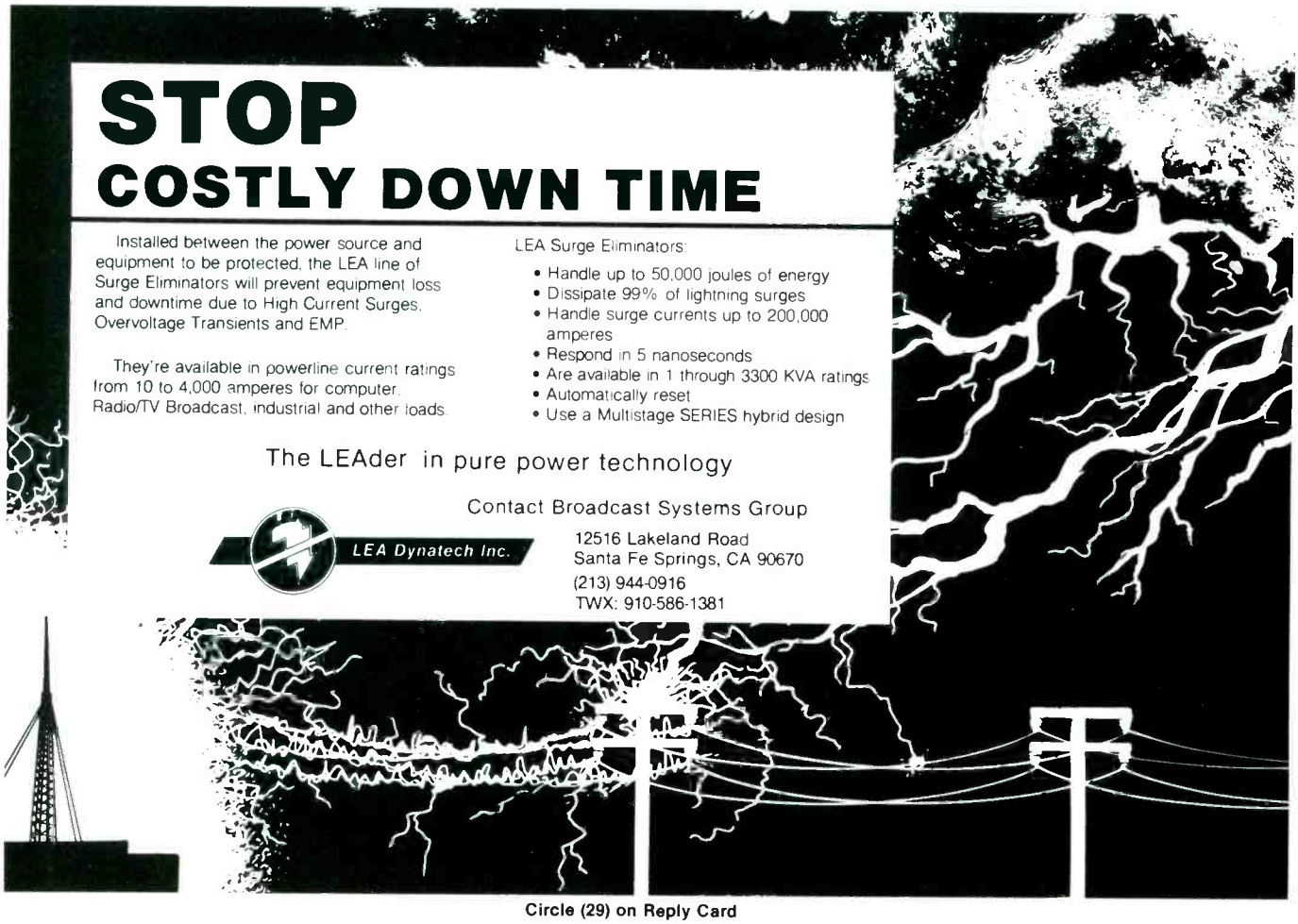
Power/cabling

Of all the technical considerations in facility planning, electrical distribution design was the most complex. Florida Power and Light had planned to supply the production center with 120/240V 3-phase open-delta high-leg ac, but the satellite transmitter and light board required balanced 3-phase 120/208V power. SIN installed transformers to make the needed conversion after Florida Power delivered it.

All technical equipment at the facility is tied into the same system—the 120/208V balanced line—to avoid creating 60Hz noise problems because of potential differences at various loads. The office lights, office equipment and air conditioning are carried on the unprocessed 120/240V open-delta utility feed.

Backup power was the next consideration. Because an uninterrupted power supply (UPS) was cost-prohibitive, SIN decided to go with a spare diesel generator and manual transfer system.

Another major consideration was plan-



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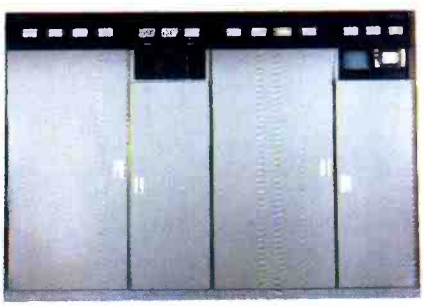
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ning of cable distribution throughout the plant. All video, audio and control cables go through a carefully laid-out system of cable trays, designed in conjunction with the equipment rack layouts. Cables can be run easily from one point to any other point. Extra cables were not installed because lines can be run through the tray system in two to three minutes. Power lines are run in metal conduit, totally separated from the trays.

Future plans

The SIN news and production center was planned for expansion—but *reasonable* expansion. You can overspend for overkill. The existing space of the center limits future growth, so planning for some expansion without wrecking the budget was important. This can be a difficult judgment, however.

The SIN project illustrates how to assess the real space requirements of each department vs. the total space available, as well as analyze traffic flow. Make every inch count. Closely examine the technical and electrical requirements of the plant. Look at other groups' facilities while you re-examine your present installation. Learn from your successes and learn from your mistakes.

Editor's note: The author acknowledges the assistance of SIN's Robert Porter, vice president of engineering, and Jose Boveda, chief engineer, in the preparation of this article.



The studios and offices of WYMT-TV, Hazard, KY.



The reconfigured peak of Buffalo Mountain, location of the WYMT transmitter and tower. Workers can be seen building an ice shield to protect the transmitter building from falling ice from the tower.

Television to go

By Robert A. Speaks

One hundred thirty-four days from shovel to switch. That's the story of the birth of WYMT-TV, a new station in the mountains of eastern Kentucky. The accomplishment is believed to be unparalleled in recent broadcast construction history. Between the June 7, 1985, ground-breaking ceremony and the Oct. 16 sign-on, workers managed to construct and equip a full-service 16,000-square-foot TV plant. And when you consider the terrain problems that had to be overcome to achieve the planned networking of bureaus and a sister station, the achievement is even more noteworthy.

WYMT is located in Hazard, a community of about 5,500. You might ask, "Why invest upwards of $6 million to put a new TV station in a community the size of Hazard?" The answer, however, would be clear if you ex-

Speaks is director of news developments for WKYT-TV in Lexington, KY.

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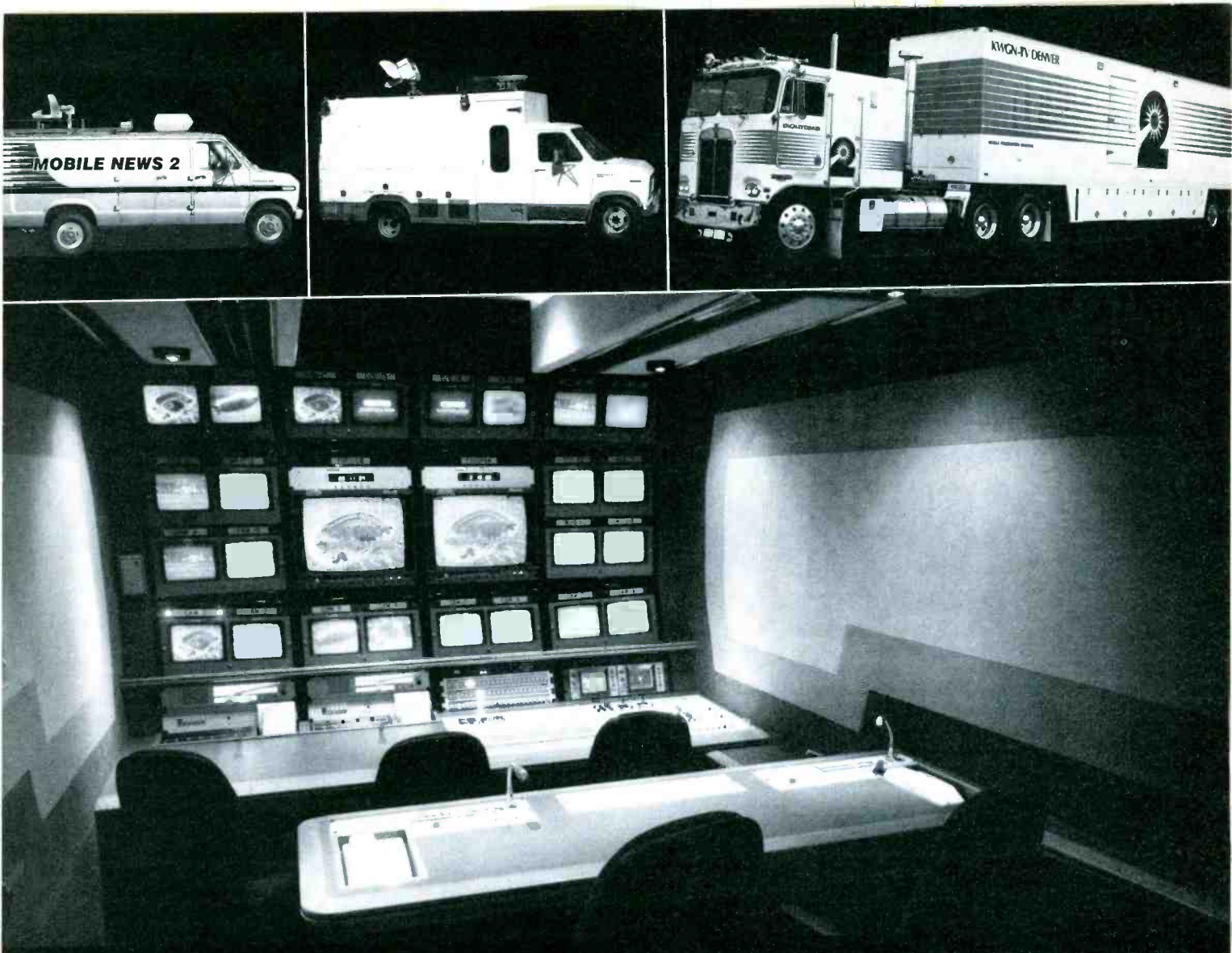
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The transmitting antenna being hoisted up the tower.

amined the community's location in relation to central Kentucky. Station management planned WYMT as a regional outlet, covering at least 25 counties with 1.33 million watts ERP on channel 57.

Building the facility

The biggest hurdle to overcome in the construction of WYMT was the topography of the area. One of the primary challenges to engineers was building 2-way microwave relay systems through the mountains to link the facility with WKYT-TV in Lexington (its sister station about 100 air miles to the northwest), with a news bureau at the state capitol, and with another bureau in far eastern Kentucky, about 65 miles east of Hazard.

WYMT is located in a valley between two small mountains. The facility is out of sight of the station's 1,000-foot transmitting tower, located atop a 2,000-foot mountain about five miles from the studio. It was necessary, therefore, to bounce the STL signal off a passive reflector located on one of the small mountains to reach the transmitter site. To tie WYMT with sister station WKYT, a second tower was erected on a mountain 54 miles away. There, two microwave receivers and transmitters complete the hop to and from Lexington. To add the far eastern bureau to the microwave network, a fiber-optic link was used between the bureau office and another tower on still another mountain.

The 2-way microwave network enables the exchange of programming and news reports, connects the computers of the two stations, ties together the telephone systems of the stations, and permits a dedicated intercom between the two master control rooms. And, WYMT has become one of the smallest TV newsrooms (the news staff totals 16) to be computerized. Terminals at the WYMT newsroom and the eastern Kentucky bureau are interfaced via the microwave network with the WKYT newsroom and the state capitol news bureau.

Now for the hard part

For openers, Buffalo Mountain, a heavily wooded peak, had to be reconfigured by bulldozers to permit construction of the transmitter building and tower. That presented another unique challenge. Can you imagine backing a loaded concrete truck 1,000 feet down a freshly bulldozed path as steep as 40°? Even a slight miscue could have sent the truck and driver hurtling several hundred feet straight down.

Furthermore, it's a rare day when the wind is not blowing on Buffalo Mountain. Actually, WYMT could have been on the air several days sooner, but the tower crew had to wait for a period of calm to hoist the antenna aloft. Mountain construction does present its special problems and challenges.

Construction crews and engineers often worked around the clock to complete the project by the target date. The entire effort can be summed up in two words: commitment and planning.

Editor's note: Hal Schumacher, WKYT-TV director of engineering, and Chas Callaway, WYMT-TV chief engineer, assisted in preparing this article.



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AVS, manufacturers of the best selling standards converter and signal processor, introduce the AVS 6500. The new model now includes Genlock…RGB output…SECAM input…PAL-M option… Automatic input selection with manual override…Freeze-frame/Freeze-field…Multigrab…other processing features of both the AVS 6000 and AVS 6500 include Switchable motion interpolation…Noise Reduction… Horizontal and vertical chroma retiming…Detail enhancement…NTSC comb filter decoder…Timing stabilisation. Both models are mountable 19" rack designs with the option of a remote control panel.

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New horizons for ITFS

By Neil Tegart

ITFS has come of age and is now assuming an important role in the distribution of educational programming.

The concept of ITFS—Instructional Television Fixed Service—has only recently received serious attention from many stations in the United States and Canada. One of the pioneers in ITFS implementation is the Access Network and its satellite-based distribution system.

The Alberta Educational Communications Corporation is a public service TV and radio network with the responsibility to meet specific educational needs in Alberta, a province in western Canada.

Tegart is manager of broadcast services at the Access Network, Edmonton, Alberta.

The Access Network (its trade name) was established in 1973 to serve the 2.4 million residents of the province, spread out over a quarter million square miles.

The network broadcasts about 95 hours of programming each week. The downlink signal is received by the cable systems in 107 communities, with 520,000 actual subscriber homes. Approximately 120 specific TVRO dish-placement sites, located in schools, libraries, museums and other educational facilities, enable receipt of the Access Network in non-cabled areas. The network also includes 14 FM stereo radio transmitter sites and one AM station.

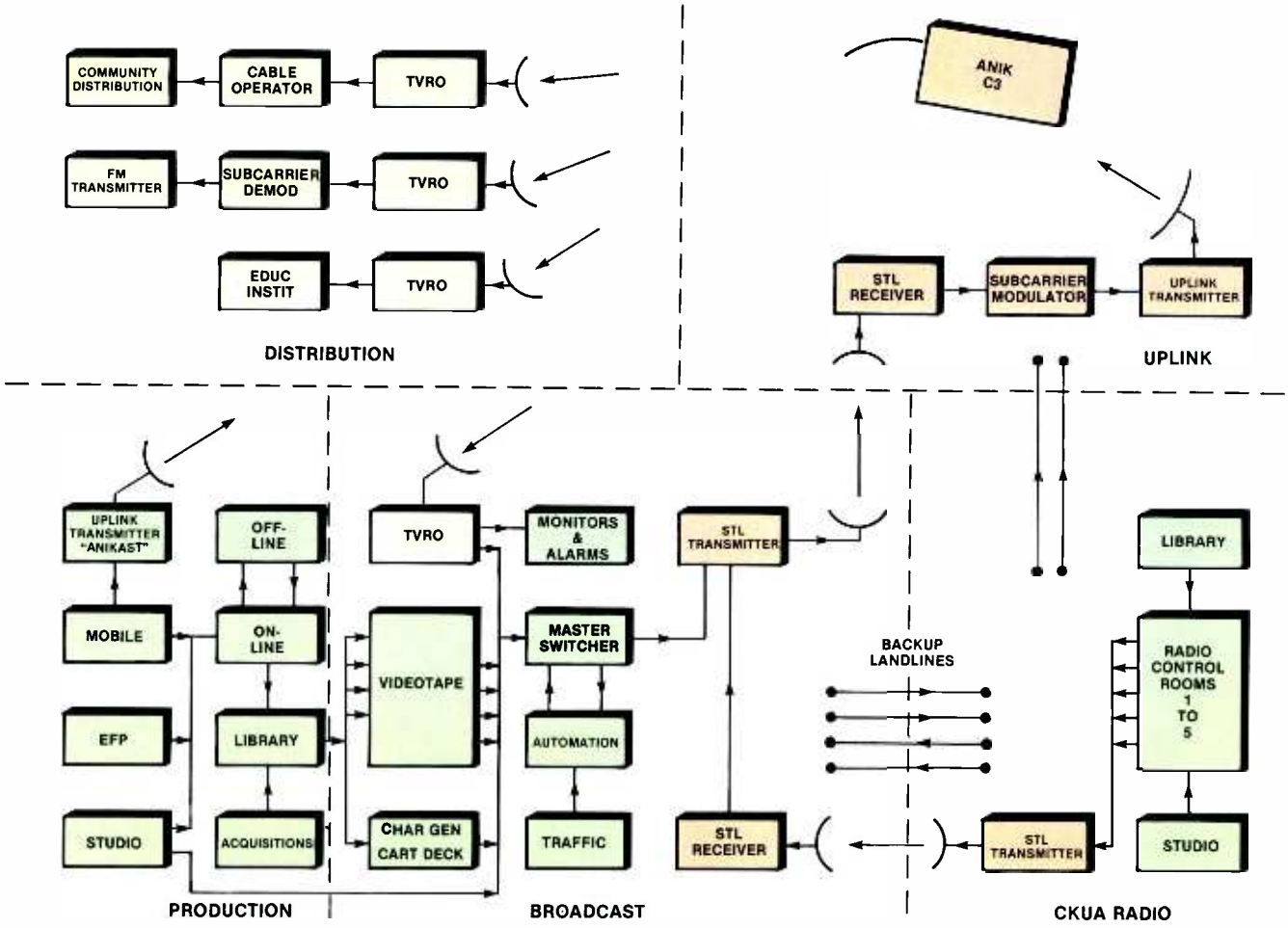


Figure 1. *Diagram of the Access Network AM/FM/TV production/distribution system.*

Broadcast operations

All programs for broadcast, whether produced in-house or purchased, whether on tape or film, are dubbed to 1-inch format with drop-frame time code. A technical check is made for quality, then the tape is forwarded to the broadcast master library. An automated control system drives the satellite feed. Block schedules are entered into the con-

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AMEK announces the "soft" solution.



See the future . . .
AMEK will unveil the APC1000-LAC and the BCII at NAB-Dallas - Booth 2558.

Introducing the APC1000™. . .

Over twenty years ago, the concept of multi-track recording for stereo went from two to three tracks. Today, mixing 64 tracks is not unusual. The nature of audio, with digital sources and programmable electronic instruments, and the wide variety of functions demanded in recording have radically changed the requirements for an audio console.

Clearly, the answer to today's needs for audio control does not lay in yesterday's thinking. **AMEK**, long the leader in audio console innovation, has just re-defined audio control — the virtual console.

By removing the constraints of twenty-year-old console philosophy, **AMEK** has designed the obvious solution for recording, sweetening, TV Stereo, and film. The need for operational features and instant repeatability has grown but has yielded consoles of outsized proportions and excessive electro-mechanical complexity. In-line or split monitors, and hard-wired systems, limit the operator's capabilities.

The **AMEK APC1000** Large Architecture Console™ System is the "soft console" we've all waited for. Centralizing all redundant switch and control functions into one simple logic driven key entry panel has greatly expanded the flexibility, while reducing the overall size of the console and dramatically increasing accessibility. Dynamic Reset,™ Synchronous Reset™ and simplified Recall, up to 128 inputs and 64 busses are just a few of the features of an **APC1000**.

And, in keeping with the **APC** concept, **AMEK** has introduced the **BCII**, a cost-effective open architecture console system for all broadcast or production applications, featuring audio-follows-video capabilities. The **AMEK BCII** is customizable for your operation, yet is totally user reconfigurable.

Take a closer look at the **APC1000** and the **BCII** . . . the soft solutions to today's serious engineering needs.

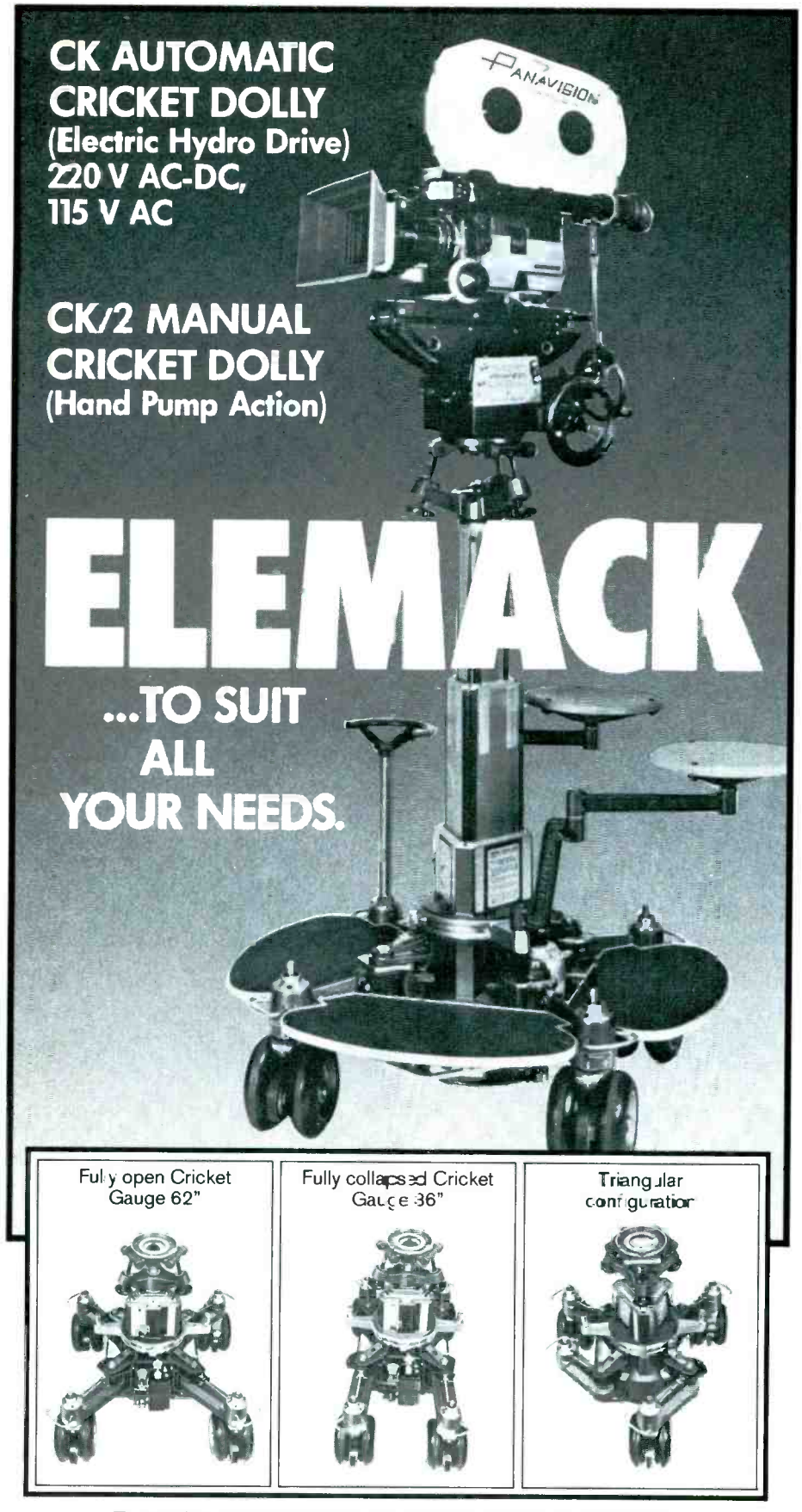
1985

AMEK

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troller weeks in advance. Program promos and fill material are then added to produce a complete air log.

Sources from VTR, live studio, audio cart, character generator or remote satellite reception are available for programming. A typical 13½-hour broadcast day may encompass 140 programmed events or tape rolls. Because the Access Network is an educational facility, station IDs, program promos and public-service bulletins are used, but there are no commercial breaks or messages.

The interconnect system

Although the master control area is tied to the production facility, it maintains the capability to run independently, if necessary. The audio/video signal leaving master control is sent via 15GHz microwave STL to the uplink site where the CKUA stereo feed from the radio studios is added using low-level subcarrier generators. (See Figure 1.)

Landlines between the studios and the uplink site serve to back up the main STLs. Discrete left and right audio signals are transmitted over the satellite. TV audio is transmitted as a conventional high-level subcarrier to permit easy demodulation of the TV network feed using inexpensive TVROs. The combined, unscrambled signal is then uplinked to Anik C3, a Canadian Ku-band satellite located at 117.5° (almost due south of Alberta), and distributed throughout the province.

Because of the unique design of the Anik series of satellites, spot beams are used. These effectively concentrate the downlink signal, producing approximately 42dBW to 45dBW EIRP, at 5dB power back-off, within the main lobe. This allows relatively small TVROs to be employed in most situations. For general-purpose applications, 1.8m antennas are used, and 3m to 3.7m units are used at cable headends and rebroadcast sites. Satisfactory results have been achieved in some areas using 1.2m dishes.

The downlink signal is received by three types of sites:

- cable headend operations for distribution to the local community;
- CKUA-FM stereo radio transmitter sites and CKUA-AM for on-air broadcast; and
- specific TVRO dish-placement sites.

With any loss of video or audio, alarms built into the system are triggered and alert the master-control operator to the malfunction. This alarm system also detects after-hours loss of carrier modulation and automatically alerts a technician to effect repairs before morning sign-on.

To log the broadcasts, to verify content and quality of material aired, and to check overall system performance, the satellite return signal is recorded (for audio and video) on VHS slow-play VCR.

Continued on page 70

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BROADCAST® engineering



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For over a half-century, JVC has worked to raise the standards of the electronic industry throughout the world. The professional video communications division of JVC Company of America is a vital part of that creative process.

Where it all began

In the early days, Victor Company of Japan, Ltd. (the parent company of JVC Company of America), was called the Victor Talking Machine Company. Implicit in its name was the manufacture of audio equipment. The company focused on a new technology, an electrical system (as opposed to the established mechanical means) of capturing sound. This system resulted in a major improvement in the recording of musical entertainment over earlier gramaphone records by expanding the dynamic range and frequency response restricted by mechanical systems.

With the invention of the photo-sensitive electronic camera tube and the emergence of television from the laboratory, JVC was involved early in the development, design and manufacture of Japan's first television equipment and broadcasting facilities back in 1939. JVC had started a research and development program on videotape recording methods at its own Central Research Laboratories as well.

In 1959, JVC demonstrated the first helical VTR using two heads to record video signal slant tracks at a small angle to the tape travel. In 1972, the first cassette appeared, the ¾-inch U-Matic format. But it was JVC's development of the Video Home System (VHS), introduced in 1976, that produced an impact on electronic lifestyles and a revolution in home viewing.

VCRs and cameras

The video research and development programs encompassed video recording systems and cameras. The outgrowth of this work has been the manufacture of both one-tube and three-tube color cameras intended to be operated as standalone units in field and studio applications or integrated with VCRs for ENG (electronic news gathering) pickup by broadcasters and cable systems.

The use of computer-aided design and manufacturing techniques have made possible compact and lightweight assemblies well-suited to ENG use and have been a major factor in the rapid increase in the use of video in place of film for entertainment and documentary program production.

EFP (electronic field production) equipment permits a mobility equal to or greater than that of film equipment and provides the significant advantage of immediate playback for evaluation by the camera operator, director and performers.

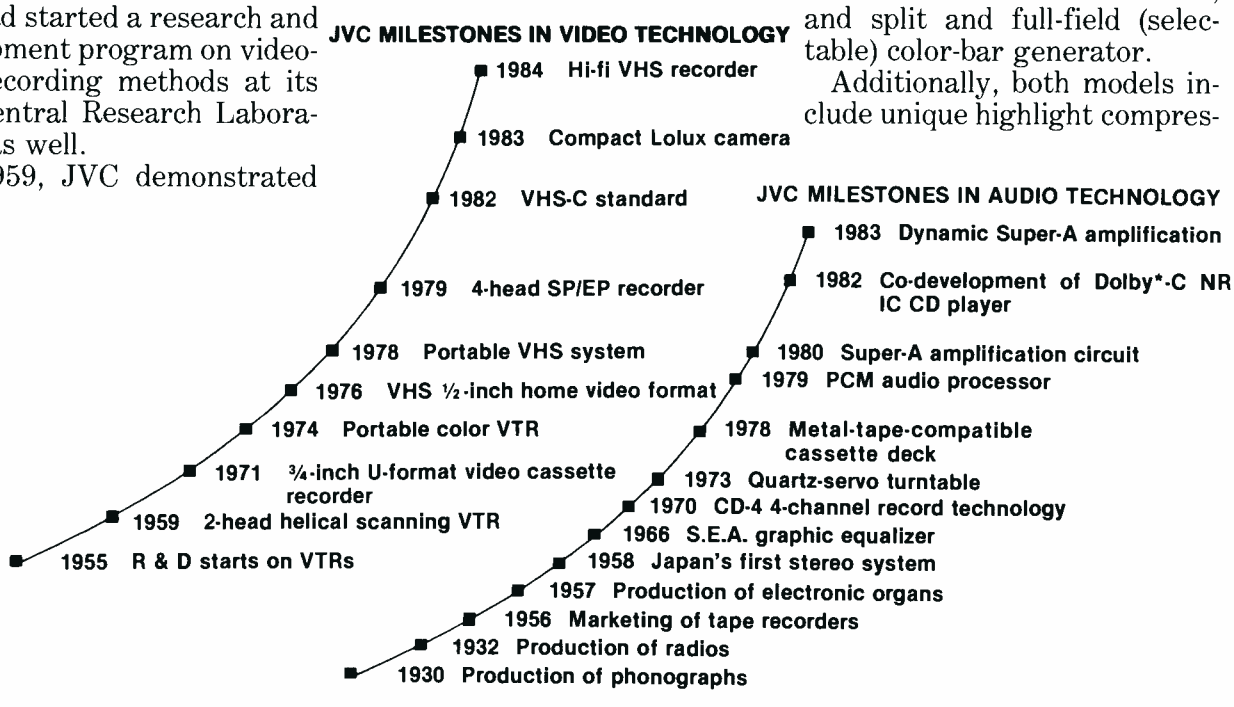
PROCAM

Most recently, JVC has expanded its line of KY-series cameras into the high-performance production market with the PROCAM line.

The KY-32OU and KY-950U PROCAMs are Plumbicon-tube production cameras with low-light sensitivity. The KY-950U utilizes low output capacitance diode gun Plumbicon pickup tubes and a broadcast grade prism system.

The KY-320U, which uses S-M (electrostatic focus/electromagnetic deflection) Plumbicon pickup tubes, provides the industry with truly professional Plumbicon performance at a retail price of under $10,000. Both PROCAM models have features such as automatic setup for black balance/white balance and centering, an RS-170A SSG circuit, dual edge vertical and horizontal contour correction, and split and full-field (selectable) color-bar generator.

Additionally, both models include unique highlight compres-



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What better way to show a commitment than to introduce the finest, most innovative ¾" Editing Recorder ever made? The commitment is JVC's. The recorder is the CR-850U.

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The quality, the convenience, the flexibility, the reliability you've asked for! Here, now, in the unique JVC CR-850U Editing Recorder!

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sion circuits and an automatic level-depend circuit to reduce noise in dark areas of the picture.

The PROCAM product line is marketed and supported by JVC through a group of video systems representatives. This allows JVC to provide a service and support program which includes: a) one-year warranty on parts and labor; b) priority-repair procedure at a central location; c) overnight parts availability; d) loan equipment; and e) on-site maintenance training availability.

Recorders—VHS and ¾-inch

The professional video communications division's line of VCRs begins with its newest addition, the CR-850U editing videocassette recorder. Built to the specifications required by dealers, customers and end-users, the CR-850U features numerous capabilities and qualities, including SMPTE time code, built-in editing control functions and 15 new circuits to give the VCR a 47dB signal-to-noise ratio. This VCR, a symbol to the industry of JVC's commitment to the ¾-inch format, contains a diagnostic warning system with double-digit codes to enable the operator to detect and correct problems. Front panel test points are provided for determination of levels and controls. The CR-850U also features an improved drop-out compensation circuit for enhanced signal quality and vertical interval head switching.

Built-in editing control functions include entry-in/out, preroll, preview and perform. Many editing jobs can, therefore, be handled without an additional controller. The CR-850U is capable of connecting to serial and parallel remote controllers, allowing it to interface with a variety of systems. When the appropriate serial controller is used, the VCR will also perform the jog-function. The CR-850U offers visible picture search from 1/30 to 10 times normal speed. In fact, it is possible to search up to 15X forward and 20X in reverse with certain monitors that can lock onto the picture. Other features include separate audio/video tracking meters with level controls, independent audio limiters, balanced audio with XLR connectors, external sync and subcarrier inputs.

Among the other models in JVC's ¾-inch line are the CR-





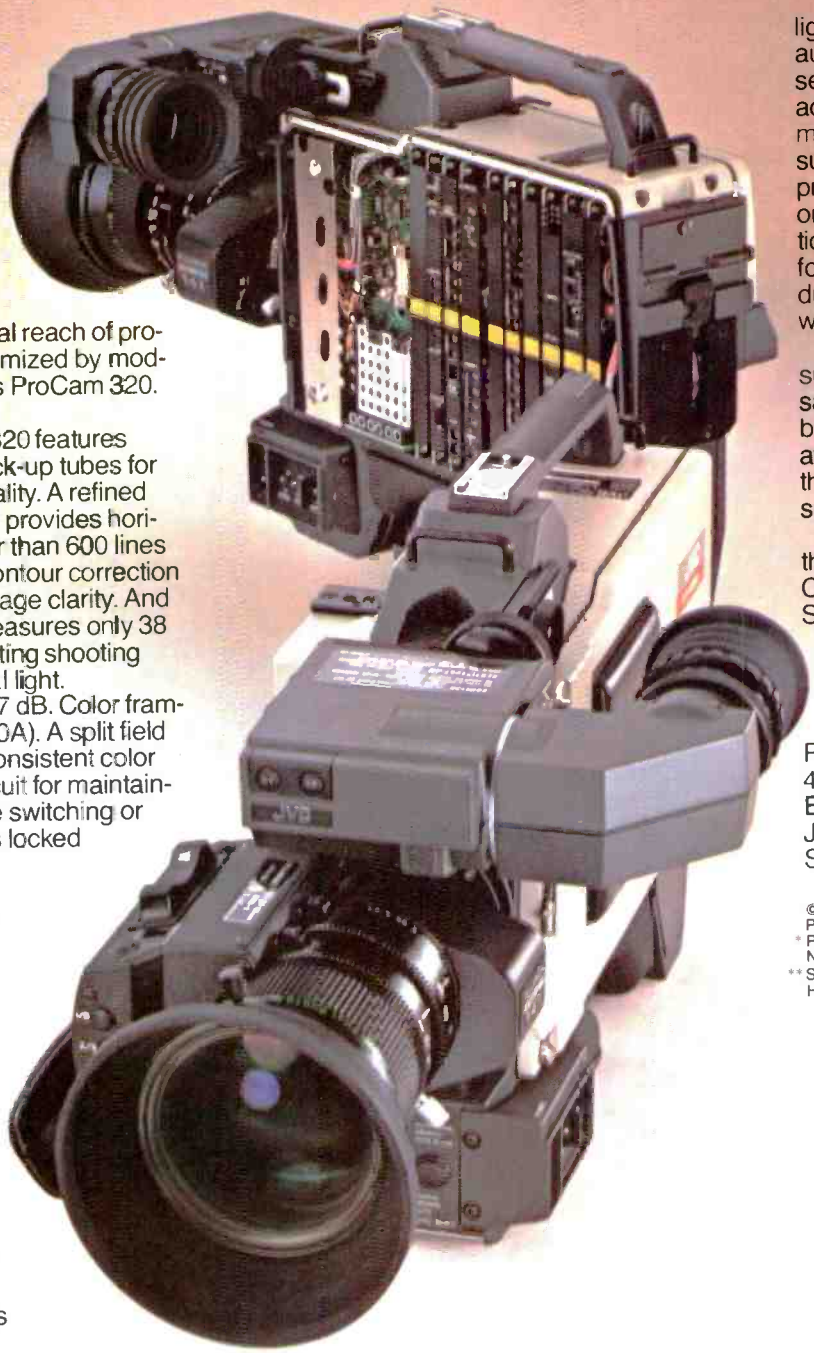
The PROCAMs KY-950U (above) and KY-320U (below) are Plumbicon, prism-optic cameras that feature low light capability.

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320.

The ProCam™ Video Camera with Plumbicon* tubes at Saticon** price.



JVC's experience—and success—in designing the highest quality and reliability into compact video production cameras is unmatched. Now, continuing this tradition of high performance at an affordable price, JVC has brought a "high-end" teleproduction camera within the financial reach of production people often victimized by modest budgets. This time, it's ProCam 320.

What a package!

SENSITIVITY. ProCam 320 features three, 2/3" Plumbicon pick-up tubes for incomparable picture quality. A refined f/1.4 prism optics system provides horizontal resolution of better than 600 lines at center. A 2H vertical contour correction circuit further assures image clarity. And minimum illumination measures only 38 lux (3.6 fc) at f/1.7, permitting shooting even in limited or artificial light.

A video S/N ratio of 57 dB. Color framing output signal (RS-170A). A split field color bar generator for consistent color reference. A genlock circuit for maintaining a stable picture while switching or mixing with other signals locked on the same source.

EASY OPERATION. Several 8-bit data memory chips offer operator conveniences for quick set-up and consistent performance. These include: Auto centering, auto-black balance and auto-white balance, auto black level stabilization and auto beam control circuits. Matrix masking for true color reproduction and automatic protection for the pick-up tubes are a few of the many features standard on this new camera.

VERSATILITY. Easy portability. Outstanding performance in low-level lighting. High degree of automation. An extensive selection of options and accessories combine to make the ProCam 320 suitable for both studio production, EFP, or ENG; or, indeed, to any application, anywhere, that calls for top quality video production while staying within a tight budget.

PROCAM TECHNICAL SUPPORT. Your ProCam sales representative will be happy to explain the availability and calibre of the ProCam technical support program.

For a demonstration of the ProCam 320 Video Camera, a 320 Spec Sheet, or JVC's complete catalog, call, toll-free:

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Professional Video Division
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Rack-mounted or tabletop-configured CR-850U units operate remotely through serial or parallel control formats.

4900U portable VCR, complete with SMPTE time code, as well as the TapeHandlers, a series of microprocessor-based logic controlled VCRs with a host of features (SMPTE time code, H-phase control, FM-FM dubbing, auto-preroll, etc).

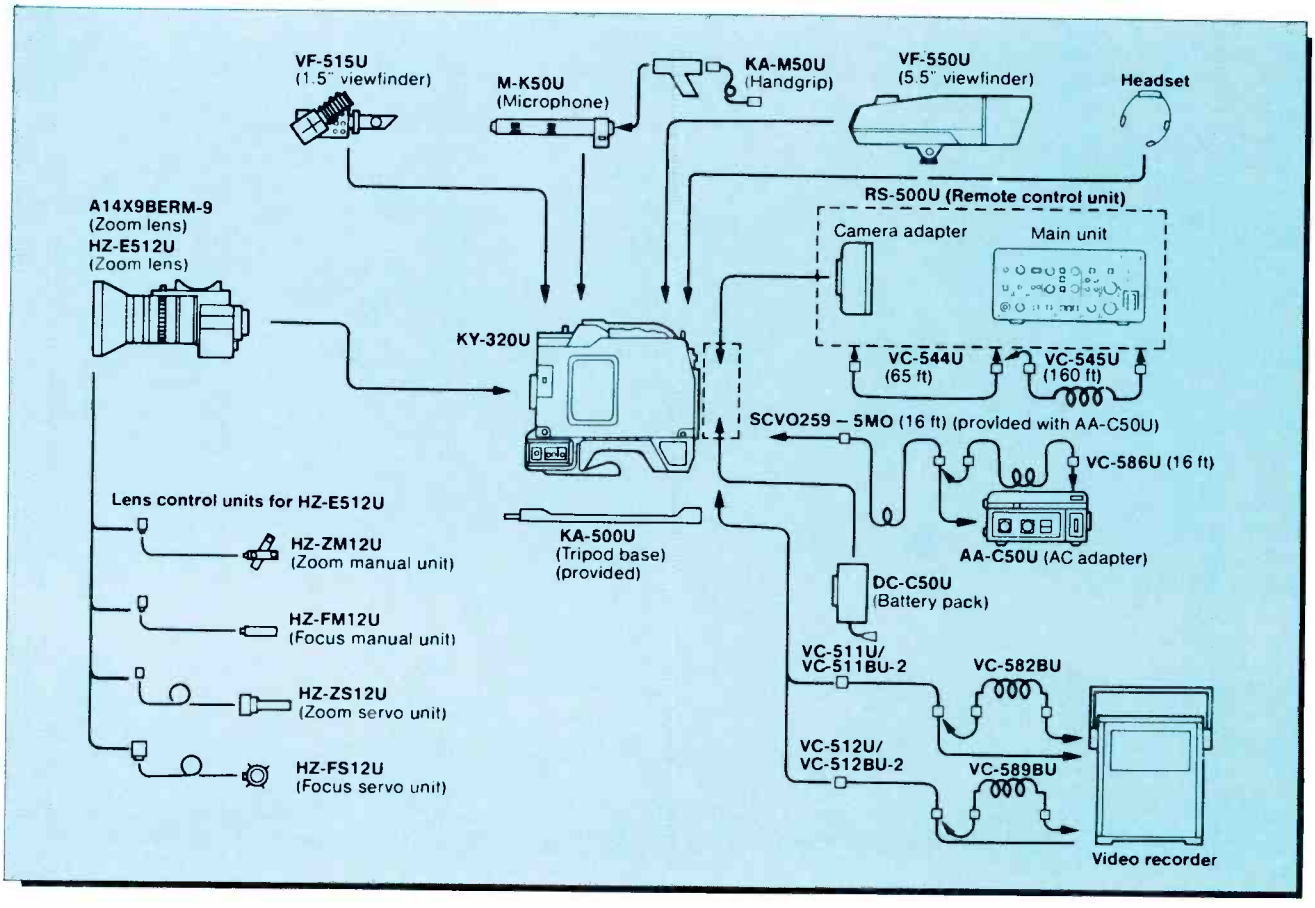
The VHS line includes the BR-8600U, a full-function editing videocassette recorder; the professional hi-fi duplicator; and the BR-6400U and BR-6400TR tri-standard VHS recorders.

Audio products

But communications means audio, too. And the professional video communications division incorporates an assortment of audio products to fulfill the requirements of the audio and video specialist.

JVC involvement in audio technology is exemplified in the many "firsts" for which it has been responsible, including the first LP (1953), the first quartz-crystal speed-controlled turntable for vibration-immune precision pitch (1973) and the first metal and oxide-compatible tape cassette deck.

Ongoing research for the maximum in quality and fidelity led to concentration on digital encoding and master recording of digital signals. JVC's commitment in this industry is apparent, with over five years of digital audio experience, first



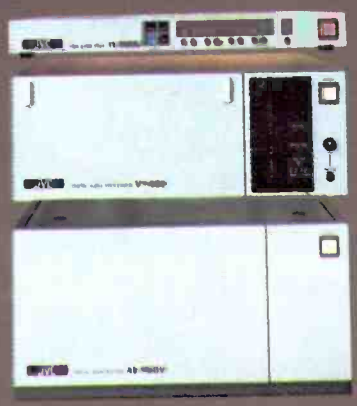
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JVC Digital Audio. The artist's editing system.

Digital audio editing takes on new speed, simplicity, and flexibility with JVC's ECO Mastering System. Anyone with a trained ear can learn to operate it in minutes and be assured of professional results of outstanding fidelity, accuracy and clarity. And while sonic excellence is surely the 900's most persuasive feature, flexibility runs a close second; for not only will the 900 operate with ¾" VCR's, but with VHS cassettes, too, with total safety and confidence, making it ideal for mastering digital audio discs and the increasingly popular hi-fi video discs.

The DAS-900 consists of four principal components.

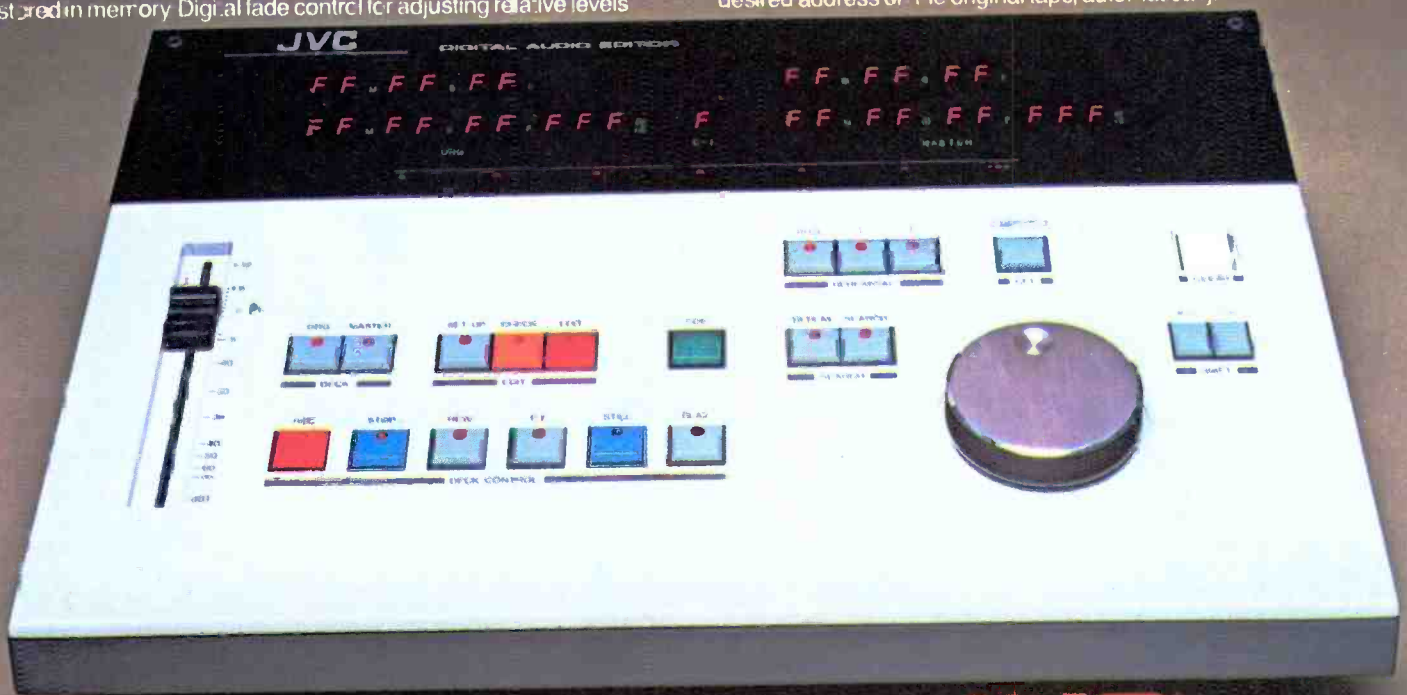
VP-900 Digital Audio Processor. Two-channel pulse count mode processor. Several 16-bit microprocessors make it compatible with other professional production equipment such as cutting lathes, synchronizers, and encoders. Dynamic range of more than 90 dB. Frequency response from 10 to 20,000 Hz (± 0.5 dB), and low recording bit rate of 3.087 Mbits/s at 44.1 kHz. Transformer-less analog I/O circuits further improve sound quality, and the analog-to-digital, digital-to-analog converter reduces distortion to less than 0.02 per cent, while an emphasis circuit improves signal-to-noise ratio. Logic circuit uses CMOS LSI chips for high reliability, compactness, light weight (48.5 lbs) and low power consumption.



Audio Editor Control Unit. Electronic governor for routing, coordinating, and executing all edit functions, both automatic and manual. All commands, from digital dubbing of original to master for continuous programs, to repetitive point-to-point manual cueing are regulated here.

TC-900V Time Code Unit. Actually two time code units in one, this unit reads and generates SMPTE standard time code and synchronizes the JVC exclusive BP (bi-parity) time code. Thus, the DAS-900 will operate effectively with both time codes; a necessity when the System is to be synchronized with video equipment.

AE-900V Digital Audio Editor. Simplicity itself to operate, this little number puts editing right in the hands of the artist, if need be. Precise to within microsecond accuracy, edit search can be carried out by manual cueing, automatic scan, or direct address. It will confirm cut-in cut-out points independently by recalling signals stored in memory. Digital fade control for adjusting relative levels between original and master tape. Shift function for changing edit points backward or forward in 2-ms steps for super-fine adjustment. And variable-gradient cross-fading function for smooth continuity at the edit point, variable in 0, 10, 20, and 40 microsecond steps. Auto tape locate function enables the user to locate the desired address on the original tape, automatically.



For a demonstration of the DAS-900 Digital Audio System, a Spec Sheet, or JVC's complete catalogue, call, toll-free

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with the DAS-90, and now with the DAS-900.

Digital audio mastering

With the development of VHS hi-fi and the growth of CDs (compact discs), professional audio mastering has increased in complexity and demand. Production studios require high quality audio in a modern, flexible system and the recording industry will settle for nothing but the best.

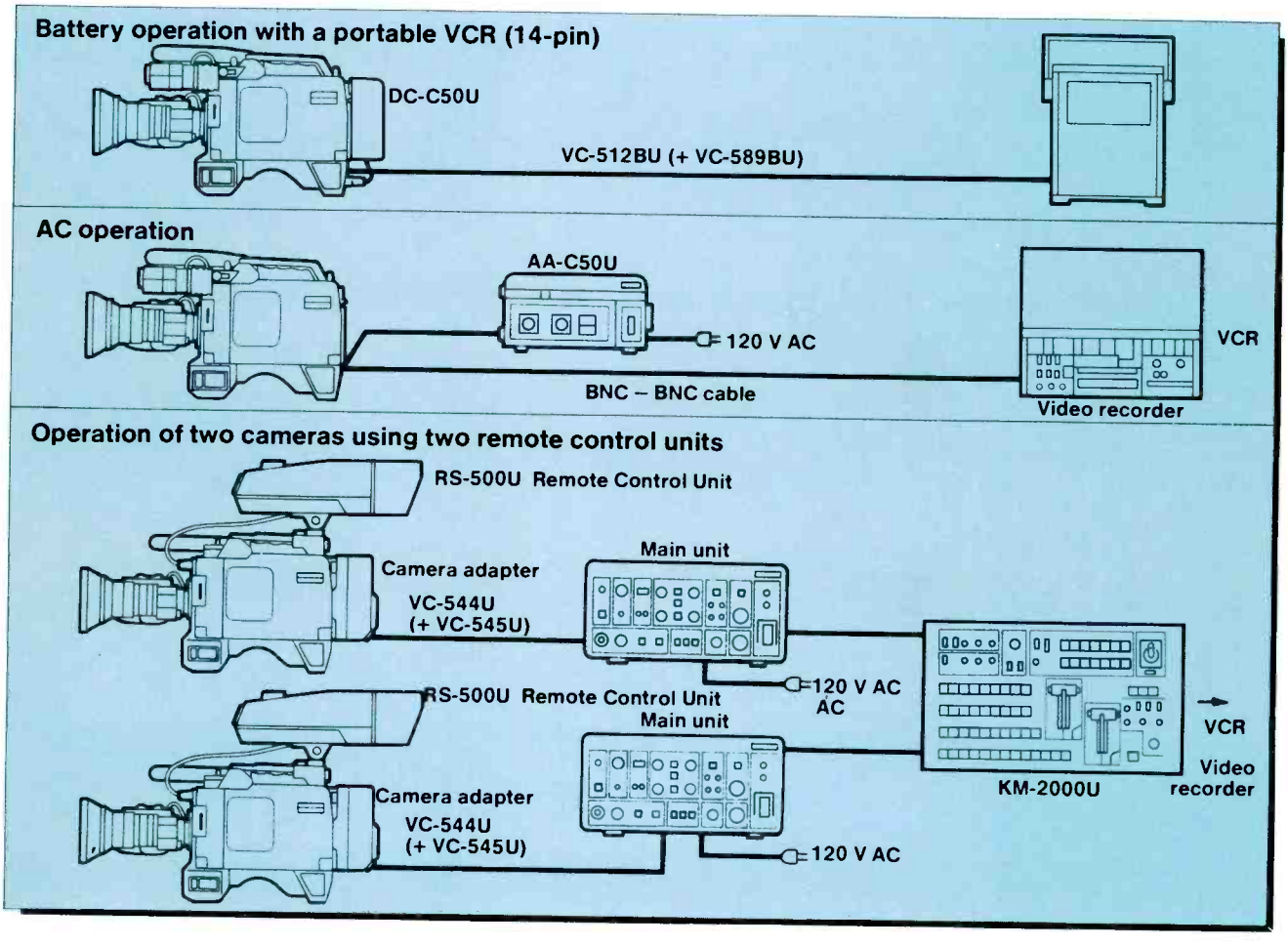
Two attributes of the DAS-900 system stand out. First and foremost is the audio quality produced by the JVC system. But secondly is its economy. Due to the incorporation of unique error detection circuits, the DAS-900 can use VHS recorders to store the digital data. VHS is economical and the two-hour recording capability makes it ideal for digital audio disks and hi-fi tape duplication, using it as a source to be synchronized with videotape playback.

The JVC digital audio system comprises two main components: The VP-900 digital audio processor and the AE-900V digital audio editor. The VP-900 is a professional two-channel pulse count mode (PCM) processor. The VP-900 incorporates several 16-bit microprocessors, giving the system compatibility with a range of other audio production equipment such as cutting lathes, synchronizers and encoders. The AE-900V is an electronic audio editor with accuracy within 180 microseconds. Searching for an exact edit point can be achieved three ways: manual cueing, automatic scanning or direct address input. The AE-900V confirms cut-in and cut-out points by recalling the signals stored in memory.

Musicians and mastering houses nationwide rely on JVC equipment for digital audio mastering. Industry experts predict that digital recording (CDs) will replace LPs for standard home listening and digital mastering will flourish. JVC continues to explore and expand its line of digital equipment, including a digital mixer, which allows the mixing of audio tracks while remaining in the digital domain.

The future

The progress of technology today is steadily increasing, and this requires a commitment to research and development. JVC has a policy of investing in new technology, and this effort has led to significant new audio and video products. Such investment can be seen in work with micro-materials, digital storage systems and tape recording media. Research is the key to interfacing with the future.



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BALANCE

The symmetry gained from the equalization of complementary forces. Symmetry as in the precise blending of sensational chrominance with outstanding signal-to-noise. Symmetry resulting in a video tape of breathtaking balance. Ampex 196.

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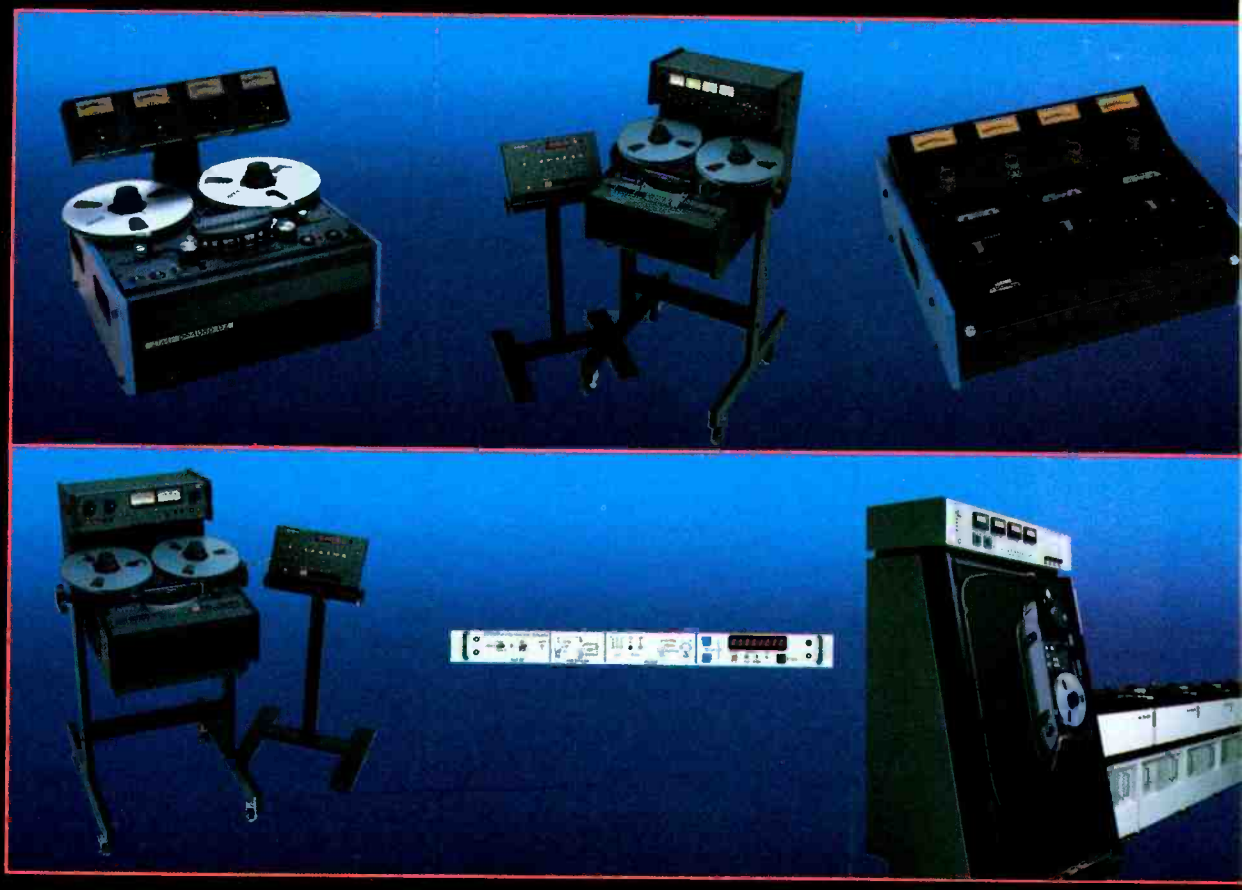
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The DP-4050-OM *is an open reel master reproducer, capable of driving up to 28 cassette slave units at 8:1 speed. The OM is fully automatic, with rewind-to-cue and repeat functions, and is available in versions providing 3.75 and 7.5 ips, or 7.5 and 15 ips.*

The MARK III/4*, an affordable ½" 4-channel recorder for professional broadcast and audio post-production. It compares, feature-for-feature and spec-for-spec, with many more expensive ½" 4-channel recorders. And for top quality audio-visual programs, the 80II (a ¼" version of the MARK III/4) is the world's best ¼" 4-channel recorder.*

The DP-4050-C2 *cassette-to-cassette duplicator with two slave units, copies cassettes at 8:1 speed, duplicating both sides simultaneously in one pass, providing full stereo duplication. The C2 can be combined with additional slave units to reproduce up to 11 copies per pass, and will process a C-60 in under 4 minutes.*



The MARK III/2 *tape recorder delivers high performance at a price that will surprise you. It excels as a broadcast editing machine, or in studio mix-down and copy applications. The MARK III/2 features a single interface connector to SMPTE time-code-based editors, machine controllers or synchronizers.*

The EC-400 Series *options for pilot tone resolve applications, and the EC-100 Series "in-machine" chase synchronizer modules, are designed to optimize the unique high performance capabilities of Otari tape transports. These options are another example of Otari's on-going product development program designed to keep your audio systems ready for the future.*

The Otari DP-80 *is the only 64:1 audio tape duplication system that is capable of running a 7.5 ips master tape. The system can be configured with from 1 to 20 slave units, producing up to 2880 C-45 cassettes per hour.*

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The "Super Analog" MTR-12. The MTR-12 combines the advanced features of the MTR-10, with expanded reel capacity to 12.5 inches, important for recording studio and post-production applications. It is available in several formats, including the state-of-the-art ½" 2-channel for record mastering.

The MARK III/8. The most widely accepted ½" multi-track recorder for broadcast production, recording studio, and audio post-production applications. The MARK III/8 is available with a remote controller and an autolocator for quick cueing and punch-ins.

The MTR-20. Otari's new "Super-Analog" with computer-controlled Record self-alignment. The MTR-20 features 4 speeds and 14-inch reels, with a transport specifically engineered for audio post-production; an application where precise machine control is a must.

The MTR-90 Master Tape Recorder, with its flawless multi-track transport is available for multi-channel music recording and audio post-production. Its pinchrollerless servo-controlled transport sets it apart from all other 8-, 16-, or 24-channel recorders.



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Master control position for the satellite-based network.

Continued from page 58

The logger tapes are kept for 30 days, then recycled. In addition, the program controller produces a hard-copy *as-aired* printout indicating automation problems or schedule deviations to further verify and analyze broadcast operations.

Production/post-production

All programs produced by the Access Network are recorded at either of two production centers, Calgary or Edmonton, on 1-inch type C format video recorders. The main studio, located in Edmonton, is a fully equipped production facility that includes a wraparound backlit cyclorama, three teleprompter-equipped studio cameras, plus adequate carpentry and lighting facilities to produce a variety of in-house programs.

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Maryland ITFS

The number of off-campus students who take courses broadcast by the University of Maryland's educational TV system is growing, thanks to some innovative programming efforts.

Nearly 1,500 students, most of them employees of government agencies and private companies in the Washington, DC, area, are enrolled in a wide variety of undergraduate and graduate-level courses transmitted from College Park to work places in Maryland, Virginia and the District of Columbia, and to several community colleges.

What is now one of the nation's most extensive ITFS schedules began six years ago in College Park with a 2-channel microwave TV system. It has grown to four channels with 20 transmitters. Classes are broadcast from 8 a.m. to 9 p.m. and include credit and non-credit offerings.

One reason for the rapid expansion of the university's educational TV service is the interest of private companies and government agencies in employee education programs. Participants have included IBM, NASA, Westinghouse and the Census Bureau.

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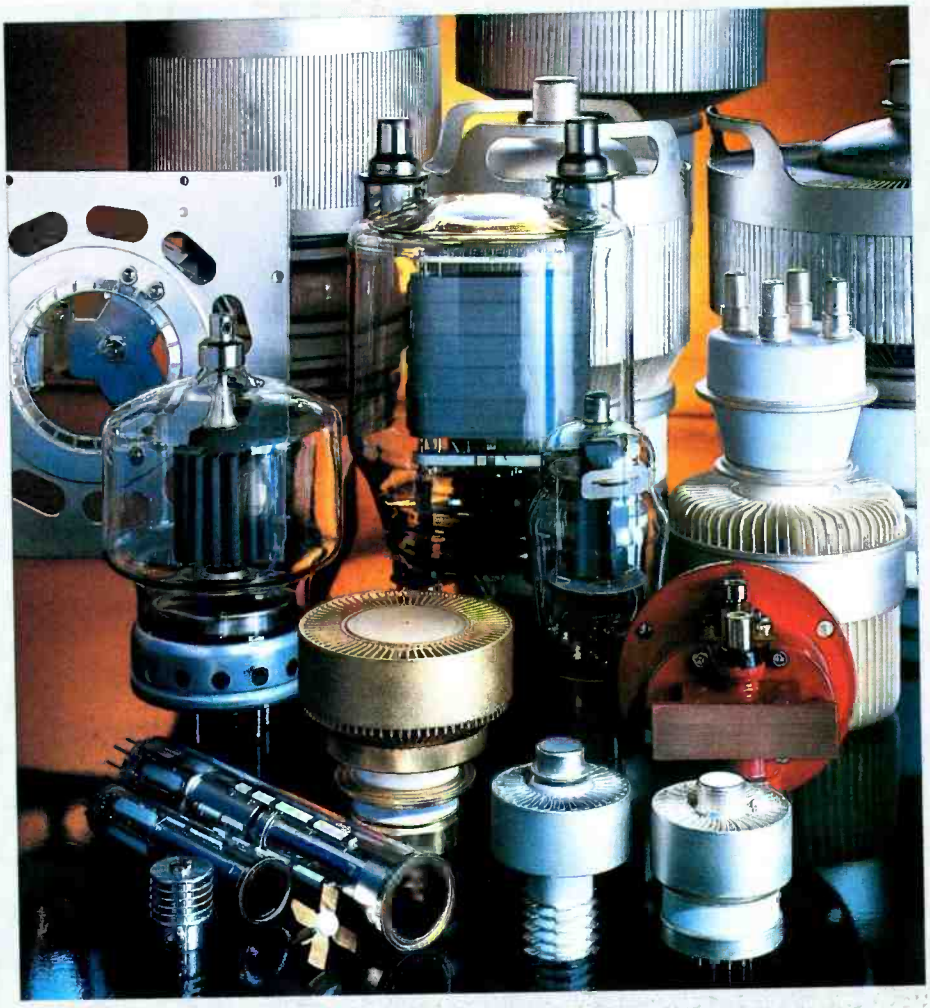
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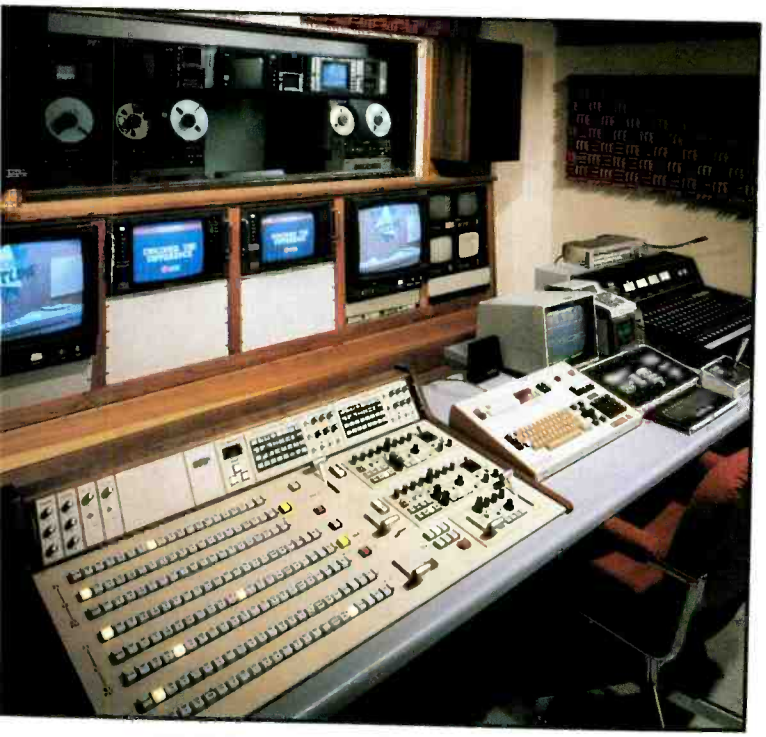
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The on-line video control room of the Access Network.



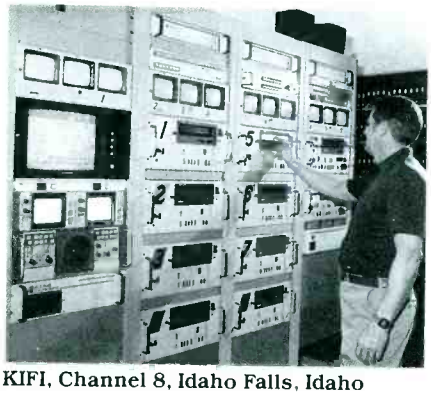
A portion of the network's master control room.

The future

Access Network is striving to stay on the leading edge of educational technology by adapting its satellite-based distribution system to new uses. The hardware is now in place to carry subcarriers on the FM radio network and closed-captioning on the video. In addition, the company is reviewing various means of distributing information to multiple-receive sites via additional subcarriers, SCPC feeds or vertical blanking interval transmissions to download computer data, voice channels and slow-scan imagery.

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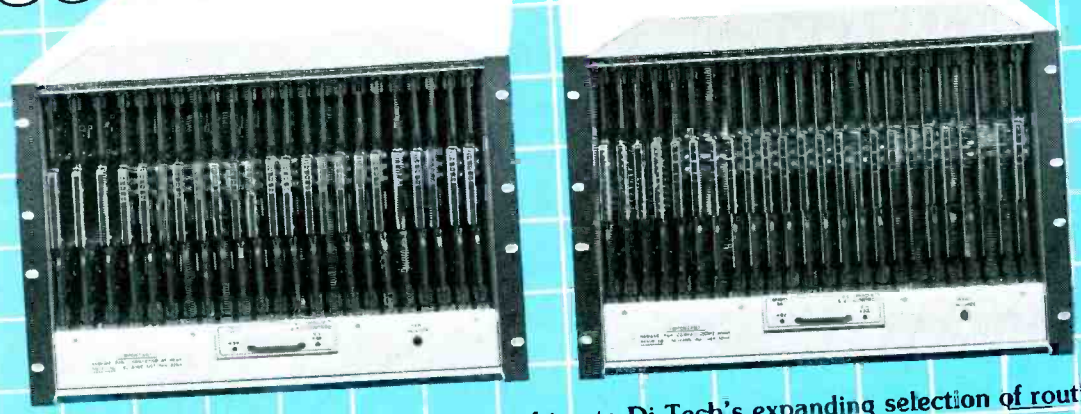
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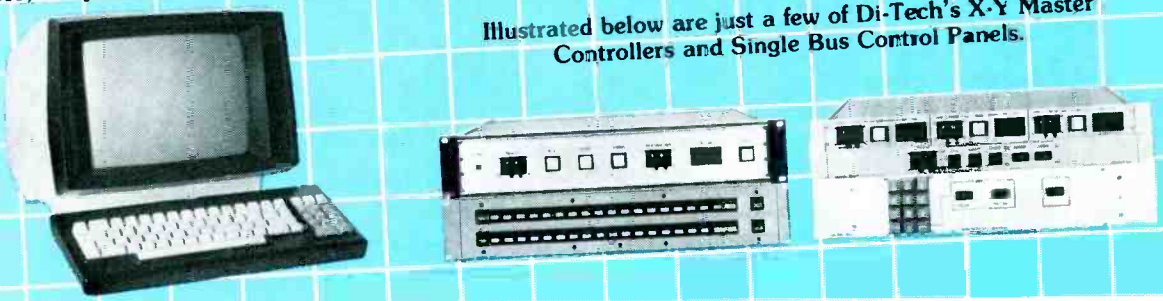


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Intercom system design

By Bob Tourkow

In today's teleproductions, modern intercoms make it possible for complex communication channels to be assembled with ease.

Intercoms. Everyone has used them, probably without thinking about them. Put on the headset or press the button and there you have it—communication. The lowly intercom system is frequently left out of budgets or is grossly underestimated. But if the creative and operational personnel cannot communicate effectively, the potentially finest production can become mediocre.

In today's complex and fast-paced broadcast world, the need for rapid, reliable and flexible communications has never been greater. Fortunately, the available intercom equipment is capable of meeting almost any need that might arise. The key to the proper purchase, installation and use of intercom equipment is a thorough understanding of the equipment basics.

About the intercom

The historical background of intercoms, as far as broadcast is concerned, lies primarily in television. The early radio stations had less need for intercoms because of the ability to use hand signals. In television, it was seldom possible for the camera operator to see the director, let alone take visual hand cues. In fact, it was the need for TV directors to be able to communicate with camera and floor personnel that brought about the first broadcast intercom systems as we know them today.

From a usage standpoint, there are two basic kinds of intercom systems: point-to-point and conference line. Point-to-point systems allow you to speak only to a selected person or area. Simply put, the communication travels from one point to another point. No other people or locations receive that communication. It's private. Point-to-point systems are sometimes called matrix systems.

Conference line systems, on the other hand, are sometimes referred to as *party line* or *PL systems*. Anyone connected to the intercom line hears all of the communication that takes place. When anyone speaks, everyone hears it. There are normally no private communications with this system. Figure 1 shows a typical conference line system.

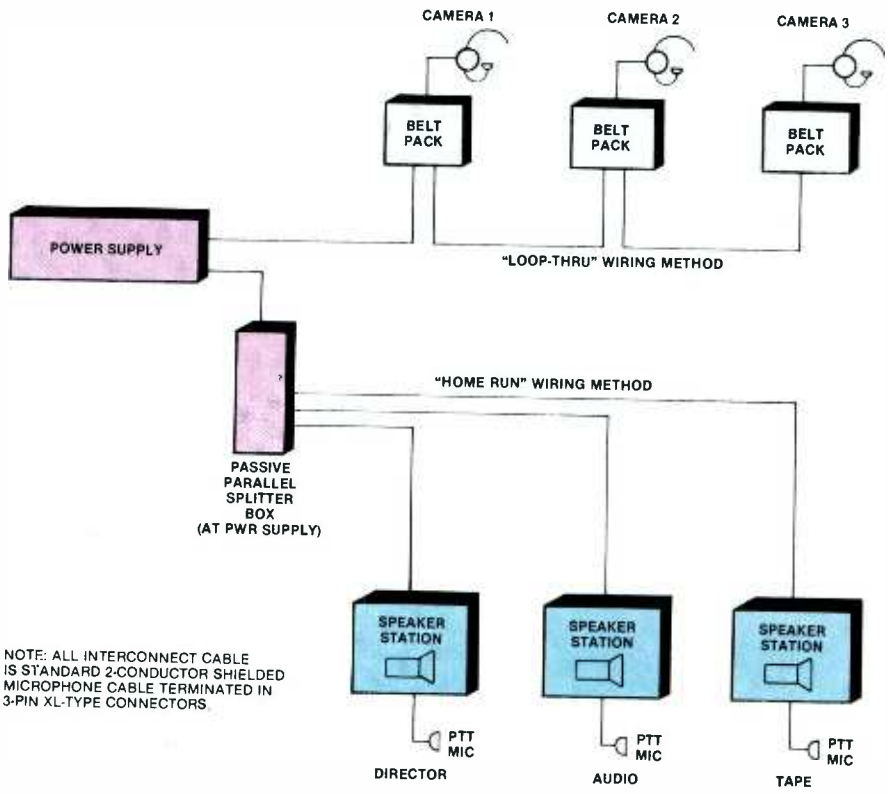
Early systems

The early TV intercom systems were quite different from what is available today. The original intercoms were conference line systems that came with the cameras and were based on telephone type technology. Right away, they were off to a bad start, as the telephone is basically a point-to-point system. They used high-current power supplies with retard coils and carbon microphones. The system had a characteristic low impedance for both the intercom line and the stations connected to that line.

These early systems had many limitations. The audio bandwidth was severely restricted, as the typical audio response was from 300-500Hz to 2,000-3,000Hz. The systems were prone to changes in level and audio quality as the number of stations connected to the line changed. The early systems were also noisy because they used carbon microphones and poorly fitted power supplies. The primary cause of the poor performance was the low impedance of the stations. As more stations were added, the equivalent line impedance went down, and so did the audio levels. (See the accompanying sidebar.)

As more advanced systems were developed, a controversy ensued over the need for fidelity in the intercom design. As manufacturers attempted to

Figure 1. A simple 6-station single-channel conference line intercom system.



Tourkow is product/applications manager of Clear-Com Intercom Systems, San Francisco, and works on various TV and film projects as a communication designer/supervisor. Production credits include the Academy Awards, Grammy Awards, American Music Awards, Miss America Pageant, 1981 and 1985 Presidential Inaugurations, and the closing ceremonies of the 1984 Summer Olympic Games.

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establish standards among intercom systems, many people felt that full frequency response was not needed. After all, telephones provided adequate communications with their limited frequency response, didn't they? Fortunately, the industry finally realized that there was an important difference between telephones and production intercoms.

Telephones are usually used for less than 20 minutes at a time. Intercoms, on the other hand, are often used for many hours at a time. The people involved in teleproduction work often can't take a break or remove their headsets. If the system has limited frequency response, then the system's filter effects create distortion. This unnatural sound can cause fatigue, which can be eliminated with a full frequency intercom.

Fortunately, many of the new companies entering the intercom business recognized this, and designed their systems for full frequency response and low distortion.

The original intercom systems only used headsets. There were no loudspeaker or hands-free stations or interface devices to connect to other types of communications systems.

New demands

Two factors placed new demands on intercoms. The first was the emerging use of live TV remotes. Sometimes the crews in these remotes were required to wear two sets of intercom headsets to hear (and talk to) all of the appropriate areas. When it became necessary to talk to the studio, an operator might have even had to move one earmuff back and hold up a telephone to that ear. In mobile trucks, some operators had to wear headsets in addition to listening to cues coming over one or more speakers.

The second factor was rapidly advancing TV technology. As additional production sources were required for TV broadcasts, it was necessary for more people to be a part of the communications links. Videotape recorders, slow motion equipment, graphics, film, audio and even live satellite feeds placed tremendous demands on the communication systems. It was no longer practical to simply tie everyone on to a common line with a carbon headset and expect the system to work. Even point-to-point systems could not solve all of these problems.

Early solutions

In TV's early days, there weren't many commercially available systems. Most stations developed their own intercom systems. These intercoms were typically point-to-point systems constructed in-house and were independent of the camera-director conference line system.

The in-house systems usually consisted of two simplex links. Each link was really nothing more than a microphone, amplifier and speaker interconnected with a pair of wires. To complete the communication link, a duplicate set of equipment was added and the system then required four wires for 2-way communications.

The point-to-point systems developed basically as a 4-wire system, meaning four wires between two points. If you added another station, you had to add another set of four wires between each of the points. Many of these in-house systems were poorly documented. As the engineers who built them retired or left, it became almost impossible to repair them. The typical alternative was to build another custom system, as there were few, if any, manufacturers that sold off-the-shelf intercom products that were appropriate to teleproduction requirements.

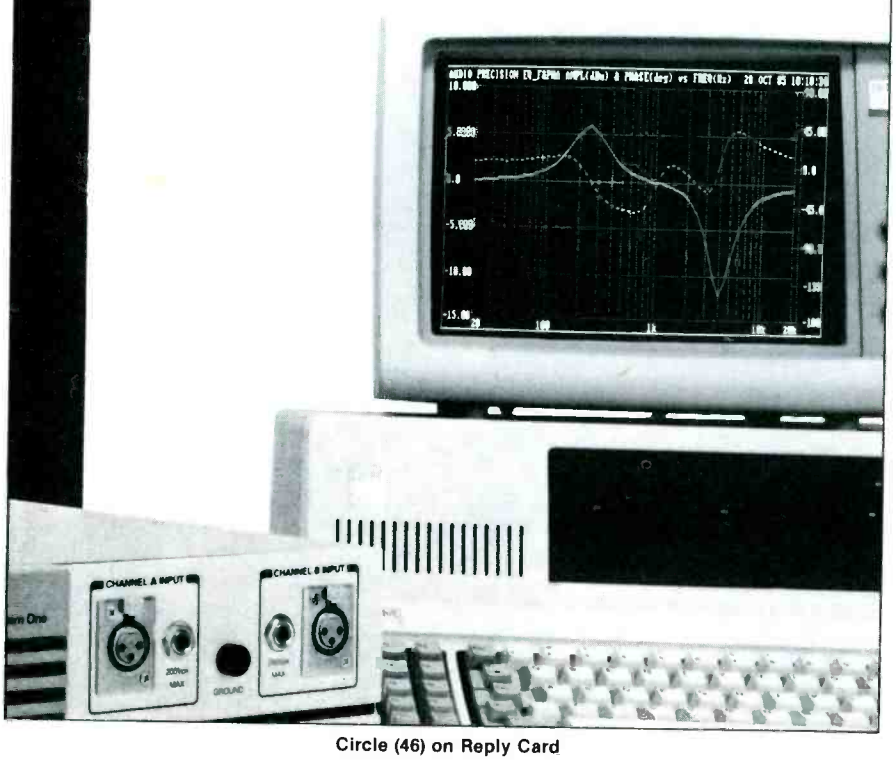
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this early equipment required at least a 7-conductor cable and came to be known as RCA Blue Boxes.

It was only about 10 or 15 years ago that two companies began to design and manufacture only conference line intercom equipment to meet the requirements of live productions. They came into being as a result of the growing need for an intercom system combining high quality, reliability, volume, ease of operation and expandability.

These original conference line system manufacturers (which are today still the primary intercom equipment suppliers) established several new technology standards that were different from those used in older camera headset systems. The most important standard developed by these manufacturers was the use of a fixed line impedance, usually around 200Ω, with the individual intercom stations bridging the line with a high impedance, generally higher than 10,000Ω.

A wide variety of different types of intercom stations with sophisticated features were soon available. With this new technology, full-fidelity communications, no matter how many stations were connected, were now possible.

The systems

The *point-to-point* (matrix) system consists of a centralized rack (or racks) of amplifiers and signal routing equipment controlled from remote stations. The audio signal paths are analog and simplex. Conversation takes place in one direction only on a single audio pair.

Each station in a point-to-point system normally requires a minimum of one audio "transmit" pair, one "receive" pair, many control, or station selection, conductors (unless control is digital) and a power pair or local power supply. It is essentially a switch-selected, multiple station, 1-way paging system.

The system allows a station to route its voice to one or more other stations. Normally, point-to-point systems require direct (home run) cabling from each station to the central rack. In this system, the *speaker* decides who hears the communication. The *listener* normally has no control over who is received at the individual stations.

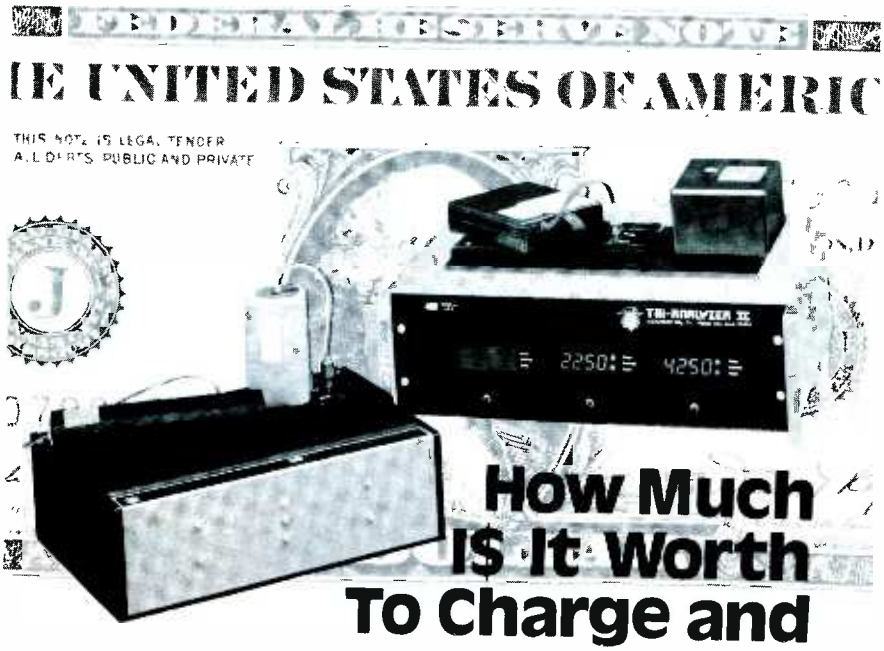
The *conference line* (party line) system is sometimes called a distributed amplifier system. In this configuration, each station is equipped with all of the required electronics for both receiving and transmitting audio and *call* signals. Conference line systems require minimal centralized rack equipment, and usually consist of the system power supplies and passive assignment switching in multichannel systems.

Conference line systems allow groups of stations to communicate in real time, full duplex fashion. Multichannel conference systems allow users access to several different channels, determining who they talk and listen to. Keep in mind that with the conference line system, all stations on a particular loop hear everything on that loop. Normally, there are no private communications such as point-to-point systems provide.

It may seem that point-to-point and conference line systems are mutually exclusive. In fact, it is not uncommon to find a hybrid of both systems. The more sophisticated point-to-point and conference line systems currently available usually have the ability to integrate both types of communications functions within one system.

Number of wires

Intercom systems are sometimes classified by the number of wires required for the audio path, not including any conductors for dc power. If it takes two wires to carry the audio, it's called a 2-wire system. If it takes four wires to





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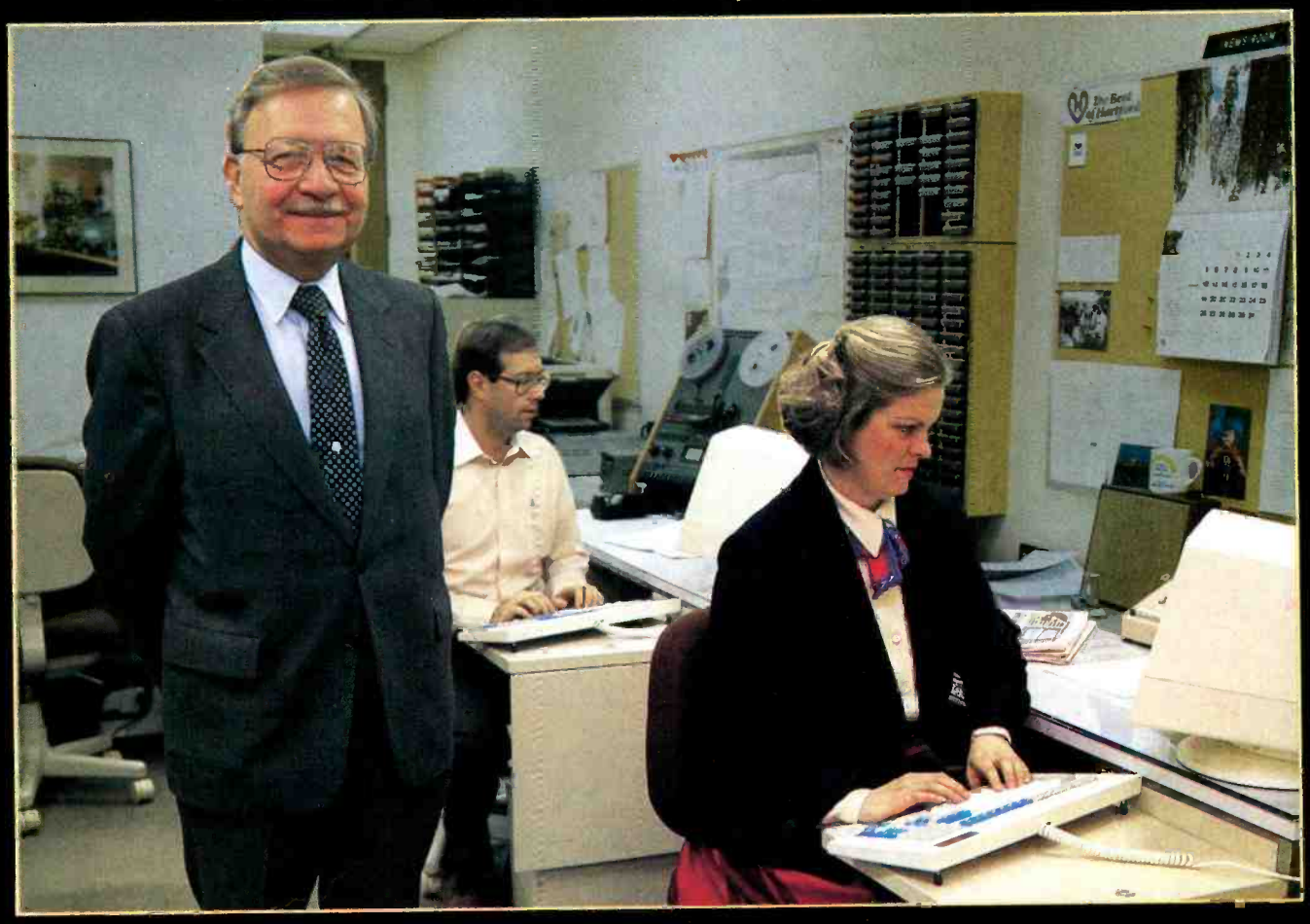
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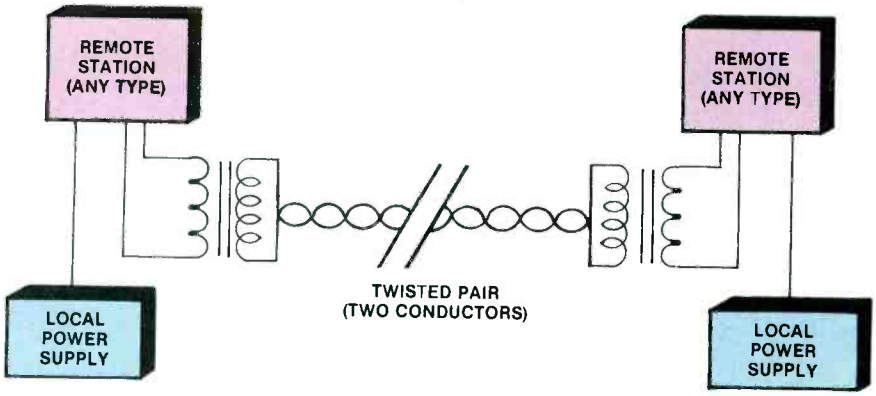


Figure 2. *This diagram shows how a pair of unbalanced intercom stations can be interconnected to a single pair of wires by using local power supplies. These supplies can be ac- or battery-powered.*

carry the audio, then it's called a 4-wire system. There are also references to 3-wire systems. Because the terms get somewhat confused, they need to be defined.

With a 2-wire system, full duplex communications can generally take place on one pair of wires. This means that conversation travels in both directions on the same pair of wires. Some 2-wire systems run balanced intercom audio, some run unbalanced audio. Also, some put the dc operating voltage on the same two wires. Others require one or more additional wires for dc power or use a local power supply (Figure 2). An example of a 2-wire system combining both audio and dc power on a single pair is the telephone.

In a 4-wire system, one pair of wires is used for each simplex (one direction) path of communication. Therefore, two pairs—a "transmit" pair and a "receive" pair (four wires)—are required for the complete 2-way communication link. Generally, 4-wire systems require a local dc power source or additional conductor(s) for dc power, plus the multiple conductors required to control station selection.

Defining 3-wire systems is confusing, as there are several different ways "3-wire" can be interpreted. It can refer to equipment and systems that interconnect using standard 2-conductor shielded microphone cable terminated in 3-pin XL type connectors, regardless of how many conductors are required for the audio path. (Two conductors plus the shield equals three wires.) The equipment of most manufacturers of conference line intercom systems interconnects via this "standard" microphone cable. But different systems use the microphone cable in different ways.

One is to provide one channel of unbalanced intercom audio between one conductor and shield and dc operating power between the other conductor and shield. (Because this type of system normally requires all three conductors to

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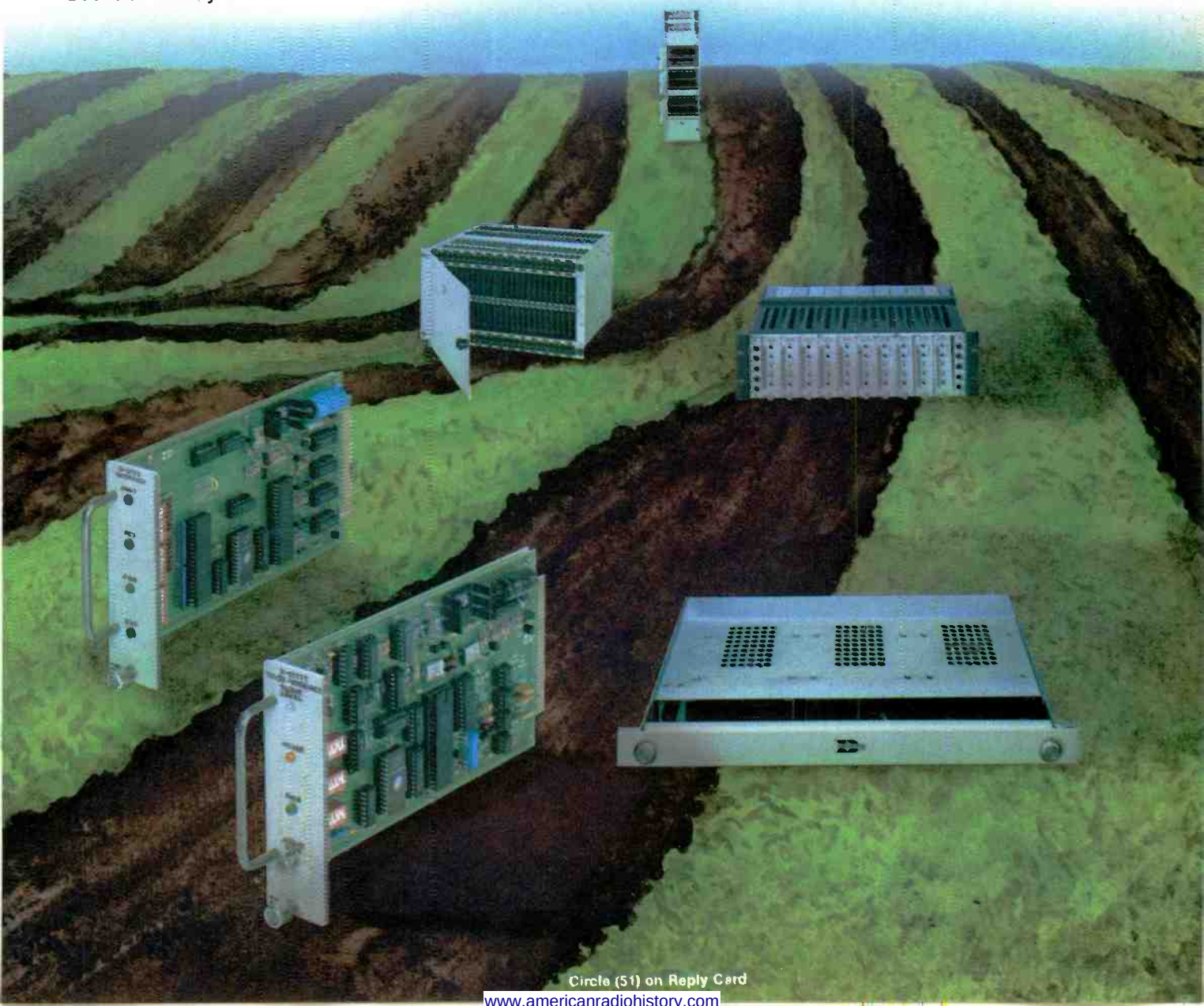
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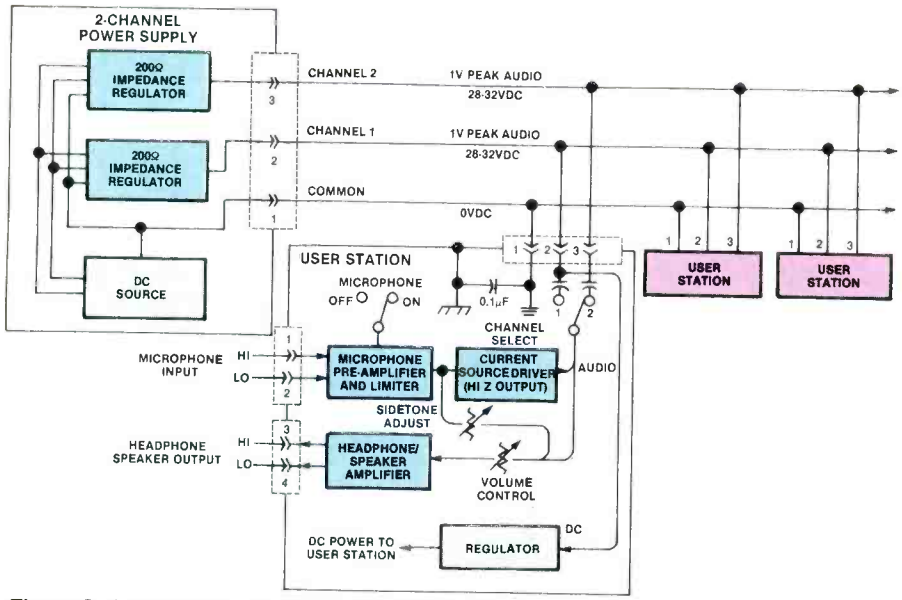


Figure 3. *A 2-wire intercom system can provide two channels of communication on a single standard microphone cable. In this example, the dc power for the system is carried along with the channel one intercom audio.*

operate, it is sometimes referred to as a 3-wire system) This is the easiest conference line system to switch and route.

Second is to provide two channels of unbalanced intercom audio, one channel between each conductor and shield, and combining the dc operating power with one of the intercom audio channels. See Figure 3. (Because this type of system actually only requires two conductors to operate, it is sometimes referred to as a 2-wire system, despite that it interconnects with 3-conductor cable.)

A third way is to provide one channel of balanced intercom audio between the two inner conductors with the dc operating power "phantomed" between the shield and the inner conductors. (Again, because this type of system actually requires all three conductors to operate, it is sometimes referred to as a 3-wire system. Only one manufacturer uses this method.)

Three-wire can also refer to the TRS (tip, ring, sleeve) plug or jack typically used on carbon mic type headsets. This is essentially a 4-wire circuit with one side of the headphone circuit and one side of the microphone circuit tied together in common, making it a 3-wire system. (Note: Any headset is inherently a 4-wire device: two wires in the receive circuit going to the earphone, and two wires in the send or transmit circuit coming from the microphone.)

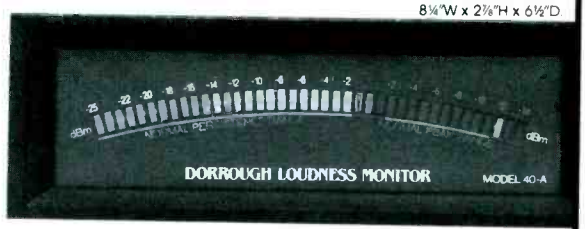
Interfaces

When interfacing intercom equipment

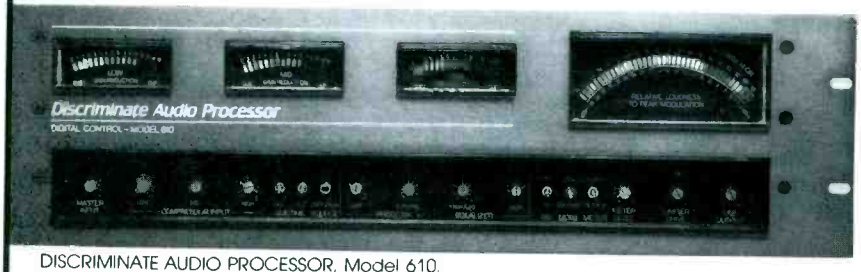
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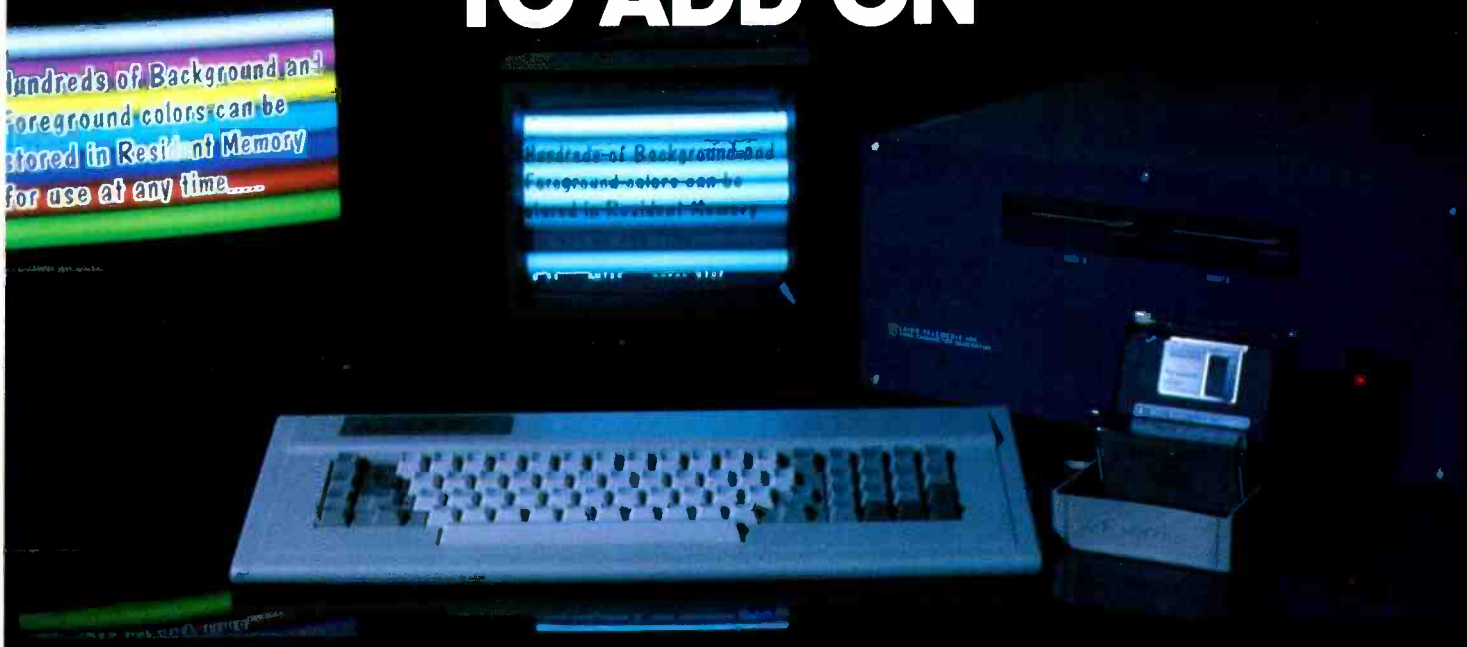
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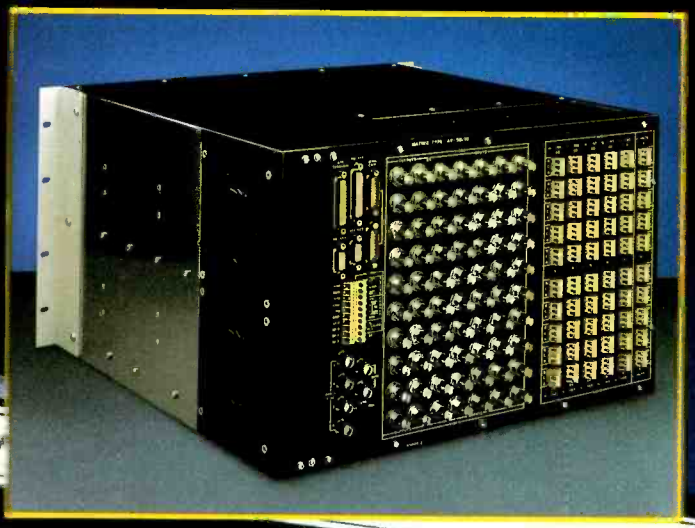
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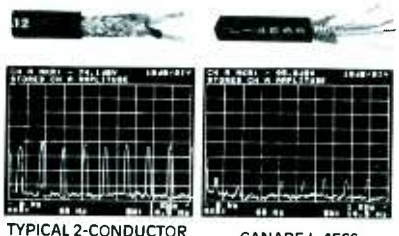
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Continued from page 82

from different manufacturers, you are concerned only about the audio portion of the system. Because each station is powered from its respective system, the dc is usually not a problem. The most common application for interfaces is with camera systems.

For example, interconnecting a 4-wire intercom to a 2-wire intercom system requires an interface. The interface must provide the proper level translation and impedance matching, and 2-wire to 4-wire conversion. Figure 4 shows how a 2-wire intercom can be interconnected to a 4-wire intercom through an interface device.

One common application for interfaces is between an intercom system and dial telephone lines. The method used to interface to a telephone line depends on which company's interface you purchase. Most will allow you to directly connect to the powered or *wet* telephone circuit, providing the necessary ring voltage protection and *line holding* circuitry.

Camera systems

Camera intercom systems create the biggest problems with interfacing and providing quality audio signals. Today's production environment requires that more headsets be coupled onto the camera line. However, simply tacking additional headsets onto the camera intercom line is inadequate.

Typical camera intercoms provide very little audio power to the headset. This is frequently insufficient to drive certain headsets if the ambient noise in the camera's environment is at all high (as at a live sporting event). On the other hand, some external belt pack intercom stations provide up to 2W of audio power.

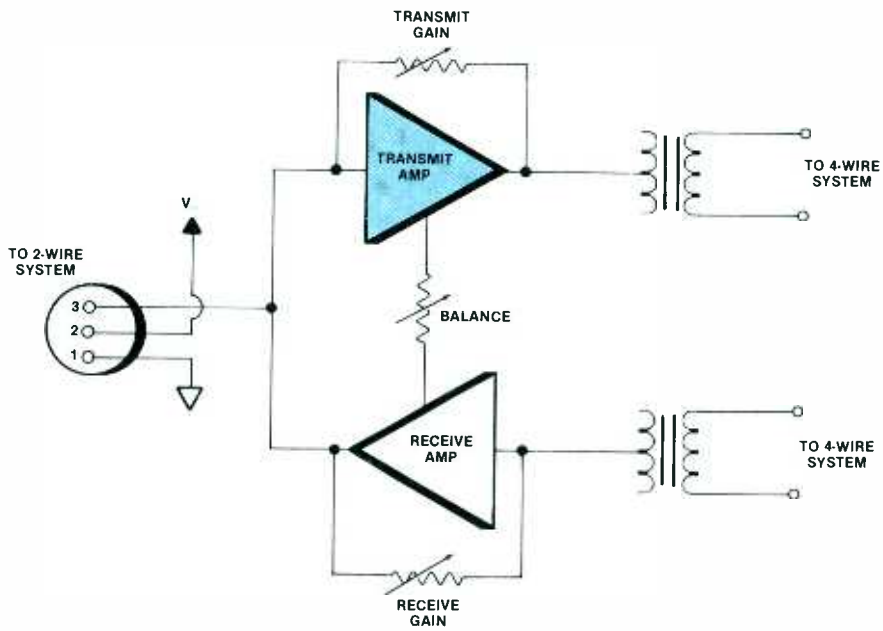
Unfortunately, there is no real standard design in camera intercom systems. Furthermore, manufacturers are not even consistent with intercom design within their own products. It is not uncommon to find that a single line of cameras from one manufacturer has completely different intercom systems.

To provide good communications, it is sometimes necessary to modify the camera intercom. Three basic approaches can be taken to improve the camera's intercom.

The first way is to completely ignore the intercom. A separate cable can be tagged along the camera cable and coupled to belt packs and headsets. This approach has the advantage of providing communications that are equally as good as the rest of the plant's intercom system. The disadvantage is that you have to run another cable along with the camera cable and provide separate belt packs and headsets.

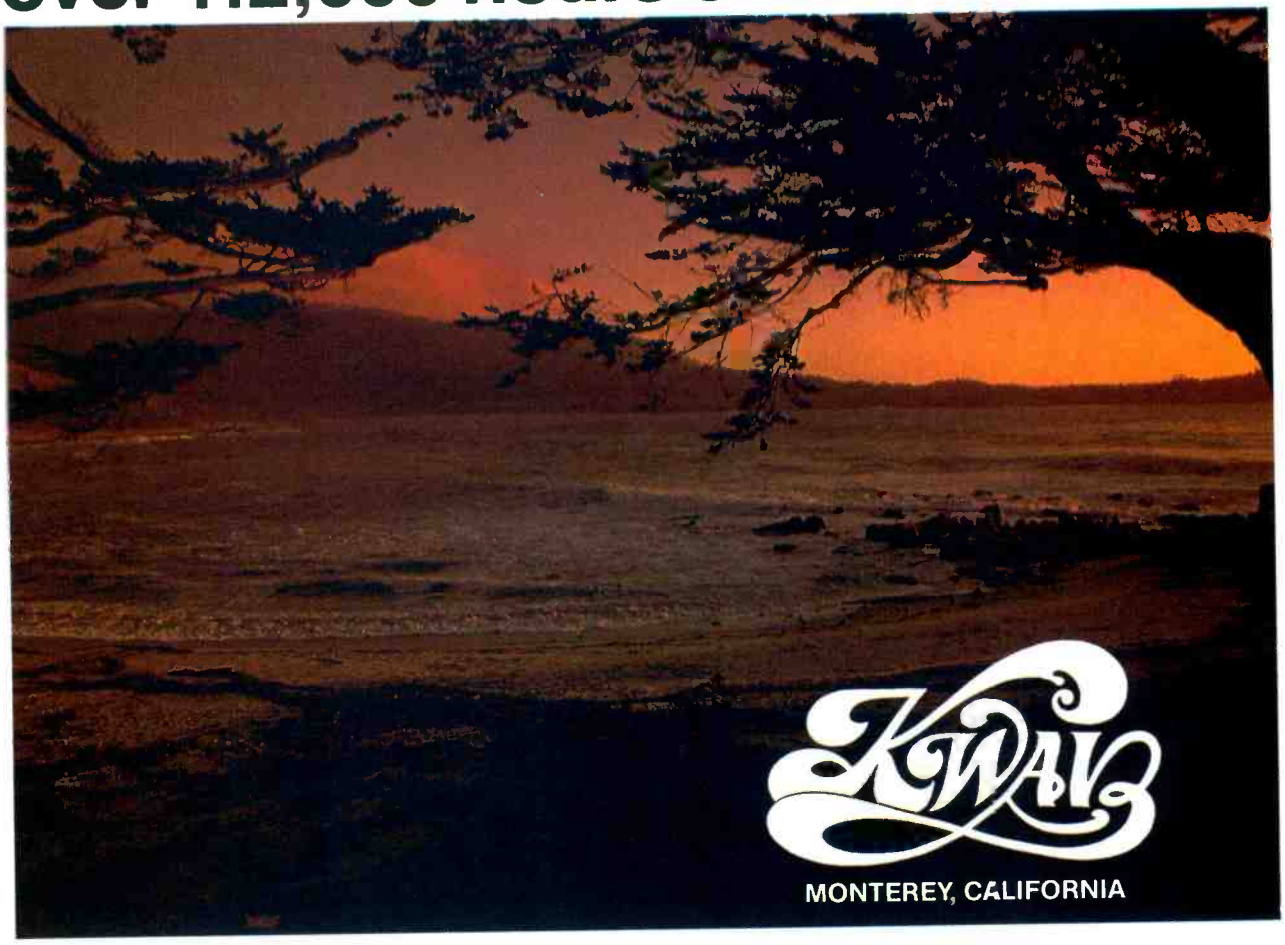
A second method of dealing with the camera intercom also requires that separate wiring be used for the intercom. If the camera operates on multicore cable, the conductors normally used for intercom and program audio in this cable can be used for the external intercom. This modification involves bypassing the internal camera intercom totally, and bringing the circuit out of the camera head for connection to an external belt pack. It does eliminate adding a separate cable to the camera.

Figure 4. *Connecting a 4-wire intercom signal to a 2-wire intercom system is easy if a standard 4-wire to 2-wire interface box is used. The box provides all of the necessary impedance and level correction.*



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Unfortunately, this option will not work with triax cable. Also, crosstalk and noise between the video and intercom circuits can sometimes become a problem if the conductors used for the intercom have insufficient shielding.

Third, you could completely remove the internal intercom. You can replace the camera's intercom circuits with a standard intercom card from the manufacturer of your external system. This method has the advantage of providing good audio quality and compatibility with the remainder of the facility's intercom. The modification will work with both multiconductor and triax cabled cameras.

The disadvantage is that not all cameras have sufficient space for the additional circuit cards. It also requires that all cameras be modified. If you bring an unmodified camera into your studio, it may not work with the modified intercom system.

The final method of modifying a camera intercom system is the easiest, but perhaps the least desirable. Interface devices can be placed between the existing camera intercom and the facility intercom. For optimum results, each camera should be interfaced individually rather than collectively. The interface device, essentially an active 2-wire to 2-, 3- or 4-wire hybrid, provides the necessary conversion of lines and levels. Because there may be a significant difference in levels between the camera and facility, optimum results are not always possible. There is a limit to the amount of level correction and isolation that can be provided with the interfaces.

The advantage of interfacing is that no modifications are required to the camera or its control unit. The disadvantage is that the audio levels and quality are limited by the original camera circuits. The interface box cannot always make up for poor levels from the camera.

Wireless intercoms

Generally, there are two types of wireless intercom systems. The first type provides a 1-way, listen-only feature for the remote stations. In this system, the master transmitter is tied to the intercom line. All communications on the intercom line are relayed to all of the wireless receivers.

This type of 1-way intercom is typically used for people who need to know what is going on, but don't need to talk back. The second type of wireless intercom is a 2-way system. In this configuration, the base unit and the field units can both talk and listen to each other.

The 2-way intercom system can be further broken down into three types. The first is a simplex, 1-frequency system, as shown in Figure 5a. All stations talk and listen on the same frequency (F1). Everyone uses a push-to-talk (PTT) switch so users cannot listen and talk at the same time. If the system is tied to a conference line, it must be turned off before any field units can talk back to the base or other units. In this configuration, a 6-station wireless system requires only one frequency.

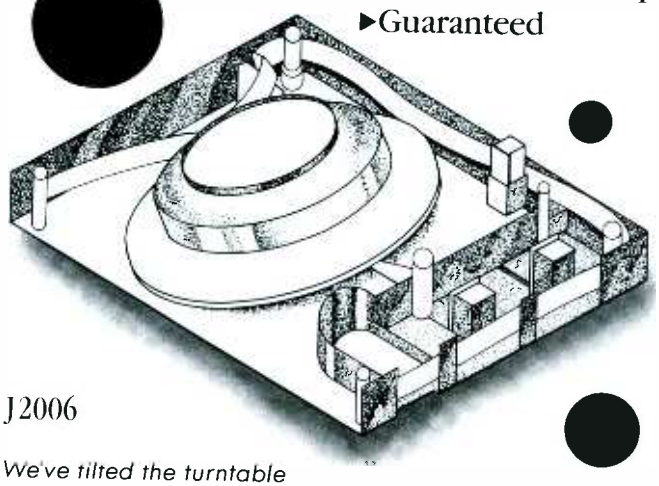
The second type of 2-way intercom system is a partial full duplex, 2-frequency system (Figure 5b). The units still use a PTT switch. The base station is tied to the conference line and is always transmitting to the remote units (F1). The remote units can then hear all of the communications on the conference line. All field units talk back to the base on the same frequency (F2) so only one unit can talk at once. This design requires two frequencies for any number of units.

The final type of 2-way wireless intercom is more complex and costly but most effective. In this full duplex design

Continued on page 92

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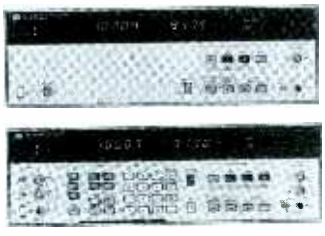
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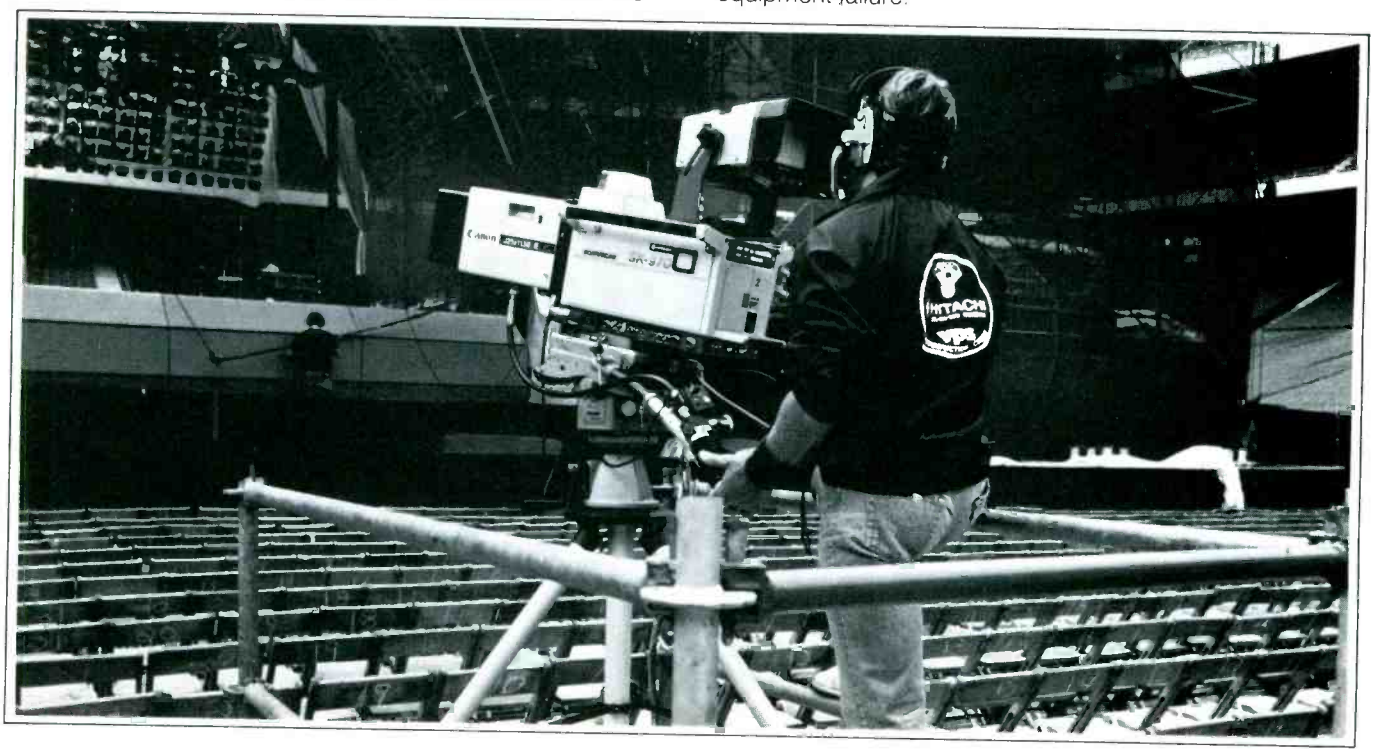
I. Jay Azimzadeh, President
Video-Pac Systems, Ltd.
Hollywood, CA

The largest producer of live concert videos in the U.S., VPS requires lightweight, low-maintenance broadcast cameras it can put on the road for long stretches.

Azimzadeh considers the SK-970 the only studio camera with 2/3-inch mobility and EFP handling. So it can meet the demands of often makeshift stadium facilities, while delivering the broadcast images that are needed for larger-screen multiple projection.

Since each of the four SK-970s and two SK-97s in the travelling package has complete self-contained auto setup, a separate box isn't needed. And any potential problems are confined to one head.

Although VPS earmarks two SK-97s and SK-970s for studio use, the ability to use both wherever they are needed is a welcome economy. Still, the greatest asset of the SK-97 and SK-970 is rockbottom reliability. To Azimzadeh, concerts are just like live TV—no one can afford any slip-ups, or an equipment failure.



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"Since each SK-97 and SK-970 has its own on-board computer, I can set everything up at the same time automatically."

Terry McIntyre, Remote Supervisor
F&F Productions, Inc.
St. Petersburg, FL

As a mobile production facility covering sports and large outdoor events for local and network TV, F&F needs broadcast quality on location.

They also need fast, independent setup. So they keep three handheld SK-97s and four compact studio SK-970s permanently stowed on one of their trucks. And with complete computerized auto setup on-board each camera, the crew can set all of them up at the same time from parameters stored in memory without having to worry about drift or last minute adjustments.



The SK-97 and SK-970 also perform superbly under low-light conditions. As a result, notes Chief Engineer Dennis Lusk, both can use very large lenses. And with real-time registration compensation automatically correcting for any changes throughout the travel of zoom lenses, the cameras are ideal for the demands of sports coverage. Resolution and colorimetry are also unsurpassed, according to Bill McKechnie, another Remote Supervisor. In fact, the SK-97 is often run by F&F as a "hard" camera, in place of the SK-970. Location recording is done on two Hitachi HR-230 1-inch VTRs.

Most important, however, is the almost complete interchangeability of both cameras. Not only are they easy to work with, but they are also easy to link up. And so similar electronically, a single set of spares can cover any potential emergency.

"The SK-97 is a real mini-cam that can be completely integrated into a total studiowide auto setup system."

Bill Weber
Vice President for Engineering
WHYY Television
Philadelphia, PA

WHYY has extensive production facilities at Independence Mall and more studios on the drawing board. To plan for this rapid growth, WHYY sought a family of broadcast cameras that was as flexibly integrated as it was advanced.

While evaluating computerized camera systems, Bill Weber and his staff found that the Hitachi SK-110 studio unit and the portable SK-97—with the same basic complete auto setup—were so perfectly matched in colorimetry and resolution that pedestal and handheld work could be combined without a hitch. And because the SK-97's auto setup is also completely self-contained, both cameras are as electronically independent as they are geared toward common console control.



Staffers like Senior Video Engineer Bob Miller consider the SK-97's auto setup easy-to-use, as well as accurate and reliable. And the on-board lens and scene files give operators instant-filter and color correction at each camera head, in addition to the console. So the staff looks upon the Hitachi SK-97 as a studio camera that they can shoulder.

As facilities grow, WHYY's Weber knows that he will have the flexibility to configure and reconfigure SK-110s, SK-970s, and SK-97s to meet production requirements of most any complexity without encountering technical snags. In fact, with Hitachi cameras at other stations in the Eastern Educational Network, joint productions can even be assured of a common look.

For a demonstration of the SK-97 and SK-970 in your studio, contact Hitachi Denshi America Ltd., Broadcast and Professional Division, 175 Crossways Park West, Woodbury, NY 11797; (516) 921-7200, or (800) 645-7510. Canada: Hitachi Denshi Ltd. (Canada), 65 Melford Drive, Scarborough, Ontario M1B 2G6; (416) 299-5900.

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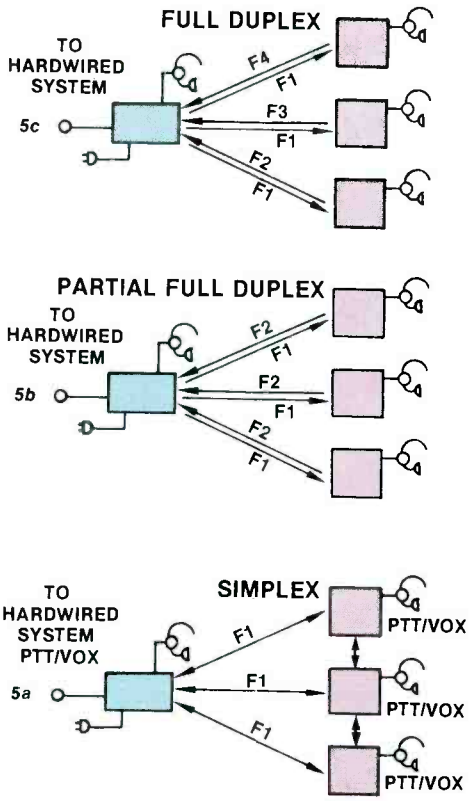


Figure 5. *Wireless intercoms provide complete mobility for the user. A full duplex system, shown in 5c, requires one frequency for each remote station, plus one frequency for the base station.*

Continued from page 88

(Figure 5c), everyone receives on the same frequency (F1), as described previously. However, each of the field units transmits back to the base on different frequencies (F2, F3, etc.). In this configuration, any number of remote units can listen and talk at the same time. A system with six remote units requires seven frequencies. This design is really a wireless version of a wired conference line intercom and no PTT switches are required. In a high-quality system of this type, a wireless remote headset is virtually indistinguishable from a wired headset.

Virtually all wireless units will interface with wired systems either by themselves or through interface boxes. The advantage of the wireless system is the mobility it provides users. The disadvantages include limited range, interference, frequency coordination (limited availability) and dropouts.

Signaling

In a conference line intercom, signaling is normally referred to as a *call* or *signal*. It provides a means (usually visual) to attract the attention of a person who is not wearing a headset or has turned off the loudspeaker. In a conference line system, all stations in a given channel of communication will be signaled at once. It is generally not possible to signal individual users in the conference line system. Although signaling is usually a visual indication, it can be made audible for special situations.

Signaling is accomplished by applying either a high-frequency tone or a dc signal to the audio pair. When using audio instead of dc for the trigger, the tone passes through many interface devices that may be in the line. However, dc signaling is less complicated and usually costs less.

Signaling simply to get someone's attention has limited application in teleproduction. It is more often used in theater work or industrial applications. There are, however, many unique applications for signaling in teleproductions that extend beyond the mere calling of someone to the station.

Signaling functions of the intercom can also be used for remote control purposes. For example, in a small ENG or SNG truck, the call light signaling circuit can be wired to turn on the 2-way radio through a relay, operating in a PTT mode. When the signaling is activated, the talent and engineers know that the studio is hearing the conference line audio because all of the signal lights are illuminated.

Another use for signaling is for *push-to-listen* features. One system allows the signal circuit to be tied to the

Interfacing cameras

One of the reasons that interfacing with camera intercoms is such a problem is the lack of standardization. There is no standard design for camera intercoms among different camera manufacturers. In addition, some manufacturers don't even use the same intercom design within their own line of cameras.

No known manufacturer designs its camera intercom to present a high-impedance load to a low-impedance conference line. Rather, most cameras present a load impedance of 150Ω to 600Ω to the line. Here's what can happen in a typical installation if an attempt is made to connect several cameras to a modern conference line system.

Assume there are six cameras, each with a load impedance of 600Ω. The intercom conference line impedance is 200Ω. If all six cameras are connected in parallel, their combined impedance equals 100Ω. When that load is connected to the conference line, the perceived audio level is cut in half, a major and unacceptable reduction.

If, on the other hand, the cameras bridged *the line with individual load impedances of 10,000Ω or higher, it would take more than 50 cameras to make a noticeable level change.*

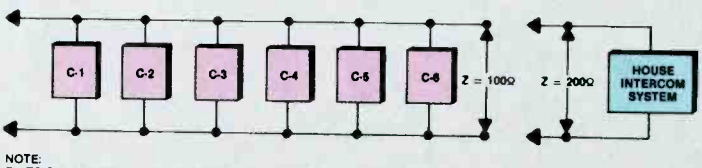
When faced with interfacing a camera to a standard 200Ω conference line intercom, you generally have several alternatives. First, you can either connect to the intercom line itself or connect via the TRS (tip, ring, sleeve) headset jack on the front of the CCU. Second, some cameras enable you to access the intercom line in either a 2-wire or a 4-wire mode (generally selectable via an internal switch).

If you have the choice, you will almost always obtain better performance interfacing in a 4-wire mode. If you are using triax cable, the intercom is always available in a 4-wire configuration. (Note: Because the intercom signal must be RF-modulated or digitized in the triax, it must exist as a separate transmit path to the camera and a separate receive path from the camera.)

All 2-wire conference line systems contain a series of 2-wire to 4-wire and 4-wire to 2-wire conversions. The primary element of a system is either a headset, with separate earphone and microphone, or a loudspeaker with a separate speaker and microphone. These are, of course, 4-wire devices. The first conversion, therefore, will be 4-wire (the headset) to 2-wire (the conference line itself).

If there is a mismatch in levels between the camera and the conference line—and there almost always is—you must convert the 2-wire conference line

Camera intercoms should not be connected to the facility intercom system without careful study. This diagram shows how the addition of several unmodified camera intercoms can affect the facility intercom system.



NOTE:
C-1 TO C-6 = CAMERA INTERCOM CIRCUITS, EACH WITH A LOAD IMPEDANCE OF 600Ω.

THE CAMERA LOOP IMPEDANCE BECOMES 600/6 OR 100Ω.

THE HOUSE INTERCOM LINE HAS AN IMPEDANCE OF 200Ω.

THE MISMATCH BETWEEN THE LOOP OF CAMERA INTERCOMS AND THE HOUSE INTERCOM SYSTEM GREATLY AFFECTS THE AUDIO LEVEL ON THE CONFERENCE LINE LOOP. THE RESULTANT 66Ω TOTAL IMPEDANCE (200Ω IN PARALLEL WITH 100Ω) PROVIDES A 10DB DROP IN AUDIO, WHICH IS PERCEIVED AS A 50% REDUCTION IN VOLUME.

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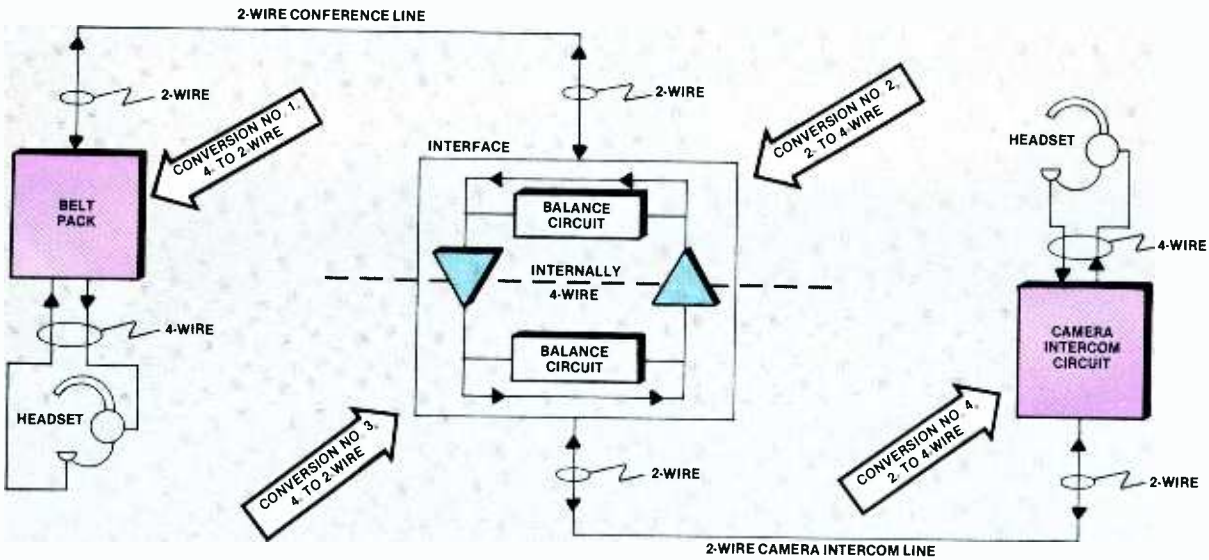
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Interfacing a 2-wire conference line to a 2-wire camera intercom can require as many as four 2-wire to 4-wire conversions.

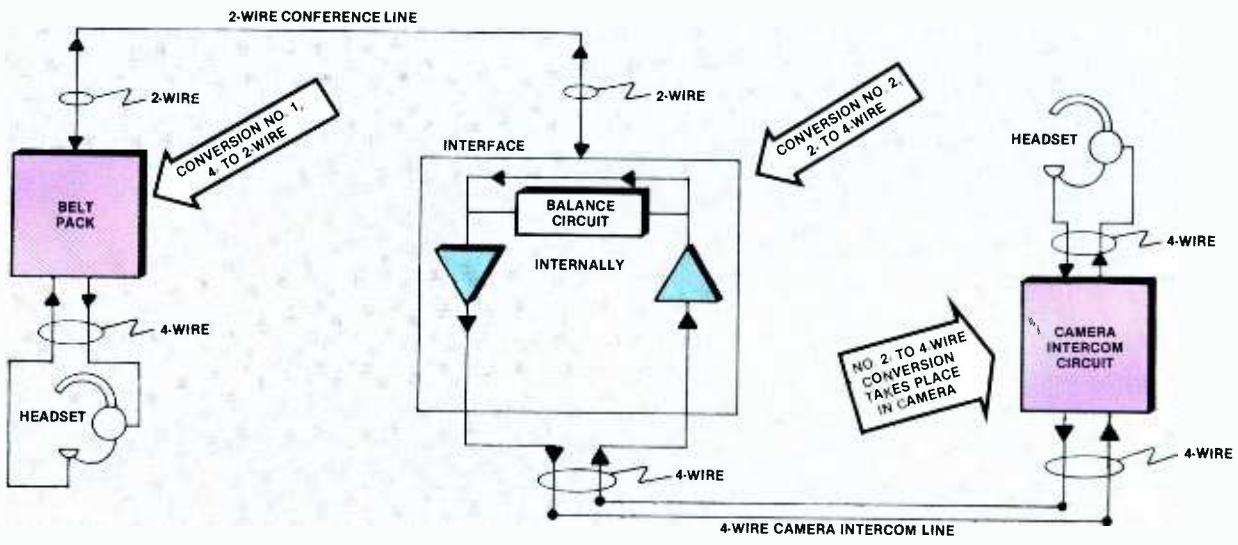
to a 4-wire circuit, then accomplish the level adjusting, and then convert back to a 2-wire circuit to connect to the camera line. Then, the camera intercom circuit must convert the 2-wire line back to a 4-wire circuit (the camera headset).

If, on the other hand, you can interface to the camera in a 4-wire mode, you have eliminated two conversions. As a general rule, the more conversions you go through, the more the audio quality will be degraded. So, if an interface choice exists, use 4-wire.

Finally, when you interface with the existing camera intercom circuitry, the quality of the camera communication will be limited by the quality of the camera circuit, which may be inferior to the quality of an external conference line system.

As an alternative, some intercom manufacturers can provide circuit cards that can be mounted directly inside the camera head. When using this alternative, you bypass the camera intercom circuit, essentially converting the camera into an actual station identical to all of the other external conference line stations. If you can use this method, then the communications with the camera will generally equal the quality of the external facility intercom system.

If the camera intercom system is modified from a 2-wire into a 4-wire system, only two conversion boxes are required.



microphone circuit of a remote station. As an example, a director presses the push-to-talk button to address the tape room. The videotape operator does not have to press any switch to respond to the director. The signaling circuit at the remote station automatically turns on the microphone in the tape room, allowing *hands-free* response from the tape operator.

In essence, this might be called a *push-to-listen* feature. The signaling circuits can also be used to override a volume control on a paging speaker or in conjunction with IFB audio.

Conference line systems that provide signaling as a standard feature can be thought of as providing a free remote control capability. The applications for signaling/remote control functions are limited only by the imagination of the engineer.

Program interrupt

Although not a 2-way intercom, interrupted feedback or foldback (IFB) is often an integral part of an intercom system. Sometimes called *program interrupt,* or PI, IFB is used to cue both on- and off-air talent.

The talent end of the IFB system usually takes one of three forms. A subminiature in- or over-the-ear earset is often used in news and field report situa-

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tions. Sportscasters often use dual earmuffs, one of which has the IFB channel. Finally, there is a less well-known application for IFB in non-broadcast uses.

In this application, the talent wears a small receiver tuned to the base station frequency. The audio output of the receiver is connected to an inductive loop antenna worn around the talent's neck. Finally, an ultraminiature receiver/earphone is worn in the talent's ear. The receiver/earphone is so small that it cannot be seen by the camera or audience and picks up its signal from the loop antenna.

With this equipment the talent can receive instructions from a director or lip-sync audio. Stunt people often use this type of arrangement to coordinate their work on complex scenes.

Most IFB systems contain more than one channel (typically four or more) and allow selective communication to individual talent without disturbing others. Most systems provide tally signals when there is more than one control point. In most designs, the program audio is cut off for the duration of the announcement or cue.

One design merely ducks the program audio under the announcement. This latter design adds a confidence factor for the talent in that they can still hear the program signal during the cues, but at a reduced level. IFB systems are available either as stand-alone systems or as an integral part of an intercom system.

POINT-TO-POINT SYSTEMS

- Generally require large amounts of rack space.
- Analog systems require significantly more wiring than conference line systems. Digital technology can reduce this requirement.
- Expansion beyond the originally designed size is expensive and difficult. Usually the addition of stations must be done in blocks of stations, rather than individual stations.
- Provide instant and unblockable communications to selected points.
- Simple to operate.
- Generally used for large in-plant applications.
- Inappropriate for field use.
- May take longer to install.

CONFERENCE LINE SYSTEMS

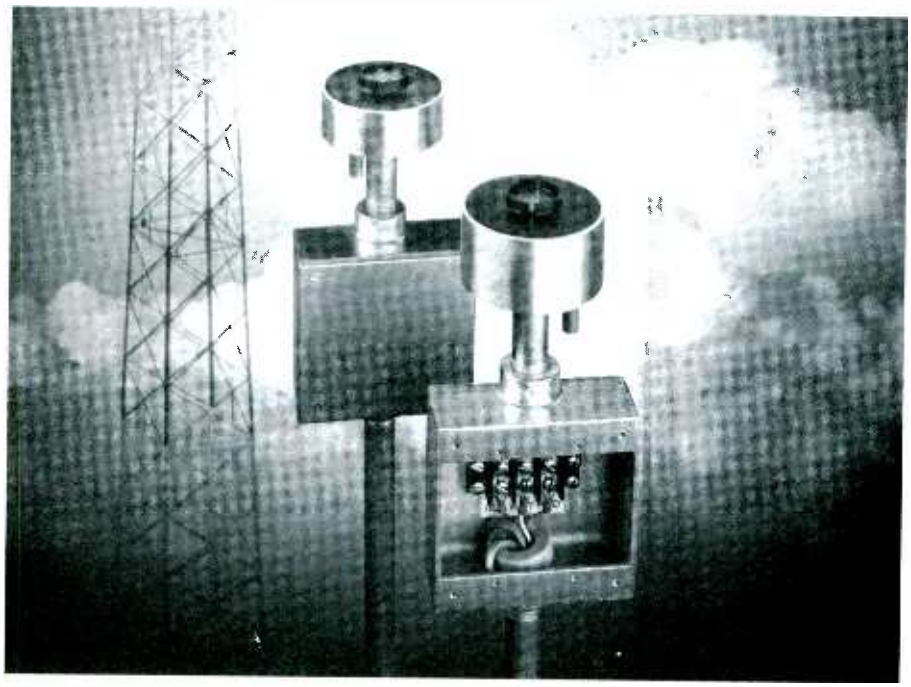
- Require a small amount of rack space.
- Easy to install.
- Generally less expensive.
- Offer more types of stations and more features.
- Everyone on the conference line must hear all communications; selective communications usually are not possible.

Careful planning

Although intercom systems can be complex, that shouldn't be a source of concern to the engineer. Today's intercom systems usually come packaged and are relatively easy to install. The primary concern for the engineer is to carefully plan the design of any new intercom system.

Planning an intercom system requires a careful step-by-step analysis of the station's communication needs. Purchasing an intercom is similar to buying a computer. You need to first decide what you want to do with the system. Only after you really know what the operational requirements are going to be, can you begin to consider the hardware.

Editor's note: A future article will discuss the design of an intercom system. Included will be examples of typical systems for different applications and a walk-through of the design of a typical intercom system. The design process will provide you with the tools you need to properly design your facility's next intercom system. |:(=)))|



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IKEGAMI'S HK-323 1" FIELD/STUDIO BROADCAST CAMERA BEGINS A NEW ERA

Ikegami's newest field/studio broadcast camera achievement has arrived—engineered and designed to provide the user with features beyond expectations.

The HK-323 1" features self-contained operation, numerous auto set-ups in any mode, a built-in encoder and sync generator, high performance prism optics, self-diagnostic functions, a control panel that connects directly to the camera head, a S/N ratio of 59dB and more—all in a camera weighing only 55 lbs.

In addition, the HK-323 1" is equipped with a 7" viewfinder featuring pan and tilt, and special functions that incluce Chroma Aperture for sharpest picture quality regardless of color or lighting; Highlight Compression Circuitry for broadcast contrast range; Soft Detail to eliminate harsh or overwhelming presence; Auto Beam Control, and more.

A companion hand-held camera is also available and is operational off the same base station.

Optional remote control is available in: triax, multicore and fiber optics.

Compare the HK-323 1" to any camera in its class and find out why the lightest field/studio camera is also the biggest value.

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The result: the HK-323 1″ and the HK-323 ⅔″–two tube sizes to meet the broadest range of preference, application or budget.

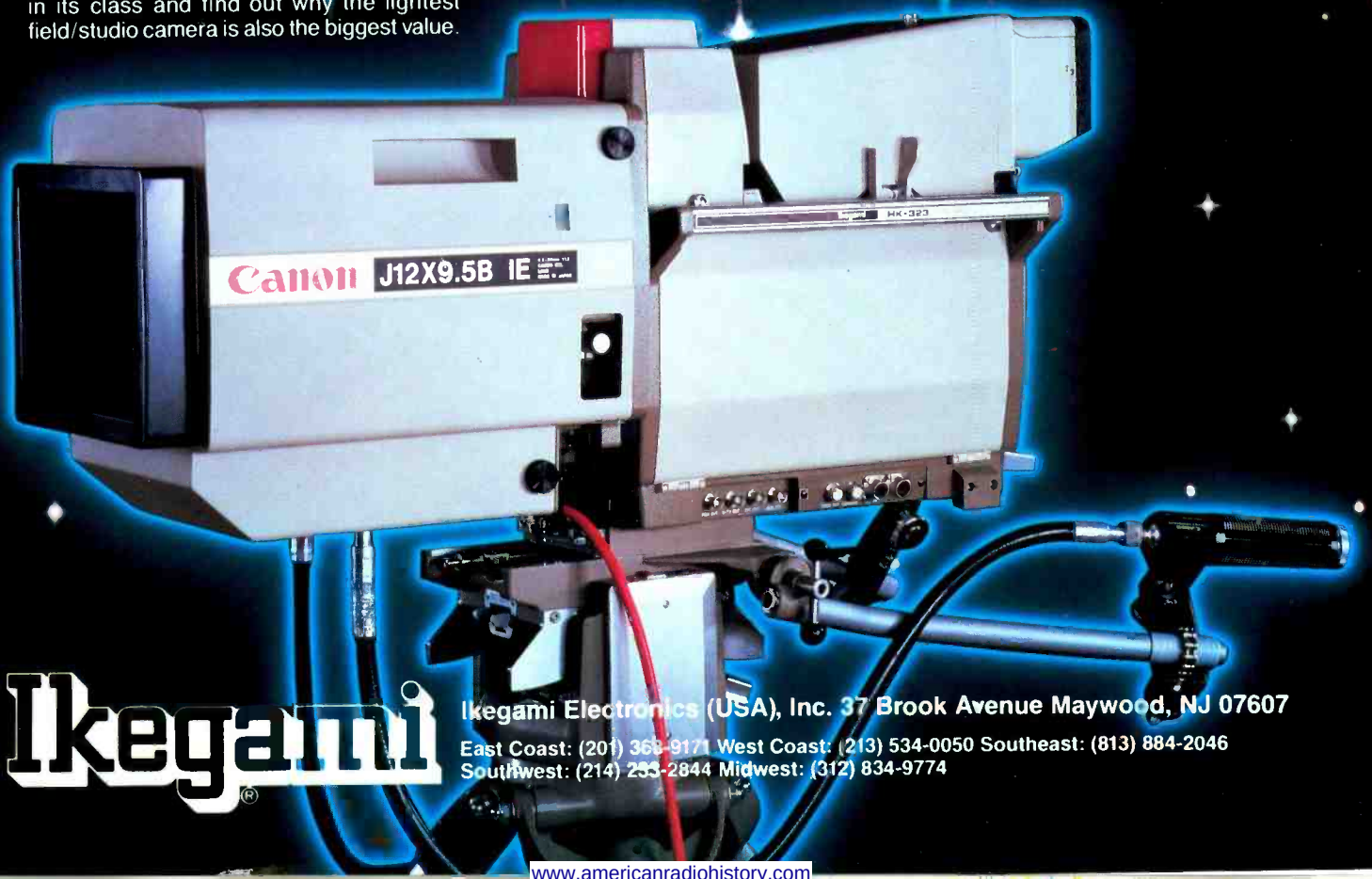
Like the 1″, the HK-323 ⅔″ features self-contained operation, numerous auto set-ups in any mode, a built-in encoder and sync generator, high performance prism optics, self-diagnostic functions, a control panel that connects directly to the camera head, a S/N ratio of 60dB and more–all in a camera weighing only 55 lbs.

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A companion hand-held camera is also available, and is operational off the same base station.

Optional remote control is available in: triax, multicore and fiber optics.

Compare the HK-323 ⅔″ to any camera in its class and find out why the lightest field/studio camera is also the biggest value.

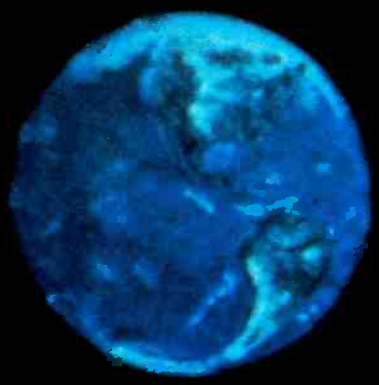


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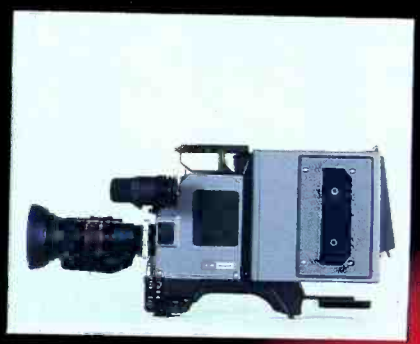
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Now the Ikegami HL-95 camera head can be the crown jewel of your ½" Sony Beta ENG system, as well as three other configurations including ¾", ¼" and M formats.

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- ☐ HL-95 Unicam ENG broadcast camera system
- ☐ HL-79E ENG/EFP broadcast camera
- ☐ ITC-730A ENG/EFP broadcast quality camera
- ☐ SC-500 Studio broadcast quality camera
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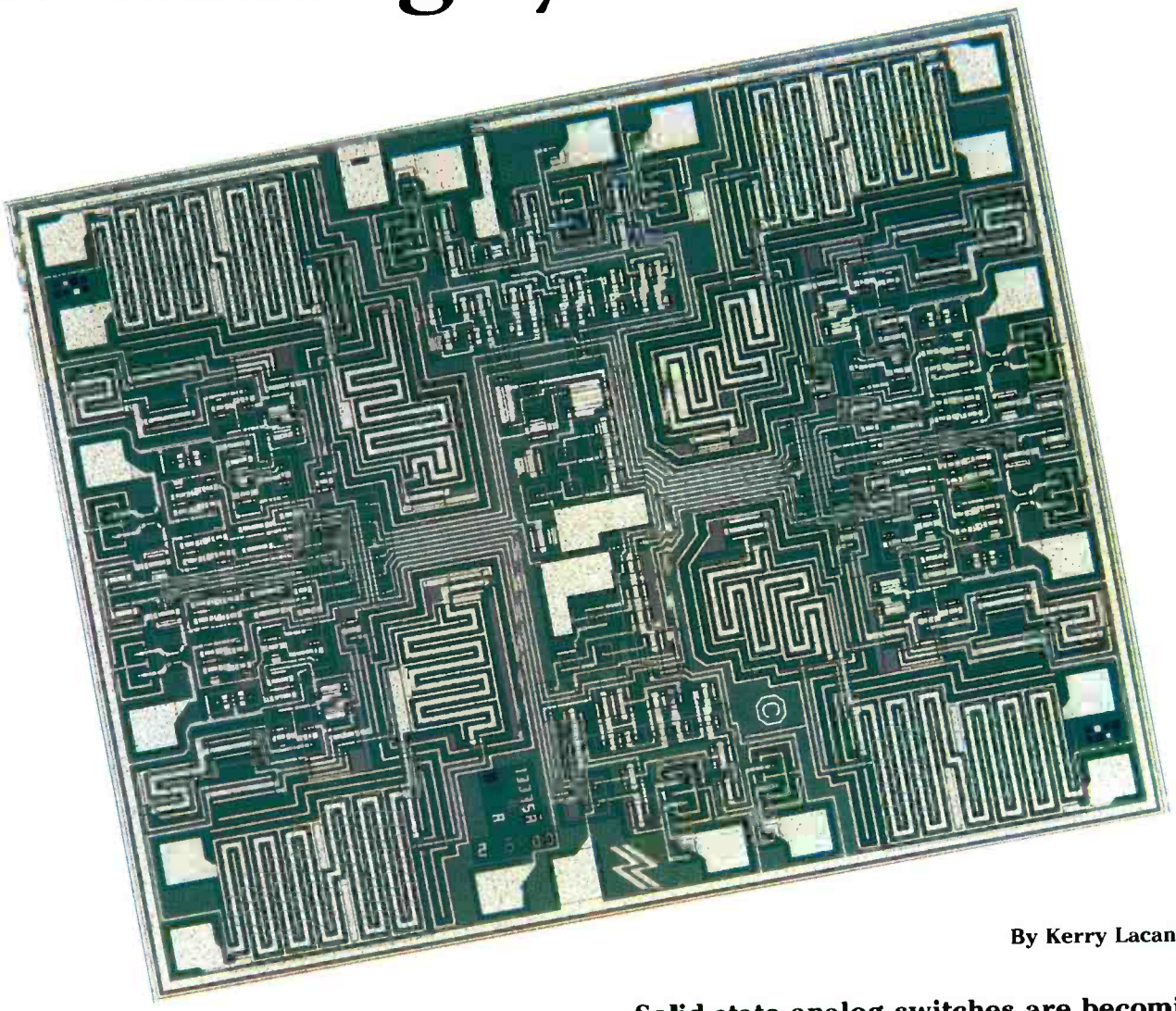
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Solid-state switching systems



By Kerry Lacanette

Solid-state analog switches are becoming commonplace in broadcast equipment. Knowing how they work allows you to design devices for your station.

The simple, mechanically operated switch is the most basic, and probably the most important, control element used in audio signal-processing equipment. However, in many audio systems—from consumer audio and video products to professional recording and broadcast equipment—solid-state analog switch ICs are being used instead of, and in addition to, standard mechanical switches to improve equipment performance and to add flexibility.

A solid-state switch differs from a mechanical switch in that it is turned on or off by an electrical signal applied to a control pin on the device rather than by physical force. The capability to control signal switching electronically solves some old problems and opens up some new possibilities.

Lacanette is manager, MOS/analog applications for National Semiconductor, Santa Clara, CA.

Applications

Many types of functions other than simple signal routing are possible with solid-state switches. A stepped-attenuator volume control can be made electronically controllable by using a number of elements, as shown in Figure 1. A series of resistors with solid-state switches at their junctions can be used to make an attenuator with any arbitrary attenuation characteristic, while eliminating the possibility of wiper noise. In addition, this method is a simple and inexpensive way to obtain excellent tracking between channels with precise and predict-

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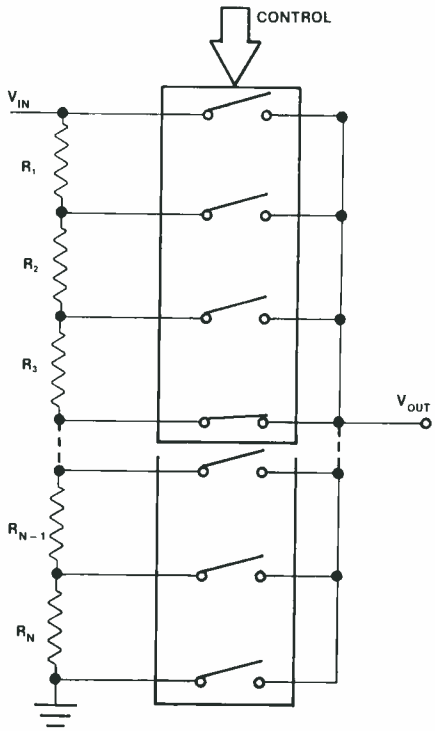


Figure 1. *Solid-state switches offer almost unlimited possibilities for replacing mechanical switches and potentiometers. With digital control, computers can supervise almost any function of a circuit.*

able level changes. Virtually any audio signal-processing functions that use potentiometers (tone and balance controls, graphic equalizers and panners) can be controlled by the use of solid-state switches.

Electronically controlled switches can also perform tasks that standard mechanical switches cannot. Especially important is the capability to place switching functions under logic control. This makes possible such features as remote control and microprocessor-operated signal routing.

Characteristics of electronic switches

There are several different types of electronic switches, each differing in cost, complexity, performance and ease of use. Before we discuss these individually, let's look at general characteristics of such devices:

- *ON resistance (R_{ON}).* This value should be as low as possible. Although a mechanical switch might have a contact resistance measured in milliohms, a semiconductor device may have a series resistance of tens or even hundreds of ohms. A large ON resistance causes signal attenuation when driving low-impedance loads.

As illustrated in Figure 2, the switch resistance and the load impedance form a voltage divider, reducing signal amplitude. When the load impedance includes significant capacitance, high switch resistance may result in a rolloff

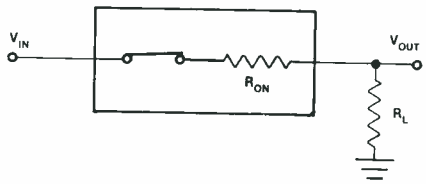


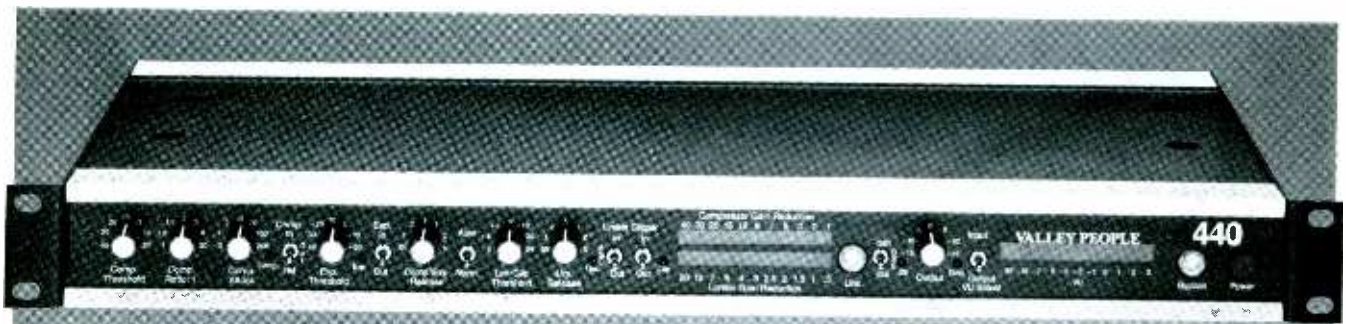
Figure 2. *The combination of the switch resistance R_{ON} and the load resistance R_L form a voltage divider.*

of high-frequency signals. In the majority of audio signal-processing applications, however, load impedances are high relative to switch resistances, and solid-state switches cause no perceptible changes in signal level.

- *ON resistance linearity.* The resistance of a solid-state switch varies with signal voltage and current, as illustrated in the curves of Figure 3. Some devices may have resistance variations of as much as 3:1, while others vary by only a few percentage points.

Because R_{ON} affects the gain of the switch/load combination, any variation in R_{ON} with signal level will produce gain non-linearity, and will result in signal distortion.

Lower load impedances and higher absolute values of R_{ON} increase distortion because the switch resistance has a greater effect on the divider circuit. Larger signal swings also degrade signal linearity. With proper circuit design, however, most analog switch ICs can



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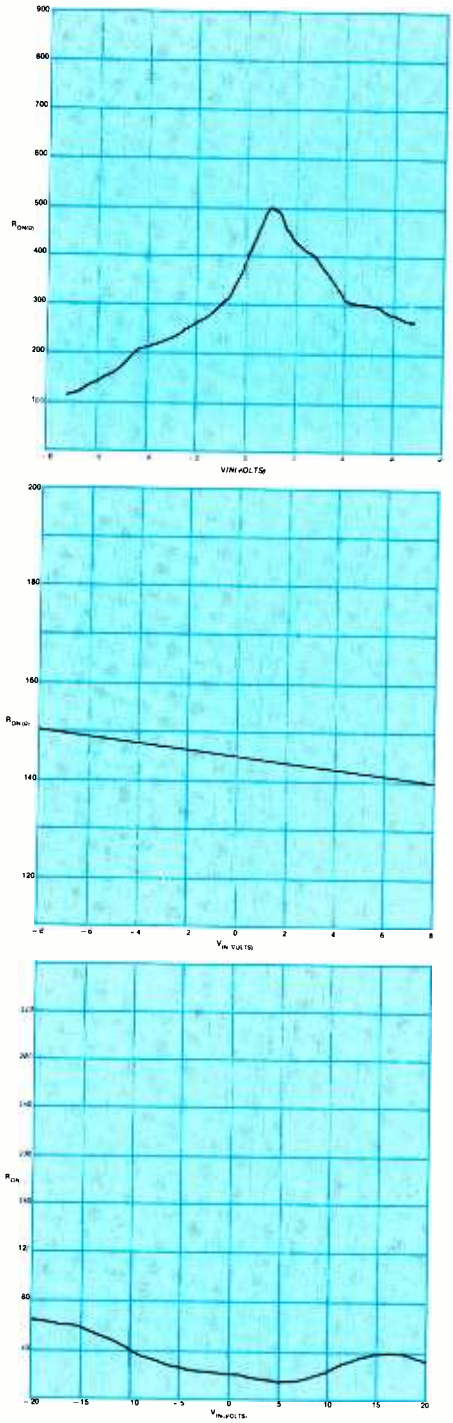


Figure 3. *The curves in the above graphs show how the switch resistance can vary, depending on the applied signal voltage. There is not a* best *value for R_{ON} or V_{IN}. See manufacturers' application notes for advice on selecting the proper device.*

provide low-distortion performance.

• *Isolation.* When the switch is OFF, the resistance should be as large as possible to achieve maximum isolation between unselected signals and the output. It is apparent from the curves in Figure 4 that obtaining sufficient isolation shouldn't be a problem at audio frequencies. Most solid-state switches give approximately 80dB of isolation at 20kHz. Performance is even better at lower frequencies. Isolation drops as frequency increases, suggesting that parasitic capacitances

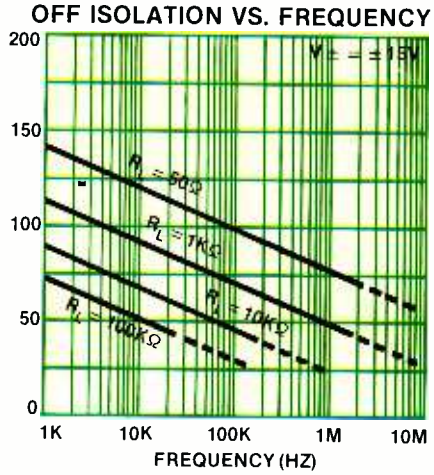


Figure 4. *Isolation is not usually a problem for solid-state analog switches. Unfortunately, however, isolation and linearity are inversely related to load resistance.*

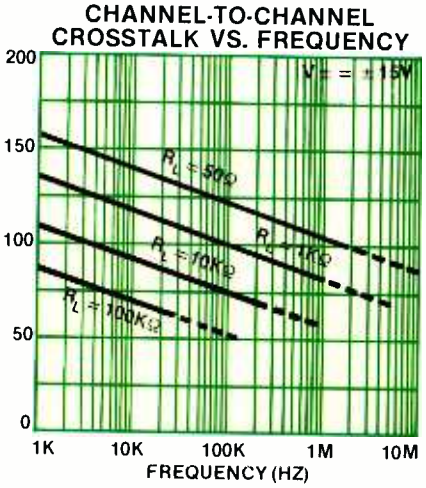
within, and external to, the IC limit isolation at high frequencies. Note that isolation improves as the load impedance is reduced. This parameter is, therefore, somewhat in conflict with the linearity specification.

• *Crosstalk.* This is a measure of the isolation between two different switches. Crosstalk depends on such things as on-chip coupling, circuit board layout, load impedance and parasitic capacitance. As Figure 5 shows, the crosstalk performance typically is quite a bit better than the isolation performance.

• *Small-signal frequency response.* The bandwidth of an electronic switch is limited by its parasitic resistances and capacitances. These are generally small in standard analog switch applications. In most cases, any rolloff occurs well beyond the audio frequency range. Typical –3dB frequencies are on the order of tens of megahertz.

• *Signal-handling.* Some devices operate only on relatively low power-supply voltages, which limits their voltage swing capability. Other devices can handle large supply voltages, but can't accept large signal swings. Some electronic

Figure 5. *Like isolation, crosstalk is seldom a problem for these devices.*



switches are restricted to signal swings of less than a few hundred millivolts. The signal-handling capability of a device has a direct influence on the overall dynamic range that can be obtained. Devices that maximize this parameter are generally preferred.

• *Transients.* When a semiconductor device is turned on or off, an audible pop can sometimes be injected into the signal path. The severity of this transient depends on the type of device, the source and load impedances and—in some cases—the rise time of the logic control signal.

Types of electronic switches

There are numerous approaches to building electronically controlled audio switches. Following are descriptions of some of the most widely used and some of the more interesting new devices.

JFET current switches

Junction field-effect transistors (JFETs) are used in both discrete and integrated form as analog switches. Figure 6 illustrates how a P-channel JFET device might be used as a switch in a simple circuit. The input signal is applied to the FET's source and the output is taken from its drain. When the drain-source voltage is small, the voltage on the gate (relative to the source voltage) can be used to control the effective resistance between the source and drain terminals.

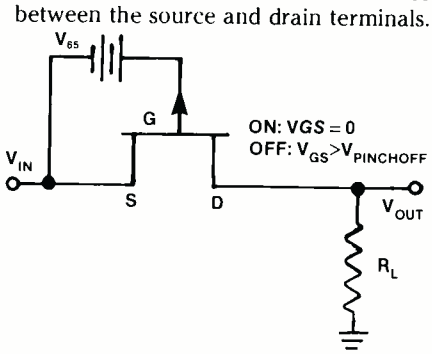


Figure 6. *The above P-channel JFET is shown in a simple switch configuration. The battery voltage, V_{GS}, controls the switch.*

In the case of this P-channel FET, the drain-source resistance is low (typically in the 100Ω region) when the gate voltage is close to the source voltage. The resistance increases as the gate voltage becomes more positive relative to the source. Once the gate voltage reaches the FET's pinch-off voltage (V_p), the JFET effectively stops conducting current. If the device is to operate as a switch, we need be concerned with only two values of gate-source voltage: $V_{gs} = 0$ where the FET is ON, and V_{gs}–V_p where the FET is off.

We end up with a voltage-controlled analog switch with a relatively low ON resistance and a very high OFF resistance. Unfortunately, the circuit shown in Figure 6 isn't practical, because it requires that V_{gs} be held to either 0V or a voltage greater than the pinch-off

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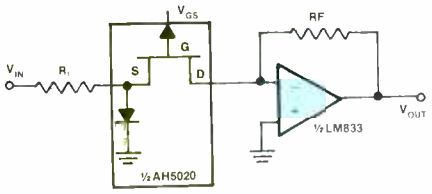


Figure 7. In this circuit, the op-amp improves the performance of the JFET switch.

voltage, regardless of the signal voltage. This would require floating logic signals and, therefore, would not be compatible with standard digital circuits.

Instead, when a single JFET is used for switching, a circuit similar to the one shown in Figure 7 is normally used. The diagram shows a single channel of one of the simplest types of integrated JFET switches, consisting only of P-channel JFETs and diodes. The drain is connected to an operational amplifier's summing node, which holds the source and drain close to ground (within about 100mV) in the ON state. The source is clamped by a diode to prevent forward-biasing of the gate-source junction when the switch is OFF.

This type of switch is called a current switch because it is intended for use at the summing node of an operational amplifier, which minimizes any voltage appearing on the switch. Integrated current switches are available as sets of independent JFETs or as multiplexers (muxes) with several drains tied together, as shown in Figure 8.

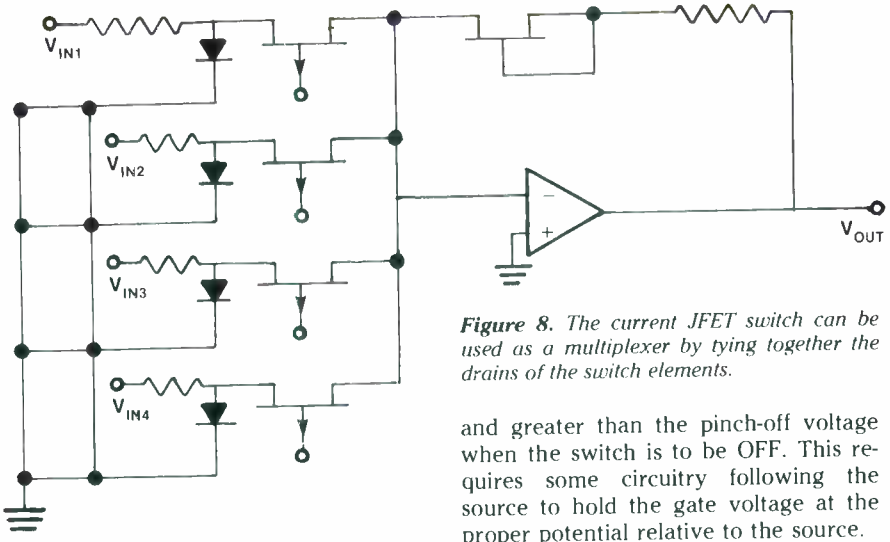


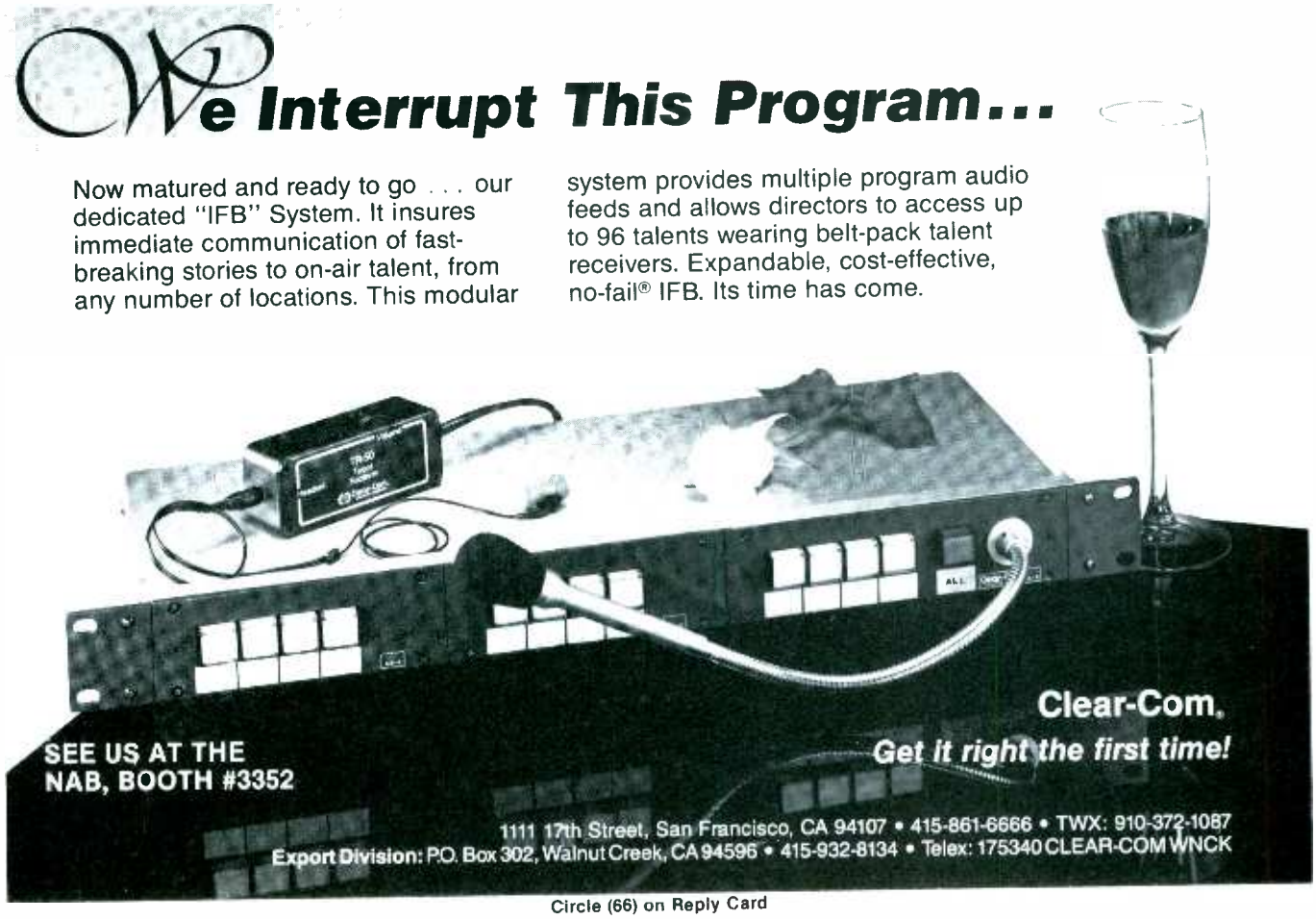
Figure 8. The current JFET switch can be used as a multiplexer by tying together the drains of the switch elements.

JFET voltage switches

The simple analog current switches described previously are designed to operate with their sources and drains close to ground potential. This makes the devices useful primarily in circuits where they are connected to op-amp summing nodes. A more elaborate approach is necessary when the switch must accept large input signal voltage swings. The trick is to keep the gate-source voltage near zero when the switch is to be ON, and greater than the pinch-off voltage when the switch is to be OFF. This requires some circuitry following the source to hold the gate voltage at the proper potential relative to the source.

The circuits in Figure 9 illustrate this concept. In 9a, the JFET's gate voltage is forced close to the source potential, thereby ensuring that the FET will be fully ON for a wide range of signal voltages. In 9b, the gate is connected to the supply voltage, keeping the FET OFF as long as the source voltage is at less than the supply voltage minus the pinch-off voltage.

FET switches of this type, such as the LF13331 family, can typically handle ±10V signal swings when operating on ±15V supplies. When the input signal exceeds about 10V, the gate-source voltage becomes low enough that an



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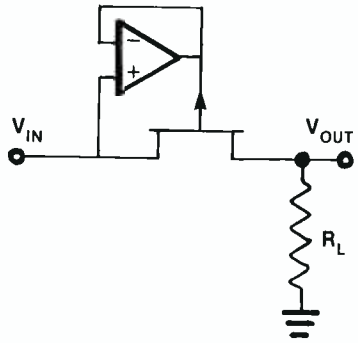
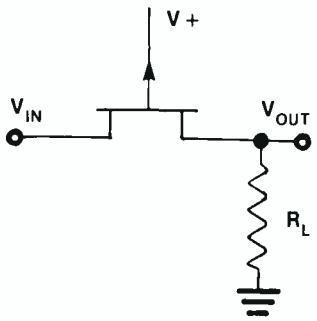


Figure 9. *If the switch is to be capable of conducting over large voltage swings, the gate-source voltage must be kept near zero. In (a), above, the op-amp performs this task. In (b), below, the switch is turned OFF by connecting the gate to the power-supply voltage, V+.*



OFF switch will begin to turn ON.

This signal swing capability is much better than that of the simple FET switch. The bandwidth is approximately 70MHz, and crosstalk and isolation, which improve at lower frequencies, are about 70dB and 90dB, respectively, at 20kHz.

These devices also feature break-before-make operation. This feature avoids inadvertently connecting two signal sources. Break-before-make is accomplished by tailoring the switching speeds so that a JFET turns OFF about 100ns faster than it turns ON. JFET voltage switches can be obtained in a number of different configurations. ICs are available with four normally open switches, four normally closed switches, or two open and two closed switches in the same packages. Some devices also include a disable pin that opens all switches in the package. Multiplexer circuits with one or two outputs selected from eight inputs are also available.

Low-voltage CMOS switches

Another useful approach to building analog switches involves the use of CMOS technology. The CD4016 and similar devices have been used extensively in analog switch applications. The basic transmission gate consists of a P-channel MOSFET in parallel with an N-channel device. The MOSFETs are enhancement mode devices. This means that they are OFF for low V_{gs}, and turn ON as V_{gs} is increased.

Connecting the two devices in parallel results in an R_{ON} curve like the one

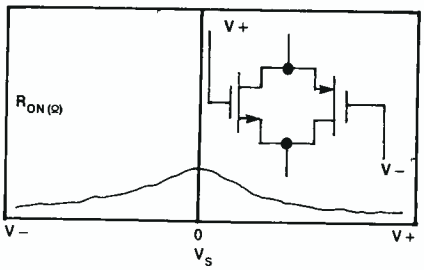


Figure 10. *In the illustration above, two MOSFETs are connected in parallel to provide a low R_{ON} value over the entire supply voltage range.*

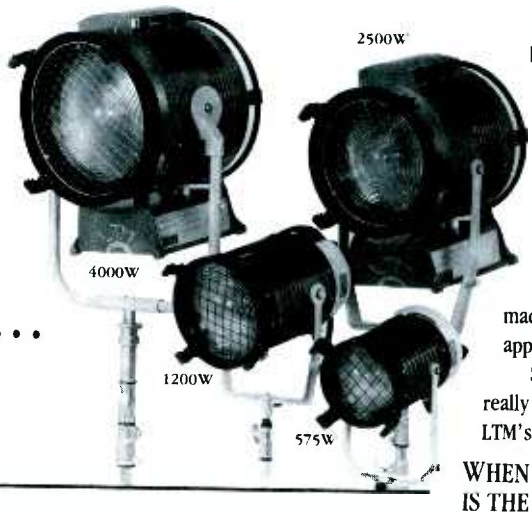
diagrammed in Figure 10. This arrangement provides a relatively constant through-channel resistance. There are, however, bumps in the middle of the impedance curve that can result in signal distortion, especially when driving low-impedance loads.

These devices can handle bipolar signals over a range that extends to the power supply rails. Bandwidth is good, with 40MHz being a typical –3dB point. Isolation and crosstalk are generally adequate, typically with numbers in the vicinity of 70dB. One of the best features of these CMOS switches is the cost, which is less than one-fourth that of a typical quad JFET switch.

Their biggest disadvantage is that R_{ON} can be large and non-linear, typically ranging from 100Ω to 500Ω. Therefore, unless the load resistance is quite large,

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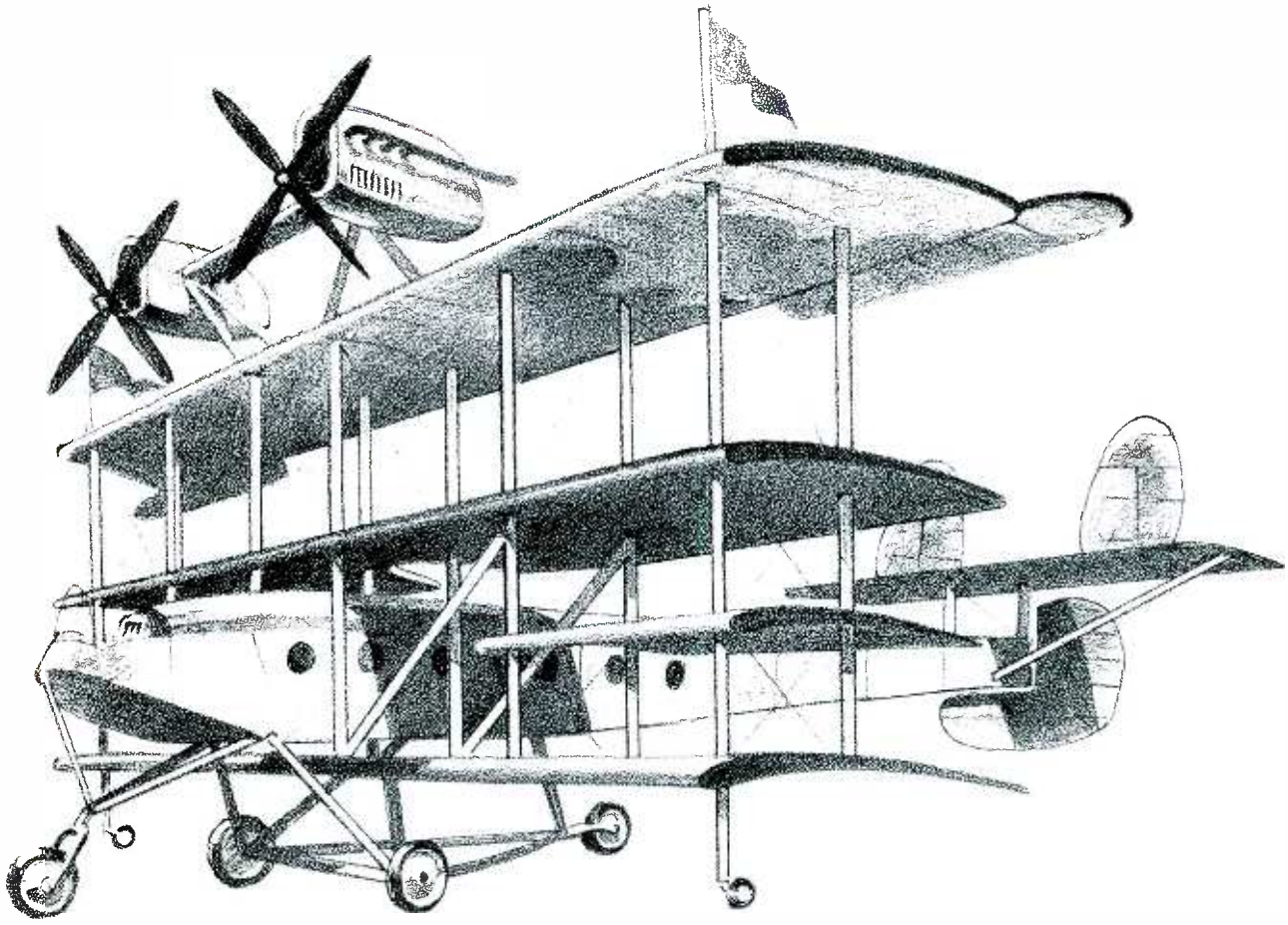
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this can be a significant source of distortion. Another disadvantage is that the maximum supply voltage (and, therefore, signal swing) is only 15V. In low noise applications, this sort of switch may induce some added noise due to signal conduction at the silicon/silicon dioxide interface.

Some low-voltage CMOS switches can also suffer from latch-up, a problem that plagued earlier CMOS logic designs. Latch-up occurs when an internal parasitic SCR is inadvertently turned on, causing the chip to draw excessive current until it is destroyed or until power is removed.

SCR action can be triggered by a transient input signal that forces an input either above the positive supply or below the negative supply. It is necessary to limit analog and logic input signal swings in order to avoid device failure. Because most of these devices are relatively inexpensive, many designers simply add the necessary external protection circuitry.

High-voltage CMOS switches

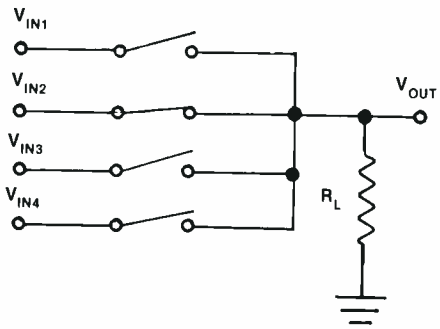
Recent advances in CMOS processing technology, along with the demand for more rugged switches with better signal-handling capability, has led to the introduction of devices with greatly improved characteristics. One of the first successful approaches used a process known as dielectric isolation, wherein individual transistors can be isolated electrically by an insulator (silicon dioxide). This is a relatively expensive process, but it completely eliminates parasitic SCRs and removes the possibility of latch-up.

Newer devices, such as the LMC13334, LMC13335 and LMC13201, have low R_{ON} values—on the order of 50Ω—and signal swing capability of up to 40V. This is a great advantage in applications requiring high dynamic range. In addition, because signals can swing to the supply rails, there is no danger of overdrive by op-amps or other circuits operating from the same power supplies. The op-amp will always limit before the switches run into trouble. The THD is lower in these devices than in the JFET or the low-voltage CMOS switches, especially at lower load impedances.

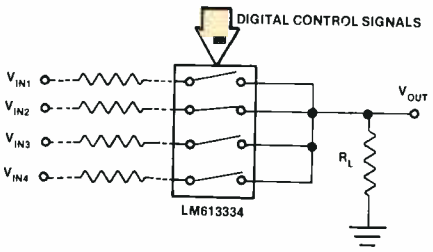
Putting switches to work

The most common switching applications involve selecting one input from several sources (see the schematic representation in Figure 11a). Besides simply selecting sources, this approach is often used to build electronically controlled stepped-level and equalization controls.

Source selectors can be implemented with CMOS or LF13331 series JFET switches as shown in Figure 11b, or with current switches as shown in Figure 11c.



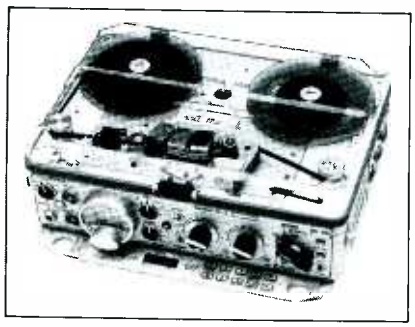
Figures 11(a), (b). In (a), above, a 4PST solid-state switch is represented in schematic form. The addition of the digital control inputs to the switch is shown below in (b).



The high-voltage CMOS switches are generally preferred because they allow the highest dynamic range and don't require external operational amplifiers. When input signals may exceed the power-supply voltages, series resistors (shown with dashed lines in Figure 11b) should be added to avoid excessive device current.



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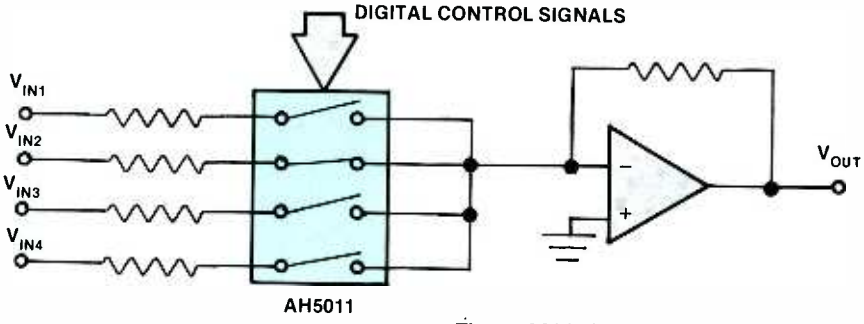


Figure 11(c). A working current switch.

The load resistance affects circuit performance in a number of ways. Because it forms a voltage divider with the R_{ON} value of the switch, larger load resistances result in less signal attenuation. This generally isn't a problem, because load resistances tend to be more than 10kΩ, and R_{ON} is often less than 100Ω, resulting in less than 0.1dB signal attenuation. But when the load resistance drops down to the 1kΩ region, attenuation can approach 1dB, which may be excessive. Before signal loss becomes a problem, however, distortion usually places a lower limit on load resistance.

The JFET voltage switches show significant increases in THD as the load drops to 1kΩ, and low-voltage CMOS switches perform poorly with small load resistances. High-voltage CMOS switches, on the other hand, are much more linear when working into 1kΩ loads. The LMC13334 family of devices can operate on ±20V supplies, ensuring lower and more consistent ON resistance than devices with lower supply capability. In any case, when designing for minimum distortion, the load resistance should be kept as high as possible.

Load impedance also affects the isolation when the switch is open. As the load impedance increases, isolation deteriorates. Therefore, when isolation is important, load impedance should be low. This conflicts with the distortion requirements. A good compromise involves the use of a load impedance between 1kΩ and 10kΩ. A value in this range will give excellent isolation and distortion performance with the LMC13334 family. If a high load impedance is desired for low THD, but a simple series analog switch can't give sufficient OFF isolation, it may be augmented by a shunt switch that shorts any remaining signal to ground (Figure 12).

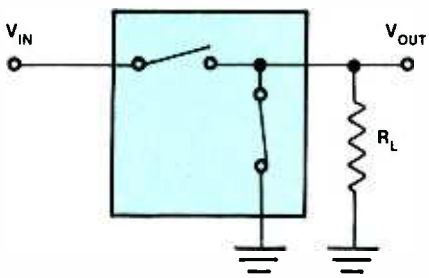


***Figure 12.** If additional OFF isolation is required, another switch can be connected across the output of the series switch. The shunting switch will short any remaining signal to ground.*

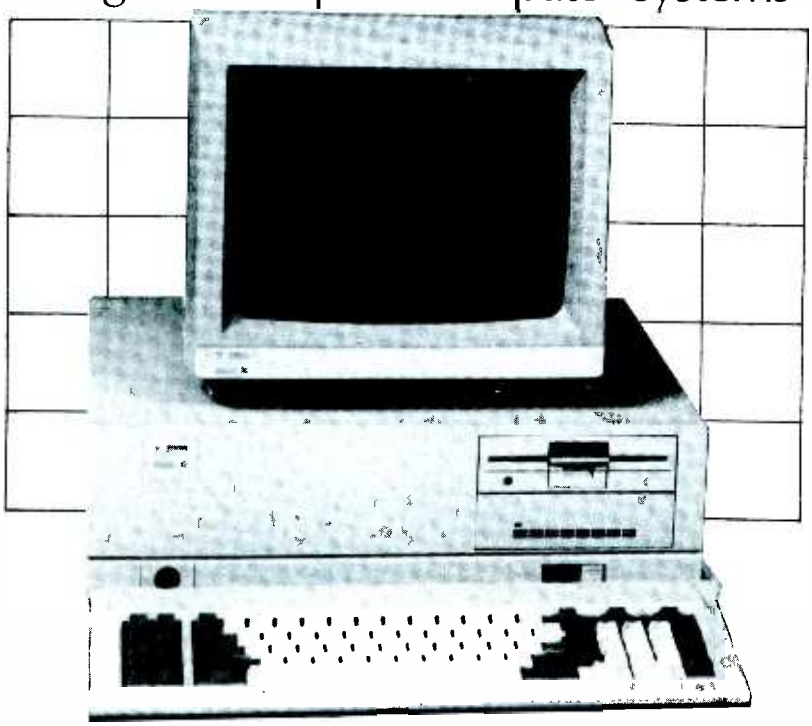
Transients

The transients generated by most FET switches can, at first, appear forbidding. Transients tend to be a few hundred millivolts in amplitude, which might be expected to cause objectionable clicks and pops during use. Fortunately, the transients are generally of short duration—about a microsecond—and therefore contain little energy in the audio band.

It is difficult to assign an objective number to the psychoacoustic loudness of a switching transient because most of the common measures of relative loudness or annoyance level are concerned with continuous sine waves or filtered random noise. However, to get a rough idea of the audibility of a switching transient, compare the pop to a continuous sine wave. You'll find that the

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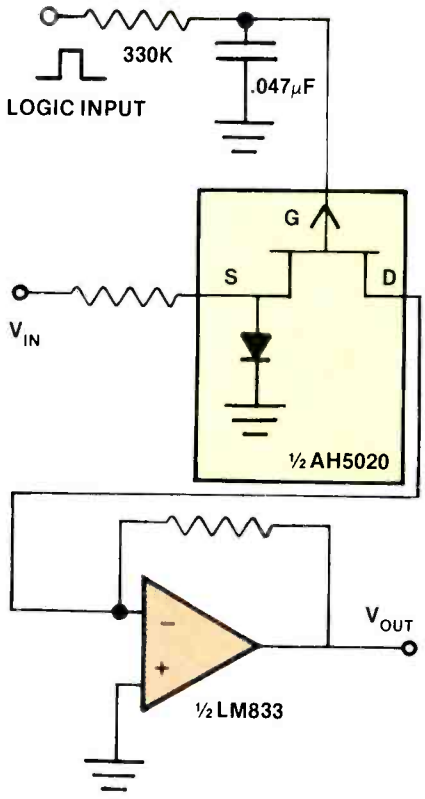


Figure 13. *If switching transients are a problem, an RC filter can be used to slow down the control signal.*

transient from an LMC13334 sounds about as loud as a 1mV or 2mV tone at 1kHz (3V output reference level).

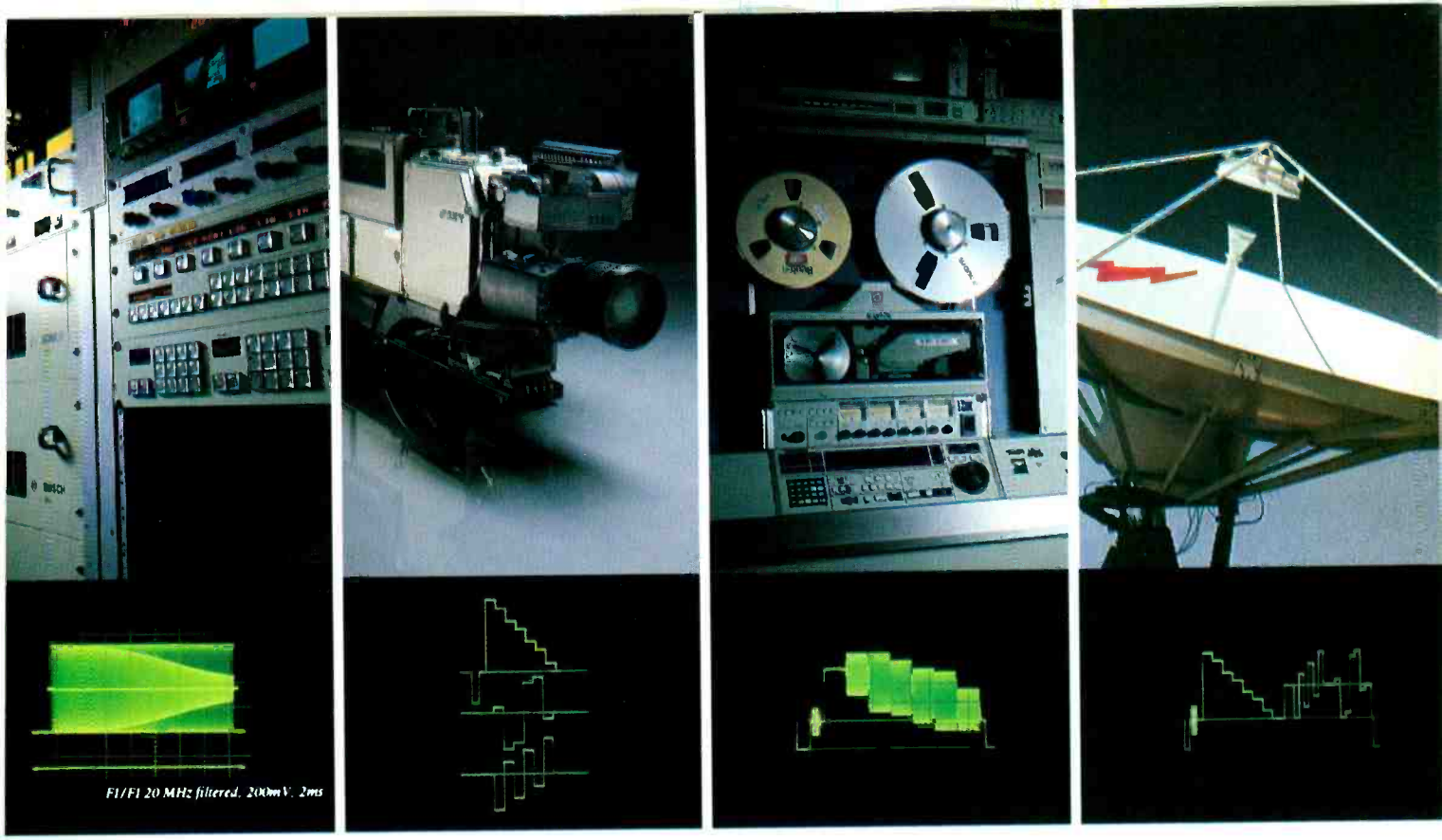
Transients from lower-voltage switches are roughly similar in apparent loudness. Although these transients make most electronic switches unlikely candidates for low-level signals from microphones or phono cartridges, they are small enough to be quite acceptable with most line-level signals.

In order to keep switching noises low, make sure that input signals have no average dc components. When dc is switched in or out, the result is a step change in output voltage, which can be highly audible. Therefore, any input signals with dc on them should be coupled to the switch through a series capacitor with a resistor to ground. This holds true, of course, for mechanical switches as well as the solid-state varieties.

If the small transient levels of a voltage switch present a problem, a simple current-mode switch can be used successfully. Because the JFET gates are available to the outside world, control logic signals can be slowed down enough to render the glitches inaudible.

Figure 13 shows a current-mode switch with an RC filter on its gate to slow the control signal. A larger capacitor can be used to slow the transition even more, or a smaller one may be substituted to improve switching speed. With the components shown, the switching glitch caused by the AH5020 is only about 20mV in amplitude. Because most of its

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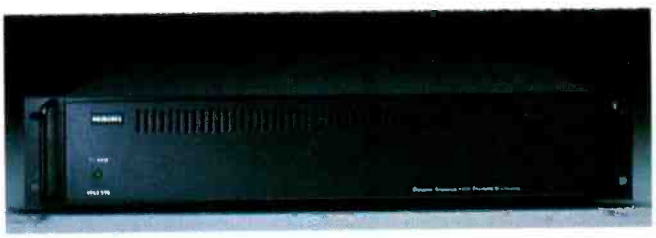
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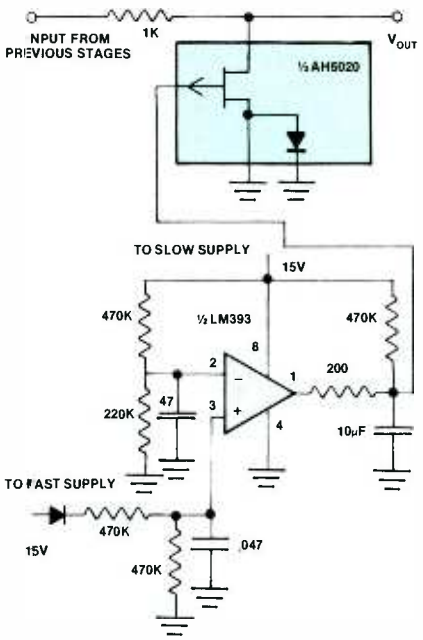


Figure 14. *The mute circuit prevents equipment turn-on and turn-off transients from feeding out of the circuit. The circuit requires connection to two separate power-supply points.*

energy is at low frequencies, the transient is effectively inaudible.

It is possible to take advantage of the JFET current switch's glitch-free operation by building a mute circuit as shown in Figure 14. This circuit uses an AH5020 and an inexpensive comparator to prevent any transients from other parts of the system from appearing at the output when a piece of equipment is turned on. The FET is on for several seconds after turn-on, effectively attenuating any unwanted thumps, pops or clicks that might be generated by other circuits coming to life. Similarly, when power is disconnected from the system, the FET turns on before the preceding circuitry begins to turn off, preventing turn-off noises from passing through the output at full power. The mute circuit operates from a nominal +15V power supply, although the remainder of the circuit is assumed to be operating from bipolar supplies.

The slow supply connection in Figure 14 goes to the regulated, filtered system power supply, while the fast supply connection is tied to the raw output of the power transformer secondary. This design ensures that the JFET switch closes before any of the circuitry ahead of it begins to generate turn-off pops.

Typical packaged circuits

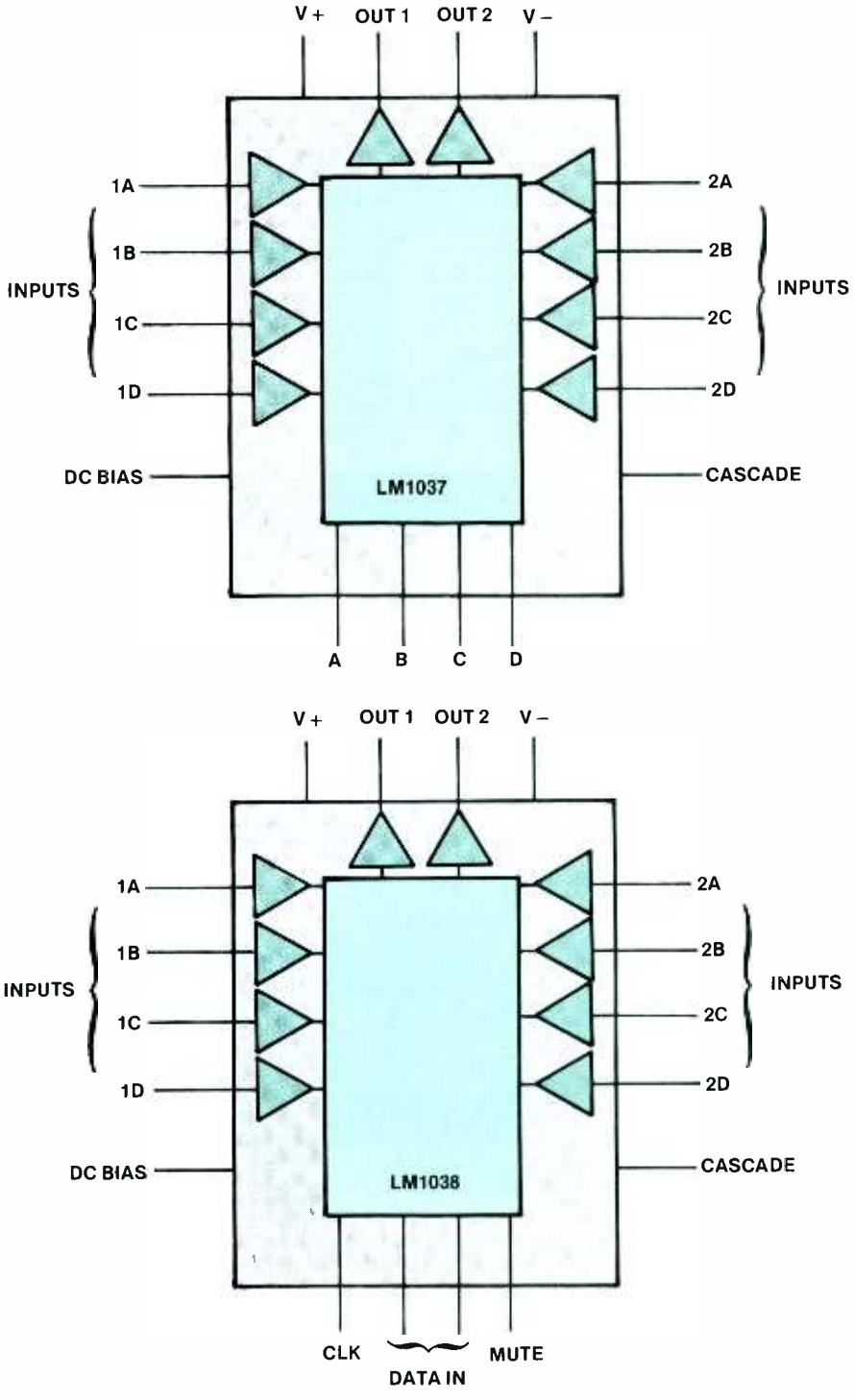
All of the devices described so far behave somewhat like mechanical switches. When closed, they are effectively small resistors, conducting current in either direction. When open, they block the flow of current. These are excellent general-purpose devices, and can serve as building blocks for numerous complex circuits. Other useful devices have been designed for more specialized audio applications.

One of these devices is the LM1037. This IC is designed to select one of four sources and connect it to a buffered output. It is a stereo circuit, so any of four pairs of inputs can be selected for connection to the output pair (see Figure 15). Essentially, each input is connected to an amplifier that is enabled if a particular input is selected. The buffers make it easy to interface high-impedance sources with low-impedance loads. Signal handling is about 27V peak-to-peak with a 30V power supply.

Because the signals pass through IC amplifiers, the noise level is about 10μV, which is much higher than that of the FET switches. However, it is still perfectly acceptable for line-level applications. Because the amplifiers are working closed-loop, THD is typically under 0.05% at audio frequencies. The bandwidth is on the order of 100kHz, which is more than adequate for audio. Crosstalk is typically –95dB. Several chips may be cascaded if more than four inputs are needed.

The LM1038 is identical to the LM1037 except for its control circuitry. The ON

Figure 15. *The top device is a 4-stereo input/stereo output switch. The lower device provides the same control functions, but allows BCD control over the switching action.*



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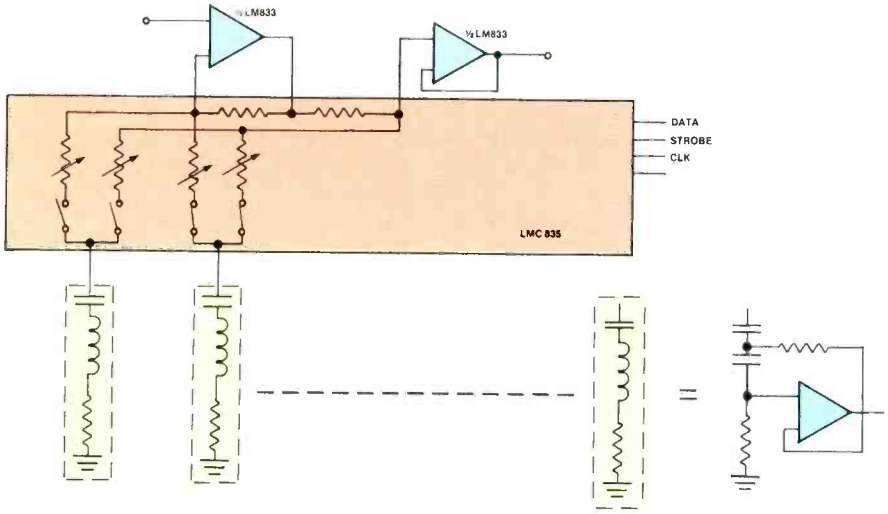


Figure 16. *Even complex analog functions can be controlled by solid-state switches. The simplified drawing shows how a digitally controlled equalizer can be built using a CMOS switch-and-logic array specifically designed for this purpose.*

channels (only one stereo pair can be on at one time) are selected by the 2-bit control word. This word can be latched and held until a change in switch states is required. The two devices are optimized for single-ended supply operation, but may be used with split supplies as well. Logic levels are referred to the negative supply, however, so level shifting may be necessary in split-supply applications.

Signal selection and routing are not the only functions that can be digitally controlled with solid-state switches. The LMC835 is a graphic equalizer chip that accepts a serial digital input signal to control up to seven frequency bands per stereo channel. A partial block diagram is shown in Figure 16. Two external operational amplifiers appear in the signal path. Internal resistors and CMOS switches connect the feedback components of the operational amplifiers to external tuned circuits, which behave like passive RLC networks, but are actually built from op-amps, resistors and capacitors (as shown in the diagram).

By varying the effective resistance between the upper amplifiers and the tuned circuits, the amount of boost or cut in a given frequency band can be adjusted. Enough resistor/switch combinations are included in the LMC835 to allow digital control of two channels of seven frequency bands. One LMC835 can also be used in a single-channel 14-band equalizer.

Products that use such hybrid devices tend to be more expensive and sophisticated than more common equipment. Even though the switches themselves are inexpensive, designers tend to incorporate more complex features and capabilities than might otherwise be attempted. It is significant that many of the most sophisticated (and expensive) broadcast products make use of these circuits.

Fortunately for the broadcaster, the use of analog switches is increasing. The devices provide so many advantages that they cannot be overlooked. A cursory examination of modern broadcast equipment shows that analog switches are common devices. One of the primary advantages of these switches is the capability to interface with computer-based equipment. And as more computer-related hardware enters radio and TV stations, broadcast engineers will encounter more solid-state analog switches.

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Collision detection in routing switchers

By Bruce Morse

The production demands placed on modern routing switchers require the use of sophisticated control systems.

Unless it has crashed, or you're designing a new facility, you probably look at your routing switcher with the same interest as you do your lawn mower. And, like a lawn mower, the switcher either works or it doesn't.

Early routing switchers were unexciting, low-technology devices. They were nothing more than a simple go/no-go electronic necessity—a barely improved version of the 1950s patch panels. However, because of the growing number and diversity of signals that broadcast and other production facilities may need to handle, switchers are gaining recognition as fertile ground for new and powerful capabilities. These system workhorses are enjoying a resurgence of interest from both users and manufacturers. (See the accompanying sidebar for a discussion on the history and future of switching systems.)

With the increasing expectations placed on switchers, system designers are responding with new and innovative solutions. Designers are adapting technologies from other high-tech fields, such as the computer industry, to the unique requirements of the broadcast and production switcher.

A new generation

One example of this transfer of technology is the recent introduction of true software-based routing switchers. In these systems, a simplified computerlike hardware structure is organized and controlled by a coordinated software architecture.

This approach has resulted in reduced hardware density and provides the advantage of increased reliability. A system with fewer components is less likely to fail. In addition, these systems are less expensive to build because of the economies of scale. Larger quantities of a few identical components cost less than smaller numbers of many different items.

Morse is president of BSM Broadcast Systems, Spokane, WA.

System capabilities are not compromised by this simplicity. In fact, the system capabilities are often enhanced. By controlling the hardware with software, the inherent flexibility of computers is used to increase the capabilities of today's routing switchers and prepare them for even greater demands in the future.

Figure 1. *Software-driven routing switcher interfacing levels. Hardware provides the interface between crosspoint matrix and system software.*

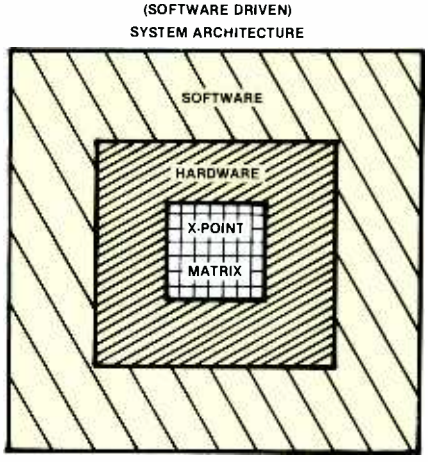
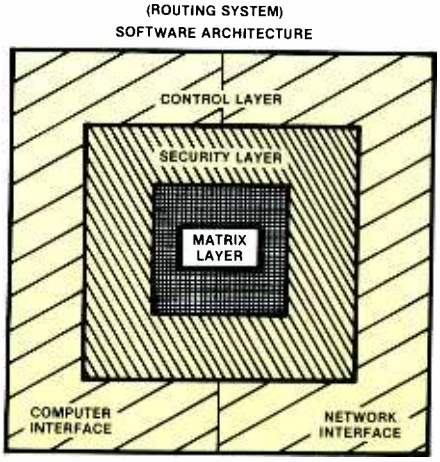


Figure 2. *Layers of software architecture. Matrix-layer software is accessed by the control layer (including both system computer and entire network interface software) only after approval by the security layer.*



Hardware structure

As illustrated in Figure 1, the crosspoint matrix is at the heart of the system where signal sources and destinations are actually connected. The translation of the software's routing instructions into the electrical signals that switch the crosspoints is handled by a hardware shell around the matrix. This shell typically consists of memory registers or latches that store routing information and voltage translation circuits. These circuits convert the low-voltage levels used by the hardware into the higher-level signals required by the crosspoints and other analog circuitry.

Software architecture

The architecture of the software that provides the routing instructions can be coarsely divided into three nested layers: matrix, security and control (see Figure 2). The matrix layer resides at the lowest level of the software architecture. It provides the control and security layers with access to the hardware shell around the matrix.

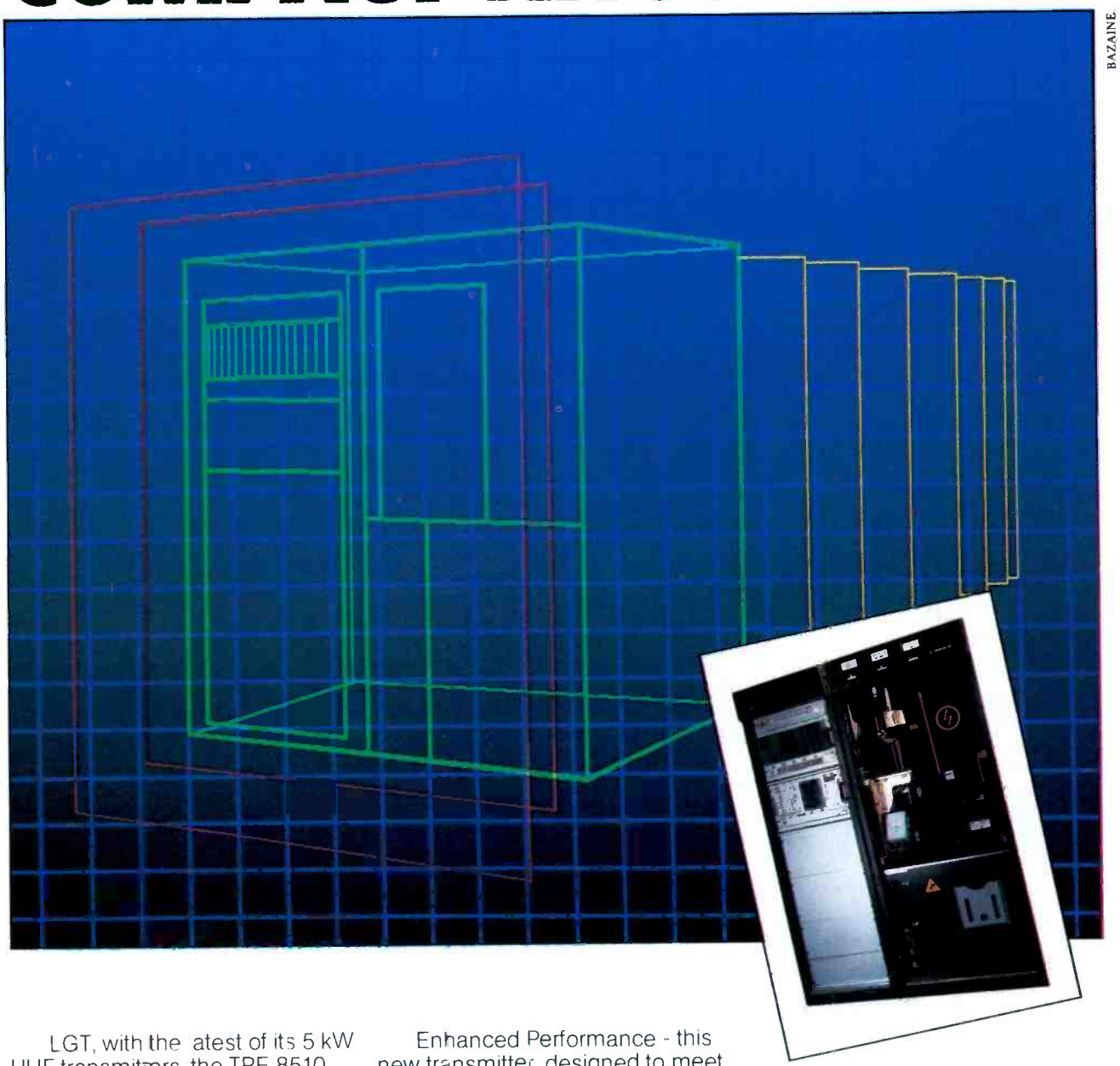
The security layer is the interface between the matrix and the control layers. Its purpose is to assure that requests for changes in matrix routing do not violate system security parameters. Typical security systems have several clearance levels that are used to restrict access to sensitive material routed through the switcher. Routing requests must be approved by the security system before being passed on from the control layer.

The control layer provides the interface between the switcher and the outside world. This layer is commonly divided into two segments: the computer interface and the network interface. The computer interface software connects the switcher with the major planning or big picture system. Depending upon facility requirements, this system could

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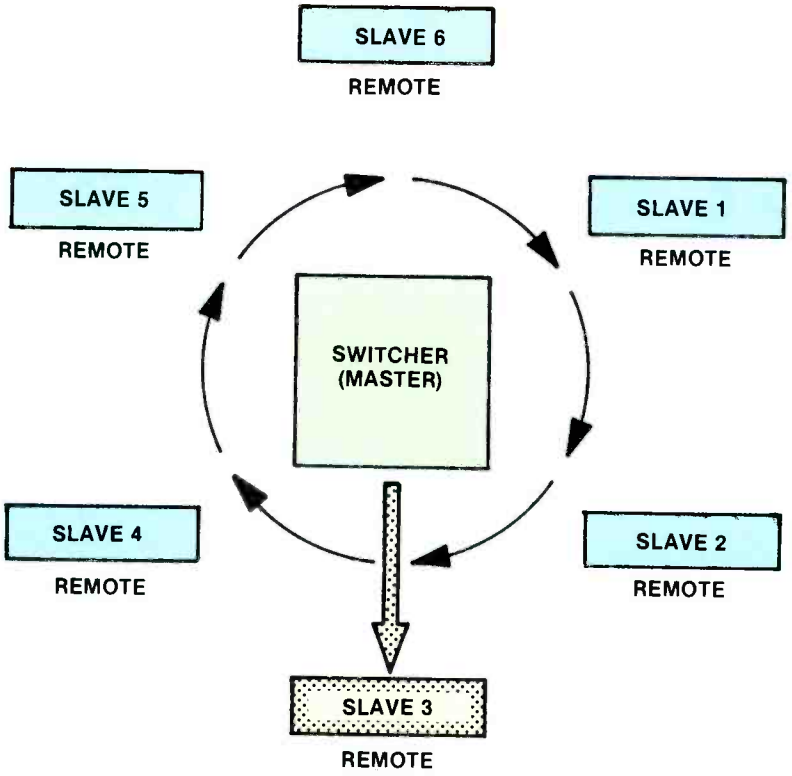


Figure 3. Remote No. 3 is being polled and may transmit routing requests to the system master. Slave remote No. 4 will be polled for requests when No. 3 is finished transmitting.

be as complex as a mainframe computer or as simple as a personal computer. On the other hand, the network interface software pays attention to the matrix users and their remote control devices.

Getting personal

When a facility must accomplish more tasks, the first step is usually to add equipment and staff. The demands that accompany an expansion add even more pressure to what is probably an already overloaded matrix. In addition, most switcher users prefer, or even require, dedicated remote devices near their work stations. A personal device such as this frees them from the inefficiency of sharing one device among several users. As a result, the need for improved methods of remote communications becomes even more urgent.

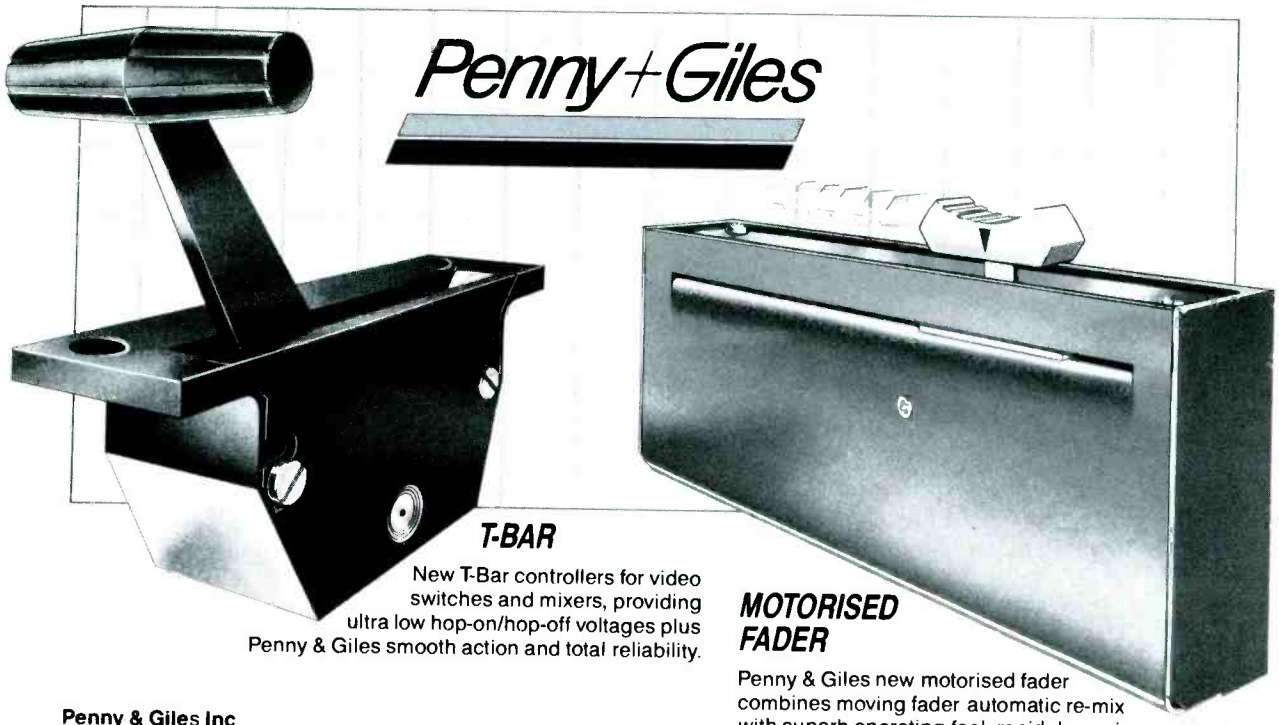
Networking principles

Switcher remotes are usually daisy-chained from device to device on a common cable connected to the matrix. This single cable relieves the need for individual wiring from each device back to the matrix. This concept of paralleling many devices on a single wire is generally referred to as local area networking.

The overriding problems that arise when a large number of devices attempt to communicate over a common wire are those of priority and organization. If two or more remote devices attempt to use the network simultaneously (a likely occurrence), information can be distorted

Continued on page 134

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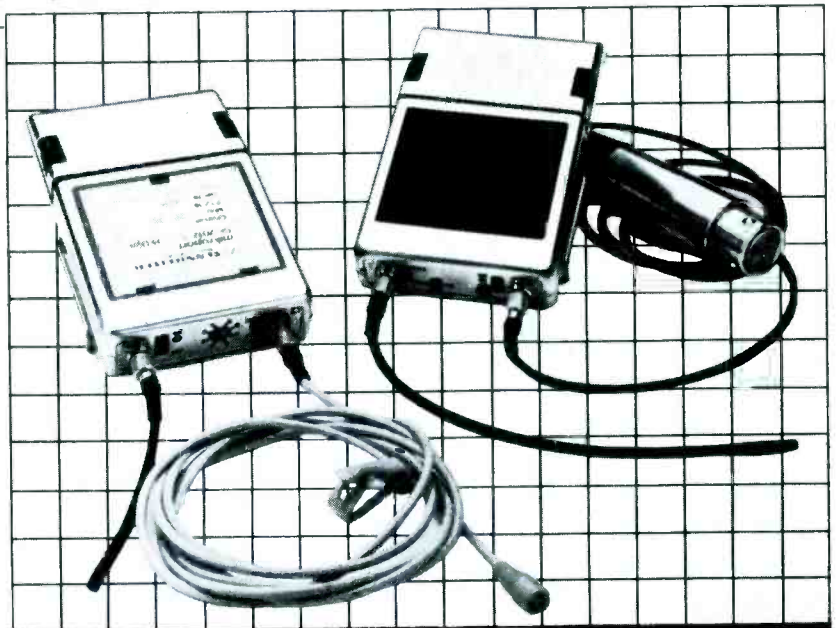
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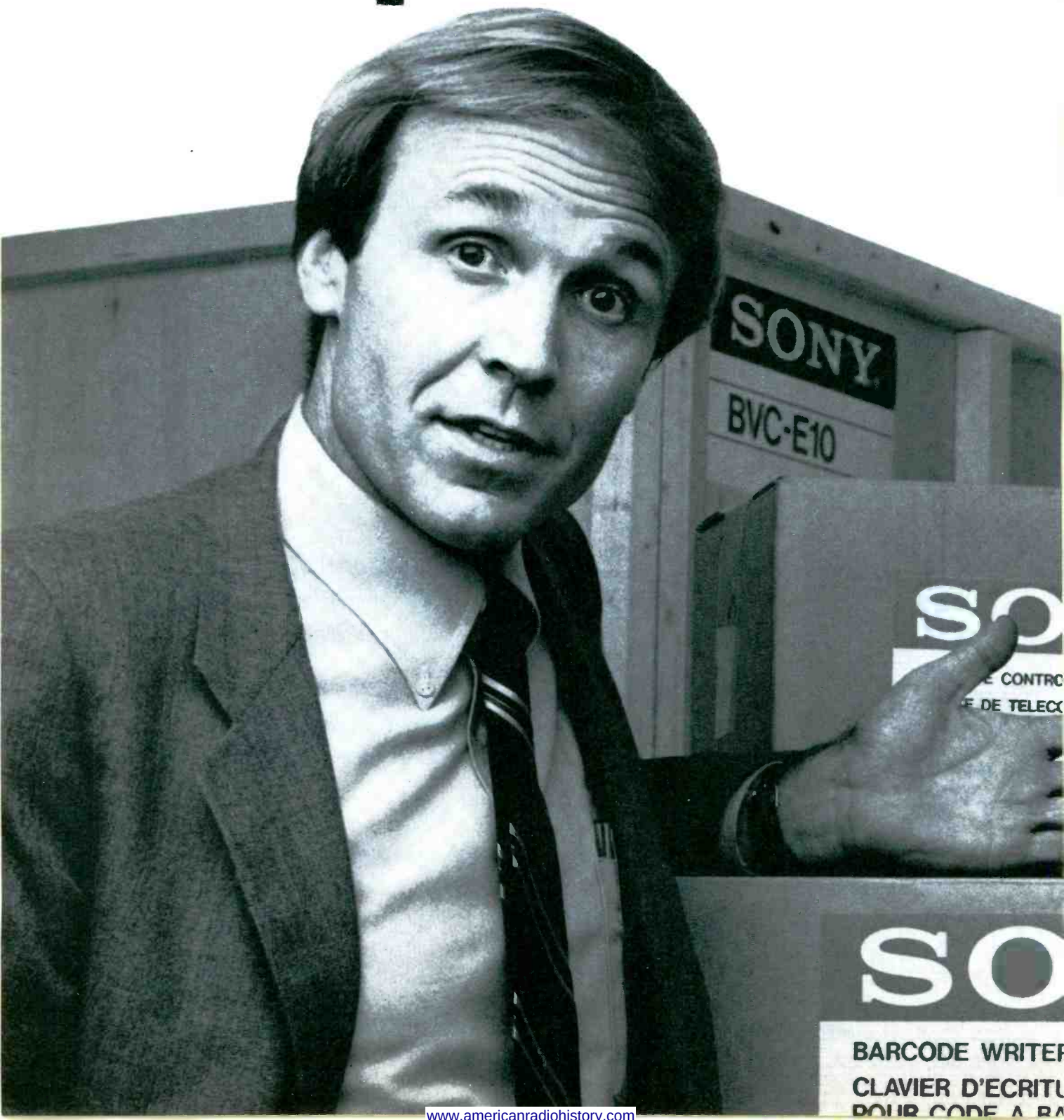
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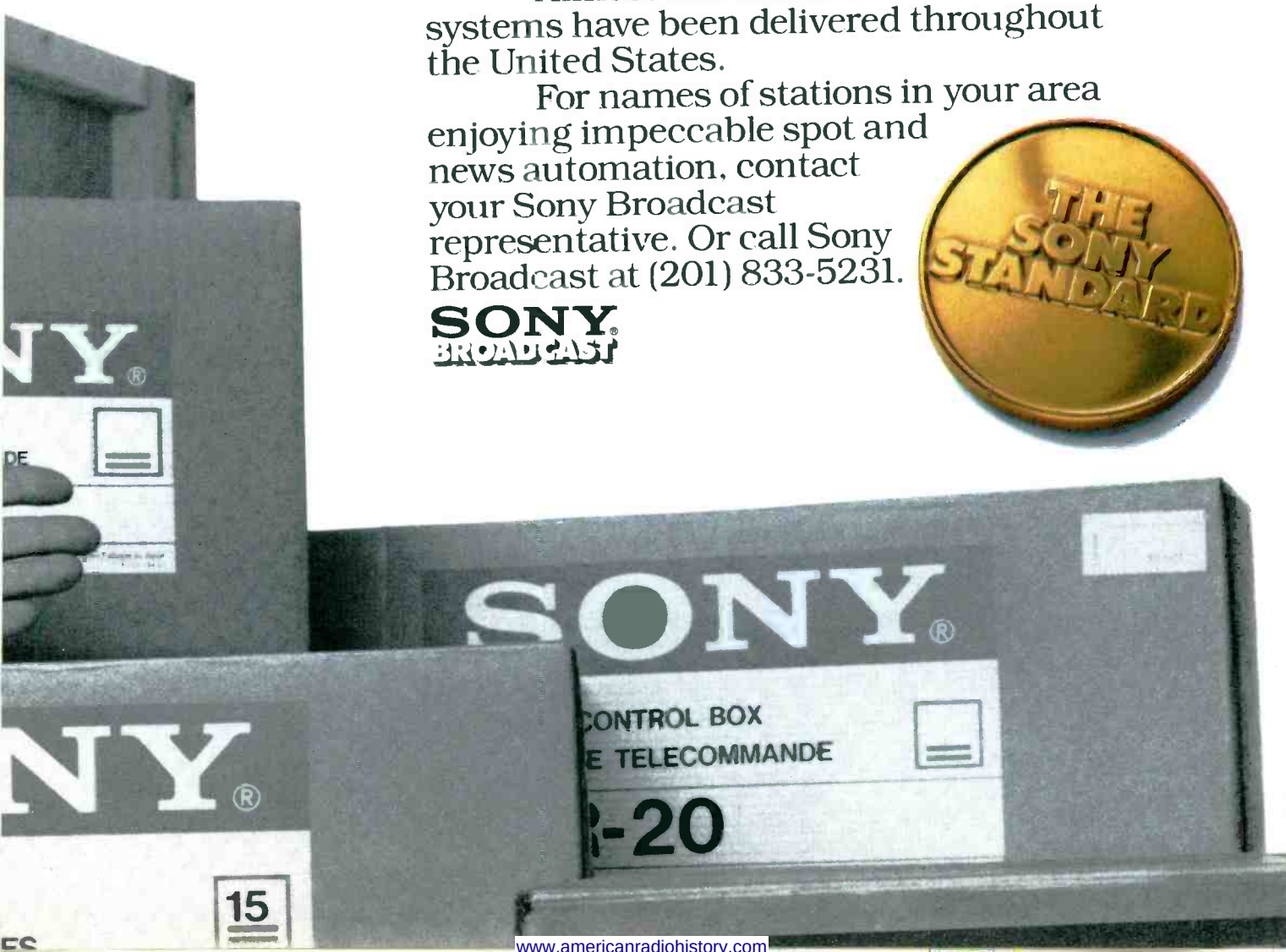
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Continued from page 130

or lost. To prevent or to recover from such conflicts, some method of network management must be employed to prioritize and control network access.

Extensive research into the management of local area networks by the computer industry has resulted in the emergence and development of three basic networking topologies: polling, token passing and collision detection. Although each can be applied to system design in communicating with remote devices, the three networks differ greatly in the methods they use to perform this and in the transparency levels achieved.

Polling networks

A polling network's common wire is constantly under the control of a master device. All other devices on the network are slaves to that master. Management of a polling network follows a strict sequential order—from one slave to the next—under the control of the master device (see Figure 3). If any slave has information available (such as a routing change request), it can transmit this information to the master only when its turn comes up in the polling sequence. Until then, it just waits.

After processing a polled slave's input (if any), the master device moves on to poll the next slave on the network. The poll/answer exchange process is repeated for each slave on the network until the last slave on the network has been polled. The master then polls the first slave and the process is repeated.

Of the three standard network topologies, polling networks are the simplest to implement. They were the first to be used in routing switchers because the concept of a network master is easily understood and implemented, even in the most rudimentary hardware-based systems. They continue to be the most widely used network interface topology.

Token-passing networks

Although token-passing networks have not seen extensive application in the routing switcher industry, they have major advantages over polling networks. A token-passing network (see Figure 4) does not have a distinctly defined master device, as does a polling network. Instead, each device on the network acts as the master for a short period during which it may transmit data without conflicting with other devices.

The software-based token-passing topology maintains control of the common network cable with a software token. While any device possesses the token, it has absolute control of the network and can be briefly considered the master device.

When the controlling device has completed its network operations, it passes control by transmitting the token to the next device. The new master obtains control of the network while the previous device reverts to its idle state until the token works its way through the network again.

Another advantage of a token-passing topology over a polling topology is point-to-point communication between network devices. Because each device acts as the network master while it possesses the token, it can transmit to any other device without going through a third party. This is in contrast to the polling topology, in which the master device must be involved with every network transaction that occurs.

However, a liability of the token-passing network is its sensitivity to network device failure. Among other considerations, token-passing network software must address the problem of how to recover or even re-create the token in a variety of situations.

One potentially catastrophic situation occurs when the token makes its way to a device that has failed. Does the token halt? Does another device sense the failure and initiate a recovery procedure? Worst of all, what happens to the network when a device crashes while in possession of the token? All of these possibilities must be accounted for in the software that implements a token-passing network.



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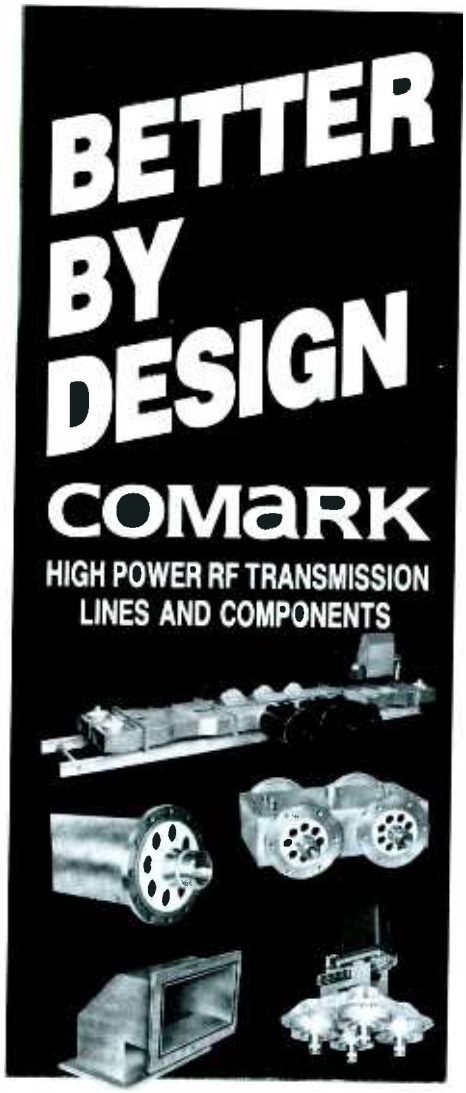
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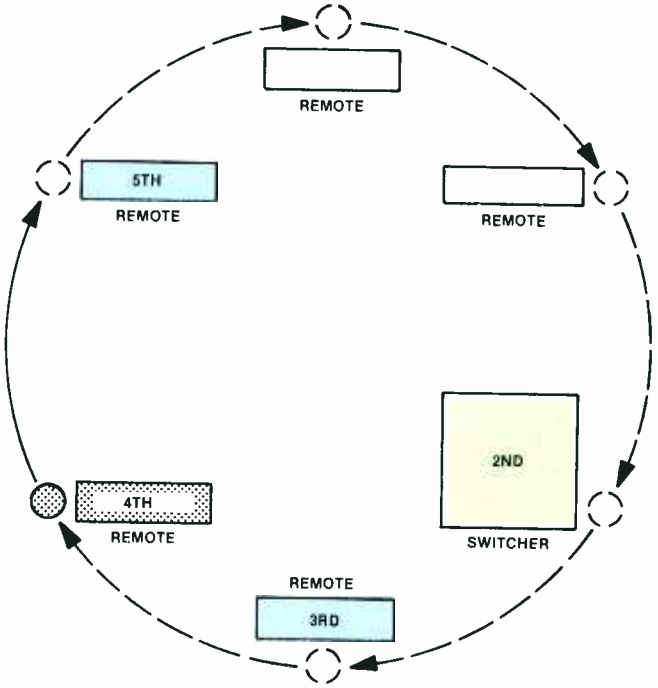


Figure 4. *Remote No. 4 is in possession of the token and may transmit data to any other device in the network. The token will be passed to remote No. 5 when the transmission is completed. While not in possession of the system's token, remote devices revert to receive-only status.*

Collision-detection network

The collision-detected (CD) network is entirely different from either a polling or a token-passing topology. Every device connected to the CD network operates on an equal priority basis at all times (see Figure 5).

Properly termed *carrier sense multiple access with collision detection* (CSMA/CD), this network topology configures each device on the common wire to operate according to a protocol that defines the handling of received data, network access and data collisions.

All devices on the network constantly monitor the common cable for data being transmitted by any other device. When a device has data to transmit, it asynchronously attempts to obtain control of the network. If successful, that device immediately transmits the data on the common cable. All other devices receive the data being transmitted and individually evaluate it for content and destination. Those devices that are not the intended destination(s) simply disregard the data.

When the device in control has finished transmitting, the resulting inactivity releases control of the network and again makes the common cable available to all devices. This simple and direct method of releasing control eliminates the need for special release codes.

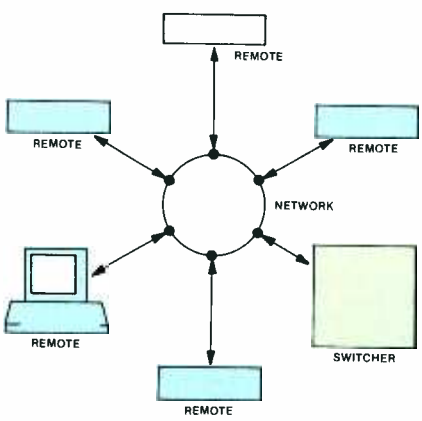
The protocol of the CD network provides for devices to sense access attempts by others. When such an attempt is detected, all other devices are prevented from accessing the network until control is released by the transmitting device, thus streamlining the access procedure.

If more than one device attempts to access the network at the same instant, there is a collision of access attempts. When the contending devices detect this condition, each immediately halts its access attempt and waits a period of time determined by an internal random-number generator. After this delay, each device is permitted to immediately attempt access again.

Because each device on the network has an independent random-number generator, contending devices wait different random periods after a collision. Network bandwidth, number of contending devices and other factors affect the length of each random period, but it is typically less than 10ms.

In every case, the device with the shortest delay will make the subsequent access attempt first. This new attempt is detected by the other contending devices, which then follow the normal access protocol of no contention until the

Figure 5. *All remote devices and the switcher have equal and unobstructed access to all other devices on the network. No particular sequence of polling takes place in this configuration.*

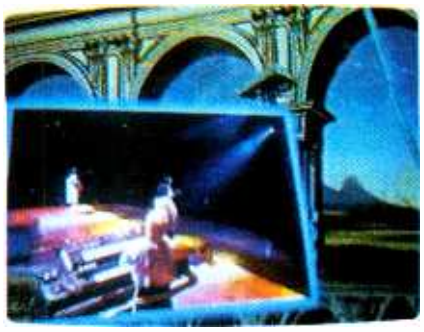


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transmitting device completes its operation and releases the network.

The CSMA/CD network provides several advantages when applied to routing switcher applications. Response time is virtually instantaneous regardless of system size because there is no time delay while a polling device or token makes its way around to a device with a command or request. Also, response time is insensitive to changes in system size because every device has equal priority in gaining access to the network. These features are essential in time-sensitive applications such as editing, production and live broadcasts.

In addition, point-to-point communications between any two devices is direct and unhindered and does not involve a third party. This flexibility allows other types of equipment (such as machine controls) to be added to an existing network without affecting the operation of the original devices.

The overall efficiency of the CD network is high—a result of the data being available to all devices at once. Because each device makes an individual decision on whether transmitted data is meaningful, every device, including the system matrix, can be updated with a single network message rather than requiring a separate message for each affected device.

CSMA/CD networks also excel in their handling of device failure. A failed device simply does nothing, whether the failure is the result of an actual catastrophic event or of an intentional action such as removal of power. Furthermore, devices on the CD network are not interdependent as in other topologies. The loss of one device has no effect on the operation or performance of the others.

Collision-detection networks have only recently been applied to the design of routing switcher systems. Although the hardware required to support a CD network is relatively simple and inexpensive, the complex software algorithms required to detect and resolve data collisions have not been compatible with earlier generations of hardware-intensive systems. As future demands on routing systems continue to grow and new software-based switchers become more predominant, however, collision-detection topologies are likely to become the desired type of network for interconnecting remote control devices.

Advantages abound

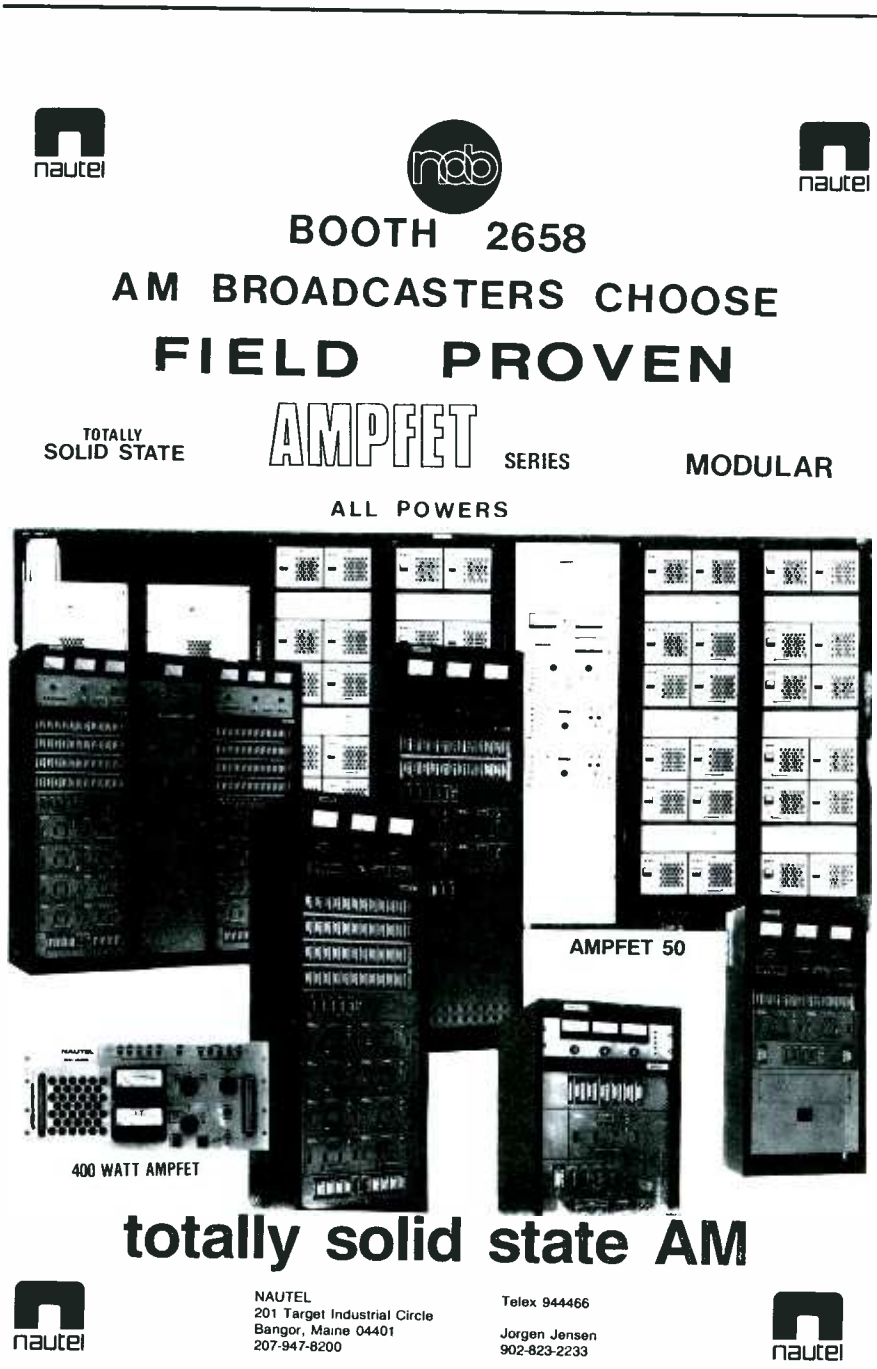
The advantages of the new breed of software-intensive routing switchers go beyond the implementation of collision-detection networks. Possibly one of the most important advantages inherent to these systems is that software can incorporate special operational characteristics for tailored applications. For example, a software-driven system can be programmed to accommodate new types of remote devices without a single hardware change.

What's more, such customization can take place at any time—either during installation or at a later date—as requirements dictate. New software can replace the old in a matter of seconds rather than the days or weeks required to physically modify hardware circuitry.

Furthermore, software can easily accommodate special protocols that allow the control layer to interface with other equipment, thereby completely integrating the operations of an entire facility. Due to simplified hardware circuitry, software-based routing switchers are easily upgraded to include both new hardware and software applications as they become available. New developments such as HDTV, digital store and special effects can be integrated by simple modification of existing equipment rather than complete replacement of an entire system.

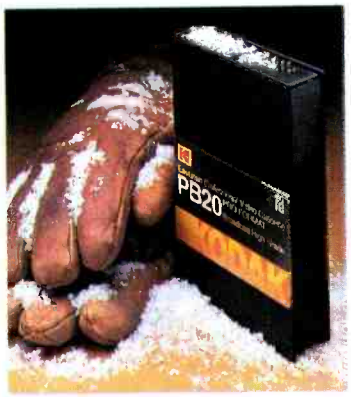
A future for software

As the designers of signal-routing equipment explore the unlimited flexibility of software-driven architectures, routing switcher network operations will become even more transparent. Without a doubt, the future of routing switchers belongs to the software that controls them.



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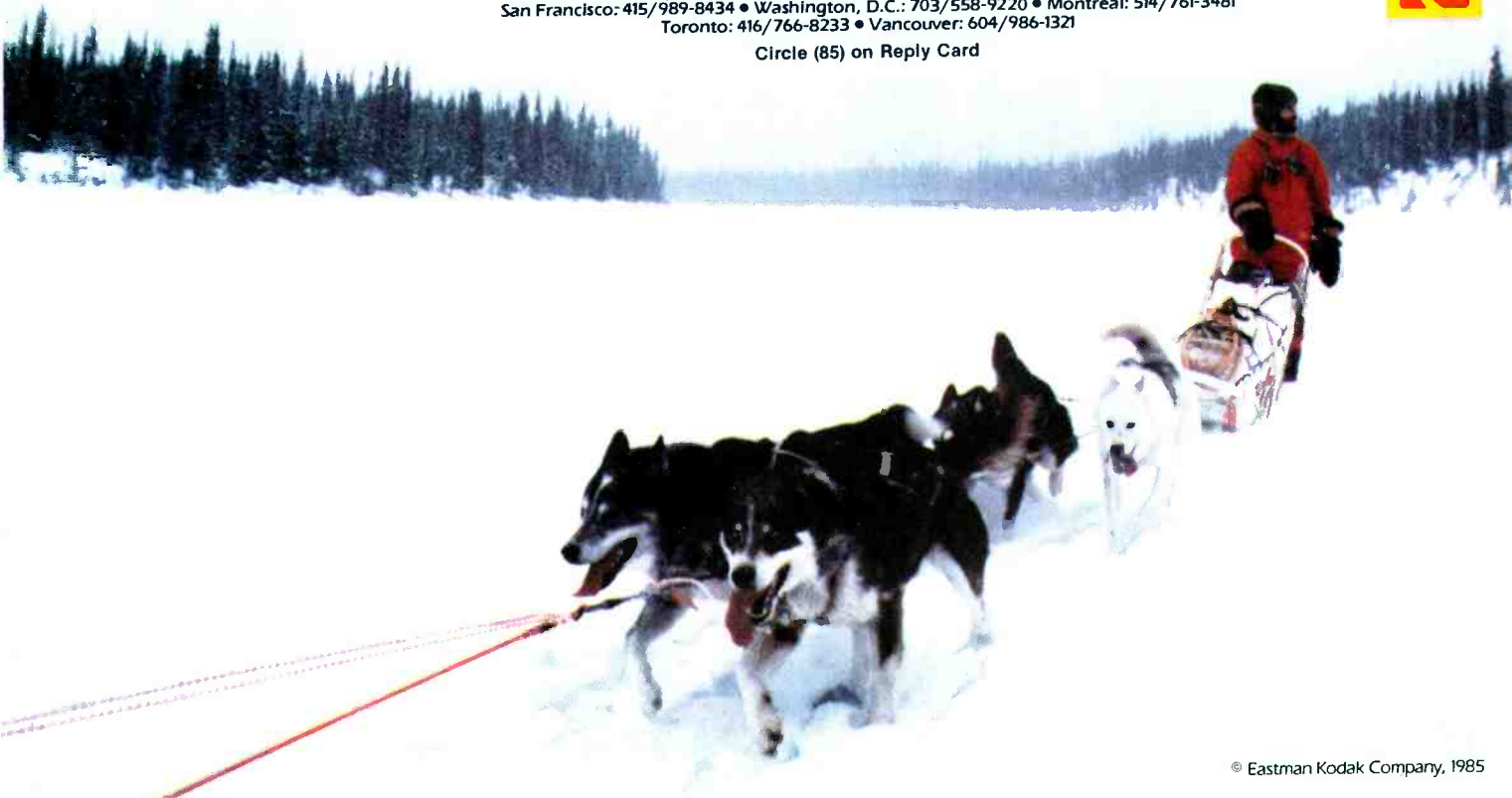
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Evolution of the routing switcher

When TV stations first began operating, engineers found it simple to route the video signal from their only camera directly to their only monitor and then out to their only transmitter. In the 1950s, as television's popularity grew, viewers began expecting greater variety and creativity than was possible in a single camera. As stations expanded their operations to meet consumer demands—and keep up with growing competition—a way had to be found to move the signal from each camera to a single video monitor. Having a monitor for each camera became less and less practical as the number of cameras increased to six, eight and 10.

The first remote switcher was developed in the 1950s to solve that specific problem. The switcher was usually a simple mechanical assembly such as a series of toggle switches in a metal chassis mounted below the monitor. The configuration required a single coaxial cable to be run from each camera to the switcher assembly, and another coaxial line from the switcher to the monitor.

Usually, only one camera had to be viewed at a time, and so this was a fairly satisfactory situation even though it required running six, eight or 10 coaxial cables to the switcher. If a second viewing station was necessary, more cable could be looped from the first switcher to another at the next monitor location.

By the late 50s, it had become evident that routing a bundle of coaxial cables all over the station would be an impractical long-range solution for two obvious reasons: First, as the number of cameras continued to grow, the bundle of cables would eventually become massive. Second, the more often video signals were looped, the more the picture quality suffered.

1958 to 1960

Because each video monitor displayed only one signal at a time, only one coaxial cable per monitor was actually required. Therefore, the solution was simple: route all video source signals to a central location, then route a single coaxial cable to each monitor. This simplified the connection of each source to each viewing station, and vastly improved video output quality.

Most of the early central switching systems—the original routing matrices—were adaptations of the old standard audio jack panel. This patch panel configuration used the same mechanical interfacing methods that audio systems had used for decades.

Although there were (and continue to be) advantages to this direct application of simple, well-known processes, there were new problems to overcome. The individual doing the actual patch usually couldn't see the results of the switch. The engineer often had to walk back to or call someone else at the monitor to visually confirm an accurate switch. Also, if two or more monitors required the same video signal, the process required temporary routing of the source signal through a video DA and then out to each monitor. Finally, if audio had to be monitored, there was an additional step brought to the process. It was obvious that some method of remote control was needed to help streamline operations.

1962 to 1964

The first problem in implementing any remote control network was how to physically change the routing of input signals. This routing was usually

Continued on page 144

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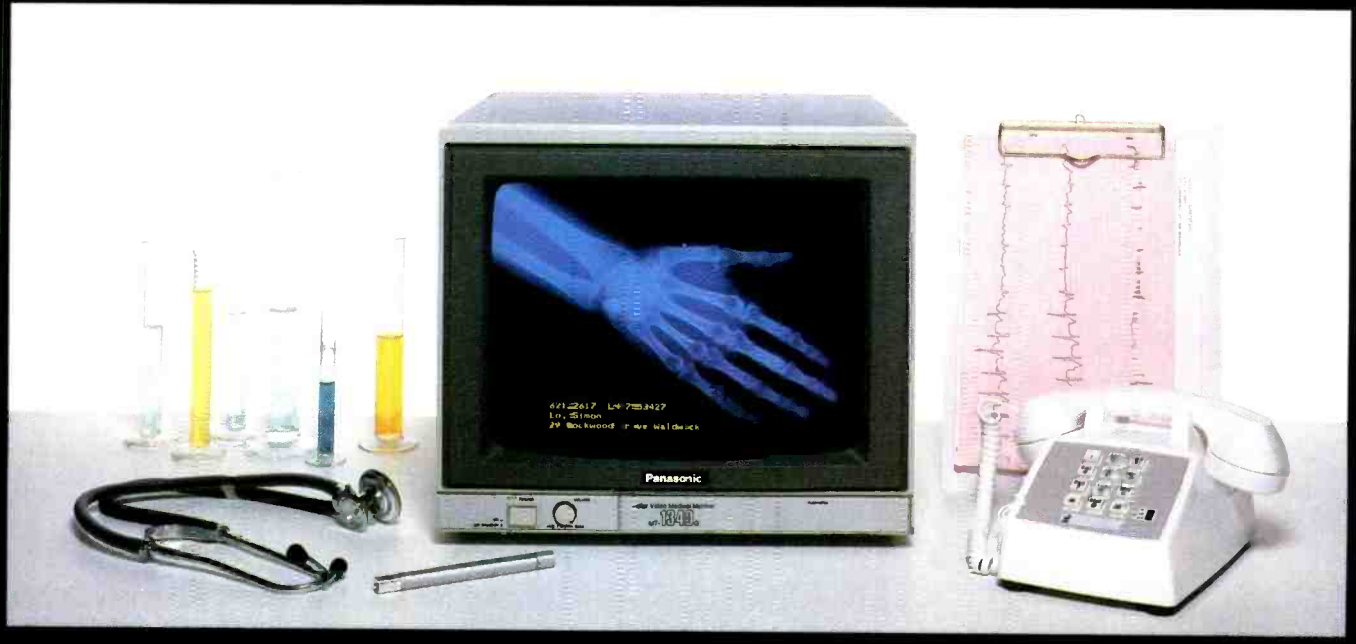
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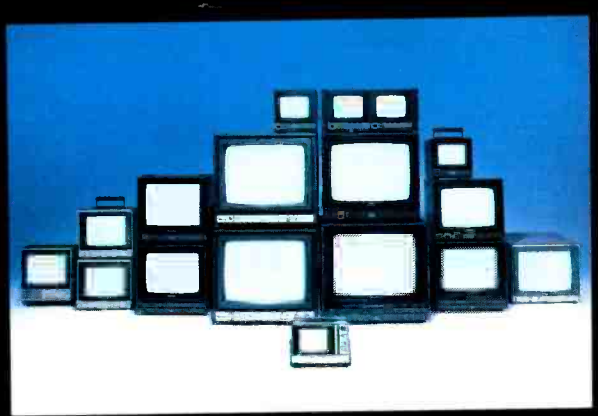
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Continued from page 140

accomplished by mechanical relays located at the matrix. Although many different types were developed and used during this period, one of the most popular was the sealed-reed relay.

The next problem centered on how to control what video you wanted to appear in each monitor. This process was accomplished by routing a number of control wires from each monitor's toggle switch panel back to the routing matrix. This wire-per-crosspoint method took up far less space and cost much less than running large numbers of coaxial cables throughout the facility. The control wires could be enclosed in one multiconductor cable. This system solved most of the obvious problems.

The reed relay response time, however, was relatively slow. As different video sources were switched from one destination to another at random points in the vertical scan, the pictures would roll on the screen. This was only a minor inconvenience if the video picture was for in-house use, but it was intolerable for on-air operation.

The next step in improving the systems was to implement faster-reacting switches: transistors. Transistors created minor distortion problems that reed relays didn't exhibit, but these problems were fairly easy to overcome. In addition, the transistors had many advantages over reed relays.

1970

Transistor circuitry provided the predictable speed required for a switch to occur during the vertical sync pulse and thus prevent rolling. Also, transistors were small, used little power, generated little heat, and were inexpensive. Unlike the performance of a vacuum tube, which steadily deteriorated during its useful lifetime, the performance of a transistor was perfect until it quit.

By the mid-70s, the matrix design for routing switchers was nearly perfected. Integrated circuits improved the performance even further. And although manufacturers continue to have different theories on how a switching matrix should be laid out, generally, all matrix designs function well.

1975

By 1975, the eight or 10 camera days were ancient history. There was an abundance of video and audio feeds available from various sources, each adding more potential burdens to switcher system requirements. The problem of the mid-70s, then, was how to control the growing physical mass of the wire-per-crosspoint system. Wiring installations were again becoming too time-consuming and too expensive. Advanced microprocessor technologies of the early 1970s provided solid-state solutions that filled the bill perfectly.

With microprocessor controls, networked remote control units (RCUs) could send requests to the matrix for input from many different sources, which by then could number in the hundreds.

1978

In a polling network many RCUs could be looped on a single control line, eliminating the mass of control lines from each RCU to the matrix. Only one line was now needed to access the entire matrix.

However, as systems continued to grow, the time required to poll each RCU became the latest signal-routing problem. There now could be hundreds of sources feeding hundreds of destinations, all controlled by dozens of RCUs. If remote No. 127 requested a change but the matrix control system was polling No. 14, there could be a measurable and even costly delay before the polling sequence reqched No. 127 to effect the change.

1985

This latest signal-routing problem

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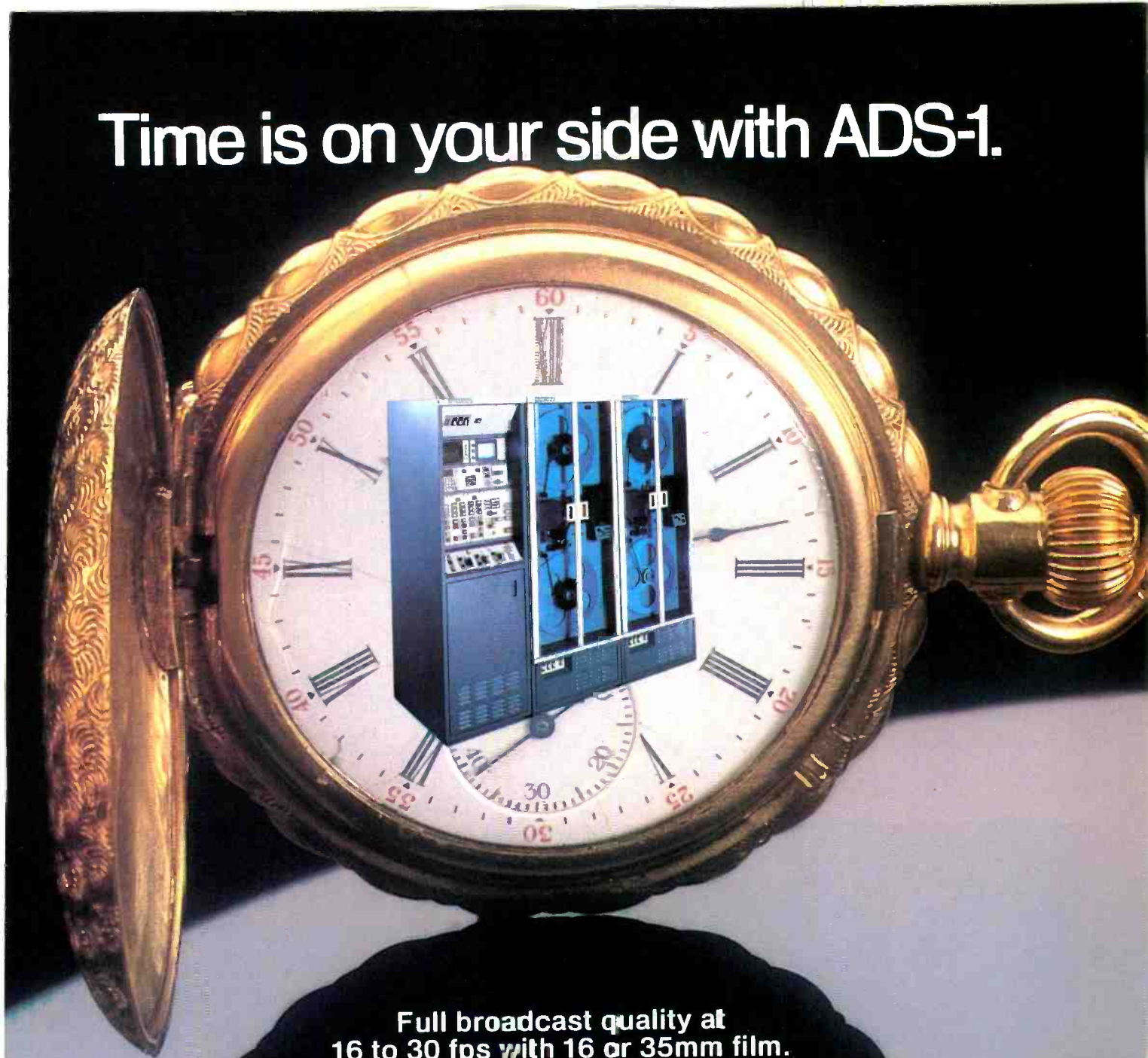


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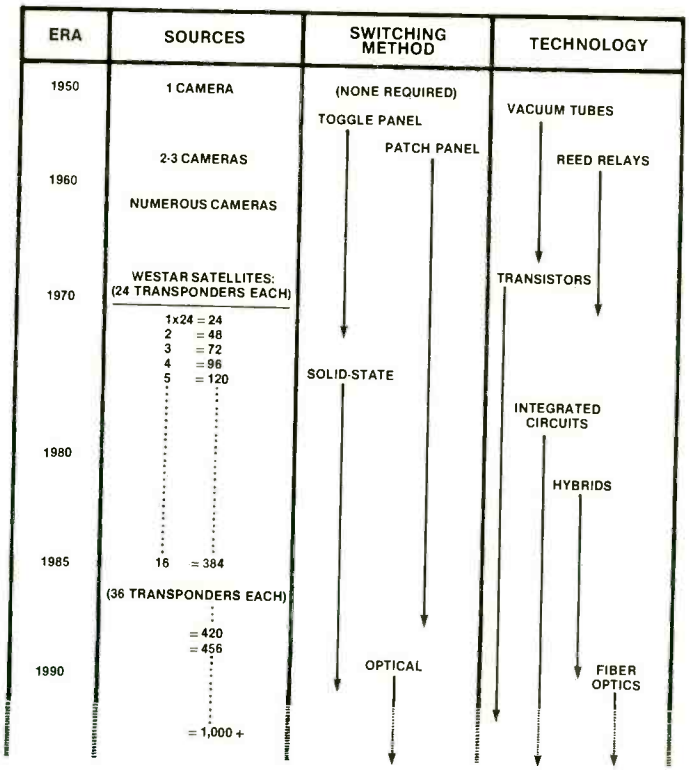
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was solved by eliminating the polling sequence with a system similar to that implemented by some computer networks. With the collision detection (CD) topology, there is no activity on the network until an RCU requests a change. Therefore, requests are processed immediately, resulting in virtually instant matrix changes.

The future

The number of available sources will continue to grow. With the number now in the hundreds, it's impossible to predict how many video and audio channels may be accessed in the future. However, the increasing number of useful sources—and demands for higher-quality output—will result in further refinements to routing switcher technologies.

Routing switcher matrices will probably decentralize and evolve into distributed, smaller subordinate switching centers. These smaller matrices would be much faster and less power hungry. Links between all matrix locations may consist of fiber-optic cables carrying many control, video and audio signals simultaneously, thereby reducing cabling needs once again. New technology will help to improve the signal quality as the industry moves into the era of stereo audio and high-definition television.



The development of modern routing switchers is tied to the advancement of technologies and the demands being placed on switchers.



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Interconnecting audio equipment

By Allen Burdick

Interconnecting modern broadcast equipment is no simple matter—not if you expect to obtain the best possible performance.

Achieving clean audio is a challenge that each broadcast engineer must face daily with renewed interest. The advent of inexpensive, high-quality receiving equipment has created new interest in top-quality radio and TV reception. Recent advancements in technology, such as AM and TV stereo, Beta and VHS hi-fi videotape systems and the compact disc have resulted in increased public awareness of the availability of high-quality audio. Broadcast engineers now have no choice but to re-examine their stations' audio systems.

Fortunately, the tools are available and the highest price to be paid is usually that of time and care during system design and installation. There are four major areas, other than choosing quality equipment, that must be properly addressed in order to achieve truly outstanding audio. They are: proper power system installation, interconnection system methods, RF immunity, headroom and signal-to-noise ratios.

Power system

If all of the lighting and electronic equipment in the world operated on dc, as Edison wanted, the only installation problems that we would face would be RF immunity and the selection of equipment that provided low noise and low distortion. As we know, however, that is not the case.

Probably the largest single source of audio interference is that of power-line-related noise being added to desired signals within the system. Most of this problem results from normal 50Hz or 60Hz voltage differences that exist between equipment chassis. (See Figure 1.) These variations are a result of the different electromagnetic environments that each piece of equipment experiences. The interference may be caused by nearby ac power lines, internal power transformer magnetic leakage and powering various pieces of audio equipment from different phases of a 3-phase power distribution system.

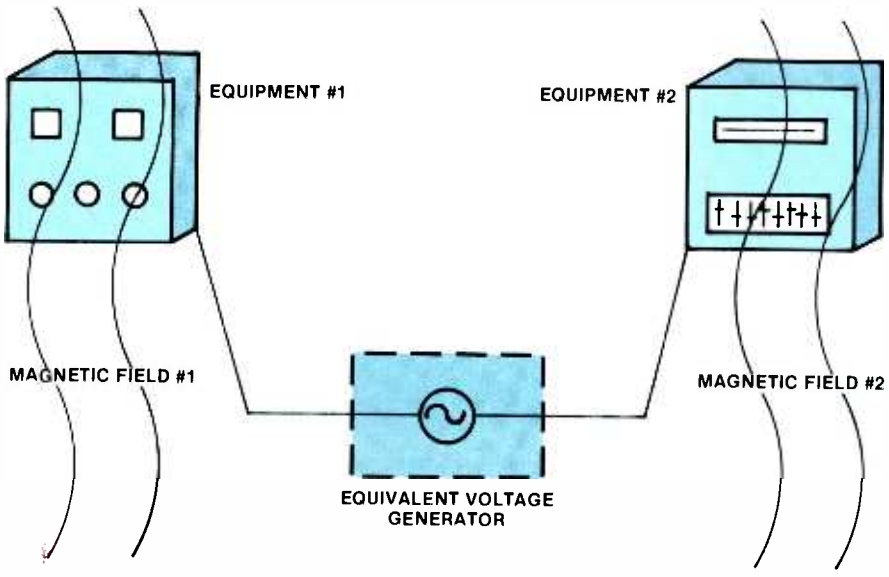
Additionally, higher-frequency audio noise may be conducted into the equipment by the power line. Our objective, of course, is to reduce or to eliminate these potential sources of interference. The following generally accepted rules should be observed:

- Use a separate dedicated feeder for all audio equipment. Install a separate transformer, if required, and breaker panel as close as possible to the audio equipment. Begin the separate feeder line as close as possible to the power-entry point of the building. Connect the equipment-grounding conductor to a point that will provide the cleanest possible earth ground source. This arrangement provides the lowest possible source impedance.
- If the previously described arrangement is not possible, then use only one of the three available phases to power all of your audio equipment. Perform load balancing on the other two phases with lighting and other equipment.
- Keep all high-power switching equipment off of the feeder used for your audio equipment. Do not place SCR studio lighting controls, motor switching or other equipment that can generate high-level transients on the audio feeder line.
- Select equipment that has input line filters and quality power transformers to minimize conducted noise and leakage coupling. Occasionally, a high-isolation transformer with ultra-low winding coupling capacitance may be necessary to eliminate high-frequency interference conducted by the power line.
- Provide individual (separate) steel rigid conduit runs for power and audio lines. Physically separate them as much as possible to avoid induced power-related signals. Be sure to use ferrous metals (not aluminum) for magnetic shielding. If you cannot use conduit or allow a separate space for audio and power lines (such as on stage) and audio and power lines must cross, do so at 90° angles.
- Tie all equipment together in a star configuration with *insulated* ground wires. This will reduce potential differences between pieces of equipment.

Interconnection systems

Although not yet universally adopted, the voltage-sourced-balanced intercon-

Figure 1. *Most of the interference that engineers experience with audio equipment stems from power-line signals and voltage differences between equipment chassis.*



Burdick is president of Benchmark Media Systems, North Syracuse, NY.

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nect system is the preferred method for the audio professional today. The single-ended interconnect system found in semi-pro equipment is not usable because of its inability to reject normal power-line-related voltage differences.

The 600Ω power matched system, developed in the days of tube equipment as a way to achieve maximum signal-to-noise ratio, is falling from favor. With modern operational amplifier technology, it is no longer necessary (or even desirable) to terminate audio lines with a matched low impedance. The foil-shielded audio cable used today does not have a characteristic line impedance of 600Ω. It is usually less than 100Ω.

The voltage-sourced interconnect system, with a low (50Ω to 60Ω) source impedance and relatively high (10kΩ to 100kΩ) input impedance, is becoming the accepted design. An output impedance of 60Ω has been found by ABC and 50Ω is reported by Deane Jensen to be the optimum drive impedance for today's foil-shielded cables. The advantages include less power drawn from the source equipment (and therefore, less heat generated); lower distortion in the output stage; 14dB lower noise pickup by interconnect lines (because of the lower source impedance); and, most important, five to 10 times the cable length that can be driven for a predetermined high-frequency cutoff point.

The output impedance of a piece of audio equipment combines with the capacitance of the interconnecting cable to form an R-C low-pass filter. For example, if a cable has 32pF/foot capacitance between conductors, the source impedance is 600Ω, the cable length is 1,000 feet (not uncommon with TV remotes) and you are feeding a bridging 100kΩ input, then the high-frequency cutoff of the interconnection is only 8.34kHz. (See Figure 2.) With the line terminated in 600Ω, the situation improves to 16.58kHz.

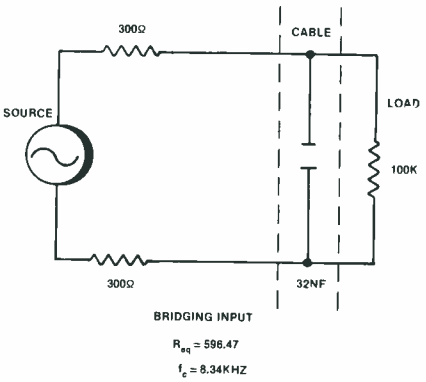


Figure 2. *Using a 600Ω impedance to drive a long line can result in a low cutoff frequency. In this typical case the resulting frequency is 8.3kHz.*

However, it is still nowhere near what you are looking for in the demanding world of high-quality audio. By using a 60Ω source, on the other hand, the cable can be extended to 2,763 feet and still achieve a bandwidth of 30kHz.

Total capacitance is determined by the formula:

$$C = \frac{1}{2\pi f_c R}$$

Here, C is the maximum allowable cable capacitance, R is the output impedance (60Ω), and f is the lowest system high-frequency cutoff that is tolerated. You might think that lower source impedance would further improve performance. That is not the case, however. Lower source impedances result in high-frequency peaking because of the serious inductance found in foil-shielded cable.

Another benefit of the 60Ω output impedance is that there is only 0.8dB amplitude difference between a bridging input and a 600Ω input. The advantage of this may not be immediately obvious.

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Consider a typical TV situation in which the nominal system reference (0VU) is 8dBv. Here 0dBv is a *voltage* reference of 0.7746V, the same voltage that 0dBm produces across 600Ω.

Next, realize that the normal peak-to-average ratio (crest factor) of most audio is 8dB, but in fact may be as high as 16dB or more on percussive material. Assume that you are feeding a bridging input with a 600Ω source. The output voltage will be 6dB higher without a 600Ω termination. Now, add up the amplitudes: +8dBv (system average) + 16dB (peak-to-average ratio) + 6dB (for no termination) = +30dBv peak output amplitude. A unity-gain differential op-amp input stage operating on a ±15V supply will clip at about +22dBv. You can see why you must reduce that last 6dB term.

Common-mode rejection

Common-mode rejection (CMR) is the property of a balanced or differential input to reject a signal, which, if referenced to ground, has the same amplitude and phase on both inputs. The amount of CMR needed is directly dependent upon the level of the common-mode signal.

Let's look at an example. Suppose the power-line-related voltage difference between two chassis was measured and found to be 200mV (−11.76dBv). This level might be typical of the level encountered in a network facility. If you wanted a system noise floor of −90dBv, the amount of CMR needed is the difference between these two values, or 78.24dB. Keep in mind that in this case you are concerned with a specific range of frequencies.

Not all differential input stages are capable of the same level of performance. The actual amount of CMR that a circuit can provide varies. To achieve the levels of CMR of which most op-amps are capable requires careful design. Printed circuit cards must be designed with CMR in mind and the system must be carefully adjusted for best performance after it is installed in the field.

Low-frequency CMR is achieved by making the resistive portion of the differential-amp gain determining network a *balanced* bridge. Some manufacturers use 5% resistors to form the differential input stage. Others use 1% metal resistors but do not use trimmers to precisely balance the bridge. The highest performance equipment uses both 1% resistors and a stable trim resistor to achieve high levels of CMR.

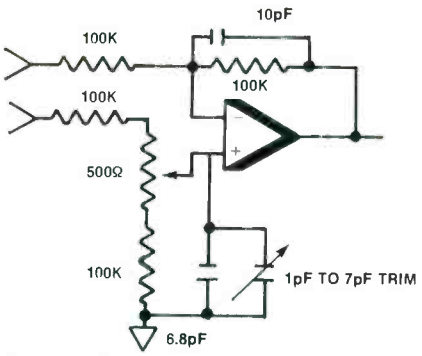


Figure 3. *The best common-mode rejection is obtained from circuits that use precision resistors, a trim pot and a capacitive trim control.*

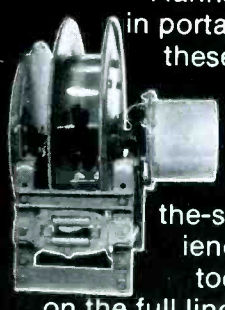
An example of this type of circuit is shown in Figure 3.

The average CMR that can be expected with 5% resistors is 26dB. With 1% resistors CMR levels of 40dB are possible. A carefully trimmed resistive input stage is capable of greater than 100dB of CMR at low frequencies. To achieve any reasonable high-frequency CMR requires that stray capacitance be trimmed out as well. Practically speaking, 75dB of CMR out to 20kHz is achievable by adding a capacitance trimmer.

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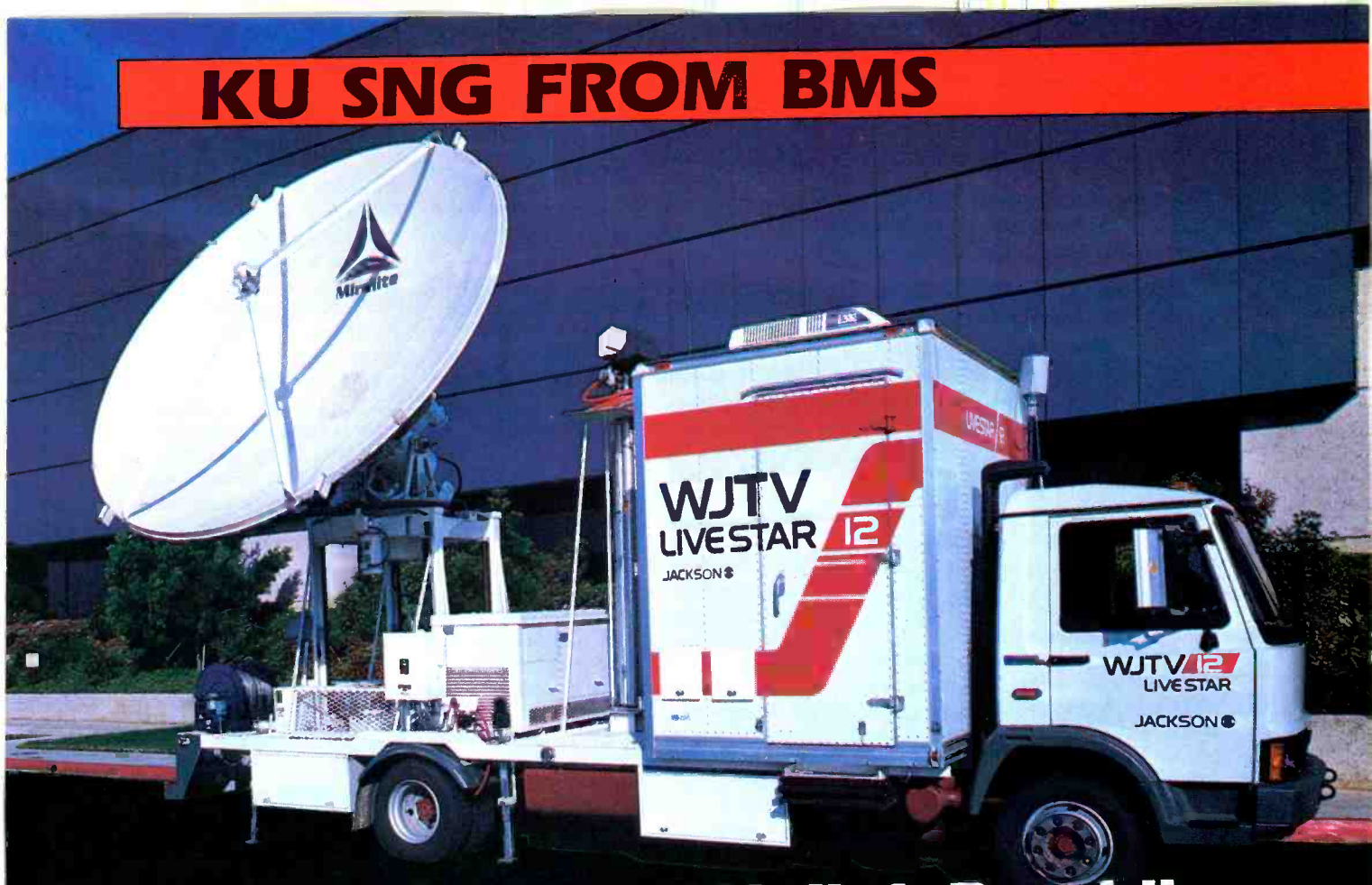
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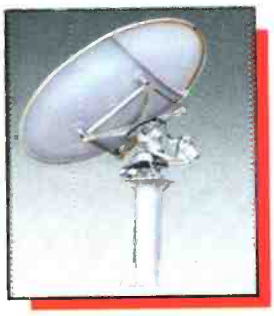
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high degree of CMR, sometimes called longitudinal balance. Although it is possible to achieve 90dB of CMR in a transformer, many transformers on the market won't begin to come close to that figure. This kind of CMR performance requires careful manufacturing.

It is usually preferable to use an active, rather than transformer, input stage. An active input is generally free from low-frequency distortion, hum susceptibility, frequency response errors and ringing. If the common-mode signal cannot be reduced below 2V to 3V, as is usually the case with telco feeds, a transformer input should be used. The transformer has an almost unlimited common-mode input voltage capability.

Interconnect

If you adopt the following rules for interconnecting your equipment, hum-free audio can almost always be achieved.

- All equipment *must* have well-trimmed high-impedance balanced inputs. This is absolutely necessary if you are to reject the residual power-line-related voltage differences between pieces of equipment. For units that do not have balanced inputs, use one of the many interface boxes available. Better yet, build in your own balanced input circuits. This approach is preferable because you have control over the interface grounds.
- Select equipment that has balanced low-impedance outputs. Satisfactory performance from unbalanced outputs can be obtained by following these same rules. However, the output impedance should be low (100Ω or less) and the line should be as short as possible and not located in a high-RF field.
- Interconnect all pieces of equipment with separate *insulated* ground wires size No. 14 or larger. Arrange the grounding wires to form a star or single-point ground system. The hub of the star may be a ¼-inch-thick copper plate about 4" x6" and located near the center of the audio signal hub. The audio console or distribution amplifier system are typically good locations for the hub. The copper plate must be insulated from any chassis ground. Add a wire to the star to connect the copper plate to the house-power ground located in the ac distribution box. If possible, connect the ground wire to the power company's grounding point using your own ground-wire clamp.

At times, the star configuration must be created by using the third-wire-safety ground of the power cord. This method is inferior to using a separate conductor from the power system star ground because the ground-reference-third wire may have a power-related signal induced into it by the parallel runs of power wiring. However, if the equipment does not have a signal ground reference within the chassis that can be floated, then this practice may be the only recourse.

Do not be tempted into eliminating the third-wire-safety ground. First, it is unwise from the point of operator safety. Second, for any equipment not mounted in racks, removal can increase the unit's susceptibility to RF. Finally, this practice is illegal. In every installation, all third-wire-safety grounds should have a separate wire that returns to the power box from every isolated-type outlet. Do not use the metal conduit as a substitute for the separate third wire. This separate third wire arrangement forces a star configuration. Third-wire grounds should tie together in the power box via a copper bus bar that is floating from the box and tied to the power system ground point with 0000 gauge cable.

In any case, all signal references must be tied together with a separate wire other than the drain of the shielded pair

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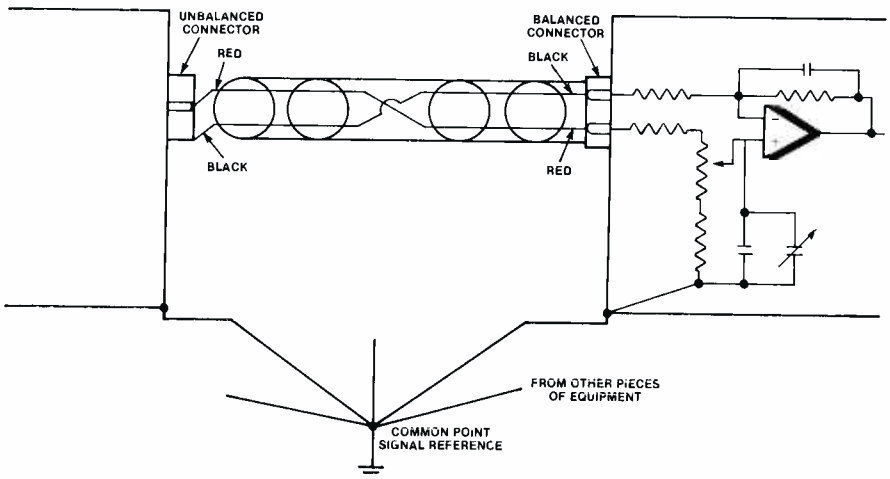


Figure 4. *The interconnection of unbalanced equipment to balanced equipment requires special consideration. Forward referencing will help reduce common-mode signals.*

used to interconnect the equipment. Ideally, the equipment chassis will be tied together via a brute force system by using the equipment racks in which the units are installed. This is best for RF immunity. The signal references are then tied together via a star wire system. Some equipment manufacturers provide a terminal strip on their equipment with the signal reference on one terminal and chassis ground on an adjacent terminal to allow proper grounding.

With large systems, such as network facilities where many pieces of equipment must be interconnected, a *star of stars* is the correct approach. The hub of the stars is again the central point of signal distribution, usually the distribution amplifier or routing switcher system. Time spent in carefully planning a signal reference system will pay large dividends.

- Connect all inputs and outputs together leaving the drain or shield floating at one end. Either end may be grounded with the other end left floating, but be consistent within your system. Connecting both ends of the shield can cause power-line-related currents to flow between equipment through the shield, inducing a signal into the audio inputs.

Balanced outputs are connected to balanced inputs in the normal fashion. Unbalanced outputs should be connected so that the signal is forward-referenced. (See Figure 4.) This is accomplished by connecting the non-inverting (+) input to the positive output terminal and the inverting (−) input to the ground (signal reference) terminal of the unbalanced output. Any difference of potential that remains between the two pieces of equipment will be ignored by the input as a common-mode signal.

- When installing jackfields, use a fully balanced interconnection arrangement. This practice allows connecting to unbalanced outputs while maintaining forward-referencing. The jackfield presents an interesting problem in light of previous recommendations because the shield lines of the jacks are usually not switched. If you wire the jackfield so that the drain wires tie across from output jack to input jack as a part of the normalled wiring and then don't bus the grounds together, everything is fine—until you patch. Then, you have improperly tied the grounds together.

Perhaps the best way to wire the jackfield is to ground all drain wires at the equipment ends, but not at the jackfield. Then at the jackfield, bus all grounds together and connect them to the system ground as though they were a separate piece of equipment. This method will prevent grounding errors when using the patch bay.

RF interference

Occasionally, RF-related problems will remain, even after the previous procedures have been followed. The presence of RF-related problems may often be heard as an increase in high-frequency noise, a gurgling sound or as outright signal detection by a PN junction in an active device or poor solder joint. RF field intensities at a transmitter site can easily range from 1V/m to 100V/m. As a result, the interconnect scheme described previously may need modification.

The open-ended shield recommended can cause the interconnection cable to act as an antenna. One possible cure for this problem is to tie the open end of the shield to its respective chassis ground through a 0.01μF high-quality disc ceramic capacitor. The capacitor provides a ground at RF frequencies, while leaving the shield open at audio and power frequencies. However, all capacitors have their own self-resonant frequencies, and you may need to parallel

Continued on page 160

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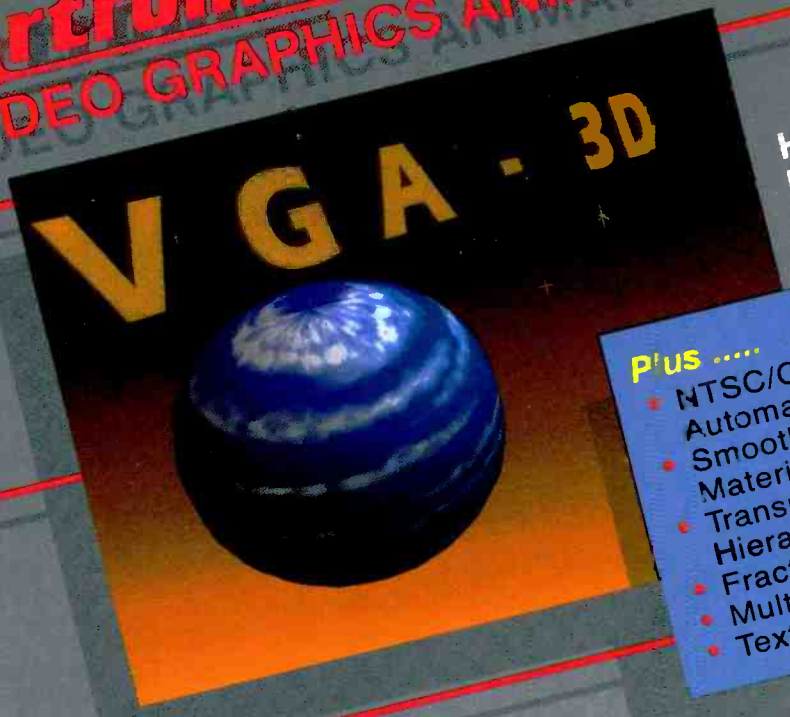
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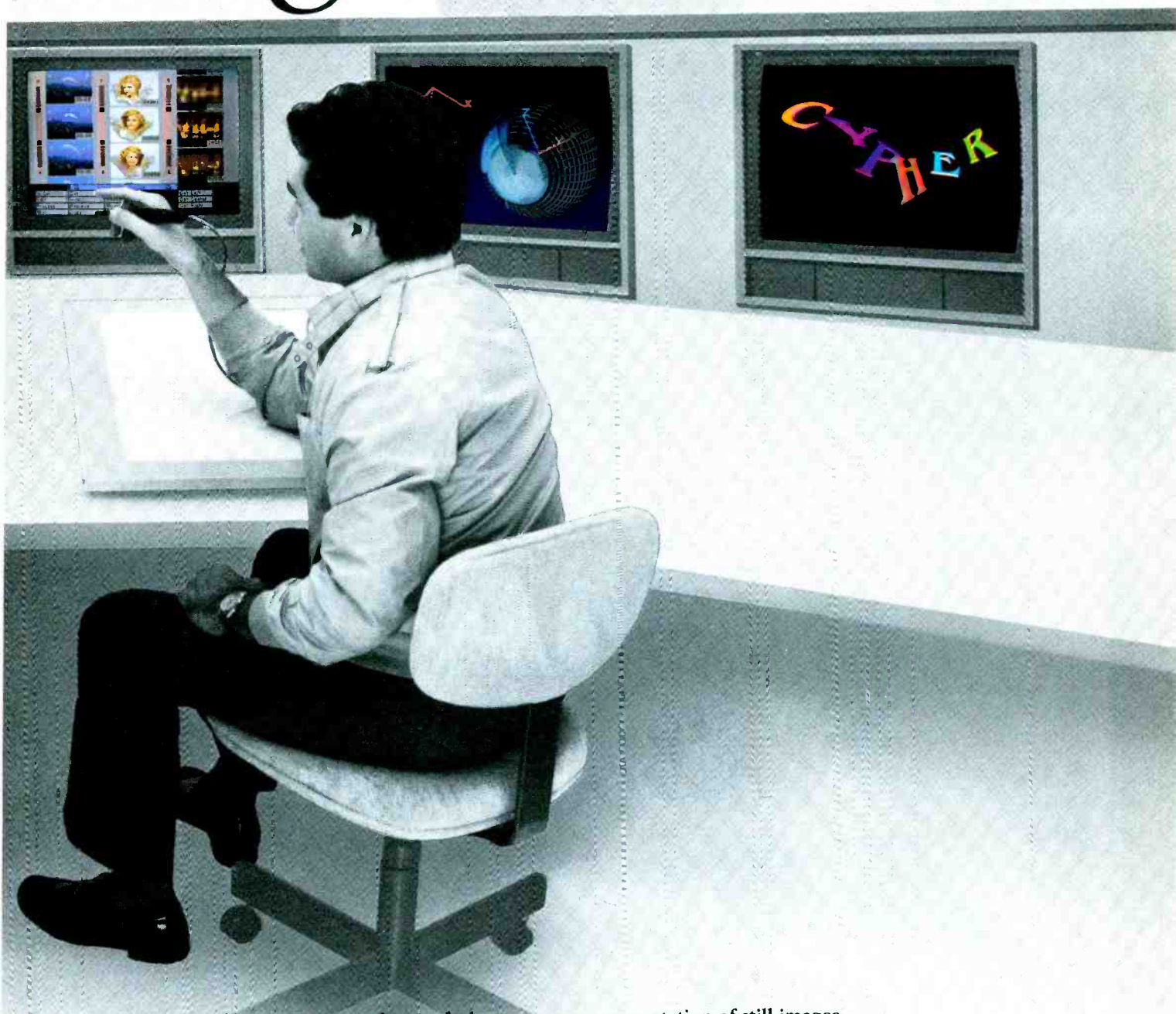
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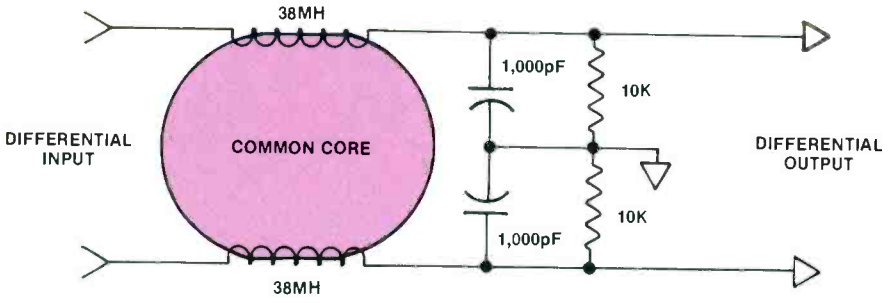


Figure 5. *If RF interference is a severe problem, a common-mode filter may be effective in reducing unwanted signals.*

Continued from page 156

two or three capacitors of different values for full spectrum effectiveness.

The three basic op-amp gain configurations—non-inverting, inverting, and differential—have different RF sensitivities. The non-inverting unity-gain-buffer amplifier is the most sensitive, and the well-balanced differential input stage is the least sensitive. Manufacturers sometimes use an instrumentation amplifier input stage consisting of two unity gain non-inverting input buffer amplifiers followed by a well-trimmed differential input amplifier. In high-RF environments it may be necessary to replace the input buffers with jumpers and accept the lower input impedance for the sake of RF stability.

At both AM and FM frequencies, series resonant L/C networks can be placed from each line of a balanced pair to ground to bypass incoming RF. These devices should be placed inside the chassis and directly at the connector terminals. At FM frequencies, self-resonant (parallel) chokes may be placed in series with the incoming lines. The lines should be shunted with capacitors that yield a maximum of 2Ω reactance to ground at the RF frequency. The capacitors should be located after the choke.

A typical self-resonant choke for 100MHz consists of a single layer solenoid about one-eighth of an inch in diameter and one inch long. The choke is tuned by varying the spacing between windings, thereby changing the distributed capacitance. This type of choke can provide approximately 45dB reduction in RF energy.

A helpful but almost unknown device in audio is the common-mode filter. When inserted in a balanced line, these filters are effective in troublesome RF environments. A typical filter consists of a common-mode choke, made up of dual, highly symmetrical windings on a common toroid core, two 1,000pF capacitors and two 10kΩ termination resistors. A well-designed filter will have a differential bandwidth of greater than 200kHz when driven from a low-impedance source, but a common-mode bandwidth of only 26kHz. (See Figure 5.)

When the choke sees a differential signal (equal amplitude and opposite polarity), the magnetic fields created in the core cancel and the inductor effectively disappears from the circuit. However, when the signal is of equal level and the same polarity on both lines, as is the case with the interference you want to remove, both lines see the L/C low-pass filter. The 2-pole device has a

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cutoff rate of 12dB/octave. The filter's response is down 60dB at 1MHz, preventing RF from reaching the active electronics.

Additional shielding may also be necessary. Separate conduit for audio cabling can be effective in reducing RF as well as power-line-related radiation. Tightening up the shielding of specific audio packages may also be necessary.

In a few extreme cases with which I am familiar, entire studios had to be constructed inside RF-tight screen rooms. If you need to construct a screen room for your facility, use steel screen for all interfering frequencies up through the FM band. Steel is more lossy and, therefore, more effective than copper (and less expensive). Copper screen is required for microwave frequencies. It's also a good idea to solder the seams. Power-line filters should be physically located at the power-entry point into the room. The filters will prevent RF from entering the room on the ac lines.

Headroom and S/N

I recommend that all audio systems be run at a maximum nominal 0VU audio voltage amplitude of +4dBv. As mentioned before, with ±15V power supplies, most op-amps will clip at approximately +21dBv or +22dBv. This limitation yields a headroom or overload factor of 17dB, which, as you saw earlier, is the bare minimum for live audio. PBS has measured peak-to-average ratios of 16dB on speech, and I have seen similar high ratios on percussive music.

My design philosophy is to take a 6dB loss at the equipment input. This yields an input clip point of +26dBv to +27dBv (up to +30dBv with 20V supplies). Operating the circuits at a nominal average level of −2dBv yields a headroom factor of 23dB.

The 6dB loss is recovered in the inverting follower circuit in the output stage. This allows both input and output clip points of +26dBv to +27dBv and provides more headroom with some sacrifice in noise performance. The output noise floor of carefully designed equipment, however, can exceed −93dBv. This yields an average S/N of 97dB and a peak S/N of 120dB.

Setting up your system correctly is also important. Adjust levels so that the gain of each unit allows the various pieces of equipment to reach their clip points at the same time. Most of the needed gain should come from the amplifier stage with the lowest noise figure. This is usually the mic pre-amplifier, the point where the system's dynamic range is established. As simple as it sounds, this adjustment is the key to having an outstanding system and will optimize the S/N of your system.

Proper operation

Most audio operators find themselves fighting a perplexing and often confusing battle with audio levels. The biggest problem stems from the inability of the VU meter to show peak program material. These peaks are a source of overmodulation, tape saturation and amplifier clipping. The VU meter, although a universal measurement device in the United States, finds little application in the rest of the world because of this problem. The late Hans Schmid of ABC, New York, demonstrated that the peak program meter (PPM) provides a superior indication of program material without lowering levels, while allowing additional control over excessive program peaks.

Existing VU meters can be converted to PPMs through the use of various conversion cards. PPMs can also be installed alongside VU meters. As a bare

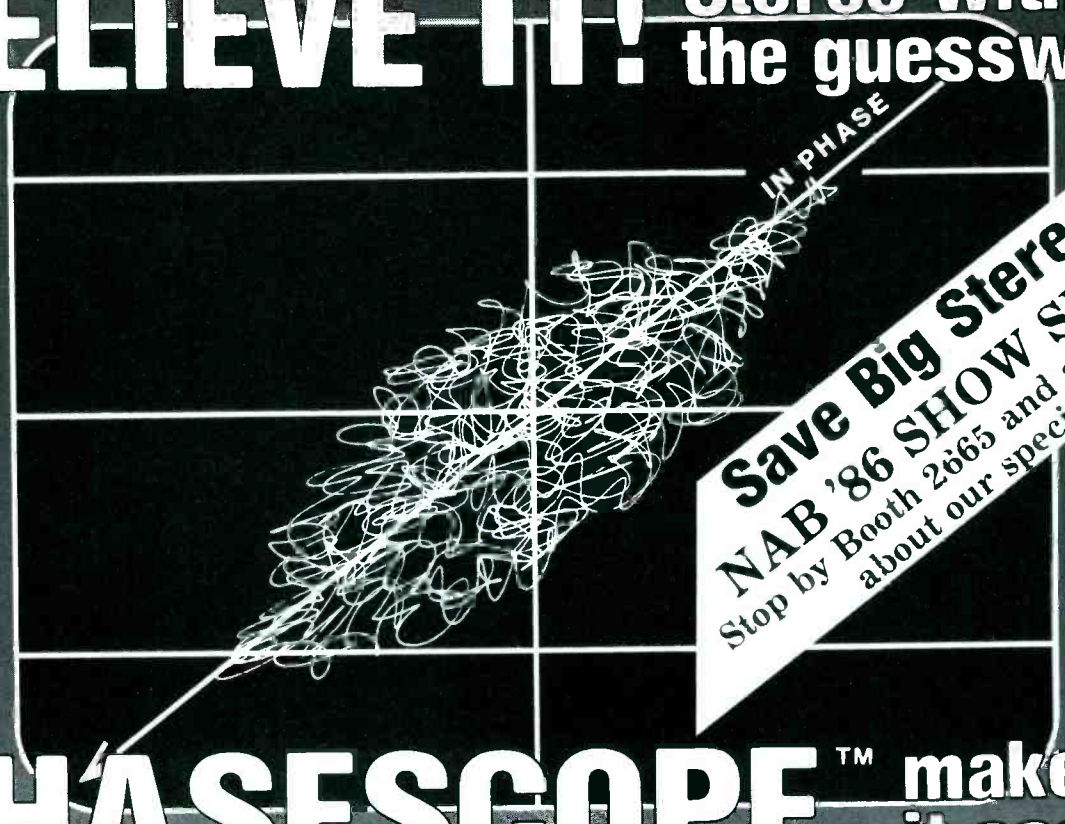


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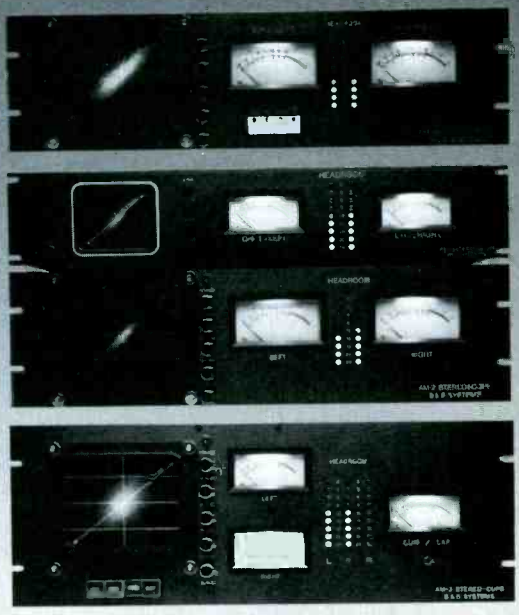
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minimum, add peak overload indicators to any equipment that does not offer PPM capability.

Testing

To check the system, conduct overall noise and frequency response measurements. If the procedures outlined earlier are followed, wideband ($f_3 = 100kHz$) audio systems (up to the stereo generator or pre-emphasis network) are feasible. This design allows the stereo generator to set the overall system bandwidth. It also provides a flatter frequency response by preventing an accumulation of 3dB rolloff points that would upset the system's high-frequency response. Other benefits include low phase shift out to 20kHz and good transient response.

Extensive 10kHz square wave system tests can be accomplished through the use of a function generator and oscilloscope. Place the function generator at the start of the audio chain and use the scope to check the output stages. If there is evidence of overshoot or ringing, it might indicate underdamping of the amplifier circuits. If so, the amplifiers may be prone to RF problems and instability.

Be sure that the amplifiers under test do not go into saturation during the measurement. Otherwise, the results will be inaccurate. When you find a stage that has significant bandwidth limitations (indicated by rounding of the square wave corners), move the generator past the offending unit. This test will tell you whether the problem is at a single stage or is a symptom of an overall problem with the audio chain.

After you are satisfied with the frequency response, noise floor and transient response of the system, perform distortion measurements. Low-frequency total harmonic distortion (THD) measurements have merit, but high-frequency THD measurements are almost meaningless in bandwidth-limited systems. The filters of the stereo generator will remove any distortion products above 15kHz. For this reason, THD measurements may look better than they are.

If slewing-induced IM (SIM) and/or transient intermodulation (TIM) distortion exist within the system, they will appear only at higher frequencies. The best way to detect their presence in a bandwidth-limited system is with the CCIF twin-tone distortion measurement. By using 14kHz and 15kHz tones mixed 1:1, a 1kHz IM product is easily detected if SID or TIM exist. You can also use 19kHz and 20kHz to evaluate equipment up to the stereo generator. It's important that every broadcast facility regularly perform these twin-tone IM distortion measurements.

There are a couple of inexpensive tools that may help you to identify the sources of problems within your facility. A small telephone pickup coil coupled to an amplifier and headphones can track down both RF and hum-induced noise. A battery-operated wideband ac voltmeter is useful in measuring the voltage differences between various pieces of equipment.

For sophisticated IM and THD tests, there are several products available. Some distortion analyzers also operate as wave analyzers, allowing you to examine the waveforms that may be causing the interference. By examining hum at the end of the chain, you can often determine its source. Power-line-induced hum is primarily fundamental and third harmonic; hum from a power supply is usually second harmonic.

The payoff

If all of these steps have been carefully performed, you should have a system that is capable of outstanding performance with a residual noise floor close to that of the equipment with the highest output noise. Satisfying these criteria will allow you to move to a higher level of



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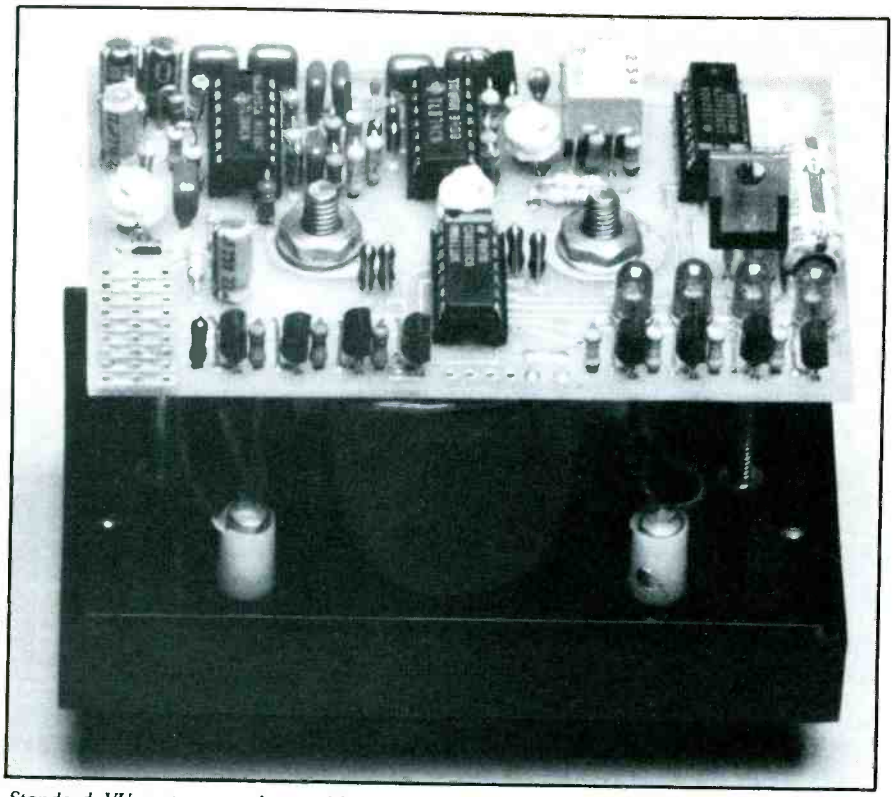
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Deane Jensen, personal correspondence, April 1985.

Clayton Roberts, personal correspondence, August 1985.

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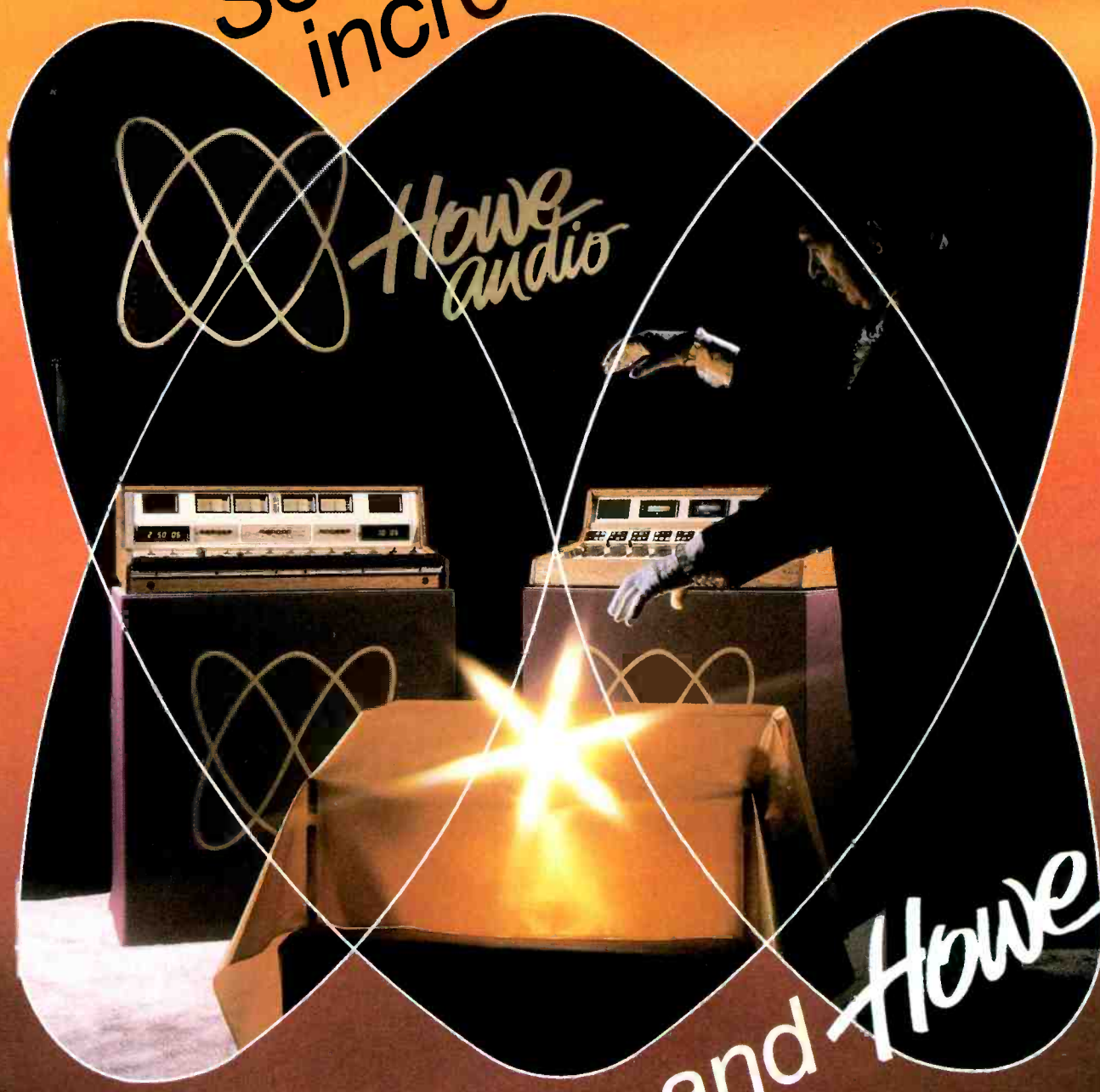
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Using satellite systems

By Elmer Smalling III

Satellite delivery of radio and TV programming, little more than a concept two decades ago, has now become commonplace.

The distribution of radio and TV signals via satellites was once the exception rather than the rule. Today, most radio and TV programs rely on satellite distribution, providing higher quality and expanded programming opportunities.

Twenty years ago, commercial satellite communication was non-existent. Satellite networking and teleconferencing were dreams of the future. Even terrestrial distribution (Figure 1) was a luxury limited to the networks and major corporations because of the high cost of multipoint facility leasing and transmission services.

It was not extraordinary to spend hundreds of thousands of dollars and weeks of preparation for a one-time teleconference or network pickup. All paths in the hookup had to be microwave links or coaxial cable routed through many connection- and traffic-handling points. After the network circuits were in place you held your breath as you ran circuit tests and began transmission. You had to rely on hundreds of people over the entire route to make correct switches and patches.

Often, the quality of the video, audio or data signals left something to be desired, for as much as the common carriers took great pains to maintain the original quality of the signal, the many amplifiers and switch points along the system added distortion and noise.

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

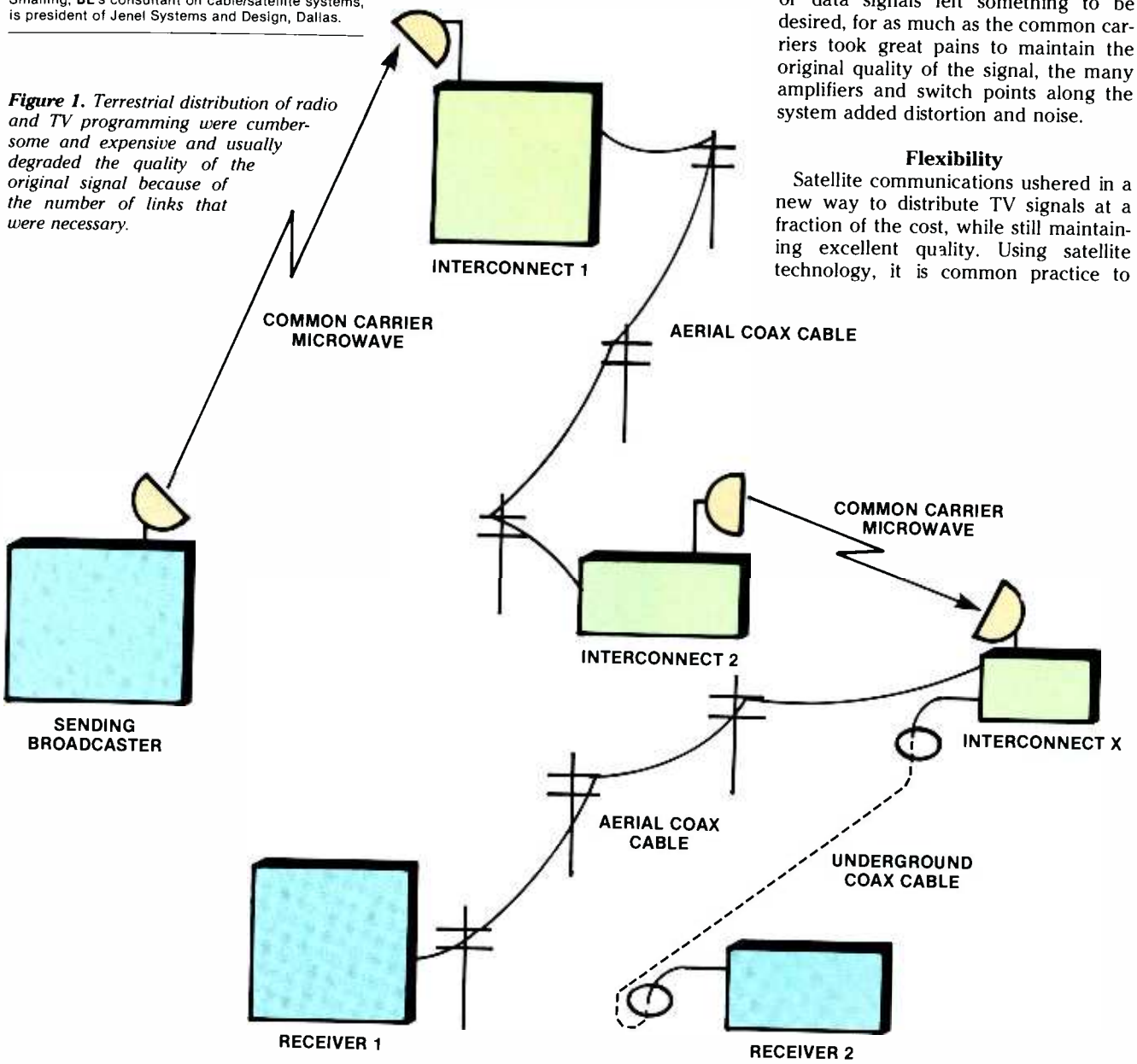


Figure 1. Terrestrial distribution of radio and TV programming were cumbersome and expensive and usually degraded the quality of the original signal because of the number of links that were necessary.

Flexibility

Satellite communications ushered in a new way to distribute TV signals at a fraction of the cost, while still maintaining excellent quality. Using satellite technology, it is common practice to

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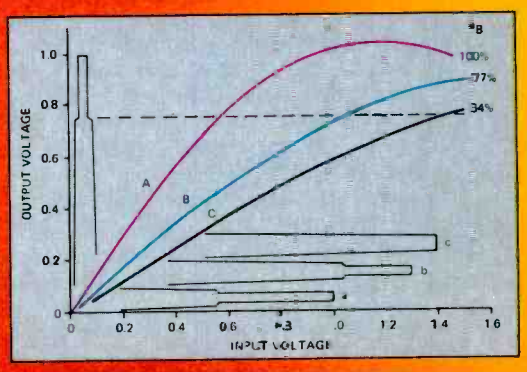
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*Station name supplied on request.



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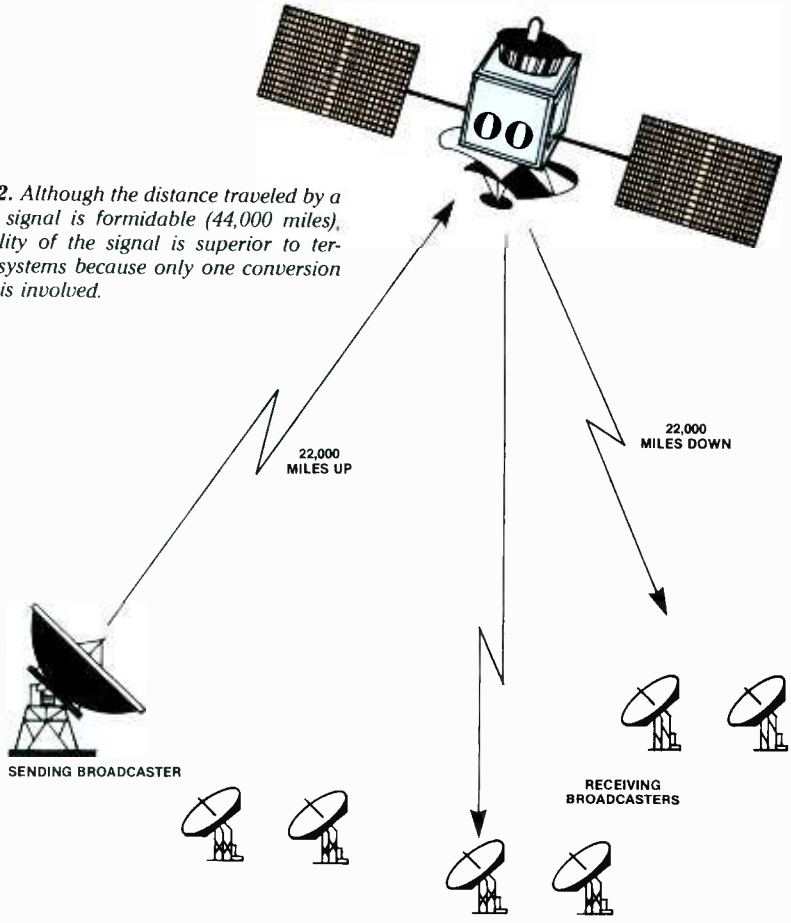


Figure 2. *Although the distance traveled by a satellite signal is formidable (44,000 miles), the quality of the signal is superior to terrestrial systems because only one conversion process is involved.*

transmit and receive from the origination point, such as a football stadium, major news event or conference site, with no intermediate points except the satellite (22,000 miles up in geostationary orbit.) (See Figure 2.) Technical set-up time for satellite distribution is measured in minutes or hours rather than days.

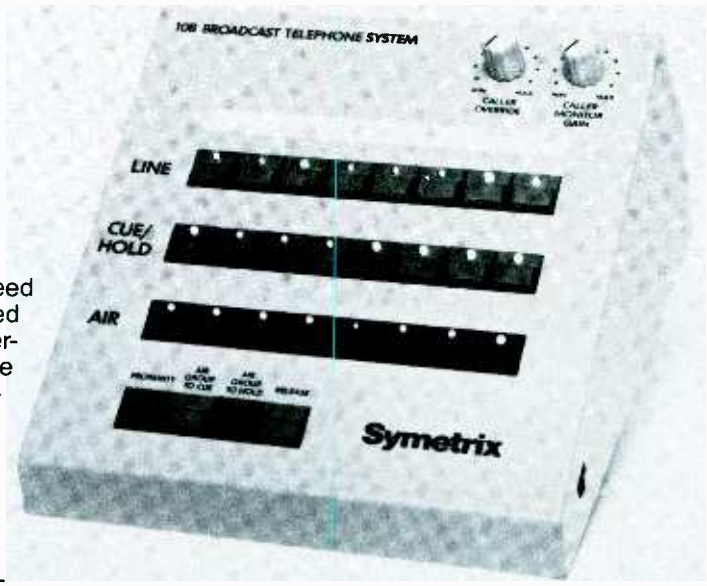
In many large cities there are no microwave relay frequencies available (except for some experimental or line-of-sight frequencies) and so, existing frequencies must be shared. The same microwave frequencies and equipment that might be used for a weekend football game may also be used for nightly news feeds, making scheduling difficult when both departments are busy.

The primary limit to operations now has become the expense of the uplink equipment. No longer must the user worry about the availability of link frequencies, clear line-of-sight shots to a remote, common carrier set-up and installation time, or intrafacility equipment scheduling. Sporting events are covered with portable earth stations and entire states can be covered with satellite news gathering (SNG) vans.

Economical advantage

Satellite transmission is economical. The hourly rental of a satellite transponder for one video and two audio

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signals may range from $300 to $600 (for duplex operation multiply by two). These TV signals may be received (or transmitted) from anywhere in the country. The satellite cost is the same whether the sender feeds one or 1,000 downlinks. There are no local line or connection charges from the receive points (TVROs) when those points are on the receiver's property. This fact alone can make satellite transmission hundreds of times less expensive than older terrestrial forms of communication.

Before the development of satellite TV distribution, there were many varied costs involved with terrestrial operation. The most important ones were central office connection and switching fees, local line charges, long distance line charges, microwave system set-up and engineering charges, and time-of-use tariffs. Most of these fees, plus the many time delays, have been reduced or eliminated through the use of satellite technology.

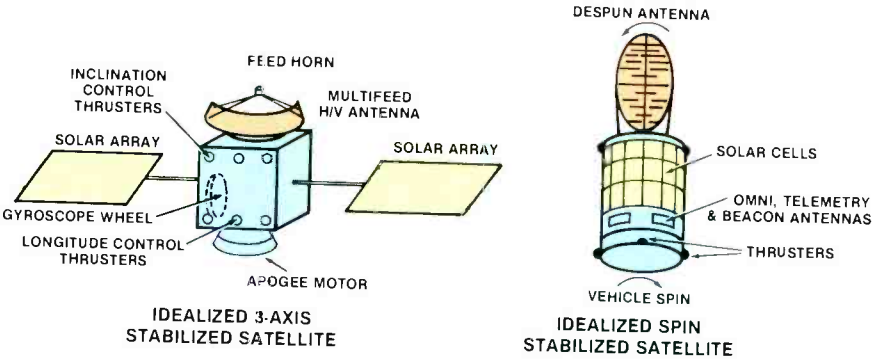
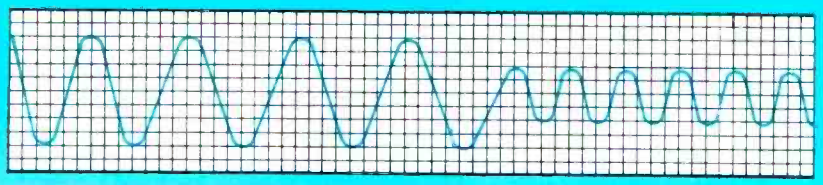


Figure 3. *At left, small rocket thruster motors combined with an internal gyroscope maintain the satellite's position in space. At right, the satellite is stabilized by the rotation of the vehicle itself.*

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Satellite design

The 40-plus communications satellites, which serve the U.S. TV industry, are located in a belt 22,000 miles above the equator from about 62° west longitude to 147° west longitude.

There are two basic types of satellites. The first (Figure 3, right) is a *spin stabilized* craft. It remains in a stable orbital position by spinning rapidly on its axis like a gyroscope. Because the satellite's antenna must always point toward the earth, the antenna assembly is spun in the opposite direction from the satellite so it appears to be stationary.

The second type (see Figure 3, left) is a 3-axis stabilized craft. This satellite is stabilized in orbit by an internal gyro wheel and miniature thrusters located around the outside of the vehicle. Because the satellite does not spin, its antennas can be pointed toward earth with little effort. This design also requires fewer mechanical devices than a spin stabilized unit. As a potential user, it is not necessary to know the type of satellite you are using, as it has no bearing on the quality of reception.

Satellite vehicles contain a number of transponders, usually 12 or 24. Transponders receive signals from earth and retransmit them back to earth. The more transponders a satellite has, the more communications it can accommodate. The term transponder is derived from the words transmit and respond.

In addition to transponders, satellites have other on-board support equipment, including: fuel for positioning, distribution facilities to allocate power from batteries and the solar cells to the transponders, a housekeeping computer, navigational computer, antenna array, and control and logic equipment. (See Figure 4.) The life of a communications satellite—about 10 years—is dictated by

Continued on page 176

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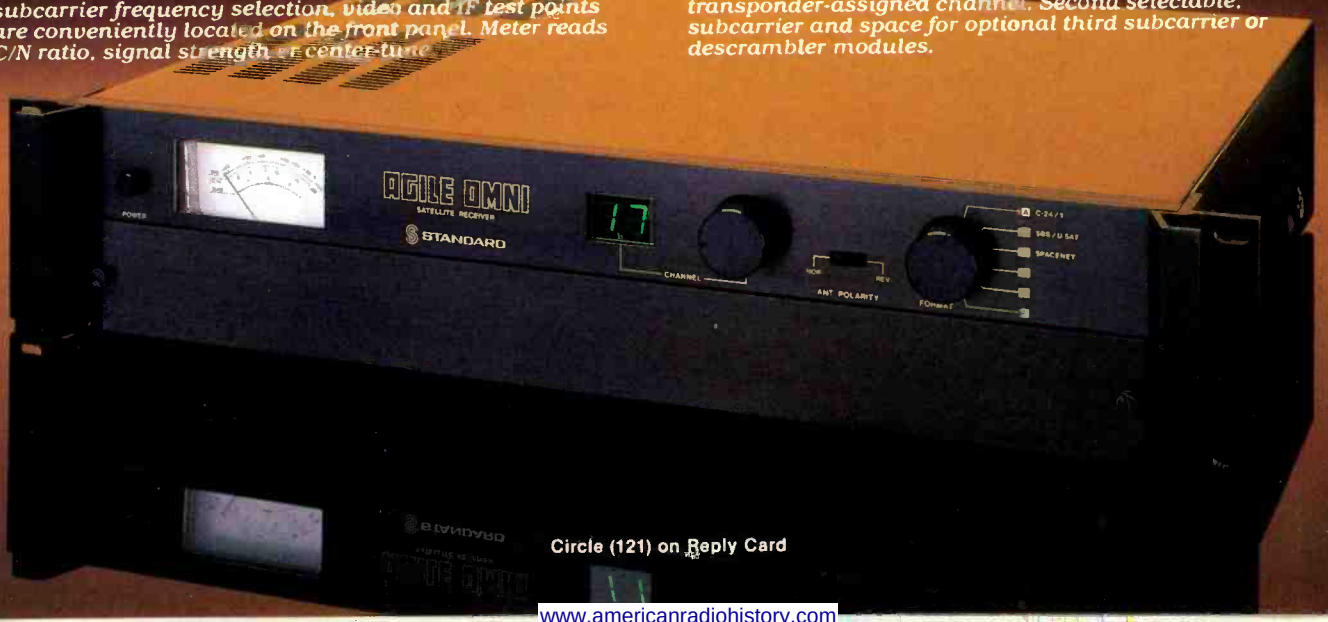
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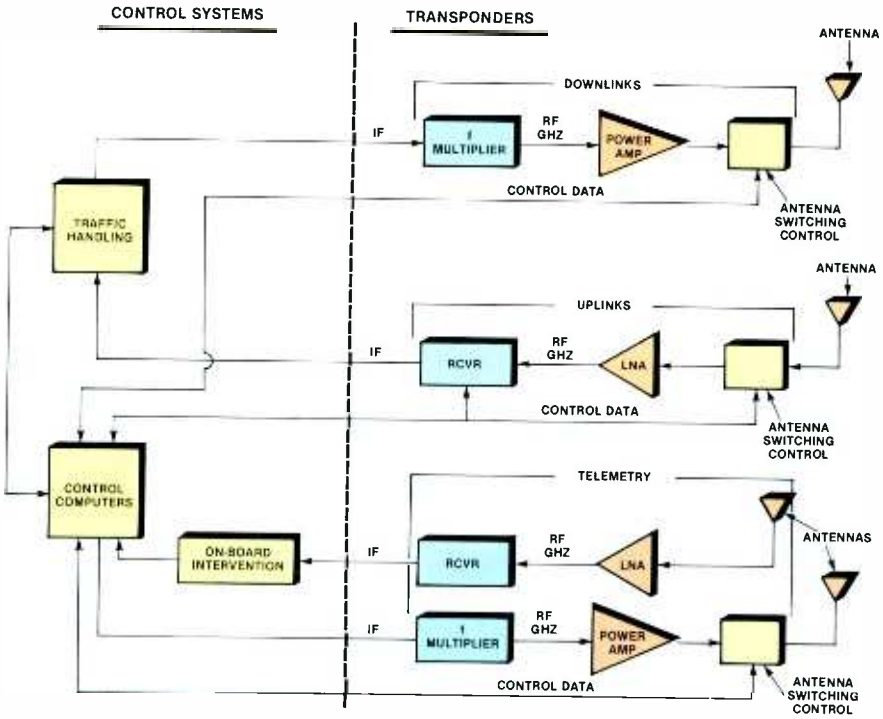


Figure 4. *The control system within the satellite is complex. This simplified diagram indicates the major technical elements of the satellite.*

Continued from page 172

the amount of fuel carried on-board.

Now that the shuttle provides a way for engineers to service satellites, many will be reused until a geostationary communications platform is in place in the 1990s.

Frequency band

Satellites operate on two basic frequency groups, the C-band and Ku-band. The C-band (3.7MHz to 6.4MHz) was originally assigned for satellite service in the late '60s. The Ku-band (11.7GHz to 14.5GHz) is three times higher in frequency than the C-band. The Ku-band has two primary advantages over the C-band: The Ku-band is less susceptible to terrestrial interference than the C-band, and Ku-band transmit and receive antennas are only one-third the size of C-band antennas. Most existing commercial satellites operate in the C-band. However, the satellites that have been most recently launched consist primarily of Ku-band transponders.

Earth stations

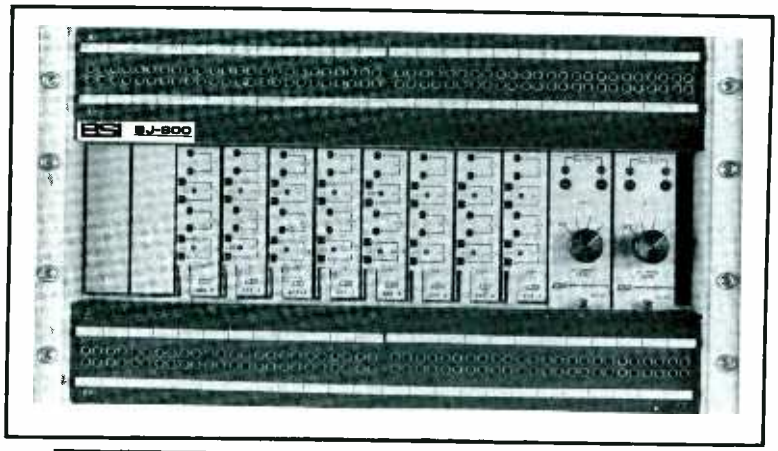
An earth station is used to communicate with a satellite, which in turn communicates with one or many other earth stations, or uplinks/downlinks. Some people interchange the terms TVRO (television receive only) and earth station. However, because a TVRO system cannot transmit, it should not be referred to as an earth station. The term uplink/downlink is used primarily by system designers. Earth station will be used in this article.

Earth stations may be equipped for C- or Ku-band operation or both. The C-band earth station requires a parabolic reflector antenna that is at least 22 feet in

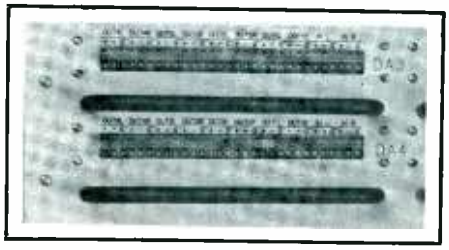
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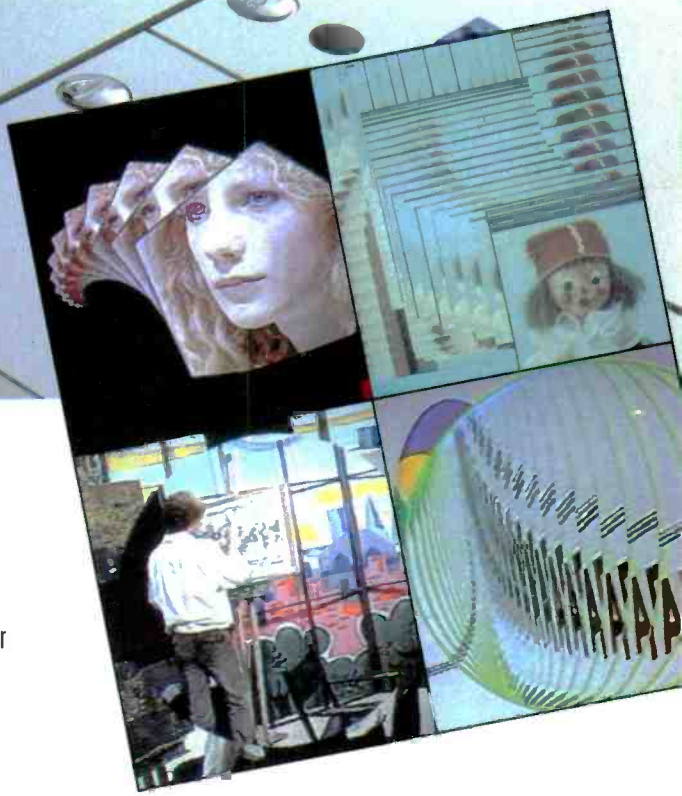
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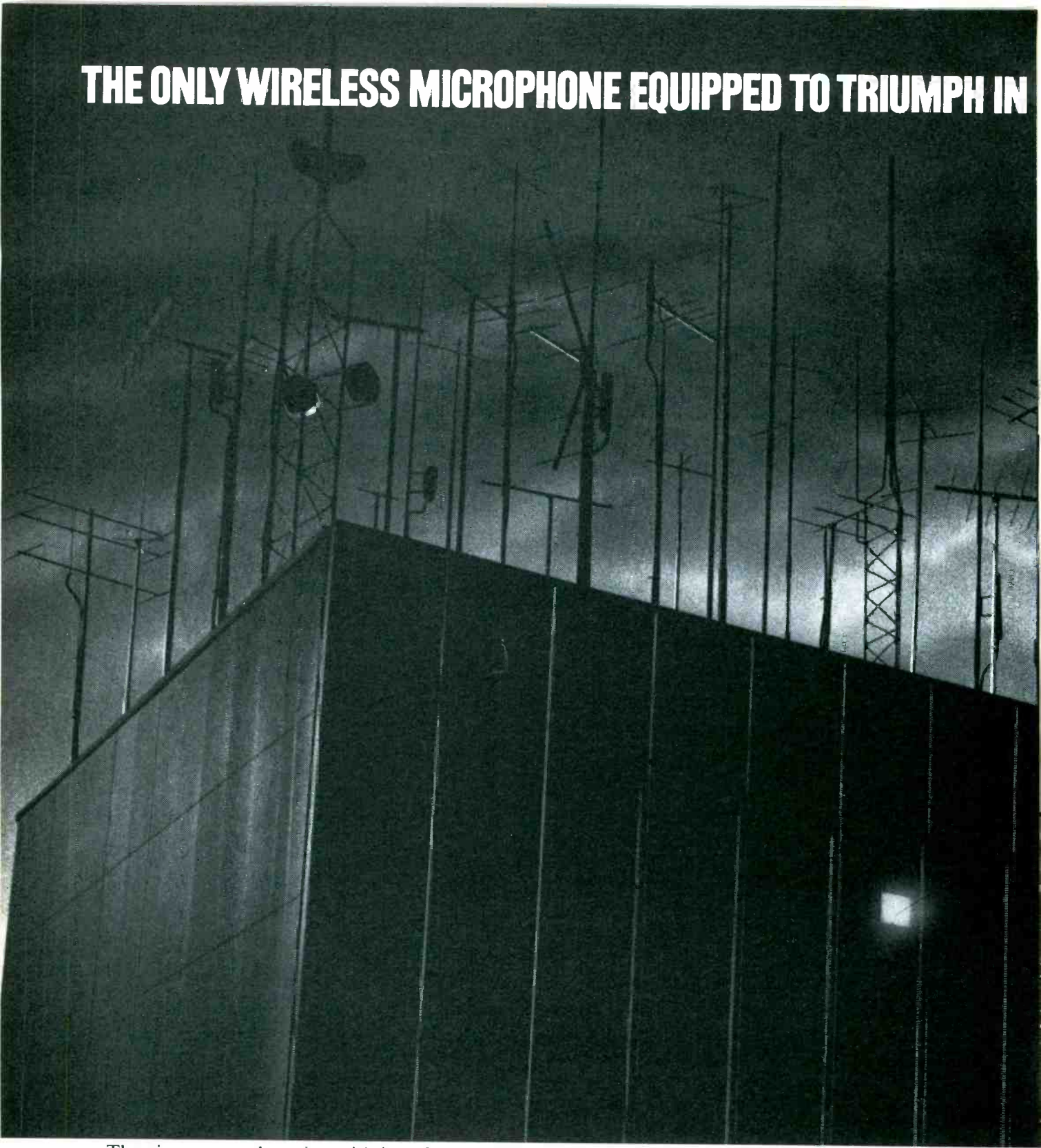
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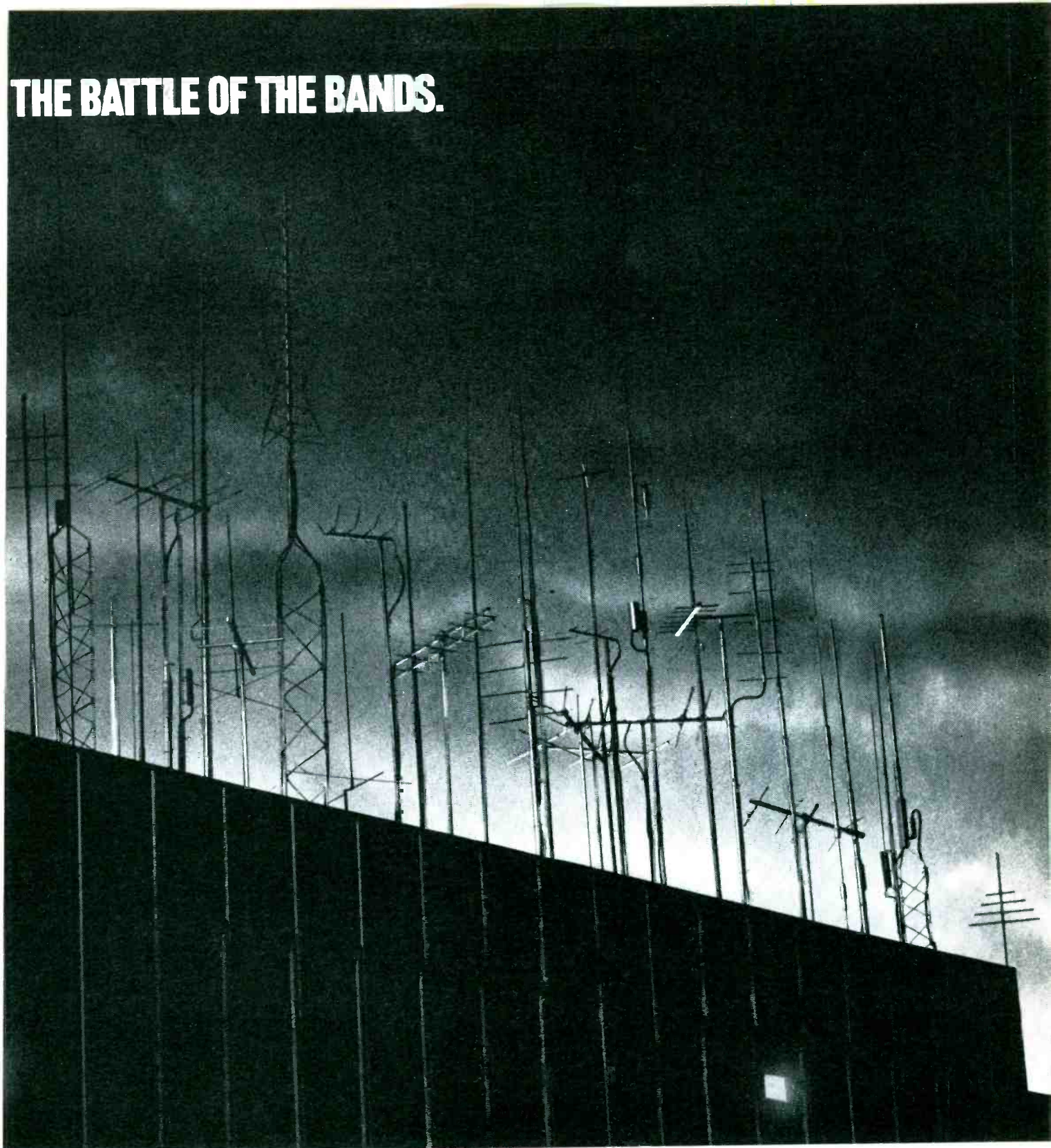
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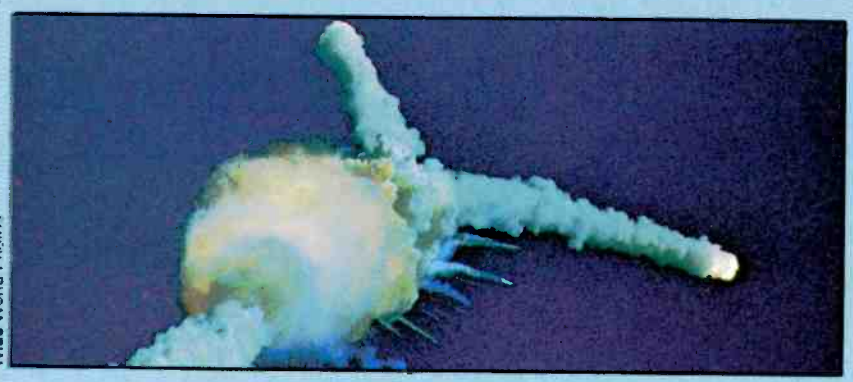
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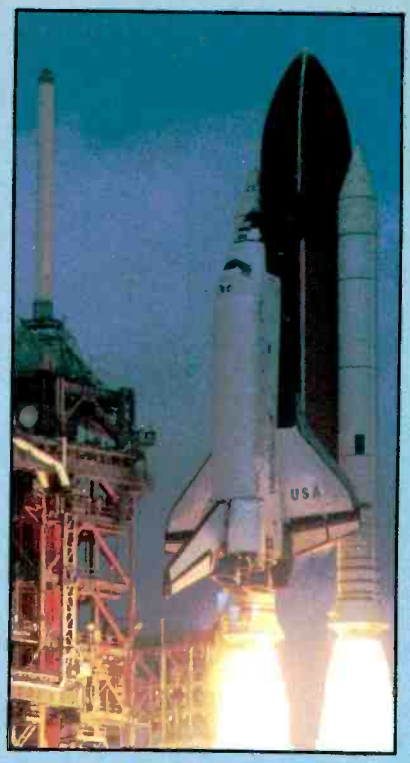
in Part 74 subpart H of the FCC regulations and requires an appropriate license.

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Disaster may cause delays

The tragic explosion of the space shuttle Challenger on Jan. 28 has caused the shuttle program to be placed on hold while all the facts relating to the loss are collected and analyzed. At this point, it is impossible to predict how long the program will be delayed.

Previous losses

The fire on Apollo I, on Jan. 27, 1967, indicates how long any delay might be. After that accident, the Apollo program was delayed almost two years until Oct. 11, 1968. On that date, the first manned Apollo was launched.

If the 1986 launch schedule is scrubbed, up to five satellites will be affected if no alternate means of launch

The loss of the shuttle Challenger on January 28 may delay the launch of new communications satellites that are needed by the broadcast industry.

is found. Alternatives are available and could include an unmanned NASA rocket or the European Ariane, which has had its share of problems.

Satellites in limbo

Several satellites were scheduled for deployment by the shuttle program this year. The Satellite Television Corporation (STC) I and STC II-Ku-band satellites are scheduled for June and December launches. The American Satellite Corporation (ASC) II-a C- and Ku-band satellite is scheduled for September. The Galaxy IV-a C-band satellite is scheduled for June. And finally, the Westar VIII-a C-band is scheduled for March.

The two STC satellites are scheduled for DBS use. The ASC II will be used primarily by ASC to expand its own commercial and private line services, which are predominately on the Westar birds. The Galaxy IV will provide TV transponders for sale. The Westar VII bird will be used to provide TV service for the United States and Puerto Rico.

There is enough satellite capacity now to provide a pad for the next year or so. However, if the shuttle program is set back too far and not augmented with unmanned rocket launches, satellite TV time will become costlier as the number of available transponder channels decreases.

Continued from page 176

diameter. A Ku-band earth station needs only a 10-foot-diameter antenna.

A Ku-band TVRO antenna may be considerably smaller. If the earth station is used for communicating with a single satellite, it may be permanently mounted. If the dish is to be pointed at more than one satellite, the antenna must include a mount on which it may swing horizontally (azimuth) and vertically (attitude). A stationary dish antenna is far less expensive than one that can be moved (a steerable antenna). Choosing one satellite for all of your distribution requirements will save thousands of dollars in equipment costs.

A typical earth station, shown in Figure 5 (C- or Ku-band), includes a modulator/exciter to transform the video, audio, and data signals from base band to radio frequencies that can drive the high power amplifier (HPA) with an intermediate power level (usually 1W). Finally, the HPA amplifies the signal from the modulator/exciter up to 200W to 1,000W for transmission through space to the satellite.

For reception, the earth station requires a low noise amplifier (LNA) to amplify signals that have arrived from space at billionths of a watt into signals strong enough to feed the satellite receiver. Most satellite receivers may be tuned to any transponder on a satellite (frequency agile) to provide base band video, audio and/or data to feed station equipment. These signals in turn feed monitors, computers and videotape recorders.

In addition to transmit and receive equipment, most earth stations require coaxial switches, waveguide transmission lines, fault protection and automatic changeover equipment.

Earth stations may be permanent or portable. Permanent units are built on-site for full-time satellite work. Portable units are usually transported or trucked to a site as required. Some broadcasters have formed networks using mobile earth stations that can be driven anywhere and set up in minutes. Because of the small antenna size and freedom

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from interference, the Ku-band is superior to C-band for satellite news gathering operations.

Distribution

Satellite distribution can be either simplex or duplex. Simplex refers to 1-way operation such as a program fed from a distributor to many stations on a daily basis. Duplex operation consists of transmissions to and from all participants in the network. Full duplex operation via satellite is quite simple because the receive and transmit frequencies are almost an octave apart and allow for simultaneous use of earth station and satellite facilities.

When setting up a satellite distribution network, the selection of a satellite and transponder is important. The only limits to the selection are the availability of a transponder or an impaired look-angle. Buildings or natural elements such as hills or trees might prevent access to the complete satellite arc and, therefore, limit the user to a smaller arc segment or look-angle. An engineering study of the site and potential look-angle impairment and terrestrial microwave interference should be undertaken early in the satellite selection process.

There are a number of service firms with extensive databases that may be able to identify potential problems without an on-site survey. These firms will provide technical documentation for your FCC filing, should you elect to install a permanent earth station. Because of its freedom from terrestrial interference, a Ku-band earth station will be much easier to license and operate.

Satellite time may be rented by the hour, week or year. The longer the lease period, the lower the hourly rate. If the satellite user does not require a set transmission time every day and can move as time slots become available, the transponder time cost will be less. Being bumped around a daily schedule to save money may be fine for a tightly controlled, sophisticated network operation, but confusing for satellite distribution neophytes.

At this time, there are many satellite transponders available with more soon to be launched, making it somewhat of a buyer's market. However, this condition will turn around quickly if SNG, and TV distribution in general, continues to grow at the present rates.

Private services

If the users of a satellite distribution network represent a common interest group, such as a news gathering organization, additional satellite services may be available on the same transponder at little additional cost. These services might include additional program audio channels, stock data, business data or control information that is piggybacked on a subcarrier along with the TV signal.

A satellite distribution network may also serve as a vehicle for electronic mail. Such a system might save the user thousands of dollars a year by replacing postal mail and terrestrial distribution with a satellite subcarrier network. Users who wish to receive data require only a simple, inexpensive earth station. This service can sometimes be sold to non-broadcast entities to help offset TV distribution costs.

Large satellite distribution systems may be automated to the degree that little human intervention is required for daily operation. Areas that lend themselves to automation include timing and control of daily transmissions, control and assignment of downlinks and remote uplinks, transmitter scheduling and data network management. Automation and computer control systems are available from most manufacturers of earth station equipment.

Packet data distribution using subcarriers on satellite transponders has taken hold in the marketplace. Many corporations are providing instant branch access to their large, central databases for purposes of inventory control, daily sales assessment, ordering and planning models. Data are sent over satellite channels using time domain multiple access (TDMA) or frequency domain multiple

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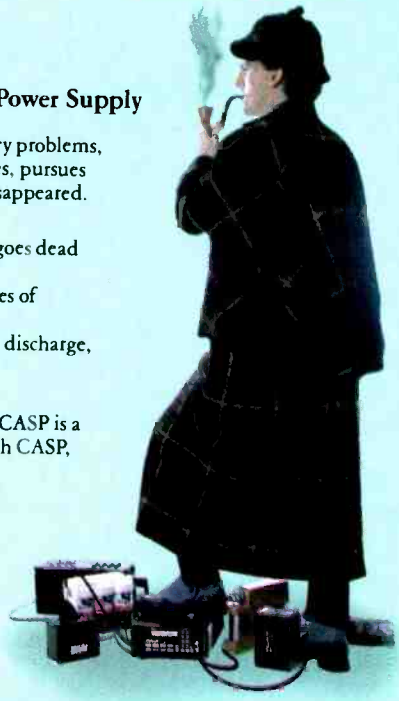
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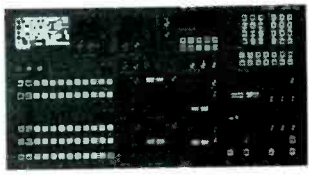
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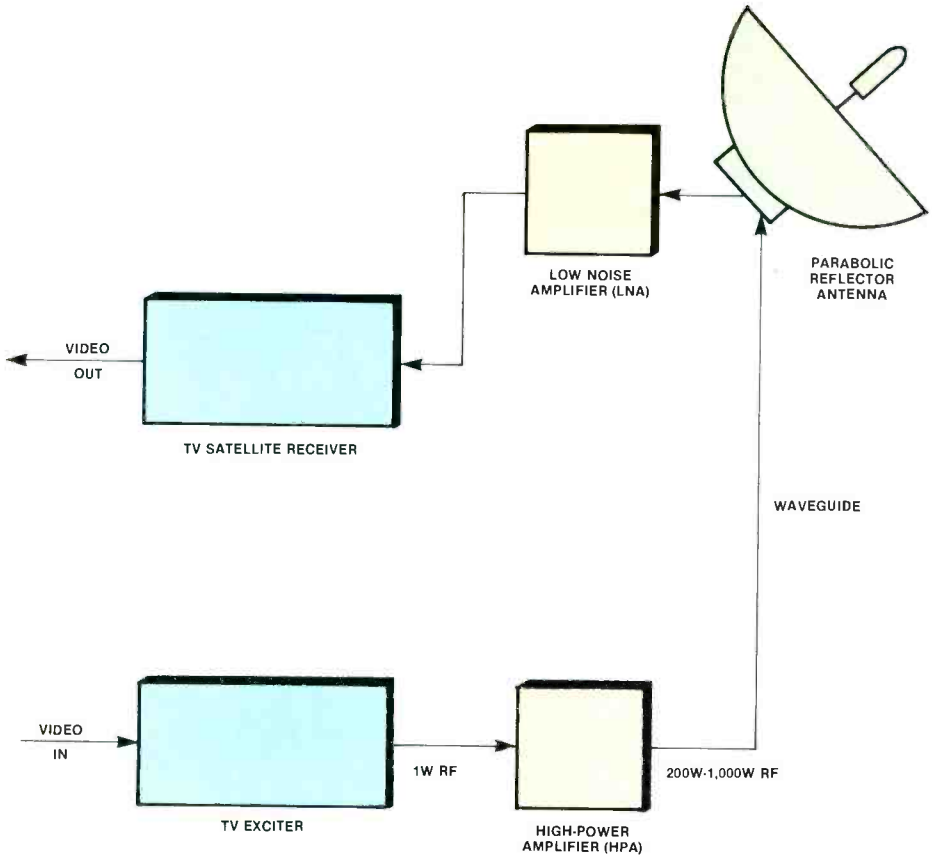


Figure 5. A typical earth station provides both transmit and receive capability. A TVRO, on the other hand, can only receive signals.

access (FDMA) technology. With TDMA, packets of data are sent in sequence every few microseconds.

Because different users' packets have their own time slots, many users can share the same data subcarrier. With FDMA, each user is assigned a particular frequency. Time and frequency assignments are scheduled and controlled by the transponder owner's computer and are invisible to the end-user.

TDMA data distribution is technically superior to FDMA because of freedom from crosstalk and small bandwidth requirements. However, it is not as popular as FDMA distribution in this country because of large computer memory and critical clocking requirements. In cases where there is no video carrier, data is usually handled by the satellite as a single channel per carrier (SCPC) signal.

What's next?

The future of communications satellites lies in orbital platforms. These platforms will provide the TV industry with almost unlimited transmission capability. This new technology cannot be equaled by current terrestrial methods such as cable, microwave or even fiber optics. The continued growth of satellite use will provide the most cost-effective and reliable TV communications possible.



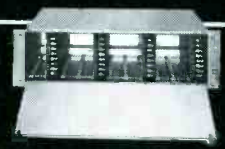
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VAR005	3-7	Continuous	Trimmer	.20	.2 Max.	**N.A.	3⅝ x 1½ x 1¼
VAR011	0-11	Continuous	Trimmer & Toggle	.20	.25	**N.A.	4⅜ x 2⅜ x 1 1/16
VAR256	0-256	Continuous	Trimmer & Toggle	.15	.4	18	4⅜ x 2⅜ x 1 1/16
VAR320	0-320	Continuous	Trimmer & Toggle	.20	.4	22	4⅜ x 2⅜ x 1 1/16
VAR640	0-640	Continuous	Trimmer & Toggle	.80	.5	27	4 11/16 x 3 11/16 x 2 1/16
VP0010	0-10.5	.5	Toggle	.15	.2	3	4⅜ x 2⅜ x 1 1/16
VP0127	0-127	1.0	Toggle	.15	.3	14	4⅜ x 2⅜ x 1 1/16
VP0255	0-255	1.0	Toggle	.15	.3	16	4⅜ x 2⅜ x 1 1/16
VP0317	0-317.5	2.5	Toggle	.15	.3	20	4⅜ x 2⅜ x 1 1/16
VP0635	0-635	5.0	Toggle	* .50	.4	25	4 11/16 x 3 11/16 x 2 1/16
VP1100	0-1100	10.0	Rotary	1.25	.4	30	4 11/16 x 3 11/16 x 2 1/16
VP1270	0-1270	10.0	Toggle	*3.00	.4	30	4 11/16 x 3 11/16 x 2 1/16
VP2075	0-2075	25.0	Toggle	*3.00	.5	40	7⅜ x 4 11/16 x 2 3/16
VW0317	0-317.5	2.5	Strap	.25	.4	28	5 x 3½ x 2
VW0635	0-635	5.0	Strap	.60	.5	33	5 x 3½ x 2
VW1270	0-1270	10.0	Strap	1.25	.5	33	6½ x 3½ x 2
VW2075	0-2075	25.0	Strap	2.50	.5	40	6½ x 3½ x 2
RACK MOUNTABLE UNITS							**Not Applicable.
VRM011	0-11	Continuous	Trimmer & Slide	.30	.3 Max.	10	1¼ x 4⅛ x 4
VRM0255	0-255	1.0	Slide Switch	.40	.4	20	1¼ x 4⅛ x 4
VRM0637	0-637.5	2.5	Slide Switch	*1.00	.4	28	1¼ x 4⅛ x 6
VRM1275	0-1275	5.0	Slide Switch	*3.00	.4	33	1¼ x 4⅛ x 9
VRM2270	0-2270	10.0	Slide Switch	*3.00	.5	40	1¼ x 4⅛ x 9
VRS0317	0-317.5	2.5	Strap	.40	.5	26	1¼ x 4⅛ x 4
VRS0635	0-635	5.0	Strap	.75	.5	35	1¼ x 4⅛ x 6
VRS1270	0-1270	10.0	Strap	1.50	.5	37	1¼ x 4⅛ x 9
VRS2260	0-2260	20.0	Strap	3.00	.5	40	1¼ x 4⅛ x 9

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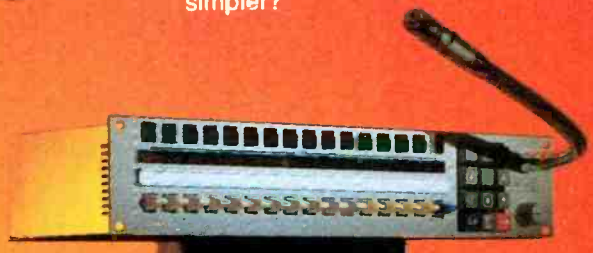


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Philips LDK 6 camera

By Joe Bruno

In mid-1985, WMAR-TV began an upgrade of its 22-year-old broadcasting facility, representing an approximate $3 million investment when completed. The end result has been much-needed improvements in versatility and productivity in on-air news operation, which includes four newscasts a day, and in spot and program production. An equally important result of the investment has been a dramatically improved on-air look for the station.

An important component in this rebuilding program was the replacement of our original multicore-cabled color camera system. Because we had previously used multicore cable in all of our facility, we were familiar with the problems it can cause.

Our master plan for upgrading called for expanding our camera cabling network so cameras could be located in several locations. We wanted the flexibility to quickly move cameras to the news or production studios, newsroom, back lot, roof or garage. The ability to quickly move cameras from one location to another location was important to the programming staff.

To satisfy our need for improved productivity, we considered only computer-based cameras, which offered a triax head/CPU interconnection. Although several companies can offer an extra-cost option for operation on triax, we decided that the best performance could only be obtained from a camera that was designed from the ground up to operate on triax cable. We had the additional requirement that the camera had to be capable of complete remote control and instant-on operation at every location.

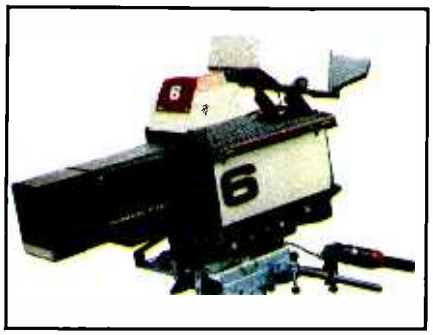
Camera selection

After strenuous technical comparisons and operational evaluations, WMAR selected the Philips triax-based LDK 6 camera. We installed four of the units in November and their performance specifications and features immediately provided the increased productivity and improved station look that we wanted.

The LDK 6 is fully microprocessor-controlled. The camera uses separate microprocessors located in the camera head, camera processing unit, master control panel and common control panel. Each microprocessor can communicate with the others, enabling a constant check on the status of the system. Each camera also has its own set-up computer. Because of the distributed intelligence of the system, it is possible to set up any number of camera chains independently, simultaneously and automatically. This feature is important to our operation.

The camera control system is completely digitally controlled. D/A converters using pulse-pot technology permit manual and automatic adjustments over the total range of the system. An example of the advantage of computer control is shown in Figure 1. Conventional scanning correction schemes only check three points for 100% correction.

A total of 49 points are individually corrected under the control of the automatic set-up facility. This results in a threefold reduction in registration error. Corner scanning errors are reduced to less than 40ns as opposed to 120ns with other cameras. The 49-area automatic correction is also applied to black shading, white shading and focus. (See Figure 2.)



Performance at a glance

- *Triax-based studio camera system*
- *Digital scan correction with 49 sample points*
- *Six operational, two setup and four lens memories for quick camera adjustment*
- *Two comprehensive diagnostics systems, on-line and off-line-on demand*
- *Full automatic control over most levels*
- *Built-in test projector/diascope*

Digital memories

The camera provides six operational, two set-up and four lens memories. All six operational memories can be recalled, providing immediate access to pre-arranged special production effects or lighting conditions. For special creative and technical applications, more than 700 parameters can be stored in two separate set-up memories. Up to four lens types and matching characteristics can be stored for use as needed.

There are two built-in diagnostic systems. The first operates on-line and is active whenever the camera is being used. If important characteristics deviate from normal, the system will warn the operator and provide a character display readout on the engineering monitor. The second system operates when the camera is off-line. Upon demand, the system uses signal injection techniques to locate faults. If any faults are detected, their location is displayed on the picture monitor.

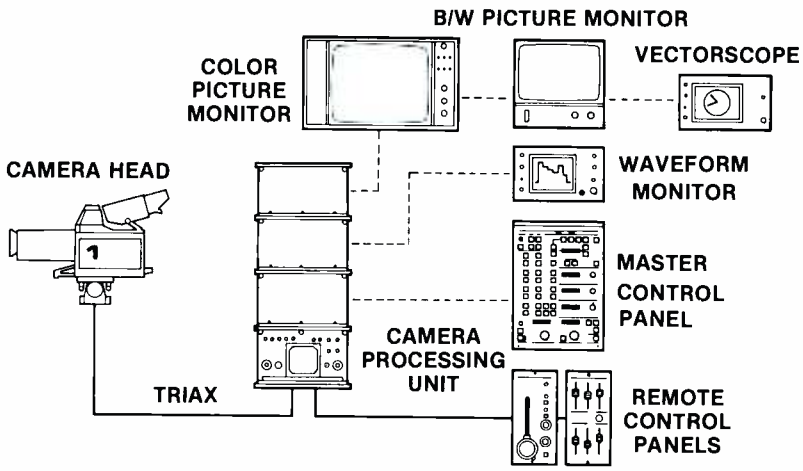
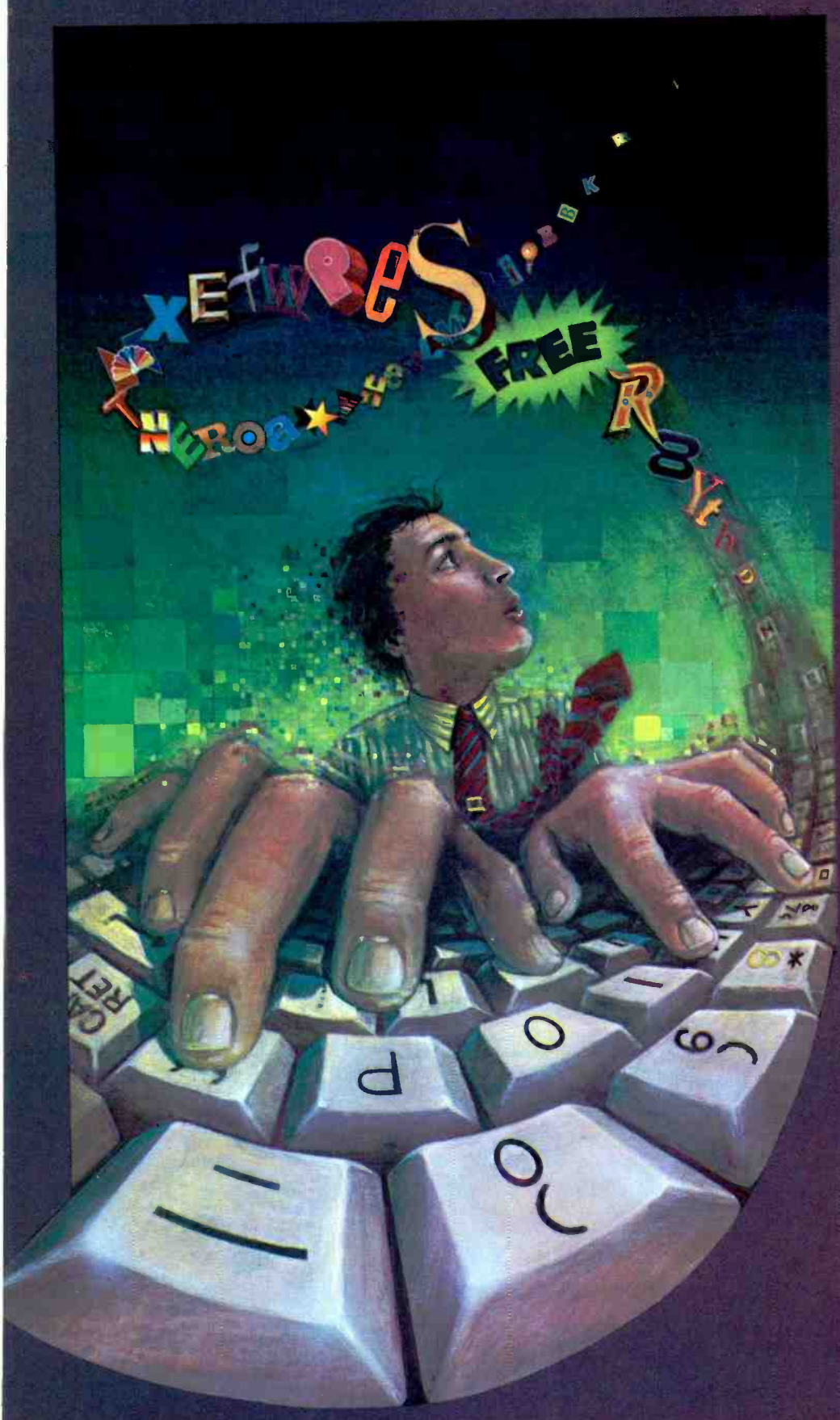


Figure 1. *The diagram illustrates a simple configuration, with the camera head linked to the camera processing unit by triax cable. This unit in turn is linked to the remote control unit.*

Bruno is vice president/engineering at WMAR-TV, Baltimore.

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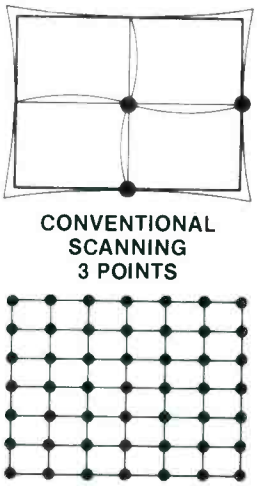


Figure 2. *With conventional scanning techniques, only three points are adjusted for 100% registration. The LDK 6 uses a digital scan correction scheme utilizing 49 points for improved registration. Typical corner error is less than 40nS.*

The camera is fully automatic. It is even possible to automatically set up the camera after tube replacement, without any manual presetting. In this instance, reference green is automatically aligned to a digital electronic test pattern, with red and blue subsequently aligned to green.

Installation

An unexpected advantage of the modular design and the distributed microprocessor controllers and bus architecture was realized the first weekend we put the cameras on-line. We had pulled and terminated all the triax runs and camera system cables earlier, but continued using our multicore cameras until sign off early Saturday morning. Technicians from Philips worked with us through the morning and all day Saturday to complete the installation.

We went on the air using the new cameras with the 6 p.m. news Saturday. The toughest job was plugging in the cables and powering up the system. The internal microcomputers completed the task of checking out and aligning all the components.

System versatility

Triax is today's hands-down choice for upgrading any facility where camera heads must be mobile and capable of radio set-up anywhere on the premises. The first advantage of triax is that you can buy three triax cables for the cost of one multicore cable.

Second, the time and expense involved

Continued on page 320

The triax system

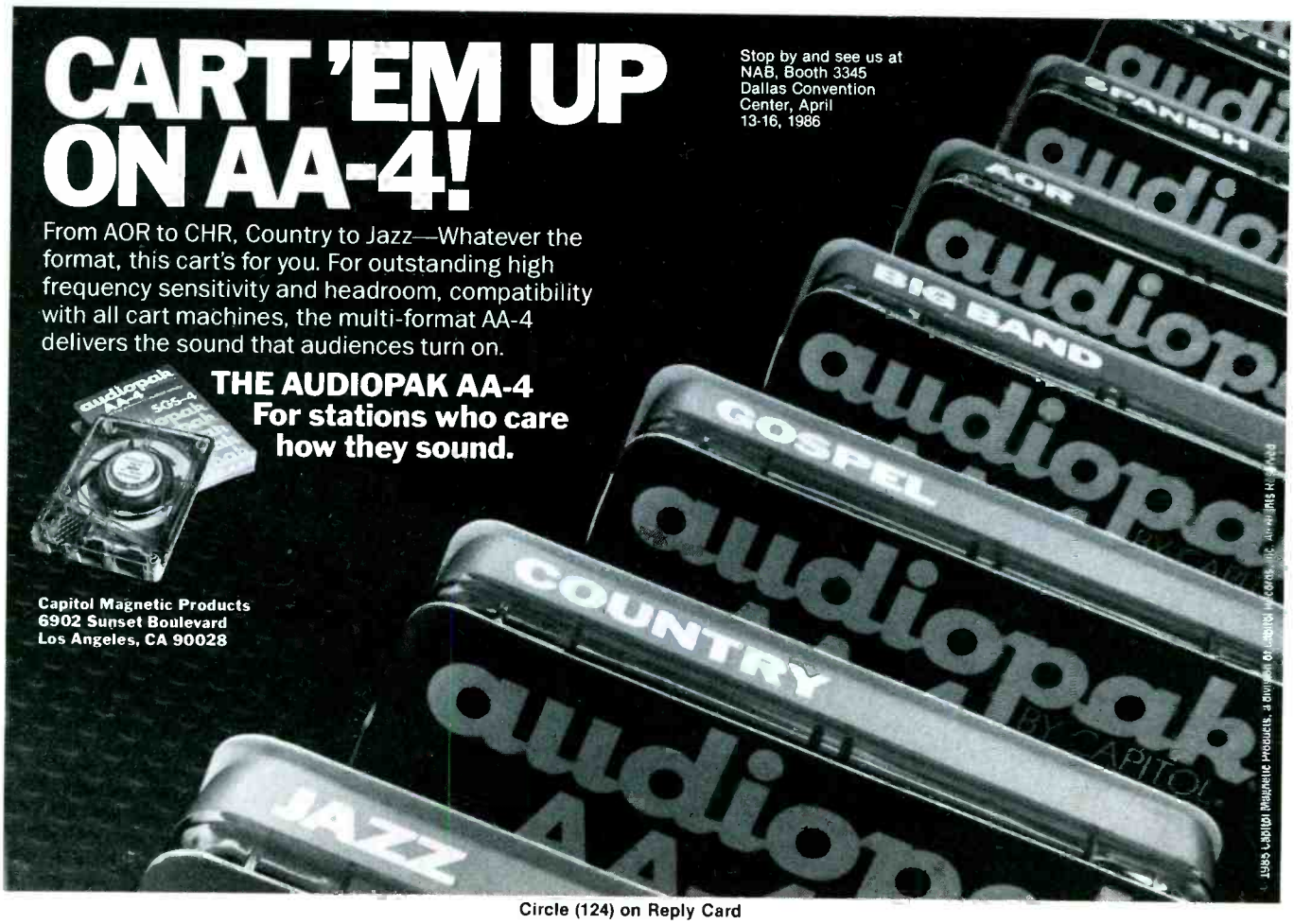
There are two basic methods to interconnect camera heads and camera control units. Some cameras use multicore cable, relying on individual conductors of the cable for each type of signal. Because of the number of signals required in a broadcast installation, these multicore cables are usually large, heavy and prone to failure. The most common failure occurs with the connectors, which may have 80 or more pins.

Triax cable consists of a cable with a single center conductor and two axial screens. Because the camera and CCU are connected with this type of cable, there is less chance for connector problems to develop. This system does require special circuits that add other types of complexity to the camera and CCU, however.

The Philips triax system breaks down the cable into three separate frequency bands. The lower band is used for the 400Hz power line, the middle band for the audio intercom channels and the upper band for the video information.

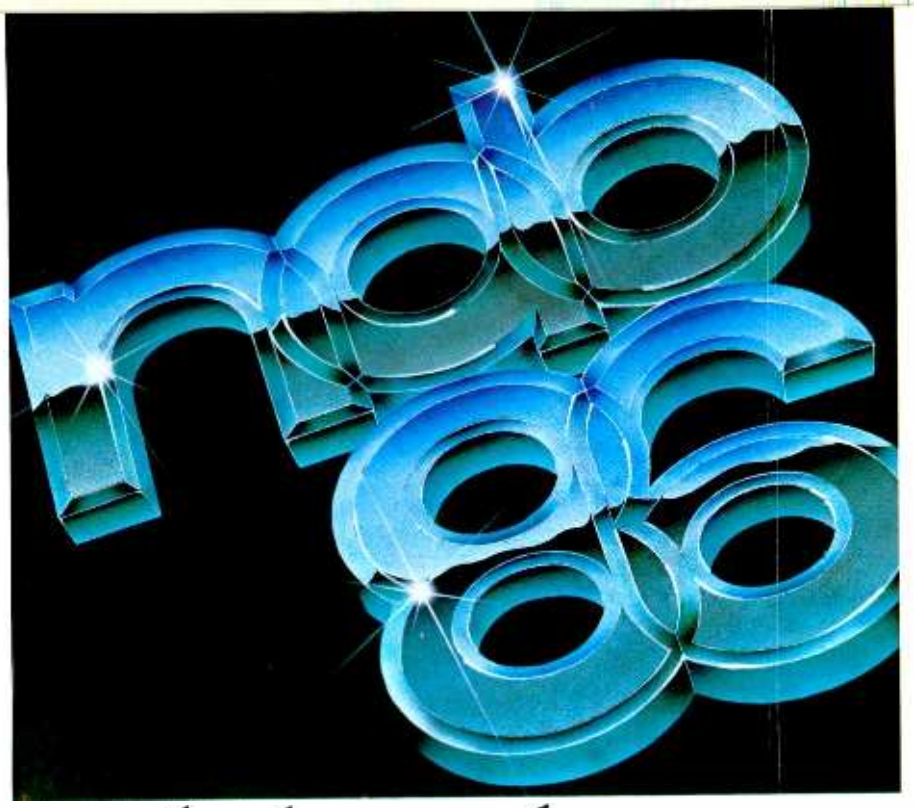
Ten interleaved channels are used

Continued on page 319



Circle (124) on Reply Card

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Exhibitor listings

If your mid-April plans include attending the 64th annual NAB Convention and International Exposition, our pre-show coverage can help you plan your convention stops.

On the following pages are listed many of the new products to be introduced at this year's exposition. During the past few weeks, the **BE** staff has been in contact with nearly all of the 628 exhibitors. Although we learned the plans of most of these manufacturers, some were unable to tell all, so expect a few surprise introductions as well.

Below each exhibitor listing are two more numbers. The number on the left that reads "Circle (#)" is the number on the Reader Service Card that you may circle to receive additional information from that manufacturer. If the exhibitor is advertising in this issue, the page of the advertisement is indicated by the red callout reading, "See ad page #." You may obtain more information about the company and its products by referring to the ads.

Although this listing is as comprehensive as possible at press time, there are changes and additions occurring every day in exhibitor signups, products to be shown and booth assignments. Check the final program at NAB '86 to make your final plans.

To help you locate the display booths of specific exhibitors, we have provided an exhibitor map of the Dallas Convention Center (see page 191). The convention center's lower level includes 100, 200 and 2,000 series exhibits. Manufacturer names in red on the map indicates advertisers. The upper level of the center will include a number of large presentations in the 3,000 series exhibits.

At press time, our count showed 628 companies booked into the show. Because others were continuing to make arrangements for exhibits, however, some booth numbers are likely to change. An updated **BE** map will be available in the publications area at the convention center.

Finally, if you are looking for particular types of equipment or services, turn to the Product Directory, beginning on page 291. There are a total of 96 categories of equipment and communications services under which companies have been listed for reference. Booth numbers have also been provided.

An extensive technical program has been scheduled for the convention. NAB is continuing to complete the program plans and, at press time, had not yet provided a final copy of the program. Whether you're interested in learning more about new technologies or in obtaining hands-on advice in dealing with current technical problems, check the final program schedule.

Hotel space is filling rapidly, so if you are planning to attend NAB '86, we suggest that you make lodging arrangements soon.

ADC Telecommunications **(2819)**

Introductions

- PATCH kit complete patch bay kit for the do-it-yourselfer; features as with prewired units.
- SAILS kit: self-adhesive identification labeling system, for almost any patch bay.

Product line

Patch panels, cords; patching ID labels; hum-stop coils.

Circle (501)

ADM Technology **(3266)**

Introductions

- BCS3243-PC; a personal computer interfaced to BCS3243 mixing console; stores, recalls mixer setups and setup sequences.

Product line

On-air, production audio mixing consoles; audio DAs.

Circle (502) **See inside front cover**

AEG Telefunken **(2700)**

Introductions

- M-20, M-21 series: professional reel-to-reel audiotape recorders.

Product line

FM transmitters; audio recording equipment.

Circle (503)

A.F. Associates **(3141)**

Introductions

- Access: Audix digital intercom systems.
- Audix assignable audio consoles.
- Pegasus: commercial compilation system.

Product line

Turnkey video, mobile systems; commercial compilation systems; telecines; intercoms; audio mixers.

Circle (504)

www.americanradiohistory.com

The PR99 MKII is a fully professional, balanced in/out ATR that's priced perfectly for broadcasters on a budget. Although compact in size, the PR99 MKII scores big on production features, audio performance, and long term reliability.

NAB Booth 3048

Help for Deadline Dodgers When deadline pressure hits, the PR99 MKII comes to your rescue with new microprocessor-controlled cueing and editing features: A highly accurate real time counter. Zero locate and address locate to find your cue and stop right on the money. Plus auto repeat for timing and rehearsing. The seconds you save will show in your production quality ... and your blood pressure. Other features include edit mode, tape dump, self-sync, input and output mode switching, input and output level calibration, and front-panel vari-speed. Console, remote control, and monitor panel available as options.

Count on It The Swiss-engineered PR99 MKII has earned its reputation for reliability. From the massive die-cast chassis to the servo capstan motor, every part is milled and drilled to fit right and stay put. For a long time. Modular electronics simplify maintenance and servicing.

Pure Performance Purity of sound reproduction has long been a hallmark of Studer Revox recorders, and the PR99 MKII is no exception. Noise, distortion, and frequency response specs rival those of recorders costing far more.

All This for Not Much Competitively priced, the PR99 MKII carries the lowest suggested list price in the under-$2500 class. For more information, contact your Revox Professional Products Dealer. Find out how easily you can fit the PR99 MKII's balanced performance into your station's budget.

STUDER REVOX

Studer Revox America, Inc., 1425 Elm Hill Pike, Nashville, TN 37210/(615) 254-5651

Circle (102) on Reply Card



www.americanradiohistory.com

Canon Quality. Canon Value.

Now available in a full line of camera support products.

MC-200/MC-300 PEDESTALS



Featuring Canon's sophisticated Modular Cassette Counterbalance (MCC) system that makes them far lighter and more mobile, Canon pedestals also feature a very short mounting height, making them ideal for low-angle shooting.

MC-200
Maximum Mounting Weight: 286 lbs.
Elevation: 24-49 inches

MC-300
Maximum Mounting Weight: 242 lbs.
Elevation: 23-60 inches

TR-60/TR-90 TRIPODS



Featuring collapsible tubular leg construction, integral spreaders, flip-tip legs with spikes and rubber padding.

TR-60
Maximum Mounting Weight: 132 lbs.
Elevation: 20-45 inches

TR-90
Maximum Mounting Weight: 198 lbs.
Elevation: 26-48 inches

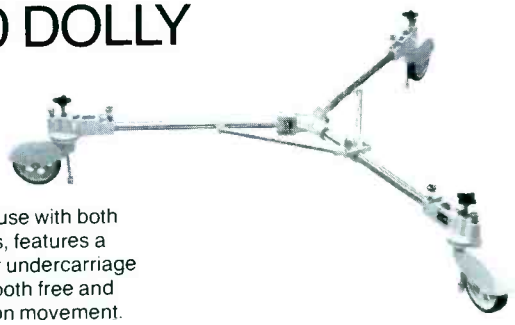
SC-15 CAM HEAD

Designed for use with all pedestals and tripods, it features a convenient "V" wedge mounting system and center-of-gravity adjustment control. The modular panning rod may be used on both sides.

Maximum Mounting Weight: 330 lbs.
Tilting: ±50° Panning: 360°



CD-10 DOLLY



Designed for use with both Canon tripods, features a tricycle caster undercarriage that enables both free and single-direction movement.

Maximum Mounting Weight: 198 lbs.

For years, broadcasters have made Canon lenses a top choice for studio, field and news production because they know and trust Canon's proven commitment to quality and value.

Now Canon is proud to introduce a complete, full-featured, high-quality camera support system, built to the same high standards and backed by the Canon service network.

Canon®

Optics Division
Canon USA, Inc., Head Office: One Canon Plaza, Lake Success, NY 11042 (516) 488-6700
Dallas Office: 3200 Regent Blvd., Irving, TX 75063 (214) 830-9600 Chicago Office: 100 Park Blvd., Itasca, IL 60143 (312) 250-6200
West Coast Office: 123 Paularino Avenue East, Costa Mesa, CA 92626 (714) 979-6000
Canon Canada, Inc., 6390 Dixie Road, Mississauga, Ontario L5T1P7, Canada (416) 678-2730

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Circle (132) on Reply Card

www.americanradiohistory.com

Canon Broadcast

Designed to meet all your



PV4Cx13.5BIE for 30mm and 25mm cameras.
The Olympian—proven at the 1984 Olympic Games, its 40X reach is perfect for sports and all outdoor broadcast operations.

Focal length: 13.5-540mm (27-1080mm w/built-in extender)
Max. Relative Aperture*: 1:1.7 through 270mm
*25mm format 1:2.8 at 540mm



P18x15BIE for 30mm and 25mm cameras.
The Widest—a very wide 60° angle of view plus incredible edge-to-edge sharpness, fidelity and sensitivity. Supplied with 1.5X and 2X built-in extenders plus pattern projector.

Focal length: 15-270mm (30-540mm w/2X extender)
Max. Relative Aperture*: 1:2.1 through 218mm
*25mm format 1:2.7 at 270mm



PV14x12.5BIE High Resolution Lens for 30mm and 25mm cameras.
A Unique Design—featuring extensive use of Fluorite lens elements, this lightweight, compact 14X studio lens provides high sensitivity and critical sharpness at all focal lengths.

Focal length: 12.5-175mm (1.5X and 2X extenders built
Max. Relative Aperture*: 1:1.6 at all focal lengths
*25mm format



J15x8.5BIE for 2/3" cameras.
2/3" Economy—full utility for all studio situations, combining a 15X zoom ratio with an M.O.D. of under two feet, a 54° angle of view and high sensitivity throughout the range.

Focal length: 8.5-128mm (17-256mm w/built-in extender)
Max. Relative Aperture: 1:1.6 at all focal lengths



J18x9BIE for 2/3" cameras.
Greater Reach, Lighter Weight—nothing matches the 18X zoom power of this lens—and it weighs less than 4 lbs.! It increases the flexibility of any portable camera.

Focal length: 9-162mm (18-324mm w/2X extender)
Max. Relative Aperture: 1:1.7 through 116mm
1:2.4 at 162mm



J14x8 BIE High Resolution Lens for 2/3" camera
Super wide (60°) and super sharp from corner-to-corner. This compact lens also provides a 14X zoom ratio and built-in 2X extender.

Focal length: 8-112mm (16-224mm w/built-in extender)
Max. Relative Aperture: 1:1.7 through 91mm
1:2.2 at 112mm

www.americanradiohistory.com

Television Lenses.
needs. Now and in the future.



NEW

J45x9.5 BIE for 2/3" cameras.
Incredible 45X reach with your 2/3" cameras! Perfect for sports and all outdoor E.F.P. applications.

Focal length: 9.5-430mm (19-860mm w/built-in extender)
Max. Relative Aperture: 1:1.7 through 201mm
1:3.0 at 430mm



J25x11.5BIE for 2/3" cameras.
Greater Reach—a 25X zoom lens designed specifically for 2/3" cameras. The power and scope of 1" systems, the economy and efficiency of your 2/3" cameras.

Focal length: 11.5-288mm (23-576mm w/2X extender)
Max. Relative Aperture: 1:1.6 through 220mm
1:2.1 at 288mm



J20x8.5BIE for 2/3" cameras.
Two Assignments—use a 13X zoom for ENG, use the J20x8.5BIE for studio or outdoor broadcast assignments—with the same 2/3" camera!

Focal length: 8.5-170mm (17-340mm w/2X extender)
Max. Relative Aperture: 1:1.6 through 130mm
1:2.1 at 170mm



J13x9BIE for 2/3" cameras.
The Portable Standard—used by cameramen around the world under all conditions, the J13x9BIE is a proven performer with superior sharpness and sensitivity.

Focal length: 9-118mm (18-236mm w/2X extender)
Max. Relative Aperture: 1:1.6 through 99mm
1:1.9 at 118mm



J15x9.5 for 2/3" cameras.
Quality plus Economy—you can't buy more lens for less money. Lightweight and sensitive, it meets the needs of both cameramen and accountants yet lives up to its Canon name.

Focal length: 9.5-143mm
Max. Relative Aperture: 1:1.8 through 112mm
1:2.3 at 143mm



NEW

J8x6 B Ultra Wide-Angle Lens for 2/3" cameras.
The widest of the ultra-wide zooms at 72.5°, this incredible 8X lens also has a M.O.D. on only 11"—it's great for interviews!

Focal length: 6-48mm
Max. Relative Aperture: 1:1.7 through 33mm
1:1.9 at 48mm

Canon®

Optics Division

Canon USA, Inc., Head Office: One Canon Plaza, Lake Success, NY 11042 (516) 488-6700
Dallas Office: 3200 Regent Blvd., Irving, TX 75063 (214) 830-9600. Chicago Office: 140 Industrial Drive, Elmhurst, IL 60126 (312) 833-3070
West Coast Office: 123 Paularino Avenue East, Costa Mesa, CA 92626 (714) 979-6000
Canon Canada, Inc., 6390 Dixie Road, Mississauga, Ontario L5T1P7, Canada (416) 678-2730

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Circle (133) on Reply Card

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AKG Acoustics (2521)
Introductions
- C460: microphone housing with integral pre-amp module.
- CK3X capsule: mic element, hypercardioid response.
- CK61/CK62: ULS series cardioid and omnidirectional capsules for C460B mic assembly.
- Q-34: combination headset with boom.
- K-240DF: studio monitor headphones.

Product line
Dynamic, condenser mics; headsets; mic stands, booms, accessories; phono cartridges; record care products; audio delay systems.
Circle (505) **See ad page 248**

AMCO Engineering (3426)
Product line
Equipment consoles, computer desks, EMI cabinets; aluminum structural systems; blowers, fans.
Circle (535)

AMEK Consoles (2558)
Introductions
- Model BC2: broadcast audio console.
- APC 1000: assignable production audio console.

Product line
On-air, production, recording audio consoles; rack signal processing systems.
Circle (536) **See ad page 57**

AMP Products (2764)
Product line
Connectors, connector installation tools.
Circle (506)

ANT Telecommunications (2745)
Introductions
- Telcom c4E: noise reduction module; for OEM equipment designs.

Product line
Noise reduction systems for ATR/VTR, telco line, STL and satellite applications.
Circle (507)

ART/Applied Research & Technology (236)
Introductions
- Model 173: balanced equalizer, 2/3 octave.
- Model 174: balanced equalizer, 1/3 octave.
- Model 240: software enhancements.

Product line
Audio processing and delay systems.
Circle (508)

ATI-Audio Technologies (2508)
Introductions
- BC8DSR/BC8DSL: Vanguard audio consoles; 8-mixer system, rotary or linear slider; dual stereo outputs, each with mono sum.

Product line
Interfacing units; mic, phono pre-amps; audio line, monitor, distribution amps; audio processors.
Circle (509)

AT&T Communications (3401)
Product line
Program distribution services; teleconferencing; information management; data services.
Circle (510)

AT&T Information Systems
AT&T Electronic Photography (3212)
& Imaging System
Introductions
- TARGA16: Truevision advanced raster graphics Adapter; frame grabber, buffer PC board.
- TFP: Truevision film printer; 3 x 4-inch instant color prints; attachments for 35mm film and XPCY's.
- STS: Truevision still-frame teleconferencing software; point-to-point picture transmission software for Image Capture board.

Product line
PC-based software and hardware for imaging and communications.
Circle (511)

AVS/Applied Video Systems (148)
Product line
TV video standards converters.
Circle (512) **See ad page 55**

Abbott & Company (2479)
Introductions
- Safety lock: high-power connector interlock; assures ground connection first.

Product line
Wiring harnesses; power cords.
Circle (513)

Abekas Video Systems (3527)
Product line
Digital still stores with library systems; single, dual channel effects systems; digital disk recorders.
Circle (514)

Accu-Weather (2761)
Introductions
- Satellite delivery: FAA 604, NAFAX, DIFAX and other weather data services available through SISCORP Satellite System.
- WeatherMate 350: interface, allows DIFAX charts to be produced with inexpensive printers.

Product line
Weather graphics, information services; printer interface.
Circle (515)

Acquis (3252)
Introductions
- ECS-225: edit controller; 8-machine system; any mix of VTR formats; fully assignable.
- ECS-195: two-machine edit controller; features include time code, full list management.

Product line
Single source to full A/B/C roll editing control systems.
Circle (516)

Acrian (2458)
Introductions
- Broadband RF amplifiers; models TV120U, TV60U, TV30U, TV10U and FM200A.

Product line
Transistors and power amplifiers for TV and FM radio.
Circle (517)

Acrodyne Industries (3521)
Introductions
- TRL30KA/TRH30KA: 30kW VHF TV transmitters, externally diplexed; low- and high-band systems.
- TRL60KA/TRH60KA: 60kW VHF TV low- and highband transmitters; external diplexing; parallel configurations.

Product line
Low-power UHF TV transmitters.
Circle (518)

Adams-Smith (2488)
Introductions
- 2600CC: compact controller; combines integrated multitransport controls and audio editing; light weight; audio-for-video synchronizing system.

Product line
Audio, video editing system; time-code systems; machine synchronizers.
Circle (519)

Advanced Designs (2419)
Introductions
- DOPRAD II: Doppler weather radar; 8-plane graphics; 256 colors on screen, 16.8 million color palette; range height indicator for vertical storm cross-section; 5-320 nautical mile range; auto-sequencing.

Product line
Weather radar display systems; Doppler retrofit systems.
Circle (520)

Advanced Imaging Devices (NA)
Introductions
- VPS1600: video photo system.

Product line
Videograph printers.
Circle (521)

Advanced Music Systems (2919)
Introductions
- AudioFile: hard-disk digital audio record/play system; linear 16-bit sampling; multihour record time.

Product line
Digital reverb, delay systems; pitch changers; time compression systems.
Circle (522)

Agfa-Gevaert (2815)
Introductions
- PE616/618: bulk audio cassette tape; low noise, iron oxide tape; increased high end response for compatibility with standard I designation.
- VHS Studio Performance: cassette medium; formulation for lower dropout, increased S/N ratio; improved ABS shell withstands variations in temperature and humidity; tabs out, 1-way screws for security.

Product line
All videocassette tape formats; bulk and pancake tape media; duplicator tape.
Circle (523)

Alamar Electronics USA (2582)
Introductions
- MC-500: low end Kart system.
- TL-2500: tape library control system.
- SC-3000: automated machine controller with SMPTE time code.

Product line
Broadcast program automation systems; station business automation systems.
Circle (524) **See ad page 72**

Alden Electronics (2759)
Product line
Single and multiframe color weather radar systems.
Circle (525) **See ad page 47**

Alexander Manufacturing (2926)
Product line
Batteries, chargers, analyzers.
Circle (526) **See ad page 78**

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Leaders in Signal Switching and Control



CONTROL

That A Ballerina Would Appreciate.....

Is by way of introducing a new era in video switching *control*. Like the ballerina whose quality of dance expression demands absolute control, broadcasters can now achieve new levels of *control* over their video switching matrix.

To become a "video choreographer", start with just 21 buttons. Add our Series 1 Control Computer. Select from a library of firmware. Put it all in a 1¾" package and call it the PCA-904A. Now you've got a switcher *control* tailored for today's job . . . reprogrammable for tomorrow's.

Choice of functions is limitless, and most features are available for EVERY Series 10, Series 25 and System 21 matrix EVER BUILT!

- **Simple Operation**–downloadable input assignments, one per button
- **More Inputs**–reprogrammable as 100 input, downloadable alpha-numeric controller
- **Compact**–a multi-bus controller in a 1¾" package
- **Rearrange Matrix**–stores up to 20 salvos, one per button
- **Sequential Control**–individual dwell adjustment with random order sequencing
- **Restricted Access**–downloaded from system controller

Try *THAT* in any other 1¾" rack-mounted panel!

And that's only a sample of what the powerful Series 1 Control Computer can do in just one configuration. Multi-level control, alpha displays and VDT interfaces are offered in other packages. The Series 1 can also give YOUR custom *control* panel all these features plus others you program yourself.

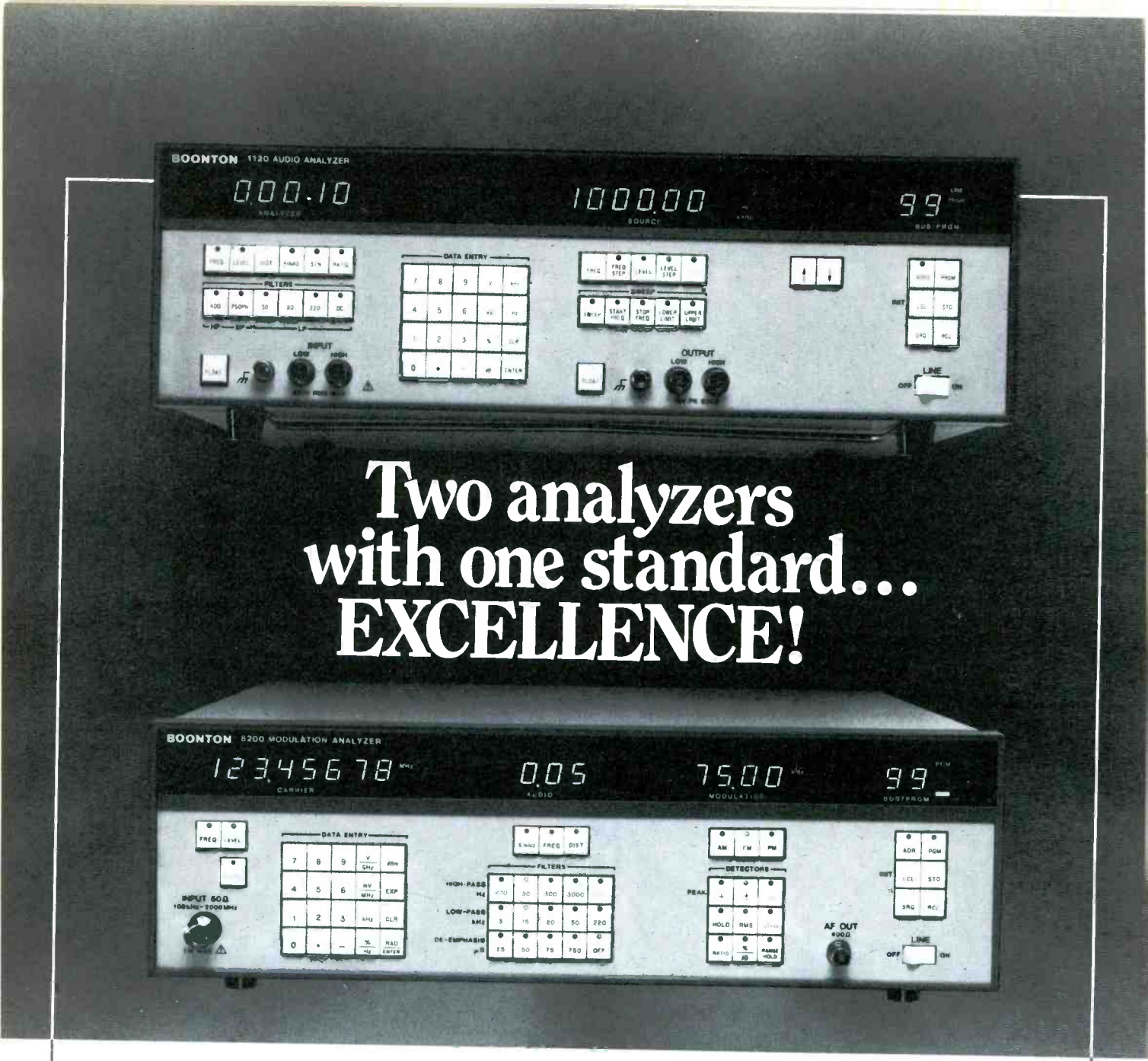
Isn't it time you assumed absolute control!

DYNAIR

5275 Market Street, San Diego, California 92114 • (619) 263-7711

Circle (134) on Reply Card

www.americanradiohistory.com



Two analyzers with one standard... EXCELLENCE!

1120 AUDIO ANALYZER

Characterize audio signals with ease from 5 Hz to 200 kHz, or audio devices using the built-in, low distortion source.

Measure:

- ☐ Frequency to 0.0001%
- ☐ Distortion in dB or %
- ☐ SINAD and signal-to-noise
- ☐ AC/DC voltage

8200 MODULATION ANALYZER

Both baseband and modulated carrier signals can be accurately analyzed with the versatile 8200.

Measure:

- ☐ Carriers from 100 kHz to 2 GHz, both frequency and level
- ☐ FM/AM/ΦM
- ☐ Baseband frequencies to 200 kHz
- ☐ Audio distortion in % THD or SINAD

Both the 1120 Audio Analyzer and the 8200 Modulation Analyzer are equally at home on the bench or over the bus. Both can store up to 99 complete panel setups for easy repetitive bench testing. Both feature a IEEE-488 interface as standard equipment for sophisticated system application. And, best of all, both offer superior performance at a price below the competition. Call your local representative or Boonton directly for a convincing demonstration.

Boonton Electronics Corp.
791 Route 10, Randolph, NJ 07869
Telephone (201) 584-1077

Signal Generators ■ Modulation Analyzers ■ RF Power Meters ■ RF Millivoltmeters
Capacitance Meters and Bridges ■ Audio Test Instruments

BOONTON

Circle (137) on Reply Card

www.americanradiohistory.com

Alias Research (2497)

Introductions

- Alias 1: graphics design system; real time 3-D system; scan in, video in; video out, video printer out; Abekas A62 interface; for post-production and other applications.

Circle (572) See ad page 289

Allen Avionics (2724)

Introductions

- VNE-75: video noise eliminator for high-resolution TV and wide bandwidth applications.
- VES series: equalized spiradel delay lines for standard and wideband video.
- VW0317, VW635, VW1270, VW2075: video and pulse delay lines.

Product line

Video, LC, switch-variable delay lines; video LC filters, hum eliminators.

Circle (527) See ad page 184

Allied Broadcast Equipment (3414)

Introductions

- Furniture: studio furnishings; prompt, overnight shipping service.

Product line

Distributors of audio and RF products.

Circle (528)

Allied Tower (3432)

Product line

Tower products for all types of communications facilities.

Circle (529)

Alpha Audio (102)

Introductions

- SONEX: additional forms of acoustic materials.
- Expanded line of noise barriers, sound absorbers.

Product line

Acoustical materials; sound control products.

Circle (530) See ad page 330

Alpha Automation (203)

Product line

Automated audio editing systems.

Circle (531)

Alpha Video & Electronics (2524)

Introductions

- VO-6800: VCR modification increases video response to NTSC bandwidth; SMPTE time-code post-striping from uP generator in RF compartment, code display provided; balanced audio; S/N 45dB to 50dB; for many type 5 VCRs.
- Direct 3/4: direct color operation, playback of color-under and SP tapes, no increased tape consumption; noise reduction; on-board TBC; field retrofit; for type 5 and BVU-800 series.

Product line

Alphatized modifications for VCR products.

Circle (532)

Alta Group (150)

Introductions

- Pyxis system: digital production system; A/B roll editing with two 16-TVL TBCs, sync generator and audio processing.
- Pyxis-P: PAL digital production system.
- Cygnus: single channel effects unit; picture freeze, strobe, posterize, mosaic, fade and image enhancement.

Circle (533)

Amber Electro Design (2741)

Introductions

- System 5500 enhancements: software features; stereo phase, dcV; for distortion/noise measurement system.

Product line

Programmable audio test systems; manual audio test systems; frequency, stereo switch matrices.

Circle (534)

American Diversified (2623)

Introductions

- Nationwide paging system via radio subcarriers.

Circle (573)

Ameritext (2789)

Product line

Teletext, video text services, systems.

Circle (537)

Amherst Electronic Instruments (107)

Introductions

- Digital video image processor.
- Editing controller system.
- Automation equipment.

Circle (538)

Amperex Electronic (2600)

Introductions

- NXA1010: 604x576-pixel frame transfer CCD device; low noise, good sensitivity; for 3-chip color or single-chip B/W PAL TV camera.
- NXA1030: for NTSC cameras.
- NXA1020, NXA1040: 604x576-pixel CCD devices; stripped filter for single-chip cameras in PAL or NTSC standards, respectively.
- XQ4187: 2/3-inch tube for ENG/EFP; high stability and resolution; diode gun (DG) design.
- XQ3457: 2/3-inch high-resolution DG tube; electrostatic deflection, electromagnetic focus; for ENG/EFP.
- XQ3467: electrostatic focus triode gun tube for 2/3-inch cameras.
- XQ1430: 30mm high resolution tube; triode gun design without bias light for studio cameras. XQ1433, XQ1435: extended red tubes.
- XQ3410: 30mm tube for 1-inch scan; DG design, low capacitance (LOC); high sensitivity, bias light. XQ3415: extended red version.
- XQ3430: 30mm full-scan camera tube; DG LOC design.
- XQ1520: high-resolution anti-comet tail gun for highlight handling; with bias light. XQ1523, ZQ1525: extended red tubes.
- YL1660: high-power AM broadcast tube.
- 9018, 9014, YL1630: VHF power amplifiers with broadband input circuitry.

Product line

Plumbicon camera tubes, diode and triode guns, 2/3-inch, 1-inch and 30mm sizes; high efficiency klystrons; tetrode power tubes; power amp cavities for AM, FM, TV.

Circle (539) See ad page 75

Ampex/MTD/AVSD (3108)

Introductions

- ACR-225: digital cart spot player, 256 cassette on-line capacity.
- Stereo kit: stereo audio record/playback upgrade kit for VPR-2 series VTRs.
- Zeus 1: fully digital video TBC processor; pixel level interpolation, digital velocity compensation; Z-freeze still frames image, audio continues; removes interfield move-

LOST AIR TIME COSTS MONEY

Tentel has gauges for RADIO and TELEVISION stations to keep tape recorders from *turning you off.*



NEW FOR RADIO BROADCASTERS

Finally a good method of sorting good broadcast cartridges from bad ones. Lost air time is expensive if you just let them fail. The new T2-H7-AC tape tension gauge has special offset probes to fit inside the cartridge, to measure dynamic cartridge tension directly. Oscillating tensions or tensions over 3 ounces cause capstan slippage, wow, flutter and splice failure. The gauge lets you know WHICH cartridges to use and WHICH one are faulty. (Also works on ¼" reel to reel recorders.) Prices: $345 to keep you "On the air".



NEW FOR VIDEO BROADCASTERS

A tape tension gauge for Sony, Ampex and Hitachi 1" Type "C" video recorders that will allow fast, easy measurements to make sure that the tape will interchange—tension measurement assures that servo arms and amplifiers are adjusted properly. The *New* T2-H18-CBD has small ball bearing probes to eliminate tape drag effects on the servo. The T2-H18-CBD reads directly in both grams and ounces on its special high resolution scale. Price $690 for recording peace of mind. (Don't wait for the editor to tell you of a tension problem.)



ALSO NEW

The worlds first universal, safe, accurate, easy to use head protrusion and eccentricity gauge—works on 1" Type "C" (Ampex, Sony and Hitachi), all U-matic VCR's and virtually any other video recorder format. Measure in both microns and ten thousandths of an inch so the readings are compatible with all manufacturers specs. The HPG-Combo sells for $825—don't let the low price make you think it's not accurate. So great because it's simple, so unique it's patented. TENTEL has other gauges to help make your life easier for Betacam™ and Recam™ too. We put in a TOLL FREE number so we could help you better-please give us a call, we want to help.

TENTEL CORP. Circle (136) on Reply Card
1506 Dell Avenue
Campbell, CA 95008
TOLL FREE 800-538-6894*
(408) 379-1881
* Except CA

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Ampex, continued

ment.
- No. 467: digital audio cassette, mastering media.

Product line
VTRs; TBCs; digital effects systems; video paint systems; digital still-stores; editing controllers; video production, master control switchers.
Circle (540) **See ads pages 37, 39, 67**

Amtel Systems **(2820)**
Introductions
- Soundmaster editor: audio editing system.
- Synchronizer: tape deck control module for Soundmaster system.

Product line
SMPTE VITC/LTC time-code readers, generators, translators; stereo audio routing switchers.
Circle (541)

Anchor Audio **(2426)**
Introductions
- AN-1000: powered speaker system; 50W MOSFET output; 5.25 inches high.
- AN-1400: powered speaker system; fits 1/2-rack mounts; shielded speaker.

Product line
Battery-operated intercoms, portable sound systems, audio snakes; mic stands.
Circle (542) **See ad page 318**

Andrew **(Outside, 3098)**
Product line
UHF/VHF TV transmitting antennas; circular, elliptical waveguide; coaxial cable and transmission lines; C/Ku earth stations; terrestrial microwave antennas; fiberglass, concrete equipment shelters.
Circle (543)

Angenieux **(3020)**
Introductions
- 14x7: super wide-angle zoom lens; 2/3-inch format.
- 40x9.5: outside broadcast lens (sports), for 2/3-inch cameras.

Product line
TV camera lens systems.
Circle (544) **See ad page 263**

Anton/Bauer **(2729)**
Introductions
- PowerStrap: multipurpose 12V, 4aH, nicad battery strap; for all portable camera, VCR and low-voltage light applications.
- UltraLight: 12V portable video lighting equipment; operates directly off camera battery or with ULPA power adapter.
- LTF-4: linear power supply: 13Vdc 4a from 115Vac/230Vac input; with snap-on mount.

Product line
Batteries, chargers and analyzers; portable lighting products.
Circle (545)

Anvil Cases **(2706)**
Introductions
- Equipment cases: new designs and concepts for teleproduction equipment, rack-mount components and computer-based devices; custom designs.

Product line
Equipment cases meeting ATA and government M.A. C.C. regulations.
Circle (546) **See ad pages 304-305**

Apert-Herzog **(2931)**
Product line
TBCs, frame synchronizers; video distribution amps; digital audio/video memory, editing accessories.
Circle (547) **See ad page 334**

Aphex Systems **(2816)**
Introductions
- Model 103: type C aural exciter acoustic/spectral enhancer.
- Model 700 Dominator: tri-band audio peak processor.

Product line
Audio psychoacoustical enhancement systems; audio processing systems.
Circle (548) **See ad page 265**

Arben Design **(154)**
Introductions
- Cyc-Wedge: cyclorama system for any studio.

Product line
Modular set design systems; set design catalog.
Circle (576)

Arrakis Systems **(2742)**
Introductions
- 600SC: 8-channel audio mixing board.
- 3000SC: modular, 16-channel audio mixer system.

Product line
Audio mixing consoles; audio routing switchers.
Circle (550) **See ad page 35**

Arriflex **(3553)**
Introductions
- Lightflex: on-camera accessory; controls amount of light on scene at the time of exposure; modifies gamma curve in the camera.
- ARRI time code: SMPTE 80-bit code for film; hour, minute, second, frame and 8 hex UB digits burned into each frame.
- ARRI HMI lights: series of lighting instruments; 200W to 12kW.

Product line
16mm, 35mm cine cameras; camera accessories; Zeiss lenses; studio, portable lighting products; portable camera cranes; time-code products.
Circle (551)

Artel Communications **(2920)**
Introductions
- SL3000 options: new capabilities for laser-based video, audio, data transmission system.
- T134: T1/T2 fiber-optic link; for full duplex data to distances greater than two miles.

Product line
Fiber-optic communications links.
Circle (552)

Artronics **(216)**
Introductions
- VGA-3D: video graphics animator.
- VPL: video paint, library system.
- 3-D modeling animation system.

Product line
Electronic videographics systems; animation systems.
Circle (553) **See ad page 157**

Asaca/Shibasoku **(3278)**
Introductions
- ACL-6000: videocassette automation systems, production models; for Betacam or M-II format decks; system software written by Dubner Computer Systems.
- Stereo TV demodulator.

Product line
Video monitors; program automation systems; HDTV monitors, test signal generators; audio, video, RF test equipment; electronic graphics products.
Circle (554) **See ad page 155**

Associated Press **(3395)**
Product line
High-speed radio and TV news wire service; radio networks; CATV videotext service; music and talk show services.
Circle (555)

Associated Production Music **(2650)**
Introductions
- KPM 1337-CD: "Tradewinds" digital compact disc from KPM music library.

Product line
Production music for film, video A/V projects.
Circle (556)

Aston Electronics **(212)**
Introductions
- A-4 titler: high-resolution production character generator; multiple faces; anti-aliased characters.

Product line
Character generators/titlers.
Circle (557)

Auburn Instruments **(2836)**
Introductions
- MC/1-RUCC interface: connects computer to MC/1 machine remote control system.

Product line
Remote control systems.
Circle (558)

Audico **(2720)**
Introductions
- 619 cycler: rewinder attachment; fast-forwards tape to end leader, rewinds; checks for broken, damaged tape.
- 8mm cassette loader.
- VHS spine labels: pressure sensitive sheets.

Product line
Tape loaders, rewinders, timers for VHS, Beta, U-matic videotape audio cassettes and carts; cart, cassette labels.
Circle (559)

Audi-Cord **(3433)**
Product line
Audio cartridge tape recorders and players; twin-deck players.
Circle (560)

Audio Broadcast Group **(2581)**
Introductions
- Turnkey studio system: human-engineered, pre-wired audio on-air or production system with mixer, CD player, audio cart deck, reel-to-reel deck and turntables with support equipment.

Product line
Audio production, on-air control systems.
Circle (561)

Audio & Design Calrec **(2708)**
Introductions
- N series: portable mixers, to 24 inputs; left, right and mono outputs.
- Digitally assignable analog mixing console; for video production, post-production.

Product line

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70 YEARS OF EXPERIENCE IN POWER GRID TUBES...

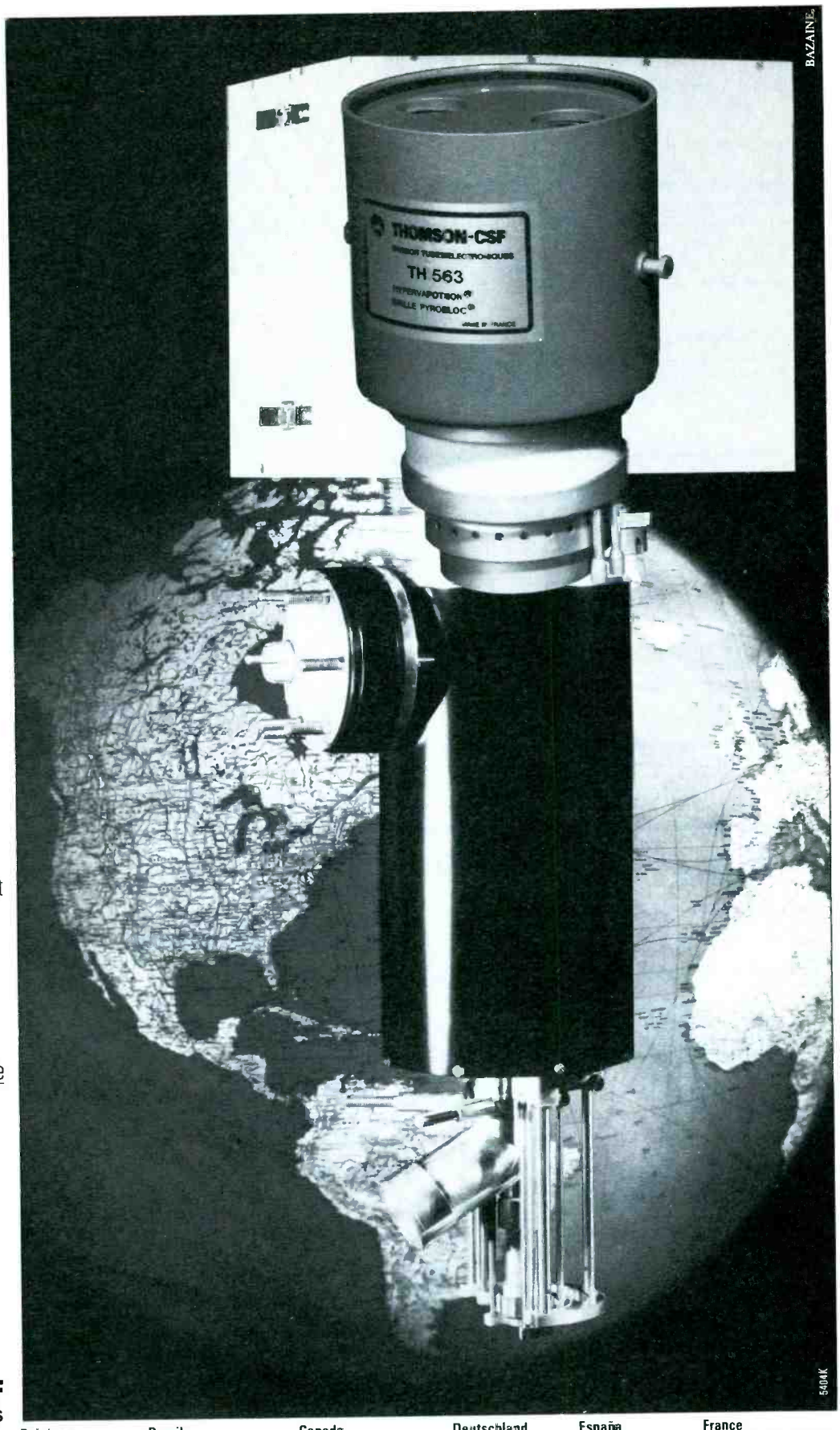
And still looking ahead! That's your assurance of world-class UHF/VHF-TV tetrodes and coaxial-cavity circuits:

- up to 50 kW UHF output power and 40 kW VHF output power
- up to 18 dB typical gain.

Incorporating decades of innovation and experience with Hypervapotron® anode cooling and Pyrobloc® pyrolytic-graphite grids.

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Audio processing equipment; audio DAs; electrically adjustable stereo mic; audio mixers.
Circle (562)

Audio Developments **(2933)**
Introductions
Portable audio limiter unit; battery operated.
Product line
Portable audio mixers; audio processors.
Circle (563)

Audio Digital **(3412)**
Product line
Digital broadcast profanity delays; audio delay, reverb, effects systems.
Circle (574)

Audio Engineering Associates **(2769)**
Introductions
- MS matrix stereo audio products; MS38 line level active matrix; MS38 with integral mic pre-amps; 3-input mixer with MS matrix, mic power.

Product line
Mono, stereo audio interfaces; MS matrices.
Circle (564)

Audio Kinetics **(2506)**
Introductions
- Eclipse: audio editor controller, interfaces to 410 Q-Lock synchronizer for 4-machine system.
- Model 410: upgraded Q-Lock synchronizer.
- TimeLink: electronic gearbox.

Product line
Audio editing systems; machine synchronizers.
Circle (565)

Audio Precision **(2560)**
Introductions
- System One test system options; wow & flutter measurements; intermod distortion (IMD) measurements; split-site software; audio routing switcher.

Product line
Personal computer-based audio test system.
Circle (566) See ad page 76

Audio-Technica U.S. **(2407)**
Introductions
- ATM5R: miniature unidirectional, fixed charge condenser vocal mic.
- ATM33R: unidirectional instrument mic.
- ATH-M7 PRO: studiophones.
- Shotgun mic accessories.
- Mic stands.

Product line
Microphones, accessories; mic cables; phono tone arms, cartridges, studiophones; audio recorder/mixers.
Circle (567)

Audio-Video Engineering **(2703)**
Introductions
- HSC-2: video hum-stop coil, seven units mount in 3.5-inch rack space.

Product line
Electrical hum filters.
Circle (568)

Auditronics **(3310)**
Introductions
- Series 310: second generation audio console; 4 or 8 output; submasters to stereo, mono mix; mono, stereo inputs, all with or without EQ; VCA level, grouping control; multiple input selectors; effects, foldback sends, receives; complete monitoring with stereo solo, mono cue; redundant power supply.

Product line
On-air, production audio consoles; peak program meter systems.
Circle (569) See ads pages 42, 43

Aurora Systems **(104)**
Introductions
- AU/220 graphics: IBM-PC/AT-based system; features 32-bit processing and storage; anti-aliasing, 3-D modeling, animation, weather software; digital interface to existing Aurora systems.

Product line
Videographics and animation systems.
Circle (570)

Autogram **(2702)**
Introductions
- LC-10: update of IC-10 audio console; linear faders, push-button switches, true VU meters.
- 20 R/TV: radio or TV stereo audio console; 20 linear sliders with VCA control; two stereo outputs, selectable mono output, two mix minus for telephone feeds.

Product line
On-air, production audio mixing consoles; automated console systems.
Circle (571)

BAF Communications **(2544)**
Introductions

Beaveronics, Inc.

8 HAVEN AVE.
PORT WASHINGTON, NEW YORK 11050
516/883-4414

Stand-alone Downstream Keyers To Upgrade Your Total System

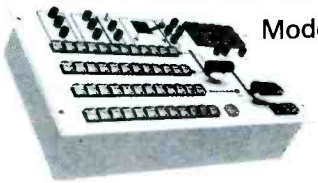


DSK-6-DL & DSK-4-DLB | Especially Designed for Character Generators | Various Other Models Offered

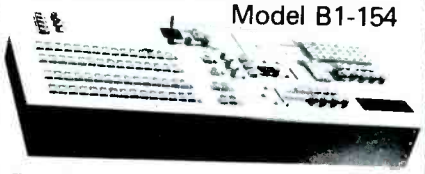
FEATURES
- Independent stand-alone keyer
- Built-in Edge Border, Shadow, and Outline, variable from black to white
- Built-in Matte Generator
- Key can be inserted or removed by cut or automatic mix at any of four rates
- "Cut" or automatic Fade to Black at any of four rates
- Edge Border variable from black to white
- Key may be filled with either key video or matte
- Can select up to four key sources either individually or simultaneously

STUDIO PRODUCTION VIDEO SWITCHING SYSTEMS

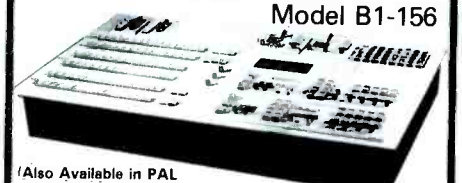
For Remote, ENG, and Small Production Facilities
Model 712



For Moderate Size Facilities
Model B1-154



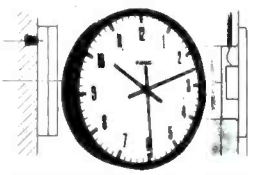
For Sophisticated Facilities
Model B1-156



(Also Available in PAL and PAL-M Versions)

OPTIONAL FEATURES

FAVAG Master Clock Systems
Minute or second impulse



6 DIGIT DIGITAL DISPLAYS AVAILABLE
Surface Mtg | Flush Mtg

MASTER CLOCK SYSTEMS MODULAR DESIGN FACILITATES FUTURE EXPANSION



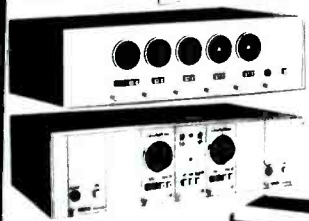
Table Top



TYPE QMS-1

Decorative









2QM5-2 Dual Unit with Auto-Changeover

NUMEROUS SECONDARY CLOCKS ARE AVAILABLE INCLUDING THOSE WITH SILENT OIL-BATH MOVEMENTS

See us at NAB Booth 2703

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Visit HEDCO in Booth 2751 during the 1986 NAB show in Dallas. While you are there, pick up an invitation to the HEDCO hospitality suite in the Dallas Hilton, where Ross (Billy Jack) Shelton* will be serving his famous Texas Chili. If you survive the chili, come see the hottest new product shown at the NAB Convention. *Y'all come!*

Hughes Electronic Devices Corporation
A Subsidiary of Leitch Video

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HEDCO™

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*Ross (Billy Jack) Shelton – born in Austin, raised in Lubbock – A Genuine Texan.

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- 340T: SNG vehicle, Ku-band system; more production space than previous models.
- Fly-away SNG systems.
- Ku-band SNG uplinks, meets international standards.

Product line
SNG and mobile uplink systems.
Circle (581)

B&B Systems **(2665)**
Introductions
- AM-1B stereoscope: measures, displays stereo audio signal phases on CRT; meters, LEDs show signal levels; all features of AM-1 in 5.25-inch rack space.
- AM-2B stereoscope: all features of previous AM-2, in 3.5-inch high unit.

Product line
Audio phase measurement CRT systems; meter panels.
Circle (582) **See ad page 163**

BGW Systems **(2825)**
Introductions
- No. 2242 DA: audio distribution power amp.

Product line
Audio power amplifiers for studio and mobile applications.
Circle (583)

BHP **(2795)**
Product line
Film, videotape editing systems.
Circle (616)

BIW Cable Systems **(3493)**
Introductions
- TV camera cables; multicore, triax and fiber-optic types.

Product line
Cable, wire and fiber-optic products.
Circle (584)

BSM Broadcast Systems **(2668)**
Introductions
- 1986 MODULA: remote control units, interfaces; allows personal computers to control switching; CDS collision detection networks.
- miniMODULA: mid-sized routing switcher; based on 8x8 crosspoint matrix; expands to 24x16.

Product line
Routing switchers; audio distribution equipment.
Circle (585) **See ad page 171**

BW Lighting Systems **(2922)**
Introductions
- 20.180, 10.180: 1kW baby softlights and kits.
- 20.170 instruments: 12kW softlights.

Product line
Electrical distribution and grid system connector strips; studio draperies and tracks; lighting instruments; dimmers and control panels; studio ladders; grip equipment.
Circle (586)

Barco Industries **(2577)**
Introductions
- CVS37: color video monitor; 14-inch diagonal; digital control and self-alignment.
- CVS51 monitor: digitally controlled, 19-inch diagonal, self-aligning.
- HDTV76: 30-inch diagonal color monitor for HDTV.

Product line
High resolution, master control TV monitors; precision decoders, demodulators.
Circle (587)

Barcus-Berry Electronics **(2485)**
Introductions
- 202CP: cinema processor, 2-channel.
- 201MI: musical instrument processor.
- 204CP: cinema processor, 4-channel.
- 202: load reactance compensator.

Product line
Sound system processors.
Circle (588)

Bardwell & McAlister **(2746)**
Introductions
- Modulite products: collapsible softlights, accessories.

Product line
Lighting instruments, accessories, lamps; grip equipment.
Circle (589)

Barrett Associates **(2654)**
Introductions
- TAS-100: Jasoni tape machine analyzer; applicable for reel, cassette and cart systems.
- Wheelock strobe lights: on-air and phone warning indicators.

Product line
Distributors of audio equipment; reconditioned RF equipment.
Circle (590)

Basys **(2913)**
Introductions
- Integrated management information systems.
- Optical disk archive: long-term memory for scripts and stories.

Product line
Newsroom computer systems based on VAX, IBM PC, Onyx, Parallel computers.
Circle (591) **See ad page 267**

Bayly Engineering **(2700)**
Introductions
- M21-½: ½-inch audio recorder.
- M20: ¼-inch audio recorder with center time-code track.
- FM transmitter/exciter, 20W.
- Shortwave transmitter 500kW.

Product line
FM transmitters, exciters; audio recorders; coaxial changeover switches; digital program audio channel systems.
Circle (592) **See ad page 313**

Beaveronics **(2703)**
Introductions
- HSC-2 hum-stop coil.
  DSK-4DLB: downstream keyer, simultaneous keys with borders, shadows, lins; audio fade in/out, fade-to-black; input selector for video or key from character generator.
- Energy-onix FM transmitters: 1.5kW to 30kW.

Product line
Video production switchers; video keyers; studio clock systems.
Circle (593) **See ad page 212**

Belar Electronics Laboratory **(3347)**
Introductions
- TVM-100: TV aural modulation monitor; mono, stereo compatible.
- TVM-200: TV BTSC stereo modulation monitor.

Product line
AM, FM, FM stereo modulation monitors.
Circle (594) **See ad page 333**

Belden Communications **(2926)**
Product line
Lighting equipment; Lee light filters.
Circle (595)

Belden Electronic Wire & Cable **(2651)**
Introductions
- Nos. 9307, 9308: conformable coaxial cable.
- Nos. 9213, 9214: satellite system cables.

Product line
Audio, control and coaxial cables and wire.
Circle (596)

Bencher **(2568)**
Product line
Vertical camera stands for photocopying.
Circle (597)

Benchmark Media Systems **(2470)**
Introductions
- DA-102: stereo audio DAs.
- MIA-4: microphone pre-amp module.
- RGC-01: remote gain control, 2-channel.
- OSC-01: ultralow distortion oscillator.

Product line
Modular audio DAs; mic pre-amps; audio equalizers; differential interface devices; remote meter modules.
Circle (598) **See ad page 296**

Bend-A-Lite **(NA)**
Introductions
- Bend-A-Light: flexible neon lights; waterproof, crush-proof; cut with scissors; seven colors.
- Letterlite: individual lighted letters, for signs, messages; seven colors, ready to plug in.

Circle (599)

Beyer Dynamics **(2823)**
Introductions
- MC736PV: short shotgun condenser mic, 12Vdc-48Vdc.
- MC737PV: long shotgun condenser mic, 12Vdc-48Vdc.
- MCE6: high SPL version of MCE5 mini-electret lavalier mic.
- MCE10: cardioid version of MCE5.
- MSB48N(C).1: portable power supply; five 9V batteries for 48Vdc.

Product line
Wireless shotgun mics; mini-electret lavalier mics; ribbon mics; announcer headsets.
Circle (600) **See ad page 215**

Biflyx **(2561)**
Introductions
- 500 system: 512x480 color frame grabber, video printing system.

Product line
Video printer systems.
Circle (601)

Bird Electronic **(3472)**
Introductions
- Load resistors: 15kW and 25kW, forced-air cooled, dry.
- Reject loads: for dual transmitters to 96kW peak; field replaceable, multi-element resistors; redundant element configuration.
- STL RF test equipment.
- FM filters, filter/couplers.
- Wattmeter elements: plug-in units for

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THE IMPORTANCE OF MICROPHONE ACCURACY IN BROADCAST AUDIO



A distinctive voice remains as important to a successful broadcast announcer as a recognizable visual presence. *Microphones are the critical first step in the broadcast audio chain. Acting as a highly accurate sound "lens," they must be sensitive enough to faithfully transmit all of the subtle personal nuances and inflections that distinguish one announcer's voice from another.*

Today's sophisticated broadcast productions demand more from microphones. Differences in relative mic performance are more readily apparent, and an inferior microphone stands out like the proverbial sore thumb.

In the most basic sense, any microphone need only capture the sound source exactly and convert it to electrical energy — no more, no less. *Obviously, microphones necessarily have different characteristics based on differing transduction technologies and designs. But at Beyer, we believe that the superiority of a microphone is in large part based on how accurately it transduces the source material — with no excuses based on size or applications.*

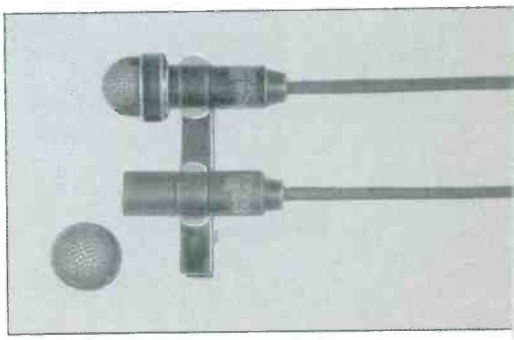
In broadcast, Beyer's concept of "accuracy" means the difference between a microphone that can focus in on a specific voice and produce a totally realistic, professionally acceptable performance, and a mic that simulates a performance by only capturing the bare outline or "silhouette" of an announcer's voice. We've dedicated the most complex and sophisticated technology in existence to reinforce the truth of this basic premise.

Sensitive and natural-sounding, the MCE5 picks up the "whole truth" of audio broadcast sound because of an unusually wide frequency range (20Hz to 20kHz) and exceptionally fast transient response for any mic, let alone one that is virtually invisible on camera. Because the MCE5 has a uniform omnidirectional pickup pattern, mic placement is not critical and the announcer's head can move without going "off mic." Handling noise is kept to an absolute minimum so the MCE5 picks up the voice, not the rustling sounds of the announcer's expensive silk tie.

The MCE5 is available in various terminations for the widest range of broadcast applications including wireless. Underscoring our longterm commitment to the broadcast industry, the MCE5 is one of a family of reliable Beyer broadcast products designed for ENG, EFP and Film/Radio/Video studio production. It has been widely adopted by discerning broadcast engineers in the U.S. and Europe.

For those engineers who feel that announcers' voices should be as recognizable as their faces, the Beyer MCE5 proves that this level of accuracy exists in a lavalier design.

Beyer Dynamic Inc., 5-05 Burns Avenue, Hicksville, NY 11801.



Circle (140) on Reply Card

ACCURACY IN AUDIO **beyerbroadcast**

www.americanradiohistory.com

Continental's top performing 27.5 kW FM Transmitter speaks for a station you know*



KLOH	KRIC
KBWC	WXKW
KSPZ	WWDM
WLTS	KRAB
KLOC	KHIT
WSKR	WETA
WBLX	WJLQ

*Partial list

Reliability and proven performance make Continental's 816R-4 compact FM transmitter a winner. Crisp clear signal, high fidelity, good stereo separation, very low noise and distortion, excellent frequency stability, simple installation, low power consumption make it a great investment. Combine with duplicate 816R-4 to get 55 kW output. For brochure, call (214) 381-7161 Continental Electronics Division, Varian Associates, Inc., PO Box 270879, Dallas, Texas 75227.

Continental Electronics
A Division of Varian Associates, Inc.
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varian

Booth 3200, '86 NAB Show

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BRYSTON

REQUIREMENTS

- Musicality
- Serviceability
- Low Distortion
- Balanced XLR Outputs
- 27dBm RMS 600 ohms balanced
- Cartridge load adjustment
- High Overload Threshold
- Linear Frequency Response
- Reliability
- Low Noise
- 1 Space Rack Mountable
- Accurate RIAA (±.05dB)
- 21dBm RMS 600 ohms unbalanced
- Non-reactive Phono Stage
- Fully Discrete Gain Blocks
- Drive Loads as low as 300 ohms

SOLUTION

BRYSTON BP-1 BROADCAST PREAMPLIFIER

(BP-5 also available with 3 switchable high level inputs)

See us at NAB Booth 2406

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RFD #4, Berlin, Montpelier, Vermont 05602
(802) 223-6159

In Canada:

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57 Westmore Dr., Rexdale, Ontario, Canada M9V 3Y6
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Circle (142) on Reply Card

relative field strength on THRULINE meters.

Product line

RF power measurement instruments, components; wattmeters; transmitter test loads, terminations.

Circle (602)

Bogen Photo **(2405)**

Introductions

- Model 3156: folding auto dolly.
- Model 3170: 3001 tripod with micro fluid head.
- Model 3142: black anodized 3140 tripod with mini fluid head.
- Model 3361: 8-foot light stand, black anodized.
- Model 3165: 13-foot light stand, black anodized.

Product line

Tripods, dollies; fluid heads; light stands.

Circle (603)

Bogner Broadcast Equipment **(3406)**

Introductions

- BMR/BCR/BBR-10/12: high gain, directional and omnidirectional base station antennas for paging, mobile and cellular radio; 450MHz and 800MHz/900MHz; constant beam tilt and heavy null fill.

Product line

UHF/VHF TV transmitting antennas; MDS/ITFS/MMDS transmit/receive antennas; communications antennas.

Circle (604) **See ad page 249**

Robert Bosch **(3170)**

Introductions

- 3-D Illustrator: graphics paint system; conventional features with full 3-D features.
- KCM125: 3-tube camera; 1-inch format; full auto-setup, microprocessor system with dynamic lens error correction; RGB outputs.
- KCF-1: lightweight camera; multicore base station system.
- FGS-4000 enhancement: off-line modeling system.
- Video DAs: 30MHz bandwidth.
- Audio DAs: 98dB S/N rating.
- Programmable sync generator.
- Routing switcher: 20x1 format, 30MHz bandwidth.
- CP-1410: switcher control panel, 10-bus category number system.
- CP-1600: switcher control panel, full X-Y matrix; individual status displays for 7-level matrices.
- X-Y zoom: for film-tape transfers on FDL; frame-by-frame programmability to 800 events.

Product line

Studio, portable TV cameras; camera/recorders; production video switchers; routing switchers, control panels; master control switchers; video recorders; telecines; video monitors; electronic graphics paint systems.

Circle (605) **See ad pages 285-288**

Bowen Broadcast Service **(2522)**

Introductions

- TCR-100 upgrade kits: replaces tape sensing incandescent lamps with infrared devices; positioning switches with LED optical isolators.

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Get hands-on with Harris
...precision tools for the Video craft

- still-stores
- time-base correctors
- dual channel TBCs
- digital effects
- graphics systems
- studio & ENG cameras
- dual channel synchronizers
- frame synchronizers
- paint systems
- multi-user still-store

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HARRIS CORPORATION Broadcast Group
P.O. Box 4290, Quincy, IL 62305
217 222-8200

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OUR NAME IS

HARRIS

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Bowen, continued

Product line
Quad cart player modification kits.
Circle (606)

Bradley Broadcast Sales **(2663)**
Introductions
- TELOS Echo: digital audio storage, retrieval unit.

Product line
Digital telephone hybrids.
Circle (607)

Walter S. Brewer **(NA)**
Introductions
- 02770-WB: Surlok pole hanger; lowers instrument from lighting grid.

Product line
Lighting instruments, hangers; studio draperies; power distribution systems; grids; gaffer equipment.
Circle (608)

Broadcast Audio **(2615)**
Introductions
- System 6: audio console; 6-mixer modular system for news editing, production; optional 6-mixer extender available.
- STL systems: aural STL links for 140MHz-480MHz international frequency range; repeater or translator configurations.

Product line
Modular audio console products.
Circle (609)

Broadcast Electronics **(3226)**
Introductions
- FM-35A: 1-tube FM transmitter, 35kW.
- FM-10A: 1-tube FM transmitter, 10kW.
- AS-10: AM stereo modulation monitor.
- DV-2: solid-state digital audio recorder; response to 6kHz.

Product line
Audio cart machines; audio consoles; FM transmitters; AM, FM stereo exciters; FM, TV stereo generators; audio program automation systems.
Circle (610)

Broadcast Microwave Services **(3578)**
Introductions
- BSM-KU: Ku-band transportable uplink vehicle.
- BPA-702: 7GHz, 10W power amplifier.
- News Car: ENG news vehicle microwave system.
- BMT-13 GP: 13GHz frequency-agile 1W transmitter.

Product line
ENG microwave transmitters, receivers; helicopter ENG systems; autotracking antennas; STL, intercity transmitters; receivers; central receiving antennas.
Circle (611) **See ad page 153**

Broadcast Supply West **(2743)**
Introductions
- Prodecor furniture:
  SB100 single-bay 23"x22.5"x27.75".
  DB100 double-bay 23"x42.5"x27.75".
  CT100 console table 30"x80"x30.25".

Product line
Studio furniture; turntables, pre-amps; audio processors; cartridge players; cart storage racks; speakers.
Circle (612)

Broadcast Systems **(2418)**
Introductions
- APS automatic program system: record, play; automatic program delay; to 24 play transports in timed event operation.
- DC-80 auto cart player: stereo audio; anti-head clogging; to 24 transports.
- BJ-800: stereo audio DAs; prewired to two jack panels, all inputs/outputs wired normally through panels.
- DC-8/EP: DC-8 cart system; 2-second preroll, anti-head clog; auto eject, auto cue record; balanced +4dBm audio in/out.

Product line
Interface panels; remote control systems; equipment cabinets, consoles; prewired jack panels; automated cart systems.
Circle (613)

Broadcast Video Systems **(2730)**
Introductions
- CK-950: component keyer.
- CDK-1000: component downstream keyer with fade to black.
- CS-1100: color corrector scene store.
- BAL: miniature video filters.
- EV4041: waveform monitor with line selector.
- Models 732/733: RGB-component converters.
- BVS component color-bar generator.

Product line
Video encoders; color-correction systems; video delay lines; safe area generators; video keyers; waveform monitors, vectorscopes.
Circle (614) **See ad page 321**

Bryston **(2406)**
Introductions
- Model 6B: 500W/100W monophonic amplifier.

Product line
Audio monitor amplifiers; phono preamplifiers.
Circle (615) **See ad page 216**

CAT Systems **(3333)**
Introductions
- 9000 controller; multisight cable monitoring for any control system; 40 sites controlled; multiple controllers possible.
- V4.10 software: doubles speed of V3 control system software; for all systems, includes resident/independent light pen and communications software.

Product line
Remote control systems with color CRT monitor display.
Circle (621)

CBS Radio Station News Service **(2718)**
Product line
Radio news network.
Circle (622)

CBSI/Custom Business Systems **(2517)**
Introductions
- The System PC: radio business software: now available for AT&T 3600, Compaq, IBM, Sperry PC, Televideo, Tele-XT, Wang and Zenith 150 PCs.
- Concert music library: retains 200,000 selections; prepares listeners' guides.
- Snow closings: management of school closing lists.

Product line
Computer software for radio business and programming functions.
Circle (623)

CMC Technology **(3340)**
Product line
Replacement video heads, type C; dynamic parallel tracking video heads; bulk tape demagnetizers.
Circle (624)

CMX **(3232)**
Introductions
- CMX 336: computer-assisted videotape editor controller; all 330XL features plus sixth port; expanded keyboard; Motion Memory, Master/Slave.
- CMX 3100: editing control system; eight to 24 ports; multiple EDL files, expanded memory; software includes Autoclean, Match-Cut.
- SuperClean, LookBack, software options for 3100, 3400, 3400A.

Product line
Videotape editing control systems; audio synchronization, editing systems; audio console automation.
Circle (625)

COMSAT General **(2482)**
COMSAT International Communications
Introductions
- SkyBridge: transportable Ku-band broadcast service.

Product line
Satellite communications services; distribution services.
Circle (676) **See ad page 253**

CSI Electronics **(3306)**
Product line
AM, FM broadcast transmitters.
Circle (626)

Cablewave Systems/Celwave **(3489)**
Introductions
- Type FLC114-50J: 1¼-inch OD copper, corrugated, foam dielectric, low-loss cable.

Product line
Coaxial cable; elliptical waveguide; RF connectors; microwave antennas; waveguide hardware; pressurization equipment; rigid line, accessories.
Circle (627) **See ad page 181**

Calaway Engineering **(149)**
Introductions
- CED+: editing controller, handles six machines.
- GPI+: general purpose interface and motion control.
- ST-225: BR-8600 translator/interface.

Product line
Editing controllers: VCR, videodisc control interfaces.
Circle (628)

Calvert Electronics **(2503)**
Product line
Camera tubes; RF power tubes; weather radar klystrons.
Circle (629)

Calzone Case **(2502)**
Introductions
- Additional rack styles.
- Custom production consoles.
- Duplication racks.

Product line
ATA approved equipment shipping cases.
Circle (630)

Cambridge Products **(2731)**
Introductions

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hen Becker took Lendl to five sets
ıe US Open final, it was Marconi's
standards converter that took the
match to a million sets
throughout the U.K.

Likewise the Olympics
from Los Angeles, the
dramatics from Dallas, and
the heroics from Hill Street.

But the game doesn't end
there. Throughout the broad-
casting industry, Marconi
equipment improves your service. Take
Marconi's State of the Art NTSC Synchronisers
and Decoders, for example, or our Line Array
Telecine; still the world's only fully digital
machine, it offers consistently superb film-
to-video conversion.

For illustrated brochures on these and
other Marconi studio products, write or
ring today.

We think you'll find our returns as
impressive as
our service.



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ther winners.
rom Marconi.



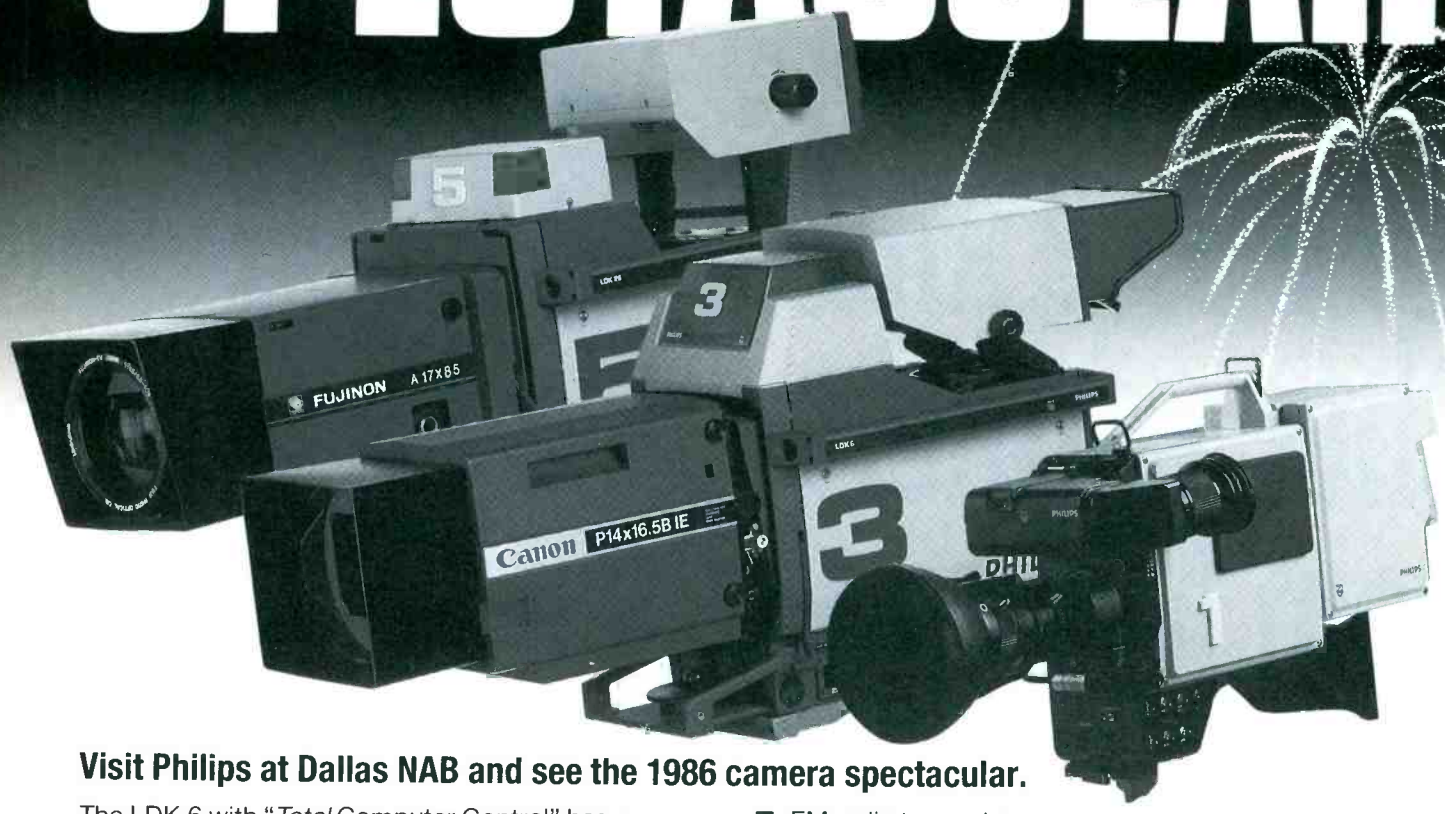
Marconi
Communication Systems

Broadcasting Division, New Street, Chelmsford, England CM1 1PL.
National 0245 353221 International 44 245 353221.
Telex 99201 Facsimile (Gp2/3) 0245 87125.

Circle (270) on Reply Card

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Dallas NAB-Philips makes it a CAMERA SPECTACULAR



Visit Philips at Dallas NAB and see the 1986 camera spectacular.

The LDK 6 with "*Total* Computer Control" has a new 1986 series, the advanced LDK 6A and LDK 26A. With new production features. Plus innovations like the unique COACH computer maintenance and diagnostic aid with telephone interconnect. There's also the new LDK 54A multi-role compatible portable.

And don't miss the other star attractions at the Philips NAB booth.

- High quality color monitors
- UHF television transmitters
- FM radio transmitters
- Television test and measuring instruments
- Philips professional compact disc player
- Philips professional lighting

See Philips at NAB or for immediate information call 201-529-1550. In Canada call (416) 439-9333

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900 Corporate Drive, Mahwah, N.J. 07430

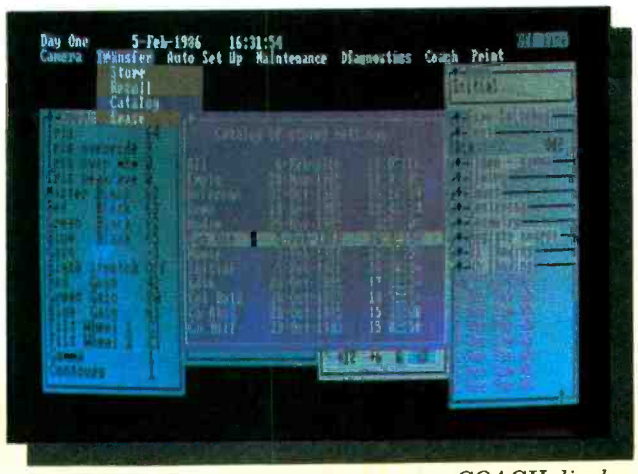
PHILIPS **Broadcast Equipment**

PHILIPS
Reliability through Quality

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Would you like . . . the assurance of your top maintenance engineer wherever your camera goes?

With COACH you can have it. COACH – the new Philips remote control and monitoring system for the LDK 6 family of automatic cameras. A system devised to give double assurance of the perfect performance provided by total computer control . . . in the studio or field . . . with your topengineer on-line supporting your production staff.



COACH display

LDK 6A and LDK 26A television cameras already have the industry's most extensive diagnostics.

The new Philips COACH is a tool for centralised maintenance and monitoring of the LDK 6 family of cameras. It consists of 2 components – an interface and an IBM compatible personal computer. Simple to use, COACH provides –

- remote control and monitoring of LDK 6 family camera systems
- flexible retrieval, storage and control of camera data with greatly expanded and highly protected memories to warn of approaching end of range and unusual changes in camera set-up
- in depth diagnostics monitoring including surveillance
- remote access via standard modems over telephone lines.



LDK 6A
LDK 26A

COACH, therefore, helps make more efficient and cost effective use of high grade engineering staff. It also allows them to give on-line technical support and advice whenever and wherever it is needed.

COACH is just another example of the developments that ensure Philips LDK 6A and LDK 26A cameras remain the fastest selling cameras in their class with over 400 sold worldwide.

Users from networks, stations, production facilities and institutions are discovering for themselves the benefits that come from *total* computer control. It is available from Philips in all tube formats . . . the ⅔" (18mm) LDK 26A and the choice of 1" (25mm) or 1¼" (30mm) LDK 6A.

Prove the total computer difference for yourself.

A demonstration will prove why these cameras are years ahead in design, performance and cost effectiveness. Call or write for demonstration or request the descriptive LDK 6A, LDK 26A and COACH technical brochures.

PHILIPS TELEVISION SYSTEMS, INC.
900 Corporate Drive
PO Box 618
Mahwah, New Jersey 07430
Tel: 201-529-1550 Telex: 37-62558

LDK 6 – the total computer control camera.

LD 15

PHILIPS **Broadcast Equipment**

PHILIPS
Reliability through Quality

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- TNC: connectors, field-installable, crimp styles.

Product line
All types of RF BNC, UHF connectors.
Circle (631)

The Camera Mart **(3040)**
Product line
TV cameras; video, audio recorders; lighting equipment; support equipment; audio equipment; processing equipment; post-production equipment.
Circle (632) **See ad page 131**

Canare Cable **(2523)**
Introductions
- ECO25FB: 25-foot L-4E6S mic cable with Neutrik connectors.

Product line
Speaker, mic cables; coaxial, video remote cables; multipair cables; junction box systems; multichannel mic cables.
Circle (633) **See ad page 334**

Canon USA **(3300)**
Product line
ENG, field and studio camera lens systems; high-speed shutters; camera pedestals.
Circle (634)

Capitol Magnetic Products **(3345)**
Product line
Broadcast audio cartridges.
Circle (635) **See ad page 188**

Capitol Production Music **(NA)**
Product line
Production music service.
Circle (636)

Catel Telecommunications **(2685)**
Product line
CATV/CAFM modulators, channel processors; FM/TV modulators; TV bandpass filters; fiber-optics products.
Circle (637)

Dwight Cavendish **(2662)**
Introductions
- Copymaster 250: videocassette duplicator.
- Routing switcher: 6x1, video and audio.
- Audio DA: 1x10, stereo.
- Audio/video DA: 1x10, stereo audio.
- VCR switcher; changeover and RF dub signal switchers.
- VCR remote controls.

Circle (638)

Ceco Communications **(3383)**
Product line
Camera tubes; RF power tubes.
Circle (639)

Celwave/Chester Cable **(0000)**
Introductions
- Video 26-3: 3-conductor mini-coax for component TV applications.

Product line
Precision video cable; TV camera triaxial cables; flexible and jacketed audio cables.
Circle (640)

Central Dynamics **(3080)**
Introductions
- 80 ICK: iso key system with RGB and encoded chroma-keyers.
- ELFS: serial editor interface for switcher control.
- APC2000: true-time master control automation system.

Product line
Video production switchers; routing switchers; master control switchers; downstream title keyers.
Circle (641)

Centro **(3181)**
Introductions
- Demonstrations: videotape presentations dealing with fixed facility design and construction and mobile unit design from ENG vehicles to 18-wheel production vans.

Product line
Mobile TV vehicles: facilities design, turnkey construction; racks, consoles.
Circle (642) **See ad page 53**

Century Precision Optics **(2422)**
Introductions
- LAP 3500: super-wide angle high-density glass prism, for video or film cameras in low-angle photography.

Product line
Lens accessories: wide-angle attachments for zooms; telephoto lens systems.
Circle (643)

Century 21 Programming **(3452)**
Introductions
- Compact discs: commercial music and sound effects library.

Product line
Program packages for automated radio.
Circle (644)

Cercone Vincent Associates **(2584)**
Product line
Lighting systems, turnkey installations.
Circle (645) **See ad page 115**

Cetec Antennas **(3587)**
Introductions
- JSL antennas: UHF TV slot design.

Product line
Broadband CP community FM antennas; CP TV spiral antennas; FM CP antennas.
Circle (646) **See ad page 266**

Cetec Vega **(281)**
Introductions
- Model 66B: portable wireless mic receiver; GaAs FET front end; improved audio characteristics.
- Model 6TB: portable diversity wireless receiver; improved audio characteristics; GaAs FET front end.

Product line
Handheld, body-pack wireless mics; standard, diversity wireless receivers.
Circle (647) **See ad page 147**

Channelmatic **(2548)**
Introductions
- The Complete System: random access commercial break system; control, traffic, billing software; turnkey package.
- AVS-10AS PATCHMASTER S: 10x1 A/V stereo switcher.

Product line
Videocassette automation systems.
Circle (648)

Chisan Photron Trading **(2494)**
Circle (649)

Christie Electric **(3324)**
Introductions
- CASP: production models of battery charger, analyzer, sequencer and power supply for ENG/EFP batteries.

Product line
Batteries; chargers; analyzers; tape degaussers.
Circle (650) **See ad page 182**

Chyron **(3072)**
Introductions
- Scribe: text generator; ultrahigh-resolution; anti-aliased; character coloring, shading, manipulations.
- Chameleon: high-resolution graphics paint system.
- 4200 with Motion: high-resolution graphics generator with digital video motion effects.

Product line
Character generator/titlers; graphic generators.
Circle (651)

Cine 60 **(3428)**
Introductions
- On-board battery.
- Battery analyzer.

Product line
Battery packs, belts; battery chargers; portable lighting equipment.
Circle (652)

Cinema Products **(140)**
Introductions
- Mini-Worrall head: continuous pan, cable driven, geared; two positive lock-down systems.
- Mini-Worrall Super: includes features above, with Sachtler-type quick release system.
- CP-35E: lightweight, handheld 35mm camera; 6fps-120fps speeds foward, reverse; RS-232 compatible; for special effects work.
- Steadigate film stabilizer.
- Steadigate TC: includes magnetic time-code head to record on Datacode.
- Insight Vision: series 75 B/W broadcast camera, image intensifier, zoom lens; for low-light levels; lightweight, compact.

Product line
Steadicam stabilizers; remote control pan/tilt heads; camera/lens control systems; wireless lens control systems; prompters; joystick zoom controllers.
Circle (653)

Cinemills **(2777)**
Product line
Lighting equipment, accessories; lighting filters, globes.
Circle (654)

Cipher Digital **(2605)**
Introductions
- No. 750: time-code reader, generator, coincidence detector.
- 710A, 716A: software enhancements.
- Shadow: enhanced transport synchronizer; locks audio, video and film systems.

Product line
Time-code readers, generator, peripheral devices; machine synchronizers; audio editing system.
Circle (655)

Circuit Research Labs **(2538)**
Product line
Mono, stereo AGC processors; multiband compressors; AM, AM stereo, FM limiters;

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Put yourself in some good company.







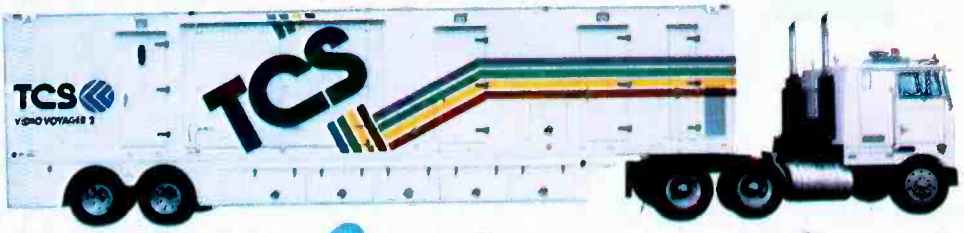
























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Communications Corp.

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TELEX 21-4370

Circle (146) on Reply Card

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Grand Rapids, MI 616-796-5238	Atlanta, GA 404-875-3753	

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TETRODE TRANSMITTING SYSTEMS 2-10kW UHF TV by COMARK



- 100% Forced Air Cooled
- Stereo Ready
- Solid State Broadband modular construction for all intermediate power amplifiers and drivers
- Uses same techniques and technology featured in "S" Series high power line of transmitters.
- Full Support Services

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P.O. Box 506
Colmar, PA 18915
(215) 822-0777

Circle (147) on Reply Card

Circuit Research, continued

FM, SCA generators; MTS TV audio processor.
Circle (656) **See ad page 13**

Clear-Com Intercom Systems **(3586)**
Introductions
- MA-4, AX-4: 4-channel access and extension access stations for stand-alone IFB systems; MA-4 has gooseneck mic.
- PIC-4000: 4-channel rack-mount program interrupt controller.
- SB-412A: 4-channel dynamic headset switchboard main station.
- RM-400A, RM-400A: 4-channel speaker and dynamic headset remote and main stations.

Product line
Intercom systems; IFB systems.
Circle (657) **See ads pages 111, 113**

Coaxial Dynamics **(2766)**
Introductions
- 82000A wattmeter: portable unit provides peak and CW readings.

Product line
Low- and high-power wattmeters; digital wattmeters; low- and high-power terminations; frequency counter with wattmeter.
Circle (658)

Coherent Communications **(2675)**
Introductions
- KS-700: combines SMPTE time-code reader, generator; LED display, keyboard.
- YAM-7: miniature, portable SMPTE code reader, generator; LCD display; jam sync.
- YAM-3: portable, miniature reader only.
- SA-300U: SMPTE reader, video inserter; ac power or portable; full feature without display.
- KVID-8062: code reader, inserter; large LED display; full featured.
- SE-8062: reader only; 0.5-inch green display.

Product line
Portable audio/mix mixers; wireless microphones, accessories; time-code equipment.
Circle (659)

Colorado Video **(3447)**
Introductions
- Model 240: vertical blanking transmission system; uses one line per TV field to send NTSC-like color images in 8s; selectively addressable signals.
- Video multiplexer: up to four synchronous video signals may be carried on a single video channel; standard motion images may exhibit some motion compression.

Product line
Slow scan TV products for security, teleconferencing.
Circle (660) **See ad page 134**

ColorGraphics Systems **(3144)**
Introductions
- ARTSTAR III-D; digital paint/3-D graphics system, 24-bit per pixel, fully anti-aliased; model construction, multiple light sources, smooth shading, textures; CAB; VTR controls for auto animation; 4,000x4,000 resolution output for film.
- Weatherline 256: color weather display/animation system; country, county or state map database in five projections; accesses weather services, dial-up radar; optional doppler radar interface.
- LiveLine IVA: weather animation system; five projections of country, county, state maps in database; links to weather services, dial-up radar; optional doppler radar interface.
- ADP relational database: NewStar add-on; cross-reference script archives, tape library archive and Roledex software; Winchester and digital laser disk mass storage.

Product line
Newsroom computer systems; electronic graphics systems; weather graphics.
Circle (661) **See ad page 79**

Colortran **(3598)**
Introductions
- Sunlight: 575W/PAR 64 to 1.2kW/PAR 64 HMI lights: lens adapters allow selection of different light field sizes.

Product line
Lighting instruments, accessories; dimmers, control systems.
Circle (662)

Columbine Systems **(3405)**
Introductions
- News Management: computer system with complete archiving, newswire, teleprompt, scripting, asignment desk.
- Enhancements to present station business systems.

Product line
Radio station business, traffic, sales systems; music rotation system; automated newsroom equipment.
Circle (663)

Comark Communications **(3561)**
Introductions
- CCT-U-60KS: 60kW UHF TV transmitter: Varian EIMAC Klystrode power amplifier device.

Product line
AM, FM transmitters: UHF, VHF, TV transmitters for all standards; RF systems; RF transmission line, components; turnkey RF installation service.
Circle (664) **See ads pages 51, 128, 224**

Comex **(2829)**
Introductions
- MMDS systems.

Product line
Distributor of RF products.
Circle (665)

Commercial Cable Inc/CCI **(2484)**
Introductions
- CUE TV: interactive laser video music system.

Product line
Program automation systems.
Circle (666)

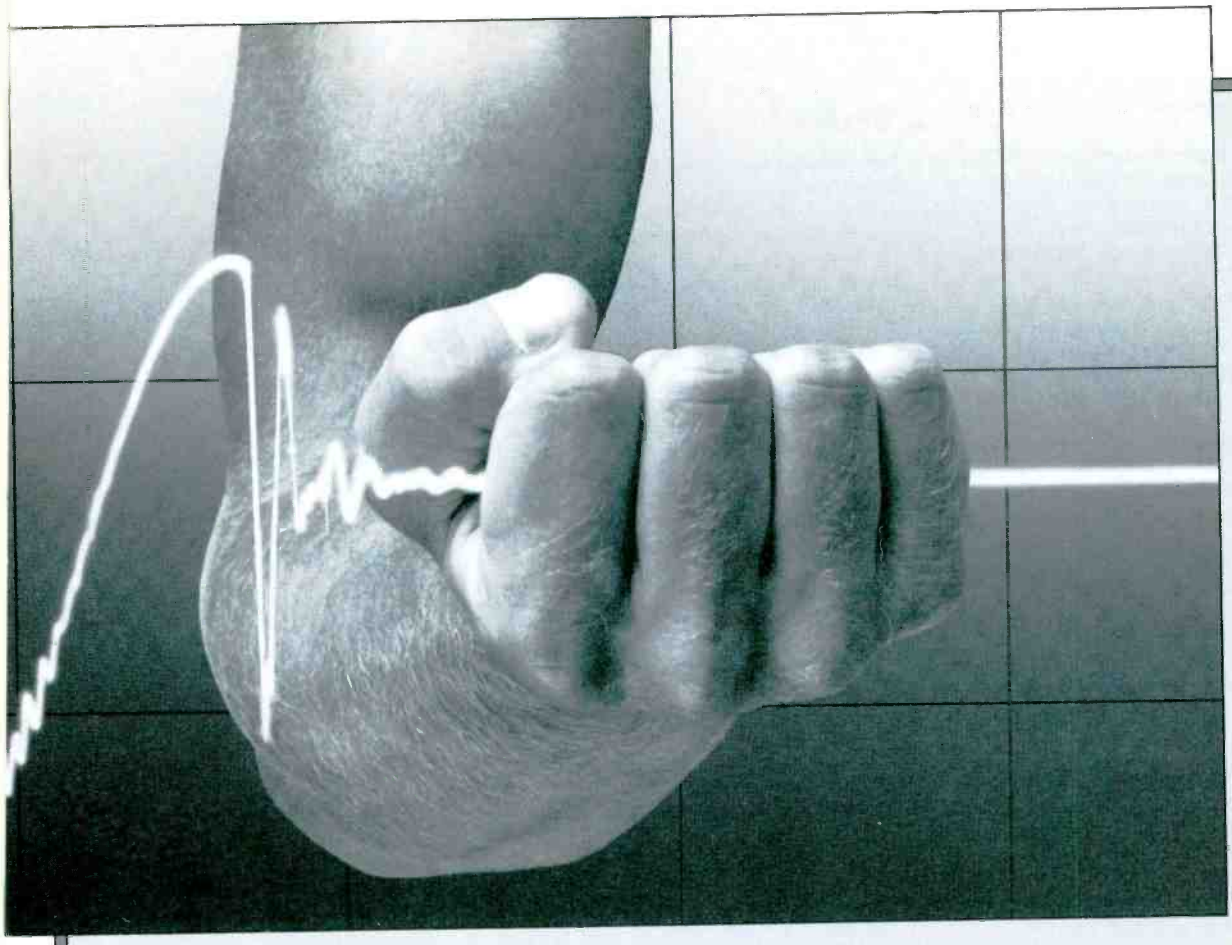
Communications Graphics **(2423)**
Product line
Promotional materials.
Circle (667)

Communication Microwave/Comwave **(2485)**
Introductions
- ITFS repeater systems.

Product line
Solid-state ITFS, MDS, OFS transmitters for audio, video, data.
Circle (668)

Comprehensive Video **(3593)**
Introductions
- APAS system: Add Pipe And Shoot light

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DO YOU HAVE A GRIP ON YOUR POWER PROBLEMS?

PUT THE RIGHT ANSWER IN YOUR HANDS TODAY . . .

Now there's a comprehensive guide that deals with attenuating power line disturbances. Compiled by a core of professional engineers, this valuable booklet dispels the myths of power related issues and answers the most typically asked questions on transient surge suppression.

Get state-of-the-art information on power line disturbances. What are they? How often do they occur? What test can I conduct to determine the sensitivity of my equipment or system? How do I proceed?

We've put the answers to these questions and more within reach so that every engineer can grasp the changing dynamics of power-related problems. Be on the forefront of good design. To get a grip on your power surge problems, get your hands on this free offer.



I WANT TO KNOW MORE about getting a grip on my power line transients. Please rush me your *free* booklet on power problems A.S.A.P.

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CITY _____ **STATE** _____ **ZIP** _____

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BE 3/86

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Comprehensive, continued

package; seven compact instruments with clamps, accessories; overhead grid not required.
- Software: Apple teleprompter; AICP bidding forms; script writing for CP/M computers; cable tracking for TV; editing controller data transfers.
- LOG-IT: software: keeps complete record of time codes, notes; prints list for edit sessions; for Radio Shack computer.

Product line
Distributors for many audio, video lines; lighting equipment; computer software.
Circle (669) See ads pages 314, 316

Comprompter **(0000)**
Introductions
- PC-ENR-FD/HD: PC-compatible electronic newsroom systems with floppy or hard disk drives.
- PC-TP-AC/DC: TotaPrompter portable prompter system.
- PC-CP-FD/HD: PC-compatible commercial production/prompting systems.

Product line
Newsroom computer systems; prompter systems.
Circle (670)

Compu-Prompt **(2768)**
Introductions
- CP-1130XM: color prompting system; extended memory; quick editing; allows foreign languages.
- MICRO: lightweight prompter display for hand-held film, ENG/EFP cameras.
- SPEAKER: for live audience presentations.

Product line
Color prompting systems; equipment transport cases.
Circle (671)

CompuSonics **(226)**
Introductions
- DSP 1500: digital disc audio recorder/player, substitute for audio carts.

Product line
Digital audio recording, editing system.
Circle (672)

Computer Graphics Labs **(2929)**
Introductions
- Agile-2000: real time animation system.
- Interprecord: single frame record software for IMAGES-II+ system.

Product line
Digital video paint and animation graphics systems.
Circle (673)

Computer Prompting **(132)**
Introductions
- CPC-1000: computer driven teleprompter system, IBM PCs and compatibles.

Circle (674)

Comrex **(3460)**
Introductions
- STLX: 2-line frequency extender mixing console; two mics/lines, noise reduction, switched AGC for all mics; intercom, PA feed.

Product line
Frequency extender systems; telephone couplers, hybrids; ENG RF cue systems; pocket TV aural receiver/monitors.
Circle (675) See ad page 228

Com Tek Communications Technology **(2653)**
Product line
TV signal monitoring receivers.
Circle (677)

Comtronix Systems **(2487)**
Product line
Klystron pulsers, gas testers; standby TV exciters; RF power amplifiers; LPTV systems.
Circle (678)

Concept Productions **(3334)**
Product line
Radio formats for automated or live assist operation; personality programming with major market announcers.
Circle (679)

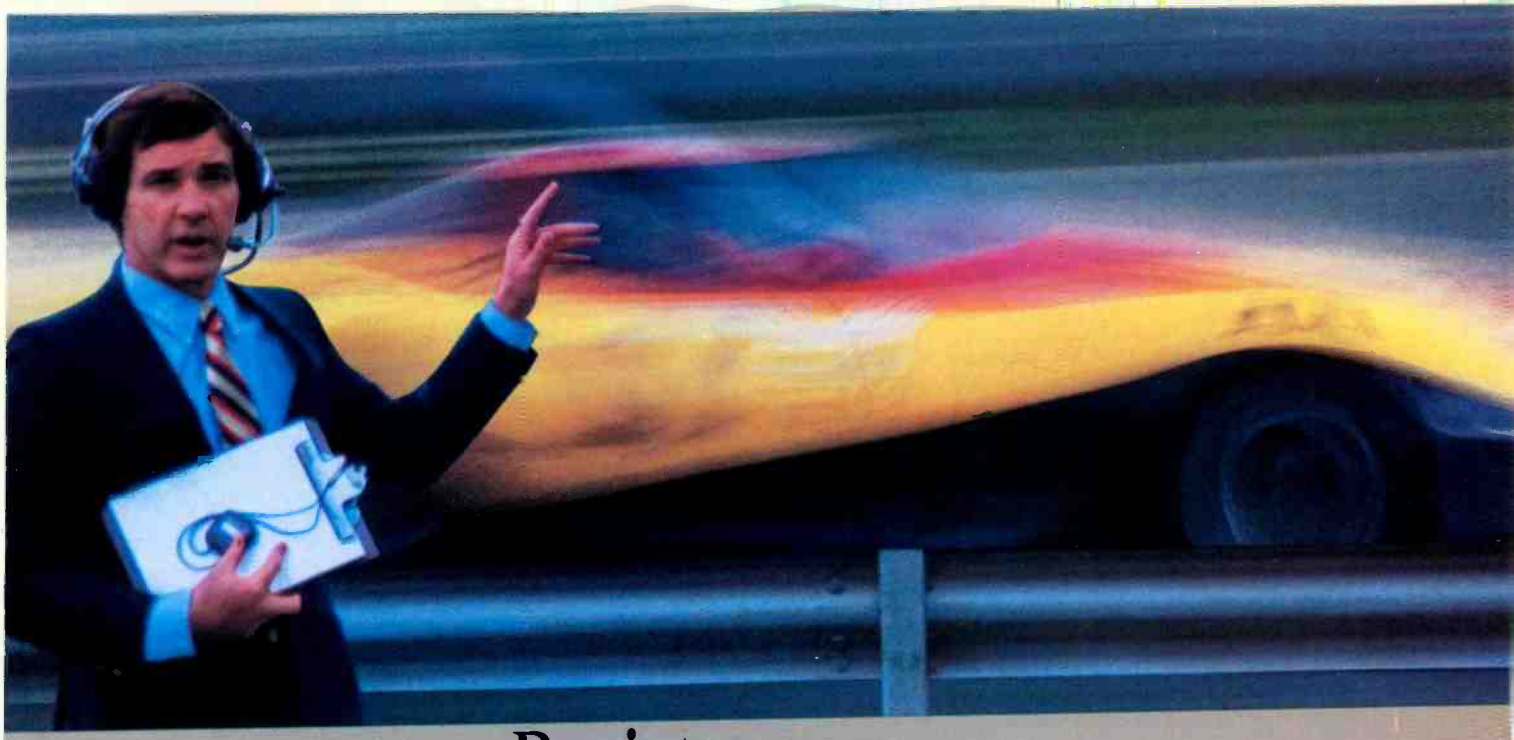
Connectronics **(2403)**
Introductions
- SECK 1882: portable audio mixer console; 18-channel inputs.

Product line
Specialized audio wiring, cable; portable mixing consoles; audio signal processors.
Circle (680)

Conrac **(3124)**
Introductions
- 6545/6550 Micromatch: 13-inch, 19-inch color monitors, PIL CRT; auto color setup with photometer; digital beam controlled feedback; auto switchable color standards, NTSC/RGB/PAL; comb filter, color tracking circuitry.



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Introducing the stereo version of our legendary FP31.

Stereo adds incredible dimension and realism to sports and news coverage. And Shure's new compact FP32 Stereo Mixer makes ENG and EFP applications easy and economical.

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- Built-in slate mic and slate tone.
- Battery, phantom, and A/B power (no special power supplies needed).

Plus new stereo advantages:

- Full stereo capability with separate, detented stereo pan pots and monitoring capability.
- Full 48 volt phantom capability.

Size? Only 2 5/16" x 7 1/4" x 6", comparable to our FP31. Weight? Just 2 1/2 pounds. Price? Hundreds less than you would expect. Stereo is here to stay. So is the FP32. For complete information about our full line of field production gear, write or call: Shure Brothers Inc., 222 Hartrey Avenue, Evanston, IL 60202-3696. (312) 866-2553



The new FP42 Stereo Production Mixer — the stereo counterpart to our M267. Four channels with independent center detented pan pots and cuing. Headphone amplifier. Adjustable limiters.



SHURE

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Breaking Sound Barriers™

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Conrac, continued

Product line
Color video class I monitors; ultrahigh-resolution monitors.
Circle (681)

Continental Electronics Div/ Varian (3200)
Product line
AM, FM radio transmitters; FM antennas; coaxial switching systems; related RF equip ment.
Circle (682) See ad page 216

Control Concepts (2652)
Introductions
Power line filters for broadcast, industrial and computer applications.
Circle (683) See ad page 225

Conus Communications (3491)
Introductions
- Washington Direct: live and taped coverage of events in Washington, DC, unedited via K-2 satellite from Conus SNG van.

Product line
News program distribution via satellite.
Circle (684)

Convergence (3252)
Introductions
- ECS-225 enhanced: fully assignable editing controller; increased to 8-machine capability, any mix of VTR/VCR formats.
- ECS-195: edit controller system; 2-machine, time-code-based, full list management.

Product line
Editing controller systems.
Circle (685)

Cool Light (2800)
Product line
Stage, studio lighting equipment, accessories.
Circle (686)

Corporate Communications Consultants (2753)
Introductions

Product line
Programmable image color correction systems for tape or film.
Circle (687)

Countryman & Associates (2425)
Product line
Microphones, accessories.
Circle (688)

Cox Electronics (2730)
Introductions
- ACC 200: analog video converters, transcoders; RGB, Beta, M formats.
- 660 corrector: component video color correction equipment.
- 600/660/TC: time-code control for composite and component color correction.
- Video, audio production, routing switchers.

Product line
Video component transcoders; encoders for all TV standards; video processing equipment; computer video converters.
Circle (689)

Crosspoint Latch (3539)
Introductions
- No. 6129: compact post-production video switcher; 7-input, chroma-keyer, three colorizers; 100 4-event sequences stored, recalled; five auto-ramp fades; options include second insert chromakeyer, second pattern generator for conversion to 2-ME switcher, DSK outline/edger, serial edition control interface.
- No. 8200: dual TBC with posterization, push-off/pull-on effects; 12 patterns, color borders, soft edges; 5-input; keying includes DSK with hard/soft edge and fade-to-black; serial audio mixer; table unit; options include color-bar generator, RGB chroma-key, audio tone, edit control input, rack-mount.

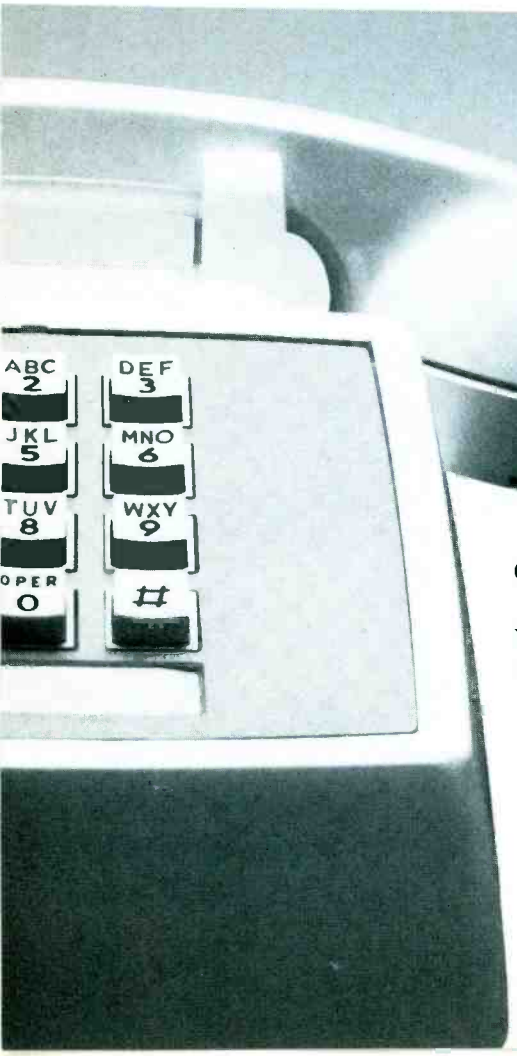
Product line
Video production, master control switchers.
Circle (690) See ad page 347

Crown International (2927)
Product line
Audio monitor amplifiers.
Circle (691)

Cubicomp (2692)
Introductions
- PictureMaker enhancements: additional capabilities for 3-D video animation and graphics system.

Product line
Computer animation systems.
Circle (692)

dbx (2740)
Product line



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Now you can take control of your remote broadcasts. Because with a Comrex Frequency Extender you can transmit a full 5K, using just two standard telephone lines.

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dbx, continued

Audio processing products.
Circle (708)

DX Communications **(2693)**
Product line
FM, TV receiving antennas.
Circle (725)

DYNAIR Electronics **(3409)**
Introductions
- Series 1600: switching equipment for graphics, HDTV; ±0.25dB over 100MHz bandwidth; hum, noise more than 60dB below 1V; high cross-talk isolation.
- System 23: SMPTE/EBU ESbus controls and components for end-user and OEM applications to whole control environment

Product line
Audio, video routing switchers; passive switchers; switcher control systems; audio, video DA equipment.
Circle (726) See ad page 207

Peter W. Dahl Company **(222)**
Introductions
- Rectifier retrofit: high-voltage assembly for RCA F-line transmitters; 4kV aural, 6kV visual supplies.

Product line
Plate, modulation transformers, reactors; HV rectifiers.
Circle (701)

Dalsat **(2424)**
Introductions
- SNV 6: Smaller version of the SNG 25 news gathering vehicle.

Product line
SNG, mobile production vehicles.
Circle (702)

Bill Daniels Company **(2631)**
Introductions
- Manufacturer literature management service.

Product line
Illustrated trade reference books.
Circle (703)

Data Communications/DCC **(3204)**
Introductions
- BIAS PC Cable: IBM XT/AT sales, traffic, accounting and billing for multiple CATV advertiser-supported channels; ad insertion and soft interconnect options.

Product line
Computer newsroom systems; radio business software.
Circle (704)

Datatek **(3547)**
Product line
Audio/video routing systems; machine control systems; audio/video DAs; interface modules.
Circle (705) See ad page 81

Dataworld **(2779)**
Product line
Broadcast database of AM, FM, TV and ITFS stations; allocation services; terrain elevation retrieval program; unused call-sign listings.
Circle (706)

Datum **(2408)**
Product line
Intelligent time-code processors; video time-code data encoders, readers.
Circle (707) See ad page 162

Delcom **(3580)**
Introductions
- Customized studio cabinets and furnishings.
- Turnkey system installation services.

Product line
Studio furnishings, draperies, lighting equipment.
Circle (709)

Del Compu-Cable Systems **(2449)**
Circle (710)

Deloitte, Haskins & Sells **(2542)**
Product line
Financial consultant services.
Circle (711)

Delta Electronics **(3488)**
Introductions
- ASE-1 exciter: improved AM stereo exciter system.
- ASM-1 monitor: AM stereo modulation monitoring unit.

Product line
RF ammeters; impedance bridges; transmitter remote control systems; coaxial transfer switches; power, modulation controllers.
Circle (712)

Desisti Lighting/Desmar **(2796)**
Introductions
- 2400 series: Rembrandt HMI spotlights: 575W, 1.2kW, 2.5kW, 4kW, 6kW, 12kW; Venture series.

Product line
Lighting instruments: dimmers; lamps; grip, mounting equipment.
Circle (713)

DeWolfe Music Library **(2712)**
Introductions
- Compact discs; music library.

Product line
Record and tape music libraries; sound effects records.
Circle (714)

Dielectric Communications **(3436)**
Product line
Transmission lines; waveguides; CP antennas, panel antennas; RF switches, combiners, diplexers, filters; test loads; dehydrators; microwave absorbers.
Circle (715) See ad page 325

Digital Services Corporation/DSC **(3304)**
Introductions
- Graphics animation system.
- Illusion enhancements: additional effects for digital video effects system.

Product line
Digital video effects equipment; still-store systems.
Circle (716)

Digital Techniques **(2493)**
Product line
Touch screen controlled interactive digital graphics and videodisc systems.
Circle (717)

Digital Video Systems **(3272)**
Product line
Digital TBC, frame synchronizers.
Circle (718) See ad page 321

DigiVision **(2527)**
Introductions
- CP-100: Real time video processor; locally adaptive, contrast enhancement, noise reduction.

Product line
Digital video converters.
Circle (719) See ad page 310

Di-Tech **(3567)**
Introductions
- 9001 controller: color CRT display of master X-Y control system; lockout capability.
- 937 control panel: alphanumeric X-Y configuration with breakaway.
- 948 panel: push-button control, 40 LEDs; triple breakaway.
- 7006 audio system: dual metering, dual speakers, monitor amps.

Product line
AFV routing switchers; audio, video, pulse DAs; control panels.
Circle (720) See ad page 73

Dolby Laboratories **(2705)**
Product line
Audio noise reduction systems.
Circle (721)

Dorrough Electronics **(2602)**
Product line
Loudness meters; multiband audio processors; FM stereo generator.
Circle (722) See ad page 82

The Droid Works **(3572)**
Introductions
- EditDroid enhancements: software; edit list editing, combining, improved logging; sound, image control functions.
- SoundDroid: audio processing, production system; systems now in production.

Product line
Film, video, sound editing systems.
Circle (723)

Dubner Computer Systems **(3113)**
Introductions
- DPS-1: graphics NTSC paint system; production models, compatible with CBG third plane; true NTSC frame grabbing.
- 10K/20K: character generator/titlers; production models; 60 million colors, linear keying; anti-aliased fonts; playback of CBG, Texta animation and graphics; real time system.

Product line
Graphic, character/title, background generators.
Circle (724) See ad page 77

Dynascan **(2464)**
Product line
Power supplies; AF, RF test equipment.
Circle (727)

ECD Industries **(2773)**
Product line
E-ROM programmers; Electron II products.
Circle (731)

EECO **(3540)**
Introductions
- Enhancements: for IVES and EMME editing control systems.

Product line
Editing control systems; time-code peripherals.
Circle (732)

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The Gyrozoom 60/300 Image Stabilizer Lens fits most ⅔" ENG cameras and eliminates virtually all image vibration. You get the shot right the first time because, many times, it's the only chance you have.



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- Independent control of Safe Title and Safe Action reticles
- Unrestricted selection of limits both horizontal and vertically
- Remote control switching of Safe Title, Safe Action and cross-hairs
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- Joy-stick control of Safe Action reticle from dead-center to edge of blanking area

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Circle (154) on Reply Card

EEG Enterprises (2802)
Product line
Captioning systems; vertical interval data insertion.
Circle (733)

EEV (2626)
Introductions
- P8498/99: 1-inch diode gun Leddicon; low lag, high-resolution; low output capacitance; barium aluminate cathode for long life.

Product line
Leddicon camera tubes; UHF TV klystrons; AM, FM power transmitter tubes; TV camera vidicons.
Circle (734) See ad pages 126-127

EG&G (2612)
Product line
Tower lighting fixtures and controls; antenna beacons.
Circle (735)

EMCEE Broadcast Products (3032)
Introductions
- TS10GS translator: ITFS/MMDS system, 10W output; phase-locked receiver.
- TSA100GA amplifier: ITFS/MMDS RF amplifier, 100W.
- Demonstration: digital transmissions on the TV channel.

Product line
UHF TV transmitters; solid-state UHF transistors; ITFS/MMDS transmitters.
Circle (736) See ad page 281

EMCOR Products/CRENLO (2402)
Product line
Modular electronic enclosures; computer support furniture; chassis slides; instrument cases; EMI/RFI emission control cabinets; packaged blowers.
Circle (752) See ad page 235

E-N-G (3308)
Introductions
- SNG compact satellite vehicle.

Product line
ENG news vehicles.
Circle (737)

ESE (3470)
Product line
Digital clocks, timers; time-code readers, generators, comparators; DAs; telephone hybrid interfaces; master and programmable clock systems.
Circle (738) See ads pages 303, 333

ESS/Spectratek (2469)
Introductions
- Diffusion; camera filters.
- Product; professional camera filter series with holographically produced star and diffraction filters.

Product line
Special effects optical filters for film, TV.
Circle (739)

Eastman Kodak (3208)
Product line
½-, ¾- and 1-inch videotape reel, cassettes; 8mm videocassettes; Datakode control surface; motion picture film.
Circle (740) See ad page 139

Echolab (2827)
Introductions
- DV5: digital effects integrated into SEG

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each one easily handles the wide dynamic range & precise acoustic demands of digital and advanced analog audio-for-video.

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Circle (155) on Reply Card

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Echolab, continued

control panel.
Product line
Manually controlled and computer-operated video production switchers.
Circle (741) See ad page 183

Econco Broadcast Service **(2578)**
Product line
Rebuilt transmitter power tubes.
Circle (742)

Elcom-Bauer **(3414)**
Introductions
- Model 610C: 10kW FM transmitter.
- Model 6300: 300W FM transmitter.
- Model 6020: FM exciter.

Product line
FM transmitter systems.
Circle (743)

Elcon Associates **(3340)**
Introductions
- EA1254: cleaner/evaluator system for 1-inch videotape.

Product line
Videotape cleaners, evaluator systems.
Circle (744)

Electro Controls **(2710)**
Product line
Lighting dimmer control consoles.
Circle (745)

Electro Impulse Laboratory **(3431)**
Product line
Forced air, dry dummy loads for FM: RF calorimeters; wattmeters; RF attenuators.
Circle (746)

Electro-Voice **(3430)**
Introductions
- RE-98: miniature omnidirectional microphone.
- Entertainer 100: portable mixing and speaker system.

Product line
Control room monitors/speakers; broadcast, reinforcement microphones; mic accesories; production, reinforcement audio mixers; mic mixers; audio processors.
Circle (750) See ad page 259

Electronic Research **(2576)**
Product line
Side mount, panel FM antennas; diplexers, notch filters.
Circle (747)

Electronic Systems **(2640)**
Product line
On-air audio mixers; hum coils; machine synchronizers; audio processors.
Circle (748)

Electronic Visuals **(2730)**
Introductions
- EV4041: waveform monitor with line selector.

Product line
Waveform monitors; vectorscopes.
Circle (749)

Elicon **(2784)**
Introductions
- CCS-XL: boom arm camera control system, extended length boom.
- Ultrasonic follow focus system for live action use.

Product line
Boom arms; camera support systems.
Circle (751)

Emergency Alert Receivers **(NA)**
Introductions
- Tone alert radios: provides emergency notification from AM, FM, weather radio stations, EBS signal; automatic cut-off after message.

Product line
Emergency monitoring receiver; subcarrier communications systems.
Circle (753)

Energy-Onix **(2703)**
Introductions
- FM transmitter series: solid-state IPA, 1-tube systems from 40W to 30kW; extensive control systems.

Circle (754)

Environmental Satellite Data/ESD **(2786)**
Introductions
- 6000 CD: enhanced front-end for weather work station; color display; interfaces host graphics system to WINX or Zephyr satellite links.
- Clutter-free radar.
- Smoothed radar.
- Custom mapping: shows high-resolution clouds.
- Weather radar: systems for radio.

Product line
Weather radar systems, displays.
Circle (755)

Eventide **(2830)**
Introductions
- Broadcast digital audio delays.
- Effects software: vocoder, auto panner.

Product line
Digital audio delays; audio effects systems; reverb systems.
Circle (756) See ad page 137

Evertz Microsystems **(201)**
Introductions
- Emulator: transport interface, allows audio transports to be integrated with video machines.
- Chase synchronizer.

Product line
Time-code-based systems; machine synchronizers.
Circle (730) See ad page 146

Excalibur Industries **(2637)**
Product line
Custom equipment cases; shock-isolated rack-mount cases; interlocking cases.
Circle (757)

Fairlight Instruments **(2460)**
Introductions
- CVI: computer video instruments; video synthesis and graphics.

Circle (758)

Faroudja Laboratories **(3408)**
Introductions
- CTE-N: NTSC encoder, delivers composite video free of cross-color and cross luminance artifacts.

Product line
Video image enhancers; detail processors; video color correctors; composite video decoders.
Circle (759)

Ferno-Washington **(2782)**
Introductions
- Ferno-Freelancer: on-location audio/video cart; 300 pound capacity; easily loaded into, removed from vehicle by one person; adjustable shelves.

Product line
Remote TV production equipment carts.
Circle (760)

Fiberbilt Cases **(132)**
Introductions
- 855 series: ATA spec 300 reusable shipping containers.

Product line
Shipping cases in rack-mount and molded styles; heavy-duty equipment cases.
Circle (761)

Fidelipac **(3092)**
Introductions
- CTR10 series: DYNAMAX tape cartridge machines.
- CTR30: DYNAMAX multideck tape cartridge machines.
- ESD-10: eraser, splicer detector for NAB audio cartridges.

Product line
Audio cart machines; audio carts; bulk audiotape; cartridge accessories.
Circle (762)

Film House **(2781)**
Circle (763)

Film/Video Equipment Service **(2803)**
Introductions
- Wide Eye I, II: Wide-angle attachments, slip over ENG/EFP lenses.
- Modification: allows Arriflex mattebox and follow focus unit use with ENG/EFP cameras; control through F/Vesco J-6 zoom controller.

Product line
Sealed lead-acid, nicad batteries, accessories; lens accessories service.
Circle (764)

Flash Technology **(3454)**
Introductions
- SC110: high-intensity lighting control unit.
- FTB139: 24Vdc medium-intensity light.
- OL-208: optical control transfer link.

Product line
FAA-approved tower lights, beacons.
Circle (765)

John Fluke **(100)**
Introductions
- 9000A-006: asynchronous probe option for Fluke 9000 series Troubleshooter PCB fault locator systems.

Product line
Computerized test systems; digital multimeters.
Circle (766) See ad page 275

Focal Press **(2541)**
Circle (767)

For-A **(3599)**
Introductions
- FA-800: frame synchronizer; auto level control; for 1-inch type C VTRs, DOC, velocity correction.
- DEC-110: NTSC-to-RGB signal decoder; color; processing circuitry.
- CCS-4400: component color correction system; Y/R-Y/B-Y inputs, outputs; RGB B/W correction, gamma control; NTSC monitor

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For-A, continued

output.
- CT-500: component transcoder; RGB, YIQ, Y/R–Y/B–Y inputs, outputs; full matrix transcoding.
- Color-bar generator: RGB, Y/R-Y/B-Y outputs; black burst, composite sync, H-, V-drives, gen-lock.
- TKY-2000: title, downstream keyer; matte, edge, background color generators.
- TGR-3300: time-code generator, reader, title display; VITC and LTC capabilities.
- LG-100: logo generator; stores four customized logos; variable position and size.

Product line
TBC, frame synchronizers; titlers; color correction systems; composite, component video switchers; video encoders, decoders, character, graphics effects interfaces.
Circle (770) **See ad page 135**

Fortel **(3044)**
Product line
TBCs; video, color noise reduction systems.
Circle (768)

Fort Worth Tower **(3360)**
Product line
Towers, services, for all communications requirements.
Circle (769)

Fostex of America **(2579)**
Product line
Audio recorders; audio mixing consoles; equalizers.
Circle (771) **See ad page 148**

Frezzolini Electronics **(2716)**
Introductions
- No-Memory: nicad batteries without memory effects.
- RPS-4: ac adapter; weighs less than 2 pounds; powers cameras up to 40W.
- Multiple Mini-Fill: portable lighting kit; three lighting instruments with 100W lamps, flip-up dichroic filters; adjustable stands, camera-mount studs; power cable plugs, 4-output 115V-to-12V ac power supply.

Product line
Batteries, chargers, accessories; portable lighting equipment.
Circle (772) **See ad page 336**

Fuji Photo Film USA **(3240)**
Introductions
- H621E: videotape, 1-inch reel.
- H421M: professional ½-inch videocassette, M format.
- H321B: professional ½-inch videocassettes, Betacam format.

Product line
Reel and videocassette tape media.
Circle (773)

Fujinon Optical **(3410)**
Introductions
- A18x8.5: ENG lens, replaces 17x9 model; weatherized, lightweight, shorter length; 2x, 1.7x extenders; MOD 0.9m.

Product line
ENG/EFP, studio camera lens systems, lens accessories.
Circle (774)

G&M Power Products **(2790)**
Product line
Light belts; replacement batteries; chargers; battery belts.
Circle (775)

GML **(2456)**
Product line
Microphones, pre-amps.
Circle (776)

GML America **(241)**
Product line
Frame synchronizing digital video effects system.
Circle (777)

GTE/Spacenet **(2573)**
Product line
Satellite news gathering, program distribution services.
Circle (778)

GTE/Sylvania **(3393)**
Introductions
- CYX lamp: rugged construction; 2kW studio unit.
- FFN lamp: 1kW PAR 64, 800-hour rated life, VNSP.
- FFP lamp: 1kW PAR 64, 800-hour rated life, NSP.
- FFR lamp: 1kW PAR 64, 800-hour rated life, MFL.
- FFS lamp: 1kW PAR 64, 800-hour rated WFL.

Product line
Tungsten halogen, fluorescent and metal halide (HMI) lamps for studio, TV, theater.
Circle (779)

Garner Industries **(2601)**
Introductions
- 2700 degausser: continuous duty rating for videocassettes, floppy disks, computer cartridges; dual coil design for high coercivity media.

Product line
Bulk tape degausser systems.
Circle (780) **See ad page 298**

General Electric **(2717)**
Product line
Watt-Miser quartz lamps.
Circle (781)

Generic Computer Systems **(2818)**
Product line
Software for trafffic, billing, affidavits.
Circle (782)

Gentner Engineering **(2669)**
Introductions
- VRC-1000 remote: transmitter controller; uses dial-up phone lines.
- EFT-900 transceiver: audio frequency extender.
- DPH-5 hybrid: dual line, digital autonulling.
- TC-100 interface: automatic system with touch-tone decoder option.

Product line
Single-line telephone hybrids; telephone interfaces; audio frequency extenders; audio patch panels; passive audio routing switchers; intercoms for radio.
Circle (783) **See ads pages 244, 246, 248**

Giese Electronic **(2785)**
Introductions
- Taker 1000: automatic dialog replacement system.
- Synchronizer lock system 3/3.
- Multislave selector unit for synchronizer.
- Time-code test equipment.

Product line
Time-code readers, generators, character inserters.
Circle (785)

Global Systems **(2788)**
Product line
ITFS/MMDS/MDS systems; receivers.
Circle (786)

Alan Gordon Enterprises **(3435)**
Introductions
- EOS/FAX: video animation controller, frame-by-frame recording on Sony or JVC U-matic; for animation, titles, pencil tests, time lapse, clay animation, pixelation and computer-generated graphics.
- Spectrum computer-assisted motion controller with FAX animation stand; menu-driven; 6-motor system for camera height, focus, X/Y and rotation adjustment; complete repeatability with non-dedicated IBM-PC (650K memory).

Product line
Microphones, accessories; masts, dollies, camera support equipment; equipment rental.
Circle (787) **See ad page 58**

Gorman-Redlich Manufacturing **(2715)**
Product line
EBS equipment; weather receivers; digital antenna monitors.
Circle (788)

Gotham Audio **(3354)**
Introductions
- EMT-448: digital audio spot recorder, reproducer; removable Winchester disk storage; for TV sound effects or fast access short sound files applications.
- EMT-227DX: limiting amplifier for medium, shortwave AM broadcast; 0.3ms delay line controls transients.

Product line
Audio consoles; phone systems; microphones, accessories; speakers; peak program meters; audio processors; audio cables.
Circle (789)

Graham-Patten Systems **(2528)**
Introductions
- 608 edit mixer: 8-input audio console; editor control capability.

Product line
Audio mixers; programmable audio equalizers; video stand-alone, DSK keyers; audio video DAs; remote status control systems.
Circle (790) **See ad page 70**

Grass Valley Group **(3112)**
Introductions
- Series 85 EZ-Link; fiber-optic system.
- DPM-1 KALEIDOSCOPE: digital video effects system.

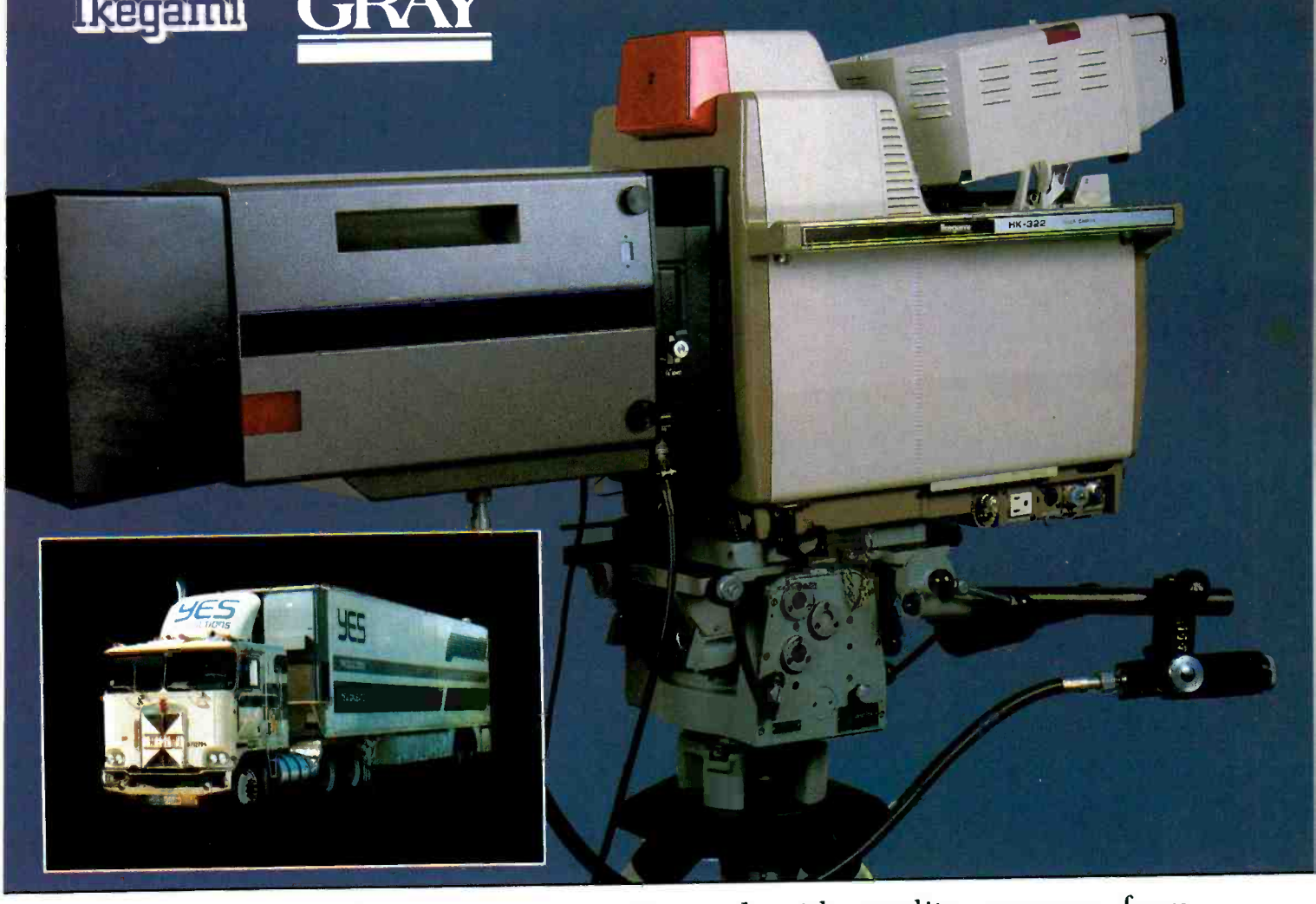
Product line
Production, post-production video switchers; master control switchers; master control automation; effects memory systems; AFV switching systems; editing controllers; audio, video routing switchers; fiber-optics materials, systems; timing, processing, distribution equipment.
Circle (791) **See ad page 9**

Gray Communications Consultants **(3402)**
Product line

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EXCELLENCE IN THE AMERICAN TRADITION

Ikegami GRAY



American business tradition is characterized by unsurpassed excellence in service, reliability and quality. True to this tradition, Gray does it the old-fashioned American way—we do it right the first time!

Teamed with quality cameras from Ikegami, Gray offers the finest equipment and over a decade of video engineering expertise. Call your local Gray office for excellence in service, reliability and quality.

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BIRMINGHAM, AL (205) 942-2824
CINCINNATI, OH (513) 896-1011
FT. WALTON BEACH, FL (904) 651-8546
FT. LAUDERDALE, FL (305) 523-3637
GAINESVILLE, FL (904) 332-2436
HUNTSVILLE, AL (205) 881-5840
KNOXVILLE, TN (615) 588-7161
N. LITTLE ROCK, AR (501) 758-3234
MEMPHIS, TN (901) 525-1135
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(504) 733-7290
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GRAY COMMUNICATIONS
CONSULTANTS · INC

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Circle (158) on Reply Card

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This signal diode survived a 20,000 AMPERE Lightning Strike and a 1KV/NS EMP Pulse.



It was protected by a USA made, Patented, coaxial protector that has low VSWR < 1.1 to 1 and < 0.1 dB loss.
No other protector in the world works better.



- For 50, 75, and 93 ohm systems.
- For coax to 2.5 GHz.
- For wire line to 2.5 MHz.
- For telephone up to 6 pair.
- For power line 120V 60 Hz. - 400 Hz.
- For random wire antennas 1-30 MHz.

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Gardnerville, NV 89410-1237
Phone 1-800-325-7170
Telex 272718 PolyPhaser

Circle (159) on Reply Card

Gray Communications, continued

ENG, EFP vehicles; audio, video products.
Circle (792) See ad page 239

Gray Engineering **(2428)**
Introductions
- TCA-143: time-code analyzer; analyzes input SMPTE editing code for a series of diagnostic faults; retransmits corrected signals.

Product line
Time-code generators, readers, analyzers, character inserters; time-code phase correctors, analyzers; reticle generator.
Circle (793) See ad page 232

The Great American Market **(2714)**
Introductions
- MicroBrute LV9: miniature 9-light with 12V lamps.
- RDS/USA: studio and portable lighting fixtures, HMI lamps, batteries, accessories.
- FOG POWER: scented fog fluid.

Product line
Studio and portable lighting fixtures; aluminum light block; projection pattern templates; light effects projector.
Circle (794)

Grosh Scenic Studios **(NA)**
Introductions
- Studio winch.

Product line
Studio scenery; studio fixtures.
Circle (795)

Grumman Electronic Systems **(2481)**
Introductions
- AIS-5000: automation system controller; allows random access from sales and traffic scheduling to spot insertion and billing; machine control.

Product line
Video amplifiers; program automation systems; sync generators; RF test equipment.
Circle (796) See ad page 279

James Grunder & Associates **(2429)**
Introductions
- EFX-2: digital effects; touch screen controller from simple menus.
- EFX-3: dual channel effects system; touch screen control.
- EFX-4: dual channel digital effects system; multichannel combiner.
- P156/2: standards converter.
- MCM37B/50B: 14-inch and 20-inch color monitors; high resolution; multistandard.

Product line
Digital effects systems; video processing systems; monitors.
Circle (797) See ad page 315

HM Electronics **(2619)**
Introductions
- BH720 belt pack: cabled-intercom, single channel headset station.
- BH721 belt pack: cabled-intercom, 2-channel, headset station.
- RL742: rack-mounted 2-channel intercom loudspeaker station.

Product line
Wireless microphones; wireless intercoms; cabled intercoms.
Circle (801) See ad page 144

HEDCO **(2751)**
Introductions
- GSC-101: microprocessor switching controller.
- HD-12/HD-50: video/audio switching systems; RS-232/422 control; 12x12 with stereo audio and 50x50 configurations.
- VAC-300 switch: video activated control.
- SSG-321: audio test generator.

Product line
Audio, video DAs with power supplies and rack frames; video/stereo audio switchers.
Circle (802) See ad page 213

Hallikainen & Friends **(2925)**
Introductions
- TVA20: stereo audio follow video mixer system.

Product line
Audio mixers; transmitter remote control, logging systems; digital telemetry update kits.
Circle (803)

Harris/Broadcast Group **(3136)**
Harris Video Systems/ADDA **(3238)**
Harris Broadcast Microwave **(3136)**
Introductions
- FM-35K: 35kW FM transmitter.
- PUP: portable uplink SNG package.
- 4.5m Ku-band satellite antenna.
- Central receiver: 2/2.5GHz for ENG.
- Wideband Challenger: 1.99GHz-2.5GHz transmitter/receiver; output power variable between 2W and 6W; receiver has switchable IF filters.
- Sentinel 48: remote control system.
- Program automation system.
- ESP II: still-store system.
- Model 640: synchronizer; 8-bit, 4X subcarrier; optional noise reduction, TBC functions.
- Model 634: synchronizer; integral effects.
- Model 560: time base corrector.
- Model VW-3: synchronizer.
- Model AC-20; dual channel TBC with effects.

Product line
AM, FM, TV transmitters, antennas; ENG, STL microwave systems; TV cameras; remote control systems; audio processors; video effects systems; still stores; TBC/synchronizers; audio consoles; phone pre-amps; graphics systems; audio phase correctors; satellite communications equipment.
Circle (804) See ads pages 217, 306

Harrison Systems **(3412)**
Introductions
- Series 10: audio console with hard disk automated support; reset to previously established signal flow and processing parameters; for television, film, multitrack recording applications.

Product line
Audio mixing consoles; console automation equipment; audio routing switchers.
Circle (805) See ad page 125

Heie Engineering **(2452)**
Introductions
- BC1 Commander: on-air broadcast console; auto sequencing; TV hybrid interface; machine controls; clock, timer, temperature sensor.

Product line
Audio mixing consoles.
Circle (806)

Karl Heitz **(2900)**
Introductions
- No. 480: fluid and counterbalanced head

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THE RIGHT CHOICE

Digital time base correctors from Microtime. Whether it's the new T-300 Series or the components T-220 FIT, Microtime has a time base corrector for every application.

Features and performance you need at the price you want:

The T-320D provides:

- ☐ Interpolated freeze with digital comb filter
- ☐ Vari-Trak™ option
- ☐ Drop out compensator
- ☐ Shuttle to 40x
- ☐ Genlock with RS-170A constant color frame output
- ☐ Proc-amp controls with presets

The T-320 or T-300 offer most of the same features.

And, for maximum flexibility, the T-220 Format Interchange Time Base Corrector allows inputs of composite, component and dub, with simultaneous multiformat outputs. Why lock yourself into one format when you can have them all?

- ☐ Interpolated field freeze for flicker-free pictures
- ☐ Vari-Trak™
- ☐ Maximum transparency component processing
- ☐ Unlimited correction window
- ☐ Field synchronizer capability
- ☐ Drop out compensator
- ☐ Shuttle to 40x

Microtime has remained the leader in TBC and digital video processing for over a decade. Our commitment to quality and dependability gives you the latest video processing technology at an affordable price.

All products are backed by a dedicated customer service department; 24-hour, 7 day-a-week hotline; replacement parts; and, a worldwide network of full service distributors.

Microtime, the right choice.

Microtime, Inc., 1280 Blue Hills Avenue, Bloomfield, Connecticut 06002 USA, Telephone (203) 242-4242, TWX 710-425-1165.

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Southcentral, Steve Krant (214) 644-0232
Southeast, Jerry Rankin (404) 979-4437

Vari-Trak is a trademark of Microtime, Inc.

Circle (160) on Reply Card

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for cameras to 30 pounds.
- 510B4/510B6: Mini Tele Studex; leveling ball 4/6 for cameras to 50 pounds and 100 pounds; range 0-61 inches; optional rapid sliding or Cremaillere gear lift column.
- 563LM: mic fishpole; 5-section; 2.5 feet to 10.5 feet.

Product line
Tripods; fluid, counterbalanced heads; dollies, monopods; lightstands; mic fishpoles.
Circle (807) **See ad page 278**

Hipotronics **(2728)**
Product line
Automatic voltage regulation systems.
Circle (808) **See ad page 172**

Hitachi Denshi America **(3160)**
Introductions
- Z-31P: Plumbicon version of Z-31 auto-setup camera.

Product line
1-inch VTRs; auto-setup TV cameras; HDTV products.
Circle (809) **See ads pages 3, 90-91**

Hoffend & Sons **(2641)**
Circle (810)

Holaday Industries **(2737)**
Introductions
- HI-3500 meters: broadband exposure hazard monitor for continuous surveillance in high RF radiation areas.

Product line
Isotropic broadband field strength meters.
Circle (811)

Hotronic **(2531)**
Introductions
- TBC/frame synchronizer: reduced size, full featured.

Product line
TBC/synchronizers.
Circle (813) **See ad page 264**

Howe Audio **(2832)**
Introductions
- Series 8000: modular audio console; rotary faders; sizes from eight to 22 channels.
- Series 10000: flexible modular audio consoles.

Product line
Audio mixing consoles; stereo phase correction systems.
Circle (814) **See ad page 167**

Hubbard Communications **(3286)**
Introductions
- HCD-500: video time delay machine, 3 minute to 2 hour range.
- Flite Pack: Ku-band transportable SNG system; rapid deployment.
- LWA-1; 275W TWTA amplifier, antenna mounted.

Product line
Telecine cameras; video cart automation systems; mobile news/ENG vans; SNG vehicles; waveguide pressurization/dehydration systems.
Circle (815)

Hungerford & Company **(2534)**
Product line
Broadcast accounting services.
Circle (816)

ICM Video **(2711)**
Introductions
- CG-7000P: character generator, gen-lock or stand-alone, infinite character and background colors, preview/program outputs, 20-page memory with auto-sequence, scroll, crawl; two character sizes with other fonts on plug-in module.

Product line
Video enhancers, processors; audio, video DAs; satellite receivers, down converters, accessories; all NTSC, some PAL.
Circle (817) **See ad page 308**

IGM Communications **(3378)**
Introductions
- IGM-SC: IBM-PC-controlled audio switcher for complex requirements.
- IGM-EC: computer-controlled audio switcher for economical requirements.
- Custom: computer-controlled audio switchers for custom systems.

Product line
Multiple tray audio cartridge players; program automation systems.
Circle (818) **See ad page 232**

ITAME **(NA)**
Product line
Audio mixing consoles; AM, FM, TV exciters; stereo, SCA generators; remote pickup systems; STL systems; AM, FM transmitters.
Circle (831)

ITELCO USA **(2765)**
Product line
FM, TV transmitters, translators; microwave systems.
Circle (832)

ITS **(2535)**
Introductions
- ITS-10: VHF TV exciter.
- ITS-70: ICPM corrector unit.
- ITS-231: UHF backup exciter, transmitter; 1kW.
- ITS-1610B: 10W MMDS/ITFS transmitter.
- ITS-29: aural IF modulator for MTS use.

Product line
VHF, UHF TV transmitters; ITFS/MMDS transmitters; TV exciters; signal correctors.
Circle (819)

Ikegami Electronics **(3150)**
Introductions
- HK-323: studio and field camera, in studio and portable (with base station) configurations.
- HL-95 Unicam: enhancements include Beta, M-II ½-inch VCR adapters.
- Series 5/Series 16: monochrome monitors; high resolution.
- HDTV telecine camera system.

Product line
TV cameras, camera/recorders; color, monochrome monitors; auto-setup telecine systems.
Circle (820) **See ad pages 99-108**

Image Video **(2636)**
Product line
Stereo master control switchers; high-density routing switchers.
Circle (821)

Innovative TV Equipment **(3258)**
Introductions
- Model T50: tripod.
- Model H50: fluid head.
- Model T20A: tripod with head.

Product line
Pneumatic pedestals; remote pedestal; tripods; fluid heads.
Circle (822)

Inovion **(2445)**
Introductions
- PGS II system: basic still-frame image processor; includes paint and flash grab functions.
- APGS processor: real time image processor, with paint system and flash grab.

Product line
Film recorder for slides; color printer.
Circle (823)

Inovonics **(2434)**
Introductions
- Model 710: TV stereo generator production unit.
- Model 390: magnetic film recording electronics.

Product line
Digitally programmable audio processors; stereo broadcast processors; recording amplifiers; electronics; on-screen audio level display keyers.
Circle (824)

Integrated Media Systems **(2476)**
Product line
Audio routing switchers; audio DAs.
Circle (825)

Integrated Technologies **(2758)**
Circle (826)

Interactive Motion Control **(2771)**
Introductions
- Camera lifter: mechanical unit for precise up/down movement of camera.
- Video slide image system: positions slide for magnification of 35mm or 2¼-inch transparencies to a 4.5-inch image.

Product line
Motion control computer for animation applications.
Circle (827)

Interand **(3429)**
Product line
Teleconferencing systems with graphic image capabilities.
Circle (828)

Intergroup Video Systems **(3312)**
Introductions
- 9310: 10-input video production switcher.
- 9410/9420: 10- and 20-input video production switchers.
- Series 8000: master control switchers.
- 1100: routing switcher.
- Suite 16: video only, analog component routing switcher.

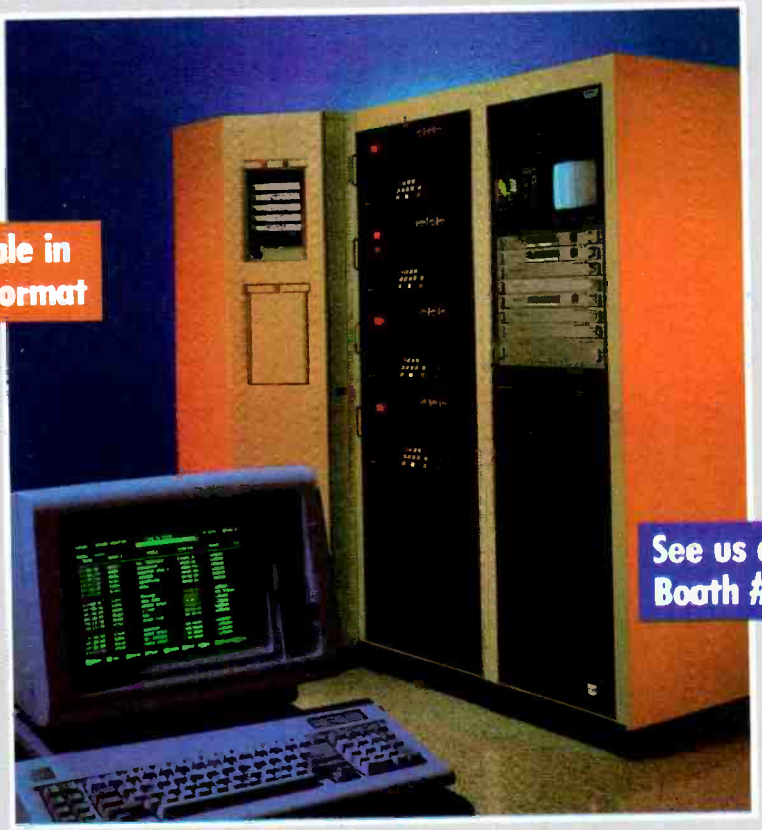
Product line
Matrix wipe generators; DSK edger; master control, production switchers; distribution amps.
Circle (829)

International Tapetronics/3M **(3052)**
Introductions
- ESL V: NAB cartridge eraser/splice locator.
- ScotchCart II: NAB broadcast cartridge.

Product line
Audio cartridge machines; telephone answering interfaces.
Circle (830) **See ad pages 142-143**

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PAY LESS ATTENTION TO YOUR VIDEO CART MACHINE



Great idea! Now you can do just that with the TCS-2000.

The Cart Machine automatically manages, records and plays-to-air all forms of spots and programs, giving you much more uninterrupted time away from programming concerns.

The Cart Machine holds up to 280 carts on-line. Tracks 65,000 carts in the database. With its 1,000 event look ahead feature, you receive a printed list of needed carts and your saturation spot carts never have to leave the machine.

The Cart Machine's comprehensive software system interacts with your traffic system to download your logs and automatically preplans the spot play lists days in advance.

Now other station operations get your undivided attention—with The Cart Machine.

Odetics

We put *smarts* in The Cart Machine.

Odetics, Inc. 1515 S. Manchester Ave., Anaheim, CA 92802-2907. Call toll free 1-800-243-2001. In California call 714-774-5000.

Circle (161) on Reply Card

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JBL Professional/UREI (2727)

Introductions

- Model 6215: 1-rack space audio power amplifier.
- Studio monitors: Model 4406, 2-way 6.5-inch, titanium dome tweeter. Model 4408, 2-way 8-inch titanium dome tweeter. Model 4410, 3-way 10-inch, titanium dome tweeter. Model 4112, 3-way 12-inch, titanium dome tweeter.

Product line

On-air audio consoles; time-aligned and bi-radial studio monitors.

Circle (833) **See ad page 41**

J&R Film/Moviola (3450)

Product line

Film-tape transfer and editing systems; telecine systems.

Circle (834)

JVC (3180)

Product line

¾-inch, ½-inch VCR recorders, players, editors, portables; VCR edit controllers; TV cameras; digital audio products.

Circle (835) **See ad pages 59-66**

Jefferson-Pilot Data Systems (3440)

Introductions

- JDS/CORE: call-out research radio software.
- JDS 1000: sales, traffic, accounting system; for IBM 36/PC.
- SALLY: TV ratings analysis system.

Product line

Radio business software; music rotation software; ratings analysis software; electronic news software; TV program management software.

Circle (836)

Jensen Tools (2721)

Introductions

- Shock-mounted cases: constructed to EIA-RETMA standards; fiberglass reinforced shells, interior racks.

Product line

Electronics service kits; tools, kits, cases; test equipment.

Circle (837)

The J-Lab (2474)

Introductions

- Betacam playback device.

Product line

Component video interface devices.

Circle (838)

Johnson Electronics (3451)

Introductions

- AT-4A tuner: addressable SCA receiver.
- DTR receiver: desktop SCA unit.

Product line

SCA receivers; audio power amps; FM antennas; audio mixers; EBS monitors; signal test sets.

Circle (839)

KEM Elektronik Mechanik (2467)

Introductions

- TRS/TRS2: vertical tape transport; for 16mm, 17.5mm, 35mm magnetic film; reduces space requirements; no capstan drive.

Circle (841)

K&H Products/Porta-Brace (2532)

Introductions

- PC-101: audio case; nylon, reinforced; 7.5x8.5x13.
- PC-201: nylon accessory case; reinforced; 10x11x6.
- C-150: recorder case; padded nylon; for Sony BVU150.
- HB20A: heavy-duty, non-skid shoulder strap with leather/foam pad.

Product line

Reinforced nylon equipment containers; transport cases.

Circle (842) **See ad page 124**

Kahn Communications (2454)

Introductions

- Signal generator: AM stereo signal source for receiver manufacturers, developed in cooperation with Boonton Electronics.

Product line

AM stereo exciters, receivers, monitors; audio processors; audio bandwidth extender systems.

Circle (843)

Kaman Sciences (3078)

Product line

Radio, TV station business systems and services.

Circle (844)

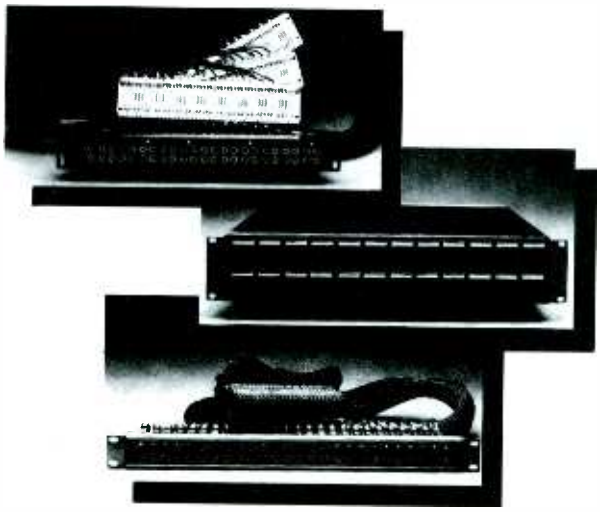
KalaMusic (NA)

Product line

Radio music formats.

Circle (845)

Time saver.



There's no need to spend your valuable engineering time wiring patch panels. Gentner Engineering's audio patch panels are meticulously hand-wired to your specifications, with fast delivery.

Not sure of your specifications? We have more than 200 standard configurations. See us at NAB booth #2669 for details.

The Clear Choice.

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Salt Lake City, Utah 84115
(801) 268-1117

Circle (162) on Reply Card

THINKING COMPONENT?

SEE US AT **BOOTH 2730** IN DALLAS
FOR THE LATEST IN
COMPONENT VIDEO EQUIPMENT

- Color Corrector
- RGB/Component Converters
- Keyers, Mix Amps
- Fade to Black
- Filters
- Component to NTSC Encoder
- Color Bar Generator
- 5 x 1 Switcher
- Sequential Monitoring

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Circle (163) on Reply Card

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TO CHECK A MONITOR'S COLOR ACCURACY, JUST PUT IT NEXT TO A SHARP.



The only colors you'll see on these Sharp monitors are true colors.

Because they both have a shadow mask CRT with U.S. controlled phosphors. Plus a comb filter that cuts cross-color interference.

They also have 600 lines of resolution, so the picture is as sharp as the color is accurate.

Plus multiple inputs, including RGB, that let you change sources at the flick of a switch.

And two time constants, so you can analyze VTR reproduction.

All for under $3,000 for our 13-inch model and $3,500 for our 19-inch.



Our 9" color monitor for remotes and editing.

Or for $700, there's our 9-inch utility color monitor for remotes and editing. With many of the features our larger models have.

So contact your local Sharp dealer, call Sharp at (201) 265-5548, or write Sharp Electronics Corporation, Professional Products Division, 10 Sharp Plaza, Paramus, N.J. 07652.

And the next time you're checking out monitors, remember:

Next to Sharp, any other monitor is the next best thing.

SHARP

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A/V Equipment, Audio, Banking Systems, Broadcast Cameras, Calculators, Cash Registers, Computers, Copiers, Electronic Components, Electronic Typewriters, Facsimile, Medical Products, Microwave Ovens, Televisions, Vacuum Cleaners, Video Recorders.

Circle (196) on Reply Card

Prices quoted are suggested list prices. © 1985 Sharp Electronics Corp.

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Kangaroo Video Products (2676)
Introductions
- KVP-150: video pack for Sony BVU-150.
- Nagra Pack: for all Nagra recorders.
- Raincover/KOTE: raincovers for most broadcast and industrial cameras.
- SQN-4: stereo mixer pocket for SQN-4.
- FP-32: Shure FP-32 stereo mixer pocket.
- SUPER-TOUGH II: prototype, top-loading case with viewfinder protection, for all cameras.
- KVP-25: prototype, for Sony BVW-25 recorder.

Product line
Video pack equipment protectors, containers; reinforced camera cases.
Circle (846)

Kavouras (2657)
Introductions
- RADAC 2020: color weather radar receiver; eliminates ground clutter interference.
- Weatherlink-Vista: push-button satellite communications system for instant weather products in video format.
- Weatherlink-Metpac: fast hardcopy satellite communications system; operates to four printers simultaneously.
- Tritron enhancements: graphics and animation software advancements.

Product line
Weather maps, graphics, information services; weather radar systems.
Circle (847)

Kay Industries/Phasemaster (2511)
Product line
Electric phase converters; power line conditioners.
Circle (848)

Keylite PSI Group (2432)
Introductions
- QuartzColor Arturo: Ianiro series of HMI and incandescent softlights.
- QuartzColor Sirio: Ianiro 12kW HMI system, Mark 2; ballast.
- Super Crank: Matthews adjustable equipment support stand.

Product line
HMI and incandescent lighting instruments; lighting stands; grip accessories.
Circle (849)

Kinemetrics/Truetime (2513)
Product line
Synchronized clock systems.
Circle (850)

Kings Electronics (3464)
Product line
RF coaxial, triaxial connectors; video patch panels, patch cords.
Circle (851)

Kintek (2455)
Introductions
- KT-960 Monogard: ele .ic stereo polarity corrector.
- KT-930 Stereogard: electronic stereo footprint generator.

Product line
Stereo conversion systems; signal polarity correctors; stereo generators.
Circle (852)

Kintronic Laboratories (2780)
Product line
Antenna phasing, tuning units; STL isocouplers; RF contactors.
Circle (853)

Kliegl Brothers (3581)
Introductions
- Performer IV: computerized memory lighting control system; 250 control channels for 999 digital dimmers; 960 event cue memory; 5x faster than previous systems; color CRT system status display.

Product line
Studio lighting control systems; lighting instruments; studio lamps.
Circle (854)

Knox Video Products (2611)
Product line
Character generators/titlers; color processing, correction equipment.
Circle (855)

Kobold Lighting (2834)
Product line
Lighting instruments, accessories; lighting packages.
Circle (856)

Kudelski SA (3453)
Introductions
- RS-422 interface: permits control of T-Audio to studio recorder by any editing controller using SMPTE/EBU or similar protocol.
- Nagra IV-S TC: portable audio recorder; center track time-code system.

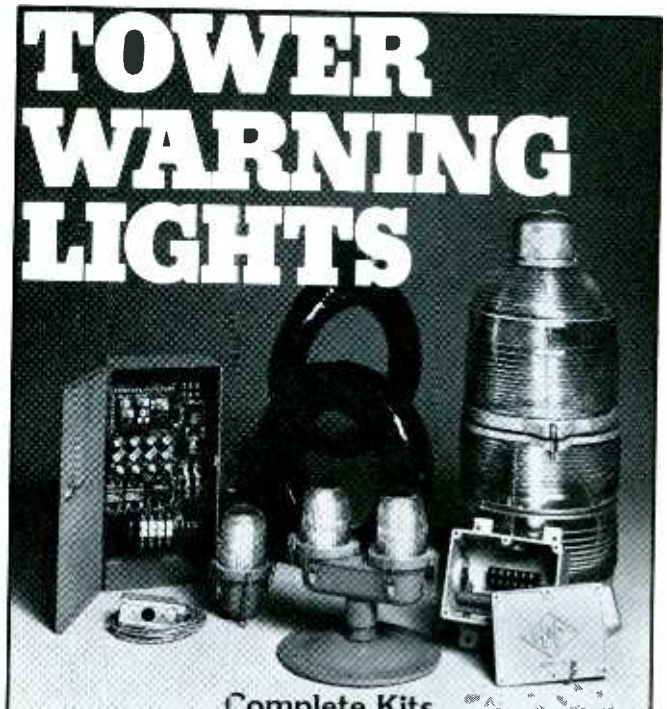
We have your telephone interface system.

System	Applications & Functions	Suggested List Price
Microtel	Portable interface for news, sports, sales	199.00
TC-100	Auto-answer, auto-disconnect, touch-tone decoding, on-air telephone calls	349.00
SPH-3A	On-air telephone calls, telephone recording, interviews, talk shows	499.00
SPH-4	On-air telephone calls, telephone recording, interviews, talk shows	699.00
EFT-900	High-quality remotes, news, sports, weather using frequency extension (improves phone line quality)	849.00
EFT-1000	High-quality remotes, news, sports, weather using frequency extension (improves phone line quality)	1899.00
DPH-5	On-air telephone calls, conferencing of callers, interviews, talk shows	1499.00
Telemix IX	On-air telephone system for talk shows, contests, answering the phone-15 line capability	3295.00

The Clear Choice

GENTNER
ENGINEERING COMPANY, INC.
540 West 3560 South
Salt Lake City, Utah 84115
(801) 268-1117

Circle (164) on Reply Card



Complete Kits
New/Improved solid state microwave control for easier maintenance. Many special features. 300mm Beacons • Flashers • Obstrucion Lights • Photo Controls • Isolation Transformers • Lamp Failure • Alarm Systems • Meets all FCC/FAA Regulations • Technical Support Provided.

HUGHEY & PHILLIPS
3050 N. California St., Burbank, CA 91504

Circle (165) on Reply Card

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PESA

The "SWAT" *
The best engineers assistant.

automatic analysis of all sync parameters of the video signal * video monitor output * local liquid crystal display * two independent video inputs * manual/automatic testing modes * alarm indicators for parameters out of tolerance * self-test software * RS 232 output to feed printer or PC * PAL/NTSC version.

Standard Measurements

Watcher-Analyzer:
- sync and burst amplitude
- field period
- number of lines
- horizontal sync width
- number of cycles in burst
- breezeway
- number of vertical sync pulses
- equalizer width
- vertical pulse width
- SC/H phase up to two degrees
- SC frequency error up to 0.2 Hz



Timer:
- H and V lock
- PAL lock
- H delay and SC phase delay between inputs A and B

- Sync
- Watcher
- Analyzer
- Timer

PESA

Pesa Electrónica, S.A.

Albalá, 12 - 28037 Madrid (Spain) - Telex: 48449 PESAE E - Tel: 754 00 78
Pesa America Inc. 6073 NW 167th St. - Miami, FL 33015 (USA) - Telex: 6712435 PESAM - Tel: 305-556 - 9638 - Toll Free: 1-800-USA-PESA

INISEL Group

The affordable hi-tech.

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Kudelski, continued

Product line
Audio recorders; recorder synchronizing systems.
Circle (857)

LEA Dynatech **(3332)**
Product line
Surge, lightning and transient protection products, systems.
Circle (859) **See ad page 50**

LEMO **(2805)**
Introductions
- Audio connector: miniature 2, 3 contacts; less than 1-inch long, ¼-inch in diameter; for cables up to 3mm OD.
- Plastic connectors: 6, 10, 14 conductor.
- High-voltage series: small size; to 5kV; push-pull self-latching.
- Prototypes: fiber-optic products.

Product line
Audio, RF, video connectors.
Circle (871) **See ad page 165**

LENCO/Electronics Div. **(3056)**
Introductions
- TBC-450: heterodyne TBC system with 8-bit resolution; pixel-by-pixel DOC; 16-line correction; constant H-phase.

Product line
Audio, video terminal equipment; sync generators; system timing devices; video encoders, decoders; monitoring equipment; DAs; test equipment; video monitors; PAL and NTSC products.
Circle (872) **See ads pages 11, 331**

LPB **(3338)**
Introductions
- Alpha-series consoles: 6-, 8-, and 10-mixer stereo on-air audio mixers; dc-controlled circuitry; CMOS, TTL/LS and TTL/ALS devices.

Product line
Mono, stereo audio consoles; audio compressor/limiters; audio DAs; phono preamps; control room furniture; low-power AM transmitters.
Circle (860)

LTM of America **(2537)**
Introductions
- Peppers: additional models in light series.
- Fiber optics.
- Lucarc: 6kW, 12kW arc lights.
- Luxarc: 575W, 1.2kW, 2.5kW, 4kW lights.

Product line
HMI and conventional lighting products.
Circle (861) **See ad page 114**

L-W International **(3427)**
Introductions
- Photo-Video: film and tape telecine systems.

Product line
Circle (862)

Laird Telemedia **(3474)**
Product line
Character generators/titlers; telecine light controls; slide projectors.
Circle (863) **See ad page 83**

Lake Systems **(112)**
Introductions
- Video cart system: configured with ½-inch M or Beta and ¾-inch U-matic videocassette decks; allows multiple spots per cassette; SMPTE time-code control; random access.

Product line
TV program automation systems.
Circle (864) **See ad pages 270-271**

Landy Associates **(2609)**
Introductions
- Ikegami HL79: ENG unicam.
- Nisus: variable speed shutter for slow motion.
- Schwemm Gyrozoom: gyroscopically stabilized lens.
- Interphase M-40: machine control system for duplicators or tape evaluation.
- Interphase M-41: machine control system for studio or production use.

Product line
Distributor of audio, radio and video products; cameras; editing controllers; character generators; color monitors.
Circle (865)

Lang Video Communications **(2533)**
Introductions
- SNG852: satellite news switcher, mixer; waveform, picture and audio monitoring.
- SK8000: 8-in, 8-out mic/line processor.

Product line
VSID systems; ENG switchers; automatic AFV switching systems.
Circle (866)

The Original

Dial-up transmitter Remote Control

- *Full ATS Capability*
- *16 Status, 16 Metering Channels*
- *32 Command Outputs*
- *Synthesized Voice Reporting*
- *Automatic Alarm Reporting and/or Correction.*

Full remote control without the cost of a dedicated line, for less than $3,000 - See it at booth #2669.

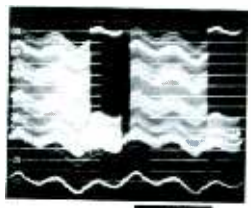
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RF PRODUCTS DIVISION
P.O. Box 32550
San Jose, CA. 95152
(408) 926-3400

Circle (166) on Reply Card

STOP GROUND-LOOP HUM!

VIDEO HUM STOP COIL...HSC 1

Will ELIMINATE HUM and other INTERFERENCE in Video Lines caused by differences in Ground Potential.



- For Color and Black and White.
- FLAT-DC to 6.5 MHz.
- No Low-Freq. or Hi-Freq. Roll-off.
- No Differential Phase Distortion.
- No Differential Gain Distortion.
- No Envelope Delay.
- Passive Device - Failure Free-Low Price.
- Small Compact Package 4" x 4" x 2-1/4".

NEW!

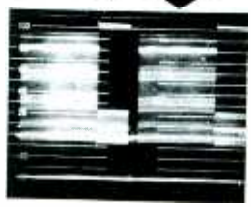


$190 F.O.B. N.Y.

ELIMINATES HUM AND INTERFERENCE:

IN STUDIO
- Between Buildings
- On long runs in Buildings
- Between Studio and Transmitter
- On Incoming Telco circuits
- On Outgoing Telco circuits

IN FIELD
- Betw. Remote Truck and Telco
- Betw. Remote Truck and Microwave
- For Intertruck Hookup
- For VTR Units
- For Monitoring Lines



Available on 10 day free trial

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Tel. (516) 546-4239

Circle (167) on Reply Card

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Bogner–20 years, over 1000 TV transmitting antennas and still climbing!



In the twenty years since we innovated a remarkable slot array design we have succeeded to a leadership role in TV broadcast antennas. We had to be better than the competition. We still are.

Today there are over 1000 Bogner TV transmitting antennas in use, more than from any other single manufacturer. Antennas with a long history of trouble-free performance and unequalled coverage.

Bogner antennas come in every power range and with the largest number of standard patterns in the industry. In addition, Bogner offers hundreds of custom patterns plus special designs to meet particular requirements.

Find out more. Call or write: Bogner Broadcast Equipment Corp., 401 Railroad Avenue, Westbury, New York 11590, (516) 997-7800.

When you need us we'll be there.

BOGNER®

WE MAKE THEM SMARTER

See us at NAB, Booth 3406

Circle (168) on Reply Card

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Circle (169) on Reply Card

Larcan Communications Equipment (3314)

Introductions

- TTC-50LH: 50kW highband VHF transmitter; 2-tube system.
- TTC-1200LH: 1.2kW highband VHF transmitter; total solid-state design.
- TTC-60LU: 60kW UHF transmitter.
- Contactless switcher: for parallel operation of VHF transmitters.
- FMT-25L: 25kW FM transmitter, self-contained in single cabinet.
- Demonstration: TV stereo audio.

Product line

VHF, UHF TV transmitters; stereo compatible VHF TV exciter; FM transmitters.

Circle (867) See ad page 328

Leader Instruments (2763)

Introductions

- LVM-5863A: EFP monitor, combines waveform and picture monitors in portable case for technical on-location monitoring.
- LBO-325: 60MHz dual-channel, delayed-sweep oscilloscope; fits into an attache case, nine pounds; with H&V sync detectors; surface-mount technology.

Product line

Sync/test pattern generators; stereoscopes; vectorscopes, waveform monitors.

Circle (868)

Leaming Industries (136)

Introductions

- Companded SCPC modulator/demodulator equipment, 88dB S/N rating.

Product line

Audio subcarrier products for microwave, satellite communications systems.

Circle (880)

LeBlanc & Dick Communications (2903)

Introductions

- Multichannel antennas: for FM and TV; various models.
- Demo: videotape presentation on design, manufacture and erection of 2,000-foot towers.

Product line

Tower services; FM, TV antennas.

Circle (869)

Leitch Video (3559)

Introductions

- SCH-7000: subcarrier-to-horizontal phase measurement device.
- TTG-1120: transmission test set.
- TTG-1130: transmitter test set.
- DAC-5000: SMPTE time-code driven conventional clocks.

Product line

Frame synchronizers; vertical interval processors; digital test signal generators; video source ID generators; sync generator.

Circle (870) See ad page 97

Lexicon (2909)

Introductions

- Time compressor/expander: stereo system; advanced processing to avoid noise, artifacts; optional time-code reader for frame accurate operation.
- 480L effects system: 20kHz bandwidth, digital I/O, dynamic MIDI, reverb, room simulation; use with LARC remote control.

Product line

Digital audio processing/effects products for delay, reverb, rooms, effects.

Circle (873)

Lighting Methods (2673)

Introductions

- SD-2400/SD-6000/SD-12000: single dimmer packs in 2.4kW, 6kW and 12kW ratings for control at the fixture or from remote location with optional console.

Product line

Lighting control systems with manual, digital and memory features.

Circle (874)

Lightning Eliminators & Consultants (164)

Introductions

- CR-6/CR-8/CR-10: vertical or horizontal CHEM-RODs; rechargeable, chemically activated grounding electrode; hollow tube structure holds chemical salt to increase ground conductivity for low resistance interface with true earth.
- Lightning, power condition consultant services.

Product line

Surge protectors; power line conditioners; lightning protection systems; lightning warning systems.

Circle (875)

Listec TV Equipment (3579)
Listec Video (3468)
Listec West (3468)

Introductions

- MicroSwift 200: Vinten remote servo camera control system; pan, tilt, zoom, iris, pedestal height functions.
- Vinten Mark I/II/III: servo pan/tilt heads for MicroSwift system; 155-pound, 255-pound, and 555-pound capacities.
- Vision series: lightweight heads and tripods for ENG, EFP.

Product line

Pedestals, tripods, pan/tilt heads, camera support systems.

Circle (876) See ads pages 302, 328

Logitek (2807)

Introductions

- Crossfire: automatic audio crossfade amplifier; for 2-machine editing systems.
- Stereorock: stereo version of Audiorack rack-mount audio console.

Product line

Audio mixing consoles; phono pre-amps; audio DAs; AGC amps; timers; level indicators; AF power amps; speakers.

Circle (877)

Lowel-Light Manufacturing (2610)

Introductions

- CM-90: Surmountable kit.
- CM-10: Maxa-mount kit.
- CM-20: scissor mount.

Product line

Studio and portable production lighting instruments, accessories.

Circle (878)

Lyon Lamb Video Animation Systems (2932)

Introductions

- ENC VI: color encoder, sync generator; provides composite and component outputs.

Product line

Animation control systems.

Circle (879)

www.americanradiohistory.com

M/A-COM MAC (3280)

Introductions

- Parabolic antenna: transmitting system for van use.
- Skypod with NAVTRACK.

Product line

ENG microwave systems.

Circle (881)

MARCOM (2433)

Introductions

- 710 TV stereo generator.
- 730 monitor: for stereo TV, with meters.
- 701-00M kit: modification for TFT-701 modulation monitor.

Product line

Audio level displays; replacement record electronics for Ampex, Scully ATRs; stereo audio processors for FM, TV.

Circle (893)

MATCO Control Products (2687)

Introductions

- M10VNAMP: audio follow video routing switchers.
- MBC-24: tape duplication system; audio, video routing, verification, distribution and control for any size facility.

Product line

Commercial insertion systems; automation control systems.

Circle (882)

MCG Electronics (169)

Introductions

- SURGE-MASTER (Avalanche): high-speed, heavy-duty ac power line protector; avalanche diode technology; to 5,000A service panels in all configurations.

Product line

Light- to heavy-duty power line protection system; data line protectors.

Circle (883) **See ad page 38**

MCL (3272)

Introductions

- 10775: 160W Ku-band TWT amplifier system; hub-mount.

Product line

C-band klystron amplifiers; Ku-band TWT amplifiers.

Circle (884) **See ad page 254**

MEI/Microprobe Electronics (2620)

Introductions

- Digisound: digital audio storage unit, instant random access system.

Product line

Automation systems for satellite and live-assist operation; mastering controller, tone generator.

Circle (885)

3M (3120)
Broadcast & Related Products
Magnetic Media
Optical Recording Project

Introductions

- Optical laser media: interactive videodiscs; CD audio and CD ROM, write-once and erasable data disks.
- HDTV routing switcher: 40MHz bandwidth.
- Series H 128x32: routing switcher; one video, three audio crosspoint format.
- Model 660: switcher control system, new control panel designs.
- MBR tape: master broadcast recording ¾-inch format.
- Panther Graphics: combines most wanted titler and paint features on one system; variable fonts; digitizing camera, frame grab.
- D3600 titler: 3-mode operation, 96 resident font sizes.
- D2200 titler: extended storage, eight resident fonts.
- Paint system enhancements: software for animation, font and special effects.

Product line

Routing switchers, control panels; titlers; graphic paint systems; optical, audio laser disc systems; recording tape.

Circle (886) **See ads pages 252, 268**

MPO Videotronics (2549)

Product line

Automatic transmission system analyzers; audio signal analyzers.

Circle (887)

MZB & Associates (2495)

Product line

Mobile production systems.

Circle (888)

Magni Systems (128)

Introductions

- Model 1527: combined waveform monitor, vectorscope, test signal generator and SC/H phase meter.
- Model 1510: digital test signal generator.
- Software enhancement: for model 2015 test signal generator.

Product line

Integrated test/measurement systems; personal computer-aided signal synthesizers.

Circle (889) **See ad page 121**

Magnum Towers (2901)

Product line

Towers for AM, FM, TV and microwave.

Circle (890)

The Management (2512)

Product line

Radio traffic, billing and affidavit software.

Circle (891)

Manhattan Production Music (2550)

Product line

Music libraries for broadcast use.

Circle (892)

Marconi Communications (3561)

Introductions

- B7536 transmitter: 30kW VHF (Band III), using B7500 solid-state modulator; ceramic tetrode PAs; containerized design with front access to all components.

Product line

TV transmitters.

Circle (894) **See ad page 219**

Marconi Instruments (2436)

Product line

TV test signal generators; VBI insertion signal analyzers; test automation.

Circle (895)

Mark Electronics (2417)

Product line

Equipment racks, enclosures.

Circle (896)

Marti Electronics (3496)

Introductions

- MW500 system: on-line STL booster-amplifier, redirects STL signal around objects on same frequency.
- RMC-16 remote: 16-channel system, provides multisite control from one portable studio unit; usable over normal telco line.

Product line

Mono, dual STL systems; ENG systems; telemetry links.

Circle (898)

Matthews Studio Equipment (2701)

Introductions

- Unit 85 dolly.
- Litt briefcase dolly.
- Super Crank.
- Boom arms.
- Auto mount accessories.
- Gift line: T-shirts, hats, jackets.

Product line

Cranes, dollies, dolly track; mounting, grip equipment; reflectors and light control devices; stands; camera mounts.

Circle (899)

Matthey Electronics (3340)

Introductions

- Low loss video delay lines: DIP module, boxed or rack-frame configurations.
- ZL series: compatible with GVG 3400 DAs; 10ns to 1830ns delays.
- Micro video filters: sharp cutoff, phase equalized; DIL packaging.
- MHD HDTV filters: passbands to 30.4MHz, compatible with 75MHz sampling rate.

Product line

Electrical filters, delay lines.

Circle (900)

Maxell (3551)

Product line

Video recording tape on 1-inch reel; ½-inch, ¾-inch videocassettes; audiotape.

Circle (901)

McCurdy Radio Industries (3028)

Product line

On-air, production audio consoles; routing switchers; intercom systems; phono systems; radio studio systems; audio DAs.

Circle (902) **See ad page 185**

Media California (2688)

Circle (903)

Media Computing (2545)

Introductions

- ANGIS software: automated news graphics interface system; enables use of microcomputer as alternate data entry device with character generator for elections, sports, weather.

Product line

Computer software for prompter, production rundown, news, script-writing, playlist, wireservice management.

Circle (904)

Media General Broadcasting (3335)

Product line

Production music libraries; sales libraries; sales promotion materials; station IDs; music formats; custom jingles.

Circle (905)

Merlin Engineering (3408)

Introductions

- ME-318 VISA: vertical interval stereo audio; conversion for ACR and TCR quad cart systems.

Product line

Station automation systems; machine modifications.

Circle (906)

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MAGNETIC TECHNOLOGY THAT ATTRACTS WORLD ACCLAIM.



In the world of magnetic technology, one name has attracted world acclaim. Producing more formats and providing more service than anyone else.

One name has won world recognition. With an Emmy in 1983 for pioneering the first videotape—and a Scientific and Engineering Award from the Academy of Motion Picture Arts and Sciences in 1985 for developing Cinetrak™ Magnetic Film.

That one name is Scotch™ Magnetic Technology—number one in the world of the pro.

Scotch™
AUDIO & VIDEO TAPES

NUMBER ONE IN THE WORLD OF THE PRO

3M

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Circle (103) on Reply Card

www.americanradiohistory.com

From fast-breaking news to on-location events, SkyBridge™ puts you on the air in minutes.



Nothing can land your story on the air faster.

News and special events don't always pick convenient places to happen. But somehow you have to get to those places, set up, and be on the air fast.

With COMSAT General's SkyBridge you can. SkyBridge is a transportable satellite broadcast service that enables you to transmit to your studio facility from remote locations anywhere in the continental U.S.

Live material can be transmitted instantly. Stories can be edited on the spot and then transmitted on the spot.

You can't do things any faster.

It puts your station in the driver's seat.

The cornerstone of SkyBridge is a compact, self-contained satellite broadcast vehicle. Its 2.4 meter antenna can be operated from inside the vehicle and folds down onto the top of the van when not in use. And since SkyBridge provides you with Ku-band satellite time, you can transmit from remote locations or the middle of a city regardless of the distance back to your studio. Wherever events are happening, you'll be there with SkyBridge.

For a very reasonable monthly lease, SkyBridge puts your station in the driver's seat.

For complete details on SkyBridge, call Judy Blake at (202) 863-7326.

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950 L'Enfant Plaza, S.W., Washington, D.C. 20024

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See us at N.A.B. Booth #2482

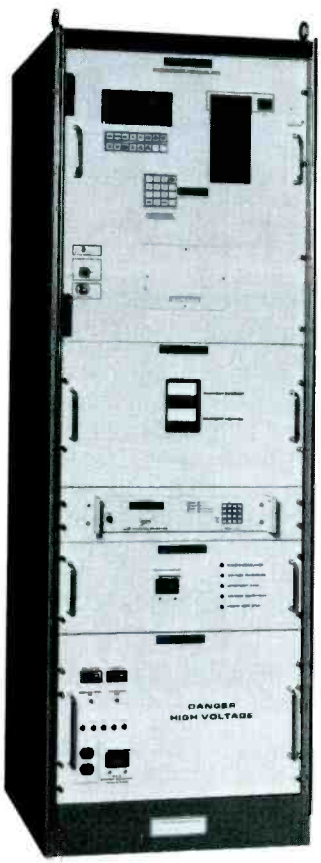
Circle (170) on Reply Card

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MCL
THE SOURCE

MICROPROCESSOR CONTROLLED KLYSTRON HIGH POWER AMPLIFIERS SATCOM C-Band/Ku-Band

The versatile Klystron Amplifier line Series 10000 is field-proven, constructed for long life, easy access, with solid state power supplies and a host of other needed, tested, exclusive features. The Klystron Amplifier shown is M/N 10667-3.35KW C-Band high gain with microprocessor interface, the latest in the continuously evolving line of MCL's State-of-the-Art Satcom transmitters. Options include the M/N 13049 microprocessor controlled Channel Selector unit.



Used throughout the world, the desirability of MCL microwave transmission equipment constantly grows. This includes Satcom C- and KuBand TWTA's (75W-3KW), instrumentation TWTA's Satcom and instrumentation KPA's and coaxial low frequency transmitters.

MCL assures you of 24 hour maximum parts replacement; provides 24 hour — 7 day access to MCL personnel for assistance in installation or servicing.

New for 1985: solid state beam regulation option.



WRITE for your complimentary copy of Reference booklet #1001 TODAY.

MCL INC

MCL, INC. Ten North Beach
La Grange, Illinois 60525
(312) 354-4350 TWX 910-683-1899

Circle (171) on Reply Card

Micro Communications (3438)
Product line
Circular & rectangular waveguide, components; coaxial transfer switches; UHF-TV, MDS, ITFS, combiners, diplexers, antennas; VHF-TV, FM CP antennas; FM doublet antennas.
Circle (907) See ad page 244

Micro Controls (2623)
Introductions
- Transmitter studio link.
- SCA/GEN: FM subcarrier paging equipment.

Product line
Aural STL systems; remote control systems; subcarrier transmission equipment.
Circle (908)

Microdyne (3520)
Introductions
- QuickLink: transportable Ku-band uplink; includes auto satellite acquisition, order wire.
- M.A.T.: Microdyne automated terminal; programmable C-/Ku-band earth station.
- 110-CIM: addressable data modem; drives hard-copy printer on normal satellite audio channels.

Product line
C-/Ku-band satellite receivers; SCPC order wire systems, demodulators; international satellite receivers; broadcast C-band receivers.
Circle (909)

Micron Audio Products (2685)
Introductions
- CTR-501 mobile: wireless microphone system.

Product line
Wireless microphones, diversity receivers.
Circle (910)

Microsonics (2543)
Introductions
- LPC series: video filters for stereo TV; 20MHz equalized delay lines for HDTV.
- Micro Filter: miniature DIL video filters.

Product line
Video delay lines; ultrasonic glass delay lines; oscillator modules; crystal filters.
Circle (911)

Microtime (3086)
Introductions
- Time base correctors: NTSC, PAL-B and PAL-M TBC systems; synchronizer function; dynamic tracking; DOC; digital comb filter for freeze with vertical interpolation; heterodyne or 3.58MHz feedback; RS-170A output.

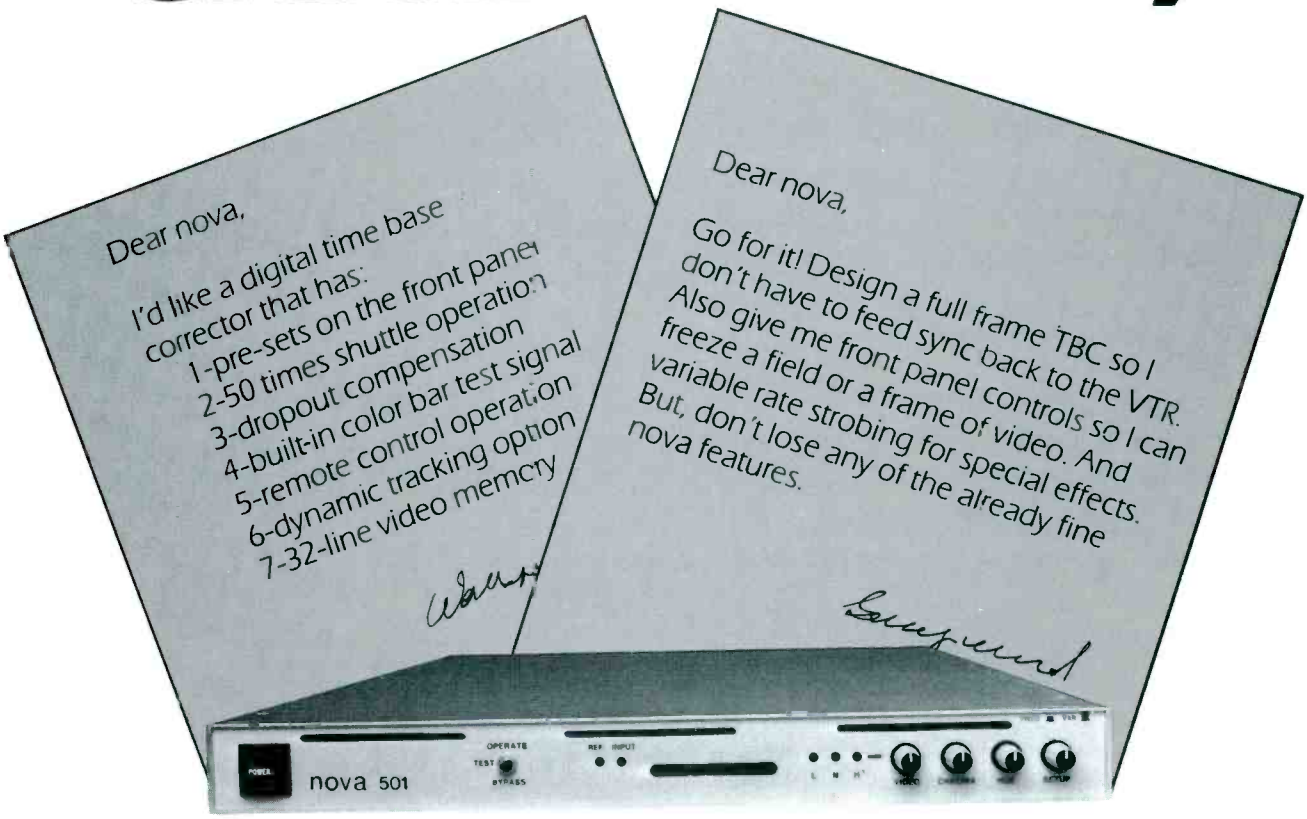
Product line
TBC/synchronizers; A/B roll effects systems; format transcoder TBC.
Circle (912)

Midwest Communications (3210)
Introductions
- S-25 vehicle: SNG system, constructed on an IVECO Z-340T chassis.
- S-18 system: SNG system with Ku-band antenna, with standard van.
- S-1 fly-away: Ku-band SNG system in rack-mount cases.

Product line
TV production vehicles.
Circle (913) See ads pages 1, 95, 223

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dear nova,



nova 501

NEW!

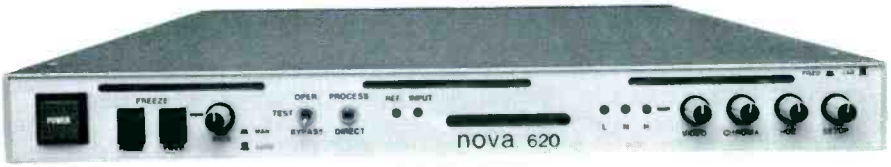
Designed for subcarrier feedback operation (most 3/4" VTR's). For under $5,000.



nova 511

NEW!

Designed for heterodyne/subcarrier feedback operation, as well. Comb filter for widest signal bandwidth. For under $5,500.



nova 620

NEW!

For under $6,000.

nova systems responds to your needs. Quality, reasonably-priced TBC's, made in America, with guaranteed turn-around of one working day on repairs and calibration.

DIGITAL TIME BASE CORRECTORS FOR EVERY PRODUCTION NEED.

nova systems, inc.

20 tower lane, avon, ct 06001 (203) 677-5252

Circle (172) on Reply Card

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Minolta (2810)
Product line
CRT monitor color analyzers; color temperature meters; luminance and illuminance meters; light meters.
Circle (914)

Mitomo (2468)
Product line
Cassette winders; automated playback systems.
Circle (915)

Mitsubishi Pro Audio Group (3530)
Introductions
- X-86: 2-track digital audio recorder.
- X-850: 32-track digital audiotape recorder.
- SuperStar: Quad/Eight audio mixing console.
- Westrex master motion controller.

Product line
Audio mixing consoles; digital audiotape recorders; magnetic film recorders, reproducers.
Circle (916)

Modulation Associates (2692)
Introductions
- KU 02 uplink: suitcase portable system; for remote stereo and ENG broadcasts; continuous 2-way voice/phone plus program channels; options provide stereo, private engineer's line, IFB, digital data and additional touch-tone channels.

Product line
SCPC and subcarrier satellite hardware for audio and data.
Circle (917)

Modulation Sciences (2811)
Introductions
- SRD-1 decoder: stereo reference system, accepts composite baseband audio from demod, produces L+R or sum and difference signals.

Product line
Signal generators for MTS TV; composite audio processor for FM.
Circle (918)

Mole-Richardson (3368)
Product line
Lighting instruments, accessories.
Circle (919)

Monroe Electronics (3028)
Introductions
- Model 5001: remote controller for transmitter sites.
- Model 6005: remote controller for transmitter sites.

Product lines
Remote control systems for earth stations; telephone hybrid couplers, audio compressors, processors.
Circle (920)

Montage (3260)
Product line
Computerized editing picture processor.
Circle (921)

Moseley Associates (3202)
Introductions
- MRC-2 option: video analyzer package.
- MRC-1600 enhancements: software for secure dial-up system for remote control.

Product line
Microprocessor-based remote control systems; control system interfaces; aural STLs, return telemetry links, antennas; remote pickup units; subcarrier, stereo generators, demods; audio processors.
Circle (922) **See ad page 7**

Motorola/AM Stereo Div. (3539)
Introductions
- No. 1300: C-Quam AM stereo exciter.
- No. 1310: C-Quam AM stereo modulation monitor.
- C-Quam receivers: single system AM stereo.

Product line
AM stereo products.
Circle (923)

Multi-Track Magnetics (2515)
Introductions
- Datakode interface; allows use of Kodak magnetic surface control data system; heads may retrofit any current dubbing products.

Product line
Film-to-tape transfer systems.
Circle (924)

Musco Lighting (Outside, 2448)
Introductions
- MuscoLight: flexibly controlled light source.

Circle (925)

Music Director Programming (2414)
Introductions
- Country Gold Oldies: restructured music service.
- Basic Gold Pop Oldies: 6-reel music library.
- Record Research: Billboard's Top 2,000 and "Book of No. 1 Hits."

Product line
Various music formats for radio.
Circle (926)

The Musicworks (2734)
Product line
Radio program services; syndicated program formats.
Circle (927)

Mycomp Technologies (NA)
Introductions
- QC switcher: for audio, video, RF.
- QC station: semi-automatic, for small format VCRs.

Product line
Distribution products; machine control products for video duplication.
Circle (928)

Mycro-Tek (2490)
Introductions
- Network Communications: option package for Mycro-Vision character generators, allows networking of CG systems; 300, 1200 baud; does not interrupt current on-air text.
- Production font: for Ernie and Max CGs, replaces MaxText font; replaces text and graphics fonts in Max.
- On-line tape storage: audio cassette data storage recorder/player.
- Dissolve: Ernie CG enhancement; controls character transparency in take mode.

Product line
Character generator/titler systems.
Circle (929)

NAUTEL (2658)
Product line
Solid-state AM broadcast transmitters.
Circle (930) **See ad page 138**

NEC America/Broadcast Eqpt. Div. (3161)
Introductions
- System 10: digital video effects system.
- SP-3A CCD camera.
- TVL-800 series: 7GHz and 13GHz microwave equipment.
- PCN-1400 series: VHF TV transmitters.
- PCU-900 series: UHF TV transmitters.
- FBN-11k series: FM transmitters.
- FS-19 frame synchronizer.

Product line
FM, TV transmitters; ENG microwave; video effects equipment; video synchronizers; CCD cameras.
Circle (931) **See ads pages 26, 27, 119, 300**

Nady Systems (2902)
Introductions
- QuadPak: coupler for multiple wireless mic systems.
- IRT-200M: studio monitor, cordless.

Product line
Wireless microphones, receivers.
Circle (933)

Nagra Magnetic Recorders (3453)
Introductions
- ARPC interface: resolver for 24-frame time code to 60Hz systems.
- TAIRS interface: connects TA-TC recorder through RS-422 and RS-232 to existing editing systems.

Product line
Audio recorders with SMPTE time code and sync timing.
Circle (934) **See ad page 116**

Nakamichi USA (2456)
Introductions
- MR2: 2-head professional audio cassette deck; wired remote control system allows daisy-chaining of two units for single control unit operation; unbalanced, balanced inputs and outputs, RCA and ¼-inch phone jacks; variable output level, −10dBv to +4dBv.

Product line
Audio cassette recorders; digital audio mastering processor; stereo headphones.
Circle (935) **See ad page 141**

Nalpak Video Sales (2792)
Introductions
- TP0936 TRIPAK: series of tubular cases for tripods, light stands.
- SP-5, -8, -12 Scrim-Paks: storage boxes for lighting scrims, gel frames.
- Pak-Krate: folding storage utility box.
- Accu-Chart: mini-folding chart set for video alignment.

Product line
Carrying, shipping containers; folding carts; test charts.
Circle (936)

Narda Microwave (2551)
Introductions
- 8682 probe: radiation monitor probe, designed per ANSI standards, 70006 simulator; multipath interference simulation instrument.

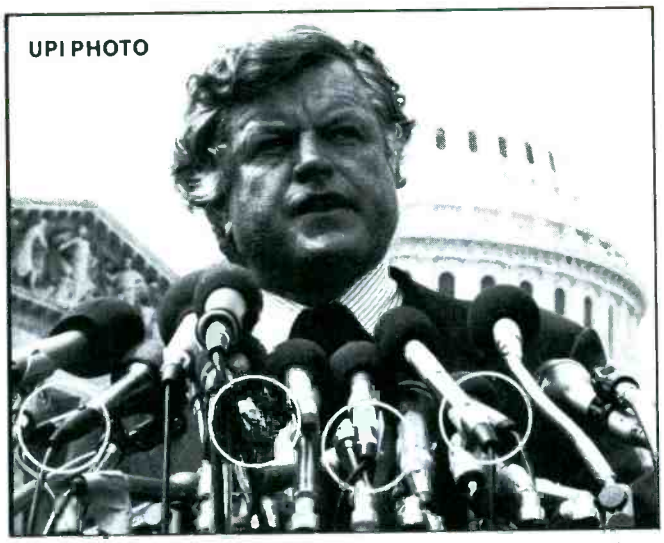
Product line
RF radiation monitors; microwave measurement system.
Circle (937)

L.E. Nelson Sales (2437)
Introductions

www.americanradiohistory.com

Do We Have Connections!





We're very close to most of the world's top personalities! They may not realize it, but Switchcraft audio connectors have long been the audio engineer's first choice for everything from a major address by one of our presidents to the smallest studio recording session. Professionals such as yourself appreciate the kind of reproduction quality, product flexibility and durability that results from our 40 year commitment to excellence in all our products.



Switchcraft makes just the right connection for the most demanding requirements.

To improve your connections and make a very sound quality decision, plug into the possibilities with Switchcraft.

From stereo phono jacks to quick-ground connectors, from versatile audio adapters to advanced mixers and switching components,



Tell me more about your impressive connections:

☐ Please have a representative contact me.

☐ Please send me your Short Form Catalog covering the complete Switchcraft line.

My area(s) of interest is: ☐ Switches ☐ Connectors ☐ Power Cords ☐ EAC Receptacles ☐ Jacks/Plugs ☐ Molded Cable Assemblies ☐ Jack Panels/Jack Fields

My application is ☐ Current ☐ Future (date)_____

Name_____

Company_____ Title_____

Address_____

City_____ State_____ Zip_____

Telephone (_____)_____

Mail To: Marketing Communications Dept., Switchcraft, Inc.
5555 N. Elston Ave., Chicago, IL 60630

At Switchcraft, Quality Begins With Fundamentals

A 2-86

Switchcraft

A **Raytheon** Company

5555 N. Elston Ave.
Chicago, Il 60630
(312) 792-2700

Circle (173) on Reply Card

www.americanradiohistory.com

- FFN/FFP/FFR/FFS lamps: Par 64 1kW tungsten-halogen; very narrow, narrow spot and medium, wide flood.
- 99-1435R lamp: Par 64 1.2kW tungsten-halogen.
- DSF lamp: 1.5kW scoop light.

Product line
Studio lamps from 200W to 10kW.
Circle (938)

Network Production Music **(2627)**
Introductions
- CD series: production music and sound effects libraries on compact disc.

Product line
Recorded music and sound effects.
Circle (939)

Rupert Neve **(3318)**
Introductions
- Necam 96: software enhancements for increased fader, muting speeds.
- Model DTC: digital transfer console; 2-channel digital audio transfer between two digital ATRs without data conversion to analog.
- System 90: audio distribution products.
- Limiter/compressor: 33609-33612 series of audio processing equipment for broadcast, recording.

Product line
Audio mixing consoles, all types; audio processing systems; audio distribution equipment; audio automation systems.
Circle (940) See ad page 25

Normex Electronic **(2453)**
Introductions
- Telnox L-O: on-air computerized telephone system.

Circle (941)

Norpak **(2574)**
Introductions
- TTX6S terminal: VLSI-based consumer teletext data reception unit.
- IPS4 system: NAPLPS videotext frame creation equipment; PC-based full digitizing.
- VTX6R terminal: lap-top videotext decoder; full-featured in low profile keyboard enclosure.

Product line
Teletext delivery system; VBI insertion equipment; NAPLPS videotext, teletext products, services.
Circle (942) See ad page 151

Nortronics **(3384)**
Introductions
- Maxtrax heads: retrofit heads for Pacific Recorders & Engineering cartridge recorders/players.
- Playback head: improved low frequency response, noise rejection shield; mono/stereo models.

Product line
Replacement and OEM heads for reel and cartridge audio recorders/players.
Circle (943)

nova systems **(2778)**
Product line
Digital time base correctors with direct, heterodyne, subcarrier feedback.
Circle (944) See ad page 255

Nurad **(3573)**
Product line
Mobile, portable ENG transmitters, receivers; central receivers; helicopter ENG equipment.
Circle (945)

Nytone **(123)**
Product line
Film chain systems; TV slide projectors.
Circle (946)

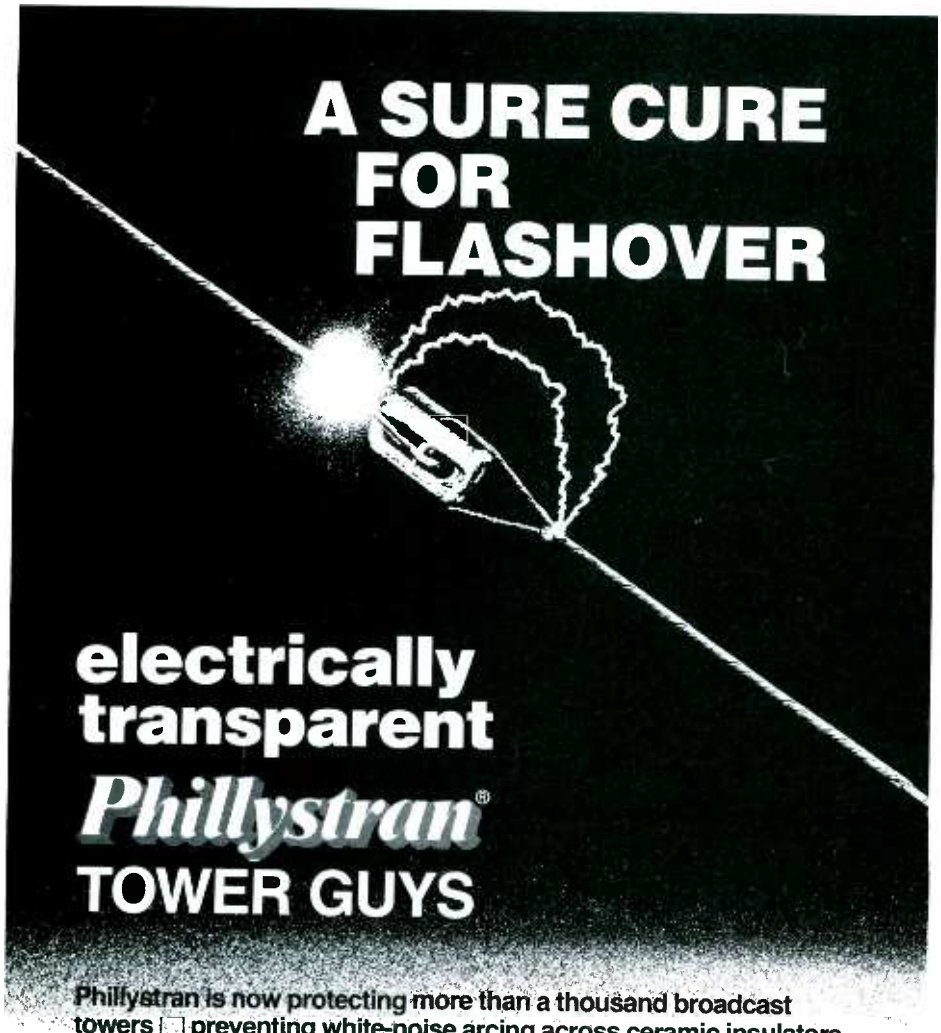
O'Connor Engineering Labs **(3364)**
Introductions
- Sys 105HD: camera support system; features fluid camera head, claw ball leveling, tripod with internal spreader and dolly.
- Sys 155: camera support system.
- Sys 105: camera support system.

Product line
Camera support equipment.
Circle (951)

Odetics **(3586)**
Introductions
- TCS-2000: broadcast TV automated cart machine.

Circle (952) See ad page 243

Olesen **(3309)**
Product line
Studio, location lighting equipment, accessories.
Circle (953)



Phillystran is now protecting more than a thousand broadcast towers ☐ preventing white-noise arcing across ceramic insulators (they aren't required) ☐ eliminating problems with on-off cycling due to static discharge on steel guys.

With Phillystran HPTG, tower-guy maintenance and costly re-guying are problems of the past.

For all the Facts—including "Electrical and Mechanical Analysis of Synthetic Tower Guys"—call/write

Phillystran®
UNITED ROPEWORKS (U.S.A.) INC.
20 COMMERCE DRIVE, P.O. BOX 306
MONTGOMERYVILLE, PA 18936 U.S.A.
(215) 368-6611 TELEX: 846342

Circle (174) on Reply Card

www.americanradiohistory.com



Finally, a Monitor System with the Power to Make Things Easy

Imagine a monitor speaker that provides its own power. Fits in tight spaces. Simplifies setup. And reproduces sound with test-equipment accuracy.

If you can imagine all that, you've just pictured the **Sentry 100EL powered monitor system** from Electro-Voice. Designed and created for your monitoring convenience, the 100EL combines the superb audio reproduction of the Sentry 100A with an integral, 50-watt amplifier.



With speaker and amplifier in one compact, rack-mountable package, this monitor system solves problems like limited rack space, equipment transport on remotes or cramped spaces in video editing booths.

Also, by requiring less hardware—fewer cables and connectors—the 100EL keeps setup simple and reduces potential interconnect problems. And there's no possibility of power loss caused by resistance from a lengthy speaker cable.

The on-board amplifier in the 100EL makes it ideal for single-channel monitoring. Why buy one speaker and an extra amplifier channel, when the Sentry 100EL does the job all by itself? And because amplifier power is perfectly matched to the speaker system, there's no chance of damage from inadvertent signal overload.

But convenience and trouble-free operation are only part of the package. Like all Sentry designs, the 100EL offers uncompromised accuracy. So you can be certain of quality sound.

The Sentry 100EL - with the power to make your job easier. For more information, write Marketing Dept. Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107.

Circle (175) on Reply Card

Electro-Voice®
SOUND IN ACTION™

www.americanradiohistory.com

Omicron Video (2661)

Introductions

- 501-10/1PT: preset take video switcher, 10x1.
- 501-10/3PT: RGB component video switcher, 10x1.
- 415 generator: RS170A NTSC sync source.

Product line

Audio and video DA systems.

Circle (954) See ad page 332

Omnimount Systems (2507)

Introductions

- No. 300 assemblies: universal mounting system for TV/audio speakers, loads 60 to 125 pounds.
- No. 25 assemblies: universal mounting devices, loads to 12 pounds.
- No. 500 assemblies: universal mounts, load range 100 to 225 pounds.

Product line

Studio equipment mounting assemblies.

Circle (955)

Omnimusic (2775)

Introductions

- Compact disc music library.
- Atmosphere music: imported from England.

Product line

Music libraries on CD, tape.

Circle (956)

Orban Associates (3444)

Introductions

- 275A synthesizer: automatic operation in stereo, for TV FMX stereo generator system.

Product line

Audio processing systems; equalizers, compressor/limiters; de-essers; FM/TV stereo generators.

Circle (957) See ads pages 19, 273

Orion Research (2499)

Introductions

- AMU series: audio mixing consoles; rack-mounted equipment bay handles analog audio functions given by digital control panel; 9-conductor serial interconnect cable; stores 32 panel setups; retrieval, reset functions; 7-band EQ.

Circle (958)

Otari (3246)

Introductions

- MX-5050-BIII: ¼-inch 2-channel reel ATR; new version of MX-5050-B.
- MX-80-24: 2-inch 24-track multichannel ATR.
- CTM-10: NAB cart recorder/player; mono or stereo; discrete or matrix stereo recording also available.
- DTR-900-32: 1-inch 32-channel digital audio PD format recorder/reproducer; remote control and autolocator.

Product line

Audio recorders in 2- and 4-track, center time-code track; multitrack recorder systems.

Circle (959) See ad pages 68-69

PACO Electronics USA (2447)

Introductions

- DP-11 pack: Nicad battery replacement for Sony NP-1; 13.2V, 1.7AH
- KD-440 charger: quick charge unit, 4 simultaneous channels.
- Mobile charger.

Product line

Nicad battery packs; battery chargers and conditioners.

Circle (964)

PAG America (2459)

Introductions

- PAG-lok: battery to camera mounting system, designed with major network guidance; family includes on-board batteries, battery clips and microprocessor-controlled charger for any 12V-14V batteries.
- Master 90: PP90 battery allows easy access for servicing; spare fuse storage in case.
- Nitecam: ENG camera with safe laser illuminator; produces recognizable images in near total darkness.

Product line

Batteries, chargers, evaluators.

Circle (960)

PEP (3378)

Product line

Batteries, accessories.

Circle (961)

PESA Electronica (3317)

Introductions

- EEFM-1A: FM transmitter.
- Solid-state TV transmitter, 1kW.
- BM-9U: 9-inch color video monitor.
- ASC-4652B: SWAT sync analyzer.
- SR-91785A: Ku-band satellite receivers.

Product line

Character generator/titlers; intercom systems; video monitors; TV stereo modulators; TV translators, transmitters.

Circle (962) See ads pages 117, 247

Tired of going through contortions, not to mention half the contents of your tool box, to assemble a simple audio connector?

Then go for this: the Neutrik X series, XLR cable connector. Assembly is so simple, you won't have to finnagle with so much as a set-screw.

Kulka Smith®

X series connectors consist of just four parts. So you can count them...and just about assemble them...with one hand. In fact, you can save up to 50% in assembly time.

Of course, that wouldn't mean much if X series connectors didn't also perform. Their compact bodies mate perfectly with standard XLR connectors. An improved self-retention locking system means even better connections. They handle larger O.D. cables. And you can select a satin nickel or black chrome finish and either gold or silver contacts.

All in addition to conniption-free assembly.

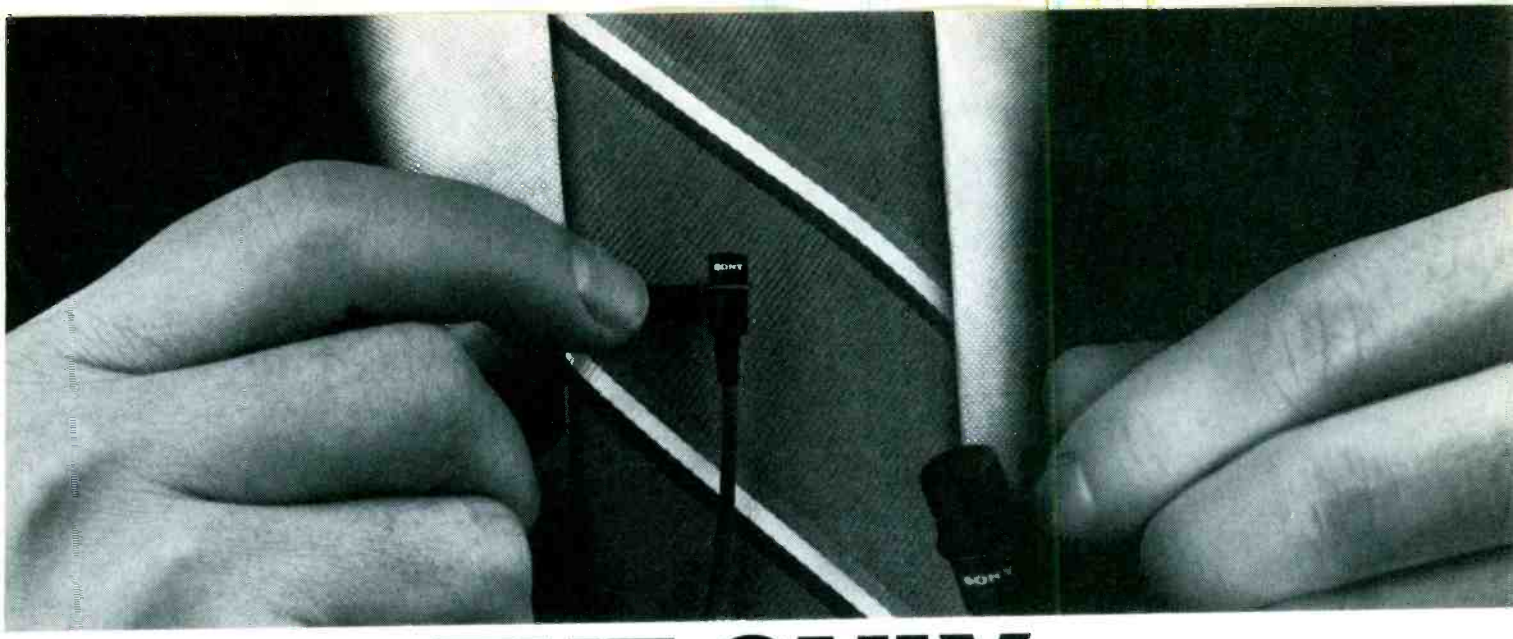
Now. Wondering what to do with your free hand? Use it to call or write for more information...naturally. Kulka-Smith, Inc., Sales Dept., 1913 Atlantic Ave., Manasquan, NJ 08736. (201) 223-9400. TLX: 244536.

Our X Series connectors connect without conniptions.



Circle (176) on Reply Card

www.americanradiohistory.com



THE ONLY COMPANY THAT DIDN'T HAVE TO IMPROVE ITS LAVALIER MICS JUST DID.

As the world's leader in lavalier microphones, we've just taken some very important steps to ensure that we retain that distinction.

For one, we've taken our mics in a new direction with the addition of the Sony ECM-66 unidirectional. Its wide-angle cardioid pattern provides better off-axis frequency response than the classic pattern—while also providing an unprecedented level of isolation from ambient noise.

We've also made the least of a good thing: The new ECM-77 is the smallest microphone in Sony history. We've even made our new cable housing smaller—and more durable.

We've made more of some good things, too. The new ECM-55, for one: the latest refinement of our successful ECM-50 series.

And we've expanded our line of accessories—with new color windscreens; pencil-type, safety-pin and necklace-type clips; and a power supply holder that clips to your belt.

Sony lavalier microphones operate on either a single AA battery or phantom-power. You also have a choice between black or satin-nickel finishes; and XLR, pigtail or Sony wireless-compatible output configurations.

So to see (barely) and hear (very clearly) the results of Sony's refusal to rest upon its laurels, call your Sony representative: Eastern Region, (201) 368-5185; Southern Region, (615) 883-8140; Central Region, (312) 773-6000; Western Region, (213) 639-5370. Or write to Sony Professional Audio Products, Sony Drive, Park Ridge, NJ 07656.



SONY
Professional Audio

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Circle (177) on Reply Card

www.americanradiohistory.com

PPS Electronics (2465)
Circle (978)

Pacific Recorders & Engineering (3151)
Introductions
- SDA-8A amps: stereo DAs.
- MDA-8E: mono DAs with filter and equalizer.
- TX-990 phono pre-amp.
- EFX-11 frame: for audio processing modules.
- Voice processing modules.

Product line
On-air, news, production consoles; audio cart machines.
Circle (963) See ad page 21

Paltex (3592)
Product line
Editing controller systems, peripherals.
Circle (965)

Panasonic Industrial (3216/3116)
Introductions
- Component video: series of ½-inch VTR products using metal particle tape.
- RAMSA WR-8628: post-production recording console, 28 inputs.

Product line
Color TV cameras; audio equipment; video monitors; VHS VCRs and equipment.
Circle (966) See ads pages 142-143, 196, 307

Patchbay Designation (2409)
Product line
Custom labeling for patch bays, control panels; film inserts for lighted switch.
Circle (967) See ad page 334

Peerless Sales (2412)
Introductions
- Equipment cart: 8-inch pneumatic wheels; for receivers, monitors from 19- to 25-inch diagonal.

Circle (968)

Penny & Giles (2774)
Introductions
- T-bar controller; provides smooth, accurate control for video mixing and video generator systems.
- Motorized fader: automation fader for audio remix desks.

Product line
Shielded slider audio faders; linear fader, balanced/unbalanced log and VCA faders.
Circle (969) See ad page 130

Perrott Engineering Labs (2733)
Product line
Nicad, AgZn and lead acid power systems; batteries, chargers; clip-on and belt battery systems; lighting systems.
Circle (970) See ad page 330

Peters Productions (124)
Product line
Program services.
Circle (971)

Philips TV Systems (3128)
Introductions
- LDK-6A, LDK-26A: upgraded models of camera family; total computer control system provides control of more than 1,000 different parameter settings.
- LDK-54A: enhanced model of portable camera; plug-compatible with LDK-6 family; no interfaces are required between camera and any LDK-6 family base station.
- Universal LDK-54A camera recorder: recorders available for three popular portable VCR formats.
- COACH: computer maintenance and diagnostic aid, interfacing camera channel with small personal computer; video display unit and hard-copy printouts of LDK-6 family set-up parameters; remotely integrates any of the cameras operational parameters and operating functions; useable between engineering base and triax-operated camera two miles away.

Product line
Standard, high-resolution video monitors; FM, UHF TV transmitters; compact disc players; sync pulse generators; studio lighting products.
Circle (972) See ads pages 220-221, 299

Pinzone Communications Products (Outside, 2411)
Introductions
- VIMCAS: vertical interval multichannel audio systems; for tape, routing, microwave, satellite; three video lines per channel, 85dB S/N.
- VIMCAS-5H: 5kHz vertical interval audio system; 1-line per channel, 85dB S/N; for ENG, talkback, news.

Product line
Turnkey satellite downlink systems; diagnostics, overhaul program for cart VTR; personnel, equipment scheduling software; satellite receivers.
Circle (974)



Circle (178) on Reply Card

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THE NEW GENERATION

Angenieux proudly introduces four new and Advanced Broadcast Lenses at **NAB Booth 3020.**

BE THERE.

angēnieux

THE HERITAGE OF EXCELLENCE.

Circle (179) on Reply Card

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Pioneer Electronics (USA) **(3546)**
Introductions
- OMDD: optical memory disc drive.

Product line
Laser video disc players; TV monitors.
Circle (975)

Porta-Pattern **(3538)**
Introductions
- P-200/P-300: RCA test patterns in chart format for all systems and 8"x10" transparency for spherical illuminator.
- Film/video interface media: for lens position checks.
- BBC zone plate: 9"x12" chart, 8"x10" transparency.

Product line
Telecine slides, films; test charts, chart systems; test transparencies and illuminators.
Circle (976)

Potomac Instruments **(3329)**
Introductions
- QuantAural QA-100: audio program analyzer quantifies character and quality of program signal.
- Subcarrier modems: mod/demod modules interface Potomac remote control equipment to other STL and return telemetry links.

Product line
DA antenna monitors; audio test systems; auto remote control systems; MW, VHF, UHF field strength meters; modulation, power controllers; AM monitor receivers; frequency synthesizer-coherent detector.
Circle (977) See ad page 80

SLIM & POWERFUL.

A FULL FEATURE BROADCAST PERFORMANCE TBC

FEATURES
- Time base correction for Heterodyne VTRs.
- Constant H phase for matched frame edit.
- 4 times sub-carrier sampling, 8 bit resolution.
- 16 line window.
- Absolutely transparent.
- Operates with or without VTR 3.58 MHz sub-carrier feedback.
- Adjustable horizontal and vertical blanking.
- Handle high speed search.
- Full processing amplifier control.
- 1¾ inches height, less than 15 lb.

OPTIONS
- Noise reducer.
- Digital Color Bar Generator.
- Station Identification.
- Digital pixel by pixel Drop out compensator.

The HOTRONIC AE61 upholds the standards of performance and easy operation that so many TBC users demand. While paring size and weight to the barest possible minimum, it does not sacrifice the rigid Hotronic standards of reliability and longevity. This product is not merely transparently *respectable*. It is transparently *superb*! The AE61 is custom-designed for the increasingly quality-conscious world of the 80s. The demand for quality in the 80s has *sharpened* the character of the AE61 — the standards of Hotronic have *formed* it!

See Us at NAB Booth 2531

THE HOTRONIC AE61.



HOTRONIC, INC.
1210 South Bascom Ave., #128
San Jose, California 95128
TEL: (408) 292-1176

Circle (180) on Reply Card

PrismaGraphics **(2791)**
Product line
Presentation folders, media kits.
Circle (979)

Provisional Battery **(214)**
Introductions
- ProPouch: lightweight battery system, replaces belt.
- ProLite: portable lighting system, durable, lightweight; 12V and 30V.

Product line
Rechargeable battery systems for lights, cameras, recorders; replacement battery inserts.
Circle (980) See ad page 337

QEI **(3336)**
Introductions
- ARC-34: automatic FM transmitter remote control system.

Product line
FM modulation monitors: FM exciters, transmitters.
Circle (981) See ad page 311

QSI **(2722)**
Introductions
- BG308/BG316: split-field color-bar generator; 8- or 16-character array for alphanumeric IDs.
- CB1601: SMPTE bar generator, to 16 ID characters; puts ID in vertical interval with active video input.
- Star-16N/16NBG: video ID generator for portable satellite uplinks; switches from full-field to vertical interval with active video.
- CHID-10: remote-controlled cable channel identifier, triggered by VBI signal from satellite relayed TV stations, momentarily places channel number on the screen.
- Synthesized visual, voice 8-character ID generator.
- AF-1000B upgrade: automatic phasing 3-channel blackburst generator.
- VT-7A upgrade: 10s countdown tone/character generator with auto recycling.

Product line
Vertical interval identification generators.
Circle (982)

Q-TV **(3469)**
Introductions
- VPS-500 II: computer prompter system.
- IBM compatible prompter.

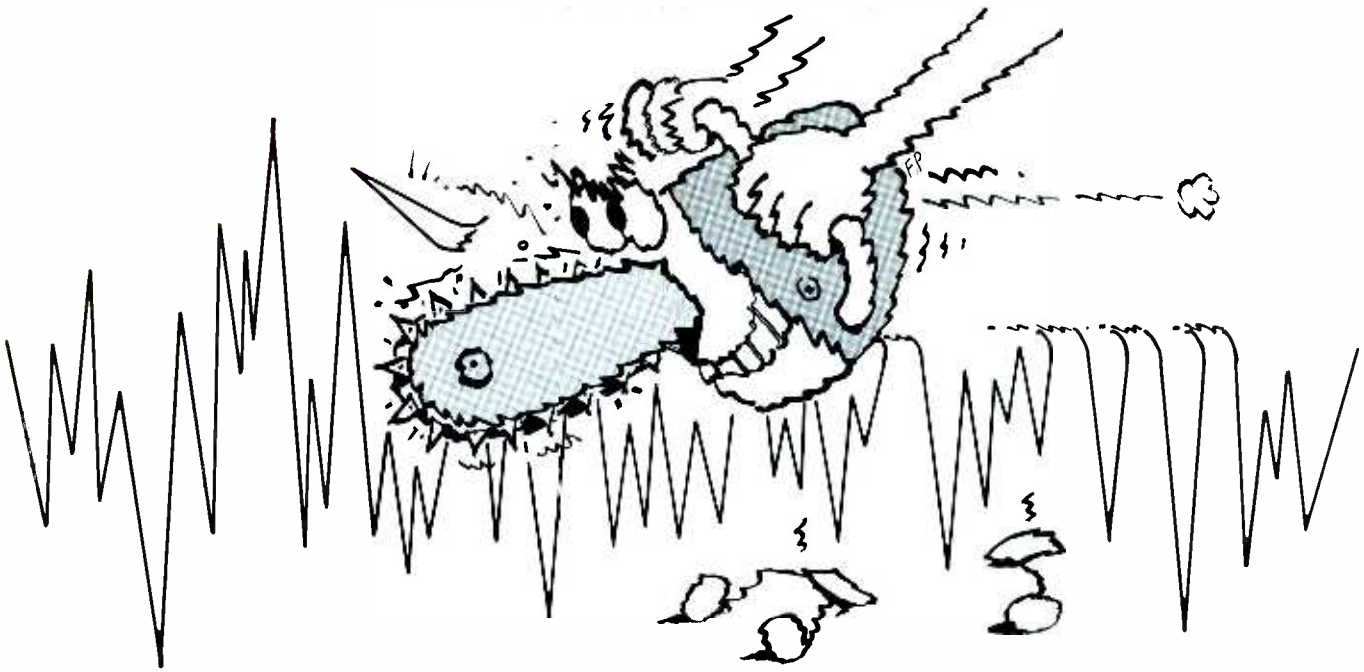
Product line
Video prompter systems for studio and on-location.
Circle (983)

Quality Video Supply **(2461)**
Circle (984)

Quanta **(3145)**
Product line
Character generator/titlers; graphic paint systems.
Circle (985) See ad page 187

Quantel **(3171)**
Product line
Digital cel recorders; electronic graphics generators; digital effects generators; caption generators; TBC, frame synchronizers; HDTV equipment; still-stores; standard converters.
Circle (986) See ad pages 158-159

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DOES YOUR LIMITER MASSACRE YOUR SOUND?

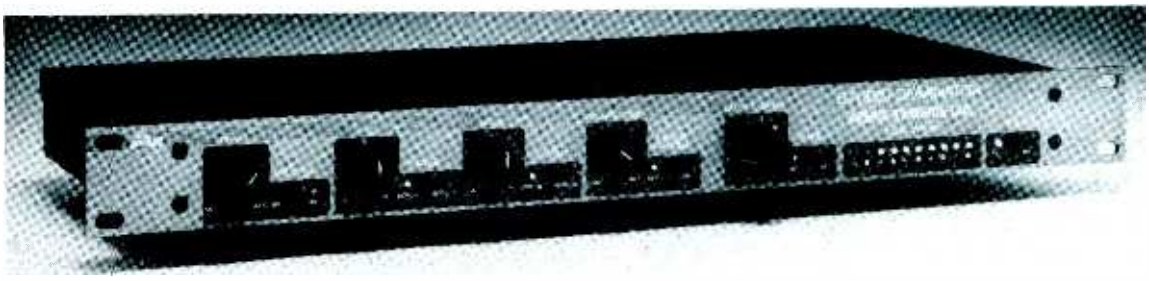
Most limiters are far from perfect... literally chopping up your sound. The new Aphex *Dominator*™ is the perfect solution. Unlike dumb, over-threshold devices, the *Dominator* is an intelligent 3-band limiter with a proprietary circuit which varies the threshold for limiting. The result is an *absolute* peak ceiling while maintaining a transparent sound. Selectable crossover frequencies, plus high and low frequency drive controls allow creative flexibility.

Aphex Studio *Dominator*

- Provides Absolute Peak Ceiling.
- Total transparency below processing threshold.
- Increased loudness
- Freedom from spectral gain intermodulation
- Minimal loss of transient feel
- High density capability
- Flexible—easy to use
- Multiple applications
- Made in U.S.A.

You can run hotter levels to maximize signal-to-noise levels without fear of overloading your recording or transfer mediums.

The *Dominator* is ideal for *any* situation where clipping is a problem, such as digital audio, disc mastering, video post production and film. Stop massacring your sound. Ask your audio professional for a free trial of the Aphex *Dominator.* Once you've heard it, you'll never be satisfied with your old limiters.



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Circle (181) on Reply Card

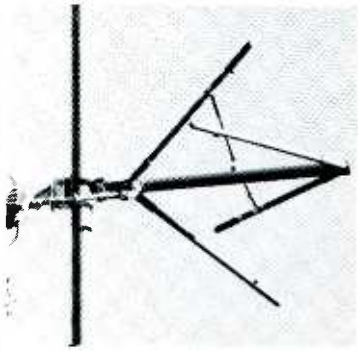
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Circle (182) on Reply Card

Quickset (3380)
Product line
Camera support products; tripods; pan/tilt heads; pedestals.
Circle (987)

RCA Americom (3298)
Product line
Satellite communications services.
Circle (991)

RCA New Products (3292)
Introductions
- 1.1kW UHF LPTV/translator tube and cavity; reduced intermodulation distortion; fast warm-up.
- VHF power tubes with cavities; low intermodulation distortion; for internally diplexed TV service.

Product line
Camera tubes: FM, VHF, UHF power tubes.
Circle (992)

R-Columbia Products (2672)
Introductions
- 6058/T: hands-free ENG/IFB telephone; tone dialing through modular phone jacks; clips to belt, accepts UL-85 headphone/mic; auxiliary ENG/IFB functions.

Product line
Wired, wireless intercoms; headphones, headsets; amplified camera operator headphones.
Circle (993) See ad page 42

RE Instruments (108)
Introductions
- RE201: dual-channel audio analyzer.

Product line
RF signal generators; stereo generators.
Circle (994)

RF Technology (2809)
Introductions
- RF-1300/RF-1301: receiver and transmitter units, portable 13GHz.
- RF-700/RF-701: receiver and transmitter units, portable 7GHz.
- RF-102B system: wireless microphone, 950MHz, diversity receiving.

Product line
ENG microwave receivers, transmitters; STL restoration systems; 7GHz microwave amplifiers.
Circle (995)

ROH (2647)
Product line
Audio amplifiers; audio distribution equipment.
Circle (1013)

ROSCO Laboratories (3443)
Introductions
- Cinefoil: matte black, lightweight flexible metal foil; shape-conforming material to stop light leaks.

Product line
Lighting products and accessories; chromakey products.
Circle (1014)

ROSCOR (3404)
Introductions
- System engineering: design and installation services for mobile, fixed production facilities.
- Ku-band systems: uplink and receive mobile units.

Product line
Remote TV production vehicles; monitor tally systems.
Circle (1015) See ad pages 294

RPG Diffusor Systems (2463)
Introductions
- QRD-734 diffusor: reflection phase grating acoustical diffusor; laminate, wood, stain or painted finish with aluminum or hardwood dividers.
- Designer: acoustical diffusor.

Product line
Acoustical room treatment materials for sound control.
Circle (996)

R/SCAN (2794)
Introductions
- Model N100: LPATS interface to Kavouras Triton-X weather system for lightning data.
- Model E100: LPATS interface to ESD Color Connection for lightning data.
- Model 600-48: NVG 48-picture GOES satellite animation system for GOES-ZAP imagery.

Product line
- Lightning and weather display systems.

Circle (997)

RTNDA (2622)
Circle (998)

RTS Systems (3366)
Introductions
- Model 8481: matrix intercom; 24 x 24 distributed summing bus; 50-conductor balanced line cabling; expandable.
- HST17 headsets.

Product line
Intercom systems; audio DAs, buffer, monitor amps; phono pre-amps.
Circle (999) See ad page 122

RUSSCO Electronics (2440)
Product line
Audio mixers; phono systems; audio distribution products.
Circle (1017)

Radio Resources (2833)
Product line
Distributors of audio, RF products; audio processors; radio system exciters. (Formerly called Broadcast Consultants.)
Circle (1000)

Radio Systems (2680)
Introductions
- DCX amps: modular studio amplifier series and accessories.
- RF-42: portable and tabletop subcarrier receivers.
- Key/Cart: audio cartridge machines.

Product line
Audio broadcast consoles; phono pre-amps; audio DAs; studio timers; LED metering systems.
Circle (1001)

RAM Broadcast Systems (3028)
Introductions
- PS-1000 phasescope: measures audio peaks, level balance, phase.

Product line
Audio consoles; extended range VU meters; audio DAs; intercoms.
Circle (1002)

Rank Cintel
Rank Precision Industries (3066)

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For every 10 newsrooms that have computerized, 7 chose Basys.*

A few of our customers include:

ABC ▼ Anglia Television ▼ Armed Forces Network ▼ BBC ▼ BCNZ

Channel Television ▼ Channel Four Network News ▼ CNN ▼ Europa Television

Figaro ▼ Granada Television ▼ ITN ▼ NBC ▼ MacNeil-Lehrer Newshour

RAI ▼ WNBC ▼ WOR ▼ WINS ▼ WMAQ ▼ WKQX ▼ WRC

KNBC ▼ CBS Xtravision ▼ KRON ▼ KYUU ▼ KSAN

WFAA ▼ KRLD ▼ KIKK ▼ KNUZ/KQUE ▼ WKYC

WJZ ▼ WTHI ▼ KTVY ▼ KTUL ▼ KATV ▼ WPRI

WTAR/WLTY ▼ WBT ▼ WBCY ▼ WKNE

KIMN/KYGO ▼ KFDI ▼ KELI

WJON/WWJO ▼ KVEO

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One of *many* reasons is that Basys™ is so easy to use.

Our customers have found the Basys newsroom computer system to be surprisingly easy to use, because it does exactly what they already do—only faster.

Basys was designed by newsroom professionals to operate with simple commands in plain English. No one on the newsroom team has to learn complex code commands. Perhaps that's why broadcasters find the average time to train on a Basys system to be so short.

*Based on the best available public information as of February 1, 1986.
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BASYS

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Product line
Digital still-stores; flying spot telecines; digital film scanners; telecine programmer; sound followers.
Circle (1003) **See ad page 145**

Reach Electronics **(2438)**
Product line
Subcarrier paging systems; communications equipment.
Circle (1004)

Real World Technologies Group **(2433)**
Product line
On-screen audio level monitor; safe area generators.
Circle (1005)

Recortec **(3327)**
Product line
Videotape cleaner, evaluator systems for ¾-inch, 1-inch media.
Circle (1006)

Rees Associates **(2500)**
Introductions
- Facilities planning: computerized programming, planning process to determine present and future space requirements.

Product line
Broadcast facility planning, design; engineering services.
Circle (1007)

Register Data Systems **(2505)**
Product line
Radio business computer software, services.
Circle (1008)

Research Technology Lipsner-Smith **(3386)**
Introductions
- TC 6120 evaluator: cleaner and tape condition analyzer for 1-inch videotape.

Product line
Videotape cleaners, evaluators; 16mm film editing systems; ultrasonic film cleaning systems.
Circle (1009) **See ad page 317**

Richardson Electronics **(2503)**
Product line
Weather radar magnetrons; TWTs; CRTs; RF transistors; linear TV devices; vacuum capacitors.
Circle (1010) **See ad page 71**

Riviera Broadcast Leasing **(2793)**
Product line
Broadcasting financial services.
Circle (1011)

Rockwell International **(3484)**
Product line
Doppler weather equipment; weather radar display systems; microwave radio systems, STLs.
Circle (1012)

Ross Video **(2616)**
Product line
Video production switchers.
Circle (1016) **See ad page 166**

SBE **(2305)**
Established services
Engineer, technician certification; professional development programs.
Circle (1018)

SEA-TEX Div/SI-TEX Marine **(2683)**
Product line
Color weather radar systems.
Circle (1031)

SELCO/SIFAM **(2450)**
Product line
Equipment knobs; audio level indicators; VU, peak program meters.
Circle (1032)

SESCOM **(3445)**
Introductions
- The Portables: problem-solving, audio interface products; ac or dc powered; plug compatible; can be integrated.

Product line
Audio transformers, amplifiers, assorted audio circuits.
Circle (1034)

SG Communications **(2556)**
Established services
Tower and antenna maintenance and installation services.
Circle (1019)

SMPTE **(2501)**
Established services
Standards development; industry reference material.
Circle (1020)

SOLWAY **(2745)**
Introductions
- telecom c4E: single-channel noise reduction module for mobile, line transmission, ATRs and VTRs.

Product line
Audio noise reduction systems.
Circle (1047)

SWR **(3350)**
Introductions
- FMST antennas: single station FM systems.
- FMPM antennas: multiple station FM systems.
- TM10 antennas: high power, low gain UHF antenna systems.

Product line
Coaxial transmission line: UHF antennas.
Circle (1021)

Sachtler **(3419)**
Introductions
- Hot Pod: tripod; self-locking center column, accommodates Panorama 747 or Video 20 fluid heads.
- Video 20 pedestal: for studio and outside broadcast, pneumatic center column; accommodates Video 20/25 fluid heads; adapts to steerable dolly.

Product line
Tripods: pedestals; fluid heads.
Circle (1022)

Samson Products **(2797)**
Product line
Hand-held, body-pack wireless microphone transmitters; true- and non-diversity wireless mic receivers.
Circle (1023)

Satcom Technologies **(245)**
Introductions
- 1523KS: offset elliptical antenna with prime focus feed.
- No. 950: dualband C/Ku-band primary feed system.

Product line
5.5M satellite earth stations.
Circle (1024)

Satellite Music Network **(NA)**
Introductions
- Heart and Soul: 24-hour Motown, rock hits of '60s, '70s; radio format.

Product line
Radio music programming formats.
Circle (1025)

Schafer World Communications **(3353)**
Product line
Radio program automation equipment.
Circle (1026)

Schmid Telecommunications **(2462)**
Introductions
- SZ340 analyzer; stereo sound program circuit test system; per CCITT 0.33 recommendations.
- SZ281: sound program DA.

Product line
Programmable audio signal generators, measuring receivers.
Circle (1027)

Schneider Optical **(3343)**
Introductions
- TV80 lens: 17x wide angle studio zoom lens for 2/3-, 1- and 1¼-inch tubes; 14.5x, integral diascope and 2x extender.

Product line
TV camera lens systems.
Circle (1028)

Schwem Technology **(2553)**
Introductions
- Wide-angle attachment; reduces focal length by 5x (12mm to 60mm); unstabilized.
- Remote control system; for focus, stabilization, iris, zoom.

Product line
ENG camera gyroscopic lens stabilizing system.
Circle (1029) **See ad page 231**

Scientific Atlanta **(3272)**
Introductions
- Model 8345: Ku-/C-band 4.5m antenna.
- Model 9630: Ku-/C-band satellite TV receiver.
- Model 367: low-noise block converter.
- Data card for digital audio system.
- Optima: modular equipment rack enclosures.

Product line
Broadcast grade satellite TV receivers; C-/Ku-band uplink exciters; earth station systems; time-base correctors, frame synchronizers.
Circle (1030)

Sennheiser Electronic **(2914)**
Introductions
- M8 mixer: portable audio console for studio or location.
- Six Pack: 6-channel portable RF receiver, enclosure holds 6 EK-2012-9H VHF body-pack receivers.
- HD 540 reference; OA monitor headset.

Product line
Wireless microphones: dynamic, condenser, EM's; headphones, headsets.
Circle (1033)

Sharp Electronics **(3305)**
Introductions

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ON AIR CONTROL
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A complete system for recording and playback of commercials, news and weather.
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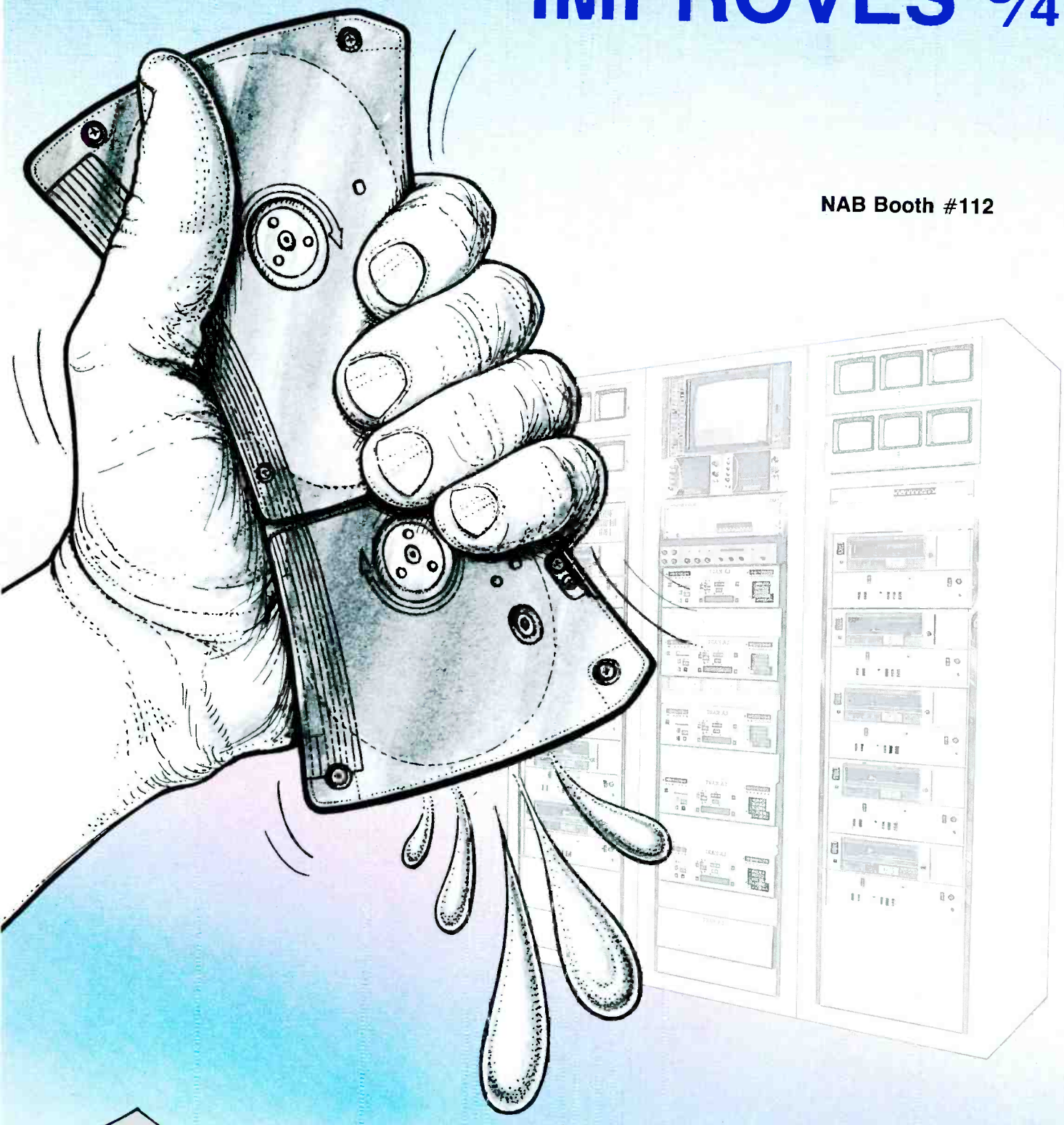
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Featuring "Turnkey Integration" of Television Stations, Post Production Facilities, Mobile Facilities, with unique Engineering Expertise in combining Audio and Video



Interformat editing suite featuring: Betacam to Sony 1"; ADO, Chyron; Harrison; and ISC.



CMX Postproduction with Grass Valley 1630

Lake's engineers have improved the ¾" image quality with a custom designed matrix switcher using a component time base corrector. Yes, it took a systems house like LAKE to squeeze the most out of ¾". Come see how good ¾" can be at **NAB Booth #112.**

LAKE is also delivering ½" **Betacam, Type M,** and **1" Type C LA-KART Systems.**



LA-KART Master Control System Featuring Panasonic Type M VTR's.

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FAX your equipment requirements for fast 24 hour pricing.

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Sharp, continued

- XM-1900 monitor: 19-inch, high resolution, rack-mount; color.
- XC-A1TC accessories: for XC-A1 camera; top mount camera plate, 3-camera remote ops panel; specialized remote control lenses.
- XA110/120 VCRs: professional series videocassette systems with VHS-HQ picture enhancements.

Product line
Color TV camera for ENG, EFP, studio, teleconference; HR color monitors; VCRs.
Circle (1035) **See ad page 245**

Douglas I Sheer & Associates **(2561)**
Circle (1036)

Shintron **(3036)**
Introductions
- DK3/CK3: component downstream shadow keyer and RGB chroma keyer.
- EC2000: EMPRESS C-2000 component switcher; includes DSK, chroma keyer.
- EMPRESS 392: DUBYC Y/C component post-production switcher.
- 12X-C4: 12-input/4-output routing switcher for component video.

Product line
Component, composite video switchers; component frame synchronizers; effects units; signal format convers; VITC LTC time-code equipment.
Circle (1037) **See ad page 302**

Shively Labs **(2709)**
Introductions
- ½-wave spaced: FM antenna; reduces downward radiation; conforms to ANSI non-ionizing radiation standard.
- Vertical polarized: FM antenna; reduces channel 6 TV interference.
- Special ratios: FM antenna; custom H/V ratios, when more power is allowed in only one polarization.

Product line
FM broadcast antennas, CP, HP; SIRA TV broadcast antennas; rigid coax, components; RF patch panels; harmonic filters, isocouplers; pressurization equipment; VSWR protection systems; multistation combiners; pattern studies.
Circle (1038) **See ad page 320**

Shook Electronic Enterprises **(3222)**
Introductions
- 14-22D: 22-foot Chevrolet mobile production system.
- 48-63: 48-foot network production trailer.

Product line
Mobile production vehicles.
Circle (1039)

Shure Brothers **(3320)**
Introductions:
- FP32: stereo ENG mixer.
- FP42: stereo production mixer.

Product line
Field production audio products; microphones.
Circle (1040) **See ad page 227**

Sigma Electronics **(2905)**
Introductions
- BSG-100: black burst generator.
- CBG-100: color-bar generator.

Product line
Video processing, distribution equipment.
Circle (1041) **See ad page 262**

Singer Products **(3344)**
Product line
Distributor, radio/TV transmission systems, audio/video equipment.
Circle (1042)

Skotel **(2738)**
Introductions
- TCR111: longitudinal time-code reader, LED display.
- TCR112: longitudinal time-code reader, video display.
- TOG-80: electronic reader; measures film feet/frames and time code.

Product line
Time-code readers, generators, accessories.
Circle (1043)

Softpedal **(3440)**
Product line
TV time sales analysis software, IBM and compatibles.
Circle (1044)

Solid State Logic **(3560)**
Introductions
- SL 5000M series modules: audio and control components, including SSL stereo submixer.
- SL 4000E/6000E options: additional software and hardware for master studio and stereo video desks.

Product line
Multichannel audio mixing consoles for stereo TV, production, outside broadcast; audio console automation; machine synchronizers, events controllers, automation peripherals.
Circle (1045) **See ad page 93**

H.A. Solutec **(2530)**
Introductions
- SOL6800/UIS: automated broadcast system for 8 VTRs/VCRs; integrated 112-input AV switcher.
- SOL6800/MICRO: automation system for one VTR/VCR with 4-input switcher.
- SOL AD, ID/Q: allows log printout of 6-digit numbers with 20 alphanumeric characters.

Product line
Automated broadcast systems; adaptive co-channel filters.
Circle (1046) **See ad page 338**

Sono-Mag **(3480)**
Product line
Audio program automation programmers, controllers; bi-directional audio cart carousel systems.
Circle (1048)

Sony **(3100)**
Sony Broadcast Products
Sony Magnetic Products
Sony Video Communications
Sony Professional Audio Products
Introductions
- BVU SP series: BVU-150 portable, BVU-850 studio and BVU-870 studio with dynamic tracking; improved characteristics—3rd generation equals 1st of previous U-format VCRs.
- BVH-2000/10, BVH-2000/12: use when all features of BVH-2000/02 are not needed.
- SU-L200 console: for use with BVH VTRs.
- SP tape: improved S/N ratio medium, for BVU SP series VCRs.
- BCT-30K cassette: 30-minute Betacam medium.
- 8mm systems; camcorder and playback VCRs.

Product line
TV cameras: VTRs, VCRs; editing controllers; video monitors; automated cassette playback systems; analog, digital audio recorders; monitor setup kits; audio mixing consoles; wired, wireless mics; large-screen projectors; cassette, reel videotape.
Circle (1049) **See ads pages 28-29, 132-133, 178-179, 261**

Soper Sound Music Library **(2443)**
Product line
Music libraries.
Circle (1050)

Soundcraft Electronics **(2770)**
Product line
Audio production recording mixers; post-production mixers; multitrack audio recorders.
Circle (1051)

Sound Ideas **(2444)**
Product line
Sound effects library on compact discs.
Circle (1052)

Sound Technology **(3328)**
Introductions
- 3000 series: programmable transmission/audio test system.
- Enhancements: menu-driven software/graphics for Sound Technology products; applicable to IBM/Compaq and HP80 series systems.
- Bus-control switching; for multichannel equipment testing.

Product line
Recorder/audio test systems; automated test equipment; audio distortion measurement systems; distortion filter kit.
Circle (1053)

Soundtrack/Aircraft **(2554)**
Circle (1054)

Soundtracs **(144)**
Introductions
- MC monitor system: mixes 32 audio channels to 12; transformer isolation.
- In-Line: 24-input/output console with VCA grouping.

Product line
Audio mixers for production, reinforcement, multitrack recording, automation.
Circle (1055)

Sprague Magnetics **(2540)**
Introductions
- Replacement heads: for Ampex, Otari ATRs, Sony BVH audio for video heads.

Product line
Replacement heads; head refurbishment service.
Circle (1056)

Spectrum Planning **(2633)**
Introductions
- BEAM service.
- FM 80/90: engineering assistance.

Product line
Telecommunications engineering, consulting services.
Circle (1057)

Stage Lighting Distributors **(2446)**
Introductions
- Q4Z light: 4.5-inch zoom ellipsoidal instru-

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IMAGINE MAKING A MILLION DOLLAR DECISION RIGHT NOW

How do you decide on a brand new, high power television transmitter that costs nearly $1 million?

It isn't easy. Especially when you have to live with that decision for the next decade. And maybe longer.

At NEC, we've been manufacturing and installing television transmitters for nearly 30 years. So we've signed on more than 1,400 systems in every corner of the world.

Now, we'd like to introduce you to two more...

The first, PCN-1400 Series VHF Transmitters, includes a powerful new one tube 35 kw system, available in the U.S. for the first time.

All our new V's give you 50% improvement in MTBF (now 30,000 hours). With 30% fewer exciter parts to repair and replace. And stereo without modification. They're 100% solid-state up to 10 kw, and only one tube to 35 kw.

Up the dial, you'll find our 4th and most futuristic generation of IF modulated UHF transmitters.

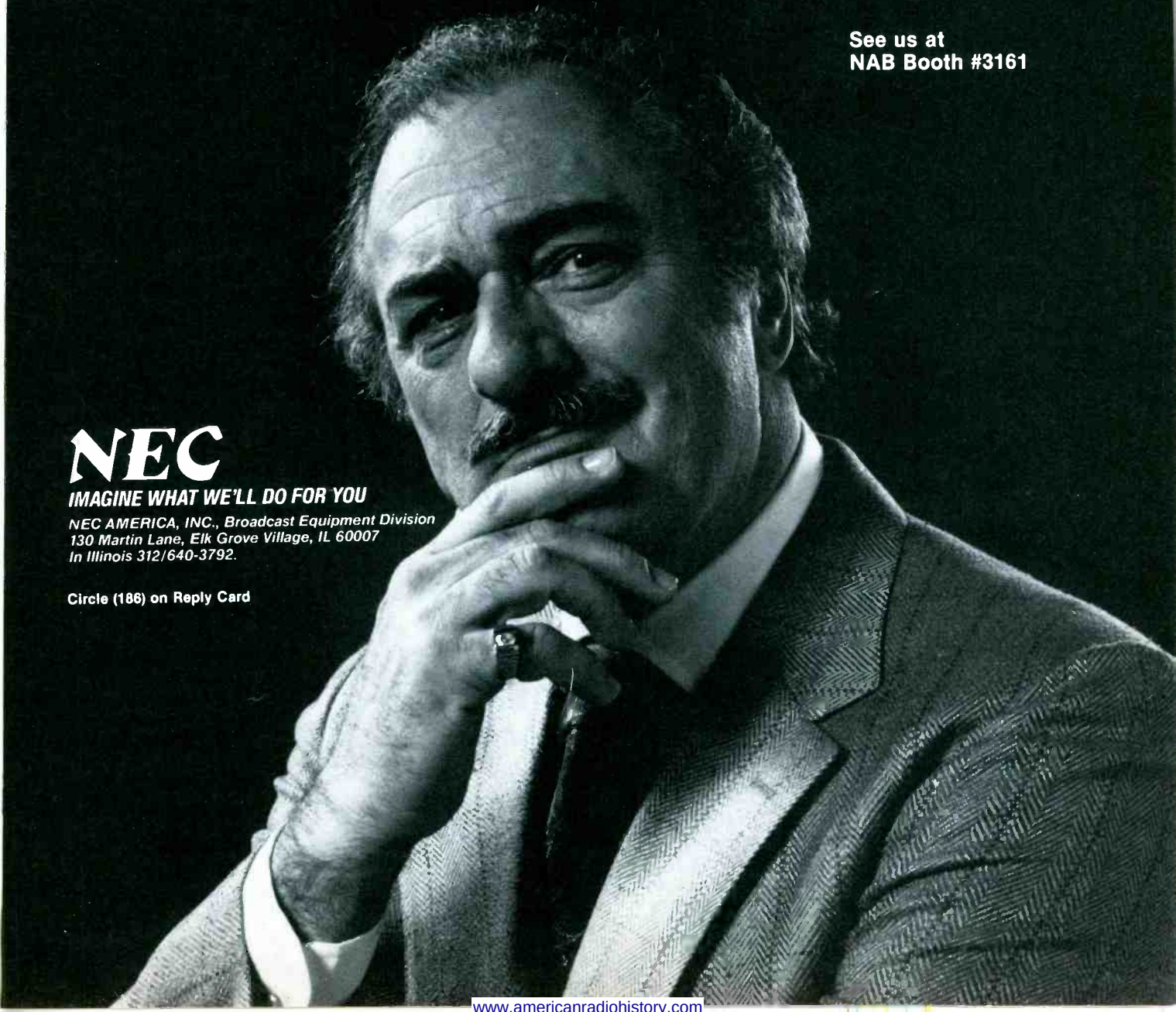
The PCU-900 Series.

These new U's range from 10 kw to 120 kw, with maximum output power to 240 kw (parallel running). And feature new, high efficiency Amperex or EEV Klystrons. To cut your power consumption, maintenance, and replacement costs.

So, why fret and fuss? Just call NEC for expert advice on some of the world's most advanced, most reliable UHF and VHF transmitters.

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In Illinois 312/640-3792.

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ment.
- SP1500: remote high density fog/smoke machine.
- 12x24 dimmer: light dimmer pack. 12-2.4kW dimmer system.
- SERVO: color changer, pan/tilt, 0 to 10V control.

Product line
Lighting dimmer consoles; dimmer packs; color changers; smoke/effects equipment; studio lighting systems.
Circle (1058)

Stainless **(2735)**
Product line
Guyed, self-supporting towers for AM, FM, TV, microwave, to 2,000 feet; multiple antenna support structures.
Circle (1059) **See ad page 280**

Stanton Magnetics **(3331)**
Introductions
- DYNA 30M/SR headphones: shoulder rest, single-cup headphone; samarium cobalt magnet; 20Hz to 22kHz response; 100Ω impedance; 0.25mW input.
- 681EEE Mk IIs: upgraded cartridge with Stereohedron II diamond stylus; response beyond 22kHz.
- 310B pre-amp: stereo; interfaces to many magnetic phono cartridges; 117/230Vac; unbalanced or active balanced output with 6dB gain; in-phase, out-of-phase L/R mix for monophonic use.

Product line
Phono cartridges, styluses; headphones; record care products.
Circle (1060) **See ad page 322**

Stantron Unit/Zero **(2911)**
Product line
Modular video center: desk consoles; equipment racks; cabinets; dubbing racks.
Circle (1061)

Star Case **(2555)**
Product line
Equipment transport containers.
Circle (1062)

Steadi-Film **(249)**
Introductions
- X/Y animation table.
- Stead-Film gate: retrofit, pin registered gate for Rank Cintel Mark III, eliminates film ride, weave during film-tape transfers.

Circle (1063)

Steenbeck **(2749)**
Introductions
- Prototype: machine synchronizer accessory; sync film, video and multiple audio tracks together.

Product line
Videotape editing controller; film editing equipment.
Circle (1064)

Storeel **(3322)**
Introductions
- Room stretcher: high density VHS cassette storage system.

Product line
Space-saving storage systems.
Circle (1065)

Strand Lighting **(3024)**
Introductions
- Color changer systems.
- Automated fixtures and controllers.
- DC-90: dimmer banks.
- Lightboard XP: lighting control system.

Product line
QuartzColor Ianiro lighting instruments for location, studio.
Circle (1066)

Strata Marketing **(674)**
Product line
Computer software for radio traffic, business.
Circle (1067)

Studer Revox America **(3048)**
Introductions
- A812: analog audio recorder; microprocesor deck and audio control.
- SC4016: multimachine controller for post-production; SMPTE/EBU bus control.
- B203: basic RS-232 bus automation controller, for radio production, on-air operation.
- A820-TC: mastering recorder, center track time-code channel; analog design.
- A810-2-TC/FM/NEO: stereo audio recorder; SMPTE, FM pilot tone and Neo-pilot tone control modes.
- A725-OC: compact disc player; digital audio data, subcode outputs available.

Product line
Audio recorders, 2- to 24-track; machine synchronizers; studio, portable audio mixers; compact disc players; studio monitors.
Circle (1068) **See ads pages 174-175, 190**

Studio Technologies **(2769)**
Introductions
- RCU-1 system: recognition control unit for MTS broadcasting; senses presence of stereo input signal to control simulator.

Product line
Stereo simulation systems.
Circle (1069)

Sunspot **(2498)**
Introductions
- Sunspot Broadcast system for IBM and compatible PCs.

Product line
Broadcast system software.
Circle (1070)

Swintek Enterprises **(2918)**
Introductions
- Mark QDC/2: dual frequency wireless microphone receiver for video cameras.
- RFSD: switching diversity systems for life audio.

Product line
Wireless microphone and headset systems.
Circle (1071)

Switchcraft **(2684)**
Introductions
- E series: XLR-type audio receptacles.
- BNC receptacles: PC-mount, straight, right angles.
- DIN plugs: standard 5-pin molded cable assemblies.
- Phone plugs: high-power ½-inch plugs and jacks.

Product line
Phone, phono, XLR plugs and jacks; jack panels; wired jackfields; PC board jackfields; molded, non-molded cable assemblies; general purpose connectors; switches.
Circle (1072) **See ad page 257**

Symetrix **(2519)**
Introductions
- 528 voice track processor.
- 544 quad expander/gate.

Product line
Telephone hybrids; audio amplifiers; parametric equalizers; noise reduction equipment; teleconferencing systems.
Circle (1073)

Symtec/One Pass Video Systems **(228)**
Product line
Electronic graphics systems.
Circle (1074) **See ad page 120**

System Associates **(3392)**
Product line
Equipment broker services: used video products: VTRs; editing systems; TV cameras, accessories; time-base correctors; character generators/titlers: switchers; effects systems.
Circle (1075)

Systemation **(2567)**
Introductions
- XLV716: screen-touch live assist automation system.
- X3710 system: satellite automation unit with improved display.
- Multiterminal automation system.

Product line
Automation systems; auto telephone record/play; auto time/temperature announce: satellite/cassette, full cassette, live assist cassette systems.
Circle (1076)

TASCAM/Teac Professional **(3416)**
Introductions
- ATR-60/2N: 2-piece console-style audio ATR; 2-track.
- ATR-60/2T: ¼-inch 2-track ATR with center timecode track.
- ATR-60/2HS: 2-piece console-style ½-inch ATR, 2-track; 15/30ips.
- ATR-60/4HS: ½-inch 2-piece ATR system, 4-track; 15/30ips.
- ATR-60/8: 2-piece console-type ATR, ½-inch 8-track.
- Studio 8 system: 8-track recorder with 8-input, 8-bus mixer in single console type frame.

Product line
Reel, mastering cassette audio recorders; cassette duplicators; audio mixers; peripheral audio products.
Circle (1090) **See ad page 225**

TDV **(NA)**
Introductions
- MDC-4: video multiplexer; 4-picture color display.

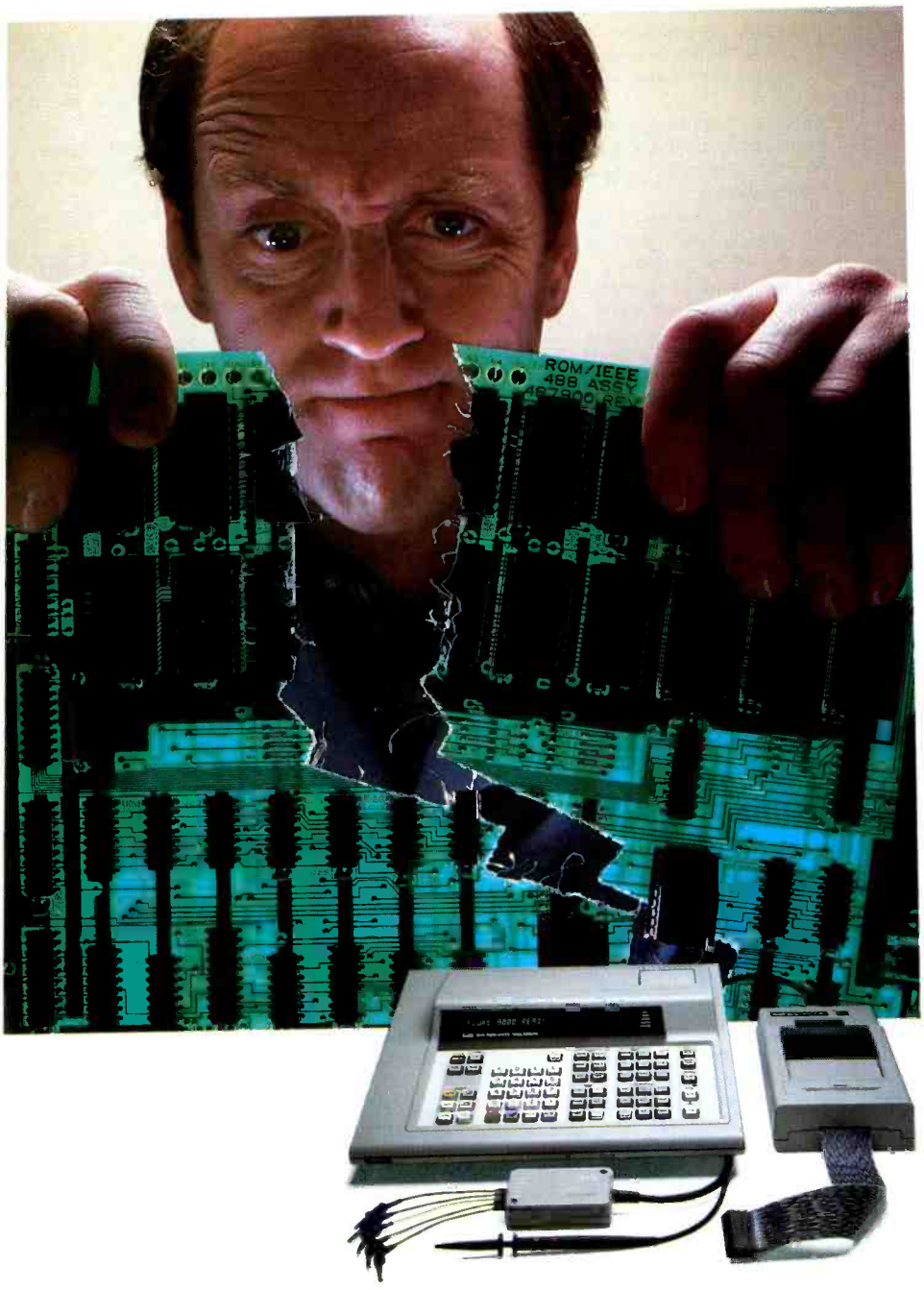
Product line
Video multiplexers; multi-image displays.
Circle (1081)

TFT **(3420)**
Introductions
- 8610 system: multichannel remote control, for uncomplicated broadcast stations.
- 855 monitor: fully compliant BTSC SAP/Pro channel aural modulation instrument.
- 850-1450 monitor: BTSC aural monitor, compatible with TEK 1450 TV demod.

Product line
AM, FM, TV modulation monitors; BTSC aural monitors; STLs; subcarrier generators/demods for TV.
Circle (1082) **See ad page 49**

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If you can't fix your board with the enhanced 9000 Series, it's beyond repair.



Introducing a new dimension of test capabilities for the Fluke 9000 Series Micro-System Troubleshooter line.

Finally there's a way to conquer some of the most difficult board testing problems imaginable. Take control of the situation with Fluke's 9000 Series and new **Asynchronous Signature Probe option.** You'll be able to pinpoint virtually every digital hardware fault on the entire board. Even those frustrating faults in circuits that operate independently of the microprocessor bus cycle.

Begin testing boards with the 9000 Series' built-in, preprogrammed test routines. In a single keystroke, you can automatically check the entire microprocessor kernel—Bus, ROM, RAM and I/O.

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- Disk Controllers
- Video Controllers
- Video-Generation Circuits
- Communication Circuits
- Peripheral Controllers
- Dynamic RAM timing relationships

Not only does the 9000 Series test more of the board, it also supports more 8-bit and 16-bit processors than any other tester on the market.

Call Fluke toll-free **1-800-426-0361** or contact your local representative, and put your most challenging board to the 9000 Series test. If it can't be fixed with the enhanced 9000, it's probably beyond repair.

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TOA Electronics (2498)
Product line
Audio mixers.
Circle (1079) See ad page 233

TVI (2752)
Product line
Lighting dimmers, controllers.
Circle (1083)

Taber Manufacturing & Engineering (3385)
Introductions
- McCurdy 2200: full duplex audio teleconferencing system.

Product line
Audio head replacements; tape erasers, degaussers.
Circle (1084)

Taft TV & Radio (2811)
Introductions
- Transponder time: occasional use, Ku- and C-band; on all major satellites, from New York, Boston, Philadelphia, Denver; teleports in Washington, DC, and Kansas City.

Established services
C-band satellite time brokers.
Circle (1085)

Tamron Industries (120)
Product line
⅔-inch lens assemblies.
Circle (1086)

Tandberg Audio (2748)
Product line
Audio cassette decks.
Circle (1087)

Tannoy (215)
Product line
Speakers, crossover networks; audio power amplifiers.
Circle (1080)

Tapecaster (3310)
Introductions
- Series 1000: audio console; standard stereo output from six to 12 inputs; any position may be mono or stereo, field convertible; 3-inch sources, mic/line levels; transformerless in/out; outputs balanced or floating; VCA faders, dc logic switching; all active circuits on plug-in PCB.

Product line
Single deck audio cart machines; cartridge loaders.
Circle (1088)

Tapscan (2664)
Circle (1089)

Teatronics (2756)
Product line
Lighting dimmers; manual, computer assisted dimmer controllers.
Circle (1091)

Tekskil Industries (2570)
Introductions
- Model 909DC: 12Vdc/110Vac portable prompter system.
- Model 909C: color computer prompter system.

Product line
Teleprompter systems.
Circle (1092)

Tektronix (3214)
Introductions
- 1730/1720: waveform monitor, companion vectorscope; bright line selector with on-screen line number indication; four 1-button auto recall functions on front panel; 2-channel on-screen operation; X – Y inputs for stereo audio display on vectorscope.
- Model 751: BTSC aural modulation monitor, decoder; displays 10 parameters on bar graph simultaneously.
- Model 760: stereo audio monitor shows signal phase relationships.
- AVC-20: audio vector converter; converts vectorscope into stereo audio monitor display.
- WFM-300: component analog video waveform monitor; monitors, measures inequalities in component amplitude, timing; lightning display.
- TSG-300: test generator; digital source of component analog signals of common formats; avoids transcoders.
- SPG-170A: compact sync generator; digital gen-lock; high color stability.

Product line
Audio, RF, video test equipment and signal generators; waveform monitors; sync generators.
Circle (1093) See ad page 15

Telemet Div/Geotel (3396)
Introductions
- 3713-A1 demod: TV broadcast products, wideband stereo and quadrature outputs, easy ICPM measurements; integral demod tester, dual trace switch.

Product line
TV demods; fiber-optic systems; isolation, clamp amps; thermal equalizers; sideband, spectrum analyzers; test generators; routing switchers; group delay measuring systems; video cable terminals; chroma key decoders.
Circle (1094)

Telemetrics (2569)
Introductions
- TM-8505: camera remote control system, coax-connected to 2,000 feet; for HL-95, BVP-30; 2.5-pound camera adapter.
- TM-900: miniaturized pan/tilt camera control system.

Product line
Remote camera control systems.
Circle (1095) See ad page 332

Telepak San Diego (2566)
Introductions
- T-mini GAF: half-size gaffer pack.
- T-68 pack: fits Sony VO-6800.
- T-GRA pack: fits Nagra recorder.

Product line
Protective transport bags for production and test equipment.
Circle (1096)

Telescript (3351)
Introductions
- C-64 software: C-64 networking prompter; includes word processing, underline, immediate edit/insert; script order features.
- 8088/8086 program: PC prompting program, font editor; select 12, 19, 23 characters per line.
- 1150-line monitor/prompter: separate enhancement, inverted video switches.

Product line
Prompters; prompter transports; optical beam splitters.
Circle (1097)

Television Engineering (3400)
Introductions
- Production unit: 14-foot vehicle with onboard power; 4-cameras, audio mixer, video switcher, titler; ¾-inch, 1-inch VTRs with slow motion; intercom, programmable IFB; microwave mast.

Product line
Production vehicles.
Circle (1098)

Television Equipment Associates (3342)
Introductions
- Matthey delays: low, zero loss video delay lines.
- Matthey micro filter: sharp-cut, phase equalized; for analog, digital video processing equipment.
- Matthey HDTV products: filters, delays; 30.4MHz passband.
- Elcon EA254: tape cleaner/profiler, 1-inch format.
- Elcon EA750: tape cleaner/profiler, ¾-inch cassettes.
- Racal Freedom One: ultra-light single-phone foam-padded headset; adjustable headband and boom; integral amp for electret mic.

Product line
Video delay, filter products; tape cleaner, evaluation systems; announcer headsets.
Circle (1099)

Television Systems (2472)
Circle (1100)

Television Technology/TTC (3593)
Product line
FM broadcast exciters, transmitters; LPTV transmitters; reel, triple-cart audio recorders.
Circle (1101)

Telex Communications (3370)
Introductions
- ENG-4: compact, ENG-type wireless mic receiver; 4-channel in 165-216MHz range; external or internal battery power; available as system with WT-400, WLM-100/200 mics.

Product line
Wired, wireless mics; signal, dual diversity receivers; headsets; headphones; intercoms; tape duplicators.
Circle (1102)

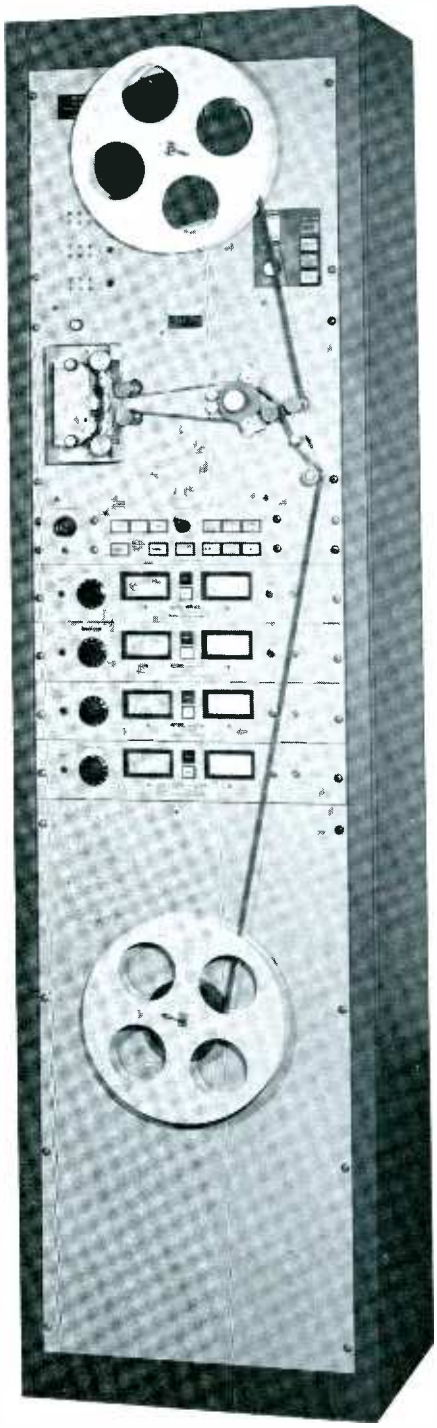
Tennaplex Systems (2812)
Introductions
- ALPHA combiner: multistation unit, to 1MW prime power (TPO).
- FM/TV antennas: cosecant null fill vertical patterns.

Product line
FM, TV broadband panel antennas for multistation operations.
Circle (1103)

Tentel (3326)
Introductions
- T2-H7-AC gauge: audio broadcast cartridge tape tension unit, requires no modification of the cartridge.
- HPG-C gauge: head protrusion, eccentricity measurement unit for SMPTE type C VTRs.

Product line
VTR tape tension gauges; spindle height,

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Telephone 7943618

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1200 Brussels Belgium

Hong Kong
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3 Salisbury Road
Kowloon, Hong Kong

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Capt. P.K. Vishwanath
234/4 Rama Baug,
Deodhar Road
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Persekutuan,
Federal Hill
Kuala Lumpur, Malaysia

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Apartado Postal 61.098
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Tentel, continued

elevator position gauges; video head protrusion, eccentricity gauges.
Circle (1104) See ad page 209

Texar **(2571)**
Product line
Audio processors.
Circle (1105)

Texscan MSI/Compuvid **(2473)**
Product line
Character generator/titlers; on-screen text/message systems.
Circle (1106)

Theatre Service & Supply **(2917)**
Product line
Studio furnishings, fixtures.
Circle (1107)

Thermodyne International **(2824)**
Product line
Equipment transport cases, containers.
Circle (1108)

Thomson-CSF Broadcast
Thomson-LGT **(3190)**
Introductions
- TTV-1530: studio, outside broadcast camera; three ⅔-inch Plumbicons; auto-setup; multicore or triaxial cable; stand-alone camera head operation with 12Vdc power source; NTSC outputs.
- TTV-2710: CCD color slide scanner; RGB output signals; centering electronic zoom; forward, reverse and random access sequencing of slides.
- Vidifont V enhancement: direct dial-up weather graphics from WSI, ESD or AccuWeather; addition of 5¼-inch Winchester disk system.
- Viditext II: medium priced character generator; interfaces to Graphic Store paint/graphics system; interface to Vidivote election tally graphics system.
- Graphic Store enhancement: Winchester disk memory, 140Mbytes; color cycling animation.

Product line
TV cameras; character generator/titlers; electronic graphics systems; slide scanners; video effects systems; video signal processors, image enhancers; FM, TV transmitters, translators.
Circle (1109) See ads pages 129, 177, 208

Thomson-CSF Components **(3422)**
Product line
VHF, UHF RF power amplifier tubes; CCD devices; TWT amplifiers.
Circle (1110)

Tiffen Manufacturing **(2736)**
Introductions
- Special effects viewing filter kit.

Product line
Optical filters; optical effects devices.
Circle (1111)

TimeLine **(2686)**
Introductions
- LYNX/V.S.I.: video systems interface; for full control of ATRs from external computers; Ampex, CMX, GVG compatible.
- System controller: control keyboard and computer; controls multiple transports through LYNX interfaces; multiple events.
- Software: office automation for recording, broadcast studios.

Product line
Timecode readers, generators; chase synchronizers.
Circle (1112)

Torpey Controls & Engineering **(2906)**
Product line
Timers.
Circle (1113)

Toshiba **(3302)**
Product line
Audio/video processing, delay systems; satellite system electronics; radio/TV transmitters; TV cameras.
Circle (1114)

Total Spectrum Manufacturing **(3534)**
Introductions
- FCS-20 title stand: upgraded from earlier product to include a color camera; self-contained lighting rated 3200°K; applications for graphics systems.
- HS-100P enhancement: 4-camera remote pan/tilt control system may be operated from either of two control points.

Product line
Pan/tilt control systems; uniplexers; ENG accessories.
Circle (1115) See ad page 292

Townsend Associates **(3418)**
Product line
UHF, VHF TV transmitters; klystron pulser systems; transmitting antennas.
Circle (1116)

Tracoustics Acoustic Systems **(151)**
Product line
Broadcast booths.
Circle (1117) See ad page 140

Transimage House International **(130)**
Product line
TBC time-share system.
Circle (1118)

Transmission Structures **(2621)**
Product line
Towers, tower accessories, services.
Circle (1119)

Trompeter Electronics **(3346)**
Introductions
- Prototype connectors: for component TV; miniature cables, bulkhead connectors in D-submin envelop.

Product line
RF connectors; video patching equipment; cable assemblies.
Circle (1120)

U.S. Tape & Label **(2723)**
Product line
Promotional bumper strips, window labels.
Circle (1121)

Ultimate Support Systems **(2783)**
Introductions
- RE-22P/–12P: large and small rack extensions.
- RR-48P/–36P: large and small rack mount packages.
- RS-22P/–12P: large and small rack stand package, for electronic panels; A-frame, T-leg configurations.

Product line
Speaker, light, antenna tripods; sound booms; utility stands, trees; background supports.
Circle (1122)

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Ultimatte (3552)
Product line
Video compositing, keying systems.
Circle (1123)

Unicol Products (2475)
Product line
Support stands for audio, video and electronics equipment.
Circle (1124)

Union Connector (2923)
Introductions
- PDC 100-6: 20/160 12kW electrical distribution center.
- StagePro 2.0: software for Unitrol lighting control system.

Product line
Stage lighting connectors, wiring devices; electrical distribution equipment; lighting dimmers, controllers.
Circle (1125)
See ad page 295

Uni-Set (2806)
Product line
Studio furnishings, scenery, set pieces.
Circle (1126)

United Media (3526)
Introductions
- Comm-ette: A/B roll videotape editing controller; reference SMPTE numbers or control track; 250-event memory, list management with ripple, list in/out; integral interfaces for ½-, ¾- and 1-inch VCR/VTRs; automatic assembly, transition control; pulse readers.

Product line
Video editing controllers; audio/video switching systems.
Circle (1127)

United Research Lab (3382)
Product line
Audio recording equipment.
Circle (1128)

United Ropeworks (USA) (2420)
Product line
Electrically transparent tower guy materials.
Circle (1129)

Universal Elecon (154)
Introductions
- EM-7700: videotape editing controller.
- 475-A-B: MTS SAP signal generator.

Product line
ENG batteries; audio/video synchronizers; MTS stereo signal generators, demods.
Circle (1130)

Utah Scientific (3144)
Introductions
- SMC-1 system: serial machine control.
- VDA-98DL: video DAs with custom delayed and non-delayed outputs.
- VDA-4x2B: video DAs to match AVS-1B routing switcher.
- VDA-8B: 8-output video DAs, matches AVS-1B.
- CSP-30/4: 4-level, 30-source, button-per-source control panel, single bus.
- CX-30/4: extends CSP system to 60 sources.
- Automation system enhancements: AVS-1B reprogramming.

Product line
Routing switchers; master control switchers; station automation, machine control systems; audio DAs.
Circle (1131)
See ads pages 84-85, 229

Utility Tower (3485)
Product line
Sections for AM, FM, TV, CATV and microwave towers.
Circle (1132)

VEAM/Litton Systems (2559)
Introductions
- CIR-FO: fiber-optic connectors, control links, splices, accessories.

Product line
Quick-disconnect, electrical multipin connectors.
Circle (1133)

Valentino Music Library (3465)
Introductions
- Compact disc: music and sound effects library.

Product line
Production music library; sound effects library.
Circle (1134)

Valley People/U.S. Audio (2747)
Introductions
- 415: dual DSP dynamic sibilance processor.
- 815: single channel DSP in rack-mount module.
- 400: single channel processor, mic level input.
- PR-2, PR-10: 2- and 10-position powered racks for 800-series processor modules.

WE WORRY, SO THAT YOU WON'T HAVE TO.

We have strong opinions about the way communications towers should be built.
Some people think that quality standards can be somewhat flexible.
We don't agree.
Some people think that "off-the-shelf" designs, with minor adjustments, are sufficient to meet most requirements.
We don't agree.
Some people think that short cuts in fabrication are justified when the end product seems "good enough".
We don't agree.
For TV, CATV, "Class C" FM, AM and microwave towers, call STAINLESS. We worry about quality . . . so you won't have to.



The Tower People

Stainless, inc.

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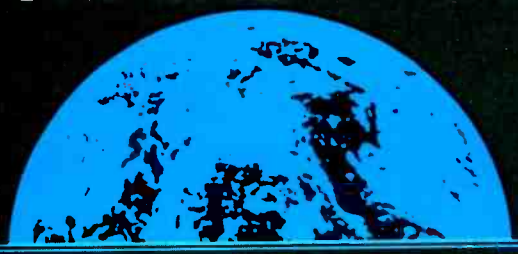
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Booth 2735.

C0186

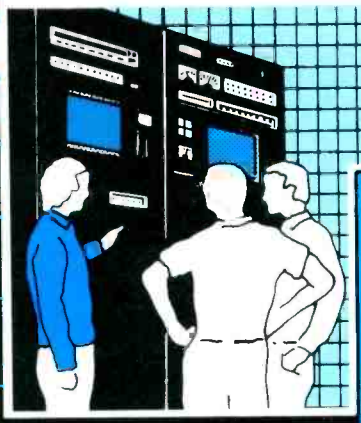
Circle (192) on Reply Card

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THE PAST, PRESENT & FUTURE OF BROADCAST PRODUCTS



DESIGN



INSTALLATION



EMCEE BROADCAST PRODUCTS

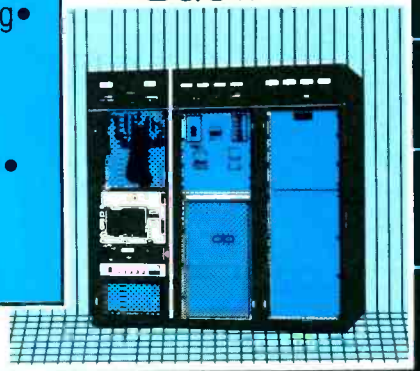
- Full-Line Manufacturer of MDS, ITFS, MMDS, & LPTV Equipment
- In-House R & D and Manufacturing
- Tower Installation Division
- Turnkey Capability
- Worldwide Distribution & Service
- Highest Quality Standards

COMPLETE 24-HOUR SERVICE

FIELD ENGINEERING



TRANSMISSION EQUIPMENT



Call Toll-free: 1-800-233-6193 • (In PA: 717-443-9575) • TWX: 510-655-7038 • Ans: EMCEE WHHV

EMCEE

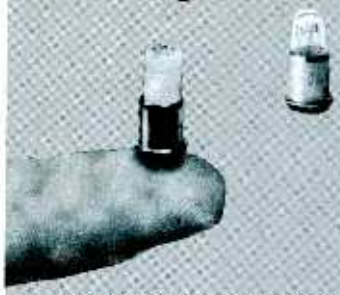
ELECTRONICS, MISSILES & COMMS. INC. 1960 25th ANNIVERSARY 1985 WHITE HAVEN, PA

EMCEE BROADCAST PRODUCTS, Div. of Electronics, Missiles & Communications, Inc. P.O. Box 68 White Haven, PA 18661

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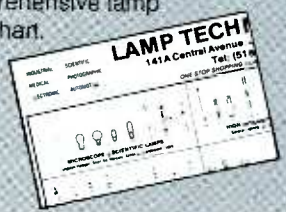
Use our bright, based LEDs and don't change bulbs again for the next 12 years.



Relamp your incandescent sockets. Our based multi LED miniature lamps are exact replacements for T 1¾ and T 3¼ incandescent miniature lamps. Shock and vibration proof, they keep your lighted panel and switches going "on" for 100,000 hours.

- T 1¾ Bases: Midget Flange, Midget Groove, Wedge, Bi Pin, Telephone T5.5 & T5.5K.
- T 3¼ Bases: Miniature Screw, Miniature Bayonet, Candelabra Screw.
- 4, 5/6, 12/14, 24/28, 48 volts.
- Red, yellow & green colors.
- Bright and Super Bright 4 and 6 chip based LEDs.
- Low power & heat consumption.
- Shock & vibration proof.

Inquire for data sheet, pricing, samples, plus our new comprehensive lamp wall chart.



LAMP TECHNOLOGY INC.
141A Central Avenue
Farmingdale, NY 11735
(516) 454-6464

Circle (194) on Reply Card

Valley People, continued

- 904 noise gate: single channel Gatex gate/expander, compatible with dbx F-900 system.
- Leveler: 2-channel audio signal and range control device.

Product line
Noise-reduction systems; audio level control systems; audio equalizer systems.
Circle (1135) See ad page 110

Varian Associates (3206)
Eimac/San Carlos
Eimac/Salt Lake
Microwave Equipment Division
Microwave Tube Division
Introductions
- VZJ-2701H: GEN IIA klystron high power amplifier for satellite uplinks.
- VPW-6892: modular power supply and RF components for SNG.
- PT-5080: UHF klystron (Thorn/EMI division).
- Switching products: in regulator service; YU-102; YU-872; YU-118. X-2252: Klystrode; UHF amplifier combining characteristics of klystron and tetrode devices.
- Cavity amplifiers: CV-2202 with 4CX20,000C; CV-2222 with 3CX800A7; CV-2223 with 3CX800A7S; CV-2228 with 4CX7500A; CV-2252 with 3CX12,000A7; AM-2215A.
- Power Grid tubes: 3CX800A7; 3CX500A7; 3CX10, 000B7; 3CX10,000B7; 3CX12, 000U7; 4CX18,000A/9019; 4CX20,000A; 4CX20,000C; 4CX20,000D/ 9015; 4CX25,000A; 4CX35,000D; 4CX40,000G; 4CM300,000G; 4CM400,000G; 8974.

Product line
Microwave frequency amplifiers and devices.
Circle (1136) See ads pages 33, 87, 161

Video International (2754)
Introductions
- DTC 2500: 2-field, 8-bit standards convert.
- DTC 3500: 2-field, 8-bit standards converter, dub and RGB inputs/outputs.
- TBC 3000: timebase corrector.

Product line
Digital standards converters.
Circle (1137)

Videomagnetics (2725)
Introductions
- Random access videocassette changer.
- Refurbishing service: for 1-inch video heads.

Established services
Quad VTR head refurbishing.
Circle (1138)

Videomedia (3558)
Product line
Editing controllers; station automation systems; traffic control systems; animation systems; commercial playback sequencers.
Circle (1139)

Videoplex (NA)
Introductions
- MDC-4: 2x2 video multiplexer; 4-picture display in color.

Product line
Video multiplexers; multi-image displays.
Circle (1140)

Videotek (3316)
Introductions
- VSM-60: vectorscope
- HR-190: 19-inch diagonal, high resolution color monitor.
- AVM-13s: 13-inch diagonal color monitor with audio.
- APM-8RS: 8-input audio program monitor, four stereo inputs.

Product line
Waveform monitors; video monitors; routing switchers; TV demods; audio, video, pulse subcarrier DAs; audio program monitors; sync generators.
Circle (1141) See ad page 149

Video Telecom (NA)
Introductions
- Barber Boom 20: boom for light-weight film, video cameras; positive reach, 16 feet; negative reach, five feet; horizontal swing span, 22 feet; camera mount includes fluid head; cable controls; top or underslung mounting.

Product line
Camera support equipment, booms.
Circle (1142)

Viking Cases (2757)
Product line
Shipping and equipment cases.
Circle (1143)

Vital Industries (3191)
Introductions
- Model 3000: video production switcher; to five separate keys, 16 buses, three titler inputs; 16 or 24 inputs with black and color backgrounds.
- MAGIC: digital video image manipulator and effects system; X/Y/Z rotation from any center point; NTSC or PAL available; integral chroma keyer; touch screen operation available.

Product line
On-air, master control video switchers; station automation manager systems.
Circle (1145) See ad page 293

WSI (2642)
Introductions
- ASTRO-WX service: ASTROfax facsimile maps, charts; ASTROgraphics weather graphics, satellite imaging; ASTROdata worldwide weather information.

Product line
Weather services, displays.
Circle (1146)

Ward-Beck Systems (3060)
Product line
On-air, production audio mixing consoles; audio routing switchers; intercom systems; radio studio systems.
Circle (1147) See back cover

WeatherBank (2930)
Established services
Satellite-delivered weather data.
Circle (1148)

Wegener Communications (2760)
Introductions
- Digital audio terminals.

Product line
Satellite, microwave communications audio, data encoders/decoders, related equipment; network communications controllers.
Circle (1149)

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Audio Transformers

Choose from a wide variety of types and packages

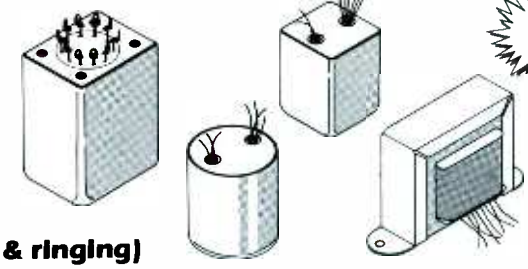
Computer optimized design

100% tested – consistent quality

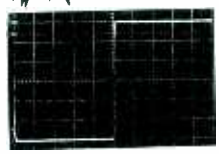
Low distortion

Wide bandwidth

Minimum transient distortion (overshoot & ringing)



REVISED AUGUST 1985



JE-16A
2 kHz Square Wave

INPUT TRANSFORMERS AND SPECIAL TYPES

	Model	Application	Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20Hz Max Input Level[1]	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Bandwidth[2] –3 dB @(kHz)	20 kHz Phase Response (degrees)	Overshoot (%)	Noise Figure (dB)	Magnetic Shield[4] (dB)	Number of Faraday[4] Shields	Package[5]	PRICES 1-19	100-249	1000
MICROPHONE INPUT																	
†	JE-16-A JE-16-B	Mic in for 990 opamp	150-600	1:2	+8	0.036/0.003	−0.08/−0.05	230	−8	<1	1.7	−30	1	A=1 B=2	65.25 71.73	43.59 47.92	30.07 33.06
	JE-13K7-A JE-13K7-B	Mic in for 990 or I.C.	150-3750	1:5	+8	0.036/0.003	−0.09/−0.21	85	−19	<2	2.3	−30	1	A=1 B=2	65.25 71.73	43.59 47.92	30.07 33.06
	JE-115K-E	Mic in for I.C. opamp	150-15K	1:10	−6	0.170/0.010	−0.50/+0.10	115	−5	<7	1.5	−30	1	3	44.84	29.95	23.39
LINE INPUT																	
	JE-11P-9	Line in	15K-15K	1:1	+26	0.025/0.003	−0.03/−0.30	52	−28	<3		−30	1	1	105.75	70.65	48.74
	JE-11P-1	Line in	15K-15K	1:1	+17	0.045/0.003	−0.03/−0.25	85	−23	<1		−30	1	3	42.69	28.53	22.27
	JE-6110K-B JE-6110K-BB	Line in bridging	36K-2200 (10K-600)	4:1	+24	0.005/0.002	−0.02/−0.09	125	−12	<1		−30	1	B=1 BB=2	63.98 74.05	42.75 49.47	31.37 34.13
	JE-10KB-C	Line in bridging	30K-1800 (10K-600)	4:1	+19	0.033/0.003	−0.11/−0.08	160	−9	<2		−30	1	3	43.45	29.03	20.03
	JE-11SSP-8M	Line in/ repeat coil	600/150-600/150	1:1 split	+22	0.035/0.003	−0.03/−0.00	120	−9	<3.5		−30	1	4	168.39	112.50	77.61
	JE-11SSP-6M	Line in/ repeat coil	600/150-600/150	1:1 split	+17	0.035/0.003	−0.25/−0.00	160	−5	<3		−30	1	5	85.11	56.86	39.23
SPECIAL TYPES																	
	JE-MB-C	2-way[3] mic split	150-150	1:1	+1	0.050/0.003	−0.16/−0.13	100	−12	<1		−30	2	3	36.22	24.21	18.89
	JE-MB-D	3-way[3] mic split	150-150-150	1:1:1	+2	0.044/0.003	−0.14/−0.16	100	−12	<1		−30	3	3	63.35	42.32	33.04
	JE-MB-E	4-way[3] mic split	150-150-150-150	1:1:1:1	+10	0.050/0.002	−0.10/−1.00	40	−18	<1		−30	4	1	98.99	66.13	45.62
	JE-DB-E	Direct box for guitar	20K-150	12:1	+19	0.096/0.005	−0.20/−0.20	80	−18	<1		−30	2	6	45.46	30.38	23.71

1. (dBu) Max input level = 1% THD; dBu = dBv ref. 0.775 V
2. With recommended secondary termination
3. Specifications shown are for max. number of secondaries terminated in 1000 ohm (typical mic preamp)
4. Separate lead supplied for case and for each faraday shield
5. Except as noted, above transformers are cased in 80% nickel mu-metal cans with wire leads.

PACKAGE DIMENSIONS:

	W	L	H
1 =	1 5/16" Diam.	×	1 9/16"
2 =	1 3/16" ×	1 3/16" ×	1 5/8"
3 =	1 1/8" Diam.	×	1 1/16"
4 =	1 1/2" ×	1 3/4"	2 1/2" w/solder terminals
5 =	1 5/8" Diam.	×	1 3/4"
6 =	1 1/8" Diam.	×	15/16"

NICKEL CORE OUTPUT TRANSFORMERS[6]

	Model	Construction	Nominal Impedance Ratio Pri-Sec	Turns Ratio Pri:Sec	20 Hz Max Output Level[7] (dBu)	across (n) windings	600 Ω Load Loss (dB)	DC Resistance per Winding	Typical THD Below Saturation (%) 20 Hz / 1 kHz	Frequency Response (dB ref. 1 kHz) 20 Hz / 20 kHz	Bandwidth –3 dB @ (kHz)	20 kHz Phase Response (degrees)	Overshoot (%)	Package	PRICES 1-19	100-249	1000
*	JE-11-BMCF	Bifilar 80% nickel	600-600	1:1	+26	1	−1.1	40 Ω	0.002/0.002	−0.02/−0.00	>10MHz	−0.0	<1[9]	7	65.36	43.66	30.12
*	JE-11-DMCF	Bifilar 80% nickel	600-600	1:1	+21	1	−1.0	38 Ω	0.004/0.002	−0.02/−0.00	>10MHz	−0.0	<1[9]	8	48.74	32.56	22.46
	JE-123-BLCF	Quadfilar	600-600 150-600	1:1 1:2	+32	2	−1.1	20 Ω	0.041/0.003	−0.02/−0.01	>450 170	−1.9 −4.0	<1[8]	7	64.57	37.71	26.02
*	JE-11SS-DLCF	Bifilar split/split	600-600 150-600	1:1 1:2	+27	2	−1.0	19 Ω	0.065/0.003	−0.02/−0.01	>10MHz 245	−0.0 −2.5	<1[8]	8	46.38	30.98	21.37
*	JE-11-ELCF	Bifilar	600-600	1:1	+23.5	1	−1.1	40 Ω	0.088/0.003	−0.03/−0.00	>10MHz	−0.0	<1[9]	9	30.21	20.18	13.93
*	JE-11-FLCF	Bifilar	600-600	1:1	+20.4	1	−1.6	58 Ω	0.114/0.003	−0.03/−0.00	>10MHz	−0.0	<1[9]	10	23.66	15.81	10.91
	JE-112-LCF	Quadfilar	600-600 150-600	1:1 1:2	+20.4	2	−1.6	29 Ω	0.114/0.003	−0.03/−0.01	>450 205	−1.2 −3.2	<1[8]	10	26.68	17.82	13.08
	JE-123-ALCF	Quadfilar	66.7-600	1:3	+26.5	3	−1.3	8 Ω	0.125/0.003	−0.04/+0.06	190	−4.6	<6[8]	8	44.09	29.45	20.32
	JE-11S-LCF	Bifilar w/ split pri.	600-600 150-600	1:1 1:2	+30	1 (sec)	−1.7	63 Ω	0.058/0.002	−0.02/+0.01 −0.02/−0.05	>10MHz 155	+1.1 −4.1	<1[8]	8	44.09	29.45	20.32

6. Multifilar construction has no faraday shield: cannot be used as input transformer. All specifications are for 0 Ω source, 600 Ω load.
7. Max output level = 1% THD; dBu = dBv ref. 0.775 V
8. Source amplifier −3 dB @ 100 kHz
9. Source amplifier −3 dB @ 200 kHz
10. Output transformers are horizontal channel frame type with wire leads, vertical channel frames available. PC types available.

PACKAGE DIMENSIONS:

	W	L	H	Mounting Centers
7 =	1 1/2" ×	2 5/16" ×	1 15/16"	2 13/16"
8 =	1 5/16" ×	1 15/16" ×	1 5/8"	2 3/8"
9 =	1 1/8" ×	1 11/16" ×	1 3/8"	2"
10 =	1 1/16" ×	1 7/16" ×	1 3/16"	1 3/4"

† IMPROVED PERFORMANCE * NEW MODELS

These charts include the most popular types which are usually available from stock. Many other types are available from stock or custom designs for OEM orders of 100 pieces or more can be made to order. Certified computer testing is available for OEM orders. Call or write for applications assistance and/or detailed data sheets on individual models.

Prices shown are effective 8/1/85 and are subject to change without notice. Packing, shipping, and applicable sales taxes additional.

jensen transformers
INCORPORATED

10735 Burbank Blvd./N. Hollywood, CA 91601
(213) 876-0059 *Closed Fridays, visitors by appointment only.*

Circle (195) on Reply Card

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Wheatstone (2400)
Introductions
- AP-500: On-air/production audio console; applicable to radio, teleproduction and live TV.

Product line
Audio mixing consoles.
Circle (1150) See inside back cover

Wheelit (2478)
Product line
Folding video camera, display and production.
Circle (1151)

Whirlwind (2643)
Introductions
Tester: checks any type of cable assembly.
Product line
Cable, cable assemblies; direct boxes; connectors; cable testers.
Circle (1152)

Will-Burt/TMD Div. (2587)
Introductions
- 6-27-157/167: light duty mast, top load to 40 pounds; 27 feet extended.
- 7-34-157/167: light duty mast, top load to 40 pounds: 34 feet extended.
- Mast bellows: external cover for weather protection.
- Restraint device: limit mast extention to specific heights.

Product line
Extendable masts, heavy to light duty.
Circle (1153)

Winsted (3424)
Introductions
- E4950: mini editing console, for ½-inch, ¾-inch VCRs.
- Modular console: for ½-inch Betacam editing systems.

Product line
Tape, film storage systems; equipment cabinets, vertical racks; dubbing racks.
Circle (1154) See ad page 318

Wireworks (2401)
Introductions
- TE-3: lightweight mic cable tester.
- MMB: mini microphone multibox; for on-stage or on-camera use.
- C1207: cable reeler.

Product line
Audio multiboxes, multiracks; mic splitter transformers; multipin connectors; mic cables.
Circle (1155)

Wold Communications (2606)
Established services
Weather, information exchange; satellite TV networking; syndicated program distribution services; mobile uplinks, microwave services; satellite delivery services.
Circle (1156)

Wolf Coach (3541)
Product line
Mobile production vehicles.
Circle (1157)

World Tower (2814)
Product line
Towers for all communications requirements.
Circle (1158)

Zellan Optics (804)
Introductions
- WideFinder: wide-angle viewfinder.
- CamRail: camera tracking system.
- Aaton FD7 camera.
- Beta-heater.
- Portamount and gimble.

Product line
Film cameras and accessories.
Circle (1159)

Zonal (2586)
Circle (1160)

Too late to classify

Altronic Research (146)
Circle (1161)

Apollo Audio-Visual (142)
Circle (1162)

Aries Industries (235)
Circle (1163)

Athans Manufacturing (173)
Circle (1164)

Ann D'Eon Incentives (224)
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Digital Broadcast Systems (170)
Circle (1166) See ad page 269

EMU Systems (174)
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Ethereum Scientific (207)
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Pelmark (240)
Circle (1182)

Phoenix Financial (160)
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Quantum Audio (3446)
Circle (1184)

RF Specialty Products (165)
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RJW Software (243)
Circle (1186)

Sloan, Leonard & Associates (234)
Circle (1187)

Spantel (3382)
Circle (1188)

Sperry/Ficon (2633)
Circle (1189)

Trimm (223)
Circle (1190)

TWR Lighting (246)
Circle (1191)

VTS Music (206)
Circle (1192)

Vertex Communications (208)
Circle (1193)

Vidcom International (225)
Circle (1194)

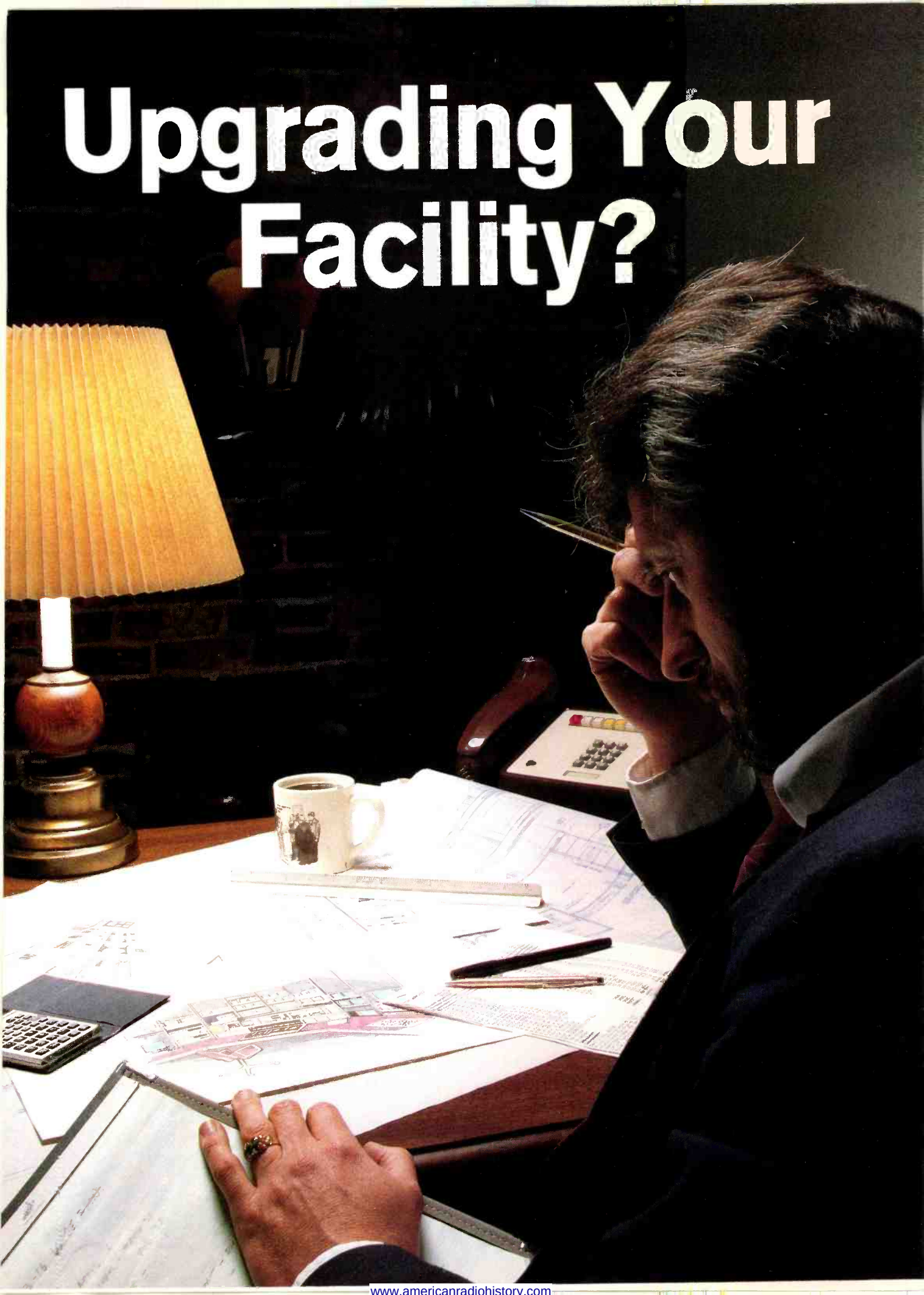
Video Aids of Colorado (175)
Circle (1195)

Videolab (210)
Circle (1196)

Wavefront (247)
Circle (1197)

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Upgrading Your Facility?



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Bosch Distribution Switching Equipment wi

Machine Control. The TCS-1 Machine Control System provides you with complete remote control from single or multiple locations.

Signal Control. The TAS/TVS-2000 Audio/Video Distribution Switcher provides you with exceptional signal transparency and allows unlimited expansion.

Switcher Control. Digital Switcher Control Systems allow you complete control of the quality.

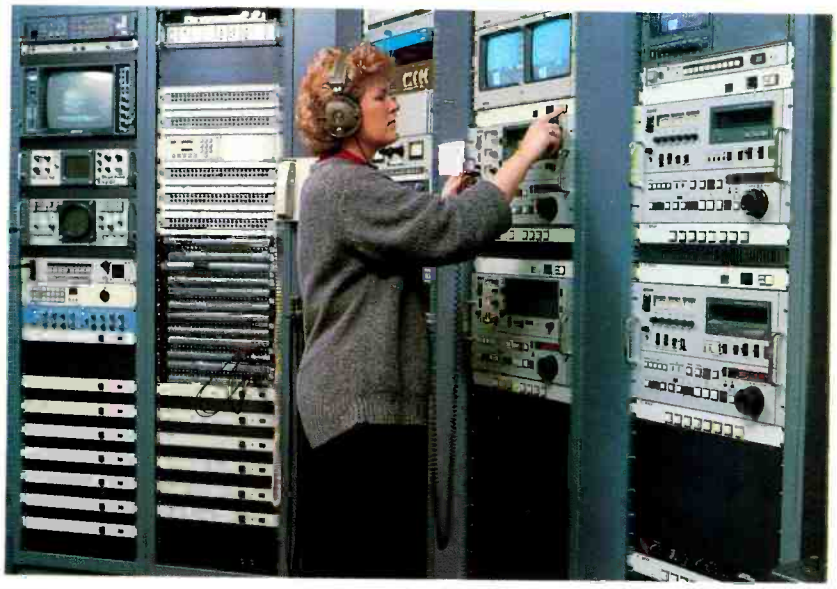
Master Control. Complete stereo, audio, video, and machine control with production switching capabilities are at your fingertips.

Reliable. Your Bosch switching equipment is fully tested and "burned in" before you receive it. The Distribution Switcher includes a free, five-year warranty.

Built for the Future. Bosch switching systems are fully capable of today's and future broadcast needs, such as stereo/audio, high-definition television, and station automation.



Master control switcher works together with the distribution switcher and machine control.



Distribution Switcher provides unlimited video and audio expansion capabilities.



Machine control interfaces may be grouped together, or located at the individual machines.

Projectors and telecine transports can be remotely controlled.



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neet your needs for today and the future. . .





VTRs can be controlled with source selection panels and machine assignment panels.

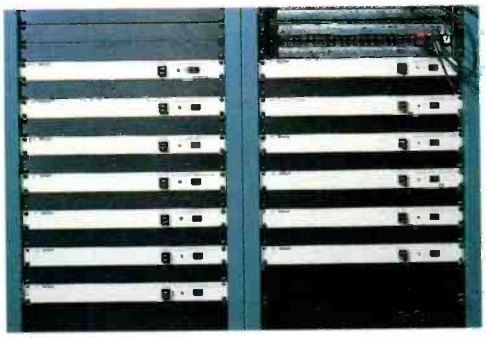
(Facility Photos Courtesy of KTZZ Channel 22, Seattle, Washington.)



Source selection and machine control in a production control room.



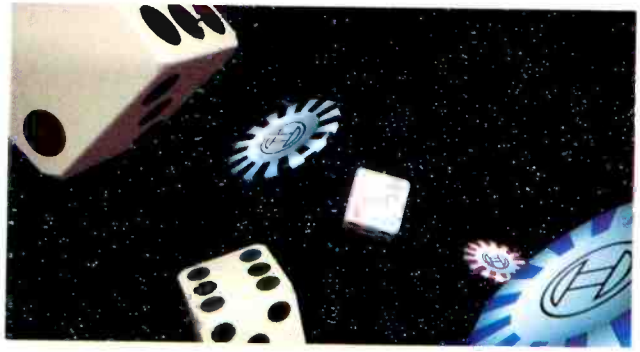
stom control panels are designed to meet ecific control needs.



. . . Putting You in complete control!

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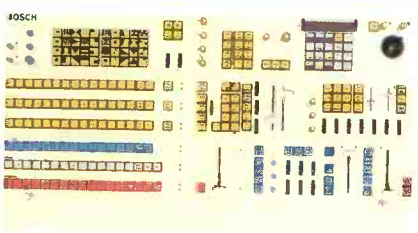
Upgrade your facility with the Bosch Family of audio and video products



Computer Graphics



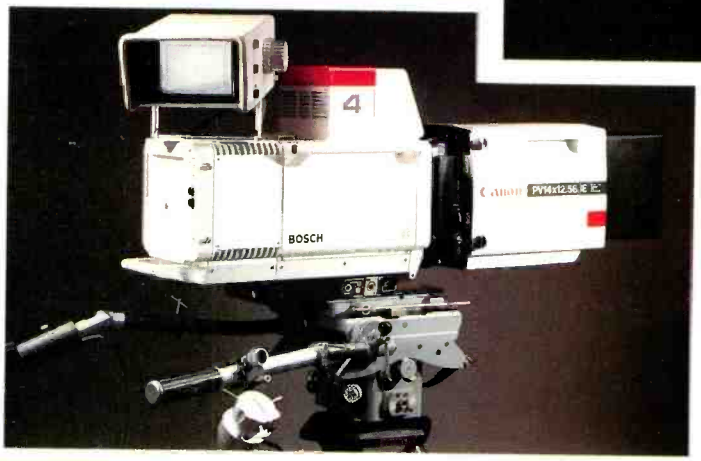
Signal Processing



Production Switchers



Distribution Switcher Systems



Cameras



Video Tape Recorders



Film to Tape Transfer

"Bosch *for* EXCELLENCE"

BOSCH

Product Integrity

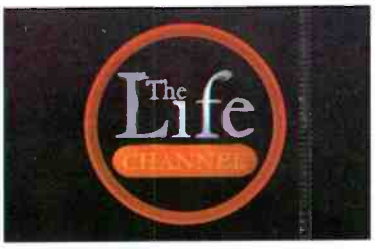
Bosch provides you with over 50 years of experience in the video business. Superior quality, excellent service, and expert engineering continue to be the standard for Bosch video products.

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- *ALIAS/1 offers natural expansion as performance needs grow. A clear upgrade path and automated access to numerous film, video, slide and print options.*

- ***NAB Booth #2497***

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Everything you've considered to be a must is there, and a whole lot more. Balanced and unbalanced, with individual connector to interface with broadcast automation equipment and SMPTE control, the 42 fits in anywhere.

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You also get a positive/negative real time counter and a precision splicing block mounted just below the plug-in fixed mount head assembly, where it belongs. That translates to faster, more accurate editing, and the peace of mind that comes with it.

To learn more about the hottest half-track in the under $2,500 class see your TASCAM dealer or write TASCAM Production Products, 7733 Telegraph Road, Montebello, CA 90640, (213) 726-0303.

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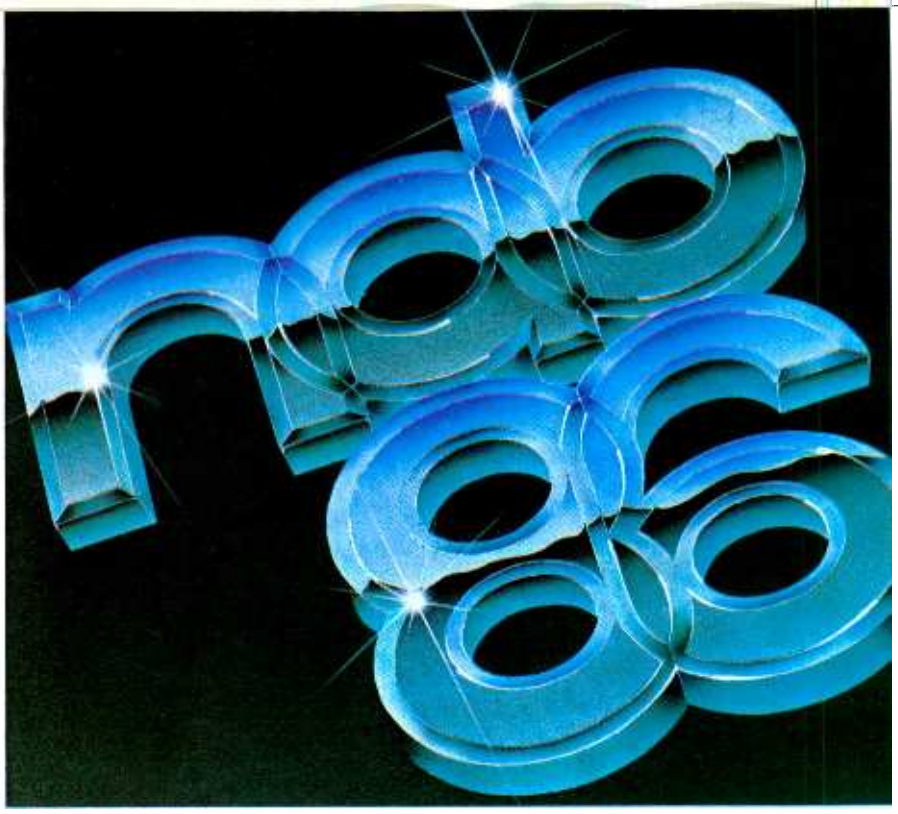
Add tag: See us at NAB booth 3416.

TASCAM
TEAC Production Products

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Product directory

This directory for exhibitor products at NAB '86 in Dallas groups the companies producing equipment in 96 categories. This should help if you are looking for a specific piece of equipment. Each exhibitor's booth number is listed to help you in locating it on the convention floor.

Because of last-minute changes, there may be some discrepancies in the booth numbers. Be sure to check your NAB program for an update.

AMPLIFIERS (Audio)

ADM Technology (3266)
ATI/Audio Technologies (2508)
Allied Broadcast (3414)
Arrakis Systems (2742)
Audio+Design/Calrec (2708)
Audio Developments (2933)
Audio Engineering Associates (2769)
BGW Systems (2825)
BSM Broadcast Systems (2668)
Benchmark Media Systems (2470)
Beyer Dynamic (2823)
Bradley Broadcast Sales (2663)
Broadcast Audio (2615)
Broadcast Supply West (2743)
Broadcast Systems/BSI (2418)
Bryston (2406)
Dwight Cavendish (2662)
Channelmatic (2548)
Crown International (2927)
Datatek (3547)
Dorrough Electronics (2602)
Dynair Electronics (3409)
GML (2546)
Gotham Audio (3354)
Graham Patten Systems (2528)
HEDCO/Hughes Electronic Devices (2751)
Hallikainen & Friends (2925)
Harrison Systems (3412)
Howe Audio Productions (2832)
JBL/UREI (2727)
Johnson Electronics (3451)
LPB (3338)
Leitch Video Int'l (3559)
Lenco (3056)
Logitek (2807)
Mark Electronics (2417)
McCurdy Radio Industries (3028)
Mitsubishi Pro Audio Group (3530)
Mycomp Technologies (NA)
Monroe Electronics (3028)
Neve Electronics (3318)
Omicron Video (2661)
Pacific Recorders & Engineers (3151)
Radio Systems (2680)
RAM Broadcast Systems (3028)
ROH (2647)
RTS Systems (3366)
RUSSCO Electronics (2440)
Schmid Telecomm. (2462)
Shintron (3036)
Shure Brothers (3320)
Sony Professional Audio (3100)
Soundcraft Electronics (2770)
Straight Wire Audio (2518)
Studer Revox America (3048)
Symetrix (2519)
Tannoy (215)
Telemet Div/Geotel (3396)
U.S. Audio (2747)
Utah Scientific (3144)
Valley People (2747)
Videotek (3316)
Vital Industries (3191)

AMPLIFIERS (RF)

Acrian (2458)
Amperex Electronic (2600)
Broadcast Microwave Services (3578)
Coherent Communications (2675)
Comark Communications (3561)
Communications Microwave (139)
Comtronix Systems (2487)
Elcom-Bauer (3414)
M/A-COM MAC (3280)
Marti Electronics (3496)
RF Technology (2809)
Richardson Electronics (2503)
Scientific-Atlanta (3272)
Sescom (3445)
Television Technology/TTC (3492)
Thomson-CSF Components (3422)
Valley People (2747)
Varian Associates/EIMAC (3206)
Varian Associates (3206)

AMPLIFIERS (Video)

Apert-Herzog (2931)
BSM Broadcast Systems (2668)
Central Dynamics (3080)
Channelmatic (2548)
Dynair Electronics (3409)

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Amplifiers (Video), continued

Datatek (3547)
Di-Tech (3567)
ESE (3470)
Grumman Electronic Systems (2481)
HEDCO/Hughes Electronic Devices (2751)
Image Video (2636)
Intergroup Video Systems (3312)
Leitch Video Int'l (3559)
Lenco (3056)
Omicron Video (2661)
Shintron (3036)
Sigma Electronics (2905)
Telemet Div/Geotel (3396)
Utah Scientific (3144)
Videotek (3316)
Vital Industries (3191)

ANTENNA SYSTEMS & ACCESSORIES (Except satellite)
Andrew (3098)
Bogner Broadcast Equipment (3406)
Bradley Broadcast Sales (2663)
Broadcast Microwave Services (3578)
Cablewave Systems/Celwave (3489)
Cetec Antennas (3587)
Comark Communications (3561)
Comex (2829)
Communications Microwave (139)
Continental Electronics/Varian (3200)
DX Communications (2693)
Dielectric (3436)
Electronic Research (2576)
Global Systems (2788)
Harris Broadcast Group (3136)
Johnson Electronics (3451)
Kathrein-Werke (2812)
Kintronics Labs (2780)
LeBlanc & Dick Communications (2903)
Marti Electronics (3496)
Micro Communications (3438)
RF Technology (2809)
SWR (3350)
Shively Labs (2709)
Tennaplex Systems (2812)

ATTENUATORS
Bird Electronics (3472)
Coaxial Dynamics (2766)
Control Concepts (2652)
Electro Impulse Laboratory (3431)
Penny & Giles (2774)
SESCOM (3445)

AUDIO MIXERS
ADM Technology (3266)
AF Associates (3141)
AMEK Consoles (2558)
ATI/Audio Technologies (2508)
Allied Broadcast (3414)
Arrakis Systems (2742)
Audio Broadcast Group (2581)
Audio+Design/Calrec (2708)
Audio Developments (2933)
Audio Engineering Associates (2769)
Audio-Technica US (2407)
Auditronics (3310)
Autogram (2702)
Barrett Associates (2654)
Bayly Engineering (2700)
Beyer Dynamic (2823)
Bradley Broadcast Sales (2663)
Broadcast Audio (2615)
Broadcast Electronics (3226)
Broadcast Supply West (2743)
Camera Mart (3040)
Central Dynamics (3080)
Coherent Communications (2675)
Comprehensive Video Supply (2526)
Comrex (3460)
Connectronics (2403)
Continental Electronics/Varian (3200)
Droid Works (3572)
Electro-Voice (3430)
Fostex (2579)
Gotham Audio (3354)
Graham Patten Systems (2528)
Hallikainen & Friends (2925)
Harris Broadcast Group (3136)
Harrison Systems (3412)
Heie Engineering (2452)
Howe Audio Productions (2832)
JBL/UREI (2727)
JVC (3180)
Johnson Electronics (3451)
LPB (3338)
Logitek (2807)
McCurdy Radio Industries (3028)
Mitsubishi Pro Audio Group (3530)
Neve Electronics (3318)
Orion Research (2499)
Pacific Recorders & Engineers (3151)
Panasonic Industrial/Ramsa (3216)
Quantum Audio/Gotham (3354)
Radio Systems (2680)
RAM Broadcast Systems (3028)
RUSSCO Electronics (2440)
Sennheiser Electronic (2914)
SESCOM (3445)
Shure Brothers (3320)
Solid State Logic (3560)
Sony Professional Audio (3100)
Soundcraft Electronics (2770)
Soundtracs (0144)
Studer Revox America (3048)
TASCAM Production Products (3416)
TOA Electronics (2498)
Tapecaster (3310)
Television Technology/TTC (3492)
Ward-Beck Systems (3060)
Wheatstone Broadcast/Audioarts (2400)

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The FCS-20... unique operating features make this stand ideal for font composition or titling.

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at NAB Booth 3534

THE NEW, INNOVATIVE EQUIPMENT SOURCE.

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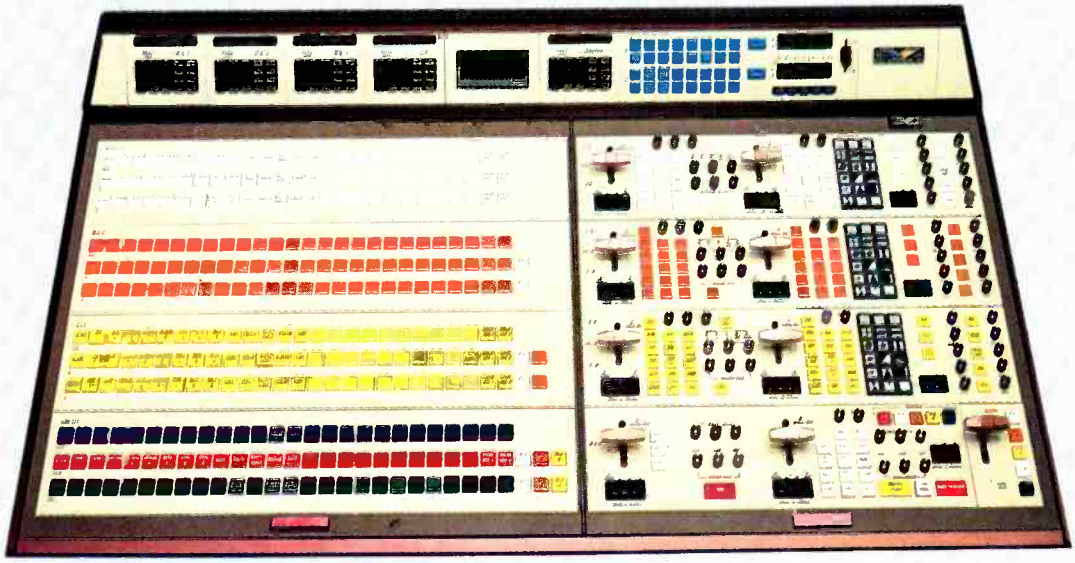
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KEYING POWER. SIMPLE OPERATION. STATE-OF-THE-ART TECHNOLOGY.



That's Vital's *NEW* 3000 Series Production Switcher.

Need more keying power? Try 4 Video Keys, or a Chroma Key plus 4 Video Keys, in each M/E. Plus, all M/E's have separate key inputs with discrete filling signals, permitting 16 self-filled keys in our largest 3000 model. That's our new 3000 Series Production Switcher.

Want simple operation? How about Dual Handlebars, two Auto Transition Units, Simul-Key System for multiple key entries and exits, plus automatic key set-ups in memory for instant access. That's Vital's new 3000 Series Production Switcher.



And state-of-the-art technology? Compare our 3000 Series with any other production switcher in the market. If you can find a better one for less, buy it! Currently the 3 Mix/Effect switcher sells for only $175,000. This is VITAL's top of the line production switcher—one so fully-loaded that the only option is the stereo audio-follow-video package.

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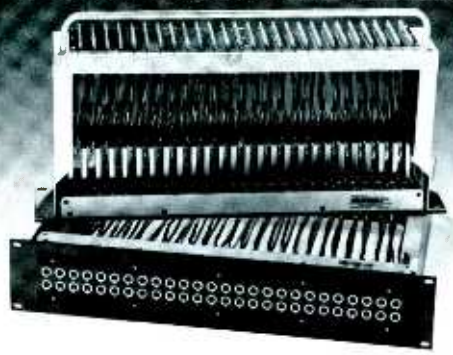
For more information call toll free 800-84-VITAL (U.S. only)

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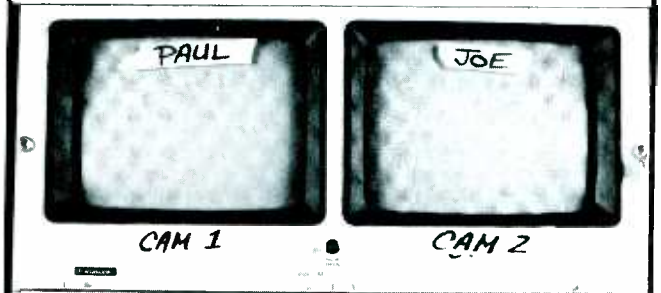
We have a vast array of audio jack panels and related items in stock, ready to ship within 24 hours. We'll get your facilities upgraded faster than some companies can give you a quote. Call us. 603/446-3335.

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"Who's on first?"



It's a question everyone in TV remote trucks and studio control rooms has asked. And until now, the solution to identifying camera numbers and operator's names has been state-of-the-art masking tape.

Roscor, a leader in the design and fabrication of TV remote trucks and studios, has developed a totally new concept in providing camera tally information, source identification and displaying operator names via characters generated *right on the monitor.*

It's the Roscor MTS-1 Monitor Tally System.

This high-tech solution to a frustrating problem is typical of Roscor's commitment to providing not only the basic required system, but exceeding the customers expectations for engineering, quality and workmanship.

See the MTS-1 and the complete Roscor story at Booth #3404 at the 1986 NAB convention and stop asking "Who's on first?".



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AUDIO PROCESSORS, DELAY, EFFECTS & LEVEL CONTROL
AKG Acoustics (2521)
AMEK Consoles (2558)
ART/Applied Research & Tech (237)
ATI/Audio Technologies (2508)
Advanced Music Systems (2919)
Allied Broadcast (3414)
Aphex Systems (2816)
Arrakis Systems (2742)
Audio+Design/Calrec (2708)
Audio Engineering Associates (2769)
Barcus-Berry Electronics (2485)
Benchmark Media Systems (2470)
Beyer Dynamic (2823)
Bradley Broadcast Sales (2663)
Broadcast Supply West (2743)
CRL/Circuit Research Labs (2538)
Connectronics (2403)
Continental Electronics/Varian (3200)
dbx (2740)
Dolby Laboratories (2705)
Dorrough Electronics (2602)
Droid Works
Elcom-Bauer (3414)
Eventide (2830)
Fostex (2579)
Gotham Audio (3354)
Harris Broadcast Group (3136)
Howe Audio Productions (2832)
Inovonics (2434)
JVC (3180)
Kintek (2455)
LPB (3338)
Lexicon (2909)
Marcom (2435)
Marti Electronics (3496)
McCurdy Radio Industries (3028)
Mitsubishi Pro Audio Group (3530)
Modulation Sciences (2811)
Nakamichi USA (2456)
Neve Electronics (3318)
Normex (2453)
Orban Associates (3444)
Pacific Recorders & Engineers (3151)
Pinzone Communications (2411)
Radio Resources (2833)
RAM Broadcast Systems (3028)
Shure Brothers (3320)
Sony Professional Audio (3100)
Studio Technologies (2769)
Symetrix (2519)
Tektronix (3214)
Telemet Div/Geotel (3396)
Texar (2571)
U.S. Audio Inc. (2747)
Valley people (2747)
Wheatstone Broadcast/ Audioarts (2400)

AUTOMATION SYSTEMS (Station business)
Alamar Electronics (2582)
Basys (2913)
Broadcast Electronics (3226)
CBSI/Custom Business Systems (2517)
Columbine Systems (3405)
Data Communications/DCC (3204)
Generic Computer Systems (2818)
Grumman Electronic Systems (2481)
Harris Corp/Broadcast Group (3136)
Hungerford & Co (2534)
Jefferson Data Systems (3440)
Kaman Sciences (3078)
The Management (2512)
Musicworks (2734)
Register Data Systems (2505)
SoftPedal (3440)
H.A. Solutec (2530)
Soundtracs (0144)
Sunspot (2679)
Tapscan (2664)
Utah Scientific (3144)
Videomagnetics (2725)
Videomedia (3558)

AUTOMATION SYSTEMS (Newsroom)
Basys (2913)
ColorGraphics Systems (3144)
Columbine Systems (3405)
Computer Prompting (0132)
Data Communications/DCC (3204)
Media Computing (2545)
Utah Scientific (3144)
Videomagnetics (2725)

AUTOMATION SYSTEMS (Radio/TV program control)
Alamar Electronics (2582)
Allied Broadcast (3414)
Amherst Electronic Instruments (107)
Asaca/Shibasoku (3278)
Autogram (2702)
Broadcast Electronics (3226)
Broadcast Systems/BSI (2418)
Calzone Case (2502)
Central Dynamics (3080)
Century 21 Programming (2630)
Channelmatic (2548)
Commercial Cable/CCI (2484)
Grass Valley Group (3112)
Grumman Electronic Systems (2481)
Harris Broadcast Group (3136)
Hubbard Communications (3286)
IGM Communications (3378)
Image Video (2636)
Lake Systems (112)
MATCO Control Products (2687)
MEI/Microprobe Electronics (2620)
Media Computing (2545)
Merlin Engineering (3408)
Mitomo Company (2468)
Musicworks (2734)
Odetics (3586)
Schafer World Communications (3353)
H.A. Solutec (2530)
Sono-Mag (3480)
Sony Broadcast Products (3100)
Soundtracs (144)

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The Remarkable NEW DIMMER That's Low In Cost And Easy To Operate

(We call it the UNITROL lighting control system)

Here's what they are saying about the UNITROL system

Brian

The UNITROL system is very effective, it allows you to go from one room to the next, setting the lighting with only one controller. It doesn't make you waste an entire 6 pack of dimmers when only 1 or 2 are needed.

Donna

We used the Unitrol system for the Atlanta Convention and Visitors Bureau meeting. We had a limited load-in and set-up time. The dimmers were great; all we had to do was hang the dimmers, plug in the instruments, power the dimmers and we were set. We had to teach the presenter how to operate the controller, and that was easy.

The Unitrol system is a good addition to our inventory. It's easy to store, transport and simple to set-up and operate. The system is ideal for small production jobs and rental orders.



Brian Rehkoph and Donna Dallas
MAGNUM-Atlanta, Georgia

George

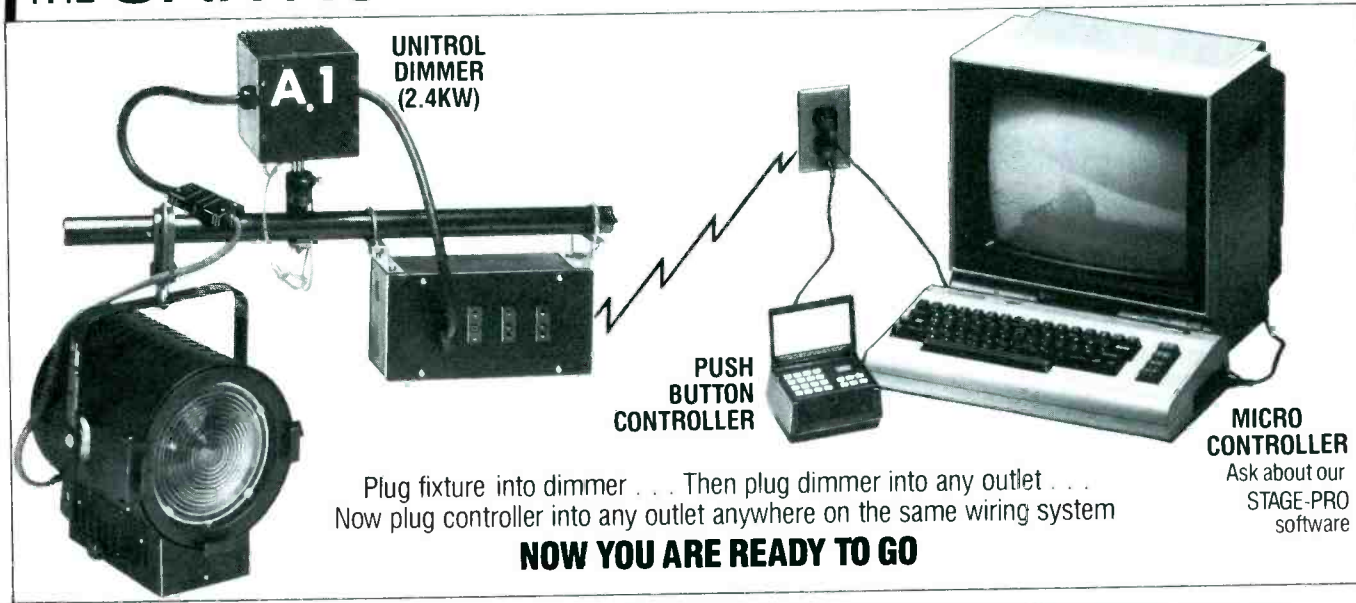
I bought the Unitrol Lighting System over one year ago and have used it continually without any problems. It is compact, easy to operate and manipulate. This lighting system is very convenient, you can move the controller anyplace which gives me better maneuverability.

The Unitrol system has made my job easier. I highly recommend it.



George Miller
TAKOTNA VIDEO-Anchorage, Alaska

THE UNITROL LIGHTING CONTROL SYSTEM . . . IT'S THIS EASY



Plug fixture into dimmer . . . Then plug dimmer into any outlet . . .
Now plug controller into any outlet anywhere on the same wiring system

NOW YOU ARE READY TO GO

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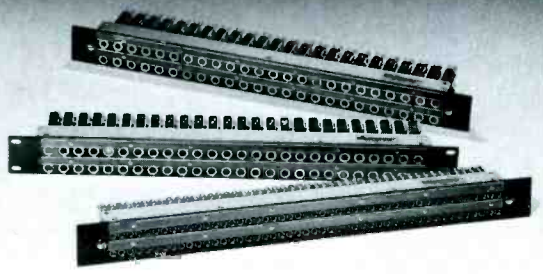
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JACKS BE QUICK.



READY TO SHIP IN 24 HOURS.

MAXI panels with 2 rows of 24 or 26 long frame (1/4") jacks per row. MINI panels with 2 rows of 48 or 52 MINI jacks per row. All featuring Audio Accessories' premium Audio-Line™ jacks. Standard pre-wired MAXI panels are also in stock.

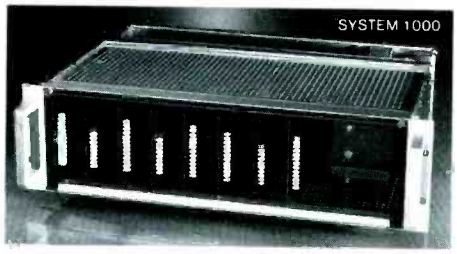
We carry a large assortment of jacks, patch cords, and accessories. And custom panels can usually be delivered within a couple of weeks of your order. Call for more information. 603/446-3335.

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Were it possible to quantify versatility, the question of what to purchase would be easy. While our specifications are supurb, our real focus is to give you total flexibility.

Our DA-101, for instance, is without peer. As a stand alone, it can be: a 2 in, 10 out mono DA capable of generating L + R, or L – R; a timecode DA with a bandwidth of 200KHz; a stereo 10 watt headphone amplifier; or a 40 watt bridged mono power amplifier. That's only the beginning. With daughter boards the possibilities are limitless.

The MDA-101 is the finest microphone pre-amplifier available, coupled with a DA, it uses the same daughter boards. Call for complete information.

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BENCHMARK—Where Second Best is not Good Enough!

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Automation, continued

Studer Revox America (3048)
Systemation (2567)
Utah Scientific (3144)
Videomagnetics (2725)
Videomedia (3558)
Vital Industries (3191)
WSI (2642)

BATTERIES, CHARGERS & ANALYZERS
Alexander Mfg (2926)
Anton/Bauer (2729)
Camera Mart (3040)
Christie Electric (3324)
Cine 60 (3428)
Comprehensive Video Supply (3593)
DeSisti America/Desmar (2796)
Film/Video Equipment Service (2803)
Frezzolini Electronics (2716)
G&M Power Products (2790)
Landy Associates (2609)
PAG America (2459)
PEP (3378)
Paco Electronics USA (2447)
Perrott Engineering Labs (2733)
Provisional Battery (214)
Universal Elecon (152)

BUILDINGS (Prefabricated)
Andrew (3478)
Tracoustics Acoustic Systems

CABINETS, EQUIPMENT CASES & RACKS
AMCO Engineering (3426)
Anvil Cases (2706)
Beyer Dynamic (2823)
Broadcast Supply West (2743)
Broadcast Systems/BSI (2418)
Calzone Case (2502)
Camera Mart (3040)
Century Precision Optics (2422)
Comprehensive Video Supply (2526)
Continental Electronics/Varian (3200)
Emcor Products (2402)
Excalibur Industries (2637)
Ferno-Washington (2782)
Fiberbilt Cases (2910)
Jensen Tools (2721)
K&H Products/Porta-Brace (2532)
Kangaroo Video Products (2676)
Mark Electronics (2417)
McCurdy Radio Industries (3028)
Nalpak Video Sales (2792)
RAM Broadcast Systems (3028)
Scientific-Atlanta (3272)
Stantron (2911)
Star Case (2555)
Storeel Corporation (3322)
Telepak San Diego (2566)
Thermodyne International (2824)
Ultimate Support Systems (2783)
Viking Cases (2757)
Winsted (3424)

CABLE & WIRE
AMP Products (2764)
Abbott & Company (2479)
Andrew (3478)
Artel Communications (2920)
Audio-Technica US (2407)
BIW Cable Systems (3493)
Barrett Associates (2654)
Belden (2651)
Cablewave Systems/Celwave (3489)
Canare Cable (2523)
Connectronics (2403)
Continental Electronics/Varian (3200)
Gotham Audio Corporation (3354)
Keylite PSI Group (2432)
Lemo USA (2805)
RAM Broadcast Systems (3028)
Stage Lighting Distributors (2446)
Switchcraft (2684)
TASCAM Production Products (3416)
Trompeter Electronics (3346)
Whirlwind (2643)
Wireworks (2401)

CAMERA LENSES & OPTICAL ACCESSORIES
Angenieux (3020)
Arriflex (3553)
Camera Mart (3040)
Canon USA (3300)
Century Precision Optics (2422)
Cinema Products (140)
Cinemills (2777)
EEV (2626)
Film/Video Equipment Service (2803)
Fujinon (3410)
Ikegami Electronics USA (3150)
Interactive Motion Control (2771)
Landy Associates (2609)
Schneider Optics (3343)
Schwem Technology (2553)
Tamron Industries (0120)
Tiffen Mfg (2736)
Total Spectrum Mfg (3534)
Zellan Optics (2477)

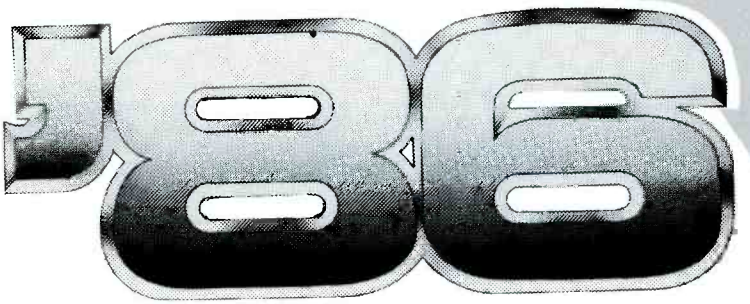
CAMERA SUPPORT EQUIPMENT
Arriflex (3553)
Bencher (2568)
Bogen Photo (2405)
Canon USA (3300)
Cinema Products (140)
Cinemills (2777)
Alan Gordon Enterprises (3435)
Karl Heitz (2900)
Ikegami Electronics USA (3150)
Innovative TV Eqpt/ITE (3258)
Interactive Motion Control (2771)
Keylite PSI Group (2432)
Listec TV Equipment (3579)
Matthews Studio Equipment (2701)
O'Connor Engineering Labs (3364)
Quickset (3380)
Sachtler (3419)
Telemetrics (2569)

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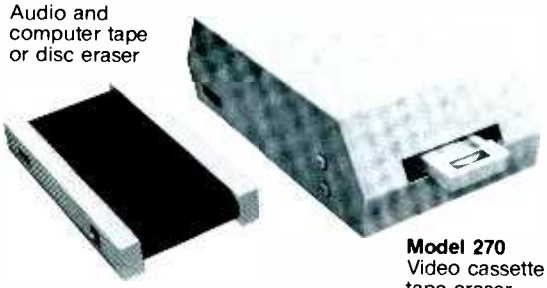
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Camera support, continued

Ultimate Support Systems (2783)
Wheelit (2478)
Zellan Optics (2477)

CAMERAS (Color TV)
AT&T Information Systems (3212)
Robert Bosch Video (3170)
Camera Mart (3040)
Cinema Products (140)
Alan Gordon Enterprises (3435)
Harris Broadcast Group (3136)
Hitachi Denshi America (3160)
Ikegami Electronics USA (3150)
JVC (3180)
Landy Associates (2609)
NEC America Broadcast (3161)
PAG America (2459)
Panasonic Industrial (3116)
Philips TV Systems (3128)
Sharp Electronics/Broadcast (3305)
Sony Broadcast Products (3100)
System Associates (3392)
Thomson-CSF Broadcast (3190)
Toshiba America (3302)

CAMERAS (Film, cine)
Arriflex (3553)
Cinema Products (140)
Cinemills (2777)
Alan Gordon Enterprises (3435)
Karl Heitz (2900)
Keylite PSI Group (2432)
Zellan Optics (2477)

COMPACT DISC AUDIO PLAYERS
Audio Broadcast Group (2581)
Bradley Broadcast Sales (2663)
Broadcast Supply West (2743)
Century 21 Programming (2630)
Mitomo (2468)
Philips TV Systems (3128)
RAM Broadcast Systems (3028)
Schafer World Communications (3353)
Sony Professional Audio (3100)
Studer Revox America (3048)

COMPUTER SOFTWARE & PERIPHERALS
AT&T Information Systems (3212)
Artronics (216)
Audio Precision (2560)
Aurora Systems (104)
CAT Systems (3333)
CBSI/Custom Business Systems (2517)
Central Dynamics (3080)
Century 21 Programming (2630)
Channelmatic (2548)
Comprehensive Video Supply

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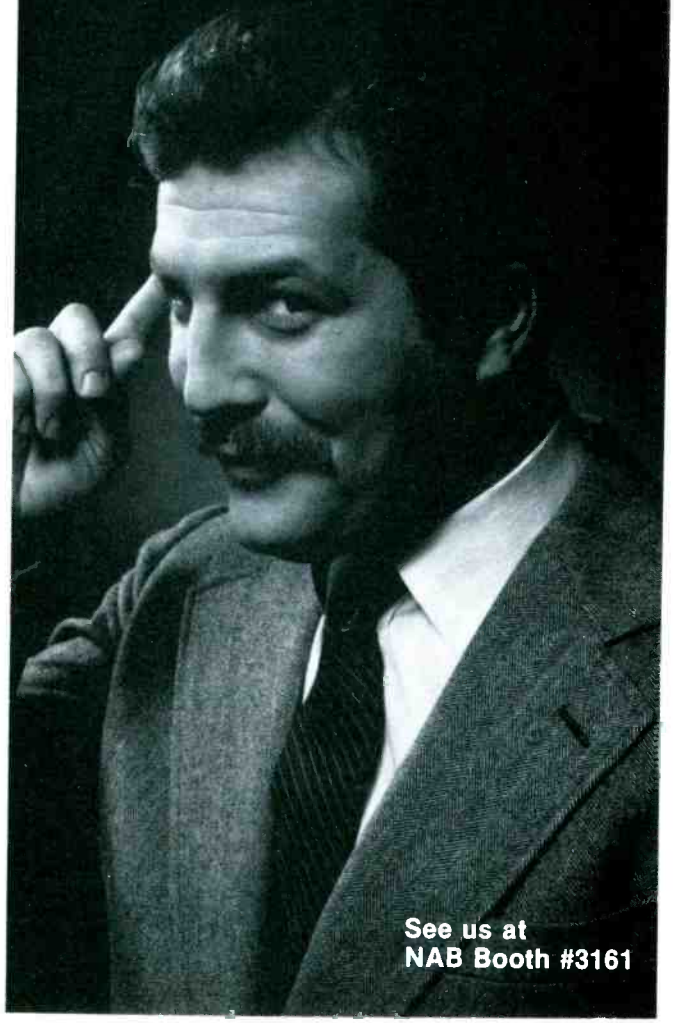
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Computer software, continued

(3593)
Computer Prompting (132)
Cubicomp (2692)
Data Communications/DCC (3204)
ESD (2786)
Elicon (2784)
John Fluke Mfg. (0100)
Generic Computer Systems (2818)
Inovion (2445)
Interactive Motion Control (2771)
Jefferson Data Systems (3440)
Kaman Sciences (3078)
Magni Systems (0128)
The Management (2512)
Media Computing (2545)
Normex (2453)
Norpak (2574)
Pinzone Communications (2411)
Register Data Systems (2505)
Softpedal (3440)
Solid State Logic (3560)
Sony Video Communications (3100)
Strata Marketing (2689)
Sunspot (2679)
Systemation (2567)
Taber Mfg & Engineering (3385)
TimeLine (2686)
WSI (2642)

CONSULTING, ENGINEERING & DESIGN SERVICES
AF Associates (3141)
Advanced Designs (2419)
Arben Design (154)
Arrakis Systems (2742)
B&B Systems (2665)
Barrett Associates (2654)
Broadcast Systems/BSI (2418)
CAT Systems (3333)
Calzone Case (2502)
Centro (3181)
Channelmatic (2548)
Control Concepts (2652)
Dataworld (2779)
Elicon (2784)
Lightning Eliminators/Conslts (164)
MZB & Associates (2495)
Micro Communications (3438)
Midwest Communications (3210)
L E Nelson Sales/Thorn-EMI (2437)
Norpak (2574)
Rees Associates (2500)
Riviera Broadcast Leasing (2793)
Roscor (3404)
SG Communications (2556)
Shively Labs (2709)
Shook Electronic Enterprises (3222)
Spectrum Planning (2633)
Taber Mfg & Engineering (3385)
Wireworks (2401)

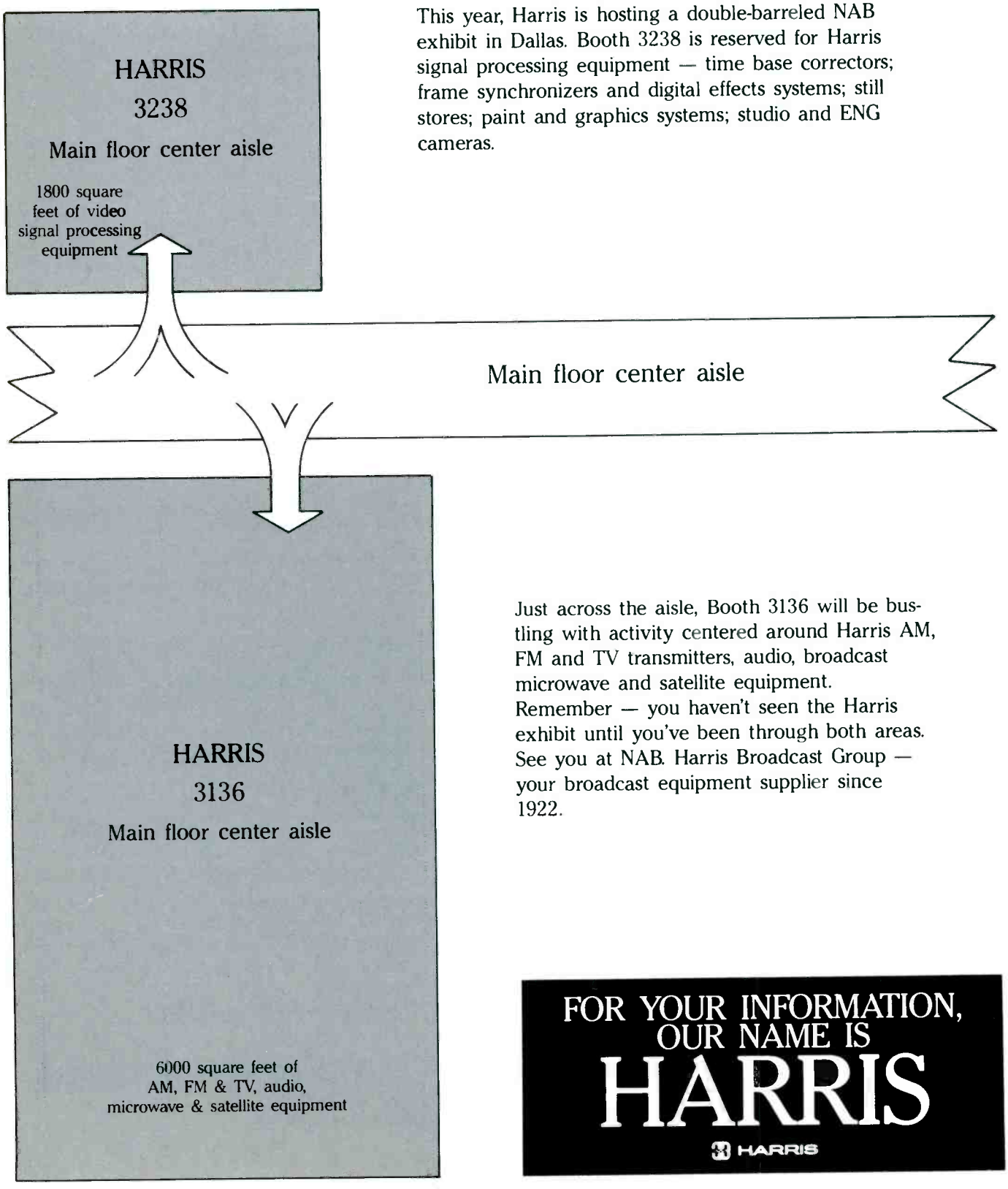
DELAY PRODUCTS (Pulse, video)
Allen Avionics (2724)
Broadcast Video Systems (2730)
Central Dynamics (3080)
Ikegami Electronics USA (3150)
Matthey Printed Products (3340)
Microsonics (2543)
Omicron Video (2661)
TV Equipment Associates (3342)
Vital Industries (3191)

EDIT CONTROLLERS (Audio & videotape)
Acquis (3252)
Adams-Smith (2488)
Alpha Automation (203)
Amherst Electronic Instruments (107)
Ampex AVSD (3108)
Amtel Systems (2820)
Apert-Herzog (2931)
Asaca/Shibasoku (3278)
Audio Kinetics (2506)
BHP (2795)
CMX (3232)
Calaway Engineering (149)
Camera Mart (3040)
Compusonics (226)
Convergence (3252)
EECO (3540)
Giese Elektronik (2785)
Grass Valley Group (3112)
Harris Broadcast Group (3136)
JVC (3180)
Landy Associates (2609)
Montage Computer (3260)
Paltex (3592)
Panasonic Industrial (3116)
Shintron (3036)
Sony Broadcast Products (3100)
Steenbeck (2749)
Studer Revox America (3048)
System Associates (3392)
United Media (3526)
Universal Elecon (152)
Videomedia (3558)

ELECTRONIC TITLING (Graphics, animation captioning)
AT&T Information Systems (3212)
Advanced Designs (2419)
Alden Electronics (2759)
Alias Research (2497)
Ampex AVSD (3108)
Artronics (216)
Asaca/Shibasoku (3278)
Aston Electronics (212)
Aurora Systems (104)
Robert Bosch Video (3170)
Chyron (3072)
ColorGraphics Systems (3144)
Computer Graphics Lab (2929)
Michael Cox Electronics (2730)
Cubicomp (2692)
Digital Services (3304)
Dubner Computer Systems (3110)
EEG Enterprises (2802)
ESD (2786)
Elicon (2784)
Fairlight Instruments (2460)
For-A (3599)
Alan Gordon Enterprises (3435)
Graham Patten Systems (2528)

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Take both Harris exits at NAB!



This year, Harris is hosting a double-barreled NAB exhibit in Dallas. Booth 3238 is reserved for Harris signal processing equipment — time base correctors; frame synchronizers and digital effects systems; still stores; paint and graphics systems; studio and ENG cameras.

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Electronic tilting, continued

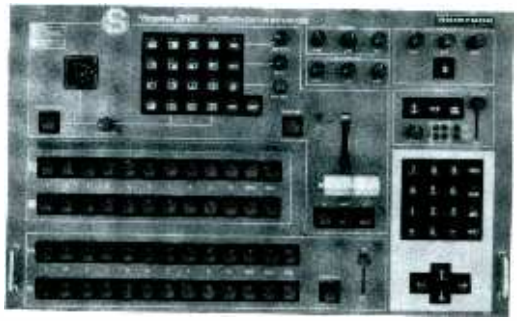
Grass Valley Group (3112)
Inovion (2445)
Interactive Motion Control (2771)
Interand (3429)
Knox Video Products (2611)
Laird Telemedia (3474)
Landy Associates (2609)
Logica UK (3066)
Lyon Lamb Video Animation (2932)
Mark Electronics (2417)
Mycro-Tek (2490)
PESA America (3417)
Quanta (3145)
Quantel (3171)
Symtec/One Pass Video Systems (228)
System Associates (3392)
3M Broadcast/Related Products (3392)
Texscan MSI/ComPuvid (2473)
Thomson-CSF Broadcast (3190)
Video Associates Labs (3330)
Videomedia (3558)
WSI (2642)

ENCODERS/DECODERS (Tone & EBS)
Barrett Associates (2654)
Bayly Engineering (2700)
Broadcast Microwave Services (3578)
Broadcast Supply West (2743)
Camera Mart (3040)
Channelmatic (2548)
Gorman-Redlich Mfg (2715)
Johnson Electronics (3451)
Modulation Sciences (2811)
RAM Broadcast Systems (3028)

ENCODERS/DECODERS (Video)
Barco Industries (2577)
Broadcast Video Systems (2730)
Central Dynamics (3080)
Michael Cox Electronics (2730)
Datatek (3547)
Digital Video Systems (3272)
Faroudja Labs (3408)
For-A (3599)
J-Lab (2474)
Lenco (3056)
Listec Video (3468)
Lyon Lamb Video Animation (2932)
Scientific-Atlanta (3272)
Telemetrics (2569)

EXCITERS (AM, FM, TV)
Bayly Engineering (2700)
Bradley Broadcast Sales (2663)
Broadcast Electronics (3226)
Catel Telecommunications (2685)
Comark Communications (3561)
Comex (2829)
Communications Microwave (139)

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Comtronix Systems (2487)
Delta Electronics (3488)
Elcom-Bauer (3414)
Harris Broadcast Group (3136)
ITS/Information Transmission (2535)
Kahn Communications (2454)
Larcan Communications (3314)
NEC America Broadcast (3161)
QEI (3336)
Radio Resources (2833)
Scientific-Atlanta (3272)
Television Technology/TTC (3492)

FIBER-OPTIC PRODUCTS
Andrew (3098)
Artel Communications (2920)
BIW Cable Systems (3493)
Grass Valley Group (3112)
LTM of America (2537)
Telemet Div/Geotel (3396)
VEAM/Litton Systems (2559)

FILM & PROCESSING (Services & equipment)
Eastman Kodak (3208)
Film House (2781)
KEM Elektronik Mechanik (2467)
Lipsner-Smith (3386)
Mitsubishi Pro Audio Group (3530)
Research Technology Int'l/RTI (3386)
Sprague Magnetics (2540)

FILM EDITING & TRANSFER EQUIPMENT
AF Associates (3141)
Apert-Herzog (2931)
BHP (2795)
Droid Works (2588)
Gray Engineering Labs (2428)
J&R Film/Moviola (3450)
KEM Elektronik Mechanik (2467)
L-W International (3427)
Magna-Tech Electronics (2785)
Mitsubishi Pro Audio Group (3530)
Research Technology Int'l/RTI (3386)
Sprague Magnetics (2540)
Steenbeck (2749)

FILTERS, ELECTRICAL & ELECTRONIC (Audio, video, RF)
ADC Telecommunications (2819)
Allen Avionics (2724)
Audio-Video Engineering (2703)
Bird Electronics (3472)
Broadcast Video Systems (2730)
Coaxial Dynamics (2766)
Continental Electronics/Varian (3200)
Control Concepts (2652)
Dielectric Communications (3436)
Digivision (2527)

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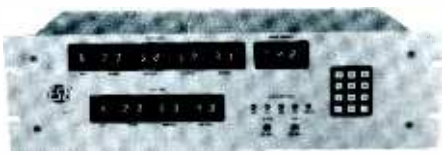
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Filters, continued

Electronic Research (2576)
Kintronics Labs (2780)
LeBlanc & Dick Communications (2903)
Lightning Eliminators/Conslts (0164)
Matthey Printed Products (3340)
Microsonics (2543)
Mitsubishi Pro Audio Group (3530)
Shively Labs (2709)
H.A. Solutec (2530)
Tennaplex Systems (2812)

GENERATORS (Stereo & SCA, AM, FM, TV)
Allied Broadcast (3414)
American Diversified (2623)
Bayly Engineering (2700)
Broadcast Electronics (3226)
CRL/Circuit Research Labs (2538)
Continental Electronics/Varian (3200)
Delta Electronics (3488)
Dorrough Electronics (2602)
Elcom-Bauer (3414)
Harris Broadcast Group (3136)
Inovonics (2434)
Kahn Communications (2454)
Kintek (2455)
Leaming Industries (136)
MARCOM (2435)
Marti Electronics (3496)
Merlin Engineering (3408)
Micro Controls (2623)
Modulation Sciences (2811)
Moseley Associates (3202)
Motorola/AM Stereo (3539)
Orban Associates (3444)
Potomac Instruments (3329)
QEI (3336)
Reach Electronics (2438)
Spantel (3382)
Television Technology/TTC (3492)
Universal Elecon (152)
Videotek (3316)
Wegener Communications (2760)

GENERATORS (Sync, video test patterns)
Adams-Smith (2488)
Asaca/Shibasoku (3278)
Central Dynamics (3080)
For-A (3599)
Grass Valley Group (3112)
Grumman Electronic Systems (2481)
Leader Instruments (2763)
Leitch Video Int'l (3559)
Lenco (3056)
Listec Video (3468)
Magni Systems (128)
Omicron Video (2661)
PESA America (3417)
Sony Broadcast Products (3100)
Tektronix (3214)
Telemet Div/Geotel (3396)
Video Aids of Colorado (175)

GENERATORS (Digital video effects)
Abekas Video Systems (3527)
Ampex AVSD (3108)
Artronics (216)
CEL Electronics (2429)
Central Dynamics (3080)
Digital Services (3304)
Fairlight Instruments (2460)
For-A (3599)
GML America (0241)
Grass Valley Group (3112)
James Grunder & Associates (2429)
Gunnerfield Marketing/GML (241)
Harris Video Systems (3238)
Inovion (2445)
Microtime (3086)
NEC America Broadcast (3161)
Paltex (3592)
Quantel (3171)
Shintron (3036)
System Associates (3392)
Tektronix (3214)
Vital Industries (3191)

HDTV EQUIPMENT
Asaca/Shibasoku (3278)
Barco Industries (US) (2577)
Digivision (2527)
Dynair Electronics (3409)
Hitachi Denshi America (3160)
Ikegami Electronics USA (3150)
Image Video (2636)
Quantel (3171)
Rank Cintel (3066)
Rank Precision Industries (3066)
Sony Broadcast Products (3100)
3M Broadcast/Related Products (3120)
TV Equipment Associates (3342)
Ultimatte (3552)

HEADPHONES, HEADSETS
AKG Acoustics (2521)
Allied Broadcast (3414)
Audio-Technica US (2407)
Barrett Associates (2654)
Beyer Dynamic (2823)
Bradley Broadcast Sales (2663)
Broadcast Supply West (2743)
Camera Mart (3040)
Clear-Com Intercom Systems (3586)
H.M. Electronics (2619)
Nakamichi USA (2456)
R-Columbia Products (2672)
RTS Systems (3366)
RAM Broadcast Systems (3028)
Sennheiser Electronic (2914)
Shure Brothers (3320)
Stage Lighting Distributors (2446)
Stanton Magnetics (3331)
TV Equipment Associates (3342)
Telex Communications (3370)

HEADS & REFURBISHING SERVICES (Audio, video)
CMC Technology (3340)
Multi-track Magnetics (2515)
Nortronics (3384)
Sprague Magnetics (2540)
Taber Mfg & Engineering (3385)
Television Technology/TTC (3492)
Videomagnetics (2725)

INTERCOM SYSTEMS
AF Associates (3141)
Allied Broadcast (3414)
Anchor Systems (2426)
Beyer Dynamic (2823)
Cetec Vega (3394)
Clear-Com Intercom Systems (3586)
Comprehensive Video Supply (3593)
Com Tek Communications (2653)
Gentner Engineering (2669)
H.M. Electronics (2619)
McCurdy Radio Industries (3028)
Nady Systems (2902)
PESA America (3417)
R-Columbia Products (2672)
RTS Systems (3366)
RAM Broadcast Systems (3028)
SESCOM (3445)
Shure Brothers (3320)
Stage Lighting Distributors (2446)
Swintek Enterprises (2918)
Telex Communications (3370)
Ward-Beck Systems (3060)

LIGHTING CONTROL & DIMMING SYSTEMS
B-W Lighting Systems (2922)
Camera Mart (3040)
Cercone-Vincent Associates (2584)
Colortran (3598)
Comprehensive Video Supply (3593)
DeSisti America/Desmar (2796)
Electro Controls (2710)
Lighting Methods (2673)
Matthews Studio Equipment (2701)
Musco Mobile Lighting (2448)
Stage Lighting Distributors (2446)
Strand Century (3024)
Teatronics (2756)
Theatre Service & Supply (2917)
Union Connector (2923)

LIGHTING INSTRUMENTS, LAMPS
Anton/Bauer (2729)
Arriflex (3553)
B-W Lighting Systems (2922)
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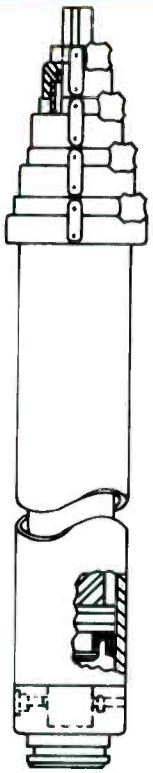
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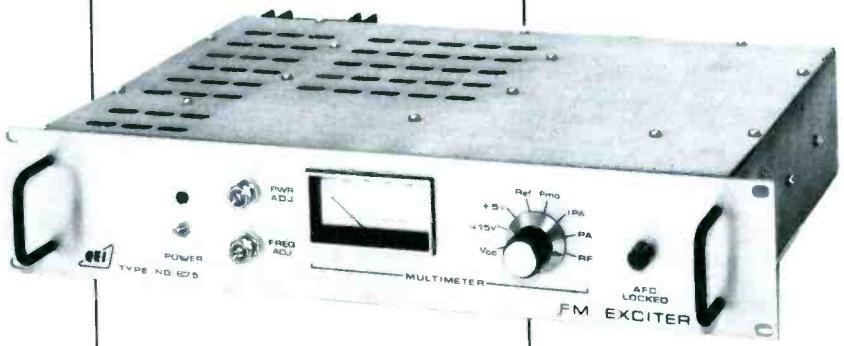
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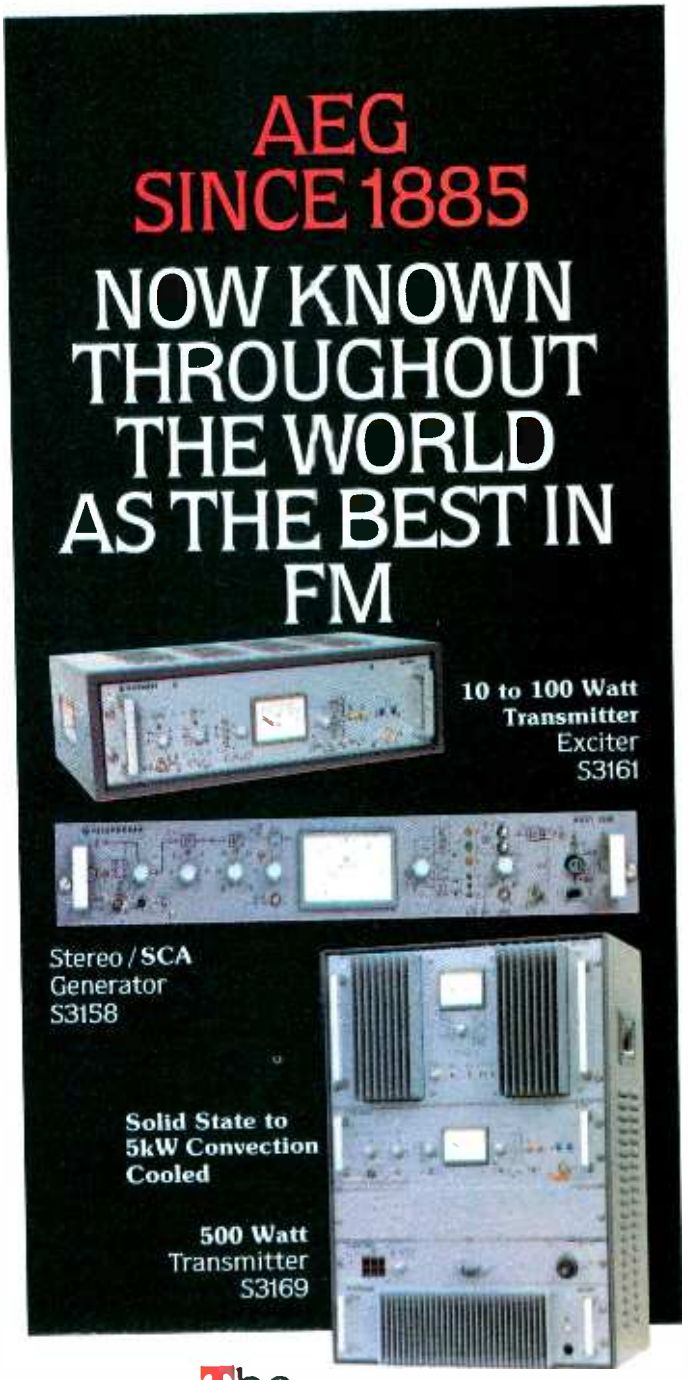
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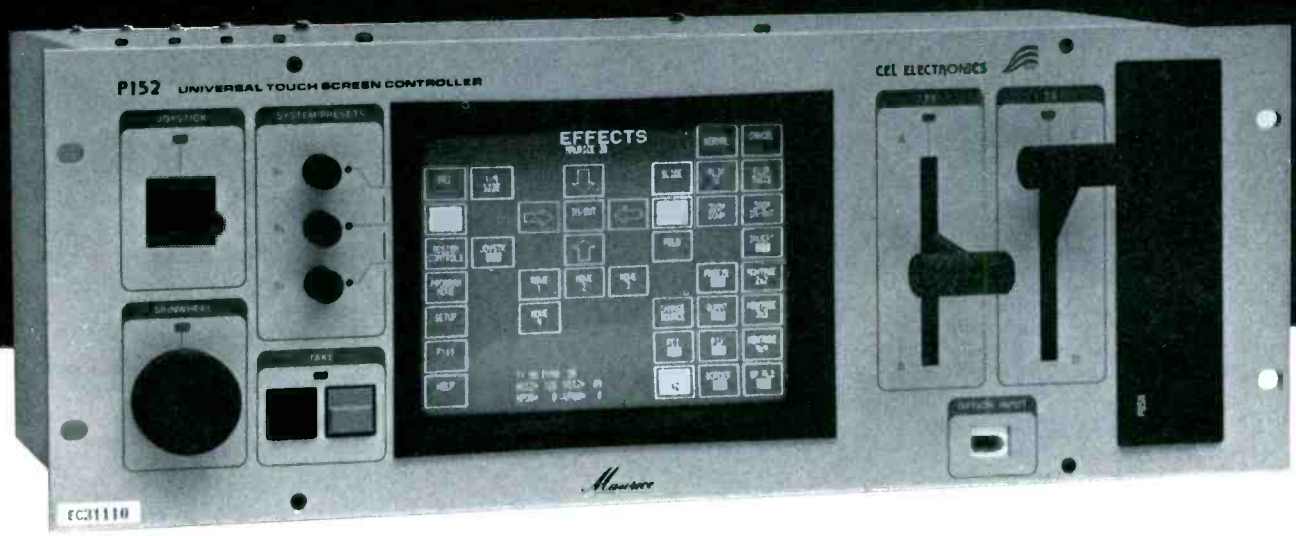
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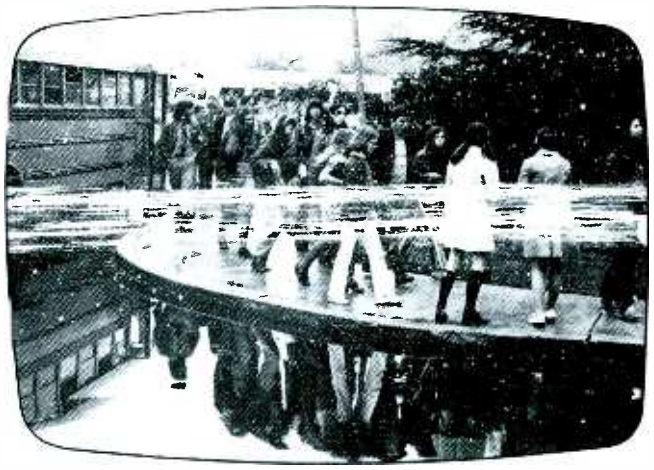
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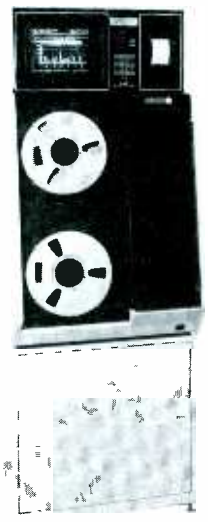


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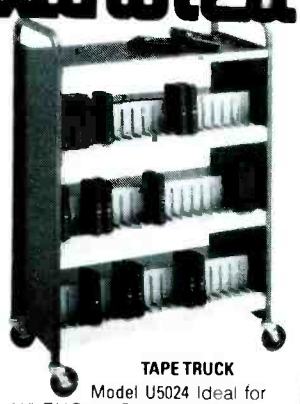
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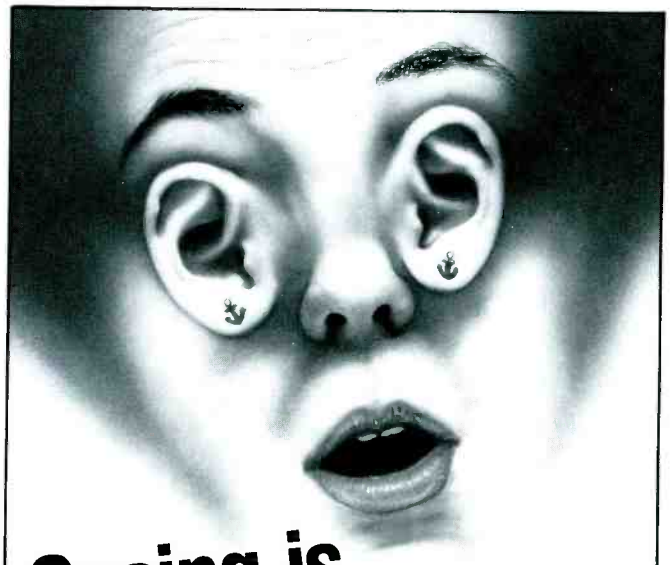
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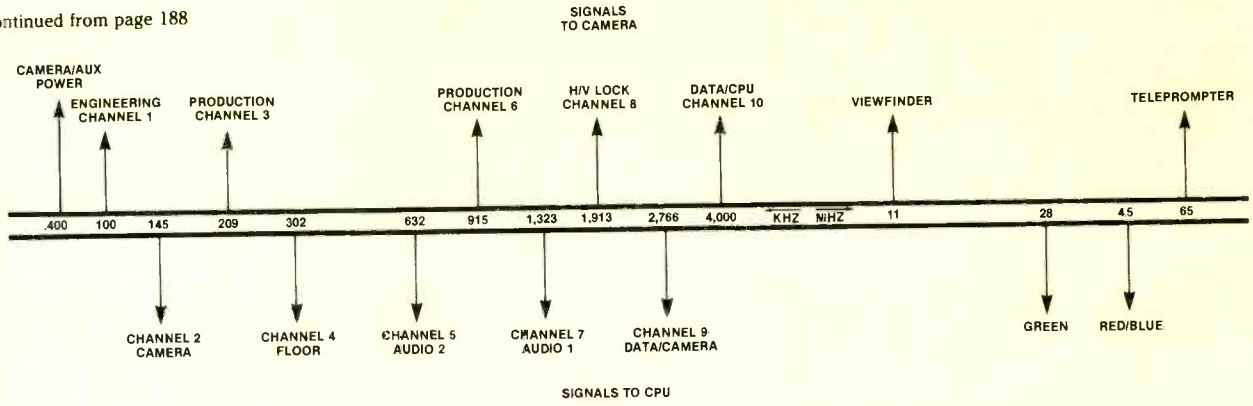
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Continued from page 188



In a triax-based system, all of the camera power, audio, video and control signals are carried on one cable. Shown above are the signals and corresponding frequencies allocated for their transmission on the cable.

This information was obtained from the Philips LDK 6 manual.

for audio and intercom channels. These channels have a spacing ratio of 1.45 and are spread from 100kHz to 4MHz. The 10 transmitters and receivers are identical. Five transmitters are located in the camera, and five transmitters are located in the CCU. The figure depicts the arrangement of the signals on the triax cable.

Both the transmitter and receivers use phase-lock loop ICs for modulation and demodulation. After the five signals are generated in the camera or CCU, they are summed before being fed to the triax cable via a midband filter. The receivers are identical and consist of an input amplifier to compensate for the insertion loss of the cable and bandpass filter located prior to the demodulator.

The video signals that are transmitted on the triax cable include viewfinder and teleprompter signals from the CPU and R, G and B signals from the camera head. These five signals are divided into four separate bands spread over 11MHz to 65MHz. Quadrature modulation is used for the transmission of the R and B video information.

The camera automatically compensates for different lengths of cable by monitoring an AGC signal. If necessary, a 26dB attenuator can be switched into the video circuit. After the video level is set, the signal is separated into the individual components that are needed by the camera and CPU.

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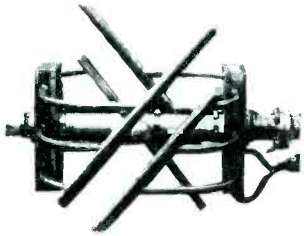
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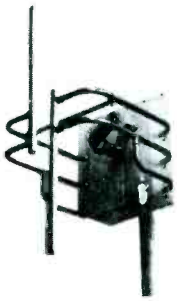
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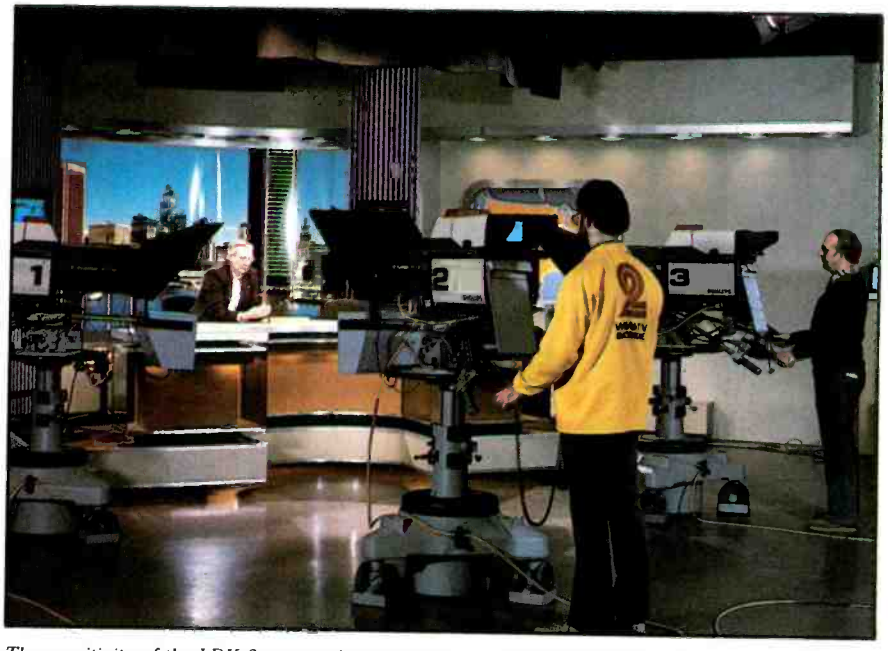
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The sensitivity of the LDK 6 camera has allowed an approximate 50% reduction in lighting requirements and an improved on-air look.



Because the cameras require no on-air maintenance attention, the crew chief's position has controls for setting up ENG feeds and graphics frames.

Continued from page 188

in troubleshooting and repairing a broken multicore cable is many times higher than for triax. And, triax cable won't develop intermittent breakdowns that can occur with multipin connectors. Bent connector pins, which make the entire cable assembly useless, are no longer a problem.

The second-generation 70MHz-bandwidth triax design provides initial and continuing benefits for the user. The camera head and CPU can be separated by as much as 2,000 meters without the need for repeaters. This feature allowed complete freedom to plan camera shooting locations anywhere we wanted. The *signal channels* that are included provide two full-bandwidth audio circuits from every camera location. This is especially important when a TV plant upgrade includes stereo audio production.

Two full-bandwidth video return circuits enable us to feed special effect switcher keys to the operator's viewfinder at the same time we're feeding script to an on-camera teleprompter. We can also relay a remote picture feed to a floor monitor positioned for use by the talent or floor manager on the same triax cable. There's even enough reserve power coming down the cable to provide 110Vac for on-camera and floor monitors. The operator can locally select the *green display* for shot framing if both returns are being used for other pictures.

Ease of operation

In daily operations, three of the four cameras are operated in the news studio.

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The fourth is locked down in the newsroom. We emphasize news in our programming schedule and air four newscasts a day between noon and 11 p.m. We also provide early-morning cut-ins during NBC's "Today." Between newscasts, the cameras are moved around the facility as necessary.

As part of the physical reorganization of the engineering operations area, we moved and rebuilt master control so that it was closer to the tape room. In the vacated area, we set up an integrated camera operations, character generator and ENG control center. The concept of total computer control reduces the need for constant video operator attention to camera set-up.

Even when a camera is on the air, we can check set-up and, if necessary, change settings or store new set-ups without pulling the camera off-line. A built-in *diascope* lets us perform imaging checks or adjustments without interrupting production.

Productivity has been improved because of the *instant-on* feature. Set-up memories in the heads and CPUs, coupled with the computer-controlled power-up and check-out routine, enable us to have any camera delivering color-balanced, broadcast-stable pictures from any location within seconds after the head arrives and is plugged into the triax cable. If a different lens is needed, set-up compensations to match its characteristics can be obtained from lens files while the camera is being installed.

Improved video quality

Set-up versatility also provides an improvement in signal quality and uniformity. The video operator can match cameras operating under extreme lighting environments by inputting pre-programmed set-ups from files and performing trims with the remote control panels. These features allow us to switch live between perfectly matched cameras located on the roof at sunset, in the news studio and in the newsroom.

The camera and its triax cable have provided outstanding results for our station. Installation of the cameras was much easier than it might have been if we had selected a multicore camera system. Because the camera is designed to be used with triax, all of the benefits of complete computer control, portability and ease of use are available. The LDK 6 has fulfilled all of our expectations.

Editor's note: The field report is an exclusive **BE** feature for broadcasters. Each report is prepared by the staff of a broadcast station, production facility or consulting firm.

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Fidelipac CTR-100

By Mike Callaghan

When upgrading a radio facility, selecting the type of cart machines to be used in the plant is a major decision. A mistake can result in years of unhappiness, excessive maintenance costs and exasperation to the air staff. In fact, there are few mistakes a radio engineer can make that are more grievous than selecting the wrong cart machines. So much depends on them. For this reason, at our station, we required that the machines we tested and found unacceptable could be returned.

A variety of machines were evaluated. Some of them were rejected for technical reasons. Some machines were hard to repair, and some were voted down because they were hard for our staff to operate. After the tests were finished, we selected the new Fidelipac CTR-100 Dynamax series.

Front panel

The CTR-100 is attractive, featuring a gray case with a black-out front panel using backlighted legends and multicolored push-button controls. Front-panel annunciators show the status of the *Cartscan* system, audio muting, secondary and tertiary tones, and capstan servo. (For more information on the Cartscan system, see the accompanying sidebar.) All the indicators use long-life incandescent lamps, and are easily changed.

Internal switches select four different display modes for the VU meters:

- playback levels;
- record levels;
- input levels when the machine is in record mode, and playback levels at other times; and
- input levels when the machine is in the record or stop mode, and playback levels at other times.

The machine also has a real time counter showing elapsed time in minutes and seconds. The timer is locked to the servo motor, and is accurate even during high-speed recue. When the stop tone defeat is used, the timer reset is inhibited, so the timer always shows correct elapsed time between cue tones on the cart.

High-speed recue can be defeated, initiated manually, or started by the beginning or the end of the 150Hz secondary cue. Audio is usually muted during fast forward, but may be unmuted with the fast-forward button.

The *audio switcher interlock* inhibits double audio output if two or more machines share a single console input. The feature permits only the audio from the last machine started to go on the air. The front-panel audio annunciator shows which machine is active.

Callaghan is chief engineer for KIIS-FM, Los Angeles.



Transport

The deckplate is constructed of heavy aluminum and provides a unique way of holding the cart in place. As a cart is inserted, four canted rubber rollers grasp the top edges of the cart and pull it against the right guide, where it is securely held. This process effectively reduces the problem of carts not being properly inserted.

Performance at a glance

- *Cartscan system allows automatic activation of optional features*
- *Three user-selectable tape speeds*
- *Wow and flutter 0.12% DIN weighted at 7.5ips*
- *Frequency response ±2dB 50Hz to 16kHz*
- *Signal-to-noise ratio −53dB stereo, −55dB monaural*
- *Stereo crosstalk 50dB minimum at 1kHz*
- *Distortion 1.0% THD maximum at 1kHz*

Pushing a cart into this machine gives you a feeling of confidence, the cart is firmly guided into proper playing position, and seats firmly against the head block. It will go in the same way regardless of how many times it is inserted.

On some machines, the cart guide screws are also used to stop the cart as it slides into the transport. The heads of these screws can eventually wear the plastic face of the cart and the resulting dents can upset the repeatability of the insertion. The CTR-100 has a smooth-faced head block to stop the cart. No abrasion takes place, and cart-seating and location are consistent.

The head block is a solid 3-piece casting and allows independent fine adjustment of height, azimuth and zenith for both playback and record heads. The block can be removed and replaced without upsetting the head alignments. The tape guides are glass-filled epoxy, and their height is adjusted with self-locking vernier setscrews.

The solenoid is driven by a constant current source. The voltage across the solenoid is sampled for the splice-find feature. As the splice passes between the pressure roller and the capstan, the components are pushed apart, producing a change in the solenoid voltage. This change is amplified and used to stop the machine. It is a simple system and requires no mechanical additions.

Electronics

The record and playback electronics use state-of-the-art op-amps. The deck produces +20dBm into 600Ω without clipping with differentially balanced ICs. The tone-detector circuit provides open collector outputs. Relay contacts are available as an option. If the variable playback speed feature is used, the tone sensors will continue to properly track over the ±30% speed window.

The secondary cue tone feature may be strapped for operation in a number of modes:

- the beginning or the end of the tone will put the deck into fast forward;
- the beginning or the end of the tone will mute the audio; or
- on the recorder, the beginning or end of the tone may be used to *freeze* the tape timer.

The electronics motherboard supports three high-density cards for the playback unit and five cards for the recorder. This architecture eliminates the need for a wiring harness. The cards are mounted in a shielded housing to reduce hum. The access cover can be removed without using tools.

Audio is coupled through 9-pin D-connectors, which fasten directly to the appropriate circuit cards through back panel cutouts. Screws secure the cables to the circuit cards. You must unscrew and remove these connectors to lift out the record and playback cards.

Playback-equalization adjustments are provided for both low and high frequencies. Two different sets of playback-level controls can be selected by one of the Cartscan sensors. This feature allows the use of both normal and elevated level carts. In the recorder, this sensor can also select the appropriate set of record EQ and bias adjustments.

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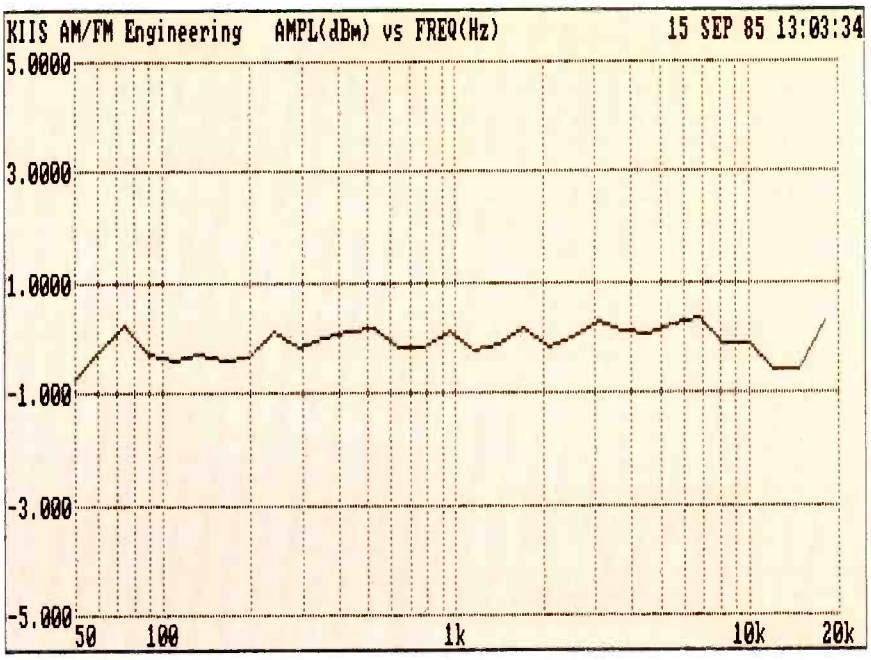


Figure 1. *The record/playback frequency response of the CTR-100. The vertical axis is scaled in decibels; the horizontal axis in frequency.*

Remote control connections are made through a 50-pin D-connector, and all but seven of the pins are used. All front-panel buttons and annunciators are available on this connector.

Capstan drive

The 3-phase dc capstan motor has a hardened stainless shaft and is servo-driven with Hall effect devices. Jumper wires inside the machine set the tape speed to 3.75, 7.5 or 15ips. If the need arises, the motor can also be sync-locked to an external reference and varied ±30% from the selected speed.

The variable cue-tone sensors are also tuned by the capstan-motor circuits. As the motor speed varies, so does the center frequency of the detectors. This design eliminates cuing problems when secondary tones go past the play head during fast forward.

If certain carts are to be played *up-tempo*, then the AUX output of the Cart-scan system can be used to boost the tape speed on only those carts by switching in an external oscillator.

The machine uses a servo reference frequency of 9,600Hz. Therefore, the deck may be locked to a video machine or other synchronizer. If the motor and reference become unlocked, a front-panel lamp indicates servo error.

Maintenance

Keeping these machines running is simple and easy. The built-in tone

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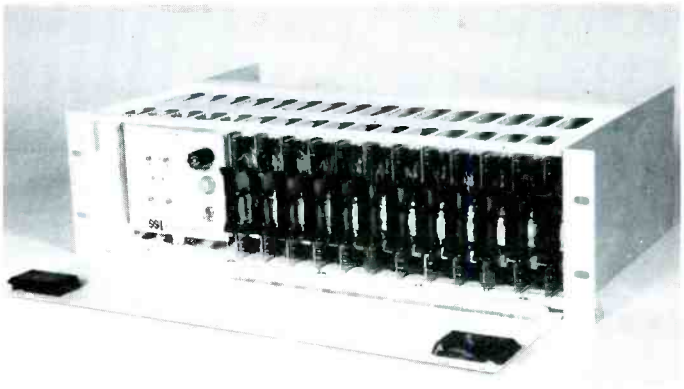
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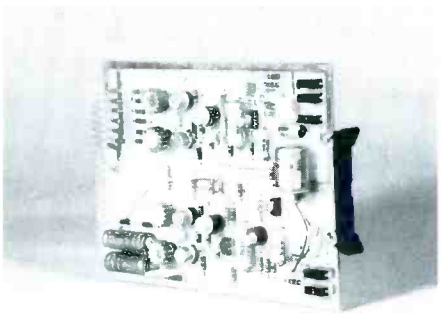
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oscillator produces 12 different tones at 0VU and −10VU. The tones can be used for most of the EQ and bias adjustments.

The circuit boards are equipped with lever-type pulling handles for removal. The printed circuits are well labeled and extender boards are available. The ICs are all socket-mounted. Current, state-of-the-art devices are used in the audio circuitry, and the control logic uses CMOS technology. No microprocessor is used.

The manual is complete and easy to use. Large schematics are provided, in addition to circuit descriptions and a full set of assembly drawings.

Performance

In terms of performance, the machines consistently meet their published specifications. The results of a series of frequency response and harmonic distortion tests are shown in Figures 1 and 2. All of the tests were conducted at 160nWb/m levels. We use this level because it provides extra headroom. The tests were conducted on a record/play machine from one of the newsrooms. The machine had been in use for about six months when the tests were made.

The CTR-100s have been readily accepted and appreciated by our air staff. The Cartscan system has been invaluable in airing mono newscasts and carts that need special encoding. The air staff doesn't have to designate special machines for news, traffic and weather. They can play any cart in any available machine. They accept the cart machines as a dependable piece of equipment, with no more and no fewer problems than they would expect from a reel machine, or any other hard-working piece of gear.

As a basic cart machine, the CTR-100 fulfills all the expectations I had for it. It's mechanically rugged, and the electronics

The Cartscan system

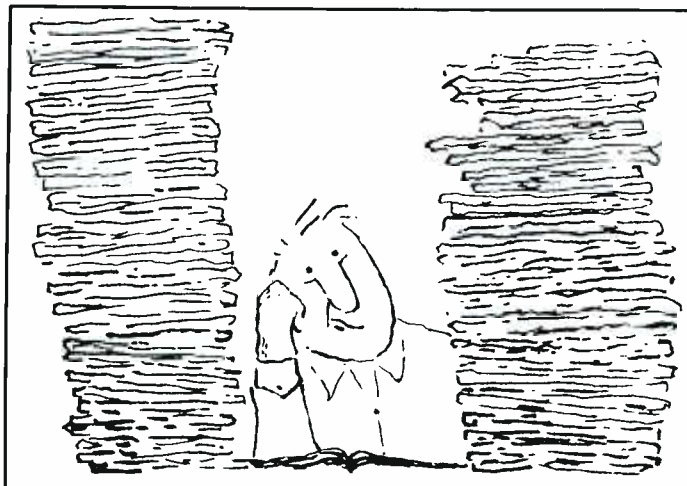


The Cartscan feature allows the machine to automatically select several optional modes of operation. If any of the four options (mono, aux, elevated level or matrix) are needed, the special cart label must be used. The desired function is indicated by a reflective area in the appropriate position. If the infared light is reflected from the label, that function is selected within the machine. The advantage of this feature is that the machine will automatically select the proper operating conditions even when different cartridges are used.

The Cartscan system uses four infrared source/sensors mounted in the right cart guide. These sensors detect the presence or absence of four reflective areas on a sticker located on the side of the cart being used.

If the cart (see above) is equipped with these stickers, the sensors operate the appropriate circuitry in the machine to complete one of four functions:

- Mono: *In this mode the left channel will play back through both outputs in a playback deck, and the left and right inputs will be summed onto the left channel in a record machine.*
- Matrix: *If the machine is in stereo, this mode switches from discrete left*



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and right audio channels to the matrix system *where L+R goes on the upper track and L−R goes on the center track.*

- Elev Level: *This mode switches the machine from one set of internal bias, EQ and level settings to a second set. This feature enables the machine to use two different types of tape emulsions. This function is useful when making the transition from one type of tape or cart to another.*
- Aux: *This sensor drives an open collector output that appears on the remote control connector. The feature can be used to enable external devices used with certain carts, such as dbx or Dolby decoders.*

An invert *switch is located inside the machine for each function. The feature allows the use of the different functions without requiring reflective stickers. Deleting the sticker in this mode turns the function on; putting the sticker on the cart turns it off. This feature would be useful, for example, in playing an entire cart library that has been dubbed in the matrix mode.*

are straightforward. The head assembly looks similar to what I would expect to find in a reel-to-reel unit. The machine is easy to service and the added features, such as Cartscan, make it that much more desirable.

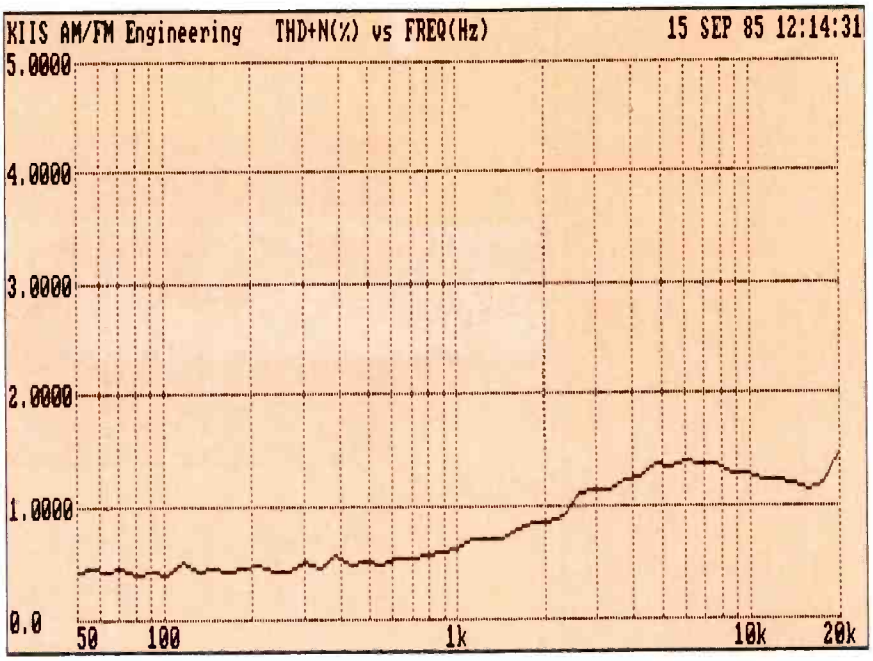


Figure 2. Total harmonic distortion plus noise from 50Hz to 20kHz. The vertical axis represents percent and the horizontal axis represents frequency.

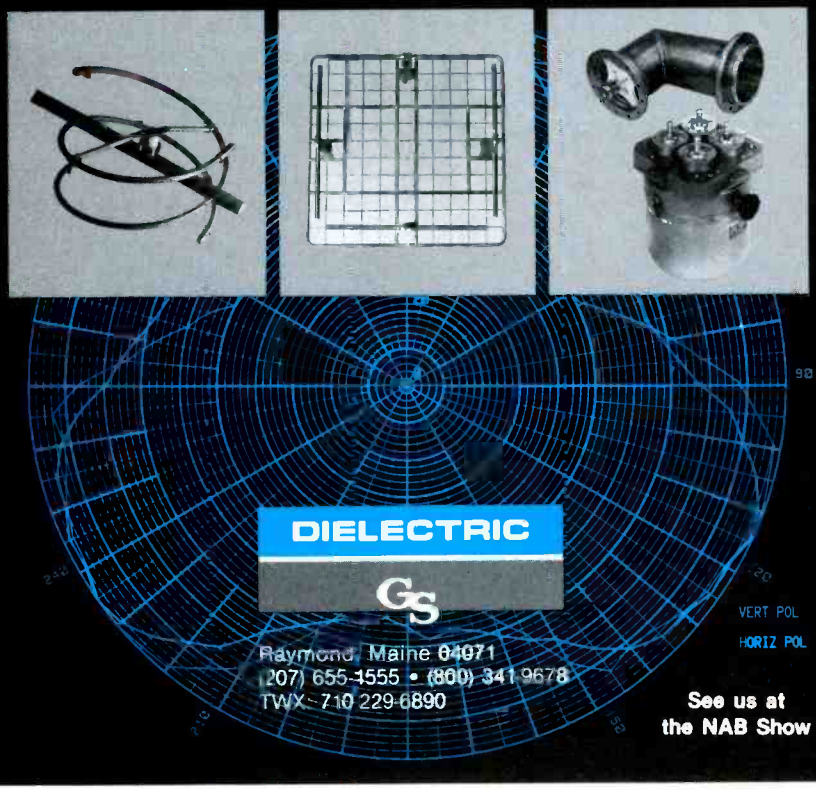
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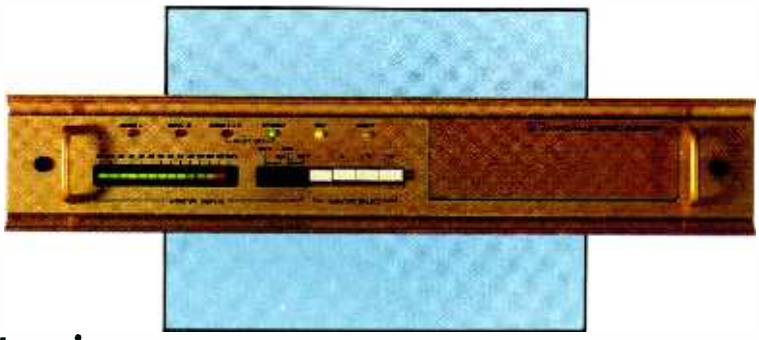
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Broadcast Electronics AX-10

By Dave Obergoenner

The introduction of AM stereo has required broadcasters to overcome a new set of complex and unique problems. The broadcaster must decide not only which AM stereo system to use, but also must select from several manufacturers of that equipment. After the equipment selection process is completed, the station engineer is required to make the system work properly. This task can be difficult, at best.

The first generation of AM stereo broadcast equipment left something to be desired. A few early exciters were not much more than prototype devices dressed up for sale. Although the exciters' specifications were satisfactory, interfacing was often difficult. Exciter controls were hard to reach and difficult to adjust. At least one new exciter seems to have resolved these problems.

Successful test

Some time ago, I had the opportunity to install the new Broadcast Electronics AX-10 stereo AM exciter at KUSA-AM in St. Louis. The unit was the demonstrator exciter at the 1984 NAB/NRBA show in Los Angeles. The exciter was retuned to our frequency and shipped to us shortly after the show ended.

The station was operating in stereo before the arrival of the exciter. Another C-QUAM unit, installed in October 1983, was still in service. The AX-10 was selected in an effort to solve what I believed to be some of the shortcomings of the early AM stereo exciters.

The KUSA 5kW transmitter feeds a 1-tower daytime and 4-tower nighttime directional antenna array. Because the station must protect another 5kW directional station, only 80kHz and less than one mile away, the antenna system incorporates both series and parallel traps. These traps and filters turn what would otherwise be an ultraflat, wide-bandwidth system into one with slightly better-than-average performance.

Obergoenner is chief engineer for KUSA-AM and KSD-FM, St. Louis.

Performance at a glance

- *RF output power: 0.15W to 10W into 50Ω*
- *L+R audio output: 0 to +20dBm, adjustable*
- *Monaural S/N: 60dB below 100% modulation at 400Hz*
- *Stereo S/N, L,R: 50dB below 100% modulation at 400Hz*
- *Frequency response: 50Hz to 15kHz, 0, -1dB*
- *Stereo separation: 35dB, 50Hz to 7.5kHz, 25dB, 7.5kHz to 15kHz*
- *THD 85% modulation, L=R, 0.25% maximum, 50Hz to 15kHz*
- *SCA capability*

Exciter design

The AX-10 exciter incorporates a number of features that make it easy to install and to use. It uses *digital independent IF modulation* with AM SCA capability. The audio inputs and outputs are transformerless, eliminating a potential source of distortion and ringing. It is fully remote-controlled, and offers an external frequency reference input. This input can be used to lock the exciter's frequency to an external standard, such as WWV. The transmitter will then become rock-stable.

The heart of the exciter is the IF modulation scheme (see Figure 1). All clock signals are derived from a single 10MHz TCXO, providing excellent internal stability. The stereo signal is generated at an IF frequency of 250kHz for all frequencies in the AM band. Each audio channel is separately modulated, then summed to develop the L–R and L+R signals. This somewhat complex exciter allows both the left and right channels to be independently equalized.

Some FM broadcast engineers do not understand the difficulties in converting an AM transmitter to stereo. The conversion from monaural FM to stereo FM is quite straightforward and easy to accomplish. The AM engineer, however, is

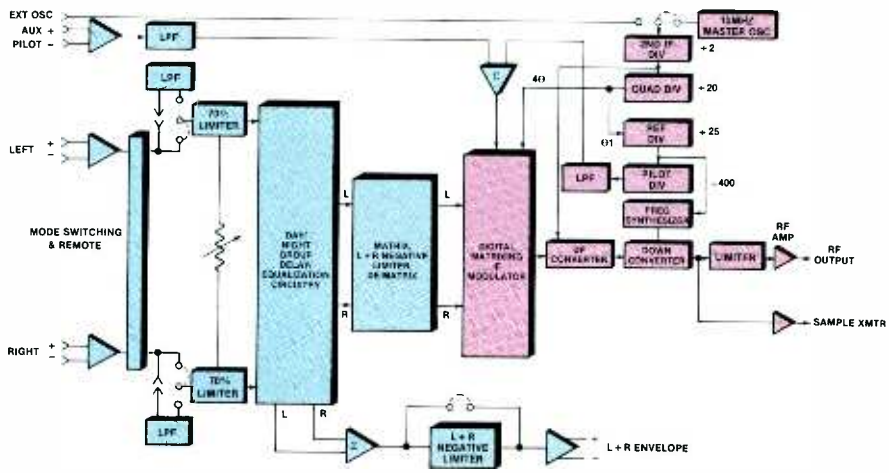


Figure 1. The BE AX-10 stereo AM exciter uses C-QUAM compatible digital IF modulation. The two matrix switches provide independent equalization for two transmitters or dual pattern operation.

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faced with a complex system of transmitter and antenna parameters that affect the results from *any* AM exciter.

The stereo exciter must be able to equalize, delay and otherwise predistort the audio signal. This predistortion compensates for transmitter and antenna deficiencies and peculiarities. Because the AM engineer is faced with trying to amplitude-modulate a phase-modulated RF signal, the adjustments provided on the AM stereo exciter are crucial.

Features

To develop proper AM stereo signals, the time delay and amplitude characteristics of the RF and audio paths must be matched properly. If they are not, the audio cannot be decoded properly in the receiver. One result is reduced separation. Figure 2 shows the relationship of phase and amplitude error to stereo separation. To obtain satsifactory stereo separation, the AM stereo exciter must be able to overcome the delay and amplitude errors inherent in the transmitter and antenna system. In other words, the exciter needs a lot of knobs.

There is a wide variety of AM transmitters and antenna systems on the market. An AM stereo exciter must be able to provide sophisticated audio equalization and time delay with these systems. The AX-10 provides the necessary control through a matrix switching system. Two identical and independent sets of equalization controls are provided, one for night and one for day patterns. The two settings can also be used for different transmitters, or even low- and high-power operation. If necessary, the two matrix systems can be connected in series, providing up to 132μs of group delay. The equalizer operates over the audio range of 20Hz to 20kHz.

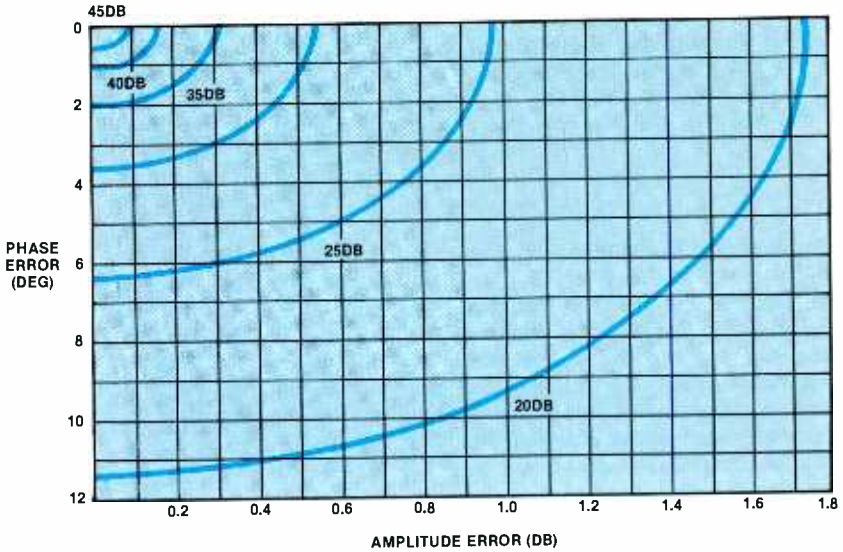
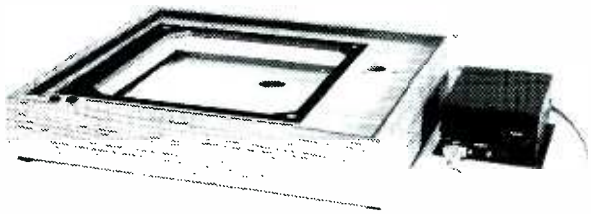


Figure 2. *As the graph shows, even small amounts of phase shift and amplitude error can cause a severe loss in stereo separation.*

The exciter provides from 150mW to 10W of RF output power. The manufacturer recommends that the RF signal be injected into the transmitter as far down the chain as possible. With this wide range of RF output level capability, it is easy to couple the exciter to the proper stage of the transmitter. For transmitters requiring an asymmetrical duty signal, an optional TTL interface is available. The interface provides a 25% to 75%

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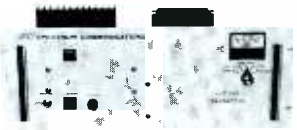
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continuously adjustable duty cycle signal.

The exciter is capable of providing +20dBm audio output. The additional audio level may be required in some transmitters. Even if your transmitter does not require a level this high, it's nice to know that there is a lot of headroom in the output circuits. The unit can also provide separate output levels for day and nighttime operation.

Although my station is not concerned with AM SCA, the exciter can provide this feature if desired. The exciter couples the low-frequency signal into the system through a low-pass filter. It is then summed with the 25Hz pilot tone and differentially summed with the left and right information.

The AX-10 does not use transformers. From an audio quality standpoint, transformers can produce a whole range of problems. The active-balanced inputs of this exciter eliminate many of those types of problems. The active inputs provide good transient response and have low distortion and noise. The input circuits are identical in phase and amplitude characteristics, with a flat response from 1Hz to 15kHz.

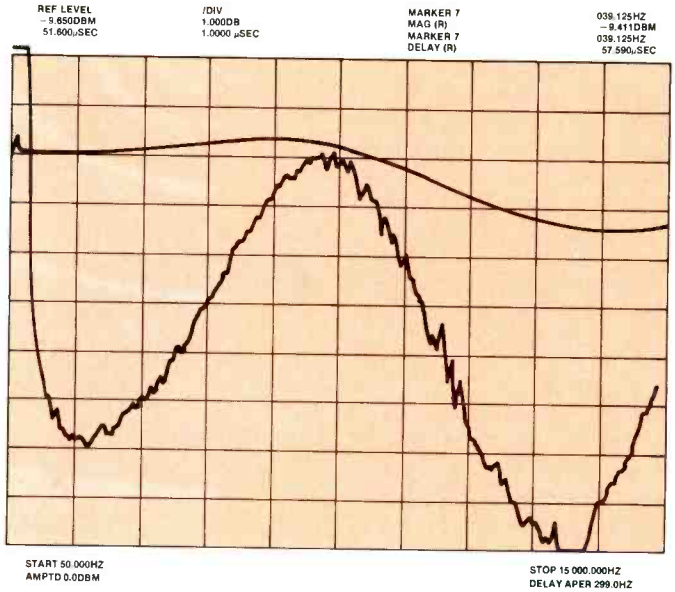
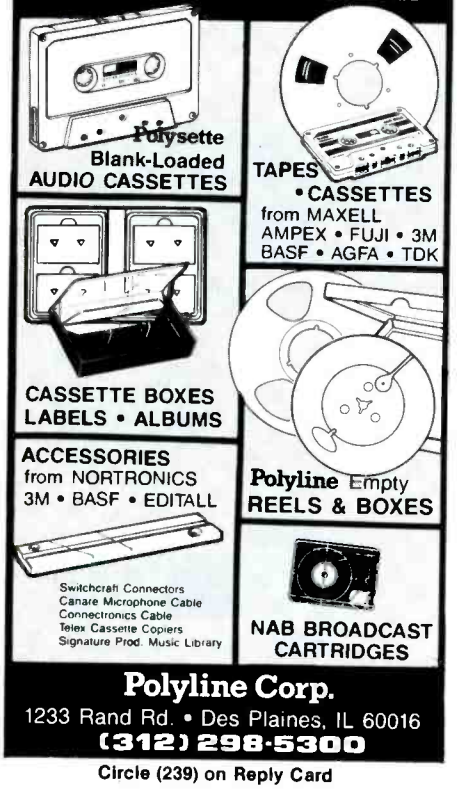


Figure 3. *The upper curve represents the L + R frequency response. The lower curve shows the L + R group delay. Both curves were measured for the day pattern.*

Remote control

The exciter provides all of the needed controls and tally for remote-control operation. If, for example, one channel of audio is lost, there is the potential for a 6dB loss in mono loudness. If an STL or phone line is lost, there must be some way to switch the exciter to monaural operation by remote control. The AX-10 provides left, right, left plus right and stereo operating conditions. If the exciter is switched to monaural operation, the loss of the other channel is not noticed by the listener. The exciter automatically

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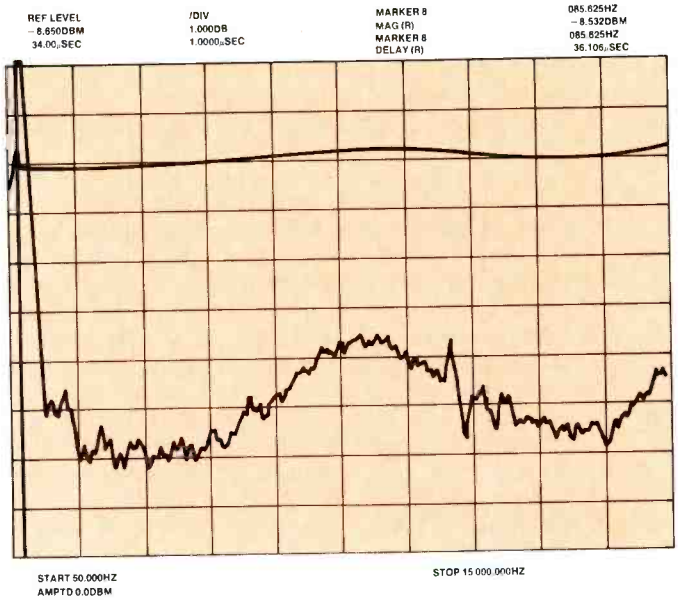


Figure 4. *The L–R frequency response and corresponding group delay for the day pattern.*

compensates for the loss in level.

Other switching functions are also available. Day and night patterns and equalization are readily accessible through the remote-control provisions. The remote-control functions are activated by momentary ground closures through optically isolated inputs. Remote tally is provided through optically isolated outputs.

Performance

Because our transmitter was already operating in stereo, the exciter was installed in one evening. The performance tests passed my requirements with room to spare. The exciter improved the audio separation in the midband frequencies by several decibels. The distortion remained about the same as before, although there was a small improvement in low-frequency performance.

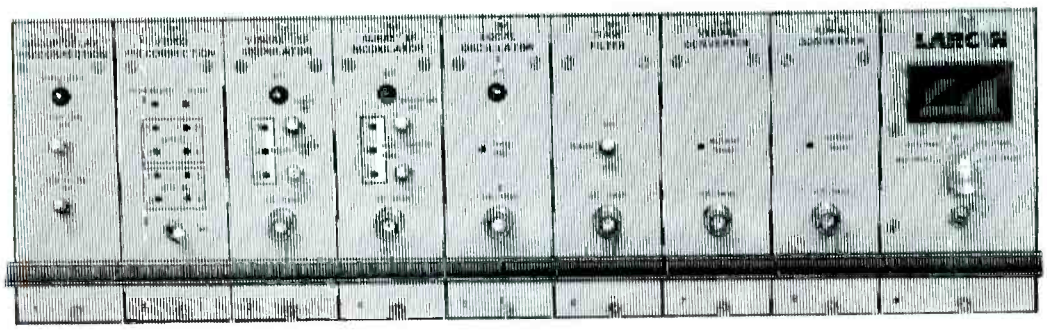
Figure 3 shows both the L+R frequency response and group delay for the day pattern. As the graph illustrates, the frequency response was quite good. Group delay exhibits a peak at 7kHz, caused by the pulse transformer in the transmitter. Figure 4 shows the L–R frequency response and group delay for the day pattern, with both parameters showing improvement over the L+R test results.

A comparison between the graphs shows why it is so difficult to equalize an AM transmitter. Typically, the best one can do is to try for an approximate curve fit between the L+R and L–R group delays. These curves show why it's not so easy to obtain excellent separation and distortion at all frequencies. As anyone who has tried to install AM stereo exciters at more than one site knows, no two installations are the same. A lot of trial and error is involved in any AM stereo conversion. In these cases, the versatility of the matrix switching system

Ready for multichannel sound

The new Larcan TEC-1V VHF television exciter was developed specifically with the new multichannel services in mind. In addition to the superior visual performance, the new exciter features excellent stereo separation, linear phase response and the flat amplitude response required for the new services.

The exciter also features modular construction for ease of service and future updating should changing technology require it, and many other user oriented features.



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really comes in handy.

The proof data provided the least noticeable improvement in the transmitter's performance. However, when music was transmitted, the improved sound was clearly noticeable. The sound was more open, and the stereo image seemed better. The low-end frequencies were tighter and the cross-channel distortion we had previously noticed was gone.

Most of the improvements were the same ones I've noticed when switching to devices with active-balanced circuits and high-quality op-amps and capacitors. I am a strong believer in getting rid of transformers, and the improved sound confirmed my philosophy.

The Broadcast Electronics AX-10's matrix switching makes installation almost easy. The performance is excellent in every regard.

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's support is limited to providing loan equipment and to aiding the author if support is requested in some area.

It is the responsibility of **Broadcast Engineering** to publish the results of any piece tested, whether positive or negative. No report should be considered an endorsement or disapproval by **Broadcast Engineering** magazine.

News

Continued from page 4

organizing the technical sessions at the convention under the guidance of John Battison, one of the founding members of the SBE.

The joint effort will combine the excellent exhibits and attendance of the SBE Central States convention with the technical conference formerly hosted by Battison at Ohio State University. Although the convention is still nine months away, booth sales have been going well, with more than 100 booths sold to a total of 47 broadcast equipment manufacturers.

Battison, who is handling the technical sessions for the convention under contract with **BE,** has released a tentative list of session times and titles. Work has already begun in the effort to line up recognized experts and leaders in radio and TV engineering for technical papers and panel discussions for the conference. Among the items of special interest planned are: *FCC at Large,* a session in which representatives from the commission's AM, FM and TV bureaus will answer questions from the floor; a session on advancing the professionalism of the broadcast engineer; and a paper discussing the impact on stations of recent FCC rulings regarding non-ionizing radiation.

The **Broadcast Engineering** conference will run for three days, opening on Oct. 14, one day before the exhibits open. This will give attendees an opportunity to zero in on sessions of special importance to them. The session times on Wednesday and Thursday have been arranged to avoid conflicts between session attendance and booth traffic.

The 1986 SBE National Convention and **Broadcast Engineering** Conference will continue the tradition of the Central States regional convention of free admission to the exhibit hall. In order to cover expenses, a nominal registration fee will be charged for admittance to the engineering sessions. The fee has been set at $25 and will be used to cover the costs of organizing the program. An optional additional fee of about $10 will be charged to those who wish to attend the luncheon on Wednesday.

All funds for the convention and conference will be collected by the SBE convention organization in St. Louis. **BE** will be reimbursed for documented out-of-pocket expenses incurred in the organization of the technical sessions, but will donate all staff time, advertising space in **BE** (and other Intertec Publishing magazines, including **Sound & Video Contractor, Video Systems** and **Recording Engineer/Producer**), and promotional materials. Any profits realized from the sessions will be retained for use by the SBE. The entire effort is being coordinated by Andy Butler, representing the national SBE office.

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1986 Broadcast Engineering Conference

Tentative Schedule

Tuesday, October 14:

- Morning session (10 a.m. to noon)

Session title: Developing Technologies

1. New developments in UHF transmitter efficiency
2. CCD camera technology
3. Synchronous AM transmitters
4. AM Improvement Committee update

- Lunch (noon to 1:30 p.m.)
- Afternoon session (1:30 p.m. to 5 p.m.)

Session title: FCC At Large

1. Six representatives from the commission (representing the AM, FM and TV bureaus) will answer questions from the floor
2. Advancing the professionalism of the broadcast engineer

- SBE national membership meeting (5 p.m. to 6 p.m.)
- Ham radio reception (6 p.m. to 8 p.m.)

Wednesday, October 15:

- Informal continental breakfast (8 a.m. to 8:30 a.m.)
- Morning sessions, separate radio and TV (8:30 a.m. to 12:30 p.m.)

Session Title: Nuts and Bolts TV

1. Implementing multichannel sound
2. Designing an ITFS system
3. Planning for a new routing switcher

Session title: Nuts and Bolts Radio

1. Directional antennas for AM and FM
2. Applying SCA technology
3. Interfacing audio systems

- **Broadcast Engineering** conference luncheon and address by speaker (12:30 p.m. to 2 p.m.)
- Exhibits open (11 a.m. to 7 p.m.)
- Exhibitor reception (7 p.m. to 9 p.m.)

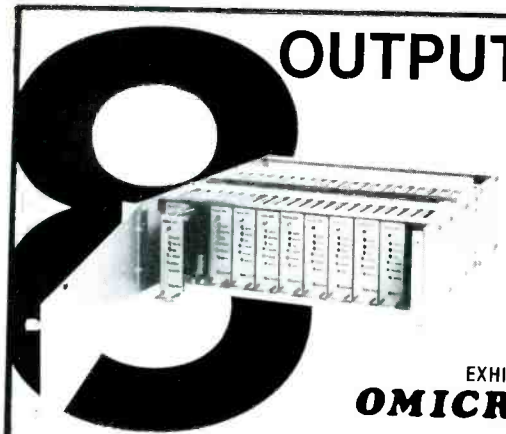
Thursday, October 16:

- Informal continental breakfast (8 a.m. to 8:30 a.m.)
- Morning session (8:30 a.m. to 12:30 p.m.)

Session title: New Frontiers for Audio and Video

1. Component video
2. Digital video recording
3. Coping with digital audio
4. The telco nightmare
5. Working with 18GHz and 23GHz aural STL systems
6. Non-ionizing radiation

- Exhibits open (9 a.m. to 3 p.m.)



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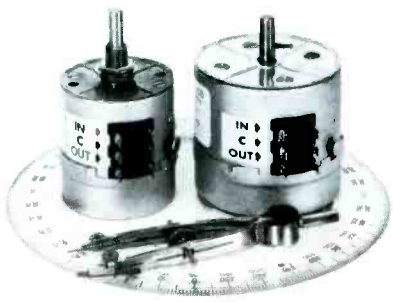
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New solid-state FM power levels

A Mountain View, CA, company has developed a new FM solid-state power amplifier subsystem that will make possible solid-state FM transmitters in the 3.5kW range and above. *Microwave Modules & Devices* developed the subsystem for use by broadcast transmitter manufacturers.

The subsystem is modular in construction. It uses nine identical 500W amplifier modules incorporating silicon FETs in a one-driving-eight configuration. Control and protection circuits incorporated into each module prevent damage because of load mismatches and other faults.

The eight individually packaged transistor modules are binarily interconnected through three levels of combining, with the final combiner using a special 90° network. With this interconnection method, the subsystem offers 1.5:1 VSWR input and output, improved forward power delivery into a mismatched load, improved back IMD and reduced third harmonic levels.

Solid-state amplifier subsystems for practical FM applications previously were limited to approximately 1kW.

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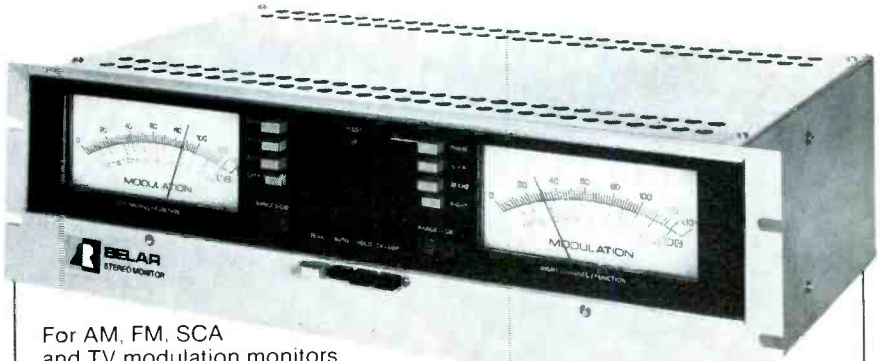
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People

Winners of the 1985 SPECtacular contest

The **BE** staff thanks all of the entrants to the 1985 SPEC BOOK SPECtacular contest for taking part in the event. On Feb. 3, 10 of the correct entries were drawn at random. Each of the winners will be receiving a monochrome Sony Watchman TV. The recipients include:

Wayne Hall, operations manager, KNES-FM, Fairfield, TX, has been in the broadcasting business since 1969.

Tom Hasselbacher, producer/director, Caterpillar Tractor Company, Mossville, IL, helps develop CAD/CAM training material.

Robert Bucholz is transmitter maintenance engineer for KIRO-TV, Seattle. Before entering the TV broadcast field in 1970, he worked with video applications in aircraft cockpits for Boeing.

William Jones, chief engineer, KUER-FM, Salt Lake City, has worked with nearly every phase of audio for more than 25 years. He has been associated with KUER-FM, the NPR affiliate and broadcast voice of the University of Utah, for four years.

Bill Jack, chief engineer, WTEL-AM, Philadelphia, started with WTEL about 14 years ago in a part-time position. His 10kW daytime-only station format includes religious programming mixed with Spanish, German, Polish and Italian.

Michael Zimbelman, chief engineer, KEZU-FM/KFLA-AM, Scott City, KS, has been at the station for about 10 years. He started with an unlicensed position and moved to his present position after getting his FCC license.

John Richardson, electronic technician for Mercy Health Center, Dubuque, IA, began working with video and medical electronics 11 years ago.

Ken Vatter, video technician, HBO, Hauppauge, NY, has worked for the CATV special service organization for five years.

William T. Hayes, chief engineer, KHON-TV, Honolulu, HI, left a southern California radio position to help get a UHF station on the air in Hawaii, four years ago.

Greg Buzzell, chief engineer, WMTV, Madison, WI, has been in broadcasting for 13 years, the last 10 at WMTV.

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Gordon Tubbs has been named national broadcast sales manager at Angenieux Corporation of America, Miami. He will operate out of New York.

William Lee has been named applications engineer for Lemo U.S.A., Santa Rosa, CA. Following training at the U.S. office and at the factory in Morges, Switzerland, Lee will be available to customers to assist them in developing solutions to meet their connector needs.

David Bowman has been appointed to the newly created position of director of professional dealer products at Studer Revox America, Nashville. He is responsible for marketing Studer and Revox professional audio products sold through the company's pro dealer networks.

Paula Graham has joined Marconi Communication Systems, Chelmsford, England, as press officer.

Ross L. Trimby has joined Shintron, Cambridge, MA, as vice president of sales, a new position in charge of worldwide sales and sales personnel.

Peter Koenig has joined the sales staff at Allied Broadcast Equipment, Richmond, IN.

C. Gary LaMunyan and **Lyle Bailey** have been appointed positions at Utah Scientific, Salt Lake City. LaMunyan is national sales manager for TV switching, automation and control equipment. Bailey is Southwest sales representative for the TV switching, automation and control equipment, covering California, Arizona, New Mexico and portions of Nevada and Texas.

Maria A. Curry has been appointed vice president and general manager of the magnetic tape division and a member of the executive council of Agfa-Gevaert, Teterboro, NJ.

Richard Frank and **David Moran** have been promoted to new positions at dbx, Newton, MA. Frank is director of marketing for dbx and ADC, both wholly owned subsidiaries of BSR International, Plc. Moran is communications manager for both companies.

Ralph Semyck has been named Midwest regional sales manager for Conrac, Covina, CA. His territory includes Illinois, Minnesota, North and South Dakota, Iowa, Nebraska, Kansas, Missouri, Indiana, Kentucky, Ohio, Michigan and Wisconsin.

Roger Lagadec, George F. Currie and **Michael Feniello** have been appointed positions at Sony, Park Ridge, NJ. Lagadec is general manager, technical management, communication product group. Currie has been promoted to president of Sony Professional Audio Division, and will direct division operations. Feniello has been promoted to manager of marketing administration, audio division.

Mark C. Gray has been named assistant general manager of Ampex audio-video systems division, Redwood City, CA. He will be responsible for long-range strategic planning and individual product families.

Joseph E. Cordts and **James W. Hulfish** have been appointed positions with Sharp Electronics professional products division, Mahwah, NJ. Cordts is Northeastern district sales manager and will head the territory from Virginia to Massachusetts. He will operate out of the corporate headquarters. Hulfish is Western district sales manager and will work out of the Los Angeles office. He will direct sales activities from Arizona to Washington.

Allen F. Jacobson has been named chairman and chief executive officer for 3M, St. Paul, MN.

David Stetson has been appointed product manager for the microwave absorber electronautic product line at Dielectric Communications, accessories division, Raymond, ME.

Ray M. Unrath has been named director of Prime Image, Saratoga, CA. He will concentrate on establishing international distribution in NTSC regions such as Canada, Latin America and Australia. He will also serve in various marketing and sales capacities.

Gary L. Carter has been appointed sales manager of HEDCO's Los Angeles sales office. He will work with the HEDCO dealer network serving Los Angeles, and will provide local factory support for its products.

Albert W. Malang has been named director of research and development for Porta-Pattern, Los Angeles, CA. He is responsible for the design of new products for the professional TV industry.

Bill Park has been named vice president of marketing for Quanta, Salt Lake City. He will be responsible for all sales and marketing functions including product development and customer service.

Andrew DaPuzzo and **Joseph E. Tibensky** have been named positions at Agfa-Gevaert magnetic tape division, Teterboro, NJ. DaPuzzo is national marketing manager for video products. Tibensky has been promoted to audio products manager. He will be responsible for studio mastering and cassette duplication tapes.

Adrian B. Ettlinger has been appointed senior vice president of Cinedco, Los Angeles, CA. He invented the EDIFLEX and will oversee its performance in all types of production.

B. Morgan Martin has been named product manager for the SoundDroid digital audio processing systems for the Droid Works, San Rafael, CA.

Paul McGoldrick, Daniel L. Barnett, David R. Chancey, Jamal Hamdani and **Eileen Tuuri** have been appointed positions at Moseley Associates, Goleta, CA. McGoldrick is director of marketing. Barnett is director of engineering. Chancey is manager of national sales. Hamdani is manager of systems marketing and engineering and will be responsible for the technical services department. Tuuri is marketing administrative assistant.

Amy L. Welton, Bill Franklin and **Raymond F. Sherlock** have been appointed positions at Fidelipac, Moorestown, NJ. Welton is sales and marketing assistant. Franklin is engineering support manager. He will direct lab operations in the production of audiotape and cartridge machines. Sherlock is materials control supervisor for cartridge machine manufacturing.

Karen Schweikher and **Wm. Bruce Pharr** have been named positions at Ampex, Redwood City, CA. Schweikher is marketing communications manager for the magnetic tape division. Pharr has been promoted from marketing communications manager to marketing manager, audiotape products, for the magnetic tape division. **Charles P. Ginsburg** retired from Ampex on Jan. 31, 1986. In 1952, Ginsburg led a 6-man development team to devise a means of recording TV programs on magnetic tape, which developed the quad videotape recorder.

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Business

Conus adds Hearst Broadcasting and KHJ-TV

All five local TV stations owned by Hearst Broadcasting Group and KHJ-TV, Los Angeles, have joined *Conus Communications,* Minneapolis/St. Paul. The stations involved are WBAL-TV (CBS), Baltimore, MD; WDTN (ABC), Dayton, OH; KMBC-TV (ABC), Kansas City, MO; and WTAE-TV (ABC), Pittsburgh. WISH-TV (ABC), the fifth station, Milwaukee, WI, is already a Conus member. KHJ-TV is the 30th member to join Conus.

Cubicomp announces support for PictureMaker PAL standard

Cubicomp, Berkeley, CA, has announced that its PictureMaker 3-D video and animation systems fully support the European PAL TV transmission standard. Users have the option of purchasing a PictureMaker system based on either the NTSC or PAL TV transmission standard. The PAL-based system supports 576-line output, and has 220V, 50-cycle per second power requirements. The NTSC version of the system supports 486-line rate, and uses 110V, 60-cycle current. PictureMaker's frame buffer gen-locks to either NTSC or PAL specifications.

Roscor unit delivered to Korea

Roscor, Mount Prospect, IL, has delivered a Roscor Elite Fleet mobile production unit to the Armed Forces Korean Network (AFKN), Seoul, Korea. The TV-14 unit was built around a Ford E-350 heavy-duty chassis and was converted to a 4-wheel drive for the mountainous terrain.

The 14-foot unit includes exterior conbays for cable interconnects, external panels for shore power inputs and roof-mounted shooting platform and back access ladder. Both air-conditioning and heat are provided as well as dual Onan generators. Power is provided to the HVAC and technical requirements through a center tap transformer and stabilizers and then is distributed throughout the vehicle by a power distribution system.

Bosch and Philips enter cooperation agreement

Robert Bosch GmbH, Stuttgart and *N.V. Philips' Gloeilampenfabrieken,* Eindhoven, the Netherlands, have entered into a worldwide cooperation in TV broadcasting to widen their basis of technology, strengthen international competitiveness and extend market position. The joint venture will be named Euro Television Systems GmbH (ETS) with its head office in Darmstadt, West Germany.

Bosch and Philips will continue activities in professional TV studio broadcasting equipment. Initially, they will each have a 50% interest in the venture. Later, Bosch will acquire the majority of the new company's shares. Bosch will also be responsible for the industrial leadership.

In the venture, the activities in the TV broadcast systems field will be merged and continued. The venture will include the Bosch television broadcast division, Darmstadt, and video equipment division, Salt Lake City, Philips development



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and production facilities, Breda, the Netherlands, and sales organizations Philips Television Systems, Mahway, N.J.

Dolby relocates headquarters

Dolby Laboratories, San Francisco, has moved its corporate headquarters from 731 Sansome St. to 100 Potrero Ave.

The 70,000-square-foot building more than doubles the work space for its engineering, licensing and U.S. marketing and administrative staff. The former Sansome Street employees are now combined with Dolby's U.S. electronics manufacturing facility. This facility has occupied part of the Potrero building since it opened in 1983.

Tekskil ships camera prompter systems

Shipment of more than 150 of its 909 series portable camera prompter systems has been announced by *Tekskil Industries*, Surrey, British Columbia, Canada.

The company has completed its roster of sales representatives for the United States and Canada, which include: George Constantine and Associates, Indianapolis; Omnivue, New York, Sales and Marketing Group, Silver Springs, MO; Jim Freeman and Associates, Atlanta; Mort Press Video, Miami; GO Video, Chicago; Bruce Dawson and Associates, Louisville, KY; Michael A. Dollacker and Associates, New Orleans; Fleehart and Sullivan, Seattle; Innovative Concepts International, Burbank, CA; Corvis Communications, Toronto; Edcom, London and Ontario; and National Electronics Agencies Ltd., Vancouver, B.C.

Latin America's first stereo TV station uses Acrodyne transmitter

Acrodyne Industries, Blue Bell, PA, formalized the purchase of one of its transmitters by Latin America's first stereo TV station. Channel 33, an independent TV station in Lima, Peru, is scheduled to begin broadcasting April 1, and will be using an Acrodyne 10kW UHF transmitter.

Electrex Company, Miami, was the distributor in the purchase.

Paltex gains acquisition of Quantum Audio Labs

Paltex Editing and Production Systems of London and Tustin, CA, have acquired Quantum Audio Labs, Glendale, CA. As an international company with worldwide sales and service, Paltex will develop the export market for Quantum.

Studioline selects Studer recorders

Studioline Cable Stereo has purchased 48 Studer A810 audio recorders from *Studer Revox*, Nashville, TN, for use in its main production/origination facility, Reston, VA. The recorders will be used for production of master tapes as well as for playback direct into the system.

CBS receives Hitachi cameras

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NY, has announced the sale of 47 field cameras to CBS for use in its mobile units. A mixture of large field cameras and hand-held portables from the SK-970 family of Computacam auto setup cameras will be used to cover sports and news events.

Hitachi has provided 60 SK-110 cameras to CBS for studio use in its New York, Washington, DC, and West Coast facilities. The SK-110 was the first in the Hitachi line of Computacam cameras.

Townsend acquires Avenir Group

Townsend Associates, Westfield, MA, a manufacturer of TV transmitters, has been acquired by Avenir Group, Bloomfield Hills, MI, and Westport, CT, a development banking company.

Australia buys Vinten remote control system

The broadcast division of *W. Vinten Ltd*, Suffolk, England, has received an order for a multichannel Microswift 200 remote control system for televising and recording proceedings at the Parliament House, Canberra, Australia.

The order includes 24 Microswift pan and tilt heads, central computer, operator control panels and associated equipment with provision for further system expansion.

W. Vinten Ltd, has also received additional orders for the Microswift 200 remote control system to be installed at SWF, Mainz, West Germany.

Chesapeake Group delivers data communications system

The Chesapeake Group, Chesapeake Beach, MD, is completing a satellite-delivered data communications system for Brookmont Communications, Nashville, TN. The system permits the 3-state radio network to provide its affiliates with hard-copy printouts of program schedules, regional news and selected weather information from the National Weather Service.

The origination computer in Nashville monitors the weather wire, formats messages, looks up station address codes and transmits messages on a satellite data channel to an addressable station decoder connected to a hard-copy printer at each affiliate station.

Tandberg reorganizes

Tandberg of America, Armonk, NY, the U.S. distributor of Norway's Tandberg electronics and tape recorders, has been reorganized as Tandberg Audio.

The reorganization will combine American management and marketing with the European company's engineering and production capabilities. Although Tandberg will maintain its R&D and production facilities in Oslo, Norway, all operations will be directed from the Armonk, NY, office.

Telarc refitted with professional Monster cable

Telarc, a classical record company, has completed a sound system upgrade using cables and acoustic controls from *Monster Cable*, San Francisco, CA.

Telarc does its recording on location and then edits the tapes at its Cleveland facility. The retrofit enables the company to fulfill all the requirements of sound production and post-production.

Prolink Series 1 super high-resolution cable and Interlink references interconnect cable link all of Telarc's equipment. The studio monitors are wired with Monster Cable's Powerline 2 speaker cable. Soundex acoustic control panels and Soundex acoustic windows are used to reduce resonance problems.

United Video selects M/A-Com scrambling technology

United Video, Tulsa, OK, which provides the WGN, WPIX and KTVT Superchannel signals to the cable industry, will use the scrambling technology and hardware developed by M/A-Com.

Shintron expands headquarters

Shintron, Cambridge, MA, has completed new executive, sales, accounting and engineering offices in a floor added over its headquarters building.

Eastman Kodak signs Andromeda 3000 agreement

Eastman Kodak Company, Rochester, NY, has placed an order for Andromeda 3000 component RGB digital framestores, along with specialized custom engineering work from *Shintron*, Cambridge, MA. The agreement provides for co-ownership between Shintron and Kodak for any software developed at the labs for the Andromeda.

In a move to accelerate further use of the Andromeda 3000 component framestore, Shintron and the media laboratory of the Massachusetts Institute of Technology have entered into a joint development program in which Shintron provides Andromeda framestores to MIT, and MIT will conduct software research in the image processing capabilities of the device.

Agfa Gevaert donates scholarship to SPARS

The Magnetic Tape Division of *Agfa-Gevaert*, Teterboro, NJ, has donated a $1,000 scholarship to the Society of Professional Audio Recording Studios (SPARS). The scholarship is to be awarded to a student who demonstrates potential in the recording field.

Agfa-Gevaert has challenged each advisory associate member of SPARS to match its scholarship donation. The scholarship offers students the opportunity to pursue an educational program that will enable them to work within and make a contribution to the audio recording industry. SPARS will use its studio exam, which was developed in conjunction with the Educational Testing Service and made possible by a grant from Sony, to award the $1,000 scholarships to students who meet all the requirements.

W.T.N. gets editing & distribution systems

Roscor, Mount Prospect, IL, has completed the installation of two editing systems and a distribution system for Worldwide Television Network.

In W.T.N.'s expanded New York headquarters, Roscor installed the master control room, which allows for the recording and distribution of material from incoming and outgoing satellite feeds, and the two edit suites, which use Convergence time-code editing systems with both Ampex VPR-80 1-inch recorders and Sony BVU-800 ¾-inch recorders. The systems also include Ikegami color monitoring and Tektronix test equipment. Routing throughout the facility is handled by a Dytech 5800 series switcher.

100th Orban stereo TV installation goes on air

Orban Associates, San Francisco, announced that its 100th stereo TV installation went on the air on Dec. 10, 1985.

All 100 stations are using the Orban 8182A Optimod-TV audio processor and Orban 8182A/SG TV stereo generator. Most are also using Orban's 245F stereo synthesizer. Some are also using the Orban SAP and/or Pro channel generator.

Lakeside Associates opens new offices

Lakeside Associates, a studio design and acoustical consulting company, has opened offices in Irvine, CA. The telephone number is 714-730-1333.

Graham-Patten receives order for its audio mixers

Graham-Patten Systems, Grass Valley, CA, has received an order for three of its model 612 edit suite audio mixers with programmable equalization, from Crawford Post Productions, Atlanta. The mixers will be installed in Crawford's three main edit bays and integrated with Ampex Ace editing systems.

Magni Systems expands into a larger facility

Magni Systems, Beaverton, OR, has moved from the Lincoln Center, Portland, OR, to the Nimbus Technology Park at 9500 SW Gemini Drive, Beaverton, OR. Magni Systems exports to Japan and Canada and has plans to expand sales into other countries using NTSC television standards.

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Comsat General Corporation	253	170	202/863-7326
Continental Electronics Mfg. Co.	216	141	214/381-7161
Control Concepts Corp.	225	148	607/724-2484
Crosspoint Latch Corp.	347	265	201/688-1510
Datatek, Inc.	81	51	201/654-8100
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Di Tech Inc.	73	44	516/667-6300
Dielectric Communications	325	236	800/341-9678
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Eastman Kodak Co.	139	85	212/930-7500
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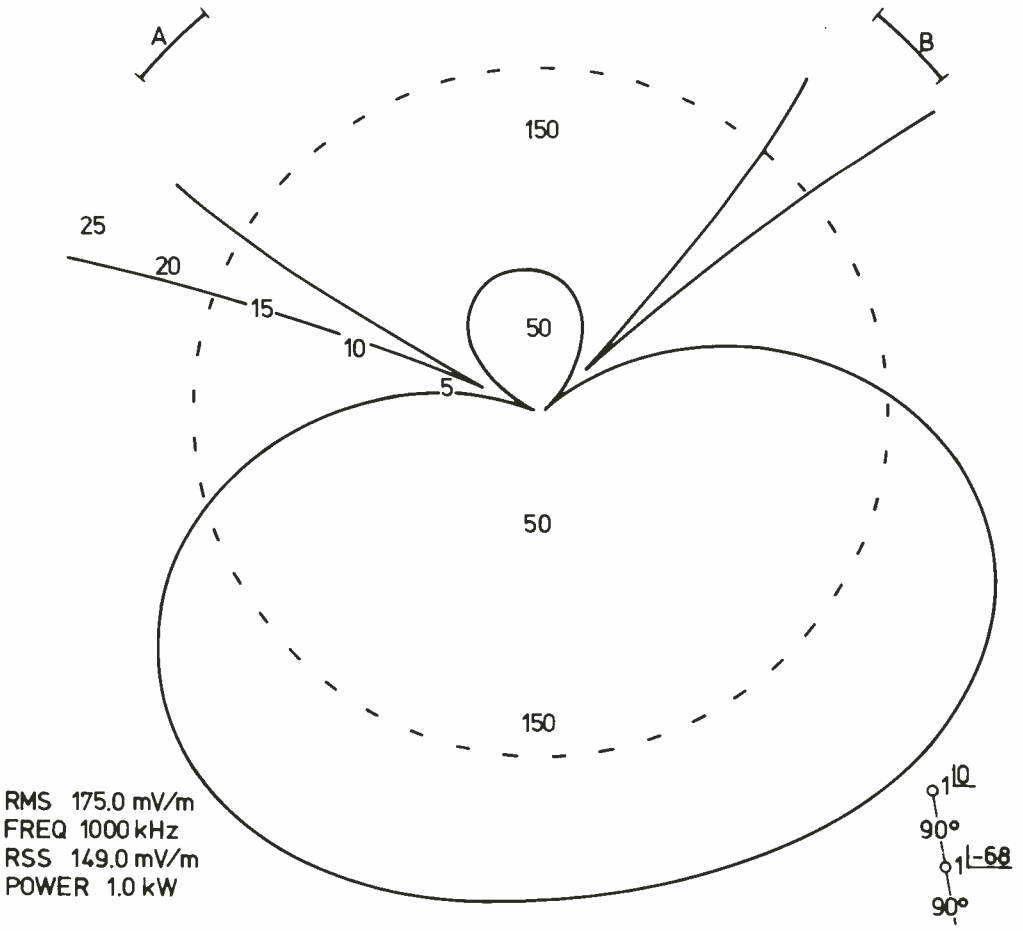
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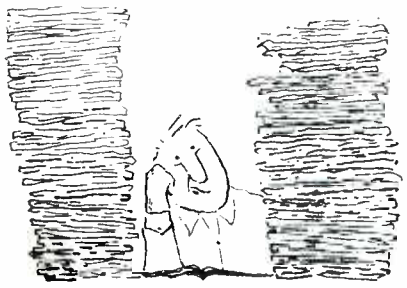
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TECHNICAL SERVICES MANAGER (Chief Engineer) for growing public television station in #1 market. Manages engineering/operations activities and technical facility. Requires minimum four years maintenance experience, FCC general license, EE degree or equivalent, three years supervisory experience and thorough knowledge of current broadcast equipment and production techniques. Salary to $42,000. Resume to Myra Pollack, WLIW-TV, 1425 Old Country Road, Plainview, NY 11803. 3-86-1t

ASSISTANT DIRECTOR/CHIEF ENGINEER of Media Services. Major responsibilities for T.V. Studio and Maintenance of Electronic Integrity of T.V. Studio, Information Retrieval System, and RF Distribution System. Also, perform ENG/EFP tasks, recommends budgets and supplies. Schedules Media Facilities, and works with users in preparing Audio and Video Productions. 2-3 years of administrative experience and 2-3 years maintenance/technical supervision experience in a professional video installation or appropriate alternate experience required. Bachelors required, masters preferred. Includes State of Connecticut fringe benefits. Compensation Administrative Rank 3; Salary negotiable. Send resume, letters of reference, official transcripts, and salary history to: Eli Segal, Director of Media Services, Eastern Connecticut State University, Willimantic, Connecticut 06226 by March 15, 1986. Eastern Connecticut State University is an Affirmative Action/Equal Opportunity Employer. 3-86-1t

BROADCAST ENGINEER: Washington, D.C. Communications consulting firm has immediate opening for experienced engineer with television, radio or cable background. Minimum of two years technical experience and college degree preferred. Radio, TV, RF technical experience preferred. Good writing skills and attention to detail. Extensive travel is required. Excellent compensation and benefits. Send resume and salary requirements to John Sanders, Manager, Appraisal Group, Frazier, Gross & Kadlec, Inc., 4801 Massachusetts Avenue, N.W., Washington, D.C. 20016. 3-86-1t

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MAINTENANCE TECHNICIAN – KRIV-TV, Houston, is seeking qualified studio and transmitter technicians. Must have minimum of three years experience and an FCC license. Send resume to: KRIV-TV, P.O. Box 22810, Houston, Tx. 77227. Attn: Wendell Wyborny VP/CE. E.O.E. 3-86-2t

WANTED: MANUFACTURER'S REPS calling on broadcasters. Lightning Sciences, Inc. is seeking qualified agents to sell its line of proven lightning protection devices for broadcast towers. Established product with good track record. Good commissions. Call Bruce A. Kaiser, 813-578-0984. 3-86-1t

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AM RADIO MULTI CABLE SYSTEM needs engineer. Broadcast, studio, transmitter and cable TV experience. Good salary, profit sharing, paid benefits. 213-384-1575. 3-86-2t

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Phone: (212) 687-5076
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