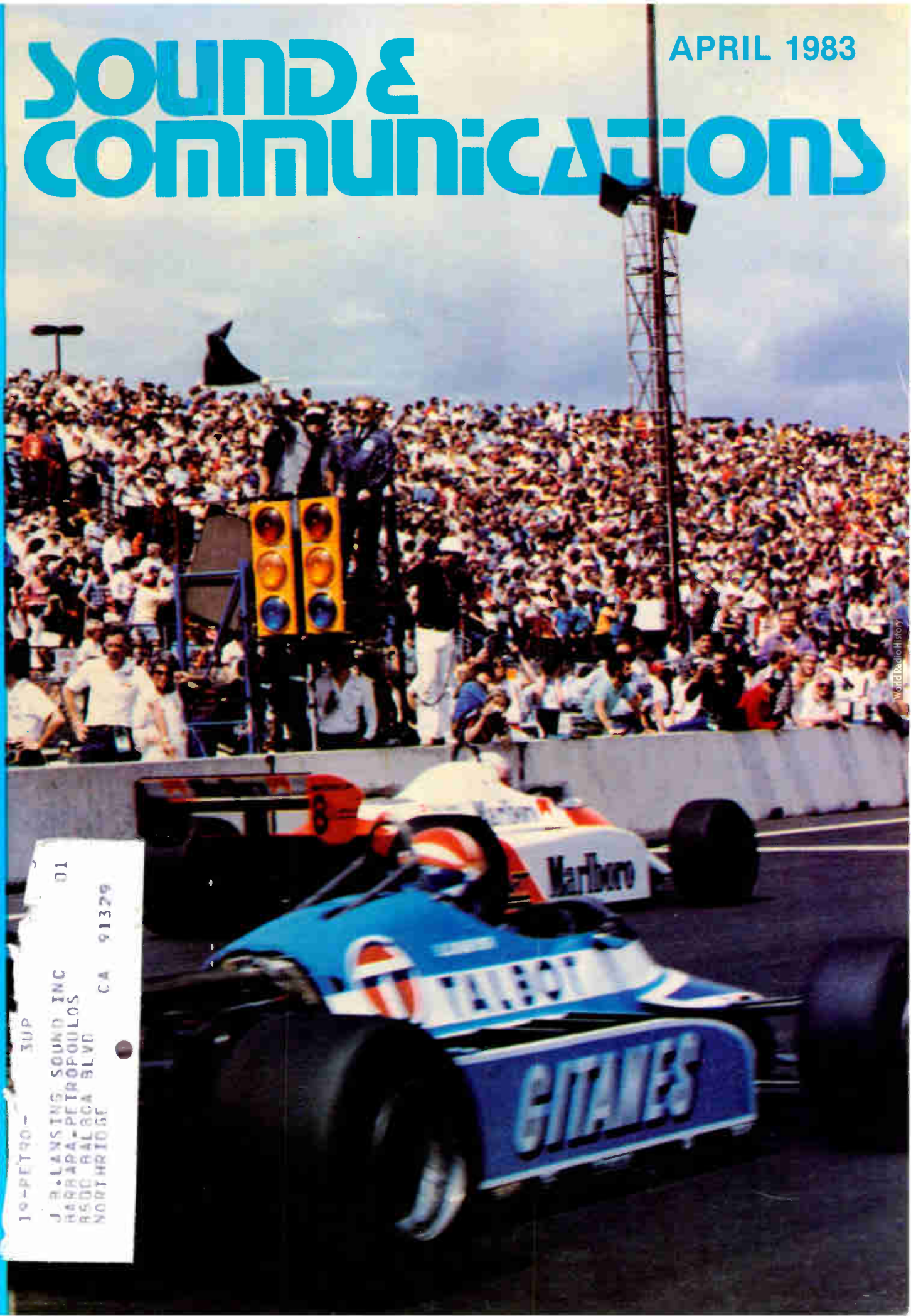


SOUND & COMMUNICATIONS

APRIL 1983



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The competition in the professional sound field is pretty fierce. Ask anyone who has ever competed for a contract with EV Professional Sound Reinforcement products and they'll tell you that on a head-on, feature-for-feature, dollar-for-dollar basis, there's really no competition at all. Especially when EV's "Sound in Action" line is pitted against Altec and JBL. The truth is that many of their basic products are based on technologies that go back more than 50 years, to the first sound motion pictures. But designing sound products that are capable of filling a theater, concert hall, auditorium or stadium with high quality sound is a lot more demanding than reproducing the sound tracks of yesterday's talking pictures. In addition, the mechanical design and manufacturing processes of today and yesteryear are miles apart. (We ought to know, since EV's been making transducers since 1927).

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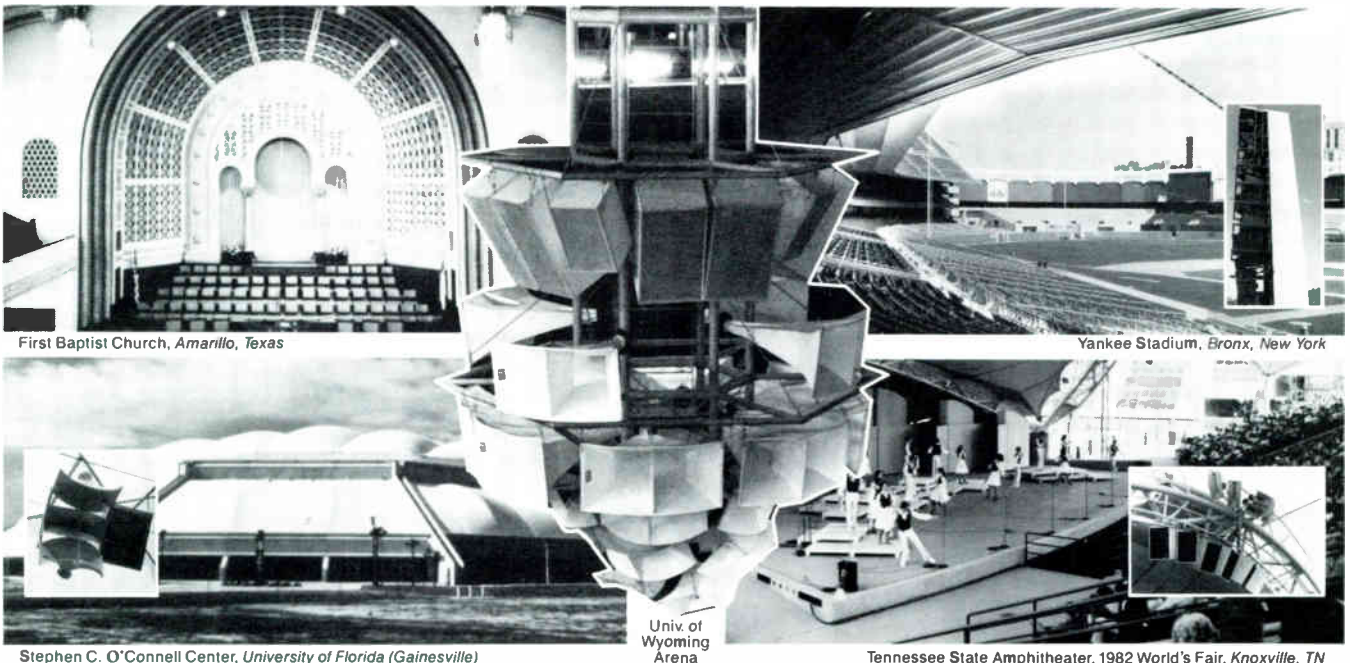
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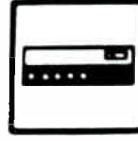
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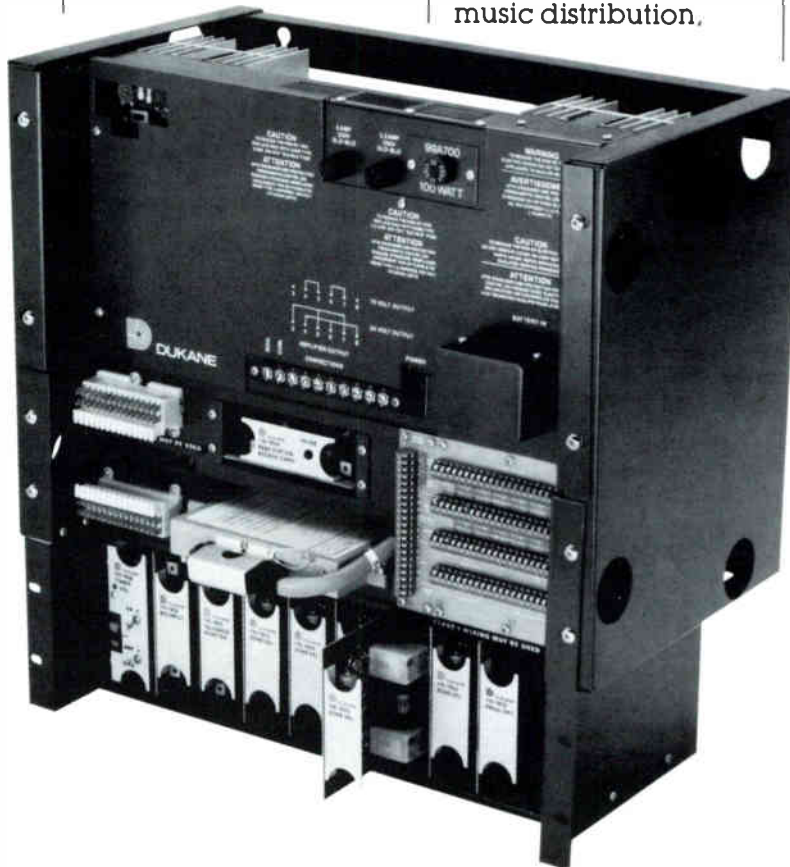
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- How much training time will it take my established personnel to sell any new systems or products? Will I need to hire a new hand?
- What's the competitive situation? Also, what's the replacement cycle time?
- Who should be going to EDS this year—the salesman?...the comptroller?...the technician?

WHILE AT EDS:

- Do we need a computer? I'd better listen hard at the conference on that topic.
- What is this fibre optic business?...is it the wave of the future for independent contractors? Now's my chance to find out.
- How many management seminars can I cram into a day? I'd better study the program carefully and pick up the most useful ones for me.
- How much of my time should be spent at the National Sound and Communications Association's Contractors Expo and Conference, jogging alongside EDS?

MEMO TO MYSELF:

- Here's my muster of musts while at EDS—
- Business conditions in 1982 forced a few competitors to go "belly up." Must talk with the supplier and the sales rep about widening the trading circle. It's going to take a bit more purchasing, but maybe the market is springing back.
 - Must check on credit terms with Manufacturer X—his bookkeeper is pressing too hard for payments, not mindful of our trade-acceptance arrangement.
 - Must look into the system specialty business with Manufacturer Y. Despite the slowdown in local and federal government spending, several institutions are halfway built. Is the timing right to move for the connection?
 - Must check Manufacturer Z about his engineering manual. Technician reports an error in the schematic. Also, their tech training course has been shortened by a day, but their costs have jumped up 18%.
 - Must ask Charlie from Milwaukee what his experience is with interconnect peripherals—SMDRs, ACDs, and automatic dialers.
 - Must check with Joe of Joplin about his luck with Pro Audio gear. Got a tip about new speakers in the works from midwest and far west makers.
 - Must look into this life-safety business. Check if it's worth the fight against the Sears or JC Penny local outlet for smoke detectors.
 - Must catch Harry of Harrisburg—hear he's big in radio pocket pagers. Is he really into an RCC operation?
 - Must remember that EDS runs May 3, 4, 5... at the Las Vegas Hilton Hotel... and that the National Sound & Electronic Conference is in the Las Vegas Convention Center, at the same time.... SO APPORTION TIME TO COVER THEM BOTH, PROFITABLY.



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Grand Prix Sound

Day 1:

Arriving at Cobo Hall, in downtown Detroit, I was less than enthusiastic about spending four days watching Formula 1 racing (not one of my favorite spectator sports). As it turned out, the behind-the-scenes work more than held my interest, especially the complex and sophisticated audio system set up for the duration of the race.

Race Preparations

I was immediately impressed with the organized way the city of Detroit went about its race preparations. Several of the main streets in the center of town had been blocked off, fenced in and *repaved*, just for the Grand Prix. Police and security guards were all over the place, doing an efficient job of keeping the curious public away from the race preparations.

Along with our "Broadcast" badges, we each got a non-removable plastic bracelet which we were told to wear for the duration of the

race. Both the bracelet and badge were required for entry into sensitive areas. Thus, a stolen badge alone couldn't be used—just one example of the well-thought-out organization we found.

Audio System Setup

If any part of the race setup required efficient organization, it was the audio system (designed and installed by the Destiny Sound and Sound Solutions, divisions of Arnold Williams Music in Canton, Michigan). Because of the large amount of equipment involved, several manufacturers had to be contacted for special shipments. Due to the great distances between loudspeakers, each speaker location had to receive AC power, for a power amplifier and limiter, and a telephone line for the audio signal. At the main announcement booth, Destiny Sound and Sound Solutions had to coordinate inputs from WCXI, a local radio station, the ABC Television group,

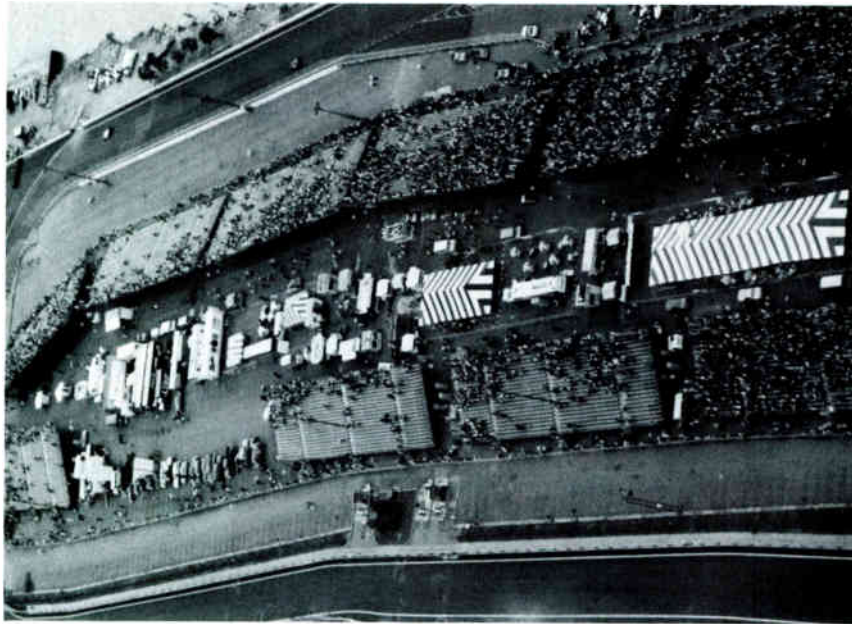
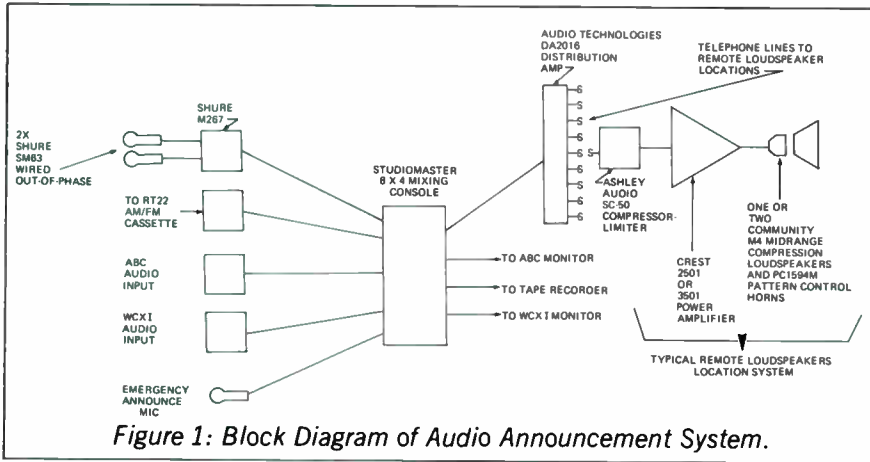
by Chris Foreman



Installing the M4 loudspeakers.

Mr. Foreman is Director of Marketing for Community Light & Sound, Philadelphia.





A view of one section of the course and grandstands from the roof of the Westin Hotel.



Peak race noise levels reached 141 dB(A) SPL in the announce booth.

and a booth announcement microphone, then mix, balance and equalize these signals and distribute them to the various loudspeaker locations, as well as providing monitor and broadcast feeds back to WCXI and ABC. Figure 1 is a block diagram of the electronics used to achieve the announce booth signal processing.

Day 2:

Though limited to practice and qualifying runs, the first actual race day did require audio. Most of the system was up and running, but the telephone company had not completed feeds to several loudspeaker locations and there were minor problems in the booth electronics setup. Yet if these problems seemed solvable, a new problem was causing considerably more concern.

Noise in the Announce Booth

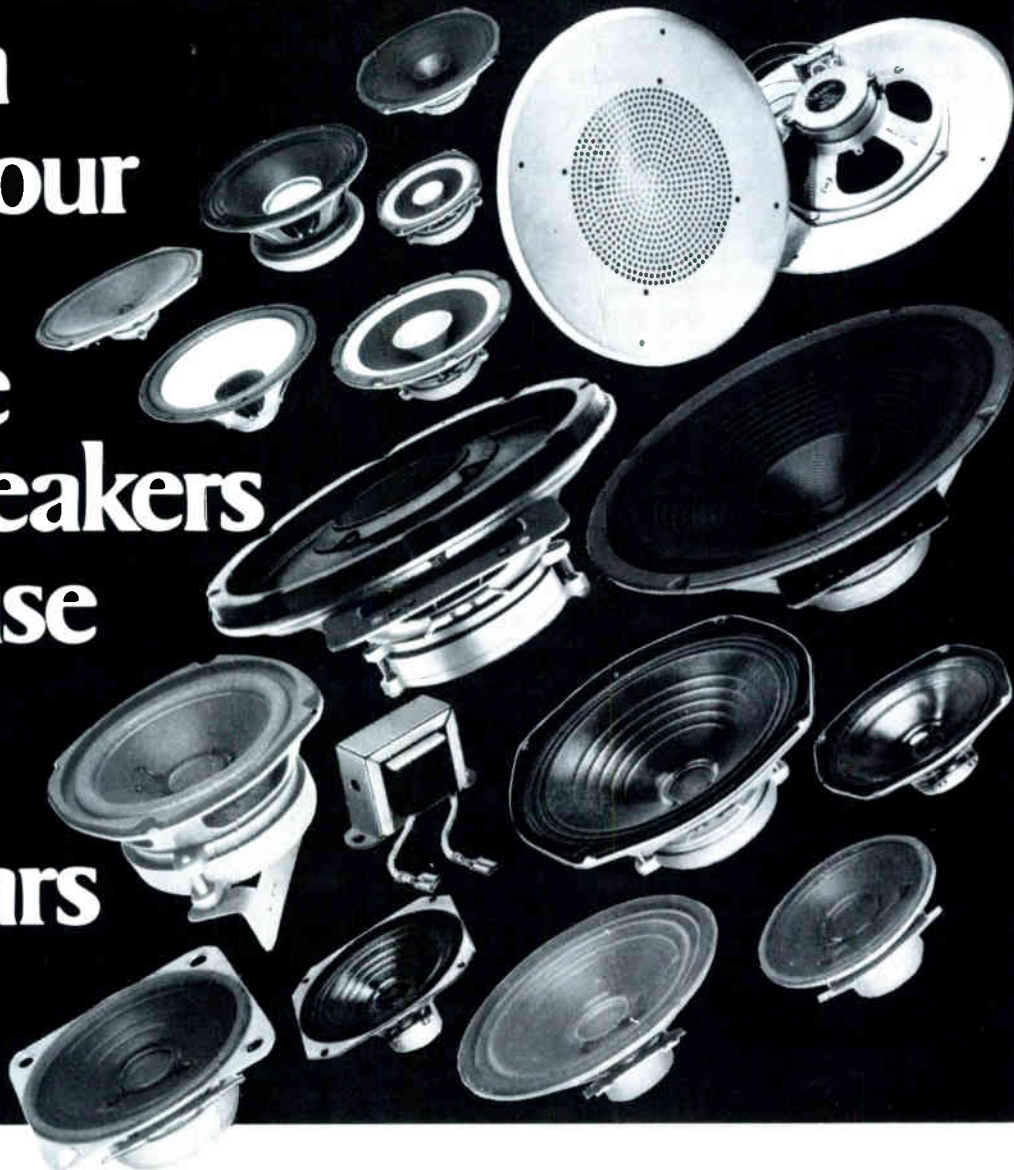
The announce booth was track-side, directly across from the pit area and in an ideal location for viewing the start and finish of the race. Unfortunately, no one had considered the problem of track noise and the effect it could have on the audio system. During practice runs, we measured peaks of 141 dB(A) at the announce booth microphone! Ear defenders solved part of the problem, but keeping the track noise out of the microphone wasn't as easy. To get even a 10-dB signal-to-noise ratio, the announcer would have had to produce over 150 dB at the microphone, an impossible feat, even for a trained announcer.

The ABC TV crew was in better shape, inside a glass-enclosed, air-conditioned booth. I'm sure the glass was included to allow air conditioning, but its primary value turned out to be noise control. The audio announce booth, without air conditioning, also lacked the glass front that would have reduced track noise to tolerable levels.

Attempting a Solution

The announcer's noise-canceling microphone had a few dB of rejection, but not the 30 dB or more that was needed. We decided to try a pair of Shure SM63, omnidirectional microphones in an out-of-phase hookup with their diaphragms as close together as possible. This setup, often called a "differential microphone," works by canceling noise sources at some distance from the pair of microphones, while selectively allowing signals close to

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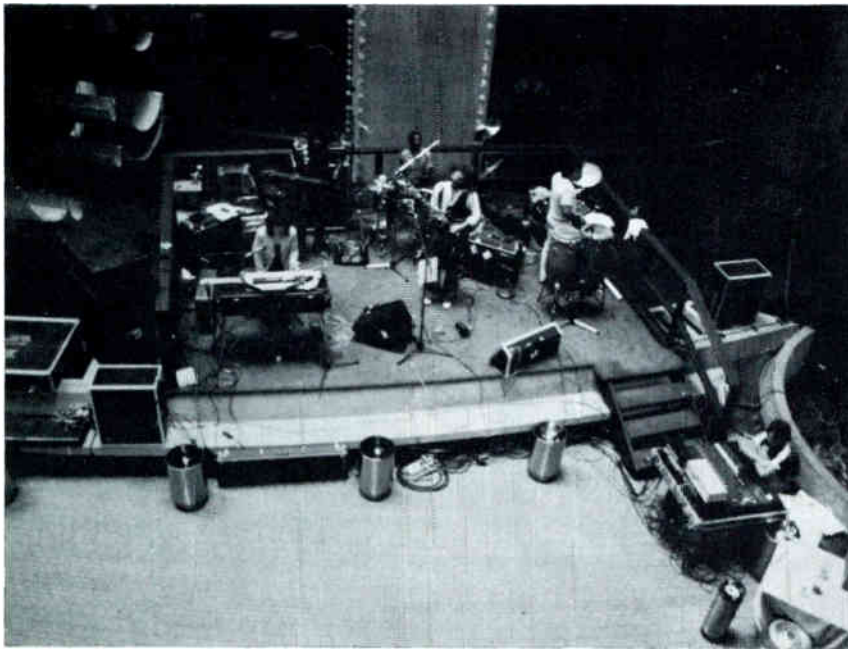
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During pauses in the Grand Prix events, entertainment was provided at nearby Hart Plaza and the Westin Hotel, including these sound systems.

a single one of the microphones to pass. Although I had never tried the technique, I was aware that it had worked well enough to allow the Grateful Dead, for example, to place microphones very near their giant speaker stacks.

For us, the technique worked, but the approximately 10 dB of rejection we obtained was, again, totally inadequate. In the end, we used this differential microphone and

instructed the system operator and announcer to shut down the input level when the race cars went past the booth (attempting to do announcement at other times).

While this combination of techniques was partially successful, there were times when announcements had to be made during a high-noise period. In those cases, it was almost comical to watch people near remote loudspeaker locations



A small audio system was provided for the press conference room at the Westin Hotel.

looking for the race cars they *heard* but could not see! It's too bad that this problem, which could have been solved easily before the race (by enclosing the announce booth) marred an otherwise very successful audio system.

Day 3:

Expecting hot, Midwest summer weather, I had come without even a light jacket, only to discover the truth about midwest weather—its unpredictability. The first two days had been cold and cloudy, and on the third it rained. Races that day, including the Super Vee championship, had to be run in the rain, a bad situation for both the drivers and the fans. I spent a good part of the day in the Press Room in the nearby Westin Hotel (part of the ultra-modern Detroit Renaissance Center) making occasional trips up to the 38th floor hospitality suite, which had a magnificent view of the race track.

While I was able to get out of the rain and actually enjoy myself, the audio system was being put to a real test. Rear covers for the Community M4 loudspeakers were not yet available so Destiny Sound covered them with plastic garbage bags (a temporary "fix" that worked out fine). The telephone company was still having problems with signals to at least one remote loudspeaker location and rain was getting into the announce booth and threatening the audio equipment. More plastic solved this last problem and, fortunately, the races went off with no major accidents.

Perhaps the most enjoyable part of the day for me was watching the Vintage Race Cars in their practice session, which happened before the rain. These old cars came in a wide variety of types and sizes and were like a rolling museum of automobile racing. They were also considerably less noisy than the modern Formula 1 cars.

Day 4:

Destiny Sound and Sound Solutions had originally planned to do a large central cluster augmented by remote loudspeakers placed on time delays in ever-increasing concentric circles away from the central cluster. The size and layout of the final race course prevented this plan. The final setup involved a more conventional

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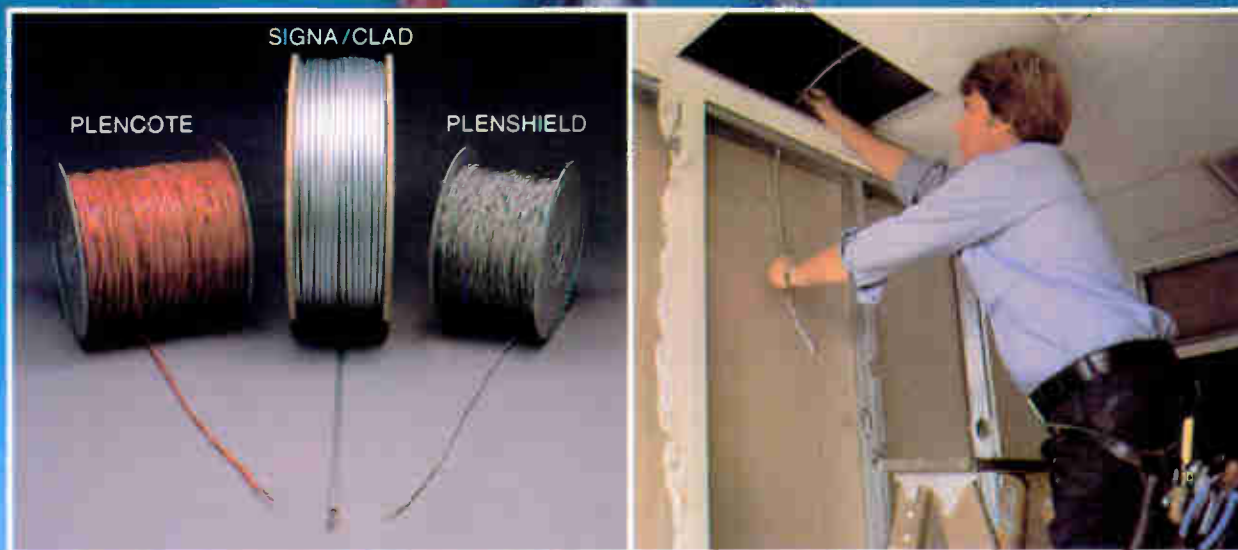
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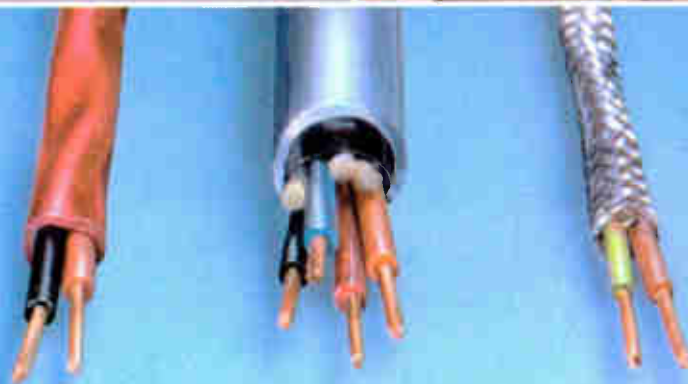
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Trackside interviews were fed through the announce system to the entire race course.

layout with loudspeakers at each grandstand location facing the audience. Carefully chosen locations and the high acoustic power output of the M4 loudspeakers allowed only 19 loudspeakers to cover the 100,000-plus attendees on the last day of the race. The small number of loudspeakers and their careful aiming also minimized interaction between loudspeakers and there were only one or two spots around the entire race course where a faint echo from another loudspeaker could be heard.

Signals and Noise

On this, the final race day, the World Championship Formula 1 race was to be held. The weather was cooperating and all looked good except for one final loudspeaker location, still waiting for a telephone hookup. I decided to take the SPL meter and check out both the race noise and the announcement levels in the various locations. Peak race noise levels were as high as 115 dB(A) SPL in some locations in the grandstands. Average race noise (when cars were passing by) was



WCXI

The Trackside Announce Booth.

between 90 and 100 dB(A) SPL. The incredible noise power of the Formula 1 cars is evident when you consider that these levels were being generated over a wide area of grandstand at a distance of about 50 feet from the race cars!

Maximum Announce Levels

Because of the expected noise level, we had made the decision not to attempt to "out-shout" the race cars. Thus, maximum announce levels in the grandstands were about 96 dB(A) SPL on the average scale. In some remote locations, farther from the race course itself, announce levels were allowed to drop to about 83 dB(A). Since the race cars were passing nearby only occasionally, these announce levels were fully adequate for natural and intelligible speech during a majority of the race. Surprisingly, I could understand a good portion of the announcements made when the race cars were passing by—a testimony to the announcer's clear voice and my brain's apparent ability to pick out speech sounds from a much higher noise level.

Announcements and Interviews

The announcer was an employee of WCXI, a local radio station, who provided track-side announcing and also sent a remote announcer to conduct interviews and commentary during pauses in the race. The audience got to hear the entire audio program, both announcements and interviews, just the way it was broadcast over WCXI (but without the commercials) and this made the race much more interesting to a novice like myself.

Last Minute Solutions and Comments

As I wandered the race course during the final Formula 1 Championship race, the telephone company was still troubleshooting one final loudspeaker location. Significantly, it came "alive" as I was sitting in that location waiting to measure the announcement level. Thus, for the most important race, the entire system was finally functioning properly.

As we flew home that evening, I had decided that Formula 1 racing was worthwhile, at least to see the latest in high-technology racing automobiles and to watch the skill and strategy of the drivers. Far more satisfying, for me anyway, was the field experience we got "audio racing" at the Detroit Grand Prix. □

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Digital Voltmeters

by Keith W. Bose

The last few years have brought advances that make possible lightweight "tool bag" digital voltmeters and at the same time "bench" or laboratory type DVMs have become more accurate and versatile.

Test and application problems in the field are now simplified by the ease of attaining specific readings not only in volts, but in decibels or any unit in which voltage is analogous. This is made possible by incorporating the circuitry found in hand-held calculators.

The digital voltage output may be directly bus-fed to obtain processing into other units and functions. Instruments are available with reso-

lution better than 10 nanovolts, with accompanying high noise rejection and response.

The digital voltmeter is essentially an analog-to-digital converter. That is, it accepts a voltage, the analog, and converts it to a digital reading. A digital reading offers several advantages to the field technician or laboratory worker. If a specification calls for a setting of say, 12.45 volts, the adjustment can be made to exactly that amount. This eliminates human error, prevents guesswork, and insures that a given procedure is exactly followed. A primary disadvantage of a digital readout occurs when a voltage dip or peak must be found. Here the continual changes

in numerical readout may be disconcerting. In such cases, a less accurate analog instrument will suffice.

As in all instrumentation, it must be assumed that the DVM is in calibration and capable of delivering accuracy to a specified degree. In general, if a quality instrument displays a given decimal point, it can be considered accurate to that decimal point. The exact limit of accuracy can be determined from specifications. A DVM will usually hold its calibration, since numeric errors do not ordinarily arise in digital circuitry.

In choosing an instrument, accuracy is an important criterion. The instrument need be no more

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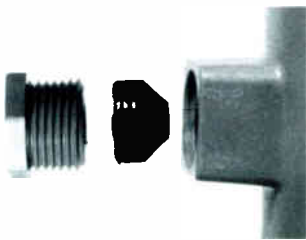
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First of all, look for a paging/talkback loudspeaker with a built-in 70- and 25-volt line transformer. Only University Sound's CFID-15T (15 watt) and CFID-32T (32 watt) paging speakers give you that kind of choice.

Next, look for features like the *six* screwdriver-selectable wattage taps of the CFID series.

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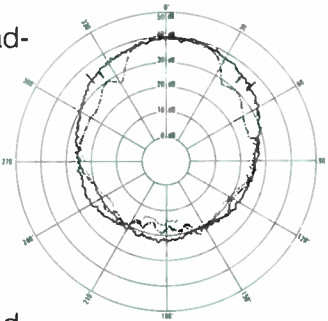


How about sound quality? For a paging speaker to reproduce critical low frequencies, bigger is definitely better. The CFID-15T horn bell is the largest of its type, and it's the only 15 watt horn capable of producing the controlled horizontal dispersion

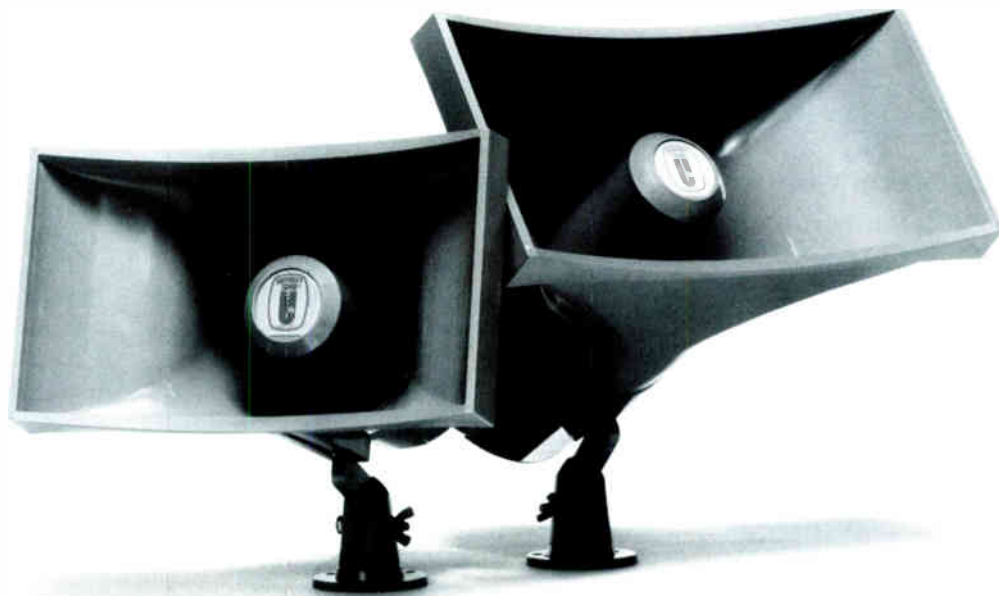


you see in the polar curve shown here. For voice/music systems requiring even broader frequency response, the CFID-32T is the logical choice, with a bell area 30% larger than competing models.

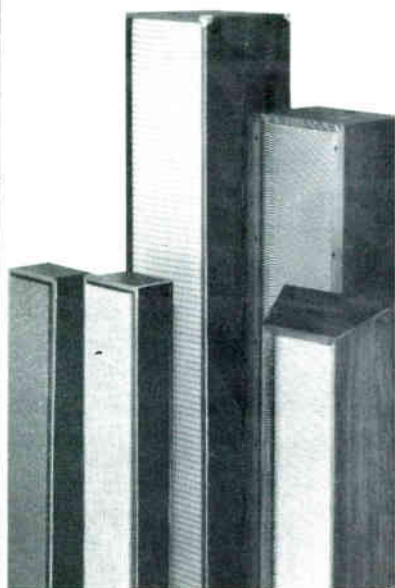
Finally, check for additional features like University Sound's weather-resistant horn/housing construction; field replaceable voice coil assembly for on-site repair in less than two minutes; and the versatility of flush or surface mounting.



The University Sound CFID-15T and CFID-32T—everything you need to know about picking a paging/talkback loudspeaker. For more information, contact Charles Round, Sales Manager, University Sound, 1515 South Manchester Avenue, Anaheim, CA 92803; 714-774-0251.



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accurate than required by its application. On the other hand, some field measurements now require better than one percent accuracy. Also, there may be situations where legal considerations suggest certifiable accuracy. Accuracy is certified by calibrating the instrument to a standard that is certified as traceable to the US Bureau of Standards. A manufacturer may offer calibration specifications of one year, 90 days or 24

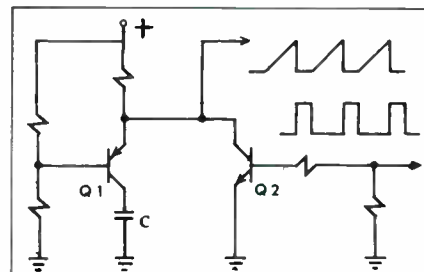


Figure 1. Q1 is configured as a constant current source that charges C at a linear rate. Q2 discharges C at the end of the ramp time.

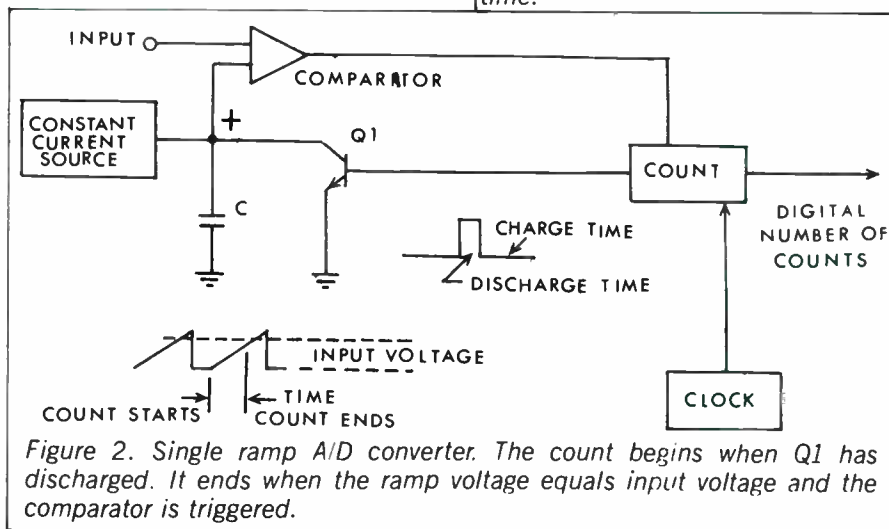


Figure 2. Single ramp A/D converter. The count begins when Q1 has discharged. It ends when the ramp voltage equals input voltage and the comparator is triggered.

hours. The 24-hour specification is useful as a comparison with another instrument, whereas the 90-day calibration figure is required for most laboratory and military standards.

The DVM, especially the portable variety, would not be practical without large scale integrated circuit chips (LSIC). Hundreds of transistors are required to process the voltage into a digital reading. Because of this, a repairman or even a design engineer no longer thinks in terms of discrete transistors and resistors, but rather of the functional relationship of the various chips. This article discusses the circuit functions found in DVMs.

Most DVMs use some form of ramp circuitry to convert the voltage under measurement to a digital quantity. A voltage ramp that rises uniformly as a function of time can be made the basis of conversion by measuring the time required for the voltage to reach a value. If a constant current is fed to a capacitor, the time relationship will be:

$$t = \frac{CE}{I}$$

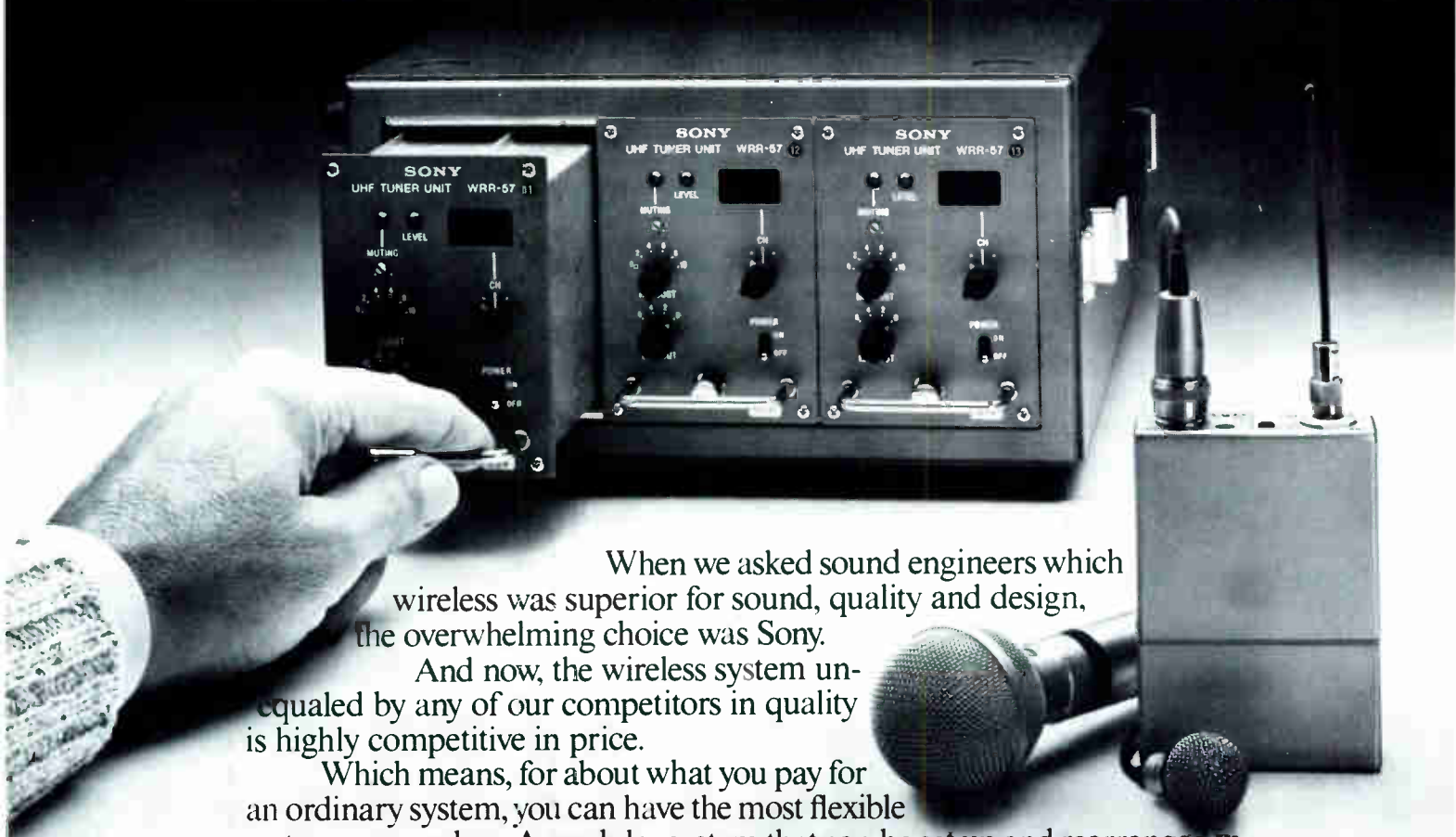
where C is capacity, E voltage, I current, and t is the time in sec-

onds.

A circuit for this is shown in Figure 1. In the circuit shown, the source of pulses feeding Q2 may be a stable oscillator, which produces accurate intervals between charge and discharge. Figure 2 is a block diagram of a single ramp analog-to-digital converter. The system is controlled by a clock, usually a crystal-controlled oscillator. The counter is so arranged that a count cycle begins when C is discharged through Q1. During the charge cycle, the counter is running to a count. When the input voltage and the ramp voltage are equal, the comparator triggers and stops the count. The number of counts follows the time relationship previously discussed. This process is repeated continuously.

A system such as this has certain drawbacks. One problem is that a noise spike will stop the counter at a false figure. In other words, the system responds instantaneously to random noise. The system is also sensitive to circuit parameter drift from temperature or other factors. The dual slope method is an improvement that eliminates many

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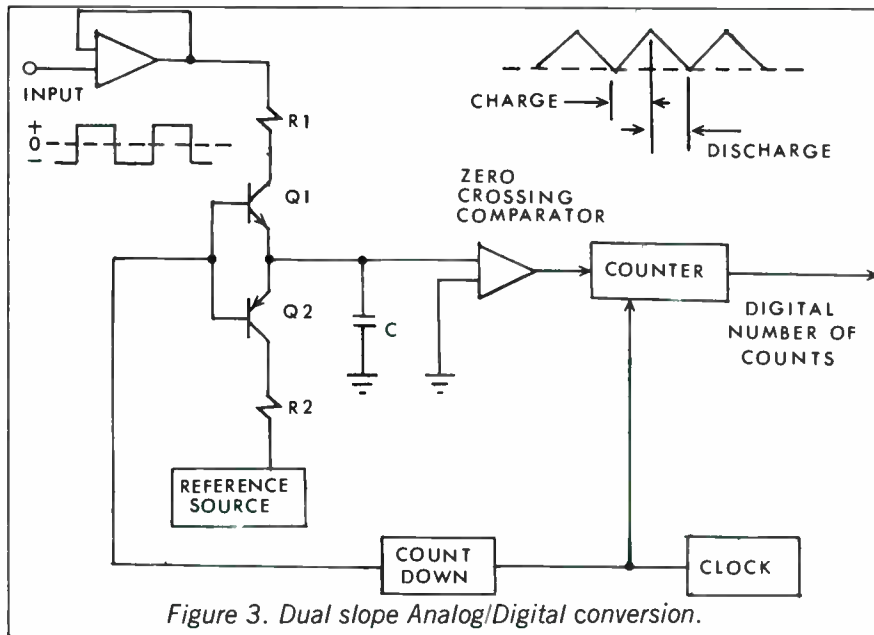


Figure 3. Dual slope Analog/Digital conversion.

problems of the single ramp.

The block diagram in Figure 3 illustrates the dual slope system. Q1 and Q2 act together as a single-pole, double-throw switch. Q1 conducts on positive clock input and Q2 conducts on the negative. When Q1 conducts, the input voltage charges C through R1. During the negative clock cycle, the capacitor discharges through Q2. The counter is

started at the beginning of the negative clock cycle. When the charge has run down to reach ground potential, the zero crossing detector triggers and stops the count. The magnitude of the input signal determines the charge time. The advantage of this system is that errors cancel out in the process of charging and discharge. This cancels errors, due to component drift

as well as input noise.

After the digital count representing a voltage has been obtained, the next step is to form a readout in numerals. Displays may be formed by light emitting diodes (LEDs), liquid crystal displays (LCDs) or gas discharge (neon) elements which illuminate in segments to form numerals. LCDs do not emit light. They operate by changing the way external light is absorbed. Also, they are operated by ac, rather than dc, as with LEDs. LCDs consist of two glass plates with a liquid between. The glass has an electrically conductive coating at those places that form the segments. When a segment is energized, the charge in that area causes the liquid to change its light characteristics. Light can be scattered to form an image area or it may be polarized. In all cases, LCD needs external light, although radioactive material is sometimes used to provide luminescence.

LCDs usually operate at around 15 VAC, and draw very little current, only a few microamperes. This can be derived from an oscillator operating from 30 to 100 Hz. The first LCDs were sensitive to temperature and slow to respond, but most instruments using LCDs now operate

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The standard readout numeral consists of seven segments, as shown in Figure 4. Each numeral element contains these seven segments and one dot to form the decimal point when illuminated. For example, the numeral 3 would be formed by segments A, B, C, D and G. The numeral 9 would be formed by segments A, B, C, D and F. There is an advantage in multiplexing when display contains more than one numeral. This is shown in Figure 5. The anodes of each numeral are *strobed*, that is, energized at intervals in turn. The cathodes are driven in proper synchronization so that the respective segments illuminate to form the numeral only during the time that strobe is present. Numerals are each illuminated in succession for a brief time. This is not apparent to the eye. One advantage is a saving on driving power, which is important in portable battery-operated instruments.

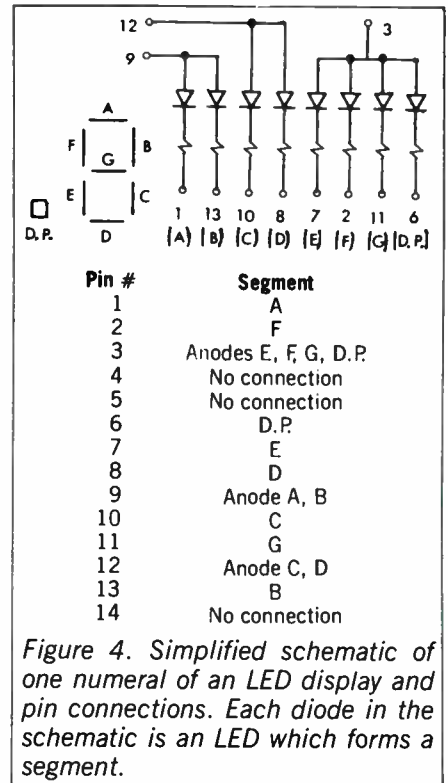


Figure 4. Simplified schematic of one numeral of an LED display and pin connections. Each diode in the schematic is an LED which forms a segment.

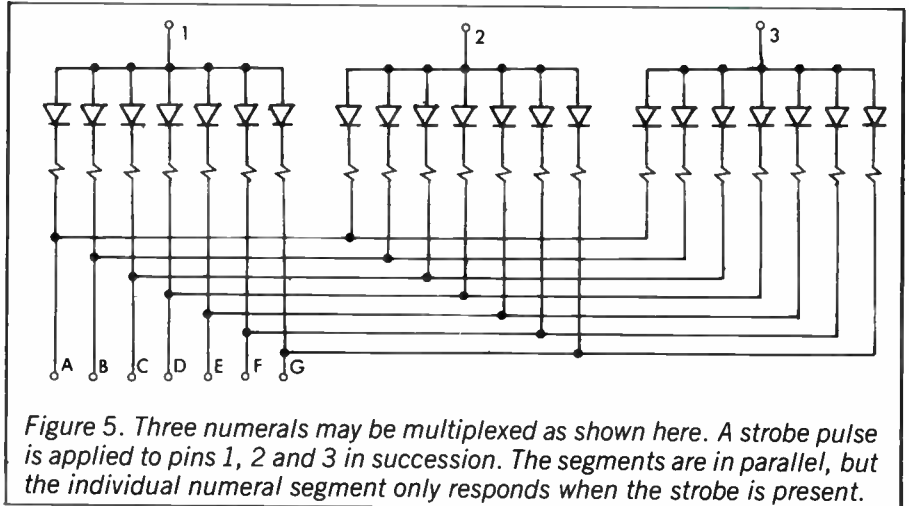


Figure 5. Three numerals may be multiplexed as shown here. A strobe pulse is applied to pins 1, 2 and 3 in succession. The segments are in parallel, but the individual numeral segment only responds when the strobe is present.

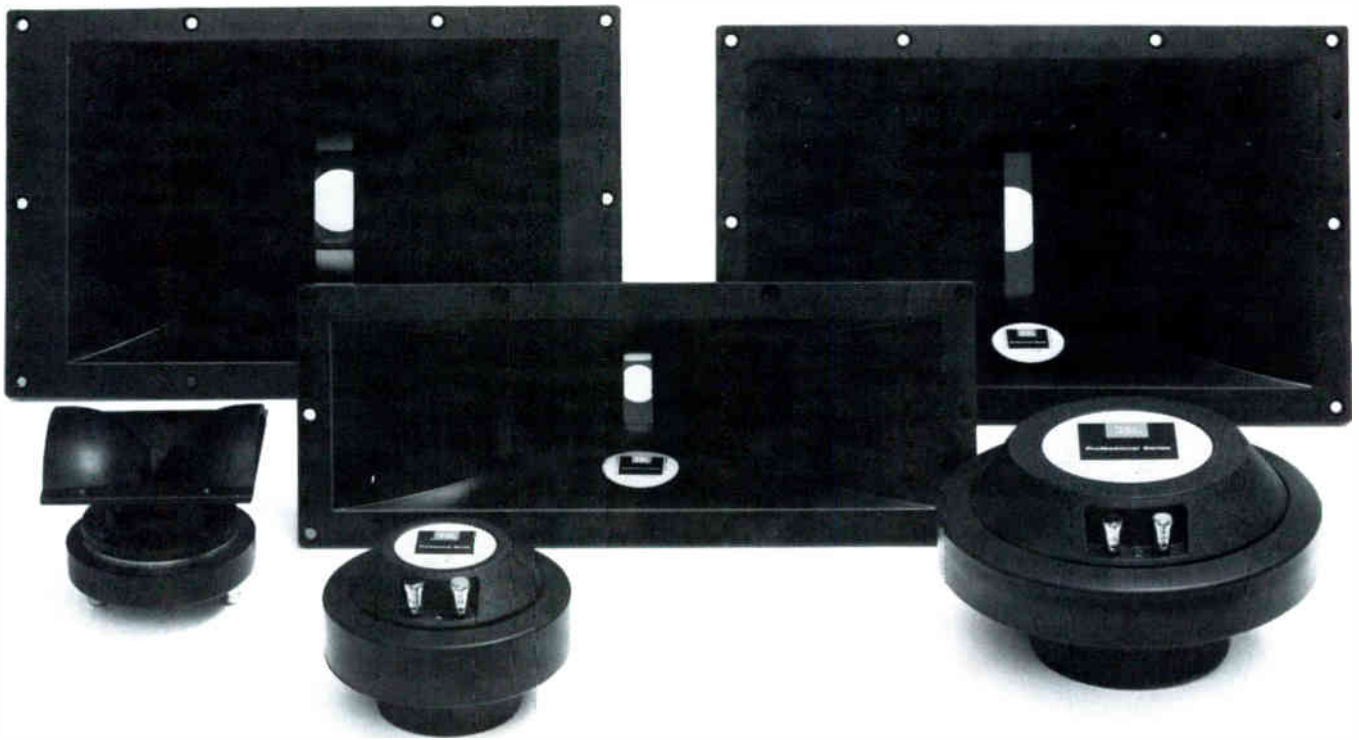
The output of the analog/digital converter is a binary signal which represents the voltage. Each decimal numeral can be considered as four lines carrying four bits in parallel. These four bits provide 16 combinations of 0 and 1 states, although only ten combinations of LED segments (0 to 9) are needed for each numeral. The process of converting the binary signal to the proper segment pattern requires complicated logic. Special chips (decoders) are used to do this.

It was mentioned at the beginning that the binary output of the analog/digital converter can be applied to a microprocessor. Thus, the user can communicate with the display. We can now go beyond the simple idea

of a DVM and think of the unit in a new concept. The input of the instrument may include signal processing in a broad sense. Amplification or attenuation can extend measurements in either direction. A precise sampling resistor will convert current to a voltage analog. A thermistor input will produce a heat analog for direct readout of temperature. Other transducers, combined with proper signal conditioning and software, will give direct readouts in weight per foot, foot pounds, and almost any form of measurement. The possibilities are almost limitless. Thus, it appears that the DVM will grow in importance as an electronic tool.

to be continued

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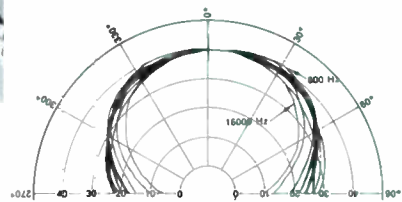


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Crossover Networks

by George Leon

Why a crossover network in a loudspeaker system? First, let's define what a crossover does. It consists of those components that divide the audio frequency output of an amplifier into two or more bands of frequencies. The number of bands depends on the number of speakers and their function in the high-fidelity system.

The question remains: Why such a network?

The modern high-fidelity system is designed to reproduce a broad

range of frequencies: usually from 20 to 20,000 Hertz. No one loudspeaker can encompass such a range without undesired distortion. Therefore to obtain satisfactory response with a minimum of distortion and other ills that plague loudspeakers, at least two are required. Three are not uncommon and some systems boast five. Each speaker is chosen for its specific ability to reproduce signals that lie within its frequency range. A five-way speaker system would include a super-

tweeter, tweeter, mid-range, woofer and sub-woofer. Such a combination is intended to expand the frequency reproduction range of the system at both ends.

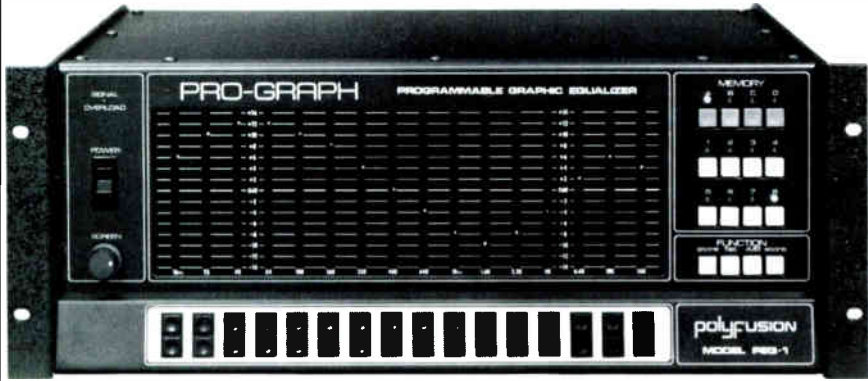
Merely connecting these speakers at the output of the amplifier, even when the impedance is matched by parallel and series connections, offers less than adequate results. Each speaker is trying to reproduce part of the sound spectrum for which it is not capable. Cancellation occurs and the response is far from smooth.

Now the crossover network comes into play. In the broadest sense of the word it is really a set of frequency dividing filters that separate the frequency spectrum into allocated bands. This is accomplished by a series of high-pass and low-pass filters, each designed for the specific speaker in the system.

The cone of a speaker resonates at a specific frequency. This resonance is determined by the mass of the cone and compliance of its suspension. As the speaker's resonance is approached, its vibration increases. This is also its most efficient point in the conversion of electrical energy to sound. Conversely, as the frequency is altered, either above or below the resonant point, the speaker is diminished in efficiency. The ideal system is one in which each frequency band is reproduced with equal strength by the speaker. Since the ideal is not yet on the drawing board—much less being manufactured—the best range for each speaker is chosen with the weaker and less efficient range “chopped off” and given to the speaker with greater mass, if lower tones are wanted, or to one with a

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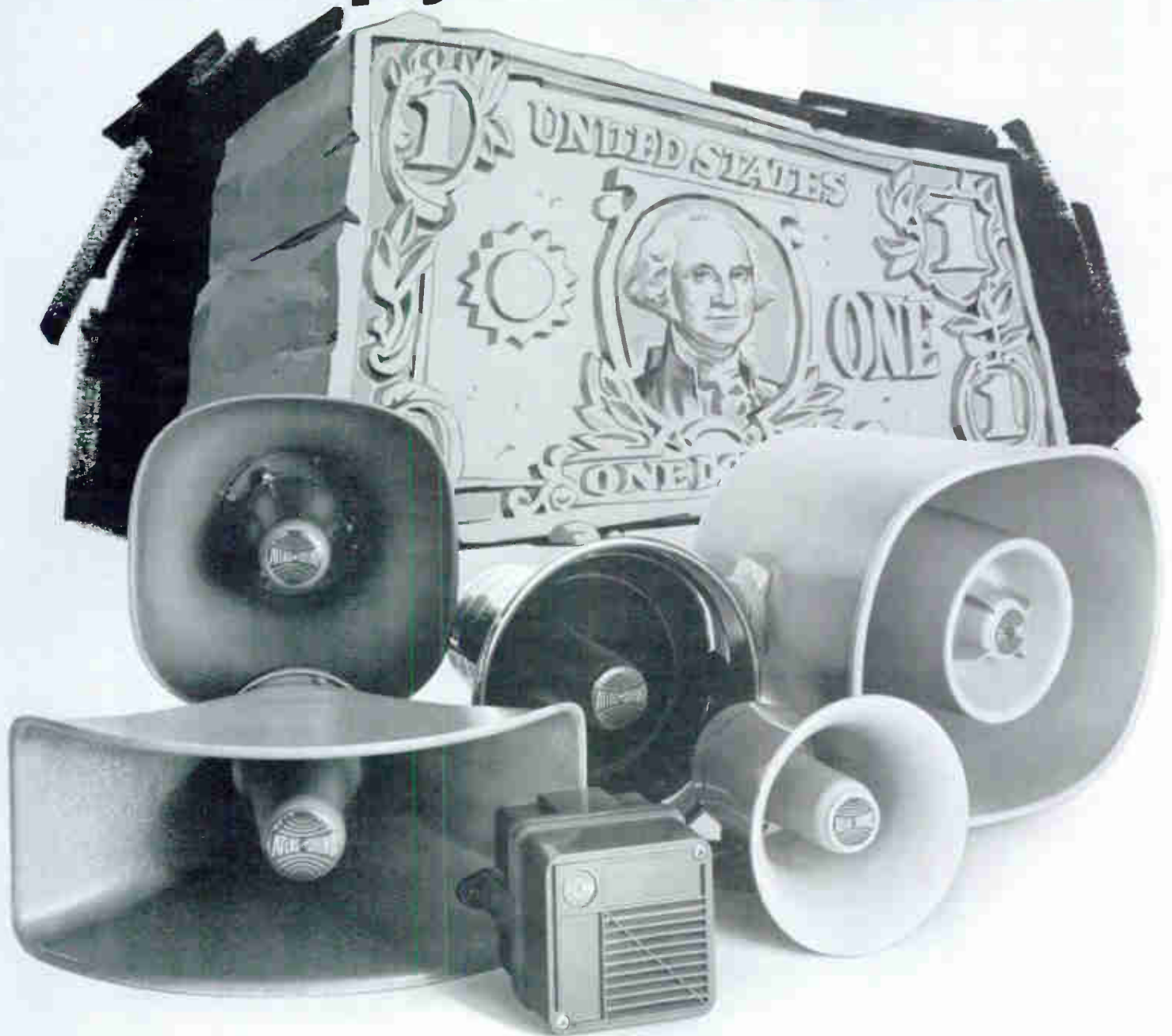
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lesser mass if the higher tones are desired.

A tweeter or even most mid-range speakers are unable to reproduce the deep growl of low harmonics, as can be heard with portable radios with their tinny effects. The lack of bass is particularly noticeable with music.

There is no denying that the proper acoustic enclosure will enhance the speaker's ability to reproduce sounds within a given range; it cannot make the speaker cone vibrate at rates for which it is not designed. A single-cone speaker with long cone excursions designed for bass tones will have a tendency generally to modulate the treble range. Ergo—the crossover network.

I mentioned "chopping off" the less efficient range of a speaker. This was not meant to suggest that a filter is capable of cutting off a signal to the driver at some precise point. The filter feeds signals beyond the cut-off point.

To illustrate the action of a simple high-pass filter, let's imagine we have a two-speaker system: a woofer and a tweeter. In Figure 1 is a capacitor in series with the tweeter.

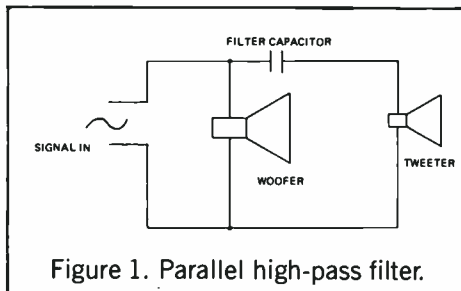


Figure 1. Parallel high-pass filter.

The capacitor acts as a trap, preventing the bass tones from reaching the tweeter. The reason for this behavior is that the capacitor has more reactance (AC resistance) to low than to high frequencies. So a capacitor is utilized that will present reactance to the signal at a wanted crossover frequency. Capacitive reactance is a function of frequency: the greater the capacitance the lower is the frequency. As with the introduction of any component in a circuit, there will be a loss of power. This will be half of the unfiltered power, or 3 dB down. The crossover frequency is generally the point at which the response is down 3 dB.

There are two arrangements for a crossover network: parallel or in

series. In the parallel setup, the speakers are in parallel to each other. The parallel arrangement is usually preferred over the series, as it offers characteristics that are somewhat better, the latter being employed only with two-way systems. The series arrangement suffers from one disadvantage in that there will be a frequency at which the inductive (coil) and the capacitive reactances cancel each other. This creates a hole in the responsive curve. The ideal response is one with no spikes or hollows.

Commercial networks use the parallel configuration; by employing the same component values for each filter, manufacturing costs are reduced.

The low-pass filter acts as a limiter to the high-frequency response of the low-frequency speakers. The high-pass filter acts inversely, in that it limits the high-frequency response of the high-frequency speakers. Thus a low-pass filter will prevent a woofer from responding to the high frequencies; the high-pass filter prevents the tweeter from attempting to



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reproduce the range that properly belongs to the woofer.

Figure 2 shows the high-pass and low-pass configurations in a series

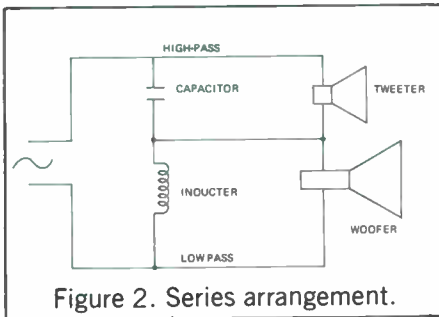


Figure 2. Series arrangement.

arrangement for a two-way speaker system. A single reactance in line with each speaker results in a 3-dB/octave slope at the crossover frequency. The final slope is 6-dB/octave. The arrangement in Figure 2 would exhibit these characteristics.

When, however, there are two reactances for each speaker (Figure 3) the slope is doubled, a slope of 6-dB/octave at the crossover and 12-dB/octave ultimately. Adding one more reactance to each speaker produces the expected result: a still sharper slope of 9-dB and 18-dB/octave at crossover and ultimately.

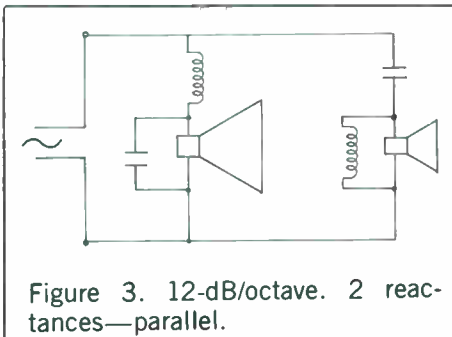


Figure 3. 12-dB/octave. 2 reactances—parallel.

No advantage has been found in increasing the cut-off-frequency rate beyond the 18-dB/octave. Pro systems are never beyond that

slope. A 12 or 18-dB/octave are almost standard.

A three-way system—woofer, mid-range and tweeter—can be furnished with a similar arrangement. So can a five-way, for that matter.

Why not add more reactances? If three are better, why not four or even five? While the response curve might be improved, it would not provide that much amelioration and this slight bettering would be at the cost of loss of power.

One point is worth mentioning. The parallel arrangements shown in the above figures can be applied to speakers of unequal impedance. This is achieved with the addition of transformers and/or series-parallel wiring of the speakers. (This series-parallel wiring of the speakers is not to be confused with the arrangement of the various components presenting reactance.

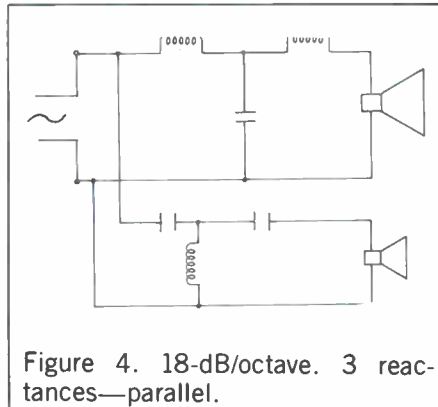


Figure 4. 18-dB/octave. 3 reactances—parallel.

JBL (James B. Lansing Sound, Inc.) offers to the professional seven frequency dividing networks (Figure 5). Designed for high and low-frequency driver combinations, the networks use a 12-dB per octave slope, a parallel arrangement with L-C circuits. Conjugate elements are added to cancel the inductive reactance of the speaker handling the

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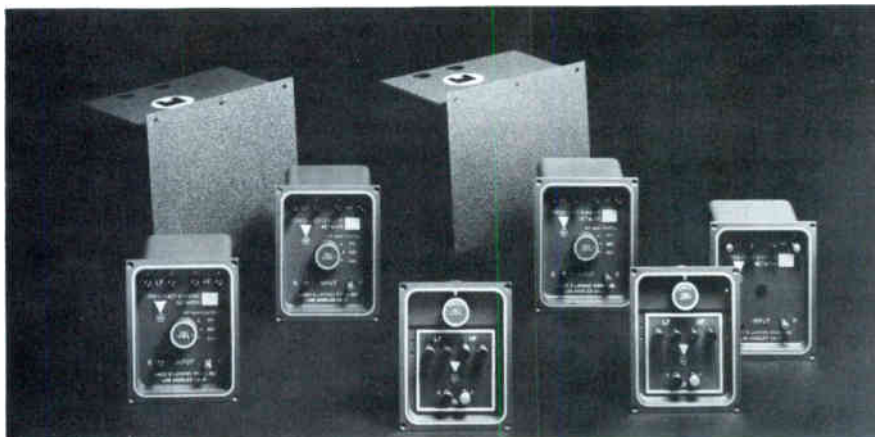


Figure 5. Frequency dividing networks by JBL.

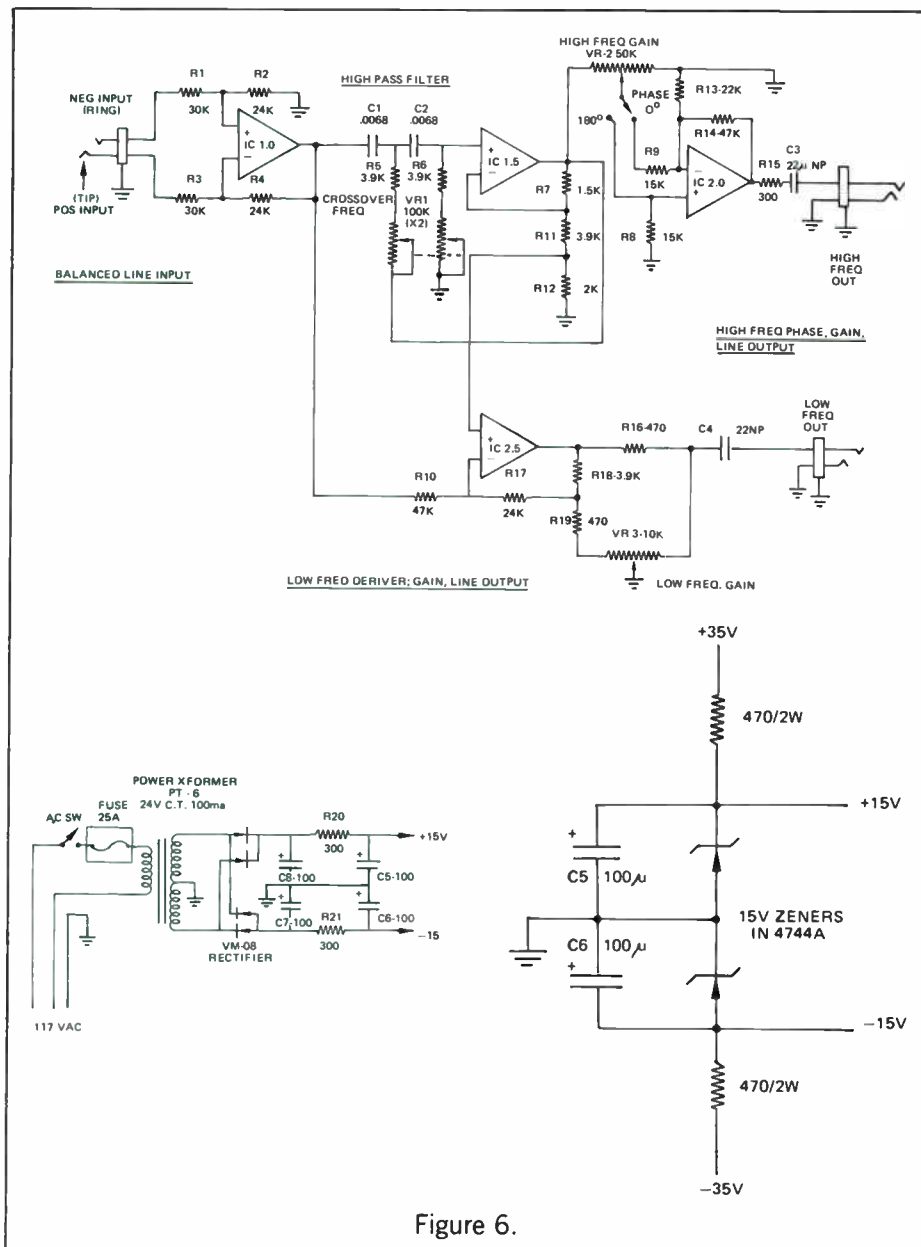


Figure 6.

low-frequency range. A control on the front panel permits the attenuation of the high-frequency drivers by means of autotransformers.

Solid state electronics, with the further advent of ICs presented a different direction for improving the response curve of a multi-speaker system. QSC Audio Products provided S&C with the schematic for their electronic crossover. (Figure 6) High speed ICs are employed, capable of delivering undistorted signals from 20 Hz to 20 KHz at levels of +10 dB. The crossover frequency is continuously variable from 250 Hz to 6 kHz. The high and low-frequency outputs are also variable from "off" to +10-dB gain. The high frequency filter crossover is 12 dB per octave, -40 dB at the crossover point.

No longer can the few chokes and capacitors of yesteryear be tucked away inside the speaker enclosure. The units are now rack-mounted to be able to vary crossover frequency as well as high and low frequency gain (see Figure 7).

United Recording Electronics Industries (UREI) also manufactures electronic crossovers. This company favors filters with 18-dB/octave slopes. Their philosophy is that this characteristic is preferred by professionals because it provides unity summing. This means maximally flat response when the filters are combined, each filter being tunable over a 100:1 range.

UREI's Model 525 has a built-in frequency counter that shows the actual crossover frequency while the bands are being adjusted. These crossover frequencies are measured with 1-Hz resolution. The LEDs accept an external audio signal to measure and display its frequency from 1 to 9,999 Hz (Figure 8).

There are four crossover filters: #1 and #3 are continuously variable from 50 to 500 Hz (x 1 range) and from 500 to 5,000 Hz (x 10 range); #2 and #4 are also variable from 100 to 1,000 Hz (x 1 range) and from 1 kHz to 10 kHz (x 10 range).

No attempt has been made to describe these units in detail, nor to list all of the manufacturers. Only a few pertinent specs are mentioned—those that aid in showing the distance filter design has traveled since the first choke and capacitor were introduced. □

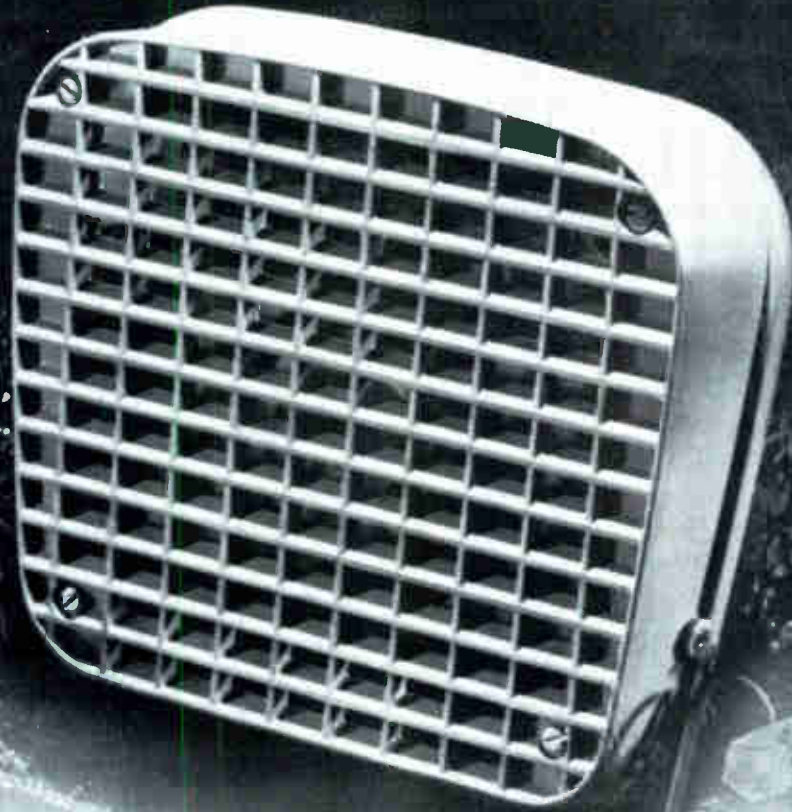


Figure 7. An electronic crossover, Model X2.2, by QSC.



Figure 8. UREI's Model 525.

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BOOK SHELF

COMMUNICATIONS STANDARD DICTIONARY by Martin H. Weik, D.Sc. clearly defines terms used by designers, developers, manufacturers, vendors, users, managers, administrators, operators and maintainers of communication systems and components. All entries are arranged in alphabetical order and every significant word in a multiple-word entry is also featured in the main listing. There are illustrations, cross-references and easy-to-spot italicized terms.

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Profile:

Audio in the Family

He's the heir apparent—and much more than Rosie's boy! He's Jim McGohan, the spark-plug that's driven McGohan Electronics, Inc., Bensonville, IL, to become one of the prime suppliers of audio products to the background music industry—and more!

There's no gainsaying the fact that Rosalie McGohan is the close supervisor of the firm's financial affairs. The lady who worked along side of Don McGohan while they struggled to organize, finance and keep a small manufacturing effort afloat, in the early years of 1949/1950, has always held the purse strings.

While Don McGohan stood on his feet working the counter of a radio parts distributing company, in Portsmouth, Ohio in 1942, his head was in the clouds. He knew retailing was not his forte, manufacturing was. He searched for an opening to leave Portsmouth and found it in Chicago with the old Howard Radio. In 1942 Howard Radio was making receivers for the WW II war effort, and they had an "open spot" for Don

McGohan. He grabbed Rosalie, his hat and coat and rushed off to Chicago, with a few dollars and the dream of owning/operating a manufacturing plant once the war was over.

The opportunity came knocking for Don McGohan in 1949, when Montgomery Ward placed an order for phonograph parts with the fledgling Don McGohan, Inc., concern. In 1950, Montgomery Ward bought several hundred pieces of a phono amplifier of Don's design, which formally established Don McGohan, Inc., with Rosalie McGohan as financial factotum.

And while Don nursed the "Inc.," Rosalie nursed three children, two daughters and a son—Jim—dividing her time unequally between the crib and the business. Rosalie's conservatism in business matters might be ascribed to the fact that she was persuaded to invest the total McGohan fortune—\$2500—to launch Don McGohan, Inc. It was a hazardous time, five mouths to feed, a not very big roof over their heads, and a gamble that did not appear (at the time) to have even a 50/50 chance of succeeding.

But those clouds that accompanied Don's head obviously had a silver lining. Don McGohan, Inc. prospered, with its production of "small audio products" for the burgeoning sound system dealer market.

While Jim McGohan was growing up—from boyhood to manhood—he worked in every capacity for the concern—Jim calls it his "handyman" training period—during his summer vacations from school, holidays and whenever he was needed in an emergency. It was this early experience that prepared him to take over upon the death of his father, Don. And to reassure his mother, Rosalie, of a continuity in her lifestyle—financial management of McGohan Electronics.

To fortify the decision to assume the stewardship of McGohan Electronics, Jim McGohan pursued a course in marketing at Southern Illinois University, earning a Bachelor's Degree in 1966. Upon first meeting Jim, one is impressed with a physique that conjures up "jock," he's broad and stubby and certainly an All-American football end. And along with the physical prowess, there's a bullhorn voice and a hand-

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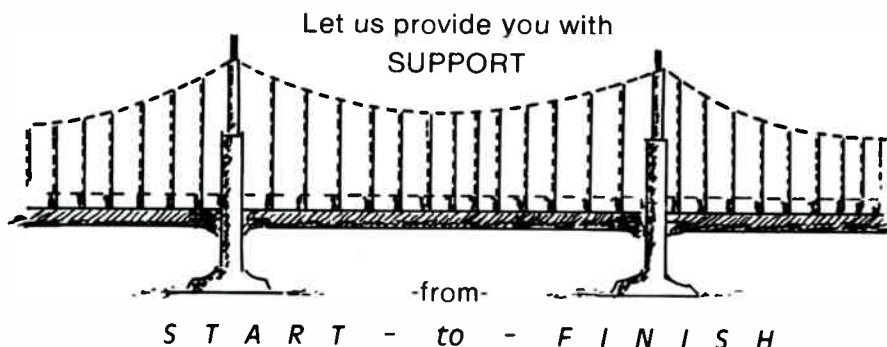
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shake that could drive rivets through steel. But the opposite is true: his football was played in high school, his approach and manner are calm, and his earnestness is deep-seated.

Jim joined McGohan Electronics in 1968, after having put in two years of service with the Navy, aboard the aircraft carrier Constellation, in Vietnam waters, handling personnel records and separation.

He immediately took up the job of buying raw materials, and instituted an evaluation program which produced a marked improvement in the quality of goods purchased, and the quantity discounts arising therefrom. This program influenced the sales program, in an unusual form—Jim was able to pass along these savings to his customers by dropping the minimum order requirements, thus catering to an ever-growing audience. Prices at McGohan Electronics have not risen with the speed of inflation.

At the same time, he set up a new product development program, with a time limit—he wanted several new products within six months. He got the development of a new one-watt amplifier for the background music operator; he got a one-watt AM/FM tuner with a port for attachment for "music-on-hold"; he got a line of amplifiers with a 600-ohm input port for telephone paging facilities; he got an audio mixer with ports to accommodate mikes or any auxiliary feed: tape, tuner, time signal generator. He got products that opened a new window for McGohan Electronics onto the interconnect dealer marketplace.

With a revamped line, a line of innovative products and an established sales rep organization, Jim has moved vigorously to increase his sales volume at an average of 10 percent a year, for the past two years. His increases have not been realized on higher prices as much as on the amount of product shipped. "As a matter of record," Jim observes, "we haven't raised our prices for almost two years, for almost every item in the line. We've achieved our increases in dollar volume because we increased the number of sales to old customers, while adding new customers from the emerging markets we've targeted."

A good deal of the increase in sales volume, Jim McGohan is quick to point out, is the end result of a warm association with his independent sales rep: Jim has no direct sales, meaning every order received over the transom (as it were) is credited to the sales rep; he's never haggled over the rates of commission—they're "standard" with McGohan Electronics, Inc. As a result, he works with a "staff" of reps who have served the McGohans for years. He does admit, however, that there are several territories that have not been as productive as they might be. He's working on solutions to that problem.

What lies ahead for Jim McGohan and McGohan Electronics? He believes that there are three areas that will impact upon the future:

- He feels that the way products are manufactured in the electronics/communications area will be reconstituted with the introduction of more automation. He does not see the total elimination of handwork, but he does see more of the mechanical jobs moving into automatic processes;

- He thinks that digital techniques will totally absorb the new product development programs of McGohan Electronics. They are busy now experimenting with tuners and amplification circuits that will embody digital techniques;

- Finally, he sees a closer marriage of audio products with the interconnect telephone dealer—more speakerphone applications, and an increasing use of audio circuits, in association with microprocessors, attached to embedded telephone and television sets, in offices, homes, plants, passenger terminals and supermarkets.

It's an exciting business, this business of producing electronic gear. It's as exciting for Jim today as it was when he was growing up in Chicago... and he's for everlastingly sticking with it.

Yet, on the family horizon there's a threat looming... a threat that may limit the span of his reign over McGohan Electronics. His youngest son—9-year-old Scott—has formally announced that when he grows up, he fully expects to "take over the business."

That puts McGohan Electronics, Inc. into the third generation, which pleases Jim McGohan. □

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sets up quickly, and its operation is easy and uncomplicated.

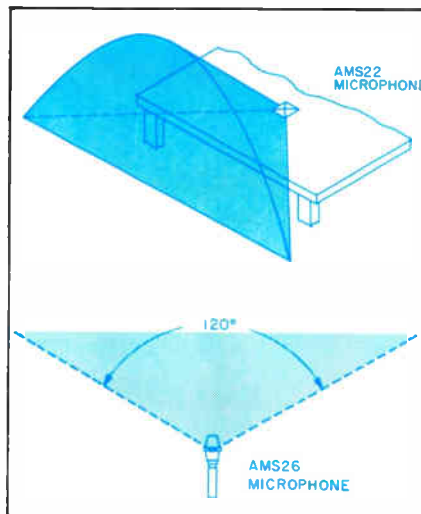
- *Acceptance angle sensitivity.* Each AMS microphone is activated only by sound that originates within a 120-degree window of acceptance. Sound sources outside this window will not make the microphone turn on, regardless of their loudness.

- *Automatic, continuous sensitivity adjustment.* Microphones designed to work with the AMS are capable of individually adjusting their sensitivity in relation to the amount of background noise. As background noise increases, each microphone becomes less sensitive and vice versa.

- *Reliable, consistent, quiet performance.* The AMS's advanced cir-



The probe mic.



The AMS microphones' respective "windows of acceptance." Sounds originating outside these windows will not make the microphones turn on, regardless of their loudness.



The low-profile microphone.

functions, the AMS is suitable for telecommunications, recording and broadcasting applications.

Michael Pettersen, Shure's product manager for circuitry, emphasizes that the Shure AMS is a true "integrated system", consisting of complementary mixers and microphones that work together to solve the problems associated with multiple microphone installations. Each component of the system incorporates several design innovations that directly address the needs of multiple microphone users and installers.

The Shure Automatic Microphone System consists of five basic component models: the AMS22 microphone (low-profile), the AMS26 microphone (probe-type), the

complementary system of unique microphones and intelligent circuitry, there are no "threshold" or "sensitivity" adjustments to be made, as with conventional automatic mixers. As a result, the AMS

circuit design provides smooth gating action, eliminating clicks, pops, noise "pumping," and missed syllables.

- *Advanced logic capability.* The

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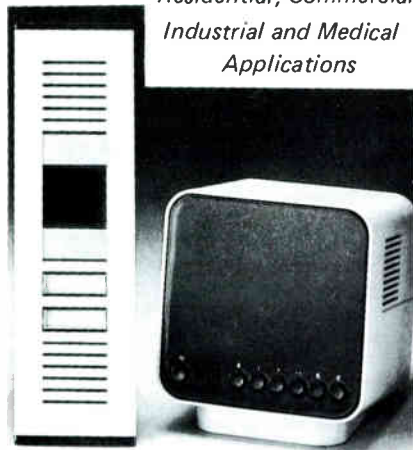
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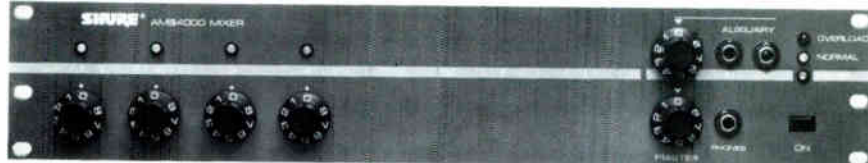
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The AMS8000 mixer.

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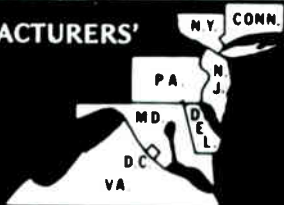
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AMS can provide many additional functions, including muting, relay switching, video switching, microprocessor control interface, and other complex electronic operations.

AMS Components

A key feature of AMS microphones is a design innovation that permits each microphone to independently analyze its own sound field and discriminate between sounds that originate within its 120-degree window of acceptance and all other sounds. This capability is made possible by the AMS's overall design as a unified microphone/circuitry system.

The AMS26 is a probe-type unidirectional condenser microphone with a front pop-filter grille and a dark brown finish that blends attractively with all wood finishes. The AMS22 is a surface-mounted, low-profile, unidirectional condenser microphone with an unobtrusive brown and black exterior.

Two Shure AMS mixers are available: the AMS4000 (four channel inputs) and the AMS8000 (eight channel inputs). To provide maximum flexibility, Shure AMS mixers have a full complement of controls,

including: individual channel volume controls; master volume control; direct output jacks; channel LED indicators; hold time switch; off-attenuation control; normal and overload LEDs; aux inputs, outputs, and volume control; headphone output; and link jacks.

In addition, the mixers feature logic terminals that make a wide variety of special functions possible, including chairman-controlled muting, loudspeaker muting, a "filibuster" mode, individual cough buttons, remote channel-on indicator, remote microprocessor control, and more.

Through the use of the microcomputer-based AMS880 video switcher interface, the Shure AMS can be connected to commercially available video switchers. After connection, the AMS will automatically provide user-programable, voice-activated camera switching with video following audio.

Comprehensive operating instructions are provided with each Automatic Microphone System, as is a detailed installer's manual covering special AMS applications and modification. □

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**WORKS WITH ALL
MICROPHONES**

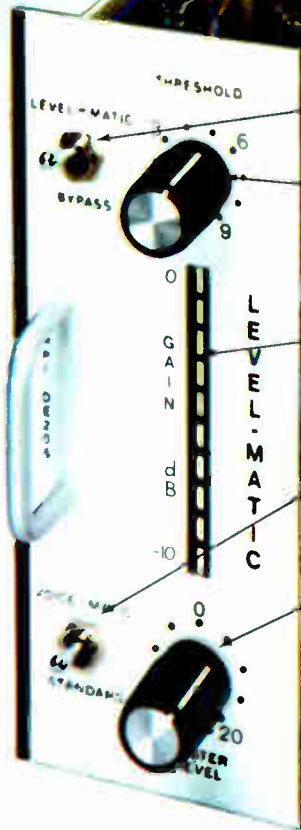
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Until now, self-powered mixers have had some serious shortcomings. Like inadequate power amplification, limited input channel capability, a serious lack of signal processing and most of all—not enough thought (or care) put into the construction.

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There are two models of RXA consoles: The 16 input console has four built-in power amps of 120 watts each into 8 ohms. The 12 input has two, 120 watt assemblies. These amplifiers are totally accessible for whatever use you may have for them, including bi-amplification.

Both consoles feature dual, 9-band graphic equalizers that are switchable to either the program or foldback outputs. Both equalizers and the power amps are assignable with panel mounted switches. Signal input is a choice of either +4 or +20 dBm sensitivity.

Every channel input is balanced, transformer isolated with an input level switch and trim control. These inputs are XLR type, while unbalanced operation appears on normal plug-in jacks. There's four band equalization for more flexibility. All the faders are log-linear type with 60mm travel. The inputs also have peak indicating L.E.D.'s, cue switch, stereo input, Aux echo input, program output, foldback output and echo send.

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Both consoles are wrapped into a rugged chassis that's lightweight, easily transportable and attractive. Our 16 input model is only 2'9" wide.

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where you've been. Check out these specs and you'll see what we mean.

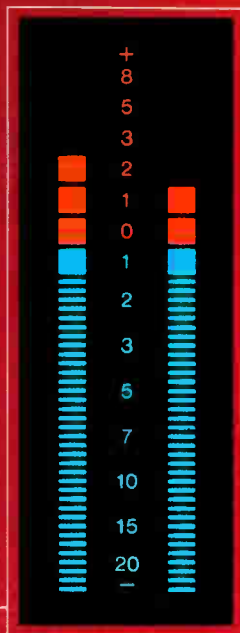
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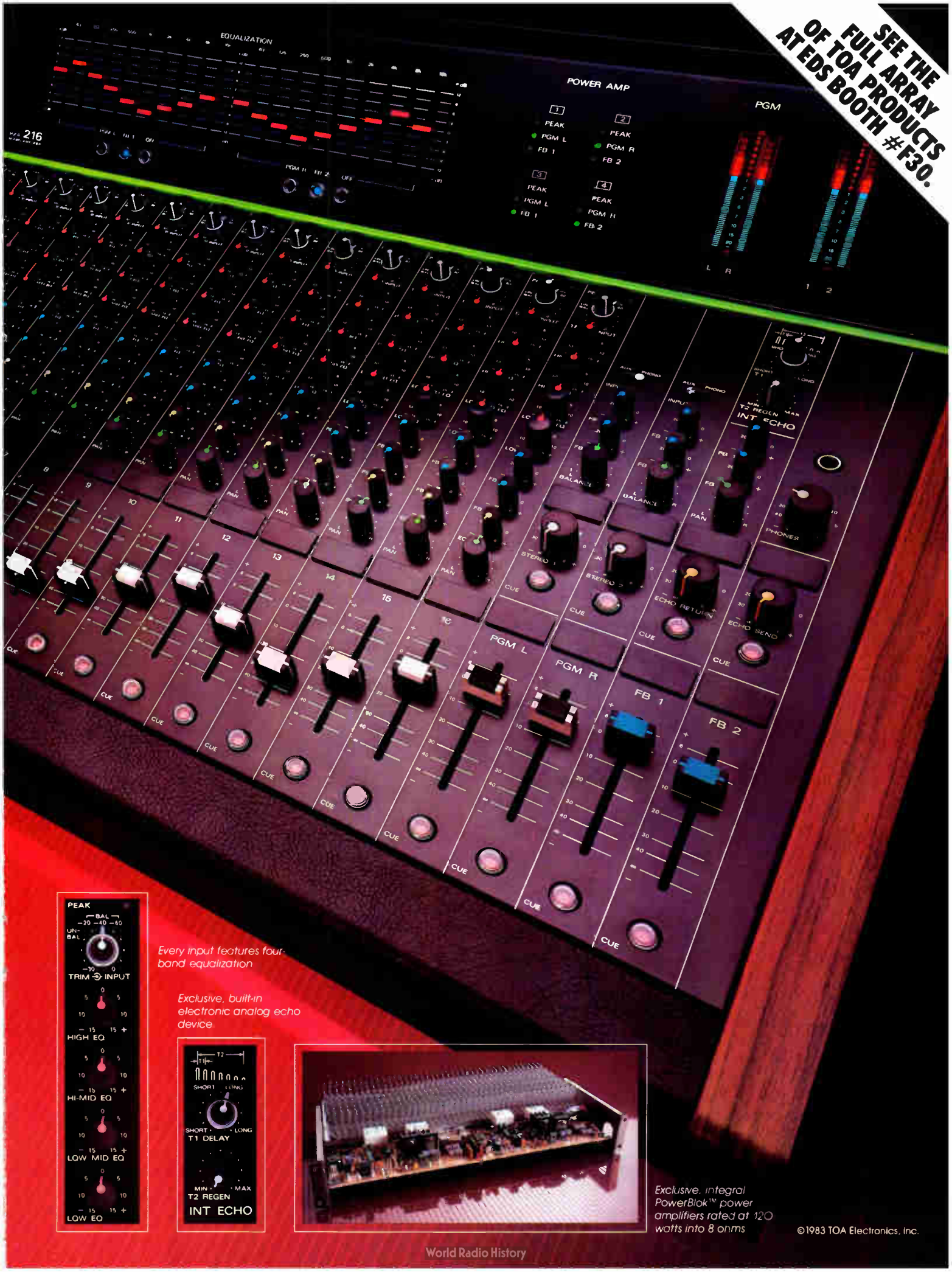


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10 10

HI-MID EQ

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LOW EQ

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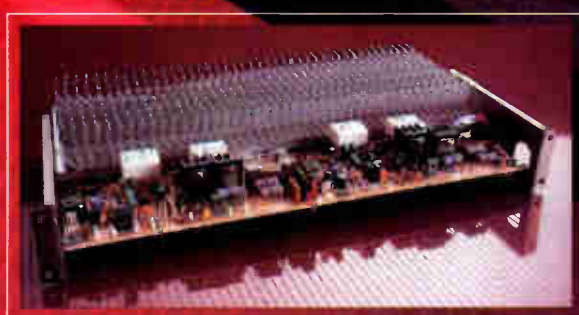
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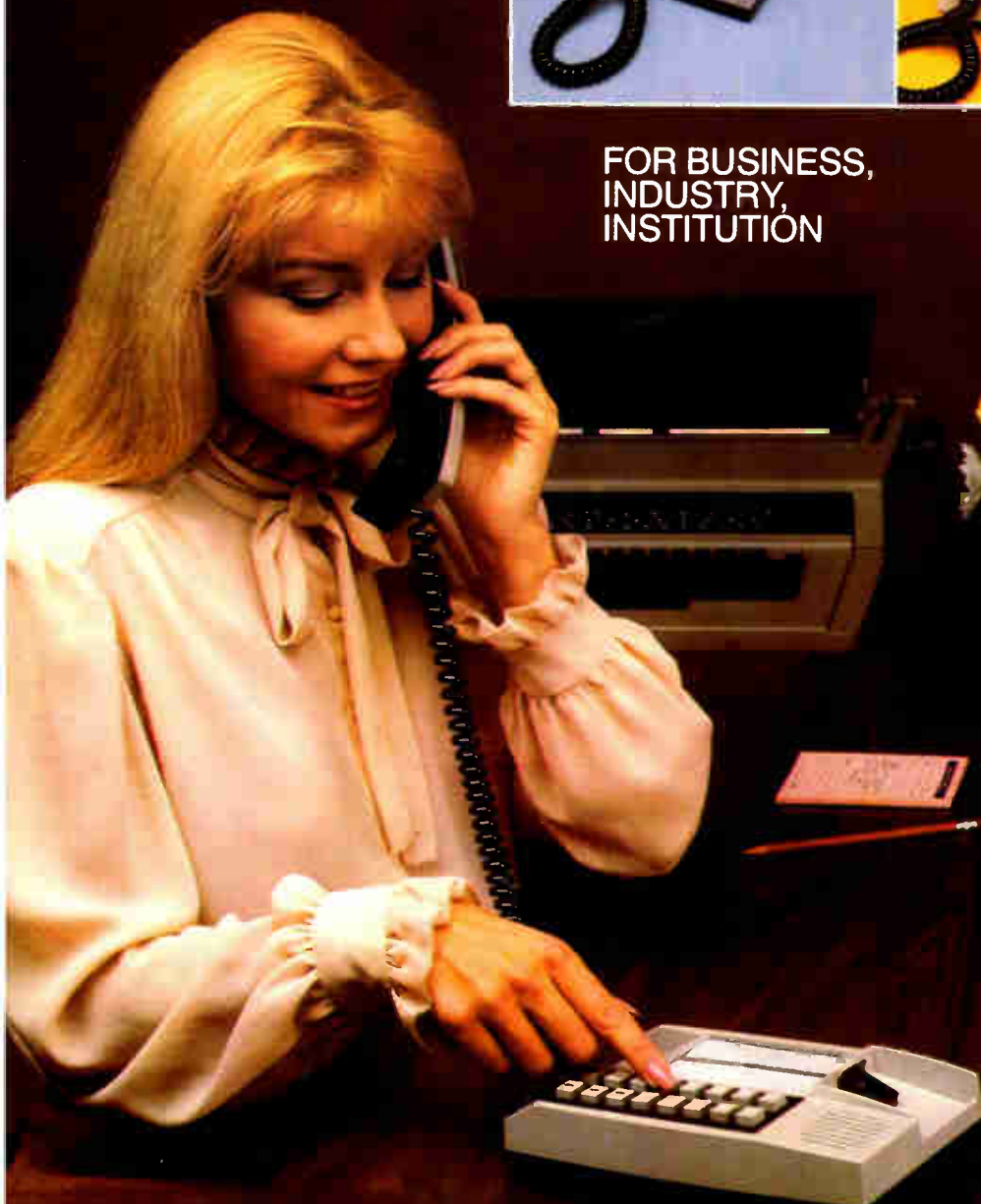
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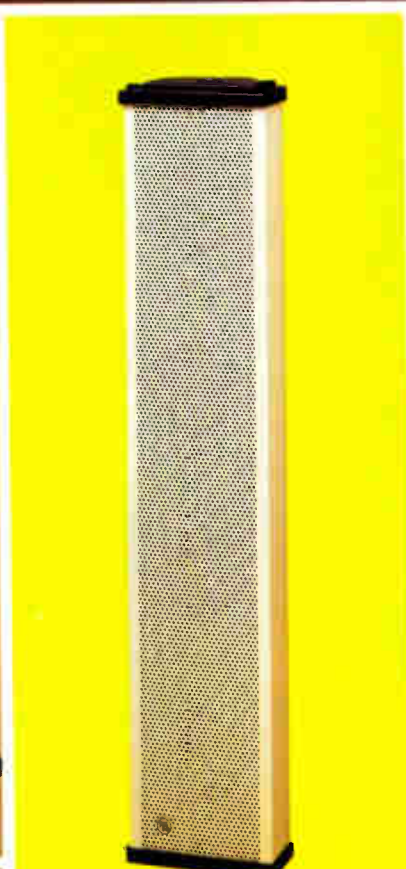
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Leafing through Pagers' History

Leon J. Hensen, Rogers Aircall vice president of engineering, holding a World War II walkie-talkie. This collection of radio pagers and radio communications devices is displayed at the Rogers Aircall museum.

The evolution of the radio paging industry has come a long way since the mid-1950s, when “beepless” subscribers (mainly doctors) had to call the operator to determine if their code number was being transmitted.

As compared to modern-day computerized paging, the process was very primitive in 1953 when Rogers Aircall introduced the first Chicago-land radio page system.

“Don’t Beep Me, I’ll Call You”

This early paging system provided each subscriber with a three-digit identification number, but the pagers had no “beep” to them. Instead, a subscriber had to listen once every

15 minutes or so to hear if his number was being read. The early device which broadcast the subscriber’s number was considered ingenious. The playing mechanism, a disc about a foot and a half across, had slots cut into it. Each subscriber’s number was voice recorded onto magnetic tape and attached to the top of a little block which would fit into the slots on the disc. As a page was called in to a Rogers Aircall phone operator, the subscriber’s “block” was inserted into the disc so that the piece of tape was flush with the top of the disc. A magnetic tape head “read” each number from the disc once a minute. After the subscriber heard his

number, on a small AM receiver, he would call his home or office for the message. His home or office would then call Rogers to tell them the subscriber had answered his page, and the block could be removed from the disc. Without notification, the block would be removed automatically after two hours.

This awkward service had an absolute capacity of just under 1,000. Today, Rogers Radio Communication Services, Inc. has over 27,000 subscribers in a 70-mile radius from Chicago.

Rogers Aircall Museum

In what is considered the most complete museum of radio pagers

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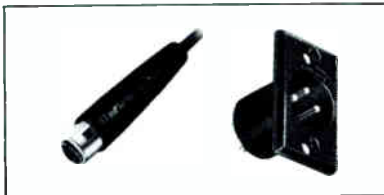


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Typical of the product line are exclusive "Q-G" audio connectors which have helped make Switchcraft the leader in professional audio connectors. "Ground Connectors" and "Ground Terminals" assure firm, constant electrical ground continuity between mating connector shells.

Switchcraft's sound component line has hundreds of types and styles of phone/phono jacks & plugs, push-button & slide switches, patch cords/components, and accessories . . . all designed to provide reliable audio connects and consistent control of power, ground and signal circuits.

Leading sound cable assembly manufacturers use Switchcraft components, like the Silent Plug, a device to cut off annoying, jarring noise when hooking up sound equipment. And there's the "Miti-Plug" – especially rugged, good looking plug designed to take the roughest treatment over long use.



New Black Velvet finish "Q-G" connectors/receptacles. Cost effective, extremely durable. Streamline design enhances the appearance of the most modern equipment. Built to withstand hard use; studio & stage abuse. Circle



Silent Plug cuts snap, crackle, pop out of interconnecting live audio equipment. Rugged 1-piece tip rod staked into tip-terminal for tight fit with jack. "Miti-Plug" – ruggedly-built 2-conductor, super slim shape, bright brass handle for added beauty. Circle



New bi-directional transformers connect low and high impedance audio equipment and systems. Designed for consoles, mixers and other equipment in the 20 Hz to 20 kHz range. Series 9000 Line Matching Transformers permit low to high impedance hookups and vice versa. Circle

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and radio communications devices, the Rogers Aircall collection traces the history of beepers from their earliest conception to the world's most sophisticated systems.

"Following the first 'mechanical-manual' pocket pager, the Rogers Aircall made a giant step forward when it introduced the first pager that transmitted an alert beep to the subscriber," stated Leon J. Hensen, the firm's vice president of engineering.

Another factor that limited the effectiveness of paging in the early 50s was the use of AM-type transmission. This meant a restricted

range, no penetration of buildings and the loss of signal when other obstruction blocked the AM broadcast.

In the middle 60s selective pagers took off on a large scale when Rogers Aircall went into FM radio band transmission. This meant a much more reliable signal, complete penetration of buildings and a much wider range of reception.

The "Talking" Pager

Then, along about 1967, the tone and voice pager marked another milestone in the evolution of paging systems. This unit not only gave the

subscriber a beep, but could also send a voice message of pre-determined length.

As the state-of-the-art progressed, transistors and high-density electronic memory chips became available, making the pager even smaller and lighter in weight, to be worn on the belt, in the shirt pocket or purse.

Other paging advances rapidly came on the communications scene. Improved tone and voice models, including the "silent" vibrating pager, were introduced by Rogers Aircall. Then a dual-tone unit that provided either of two pre-determined locations to call offered an added service. This pager even included a light to advise the subscriber which of the two locations the call came from. Coupled with this wide variety of paging services was the introduction of touch-tone dialing that further automated and speeded up the transmission from caller to subscriber.

Computerization Adds New Dimension

Coinciding with these developments, computer technology and sophisticated circuitry added another dimension. No longer were there constant busy signals, and where earlier service took over four seconds to make a pager alert, pager calls can be made in 200 milliseconds. This opened up high capacity paging terminals capable of processing millions of calls for more than 100,000 subscribers in the Chicago area. Evidence of this expanding art is that even with such large volume, the chance of getting a busy signal is only one in an average of 1.5 million calls.

Wrist-Watch Pager Coming

Looking ahead, the Rogers Aircall museum is destined to grow as new radio paging technologies are added to the communications art. The digital display pager has become a reality, whereby virtually millions of coded numbers can be offered to subscribers, with coverage extended to a radius of over 100 miles. And, according to Hensen, Rogers will be introducing shortly a miniature mobile printer that works via radio transmission off the car's 12-volt battery, capable of continuous word messages.

What next? The wrist-watch size pager is certainly a possibility in the not too distant future, Hensen stated. □



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April 19-21: Mini/Micro-Northeast, New York Coliseum, NYC. (Electronic Conventions, Inc., 8110 Airport Blvd., Los Angeles, Cal. 90045. 213 772-2965)

April 27-29: Synergetic Audio Concepts' Workshop on Loudspeaker Arrays, Syn-Aud-Con West Coast Seminar Center. Also, June 8-10, Workshop on Microphone Applications. (Synergetic Audio Concepts, P.O. Box 1115, San Juan Capistrano, CA. 92693. 714 496-9599)

May 3-5: Electronic Distribution Show & Conference, Las Vegas Hilton, Las Vegas, Nev. (Electronic Industry Show Corp., 222 S. Riverside Plaza, Chicago, Ill. 60606. 1 312 648-1140) **Contractors Conference Expo**, in tandem with EDS '83. (National Sound and Communications Assoc., 5105 Toll-view Dr. #201, Rolling Meadows, Ill. 60008. 312 577-8350)

May 10-12: Northcon/83 High-Technology Electronics Exhibition and Convention, Portland Coliseum, Portland, Ore. (Electronic Conventions, Inc. Address above)

May 16-19: 1983 National Computer Conference, Hilton At The Park, Anaheim, Cal. (American Federation of Information Processing Societies, Inc., 1815 N. Lynn St., Arlington, Va. 703 558-3612)

May 31-June 2: EIA Telecommunications Group Seminar, Trends and Directions, Dunfey's Hyannis Hotel, Hyannis, Mass. (EIA. Address above)

June 2-5: Society of Telecommunications Consultants Spring Meeting, Industry Hills Conference Center, City of Industry, Cal. (Society of Telecommunications Consultant, One Rockefeller Plaza, New York, N.Y. 10020. 212 582-3909)

June 4-8: Associated Telephone Answering Exchanges Annual Meeting, Sheraton Hotel, Bal Harbour, Fla. (ATAE, 320 King St., Alexandria, Va. 22314. 703 684-0016)

June 14-16: Ohmcon/83 High-Technology Electronics Exhibition and Convention, Cobo Hall, Detroit. (Electronic Conventions, Inc. Address above)

June 19-22: International Conference on Communications, Sheraton Hotel, Boston, Mass. (Paul Spiers, New England Telephone Co., 185 Franklin St., Boston, Mass. 02107. 617 743-3731)

August 21-24: International Background Music Association Convention, Hyatt Hotel, Lake Tahoe, Nev. (IBMA, 4949 W. Belmont, Chicago, Ill. 60641. 312 685-7850)

August 23-24: Indycon '83 Microcomputer/Electronic Components Show, Indiana Convention Center, Indianapolis, (Indycon '83, 8326 Trace Circle, Indianapolis, Ind. 46260. 317 875-7711)

September 13-15: Midcon/83 High-Technology Electronics Exhibition and Convention, O'Hare Exposition Center and Hyatt Regency O'Hare, Rosemont, Ill. (Electronic Conventions, Inc. Address above)

October 26-November 1: Telecom '83, Geneva, Switzerland. (Electronic Industries Association, 2001 Eye St. N.W., Washington, D.C. 20006. 202 457-4981)

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In 1975 Fourjay produced the first all non-metallic Re-entrant Paging/Talk-back Horn Speaker. Most recently they introduced the compact Model 440 Thundering Mini, 40 watts continuous speaker with response 500 to 7000 hertz.

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PEOPLE

The new general sales manager at Yesco, Inc., Seattle, is **G. Paul Sullivan**. With a background in radio programming in Detroit, Los Angeles and Seattle, he will coordinate the nationwide foreground music service firm's marketing activities.



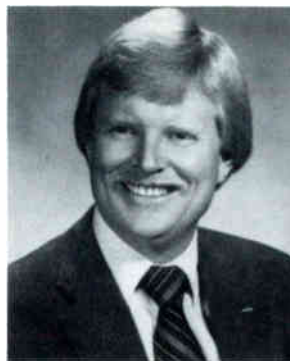
Sullivan



Romeo

Joining the professional products division of Bose Corp., Framingham, Mass., **Steve G. Romeo** will be product specialist. He will head the company's liaison program with acoustical consultants and sound system designers, and will offer application assistance to sound contractors and end-users of Bose professional products. Romeo had been chief of design for Scenario Systems and president of Destiny Light and Sound.

The newly created post of sales manager for the Dallas/Fort Worth region at Comcast Sound Communications, Inc., Dallas, goes to **Bill Haddon**. **Thomas D. East**, vice president, marketing, moves to the company's Philadelphia headquarters, relocating from Dallas.



Haddon



East

Comcast Sound designs and constructs sound and communication systems and is also the largest network of independent Muzak affiliates. Other Comcast divisions include Comcast Cable Communications and Storecast Corp. of America.

Robert Gray has been named vice president, retail markets for Audio Environments Inc. (AEI), Seattle. He will be based in AEI's New York City offices, guiding the firm's presentation of contemporary music programming for the retail and hospitality industries. Gray had been executive vice president of Yesco; earlier he was president of Segway, Inc.

All you need to give any PBX multi-zone paging: Voicepac.



Low-cost Voicepac adds selective "soft" paging and handsfree intercom to any PBX or key telephone.



Voicepac can make your customer proposals super-competitive (and more profitable) by adding multi-zone paging, handsfree intercom and other features — all at very little cost.

Customers love it because it eliminates blaring speakers and offers "soft" paging over each phone. You'll both like it because there are no expensive speakers to install.

But Voicepac actually adds a whole host of appealing features to any PBX or key system: individual station paging; group paging; all-call paging; handsfree intercom; privacy tone; station add-on. And it's so simple. No modifying phones. Voicepac's transducer fits

inside any telephone base and connects to a spare pair.

Choose Voicepac in systems for up to 15, 25, 50 or 75 stations. (You can even use it as a stand-alone intercom for clinics, etc.) And it comes with a 1-year limited warranty.

Give yourself a big edge in the bidding. Get details on Voicepac by writing Xtel, 1301 Cornell Parkway, Oklahoma City, OK 73108. Or call toll free 1-800-654-XTEL; within Oklahoma (405) 946-1200.

Xtel

NEW PRODUCTS

LEVEL DISPLAY

A user-programmable peak hold LED audio level display, Model 511, incorporates highly linear, dual-phase peak detectors, both line level (dBm) and power level (dBw) inputs.



In use, the highest LED is digitally held while the lower LEDs continue to function in real time. The peak hold circuitry functions in both the dBm and dBw modes and is operated by turning the mode selector button on the front panel to the desired hold time. The instrument will find application in situations requiring a highly accurate indication of audio signal level: studio and broadcast consoles, disc mastering, tape duplication, audio-visual, communication and sound reinforcement. An entire tape can be monitored and the highest level stored prior to being duplicated or cut on a disc, sync pulse level can be measured and stored for comparison, amplifier output can be stored—all without an operator present to record levels. Continuous level monitoring is also enhanced with shorter hold times. The unit comes in horizontal or vertical format. Rack panels are available for combinations of one, two or eight displays.

□ For more information write 381 on the inquiry card. Or write: Audio Technology, 1169 Tower Rd., Schaumburg, Ill. 60195.

COMPONENT CONTAINERS

Neutro-Stat conductive modular tote boxes, kitting trays, and stack bins are constructed of carbon impregnated polypropylene resin, which safely dissipates static charges. Unlike ordinary plastics, they will not generate static electricity during handling. All units conform to DOD-STD-1686A and DOD-HDBK-263. The tote boxes are available in eight sizes, and will accommodate long and/or short divider inserts, which allows com-

partmentalizing to as small as 1" x 1". They are stackable and can be supplied with snap-on covers for additional protection. The kitting trays have permanently molded-in dividers which form individual compartments for organizing components at the electronic assembly work station. For parts identification, pressure-sensitive labels may be affixed to the flat, top surface of the dividers. The trays are stackable, and available in one size, with either nine or twelve compartments. The stack bins are designed for easy access to parts at the assembly work station. They are stackable and are designed to allow gravity feeding of components.



□ For more information write 382 on the inquiry card. Or write: Simco Co., Inc., 2257 N. Penn Rd., Hatfield, Pa. 19440.

SPECTRUM ANALYZER

The Banner 1232 1/3-octave real-time audio spectrum analyzer/SPL meter has double-tuned filters, providing very high selectivity without the loss of interband frequencies. This high-Q performance is the result of an electronic filter shaping circuit that exhibits the steep skirts and somewhat flap-top shape of conventional double-tuned, four-pole filters, but does so with about half of the electronic parts of lower performing single-tuned (2-pole) designs. The instrument provides 31 ISO bands from 20 Hz to 20 kHz, with frequency distribution displayed on a 12 x 32 LED matrix. Features include the ability to accurately measure broadband SPL with an optional calibrated microphone, two phantom powered (15 v)

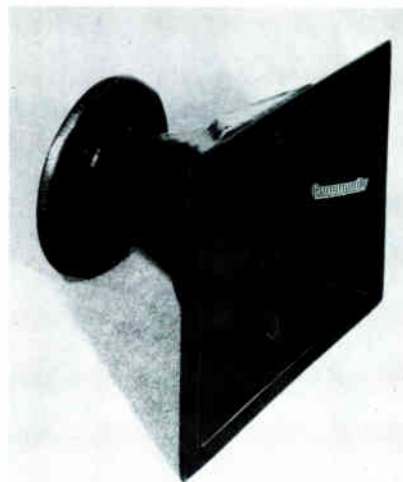
mic inputs that let the user check from two locations and two line level inputs. Three SPL decay rates are available using the front panel switch. Meter reference range is 65 to 120 dB, with selection of 1, 2 or 3 dB per step. Digital pink and white noise generation is built-in. The unit has standard rack-mount dimensions of 19" wide by 3 1/2" high and is housed in a rugged steel enclosure.



□ For more information write 383 on the inquiry card. Or write: MXR Innovations, Inc., 740 Driving Park Ave., Rochester, N.Y. 14613.

HORN

A compact constant-directivity horn, Model PC494, fits any 2-inch-throat compression driver; adapters are available for 1.4-inch and 1-inch screw-on drivers. The special pattern control includes a "dispersion control vane" which maintains the rated coverage pattern over a wide frequency range. The unrestricted throat eliminates undesirable throat reflections and reduces throat distortion. The one-piece, balsa-reinforced fiberglass construction virtually banishes undesirable resonances and maintains strength combined with light weight and weather resistance.



□ For more information write 384 on the inquiry card. Or write: Community Light & Sound, Inc., 333 E. 5th St., Chester, Pa. 19013.

WIRE STRIPPER

A lightweight V-Notch wire stripper uses a convenient, thumb-adjustable cam to quickly adapt to wire ranging from 10 to 28 AWG.



Designed for solid and stranded copper or aluminum wire, it weighs 3 oz., and has vinyl-cushioned curved handles for user comfort and to minimize fatigue with repeated use. The tool also serves as a wire cutter, and has hardened carbon-steel blades for consistent stripping performance and long life. Because of its small size and versatility, it is especially well suited for wire-assembly operations as well as for the electrician's tool kit. Both spring-loaded and non-spring models are available. A positive mechanical lock keeps the tool closed when not in use.

For more information write 385 on the inquiry card. Or write: Ideal Industries, Inc., Becker Pl., Sycamore, Ill. 60178.

MESSAGE REPEATER

The Mini Persuader, a message repeater for in-store merchandising, may be used with most public address or background music systems. It uses standard audio cassettes to provide a conveniently obtainable and compact medium for message storage. The cassettes also offer an inexpensive means for producing and duplicating messages for distribution to branch stores.



The unit will record up to sixty messages, which can be repeated in any sequence chosen by the user.

For more information 386 on the inquiry card. Or write: Phi Technologies, Inc., 4605 N. Stiles, Oklahoma City, OK 73105.

CONTROLLER

The X10 is a microprocessor-controlled unit for cycling two reversing tape machines. It provides reliable, trouble-free control of music systems that require long, unattended operation. The device selects the proper head track and switches audio, allowing for 4-track monaural or 2-track stereo formats. A built-in cue amplifier and speaker make it easy to cue tapes or check air quality. Built-in silence sense circuitry can be used to advance the controller, or 25-Hz sensing circuitry (optional) may be used to sense tones off the tape. In this case, the X10R may be ordered with a 25-Hz notch filter installed. The unit provides a high-level transformer stereo output or two monaural outputs. With a firmware change, the device can control four non-reversing tape machines in either a stereo or monaural format.



For more information write 387 on the inquiry card. Or write: Microprobe Electronics, Inc., 875 N. Michigan Ave., Chicago, Ill. 60611.

CROSSOVER

The S27 Crossover/4-Band Processor Module splits the audio signal into four bands with crossover points at 220 Hz, 1.6 kHz, and 4.5 kHz. The four signals are then routed out for processing, or, if used as a crossover, to drive amplifiers. If the band-split signals are processed by any external devices, they are then returned to the S27, where they are re-combined. The unit makes use of 12-dB/octave fully phase-compensated filters—there is no phase shift. The device uses differential balanced input and outputs. Clip level is +22 dBm; total distortion is better than .05%, and noise better than -85 dBm.

For more information write 388 on the inquiry card. Or write: Audio + Design Recording, Inc., P.O. Box 786, Bremerton, WA 98310.

DIGITAL DELAY

The 1745M modular digital delay offers delays of up to 2.5 seconds (5 seconds in the "double" mode) to each output. Up to five output modules may be installed in the mainframe. Frequency response is 50-15 kHz \pm 1 dB at all delays up to the 2.5-second maximum. To accommodate 1745M units already in operation, a retrofit kit is available to add the new, much longer maximum delay.

For more information write 389 on the inquiry card. Or write: Eventide Clockworks, Inc., 265 W. 54th St., New York, NY 10019.

CCTV MONITOR

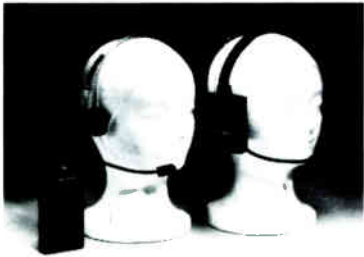
A 12-inch monochrome video monitor, Model 12VM968, offers horizontal resolution of 800 lines or better, for clear images, and the availability of optional P-31 green phosphor, for a wide spectrum of uses. It features all-silicon solid-state circuitry providing maximum performance and stability, long life and low power drain. Major controls are accessible up front for ease of operation. The single-module construction is plugable to provide any possible on-the-spot maintenance.



Other features include bandwidth of 12 MHz, geometric distortion less than \pm 5% of display height, switchable 75-ohm termination provided for loop-through connection on video input, BNC connectors, AC fuse and convenient carrying handles. The monitor is designed to meet UL-478 requirements and has a superior gray scale plus VTR capability.

For more information write 390 on the inquiry card. Or write: Audiotronics, 7428 Bellaire Ave., N. Hollywood, Cal. 91605.

Sound and Electronic Systems Installers



PRC-1 Rugged, pocket-size transceiver
PRC-2 Totally self-contained headset

EasyTalk™

Voice-Activated, 2-Way Radio

Stay in Touch With Every Part of the Job

Coordinate every part of your next installation. Test a system from several points at one time. You'll improve your efficiency tremendously. And you'll spend less time on every job.

Your Hands Are Freed By EasyTalk's Voice-Activated Mike

Just talk and be heard. Forget about bothersome walkie-talkie buttons. Use both hands to get that system installed, tested, perfected. And EasyTalk's mike automatically adjusts to your voice level. It's so sensitive you can whisper and your partner will hear you.

EasyTalk's "smart circuitry" shuts down your transmission circuit when you stop talking. So you won't have to change 9-volt batteries as often as ordinary walkie-talkies.

A Headset So Light, You'll Forget It's There

It's a featherweight but it's durable. EasyTalk's foam ear cushion fits snugly and comfortably against your ear. So you get clear, private sound in one ear. But you still hear what's going on with the other. You can even wear it comfortably under a hard hat or a helmet.

Built to Rugged Military Specs With a Big 1/2-Mile Range

EasyTalk's 49 MHz transceiver punches out your message sharp and clear for 1/2-mile or more, so you can use it on your biggest jobs. There's no interference from walkie-talkies or CB's. And EasyTalk's casing is built to survive storage in your tool box or trunk.

Put EasyTalk To Work For You — Now!

The fewer distractions — like pushing buttons to talk to your partner — the better, easier, faster your work goes. That means fewer service calls, more satisfied customers, and more work for you. EasyTalk helps you do all that.

\$89.95 each unit

Now Only \$179.90 per pair (you need two units to send and receive). EasyTalk comes ready-to-use, no FCC license required. Call today!

1-800-233-0013

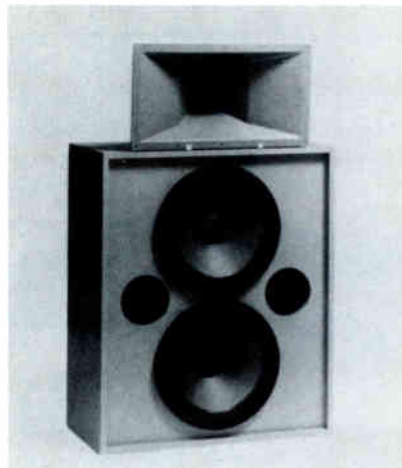
In PA call (215) 887-8600

Dealer Inquiries Invited

ADVANCED
VIDEOTECH
CORPORATION
PO BOX 122 SOUTHAMPTON PA 18966

SPEAKER SYSTEM

Model A6A is a loudspeaker system in the Voice of the Theatre line; it combines a compact, optimally tuned dual-woofer enclosure with special mid-size constant directivity horns. The tuned cabinet, designed in conjunction with the high-efficiency 16-inch woofers, assures solid, powerful bass and realism in voice reproduction. Due to the technology of the Mantaray horns and the high-performance compression driver, the same rich mild and high-frequency sound reaches listeners both directly in front of the loudspeaker and off to the sides. Overall, the A6A is less than 20-inches deep.

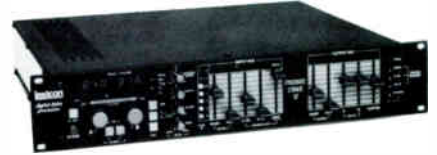


□ For more information write 391 on the inquiry card. Or write: Altec Lansing, 1515 S. Manchester Ave., Anaheim, CA 92803.

DELAY PROCESSOR

Model 95, the Prime Time II, is a digital effects processor with two independently adjustable delay outputs. It includes complete input and output mixing and a wide array of control and interface capabilities. The device combines microprocessor-controlled digital signal processing technology with low-thermal, high-reliability packaging. Delay capabilities are 1.92 seconds standard and 7.7 seconds with memory option. Special dynamic recirculation control (DRC) and metronome features are included, permitting the unit to be used as a short-term digital audio recorder, to create dramatic sound-on-sound layering effects. The DRC automatically controls the level of recirculating delays to provide clean articulated phrasing with long decaying echos at the end of phrases. The metronome feature, when used with the infinite repeat,

allows creative use of captured delay loops, which may be synchronized by the metronome clock, to drive external automatic drum and synthesizer equipment. Prime Time II utilizes PCM encoding technology which contributes to its fine audio performance. It provides ultra-low distortion of 0.04% throughout its full power bandwidth, 90-dB dynamic range and 20-Hz to 16-kHz audio bandwidth.



□ For more information write 392 on the inquiry card. Or write: Lexicon, Inc., 60 Turner St., Waltham, MA 02154.

BACK-UP ALARMS

The Warn-A-Larm series now boasts 115-VAC Evacuators models in 97 and 107 decibels and 48-VDC versions with 87 and 97-decibel ratings. These back-up alarms feature a piezo-electric output circuit that takes the place of the heavy magnetic coil and speaker found in conventional electronic alarms. The piezo design makes the Evacuators virtually impervious to vibration damage. The innovative circuitry also draws about one-tenth the power of coil and speaker alarms. Although the Evacuators are more rugged than conventional alarms, they require less than nine square inches of mounting surface. The alarms' compact size also helps prevent damage due to impacts.



Available in 87, 97, 107 and 112 decibel outputs, the Evacuators meet all SAE performance specifications for back-up alarms, SAE J994b.

□ For more information write 393 on the inquiry card. Or write: Warn Industries, 19450 68th Ave. So., Kent, WA 98032.

INTERCOM

"HDP" phones provide intercommunication for industrial environments. These "page/reply" units have been designed especially for use in heavy-industry applications.



The tough, waterproof phones provide a quick and reliable means of locating and speaking with key personnel. These units can be integrated with the supplier's standard-duty and explosion-proof phones, forming an efficient communications network for both office and manufacturing facilities. In addition to providing on-site intercommunication, the system easily interconnects to outside telephone circuits, if desired. The phones are available in both single and multi-channel configuration. They feature thick-wall fiberglass cases (NEMA 4X/13) and corrosion-resistant hardware. The handset has a convenient bar-type "push-to-page" switch and comes standard with a six-foot neoprene coiled cord. To make installation quick and easy, "insulation-displacement" connecting blocks are used. To facilitate service, a phone can be unplugged and exchanged for a new unit in a matter of seconds.

□ For more information write 394 on the inquiry card. Or write: Encom Products Co. Inc., Box 300, Oxford, PA 19363.

EQUALIZER

The DN301 Attenuating Equalizer features 15 db of cut at 30 1/3-octave I.S.O. center frequencies between 25 Hz and 20 kHz. The filters provide smooth combining action, even with large amounts of attenuation applied. Sweepable high and low pass filters are also included with the low pass filter featuring switchable slope (6 or 12-db/octave). Up to 20 dB of overall gain is available to restore the signal to unity gain. The DN301 is supplied with a security cover, and transformer balancing is available as an option.

□ For more information write 395 on the inquiry card. Or write: Klark-Teknik Electronics Inc., 262A Eastern Parkway, Farmingdale, NY 11735.

POWER AMPS

The CM 925 professional power amplifier delivers 250 watts per channel into 8 ohms, and 400 into 4 ohms. Input levels are controlled by eleven-position stepped attenuators. Output power levels are indicated by use of 10 color-coded LEDs. Front-mounted professional circuit breakers offer speaker protection and a pair of amber LEDs

indicate possible overtemp conditions before sonic degradation or amplifier damage can take place. D.C. offset protection and silent switch-on are handled by a high-speed relay and LED indicators show that the amplifier is in the standby or protection mode. Model CM 915 delivers 150 watts per channel into 8 ohms and 225 watts into 4 ohms.



It has many of the features of the 925, including stepped attenuators, power output LEDs, overtemp indicators and circuit breakers. The unit can be used in the bridged mono mode. For applications where lower power or bi-amplification are used, the CM 910 at 70 watts per channel into 8 ohms is suitable. LED power output indicators are standard, as are overtemp indicators and a mono bridge mode switch. All CM amplifiers are 19" rack-mountable as standard.

□ For more information write 396 on the inquiry card. Or write: CM Labs, 8000 Madison Pike, Madison, AL 35758.

A class 1 idea from a first class company.

Community's new Class I Program makes a select group of high-quality Community products available at extremely competitive prices and on a hassle-free non-exclusive basis. So you get the best quality sound components money can buy at about the same price you'd pay for a mere copy... an idea that's Class I all the way down to the bottom line. Call for complete information today. And stop settling for second best.

Community
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Chester, PA 19013 (800) 523-4934

Intercom Is Still

“In”

On the occasion of the first demonstration of his invention of the telephone, Alexander Graham Bell said, “Mr. Watson, please come here. I want you.” This was to his assistant two floors below. In reality this was more a demonstration of *intercom*, than an application of the *telephone*, as we understand it today. He was using the new invention as a communication system within an office—i.e., *intercom*.

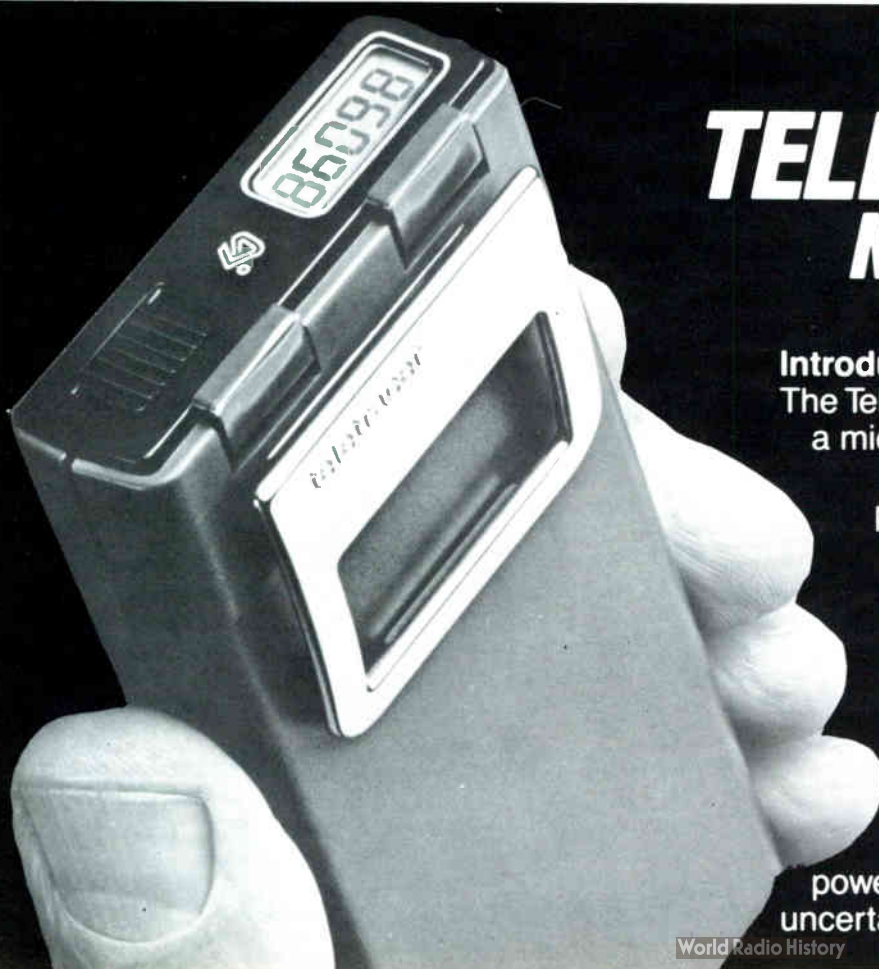
For years the intercom and the telephone were employed side by side. When the interconnect industry made available their up-to-the-

minute telephone systems with some 40 features, they promptly declared that intercom was dead. It only remained to be buried. The claim made was that the new telephones could do all that an intercom could, plus extra services for outside the immediate vicinity.

However, the intercom industry refused to be buried. As a matter of fact, it even refused to believe it was on its sickbed. True it was that America slowly gave up the manufacture of few-line intercom systems. The giants of that industry, with big-line availability, went into the health care industry. Hospitals

needed intercoms, with their ability to locate doctors and nurses who could be anywhere within the building. Businesses showed a tendency to wear themselves away from these instruments. One business person told me, “They aren’t chic.” Not to be compared to the deskset of a telephone, with LEDs glowing like a computer, plus dozens of coded buttons. A person with that set on his desk must be important.

Intercoms fall into three broad categories, plus a variation or two. This will be dealt with later. The original units were in the simplex mode. A conversation could go only



TELETRACER 2800 **No. 1 in Paging**

Introducing the intelligent paging system.

The Teletracer 2800 is the first paging system with a microprocessor built *into* every receiver.

The result? A receiver that’s fully programmable. And flexible. Addresses can be programmed or, if necessary, changed in seconds. Effortlessly.

The amazing 2800 receiver.

Each lightweight receiver features a full five digit liquid crystal display to communicate messages and receiver status.

If the receiver is out of power, low on power or out of range, it tells the user in no uncertain terms.



The ITT 511E system.

in one direction at a time. Press a button to talk, release to listen. This meant that the end of one person's speech had to be announced before the other could answer.

Another system employed is a common-channel unit. A button is pressed on the handset, allowing a voice announcement to be made. This type of system is frequently heard as a paging device.

The third, and the most sophisticated, is the duplex system. Voice-

switched, it allows a two-way conversation without pressing any button. VOX, as it is called, is a voice operated switch that recognizes when one person is through talking. A pause instantly switches the talk path over to the other party.

"There are three ways someone can be located quickly with a duplex intercom," said Ron Stone, President of ITT's Data Equipment and Systems Division and an 18-year veteran of the intercommunications field. "Using a voice announce-

ment, a digital light, or by means of a pocket pager." The choice of modes depends on the features included in the intercom package.

A problem with VOX is that it responds not only to voice but to noise. A caller in a noisy area will dominate the conversation entirely, due to the sensitivity of the switching circuit.

The ITT unit offers a variation on the VOX unit. If the handset is picked up, the unit switches automatically to telephone duplex, killing the VOX switching.

Stone went on to point out that there is a tendency to reduce the number of workers within an organization. Yet to produce the same output, higher efficiency is demanded from its employees. Every minute counts. "If 10 key people waste half an hour a day in walking time, at \$20 an hour each, \$200 is wasted each month, or \$24,000 a year. With the calculation of five percent after taxes, that amounts to about \$50,000 worth of

And, as you might expect, the options are truly mind-boggling. For example, you can specify programmable features such as volume control, and automatic or manual speech acceptance.

For high noise areas, you can even order receivers that vibrate.

This receiver has a mind of its own.

There's a "do not disturb" mode to screen all but urgent calls. As well as a call transfer feature.

Virtually unlimited "group call" or "all call" capabilities fulfill the emergency communications needs of any organization.

And, a universal paging adapter makes all 2800 system features available from phone or intercom stations.

Link up with the ultimate connection.
The Teletracer 2800. The intelligent paging system. The intelligent choice.

To find out how you can participate in our expanded distribution program for Teletracer's full line of paging, intercom and hospital communications systems, call Leonard Lipsky.



Nira International Incorporated
175 Great Neck Road
Great Neck, NY 11021
Tel: (516) 829-6586
Telex: 14-6333



new business that must be generated to make up for that loss." If 30 minutes per day per person seems excessive, it can be seen in a different perspective as segments of five minutes wasted six times a day.

American manufacturers continued to meet the demand for simplex and common-channel systems. Scandinavia, on the other hand, has owned the majority of the patents on duplex systems. The Japanese and the Germans got into the act recently to challenge this exclusivity. Nevertheless, Standard Radio and Telefon AB, the Swedish subsidiary of ITT, holds over 25 percent of the world's duplex system, with more than half-a-million lines installed since 1962.

One big reason for the resurgence of intercom is that it offers some of the same features as does a telephone system, with a simpler practicality. Microprocessor-controlled

with memory, stored-program controlled systems are the fourth generation of technology in the world of intercom. That's the technical side. The personal element also enters into it. Everyone is on the move in today's busy offices. A call comes in, an answer is needed. No one is there to answer. "Hold please." Intercom dial. No dialing levels exist. The choice remains between an excellent telephone with a simple intercom system and a sophisticated but complex telephone with unused features.

If the telephone does what the intercom is able to do, plus the ability to reach the outside world, why have an intercom system as well? Here's a telephone on the desk with an overwhelming number of features built into it. Why add another system?

There's one catch to all of those features that seemed needed when

the salesman offered them.

If all were utilized daily, they would be remembered without having to check a code book like a CIA agent reporting back to Langley. What happens usually is that the rarely used features end up by not being used at all. To look them up each time becomes wasteful of time. They are forgotten and the code book gathers dust in the back of the desk drawer.

According to Ron Stone, the telephone is in use 40 percent of the average working day. Of that, 50 percent of the time it is employed internally. In the health care field, internal communications goes up to 80 percent.

Call-backs are reduced substantially by means of intercom. The phrase, "locate before communicate," aptly describes the advantage of the intercom. It frees the telephone for other calls. While the

TELETRACER 2500.

*The intercom
that speaks
for itself.*





The desk set in the 511E setup.

telephone is being employed between offices, incoming calls receive a busy signal, requiring the caller to hold until the intra-office call is terminated.

The intercom thus frees the tele-

phone to be employed exclusively for outside calls. Reduction of call-backs, according to Stone, can vary from 10 to 30 percent. "Not a small factor for a busy office," he went on to say. While the telephone joins

station to station, the intercom joins person to person, he added.

There are three models of master stations: One is designed for hands-free conversation only, one combined with the handset for privacy, and the last with the handset for soft speech only. Despite the options offered in ITT's units, only four wires are needed to unite each station to the exchange.

Model 511E is the umbrella for several types. It is a duplex system operating as a dual track system alongside the telephone or as a stand-alone intercom. The system contains several variations of exchanges. These can range from as few as six lines up to 8,000 lines, with traffic handling capacity designed for every need, from high to low traffic.

Their equipment is not sold by exclusive ITT distributors. "If we can't supply the best equipment, then our distributor can go to a competitive company to satisfy his customers, Stone concluded. □

A "hands-off" intercom that's as functional as it is handsome.

Teletracer introduces the first intercom with a liquid crystal display to announce who's calling, to confirm the station you've reached, to pass along important messages, and much much more.

Its voice quality is amazing. And its exclusive Teletracer features are even more amazing.

Even when the user is away, the intercom keeps on working.

With the Teletracer 2500, it's impossible to miss important messages.

Incoming messages—such as "call back" requests—are automatically stored in the 2500's memory, and displayed on the screen.

If one party wants to call back the last station to which he was connected, "automatic recall" does it for him—instantly.

When a user is going to be away, he has two unique options. He can either enter a message—such as the time or date he will return—to notify callers. Or, if he prefers, he can reroute calls to any other station in the system.

The correct time is displayed at the touch of a button. There's even a built-in alarm, to keep busy organizations running on-time.

It's easy to install. And ideal for installations of all sizes.

The Teletracer 2500 is the ideal system for as few as eight or as many as 3,000 user stations.

All stations are connected with modular plugs, for easy installation. An optional handset is available for both desktop and flush-mount stations.

Radio paging interface gives every 2500 station access to your pocket paging system.

Link up with the ultimate connection.

In the world of on-site communications, the name "Teletracer" speaks for itself.

To find out how you can participate in our expanded distribution program for our full line of paging, intercom and hospital communications systems, call Leonard Lipsky.



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Telex: 14-6333

Selling to Uncle Sam

by
Michael Keating

Some dealers might think selling to Uncle Sam is a complicated, time-consuming process, best handled through Washington. So here are a few pointers from dealers, manufacturers, and government officials that might simplify things; also some statistics on the federal market.

It's not necessary to journey to Washington to land federal business. Terry Miller, president of Gov-

ernment Sales Consultants, advises first-time sellers to government: "Go to your nearest General Services Administration (GSA) Business Service Center (see addresses at the end of this article) or call on federal building managers in your com-

munity and ask them about the federal market. Get a briefing on what their plans are for communications equipment."

Charles Rothstein of the Chicago Regional Office of Information Resources Management (part of the GSA and a major buyer of communications gear), says federal departments can buy locally with little red tape: "If Mr. HUD (Federal Dept. of Housing and Urban Development) wants to buy a 6-button set or some other piece of equipment, he can buy it locally without going through a formal bidding process." Each department/agency, however, has a price limit for these small, local purchases—sometimes \$150.

Does the federal government only buy from Bell suppliers? The answer is no. Miller at Government Sales Consultants reports that the federal government is getting away from relying exclusively on Bell. Says Miller: "More and more federal agencies are buying modems and switches from Rolm, Fisk, and other non-Bell suppliers. The Dept. of State, for instance, has an RFP (request for proposal) out now to convert 5,000 different phone lines to non-Bell." Further evidence: a recent GSA "Award Status" report shows more than half the federal installations listed have or are planning to acquire non-Bell PBXs.

Mr. Keating is senior market analyst at Penton/IPC's Marketing Information Center, and research manager for Penton's Government Product News.

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Some of the contractors mentioned in the report include: Fisk, Executone, GTE, COMPATH, and Teletronics.

Don Hardesty, head of the Telecommunications Systems Division in the federal Office of Regional Information Services (part of the Office of Information Resources Management), reports that the federal government still obtains much of its equipment through Bell, but "it could be a whole new world" under deregulation.

If dealers want to land federal purchase orders for non-Bell equipment, Claude Kleiman says, "It's essential that manufacturers list dealer and distributor locations on literature (such as GSA price schedules) that they send to federal agencies and offices." Kleiman is audiocom specialist at Telex Communications, a Minneapolis manufacturer of phone pagers, microphones, wireless systems, and related products. Telex sells to all levels of government, including federal.

Speaking of literature and schedules, dealers should check to see if the manufacturers they represent are on Multiple Awards Schedules (MAS) issued by the Schedules Division of the Office of Information Resources Management. The 9/15/82 MAS for intercoms, public address systems and related items lists 91 vendors who have been awarded contracts (good through 9/30/83) to supply federal agencies with indefinite quantities of these products. Dealers that represent manufacturers listed in the MAS already have a foot in the door of the federal government market.

So you've talked to counselors at your nearest GSA Business Service Center and have completed Standard Forms 129 and 3038 to insure that your firm is notified when some (but not all) federal agencies solicit bids from suppliers of communications equipment. At the Business Service Center, you've glanced at copies of "Doing Business With the Federal Government," "U.S. Government Purchasing and Sales Directory," and other useful publications. You've also checked with local federal offices to see if they need new communications systems.

What do you do now?

1) Scan Commerce Business Daily for possible sales leads. This Com-

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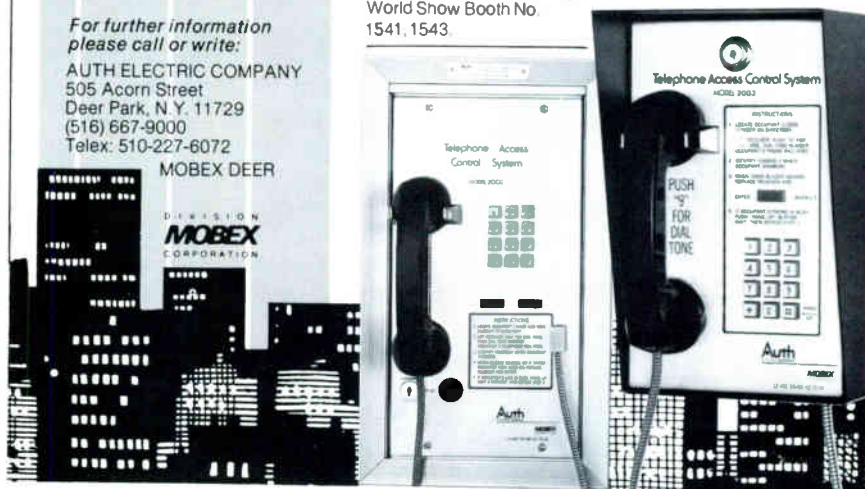
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merce Dept. publication lists many federal agencies that are planning to buy communications equipment and other products. Here's a small sample of sales leads in the 11/19/82 Commerce Business Daily:

PRODUCT

2 miniloop tunable transmitting/receiving antennas

9 frequency converters

Upgrade telephone switches & telephone cable plants at 20 Army installations

464 audio receivers

23 infrared booster igniters

321 desk-type telephone sets

Telephone equipment and accessories (to buy or rent) and servicing of equipment

159 intercom panel slaves

6 receiver/transmitter systems

3-receptacle cable assembly

Spare parts for receiver

681 panel telephone switches

32 circuit-card assemblies

4600 telephone sets (Type G touchtone) Western Electric switches

AGENCY/ADDRESS

U.S. Coast Guard, 8th District, New Orleans, La.

U.S. Army Communications-Electronics Command, Ft. Monmouth, N.J.

General Services Administration, Office of Information Resources Management, Washington, D.C.

Sacramento Army Depot, Sacramento, Calif.

Naval Supply Center, Charleston, S.C.

Defense Electronics Supply Center, Dayton, Oh. (The center, part of the Defense Logistics Agency, buys impressive quantities of headsets, handsets, tapes, black boxes, and other consumables).

Public libraries and GSA Business Service Centers often have *Commerce Business Daily* on display. Dealers can also order it through the Government Printing Office.

2) Contact the North American Telephone Assn., the National Burglar and Fire Alarm Assn., the Security Equipment Industry Assn., and other trade groups to see if they can help. According to Edwin B. Spievack, executive director of the North American Telephone Assn.: "Our group will be pushing hard to expand telecommunications procurement by the Defense Dept. and other federal executive agencies from independent manufacturers and distributors. One of the things we'll be working for is simplified acquisition procedures, so that delivery of products/services to government can be substantially improved."

Dealers can order the telephone association's "GSA Marketing Handbook," which has a lot of tips for selling to the federal government. Two chapters in the handbook: "Why

the Federal Government Should Be Your Best Customer" and "Dispelling the Myths About Government Procurement."

3) Contact the manufacturers that your firm represents. Perhaps their government sales specialists have some advice.

Like selling to private industry, selling to Uncle Sam takes time and special strategies. Roger Hasson, corporate systems director at Roanoke-based Universal Communications Inc., says it takes a lot of experience to develop talents for selling to the federal government. "It's a very detailed procedure, and agency evaluation criteria is strict," says Hasson, who advises that small hometown interconnects may have some trouble getting the performance/payment bonds required for some federal contracts.

Dick Duncan, manager of communications of Sentry Systems, a dealer that has sold to federal agencies in Texas' Rio Grande Valley, advises that there may be too much paperwork for small firms wanting to

sell to Uncle Sam.

The government sales manager for a Rolm distributor in two midwest states suggests that "distributors make sure that their prices are rock-bottom when bidding for federal business. Federal agencies look at price first—they don't look at long-distance call controls and other intangibles when the bid comes up."

Uncles Sam is trying to make the government market more attractive to distributors. Example: the federal government now pays interest on overdue payments to businesses. Slow federal payments were cited as a problem by several dealers and contractors in an informal *Sound & Communications* survey.

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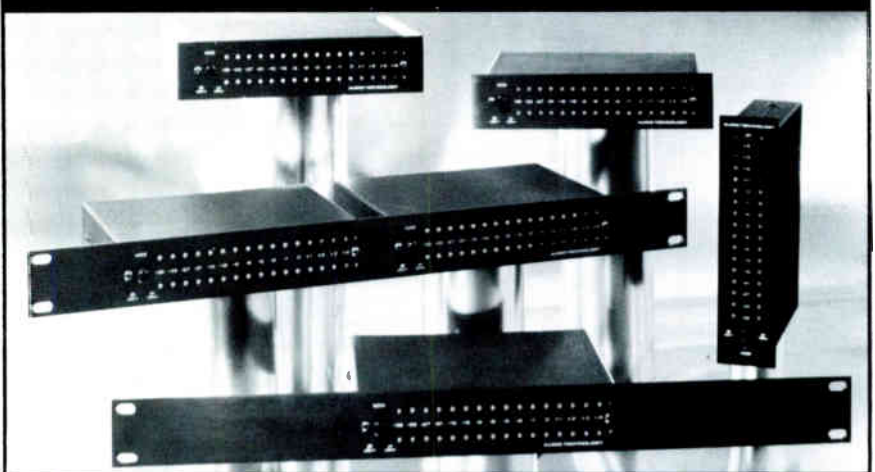
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Here are a few statistics that throw some light on the size of the federal government market:

In its March 1982 "Economic Projections to 1990" report, the U.S. Bureau of Labor Statistics offers the following forecasts, in millions of 1972 dollars:

Federal Gov't. Purchases of Communications Gear (in millions of 1972 dollars)

Product	1972	1985	1990
Telephone and telegraph apparatus	204	305	340
Radio and communication equipment	5,260	7,643	8,542
Communications gear, except radio and television	858	1,666	2,106

To convert the above totals from 1972 dollars to current dollars (to show effects of inflation), multiply the 1985 totals by 2.84 and the 1990 totals by 4.03 (based on 10/82 "Predicasts Forecasts" federal price deflator data).

Here are a few statistics that show that the military is one market you can't sneeze at:

Military Prime-Contract Spending for Communications (NOTE: only covers purchases over \$10,000)

Product	1980 (in millions of \$)	1981 (in millions of \$)
Telephone/telegraph equipment	55.8	77.4
Communications security equipment & components	158.6	210.9
PA (intercom) systems, except airborne	17.4	19.8
Sound recording and reproducing gear	45.4	37.2
Alarm and signal systems	13.8	25.1
Maintenance and repair of comm. gear	188.7	253.2
Maintenance and repair of alarm and signal systems	1.5	2.5

Source of above statistics: "Prime Contract Awards by Service Category and Federal Supply Classification" report... issued January 1982 by the Defense Department's directorate for Information Operations and Reports.

The office of Personal Property in the (federal) General Services Administration recently made some forecasts of communications equipment purchases:

Commodity Group	1982	1983
Communications Equipment	\$2,743,000	\$2,861,000
Alarm Systems	\$3,918,000	\$4,086,000

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Defense Fuel Supply Center
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I'm hoping to get a detailed inventory of the kinds of communications equipment installed in Region 5 of the federal General Services Administration. This region, which covers Illinois and surrounding areas, may have as many as 270,000 telephones under its jurisdiction... as many as 160,000 may *not* be under Federal Telecommunications System (FTS) control, says Charles Rothstein of the federal Office of Information Resources Mgt.

to be continued

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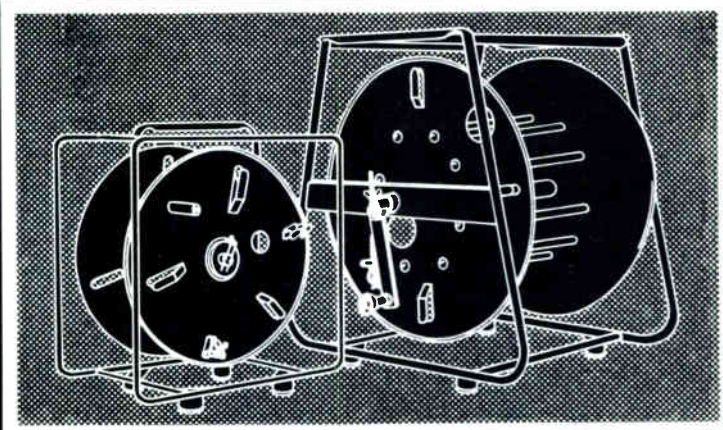
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THE INTERCONNECT INDUSTRY & ITS INFRASTRUCTURE

by Fred Goldstein & Nelson Hanover

In the pre-Cartertone days (before 1968), virtually all telephones in the United States were installed by local monopoly telephone companies. Both AT&T and GTE had manufacturing subsidiaries and there was only a handful of other PBX manufacturers, none with a large market share. In the years since competition has existed, at least 50 new manufacturers' PBXs

have come to market.

Most of the early interconnect installations were done by small entrepreneurial companies that sold inexpensive imported key and PBX equipment. Later, some manufacturers established a franchise system by which a single dealer would be allowed to sell a given product line in a marketing area. Some manufacturers then bought out their

dealers or established their own local offices, making them vertically integrated or "factory-direct" vendors, not unlike AT&T's structure with Bell Operating Companies distributing Western Electric equipment. **Independent distributors dominate smaller systems market**

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North Supply, etc.). The manufacturer may provide a parts-replacement warranty to back up the final vendor's, but the hardware manufacturer generally has little contact with the interconnect installer or end-user. Some large end-user companies have their own employees do the work, instead of the more typical approach of using an interconnect vendor, and simply buy telephone hardware wholesale and assume maintenance and responsibility.

Equipment sold in this fashion tends to be very standardized or, at least, have substantial commonality within its own product line. For example, traditional 1A2 key equipment is interchangeable whether it is made by ITT, Western Electric, or Stromberg-Carlson. Small PBXs tend as well to be suitable for such "commodity" treatment. While an ITT, Siemens, or Mitel PBX is unique in its design, compared to other manufacturers, their features and software permit them to be sold via wholesalers on a similar basis. Hence, several vendors may retail a given PBX in the same city, and the buyer can choose based upon price and reputation for service.

In the early days of interconnect, price itself was the major selling point. "Payback" times were the big attraction, and profit margins for interconnect vendors were often small. While interconnect grew rapidly in the early 1970s, many vendors were undercapitalized and failed during the 1974-75 recession. Customers sometimes found their telephone systems unsupported. Because the manufacturers did not deal directly with the end users or even the vendors, they were not generally held accountable, although other interconnect companies generally stepped in to assume support for "orphaned" systems. The problems of the interconnect industry during this period helped lead to more restrictive distribution policies.

While the majority of interconnect vendors today do not have an exclusive franchise from a major manufacturer, these companies are most active at the low end of the market where "commodity" systems are predominant. But some PBXs are too complex to be sold in such a fashion, even if the manufacturer didn't object. To be a "commodity" a PBX must have *monogeneric* soft-

ware—in layman's terms, "one size fits all."

Monogeneric software generally presumes the way a system will be configured, and predefines a given set of features and size limitations. For example, the Oki Discovery III PBX has a certain software package called Release Level E. All Oki PBXs with that package have the same features available to them without paying extra fees, unless special hardware is also required. The software is shipped with the hardware, and is not custom-generated to a customer's specifications. User data is field programmed by the interconnect vendor, and desired features can be activated on a move-and-change basis.

A different approach is used by some other vendors, such as Rolm for its CBX line. While a tremendous variety of specialized features is available, each is sold separately. In turn, the details of each system's software are customized to meet the customer's needs. A Rolm CBX equipped with Automatic Call Distribution (ACD) is likely to need a higher trunk-to-

extension ratio than a larger, non-ACD system. Other features, like Direct Inward Dialing, Route Optimization and Electronic Telephone Set support, require additional memory; no one system would be able to, or need to, support them all. This type of program requires a close level of interaction between the customer, vendor, and manufacturer.

Rolm and several of its medium and large-system competitors such as Northern Telecom deal only through exclusive distributors or their own subsidiaries. (Independent telephone companies also distribute some of these products under tariff.) A Rolm CBX buyer specifies a feature mix, not just a "package," and both hardware and software are assembled to customer specifications. Nippon Electric, while not selling through exclusive dealers, limits the number of distributors and services them more closely than many other vendors.

Market exclusivity tends to preserve dealer profit margins. Nonetheless, an undercapitalized vendor can fall rather easily onto hard

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times. This happened to several franchised distributors during the late 1970s, and some were acquired by the manufacturers whose products they sold. In other cases, manufacturers chose to retain total control of their distribution by only selling factory-direct. Rolm has done this in several major markets, and appears to be attempting to eventually move all or most domestic marketing into its Rolm Operating Company division. Rolm has terminated most distribution rights in favor of its own subsidiaries in New York and California, has acquired several distributors, and may acquire more.

When a company chooses to bring a market into factory-direct exclusive sales, it takes on service responsibilities for most of its installed base. Usually this does not hurt the end-user. Sometimes, however, it can backfire. Tele-Resources, one of the earliest interconnect distributors-turned-manufacturer, went bankrupt recently. When independent distributors maintain inventories of spare parts and are able to provide service, problems are less likely to occur for end-users, at least until the parts supply runs out.

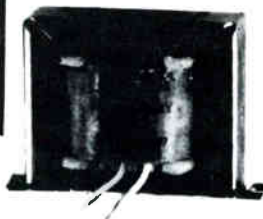
Few non-Telephone Company distributors are able to handle the largest PBX installations so, with rare exception, only franchised or factory-direct sales are the rule for systems exceeding about 1000 lines. Exxon InteCom, for example, is planning to sell only factory-direct; its IBX line of voice and data PBXs is targeted at the 700 - 10,000-line range. Each will receive full factory support, including a full-time Exxon employee at each customer site. Bell sometimes does the same for its larger installations, as do some interconnects.

No one type of interconnect vendor, or telephone company, is necessarily best for any given user. Each type of distribution has its advantages and disadvantages. While "commodity" hardware tends to be inexpensive and easy to maintain, its off-the-shelf nature may impose certain limits or costs not found in systems sold with more direct contact between the manufacturer and the final user. □

This article initially appeared in Trends in Communications Management, a monthly newsletter published by TELEMATON.

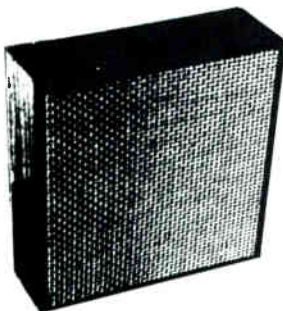
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TIP & RING

LITTON SYSTEMS/LITTON INDUSTRIES TRIPLE-DAMAGE ANTI-TRUST AWARD AGAINST AT&T AFFIRMED BY THE SECOND U.S. CIRCUIT COURT OF APPEALS. A lower court jury had awarded a \$277-million-dollar triple-damage suit to Litton Systems, who had charged AT&T with using monopolistic tactics in early 1970 to force them out of the office telephone equipment business. The jury awarded Litton \$92.3 million in damages, and that amount was automatically tripled under Federal anti-trust laws.

Litton's complaint was that AT&T had refused to allow equipment produced by its competitors to be connected to the Bell System network without an interface device. The FCC has since ruled that AT&T must permit the connections.

AT&T has some 50 private anti-trust suits against it in various stages of litigation.

AMERICAN TELECOM INC./ANAHEIM, CA, AND THE CORADIAN CORPORATION/NY, HAVE ENTERED INTO A CONTRACT ALLOWING AMERICAN TELECOM TO PURCHASE \$2 MILLION IN CORADIAN SECURITIES. Coradian is a major interconnect company serving accounts in New York and New Jersey. American Telecom is an affiliate of Fujitsu, Ltd. and expects to name Coradian as a distributor of some of its products.

GENERAL ELECTRIC COMPANY/SCHENECTADY, NY, HAS FORMED A TELECOMMUNICATIONS OPERATION to handle the firm's expanded activities in the voice and data equipment fields, including value-added telecommunications gear, data networking, computer terminals and PBX products from IPC, NEC and Oki. It is expected that GE will manufacture its own computer and data products.

MCI COMMUNICATIONS CORP./WASHINGTON, DC, REPORTED A NET INCOME OF \$43.6 million, or 44 cents per share, on revenue of \$295 million, for the 3 months ending Dec 31/82, compared with net income of \$26.6 million, or 28 cents per share, on revenue of \$140.6 million for the same period a year ago.

MCI'S \$1.8-BILLION ANTI-TRUST AWARD AGAINST AT&T WAS OVERTURNED BY A FEDERAL APPEALS COURT, AND HAS SET INDUSTRY OBSERVERS SCURRYING FOR ANSWERS AS TO WHAT CONSTITUTES PREDATORY PRICING. The court in Chicago ruled 2-1 that AT&T had not used predatory pricing to thwart MCI Communications Corp.'s attempt to enter the long-distance telephone market, as MCI had charged in its anti-trust suit. The ruling overturned a jury finding on that issue and sent the case back to a lower court.

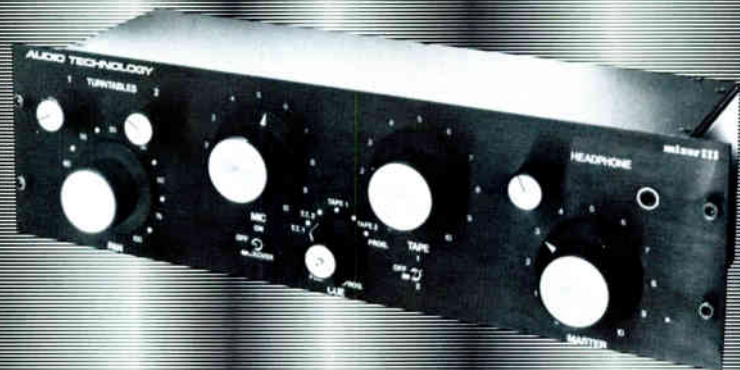
The judges agreed that AT&T had violated some anti-trust laws in the 1970s, mainly by delaying, disrupting or providing inappropriate connections for MCI's long-distance service, which is linked to AT&T's local phone service. They disagreed that predatory pricing also took place, splitting over what legal standard to use in deciding whether this tactic was used.

In the majority ruling, Judges Thomas Fairchild and Richard Cudahy said that almost the sole test for predatory pricing should be whether a company's prices are below its costs. Judge Harlington Wood disagreed, calling this too narrow a view. A company's entire strategy for dealing with a competitor should be considered, he said.

Their disagreement reflects a split among U.S. jurists in general. In their ruling, Judges Fairchild and Cudahy held that the only rational way to test for predatory pricing is to compare "prices charged and a rigorously defined measure of the cost of production." If there isn't any such objective standard, the judges said, businesses won't know what price cuts are legal, and price competition will be hindered.

Applying the strict cost-price standard, the two judges found there was not sufficient evidence to prove that AT&T, as MCI alleged, cut its prices below costs on private

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telephone lines in parts of the country where MCI was trying to enter the private lines market.

Judge Wood's dissent, however, said that a look at AT&T's strategy as a whole made it apparent that predatory pricing had been used.

Some anti-trust specialists applaud the majority view that the cost-price test alone should be used. But other anti-trust lawyers say that concentrating only on cost-price relationships is unrealistic.

The Appeals Court ruling that predatory pricing did not happen voided the award to MCI and sent the case back to a lower court to determine damages from the anti-trust violations that the judges agreed had taken place.

WEBCOR ELECTRONICS/PLAINVIEW, NY, AND HITACHI AMERICA, LTD, A SUBSIDIARY OF HITACHI, LTD. OF JAPAN, HAVE CONCLUDED AN AGREEMENT WHEREBY HITACHI AMERICA WILL MANUFACTURE FOR WEBCOR AN ELECTRONIC KEY TELEPHONE SYSTEM

that accommodates three outside telephone lines and up to eight stations. The system, to be marketed under the Webcor trademark, is designed primarily for use in small offices and small businesses, but is also suitable for use in large residences. This product marks the initial entry for Webcor into the small business market for telephones and accessories.

3M COMPANY/ST. PAUL, MN, HAS ACQUIRED APC INDUSTRIES INC./AUSTIN, TX, a privately held manufacturer of electronic test and measurement equipment for the telecommunications industry. The acquisition included purchase of all APC assets and land. Terms of the purchase were not disclosed.

HARRIS DIGITAL TELEPHONE SYSTEMS/NOVATO, CA, AND EXECUTONE, INC./JERICHO, NY, HAVE ENTERED INTO A DISTRIBUTION AGREEMENT whereby Executone will market the Harris 110 series PBX for an initial period of up to 18 months. Marketed under the trademark "ECHELON," the Harris PBX will provide up to 110 telephones for business, lodging and industrial applications, and will be sold, installed and maintained through the more than 230 Executone sales and service locations nationwide.

AT&T WAS CLEARED IN FEDERAL COURT OF CONSPIRING TO PREVENT SOUTHERN PACIFIC COMMUNICATIONS CORP. (SPRINT) FROM SUCCESSFULLY COMPETING WITH IT in the long-distance phone business. Judge Charles R. Richey ruled that the business practices of AT&T which SPCC had challenged are immune from anti-trust law, because the Bell System is under "pervasive" federal and state regulation. SPCC had alleged that AT&T blocked its growth by not permitting its long-distance service to connect to the Bell System's local telephone network.

"This court believes that the anti-trust laws were never intended to destroy an essential public utility, such as we have here," the judge declared.

Judge Richey issued a plea in his ruling for the reversal of two decades of FCC activity that has led to the deregulation of telecommunications and, with the help of a Justice Department anti-trust case recently

settled, to an end to AT&T's monopoly position.

"This court believes that sound and honest regulation of telecommunications at the federal and state level is our only guarantee of access to this necessity throughout the whole country and not just part of it. Regulation in this area of telecommunications up until the 1970s, at the federal and state levels, has served this country well and it is hoped sometime in the future it will again do its proper job without abdicating to the greed of the few," the judge said.

"It may be necessary for Congress and the Justice Department...to bring about the return of responsible regulation, so there will be no more contrived competition in profitable areas only," Judge Richey commented. Richey's decision appears to run counter to rulings by other federal judges in a series of cases in which the Bell System was found to have violated anti-trust law.

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THE NATIONAL ASSOCIATION OF REGULATORY UTILITY COMMISSIONERS (NARUC) FORMALLY REQUESTED THE FCC TO RULE THAT STATE PUBLIC UTILITY COMMISSIONS WILL RETAIN THEIR AUTHORITY to require any local telephone company to provide and maintain at their subscribers' request basic telephone equipment and associated inside wiring.

NARUC's Petition for Declaratory Ruling stems from concerns raised as a result of the FCC's Computer II decision, in which the Commission ruled that effective Jan. 1/83, new customer-premises equipment (CPE) will no longer be provided under tariff as a part of regulated local service. Although the FCC intended its decision to promote competition in the terminal equipment market, the NARUC petition points out, the detariffing of CPE

"could have an unintended adverse effect" on subscribers in areas that will not attract equipment competitors, particularly in rural, sparsely populated or economically depressed regions.

Problems are also anticipated in ensuring that necessary services associated with basic telephone service, such as inside wiring, remain available, the petition notes. In a separate proceeding (CC Docket 79-105), the FCC is considering whether inside wiring should be offered on a detariffed basis as well.

"Unless state commissions are free to require exchange telephone companies to provide basic telephone instruments, inside wiring, and associated maintenance service, many telephone subscribers could be severely handicapped in their efforts to access the telephone network," the NARUC petition warns.

MCI CHAIRMAN WILLIAM G. MCGOWAN, COMMENTING ON THE APPEALS COURT DECISION (SEVENTH CIRCUIT COURT OF APPEALS/CHICAGO), SAID: "The key point is that an appellate court affirmed AT&T's liability. The court upheld AT&T's guilt on the vast majority of the ten counts on which MCI's anti-trust action was based...AT&T's liability is no longer in question...what remains to be decided are the monetary damages appropriate to compensate MCI for AT&T's violation of the law."

MCI said that the two reversed counts (8 were upheld) were not central to its case. "We are generally pleased with the decision," said McGowan, "and are now confident of the outcome, because the question of AT&T's guilt has been resolved in our favor."

The company said its history of profitability since securing interconnections, denied illegally by AT&T (at issue in the case) proves the validity of MCI's lost profits analysis, upon which the damages were calculated.

MCI will choose one of two courses of action: (A) ask for a hearing before the full 9-judge Appellate Court, or (B) retry the damages portion of the case before the original District Court. That decision is pending.

METRO TEL CORP./SYOSSET, NY, HAS ACQUIRED C-FIVE, INC., ARLINGTON/TX maker of telephone call sequencers, for undisclosed terms. The C-5 call sequencer production will henceforth be in Metro Tel's facility in Syosset. Phil Richard Johnson remains with C-5's new parent as national sales/marketing manager. He will be in charge of Metro Tel's sales offices in Grand Prairie/TX.

AMERICAN BELL/MORRISTOWN, NJ, DEBUTED ITS DIMENSION AIS SYSTEM 85, OFFERING VOICE, HIGH-SPEED DATA, SENSOR-BASED ENERGY AND SECURITY MANAGEMENT AND NETWORKING CAPABILITIES IN A SINGLE, FUNCTIONALLY ENHANCED SYSTEM in mid January. The company announced that in addition to this energy and security management system a new "office mail" system being offered on System 85 will also be available on current DIMENSION PBX systems.

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RCA COMMUNICATIONS HAS NAMED JOSEPH FREITAG, JR. VICE-PRESIDENT, STRATEGIC PLANNING & BUSINESS DEVELOPMENT. In this post, Freitag will play a key role in formulating and implementing business strategies for RCA in the communications area. He also will be responsible for coordinating and guiding the long-range planning effort of the corporation's communications businesses, as well as the development of new business opportunities.

TELECOM PLUS INTERNATIONAL, INC., LONG ISLAND CITY, NY, HAS COMPLETED THE PURCHASE OF GULF COAST ELECTRONICS/MOBILE, AL. Gulf Coast Electronics has an account base of more than 800 customers. At the same time, Telecom Plus has signed an agreement in principle to purchase Business Communications Systems, an interconnect dealer based in Niantic, CT, with sales and service offices in Newport, RI and Hartford, CT, with an account base of 400 clients. According to a Telecom officer, "Business Communications Systems' service base, combined with Telecom Plus' existing service coverage in New England and New York, enables us to provide service throughout the northeastern United States."

Telecom Plus also said that Karen Malachowsky has been promoted to senior vice president/Telecom Plus Rental Systems, Inc., responsible for all administration activity for the Rental Systems Division.

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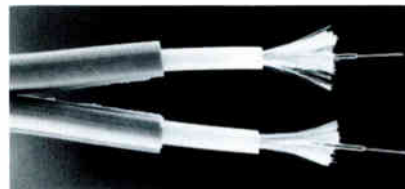


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□ For more information write 399 on the inquiry card. Or write: Mohawk Cable Co., 9 Mohawk Dr., Leominster, Mass. 01453.

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(Touch-Tone and pulse), the push-button dial telephone is capable of automatically redialing the last number called when the user presses a redial button on the handset. The handset has a tele-

scopic antenna that communicates with a similar one on the base. Power is supplied by nickel-cadmium batteries that are recharged automatically when the unit rests in its cradle. The portable extension phone can be used indoors or outside. The remote handset contains a talk/standby switch that is positioned to receive or transmit calls, an on/off switch on top of the unit, and a buzzer that sounds to indicate a call is coming in or someone at the base is paging the user. In addition, the handset has a slide control for volume adjustment and an indicator light to signal the need for recharging. The base connects to an electrical outlet and a conventional telephone modular wall jack. The base also features an in-use light, a charge light, a power-on indicator and a modular phone jack that will accept a standard extension phone. It comes with hardware for easy wall mounting, if preferred to normal desk-top use.

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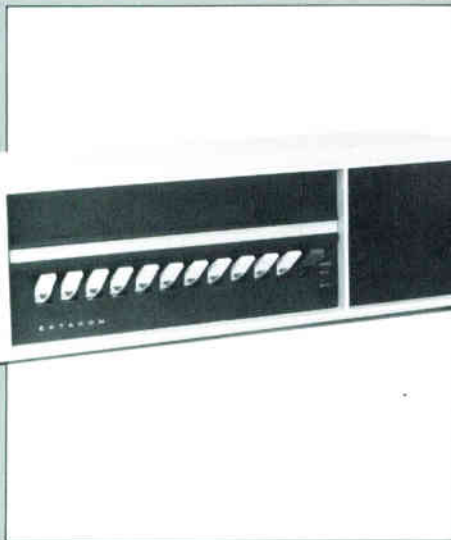


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For more information write 402 on the inquiry card. Or write: Voice-tek Corp., 15 Soldiers Field Pl., Brighton, MA 02135.

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tem-wide speed dial numbers, toll restriction, station or line restriction, exclusive l-hold, DTMF or rotary dialing, conferencing, call monitoring, private lines, assignable ring groups and timed flash.



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Electronics: the Scarcity of Skills

The U.S. electronics industry currently represents about \$200 billion in annual sales, 6.5 percent of the nation's Gross National Product, and it's suffering from a severe shortage of technically skilled workers. Yet America's population is almost double that of Japan, a nation facing no such

shortage. A recent survey elucidates this irony through the personal experiences of some of the nation's leading experts in the electronics industry and education.

According to the National Science Foundation, a shortage is apparent even at the new graduate level in engineering fields such as elec-

tronics, electrical and computer as well as the computer science area. For 1982 alone, industry reported 1,252 job vacancies in these fields.

"If current trends continue, America's work force won't have the magnitude, despite its population, to meet this demand," says Douglas Bonham, director of Heathkit/Zenith

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<p>PLUS 170 different speakers ready for instant off-the-shelf delivery to provide you a complete selection from standards to exotics. Stop in at Booths D6, E5, at EDS '83 and check out some of the new ideas from Oaktron.</p> <div style="text-align: right;"> <p><small>YOUR BLUEPRINT TO BETTER SOUND</small></p>  <p>OAKTRON INDUSTRIES, INC.</p> <p>1000 30th St. • Monroe, WI 53566 1-800-356-3609 (in Wis. - 1-608-328-5560)</p> </div>				

Educational Systems, a major supplier of electronics education courses to industry and education and the company that conducted the survey, which consisted of 13 informal telephone interviews with opinion leaders from industry and education. Some of the companies that participated are IBM Corp., Westinghouse Electric Corp. and Western Electric Co., Inc. Universities that participated include Purdue, Georgia Institute of Technology and Columbia.

Industry/Education Cooperation

Experts from a cross section of American industry and educational institutions believe that critical technical skills training problems exist in the electronics industry. The primary problem is an increasing shortage of technically skilled personnel. Demand simply exceeds current supply. A deficit of capable people to train results in both a shortage of trained workers, and a shortage of technical professionals. Some business experts commented on the need for additional training of new employees even after recent graduation from universities and technical/vocational schools. They think that curricula need to be adjusted to relate more closely to the needs of the businesses in which the people will eventually work.

Industry and education experts agree that the problem must be solved as soon as possible. But, according to the survey, the two sides don't appear to be working together on it, even though increased cooperation between industry and education surfaced as the solution from both sides.

"Industry claims an inadequate supply of qualified technical job candidates, because of the educational system's failure to teach people the skills needed to meet industry's demands," adds Bonham. "But educational experts assert that industry isn't supporting educational programs that correlate with the jobs that are available."

There appears to be a general consensus on the recommended solutions to the technical skills training problems. To resolve the problem of a shortage of skilled people, the recruitment of more people into universities and technical/vocational schools is necessary.

It was recommended that recruiting be active on the high school level and include working closely with guidance counselors to stimulate the students' interest in the field. Also recommended was the incorporation of some technical/vocational courses into the basic curriculum. In essence, this would promote the profession and encourage more young people to pursue a career in this field.

Bridging The Gap

There are perceived technical training problems which are unique to the academic and industrial communities. Academicians, whose problems are caused by inadequate funding, believe the solution to their problems is increased support by the industries that use the services of their graduates. If industry refuses to increase its support of the educational system, the leading academicians claim, their schools will soon be releasing less qualified graduates, which will only aggravate the situation. Academicians feel that there is a need to increase the number of qualified professors and to update the equipment on which the students are taught. Without additional funds from either industry or government, they feel that the technical training process will continue to deteriorate.

The technical training problems perceived by the industrial community are an offspring of the problems found in the academic world—there is a critical shortage of qualified people. Therefore, industry leaders want to solve their problems by training more people through traditional institutions, by establishing separate schools, or by creating their own training programs. They also recognize the need to develop a better understanding between industry and academia. Only then, they feel, might the curriculum be altered to become more responsive to industry's needs.

"The survey generated many comments about the technical skills shortage and suggestions for alleviating it. They provide insight into a problem that has plagued the United States since the discovery of the silicon chip in 1969. But more importantly," says Bonham, "they indicate a willingness between industry and education to begin to

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cooperate in solving this critical problem."

The following are comments by experts from industry and education, who offered their viewpoints on the nature of the technical skills training problem and potential solutions.

Ken Zuncic,
Director of Employee Relations, Allied Electronics Components Co.

"A lot of people have been swayed away from jobs in the electronics trade because much of the training that's done in the technical areas

isn't applicable to the workplace. Within five years, 50 percent of our people in the skilled technical positions probably will retire. And right now, we don't have the technically skilled people to fill those vacancies.

"More emphasis should be placed on intern programs that offer practical experience for students as part of their education. Perhaps these programs should be funded more by companies, something that is being done in one of our plants in Pennsylvania. People from the area's local vocational schools are being trained on the job."

Charles Hulse, Engineering Operations Manager, Communications Network, Western Electric Co., Inc.

"You just can't take people out of college without a minimum of two years training and make them productive employees. If certain courses were offered in the schools, some of that extra training might be minimized. The courses have to specialize more in current technology, such as data communications, the use of concentration theory, networking theory and main frame operating systems.

"To solve the problem short term, industry will have to take care of its own needs. Eventually, colleges will address these needs, but not for five or ten years."

Steve Komjathy, Program Director of Technical Education, IBM Corp.

"From what I'm hearing, academia is a little bit behind the times and many companies can't afford up-to-date training programs. Consequently, this creates a problem. For instance, there are very few schools today in the United States that have processing lines or laboratory or pilot lines for manufacturing silicon chips. Therefore, graduates enter the job market without these skills.

"We're solving this problem internally. We don't have the right skills coming into the company from the outside, because that education doesn't exist on the outside. We do it on our own. Traditionally, IBM has been very good at this. But we are always breaking into new technology and that's exactly what has created our problem. We have to solve it on our own. I don't think we can rely on anyone else."

George Moore, Director of Education & Training, Westinghouse Electric Corp.

"The problem is complex. It exists at the four-year degree level and may include the Masters and PhD levels, too. At the technician level, there's a serious shortage and at the vocational level, it's even worse.

"The answer is to convince the right people that a problem does exist. We've got to convince the educational community that there really are positions for the kinds of people that need the training. All too often people are trained because

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industry says there's a tremendous need for a particular kind of training. Then after the training or educational process is completed, the positions aren't available, because nobody took the time to find out if more training was really the solution to the problem. We must identify the job opportunities carefully and then demonstrate that the training that will be provided will address the skills needed in those jobs and that, in the interim, industry's needs won't be accommodated some other way."

Dick Hornicak, Service Training Manager, Textronix, Inc.

"One of the biggest problems is that vocational/technical schools today may provide individuals with the basic rudiments of electronics, but they don't provide the students with practical experience.

"Some of the in-house training programs are strong but others take more of an academic approach and for an individual to wade through 32 one-hour videotapes and learn the material is an unreal expectation. I think that for training to be effective, it's got to be clear, precise and to the point and, most of all, practical."

John Miles, Director of Technical Training, Bell & Howell

"I find that most people in the technical fields don't have enough skills in basic electronics. It seems that people believe that anyone should be able to pick up electronics and mechanical training just by going to a one- or two-day seminar, which is not correct. This is a short change way of dealing with the problem and it really doesn't solve anything.

"There should be more studies set up in universities to train people in the electronics and mechanical areas of audio visual. There's a need for more basic education at the high school and college level."

Professor W. P. Birkemeier, Chairman, Department of Electrical & Computer Engineering, University of Wisconsin

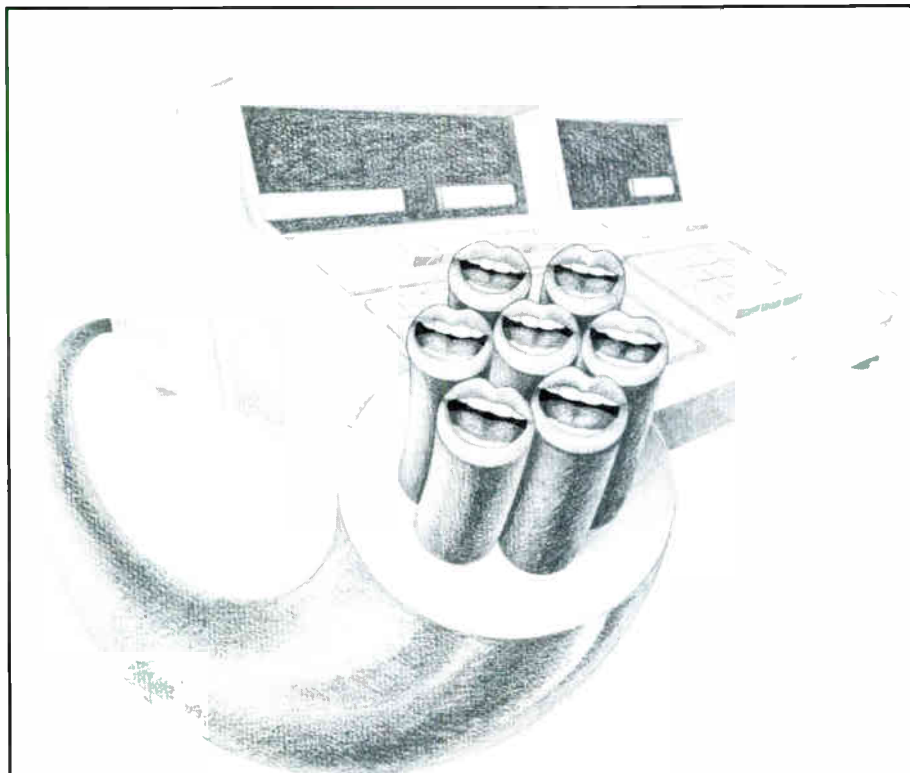
"When you consider what the Japanese are doing to us in the electronics industry, you realize that the only way we can fight that threat is by high-technology education. The Japanese graduate more engi-

neers than we do and they're probably better trained. But our problem isn't people. Students are breaking down the doors to get into our electrical engineering department, because that's a field with available jobs. But we can't accommodate any more students. We've had no increase in dollars for ten years in this department. We go to private industry, to the people who use our products, and explain that if industry doesn't help us, we're going to turn out unskilled graduates. So

industry gives us some money and a lot of equipment. They've even lent us some of their people to teach on a part-time basis to help with our faculty shortage. For example, we have gotten free computers from several, but we have not been able to find the money to maintain them."

Dr. C.L. Coates, School of Electrical Engineering, Purdue University

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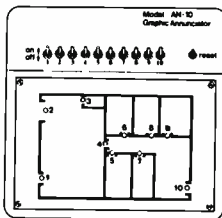
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tried to increase the number of students in the department and as a result, our graduate figures have increased. But we're in serious financial trouble. Many universities simply limit enrollment because they don't have the facilities or the faculty to handle all the students. Facilities are a big problem. We're a high-technology country and we're educating people with out-of-date equipment."

Dr. Dennis Malone, Department of Electrical & Computer Engineering, State University of New York at Buffalo

"The problem is serious enough that the electronics industry is going to have to re-evaluate how it uses engineers. Perhaps part of the problem is that industry is using engineers to do work which can be done as well, if not better, by technicians. Industry is going to have to pay a great deal of attention to supporting local engineering schools to get the people that are needed for the jobs that are available.

"Universities, colleges and vocational schools that offer technical training simply must be supported in a major way by the industries they serve. This is a problem that covers the entire spectrum of engineering, ranging from engineering schools down to vocational training schools. It is a subject on which the industrial technology of our own country rests, and yet it has not seen that support at all."

Thomas Rabson, Chairman, Department of Electrical Engineering, Rice University

"The problem faced by all engineering departments is a heavy student demand with inadequate facilities and faculties. Many of our students opt to work in industry rather than go on to graduate school and become professors, because graduate stipends appear rather anemic compared with the salaries that bachelor students can earn in industry. One way of solving this problem is to produce as many technically trained engineers in the electrical engineering and computer science areas as we can, through increasing funds for more facilities and faculties. We have to entice the talented people back into education."

Dr. Thomas M. White, Assistant Director for Undergraduate Affairs, School of Electrical Engineering, Georgia Institute of Technology

"We could probably place four or five times as many people in technical jobs as we graduate, but we can't handle that many students. Obviously, more funding from the various states that support state schools and from businesses that use graduates would help. We can't keep enough PhD students around, because the outside job market is too attractive. Some kind of understanding between industry and colleges would be helpful in maintaining a good ratio of faculty to employed engineers. The only way some companies survive is by training their own technicians and engineers for highly specialized jobs. We just can't provide the right people with the right skills with the current situation."

Dean A. Richard Seebass, College of Engineering & Applied Science, University of Colorado

"There is an acknowledged technical skills training problem not only in the electronics industry, but also throughout engineering. We have a deficit in terms of capable people to educate the base load of undergraduates we now have. We have to maintain our technical leadership through quality programs, not through quantity. The best way to do that is to enhance the productivity of individual faculty members until we get a better stream of PhDs coming through, but nobody is approaching the problem with the kind of money and education that is required.

"The problem we now face is getting the stream of very good undergraduates into the PhD program. That can only be solved by supporting those students with about half the starting salary as a graduate in industry with a BS degree. To do it right, the federal government should make that investment."

Dean Ralph Schwarz, School of Engineering & Applied Science, Columbia University

"Some of the problems are very serious. In part, they result from inadequate educational equipment for electronics programs at the high school and college level." □

NEW LITERATURE

For free copies, write company names on the inquiry card.

SOUND PRODUCTS: A booklet from Argos Sound, Genoa, Ill., displays a broad line of sound columns, speaker/baffle systems and packaged sound systems. Recently designed rostrums and lecterns are also included.

COAX COMMUNICATIONS: "The Local Area Network Reality" is the title of a pamphlet from The Consultant Group, a division of Rich, Inc., Franklin Park, Ill. It explains the various electronic communication and information services



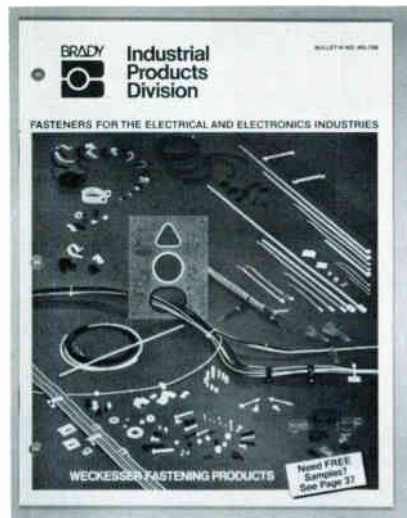
that may be distributed over one broadband coaxial cable. Incorporating the probable questions a facility manager might have about networking such services, the publication also has information on technical design options for present and future network requirements.

KEYPHONES: Strata VI, a microprocessor-based electronic key telephone system, is introduced in a data sheet from Toshiba Telecom, Tustin, Cal. The digital system has a capacity of 6 CO/PBX lines, 2

intercom lines and 16 stations. Among the features available are automatic dialing/last number redial, call conferencing, speakerphones, toll restriction, do-not-disturb and message-waiting.

ALARMS: A brochure from Floyd Bell Associates, Inc., Columbus, Ohio, covers more than 500 piezoelectric alarms, the AudiLarm II series of continuous, intermittent, chime and warble tone types. Complete specifications, including performance curves and case diagrams, appear.

FASTENERS: Molded and formed cable clamps, cable ties, strapping, grommeting, press clips, screws and nuts, and PC board supports are among the items illustrated in a 40-page catalog from W. H. Brady Co., Milwaukee.



It also offers selection tables, dimensional drawings and technical data. All the products are made of non-conductive/non-corrosive materials.

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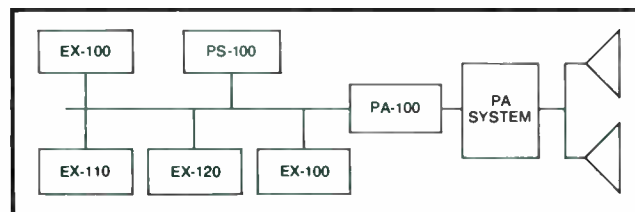
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