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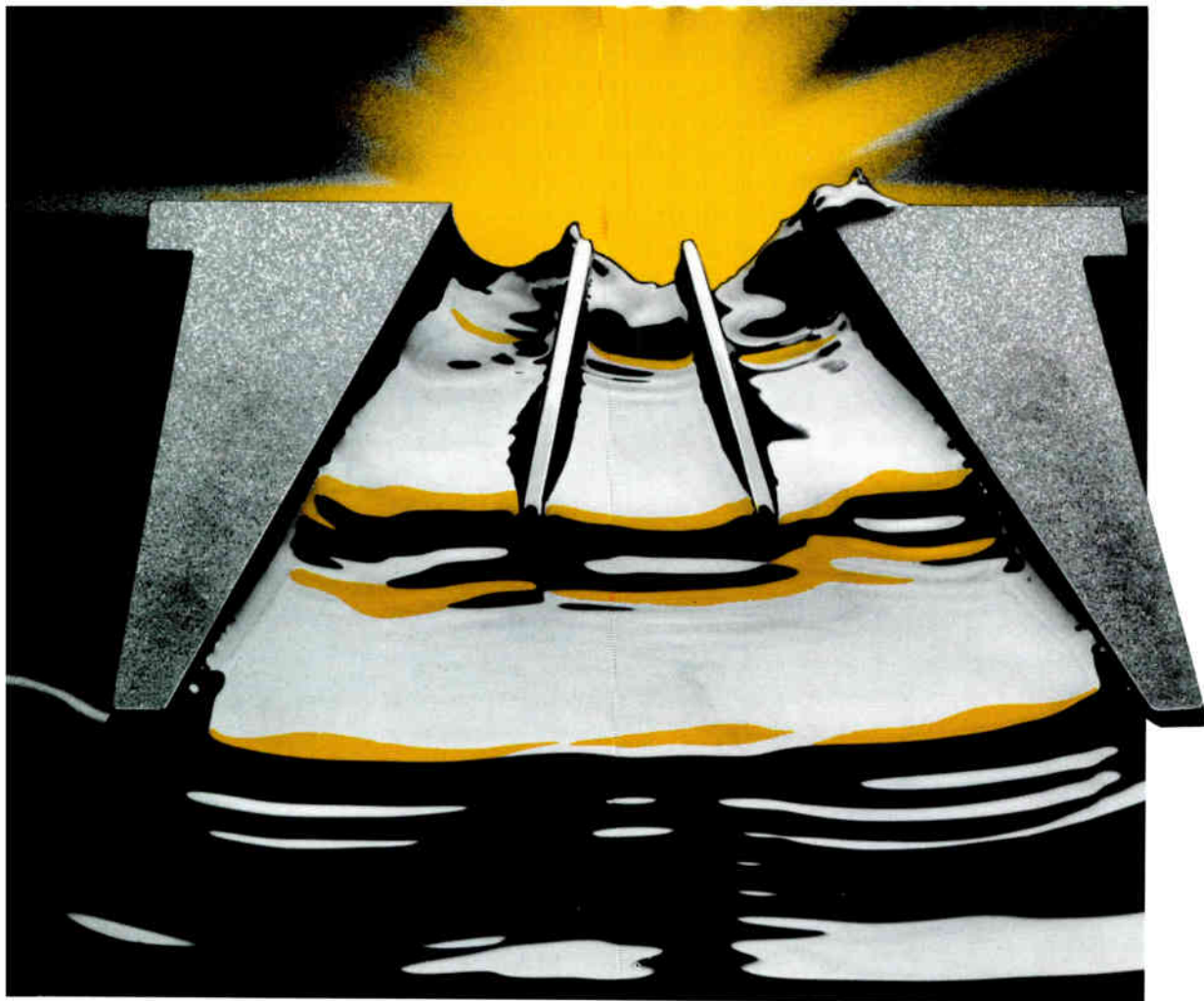
**MIDI and The
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**1990: What's
Ahead for
the Industry**

**1988
Olympics:
The Sound
System**

**Starting
Your Own
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OUTBOARD GOES INBOARD. Each PM-175 and PM-350 has an internal circuit card bay which accepts Carver's new plug-in signal process-

ing modules. Soon to be available is an electronic, program-mable 2-way stereo crossover, with 24 dB per octave Linkwitz-Reilly phase -aligned circuitry, a built-in adjustable high-end limiter and balanced outputs. And more modules will be available in the near future to further help you streamline your system.

PRO FROM CONCEPTION. The PM-175 and PM-350 inherited their father's best features. Including slow startup and input muting to eliminate turn-on current surge, 11-detent level controls, phone jacks, power, signal, clipping and protection indicators as well as balanced XLR input connectors. In a bridged mode, both amplifiers will drive 70-volt lines without the need for external transformers.

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SPECIFICATIONS: CARVER PM-175 Power: 8 ohms, 175 w/channel 20-20kHz both channels driven with no more than 0.5% THD. 4 ohms, 250 w/channel 20-20kHz both channels driven with no more than 0.5% THD. 2 ohms 300 w/channel 20-20kHz both channels driven with no more than 0.5% THD. Bridging: 500 watts into 8 ohms, 400 watts into 16 ohms. THD-less than 0.5% at any power level from 20 mW to clipping. IM Distortion less than 0.1% SMPTE. Frequency Bandwidth: 5Hz-80kHz. Gain: 29 dB. Input Sensitivity: 1.5 V rms. Damping: 200 at 1kHz. Slew rate: 25V/micro second. Noise: Better than 115 dB below 175 watts. A-weighted. Inputs: Balanced to ground, XLR or TRS phone jacks. Input Impedance: 15k ohm each leg. Compatible with 25V and 70V systems. 19"Wx3 5"Hx11 56"D

SPECIFICATIONS: CARVER PM-350 Power: 8 ohms, 350 w/channel 20-20kHz both channels driven with no more than 0.5% THD. 4 ohms, 450 w/channel 20-20kHz both channels driven with no more than 0.5% THD. 2 ohms 450 w/channel 20-20kHz both channels driven with no more than 0.5% THD. Bridging: 900 watts into 8 ohms, 750 watts into 16 ohms. THD-less than 0.5% at any power level from 20 mW to clipping. IM Distortion less than 0.1% SMPTE. Frequency Bandwidth: 5Hz-80kHz. Gain: 31 dB. Input Sensitivity: 1.5 V rms. Damping: 200 at 1kHz. Slew rate: 25V/micro second. Noise: Better than 115 dB below 350 watts. A-weighted. Inputs: Balanced to ground, XLR or TRS phone jacks. Input Impedance: 15k ohm each leg. Compatible with 25V and 70V systems. 19"Wx3 5"Hx11 56"D



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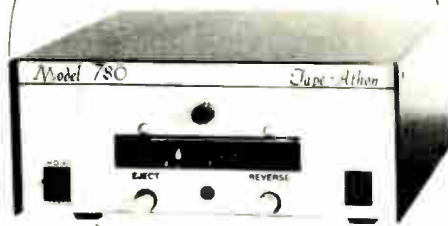


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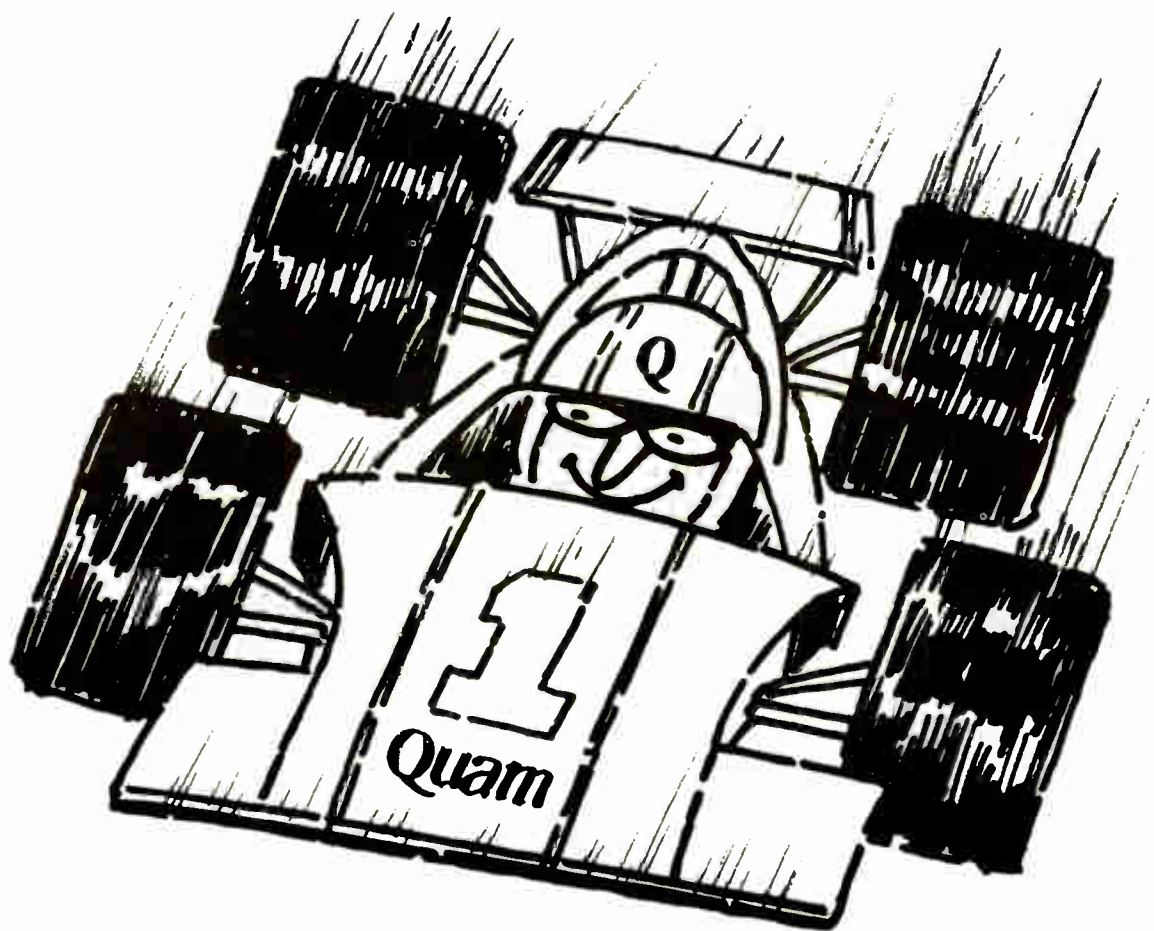
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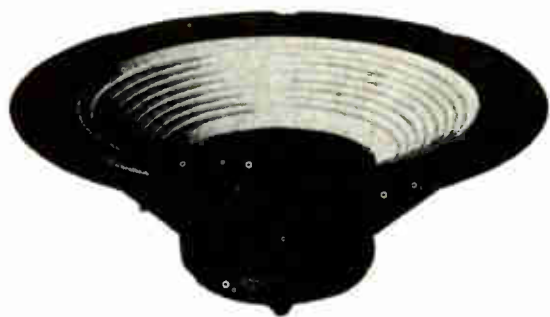
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ICIA FIRST ANNUAL ACHIEVEMENT AWARDS

The ICIA is presenting its first annual Achievement Awards at Commtex International in Atlanta on February 26. According to Harry R. McGee, executive vice president of ICIA, "The men and women of this industry are producing exciting new products and utilizing them in a variety of creative and innovative ways. We have established this awards program to recognize and highlight their achievements." The ICIA's highest recognition for contributions to the communications industry—the Distinguished Achievement Award—went to Jerome Kintner, chairman of Photo & Sound Company of San Francisco, CA. Kintner was honored for his leadership. It was under his direction that the firm successfully made the transition to the new video and computer technology, becoming one of the largest dealers for each and proving that audio-visual dealers need not limit their horizons. The Manufacturer of the Year went to Schneider Corporation of America of Woodbury, NY, for its new motorized, programmable zoom lens for slide projectors. Producer of the Year went to the Society for Visual Education of Chicago, IL, for its video tape "Anne Frank: A Legacy For Our Time." Educator of the Year went to Dr. Bill Wagonseller, professor, Special Education, University of Nevada, Las Vegas who initiated, created and coordinated a four-part television series on parenting skills called "Practical Parenting." The Business and Industry Communicator of the Year went to Ken Price, director, Corporate Communications, Compaq Computer Corporation of Houston, TX, for taking Compaq from a new and unknown company to one with an international reputation. Not-for-Profit Communicator of the Year went to Greg Coenen, manager, Publications and Information, Milwaukee Department of City Development, Milwaukee, WI, for the development of "The Spirit of Milwaukee," a 56-projector, multi-image slide show. ICIA will continue to present its Communications Achievement Awards annually. Entry forms for the 1988 awards will be available in the summer of 1987.

INFORMATION GATEKEEPERS TO LAUNCH THREE NEWSLETTERS ON FIBER OPTICS

In response to the demand for specialized fiber optic news in industries outside the telecommunications industry, Information Gatekeepers will be publishing three newsletters. *Military Fibercom* will track and report all development and business opportunities arising from the increasing application of fiber optic technology within the military. The Defense Department now ranks as the second largest market for fiber optics, with expenditures expected to top \$2 billion by 1990. Editorial will cover government procurements, programs, contracts and sources; applications; defense standards; contract results; marketing trends; new technologies; key people and organizations. *Fiber Datacom* will be devoted to the market and applications of fiber optics in data communications. Computer communications is one of the fastest growing segments of the fiber industry and represents a major growth area for manufacturers of systems and components. Editorial will cover Systems: office and factory automation; intelligent building; fiber optic LAN; data bases; instrumentation; data collection systems; data links; receivers, couplers; automobiles; robotics; components; data links; receivers, couplers; transmitters; connectors; and test equipment. *Fiber Optic Sensor Systems* will offer exclusive coverage of what currently represents the largest area of research and development in electro-optics. Driven primarily by the needs of military and space programs, the R&D in fiber optic sensors has drastically reduced costs and will soon result in a tremendous boom of new products in all areas of industry. Prominent among these will be the automotive and medical industries, where millions of low-cost, throwaway sensors will be required. Coverage will also be given to fiber optics for imaging and inspection.

FROST & SULLIVAN REPORT STUDIES COMPUTER CALL ACCOUNTING SOFTWARE

A new 335-page report from Frost & Sullivan, "Computer Based Call Accounting Software: PC, Mini, Mainframe" (#1670) discerns "incredible growth potential" for the computerized call accounting market. The report estimates the 1986 market for call accounting software (micro, mini, mainframe combined) to be about \$179.3 million.

Breaking that down: micro-based accounts for \$84.8 million; mini \$50.1 million; and mainframe \$44.3 million. The market is projected to reach \$797 million by 1991, growing by as much as 50 percent in 1987 alone and by an average of over 30 percent a year through 1991. The report traces the history of call accounting, profiles the major players in the market today, and discusses the continuing effects of government deregulation in the field of telecommunications as a whole. The report takes note of the large and growing number of PBXs installed by American companies across the industrial spectrum. The installed base of PBXs represents a market, much of it still untapped, for call accounting software. The price of the report is \$1,850.

ITEL TO ACQUIRE ANIXTER FOR A HALF-BILLION DOLLARS

The board of directors of Itel Corporation and Anixter Bros. Inc. approved the acquisition of Anixter Bros. by Itel in a transaction valued at over \$500,000,000. Itel has agreed to pay \$14 per share in cash for all Anixter common shares. At publication, Anixter had 36.4 million shares outstanding. Anixter is a supplier of wire and cable and other products used in the telecommunications, data communications and cable TV industries.

STUNTED FIBER OPTICS MARKET EXPECTS TO SEE FUTURE GROWTH

A report from Frost & Sullivan, Inc., "Fiber Optic Telecommunications Networks in the U.S." predicts that the sales of fiber optic components used in telecommunications applications will increase less than five percent annually from \$515 million in 1986 to \$560 million in 1988. But growth in each of the following three years will average nearly 15 percent, yielding an \$851 million market in 1991. (Constant 1986 dollars are used throughout the study.)

The Regional Bell Operating Companies (RBOCs) will provide the bulk of post-1988 growth, as consumption of fiber cable for feeder line jumps from 200,000 km in 1986 to 750,000 km in 1991. The local loop application using fiber rather than wires to connect individual telephone subscribers to a telephone company central office switch—is expected to grow even more from 120,000 km to 740,000 km over the forecast period.

The long-haul telecommunications market, which drove the fiber optics industry to double its sales annually during the early 1980s will decline in near-term fiber cable footage demand. Falling prices will also contribute to slow growth, which expects fiber cable that costs 30 cents per meter in 1986 to go for 25 cents in 1988.

The major growth factor that will begin to be felt in the late 1980s will be the spread of Integrated Services Digital Network (ISDN). ISDN will provide for voice, data and video transmission from any telephone/workstation to any other.

SIGHT & SOUND ENTERTAINMENT'S U-VU AIMED AT CHILDREN'S MARKET

Sight & Sound Entertainment has introduced a new concept of music video entertainment that has set a precedent within the industry, according to the company. The children's retail market has now been targeted to receive custom programming tailored to meet the needs of an audience between the ages of 6 and 13 years old. The new program, entitled U-VU, combines a blend of music video, cartoons, special features, and public service announcements into a two-hour format. According to Michael DuKane, president of Sight & Sound Entertainment, "Fashion retail is the largest growing video market for closed-circuit music video. The problem is that it has only targeted young men's and junior departments. We have designed a program that not only meets the needs of children, but parents as well. They will find this customized program to be not only entertaining, but educational." The U-VU program is currently being implemented in Kids "R" Us.

Starting Your Own Business

The sound and communications industry has proven to be a lucrative area for those who have opted to start their own businesses. Individuals who have started sound contracting, consulting, and sales rep firms often leave secure, well-paying jobs with major companies to embark on an entrepreneurial endeavor which they hope will be even more rewarding.

Because this is an industry that requires extensive knowledge and experience, whether it be engineering experience or strong ties with major manufacturers, there are some basic issues that must be addressed before forming a business. Those who have recently started their own companies acknowledge that it is important to see a financial planning consultant (either a CPA or business consultant).

While experience and reputation are givens, equally important is discipline and the organizational skills necessary in managing a business. After this is established, the financial planner will provide an outline of the necessary procedures in forming a business. For example, he will help determine the necessary capital requirements, proper cash flow to start and maintain a business, tax regulations, and local licensing procedures. (Where licensing is concerned, it is also important to consult with an attorney.)

The financial planner will also help the individual determine whether or not to form a corporation, sole proprietorship, or partnership (when more than one principal is involved). Although, each situation is unique, if the business being formed will impose any kind of liability, the individual(s) forming the new business should incorporate to protect their personal assets.

Warren Brown, a business consultant in the Los Angeles

area, who advises sales reps in various industries, noted that there are several advantages associated with forming a proprietorship. "In a sole proprietorship you have a lot more flexibility in what you are doing," said Brown. "If you incorporate, even if you are the sole stockholder, you still have to work in a certain way to meet state corporation board requirements. A proprietor can change things overnight at the blink of an eye. Such changes might include financially regrouping."

However, he cautioned that a contractor or consultant, who may be open to lawsuits, may be better off incorporating. "In a situation where insurance can't properly protect a business from a lawsuit that would devastate the owner of the business, then he may be advised to incorporate," said Brown. "One might also want to incorporate to shelter his income."

One of Brown's clients is Geoffrey Keleher, who started Design Factors, a manufacturers' rep firm in Arcadia, CA, covering the sound signaling and security marketplace. With his rep firm now established, his clients include sound contractors, fire and security specialists, and he deals in the interconnect market. He started his firm in 1985, after serving as sales manager for MacKenzie Laboratories for 16 years. After leaving MacKenzie he spent one year working for a sales rep firm and then decided to go into business for himself. He noted that he had no problems in establishing the business.

"When you have problems in starting a business it means either you don't know enough about the business, you don't understand the industry, or you are undercapitalized," said Keleher. "If you don't have any of those problems, then your only other problem could

be personnel, unless you already know the people you hire."

The initial organizational procedure Keleher underwent was to consult with an attorney and financial consultant (Brown) to determine how to structure the business (eg: whether or not to incorporate) and set up an office with telephones and a letterhead.

Keleher noted that to be a successful sales rep in this industry it is important to have good organizational skills. "We require a good record-keeping system, a good copy machine, typewriters, a computer with appropriate software, and good filing systems," said Keleher. "A contractor, on the other hand, has to have a labor force up front, a warehouse, vehicles to move equipment around, and liability insurance."

For sound contractors starting their own businesses, additional logistical requirements such as inventory and setting up a showroom arise. Greg Lukens and Tom Peters formed Washington Professional Systems in Wheaton, MD, a contracting firm that services the church, conference room, and industrial film markets. Reputation in the industry, ties with manufacturers, and a vision of a strong potential for growth in the Washington market motivated them to form the business.

Washington Professional joined forces with Washington Music, also in Wheaton, MD, because of its large inventory, much of which is used in the church systems the company installs. "If we were to have started the business without having a sister music store, it would have cost us as much as \$1 million," said Lukens. Factors such as ample industrial sound installation work available in their region, along with their reputations, alleviated any potential problems in starting

up this particular company. In establishing the new firm, the two rented a facility, and built two acoustically treated demo rooms with Soundcraft and Yamaha PM 3000 mixing consoles on display.

"We have been in the sound and communications industry for many years and decided to organize our talents into a new company with added features," said Lukens, noting credit as the barrier for most contractors who start their own companies. "Tom Peters worked for EMCO, which created a division geared toward marketing government audio video systems. He increased EMCO's work from \$150,000 to \$5 million in a five year period, which helped get manufacturers' attention. When he told manufacturers that we wanted to market their products, they knew we had the clout to do the work. Financial organization and history is critical. For someone to come into the sound contracting market starting with \$1,000 to \$5,000 jobs and grow to \$100,000 and \$500,000 jobs, and build a credit line with major manufacturers, is realistically a 10 year fight. Manufacturers don't want to underwrite the credit of a beginning contractor."

Consultants, who often vary in their design philosophies, frequently choose to start their own firms in order to produce systems using their ideals and to raise their personal income ceilings. Tom Norman, who formed Design Ethic in Lake Forest, CA, a consulting firm that specializes in the area of audio and video security systems, found that it required a small capital investment to start his business.

"A consulting firm is a relatively inexpensive business to open," noted Norman, who put aside six months income to

(continued on page 39)

by Marc L. Beningson
Jaffe Acoustics, Inc.

FINISHING THE JOB

Completion of a sound system project should be more than simply finishing the installation. The success of a system depends on the owner's ability to make proper use of it and, therefore, the sound system must be thoroughly burned in, tested, tuned and adjusted. Most importantly, the owner (or the actual users) must be given sufficient training in the operation of the system. The world's greatest sound system design and installation is useless if the owner cannot operate it correctly. Finally, sufficient documentation must be provided so that the owner can make use of the system without constantly calling in the installer.

Completion of a sound system project should be more than simply finishing the installation.

A good specification will include provisions for the particular steps in completing the installation, but even when it does not, the contractor should consider taking the following steps—once the last wire has been connected, one last check of signal flow should be made

prior to full power up to prevent any damage to equipment due to errors. Then the entire system can be turned on, and although the temptation is great to throw in a favorite compact disc and start listening, each portion of the system in the signal check should be individually tested for proper gain, bandpass, noise level, and stability under various operating conditions. Once proper operation of all devices is verified, a rough tuning can be established and some listening can be enjoyed.

Although final tuning and adjustment may be done by the consultant or designer, the contractor should perform an initial tuning of the system. Multiway arrays can be adjusted through one-third octave real time analysis. Signal delays can be set with an impulse generator and an oscilloscope, and proper gain structure can be set up. All tuning should be verified by ear with recorded and live sources.

A verification test report should be compiled before the consultant or other authorities are brought in to inspect the installation for conformance with the design specification. This report should include one-third octave sound level measurements at a variety of locations, especially in critical areas such as under balconies, back rows, and far side seats. These measurements should be made separately for each of several systems covering each area, such as the array, side stacks

and underbalcony speakers. The report should also include a checklist of all devices and circuits and a signed verification that they all have been checked for proper wiring, polarity, signal pass and correct operation. This report signifies that the installation is complete, and that the contractor is prepared for acceptance testing. Note that in many specifications, the contractor is frequently responsible for the consultant's lost time and travel due to failure to have the system complete in time for acceptance testing, so the report should not be issued until the system is truly complete.

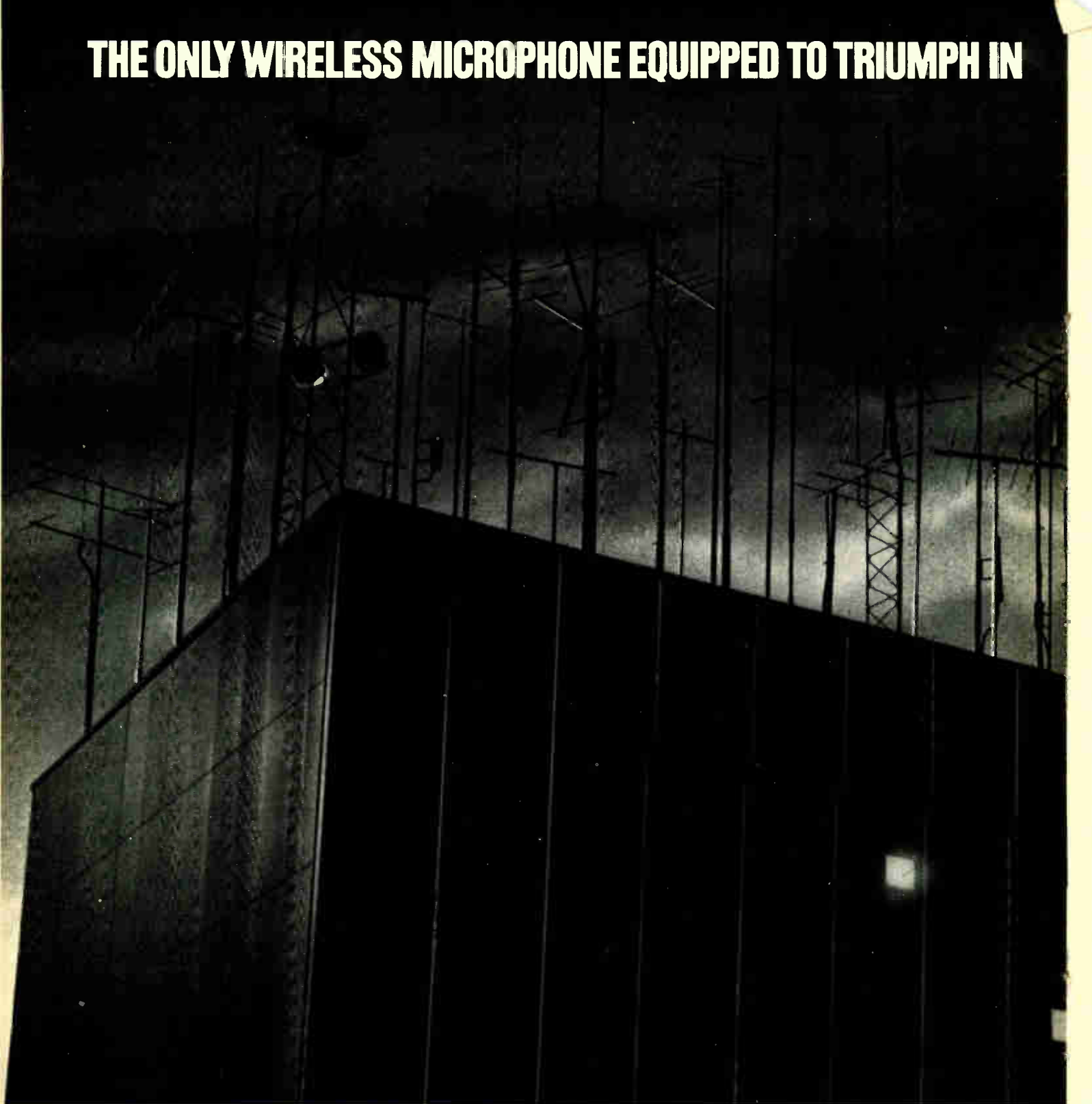
Although acceptance testing is the responsibility of the consultant, the contractor should assist in whatever procedures the consultant may want to perform in order to verify for the owner that the system has been installed as specified, and will perform as intended. Many of these tests will duplicate those performed during the verification tests, so the advance preparation by the contractor is well worth it. In case problems develop, the contractor's intimate knowledge of the installation combined with the designer's knowledge of the system's intended performance based on previous designs make a powerful combination for troubleshooting.

In many instances, training and technical operations assistance may also be in the consultant's workscope, but

the contractor should play a role in educating the user because, in the long run, the contractor may have to live in the same community as the installation and any perceived problems may reflect back on him. (Remember that the consultant's reputation may also be tarnished by a poor installation of a perfectly adequate design.) It is in the best interests of the contractor to ensure that the owner knows how to make use of each piece of equipment and the system as a whole.

Documentation should describe basic functions such as power on and off procedures, signal routing for basic functions, a listing of all tuning presets (90 percent of all service calls in the first three months of operation are doubtless caused by misadjustment of settings by itchy fingers), a running sheet of all wiring connections, a signal flow diagram, cutsheets and operator's manuals for all equipment supplied (in a well-organized binder), and all as-built drawings. The contractor's 24 hour service phone number should also be prominently displayed in the documentation in case of emergencies. No job is over until the paperwork is done, and the project should not be considered complete until documentation is supplied in its entirety. The consultant should not sign off the installation as complete until this is done, so the contractor will not receive his final payment, which ought to be incentive enough.

THE ONLY WIRELESS MICROPHONE EQUIPPED TO TRIUMPH IN



The airwaves are bursting with interference. TV broadcasts, police emergency calls, taxi dispatches, even other wireless microphones.

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THE BATTLE OF THE BANDS.

in excess of 94dB. Well within the realm of wired microphone performance.

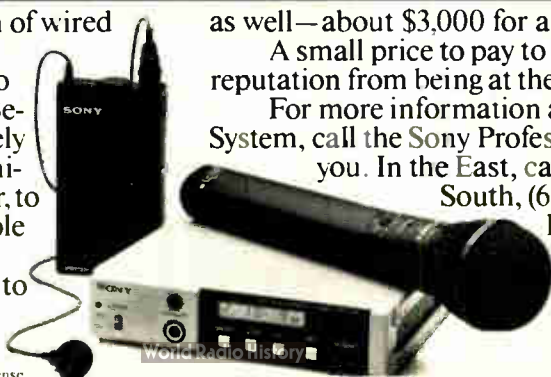
The Sony system is also designed to withstand the rigors of live recording. Besides being lightweight, it's also extremely sturdy. Including everything from the microphones, to the body pack transmitter, to the tuners, to the shock-resistant portable cases and rack-mounting brackets.

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THE NEW AGE OF WIRELESS MICROPHONES

by Bill Sien and Steve Barbar

Wireless microphones have come a long way since they were first introduced some 25 years ago. Back then they were considered luxury items reserved only for the rich and famous and even then they were only used after all other alternatives had been exhausted. After all, cordless microphones in those days had more snap, crackle, and pop than any cereal you could find on the market. When they were used, however, eliminating those ugly cumbersome cables freed the performers to "do their thing."

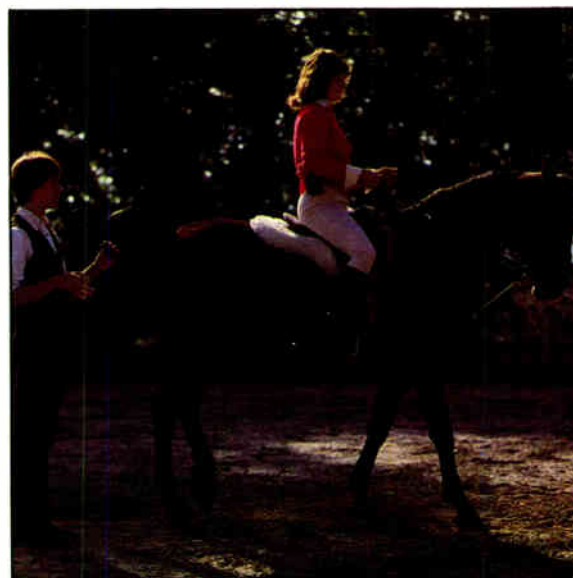
Today, it is a new story. Due to the technical revolution of wireless systems over the past several years, cordless microphones are no longer difficult to use, unreliable, or of poor sound quality. The snap, crackle, and pops are gone and wireless microphones are being used daily in TV, CCTV, film, on stage, in sports, churches, conference rooms, and auditoriums. They are used not only for voice reinforcement but also for wireless musical instruments, as well as wireless voice recognition systems. Furthermore, one does not have to be rich or famous as there are systems available in all price ranges.



The instructor is wearing a microphone from Williams Sound.



This shop teacher is talking to a hearing-impaired student via a Com Tek wireless microphone system.



This teacher is using a Com Tek hand-held wireless microphone.

FCC CONSIDERATIONS

There are several factors that have helped in the wireless revolution. One of the important factors concerns the question of frequency allocation. In the United States the FCC (Federal Communications Commission) governs our airwaves including wireless (radio) microphones. As any ham radio operator will confirm, the airways are very crowded and competing for usable frequencies is a difficult task at best for the .05 watt wireless microphone user. Using wireless microphones successfully in areas that have two-way radios is very difficult. Typically, the output of two-way radios ranges between two watts for portables up to 100 watts for base stations. As a matter of policy, and as a result of the frequency shortage, the FCC goes to great lengths to discourage the use of the airways in situations where wired communication is feasible.

In addition, the FCC does not appreciate the need for wireless microphones, as it is generally considered nonessential. However, the FCC has seen fit to allow wireless microphones on certain portions of the VHF high band. Specifically, the frequencies between 174 MHz to 216 MHz have been set aside for the use of wireless microphones in motion picture/TV production and radio/TV broadcasting. This portion of the band contains the frequencies used by TV channels 7 through 14. However, wireless microphone users are

considered by the FCC to be secondary users, meaning that they may not be used when interference is experienced by the primary (broadcast station) user. Problems are avoided by utilizing the local unused TV channel since no two adjacent channels are present within the same city.

Since 1984 the FCC has also set aside discrete frequencies in the high 169 MHz and low 170 MHz range for radio microphones. For the most part, authorized users have relatively clean frequencies within these new frequencies, and therefore only need to concern themselves with interference from other wireless microphone users. In actual practice this is generally not a major concern since, as pointed out above, wireless microphones radiate such low power.

It should be mentioned that there are wireless microphone systems manufactured in the UHF band. Currently there is little interest in this band in the US because there are no UHF frequencies set aside by the FCC for wireless microphone use. Due to the congestion of high powered two-way radios operating in the UHF band, interference is greatly increased. Furthermore, the cost of manufacturing systems in the UHF band is considerably higher. Because radio propagation in this band is highly subject to multipath-induced dropouts, diversity receivers are mandatory, thereby increasing costs. Additional radio propagation losses in the UHF

band results in either very short working range or the need for RF power amplifiers. Generally, directional antennas are needed for the receivers, further reducing system operational flexibility.

There are some low cost systems manufactured in the 49 MHz and 72 MHz bands. These systems are for the most part of limited quality and are not of interest for high performance applications. They compete for the airways with garage door openers and other consumer products, further reducing the chance of successful performance. These systems, as well as infrared systems, will not be included in this discussion.

AUDIO AND THE FCC

The audio quality of early wireless microphone designs often presented the user with less than desirable performance. This is partially due to technical restrictions imposed by the FCC on wireless transmitters that preclude obtaining the signal-to-noise and dynamic range levels required for professional applications

The FCC regulates the maximum permissible carrier deviation and occupied RF bandwidth—thereby limiting dynamic range in wireless microphone systems, FM broadcasting, and TV audio carriers. For wireless microphones operating in the VHF high band, FCC requirements limit deviation to ± 15 kHz. Residual FM due to transmitter audio circuit noise, transmitter oscillator noise, and receiver local oscillator noise must be less than 0.34 Hz (rms) to achieve a 90 dB S/N (signal-to-noise-ratio). This does not include the noise contribution of the additional receiver circuits. Without audio processing, even extremely well designed wireless microphone systems can rarely achieve better than 85 dB S/N.

Wireless microphones operating in the 900 MHz frequency range are allowed ± 75 KHz deviation. At first glance, this additional deviation might seem to solve the S/N problem, but in actuality it does not. The fact is that at higher frequencies, incidental FM (phase noise) increases and the wider deviation merely offsets the incidental FM.

What we have discussed thus far has been under ideal conditions. In metropolitan areas, the spurious output from high power transmitters, low level broadband transmitter noise, and electrical contact noise and arcing can result in a high ambient RF noise level across a wide RF-spectrum range. The noise generated is usually of an objectional nature consisting of random noise bursts and low level modulated tones. Even if wireless equipment could be designed to achieve 90 dB S/N without processing, it is unlikely that 80 dB S/N would be realized in urban areas.

AUDIO SIGNAL PROCESSING

To overcome the S/N and dynamic range limitations, most manufacturers employ

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cooperative compressor/expander processing. The term "cooperative" is used because complementary signal processing is applied at both ends of the audio link. The total input dynamic range is compressed by a 2:1 ratio in the transmitter, and expanded by a 1:2 ratio in the receiver.

For instance, if a signal enters the transmitter with 100 dB of dynamic range, the compressed transmit-signal's dynamic range would be 50 dB. The maximum audio level fully deviates, just as in an ordinary transmitter, and the receiver demodulator output is a replica of the compressed audio signal produced in the transmitter. The noise floor of the RF link is assumed to be 70 dB to 80 dB below the audio level at full deviation. This is typical of the S/N found in unprocessed wireless microphone systems. When the compressed demodulator output is expanded in the receiver, the full 100 dB of dynamic range is restored.

In the expansion process, RF link noise is processed in the same manner as the audio. If the link noise is 70 dB below the audio level at full deviation, the 1:2 expansion will result in a reduction to a theoretical 140 dB below the same reference audio level. Nonetheless, the performance of the processor circuitry itself limits the actual dynamic range to 90 dB-105 dB (depending on the design). The only residual noise is the "white" self noise of the processor, which is far and away more tolerable than the objectionable RF link noise. The processing removes the dynamic range limitations of the RF link—reducing low level spurious tones and noise bursts to inaudibility.

The processors in wireless microphones have much in common with the processors used in recording. One typical device is the NE-572 which permits control over attack and release times, and offers much faster attack time than previous devices. The NE-572 allows the use of an external low-noise op-amp for the processing amplifier, yielding an improved dynamic range. Another device of note comes from dbx, a leader in the development of similar devices used primarily in the recording industry. Until recently, other systems by dbx did not meet the size and current (i.e., electrical) criteria necessary for wireless transmitter design. The device works in very much the same way as the NE-572, and has recently been introduced in a unit by Samson.

Due to the high performance offered by new processors, the emphasis of their inaudible operation can be tempting. However subtle, the finite attack and release times of the audio level detectors within the compressor/expander circuit slightly alter the dynamics of complex audio waveforms. Also, during compression, certain phase information is lost. In both cases it takes a discriminating ear to detect the presence of the processor, and the benefits of the increased dynamic range and S/N far outweigh the insignificant ef-

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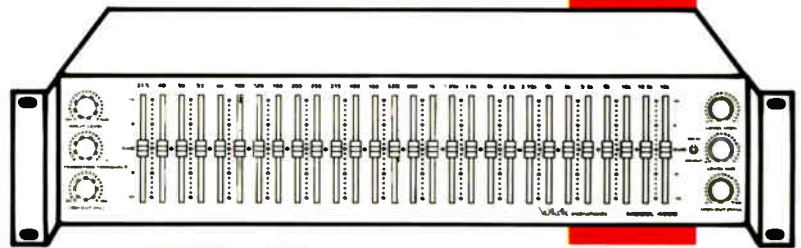
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facts of the processor.

As component designs improve in both size and power consumption, additional methods of processing may become available for wireless equipment. One such method would be an improvement on existing companding technology, providing dedicated spectral companding over several sections of the audio bandwidth. Another would be to incorporate a Dynamic Noise Reduction (DNR) system that would react to input levels. Both of these methods are routinely used in the recording industry.

Digital audio offers a different approach to solving the problem of dynamic range in wireless microphones. In this type of system the input signal would first be converted to a digital signal via an A/D converter and then transmitted. After the demodulator, the signal would be converted back to analog via a D/A converter. Hence, a multitude of processing functions could be performed using DSP (digital signal processing). Also, a direct digital output could be used for a digital mixer. (See: "Digital Signal Processing," Sound & Communications, Mike Biegel, Dec. 1986)

This method is currently not feasible for several reasons. PCM digital signals require much greater deviation than analog signals. The phase relationship of the RF carrier and diversity switching can cause glitches. Also, the accumulation of unsynchronized digital clocks can cause noise more unpleasant than that found in unprocessed systems. Limitations by the FCC on both digital transmission and occupied bandwidth are a problem.

The processing found in today's wireless microphones offers professional quality audio with a minimal amount of artifacts. These newer DNR devices are small, offer low current drain, and provide manufacturers with proven low-cost performance.

DROPOUTS & NOISE

Areas with metal obstructions (ducts, reinforced concrete, steel beams, furniture, etc.) are good reflective surfaces for the

VHF-band. Nonmetallic objects (including the human body) can absorb RF in the same manner as audio frequencies are absorbed in the acoustical environment. Thus, reliable range is significantly reduced by both absorption and reflection of the RF energy. These multipaths create multiple small points in space where the signal level is much lower than the average level. The worst case, a total dropout of RF and consequentially audio as well, occurs when the two radio-waves are 180 degrees out of phase with each other. These dropouts, frequently called "hits," can be most annoying and, depending on the situation, may render the system unusable.

An equally annoying phenomenon, appropriately called "noise-ups," occurs when the two signals are less than 180 degrees out of phase with one another. This occurs when the average signal level is low, due to the vector summation of the direct and the reflective waves, and the receiver squelch circuits briefly close causing the receiver to lose capture of the intended transmitted signal. Stray interfering signals then may be permitted to enter the receiver, causing any of a wide variety of objectionable noises.

DIVERSITY

Diversity is one of the most familiar buzz words one hears whenever the discussion of wireless microphones comes up. It was through the use of diversity receiver techniques that one of the biggest problems plaguing cordless microphones—fades and dropouts due to multipaths—were significantly minimized. The first wireless microphone diversity system was introduced by Cetec Vega in the mid-1970s.

Diversity provides the continuous and instantaneous selection of the output of two antennas—passing the larger signal. With properly spaced and positioned receiving antennas, the variations tend to average out. A good diversity system will provide almost total freedom from dropouts and noise-ups caused by multipaths and will increase the effective working range, particularly when the average RF

signal levels are low. When used with audio processing, diversity provides a high degree of immunity to audio disturbances caused by RF propagation effects.

Not to be overlooked is the fact that diversity systems are nearly foolproof. That is, untrained personnel can place the antennas randomly (within reason) therefore, large areas can be covered with minimal setup time, and the probability of successful operation will be quite high. Furthermore, successful operation is greatly increased with diversity systems when extremely large areas need to be covered or where the performer will be going from one room to another.

Many contractors find that the time saved, reliability, and peace of mind more than justify the additional expense of diversity systems. In those extremely difficult applications, like the 32 Vega systems that were used for Liberty Weekend, there is clearly no alternative to the use of a good diversity system with audio processing.

It should be pointed out to cost-conscious users that successful performance of cordless microphones with single-ended receivers is possible if extreme care is exercised in selecting a quality system. Placement of the single antenna should be carefully considered. Ideally, the area where the transmitter is to be used should be "walk tested" to discover the dead spots.

NEW HORIZONS FOR WIRELESS MICROPHONES

Cordless microphones have indeed come a long way. The latest improvement is Cetec Vega's use of Gallium Arsenide Field Effect Transistors (GaAsFETs). These semiconductors offer a vast improvement in performance over the silicon transistors they replaced as RF amplifiers because they have lower noise figures. They are used in the front-end of the receivers, improving the sensitivity, and approximately doubling the useful operating range of previous designs. An enhanced RF selectivity also allows the simultaneous use of more wireless systems.

It is expected that other manufacturers will use these same devices in their new designs, as well as others as they are discovered. Future designs will surely employ surface-mount technology, reducing the sizes of the transmitters and receivers even further than they are.

Next Month: The technology and practice of diversity systems.

Bill Sien is a principal of Systems Wireless, Ltd and has a BS from the University of Maryland.

Steve Barbar has done extensive course work at the University of Maryland while working in their A/V Department. He has over seven years working experience in the field of audio doing studio recording and live concert mixing.

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Sound and Communication in... THE 1990s

Industry executives talk to S&C about the future and how to get ready for it.

By Greg Prince and Fran Avnet

Thinking ahead? Get ready for the great leap forward. The consensus of the industry is: In the 1990's the sound and communications industry will be more specialized, yet more diversified; will be more dependent upon microprocessors; will be more software based; will use more video products; and will be gearing up for fiber optics and more use of satellite communications.

Watch the demographics: The baby boom will continue to have an effect. As Jim Morrison, sales manager of Aiphone says, the new baby boom in concert with an increasingly older population will create new opportunities for school systems and for nursing and retirement homes.

Watch the technology: As Robert McMartin, financial administrator of McMartin International notes, there will be more use of satellite transmission and more use of subcarrier systems for communications in new and useful ways.

Watch the products: As products become miniaturized, more uses are found for them. As Vicon president Donald Horn points out, "Before, we were an original access manufacturer creating parts but not the whole system. In the future, we will see the camera being more involved with the system and being able to relate more directly to the applications. The biggest change has been in the introduction of the solid state camera—the whole industry has become solid state. With the shift to solid state, the cameras get smaller and that opens up whole new applications."

And watch the marketing: Projections made by the smart companies today are including all the factors listed above, and the industry is presumably ready for the future of a new and expanded sound and communications industry in which the words sound and communications will have evolved into having richer and fuller definitions. JBL president Ron Means may have set down the principles that will help guide this business into the next century: "Contractors can be a little more open-minded regarding the definition of their business," Means declares.

Bogen vice president of marketing Carl Dorwaldt adds a similar sentiment: "I think you'll see more quote, unquote 'contractors' broadening out from sound to sound, security, TV, fire alarms and so on."

When it comes to considering the sort of products that may emerge in the not-so-distant future, intercoms may have a

tough go of overcoming public perception of what these devices are about. "The customer is still thinking of the old squawk box business," says Ken Jensen, general manager of Stentofon. "You just press a button and talk to somebody. That's how it got its name—it sounded like a squawk box hollering at you. Compared to what the average person knows, it is a fairly sophisticated product. It's as sophisticated as any telephone switch on the market today."

"The American mentality is that they have depended on, and rightly so, the telephone for inter-office communication for so long, that they think that's the only way to do it. Americans have walked away from the high-tech intercom market."

Zvie Liberman, president of Talk-A-Phone, looking at intercoms designed for security purposes, says his company's new products are being developed and released on a continuous basis. The key to their development, Liberman states, is, not surprising, the direction technology takes.

"Intercommunication equipment fills a lot of different needs that are developing. Right now one of the most obvious needs is the security area," Liberman explains. "We see changes in our equipment in terms of complexity and production techniques as electronics themselves become more chip-oriented, more compact and more able to do complex things. The contractor has to keep his eyes open to see where the intercom can be integrated with other equipment he's working with."

Aiphone's Morrison expects his product line to change in accordance with the needs of the population. "We expect to update and refocus our product line to meet those needs," Morrison speculates. "In all probability, some of our present intercom systems will be replaced by systems based on microprocessors within the decade. Beyond the decade, other new technologies, such as fiber optics are sure to have an effect on the products in our industry."

For Jeron's Alicia Adams, new products will simply reflect the evolving nature of the industry. The health field provides a good example. "I expect our product line to continue to change in a manner similar to what has been taking place," Adams says, "Some products are developed and become standard. Then new products are developed that are modifications of the original, but they become the standard of the industry. As an example, our AV-600 nurse call system is a standard of the industry. Now we at Jeron have developed a modified product, the AV-350 communications system. This product meets similar needs where economy is a greater factor, such as in long term care facilities, dorms, schools, prisons and in military installations."

Ring Group vice president Peter McLean takes the view that there is no crystal ball which will tell what kind of intercoms we will have by the late '90s. However, he knows substantial progress will be made.

"I don't think the office of the future is a good term," McLean said. "It's an overworked term. People get confused. The general consumer is inundated with advertising as to where he's going to go. A lot of them don't know what they want. It's up to people like ourselves to direct them."

One change McLean does forecast concerns general intercom networks. "They will provide not only voice but data as they do now if people will use them," McLean says. "Right now, it's a very small segment of the market. The increase of technology and the ease and use of technology in the last two, three years is phenomenal."

Business music systems are bound to sound different in the next decade. AEI president Mike Malone speaks of a high-quality extended play cassette for on-premise use. "It's a four-hour cassette with custom playback heads," Malone explains. "Satellite transmission brings an opportunity for high power direct satellite broad-

cast for strictly-music programmers to diversify. The use of the satellite will allow these companies to transmit high-speed data and other information."

"There will be more use of high-tech items being used for everyday use," agrees EMS Music vice president of national music service and sales G. Bernard Kron. "There will be more use of computerized

"There will be more changes in the intercom industry in the next 10 years than there were in the last 30 years."

Jim Morrison
Aiphone Corporation

and digitalized technology in specialized ways that offer advantages.

Robert McMartin predicts McMartin International's product line will remain industrially-oriented. He also points out, "Once they figure out how to do a car radio for the SCA, SCA will go into car radios."

Larry Karr, president of SCA Data Systems, thinks the emphasis in the music system field will be on services. "I think we're going to see a lot of variations of more services", Karr projects. "We're going to see more tailored audio. In other words, we'll see things like commercial announcements that are incorporated in various tricky ways into the audio, which are pulled out of another channel, let's say, and tailored for that particular establishment. I think we'll also see the broadcast side, compact disc changers, where the music provider provides compact discs and a play list."

"Video is now part of our culture and is now accepted and expected by the baby boomers," notes Muzak president Mark Torrance. He definitely sees visuals as part of the company's future. "I can't speak for other companies, but in our case, we are expanding beyond background/foreground music into areas such as video, advertising and other sound and communications needs the market may have," Torrance says. "I think it is a positive trend because it gives us room to expand. It would be a mistake to get into an area that we are not experts in because of the danger of being expansion-oriented."

And in Tape-Athon president Lee Tate's mind, a company can take two different routes in product development. "Either saturate the marketplace and have to get into something different—so we can come out with new products, or within the industry, creating allied or alike products," Tate figures. He's also counting on more full-line manufacturers. "We can't afford to be specialty manufacturers anymore," Tate declares.

In closed circuit television, Vicon's Horn foresees "an evolution where the camera

and the product are easily identified as individuals visibly. The size of the camera and its design are beginning to be recog-



Once they figure out how to do a car radio for the SCA, SCA will go into car radios.

Robert McMartin
McMartin
International

nized as individual elements. Now they'll blend together. We are now working on the track light camera. This is where the camera is part of a track lighting system."

"Vicon has been in the midst of a five-year project. In the first year, we studied the needs of the CCTV industry. For the next two, the evolution of our product line and packaging and new camera elements."

Avtec Industries president James Gore is not shy about predicting drastic changes in his field. "The communications industry, as we know it today," Gore insists, "will be obsolete by the mid-90s." Gore refers to recent developments in two seemingly unrelated and young industries which have sparked unprecedented growth in communications technology.

"Some call it a marriage," says Gore, "but I like to refer to it as a love affair, and the relationship of video and the personal



"We are now working on the track light camera."

Donald Horn
Vicon

computer has been technologically torrid. Look what has happened already in these industries: Through digitalization, we have smaller, trimmer and lighter TV monitors and are able to generate an unprecedented array of sophisticated graphics. Through video and the computer, we are able to take original objects, including written documents, data, charts, vu-graphs and 35mm slides, and display these images on an auditorium or board room screen. We can convert PC data into a format that can be displayed on a high resolution television screen. Then these images can be transmitted instantaneously to any number of locations around the country."

In audio, expectations are diverse. For example, ART president Phillip Betette says his company's products will become more and more software based, with emphasis on items that will have a specialized nature. In the view of Bogen's Dorwaldt, the watchword for amplifiers will be digital. And John Lee, president of Crest Audio, believes the future holds, more than anything, amps that are lighter in weight and higher in power than they are today.

Eddor president Larry Weston believes

"I believe dealers will have to be able to do things on a production line basis rather than reinventing the wheel every time a new job is designed."

Ron Means
JBL

that the biggest change that can happen in audio is for the equipment to be more user-friendly, a factor he says will be more important than miniaturization. IED director of marketing and sales Tom Roseberry looks to the computer for answers about new audio products. "We'll diligently expand control of the system through the flexibility of the computers," Roseberry says. "We will see more pressing of the audio actually being taken over in that manner."

Similarly, JBL's Means expects "to see more computer or more microprocessed devices, higher quality versus size and weight in our product line, and much more of a packaged concept, an integrated concept, allowing the contractor to spend more time pursuing the job than installing it."

Quam-Nichols president Bill Little sees things in a two-pronged way. "The two tracks taken for the future are improved performance for the more discerning listener and components that reduce labor involved in installation. The latter is the most important. You might see changes in niche products, but typically the contractor is very slow to make changes."

Electro-Voice's, vice president of sales and marketing Paul McGuire says the loudspeaker scene will see "a concerted effort to pack more power into smaller packages. Many loudspeakers are being moved from place to place and it becomes a great concern because of cost and cargo space." And microphones? "The whole aspect of voice recognition will be impor-

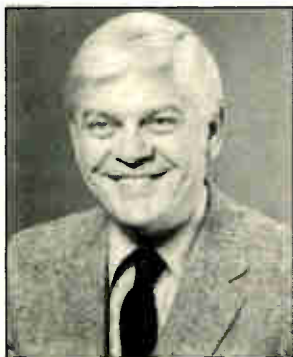


"If I had a soapbox to stand on, I would say contractors should be doing market research and long-range planning."

Carl Dorwaldt Bogen

tant," McGuire says. "We've been looking at it seriously from a research point of view. Not all microphones are responding accurately to voice commands in the voice recognition application. This calls for a need for more highly specialized microphones."

Tony Tudisco, vice president of sales for Sennheiser, predicts advances in microphones and headphones will involve "convenience, better fidelity, newer material and lightening of pieces to get the job done better without the equipment using too



"Americans have walked away from the high tech intercom market."

Ken Jensen Stentofon

much." Tudisco projects less of a role for entangling wires and cables, which he thinks will continue to be replaced by infrared wireless transmission.

As in any electronics-related industry, one must explore new technology in sound and communications, not just for what it means to specific products, but to get a handle on the field's direction in general. And without a doubt, high-tech can only fly higher in the '90s.

"I would say pretty much that the technology today won't be around in 10 years," says Crest's Lee. "Very little of what we're doing now has very little of the circuitry from a few years ago and the advances should be even greater in the next 10 years.

"There have been a lot of technological advances and there are still a lot more to come," McMartin points out in trying to put the Big Picture in perspective. "People are always wanting to communicate with each other. And people are always trying to find better and more productive



"The contractor has to keep his eyes open to see where the intercom can be integrated with other equipment he's working with."

Zvie Liberman Talk-A-Phone

ways to communicate."

Demographics will play a large role in shaping the sound and communications market of the next decade. One factor will be where people live. "Our particular industry always has to track new construction markets and follow population shifts," says Bogen's Dorwaldt. "You see where people are moving, where there will be new schools, where people are getting old, where there will be nursing homes and other service industries, where you might see more fast food establishments for paging and music systems."

Music systems and audio, in particular, may be affected by demographics. We are reaching a stage where a large segment of the population takes more than a passing interest in sound quality. "It's a more

"Now the nurse is working smarter. And this trend will continue."

Alisha Adams Jeron

discerning audience," says Quam-Nichols Little. "A generation that has grown up on quality music will be a little harder to satisfy."

"I think that the tremendous acceptance of the compact disc indicates that the world at large is interested in high fidelity," adds Karr of SCA.

With the original baby boomers having kids of their own (perhaps not a second baby boom, but the sheer numbers produce the same effect), the institutional market for security and communications intercom systems will be a promising one with an upswing in school construction. And as Aiphone's Morrison points out, "the growing population in the over-55 age group will mean more nursing homes, retirement homes and convalescent centers."

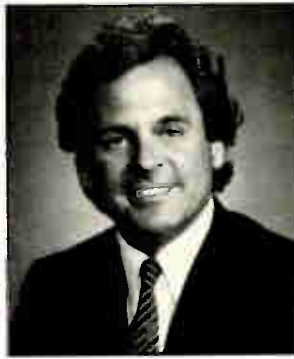
New markets are likely to open up for the contractor. It is Avtec's view that new technologies have potentially far reaching effects in the medical profession. Malpractice suits, combined with spiralling costs of insurance have forced many doctors and surgeons to consider alternative specialties. To meet the changing needs of this field, Avtec has developed a video tape recording system providing limitless applications and opportunities for the medical profession, including surgical, consultation, education, study and research and hospital administration procedures such as record keeping.



"I don't look upon the other fellows in the intercom business as my competitors. The telephone system is my competitor."

Peter McLean Ring Group

Stentofon's Jensen hears only good things about intercoms. "The market will be growing dramatically," he says. "There



“Contractors have to align themselves with suppliers or a music supplier that provides them with new technology and state of the art services.”

Mike Malone
AEI

are a lot of different areas of the market, such as the typical apartment intercom that hasn't changed except where they have introduced the telephone where it rings on the telephone instead of an independent



“We see a lot of specialty music for specialized markets.”

G. Bernard Kron
EMS Music

speaker. The industry has grown, not in quantum leaps, but it has grown.”

“The market for intercoms will also be affected by the public's changing attitude toward security,” says Morrison. “While many Americans didn't even lock their doors 30 years ago, now they're locking them 24 hours a day, and many are installing alarms. In 10 years, the majority of homes also will add intercoms with electric door releases that help identify who is at the door before it is opened.”

New applications and markets are likely to emerge for music systems. Kron of EMS Music sees a more fragmented scene. “We're breaking down into more specialized businesses,” he says. “We are selling equipment to people who weren't

“The acceptance of the compact disc indicates that the world at large is interested in higher fidelity.”

Larry Karr
SCA Data Systems

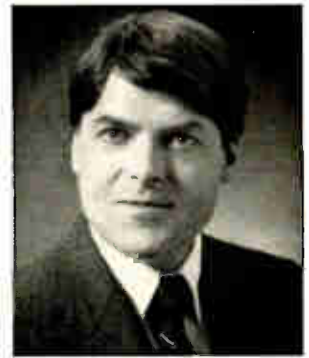
traditionally into it, such as hotels, arenas, restaurants and retail clothing chains. We see a lot of specialty music for specialized markets.”

Attitude will play a big part in the future of the audio market. “If you're going to spend two million on a new building, you should not spend \$20,000 on the sound system if the building's purpose is music entertainment,” Lee says, referring to price-over-quality philosophy some institutions still have. “You should spend \$200,000.”

“New applications for sound systems is a rough topic to talk about,” admits IED's Roseberry. “I'd have to say the replacement market for the sound industry will be important. The users of equipment that's 10 years or older are unaware of improved operation. The market for this industry isn't pursued to the full extent it should be.”

There's plenty for the sound contractor

to consider for the future. Staying abreast of new technologies and markets is just one aspect of the contractor's planning. “The contractor has to be sensitive to what he sees in the market place,” says Talk-A-



“Video is now part of our culture and is now expected by the baby boomers.”

Mark Torrance
Muzak

Phone's Liberman. Musak's Torrance suggests the contractor can prepare for changes by attending conventions, among other things. It is better to be cheerful, not

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fearful, about the future, Torrance says.

"Contractors can prepare for the future by pinpointing new markets—such as automobile dealers, schools, retirement homes, local, state and federal offices, warehouses and prisons," Morrison recommends. "Go after sales now and also establish contacts that will be useful when newer high technology products become available."

Manufacturers stress they are anxious to work with contractors in the interest of mutual benefit. The two parties getting together as a team is "the only way," according to ART's Betette. "Contractors have to align themselves with suppliers that provide them with new technology and state of the art services," adds Malone.



"We can't afford to be specialty manufacturers anymore."

Lee Tate
Tape-Athon

According to Barry Rubin, sales manager, TOA Electronics, Security Group, the solid state camera may become obsolete "because the chip technology keeps getting better and closer to what we can now get with tube cameras. Our line of current tube cameras will probably be the last we'll build." Rubin admits that it's hard to tell when the tube camera will bow out "because there still may be some applications for it in the future." He feels five to seven years is a good estimate.

"Contractors should be looking to manufacturers for products that support their efforts," says Electro-Voice's McGuire. "We are trying to introduce contractors to computer aid design systems for acoustics. In two to three years, we'll see systems that are more accurate and easier to deal with."

Rubin agrees there is a need for improved communications between the manufacturer and the contractor. "It's part of TOA's philosophy to build a better relationship between us and the customer."

Another concern for the contractor has to be the range of services his own business provides. Weston of Edcor thinks carving out a niche is important. "Everybody now thinks they're a sound contractor," he says.



"The communications industry as we know it today will be obsolete by the mid-90's."

James Gore
Avtec Industries

"Music stores, furniture stores with a hi-fi section, Radio Shacks. Not to say some of these guys can't do the job, but that makes it tough on the legitimate sound contractor. I've never heard of some of the people who are doing installations of our products. Anybody can buy anything."



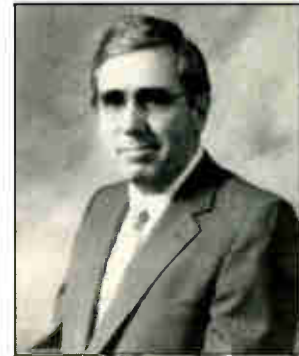
"The contractor and the manufacturer have to work together as a team. That's the only way."

Phillip Betette
ART

"The low voltage sound contractor has to be a generalist," insists Jeron's Adams. "He may be called on to design a nurse call system for a hospital, or an intercom-entry system for a multi-unit housing development, or an emergency call system with smoke detectors for a senior center or dormitory. Today, he may be installing in-out registers or room status or door monitor systems in any number of facilities. Tomorrow, he may have to solve an intercommunication problem for an entirely new type of application."

The sound and communications industry is proceeding at pace with the

demands of new technology. As digital audio becomes commonplace for the consumer, he is going to demand better audio in every place he's in. As quick communications becomes expected, the in-



"We'll diligently expand control of the system through the flexibility of computers."

Tom Roseberry
IED

dustry will respond with quicker and better demands. Miniaturization will create new products and new markets; the expectations of video will be met by all facets of the market; advertising media may become ubiquitous; fiber optics will be the transmission of choice for some applications; satellites will be used for applications undreamt of today.

And, in 1999, with a little luck, Sound & Communications magazine will do an article on what to expect in the 21st century.



"Contractors should be looking to manufacturers for products that support their efforts."

Paul McGuire
Electro-Voice

Greg Prince is a freelance writer specializing in electronics, audio and video. He has written for *Billboard*, *Backstage*, *Crain's New York Business* and *Home Entertainment*.



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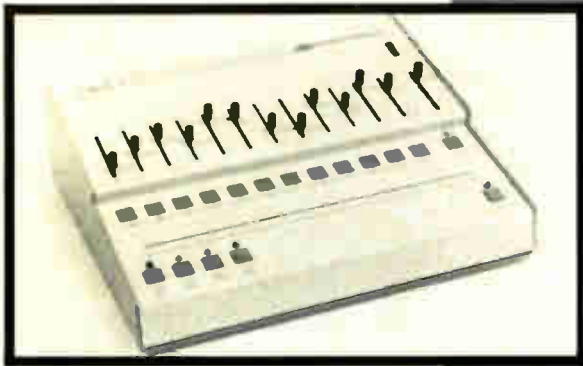
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MIDI and The Contractor

by Jesse Klapholz

(Top to bottom) Everything in an installation can be MIDI controlled, including lighting with JL Cooper's MIDI Lighting Controller. Roland's DEP-5, a digital effects processor. Korg's SDD-3300 has three 500 msec digital delays. ADA's MQ-1 MIDI EQ has 99 programs and full MIDI capability. One of Yamaha's many digital products, the DMP7, a digital mixing processor.

“If purely electronic music becomes the vogue, even the musician would be eliminated; the concert hall would pass from the scene, along with the symphony orchestra, the concert-goer, the usher, and the ticket-taker. The musical innovator and the electronic technician would then rule supreme—unless the electronic computer manages to displace them.”
—Leo Beranek, *Music, Acoustics & Architecture*, 1962.

MIDI, which is firmly established in the M.I. marketplace, is rapidly being included in a myriad of signal processors and now mixing consoles. Today's contractor should be familiar with what MIDI is and how he can use it effectively.

MIDI, which stands for Musical Instrument Digital Interface, is an industry agreed upon standard for serial communications among synthesizers and/or between synthesizers and any other piece of electronics, whether it be signal processing, a console, a tape deck, a sound system, a lighting console, or a computer. Personal computers, as simple as the Commodore 64, give the musician and engineer the same utility that word processing gives the writer and spread-sheets give the businessman.

The standard was first proposed in 1981 at the 70th AES convention in New York as the Universal Synthesizer Interface (USI) by Dave Smith and Chet Wood of Sequential Circuits, Inc. Sequential's original proposal was amended and approved by a joint committee including representatives from Sequential, Roland, Yamaha, Korg and Kawai, all keyboard instrument manufacturers. Changes made from the Sequential proposal were said to be compromises aimed at quickening the MIDI pace, still a drawback of the system. While the USI was more comprehensive than the present embodiment, MIDI has nevertheless proven itself with its myriad of applications. MIDI is not to be scoffed at as “that music store stuff.” It is an important standard that will ultimately complete the union of musician and engineer.

The computer, using a MIDI card and software, can serve as the communications and control center for extremely complex setups and operations with archival storage on disk. These data, which may be a combination of performance and manipulation of other devices, can be later called up and be re-performed, and/or edited as in “copy-and-paste” of word processing. Time signatures, tempo, key, etc., can be changed from bar to bar; signals can also

be sent out to external gear changing their settings from bar-to-bar. MIDI info can be synchronized to SMPTE time code, and the possibilities are almost limitless.

MIDI is significant to all phases of audio engineering and its operation and technique are important to all of us. First and foremost, like most computer-related protocols, all MIDIs are not created equal. Every device has its own kinks and/or limitations usually determined by how much technology a manufacturer can cram in for a given price point. The key words here are “data exchange” and “protocol.” It was in 1983, after the leading manufacturers had agreed on the MIDI-1.0 standard, MIDI was used for the first time in connection with keyboards.

MIDI facilitates the exchange of data between devices that are operated in its domain. This means that MIDI is a standardized *interface* where MIDI signals are sent and received: a MIDI-receiving device will receive MIDI signals and execute the corresponding commands, a MIDI-sending device will generate MIDI signals and send them. Thus, there is an *active* (SEND) and a *passive* (RECEIVE) status in a MIDI system, a hierarchy is built up where the passive components will *submit* to an active MIDI device and execute the commands received.

MIDI is a high-baud-rate asynchronous serial interface for the bi-directional communication of MIDI IN and MIDI OUT information. *Serial* means that MIDI information is transmitted one bit at a time, in sequence. *Asynchronous* means that each MIDI receiver responds to the incoming MIDI data just as fast as it can, without waiting for a signal that other MIDI devices are ready to act. *High-baud-rate* means that the MIDI implementation is fast—31.25 Kbaud (31,250 bits per second). The information itself consists of words, where each word contains eight bits plus one starting-bit and one stop-bit:

MIDI can communicate various types of data between devices properly interfaced that include commands for note-on/note-

off, select a new voice, pitch change, velocity, pitch bend, modulation change, sustain control, after-touch, clocking information, various sequencer commands, plus a variety of system-exclusive commands which are up to the individual manufacturer to define. The system-exclusive commands allow manufacturers of devices that have special features to be controlled via MIDI, i.e. delay line settings. There are 16 different channels in the MIDI standard in which each can transmit up to 16 notes simultaneously or a total of up to 256 notes. In practice, several of the 16 channels are used for sequencers, drum machines, and other automation tasks.

Devices that adhere to the MIDI standard are intended to work together properly in their least common level. MIDI can't add features to a device that does not have them. For example, if a synthesizer is not velocity sensitive, then it will ignore velocity information from a velocity sensitive master keyboard.

How does MIDI work? Normally, MIDI devices have three different MIDI jacks (5-pole DIN): MIDI OUT where the MIDI data are sent; MIDI IN where the MIDI data are received; and MIDI THRU where the received MIDI data are looped through.

Devices that are designed for passive (receive) mode of operation have only the IN and THRU jacks, thus cannot send MIDI signals themselves. Hardware-wise, the MIDI circuitry is an opto-isolated TTL-compatible current loop configured for the 31.25 ki lobaud asynchronous serial data transmission.

The opto-isolation may seem like a panacea at first since there is complete isolation from the audio ground and one can almost completely forget about ground loops. However, each opto-isolator requires a finite amount of time in which to respond to data on its input. Since the serial data pulses transmitted by MIDI have rise times that are faster than the response times of the opto-isolators themselves, each opto-isolator introduces slew-rate-limiting

(Clockwise) Alessis's Midiverb. Soundtracs MIDI series mixer is one of many "user friendly" products on the market. ART's Proverb. Allen Heath Brenell's CMC 24 mixer.



distortion to the MIDI data. Thus, if for example, three devices are communicating via MIDI daisy-chaining, then the MIDI data has passed through four opto-isolator

circuits and the data distortion has been compounded three times. After only three or four times, the pulse symmetry becomes so degraded that the MIDI circuitry down-line can no longer read the MIDI data reliably. In practice, three receiving devices is the limit in daisy-chaining.

The solution to this most common problem in MIDI applications is to use a MIDI THRU "box" as the heart of a star network. An ideal MIDI THRU box would incorporate a single MIDI connected to a fast opto-isolator to drive up to 20 MIDI THRU's via digital logic. Thus, a single MIDI source could drive each receiving device with a virtually distortionless replica of the transmitted data. Currently, both Yamaha and Roland manufacture MIDI THRU boxes, but these devices utilize standard (slower) opto-isolators and have only four MIDI THRU's each. In context, they represent a small-scale solution to the problem.

MIDI cables transfer high-speed digital data and as such must be constructed accordingly. The cables should be properly shielded to prevent MIDI data errors caused by electromagnetic and electrostatic interference. They must be low-capacitance



cables to minimize data distortion due to high-frequency attenuation. MIDI cables should be as *short* as possible. At no time should a MIDI cable exceed 50 feet in length.

Getting MIDI signals in and out of computers is another matter that requires a MIDI port. Yes, that's right, even if you have a serial, parallel, Centronics printer, joystick, mouse, RS-232, and IEEE ports, that's not enough. With the exception of the Atari 520ST, the Commodore Amiga, and the Yamaha CX5M computers (where the MIDI port is built-in), a peripheral-card that has the appropriate opto-isolators, digital-data buss interface, and DIN plugs is what it will take. These cards range from about \$100 for a dumb card to about \$300 for a smart card as exemplified by the Roland MPU-401. A dumb interface does only the electrical conversion to and from MIDI, while a smart interface takes some of the processing burden off of the computer.

Just about any popular PC can take advantage of MIDI. The computer becomes the digital heart of the MIDI system and techniques are under constant development that are expanding its horizons.

Technology from the computer and communications sector is providing musicians and engineers with new tools at an unprecedented rate. High-speed digital data transmission technology, for example, will allow transmission of MIDI information across town or across the world. The need and resources of the information technology sectors greatly exceeds those of the music industry. Therefore, contractors are benefiting from the technology that trickles down.

New features of MIDI are about to be implemented. They are: MIDI Time Code and MIDI Sample Dump. The Time Code will allow a MIDI device to directly communicate with any SMPTE device. Tape decks in a multi-media show, for example, will be able to be tied in with consoles, ef-

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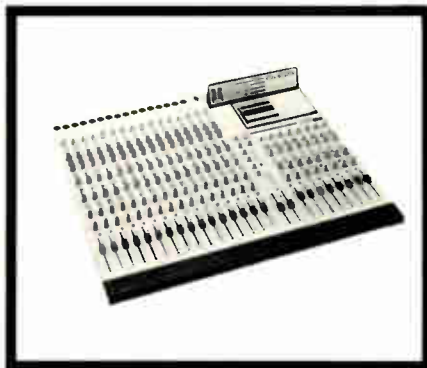
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fects, etc., and be controlled by a simple-to-operate computer. The Sample Dump will allow the transmission of digitally sampled sounds between MIDI communicating devices. This will allow a unit to playback and/or process sounds even though it does not have A/D conversion circuitry.

MIDI has the potential of linking music, physics, and engineering if we all open our minds. MIDI has been around for just a few years. In this short time it has demonstrated the direction of the industry and has provided a preview of the future. When companies like Boesendorfer demonstrate digital mechanical record/playback on a nine-foot grand piano, it clearly shows the narrowing of the gap between the acoustical world and the electronic world.

With powerful and inexpensive DSP-based effects and mixers, personal computers can be used to control unlimited nuances in performance, variable electroacoustics, and sound animation, all via MIDI. The lighting console and multimedia/image controllers have been performing complicated control functions with expensive price tags. With MIDI the contractor will be able to design extremely complex systems that perform limitlessly with open-market, open-architecture expansion capabilities. Furthermore, the contractor will be able to design and supply these systems easily, economically, and profitably.



Jesse Klapholz is Sound & Communications' technical editor. He has written many articles dealing with the sound and communications field.

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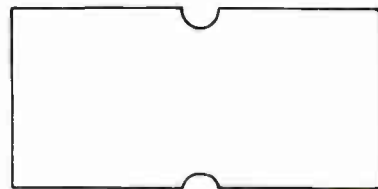
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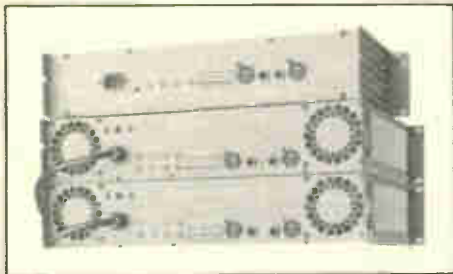
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DX1500 output power: 300 watts into 8 Ω , 500 watts into 4 Ω , 750 watts into 2 Ω (per channel, both channels driven, 20Hz - 20kHz, -0.5dB), 1000 watts into 8 Ω , 1500 watts into 4 Ω (bridged mono) 1500 watts into 2 Ω , 1600 watts into 1 Ω (burst power*) distortion (250mW to rated power at 8 Ω): IMD SMPTE: < 0.01%. THD (1kHz): < 0.01%. THD (20Hz-20kHz DIN): < 0.02% size: 2 rack spaces, 13" behind front panel weight: 15Kgs, 34 lbs. cooling: 2 servo controlled DC fans.

*Burst power is a 1kHz tone for 10ms every 100ms, single channel (an indication of the amplifiers ability to handle music transients and tolerate deviations in nominal speaker impedance)

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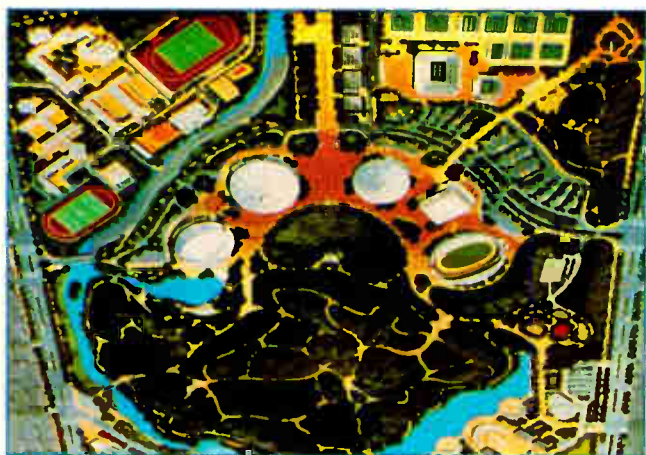
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THE 1988 OLYMPIC GAMES

Part II

Testing The Sound Systems



By **MICHAEL KLASCO**
Menlo Scientific

During May 1986, four of the five arenas were nearing completion and in only a short period the scheduled summer sports events would begin. These would be the initial trial run before the 1986 Asian Games in September. Comprehensive computer simulations of the acoustics and sound reinforcement systems had been completed and the sound systems were installed and operating.

The Sigma RS-4000 Computing Acoustic Analysis Workstation was used for the simulations and was also to be used for the actual testing of reverberation time, one-third octave equalizations, maximum acoustic output, uniformity of coverage, time/frequency/energy spectral decay, and speaker array/digital delay alignment.

The testing procedure used in each

stadium was to roughly adjust the one-third octave equalizer (UREI) for the broadest, most linear response. This would provide enough energy in each one-third octave band for accurate RT60 measurements. After the RT60 measurements were finished, the 3-D time/frequency/energy spectral decay characteristics were reviewed.

The Sigma RS4000 is optionally available with an IQS 401 FFT Spectrum Analyzer, in addition to the Sigma RS4 one-third octave analyzer. The IQS 401 is used for echogram analysis of early reflections while the lower time resolution, but longer time base of the RS-4 is used for spectral decay analysis of global reverberation characteristics. Additionally, the IQS 401 was used to calibrate the electronic crossover settings.

The final adjustment of the one-third octave equalizers was set in con-

sideration of minimizing acoustic feedback, intelligibility, reliable operation and sound quality.

The Asian Games were held from the last week in September to the first week in October, and the sound systems all worked without mishap. Satisfactory sound levels were achieved, with good uniformity and intelligibility.

The Gymnastics and Fencing Arenas both used a central cluster hung from a super structure that was covered with fabric. The sound quality was excellent and the results very close to those predicted in the simulations.

The Cycling Arena featured a complex system of a split cluster and secondary distributed system. Some worries of a flutter echo from one seating section were unfounded, as the seating pitch (incline) was very shallow and the energy reflected upwardly,

(Left) The Complex blooms in color during the '86 Asian Games.
(Right) The Sports Complex as seen from above.

Courtesy of the Korean National Tourist Corp.

above the opposite seating area.

The simulations for the Weight Lifting Arena predicted a RT60 of five seconds (midband) and, unfortunately, these predictions were accurate as confirmed by the testing. I developed a plan for acoustic treatment including diffraction and absorption, but these refinements had not been implemented in time for the Games. The treated Weight Lifting Arena will be ready for the 1988 Olympic Games.

The Tennis Arena simulations had showed some problems with the distributed system arrival times (too much overlapping coverage), but the sound system was never installed, as the Tennis Committee objected to any speakers blocking spectators (or television cameras). A new system is being installed, using a central cluster suspended from the (open) top frame of the structure.

The Main Stadium could benefit

from treatment on the back walls and hard surfaces directly above the speakers. One trade-off that is presently being considered is bass response vs. low frequency RT60 vs. budget. Various solutions are under consideration.

SOUND SYSTEM COMPONENTS PERFORMANCE

While it should not be a surprise that the 2 inch JBL compression drivers and the UREI equalizers performed well, I had a special interest in the performance of the Korean-manufactured compression drivers and cone speakers (especially as I was part of the engineering group that developed these products.). Happily, all the equipment performed to expectations. The mixing boards and amplifiers (manufactured by JE-IL Electronics) also performed well and were more reliable than the equipment I usually see in U.S. installations.

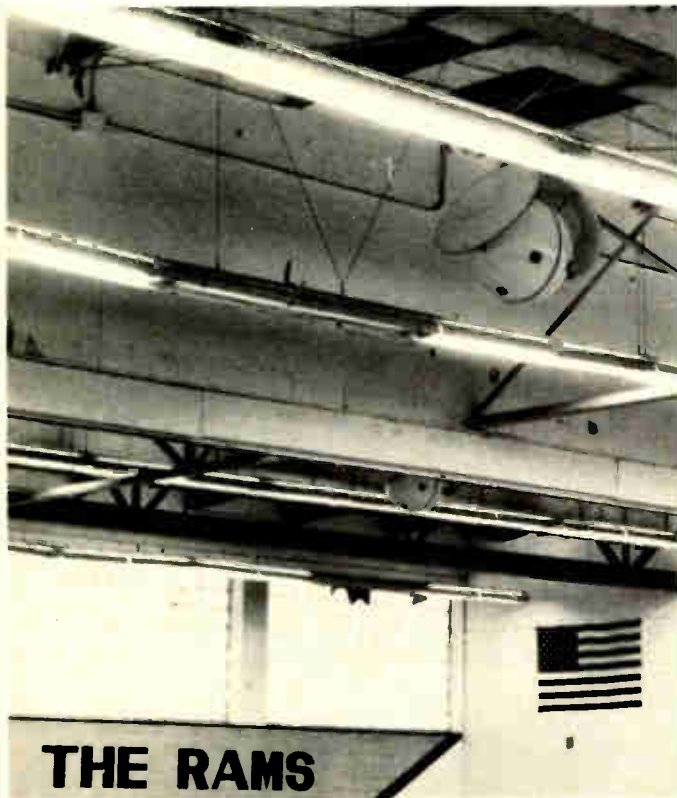
THE RS-4000 ACOUSTICS ANALYSIS WORKSTATION

The RS-4000 is a transportable computer consisting of two disk drives, a 9 inch video monitor, and 176k memory. The computer is compatible with Apple software and plug-in boards. As the computer and programs are in color, an external 14 inch color monitor is included.

As an acoustics analyzer, the RS-4000 was designed as a missing link between the scientific instruments useful for product development/research purposes and conventional one-third octave analyzers. While sophisticated analyzers such as the TEF system can be very powerful tools in the hands of experienced

Mike Klasco, president and founder of Menlo Scientific, is a member of the AES, and is currently working toward a PH.D. in Signal Processing Time Compression.

"I CAN UNDERSTAND WHAT'S BEING SAID!"



After the installation at Taylor Center High School Gym of a new sound system with two #2715 Soundsphere speakers and various electronics, Dave Hill, of Comcast in Warren, MI, received the comment, which speaks for itself "Great full sound." Robert Haarala, Principal has told Tina Merwin, President of the Class of '85 that the system, partially paid for by the class, is "fantastic."

Dave Hill also comments, "Recently, I received a call from another high school sports booster club asking Comcast to visit their school and tell them how their gym could be made to sound as good as the one at Taylor Center." Dave continues, "It's always a pleasure to receive compliments, but better yet to get referrals from customers."

Write or call direct for further information.

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Circle 232 on Reader Response Card

users, many contractors do not have the money or time to invest in their test equipment. Conversely, many sound contractors have outgrown their one-third octave test sets and need to be able to perform RT60 measurements, align electronic time delays, as well as to use computer simulation programs for predicting RT60, room modes, sound system layout, box design, computer aided drafting, etc.

The RTA Real Time Analyzer mode has 48 dB dynamic range; fast, slow 1 and slow 2 "meter" balistics; peak hold, A,B,C and linear frequency weighting; precision SI,II filters; cursor with digital readout to .1 dB; linear and exponential (floating) average with up to 256 samples average; separate or simultaneous peak and average displays; pseudo random pink noise generator. A unique Report function compiles all the data from the RTA mode and generates a report.

The Time Domain Modes include energy/time displays for RT60 and time alignment, and time/frequency/energy 3-D plots of spectral decay or other time varying phenomena. All the frequency resolution is in the familiar one-third octave format, so the operator is not required to set bandwidth or resolution parameters.

The RT60 reverberation time subsystem is especially easy and flexible in operation. Gun shots, impulsers, gated pink noise can be used. Extensive triggering facilities are built into the hardware and software to accommodate pre or post trigger, positive or negative wavefronts, thresholds, and various other factors. Typically useful settings automatically are preset, and RT60 only requires the pink noise generator to be shut off. The computer will do the rest. A visual display will show the energy time curve for wide-band and for each one-third octave band. The computer will also apply a curve-fitting algorithm and calculate the RT60 from the most accurate region of the test.

Both the computer simulation software for predicting RT60 and the hardware for testing the RT60 can be used interactively to help optimize room acoustics.

The time/frequency/energy 3-D function aids in the visualization of time varying phenomena such as room decay (3-D reverb settling time), early reflection room characteristics, visualization of material absorption characteristics, room feedback effects, etc.). The total elapsed time period

that can be shown can be up to two seconds. The quantity of spectra (response curves) can be any number up to 120; additionally, any group within that number can be displayed (e.g. spectra #34 to #43). The time resolution between spectra samples can vary from 10 ms. to 1 second (1000 ms.). The larger the time period between samples, the larger the total elapsed time that may be viewed, but the lower the resolution between samples (similar to time lapse photography). Early reflection analysis would use the shortest time samples,

while a study of low frequency reverberation in a hall would use the longer time samples. For experienced operators who want the increased resolution of FFT analysis, user-selectable bandwidth and frequency resolution, the RS-4000 can be supplied with the popular IQS 401 FFT spectrum analyzer—or this option can be retrofitted by the factory or the customer.

All the functions of the RS-4000 can be filed to disk and printed out on a dot matrix printer (color optional) or x/y plotter.

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S & C's Job Report

Format

STATE

city: Name of Job, \$ Total of Construction, Phase of Project. Contact: Name, Company, City, State; Telephone Number.

TOTAL CONSTRUCTION

- 1—up to \$1 million
- 2—\$1 million to \$9 million
- 3—\$9 million to \$17 million
- 4—\$17 million to \$25 million
- 5—\$25 million and up
- NA—Not Available

PHASE OF PROJECT

- A—Planning = Consultant is designing system
- B—Pre-Bid = Final plans near completion
- C—Bidding = Bid date set
- D—Starting = Electrical Contractor/
General Contractor/
Owner buying now

The following jobs are in various phases leading up to bid. If you are interested in any of the projects, please contact only the names printed below.

CALIFORNIA

Bakersfield: Bakersfield Christian Life Center, 3, D. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.

Beverly Hills: Ma Maison Hotel, 4, B. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.

Cerritos: Performing Arts Center, 4, A. Contact: Robert Long, Theatre Projects, New York, NY; (212) 873-7211.

El Segundo: Aerospace Building A-8, 5, C. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Escondido: Escondido City Hall, 3, C. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Los Angeles: Western Airlines Terminal, 5, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Ojai: Ojai Valley Inn, 5, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates Inc., Santa Monica, CA; (213) 450-1733.

Pasadena: Lake Avenue Congregational Church, 4, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Sacramento: Mercy Hospital, 2, B. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc. Santa Monica, CA; (213) 450-1733.

San Jose: Fairmont Hotel, 5, D. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

CONNECTICUT

Hartford: Connecticut Legislative Office Building, 5, D. Contact: Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT (203) 838-4167.

Hartford: Connecticut State Capitol Hall of the House of Representatives, NA, C. Contact: Mark Beningson, Jaffe Acoustics Inc., Norwalk, CT; (203) 838-4167.

FLORIDA

Naples: Naples Performing Arts Center, 4, A. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates, Inc., New York, NY; (212) 420-8787.

St Petersburg: Bayfront Center Auditorium Renovations, 3, B. Contact: Robert Long, Theatre Projects, New York, NY; (212) 873-7211.

ILLINOIS

Highland Park: Ravinia Young Artists Institute, 2, C. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

KENTUCKY

Alexandria: Campbell County H.S. Gymnasium, 1, B. Contact: Richard J. Lemker & Associates, Covington, KY; (606) 261-9529.

Covington: Holmes High School Auditorium, 1, A. Contact: Richard J. Lemker, Lemker & Associates, Covington, KY; (606) 261-9529.

MISSOURI

Mokane, Callaway County: South Callaway R-2 School District, NA, C. Contact: J. T. Weissenburger, Engineering Dynamics International, St. Louis, MO; (314) 991-1800.

NEBRASKA

Lincoln: Lied Center for the Performing Arts, 4, D. Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

NEW YORK

Jamestown: Palace Theater, 2, B. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates, Inc., New York, NY; (212) 421-8787.

New York: John Jay College for Criminal Justice, 5, B. Contact: Robert Benson, Knudson-Benson Associates Inc., Mercer Island, WA; (206) 232-2273.

New York: JP Morgan Bank Trust Committee Room, NA, B. Contact: Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT

(203) 838-4167.

New York: Metropolitan Opera, NY Philharmonic Summer Parks Concerts, NA, A. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

OKLAHOMA

Oklahoma City: Remington Park, 5, A. Contact: Neil Johnson, Ewing Cole Cherry Parsky, Philadelphia, PA; (215) 923-2636.

OHIO

Cleveland: Palace Theatre-Playhouse Square, 2, B. Contact: Mark Beningson, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

Columbus: Ohio State Office Technology Tower (Office) NA, C. Contact: Marc Beningson, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

Columbus: Ohio State Office Tower (Theaters), 5, C. Contact: Chuck McGregor, Jaffe Acoustics Inc., Norwalk CT; (203) 838-4167.

Columbus: Ohio State University Wexner Center for the Visual Arts, 5, D. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

Sharonville: Sharonville Municipal Building, 2, B. Contact: Richard Lemker, Lemker & Associates, Covington, KY. (606) 261-9529.

SOUTH CAROLINA

Columbia: University of South Carolina, Kogor Center for the Arts, 3, B. Contact: Chuck McGregor, Jaffe Acoustics, Inc. Norwalk, CT; (203) 838-4167.

WASHINGTON, D.C.

Washington, DC: National Council of Catholic Bishops Conference Center, 2, C. Contact: Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT; (203) 838-4167.

NEW BRUNSWICK, CANADA

St. John: Bicapital Theater Project, 2, A. Contact: Robert A. Lorelli, Brannigan-Lorelli Associates Inc., New York, NY; (212) 420-8787.

NOVA SCOTIA

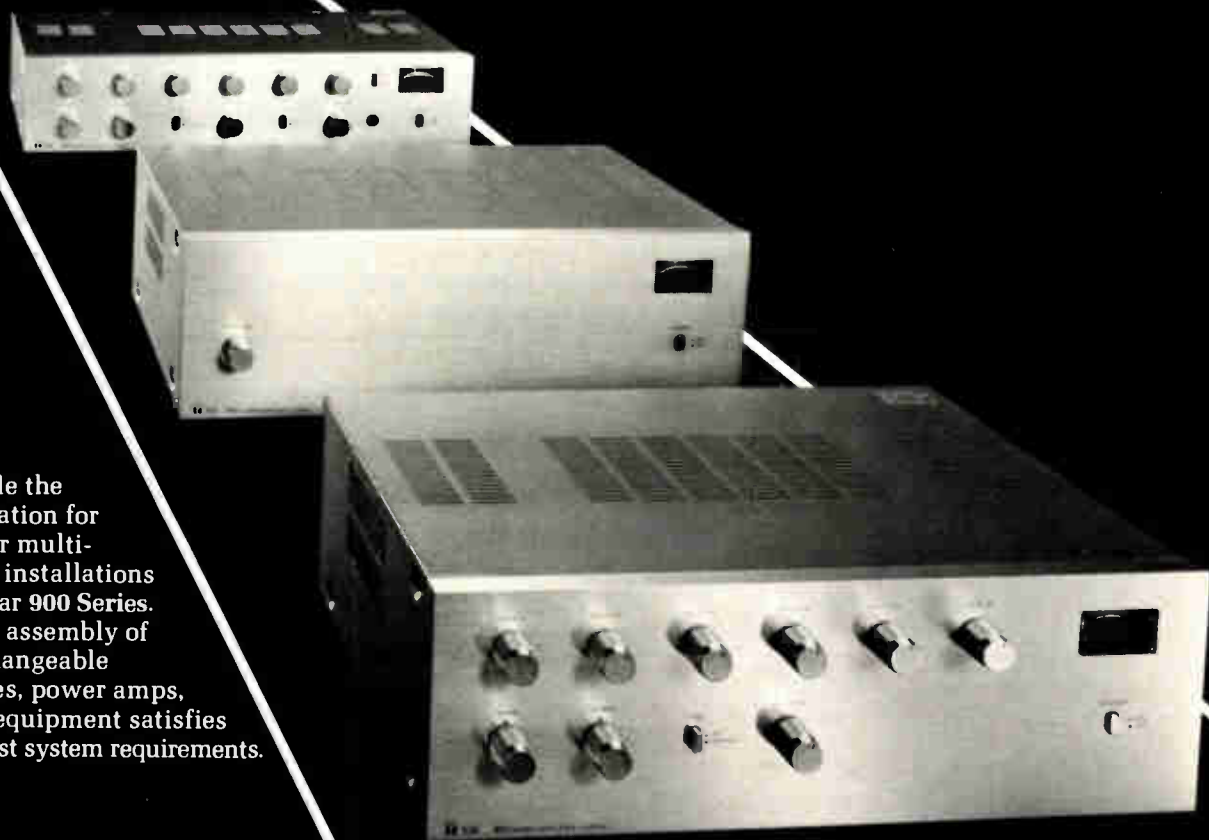
Halifax: Art Gallery of Nova Scotia, NA, B. Contact: Peter Terroux, Halifax, N.S. (902) 429-4616.

Halifax: A/V system for City Council Chamber of Halifax, NA, B. Contact: Peter Terroux, Halifax, N.S. (902) 429-4616.

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Circle 254 on Reader Response Card
World Radio History

THE IED MODEL 6000 SERIES POWER AMPLIFIER SYSTEM

by Jesse Klapholz and
Richard Feld

IED has been manufacturing a line of computer-controlled sound systems for several years now. Its latest entry is into the fiercely competitive power amplifier market with the 6000 Series. Like the rest of IED's line the 6000 power amplifier series introduces some new features that should prove themselves useful to many sound contractors. The 6000 Series is based on a mainframe style 19-inch rack-mount enclosure that will house up to eight Model 6270 power amplifier cards. Each 6270 card is rated for a 200-watt output directly into a 70-volt line without having to use an output transformer.

The 6270 amplifier is based on a Class D design which offers several advantages to the designer and contractor. The amplifier uses a switch-mode supply (each card has its own) that eliminates bulk normally associated with high-power amplifiers. The amplifier also operates between 70 and 85 percent efficiency which means very little heat is generated. During all of our tests, we could not feel any heat at all. The size of this package allows the contractor to install a four-space (seven-inch high) rack-mount unit that weighs just over 30 pounds with eight 200-watt amplifiers that can connect directly to 70-volt lines.

The amplifier uses high-voltage

MOSFET output devices in a bridged configuration providing a balanced output and reduced voltage stress on the output devices for very low stress and stability under any commonly used load conditions. Because the amplifier does not directly rectify the AC line, but, instead used a 200 kHz signal, the isolation from the AC line virtually eliminates internal ground loop problems.

The input stage of the amplifier features a six-pole DIP switch which is a 1 dB/step attenuator providing up to 63 dB of attenuation. The input is a fully balanced and true differential circuit. The input sensitivity is 0.9 volts for full output, and shorting either input side to ground will not affect the gain. The front edge of the card, which is visible through a smoked plexiglass door, includes the attenuator DIP, a miniature power switch, and three LEDs indicating "power on," "signal presence," and "clipping."

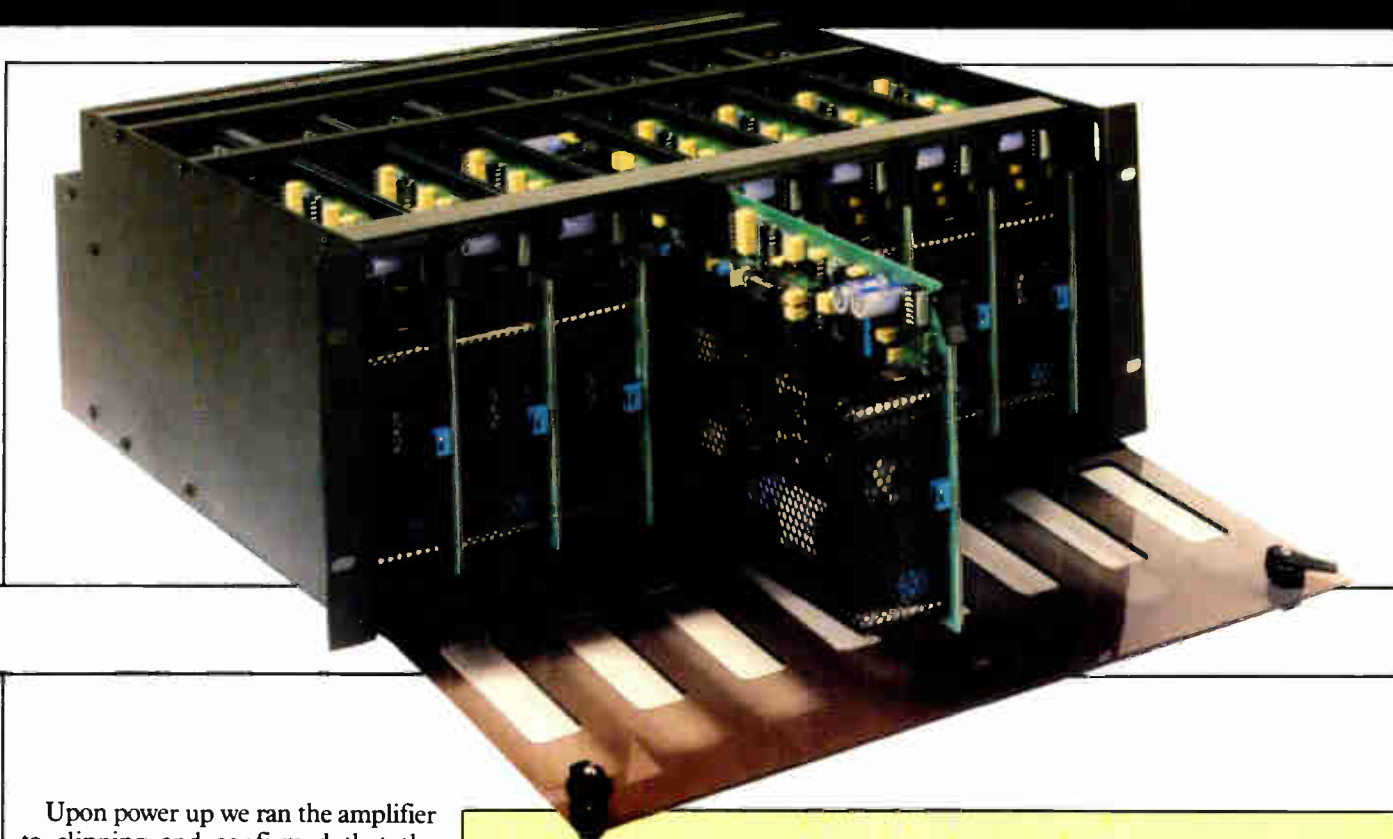
The back plane includes a nifty fuse-holder/AC-receptacle that will not allow for the removal of a fuse with the AC cord connected. The standard three-way binding posts are used for the outputs but the input connections use a non-standard scheme—lugless compression-type screw terminal connectors. We found these to be very contractor friendly and are also used

for a logic-level "fault" indicator output and a "Monitor" output.

Protection schemes in the amplifier are straightforward and need no adjustment by the installer as may be the case in other designs. Four levels of protection are provided as follows: (1) current limiting in the DC power supply, (2) current limiting in the audio output stage, (3) voltage limiting in the driver stages to prevent overdriving the output, and (4) a 3A fuse mounted on the card which limits sustained power outputs to below 200 watts. The voltage limiting is employed in a low-level stage and its effects are a softer clipping which sounds more musical, like a good limiter in front of the amplifier. Clipping occurs only above 200 watts RMS output, or 100 volts instantaneous peak.

The Tests

We tested the 6270 with a Sound Technology 1710 (fitted with the intermodulation option), a HP square-wave generator, and a Tektronix 502 oscilloscope. These instruments are commonly used and the test procedures are ones that any technician should be normally performing. Our tests included standard test bench resistive loads as well as using a high-quality auto-former and loudspeaker for real loads.



Upon power up we ran the amplifier to clipping and confirmed that the unit was drawing just under 2.0 amps from the AC line, also, further confirming the efficiency rating of 83 percent at full power output. Tracking the current draw from the AC line at progressively lower power outputs also confirmed the amplifier's low-power efficiency ratings. These efficiencies account for the lack of necessary high volume air flow normally associated with 200-watt amplifiers.

Checking the output for excessive residual clock noise indeed showed a 200 kHz output as one would expect, but only at 0.8 volts peak-to-peak, about half of what the manufacturer states. The output filter's characteristics did exhibit itself as a pre-ringing on the square-wave response. However, this takes place sufficiently far above the audio range that it is unlikely to become audible to the most discriminating ear. We could not hear the clock. While we were looking at the amplifier output on the scope, we observed the clipping, which is just exactly above the 0.9 volt input rating, to be smooth just above 200 watts, but slightly different than conventional amplifiers. Perhaps this might be part of the amplifier's highly linear characteristics.

We measured the harmonic distor-

Specifications:

	MANUFACTURER'S	LAB TEST'S
Frequency Response	+0, -3dB, 20Hz to 20KHz	+0, -3dB, 28Hz to 20KHz (<1watt) +0, -3dB, 20Hz to 20KHz (>10watts)
Distortion THD	<0.5%, 1watt to 200watts, 30Hz to 15KHz	<.15%, 1watt <.15%, 10watts <.2%, 100watts <.3%, 200watts
Distortion IM	n/a	2.0%, .5watt 1.5%, 1watt 0.6%, 10watts 1.0%, 100watts 1.5%, 200watts
Input Sensitivity	.9volts	.9volts
Common Mode Rejection	>40dB, 20Hz to 20KHz	>55dB, 20Hz to 20KHz
Signal to Noise Ratio	>90dB, unweighted, 20Hz to 20KHz	>88dB, 1Hz to 30KHz

GENERAL SPECIFICATIONS

MODEL 6270 POWER AMPLIFIER CARD

Overall Dimensions	12.7D" x 6.1H" x 2.1W"
Weight	2.38lbs.
Outputs	Main, 70.7V RMS Monitor, in parallel with Main Output Fault Indicator Amplifier Operational Amplifier Faulted

(continued on next page)

Front Mounted Controls Input Stepped Attenuator, 1dB steps, 0 to -63dB
Power Switch

Front Mounted Indicators Clipping Level, Red LED
Signal Present, Green LED
Power On, Red LED

Price \$783 pro net

MODEL 6084 POWER AMPLIFIER MAINFRAME

Capacity
6270 Amplifiers 6084-4, 4 Cards
6084-8, 8 Cards

Audio Inputs Lugless compression-type screw terminals

Outputs 2-5 Way binding posts on 3/4" centers

Signal Outputs Lugless compression-type screw terminals

Power Requirements
all card slots full
maximum power out 6084-4, 120V, 50/60Hz, 970watts
6084-8, 120V, 50/60Hz, 1950watts

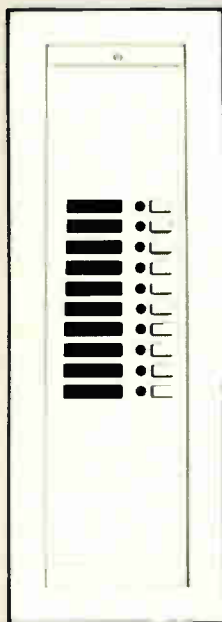
Size 7"H x 19"W x 16.1"D

Weight 6084-4, 9.1lbs.
6084-8, 11.5lbs.

Price 6084-4/\$786 pro net 6084-8/\$1016 pro net

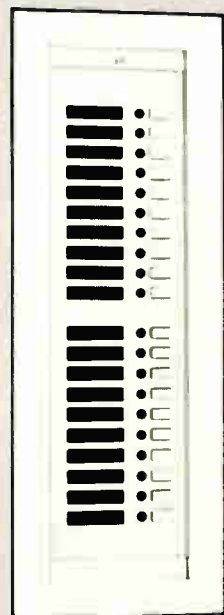
Manufacturer Innovative Electronic Designs, Inc., Louisville, KY

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tion and show the results at 1, 10, 100, and 200 watt levels. These results show that the amplifier has harmonic distortion while not as low as some esoteric hi-fi models, certainly well within reason for high-fidelity commercial applications. While the manufacturer did not publish IM (intermodulation) distortion figures, we measured very low levels at the same power levels used in the previous tests. Frequency response was checked at the four power levels and showed some low-frequency roll-off below 30 Hz at a 1-watt level, which is of no practical concern, but measurable nonetheless. Both the THD, IM, and frequency response tests were repeated using a fully loaded auto-former and showed no change in the amplifier's output characteristics. This shows that the amplifier is stable and will maintain signal integrity at any level with any load.

The CMRR (common mode rejection ratio) was measured at more than 15 dB better than the manufacturer's specification. Unfortunately our 1710A only has 400 Hz and 30 kHz filters for noise measurements, so we were unable to fully duplicate the manufacturer's signal-to-noise ratio tests. However, our tests were only 2 dB less with no low-frequency filter and with an additional 10 kHz bandwidth. The amplifier behaved nicely throughout all of the tests and we were not able to put the unit into a failure mode. Since we had only one amplifier module to test, we were not able to test for crosstalk between modules. While the manufacturer does not specify a crosstalk measurement, we would like to see how low that number is. Because of the almost total independence from the power line, and due to the balanced output configuration, the crosstalk between the modules should be extremely low, or as low as the residual noise in our test equipment.

With loudspeaker manufacturers offering more high-quality/high-power loudspeakers for 70-volt distributed systems, the need for an amplifier such as this is growing. The construction, layout, computer-grade components, lugless terminals, and weight make the amplifier highly attractive from the viewpoint of standing behind the reliability of the unit.

BIZ FRONT

(continued from page 10)

establish his firm. "It requires the ability to produce contract documents and the extensive expertise of at least one individual. I sat down with my attorney and CPA and they recommended we operate as a sole proprietorship rather than incorporate, which was our original plan. Legally all we had to do, because we are in an unincorporated city, was to register a DBA."

As for liability, Norman makes it a point to never use the word "engineer" in any of his documents, whether referring to himself or his work. "We are *project consultants* and not consulting engineers," said Norman. "There is generally very little liability with regard to audio as long as what you are doing meets UL code, which

we specify in all of our drawings. But in security systems there is considerable liability, especially if a consultant is giving a client a feeling he is secure and he, in fact, is not. That is why it is important to use common sense and document any problems you may detect."

Certain resources, he noted, are necessary in starting a consulting firm. He put together a product library of 1,200 manufacturers. Also helpful was access to a testing facility, and a stringent bookkeeping and accounting system. He cited organization and competence to do the job and willingness to follow it up completely, as critical factors for consultants.

"After a consultant charges 80 percent to get a project to the drawing stage it is that last 20 percent that consultants can tend to not take seriously," said Norman.

"But that 20 percent is where the consultant's reputation is made or broken."

To keep the cost of starting the firm at a minimum, he set an office up in his home where he has two draftsmen and a full time secretary. By operating out of his home he noted he can operate for \$1,000 a month. As his business expands he will consider moving into larger offices.

Generally, Norman said the most difficult part of starting the business was not having any income during the first few months. "The reality of this business is while you bill in 30 days, most people don't pay that rapidly," he said. "If you are lucky enough to get a few fast pays, then you are in good shape. I was working without a paycheck for a couple of months and that's always scary, but those are the kind of things you have to do."

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Remember 2 new 515/588 dual-Z models and forget 11 old ones.

Shure just made the most popular low cost dynamic mics in the industry easier to stock and sell. Each now features a unique 3-position on/off switch so your customer can use the mic in high or low impedance applications without rewiring or opening the mic case. The new configuration also allows you to meet nearly any customer need with just two models versus the eleven old ones they replace.

The new 515SD-LC and 588SD-LC dual-Z mics give customers added flexibility to plug into any sound equipment from a sophisticated PA system to a guitar amp.

We've also made other improvements. A new platinum beige finish blends better with wood podiums and doesn't reflect lights. The 515SD-LC now comes with a 3-pin professional connector instead of an attached cable. And, of course, the 515 and 588 are both built to meet Shure's legendary requirements for ruggedness and reliability. All at a price competitive to off-shore models.

For more information, write or call Shure Brothers Inc., 222 Hartrey Ave., Evanston, IL 60202-3696 (312) 866-2553. G.S.A. approved.

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SCS

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SCS Audio Amplifiers sound better and perform better than our competitors, thanks to the new power MOS-FET output device.

Keep pace with today's new technology and claim the same advantage for yourself.

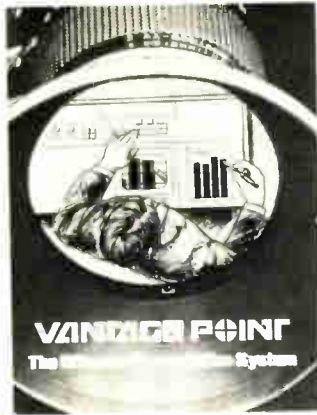
SCS MOS-FET Audio Amplifiers

Model 2150A	150w/channel	\$579
Model 2350A	350w/channel	\$729
Model 2450A	450w/channel	\$895
Model 2600A	600w/channel	\$1099

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(714) 554-0903

Circle 248 on Reader Response Card

DATAFILE *info.sources/new literature*



Vantage Point Video Lectern Literature from Avtec

Free literature is available from Avtec Industries on its new product Vantage Point, a meeting room lectern with the capabilities of a video control center to project hard copy, vu-graphs, or three dimensional product samples onto a screen for audience viewing.

Now available in both permanent and portable units, Vantage Point gives the speaker the ability to switch from video, slides, or film and to zoom in and instantly focus on any image on

the screen. A built-in color monitor on the control panel allows him to see precisely what is on the screen without turning around. The lectern also has the capability to energize lighting, draperies, and motorized projection screens.

Circle 42 on Reader Response Card



Audix Booklet Describes Voice Alarm System

A four-page booklet from Audix Limited describes the company's Voice Alarm System which is a system designed to broadcast speech messages to convey specific instructions or advice to people across single or multi-zone areas in the event of an emergency.

The booklet also compares the effectiveness of the Voice Alarm System and the conventional siren and bell sounders and describes the conditions faced in both the indoors and the outdoors as hints to installing speakers.

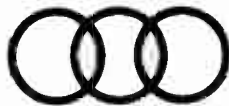
Circle 43 on Reader Response Card

West Penn Wire Catalog Features 50+ New Products

West Penn Wire Corporation has released its 1986 Product Catalog which features 59 new products in addition to the company's line. Among the new products listed are the RS-232 computer cable, coax computer cable (and twinax), Dual 59 and RG-62/AV (available in plenum and npn plenum construction). The 55-page catalog also lists mic cable, plenum for telephone cables, speaker cable, and television wire. All products are made in the U.S. and the catalog is available free from West Penn Wire.

Circle 44 on Reader Response Card

MAC IS BACK



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international

AND HERE'S THE TEAM!



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New Address: **111 Camino Del Rio**

Gunnison, Colorado 81230

New Phone: **(303) 641-5500**

Telex: **484485**

CALL RAY TODAY!

Circle 237 on Reader Response Card

World Radio History

Sound & Communication



Brim Electronics Introduces Commercial CATV Cable

Brim Electronics, Inc. has announced the introduction of an inexpensive commercial RG59/U CATV cable: BRIM BCAC-59.

BRIM BCAC-59 cable is composed of a 20 awg solid bare copperweld inner conductor, with a .058 inch wall of cellular polyethylene dielectric, an aluminum, polypropylene over aluminum tape shield for 100 percent coverage, than a 42 percent aluminum braided shield over the tape, and a black PVC jacket overall, for a .242 inch nominal O.D.

The cable is 100 percent sweep tested for accuracy. The cable has an operating temperature of 80C and a maximum operating voltage of 500V.

Circle 14 on Reader Response Card

Monster Cable Debuts "M Series" Cables

Monster Cable, has introduced its new top-of-the-line products, the "M Series." Initially consisting of the M1 speaker cable and M1000 interconnect, the Series' technology enables a sound system to operate at its top capacity, resulting in accurate, full range musical reproduction.

The cables use the company's new MicroFiber™ dielectric technology and sophisticated winding techniques. MicroFiber dielectric construction is an intricate process whereby each conductor is individually wound with a special material, allowing signals to travel faster and cleaner, eliminating background noise and increasing transient response.

The M1's new winding configuration utilizes multiple wire gauges for various frequency bands which are combined in "grouped networks" for improved imaging. In addition to custom lengths, the M1 speaker cable will be available in 15- and 25-foot pairs terminated with Monster Cable's X-Terminators. The pre-cut lengths will be packaged in handsome, durable cases that can be used for storage of more than 100 compact discs.

The M1000 interconnect cables also incorporate the "MicroFiber" dielectric technology plus Monster Cables' Bandwidth Balanced™ construction for quicker transient response and a clearer, more three-dimensional image. Comprised of a three-wire multiple-gauge network for each conductor, the Bandwidth Balanced design provides absolute coherency of frequency and phase response over the entire musical spectrum. Available in a variety of pre-cut lengths, the M1000 will be terminated with a RCA gold-plated connector featuring a locking outer ring for better contact and pull proof reliability. Off-the-spool lengths also will be available.

The suggested retail prices for the M1 Speaker Cables are \$9/foot, \$400 for the 15 foot pair, and \$550 for the 25 foot pair. The M1000 Interconnect Cables have a suggested retail price of \$9/foot. \$110 for the .5 meter pair, \$150 for the one meter pair, \$180 for the 1.5 meter pair, \$210 for the two meter pair, and \$450 for the 20 foot pair.

Circle 15 on Reader Response Card

New Rack Slide Kits for JVC VCRs

The Winsted Corporation has designed two new Rack Slide Kits for use with JVC VCRs. The kits attach to the VCR for simple mounting in a 19 inch EIA rack cabinet. Full extension ball bearing slides accommodate even the heaviest VCRs for smooth, easy movement according to the company. Slides have a positive automatic lock feature at full extension to allow trouble-free service and maintenance of the VCR.

Circle 16 on Reader Response Card

Berk-Tek Announces Connectors for PVC and Plenum Hookups

Berk-Tek has introduced its coaxial and twinaxial connectors designed for PVC and Plenum hookups in crimp-on and twist on styles.

Gold-plated mating surfaces ensure interruption-free data transmissions in the micro-second range. Phosphor bronze is used as the base metal. The inner dielectric is Norlyn for high temperature applications.

Circle 17 on Reader Response Card

EKTACOM G

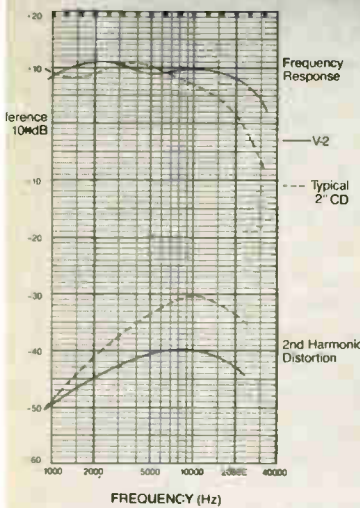
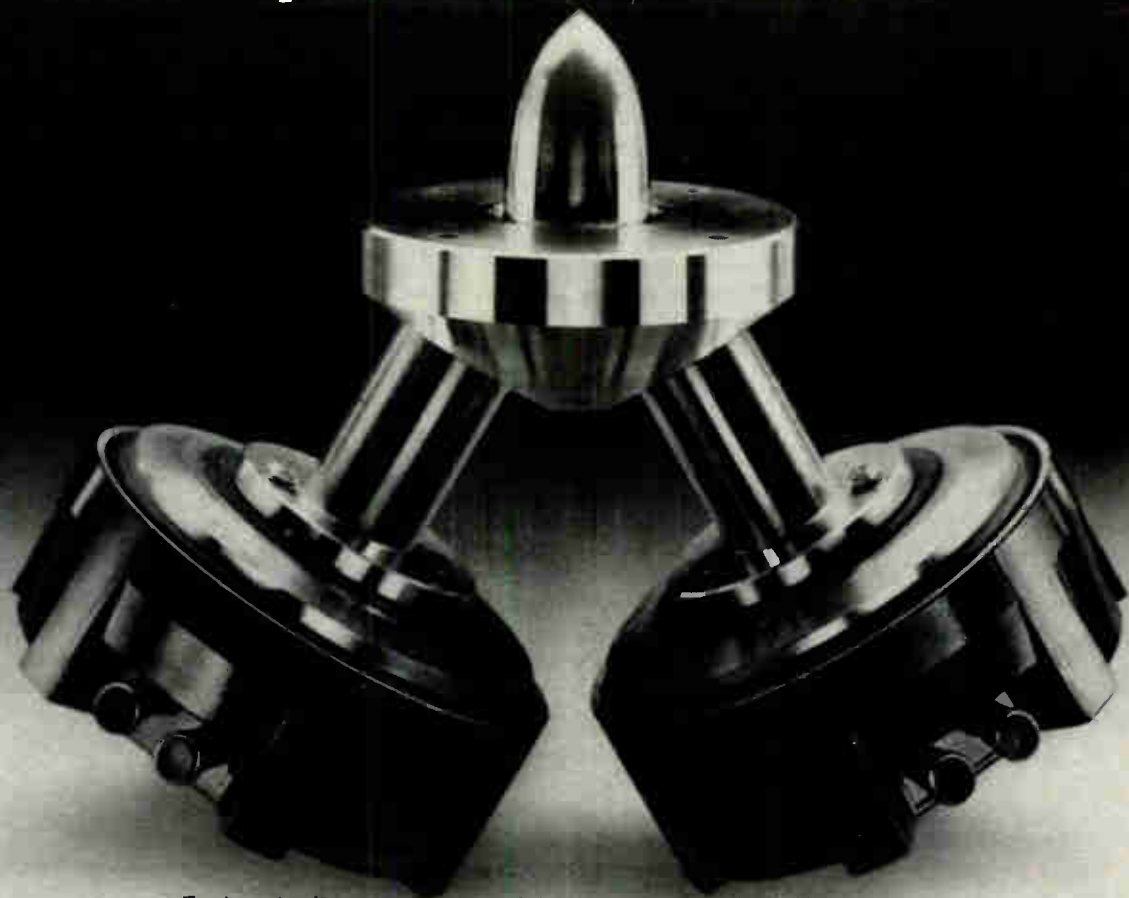
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Many call it the world's best direct-select intercom. This premium quality system has been proven in thousands of installations. Six to 1,000 key masters; all light annunciation; solid gold switch contacts; 4" speakers; 45 ohm, balanced lines; plug-in 25 pair cables; in and out volume controls; solid state T/L muting and compression; desk, flush or rack mounting; UL Listed power supplies. Many options including central and group paging; parallel call from one remote to multiple masters; master-to-master annunciation; 11 watt RMS output. The G is used by all branches of the Government from Walter Reed Hospital to the USS Enterprise. Two year Factory warranty.

You should know more about EKTACOM G!
Write Today!

DATE	EVENT/COMMENT	LOCATION	CONTACT
February 18-20	Satellite Communications Engineering Principles. Course at George Washington University.	Washington, DC	George Washington University (202) 994-6106
February 23-24	"Today's Telecommunications, What It's All About." Seminar.	New York, NY	J.H. Morgan Consultants (201) 766-0969
February 26-28	Commtext International '87 Products, seminars, training.	Atlanta, GA	Bobbie Hunt (703) 273-7200
March 2-6	Integrated Telecommunications Systems. Course at George Washington University.	Washington, DC	George Washington University (202) 994-6106
March 9-11	VSAT Applications Design, and Analysis for Data, Voice and Video Environments and a Comparison with Other Technologies. Course at George Washington University.	Washington, DC	George Washington University (202) 994-6106
March 10-13	Audio Engineering Society.	London, England	AES (212) 661-8528
March 16-17	"Today's Telecommunications, What It's All About." Seminar.	Phoenix, AZ	J.H. Morgan Consultants (201) 766-0969
March 16-18	Technical Report Writing. Course by The Center for Professional Advancement.	E. Brunswick, NJ	The Center (201) 238-1600
April 6-8	National Sound and Communications Association's Annual Expo. Meeting of contractors, manufacturers, and consultants.	New Orleans, LA	NSCA (312) 593-8360

We don't mind looking a bit ridiculous if it helps make live sound sublime.



Curves have been smoothed for purposes of comparison.

Engineering live sound means solving a multitude of "impossible" problems. Every audience — and every artist — expects great sound. Unfortunately, venues rarely cooperate with those expectations. Fortunately, Turbosound goes to any lengths to develop effective solutions to sound reinforcement problems — even when that entails a total re-examination of fundamental principles.

Our determined refusal to rehash the conventions of enclosure design has led us to develop several patented design principles. And to produce unusual-looking loading techniques like our unrivalled TurboMid™ and TurboBass™ devices. Our search for a solution to the dilemmas of HF projection and distortion has now produced the radically advanced V Series.

V Series combines aspects of manifold technology with Turbosound loading techniques to blend the outputs of multiple drivers gradually, minimizing phase cancellation. The first realization of the V Series principle is the V-2 shown here. Available initially for the T-3 flare in our world-travelling TMS-3 full-range enclosure, this central focussing device couples two custom-built 1" drivers. It extends the TMS-3's HF response to a true -3 dB at 20 KHz, reduces harmonic distortion dramatically and paves the way for the

soon-to-be-released UHQ system, incorporating Turbosound Flashlight™ technology.

The V-2 also solves "impossible" problems of intelligibility without artificial electronic enhancement or extraneous ultra-HF devices. It transmits every nuance of the performance to every seat in the house. And makes live sound more "lifelike" than it's ever been.

Finally, we'd like to point out one more important fact about this unique advance in professional audio performance — the ridiculous-looking part goes *inside* the box.



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*TurboMid™ and TurboBass™ devices are covered worldwide by Principle Patents, not simple design patents. Principle Patents covering V Series have been applied for.

The concepts embodied in these designs are, therefore, entirely unique. See Turbosound literature for full information.

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PRODUCTS IN REVIEW



EDCOR INTRODUCES AN EIGHT CHANNEL MIXER

The newest mixer offered by Edcor, the MX300+, is an eight channel microphone or line mixer. Each channel of the MX 300+ mixer offers the option of programming for balanced or unbalanced microphone or line inputs.

In addition, each mixer can be used as a master or slave to link mixers with a single master unit. The main output is a balanced or unbalanced microphone or line level. Additional outputs include unbalanced line, tape level, and monitor.

Circle 18 on Reader Response Card

APOGEE SOUND DEBUTS SUBWOOFER SYSTEM

Apogee Sound Inc. has introduced the AE-10/A-10 subwoofer system. The AE-10 loudspeaker and its attendant A-10 dual channel dedicated signal processor are a high power, arrayable subwoofer system. The AE-10 loudspeaker is comprised of two 15-inch high power handling cone drivers with foam suspension. The trapezoidal cabinets are designed to be used as stand alone units or, when used with other AE-10 subwoofers, as a modular part of an array. When arrayed, the power output capability increases dramatically providing the performance of a much larger system. The AE-10 arrays effectively in its horizontal plane, vertical plane, or a combination of both.

The A-10 dual channel processor circuitry includes two discrete channels of active balanced inputs (transformer inputs optional), active crossovers frequency corrective equalization, and limiters for protection of drivers utilizing the Apogee PAF system (Positive Amplifier Feedback) which operates from actual speaker level return. The A-10 processor is available in both a road version with front panel inputs and outputs and a permanent version with rear inputs and outputs.

Frequency response is 38 to 140

kHz, ± 4 dB measured one meter on axis. The AE-10 can handle 800 watts continuously with 2,400 watt peaks. Maximum SPL is 124 dB with 140 dB peaks.

Accessories include protective canvas covers with Velcro closures, road cases, and Apogee Radial Strapless Rigging.

Circle 19 on Reader Response Card

EVENTIDE ENHANCES SP2016 EFFECTS PROCESSOR/REVERB

Eventide has announced that it has added enhancements to its SP2016 Effects Processor/Reverb. A new MIDI interface board is now available, which puts SP2016 program selection and parameter control under MIDI command. The MIDI option is available on new units or as a retrofit, in conjunction with a revised PC board.

The SP2016's internal ROM program storage capacity is increased by the revised board which is now standard on new units and available as a retrofit for units in the field. This board relocates those ROMs which contain the SP2016's two dozen standard programs. The unit's top-mounted ROM sockets are thus free for additional optional ROMs, such as the Vocoder, Stereo Synthesis, and Auto Panner programs available from Eventide.

Circle 23 on Reader Response Card

DIGITAL VOICE RECORDER FOR TELECOM APPLICATIONS

Viking Electronics has introduced a cost efficient Digital Voice Record/Playback System, the Model DA-1000, which can replace existing and obsolete drum and professional tape announcing systems in high usage A.C.D./U.C.D., "976" and announce only applications, according to the company. Model DA-1000 provides from one to 64 seconds of digital record/playback time.

The DA-1000 is 100 percent of solid state in construction and provides instant rewind and C.P.C. disconnect. Record using a standard single line phone or "down load" from a tape player. The DA-1000 automatically adjusts the outgoing message to your record time for fastest call processing. E&M control leads provide interconnection to existing systems. One or

two messages may be recorded for day/night applications.

The DA-1000 is complete with power supply and five minute battery back up for \$329 dealer/interconnect pricing.

Circle 21 on Reader Response Card



NEW 6-INPUT AND AUDIO MIXER FROM STUDER REVOX

Studer Revox has introduced the C279, a compact and inexpensive six-input audio mixer. Although designed for relatively basic production chores, the C279 offers a high level of ruggedness and signal quality which reflects its close kinship to Studer's full-size production consoles.

All six input channels of the C279 are switchable to accept either balanced microphone, balanced mono line, or unbalanced stereo line inputs. Each input also features 48 volt phantom power, low cut filter, input gain control, HF and LF shelving equalizers, pan (mono) or balance (stereo) control, PFL button, auxiliary level control (switchable pre or post-fader), and mono direct output. Professional grade long-throw faders control input level through voltage-controlled amplifiers.

Other C279 features include click-free solid-state switching in audio circuits, bar graph PPM metering of master output, phase metering for mono/stereo compatibility, built-in monitor speaker and talkback mic, headphone output, and level control for monitoring. Both balanced XLR and unbalanced master outputs are provided.

An optional expansion module enhances production flexibility by providing two phono inputs, dbx noise reduction, a 400 Hz test generator, and fader start for all inputs and master.

The C279 compact mixer has a suggested professional user net price of \$2,750.

Circle 31 on Reader Response Card



IMC ADDS COAXIAL SPEAKERS TO FANE PRODUCT LINE

Fane Acoustics has introduced a full range of coaxial speakers which are built on rigid, cast alloy chassis and incorporate mounting holes to fit most European and American enclosures.

The speaker cones employ wide, single roll, high compliance PVC edge termination. The constant coverage 60 degrees by 40 degrees high frequency horn is driven by the new MD2050 compression driver. This driver features a low mass, 45mm diaphragm with edgewound aluminum coil which provides frequency response to 22 kHz.

The CX15 provides bass response down to 32 Hz and the CX12 will reproduce bass responses down to 40 Hz. The CX studio models are designed for use in tuned or infinite baffle enclosures. Power rating of both speakers is 150 watts.

These coaxial models are designed for studio and stage monitors, keyboard systems, compact club and disco systems, and for high quality domestic markets.

Circle 45 on Reader Response Card

TELEDIAL'S PROGRAMMABLE PHONE FOR HOTELS/MOTELS

Teledial Devices Inc. has introduced a hotel/motel guest room telephone that provides fast, efficient communications with in-house services.

Teledial's TDP-1000-19 has 10 programmable keys of up to 22 digits that give guests single-touch access directly to services such as front desk, room service, hotel operator, local and long distance telephone lines, and others. Staff use of the telephone also improves internal communications. With speed dialing of services, guests and staff don't have to look up or remember extension numbers or access codes. Full manual dialing capability is included.

A built-in modem jack allows

business persons and others to conveniently connect their personal computers. It has a message waiting lamp that advises users to contact the front desk or message center, and comes with a hearing aid compatible handset in accordance with FCC regulations. The telephone is also suitable for conference centers, condominiums, and shared tenant service arrangements.

To prevent loss of memory in the event of a power failure or accidental disconnection, the TDP-1000-19 comes with a built-in lithium battery. The single-line TDP-1000-19 is fully modular and line powered and has A-lead control. PBX and Centrex compatible, it has tone and pulse dialing capability, an electronic ringer with three volume settings and a built-in directory.

The TDP-1000-19 comes with an 18-month limited warranty.

Circle 46 on Reader Response Card



VISTA TELEPHONE ENTRY WITH LIGHTED DISPLAY

Sentex's new Vista telephone entry system features an integral, lighted directory that handles up to 115 names. The directory is edge-lighted from behind the system's stainless steel faceplate. The directory and its lights are protected by a gasketed, lexan window making the unit weather and vandal resistant. The Vista simplifies the need to purchase and install a separate directory.

The Vista has all the features of other Sentex telephone entry systems including capacities up to 750 tenants, EEPROM memory, crystal tone detection, sealed metal keypad, lexan display, individual access codes and postal lock. All Sentex telephone entry systems, including the Vista, have

an option that allows them to be remotely programmed from any touch-tone telephone. The Vista comes in either handset or hands-free versions.

Circle 47 on Reader Response Card



NEW PRODUCTION METHODS IMPROVE JBL DRIVER

Through the use of computerized numerically-controlled milling machines in the manufacturing processes, tighter tolerances and greater accuracy are achieved in JBL Professional's new 2485J Compression Driver.

In contrast to conventional hand-operated milling machines, JBL's computer-controlled machines manufacture the 2485J five times faster and with more precision, according to the company. Changing from an alnico to a ferrite magnetic circuit design also reduces material costs. The result is a more durable driver for \$200 less than the previous JBL model, the 2482.

Designed for applications where maximum efficiency midrange response is needed, the 2485J can handle 120 watts continuous program above 300 Hz. At these low frequencies, the driver's phenolic-impregnated linen diaphragm will bend instead of shattering, unlike most metallic diaphragms.

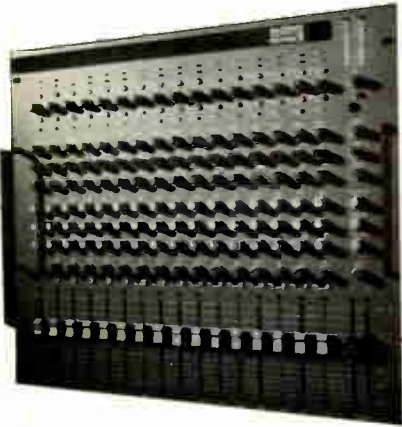
When used with a JBL large Constant Coverage Bi-Radial™ Horn, full voice-range response may be obtained without the use of additional bass drivers, enclosures, amplifier and crossover elements.

The 2485J is specifically designed for outdoor applications. A rear cover provides a protected cavity for mounting a line matching transformer. In addition, a waterproof gland nut allows cable connections to be made while maintaining moisture isolation.

Circle 49 on Reader Response Card

a closer look

by gary d. davis



Biamp's High Performance Rack Mount Mixer

Biamp Systems has introduced a new high performance rack mount mixer. The new unit, the RackMax, is a 16-input stereo mixer with per-

formance specifications and features normally only found in expensive console mixers, according to Biamp.

The RackMax includes 48-volt phantom power switchable on each channel, 100 mm faders, a complete solo system, three jumperable auxiliary sends per channel, and complete LED metering in a standard rack width three-inches deep. Specifications include EIN - 128 dBV, THD of 0.05 percent any input to any output and frequency response of ± 0.5 dB Hz to 20 kHz.

Comments: While attending the recent AES Convention in Los Angeles, I heard about Biamp's RackMax. "Sixteen input channels on a rack?" I said half-believing to Bill Mitchell, Biamp's sales manager. Bill explained that this 16x2 unit filled a niche for

those people who need a lot of inputs in a small space, where the typical desktop 16-input mixer (or console, if you prefer the term) is simply not the right package. Well, this is a very capable mixer, and it does fit in a 19-inch wide rack, where it occupies a full 10 spaces (17-inches high), and it is just three-inches deep. Even allowing for cable connections, there would be room for accessories, audio transformers, AC power strips, or other goodies to be mounted on the back of the rack behind the mixer.

The unit includes most of the features you'd find in a full-sized console. For example, each input strip has a 40 dB gain trim control, a 20 dB pad switch, signal present and clip LEDs, three-band EQ, three auxiliary send controls (each internally jumperable

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REAR VIEW



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LED indicators

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for pre EQ and fader, pre fader post EQ, or post fader and EQ), a recessed 48 volt phantom power switch, a mic/line input switch, a solo switch (jumperable for PFL or post fader), a pan pot, and a long-throw linear fader. All connections are on the rear, including an electronically balanced XLR and an unbalanced one-quarter-inch phone jack for each input. Given the choice of input connections and 60 dB input sensitivity range, this unit truly is useable with just about any stage mic or instrument (though a direct box would be useful with an electric guitar pickup).

It is indicative of the progress and growth in this industry when the traditional little "rack mixer" has increased in capability to be more complex than the mixer used to handle the Beatles' first concert in Shea Stadium some 20 odd years ago. At a list price of \$1,899, we feel Biamp's RackMax deserves your closer look.

Circle 40 on Reader Response Card



Aphex Model 303 Combination Compellor/Aural Exciter

Aphex Systems, Ltd. is now shipping its new combination Compellor/Aural Exciter (Model 303). The new single rack height product provides complete invisible control of audio program dynamics, both long and short term, while also increasing presence, brightness and intelligibility, especially in low fidelity situations such as paging and PA systems.

The 303 accomplishes this by combining two of Aphex's proprietary audio processors, the Model 301 Compellor and the Model 9001 Aural Exciter, to form a single-channel multi-function processor. The unit features balanced XLR inputs and outputs. Suggested price is \$949.

The Compellor section of the Model 303 provides program-controlled dynamic control, including slow AGC, fast compression, and instantaneous peak limiting. Analog computer control circuits analyze incoming audio and vary the parameters for

smooth, inaudible compression without pumping, breathing or choked sound. Leveling circuits provide "automatic gain riding." This "invisible" processor features the same unique, dual-function, bi-color LED display of all compellers, which shows total gain reduction at a glance. Leveling action is shown as a red dot with compression as a green bar above it. A front panel switch also enables monitoring output level, which is shown as a solid red bar with a VU scale.

The Aural Exciter section uses Aphex's new MAX (Monolithic Aural Exciter) chip, and has controls for Drive, Tuning, Mix, and Peaking.

Once the 303 is installed and initially set up in a PA or other sound system, no further adjustments are required. The Compellor section provides automatic and invisible compression, leveling and peak limiting simultaneously. The Aural Exciter section will provide increased penetration and audibility at reduced power levels.

Comments: When I first heard of Aphex around 1974 or 1975, I thought it was a joke. How, I reasoned, could the intelligibility and penetration of sound be improved by adding distortion and phase shift, as they claimed. Well, I was too quick to judge, and the recording and reinforcement industries subsequently found that the Aphex system did good things for their music and speech. (I'm talking about the Exciter here, not the Compellor portion, which is explained in the press release.) Basically, the main portion of the signal goes through the Exciter unaltered. A side chain taps part of the signal, where it is routed

through a high pass filter, which Aphex said is "to get rid of superfluous low end and create intentional, frequency-dependent phase shift." Here's where I have trouble with Aphex. . . isn't all phase shift frequency dependent? If not, it's just time delay. Well, semantics aside, after filtering/phase shifting, the material is sent to a harmonics generator, where "musically related harmonics" (even order?) are mixed with the high-passed signal and sent to a Mix pot. This processed signal is thus combined with the unaltered input. The result, ostensibly, is that the listener perceives a higher level of mid- and high-frequency energy, even though the actual power level is not appreciably changed. This enables the signal to cut through better without promoting feedback, blowing drivers, or requiring larger amps. Incidentally, Aphex has sold similar systems for telecommunications, where the speech intelligibility is supposed to be enhanced.

It doesn't seem to make a lot of sense to spec things like distortion or frequency response on a unit that adds distortion and filters response, but a comment is in order. Aphex has also developed some very high quality VCAs, and, as a company, has paid close attention to audio quality. Donn Werrbach, who designed the Compellor, gave us some of the specs: Frequency Response -3 dB at 220 kHz (yes, 220 kHz!), noise -75 dB (ref 0 dBm nominal), maximum input level +27 dBu peak output +27 dBu (or dBm) balanced, or +21 dBu unbalanced. This looks to us like an interesting signal processor, and one which probably deserves your closer look.

Circle 41 on Reader Response Card



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FACES AND PLACES

Dick LaMarsh Joins The Audio Group

Dick LaMarsh has joined the Portland office of Audio Group as sales engineer for the Oregon-southwest Washington area. He will provide assistance to the sales force, architects, and electrical engineers related to pre-engineered sound. LaMarsh was formerly a partner in Cable Electronics, a Portland-based company specializing in industrial electronics.

Comcast Sound Names Tracy General Manager

Steve Tracy has been promoted to general manager of Comcast Sound Communications, Inc.'s San Diego office. The announcement was made by James T. Boggins, regional vice president for Comcast.

Tracy joined Comcast's San Diego sales force in 1980 and was appointed sales manager in 1984. In his new post, he will be responsible for marketing, administrative and engineering functions of Comcast's background music, commercial sound and electronics business on the West Coast.

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REP NEWS

Paul and Elizabeth Pusecker of Pusecker Sales of Upper Montclair, NJ, have been selected as members of Aiphone's Million Dollar Sales Club for selling more than \$1 million of company's products last year. Pusecker Sales is Aiphone's manufacturer's representative in the metropolitan New York area.

To be admitted to the club, representatives must have at least \$1 million in sales in one calendar year. As a member of the Club, the Puseckers will be awarded a trip for two to Japan, a permanent seat on Aiphone's Manufacturer's Representative Council plus other prizes and privileges.

Pusecker Sales has also been recognized as the outstanding Aiphone sales representative in the nation for the last two years. The award is based on overall outstanding sales and performance.

FSR, Inc. has appointed the Burcaw Company of Warren, MI, as its representative in the state of Michigan. The contact at Burcaw is Lynn Tous-saint, president of the company.

CONTRACTING CLOSE-UP

Muzak Installs TOA In Conference Center

Muzak Northern Musicast, Inc. of Appleton, WI, has installed 36 TOA Electronics 900 Series mixer units in the Regency, in Green Bay, Wisconsin.

Equipment included 18 M-900 six-channel mixer/pre-amplifiers; 16

A-901 two-channel mixer/power amps; and two six-channel mixer/power amps. This complex configuration is capable of providing sound reinforcement for 77 different room system combinations.

PA/Broadcast

EXPANDING CONTRACTOR ENTERS MUSIC MKT.

"Phenomenal growth," is the reason Tekcom, Philadelphia-based contracting firm, has relocated according to company President Richard Feld. "We had grossly outgrown our old location. Here we have some room to grow. The new building is four times the size of our old one," Feld said.

The new building has 10 rehearsal studios, "which brings heavy music traffic into the building for the retail end of the business. Where we were before we had little or no traffic," Feld said.

Located in the new building is a Music Resource Department. According to Tom Stephenson, head of the Music Resource Department, "The pro audio industry has been affected by MIDI, and Tekcom came up with a way to serve that need. A lot of people don't know how the parts work together. We teach them how to print music out, how to combine MIDI controllers, etc."

The Music Resource Department has come up with a few ways to help people. First it's a retail store "but not a music instrument store, we don't have little kids running around," said Stephenson. "We do a lot of consulting and system design work for people with small studios to major facilities." Although people can come in and buy one piece, many people come in for a full system. "We sit with them, talk with them and design a system for them, then we teach them how to use it," Stephenson explained.

The department carries everything used in music production "from keyboards to software to samplers, drums, synthesizers," said Stephenson. Tekcom is also planning to offer seminars and product classes, as well as outside training.

MONTREAL FORUM

Audio Analysts of Plattsburg, NY, recently completed work on the house PA and broadcast system for hockey games held in the Montreal Forum in Canada.

"The Forum had put in a new scoreboard. This meant that we couldn't attach the loudspeakers to the scoreboard so we had to attach them to the main winches. It took some finagling, but in the end we got the speakers attached and as an extra benefit it made the scoreboard more rigid," said Albert Leccese, vice president of engineering at Audio Analysts.

To combat the high noise level the system is capable of 95 to 100 dB at every seat, with some of the seats further away having a dB level of around 92.

Among the equipment that was installed were JBL speakers, Electro-Voice and Soundcraft consoles.

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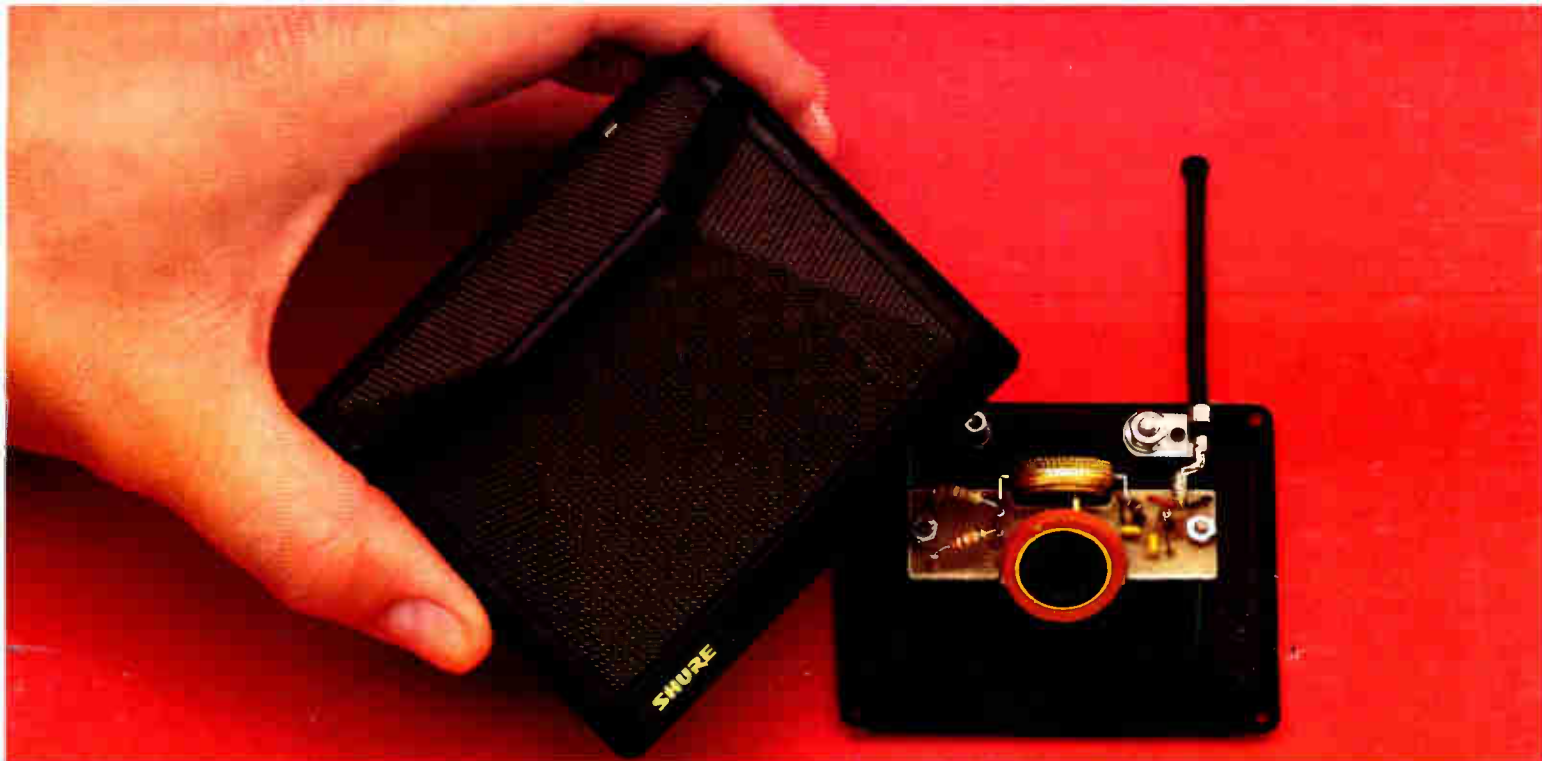


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