

A Technical Tutorial: Fiber Optics

SOUND & COMMUNICATIONS

FOR CONTRACTORS, SYSTEM MANAGERS AND SPECIFIERS

MAY 1987

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ANNUAL

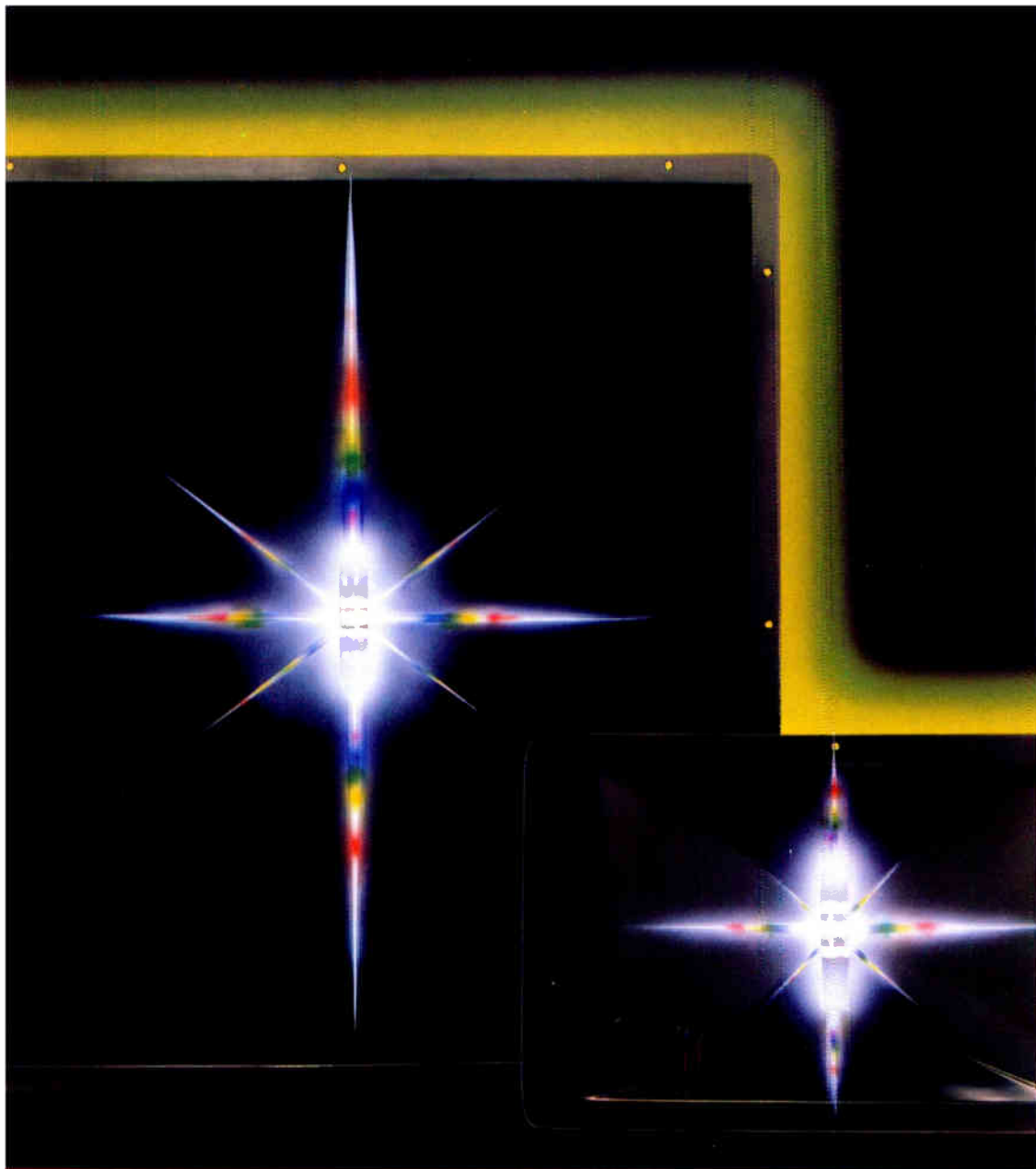
Survey of Today & Tomorrow's

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BUSINESS

-Depth Market Report

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When the Competition Beams, We Just Smile

One problem with ordinary high-frequency horns is that they **beam** above 10,000 Hz. Their coverage angle narrows, so what you hear depends on where you sit.

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DH1A

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Who would believe a microphone this flat...



Model AT871 UniPlate™
Condenser Cardioid

could have a curve to match!

If you've tried other hemicardioid boundary microphones, you may have been disappointed in the sound... thin, peaky, and requiring lots of equalization. If so, it's time to listen to ours: the new AT871 UniPlate Condenser Cardioid.

UniPoint Technology at Work

Our experience pioneering UniPoint miniature condensers permitted us to take a new approach to boundary microphone design. We optimized the basic UniPoint cardioid element for boundary use, creating remarkable reach and presence, yet retaining extended high and low-frequency



response so vital to natural sound reinforcement.

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The AT871 UniPlate Cardioid has both the polar pattern and response curve to provide higher gain-before-feedback than you may have thought possible. But better gain-before-feedback and a great sounding element are only a part of the story.

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By using a very low-mass diaphragm and a case heavier than the others, we sharply reduced sensitivity to mechan-

ical noise. The electronics are audibly quieter as well – a tremendous advantage in typical boundary microphone applications. We also include a low-cut switch to help control acoustic room noise. The AT871 can be powered by an internal battery or from 9-52VDC phantom power.

Effective Problem Solver

The AT871 is solving problems in stage sound reinforcement, church sound, teleconferencing, boardroom applications... even TV and film locations. Wherever great sound is needed... unobtrusively. We urge you to test the AT871 side-by-side with any of the rest. Choose your most critical sound problems. The difference you hear will prove our point.



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SOUND & COMMUNICATIONS

Volume 33 #5

May 1987



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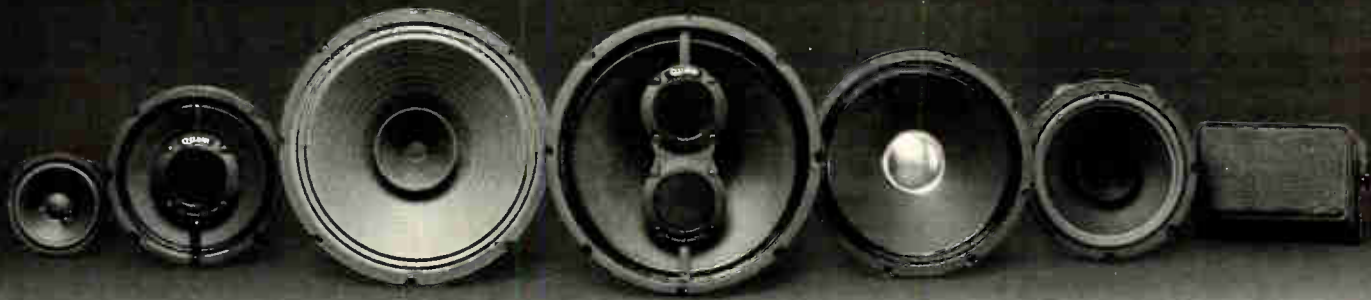
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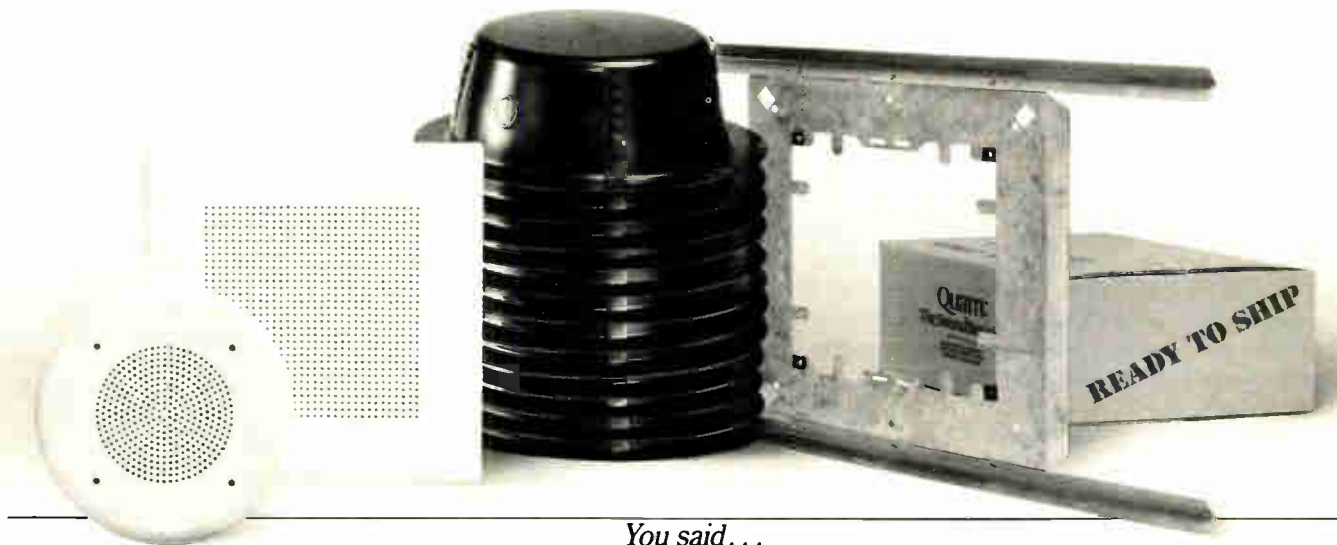
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YOU KNOW US FOR SPEAKERS.



THE FACT IS, WE'RE LISTENERS.

Speakers started our business more than 50 years ago. Listening keeps us prospering today. Developing products and services you need. Continually introducing improved techniques. Providing you with the tools to be a leader in your market.



You said . . .

"GIVE ME BAFFLES THAT REALLY LAST."

Quam's do. The tile-matching, white powdered-epoxy finish of our full-range series of 8" and 4" baffles provides durability far superior to enamel or lacquer. They stand up to handling during shipping and installation, and maintain their fresh look.

"BACKBOXES TAKE UP TOO MUCH SPACE."

Not Quam ERD-8 backboxes. The unique, drawn design of these lightweight backbox enclosures means they nest for storage and transit—taking up one-fifth the space of traditional high-hats. More important to your customer, the one-piece, leak-proof construction of the ERD-8 backboxes results in problem-free air pletum installations with better audio response.

"MOUNTING ASSEMBLIES ON CEILING TILES TAKES TOO MUCH TIME."

The design of the Quam SSB-2 Speaker Support Bridge saves you substantial time. It eliminates the need to cut a close-tolerance round hole in the ceiling tile. Locking tabs on the bridge's center plate prevent movement during installation. And the SSB-2 accepts most of the industry's popular round or square baffles, with or without backboxes.

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Quam's toll-free order line and factory inventory of over 100,000 products means you get exactly the products you want—even complete sound masking assemblies—shipped within 24 hours of receipt of your order.

So while speakers started it all, listening keeps us—and you—prospering. And we'll continue to listen—and respond to what we hear—while we refine and enhance our current products and create new ones to meet your evolving needs.

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Taking an In-Depth Look at the Industry

This year's tremendous turnout at the NSCA Expo in New Orleans, April 6-8, demonstrated that the sound and communications industry is booming. The convention center at the Fairmont Hotel was packed with 4,000 industry people. Next month we'll present an in-depth, NSCA wrap-up report on what we saw.

In this issue, we are happy to be the bearer of more good news. This industry's most authoritative report on the state of the market is the *Sound & Communications* Second Annual Contracting Business In-Depth Market Report.

This most serious, quantitative investigation into the contracting market comes together with the 1987 Dodge/Sweet's Construction Outlook in an interesting way. The Dodge/Sweet Outlook projected a cyclical decline in new non-residential starts—affecting the sound contracting business. Dodge/Sweet says housing starts are not expected to decline. Major factors impacting on a lack of growth in office buildings are the tax reform act (elimination of real estate tax shelters), deficit reduction, interest rates, and the trade gap.

But as Dodge/Sweet points out, new housing starts lead to construction of peripheral facilities—retail establishments (shopping malls), conference areas, schools, hospitals, etc. (all facilities favorable to sound contracting). In addition, increased renovation of old office space (also favorable for sound contracting) is expected.

The respondents to the *Sound & Communications* Contracting Survey are in a favorable position to take advantage of these market changes through their ability to change gears within the general business climate. They are primarily small companies, and therefore usually flexible. They are concerned about "neglected markets," with two-thirds of them offering their choices of what is the most neglected market in the business. Most contractors in our survey checked a dozen or more market categories that they serve, with many of them wanting to further expand into other market sectors.

Overall, the statistics and contractors' comments give a clearer outlook of where our industry stands and where it is going. This is an important study, one that we will continue to publish every year. . . after all, we initially helped identify the market 30 years ago. Thanks to all of you who participated.



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MEET THE FRAZIER CATs



Frazier introduces the **CATs**. Our new speakers utilize **Coincident-Aligned Transducer** technology to bring you brilliant sound quality and sparkling performance. With CATs all of the sound - the highs, mids and lows - radiates from the same point at the same time.

Studio monitor designers have long understood the advantages of coincident-aligned transducers for critical broadcast and recording situations. Frazier CATs achieve the same superior quality response by acoustically aligning the high frequency driver with the woofer.

The results are outstanding on and off axis frequency response and enhanced intelligibility. CATs maintain correct tonal balance in a wide variety of acoustical environments and produce a larger, more exciting, and easier-to-sell sound.

THE CATs

The **CAT 10** (90 dB/W/M; 25 watts AES) is an ideal super micro for foreground systems. For ceiling mounted and general sound reinforcement use the **CAT 30** (94 dB/W/M; 30 watts AES). The **CAT 40** (93 dB/W/M; 85 watts AES) is eminently suitable for theater surround, foreground, high quality sound reinforcement and near field monitor applications.

FRAZIER

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ICA '87 COMES TO NEW ORLEANS

The 1987 International Communications Association's Exposition will be held in New Orleans on May 17-22. The theme of this year's expo is "ICA: Pioneers of the Information Age—40 Years of Service". Over 300 companies will be displaying technology and services that range from T-1, multiplexers, key systems, PBX, diagnostic equipment, call accounting software, routing systems, microwave, and satellite. The exposition opens at 10:00 a.m. Tuesday, May 19, at the New Orleans Convention Center and runs through Thursday, May 21. This year the exposition will remain open until 5:30 p.m. everyday. Some of the telecommunications firms that will be exhibiting and sponsoring events are: RCA Communications and Electronic Services, Lightnet, AT&T, American Satellite, Racal-Milgo, MCI, U.S. Telecom, Lane Telecommunications, Northern Telecom, Bell South, National Telecommunications Network, British Telecom and France Telecom.

COMMUNITY LIGHT & SOUND HAS FREE FREIGHT POLICY

A full freight allowance policy has been implemented by Community Light & Sound, Inc. In operation until further notice, the policy applies to invoice amounts of \$3,000 and over, and to any combination of products, as long as the invoice is paid according to current terms. Current terms offer a five percent discount east of the Mississippi River on invoices paid within 20 days, with the full net amount being due in 30. West of the Mississippi, a five percent discount is offered on invoices up until 25 days after their date of issue, with the net amount being due in 40. Regardless of whether a customer qualifies for the five percent discount or not, the free freight policy remains in effect until the 30 and 40 day net limits. If eligible, attach the freight bill to your invoice, and return it with payments, less the freight amount.

RING GROUP TO PROVIDE NY TELEPHONE WITH ENHANCED 911 SYSTEM

Ring Group of North America has announced the sale of its enhanced 9-1-1 Automatic Call Distribution system by New York Telephone to Nassau County, a suburb of New York City. The Ring system identifies a caller's address and phone number allowing police, fire and medical personnel to be dispatched, even when a caller is unable to communicate, hangs up too soon or is too distraught to provide a complete address. The county-wide system will serve the 1.5 million residents of Nassau which contains some 800,000 business, residential and coin telephone lines. The system is Ring's second in the state; a similar system has been serving the public in Rochester, NY, since 1985.

CORNING PURCHASES INTEREST IN FIBER-OPTIC SENSOR COMPANY

Corning Glass works has announced that it has purchased a 50 percent interest in Technology Dynamics, Inc. (TDI) a privately held company involved in research and development of fiber-optic sensors for the process control, semiconductor, aircraft, electric power, industrial machine and equipment and medical instrumentation markets. Industry observers estimate that the fiber-optic sensor market will grow in excess of 50 percent a year over the next five years. TDI president Elric Saaski said, "We're eager to bring together our R&D expertise with Corning's fiber-optic technology base and commercializations skills." TDI plans to introduce its first line of fiber-optic sensors later this year. The purchase price was not disclosed.

SOUND SYSTEM ENGINEERS SHARE INVENTOR AWARD

A pioneer in sound system development and one of his former students were named Inventors of the Year for 1987 for developing a compact, high efficiency loudspeaker system that produces deeper, more powerful bass notes than previously possible from a small enclosure. The awards were given by Intellectual Property Owners.

Amar G. Bose and William R. Short shared a \$3,000 cash award and received plaques at ceremonies in the House Caucus Room on Capitol Hill. The awards were presented by Rep. Robert W. Kastenmeir (D-WI), chairman of the Judiciary Subcommittee on Courts, Civil Liberties and the Administration of Justice. The awards are based on work that either was patented during the previous year or was first commercially introduced during that year.

Bose and Short were granted a patent in 1986 for a loudspeaker system that employs a driver located inside a folded acoustic wave guide. The driver is one-quarter wave length from one end of the wave guide, in order to facilitate high efficiency reproduction of bass notes with a low power amplifier. The folded wave guide allows the loudspeaker to be used in unusually compact packages.

MEMORY PROTECTION DEVICES BUYS BOGEN

Bogen was recently purchased from Lear Siegler by Memory Protection Devices (MFP), Inc. of Farmingdale, NY. Along with the purchase came a name change—Bogen will now be known as Bogen Communications, Inc. John H. Ochtera, Bogen's president since 1980, will continue as president of Bogen Communications, Inc. and will also be a director of MFP, Inc.

CROWN GIVES SPECIAL OLYMPICS A HELPING HAND

Crown International, Inc. recently announced its commitment as a Principal Games Sponsor to the 1987 International Summer Special Olympics Games to be held at the University of Notre Dame and Saint Mary's College in South Bend, IN, on July 31 to August 8. Crown's contribution will be designing the sound systems, coordination of equipment, and providing operators.

Special Olympics is the largest worldwide program for mentally retarded citizens. More than one million athletes compete annually, guided by the Special Olympics oath: "Let me win, but if I cannot win, let me be brave in the attempt", and the words skill, courage, sharing and joy.

NSCA EXPO A BIG HIT

The NSCA convention held in New Orleans from April 6-8 had the largest turnout ever. Over 4,000 industry people attended the show, which included 2,800 exhibitors and reps and 1,200 contractors. Bud Rebedeau, NSCA executive director, said, "Comments have been very favorable from contractors, exhibitors and reps about Expo '87. We're looking forward to further servicing the industry by offering video and audio tapes from the educational sessions held during the Expo." (Further NSCA information will be included in the *Sound & Communications* June issue.)

TANNOY WINS THE GOLDEN SOUND AWARD

Tannoy Limited has been awarded the Japanese Golden Sound Award for a second time. Tannoy is the only manufacturer to have won this prestigious award from the Japanese audio industry more than once. The award, initiated in 1982, is judged by a panel of independent reviewers throughout Japan. Tannoy first won the award in 1982 with its Westminster speaker and was honored again with the 1986 award for its RHR special loudspeaker. In another Tannoy Limited news item, the company has appointed Ed Form as director of engineering. Form will be responsible for all loudspeaker development and production engineering. Form was previously with Celestion Loudspeakers as technical director for several years. He takes over this responsibility from Alex Garner, technical director, who will assume direct responsibility for the marketing and engineering of Tannoy's public address and security products.

LETTERS

1990s LOOKING GOOD

The February 1987 issue has reached me, and it is an issue to crow about. I particularly was taken with "1990: What's Ahead for the Industry." It reads well with some decent expression of ideas.

Unquestionably, you're looking a good sight better than we ever did.

Kudos to the entire staff.

Regards,
Jerry Brookman
Former Editor
Sound & Communications

AUDIO AGREEMENT

Regarding the comment Marc Benningson made in the February *Consultant's Comments* that the world's greatest sound system design and installation is useless if the owner cannot operate it correctly, I couldn't agree with him more. In fact, these are practically the very same words on our literature sheet of "Set-It-To-Here" Position Markers.

They say "necessity is the mother of invention." In our many years of installing sound systems, both commercial and residential, I felt there should be a better method of making it possible for the system owner to know where his controls should be set to in addition to personally instructing him. With our system, drawing won't be misplaced, or control panels won't be disfigured from pen marks or unsightly pieces of tape. I can't take for granted that the sound system in a commercial installation will only be used by engineers. And it's even beneficial to an engineer to have a helpful visual reminder for where he adjusted a particular knob, switch or push button, etc.

We developed a new and innovative product, "Set-It-To-Here." These Markers of both special vinyl and removable adhesive, are miniature replicas of knobs, push buttons, rocker switches, arrows, etc. in various function modes, available in red, black

and white. When applied to a panel, they have a professional appearance which looks as if they were silk screened or printed.

Sincerely,
Y. Brevda
President
Yale Audio

ERRATUM

Due to an editorial error our readers may have misunderstood what Barry Rubin was trying to say in February's article "Sound and Communication in the 1990s. Industry Executives Talk To S&C About The Future And How To Get Ready For It." We quoted Rubin as saying that the solid state camera may become obsolete because chip technology keeps getting better. As Rubin pointed out to us, solid state cameras use chip technology—so it's the tube cameras that may become obsolete and not the solid state cameras. Our apologies to Mr. Rubin and our readers.

SOLVING SOUND PROBLEMS WITH SOUNDSPHERE

Here are some of the enthusiastic comments we have received from Pastors who use Soundospheres...

“Rev. Clifford Ruskowski, Vice Chancellor of the Our Lady of Orchard Lake Schools was delighted to discover that the installation of the correct product could solve the sound problems of the Shrine-Chapel. He stated, “a word about the Soundisphere system installed in our Shrine-Chapel: wonderful, magnificent. The clarity, the fullness, the sensitivity of the microphones and speakers have greatly enhanced our Liturgical celebrations. For years we labored under a sound illusion: that the architectural design of the building prohibited full and clear sound reproduction. How wrong we were! Faculty, students and our many guests to the campus this summer remarked about the quality of ‘our’ new sound system. It has made public prayer in the building an uplifting, joyous and total experience.” ▶

“Soundisphere loudspeakers have helped many churches solve difficult problems, like: reverberation, feedback, hot spots and dead spots. In many instances, one Soundisphere is installed and it operates as a single point source (the best approach for any highly reverberant location). Often one Soundisphere replaces many existing loudspeakers. In Pastor Stewart Yandle's church, First Presbyterian Church, Monroe, NC., one #110 Soundisphere replaced seven loudspeakers. He writes...

“You must surely have worked a miracle with our public-address system. The response by the members of the congregation has been marvelous. Those persons who used to complain regularly about not being able to hear are actually praising the systems we are using now.

The first Sunday we used the system with the single Soundisphere there were many questions and compliments—I heard several say, ‘I just can't believe that much sound comes from just one speaker.’

On behalf of this congregation I say, ‘Thank you very much!’ My own personal appreciation continues to increase the longer I use the system.”



If you wish to read more of Pastor Yandle's letter, contact:

SOUNDSPHERE A PRODUCT OF
SONIC SYSTEMS, INC.

737 Canal Street • Bldg 23B • Stamford, CT 06902 • USA • Tel (203) 356-1136



Microphones

In the studio, over the air or up on stage, there's a Fostex RP mic specifically designed for the job at hand. RP stands for regulated phase, a transducer technology which has been awarded over 20 international patents to date. These mics have the warmth of condensers, the ruggedness of dynamics and a sound as transparent as it gets.



Headphones

These are more outstanding examples of RP Technology. Model T-20 has become almost legendary among studio musicians, producers and engineers. Its flat response at any listening level and its comfortable design help you listen longer without fatigue. And the sound is so clear and well-defined, critical listening is enjoyable.



Speaker Systems

You're up & going with Fostex PA systems. Modular designs let you control the sound according to the needs of the event. Stack them, gang them. From a simple portable PA to an entire rig, look to Fostex speaker systems to help you solve your sound problems.



Powered Mixers

Model MP-800 has 8 inputs and delivers 180 W per channel and Model MP-1200 has 12 inputs and delivers 250 W per channel. These rugged, road worthy stereo mixers have quiet running fans, digital echo, normalled connections at all critical patch points, stereo graphics on the mains and super monitoring flexibility. The best at any price.

Complete PA Systems

Look to Fostex for any and all of your PA needs. Complete systems or individual components. High quality sound from input to output.

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To solve the most in sound reinforcement, uncommon



We've seen and heard what's out there and, frankly, we are not impressed.

Of course, this comes as no surprise to anyone familiar with Celestion. We remain wary of conventional thinking because, too often, ordinary solutions produce only the most common results.

Let's face it. Anyone genuinely committed to high quality sound reinforcement must feel a real, almost tangible need to improve the status quo. Here are the 1980s and supposedly "full-range" systems are still large, heavy boxes crammed full of drivers, crossovers and God knows what kind of miscellaneous hardware.

What it is. Because sound quality doesn't improve exponentially with increased cabinet size and system complexity, we thought: "Simple, accurate, and *small!*" A compact and true full-range system able to reproduce music at supersonic volume levels with absolute fidelity and full low frequency impact.

Too much to ask? We don't think so, though it wasn't easy. Well into it, we realized our goals actually compelled us to

redesign the conventional driver. Only this would allow the Celestion *SR1 speaker cabinet* to function with just two 8" drivers, free from the typically massive array of specialized units and crossovers.

First you notice the sound. The difference is dramatic, even breathtaking: clear, natural and unusually discrete reproduction of any program material. Deep, fundamentally powerful lows. Brilliant, clarion highs. Audio quality of such transparency that one never tires of listening.

How we did it. The success of the SR system is based on the realization that

you actually *can* build a single 8" integrated dome/cone driver with an expansive frequency response of 50 Hz to 20 kHz. Putting our oft-mentioned but sadly misunderstood Laser Interferometry mapping system to this purpose, we built one.

Now, just think beyond the immediate sonic impact of the SR1 cabinet to the practical benefits derived from single point source drivers. No intermodulation distortion typical of crossovers, no phase-/time- coherence problems or coaxial coloration. In general, fewer things to go wrong.



SR1 Speaker Cabinet

common problems we had to design a most speaker system.



How we protect it. No matter how good, or how simple, a speaker system is of little value when it becomes yet another downtime statistic on the road. With this in mind, we designed the "thinking" *SRC1 electronic controller*. It carefully monitors amplifier distortion and

voice coil temperature. Circuitry senses potentially damaging low frequency transients and inaudibly compresses them before instantly restoring complete low end power.

The result? Deep, visceral low end impact and miraculous clarity, while you bask in the knowledge that the speakers are completely protected from thermal or mechanical failure and amplifier distortion. The optional *SR2 subwoofer*, easily capable of handling 1000 watts RMS, accurately reproduces ultra low frequencies from 40-150 Hz at maximum volume.

How we package it. Eminently transportable, SR1 cabinets are made of rigid and durable non-resonant high-density polymers to better isolate the sound and protect internal components from external damage. Fitted with flexible mounting options, they are easily integrated into any sound reinforcement setting. Internally, the speakers are resistant to humidity and

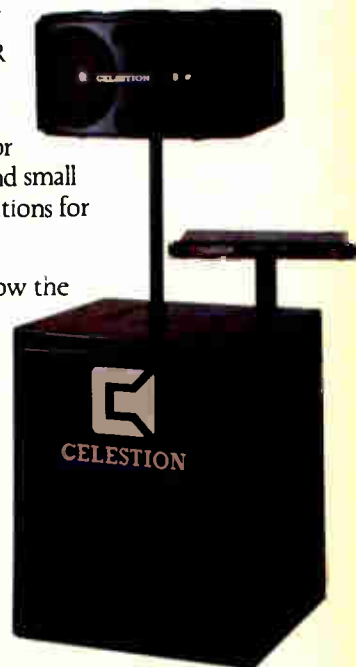
adverse weather conditions because of our sealed hard dome tweeter design, and the fact that we impregnate the paper cones with special waterproofing agents.

What is it good for? The SR system radically upgrades the audio quality of many critical sound reinforcement applications, like near-field monitor systems (drums, keyboards and vocals) and small group PA. Not to mention sound installations for clubs, bars, restaurants and auditoriums.

Why we did it. Because we know the potential for better sound exists, even in the none too imaginative arena of sound reinforcement. And that only by risking uncommon solutions could we solve problems common to us all while maintaining our own high standards.

CELESTION

Celestion Speakers, Kuniholm Drive, Box 521,
Holliston, MA 07146 (617) 429-6707



SR1 Speaker Cabinet, SRC1 Controller
with optional SR2 Subwoofer

by Dale R. Patrick

Computer Based Systems

Part one of this article focused on computer hardware and microprocessors. In this installment, we will take an in-depth look at computer memory.

Industrial computer-based systems range from a number of single-chip microprocessors to some rather complex networks that employ several auxiliary chips connected together in a massive system. In general, the primary difference in this broad range of hardware is in the memory capabilities of the system. Single-chip microprocessor units are generally limited in the amounts of memory that they can have owing to the large number of essential logic functions needed to make the unit operational. Additional memory can be achieved much more economically through the use of auxiliary chips. The potential capabilities of a microprocessor type of system are primarily limited by the range of memory that it employs.

Memory refers to the capability of a device to store logical data in such a way that a single bit or group of bits can be easily accessed or retrieved. In practice, memory can be achieved in a variety of different ways. Computer-based systems are usually concerned with read/write memory and read-only memory. These two classifications of memory are accomplished by employing numerous semiconductor circuit duplications on a single IC chip.

READ/WRITE MEMORY

Read/write semiconductor memories are the most widely used form of electronic memory found in computer-based systems today. Read/write chips of the large-scale integration or LSI type are capable of storing 16,384 or 16K bits of data in an area less than one-half of a square centimeter. New technologies are responsible for 64K, 128K, 256K, and 512K units. The ac-

tual structure of a chip includes a number of discrete circuits, each having the ability to store binary data in an organized manner. Access to each memory location is provided by coded information from the microprocessor address bus. The read/write function indicates that data can be placed into memory or retrieved at the same rate.

A simplification of the memory process is represented by the 8×8 memory unit of Fig. 7-4. As shown here, the memory units of an IC are organized in a rectangular pattern of rows and columns. This particular chip employs eight rows that can each store 8-bit words or a total of 64 single bits of memory. To select a specific memory address, a 3-bit binary number is used to designate a specific row location and three additional bits are used to indicate the column location. In this example, the row address

(continued on page 47)

Fig. 7-4 Memory Process, 8 by 8 memory unit.

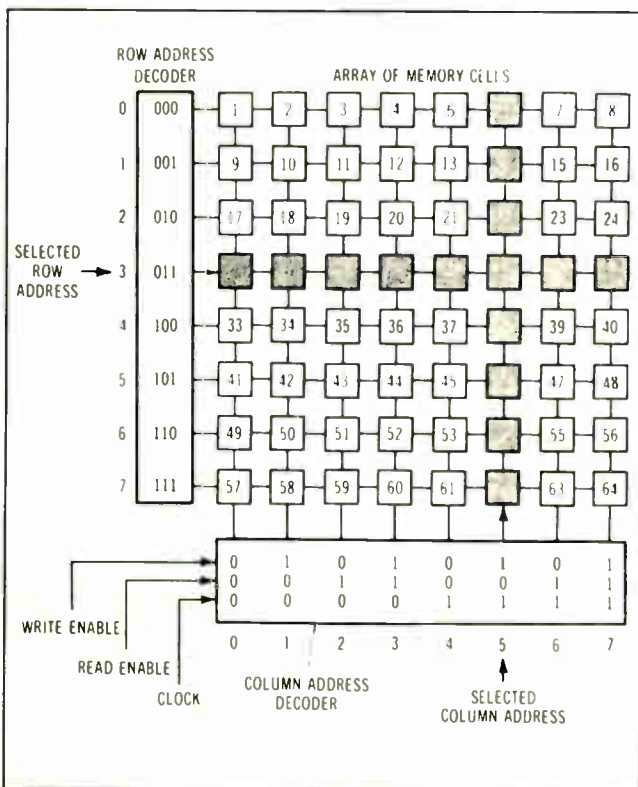
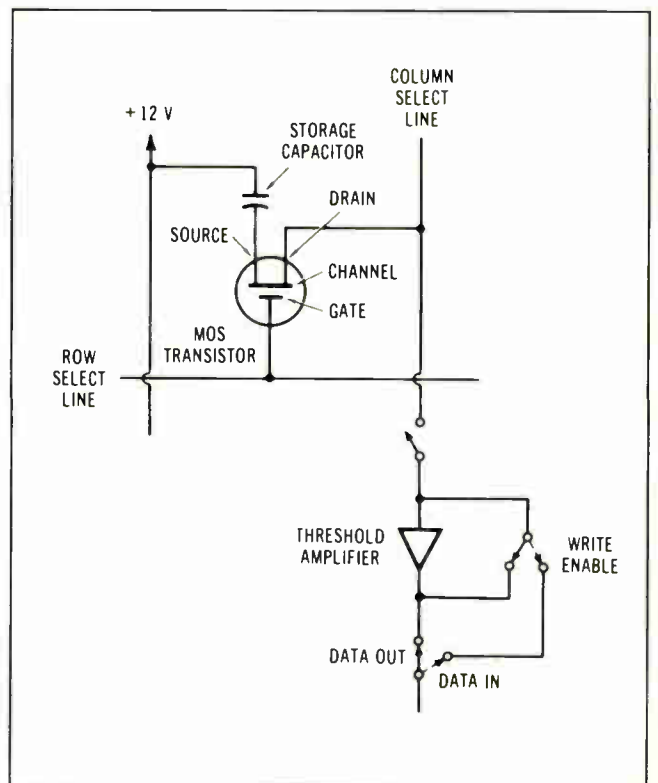


Fig. 7-5 MOS transistor memory cell circuitry.



by Marc L. Beningson
Jaffe Acoustics Inc.

Working With Electrical Contractors

The biggest challenge a sound contractor faces in the installation of a sound system is dealing with an electrical contractor. In the case of a new installation in an existing building, an electrical contractor may not be involved, but in a new building or complete renovation, an electrical contractor is involved as a prime contractor to the general contractor or construction manager.

From the early days when sound systems were much less complex than they are today, sound systems have been included in the electrical section of construction documents. In the A.I.A. stan-

“The biggest challenge a sound contractor faces...is dealing with an electrical contractor.”

dard specification, the electrical specification is Section 16, and sound systems have found a home in one of the subdivisions—Section 16800, Communications Systems. The electrical contractor, who is normally responsible for high voltage systems, including AC power distribution, lighting and similar systems, may have other low voltage systems such as phone, intercom, fire alarm, security, and CATV systems as well as sound systems in his section. For those low voltage systems which were beyond his exper-

tise, the electrical contractor would normally hire a specialty sound system installer as a subcontractor.

For simple systems, this was adequate enough. Electrical installers are certainly competent, skilled and capable technicians, but their work typically involves clamp and screw terminations of large wires, typically No. 16 AWG and greater. Because of the high voltages, the quality of the connection is less critical. Sound systems involve low voltages and much smaller wire gauges, and the termination means is largely soldering in the field. This requires different kinds of installation skills.

Sound systems require AC power, ranging from a single 20 amp circuit to 120 amp, three-phase; and, in general, sound system wiring must be installed in conduit, and both power and conduit in most cases must be performed by a licensed electrician. Although some sound contractors may have on staff a licensed electrician, most frequently in a construction project all electrical work is in the workscope of a single prime electrical contractor. Because the sound system requires this much electrical work, the rest of the sound workscope is placed along with the rest of the low voltage systems in the electrical specification. If the electrical contractor farms out the sound system to a specialty installer, this arrangement can work fairly well. Many electrical contractors, however, try to do more of the work than they are capable of performing well in an attempt to reduce the cost of the subcontract and increase their profits.

Over the years, sound systems have become more complex than power distribution systems. Component performance has drastically increased over the years and the public's expectations of sound system performance are much greater than before. It followed that the traditional methodology of subcontracting was inadequate for the level of systems being installed, and that a better way is now required. The key problem is in how to separate completely the low voltage work from the power and conduit work between the sound and electrical contractors.

The simplest way to divide the high and low voltage portions of the work is to configure the sound specification as a free standing subsection of Section 16 with the provision that the sound package be subcontracted as a single unit to a specialty contractor. The specification must be carefully coordinated by the sound system designer and electrical engineer to define clearly the worksopes of each contractor and to ensure proper coordination of sound system electrical requirements. Subcontracting a complete sound package only ensures that the system as a whole is installed by a qualified sound contractor, but responsibility for the performance of the system ultimately lies with the electrical contractor, and this is the largest disadvantage to any type of subcontracting arrangement. Other major disadvantages include: Additional cost to the owner because the electrical contractor will mark up the sound subcontractor's price 10-20 per-

“...In a new building or complete renovation, an electrical contractor is involved as a prime contractor...”

cent for “administration and coordination” which does not always take place; the electrical contractor is an additional middleman through which all submittals must flow, which can cause additional unnecessary delays.

In addition, special sound system requirements such as isolated grounding, conditioned power, conduit spacing and separation of microphone, line and speaker level wiring are not apparent to the electrical contractor. The subcontracted sound contractor has little control over the electrical—who incidentally approves his payments—and these requirements are rarely properly addressed; while the electrical contractor may seek quotes from a number of potential sound subcontractors, he may decide to carry less than these quotes in his own bid to get the job. Once the electrical contractor is on board, he is in a position of power over the subs, and can put the sound contractor in a marginally profitable situation right from the start.

How can these disadvantages be overcome? There are a number of possibilities which will be discussed in upcoming columns.




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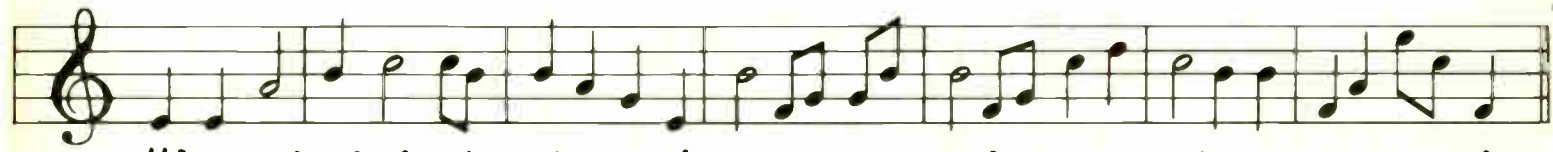
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Advice on how to prepare a winning bid was offered to attendees at a panel discussion by Sound & Communication magazine during the recent NSCA convention in New Orleans. Marc L. Beningson of Jaffe Acoustics moderated the discussion. Glen Meeks, systems engineer for Midwest Communication, Mike Hoover, vice president of Julien Enterprises/Audio Technical Services, Dick Printe from Command Performance and Steve Simpson from Southwest Sound and Electronics were the panelists.

The first question posed to the panel was: What is a Winning Bid?

Mike Hoover: Well the first and obvious answer is the bid you have, but it also needs to be the one you also made money on, too. It's real easy to win if you leave all the labor out.

Dick Printe: My answer would be the same. If you don't make the amount of money you need to make, why do the job? I could stay at home and go broke rather than go out in the field all day long for about six months. I know a number of you have been there—all of us have at one time or another. I guess it was best put in the words of a song, "You know when to hold them and you know when to fold them." You know what your people can do, you know what your costs are, and are able to evaluate not only what you can do, but also in that package be able to make a comment on who else is bidding on it. If it's a contractor that's working out of his garage, certainly his overhead and so forth is going to be considerably lower. If his overhead is low and his quality and his reliability is high, then there is a good chance that he may, in fact, be able to give the customer a good job.

Steve Simpson: Knowing your competition is a key issue. We usually chart out every company that's going to be bidding on a job and we take a graph of where they normally stand, compare it to ourselves, and most of the time we can pretty well tell exactly where he's going to come, because most companies usually have a particular type of project that they like.

Dick Printe: Some are very good at school systems, some are very good at the alarm systems, some are good at large arenas, and some are better at just church sound jobs. We try and find a particular niche where we feel we are the best in that particular area of the

HOW TO PREPARE A WINNING BID

country, and then we find out where everybody is. We'll go into a few bids with a very high one just so we're there, so we get a list of who's there and where they range, and we do a few samples. Then we know where people are. We just stay high for a little while until everybody is kind of settled out, and then we come in because we know where they are going to be. We take about four or five in a row.

Mike Hoover: I want to expand on what Steve Simpson just said—you need to know what your costs are. That is the real secret to both winning the bid and then making money on it; it is how you analyze the costs and how you break them out. If you leave costs out because you are not aware of them, you may well win the bid, but you may well be hurt at the end. If you put costs in that aren't really

there, as one of our competitors once did—bid on about half of the job that wasn't even in his scope of work—you don't get the job. And that's the key—learning what your costs really are.

Glen Meeks: I agree with Mike—you really have to know where your costs are in order to be truly competitive. If you don't know where your costs are, it's a wild guess when you turn in your bid. Totally silly. In addition to knowing what your costs on the job are, you really have to know what your true labor costs are. If you're a non-union company, you may be paying a guy anywhere from \$5 to \$8 an hour. If you're union-run, you'll pay anywhere from \$6 to \$14 an hour depending on where in the country you are located.

But what are the true costs attached to that labor? Most companies don't have the foggiest idea.

There is a portion of accounting called Cost Accounting under which you can sometimes hire someone for a minimal fee of \$500 or \$1,000 with an actual cost based on insurance, based on your overhead. What should you be charging that job as a cost for your labor. That's real important. Also, what's your true overhead? What is the percentage of your yearly income that goes towards your rental, salaries, bonuses, anything? If you don't know all those percentages, you'll never know what percentage you'll have to go in at on the job. If your yearly overhead is 22 percent and you

HOW TO PREPARE

want to make a 10 percent profit return on your business, you have to go in at 32.

The one thing that we always worry about is the guy who really doesn't know what he is doing and gets in there and gives a real inexpensive bid. He ends up losing money. Typically, the guy will get it done, and he learns a hard lesson, the real hard way. I have to admit, I have done that. I've done it on smaller jobs, rather than getting into real monstrous ones. That's a good way to learn; you find out how to estimate, how to cost it, but beyond the actual cost estimate, you have to know what your real costs are in order to determine what kind of percentage you need to go in at and to make the return you want to make.

Simpson: One of the things that I consider is a travesty of justice on the take-off sheet is if any of my people write down miscellaneous parts, miscellaneous equipment, etc. If you don't have an idea of what those miscellaneous parts are going in, they'll kill you coming out the other end. An example would be engraving or hooks, chains, hangers, or miscellaneous equipment to suspend a cluster. You've got to have an idea of where and what you're going to have in that ceiling or how many letters you intend to engrave. Are you engraving plastic or do you have to do a Jaffe Acoustics specification where you are engraving on a special bond of plate? There is a difference in price.

Going back to your audit sheets and finding out what an hour of labor costs you is quite surprising. If you start with a premise that there are 50 weeks of the year that a man works, but you still have to pay him for those two weeks off and work backwards, eight hours a day times whatever his wage is, and start adding numbers, you are actually going to get about 1,950 paid working hours out of the man. The rest is vacation time, sick leave, paid holidays, and so forth. Then start adding up all those other known expenses—what's the insurance, total the insurance bill divided by the number of trucks; what's your utility bill, utility bill divided by the number of people that are out there producing.

I'm overhead, so theoretically the guy that's in the shop is working not only for himself and his wage, but also for whatever supervisor he has. If you have one supervisor working four crews, or four people, they have to pay his wage. In adding up those numbers, it takes about three pages of regular double column pad, and, in fact, it does cost about three times what you are paying the guy as long as you are paying him under \$10. For me it's \$29 and some odd cents an hour, and that's assuming 75 percent deficiency. When you get your bottom line, divide by .75.

Printe: That's a good point about the laborer. This has been one of the hard parts about figuring all the things that are going to speak, how much do you tell without giving away.

Beningson: I should point out that I had a list of about 12 contractors to choose from for this session and a number of people declined to be involved. But one thing we were discussing earlier today is that nobody knows anybody else's secrets, so everybody is coming from it in a different way. If everyone were approaching the job in the same way, and everybody knew all the secrets, the bids would be much more tightly clustered, and basically who got the job would depend on who could develop an edge. But, all the jobs would be competitively bid and you would not lose to someone who made a mistake. I mean the low bidding process is really a problem in that way.

Printe: Many years ago, I was a manager of a computer firm and we had to bring technical staff on and off at regular times. We developed and found out that there is a nationwide Manpower Organization where you can hire two-year technical degree people for an hour, a day, a week.

They pay all their vacation, their hospitalization—I don't know how they do it—and these people only cost you \$7.50 to \$9 an hour tops. One particular job that comes to mind was in Minnesota. We were requested to bid on a \$600-and-some thousand dollar project, over 1,200 ceiling speakers plus many multiple clusters, and the bid was six weeks before opening day. In three days, we had to contract and had 21 people on staff. Only two were our permanent people. We started our assembly lines, and we opened three days early.

We paid the taxes on all the materials as we bought it. On a \$625,000 job, if we paid taxes on the whole thing, it would have been \$28,000. If the materials were billed out at the cost put in on the contractor sheet, the taxes were \$17,000. We were \$10,000

less on taxes, our bid was \$6,000 lower than the other guy. If we put it in on the taxes on the total project, we would not have been the low bidder.

Beningson: Before we get into control of cost, which everyone has emphasized as a key portion of putting together a bid, we'll discuss competition. Once you've arrived at what you think you can do the job profitably for, do you adjust that depending on who else is bidding?

Simpson: It's not worth getting a job for the privilege of just being able to say I did it in most cases. Adjusting prices downwards, in most cases, is what they're saying is usually not worth it. We'll cut our margin a little bit, but we won't just give the job away unless we can see that there is a significant reason out there to do so. There's another addition that you can make up the difference with later. There's significant changes that may be approved. But just because XYZ is going to bid it or I find out that Hoover is going to show up and bid on the University of Texas job, I'll let him have it before I'll let it turn into a blood bath.

Hoover: I will admit to having adjusted bids in the face



Over 150 people attended the seminar, "How to Prepare a Winning Bid," during the NSCA convention last month in New Orleans. Marc L. Beningson, of Jaffe Acoustics, (far left) was panel moderator.

Photos by Jimmy Cresson.

A WINNING BID

HOW TO PREPARE

of competition but usually bids will be adjusted up when I know that my costs are significantly below their costs.

Meeks: We've set up a series of margins we want to work with beginning with the size of the job, materials to labor relationships and then go straight across the board. We work a little bit differently. Back when I was with Comcast, we ran D & B's on everyone we could think of, including Mr. Hoover and Mr. Printe. And the whole reason was we wanted to find out who our competition was. Most interestingly, there is a real brick wall around \$2, \$2.5 million corporations and this is because many of them are closely held family-owned corporations. All of us, for the most part, are small business entities, and some of the things I am talking about may not apply to you.

We're a corporation and have 300 employees with 32 offices and we gross \$100 million. There are reasons why we are at the size we are. One of them is we simply go for the margin we feel we must have. You find out what you have to do, and you go with it. I have personally found by keeping track of my bid proposals over a two-year period, typically, one third of everything I put out will come back in. That's over a long-term period type of review. So, I just simply said, "OK, so it's basically a numbers game. How many bids can I get out there?" So I go at a certain margin, just get x amount of them out there, and I know over time I will get x number of them back. That's pretty much worked out to be the case. So we go straight with just a margin; we don't change it.

Very seldom do we even go up, because there are things we are afraid of. When I had my own company, we were under one structure, and when I was with Comcast, it used a larger margin than in sound contracting. So when I wanted to go at 30 percent, they were upset because they were used to 50 percent and 100 percent mark ups on these little \$5,000 to \$10,000 jobs. Now, of course, we're doing a single job for \$400,000, \$200,000 or whatever. In order to do that many jobs, they have to sign on 1,000 customers. There's a whole different level of productivity, and what you have to know is where you fit in that range of things. Are you doing schools? If you're doing \$1 million a year, how many purchase orders does that take? How many contracts does it take for you to do \$1 million a year? Those things are real important. It gives you an idea of exactly where you have to be with your margin. The point I'm leading to is that it really varies from company to company and from region to region, based on what your business is.

Back on the margin type thing—Midwest is a company that's historically in the video systems business, which is according to video engineers. You know audio is a ripple in their power supply. That's the way most of the guys I deal with think about it. What they're used to as a margin

is fairly low, compared to what most sound contracting people are used to. What we're afraid of is if we continually bump up our price. Any company, no matter who you are, will fill in the void. Your general administrative cost will find some way to eat up that extra money you are making, and you will come back to your 10 percent or 12 percent or whatever percentage of growth you're looking for after it is all said and done.

If you keep on bumping your percentages, you'll eat up that extra margin eventually, and your overhead will just somehow creep up there, and two years from now when your competition comes in and sees you're weak, and you're going to have to start going back down, you're going to find that extremely hard, if not impossible. The majority of the large corporations of America are going through that right now.

In my opinion, there is a real need to maintain your costs. Maintain your margins, because if you keep on bumping them up and keep on rising higher, and keep on driving your general administrative costs up, five years from now you're going to be out of business. Someone else is going



Seminar panelists were (L-R) Mike Hoover, of Audio Technical Services; Glen Meeks, of Mid West Communications Corp.; Steve Simpson, of Southwest Sound and Electronics; and Dick Printe, of Command Performance.

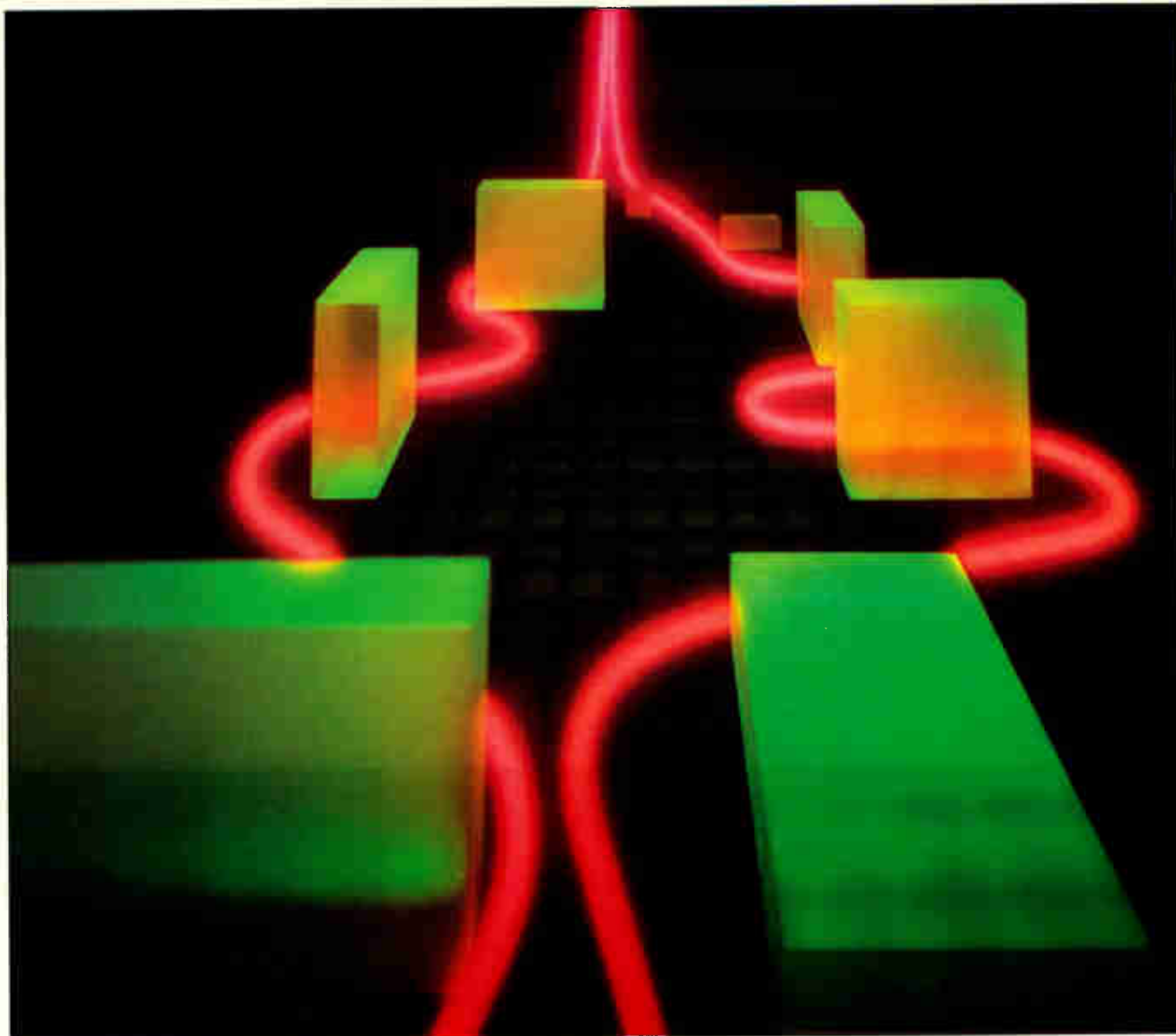
to come in and start taking over the type of business where you are getting real high margins. They're going to see an opportunity. Maybe one of your ex-employees, who knows? So we at Midwest have a real firm belief that you go with what you need and that's it. Even if you left a chunk on the table. I have no problems saying that in one bidding situation where one was \$1 million and the other was \$2.3 million, I was the \$1 million player. The other company did not want the job, obviously. We had no idea what they were doing.

The other problem was the electrical contractor was charging \$360,000 on the base bid to pull the wire. Why, I don't know. We're very satisfied with the margin we made on that. Again, it's the whole thing. We don't want to become fatter as a company, we want to stay a very lean structure. So we do not typically bump our prices up, and we never bump them down. We just simply to with what we know we need to make and pretty much stay with it.

Printe: We have a typical base and we never go below either. But there are a few companies that we know that are typically higher, and that's the only way we'll go is up. I'm not going to particularly mention the brands, but there are deals to be made from your suppliers. They'll probably kill me on this. But, if I bought 200 speakers every month I pay so much a price. But, if I know that over this year I'm going to use that many speakers, I will buy 2,500 speakers, get the 2,500 low price and have them deliver 200 every month. You're taking another 10-15 percent. That's in your pocket. You keep doing this on enough of your product lines, it makes a big difference in where your margins are.

(continued on page 46)

A WINNING BID



Photos by Chuck Shotwell and Belden Wire and Cable

A TECHNICAL TUTORIAL

Fiber Optics

by Ron Ohlhaber
Belden Wire and Cable

Fiber optics is heralded as the transmission medium of the future because optical fibers can make tremendous amounts of information clearer, at lower loss, and with greater capacity than conventional copper wire or satellite systems.

The signals generated in fiber optic communication systems are not distorted by any form of outside electronic, magnetic, or radio frequency interference, making them completely immune to lightning or high voltage interference. Also, optical signals do not require grounding connections, so the transmitter and receiver are electrically isolated and free from ground loop problems.

Satellites also do not compare favorably to optical systems when the following factors are considered: Satellites are limited to far fewer transmission bands than their optical fiber counterpart and the delay or echo problems traditionally associated with satellite transmission are non-existent with fiber cables. Optical cables also have a life span of over 25 years; satellites generally last 10 years.

Fiber Structures

In describing the transmission of signals via optical fibers, the term *light* is commonly used. However, *light* actually refers to optical radiation which is visible to the eye, whereas optical fibers exhibit their lowest transmission loss at wavelengths longer than that of visible light. This longer

wavelength region is the near infrared, and the signal energy is referred to as optical or infrared (IR) radiation. Both visible light and IR radiation are in a region of the electromagnetic spectrum characterized by wavelengths much shorter than microwave radio.

An optical fiber system consists of: the transmitting equipment that transforms electronic signals into light pulses, the optical fiber itself and the receiving unit that acts as a light detector.

The fiber is an incredibly thin strand of pure glass (usually silica) that is composed of a core and cladding. The core material carries the light, surrounded by the layer of cladding that both protects the core from surface contamination and reflects the light within the core. Since the cladding has a lower index of refraction than the core, it causes the optical energy, which would otherwise tend to leave the core, to be bent back towards the core center, thereby continuing its propagation. In fibers, the various light paths are referred to as modes.

Long-distance transmission systems use fibers with glass cores. Most long-distance fibers also have a glass cladding which is an integral part of the fiber construction. These are frequently referred to as "all-glass" fibers. Fibers which use a glass core to carry light, but have a plastic or polymer cladding, are called PCS (Polymer Clad Silica) fibers.

Optical signal pulses are generated either by laser or light emitting diode (LED) components. Lasers are better for long distances because their signals travel farther without the need for boosting, but LEDs are more reliable and less expensive.

Multimode vs. Single-Mode Fibers

Still in widespread use, the first commercially available optical fibers were known as multimode fibers because they propagate light energy by allowing it to travel in a number of different angular paths or modes inside the central core region. To guide infrared optical radiation, the core and the surrounding cladding have different indices of refraction.

Multimode optical fibers are available in two styles: step index and graded index. In a step index fiber, the indices of refraction of the core and cladding change abruptly at their interface. Graded index fibers exhibit a more gradual change of the refractive index from the center outward to the cladding.

Single-mode fibers can have either a step index or graded core, but the core is considerably smaller to afford a straight axial propagation path. This direct transmission pattern gives single-mode fibers some important advantages over multimode systems: they have a greater information-carrying capacity and they allow longer distances between repeaters—by at least one order of magnitude.

For single-mode fibers, the single axial path permits the transmission of higher signal bandwidth than multimode fibers. This is because the numerous angular optical paths in a multimode fiber permit the optical pulse to travel over different distances inside the fiber core and arrive at slightly varying times. The result is a time spread of the optical pulse which corresponds to a reduction in the transmission bandwidth. Single-mode fibers, with their one axial

propagation path, do not experience this type of pulse spreading.

To permit single-mode transmission, the single-mode fiber core diameter is extremely small (0.0004 inch or 10 microns), necessitating the use of expensive emitters (such as laser diodes) and special light emitting diodes (LEDs) to introduce sufficient optical energy into the fiber core. A typical outer diameter dimension for single-mode cables (and many multimode) is 0.005 inch (125 microns).

Without elaborate multiplexing schemes, single-mode optical fiber systems will routinely transmit up to 500 million bits of information per second over 40 kilometers. This information rate is sufficient to carry simultaneously several video channels, high-fidelity audio, data, and thousands of telephone calls. In the laboratory this performance has been exceeded by about 10 times.

In contrast, good-quality multimode fibers can transmit 100 megabits of information per second over 20 km. This means the repeater spacing is less by a factor of two and the potential data rate is one-fifth that of the single-mode fiber.

Considerations of Single-Mode Introduction

While single-mode fibers, and their advantages, have been known since the very first optical fibers were made in the laboratory, initial commercial offerings employed multimode construction. It simply took time for the technology to evolve to the point where single-mode fiber was fully developed, and therefore economically practical.

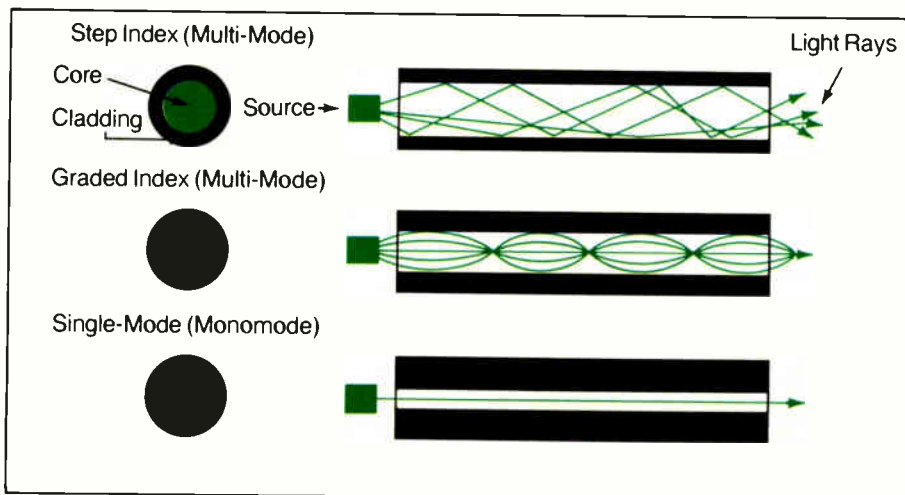
Connectorization was a major obstacle that had to be overcome. Since the core of a single mode fiber is so small in diameter, it is extremely important that connectorization takes place with a high degree of precision. Initial attempts to create practical connectors were hampered by high costs, unacceptable attenuation, and difficulty of installation in typical field conditions.

Another problem was the development of sources and detectors capable of operating at the 1.3 μm and 1.5 μm infrared wavelengths preferred for single mode systems. Here again, time was required for the development of the necessary component technology.

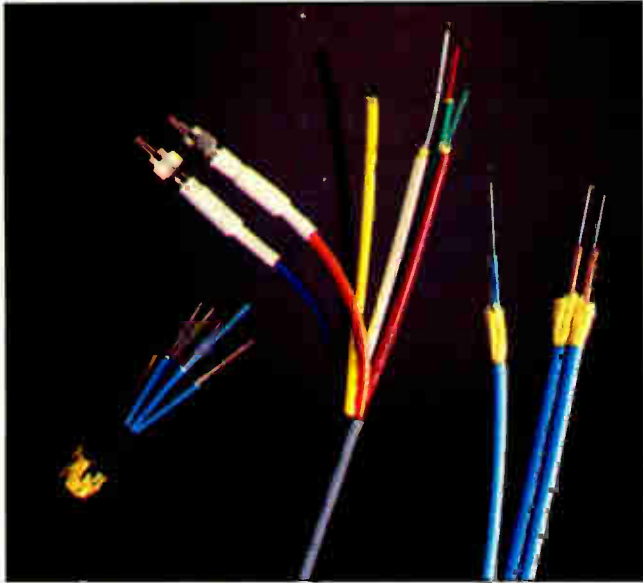
Clearly, none of these problems were insurmountable. Today, the cost versus performance tradeoff is in favor of single mode systems when the application involves long distance telecommunication links.

Installation Methods

Installation methods for single-mode fiber cables are



A graphic representation of how light rays travel in three fiber types.



Belden Fiber Optic LAN Cable

quite similar to those used for multimode fiber cables in a typical telecommunications-type system. However, connectorization of single-mode cable is generally more expensive. This is because the small core or mode-field diameter of single mode fiber makes it more sensitive to misalignment. Even so, properly installed connectors can achieve average losses as low as 0.25 dB.

Single-mode fibers also can be spliced. While at first glance it may seem extremely difficult to splice a fiber with a mode-field diameter on the order of 10 microns, as of this writing well over 100,000 single mode splices have been successfully performed.

With the development of 1.55 μm single-mode fiber, attenuation loss is so low that losses from splicing and connectorizing can be a significant percentage of the total system attenuation.

Telecommunications Applications

Today, virtually all new installations of long haul, inter-exchange and feeder loop applications use single-mode optical fibers. These applications are 5 km or longer, with capacities exceeding 1,000 voice circuits.

The distribution loop is the one area in which metallic cable still sees widespread use. Distribution loop refers to the connection running directly from the central office to the subscriber. The typical distance is less than 5 km, with less than 100 voice circuits carried. Virtually all of today's subscriber services are handled by metallic cable. However, as optical fibers drop in price, and as subscriber services become more complex, the motivation for turning to fiber optics will increase.

Video

Cable TV is a very promising area for optical fiber use. Closed circuit TV involves limited transmission bandwidth over moderate distances, and multimode fiber is being used. However, single mode fiber is being employed for the trunk portion of newer cable TV networks, in which a number of video channels are transmitted on a single fiber over relatively long distances (10 to 30 km).

Ron Ohlhaber received a BS degree in Physics from Loyola University and a MA, also in Physics, from DePaul University. He joined Belden in 1977 and is presently Product Development Manager for fiber optics. His industry-related activities include participation in EIA FO6 and IEC SC 86A fiber optic cable committees.

GLOSSARY OF FIBER OPTIC TERMS

Avalanche Photodiode (APD): A photodiode designed to take advantage of avalanche multiplication of photocurrent.

Bandwidth: 1) A range of frequencies, usually specifying the number of hertz of the band or the upper and lower limiting frequencies. 2) The range of frequencies that a device is capable of generating, handling, passing, or allowing, usually the range of frequencies in which the responsibility is not reduced greater than 3 dB from the maximum response.

Buffer: A material that may be used to protect an optical fiber waveguide from physical damage, providing mechanical isolation and/or protection.

Cladding: The dielectric material surrounding the core of an optical waveguide.

Core: The central region of an optical waveguide through which light is transmitted.

Connector: A device whose purpose is to transfer optical power between two optical waveguides or bundles, and that is designed to be connected and disconnected repeatedly.

Coupler: A device whose purpose is to distribute optical power among two or more ports.

Coupling Loss: The power loss suffered when coupling light from one optical device to another.

Dispersion: A term used to describe the chromatic or wavelength dependence of a parameter as opposed to the temporal dependence which is referred to as distortion. The term is used, for example, to describe the process by which an electromagnetic signal is distorted because the various wavelength components of that signal have different propagation characteristics. The term is also used to describe the relationship between refractive index and wavelength.

Fiber Bundle: An assembly of unbuffered optical fibers. Usually used as a single transmission channel, as opposed to multifiber cables, which contain optically and mechanically isolated fibers, each of which provides a separate channel.

Fiber Optics (FO): The branch of optical technology concerned with the transmission of radiant power through fiber made of transparent materials such as glass, fuses, silica, or plastic.

Injection Laser Diode (ILD): A laser employing a forward-biased semiconductor junction as the active medium. Synonyms: diode laser; semiconductor laser.

Modulation: In lightwave communications, the variation of a characteristic or parameter of a lightwave in order to superimpose an intelligence-bearing signal on a carrier wave. For example, a variation of the amplitude, frequency, or phase of a lightwave by an analog or digital signal that is first coded to bear intelligence, then transmitted, and finally recovered by a photodetector at the receiving end of an optical cable. The carrier is usually a continuous or sinusoidal wave when it is not modulated.

Photodiode: A diode designed to produce photocurrent by absorbing light. Photodiodes are used for the detection of optical power and for the conversion of optical power to electrical power.

QUALITY

*the process begins
here...*



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Survey of Today & Tomorrow's

CONTRACTING

BUSINESS

In-Depth Market Report

Sound & Communications Magazine recently surveyed over 1,400 sound and communications systems contractors and received an overwhelming 25 percent return of responses. Our survey contained a geographically representative sample of the industry. The results of this survey depict some changes over last year's survey, new industry trends, and what is on the horizon in the sound and communications contracting business.

BUSINESS

We asked contractors how many branch offices they have and found that the majority of them, 44 percent, have just one office. Of the remainder, 37 percent have one branch office, 8 percent have two branches, and 11 percent have three or more offices. Last year's results were similar with an average number of offices per contractor at 1.4. These results indicate that the sound and communica-

tions contracting business has remained a small-office industry.

Other questions in this category define the size of the typical sound and communications contractor. Almost 47 per-

“...the typical contractor’s marketing efforts are nearly as diverse as the industry as a whole.”

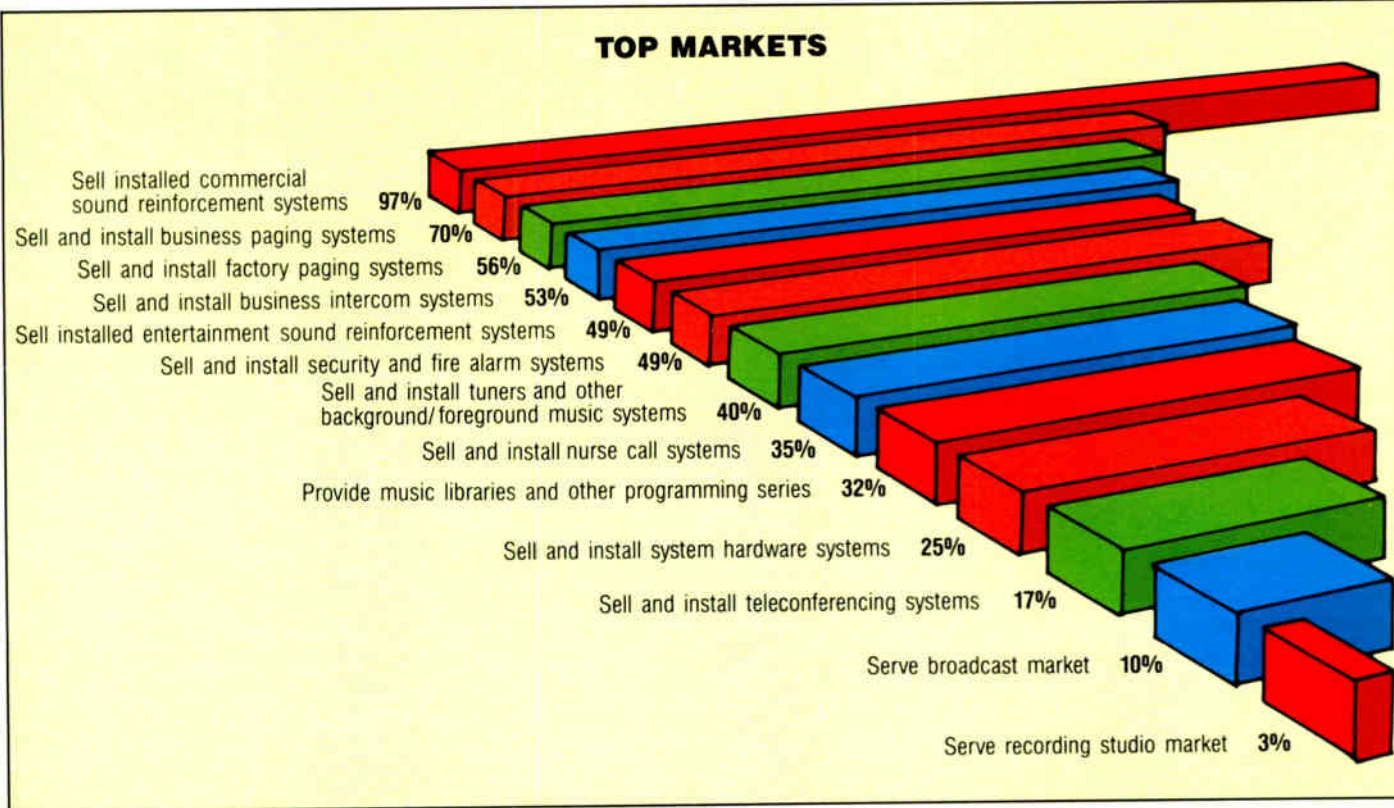
cent said they have fewer than 10 employees and 30 percent said they had fewer than 25—a total of 77 percent. This figure is down 13 percent over last year’s

total of 90 percent. Therefore, 23 percent of contractors are employing 25 or more workers, which could depict a trend towards expansion in the marketplace.

In a related question, approximately 27 percent of respondents reported gross income (total of all branches) to be between \$1,000,000 and \$5,000,000. Yet 31 percent reported gross income between \$100,000 and \$500,000; and 17 percent reported between \$500,000 and \$1,000,000. About 15 percent said their gross income was under \$100,000 and 10 percent reported gross income over \$5,000,000. These figures indicate that the lower end and higher ends of total dollar sales are up and the middle dollar sales are spreading out more, as compared to last year’s figures.

MARKETS

In this section, we asked contractors to tell us what markets they served and



which were the most important to them. We suggested 28 different market categories and left a space for "other." For the most important markets served, we asked the contractors to indicate what services they provide.

While many of the contractors checked off just commercial sound reinforcement, most of them checked a dozen or more of the 28 categories and added their own. This seems to point out that individual contractors are unlikely to specialize in any one market area and that the typical contractor's marketing efforts are nearly as diverse as the industry is as a whole.

From the numerous responses, here are some of the highlights of this year's survey: over 97 percent of those who responded said they are engaged in the sale of installed commercial sound reinforcement, 49 percent said they sell installed entertainment sound reinforcement, 53 percent said they sell and install office intercoms, 35 percent said they sell and install nurse call systems, and 56 percent sell and install factory paging systems.

While only 29 percent sell tape, cartridge, CD players and SCA, 32 percent provide music libraries and or other programming services. Just under 18 percent serve the recording studio market with systems and installation and about 10 percent serve the broadcast station market with systems and installation. Also, about 17 percent sell and install

teleconferencing systems, and the sales and installation of security and fire alarm systems have gone up from 41 to 49 percent. Related to this as indicated in the "other" category, some people wrote closed circuit television as separate from security. Interestingly, three percent wrote in that they sell and install stage lighting. Other categories written in included A/V presentation, fast food drive thru, motion picture theater sound, and master antenna systems.

***"contractors have
the best rapport
with manufacturers
of their largest
selling lines."***

When asked which three of the 28 market segments were the most important to them, contractors responded with these answers: over 44 percent of those surveyed reported that the sales and installation of commercial sound reinforcement systems makes up a large percentage of their yearly gross sales and they chose this market segment as being most or second most important. Background/foreground music came in as third most important

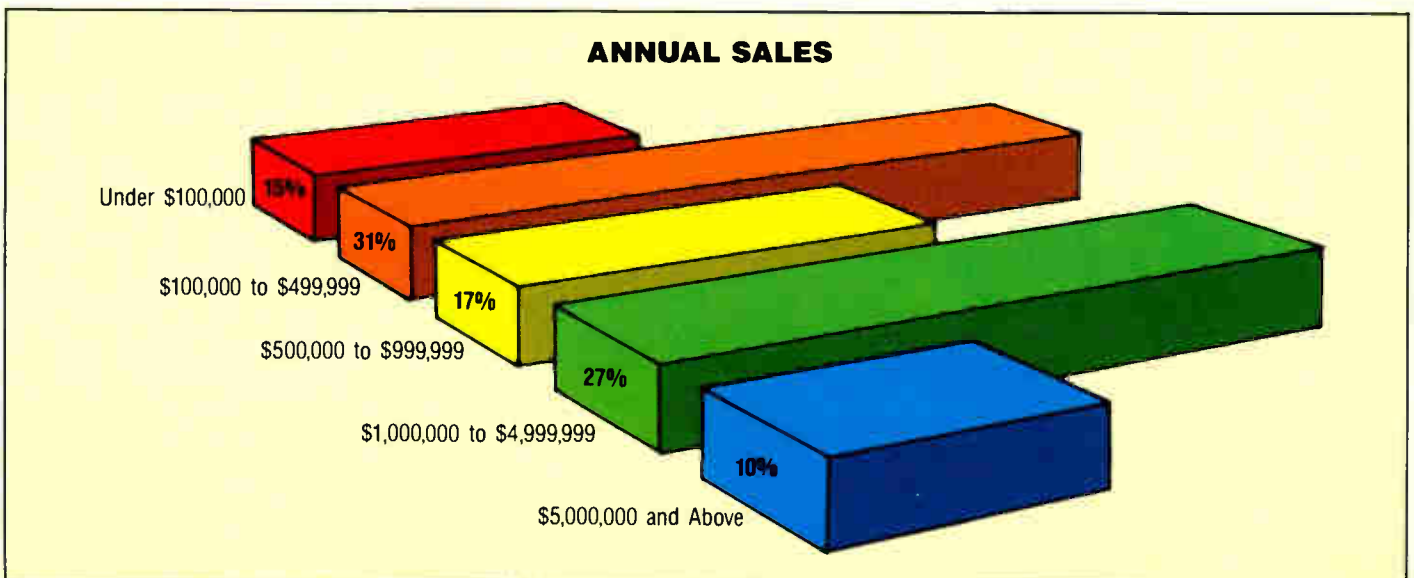
with a 12 percent response. There was a small percentage of contractors who felt that security was most important.

In each of their three most important market segments, 82 percent of the contractors reported that they provide equipment, design and install systems and provide repair and maintenance. In other words, almost all contractors surveyed consider themselves "full service" businesses.

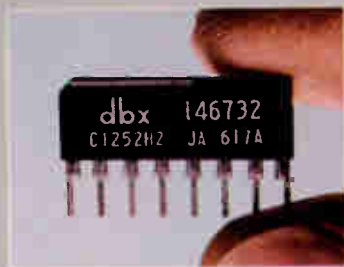
In addition, we asked contractors to report on which market segments would be most important to them in 1987 and beyond. Almost 40 percent picked installed commercial sound systems as their first, second or third choice. Obviously, this remains the basis for the business.

Some other answers included the security and fire alarm segment which received a 16 percent vote as contractors' first or second selection. Twenty percent said that other wired intercoms was their first, second or third choice.

Another important question we asked contractors was to name three market segments they thought were "most neglected" by contractors in general. One quarter of the people responding to that question felt that sound masking was the most neglected, while another quarter felt that the video systems business was not getting enough attention. Ten percent of the people felt that the security alarm industry was the most neglected, seven per-



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CONTRACTORS SPEAK OUT

A New York Contractor: "I want to convey to manufacturers that we, the contractors, are not the enemy. We must have maximum information on their equipment in order to represent them to the end user."

A Pennsylvania Contractor: "Manufacturers would do well to build loyalty rather than trying to place each of their dealers in every one of the businesses known to this industry."

A Quebec Contractor: "Sound industry should make a more determined effort in establishing itself as a separate subcontractor and not as a subcontractor to the electrical trade."

A Maryland Contractor: "I feel the industry is heading towards a large growth, especially in the foreground business and concert sound business..."

An Arizona Contractor: "I see all markets served well by contractors who have discovered their niche."

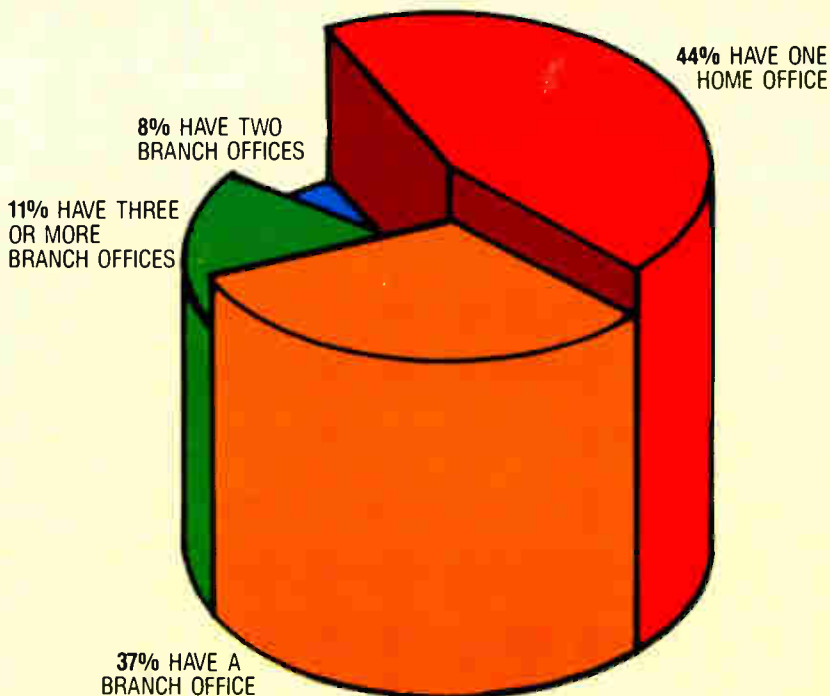
A Missouri Contractor: "There are too many fly-by-night slap-it-in companies rapping the business by selling "junk" that doesn't hold up..."

An Illinois Contractor: "I am consistently surprised by two things in this business: 1) how few contractors take the time to figure out what their clients really want and 2) too many clients are willing to listen to any basement expert and then compare his price against a legitimate professional contractor."

An Indiana Contractor: Major (and minor to some degree) companies treat the dealer/contractor as the end user rather than as part of a two way pipeline of product/support/marketing information..."

A Florida Contractor: "...I think that the industry as a whole needs to educate its members. If you offer a good and valued service you are entitled to be paid for it. Profit is not a dirty word."

NUMBER OF BRANCHES



THREE LARGEST SELLING LINES

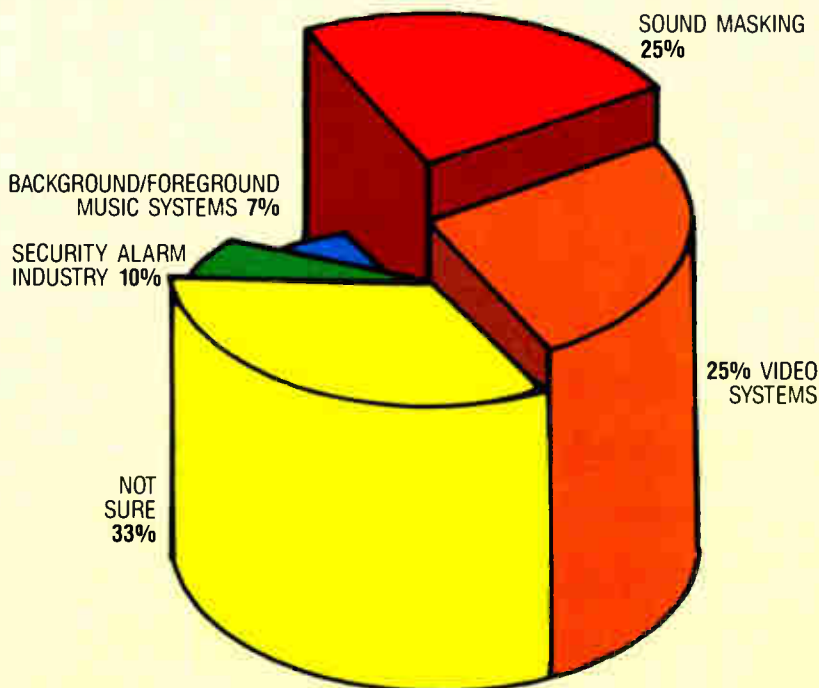
Rank	Company	Percentage
1	TOA	1
2	Electro-Voice	5
3	JBL	1
4	Soundolier	3
5	Boya/Dykane (10)	4/2
6	3M	
7	Shure	
8	Alphacore	

1986

MANUFACTURERS CONTRACTORS HAVE BEST OVERALL RELATIONS WITH

Rank	Company
1	TOA
2	JBL
3	Soundolier
4	Dykane
5	Boya

MOST NEGLECTED MARKETS



cent said it was background/foreground music systems and 1/3 of the people weren't sure what was. People responded to this question very differently last year, which seems to indicate that those market segments, broadcast station systems and teleconferencing, are now receiving recognition. However, the categories selected in this year's survey, with the exception of sound masking, were in third place in last year's survey.

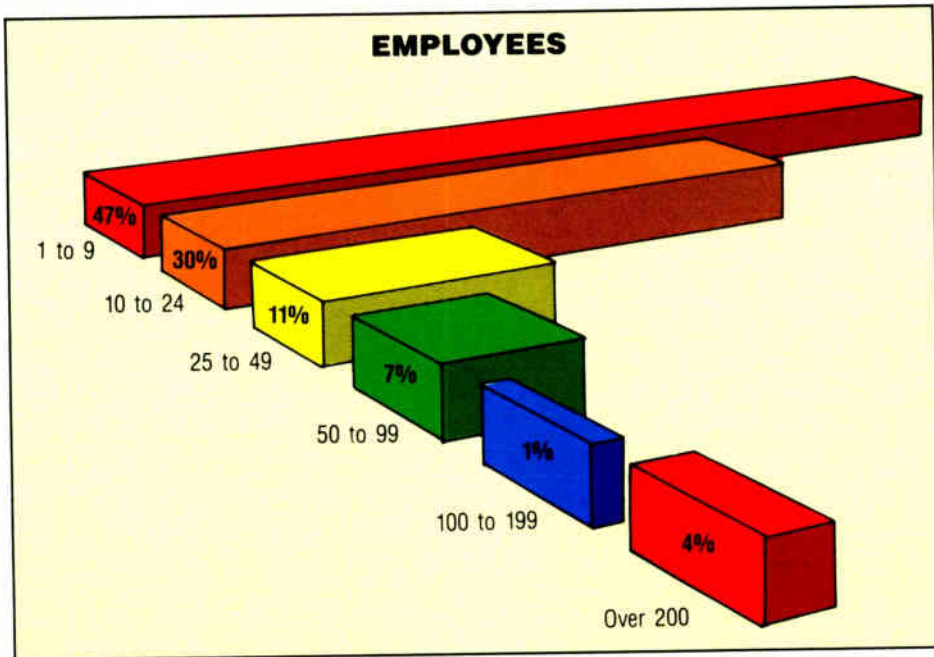
Sound & Communications Magazine's survey also asked people what markets they would like to expand in. Nine percent would like to expand in video, four percent in entertainment sound reinforcement, four percent in sound masking and four percent in commercial sound reinforcement. Since many contractors did not respond, this may indicate that many of them are content in the businesses they are already in—27 percent of the contractors are making over \$1,000,000 in gross income.

INSTALLED SYSTEM JOBS

In this area, we asked contractors to report on the average dollar size of systems they install. The median answer, \$9,762, was slightly lower than last year's. Some contractors were reluctant to respond to this question, possible because this question was asked on a one-year basis and some jobs can take much longer. For those who install smaller systems, answering this question was an easier task.

When asked for the dollar size of the largest system sold during 1986, the contractors responded answers came to a median of almost \$157,000. Also, remembering that 46 percent of contractors reported gross income below \$500,000, it seems likely that these large jobs are primarily going to a relatively small number of larger contractors.

We also asked contractors to give us the typical number of days from purchase order to completed system on a typical job. The majority said it takes about three and a half months, slightly more than last year's survey indicated. This may mean that jobs are becoming a little more complicated.



EQUIPMENT BRANDS

Manufacturers are always looking for new dealers but often are told by contractors that they can't support any more lines. The average number of lines contractors are authorized to sell is just under 27, up from 24 last year.

We also asked contractors to list the brands which accounted for the largest proportion of their sales. The top brand for the second consecutive year is TOA, followed by Electro-Voice (up from fifth place last year) and JBL in third place. Soundolier came in fourth (which was in third last year), Bogen in fifth (down one notch from last year), and Dukane also tied for fifth place (down from second place last year). In addition, 3M came in sixth, Shure in seventh and Aiphone in eighth place.

Sound & Communications editors also asked contractors what three manufacturers they have the best overall relations with. The results in order are TOA, JBL,

Soundolier, Dukane, and Bogen. This indicates that contractors have the best rapport with manufacturers of their largest selling lines.

In a side question, we asked people if they used personal computers, and if so what kind. Twenty-five percent of the contractors responded with IBM. This is a sure sign that computers have made their mark in the sound and communications industry, and will probably keep growing.

ORGANIZATION AND PUBLICATIONS

Surprisingly, more people either belong to or attend the AES (Audio Engineering Society) convention than the NSCA (National Sound and Communication Association) convention. This may mean that more contractors need to become more involved with NSCA. Third place goes to the IBMA (International Business Music Association), fourth place goes to NATA (North American Telecommunications Association) and fifth place is handed to the ASA (Acoustical Society of America).

When asked to rate publication in order of what they read on a regular basis, we are happy to say that contractors we surveyed rated our own *Sound & Communications* first for the second consecutive year (not surprising since we surveyed "our" readers). *Pro Sound News* came in second ("very surprising"), *Sound and Video Contractor* in third, *Mix* and the *AES Journal* tied for fourth place, and *db* came in fifth.

The 1987 Sound & Communications Contracting Survey Contest winners are: Mark Prody, Fort Smith, AR, first prize winner of a TEAC CD player; Arthur Enteles, Venena, NJ, second prize winner of an Emerson VCR; B. Gellhaus, Cheltenham, PA, third prize winner of a Shure phonocartidge; Walter Hennelly, Orange, CA, fourth prize winner of a Telex microphone. In addition, 10 people each won the fifth prize, a free subscription to Sound & Communications magazine.

Installation Profile



NATIONAL				UMPIRES				AMERICAN				
TEAM	STATUS	INNING	SCORE	PLATE	IN	OUT	SCORE	TEAM	STATUS	INNING	SCORE	
SAN DIEGO	NITE	11	11	11	11	11	11	SEATTLE				
SAN FRANCISCO	GAME							CALIFORNIA				
MONTREAL	NO							OAKLAND	NITE			
CINCINNATI	GAME							MINNESOTA	GAME			
LOS ANGELES	N	G						NEW YORK				
HOUSTON	I	A		BALL		STRIKE		DETROIT	N			
PHILADELPHIA	T	M						CLEVELAND	O			
ATLANTA	E	E						TORONTO	G			
PITTSBURGH					OUT			BOSTON	A			
NEW YORK								MILWAUKEE	M			
ST. LOUIS								SOX	E			
CUBS								KANSAS CITY				
SP	RP	INNING	1	2	3	4	5	6	7	8	9	10

OPENING DAY
1987

400

WRIGLEY FIELD

by John Parris Frantz

The words "Play Ball" rang out loud and clear last month through an updated sound system at Wrigley Field when the Chicago Cubs major league baseball team began its season.

More than \$35,000 in equipment, one mile of 12 gauge speaker wire, and 500 hours of labor were used to complete the job in February.

The National League team decided to update a system that was installed as a "temporary" measure in 1967. The temporary measure gradually became a permanent installation. However, the system was considered adequate and it did an outstanding job for 19 seasons even though it was undersized. The system is used for game announcements such as "now batting..." and live ballpark style organ music between innings.

The Tribune Co., the parent company that bought the Cubs (Chicago National League Baseball Club Inc.) in 1981 from Wrigley Gum Co., made an updated sound system a major priority among other improvements.

Contractor Gary Gand of Gand Music and Sound, Northfield, IL, combined with audio systems designer, Jim Brown of Audio Systems Group, Chicago, won the job with their suggestions of high technology at a reasonable price.

It was Brown's design that will help the baseball team get its message to the crowd while still keeping surplus sound from drifting into the neighborhood. Unlike most sports stadiums, which are surrounded by miles of parking lots and access highways and far removed from residential areas, Wrigley Field is surrounded by homes on all four sides. This was a prime consideration in the sound system's design.

The entire job originated from the management's idea of installing a cluster of speakers attached to the centerfield scoreboard. They thought this would fill a sound void not serviced by the old system. Baseball fans in bleachers could

not hear the game announcements through the existing system. Brown, who had consulted the Cubs for 10 years prior to the job, felt the cluster's sound spill would strain the already damaged relations with the immediate neighborhood.

Brown also asserted the fact that atmospheric conditions can take sound from the speakers and put it right into a neighbor's bedroom. The Cubs management, which had already seen its team experience wild winds that produced games with up to 30 and 40 runs total be-

"... we found in our experiments with the TEF analyzer that different capacitor styles have big differences in tonal quality."

tween two teams in the last few decades, listened loud and clear when Brown explained how atmospheric conditions can affect the travel of sound.

Brown advised against the speaker cluster in favor of a distributed system based upon his past experiences that showed that temperature gradients are capable of producing atmospheric "ducts" that can lift or drive sound into the ground—common problems with any outdoor sound installation. These variables can easily transport the Wrigley sound into nearby living rooms and bedrooms.

Brown, who spends half of his time as a systems design consultant for the acoustic design firm Kirkegaard & Assoc., Chicago, felt the best application would be the mounting of two JBL model 2366 40 x 20 degree and one JBL

model 2360 90 x 40 degree bi-radial horns to the scoreboard in centerfield; all three speakers use the model 2486 phenolic drivers. The JBL's provide a defined pattern of coverage that doesn't spill over into the nearby residential areas. The team and its neighbors have walked a thin line of compatibility since the former decided to install lights. Although the Cubs is the only Major League baseball team that doesn't play night games at home, a neighborhood citizen group filed lawsuits halting light installation.

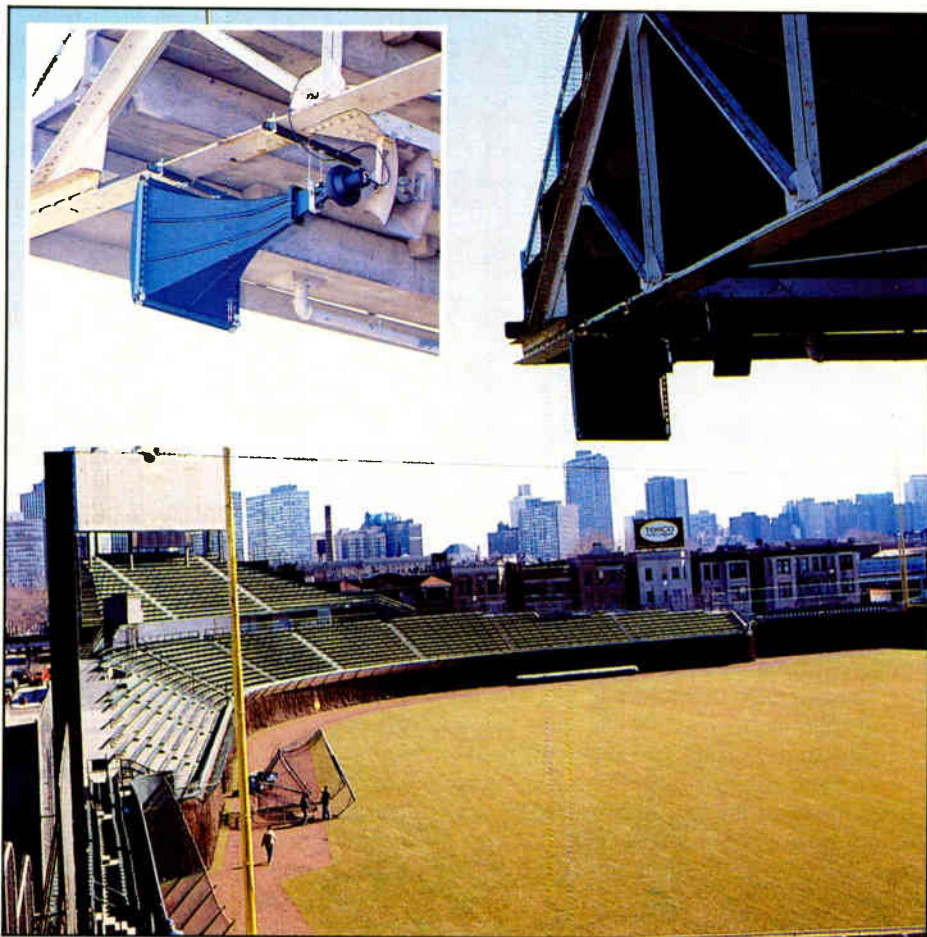
The bleachers were a priority, because there was virtually no sound at all, according to Brown. "Now people in the lower priced seats will be able to hear just as well as the people in the higher-priced seats," Brown said.

INTELLIGIBILITY IMPROVED THROUGH DELAYS

An expansive area such as Wrigley Field with its surrounding paging horns tends to naturally process announcements into an inaudible mess with poor coverage and placement. Reverberation time causes much of the havoc. However, Brown employed several innovative techniques to add intelligibility.

One technique was the use of delays on several speaker circuits so an announcement from two separate speaker sources would hit listeners' ears simultaneously. For example, speakers weren't placed in positions under the press box section that would be audible from inside the press box—a major complaint of the early system. Speakers instead were placed in alternate locations creating an overlapping situation. One series of alternates is delayed approximately 30 milliseconds so announcements will reach the listeners' ears simultaneously with the other alternates some 30 to 40 feet further away.

Still, Brown found a sound void near eight rows of seats directly beneath parts of the press box. Those sections are supplied with speakers with 20-foot throw distances. They're attached to the under-



JBL upperdeck speakers showing the special brackets used for easy installation and quick removal.

side of the press boxes and face directly down. The delay for those speakers is less at 10 to 15 milliseconds. "That's not a lot, but it could make things pretty messy if they weren't delayed," Brown commented.

The update called for adding 80 Electro-Voice model 848 compound defraction projector (CDP) horns with a 110 x 80 degree dispersion. The Electro-Voice products have FC-100 horns with 1828T drivers. These were added to an existing number of 24 of the same model. The main complaint with the original installation was the lack of coverage; however this was due to previous management's view of the first sound installation as temporary. "We didn't want to go back and make a judgment on what they did 20 years ago. We were brought in to improve on it," Gand noted. "We confirmed the CDP to be the most cost-effective speaker for the job. You'd think that 20 years later someone would have come up with something better. We experimented with some of the things the industry thought might be better, but found that what Electro-Voice offered 20 years ago is still the best way to go today."

The existing Electro-Voice horns have performed well enough and endured the elements to where 18 will remain in

place. The remaining six horns were reconditioned for rusted drivers and other ailments as part of the contract.

Since coverage was the major problem, it affected all modifications the team made to the system over the years. "Not nearly enough speakers were installed in the first place, for whatever reason," explained Brown. "The coverage was very uneven. Throughout the years, many loudspeakers were removed because they were turned up too loud and they annoyed VIP's, camera positions, or press people. So the coverage got worse and worse."

The budget wouldn't allow it. However, Brown ideally wanted to use a device of constant directivity design with more modern drivers that could handle higher sound pressure levels. "Unfortunately, we found nothing else available that fit within the usable budget area and didn't have any kind of coverage angle that would do us any good," Brown noted.

"Within the budget there was nothing that could give us 90 x 90, 90 x 60, 120 x 40, 120 x 60 in degrees," Brown continued. "There are places I might have liked to have had 120 x 60 or even 120 x 40, but unfortunately the devices available with those specifications can only be operated down to 500 Hz minimum

and in practicality, 800 Hz. Plus, they don't have pattern control below 2 kHz."

TEF analysis, a computerized alternative to using real time analysis, was important in tuning the system and not disturbing the neighborhood in the process. Instead of pumping white or pink noise through the system for long periods, the TEF analysis is a long "swoop" sound enduring about 10 seconds, according to Gand. In fact, much of the speaker tests were performed outside of Gand's headquarters in Northfield prior to installation.

Another consideration in the Gand design was the capacity to move the equipment in the future. Since it bought the Cubs, the Tribune Co. has considered rebuilding Wrigley Field to accommodate more than its present capacity of 43,000 people. The firm has even considered building a new stadium in the suburbs. Gand made it possible for management to easily disconnect the system in the event of a move.

"They're talking about remodeling the upperdeck, so with the special brackets we used in the installation, we could take down all of the upperdeck speakers in one afternoon," Gand estimated.

Other equipment, most of which will be located in an equipment room underneath the stands near home plate, includes: nine Crown microtech 1200 LX amplifiers; two UREI 5549A graphic equalizers (cut only) and a dbx 166 limiter/compressor. Holding the equipment is a 500 Series Soundolier custom steel rack with a Cub-blue enamel.

"We're dealers for 10 power amp companies, but we felt Crown was the best choice for the job because it's designed to be used under the worst conditions all of the time," Gand said. "These amps are going to sit there all winter in a cold room year after year."

All nine amps are the same for uniformity purposes. Several are only providing a fraction of their power capabilities. However, expansion will be easier if needed. Uniformity will also ease replacement.

Since the JBL speakers have different specifications from the Electro-Voice devices, an equalizer for each brand was required.

Better coverage and more overlapping will enable the system to be equalized with more efficiency. "The horn patterns are broader at low frequencies, so that'll mean we'll get considerably more low end," Brown said. "It may only extend down to 200 hz, which a music system person may think is no big deal, but in a speech reinforcement system, it's pretty good when you get an additional octave

of response (400hz down to 200hz). This is a major improvement."

In addition, the system includes a better feed from the organ, which has been modified with a custom-built direct box using two Jensen transformers. Gand claims the organ sound now has better highs, lows, transient response and other factors in high fidelity. "Everyone thought the transformer was a dead issue, but Dean Jensen has come up with some innovative products that give you better hi-fi," Gand said.

Singers of the National Anthem now use a \$4,000 Cetec-Vega FM wireless microphone model T82-R42 that was supplied with the contract.

NO HUM...NO BUZZ

Wrigley Field has police radios, broadcasts and other possible radio frequencies that could possibly interfere with the sound system. Special attention was given to protect against unwanted hums or buzzes from stray sound fields with Jensen transformers on the unit. The Crown amps come equipped with balanced inputs to guard against stray fields. Proper shielding has been added especially if Cubs management successfully appeals a court order prohibiting lights and the subsequent night games. Management is currently compromising with the local community on the matter. Lights could possibly infiltrate an unshielded system with hums and buzzes.

Sprague 3000 series protection capacitors were also used to protect the system against DC spikes. "Capacitors are something everyone knows about, but there hasn't been a lot of experimentation on it recently," Gand noted. "Everyone figures they should just put a big electrolytic in there and that's that. But we found in our experiments with the TEF analyzer that different capacitor styles have big differences in tonal quality."

HANGING SPEAKERS WAS A BIG JOB

Installation was performed by Gand's in-house service department, Excelandt Service. Four field installers plus an extra employee to wire the racks at Gand's headquarters were used.

Field installation was no easy matter because no two parts of the ballpark are the same. Since it was built in 1917, Wrigley Field has undergone several facelifts that have changed everything from the placement of homeplate to the addition of the upper deck and scoreboard. Even if blueprints were available, they would be useless.

"Every portion of the ballpark that got speakers needed a different approach of installation," explained Thomas Wend-

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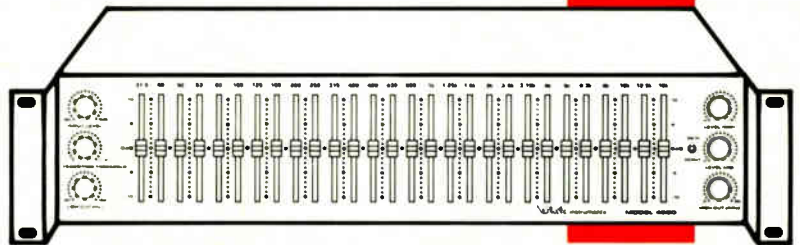
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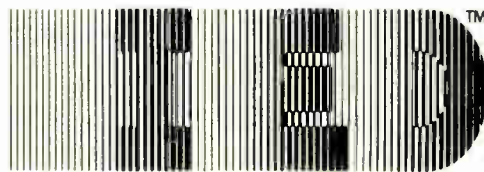
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Circle 265 on Reader Response Card



landt, president of Gand's Excelandt Service division.

Upperdeck speakers were checked for proper coverage before expensive rented power lift equipment was returned.

While he admitted he enjoyed the challenge of completing the installation, Wendlandt still said, "I hope the White Sox (another major league baseball team with an antiquated stadium on Chicago's south side) don't need a sound system."

"... so with the special brackets we used in the installation, we could take down all of the upper deck speakers in one afternoon."

The absence of blueprints also made Brown's job more challenging. After discovering seating charts were inaccurate, Brown simply took a 100-foot rule and made his own blueprint of the ballpark's dimensions. This process combined with measurements from photographs he shot himself took about two weeks to complete.

From all of his calculations, he superimposed loudspeaker patterns onto a sphere to get the proper dimensions via a computer program. Loudspeaker mapping through the use of a sphere is a program originally developed by John Prohs and David Harris.

During the baseball season, Gand's crew will check the system every 30 days for efficient operation. The main amp rack has been set up to allow monitoring of different zones with either headphones or an onboard speaker.

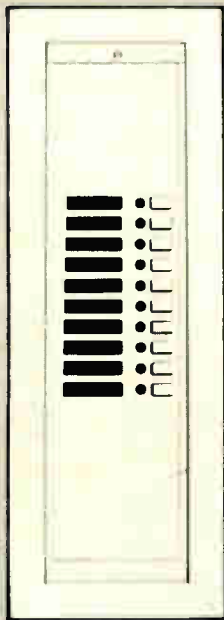
Other service aspects include a spare Crown amp for quick replacement. The one-year service contract, which Gand built into the job, offers free maintenance. After the system's warranty expires, Gand will issue a service contract to Cubs management, he said.

Now that they have one ballpark sound system under their belt, both Brown and Gand hope to present proposals to other major league teams.

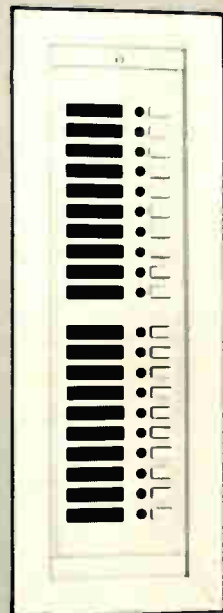
Now when baseball players such as the New York Mets' Mookie Wilson steps to the plate in Wrigley Field, the announcement won't sound like Mookie-ookie-ookie-ookie Wilsona-na-na-na..

John Parris Frantz is a public relations and trade magazine/writer specializing in audio and video in Chicago. He has written for Testa Communications for nine years and is the president and owner of JPF Associates for 10 years.

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DR-150/20

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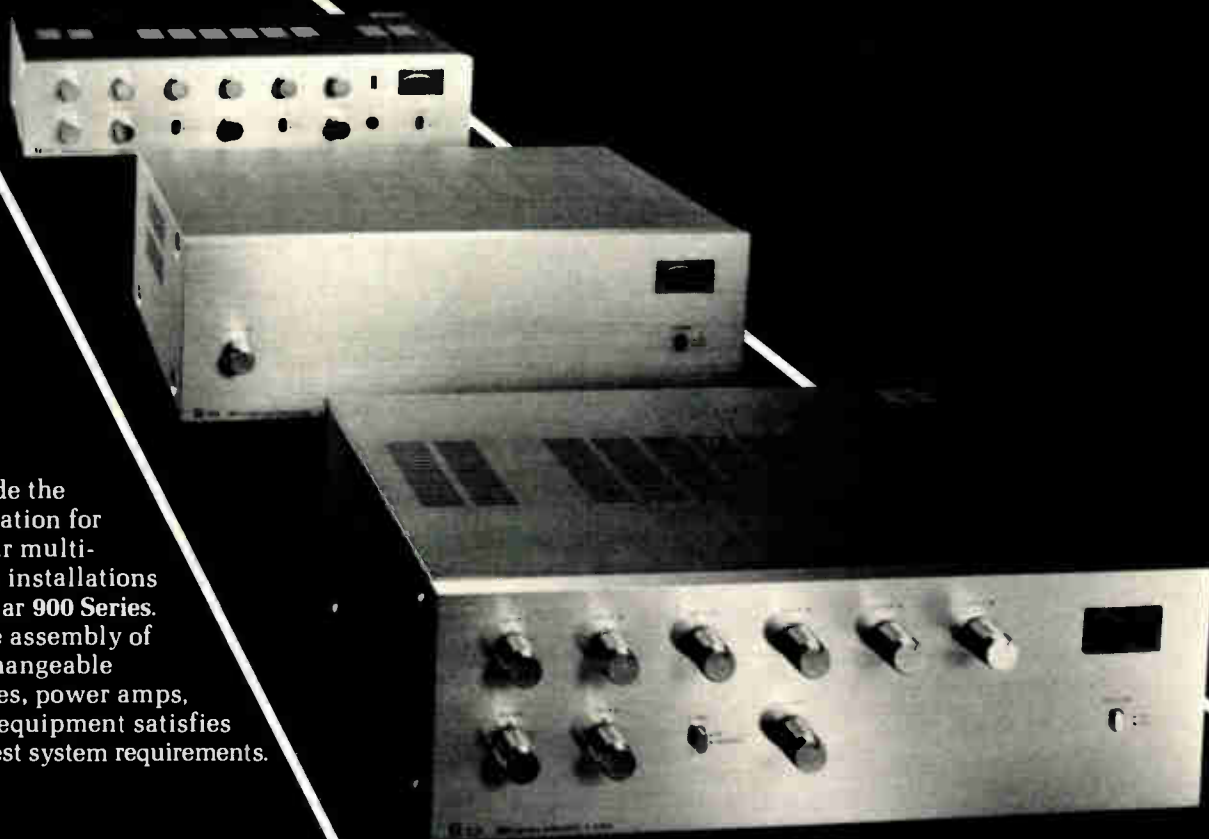
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Circle 243 on Reader Response Card

World Radio History

The BGW SPA-3 Signal Processing Amplifier

by Jesse Klapholz and Richard Feld

BGW has been manufacturing time-proven, reliable power amplifiers for over 10 years. These have been more of a traditional type—two channels and volume controls. While BGW's only other entry into the signal processing sector has been an electronic crossover, this new amplifier has incorporated several new and unique features. The name SPA-3, which stands for Signal Processing 3-Way Amplifier, tells part of the story. It consists of a three-channel power amplifier, and a crossover/alignment-delay/eq section.

The three-rack-space unit has a removable security cover on its front panel, which provides access to the various level, eq, and delay settings. All of the functions are easy to set and are completely repeatable by the use of detent-type thumbwheel, slide, and DIP switches. Included on the front panel are a 20-amp magnetic circuit breaker (which acts as both an over-current protection device and power switch); power, and input signal presence LED's; and signal and clip

indicator LED's for each of the three channels. The rear-panel includes three sets of standard five-way binding post outputs, parallel male/female balanced XLR-type input connectors, an octal-socket for an optional input transformer, and a ground lift switch.

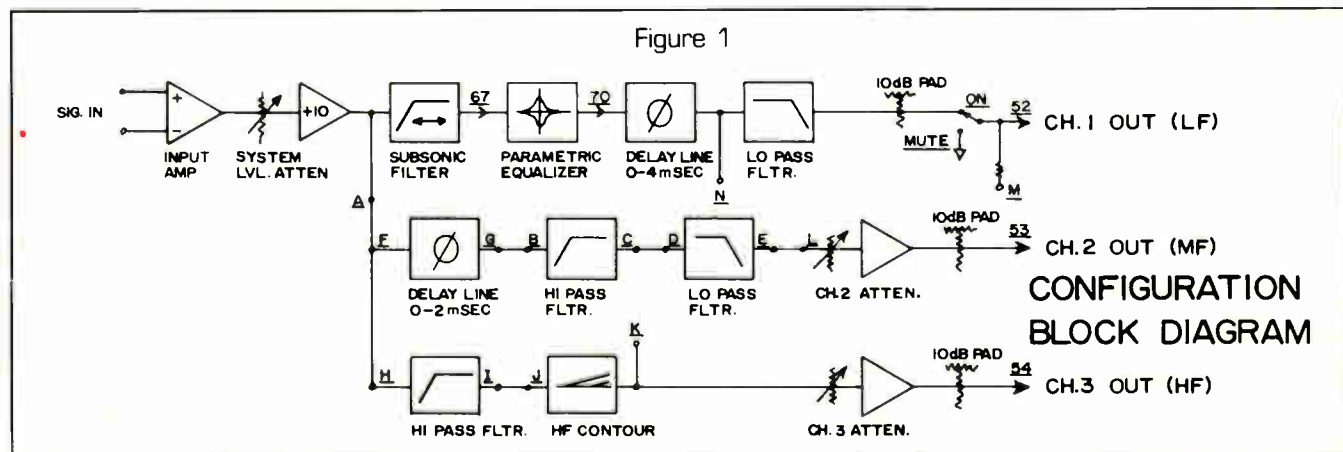
Opening the amplifier uncovers a well designed layout, with circuit cards easily removed for servicing, and headers easily reached for user changeable options. A closer inspection revealed high-quality low-noise op-amps were used throughout the signal processing circuits (TLO74's and 5532's). Also, the input circuit incorporated phase-reversal jumpers, and CMR (Common Mode Rejection) adjustment. A main reason for using a balanced input is to optimize CMR. Both the high-frequency and DC gain are adjustable and the second half of the input—a feature not even found on many recording consoles.

We just mentioned *headers* above. These are DIP sockets into which jumpers may be installed using a

14-pin block assembly the size of an IC-chip. These jumpers are used to configure the signal flow through the amplifier. The overall block diagram of the signal processing section is shown in Figure 1. Channel 1, or the low-frequency output, is hard-wired as follows: subsonic filter, parametric equalizer, 0-4 ms delay-line, and low-pass filter.

The delay will allow for up to 4.5 feet of alignment correction in the low-end with 100 us/step adjustments (100 us equals approximately 1.35 inches). The Mid/Hi Frequency delay will allow for up to 2.25 feet of correction with ten 50 us/step adjustments (50 us equals approximately .68 inches).

Channels two and three share five remaining blocks which are: two high-pass filters, a low-pass filter, a 0-2 ms delay-line, and a high-frequency contour equalizer. These channels are usually used for mid- and high-frequencies, and can derive their input signals from one of the three following stages: a) after the system in-





put level control; b) after the sub-sonic filter, parametric eq, and delay; and c) after a), c), and a low-pass filter. A flow-chart can be drawn, and implemented by simply wiring jumpers into a DIP header, providing for several variations in either two- or three-way setups.

A turn-on-delay/fast-off circuit is built into the amplifier to eliminate transients and *thumps* into the loudspeakers at power-up/power-down. The crossover network used is the currently accepted state-of-the-art Linkwitz/Riley type, with either 4th-order or dual 2nd-order slopes available. The dual-slope scheme, according to some, sounds better and still affords twice the power handling capability through the crossover region (more on this may be found in *Directing the Signal Flow*, October 1986 *Sound & Communications Magazine*). However, 12 dB/octave Butterworth filters are also available for those *die hards* who still use them.

The Tests

We tested the SPA-3 with a Sound Technology 1710, and a Tektronix 502 oscilloscope. These instruments are commonly used and the test pro-

cedures are ones that any technician should be normally performing. Our tests used standard test bench resistive loads.

Upon power up, we ran the amplifier to clipping and verified smooth wave deformation which caused only minimal temperature increase of the heat sinks at these above normal output levels. The crossover frequencies were 800 Hz and 5 kHz. Since the amplifier was not set up as a full-range system, we were not able to test for IM distortion. These tests, however, would not be applicable because the individual amplifier channels are used over restricted bandwidths.

It should be noted that these tests are the same as testing a system from delay input, through eq/crossover, to amplifier output. There are from three to five stages of processing in any one amplifier channel with up to some 76 op-amps in the SPA-3 in all.

The manufacturer does not specify distortion figures for the amplifier, but we ran wide-band THD tests in all three channels, at both 8 and 4 ohm loads. We found the amplifier to have more than acceptable THD levels, and the power output exceeded that specified by the manufacturer. Also, the

signal-to-noise was not specified. These measurements were very good in all three channels as shown in our measurements. The amplifier performed well throughout our tests and never overheated or went into protection mode.

Comments

We found the amplifier to be easily adaptable to a number of design/install situations. The precision level controls allow for exact gain structures to be established within a system and repeatability is simple. The parametric equalizer can be used for a step-down eq, or power response correction of low-frequency devices. The high-frequency eq is really utilitarian, in that it will compensate for the roll-off common to all constant-directivity type horns. This eliminates the need for external eq—reducing overall noise levels—a feature incorporated in some of the better crossover networks.

The optional input transformer socket can be used to bring out any signal processing block output. Thus, the crossover, delay, and eq can be used to drive other amplifiers. Furthermore, just about any frequency can be easily modified by changing a capacitor,

REP NEWS

AKG Acoustics has announced the appointment of several new representative firms. **ProMusica Sales** in Keene, New Hampshire, will represent all AKG products to the professional audio and music dealers in New England. **VF Sales** in Natick, Massachusetts, continues to represent AKG products to the hi-fi market. **Profit Line Marketing** in San Rafael, California, will represent AKG products to the hi-fi market in northern California. **J.N.D.** in Fairfax, California, continues as pro products representative. **Sound Marketing** in Palos Heights, Illinois, will represent all AKG products to all dealers in Indiana and Kentucky. **Central Electronics Sales Company** in Royal Oaks, Michigan, will represent all AKG products to all dealers in Michigan.

Lowell Manufacturing Company has appointed **Lichtenauer & Associates** to represent the company in northern California and northern Nevada.

Martin America has appointed three new rep firms to handle Martin Audio Products of London. They are **North Coast Marketing** in Erie, Pennsylvania; **Ludwig Marketing** in Kenosha, Wisconsin; and **Central Electronics Sales Co.** in Royal Oak, Michigan. North Coast will serve Ohio, West Virginia, and western Pennsylvania; Ludwig will serve Illinois, Indiana, Kentucky and Wisconsin; and Central will serve Michigan.

1

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the high-frequency contour eq for example. The *programmable* signal processing combined with three good-sized

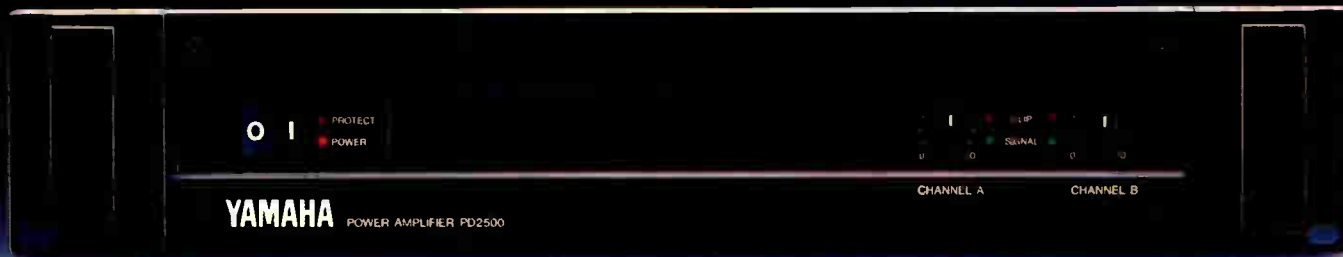
power amplifiers in a compact package will find itself useful in many integrated or single cluster type systems.

Specifications:

	MANUFACTURER'S	LAB TEST'S
Distortion THD	n/a	<.02%, 280W <.04%, 450W
Max Power Low Section	250W @ 8 ohms 400W @ 4 ohms	280W @ 8 ohms 450W @ 4 ohms
Max Power Mid/High Section	250W @ 8 ohms 300W @ 4 ohms	260W @ 8 ohms 450W @ 4 ohms
Signal to Noise Ratio	>100dB unweighted	>112 dB, low >106 dB, mid >102 dB, hi
Common Mode Rejection	n/a	>80 dB

GENERAL SPECIFICATIONS

Attenuation	Precision stepped rotary decimal switches adjustable in 1 dB steps, provides from 0 to 89 dB attenuation. Three attenuators are provided, system level, mid, and high output.
Input Impedance	15K ohms, transformer or active balanced
High Pass Frequencies	10, 20, 30, 40, 50, 60, 70, 80 Hz or bypass
Crossover Fc	User specified ISO centers, specify slope as 24 dB/octave Linkwitz-Riley, 12 dB + 12 dB dual-point, or 12 dB/octave Butterworth.
Parametric Equalizer	Fc: 50 Hz - 500 Hz Q: 0.5 - 2.0 Boost/Cut: +/- 6 dB
Delay	Low-Frequency: 10 steps of 100 ms, 3 steps of 1 ms; delay range from 100 μ s to 4.0 ms Mid/Hi-Frequency: 10 steps of 50 μ s, 3 steps of 0.5 ms; delay range from 50 μ s to 2.0 ms
Dimensions	5.25"H x 19"W x 13.1"D
Net Weight	43 pounds
Price	\$2499 pro net



We're not big in power amps anymore.

At just 26½ lbs., our new PD2500 power amplifier makes light work of large-scale sound reinforcement.

But unlike previous attempts to reduce the bulk of high power, Yamaha's doesn't reduce performance.

You get an impressive 500 watts RMS per channel into 2 ohms; 250 watts into 8 ohms. And 1000 watts into a 4-ohm bridged mono load.

All in a very compact 3½-inch by 19-inch rack space.

Yet while it carries like a briefcase, it still sounds like a Yamaha.

The newly designed high-frequency switching power supply is more stable and better regulated than conventional designs. We also increased the switching frequency to 125kHz. For an

improvement you can hear, especially in the low frequencies.

We added a better forced cooling system, and independent dB-calibrated attenuators for precise level balancing.

The PD2500 is even listed by Underwriters Laboratories.

There's more you should know about this elegant combination of high power and easy handling. So write: Yamaha International Corporation, Professional Audio Division, P.O. Box 6600, Buena Park, CA 90622. In Canada: Yamaha Canada Music Ltd., 135 Milner Avenue, Scarborough, Ontario, M1S 3R1.



Circle 247 on Reader Response Card

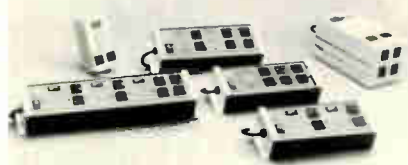
World Radio History

PRODUCTS IN REVIEW

PMC INTRODUCES AC LINE FILTER MODELS

PMC Industries, Inc. has announced its six new models of AC line filters with built-in high voltage transient/surge suppression for use with computers, microprocessor-based instrumentation, and audio and video equipment.

The units feature noise suppression from 55 dB to 70 dB in the frequency ranges most affected by sensitive

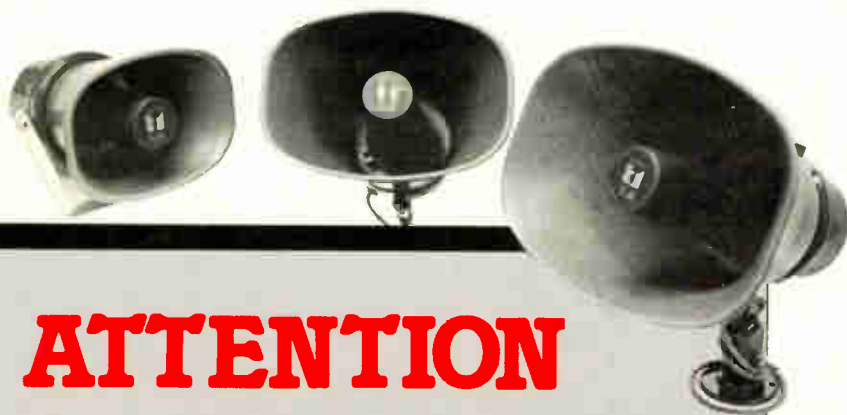


equipment while suppressing voltage surges and spikes from line to line to

ground. Spike suppression is instantaneous with current suppression to 6,500 amps.

They feature six-foot shielded line cords, filters enclosed in individual modules, on-off lighted rocker switches, resettable circuit breakers, multiple filters and suppression banks of outlets in some units, and one year warranty. Prices range from \$79.95 to \$249.

Circle 35 on Reader Response Card



ATTENTION PLEASE!

Presenting: a new generation of paging speakers, with 52 years of Toa reliability behind them.

You've never seen speakers quite like these.

Toa Electronics announces its unique new TC Series weather-resistant speaker horns. **The shape**—elliptical horns made from chemically treated aluminum to withstand both severe weather conditions and corrosive environments. **Installation**—choose between standard stainless steel U-mount brackets, or universal swivel-mounts that can be mounted onto threaded 1/2" conduits, or strap mounted onto beams. A 24 inch, jacketed pigtail is included as well. In addition, the "wattage" selector switch is screwdriver-adjustable but does not require any dismantling of the horn.

But hearing is believing

And Toa's latest paging horns speak for themselves. Designed for clear penetration in high noise areas, these 10, 15, or 30 watt speakers are especially suitable for industrial use: warehouses, factory yards, even ocean-going vessels (they are salt air resistant). The new horns are available with dual 25/75 Volt transformers, or at 3Ω voice impedances.

Want to hear more? Call or write for information.



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Commercial/Engineered Sound Div.
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(415) 588-2538
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Edmonton, Alberta T5S 1K8
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Install Confidence.

Circle 257 on Reader Response Card



PYROTRONICS INTRODUCES CXL FIRE COMMAND CENTER

A new CXL life safety control panel has been introduced by Pyrotronics. This new system expands the capabilities of XL-3 Fire Detection Systems. The XL-3 Fire Detection System is the only UL listed fire system which allows the user to test, adjust, and print each individual detector's sensitivity from a control panel.

With the new CXL fire command center, detector information may be displayed and printed at a central location for sites containing multiple XL-3's.

The CXL command center can communicate with up to 28 individual XL-3 fire system panels and acts as the central monitoring point for the entire complex.

Each CXL consists of a Color Video Display Terminal (VDT) with keyboard, receive-only printer and a wall mount enclosure which contains the necessary electronics for the communication network and data processing. It transmits and receives information from remote XL-3 panels via dedicated modems. Received data is announced on the system Color VDT. The CXL directs all received data to the logging printer to create a permanent record. The operator views the displayed information and issues the appropriate command using the sys-

tem keyboard connected to the VDT.

At the CXL, the operator has the ability to communicate with individual XL-3 systems, issue commands and change several control functions contained within memory.

Circle 36 on Reader Response Card



ALTEC LANSING'S NEW COMPRESSION DRIVERS

Altec Lansing has announced its 299-8A and the 299-16A high frequency compression drivers. They are designed for use in high level sound reinforcement systems where wide bandwidths and large acoustic outputs are essential.

Altec Lansing, combining modern materials and adhesives with a proven dome and compliance geometry, has developed a driver featuring a new Pascalite™ diaphragm construction that has the power handling and output capabilities of drivers with two inch exit throat diameters.

The model 299-8A provides a minimum impedance of eight ohms; the model 299-16A, 16 ohms. A Tangerine® radial phasing plug guarantees a smooth upper range response, according to the company. And like every Altec Lansing compression driver, the diaphragm/voice coil assembly can be replaced in the field without the use of special tools.

Circle 34 on Reader Response Card



VALLEY INTERNATIONAL'S AUTOGATE EXPANDER

Autogate's new processing parameters are automatically varied in response to the demands of the program material.

Proprietary Auto Slope circuitry

alters the slope of the Autogate in response to program content dependent upon the range control setting. With Auto Slope, if a transition from expansion to noise gating, or vice versa, is demanded by program content, the change in processing modes occurs. Program variable Release Shape circuitry continually analyzes the input signal level and the settings of the threshold, range, and release controls, and varies the release time so that the gate exhibits the desirable character-

istics offered by a "hold" circuit, without the drawbacks such as the perceived sensation that noise is being switched "off and on" concurrently with the desired signal.

Autogate's high and low pass filter set can be used in the normal audio chain of the gate or may be switched to the external input. Thus, the unit may attenuate a bandwidth controlled signal or may be used in a "frequency-conscious" manner.

Circle 38 on Reader Response Card

"With BBE, you're in Aural Heaven!"

— Music and Sound Output Magazine



It is truly magical the way the dynamic BBE process will restore the harmonic balance, increase intelligibility, and give the total sound image a fresh, sparkling clarity. The BBE 402 and 802 Processors are ready to perform their aural "sleight of hand" the moment you insert them into your recording studio, live sound, or broadcast audio chain. Both units will dramatically improve the overall reproduction of program transients in any audio system.

The BBE processors achieve *time-alignment* of harmonic and fundamental frequencies that were present in the live performance but became re-shuffled in the often convoluted paths of recording, playback, and broadcast of audio.

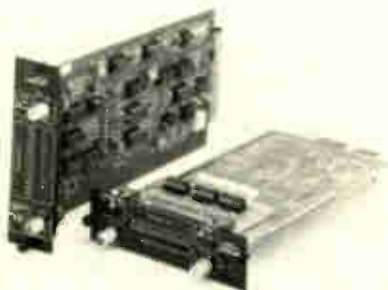
To hear how BBE can work its magic for you, call us toll free at: 1-800-233-8346. (In California call 1-800-558-3963) or 1-714-897-6766. Or write us at:

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Electronics, Inc.**

5500 Bolsa Ave., Suite 245, Huntington Beach, California 92649

a closer look

by gary d. davis



Valley People's Leveller Detecting Limiter

Valley announces the addition of the Levellers to its product line.

The Leveller is an audio level controller whose capabilities begin where those of ordinary limiters and compressors end. With its proprietary *Linear Integration Detection*, the Leveller is able to comprehend the intent of the performer in terms of optimum output loudness for each note, syllable or accent.

Once the desired input level is set and the output gain determined, the operator of the Leveller merely decides whether more or less "levelling" action is required and operates the unit's controls on the Leveller, because these functions are program dependent and correspond to one of the two switch-selectable integration times chosen. *Automated Program Dependency* circuitry optimizes the attack and release times as the program content changes. Continual monitoring and recalibration of the attack and release times by the APD circuitry ensures that non dynamic distortion is added to the signal.

The Leveller is available in a two channel, 1.75" x 19" rack mount package or as a single channel, module designed to be housed in the Valley 800 series powered racks, the Model 816.

Comments: The Leveller is an average detecting limiter designed for easy operation. Whereas most limiters require a fair amount of "knob tweaking" to sound good with different

types of program material, this product has been enhanced with automatic circuitry that preserves (and may even improve upon) the quality available with manually controlled limiters... while avoiding the tedium of precise setup. It is not unlike dbx's "one knob squeezer" in this regard, though the actual circuitry is different. I feel the Leveller deserves *your closer look*.

Circle 31 on Reader Response Card



Numark's VAM2000 Digital A/V Mixer

The PPD VAM2000 is the first video mixer to let you combine any three video sources to do dissolves and wipes without special VTR's or the need for any other units!

Previously, to wipe or dissolve between two VTR's (VideoTape Recorders), you needed special VTR's, Time Base Correctors for each machine, and a common sync generator connected to all the units and the SEG (Special Effects Generator). The VAM2000 accepts three unsynchronized video inputs from VCR's, cameras, or any other combination of video sources, and combines them with each other without the need for sync generators or TBC's.

The VAM2000 uses custom high-speed digital IC's to do glitch-free digital freezes, spectacular variable rate "strobe freezes", and it can "freeze to the beat" of audio from any one of its four stereo audio inputs.

A large, long throw "T-Bar" allows complete user control for clean dissolves and wipe patterns, including vertical, horizontal, and corner wipes. These can be a combination of any one of the three video inputs with another, or with a background of white, black, or a color chosen by joystick from an

almost infinite palette of hues.

Stereo balance and gain controls for each of four audio inputs are on the front panel along with an A/B audio buss fader, illuminated mono, stereo, manual fade, and "audio follow video" select switches which are conveniently located for each single-user operation. In the "audio follows video" mode, the A and B busses for the audio—as well as the video—are smoothly faded as the large "T-bar" style lever is moved from A buss to B. Separate external video and audio effects loops are front panel switchable for maximum flexibility.

Professional Net: \$4,990.00

Comments: Numark has been busy developing their PPD Label into a broad line of professional audio products. The VAM2000 looks to us like it fall in an interesting niche: below broadcast quality, but with features and capabilities that place it squarely in the large cable and live video/audio facility market.

The use of digital processing is taken for granted in audio these days, but has only recently become widespread in video. After all, video is still recorded and broadcast as an analog signal, and most receivers and monitors are still analog devices (albeit, with digital tuners). The digital processing in the VAM2000 enables it to do the usual freeze frame, which requires 9.408 Megabytes of dynamic random access memory (DRAM). Frame sync utilizes another 6.27 MB of memory. [An aside: it used to cost tens of thousands of dollars for that much memory, and, who knows, if the recent congressional effort at price support for memory chips is successful, it may cost that much again. So grab those Megabytes while you can afford to!]

Freeze frame is nothing new, and even the VAM2000's 0.5 to 10 frame/sec strobed freeze, while nice, is not extraordinary. However, Numark's Jon Criss is very excited about a third frame mode, Beat Freeze. In this

(continued on page 46)

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.

ALABAMA

Birmingham: University of Alabama, Convention and Activity Center, 1, C. Contact: M. David Egan, PE, Boston, Ma; (617) 262-2428.

ALASKA

Fairbanks: Fairbanks Activity Center, NA, C. Contact: Craig Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.

CALIFORNIA

Beverly Hills: Ma Maison Hotel, 4,D. 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.

Cupertino: Hewlett Packard, NA, D. Contact: Edward McCue, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.

Irvine: Donald Bren Events Center, NA, B. Contact: Edward McCue, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.

Los Angeles: New Otani Hotel, 2, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Los Angeles: Simon Wisenthal Center, 3, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

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

San Francisco: St. Mary's Cathedral, NA, B. Contact: Marc Beningson, Jaffe Acoustics, Norwalk, CT. (203) 838-4167.

San Jose: San Jose State University Recreation and Events Center, NA, D. Contact: Edward McCue, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.

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

CONNECTICUT

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

FLORIDA

Miami: Bayfront Park, 2,C. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

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

St Petersburg: Bayfront Center Auditorium Renovations, 3,C. 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,D. Contact: Richard J. Lemker, Lemker & Associates, Covington, KY; (606) 261-9529.

MASSACHUSETTS

Medford: Cohen Auditorium Tufts University, 1,C. Contact: M. David Egan, PE, Boston, MA; (617) 262-2428.

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.

NEW YORK

Astoria: American Museum of Moving Images, NA, B. Contact: Marc Beningson, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.

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,C. Contact: Robert Benson, Knudson-Benson Associates Inc., Mercer Island, WA; (206) 232-2273.

New York: JP Morgan Bank Trust Committee Room, NA, D. Contact: Marc Beningson, Jaffe Acoustics, Inc. Norwalk, CT (203) 838-4167.

New York: Metropolitan Opera, NY Philharmonic Summer Parks Concerts, 3,A. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

OHIO

Cleveland: Cleveland State Music Building, 5,A. Contact: Chuck McGregor, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.

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

Columbus: Ohio State Office 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.

Dayton: US Air Force Logistics Command Post, 2, A. Contact: Marc Beningson, Jaffe Acoustics, Norwalk CT; (203) 838-4167.

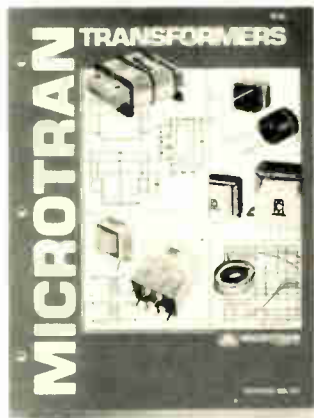
Sharonville: Sharonville Municipal Building, 2,C. Contact: Richard Lemker, Lemker & Associates, Covington, KY. (606) 261-9529.

OKLAHOMA

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

SOUTH CAROLINA

Columbia: University of South Carolina, (continued on page 57)



Comprehensive FOCP Catalog Available from GMP

A new catalog covering a complete line of fiber optic cable placement tools and accessories has been made available by General Machine Products Co.

This illustrated four-color catalog features descriptions of such products as FOCP lashers and lashing filament, capstans, reels, dynamometers, quadrants, sheaves and pulling line accessories.

Circle 39 on Reader Response Card

Bulletin Describes Panduit's Replacement Pages

A new line of wire marker replacement pages for use in marker books or index files is described in a free, new bulletin available from Panduit Corp.

All popular legends are available in the new replacement page form. These include numbers, letters, symbols, and solid NEMA colors. Since individual pages have identical legends, the user now has the convenience of wire marker cards available in book form.

The marker pages can be added to existing comb bound marker books to replace frequently used markers.

The new replacement pages have special die cuts which facilitate their use in standard "roll over" index files. Thus, a convenient filing system can be custom-made, containing just the needed marker legends.

The markers are vinyl impregnated cloth material. Each marker is 1-3/8 inches long for wire O.D. up to 3/8 inches; and each is perforated so it can be used as a half-length marker for smaller wire sizes. A matching terminal marker is also provided.

Circle 40 on Reader Response Card

WINNING BID

(continued from page 21)

Simpson: One other place is knowing your consultant, what he will and won't accept. If the local fly-by-night contractor's bid is low, there is no way that the consultant is going to sign his name to accept that contractor and sit tight. Push a little bit and say nice things about deity and you're going to be able to wait the guy out. He cannot do the job; the consultant knows he cannot do the job; and if you're hanging in there with a good reputation, with good prices, and fairly close; it's on your side.

Beningson: One thing I want to say is, yes, know your consultant. People who have done jobs for me once and completed them successfully stand a very good chance of doing another job for me. I don't deal with an approved list where certain contractors may bid and others may not. But, at the beginning of the job, I always provide the construction manager with a list of about six contractors that I would like to see bid. Since the general contractor or the construction manager is trying to cut down on his costs, all he wants to send out is six sets to my six. So, it pays to have the consultant on your side. It only takes one paragraph really to put your company out of business.

I have had some contractors get down to the point where providing the back boxes or not providing the back boxes may not make or break the job, but it certainly sets the tone for the job when the sound contractor has been on board for one week. For example, the electrical contractor wants to put in the back boxes, and the sound contractor must supply them but he may not have a handle on them, or realize he was supposed to supply them. Meanwhile, the electrical contractor is waiting for the boxes, and this is a guy you're going to have to work with for anywhere from six weeks to two years, whether or not you're subcontracted to the electrical contractor. You're going to have to get along with the electrical contractor and he can make your life miserable.

I have a project right now where the conduit is 95 percent installed. So how come the sound contractor is not 95 percent done? Well, sure the conduit is 95 percent installed, but it is 0 percent pullable because the last 10 feet going into the amp rack is not there yet. The electrical contractor is not

someone you want to offend. The point that I wanted to make was read the spec, see what's in your work scope, see what's in someone else's work scope, and know that, because you know that at a project meeting you're going to be discussing it. And someone else's interpretation may be different.

Beningson: We've touched on the fact that cost control is very important—how you estimate your costs. What tools did you use to come up with for your cost control?

Next Month: How to Estimate Costs for a Winning Bid.

CLOSER LOOK

(continued from page 44)

mode, Criss told us, the audio is examined in the low frequency range, and if a "beat" (kick drum?) is detected, that will be used to trigger the frame freezing. If a camera is aimed at a dance floor, for instance, images of dancers synchronized to the beat of the music will flash automatically on the monitors. Neat trick!

This brings us to the audio part of the mixer. It's a straightforward line-level mixer with four stereo inputs and one stereo output. Three of the stereo inputs correspond to the three video inputs, and there's a spare input.

The video in/out BNC's are standard 75 ohm, 1V P-P connections. Audio specs call for 20 Hz to 20 kHz response (± 1 dB), better than 70 dB S/N, better than 60 dB crosstalk (1 kHz), and THD no more than 0.5 percent. Nominal line level is 0.775 V RMS (0 dBu), and maximum level 8 V (about ± 20 dBu). At less than \$5,000 list price, the VAM2000 has features and performance that deserve your Closer Look.

Circle 32 on Reader Response Card

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COMPUTER

(continued from page 14)

is 3_{10} , or 011_2 , and the column address is 5_{10} , or 101_2 . The selected memory address is at location 30_{10} .

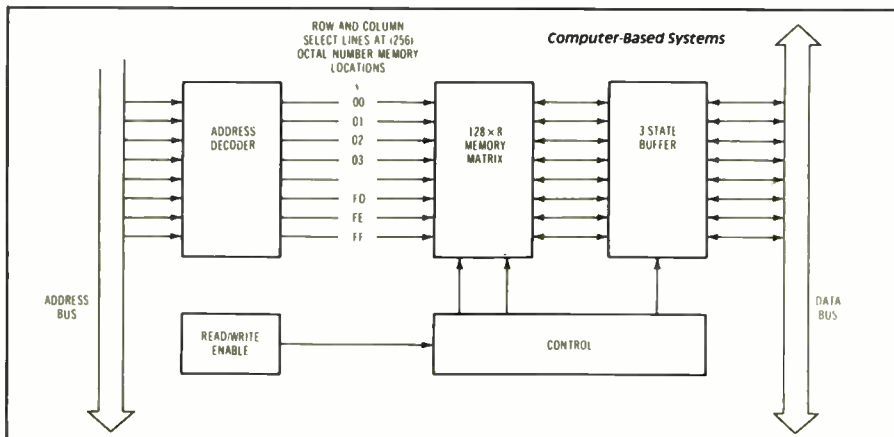
Many read/write memory chips employ a single MOS transistor for each memory cell. Fig. 7-5 shows the circuitry of a discrete MOS transistor memory cell. Electronic data in the form of a binary signal is stored in the transistor as a charge on a small capacitor. The gate and source-drain electrodes of the transistor serve as the plates of a capacitor. No charge across the two electrodes represents a 0 or no memory condition. A charge appearing across the two electrodes indicates a one (1) or active memory state. When a row select line is activated, it energizes the gate of each transistor in the entire row. When a column line is selected, it energizes the source-drain electrodes of each transistor in the column. Simultaneous activation of a row and column energizes a specific transistor memory cell.

The charge placed on an MOS transistor memory cell must be restored periodically in order to overcome component leakage. Charge restoration is achieved by a special transistor circuit outside of the memory cells. The charge restoring transistor is called a thresholding amplifier.

Eight-bit word storage is achieved in the MOS memory unit by energizing one row and all eight columns simultaneously. The row and column decoders are responsible for this operation.

To write a word in memory, a specific address is first selected according to the data supplied by the address bus. See the block diagram of the read/write memory unit of Fig. 7-6. The address decoder, in this case,

Fig. 7-6 Read/write memory unit.



selects the appropriate row and column select lines. A high or 1 write-enable signal applied to the control unit causes the data bus signal to be transferred to the selected memory address. This data then charges the appropriate memory cells according to the coded 1 or 0 values. Removing the write-enable signal causes the data charge accumulations to remain at each cell location. The output is disconnected from the data bus after the write operation has been completed.

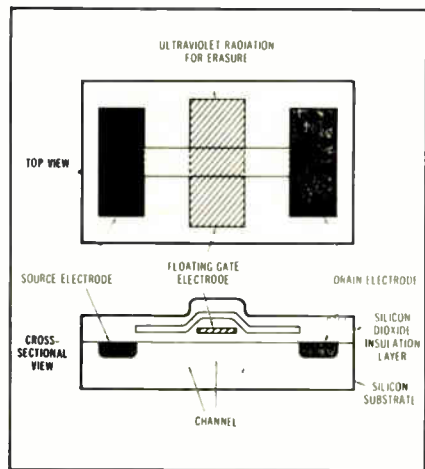
To read the charge accumulation appearing at each memory cell, the read-enable control line must be energized. Selecting a specific memory location causes charge data to appear at the data bus as memory output signals. Charge restoration from the thresholding amplifier continuously maintains the same charge at each cell. This means that reading from memory does not destroy the charge data at each cell. All this takes place as long as the memory unit is energized electrically. A loss of electrical power or turning the unit off destroys the data placed at each memory location.

READ-ONLY MEMORY

Most computer-based systems necessitate memories that contain permanently stored or rarely altered data. A prime example of this would be math tables and firmware program data. Storage of this type is provided by read-only memory (ROM). Information is often placed in this type of memory unit when the chip is manufactured. ROM data is considered to be nonvolatile. This means that it will not be lost when the power source is removed or turned off.

Read-only memory is achieved in a variety of ways. One very common

Fig. 7-7 Cross view of an UV erasable ROM.



process employs fusible links built into each memory cell. Data can be placed in memory by melting the necessary fusible links. This type of procedure is used to open interconnecting conductors, to place a diode between conductors, or place a small capacitor between the two electrodes. Obviously, a fusible link cannot be reformed after it has once been altered. This principle of ROM development can only be used once to alter the chip.

Programmable read-only memory (PROM) chips can be altered or erased by exposure to an ultraviolet energy source. Exposing a PROM to a UV energy source causes all memory cells of the entire unit to change to the zero state. Altering the chip electrically will cause a new program to be initiated.

Fig. 7-7 shows a cross-sectional view of a UV erasable ROM. The floating gate of the MOS transistor of this device is not connected to anything. Data to be stored in the cell is written into the transistor by applying 25 volts dc between the gate and drain, while the source and substrate are at a ground potential. This condition causes a static field to appear between the gate and source, which causes electrons to move with a great deal of velocity. Electrons that move through the thin silicon dioxide layer become trapped on the floating gate. The charged gate-drain electrodes serve as the plates of a small capacitor. A charged condition represents a 1 or high state, while an uncharged state represents a 0 condition. The charged condition of each transistor of memory cell is nonvolatile.

Erasing the charged data of each MOS cell is achieved by exposing the chip to a source of ultraviolet energy.

(continued on page 53)

The New, Improved Cyclopedia

Ed note: The reviewer has contributed a section to the book being reviewed this month. All comments about the anthology should be understood to exclude the reviewer's contribution, and the reviewer receives no royalty based on sales of the book.

Ballou, Glen, ed., *Handbook for Sound Engineers, The New Audio Cyclopedia*, Indianapolis, Sams, 1987, 1247 pp., \$79.95, cloth.

If our industry has a standard reference book, it is Howard M. Tremaine's classic *Audio Cyclopedia*.

The first edition is dated from 1959, and the second edition from 1969. The strengths of the *Cyclopedia* were

“One must mark the maturity of our industry by the improving professionalism of subsequent editions of the *Audio Cyclopedia* and the *Handbook for Sound Engineers*.”

two-fold. First, it provided reference tables and charts in one handy place for the daily practitioner to look up things not worth committing to memory. Second, it provided a look into other areas of a rapidly expanding audio industry. From 1959 until today, our industry split into areas with less and less contact between them, and the *Cyclopedia* provided a place where disk cutting engineers could look up reinforcement information of endur-

Ted Uzzle is a member of AES, the Acoustical Society, and SMPTE. He is director of marketing development at Altec Lansing and has written several book reviews for *Sound & Communications*.

ing value. The *Cyclopedia* was truly an industry-wide collaboration.

The *Audio Cyclopedia* did, however, have some faults. One was the use of a question-and-answer format, rather than a straightforward expository style, that often didn't serve well. Lengthy and trivial subjects were both dealt with in articles that struggled to be the same length. Often the question didn't really draw out the material that followed as an answer.

Another fault of the first two editions was the great dependence, perhaps the over-dependence, on product photographs and schematics provided by manufacturers. At its best, this technique shows a cross section of successful devices. At its worst, it condemns the book to be outdated very rapidly in today's environment of constantly-appearing new products. There was seldom the necessary description of what details about the sample device merited attention and study.

Strengths and faults all taken together, the *Cyclopedia* instantly became and enduringly remained the indispensable technical reference for the audio industry.

Howard Tremaine is now dead. The editor for this new, third edition is Glen Ballou, manager of marketing communications for Sikorsky Aircraft in Stratford, CT. The book is retitled *Handbook for Sound Engineers, the New Audio Cyclopedia*, and this change aptly hints at the innovations from previous editions. The questions and answers are gone, and the book is written in a more formal style, as one would expect from an engineering handbook. More fundamental material is covered in depth, and there is less of a snapshot of the sound products industry at the moment of publication.

The *Handbook* is divided into seven parts, most of them consisting of the contributions of several writers. The first part deals with acoustics, and travels through the fundamentals of sound, including psychoacoustics and physiological acoustics. There follows a series of chapters on the architectural

acoustics of different types of rooms, including noise control considerations, reflection and reverberation, and other matters. This part is written by F. Alton Everest, a recording studio designer and writer on acoustical subjects, and by Rollins Brook, a senior consultant for BBN Laboratories in Canoga Park, CA.

Two bravos are in order for this part of the book. First, Everest gives a numerical and graphical conceptualization of reverberation which gives a good understanding of the subject. Purists will complain that reverberation as a stochastic process is rather more complex, but clearly readers of this *Handbook* will neither want nor need that level of theoretical sophistication. Secondly, Brook emphatically explodes the 80-year old error of calculating theater-type audience absorption per person, rather than as a surface coefficient, the more modern and more accurate approach. Unfortunately, a table giving usable data on audience absorption seems to have been misplaced in the book's typography.

The second part of the book covers electronic components (resistors, transformers, transistors, and the like) as they are used in sound engineering work, and has been contributed by the editor. While there are many books covering these components, audio readers seem to prefer the descriptions to be restricted to audio applications, and that is done here. More reference in the bibliography to the particularly rich literature on these subjects might have been useful to the reader who needs much more depth of information on some component.

The third part of the *Handbook* covers microphones (written by Ballou) and loudspeakers (written by Clifford Henriksen, formerly of Altec Lansing, Community Light and Sound, and ElectroVoice, Inc.). On subjects as broad as these, about which such passionate opinions are held, it would be impossible to write volumes, much less chapters, satisfying to all readers. Even so, one has the

(continued on page 53)

FACES AND PLACES

Price Becomes Sales Support Rep for Raymer

Cetec Raymer has announced the appointment of Michelle Price to the position of sales support representative. Price's responsibilities will include direct support of Raymer field representatives and new product training. She joined Raymer in 1981 and in recent years has worked in the customer relations department. Price will be traveling with company representatives and attending trade shows in Cetec Raymer's behalf.



MICHELLE PRICE



ARTHUR B. BRANSTINE

Branstine To Head TRW System And Business Unit

Arthur B. Branstine has been named vice president and general manager of the Systems and Equipment Division of TRW Electronic Components Group.

In his new position, he will be responsible for the company's entry into the local area network and RF systems businesses. The Information Networks Division (TRW's LAN product) and the RF Devices Division will report to him and form the nucleus of the Systems and Equipment Division.

Both divisions are located in the Los Angeles area and Branstine will operate from the Torrance headquarters of the Information Networks Division. In addition, he will head up an accounting and administrative unit, providing support services to Systems & Equipment and the Los Angeles based staff and operations of the Electronic Components Group.

Branstine brings a background of general management experience to his new assignment. At Silicon General he was vice president for military products where he had full P&L and

strategic planning responsibilities for Silicon General's linear IC business. Prior to that, he held a number of senior management positions at Rockwell International including vice president and general manager for the Interconnect Systems Division and later for the Microsystems Division, where he focused on telecom and microcomputer based subsystems. He was also director of strategic marketing for Rockwell's Semiconductor Product Division.

Wick Becomes Marketing Manager for Stentofon

Stentofon Communications Inc. has announced the appointment of Linda Wick to the position of marketing manager for its line of telecourier paging systems and products. Wick previously served as district sales manager for the company in the Pacific northwest area.

As marketing manager, Wick will be responsible for product development, marketing strategies and distributor sales programs throughout the United States and Canada.



LINDA WICK



ROBERT P. DAMMEYER

Contel Tenant Services Opens SW Office In Dallas

Contel Tenant Services, Inc. has opened a regional office in the Dallas area to service the firm's customer base in the Southwest. Contel Tenant Services currently has regional offices in Atlanta and Seattle which service more than 9.3 million square feet of office developments.

Robert P. Dammeyer has been named director-Southwest Region, bringing to Contel his tenant services experience as executive vice president and co-founder of Lincom Corporation.

Ad Index

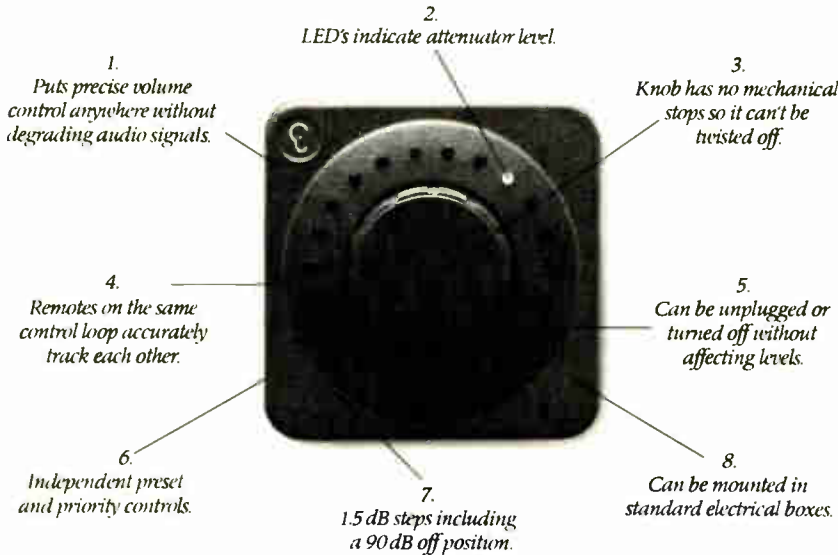
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SUPPLIES



Cornell's Battery Backups and Charges

Two new battery backups and chargers for use with, or in place of, conventional power supplies have been introduced by Cornell Electronic Products, Inc.

The 12-volt C-5122 was designed primarily for use with Cornell's A-1000 Door Monitor System, Glau-bitz said; the 24-volt C-5242, for use with the company's Visual and Audio/Visual NurseCall systems.

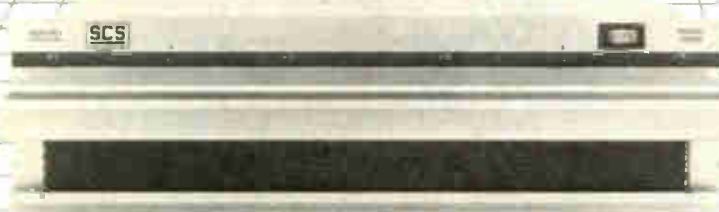
Both battery packs provide the instant response critical to back-up application, he added. "Although the host systems draw no power from them under normal conditions, the batteries are always on charge. That means they can kick in instantly when the need arises."

Glau-bitz estimated that each will provide power for up to an hour per charge, depending upon the load involved.

Circle 26 on Reader Response Card



MOS-FET Audio Amplifiers

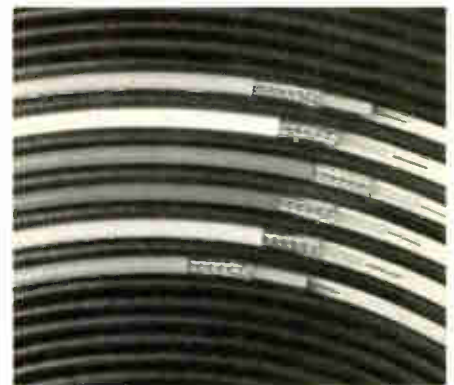


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Belden's Color Jacketed Video Cables For Easy ID

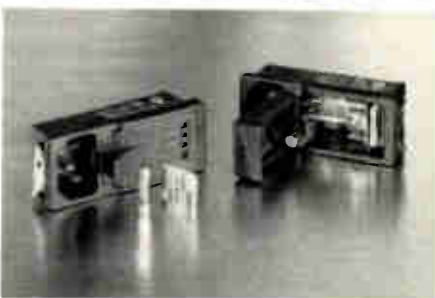
Belden Electronic Wire and Cable now offers an RG-59/U coaxial cable in six jacket colors in addition to black.

Belden 8241 is designed for short

length video signal transmission in color and monochrome TV studios. The red, yellow, green, light blue, white, orange and black jackets aid the identification of broadcast channels.

These 73 ohm polyethylene-insulated cables have 22 AWG (solid) bare copper covered steel conductors. An overall bare copper braid shield provides 95 percent coverage. Belden 8241 is UL listed, conforming to Style 1354.

Circle 26 on Reader Response Card



USD's Power Input Module Combines Components

Underwriters Safety Device® (USD) now offers the Series 15140 Power In-

put Module, an integrated, single component that interfaces a multi-voltage power supply to any common voltage or type of fusing method used worldwide. Component inventories are reduced with USD's Power Input Module since it combines a CEE-22 receptacle, a dual fuseholder and a voltage selector into a fully assembled package. The 15140 Series is also directly interchangeable with the Corcom "J" Series module.

The universality of USD's module is a result of the numerous options offered by each of its components: The CEE-22 power receptacle assures worldwide acceptance by using an IEC connector. (IEC connectors enable termination with a variety of line cards.) The dual fuseholder accepts either a ¼ x 1¼ inch fuse or a 50 mm x 20 mm fuse. And, the voltage selector is able to provide any of four voltage levels (100, 120, 220 or 240 VAC).

The Power Input Module has a current rating of 6 amps/250 VAC. It is temperature rated at 140°C and has a dielectric strength rating of 2000 V. It

is available with either quick connect or solder terminals and is UL and CSA recognized and VDE approved.

Circle 27 on Reader Response Card



Jensen Tools' PC Workstation Kit

The JTK-49C PC Workstation Kit, new from Jensen Tools Inc., contains a selection of tools for in-house, field, and shop servicing of micro computers, word processors, printers, modems, terminals, and similar hardware for PC workstations.

Included are torx drivers, contact

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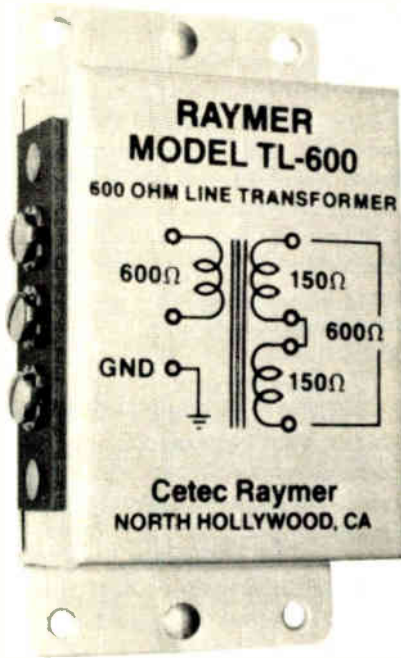
and DIP insertion and extraction tools, pin vise, key cap puller and telephone line tester, as well as such basic tools as screwdrivers, nutdrivers, hex drivers, pliers, hemostats, wirestripper, adjustable wrench, magnetic retriever/mirror combination tool, soldering equipment and more. Optional logic probe, pulser, wiretap breakout box and other test equipment are also offered.

The tools are contained in a 13-½ by 10 by 2-½ inch zipper case of water/stain-resistant Blue Cordura with a webstrap handle. The case features two inside pockets for the optional test equipment, and three large outside pouches for documents, spare parts and test leads.

Circle 28 on Reader Response Card

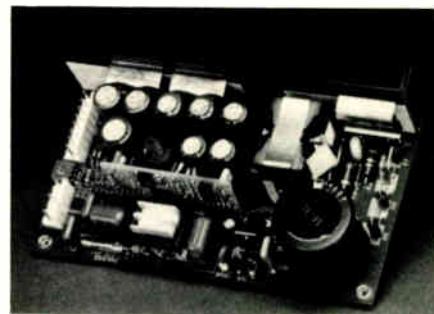
Raymer Offers Versatile 600 OHM Line Transformer

RAYMER's TL-600 is a 600 ohm to 600 ohm audio isolation transformer that can be used in one-way or two-way audio circuits because either winding can be used as primary or secondary.



One winding is split to permit an alternate impedance match of 600 ohms to two 300 ohm circuits; or 600 ohms to a single 150 ohm circuit. The unit is 3-7/8 x 2 by 1-inch.

Circle 29 on Reader Response Card



Converter Concepts Introduces Switching Power Supply

Converter Concepts Inc. has announced the new WI 60, the 60 watt high efficiency switching power supply. This unit features a wide input of 90 to 250 VAC and operates anywhere in the world without modification.

Other features include: surface mount technology, power MosFet high frequency design, overvoltage limit protection, and optional extended temperature range (-20C to +80C).

The WI 60 is designed to meet UL 114, 478, 1012; VDE 0805, 0806, 0871 Class A; CSA 1402; FCC Class A.

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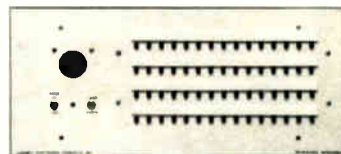


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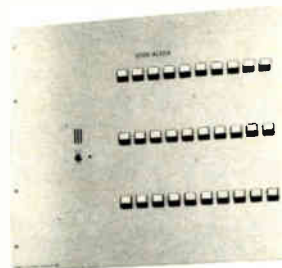
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Circle 270 on Reader Response Card

COMPUTER

(continued from page 47)

This action causes the silicon dioxide layer to be temporarily conductive. As a result, excessive leakage causes the charge formed on the gate to dissipate. During the exposure operation, each cell is discharged at the same time. Memory can be restored by writing data back into each transistor cell. PROMs can be altered while attached to a circuit board if the need arises. An alternative to the UV erasable ROM is the electrically alterable read-only memory (EAROM). This type of memory chip permits individual cells of memory words to be erased instead of the entire chip. Cell structure is primarily the same as that of the UV erasable ROM. The floating gate structure of each cell is altered by having a discrete insulation strip between it and the drain. Selective charge and discharge of cells can be achieved by electrical signals applied to the gate. Applications of the EAROM are not very common today.

This article was reprinted with permission from the book *Electronic Instruments* by Dale R. Patrick. The book is published by SAMS Publishing and costs \$21.95.

Next Month: A Programming Example.

Dale R. Patrick is a professor of Industrial Education and Technology at Eastern Kentucky University.

BOOK REVIEW

(continued from page 48)

sense that a real attempt has been made to cover the subject of electroacoustics in a schematic and inclusive way, even if a particular device the reader likes (or sells) has been omitted. At any point where the reader feels this *Handbook* pays insufficient attention, he need only look up a previous edition of the *Cyclopedia* to assure himself the new book is an improvement over what came before.

In part four, the book covers audio electronics, as functional boxes and as the circuits within them. These chapters were contributed by Eugene T. Patronis, Jr., of the Georgia Institute of Technology; Mahlon Burkhard of Industrial Research Products, Inc.; Steve Dove, a design consultant and author; and Ballou. In these chapters we look at amplifiers (a particularly sprightly discussion), attenuators,

delays, equalizers, consoles, and the like. These chapters are not so encyclopedic as those on electroacoustics, and tend to stay in the mainstream of industry opinion and commercially-available devices.

Part five covers recording and playback, with chapters by George Alexandrovitch and Dale Manquen on disk recording, and digital recording. There are some strange things here. Dolby A, B, and C and the dbx processes appear on a few pages in the chapter on disk recording, not the chapter on magnetic recording. Dolby SR isn't mentioned. It isn't clearly

stated whether they are disk or tape techniques, or both. The compact disk has a half-dozen pages to itself, out of over one thousand pages in the book (and most of the CD material isn't listed in the index). If these were not to be shown in depth, then at least a strong bibliography on the subjects could have been included. A few such curiosities aside, these are strong chapters.

In part six, this book departs completely from all earlier editions of the *Audio Cyclopedia* by presenting chapters on design applications by Chris
(continued on page 57)



38 Revox Industrial and A/V Audio Recorders

Thirty-eight? Where are the other thirty-five?

No need to show them. They all look pretty much the same as the three basic transports shown: PR99 MKII, PR99 Playback Only, and B77 MKII. But, with all our special versions, modifications, and options, you can order a Revox to fill virtually any application. The "menu" includes:

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Avtec Industries Announces a Series of Contract Awards

AVTEC Industries, announced that it has been awarded a series of contracts ranging from the design and installation of a high technology executive briefing room at the IBM facility in Wyomissing, PA, to a consulting

contract for the state-of-the-art \$8.5-million Unified Technologies Center at Cuyahoga Community College in Cleveland, Ohio.

The IBM contract also includes a facility meeting room and both rooms

will be controlled by an integrated system which will energize various audio/visual functions such as window drapes, lighting, video projection, VCR modes, audio tape, 16mm movie and 35mm slide projection. The interlinking of such functions will be performed through a digital control programming system from AVTEC.

The Cuyahoga Community College contract calls for assistance from AVTEC on the design, specification and installation of the most modern equipment in telecommunications technologies. The conference center will be designed to facilitate internal and multi-site visual and audio satellite, microwave and fibre optic transmission, reception and simultaneous display of computer data, graphics, moving pictures and still pictures. When fully operational, the 96,000 sq. ft. center will contain an amphitheater for 80 participants, a single level meeting room for 47 and an executive conferencing area for 12. The center will serve as a training and business resource facility dedicated to provide technically trained personnel who are cable of working with new technologies, procedures and products.

At Prudential Life Insurance Company of America in Newark, NJ, AVTEC was awarded the contract to engineer, procure and fabricate a complete audio/visual and television system for an executive conference room to include audio conferencing. The contract also calls for the display of computer, video tape and CATV programs through a large screen video projector.

For Mobile Corporation's Headquarters in New York City, AVTEC was awarded the contract to fabricate a video control room and screening facilities with the capability to gather, record, duplicate and edit radio and TV spots and news reports. The contract calls for a multi-purpose conference room and two viewing rooms with videocassettes, 35mm slide projectors, audio-cassette recorders video projectors, turntables and monitors.

Peirce-Phelps Drives for Five

Peirce-Phelps recently completed five audio teleconferencing installations. The companies and system locations include Columbia Gas System in Wilmington, DE; Boeing Vertol Corporation in Philadelphia, PA; CIGNA Corporation in Washington, D.C. and two domestic installation for an undisclosed major financial services company. The Columbia Gas installation is located in the company's executive board room and includes Shure ST3000 teleconferencing capabilities along with Shure, Electro-Voice and Whirlwind support equipment. Special features allow up to 24 people to participate and give presenters the option of using the room's podium microphone for teleconferencing and/or sound reinforcement applications.

The Boeing Vertol teleconferencing room in suburban Philadelphia which uses Shure ST6000 equipment and custom components provided by Peirce-Phelps, is linked with a Sikorsky Aircraft teleconferencing facility in Stratford, CN, also installed by Peirce-Phelps. The two companies are working on the joint development of a new utility and attack helicopter for the military.

The Boeing Vertol installation has 10 Shure low-profile microphones designed to provide even coverage for the teleconferencing room table that seats up to 13 people. The room is designed also to accommodate different table positions, has a separate podium microphone for presenters, features a custom mute light system

and includes ceiling loudspeakers for even sound coverage.

CIGNA Corporation contracted with Peirce-Phelps to install an audio teleconferencing system in the company's Washington Office of Federal Affairs. The system consists of Shure ST6000 equipment and a custom table centerpiece provided by Peirce-Phelps. This centerpiece contains six low profile microphones and a speaker.

Peirce-Phelps' work for the unnamed financial services client involved two sites. The one location uses Shure ST6000 equipment and incorporates custom modifications including a table centerpiece similar to the one designed for CIGNA. This facility seats up to 35 and has 17 low-profile microphones for even pick-up around the table. In addition, Peirce-Phelps added a custom modification that allows each microphone to be muted individually or simultaneously.

The second teleconferencing system for this client includes Shure ST3000 equipment along with a custom power supply and custom interface provided by Peirce-Phelps.

Those seated at the room's conference table are picked up by two Shure STL32W audio modules that provide fully interruptible conferencing with high quality audio. The modules offer pick-up for as many as 16 people; an adjacent gallery with seating for up to 40 is covered by four additional modules suspended from the ceiling. Such an arrangement means the elimination of unsightly microphones and floor cables.

DATE	EVENT/COMMENT	LOCATION	CONTACT
May 17-22	ICA Conference and Exposition.	New Orleans, LA	ICA (214) 233-3889
May 18-21	National Fire Protection Annual Conference.	Cincinnati, OH	(617) 770-3000
May 30-June 2	Consumer Electronics Show.	Chicago, IL	CES (202) 457-8700
June 7-9	Houston Space and Telecomm Symposium.	Houston, TX	(713) 225-1950
June 8-11	"Instrumentation for Engineering Measurements." Course presented by the Center for Professional Advancement.	East Brunswick, NJ	(201) 238-1600
June 12-14	Recording Studio Designer's Workshop. Sponsored by Syn-Aud-Con.	Astoria, NY	Syn-Aud-Con (812) 275-3853
June 15-17	Audiotex '87. Exhibition and conference on voice technology.	New York, NY	Online International (212) 279-8890
June 15-18	National Computer Conference.	Chicago, IL	NCC '87 1-800-NCC-1987
June 15-19	ISDN/Broadband Networks for the Future. Seminar Sponsored by Information Gatekeepers.	Atlanta, GA	Information Gatekeepers (617) 232-3111
June 16-18	Principles of Traffic and Network Design. Telecommunication workshop sponsored by abc TeleTraining, Inc.	Chicago, IL	abc TeleTraining (312) 879-9000
June 18-20	International Security Conference.	Chicago, IL	(312) 299-9311
June 23-25	Advanced Manufacturing Systems Expo and Conference.	Chicago, IL	Chaners Exposition Group (312) 299-9311
June 23-25	Product Safety Seminar.	Cincinnati, OH	MIRA Corporation (513) 434-7127
June 27-30	NAMM.	Chicago, IL	NAMM (619) 438-8001
August 25-27	Static Overstress Seminars.	Bloomington, MN	Judy Ward 1-800-826-6270

Looking back at **SOUND & COMMUNICATIONS**

30 Years Ago . . .

In the May, 1957 issue of Sound and Communications:

"An Answer to Worker Tension" by Joseph W. Roberts, marketing vp of Muzak, detailed how background music was the answer to worker absenteeism, poor work habits, etc. It seems that background music overcame tension, reduced fatigue, mistakes, and wasted time. "Music is widely known as an emotional stimulant" the article said.

20 Years Ago . . .

In the May, 1967 issue of Sound & Communications:

In "Selling Sound with a Boom," Sound Merchandising—which is what S&C called itself back then—visited Boom Sound Engineering in Chicago to see the company's Demonstration

Room. Among the equipment that was demonstrated were Edwards Company's nurse/patient system, a switchboard from Telex, and an Altec Lansing microphone among other equipment and manufacturers.

The monthly column db's reported that Ma Bell sent management personnel around the country into the homes of stockholders selected at random. People were asked if they were content with their company and if they had any questions about its operation. db also reported that there was no truth to the rumors that the visits would include phone users.

15 Years Ago . . .

In the May, 1972 issue of Sound & Communications:

A profile of the seventh street business district in Rockford, IL, told of a town where background music is literally played in the streets. Ray Gustofson,

president of Rockford's Wired Music, received the contract to update the system that was installed in the 1930's. Twelve Argos SD-1022 sound columns were mounted on lightposts in the 3,200 foot-long district.

10 Years Ago . . .

In the May, 1977 issue of Sound & Communications:

A new product from Jacobs and Associates called the TJ3-1 Auto Tone System worked with a telephone company installed interface unit to reduce the length of long distance phone calls. It reminded the caller how long he had been on. The controller could be set for 2-16 minutes. At the end of the preset time a pleasant tone, which only the caller could hear, inserted itself into the conversation. There were no reports of employees also timing their three minute eggs with this device.

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JOB REPORT

(continued from page 45)

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

TEXAS

Houston: Enron Corporation Headquarters, NA, D. Contact: Edward McCue, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.

WASHINGTON, D.C.

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

Washington, DC: US Holocaust Museum, NA, A. Contact: Marc Benningson, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.

CANADA

NEW BRUNSWICK

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,C. Contact: Peter

Terroux, Halifax, N.S.; (902) 429-4616.
Halifax: St. Theresa's Church, NA,B. Contact: Peter Terroux, Halifax, N.S.; (902) 429-4616

ONTARIO

Toronto: Greenwood Race Track, 2,A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.

Toronto: Metro Toronto Convention Center Ballroom, 1,B. Contact: Neil A. Shaw, Paul S. Veneklasen and Associates, Inc., Santa Monica, CA; (213) 450-1733.

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BOOK REVIEW

(continued from page 53)

Foreman of Ramsa Corporation; Brook and Lawrence Philbrick of BBN Laboratories; Douglas Fearn, a consultant and author; and Ballou. These chapters cover reinforcement system design, broadcast chain design, image projection, and systems for the hearing impaired. These are broad, interpretive essays that present a balanced view of the system design proc-

ess. They could never have been included in the old *Audio Cyclopeda* question-and-answer format, and they strengthen the more esoteric and detailed parts of the book that have come before.

Compared to the first and second editions of the *Audio Cyclopeda*, this new *Handbook for Sound Engineers*, the *New Audio Cyclopeda* has larger pages, larger type, larger illustrations, but about 40 percent fewer pages (although exactly the same weight). By abandoning the question-and-answer format, and de-emphasizing the mindless republication of product photographs and electronic schematics, it presents more meaty material in less space. One can sit down with it and read it at length and not suffer the roller-coaster buffeting of constant changes of subject and direction.

On its own merits, the *Handbook* is as serious and authoritative and engineering reference book as any technical discipline can boast. One must mark the maturity of our industry by the improving professionalism of subsequent editions of the *Audio Cyclopeda* and the *Handbook for Sound Engineers*.

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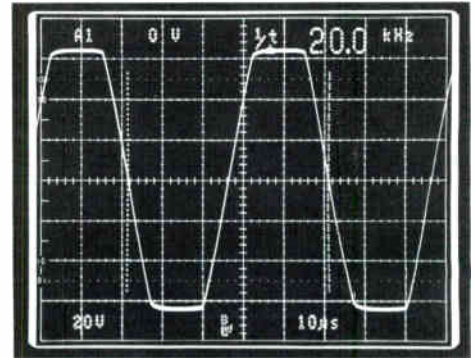
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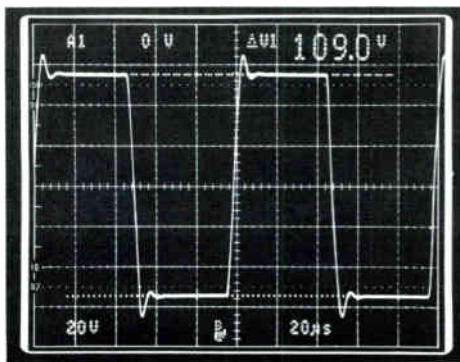
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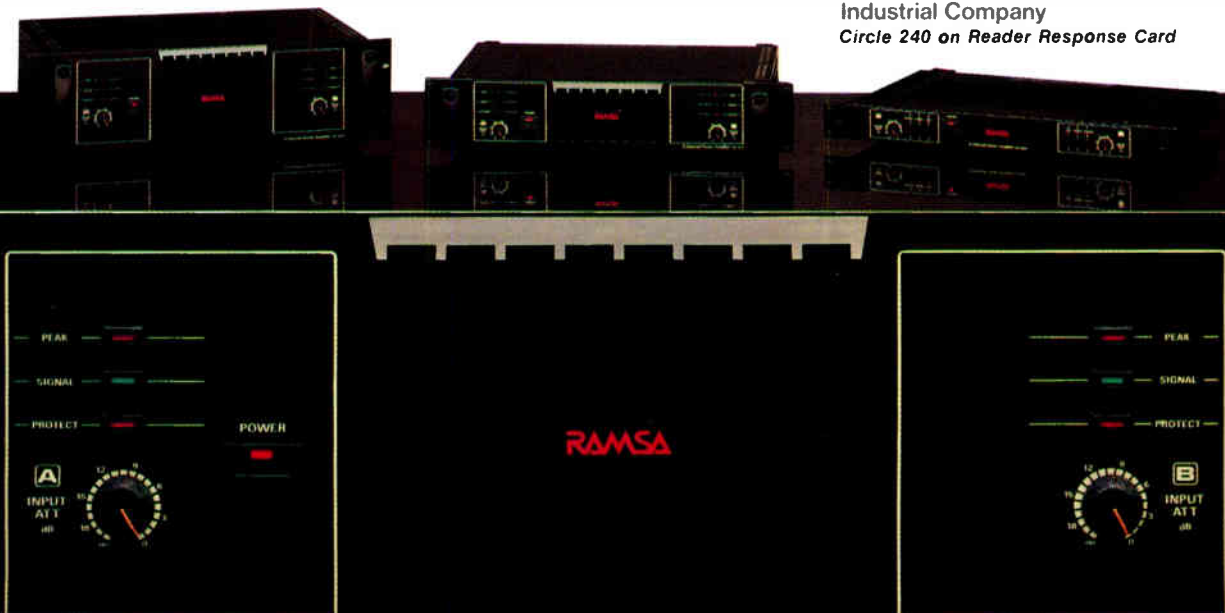
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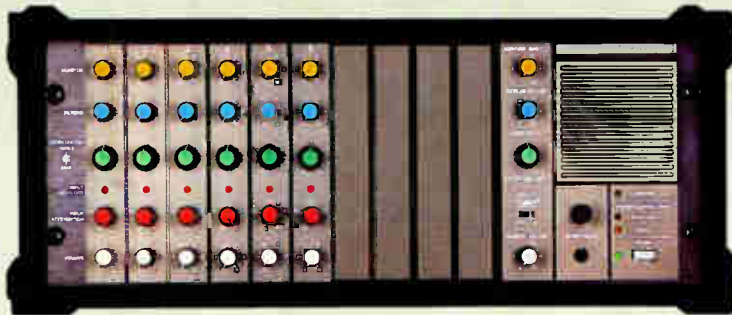
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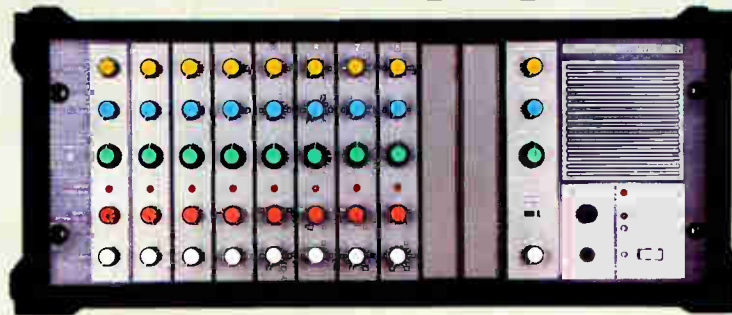
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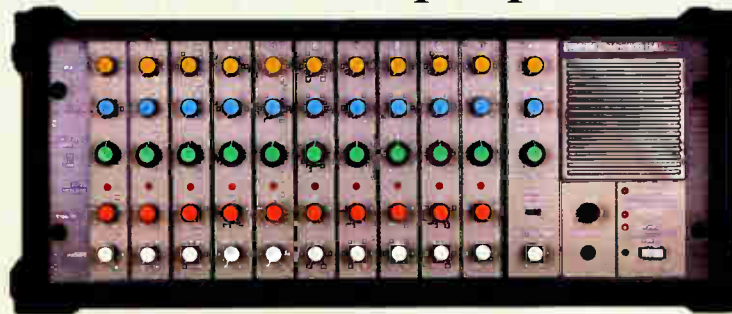
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