The Many Venues of the Special Olympics

SOUND & COMMUNICATIONS

FOR CONTRACTORS, SYSTEM MANAGERS AND SPECIFIERS

NOVEMBER 1987

A Consultant's Viewpoint:
The Gus Wortham Theater

CCTV Coming of Age

SPECIAL PULL-OUT SECTION
The Contractor's Guide to Loudspeakers
Part I

The first 500-Hz Driver that doesn't turn cymbals into trash can lids

Listen to most of today's HF drivers, including our leading competitor's, and you could logically conclude that "trashy" sound is an inescapable fact of life. Poor definition, inadequate output beyond 10 kHz, annoying breakups, and "ringing" are all too common.

EV engineers, rejecting the notion that poor high frequency sound is inevitable, created the DH1A, a driver that deals effectively with every one of these problems.

To boost high-frequency output we utilized a magnet with the greatest flux density available, plus an optimized, balanced magnetic circuit to "stiffen" the coupling between the amplifier and the diaphragm. The resulting increase in high-end response also solved the problem of definition and articulation, so the sound is cleaner and livelier, with better transient-handling capability. As a result, trashy instrumental and vocal sounds are consigned to the trash can, where they belong.

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Talk, as they say, is cheap. So, we insist that you make us prove our claims. Audition a DH1A today and hear for yourself how easily you can bid a hasty goodby to trash-can cymbals and high-end distortion.

For more information, write Electro-Voice, Inc., 600 Cecil Street, Buchanan, MI 49107.

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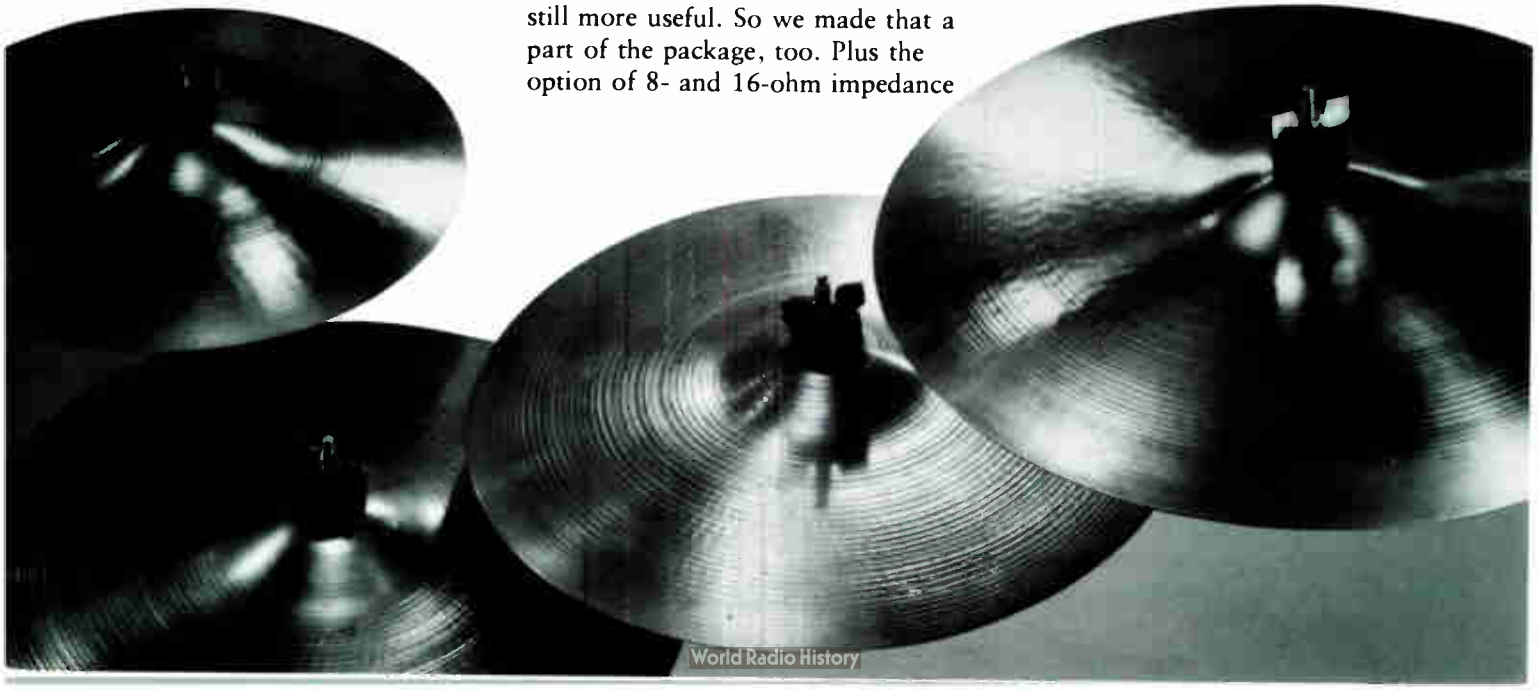
Circle 201 on Reader Response Card



What sound does a loudspeaker make when it's on backorder?

No sound at all, obviously. But you may hear loud noise from customers whose requirements can't wait.

At Quam, we don't like backorders any more than you do... in fact, we won't tolerate them! To give you total protection from backorders, we keep 60,000 speakers in stock at the factory, so we can always ship, within 24 hours of your order, any standard item, including line matching transformers and ceiling grills or speaker/transformer/baffle assemblies. So when you deal with Quam, your work schedule won't be delayed because the speakers you need are missing from your shelf. Nor will you have to tie up cost in inactive inventory to guard against shortages. Nor will you ever have to worry about a speaker causing a call-back. At Quam, we believe in allowing sound contractors the peace of mind that comes from having a totally reliable source for speakers.

Doesn't that sound good to you?

Quam: The Sound Decision

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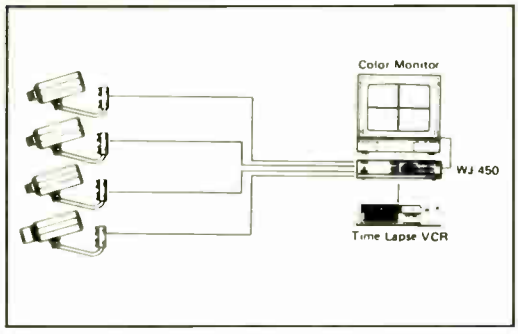
SOUND & COMMUNICATIONS

Volume 33 #11
November 1987



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DEPARTMENTS

ON THE COVER
The 700,000 cubic-foot lobby of the Gus Wortham Theater includes 16 eight-inch T51 custom-made Soundolier Baffles with JBL 8140HT loudspeakers. (One is shown next to the doorway.) The lobby's sound system now includes a dozen Electro-Voice HR60 horns with 1828T drivers. *Cover photo by Paul Hester.*

FEATURES

COLUMNS

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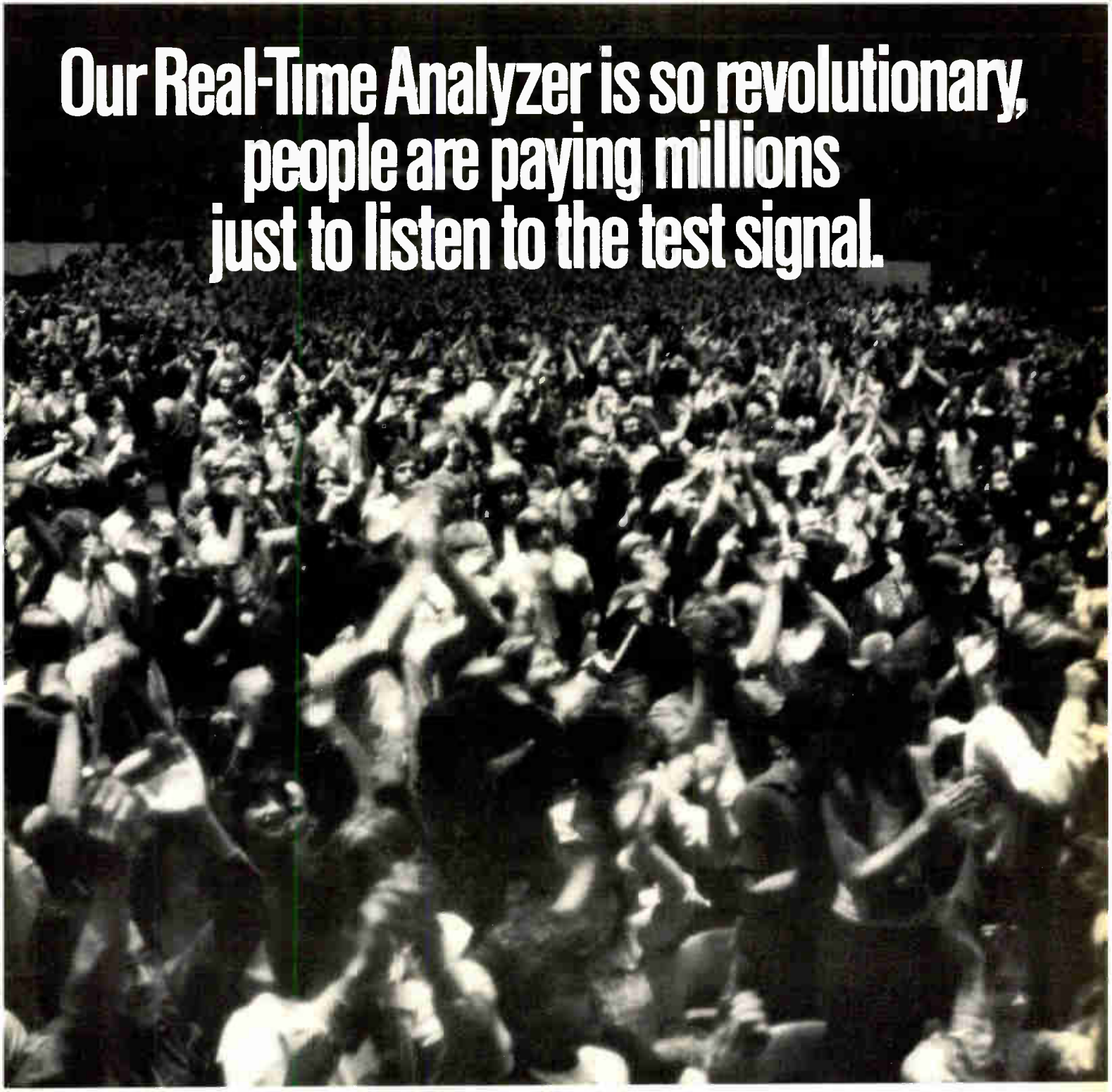

Unlike any other test instrument, the new dbx RTA-1 lets you measure frequency response with the music itself as the test signal. In real time. In real situations. In depth, in detail, and with remarkable certainty.

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We should also point out the RTA-1's compatibility with equalizers, PCs, color monitors and printers; its flexible microcomputer architecture (complete with user-friendly menus and Help function); its two microphone inputs, six line inputs, built-in preamps and phantom power supplies.

Call 1-800-525-7000 x D251 for an analysis of our real-time analyzer, including an Engineer's Information Packet. In the meantime, you can sit back and enjoy our test signal.

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Guest Editorial:

Foreground Music: Opportunities For The Future

Once in awhile it's a good idea to sit back and take stock of what's going on around you, just to see if you're missing anything. I happen to be knee deep in the foreground music industry, so I'll tell you what it looks like to me.

My concept of foreground music is a hardware/software system which provides customers with the music they want to hear, the way they want to hear it. Choice and quality are critical. That is the *force* behind the foreground music explosion. Convenient, programmable, high quality on-premise equipment, and popular music, licensed from the major record labels, are the means that make it happen.

While ordinary background music sales have remained flat or shrunk in most markets, foreground music sales have been soaring. In little more than 10 years, it has dramatically changed the commercial music business. Today, in virtually every market, foreground music is the music of choice for the majority of the market. "Choice" is a key word and a major reason for this trend.

In the past, the market was less demanding. Customers were allowed only one style of music—a state of affairs that the market tolerated for many years. It was possible for a single business to supply the music needs for an entire city with an SCA or phone line broadcast system and one style of generic music. For independent sound contractors and companies involved in the security and telecommunications sides of the industry, there was simply no room for sales opportunities. As a result they gave up their music sales to the local background music monopoly.

With the advent of high fidelity home systems, LPs, CDs, and the explosion in popular music, businesses demand choice and quality in their music. The "one-size-fits-all" approach no longer sells. Today's foreground music supplier allows the contractor to offer his client exactly what he wants—choice and quality both in his music and his music system. Literally thousands of hours of music programming are available to him, running the full range of musical styles from classical to pop to jazz (and even good old BGM). With complete customer service, billing, and distribution services, the contractor can be confident that his customer's needs will be fully met by his foreground music supplier.

Choice of music demands control over which style is played, and when it is played. Reliable, durable, high fidelity tape systems have become the standard in modern foreground music systems. Multi-channel broadcast systems showed a lot of promise but have turned out to be too limited in choice of music, fidelity, and profitability. Only on-premise music systems allow the client to change his music throughout the workday, permitting him to get the most out of the broad choice of styles available to him.

The right music demands the right sound system. Foreground Music has opened up a whole new market of systems design and installation which has never existed before. The standards for environmental music systems have escalated. People hear the same songs they're used to hearing on their CD player at home, and they know what they should sound like. With the arrival of high quality commercial software and playback equipment, cus-

(continued on page 73)

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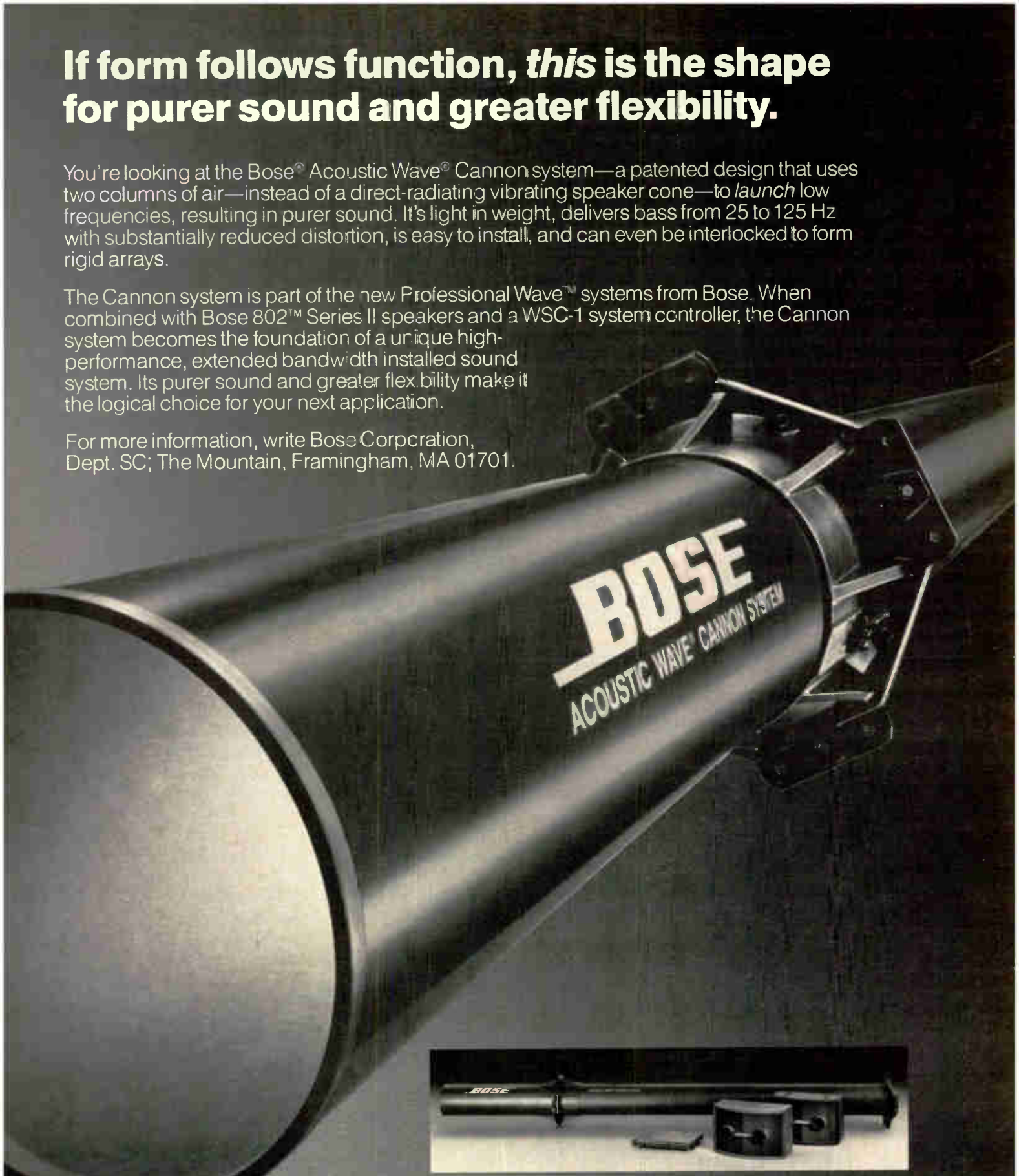
If form follows function, *this* is the shape for purer sound and greater flexibility.

You're looking at the Bose® Acoustic Wave® Cannon system—a patented design that uses two columns of air—instead of a direct-radiating vibrating speaker cone—to *launch* low frequencies, resulting in purer sound. It's light in weight, delivers bass from 25 to 125 Hz with substantially reduced distortion, is easy to install, and can even be interlocked to form rigid arrays.

The Cannon system is part of the new Professional Wave™ systems from Bose. When combined with Bose 802™ Series II speakers and a WSC-1 system controller, the Cannon system becomes the foundation of a unique high-performance, extended bandwidth installed sound system. Its purer sound and greater flexibility make it the logical choice for your next application.

For more information, write Bose Corporation, Dept. SC; The Mountain, Framingham, MA 01701.



The Bose Professional Wave sound system.

BOSE
Better sound through research.

Circle 205 on Reader Response Card

BIAMP'S SYSTEMS SELECTED BY RODGERS ORGAN TO PROVIDE AMPLIFIERS

Rodgers Organ Company has announced that it has contracted with Biamp Systems for the development and manufacture of power amplifiers to be used in Rodgers' organ products. Biamp has been commissioned to design a 150 watts per side MOSFET stereo amplifier for Rodgers. The amplifier will be rack mounted, two spaces high with passive cooling. The initial order is for 1,000 units.

RING GROUP OF NORTH AMERICA GETS NEW PRODUCT MANAGER

Sound & Communications has learned that Joel Kahn has just been hired as product manager by Ring Group of North America. Kahn is a seasoned senior executive in the communications industry. His new responsibilities in Ring's intercom group will include sales and distributor support. Kahn previously served a one year stint as Bogen's director of marketing. He also spent six years with Executone as product manager of the Internal Communications Products Group.

BOSE TO PROVIDE SOUND FOR '88 WINTER OLYMPICS

Bose Corp. has announced that it has been named official supplier of professional sound system equipment by the XV Olympic Winter Games Organizing Committee in Canada. Bose will provide sound systems for all 12 venues at the Calgary games, which begin February 3, 1988. Bose expects that the 16-day event will require more than 450 loudspeakers and 75,000 watts of amplifier power. The company will use a number of its professional loudspeaker products, including the 802, 402, and 102 systems.

AGFA-GEVAERT INC. MAKES MAGNETIC TAPE DONATIONS

As part of a campaign to assist entertainment and information projects in the public interest, Agfa-Gevaert, Inc., has donated audio and video mastering tape to Orpheum Records and AIDSFILMS. Orpheum Records used AGFA PEM 469 audio mastering tape to record the song, "A Time for Heroes," the official theme of the 1987 Summer Special Olympics, an athletic event for the mentally handicapped (see story, page 54). The recording represents the musical efforts of Meat Loaf and Germany's Tangerine Dream.

AIDSFILM is a nonprofit organization that produced and distributes a series of public service announcements to educate the public about AIDS. Company producer Franklin Getchell directed the film, "Sex, Drugs and AIDS," which has been endorsed by the New York City Board of Education. Agfa Super HGX VHS cassettes are being used to distribute the spots to regional and national broadcasters.

POPE USED HME WIRELESS MICROPHONE DURING U.S. VISIT

For the first time in history the Pope used a wireless microphone. Pope John Paul II wore an HM Electronics, Inc. (HME) Wireless Microphone during his visit with over 6,000 school children at his Universal Studios Amphitheatre teleconference. The Pope wanted to be able to move about freely among the children at the Amphitheatre while answering questions via two-way closed circuit television from kids in St. Louis, Denver, and Portland. Mayhew & Co. in Burbank, a wireless supplier to the broadcast, motion picture and entertainment industry, used HME's new Series 50 wireless microphones which were introduced only days before the Pope's visit. The body pac unit was concealed under the Pope's cassock, where it transmitted to HME's new RX520 switching diversity receiver, located under the stage. A 3/8 inch piece of steel was placed on the front of the stage risers for the Pope's protection, but this did not interfere with the performance of the microphone, according to the company.

In related news, HME has signed a master distributor agreement with Gexco International, Inc. Gexco will be distributing HME's complete line of professional audio

equipment to all territories except Australia, Canada and Mexico. Gexco will have HME products available for shipment in their New Jersey facility. They will also be available to provide technical support to the international market.

GENTNER ELECTRONICS CORP. ACQUIRES ADVANCED DESIGN TECHNOLOGY

Gentner Electronics Corp. has announced the acquisition of Advanced Design Technology (ADT). ADT is a firm specializing in computer aided design and layout of printed circuit boards. According to Russel Gentner, president of Gentner, the acquisition of ADT will facilitate the flow of new product development by providing rapid turn-around of technically advanced printed circuit boards. He also said that the company's capability of producing custom and OEM products will be enhanced.

SOUNDTRACS WINS SECOND QUEEN'S AWARD

English mixing console manufacturer Soundtracs, Plc. has been awarded the Queen's Award for Export, 1986, an award that signals out a combination of export sales and excellence in quality. This is the company's second such award, the first being for 1984.

According to S. Richard Ravich, president of AKG, Soundtracs' success is based on its continued development in product design combined with reaching new levels of export. "We're using computer aided design and production systems to determine the cleanest, most direct signal pitch and doing it more economically," he said. "Through better design, we're speeding up production and producing a quieter and more efficient product. Also, we've increased new product output from two to four consoles per year and have opened new markets throughout the world."

NATA'87-UNICOM 1 TO FEATURE RECORD NUMBER OF NEW EXHIBITING COMPANIES

Over one third of the current exhibitors for NATA'87-Unicom 1 Expo and Conference are first-time NATA convention participants, the North American Telecommunications Association (NATA) announced. The expo and conference is scheduled December 2-4 at the Dallas Convention Center. "We have never has such a high percentage of first-time exhibitors," said NATA convention director Karen Palermo. "This is a clear indication that industry members want to reach the broader computer-communications marketplace at Unicom 1. Most of these new exhibiting companies are from the data industry." Applied Voice Technology, Armiger, Cannon, RAD Data Communications, Inc., and Texas Instruments are just some of these first-time participants.

FANE ACOUSTICS AND McKENZIE ACOUSTICS JOIN FORCES

Two UK chassis manufacturers, Fane Acoustics Ltd. and McKenzie Acoustics Ltd., have joined forces. The deal will see Fane Acoustics' parent company, Audio Fidelity PLC, acquire control of McKenzie Acoustics and its product lines which include loudspeakers, loudspeaker enclosures, amplifiers and crossovers. Both companies intend to maintain their separate companies, separate company HQ's, separate product lines and separate product identities in a bid to improve market share.

In a related issue, McKenzie Acoustics has appointed Bunn International Inc. as its sole US distributor. Initially Bunn will carry McKenzie's Studio 7 and Professional series drivers that will be warehoused at its Elkhart, IN, headquarters and be responsible for Elkhart/Goshen setting up a distribution network for McKenzie products in the US.

CONSULTANT'S COMMENTS

by Marc L. Beningson
Jaffe Acoustics, Inc.

Design/Build Projects, Part II

Design-build contracts, as we have discussed before, comprise the bulk of many sound contractors work. Ranging from small school and church systems with minimal budgets to huge low voltage systems with appropriate budgets, a sole contract is tendered by the owner for both design and installation of the sound system. While occasionally a consultant may be employed to prepare a general outline specification, most of the time the bidding contractors must propose both a design concept and an installed price. Of course, concepts and prices can vary wildly from one proposal to another. And unless there is a technical merit scoring or other evaluation of the various proposals, the least practical, worst thoughtout, inadequate or lowest priced system will win. This, of course, is the disadvantage of the design-build situation.

Hiring an independent consultant to prepare a specification is an insurance policy of sorts, assuring the owner of a correct and adequate design concept and a secure specification to the bid among equally qualified contractors. However, many owners are under the impression that the less expensive solution is a design-build contract because the consultant's fees are eliminated, and "absorbed" by the contractor. This is only partially true, because the contractor who does not include dollars for design and development in his bid does not have a true accounting of his costs, and is destined to lose money in the long run. Design costs must be accounted for.

How will the design concept be formulated and how will it develop into a fully engineered installation? What resources can be used? Here are a few possibilities: Your salesman has a good knowledge of what is popular, well priced, and what has worked for him in previous installations. He has

(continued on page 71)

"The last resource for a design-build contractor may be surprising to some—how about hiring a consultant?"

Refined.

MA/MR Series mixer/amps put style in sound reinforcement. The MA/MR Series mixer/amps look right in any setting. Clean lines and a modern black finish add to their attractive, professional appearance.

And behind the styling is pure practicality. The first of the new University Sound electronic products line, the MA/MR Series offers conservatively-rated outputs of 35, 60 and 100 watts, with the features you asked for. Two balanced mic inputs, two auxiliary source inputs and a switch-selectable mic or magnetic phono input are standard, as well as a rear panel "paging" input with automatic muting. The MR-355 model (35 watts) includes an AM-FM tuner for background music applications.

A helpful, easy-to-understand owner's manual provides clear instructions on installation, operation, and service. In the unlikely event of a problem, a bottom panel can be removed for access to the main circuit board. Day after day, year after year, you can rely on the refined MA/MR Series to deliver the performance you need.

The MA/MR Series—**pro quality in commercial sound from:**

™ University Sound®
a MARK IV company
600 CECIL STREET
BUCHANAN, MICHIGAN 49107
(616) 695-6831

Circle 215 on Reader Response Card

by Sally S. Petersen

How To Win Customers and Influence Profit Margins

When the staff of Sound Advice Institute of Willmar, Minnesota, discovered the best, fastest, easiest and cheapest way to generate new business—and profits—you'd think they'd want to keep a secret like that to themselves. Not true.

After developing and fine-tuning the marketing tool that turned the volume up loud and clear for their own contracting business, they're now making this unique tool available to sound contractors all over the United States.

Funny thing is, the program is so simple to implement and so cost-effective it's a wonder someone hasn't thought of it before.

Actually, this type of marketing tool isn't a particularly new idea in itself, but it is to the sound contracting business.

"To our knowledge, no other sound contractor has done this before," said Randy Huisinga, president of Sound Advice Institute.

"We knew that direct mail newsletter advertising was probably the best buy for a sound contractor," Huisinga continued. "It's a great way to communicate with existing and potential customers. And the soft-sell newsletter approach is a popular and successful way to generate new business. But we simply never got around to actually doing it, which was a mistake. But at the time we didn't realize what we were missing out on."

Since good intentions alone weren't solving any problems, the company finally reached a level of frustration that demanded action.

"We could see what the churches' needs were. We knew we had big holes that needed filling. But nothing changed until we plunged right in and hired a direct marketing consultant who specialized in producing high-tech quality newsletters. Under his direction we began to publish a professional newsletter that provided practical help to everyday church sound problems. That's what brought results," explained Ronald Huisinga, owner and general manager, referring to the 350 percent increase in his company's business in less than two years.

Life at the company hasn't been the same since. Company visibility has increased by 8-10 times. The phones don't stop ringing during the two weeks following each quarterly mailing.

Compared to other forms of advertising, the direct mail newsletter appears to be the most efficient use of advertising dollars. As a method of acquiring new business, it gets more "db" for the dollar.

Sound Advice Institute, after doing extensive research, has discovered that professional sound system designs and installations for churches will be, within the next 5-10 years, the focus for future growth.

Why? Take a look around you. Many locations—even small towns—are equipped with a few schools and maybe a municipal auditorium. But take a closer look and notice the large number of churches that dot the horizon.

"Because of the clear results of our recent survey, we're convinced that providing churches with valuable technical sound information will be our main emphasis," said Chris Olsen, marketing director. "That's also why we have tailored our newsletter pack-

(continued on page 73)

Sally S. Petersen is a Minnesota-based free-lance writer and the editor of several books.

If only the rest of show business was this reliable.

When you're on tour, Murphy's Law rules.

The bus overheats. Rain's predicted for your outdoor show in Phoenix. The caterers left brown M&Ms in the backstage buffet and the band won't go on until they're removed.

In short, there are precious few things you can really count on. And one of them is the new Yamaha PM1800 Professional Audio Mixing Console.

The PM1800 inherited most of its features and capabilities from the legendary PM3000. So it's already got a lot going for it.

Most importantly, though, the PM1800 is remarkably reliable. Performance after performance. With system after system. Through bumpy loads and bumpy roads.

The design, just like the M1500, is familiar in all the right aspects and improved in the others. Such as a unique transformer option, so you can work with or without them. And wide use of internal jumpers so you can change signal flow just about any way you want.

So when the bus rolls into the next town, have the driver drop you off at the nearest Yamaha Professional Audio Dealer to take a look at the new PM1800.

And take Murphy's Law into your own hands.

Yamaha Music 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.

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Circle 213 on Reader Response Card

A Consultant's Viewpoint:

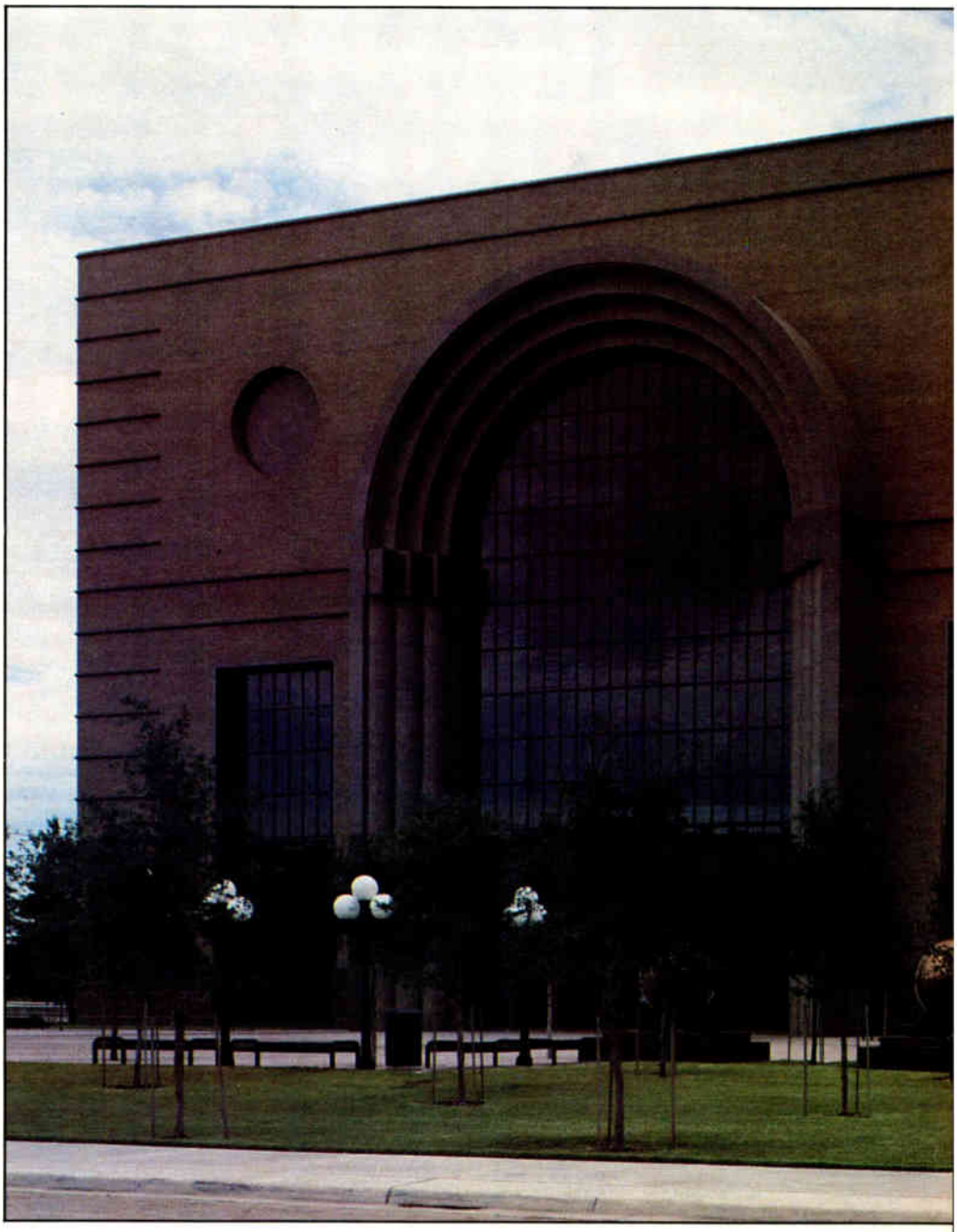
THE GUS WORTHAM THEATER CENTER

by Marc L. Beningson

The last major opera hall to open in North America in this century came to life on the 15th of last month when the Houston Lyric Opera presented its season premier *Aida* in its new home, the Brown Theater, the larger of two halls in the new Gus Wortham Theater Center in Houston, Texas. Immediately adjacent, on the opposite side of an acoustic buffer zone, is the smaller Cullen Theater, where the Houston Grand Ballet began its inaugural season in its new home on October 15.

Rounding out the Wortham Theater Center are five rehearsal halls—each specially built for use by ballet, opera and orchestra—and office space for the various performing arts organizations, both permanent and touring.

Topping off the facility is a grand lobby common to both theaters that can only be described as, well, Texas sized. Located a short two block walk from Jesse Jones Hall, where the Houston Symphony Orchestra performs, the new Wortham Center gives Houston a performing arts complex among the finest in the world.

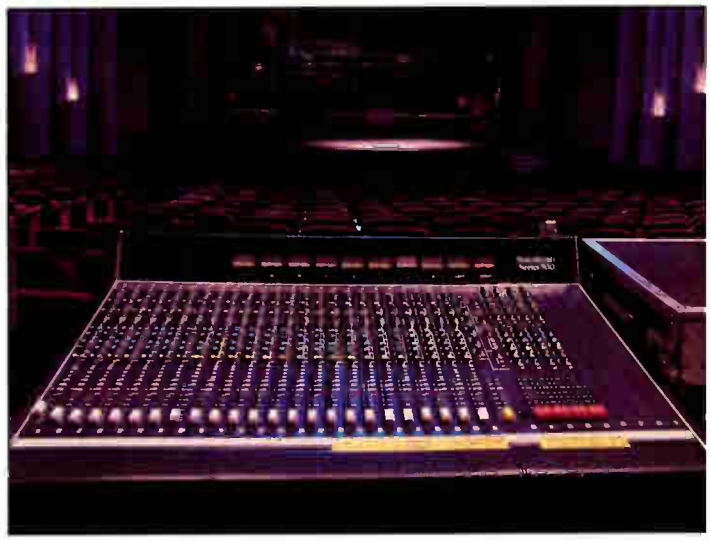


Nearly 10 Years of Work

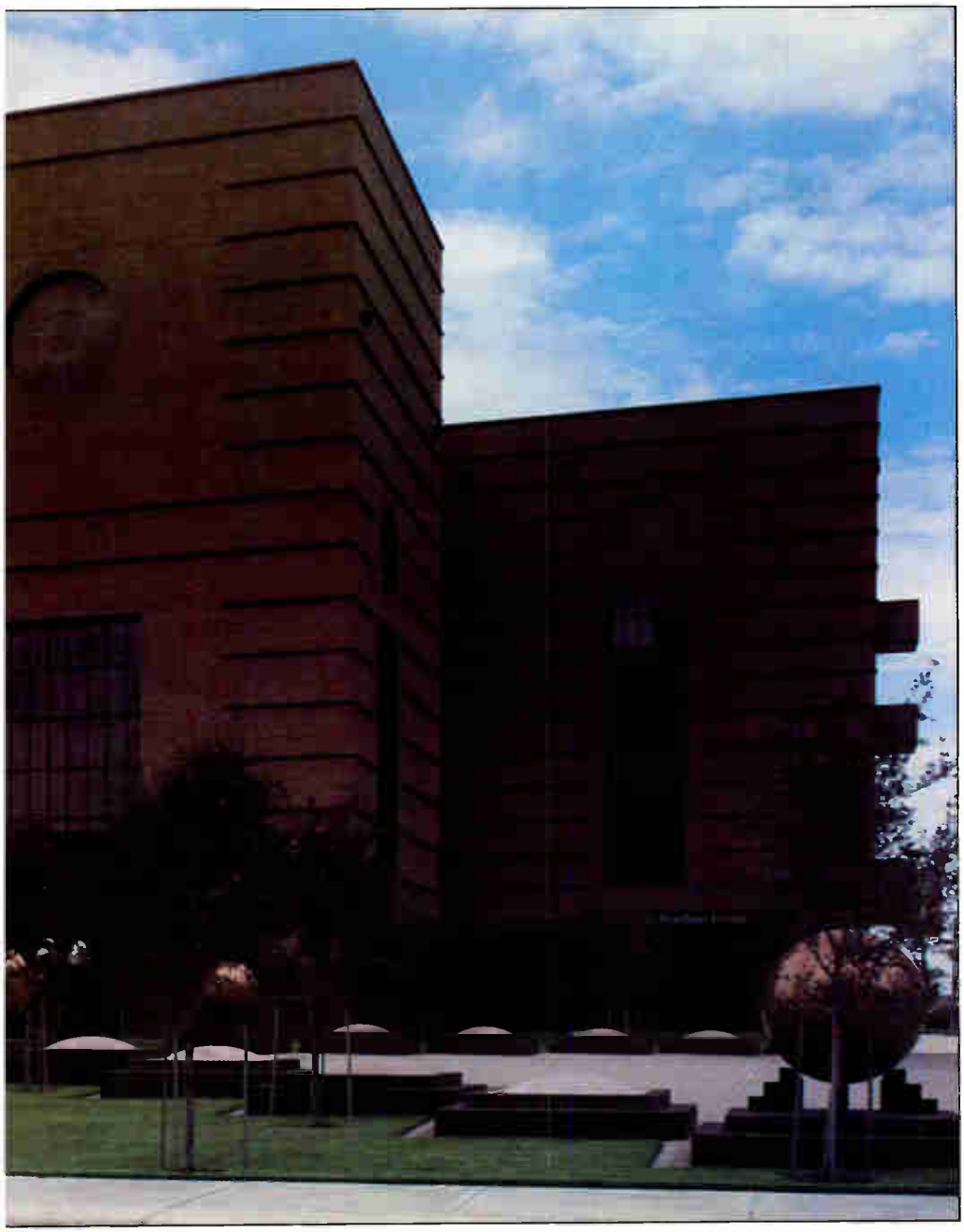
The opening of the Wortham Center was the culmination of nearly 10 years of work, beginning with the initial study by the Lyric Opera Company in 1977.

The success of any performing arts facility depends, for the most part, on the ability of the architect and engineers to understand and integrate the acoustical and theatrical requirements into a unified, balanced and complete design.

Marc L. Beningson was a senior acoustics consultant at Jaffe Acoustics for five years and is now an independent consultant in Norwalk, CT.



View of the Cullen Theater from the House Mix Position.



Morris Architects (formerly Morris* Aubry) were selected to design what was envisioned from the start as a first class facility, under the influence of a strong design team. Cook & Holle were the electrical and mechanical engineers, and along with the architects, were able to apply their design skills to the highly specialized requirements of the facility as developed by Jean Rosenthal Associates (JRA), the theater consultant and communications systems designer, and Jaffe Acoustics, Inc. (JAI), the acoustical consultant and sound system designers.

It should be noted that the two main programs at the Wortham Opera and Ballet will operate acoustically without sound reinforcement. A high quality, light duty "voice lift" system in the Brown Theater can provide subtle amplification when required.

The four-way sound systems provide high SPL reinforcement for many other programs that push the Wortham Theater Center to full capacity, including dramatic and musical theatre, touring Broadway productions, middle of the road and popular entertainment. Stage lip, stage lift, and underbalcony speakers on signal delays supplement the center array and speaker stacks. A portable stage monitor system with custom low profile slanted speakers includes two-way transformer isolated splitters, and a 32 x 8 monitor console (see sidebar for products specified). A microphone and tie line system feeds the broadcast booths and truck dock areas separately from the reinforcement system.

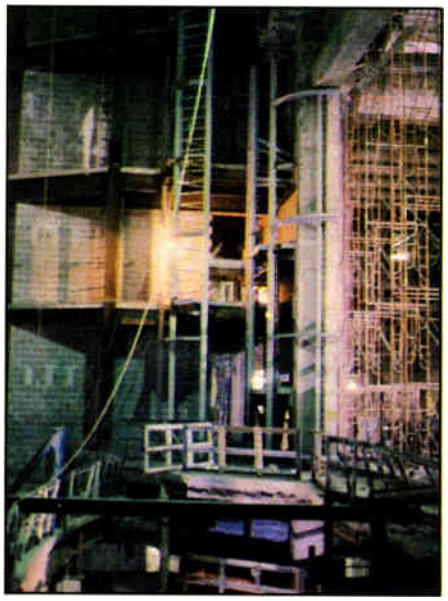
Intergrating Sound, Facilities

Because JAI was involved in the design process from the start, it was much easier than usual to integrate sound system devices and facilities into the building

From the first set of schematic drawings, prime pieces of real estate were reserved in each hall for major sound system elements including a center array, side stacks, super-low frequency speakers, front of stage lip and lift speakers and under-balcony speakers; and, just as importantly, good locations for sound system control spaces—rack rooms, storage rooms, control rooms, and house mix positions—were negotiated at the beginning, so that less important surrounding support spaces could be located around them.

The acoustically transparent proscenium in each hall is a key feature that was developed early in the schematic design phase. About 3½ feet in front of the actual concrete and steel proscenium wall is another wall of expanded metal on steel structure, covered with a suitable acoustically transparent fabric which matches the surrounding walls. Speakers placed behind this wall are nearly invisible to the audience, but sound passes through with minimal high frequency losses. The interior of the speaker "pocket" is lined with fiberglass absorption behind a protective expanded metal cover to prevent extraneous reflections and backwaves from the speakers. Although the coordination of the acoustically transparent procenium was not a simple task for the architect, Morris Architects chose this option to avoid the somewhat "high tech" appearance of exposed loudspeakers and other equipment.

During the design development phase of the project, the architectural details of sound system related spaces began to take shape. In the Brown Theater, a large sound control room was created on the house right side on the main floor level. All microphone and line level feeds in the theater pass through patchbays in the control room, and all equipment requiring active control is located in this room. One entrance door provides easy access to the back of the house, and another provides access to the backstage area via a non-public corridor. A dedicated room for the equipment racks housing crossovers, signal delays and power amplifiers is located close to the stage on the second level to reduce the length of speaker wiring runs. A house mix position was established on the main orchestra level behind the standee rail. This area can be cordoned off from public access because it is not considered a fire exit aisle.



This construction shows the aluminum framing for the acoustically transparent proscenium being erected in front of the structural proscenium.

Two six-inch empty conduits lead to a large plug box in the return air plenum below the seats where patching in a house console is more convenient. The plenum has better than standing headroom, and is accessible from the basement or, more easily, by a ladder directly to the sound control room. There are two additional empty conduits, which lead from the plenum plug box to each side of the stage, to permit touring sound companies to run their own snakes without laying them down on the audience floor.

On an upper level above the balcony is a "technical suite" adjacent to the spotlight booth, where a broadcast control room and announcing booth are located. These are designed for outside users with empty racks, and tie lines to the stage, control room, and loading dock so that a broadcaster or recording company can operate independently of the house system.

The Cullen Theater

The Cullen Theater is set up virtually the same way, with several minor exceptions. The control room is on the house left side, and because the theater is that much smaller than the Brown, the power amplifier rack room is located over the control room to form a "sound system townhouse." Unfortunately, a convenient spiral staircase linking the two rooms was lost somewhere in a budget cut. The broadcast facilities in The Cullen are identical to the Brown, but the technical suite is on the second level, adjacent to the rack room. In the Cullen Theater the power amplifier racks are connected directly to the air conditioning system, so the equipment remains cool without noisy rack mounted fans.

Computer style access floors were installed in the control rooms and rack rooms of both halls to permit all conduit and wiring to enter the racks from below. All control and rack rooms have dedicated air conditioning systems that operate independently of the main house systems, and these rooms also have Halon fire extinguishing systems in place of a water sprinkler system.

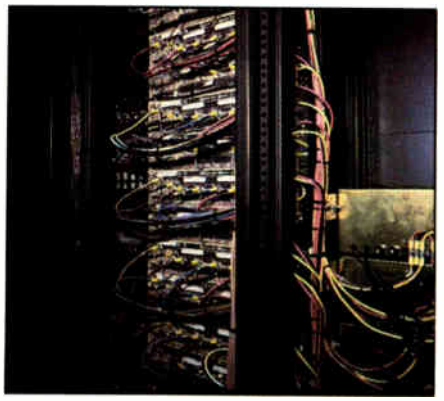
Trade Specifications

As with most buildings of this magnitude, the various trade specifications were bid in a series of packages by the construction manager. JAI's sound system specification and JRA's communications specification (intercom, stage page, talkback, CCTV, etc.) were placed in a single package for bid to a single contractor. While this placed all responsibility for sound and video work in the hands of a single supplier, the size and complexity of the systems and the coordination with two separate design firms often took more of the contractor's resources than necessary. However, the decision was made to combine these two specifications into one bid package prior to bidding.

Per JAI convention, and as frequently discussed in *Sound & Communications* "Consultants Comments" column, this package was kept separate from the electrical packages. Because Section 17 (specialty low voltage systems) was being bid as a package for a computerized building control system, Section 18 was created es-

PHOTOS BY ASHTON TAYLOR

The Sound Control Room of the Cullen Theater.



Power amplifier rack assembly in the Brown Theater.

pecially for the sound system and communications specifications. Section 18 was then bid directly to a number of prequalified sound contractors; five submitted proposals. The sound contract was warded to Audio Communications Corporation (ACC) of Houston in April, 1984.

Unfortunately, the construction manger chose to assign the winning bidder subcontract to the electrical contractor, nstead of retaining the sound contractor is a prime as recommended by JAI. This ituation caused a number of problems. The electrical contractor was good and competent, but the scope of the project nd its special requirements were too nuch. Along with the normal electrical vork required in any building, there were heater lighting, special architectural acent lighting, separate conditioned power or sound, communications, and broadast television, and an extensive triaxial able tie line system for broadcast televiion. It was difficult for the electrical contractor to take responsibility for all of hese highly specialized systems at once. Thus, there were inevitable delays and he sound system work performed directy by the electrical—power and onduit—did not always receive first riority. In fact, six months before cheduled completion, 95 percent of the onduit was installed, but because the ast five percent was the conduit that connected to the racks, the sound contractor was able to pull zero percent of the vire. This contributed to delays in sound ystem work.

The Construction Phase

During the construction phase, there was much coordination between Audio Communications and JAI. Although architects frequently frown on direct contact between a consultant and a subcontractor—there are correct channels for this type of information exchange—the magnitude and complexity of the sound system were such that Greg Yost of ACC and Marc L. Beningson of JAI were allowed to communicate directly and coordinate every last detail.

As required by specification, ACC submitted detailed and thorough shop drawing for the second system. Not just photocopies of specification drawings, or hastily handsketched on yellow paper, these were full engineering drawings for each customer component and each fabricated assembly. For example, the shop drawing for a rack mounted custom panel was exactly what was required by a metal shop (hence the name "shop drawings") to fabricate the panel.

One drawing showed the panel's size, and the dimensions from one corner to each hole to be drilled or punched, as well as the size of the opening. As is common in metalwork, all dimensions were given in thousandths of an inch. A separate drawing showed the engraving specifications and dimensioned locations of panel-mounted devices. Other drawings showed the assembly details of the array, speaker stacks, all of the permanent and portable rack assemblies, and custom printed circuit boards. A one-line diagram for each theate showed the schematic of the systems—these two drawings, of course, were virtually identical to the JAI specificatio drawings. The most significant drawing was a riser diagram showing sound system conduit requirements for th

WORTHAM THEATER CENTER SOUND SYSTEM DETAILS

In each of the Brown and Cullen Theaters—

MICROPHONE LINES TO PATCHBAY:

Stage:	52
Fly Floor:	6
Forestage:	6
Orchestra Pit:	20
Grid:	6
Catwalk:	6

HOUSE MIX TO PATCHBAY:

Microphone Lines:	52
Returns:	8

CONTROL ROOM MIX TO PATCHBAY:

Microphone Lines:	52
Returns:	8

SPEAKERS:

Central Speaker Array:
(4) JBL 4622M with
(8) JBL 2204H
(2) JBL 2360A with
(2) JBL 2445H
(4) Renkus-Heinz CBH820 with
(4) SSD-1801-8

Four Speaker Stacks—each consisting of:
(2) JBL 4622M with
(4) JBL 2204H
(1) JBL 2360A with
(1) JBL 2445J
(2) Renkus-Heinz CBH820 with
(2) SSD-1801-8

SLF Speakers:
(4) JBL 4645

Stage Lip/Lift Speakers:
(9) Bozak CM-209-16CH
(6 in Cullen)

Speaker Bar (Part of Voice Lift System):
(5) Bozak CM-209-16CH
(4 in Cullen)

Voice Lift System:
(4) Bozak CM-109-23 (Brown)

Underbalcony System:
(12) Bozak CM-109-1 (Brown)

Effects System:
(8) Channels Amplification
(64) Speaker Circuits patchable throughout the Stagehouses and Theaters

Amplification:
(148) Spectra Sonics 701A in single card and bridged pair configurations (134 in Cullen)
(2) QSC 3500 for SLF
(6) QSC 335 for Monitor

Crossovers:
(8) JBL 4234A
(2) Spectra Sonics 502 (Brown Only)

Signal Delay:
(7) Industrial Research DF-4015 (3 in Cullen)

Mixing Consoles:
(1) Soundcraft 500 32/8/2 (Brown)
(1) Soundcraft 500 24/8/2 (Cullen)
(1) Soundcraft 500 Monitor 32/8/2 (Brown)
(2) Yamaha DMP7

Stage Monitors and Effects Speakers:
(6) Custom Slants with (1) JBL 2202H and (1) JBL 2344
(6) Renkus-Heinz FRS and SMS 1280
(4) Bozak CM-200Z

Signal Processing:
(2) Industrial Research DE-4017 Transversal Equalizer
(4) Klark-Teknik DN-360B Graphic Equalizer
(2) Yamaha SPX-90 Effects Delay
(1) Yamaha REV-7 Reverb Processor
(1) UREI 562 Notch Filter

Microphones:
Shure SM-57 and SM-58
Beyer M-500 and MCE 5
Sennheiser 421-U nd 441-U
AKG 460B with CK-61ULS and CK-62ULS Capsules
Countryman Isomax II (Omni)
Crown PZM-6RB and PZM-6FS
HME 820 and 850 Wireless Microphones
Wireworks MSRT19-1 Microphone Splitters, MB-19 Stage Boxes, MK-19 Microphone Splitters, MK-19 Microphone Snakes, and Microphone Cables

entire complex.

All in all, the shop drawings included over 35 20-inch by 30-inch drawings, countless 8-inch by 10-inch drawings, in addition to the equipment lists and cutsheets for each device to be purchased. It should be noted that the equipment lists were done on an electronic spreadsheet, and all of the drawings were generated on an IBM-PC bused CAD system with a full-sized plotter. This allowed revisions to be quickly and easily made and distributed.

Few Substitutions

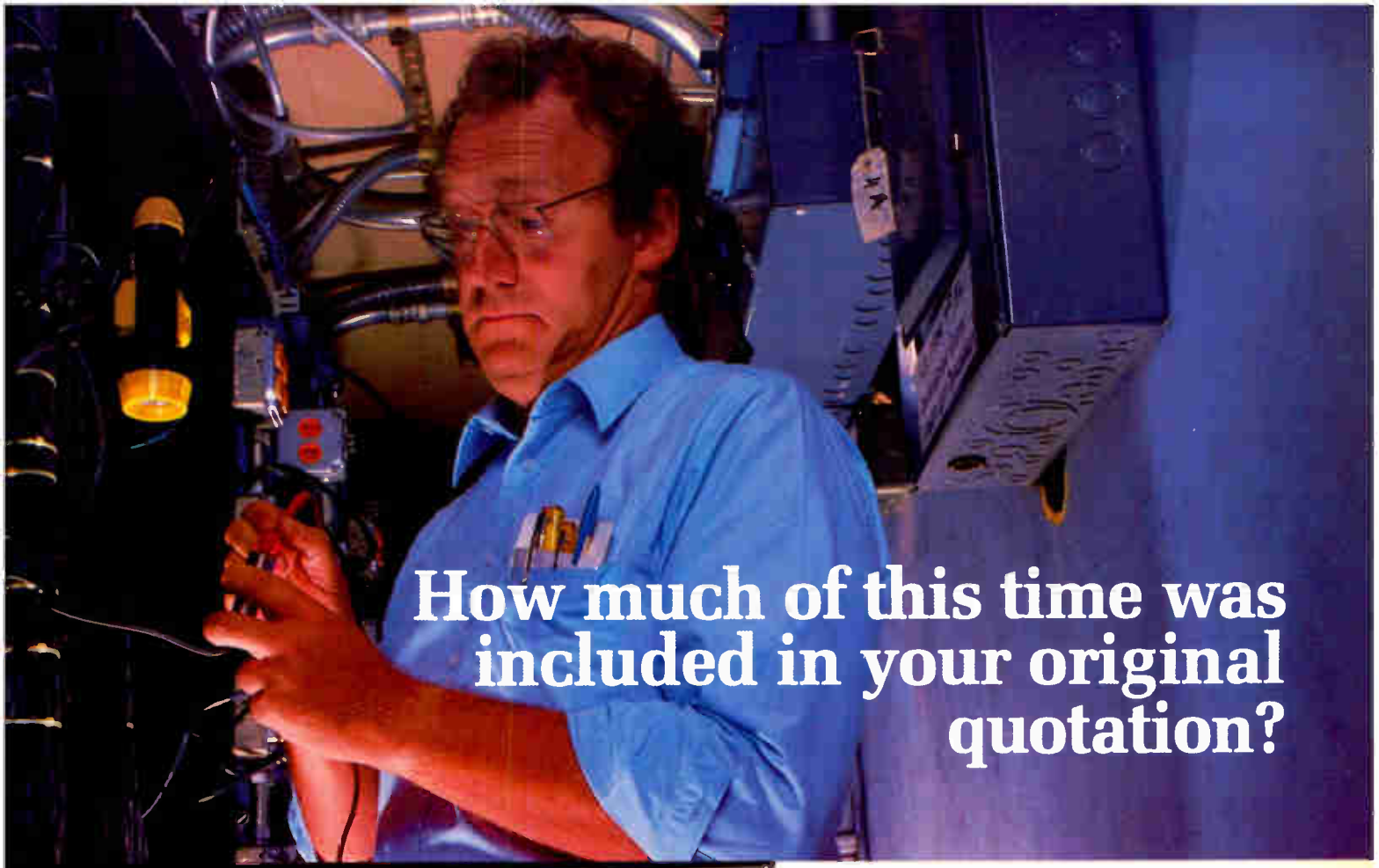
ACC made few substitutions of equipment from their original proposal. However, it became apparent to both JAI and ACC that there were a number of pieces of equipment that were discontinued, replaced or in limited supply because manufacturers were continually improving their products. This was not surprising, considering that it had been three years since the specification was written.

For example, a few of the specified Soundcraft 400B mixing consoles were still available, but a new Soundcraft 500 had been recently introduced. There was no question that the 500 was a superior console, but it had a cost premium attached to it. Further, the companion 500 series monitor console had not yet been introduced except as a prototype. (Soundcraft later cooperated by supplying an 800B monitor console until the Series 500 monitor console number 001 arrived.) Clearly, it would have been impractical to supply consoles that would be out of date by the time the Wortham Theater Center opened.

Further, new equipment that did not exist when the specification was written had become available—devices such as the Yamaha SPX-90 reverb processor and the DMP7 automatic preset console—but no additional money was available for any reason, even a practical one such as the purchase of desirable equipment.

The solution was interesting and unusual. Based on other theater installations, which had shorter gestation times, JAI was able to reevaluate some of the equipment to be supplied. ACC cooperated fully by giving JAI information about pricing and availability of specified equipment and potential replacements. Over a period of weeks, Yost and the author shared information and traded suggestions on possible additions and deletions. The archi-

(continued on page 73)



How much of this time was included in your original quotation?

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Years ago, our equalizers pioneered the use of thick film micro-electronic circuits. This technology reduces equivalent solder connections by more than 50%: its proven reliability is one reason we back Series 300 Graphic Equalizers with a five year limited warranty.

The other reason is the 100 hours of testing every Klark-Teknik product undergoes before being shipped. Our standard procedures include stereo dynascope board inspections, full performance verification and a cycled burn-in followed by a complete re-check.

Lower standards of design, construction and testing could make our equalizers less expensive to purchase. But it would make them more costly to own. There are no short cuts to true "set and forget" operation.

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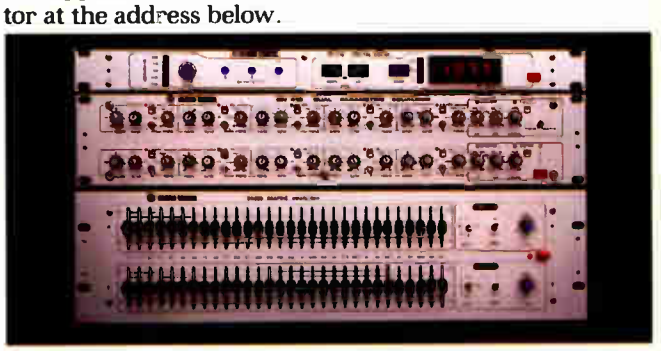

Each one of Klark-Teknik's Series 300 Graphic Equalizers, Series 400 Parametric Equalizers and Series 700 Digital Delay Lines is optimized for specific applications.

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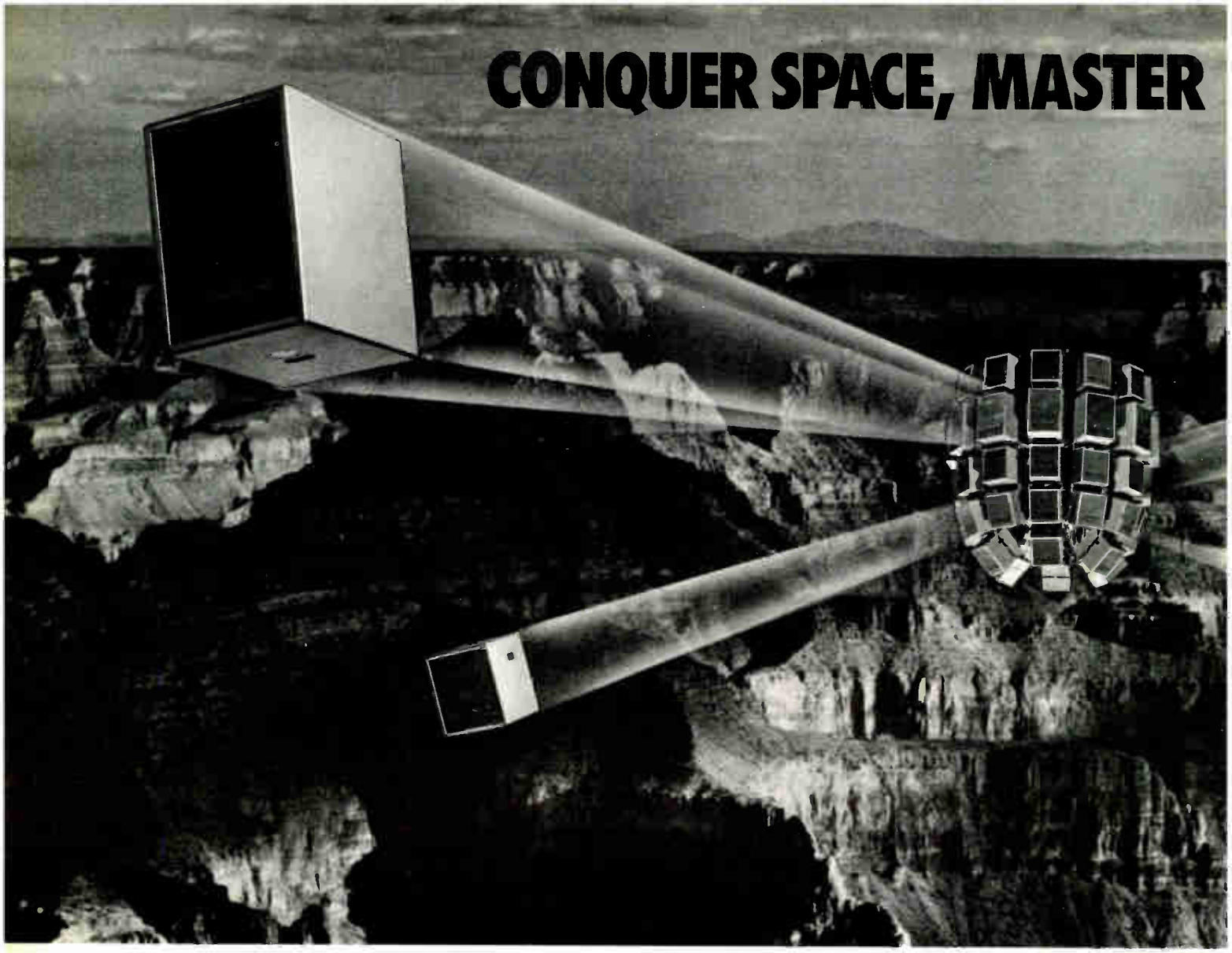

Some speaker systems attempt to conquer the acoustic environment through brute force, deploying massive cabinets and firing horns at everything that moves. Others resort to the sort of electronic trickery that requires delicate and finicky racks of complex gadgetry.

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Make full use of your skills

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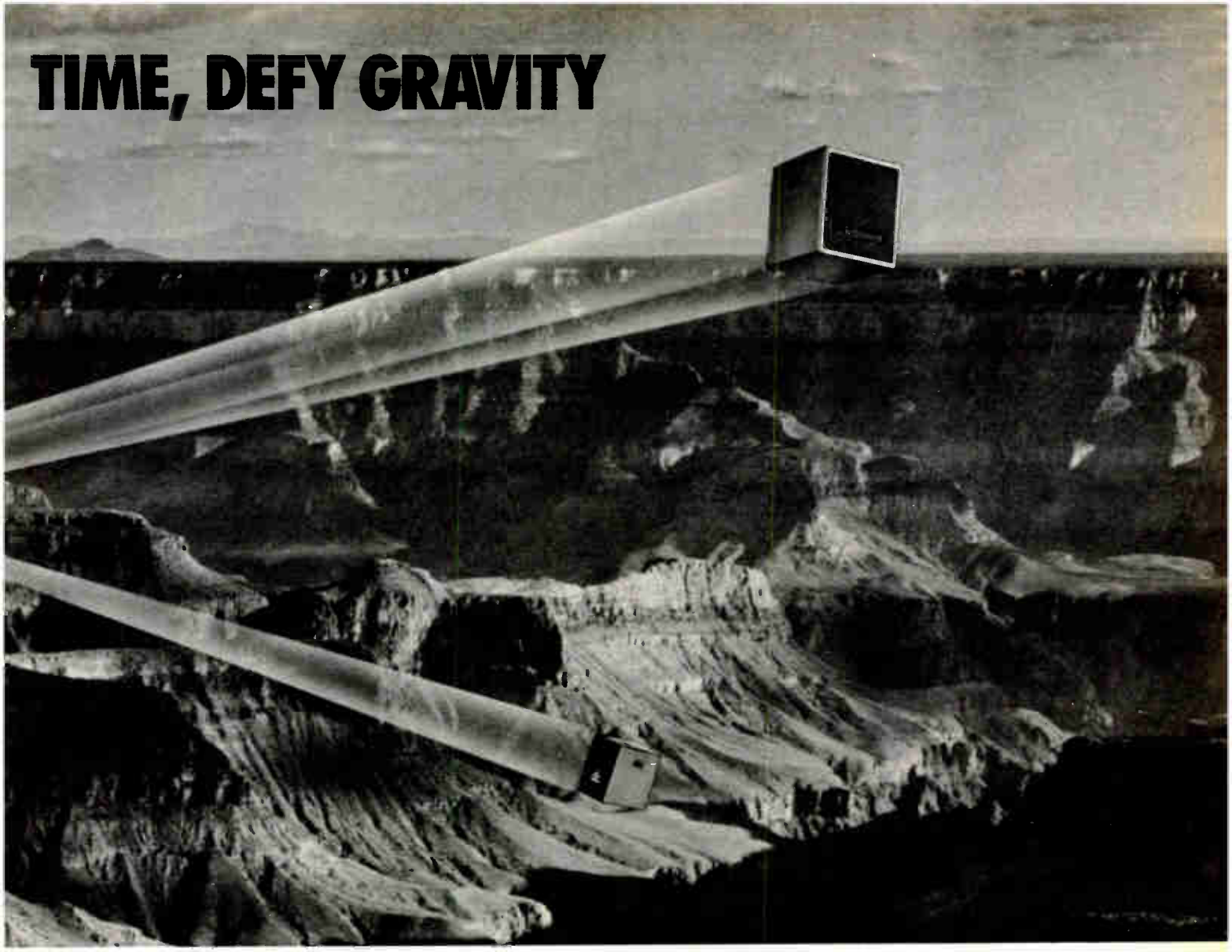

TSE Flying Frames distribute the weight around the enclosure, removing load stress from the cabinet. Connected with Quicklinks, the frames and cabinets pivot vertically to form a smooth coverage arc. The overall angle of vertical dispersion is easily configured with the TS-6 or TS-10 adjustable strap, connected between the bottom flying frame and the suspension quadrant.

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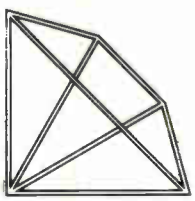
Horizontal dispersion is provided by Suspension Quadrants. Each quadrant will hold any combination of TSE enclosures. Combining quadrants yields arrays with horizontal dispersion of 70° — 360° and vertical dispersion of 50° — 270°.



TSE-211 — 2 x 10" TurboMid + V-2 HF unit. Designed for superior midrange and high frequency projection, with switchable active bi-amped or passive two-way operation. Dual vertically coupled TurboMid devices double the power handling of the TSE-111. The V-2 HF device extends upper octave response.

TSE-260 — V-2 HF unit. Two HF compression drivers are coupled with Turbo loading techniques, minimizing phase cancellation and distortion.

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CCTV COMING OF AGE

No matter where you travel to, whether it be a shopping mall, gas station, restaurant, amusement park, or even the local corner grocery store, there is a high probability that you will be observed by some type of a closed circuit television (CCTV) surveillance system. You may never see any of the cameras, but they are there! Today's cameras, due to their small size, can be concealed behind mirrors, in recessed ceiling enclosures, or even inside fake lighting fixtures. A few of the larger department stores have even replaced the eye of a mannequin with a camera. What's next?

CCTV cameras today are used for traffic control, various manufacturing processes, in nuclear power plants, and even in the medical field for such things as microscopic observation and orthoscopic surgery. The different uses for CCTV cameras are virtually endless. However, with so many new CCTV related products on the market today, it seems the end users' choices are not only confusing, but also endless.

Remember the good old days, when a camera using a pickup tube was your only choice, especially if you wanted good resolution and high sensitivity? How about those early solid-state chip cameras with their poor resolution? You know the ones I'm talking about. In order to receive a usable picture, flood lights were required! To add salt to the wound the camera manufacturer charged several thousand dollars for the privilege to own one of these solid-state beauties. Well, those days are ancient history. The solid-state chip camera has come of age.

If you examine a pickup tube camera's specification, you will find it offers higher resolution, increased sensitivity, and is priced considerably less, in most cases, than that of a solid state chip camera. However, a specification sheet doesn't tell you everything. First of all the pickup tube camera does offer anywhere from 450 to 800 horizontal lines of resolution at center. The key words here are "at center." Since a pickup tube is not linear in its operation, due to its design, the farther you go from the center of the tube the less resolution there is, and geometric distortion increases. In simple terms, the quality of the picture gets worse. With a chip, which is linear, you may have less resolution, but in most cases, the picture being produced actually looks as good if not better than that of the pickup tube.

BY AARON CHESLER

Aaron Chesler is systems sales manager, Closed Circuit Video Equipment Division, Panasonic Industrial Co. He has written articles for several security publications, including CCTV.

THE CHIP CAMERA

I bet you're now thinking, "well, so what, who cares about resolution, give me that good old pickup tube sensitivity anytime." Yes, it is true that a solid-state pickup device, by itself, currently cannot match the high-end Newvicon tube cameras in a sensitivity contest. However, many chip cameras are available today which will give you a usable picture in the 0.1 to .06 footcandle range. Not bad! Those light levels cover a lot of CCTV system applications. There are even some manufacturers that combine an intensifier with the solid-state pickup device, in order to achieve the extreme sensitivity required to match lunar and stellar cameras.

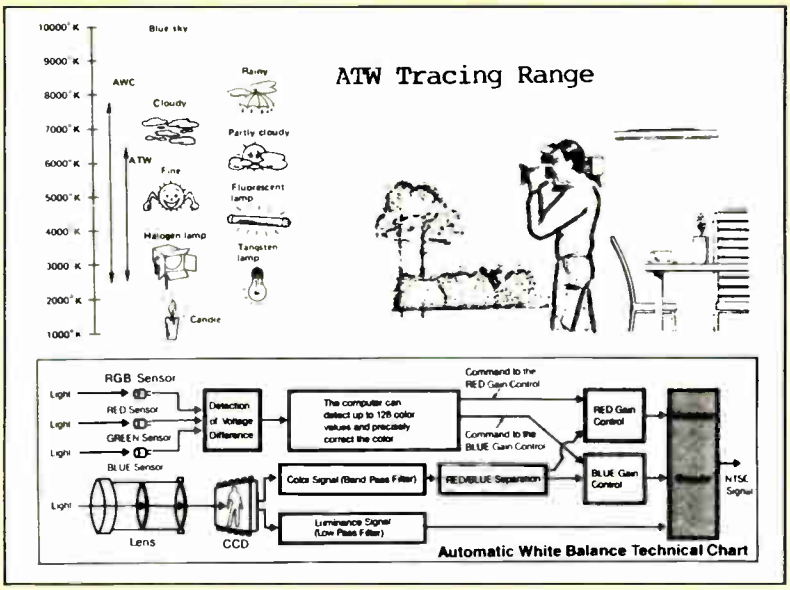
Most chip cameras today are priced in the same range as a premium tube camera, or from approximately $600 to $1,200 retail. Many people believe they are still priced too high to even consider their use in most well-lit indoor surveillance applications, where an inexpensive Vidicon or general purpose Newvicon will do the trick. But, how often does the tube in a conventional camera have to be replaced? Well, that depends on its environment, but it could be as much as once a year or once every several years. Just look at the tube warrantees offered by most camera manufacturers. Most are good for only 90 days. Some solid-state chip camera manufacturers are now offering a five year warranty on the chip. If a five-year warranty is offered, then the manufacturer surely feels that this is a very conservative figure. All right, maybe that is not important to the CCTV system installer. Every time a new tube goes in,

additional profits can be made. Well, that's not really the case, unless the installer has figured periodic service calls for camera adjustment into the original system price. A camera with a pickup tube will require periodic "fine tuning" in order to maintain optimum performance. Remember, a chip camera virtually never needs adjustment after the CCTV system is up and running. Don't forget that the tube camera currently can offer a wider camera selection, and in most cases, a lower cost to the end user. In today's business atmosphere the basic CCTV system's bottom line cost may far outweigh any long term benefits that chip cameras offer. However, I strongly believe the chip camera will be the camera of choice within only a few years.

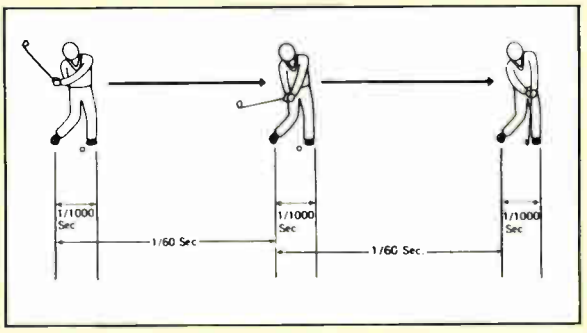
I mentioned that the tube camera still offers the end user a wider selection to choose from. One example is the model WV-1850 CCTV camera offered by Panasonic. The WV-1850 utilizes an Extended Red Newvicon pickup tube. It offers the customer exceptionally high resolution, 800 lines at center, low light sensitivity, .01 footcandle in the visible light range, and is sensitive to invisible light in the near infrared spectrum. A camera such as this, when used in conjunction with an infrared illuminator, can actually rival the performance of the more costly stellar type cameras, at approximately one third the cost. Even though the human eye cannot detect the invisible infrared light, the camera can, turning a seemingly unusable scene into a usable picture. Don't forget, the Extended Red Newvicon tube even offers 800 line resolution as compared to a stellar camera's 500 to 600 line specification. What technology offers is high performance at a lower cost.

COLOR CCTVs

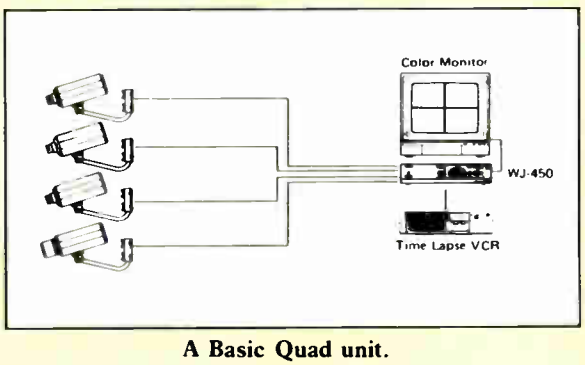
Another movement has started in the CCTV industry towards the use of color cameras in surveillance applications. Several years ago if a manufacturer had more than one color CCTV camera in their product line, it was considered a waste. Color cameras, back then, were only good for studio applications, or perhaps some manufacturing process. They offered poor resolution, were high priced, and had to be manually white balanced for proper color rendition. The new breed of color cameras, thanks to the advances made with solid-state technology, provide high resolution at a relatively low cost. Something called Auto Tracing White (ATW) Balance has virtually replaced the constant need for manually white balancing the color camera. This circuitry, originally incorporated into an externally mounted sensor located on the body of the camera, informs the camera when to adjust for the changes in color temperature of the light source. As new as this method is, some manufacturers have already found a way to incorporate the ATW circuitry entirely inside the camera with color temperature sensing accomplished directly through the camera lens. This method is commonly known as "Through-The-Lens," or TTL. With the older type external ATW sensor, certain application problems could arise. For instance, if the color camera was mounted on a microscope, the sensor would be blocked from viewing the same scene as the camera. A similar problem came up many times when mounting the camera inside an environmental enclosure or when using a large diameter zoom lens, which could block the sensor's view. With TTL the color camera has officially arrived. Perhaps the color CCTV camera will be the most popular format in five years or less.



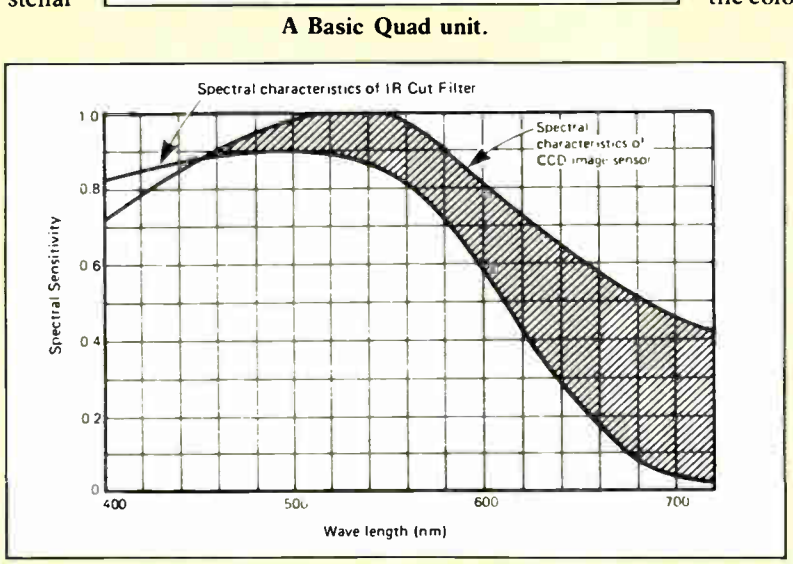
An ATW system.



The strobe effect shutter.



A Basic Quad unit.



CCD pick-up sensor's sensitivity to IR.

THE QUAD SYSTEM

Several years ago, you could walk into any major company's security

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TOA

control center and see a guard attempting to simultaneously view dozens of monitors. An alternate method was to provide fewer monitors with groups of cameras being switched, one by one, in sequence. Of course that meant that the guard viewing the sequencing cameras had to wait a relatively long time for all the cameras to complete one single viewing period. This allowed some of the cameras to be off line for a period of time. A crime could have been committed without ever being viewed!

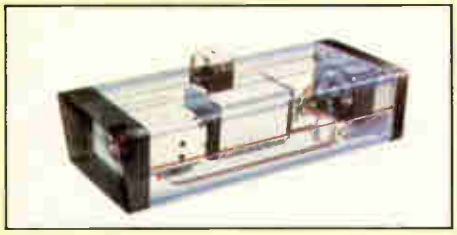
Present technology now offers us the ability to place the scenes, being transmitted from four separate cameras, onto a single monitor. This is accomplished by a device called a "Quad System." The quad system can alleviate some of the problems caused by the video switcher. Of course, quad systems are not exactly new items. They have been around for several years. However, many of the older units only allowed for the use of expensive, specially modified cameras. In some cases, additional wiring was required to each camera for synchronization. We also must not forget the price. It could be summed in only one word, "high."

Today's quad control units, through digital circuitry, allow the customer to use almost any camera available on the market without additional wiring for camera synchronization. The Closed Circuit Video Equipment Division of Panasonic even offers a color quad system, where all color of a mix of color and black and white cameras can be employed. Today, most of the quad systems, including Panasonic's color quad, range in price from approximately $995 to $2,500 suggested retail.

HIGH SPEED CAMERAS

A major problem for the CCTV camera has always been its inability to reproduce high-speed action with clarity. For example, a man's face as he was running, a license plate on a speeding car, or perhaps deciphering series of identification numbers on the side of a boxcar as it sped by.

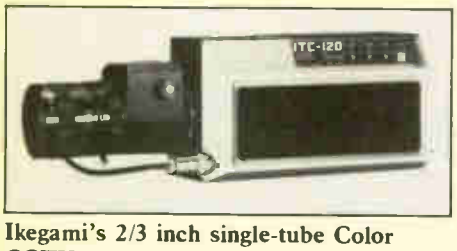
With the introduction of the solid-state chip, manufacturers have created cameras with a timed electrical output. This enables an external strobe light to turn on and off in sync, with the solid-state chip's scanning rate. This system allows high-speed objects to be "frozen" for viewing purposes. However, such a method can only be used in a controlled environment, such as in factory automation systems and other similar applications.



Javelin's Electronic's rendering of the Chromachip CCTV Camera Housing.

RCA/BURLE'S Solid State 2/3 inch Color CCD Camera.

VCS' Series 4500 Solid State Black & White Camera.

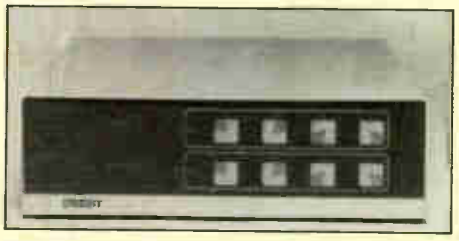


Ikegami's 2/3 inch single-tube Color CCTV camera.

Vicon's 2/3 inch Color CCD Camera.

TOA's 1100 Black & White indoor/outdoor CCD Camera and a 2090 Black & White Monitor.

Panasonic Industrial's WJ450 Digital Quad System.



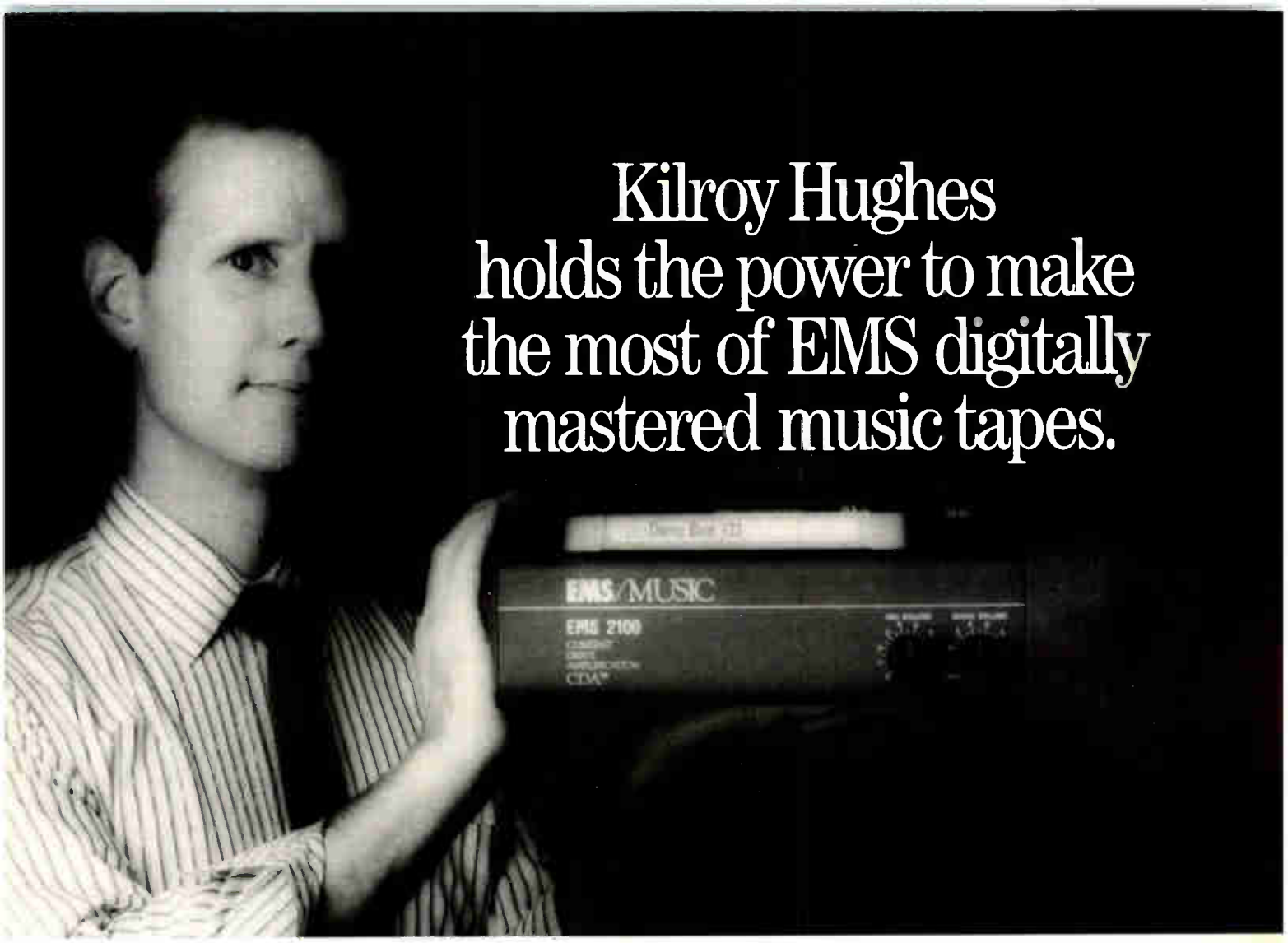
Crest's QCS 1400 Quad Module Digital Video Compressor.

JVC's Solid State TK-S210U Black & White CCV Camera.

Philips CCTV Division's Series 40 outdoor Black & White CCTV Camera.

Elbex's EX500 indoor Black & White CCD Camera.

Kilroy Hughes holds the power to make the most of EMS digitally mastered music tapes.



EMS president, Kilroy Hughes, is the creative force behind Current Drive Amplification (CDA™*), a combination amp and preamp that's *built into* EMS tape players.

This man has single-handedly eliminated the need for separate, high powered amps and transformers to achieve high fidelity in commercial sound systems.

EMS players have a built-in amp and preamp. It's called Current Drive Amplification (CDA™). And it's knocking the sound industry for a continuous loop.

CDA™ does mind-boggling things to a speaker's dynamic range. Boosting both ceiling mounted or bookshelf speakers to crisp highs and gutsy lows. With incredible sound clarity only EMS digitally mastered music tapes can deliver.

What's more, the tape player above has built-in paging, and can drive over 500** speakers.

Call EMS today. And give your customers *better* sound from *fewer* components. Saving them 30% over competitive systems—while you take advantage of the highest gross profit margins in the industry.

Only the wizardry of CDA™ amps and tape players take full advantage of EMS digitally mastered music tapes.

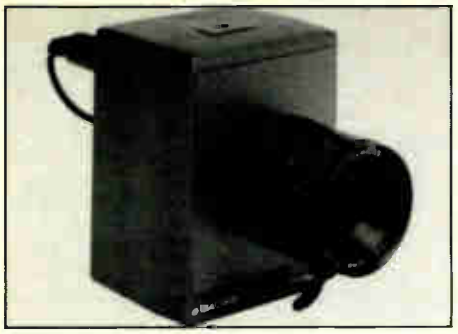
COMPLETE
FOREGROUND MUSIC SYSTEMS

EMS/MUSIC

2264 15th Avenue West, Seattle, WA 98119 (206) 281-8686

* Patent Applied For
** 500, 25 volt ceiling speakers at 1 watt tap, SPL 87 dB at 4 ft.

Circle 217 on Reader Response Card



Sanyo's VDC3800 Solid State Black & White CCV Camera.

GYYR's TLC1400 Timelapse Video Recorder.

Sony Security Systems' EVT-801 WatchCorder™ Timelapse Video Recorder.

To enable the camera to reproduce high-speed events without the use of an external strobe light, and under virtually any environmental condition, a new camera has been developed. The method which it employs is called the "strobe effect shutter," or SES. As the name implies, a shutter system is used to duplicate the same effect as that of the strobe light. The strobe effect shutter is not a mechanical device, but an electronic one. It turns the camera's solid-state chip on and off at a very high rate of speed, allowing blur-free viewing of high-speed objects. Some applications for such a camera include sports training and evaluation, scientific, vehicle identification, and even high security surveillance applications, such as in banks, for positive identification.

Another product which has been continuously improved over the years is the time lapse video cassette recorder. The modern time lapse recorder can replace the need for 24 hour, seven days a week surveillance by a security guard. Whatever the camera sees the VCR can record. There are so many units available on the market today, where and how does one begin the selection process. Actually it's a lot easier then you might think. First of all, the time lapse VCR must be constructed in such a way as to stand up to continuous useage. In many cases continuous useage means 365 days a year. Remember, if your VCR is not operating due to failure, then a good portion of your surveillance system can be considered non-operational. A quality made time lapse recorder should have a die cast chassis. This provides a stable platform for optimum tape-guide positioning. Secondly, it should have a direct-drive capstan which offers precise head-to-tape alignment, thus eliminating belts and pulleys which may stretch or deteriorate. A time lapse VCR should also be designed from the ground up as a time-lapse VCR, not a modified home unit. Another important feature to look for is a four-head video system for noise-free record and playback, and of course, the unit should have the features you require for your application. Don't base your purchase solely on the total amount of hours the time lapse VCR is capable of recording at. Some machines on the market today can record up to 999 hours of information on a standard T120 VHS tape. However, shorter time lapse recording modes provide better quality pictures, and more importantly, more information on tape.

(continued on page 66)

THE PANASONIC CCTV LINE...

A strong foundation you can build in.

Whether you're a small retail business or a large manufacturing facility—no matter if you're looking for one piece of equipment or a complete system—Panasonic has you covered. With a full line of CCTV equipment to suit a host of different applications.

Like our wide array of B/W and color cameras and monitors—including one of the largest selections of tube and solid-state cameras. There's also a choice of Time-Lapse VCRs and B/W and color Quad Systems and pre-packaged, ready-to-install Mini-Systems. Plus all the Pan/Tilts, housings, switchers and accessories necessary to complement our full line.

And of course, every piece of CCTV equipment features the same Panasonic quality and reliability you've come to expect. Not to mention the support of a strong dealer network throughout the country. With the technical expertise to help you select and design a CCTV system to meet your particular specifications—regardless of how simple or complex.

What's more, all Panasonic equipment is backed by a nationwide service network. And each authorized service center is trained and fully equipped to handle the repair and maintenance of every CCTV product we sell.

So when it comes to CCTV equipment, take a look at the Panasonic line—a foundation strong enough to support the growth of your needs.

For more information, contact your nearest Panasonic Industrial Company Closed Circuit Video Equipment dealer or call your nearest regional office.
Northeast: (201) 348-7303, Midwest: (312) 981-4826,
Southeast: (404) 925-6835, Southwest: (214) 257-0763,
West: (714) 895-7265.

Panasonic
Closed Circuit Video Equipment

Circle 216 on Reader Response Card

LOUDSPEAKERS

Loudspeaker specification is about one of the hardest things to qualify due to subjective factors. Also, standards are not agreed upon across the board—while some do exist. With so many types of loudspeakers on the market, it becomes difficult to select the right one for the job at hand.

Sound & Communications magazine reviewed the many available types and came up with six categories. The first two, **Background/Foreground** and **Integrated & Portable Systems**, are included here. Loudspeaker components and paging horns will be covered in an up-coming ***Contractor's Guide To Loudspeakers.***

This guide is not intended to be an all inclusive or decisive source. It is, however, intended to be used as a *guide* in selecting an appropriate group from which a final decision can be made. Also, for your convenience, an alphabetical listing of companies, addresses and phone numbers are located on page 40 of the pull-out section. After using this guide, the manufacturers' specification sheets should be reviewed, and if appropriate should be tested and/or auditioned.

Every attempt was made to make this guide as complete and accurate as possible. However, the editors cannot be held responsible for any errors and/or omissions in the listings.

BACKGROUND/FOREGROUND

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
ALTEC LANSING CORP.										
9813B	Surface	Freestanding	25½" x 15½" x 13½"	8Ω	92	40 w	100 x 40	60-20 k	37	$576.00
310	Surface	Freestanding	23" x 14½" x 12¼"	4-8Ω	92	25 w	120 x 90	15-20 k	30	252.00
312	Surface	Freestanding	28¼" x 16¼" x 12¼"	4-8Ω	93	32 w	120 x 90	55-20 k	41	340.00
9872-8A	Surface	Tee-nuts for hanging	23" x 17¾" x 9"	8Ω	99.5	150 w	90 x 40	80-20 k	45	696.00
9872-8F	Surface	Tee-nuts for hanging	23" x 17¾" x 9"	8Ω	99.5	150 w	90 x 40	80-20 k	45	716.00
9812-8A	Surface	Tee-nuts for hanging	33" x 26½" x 17½"	8Ω	100	200 w	90 x 40	60-13 k	94	1700.00
APOGEE SOUND INC.										
AE-1	Surface	Omnimount/yoke	104 x 16 x 8	8	—	50 w	90 x 45	63-19k	19	$350.00
AE-2	Surface	Yoke	10¼ x 32¼ x 10	16	—	150 w	165 x 45	65-19k	40	1025.00
AE-3	Surface	Omnimount/yoke	16⅜" x 12⅜" x 10⅛"	8	—	200 w	85 x 45	70-18k	42	620.00
ATLAS/SOUNDOLIER										
FM42-T70	Free-standing	Optional wall bracket	11" x 8" x 74"	8Ω70v	96	25 w	—	100-10k	10	$134.92
CP802-T70	—	—	8" Lf, 2" Hf	8Ω70v	96	16 w	120	40-25k	3	46.14
D51-8	Flush	Ceiling	8" speaker	8Ω70v	97	25 w	—	30-19k	4.3	41.00
EZFD-70W	Flush	Ceiling	8" speaker	8Ω70v	96	15 w	—	30-15k	4.0	30.11
C5WT-70	—	—	8" speaker	8Ω70v	96	15 w	—	30-18k	2.4	23.03
AUDISAR										
14K100	Rack/Surface	RM Rails Included	5¼" x 17" x 8"	8Ω	87	30 w	—	68-18 k	10	$191.66
AUERNHEIMER LABS AND CO.										
Auditon	Surface	Floor	28" x 16" x 12"	8Ω	99.5	90 w	140	35-18 k	52	$297.00
SC-58	Surface	Wall	46" x 8" x 7"	4Ω	97.5	120 w	120	58-13 k	41	252.00
SC-4	Surface	Wall/Floor	36" x 10" x 10"	8Ω	96.5	65 w	120	55-12 k	36	231.00
Studio III	Surface	Floor	23½" x 12⅜" x 14⅞"	8Ω	92.5	55 w	140	45-18 k	31	183.00
Studio	Surface	Floor	23½" x 12⅜" x 14⅞"	8Ω	95.5	50 w	140	40-18 k	30	161.00
SC-54	Surface	Wall	24½" x 8" x 7"	8Ω	93.5	50 w	120	65-12 k	21	159.00
Monitor	Surface	Floor/Shelf	19½" x 11" x 7¼"	8Ω	99.5	40 w	140	50-16 k	20	124.00
Monitor II	Surface	Floor/Shelf	19½" x 11" x 7¼"	4Ω	99.5	35 w	120	45-15 k	20	106.00
Announcer	Surface	Shelf/Wall	7⅞" Cube	8Ω	86.5	20 w	140	60-15 k	8	59.00
AURATONE CORP.										
5CT	Flush/Surface	Brackets	62" x 62" x 62"	8Ω	90	40 w	60	60-12.5k	5	$99.00/pr
5CTV	Flush/Surface	Brackets	7½" x 7½" x 7½"	6Ω	87	50 w	60	90-25k	7	159.00/pr
RT5V	Rack Mount	Rack Ears	5¼" x 16½" x 8½"	6Ω	88	40 w	60	70-20k	12	135.00/pr
T6	Surface	Brackets	14½" x 9½" x 10"	8Ω	88	80 w	60	60-20k	17	300.00/pr
T66	Surface	Brackets	12" x 18" x 12"½	8Ω	90	100 w	60	55-18k	32	495.00/pr
QC66	Surface	Brackets	13½" x 16½" x 12½"	8Ω	90	100 w	60	50-20k	34	595.00/pr
BES/BERTAGNI ELECTROACOUSTIC SYSTEMS, INC.										
CT-12BHT	Flush	w/hardware	104" x 104" x 3"	8Ω	93	20/40 w	180 MTD 360 free	100-10k	3.5	$80.00

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
CT605	Flush	Plaster ring	23⅜" x 17¾" x 3"	8Ω	89	60/100 w	180	50-10k	5.5	186.00
CT60D	Flush	Plaster ring	23⅜" x 17¾" x 3"	8Ω	92	75/125 w	180	40-19k	8.0	230.00
CT70S	Flush	Drop-in	23⅜" x 23⅜" x 3"	8Ω	89	60/100 w	180	50-10k	7.5	206.00
CT70D	Flush	Drop-in	23⅜" x 23⅜" x 3"	8Ω	92	75/125 w	180	40-19k	10	250.00
	Surface	—	25" x 19" x 4½"	8Ω	92	75/125 w	360 x 360	40-19k	14.5	330.00
BOGEN COMMUNICATIONS, INC.										
SCW80	Sound Column	Wall	52" x 112" x 74"	8Ω	110	80 w	120 x 25	50-16k	48	$469.40
SCW35	Sound Column	Wall	42" x 9½" x 6"	8Ω	105	35 w	120 x 25	70-16k	31	324.90
TBAG2	2-way Ampl./Flush	Ceiling	8"cone,12⅜" x 3½"	600Ω	93	1.5 w	90	—	3	227.15
TBWG2	2-way Ampl./Flush	Ceiling	8"cone, 12⅜" x 3½"	600Ω	93	1.5 w	90	—	3	227.15
TBWB2	2-way Ampl./Surf.	Wall	9½" x 11⅜" x 6⅜"	600Ω	93	1.5 w	90	—	8	214.65
SCW20	Sound Column	Wall	20" x 7½" x 5"	8Ω	100	20 w	90 x 45	80-14k	12	161.00
ASWB1	1-way Ampl./Surf.	Wall	9½" x 11⅜" x 6⅜"	600Ω	92	1 w	90	100-10k	8	74.75
ASWG1	1-way Ampl./Flush	Ceiling	8"cone,12⅜" x 3½"	600Ω	92	1 w	90	100-10k	3	69.00
ASAG1	1-way Ampl./Flush	Ceiling	8"cone, 12⅜" x 3½"	600Ω	92	1 w	90	100-10k	3	69.00
WBS8T725V	Surface	Wall	9½" x 11⅜" x 6⅜"	8Ω	95	7 w	90	50-12k	23	56.25
WBS810T725	Surface	Wall	9½" x 11⅜" x 6⅜"	8Ω	96	15 w	90	70-15k	23	48.75
WBS8T725	Surface	Wall	9½" x 11⅜" x 6⅜"	8Ω	95	7 w	90	50-12k	22	45.15
S86T725PG8WV	Flush	Ceiling	8"cone,13½" x 3½"	8Ω	95	7 w	90	50-12k	23	37.90
S86T725PG8V	Flush	Ceiling	8"cone,13½" x 3½"	8Ω	95	7 w	90	50-12k	23	27.15
BOSE CORP.										
102	Flush	—	11¾" x 3¾"	—	95	25 w	150	80-18k	5	$120.00
102	Surface	—	5⅝" x 8¾" x 6"		95	25 w	150	80-18k	5	153.00
BOSTON ACOUSTICS										
360	—	—	12" x 8⅝" x 3¼"	8Ω	90	60 w	—	48-20 k	3.5	$350.00
350	—	—	9½" x 6¾" x 2⅝"	4Ω	90	50 w	—	58-20 k	2.5	300.00
705 White	—	—	5⅞" x 5⅞" x 1¾"	4Ω	87	40 w	—	58-17 w	1.5	90.00
BOZAK, INC.										
CM-6000	surface	floor	41 x 15 x 12	8Ω	94	250	120	30-21k	80	$699.00
CM-4500	surface	wall-floor	26 x 15 x 10	8Ω	94	100	120	35-21k	48	349.00
CM-200ZM	surface	free-bracket	20 x 11 x 18	8Ω	91	150	120	40-18k	30	269.00
CM-109-6	outdoor surface	free-wall	18 x 18 x 12	8 Ω	89	75	90	50-10k	20	229.00
CM-2000	surface	free-wall	20 x 11 x 18	8Ω	92	75	120	45-21k	20	129.00
CERWIN-VEGA										
CM-12	Surface	—	23" x 14" x 14"	8Ω	96	150 w	—	32-20k	44	$350.00
CM-10	Surface	—	24" x 14" x 10"	8Ω	94	125 w	—	30-20k	34	200.00
CM-8	Surface	—	20" x 11" x 10"	8Ω	92	100	—	30-20k	49	150.00
CETEC GAUSS										
3588	co-ax	—	15"	8Ω	96	400 w	40 x 40	40-18 k	25	$900.00
3288	co-ax	—	12"	8Ω	91	400 w	40 x 40	40-18 k	24	840.00
3285	co-ax	—	12"	8Ω	99	400 w	40 x 40	70-15 k	24	840.00

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
CLARITY										
S-500	Flush	Ceiling	8"	25 /70 v	92	5 w	90	65-17 k	3.75	—
S-501	Flush	Ceiling	4"	25/70 v	93	5 w	90	80-12 k	3.5	—
S-505	Surface	Wall	8"	25/70 v	98	5 w	—	65-17 k	4.75	—
S-506	Surface	Corner	8"	25/70 v	98	5 w	—	65-17 k	4.75	—
S-508	Column	—	(4) 4"	8Ω	103	20 w	—	65-17 k	16	—
S-509	Column	—	(4) 8"	16Ω	107	50 w	—	65-17 k	25	—
EDEN ELECTRONICS, INC.										
CP-8D	Panel	Ceiling Grid	23¾" x 23¾" x 6⅝"	8Ω	96	75 w	120 x 40 or x 120	50-20 k	21	$
CP-8C	Panel	Ceiling Grid	23¾" x 23¾" x 6⅝"	8Ω	98	25 w	60	80-15 k	17	
CI-12T	Shelf	—	22" x 16" x 15¼"	8Ω	100	150 w	90 x 40	65-15 k	42	
CI-152	Shelf	—	21" x 28" x 15¼"	8Ω	100	150 w	75 x 35	60-20 k	54	
ENVIRONMENTAL SOUND										
ES-2802	Flush	Multiple ceiling/wall	13" x 23.75"	8Ω	94	200 w	—	28-24k	30	—
Pro Drop CMI	Surface	Multiple	11" x 12" x 23.75"	8Ω	96	125 w	120 x 100	32-24k	32	—
ES-1002	Flush	Multiple	16" x 16"	8Ω	92	150 w	—	30-24k	20	—
ES-802	Flush	Multiple	13.5" x 13.5"	8Ω	90	125 w	—	32-20k	15	—
ES-602	Flush	Multiple	12" x 12"	8Ω	89	80 w	—	38-20k	9	—
ES-502	Flush	Multiple	7" x 10.5"	8Ω	89	50	—	40-20k	5	—
FOURJAY INDUSTRIES, INC.										
S-IC8CG	Surface	Hanging	14" x 10"	8Ω	96	10 w	120	50-12 k	6	$51.50
S-HF8CG	Surface	Bracket	14" x 10"	8Ω	96	10 w	120	50-12 k	8	65.90
S-FW8MS	Surface	Wall	9.69" x 11.19"	8Ω	96	10 w	120	50-12 k	4	33.40
FRAZIER										
CAT10	Surface	Bracket	11½" x 72" x 5¾"	8Ω	90	25 w	—	90-14 k	6.5	$92.00
CAT30	Surface	Bracket	11½" x 11½" x 11½"	8Ω	94	30 w	—	70-17 k	19	157.00
CAT35	Surface	Bracket	17¾" x 11½" x 8¾"	8Ω	94	30 w	—	70-17 k	19	157.00
CAT40	Surface	Bracket	17⅝" x 17⅝" x 8½"	8Ω	93	85 w	90 x 90	65-17 k	33	330.00
CAT60	Surface	Bracket	28¼" x 17⅝" x 14"	8Ω	93	150 w	—	40-100	62	N/A
Sub-woofer	Surface	Bracket	25¼" x 25½" x 16⅝"	8Ω	96	250 w	90 x 40	40-15 k	125	—
HARRIS CORPORATION, DRACON DIVISION										
PTEC 701	Surface	Push-N-Loc	8"	70 v	88	4 w	160	200/10 k	1.25	—
702	Surface	Push-N-Loc	8"	70 v	88	4 w	160	200/10 k	1.25	—
745	Surface	Push-N-Loc	8"	45Ω	88	1 w	160	200/10 k	.75	—
501	Surface	—	—	Piezo	88	15 w	160	450/10 k	.5	—
502	Surface	—	—	Piezo	88	15 w	160	450/10 k	.5	—
22016-163	Flush	12" mount recessed	8" cone	70 v	93	2.5 w	140	70/15 k	3.5	—
22016-130	Flush	12" square recessed	8" cone	70 v	93	2.5 v	140	70/15 k	3.5	—
JBL PROFESSIONAL										
8330	Surface	Omnimount	19½" x 19" x 10½"	8Ω	91	100 w	90	40-20 k	—	$—
8325A	Surface	—	26" x 15¾" x 9¼"	8Ω	91	80 w	120 x 100	40-20 k	37.5	180.00

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
8216AT	Surface	—	15" x 10" 9"	8Ω	89	60 w	120 x 100	40-20 k	19	99.00
SLT-1	Surface	Bracket included	10" x 6" x 5"	8Ω	87	50 w	90	100-18 k	13.5	159.00
Control 1	Surface	Bracket available	19" x 6" x 6"	4Ω	90	150 w	100 x 100	120-20 k	4	90.00
Control 5	Surface	Bracket available	15" x 10" x 9"	4Ω	92	175 w	—	75-20 k	10	—
LEN FINKLER COMPANY										
MBRC-70T	Flush	4-8" Centers	12¾" Dia Baffle	8Ω	95	17 w	120	150-12k	2.38	$14.95
MARTIN AMERICA										
CX2	Surface	U-Bracket	22" x 17" x 17"	8Ω	99	300 w	90 x 40	50-20 k	52	—
BX2	Surface	—	21" x 32" x 19"	8Ω	97	600 w	—	35-120	88	—
MG ELECTRONICS										
SB-20	Surface	Bracket	8⅜" x 5½" x 5"	8Ω	90	50 w	—	50-20 k	7	—
SB-2070/25	Surface	Bracket	8⅜" x 5½" x 5"	25/70 v	93	50 w	—	50-20 k	8	—
HS-8T	Surface	Swivel Bracket	8" x 8" x 11¼"	25/70 v	116	40 w	—	450-8 k	6	—
HS-12T	Surface	Swivel Bracket	11" x 6½"	25/70 v	120	40 w	—	450-8 k	7	—
HS-12SBP	Surface	Swivel Bracket	11" x 6½"	8Ω	108	60 w	—	400-13 k	5	—
SC20W	Surface	Bracket Type	20" x 5" x 7½"	8Ω	100	20 w	—	80-14 k	11	—
SC40W	Surface	Bracket Type	20" x 5" x 7½"	8Ω	110	40 w	—	70-16 k	12	—
810CX	Flush/Co-ax	Ceiling	8" Round	8Ω	88	20 w	—	50-18 k	2.5	—
820CX	Flush/8" Co-ax	Ceiling	8" Round	8Ω	88	35 w	—	50-20 k	3.5	—
PS-100	Surface/Patio	Bracket	7" x 7" x 10"	8/16Ω	92	25 w	—	100-15 k	—	—
PS-100T	Surface/Patio	Bracket	7" x 7" x 10"	70 v	102	25 w	—	100-15 k	—	—
MISCO/MINNEAPOLIS SPEAKER CO.										
JC80WP-8WB	Flush	Screws/13" Baffle	8" Waterproof Co-ax	8Ω	93	30 w	120	50-18 k	3	$33.29
JC80F-8WB	Flush	Screws/13" Baffle	8" Co-ax	8Ω	94	30 w	120	35-18 k	3	31.87
JC80F-8WB	Flush	Screws/13" Baffle	8" Co-ax	8Ω	97	30 w	120	45-18 k	3	30.43
JC8WP-8WB	Flush	Screws/13" Baffle	8" Waterproof	8Ω	94	30 w	90	50-8 k	3	33.25
JC8FD-8WB	Flush	Screws/13" Baffle	8" Hi-Compliance	8Ω	94	30 w	90	35-14 k	3	19.68
JC8PA-8WB	Flush	Screws/13" Baffle	8"	8Ω	97	30 w	90	40-14 k	3	18.04
FC8PA-8WB	Flush	Screws/13" Baffle	8"	8Ω	95	24 w	90	55-13 k	2.75	16.48
MOTOROLA, INC./CERAMIC PRODUCTS										
KSN1103A	Surface	Co-ax	3.75" x .608"	28[1]	82	50 w	—	500-20 k	1.2 oz.	$12.75
KSN1090A	Surface	Co-ax	3.75" x .608"	28Ω[1]	82	50 w	—	500-20 k	1.2 oz.	10.61 at 1K
[1] @ 5 kHz										
MTX LOUDSPEAKERS - THE MITEK GROUP										
89C8W	Flush	3 inch	8"	8Ω	91	15w	—	65-17k	—	$19.95
8KU492	Flush	3.06 inch	8"	8Ω	93	30 w	—	50-20k	—	49.95
FO810C	Flush	3.06 inch	8"	8Ω	92	15 w	—	60-18k	—	29.95
129C8W	Flush	4.25 inch	12"	8Ω	92	15 w	—	58-16k	—	29.95
OREVOX CORP.										
SW620PP	Flush	—	6"	8Ω	91	60 w	—	50-8 k	2.6	—
SW820PP	Flush	—	8"	8Ω	92	60 w	—	45-8 k	3	—
SW830PP	Flush	—	8"	8Ω	94	100 w	—	35-7 k	4.9	—

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
SW1030PP	Flush	—	10"	8Ω	94	100 w	—	25-7 k	6	—
SW1040PP	Flush	—	10"	4Ω	93	150 w	—	25-7 k	6.6	—
SW1240PP	Flush	—	12"	8Ω	93	150 w	—	25-500 k	8	—
OWI										
2300-FX	Flush	Ceiling/Wall	9" x 9"	4Ω	85	60 w	360	50-20 k	3	$125.00
OWI-702	Surface	Bracket	7" x 4" x 4"	8Ω	92	15 w	360	90-20 k	6	100.00
OWI-703	Surface	Bracket	7" x 4" x 4"	8Ω	92	15 w	360	90-22 k	6	110.00
BAW-50	Surface	Bracket	7" x 4" x 4"	8Ω	92	50 w	360	90-20 k	4.5	75.00
BAW-103	Surface	Bracket	7" x 4" x 4"	8Ω	92	100 w	360	90-22 k	5	85.00
PASO SOUND PRODUCTS										
C90	Surface	Bracket	11¼" x 7" x 4¾"	8Ω	97	20 w	—	100-20 k	6	$130.56
C91T	Surface	Bracket	11¼" x 7" x 4¾"	25/70 v	97	20 w	—	100-20k	6.5	152.00
C1000	Surface	Bracket	17" x 6¼" x 4¼"	16Ω	107	50 w	120 x 40	120-20 k	9	321.00
C51T	Surface	Bracket	8" x 11"	25/70 v	97	20 w	—	120-15 k	8	129.00
C322THP	Surface	Bracket	17" x 6¼" x 4¼"	25/70v	103	50 w	120 x 40	120-20 k	12	279.45
C15T	Flush	Baffle	8"	25/70 v	—	10 w	—	150-16 k	3	35.00
PEAVEY ELECTRONICS CORP.										
115 Oak Int I III	Surface	—	21½" x 29½"x 16¾"	8Ω	100	400 w	90 x 45	50-20k	83	$499.50
CL-1	Surface	Hardware equipped	23¼" x 21½" x 14¾"	4Ω	100	300 w	90 x 45	80-16k	60	399.50
112CriterionII	Surface	—	14½" x 22¼" x 11¼"	8Ω	99	300 w	80 x 45	50-20 k	37	199.50
POLY-PLANAR, INC.										
CP-40-70	Flush	Drop Ceiling	24" x 24"	8Ω	85	25 w	120	40-20 k	1.8	$59.95
P-40	Surface	—	12" x 15"	8Ω	85	20 w	120	40-20 k	1.2	34.95
P-8-70	Flush	—	8" Diameter	8Ω	90	10 w	120	60-18 k	1.5	47.95
G-51	Flush	—	5" x 9"	8Ω	80	20 w	120	60-20 k	.9	34.95
RP8	Surface	—	8" Diameter	8Ω	90	20 w	120	60-18 k	.69	24.95
RP-6	Surface	—	5¼" Diameter	8Ω	85	20 w	120	85-20 k	.5	24.95
PORTLAND INSTRUMENT										
6S3T	n-ground Landscape	4" above/9" below	14" x 14" x 13"	70 v	89	50 w	360	100-18 k	10	$139.00
6S350	n-ground Landscape	4" above/9" below	14" x 14" x 13"	8Ω	89	50 w	360	100-18 k	12	129.00
VDO8.1	Surface	Electrical wall box	10" x 10" x 3.5"	70 v	92	25 w	180	150-7 k	6	47.00
PS10	Potted Sound	Hanging Plant	56" x 13"	8Ω	89	20 w	360	200-6 k	25	119.00
PROFESSIONAL AUDIO SYSTEMS (PAS)										
PI-122P	—	—	—	8Ω	101	200 w	—	60-19 k	55	$760.00
PI-152P	—	—	—	8Ω	101	200 w	—	50-19 k	65	800.00
PI-181	—	—	—	8Ω	99	200 w	—	30-100	83	500.00
2-18BM	—	—	—	4Ω	101	400 w	—	40	150	750.00
1-12MBM	—	—	—	8Ω	103	200 w	—	—	65	440.00
HF30x60CC2	—	—	—	—	—	—	—	—	60	640.00
PROJECTED SOUND, INC.										
8CX10	—	—	8"-Co-ax	8Ω	97	20 w	—	30-20 k	2.75	Contact

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
8C10W	—	—	8"	8Ω	97	15w	—	30-20 k	2.5	Factory
8C5W	—	—	8"	8Ω	96	10w	—	80-15 k	1.5	for
5C10CE	—	—	5"	8Ω	94	12w	—	60-18 k	1.9	Pricing
QUAM-NICHOLS CO.										
8C5BAX	Flush	Ceiling	8"	8Ω	93	8 w	90	65-17 k	2	$27.46
8C10PAX	Flush	Ceiling	8"	8Ω	96	15w	100	60-16 k	3	29.62
8C10FEPAX	Flush	Ceiling	8"	8Ω	92	18w	130	30-20 k	3	37.83
8C10C0	Flush	Ceiling	8"	8Ω	97	20 w	140	40-30 k	3	53.27
FM4x2/70	Surface	Wall	7.2" x 4.5" x 4.2"	70 v	95	10w	—	70-20 k	5	77.00
FM6/70	Surface	Wall	9" x 6.5" x 5"	70 v	95	20 w	—	60-15 k	7	154.16
RED ACOUSTICS (USA) LTD.										
R300P	Surface	U-Brackets	13¼" x 19¼" x 8¾"	6Ω	86	300 w	—	10-18 k	40	$860.00
R150P	Surface	U-Brackets	13¼" x 19¼" x 8¾"	6Ω	86	150 w	—	50-18 k	20	460.00
RING GROUP OF NORTH AMERICA, INC.										
8905T/25	Flush	E.I.A.4 Hole	8" x 2.5"	25 v	—	15w	—	50-16 k	—	—
8910/T/70V	Flush	E.I.A.4 Hole	8" x 3"	70 v	—	15w	—	40-17.5 k	—	—
810CX	Flush	E.I.A.4 Hole	8" Hi-Compliance	8Ω	—	20 w	—	50-18 k	—	—
820CX	Flush	E.I.A.4 Hole	8" Hi-Compliance	8Ω	—	35 w	—	50-20 k	—	—
5110T	Flush	E.I.A.4 Hole	4½"	8Ω	—	15w	—	60-17.5 k	—	—
ROSS SYSTEMS-DIVISION OF INTERNATIONAL MUSIC										
R-28	Surface	Wall Brkt, Mic Stand	17½" x 12¼" x 9¼"	4/16Ω	94	175 w	71 x 70	70-14 k	16	$199.95
R-24	Surface	Bracket, Mic Stand	12" x 6½" x 5"	4/16Ω	89	130 w	70 x 70	85-14 k	12	99.95
SONIC SYSTEMS INC.										
#110	Flush to ceiling	—	11½" x 15"	8Ω	89	35 w	360 x 270	55-16 k	9	$300.00
#168	Flush to ceiling	—	19" x 20"	8Ω	89	55 w	360 x 270	35-20 k	20	580.00
#2212-1	Flush to ceiling	—	26" x 26"	8Ω	100	200 w	360 x 270	40-20 k	45	1,120.00
#2212-2	One eyebolt	—	32" x 34"	4Ω	105	400 w	360 x 270	35-20 k	70	1,640.00
#2215	Flush to ceiling	—	26½" x 32"	8Ω	105	200 w	360 x 270	35-20k	50	1,200.00
#2715	One eyebolt	—	36" x 38"	4Ω	108	400 w	360 x 270	35-20	75	1,740.00
SOUND DEVELOPMENT INDUSTRIES										
AI-10 SST-8	Masking	Plenum	8"	8Ω	—	15w	120	125-8 k	3	$6.84
CS-12	Flush	Tile	5½" Diameter Grill	8Ω	—	15w	120	125-10 k	3	26.54
CS-12SPR	Flush	Gypsum	5½" Diameter Grill	8Ω	—	25w	120	125-10 k	2.25	24.10
SOUND PRODUCTS/3M										
RMW-CX70	Flush	White metal grille	8"	70 v	91	10w	120	70-20k	3.5	$25.90
RMW-70	Flush	White metal grille	8"	70 v	91	10w	120	70-15k	3.25	19.20
RPW-70	Flush	Plastic grille	8"	70 v	91	10w	120	70-15k	3	19.20
TB-70	Surface	Tilted baffle	8"	70 v	91	10w	120	70-15k	6	29.00
TB-CX70	Surface	Tilted baffle	8"	70 v	91	10w	120	70-15k	6.25	36.50
SL-70	Surface	Slimline baffle	8"	70 v	91	10w	120	70-15k	7.5	35.90
SL-CX70	Surface	Slimline baffle	8"	70 v	91	10w	120	70-20k	3.5	42.50
CN-70	Surface	Corner baffle	8"	70 v	91	10w	90	70-15k	3.25	39.90

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
HW-70	Surface	Hallway baffle	8"	70 v	91	10 w	Bi-direct	70-15k	3	45.90

SOUNDSCAPE SPEAKERS, INC.

ATS-360	Direct Burial	Landscape	11" Dia. x 14"	8Ω	92	15 w RMS	360 x 40	50-15 k	8	$130.00

SPEAKERCRAFT

SC-602	Surface-In-Wall	Wall Anchors	6⅞" x 10"	8Ω [1]	89	50 w	55	50-24 k	2.7	$80.00
SC-603	Surface-In-Wall	Wall Anchors	7½" x 10"	8Ω [1]	89	50 w	55	250-24 k	2.2	70.00
SC-502	Surface-In-Wall	Wall Anchors	5½" x 8¾"	8Ω [1]	87	35 w	55	65-24 k	2.2	70.00
SC-603S	Surface-In-Wall	Wall Anchors	7½" x 10"	8Ω [1]	92	25 w	55	65-24 k	1.6	60.00

[1] All models are also have a 70 volt input

SPECO DIV., COMPONENTS SPECIALTIES, INC.

C-8CF6W	Dual	—	8"	8Ω	—	6 w	360	95-15 k	—	$16.45
C-8CF10W	Dual	—	8"	8Ω	—	15 w	360	85-15 k	—	19.95
G-8CA10W	Dual	—	8"	8Ω	—	15 w	360	50-15 k	—	20.95
G-8CA10C	Dual	—	8"	8Ω	—	15 w	360	50-15 k	—	28.95
G-210CPP	Dual	—	8"	8Ω	—	25 w	360	50-15 k	—	33.95
G -8CA20C	Dual	—	8"	8Ω	—	25 w	360	50-15 k	—	37.95
G-26FT700W	Flush	Ceiling	8"	8Ω	—	10 w	360	45-15 k	—	32.95
G-810FT700W	Flush	Ceiling	8"	8Ω	—	15 w	360	85-15 k	—	35.95
G-810AT700W	Flush	Ceiling	8"	8Ω	—	15 w	360	50-15 k	—	37.95
G-810T700W	Flush	Ceiling	8"	8Ω	—	15 w	360	50-15 k	—	43.95
G-8CA	Dual	—	8"	8Ω	—	40 w	360	45-15 k	—	40.95
WB8-6D	Wall	—	8"	8Ω	—	10 w	360	85-15 k	—	69.95

SPECTRA SONICS

3000	Tri-Amp Monitor	—	5.3 Cubic Feet	—	—	—	—	20-20 k	118	$1300.00
3085	3-Way Tri-Amp	—	11.6 Cubic Feet	—	—	—	—	20-20 k	350	2825.00

TECHNICAL AUDIO DEVICES (TAD)

TSM-1	2-Way Monitor	—	33½" x 43⅜" x 28"	4Ω	98	600 w	—	29-20 k	319	$7000.00
TSM-2	2-Way Monitor	—	31½" x 26" x 24¼"	8Ω	95	300 w	—	29-20 k	205	5750.00

TOA ELECTRONICS, INC.

HS-315	3-Way Reflex	Ceiling Suspension	15"	8Ω	100	360 w	90 x 40	50-20 k	77.2	$
HS-215	2-Way Reflex	Ceiling Suspension	15"	8Ω	100	360 w	90 x 40	50-15 k	59.5	
HS-212	2-Way Reflex	Ceiling Suspension	12"	8Ω	100	360 w	90 x 40	55-15 k	52.9	
HS-15	2-Way CD Horn	Ceiling Suspension	15"	8Ω	98	180 w	90 x 40	60-20 k	35.3	
SM-68	Personal Monitor	Bracket/Stand	2-5" Full Range	8Ω	90	200 w	—	110-16 k	10.6	
SM-75	Personal Monitor	Bracket/Stand	2-5" Full Range	8Ω	90	200 w	—	110-20 k	10.5	
SM-25M	Powered Monitor	Bracket/Stand	5" Full Range	—	88	25 w	—	90-20 k	13.9	
380 SE	Reflex	Bracket/Stand	15"	8Ω	102	360 w	90 x 40	50-20 k	79.2	
480 SE	Reflex	Bracket/Stand	18"	8Ω	102	360 w	90 x 40	45-20 k	99.2	
F-150	Reflex Full Range	Bracket	5"	8Ω	90	120 w	—	60-18 k	6.6	
F-300	3-Way Reflex	Bracket	8"	8Ω	90	150 w	—	50-20 k	15.4	
SM-25A	Powered Monitor	Wall/Stand	5" 2-Way	8 kΩ	88	25 w	—	90-20 k	13.9	
SM-60	Full Range	Bracket	5"	16Ω	90	70 w	—	110-16 k	10.6	
RS-21M	Full Range	Wall/Stand	5"	8Ω	88	100 w	—	100-17 k	2.4	
PC-671 Series	Flush Mount	Ceiling	8" Driver	8Ω	96	15 w	—	30-16 k	3.5	

Model	Type-Flush/Surface	Mounting	Size	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 Meter	Maximum Power	Dispersion	Frequency Range	Weight	List Price
PC-672 Series	Flush Mount	Ceiling	8" Driver	8Ω	96	15w	—	30-16 k	3.5	
22-ME	Studio Monitors	—	5"	8Ω	90	120	—	100-17 k	5.1	
312-ME	Studio Monitors	—	6.3" 2-Way	8Ω	88	75 w	—	60-20 k	11.5	
280-ME	Studio Monitors	—	8" 3-Way	8Ω	—	90 w	—	60-20 k	15.4	
312-ME	Studio Monitors	—	11" 3-Way	8Ω	—	135 w	—	50-20 k	35.7	
UNIVERSITY SOUND										
PI15-3	Surface	—	24¼" x 13¾" x 28"	8Ω	98	100 w	125 x 125	50-16 k	108	$715.00
PI12-2	Surface	—	21" x 11½" x 18¼"	8Ω	97	100 w	125 x 125	75-16 k	66	450.00
Interface III	Surface	—	14¾" x 25¼" x 18¼"	8Ω	92	50 w	125	40-18 k	38	315.00
Interface II	Surface	—	13¾" x 24¼" x 10¾"	8Ω	92	50 w	125	47-18 k	33	273.00
Interface I	Surface	—	11⅜" x 21¼" x 9¾"	8Ω	92	50 w	56-18 k	28	28	210.00
CS810	—	—	8"	8Ω	94	10w	100	80-15 k	3	12.25
CS410	—	—	4"	8Ω	91	10w	120	90-18 k	2.5	11.90
UREI										
809	Surface	—	23" x 16" x 13"	8Ω	93	100 w	90 x 45	50-17.5 k	75	$729.00
811C	Surface	Yes	21" x 26" x 19"	8Ω	97	150 w	90 x 45	70-17.5 k	110	1552.00
813C	Surface	Yes	36" x 31" x 23"	8Ω	101	150 w	90 x 45	50-17.5 k	198	2060.00
815C	Surface	Yes	32" x 14" x 21"	8Ω	103	150 w	90 x 45	40-17.5 k	260	2568.00
VALCOM INC.										
V-1024C	Surface, Built in amp	Corner	8"	600Ω	—	1w	100	60-12 k	6	$36.00
V-1022C	Surface, Built in amp	Wall	8"	600Ω	—	1w	100	60-12 k	6	32.00
V-1010C	Flush, Built in amp	Ceiling	4"	600Ω	—	1w	110	80-12 k	3	29.00
V-1020C	Flush, Built in amp	Ceiling	4"	600Ω	—	1w	100	60-12 k	4	25.00

SOUND & COMMUNICATIONS'

Listing of Background/Foreground and Integrated & Portable Sound Systems Companies

Altec Lansing
Box 26105
Oklahoma City OK 73126
(405) 324 5311

Apogee Sound Inc
1150 Industrial Ave
Suite C&D
Petaluma, CA 94952
(707) 778 8887

Atlas/Soundolier
1859 Intertech Dr
Fenton MO 63026
(314) 349 3110

Audisar
Box 1561
Bellevue WA 98009
(206) 454 2040

Auernheimer Labs & Co
4561 E Florence Ave
Fresno, CA 93725
(209) 442 1048

Auratone Corp
PO Box 698
Coronado, CA 92118
(619) 297 2820

Bag End Loudspeakers
The Mitek Group
1 Mitek Plaza
Winslow, IL 61089
(815) 367 3000

BES/Bertagni Electro acoustic Systems Inc
12753 Moore St
Cerritos, CA 90701
(213) 926 0201

Bogen Communications
PO Box 575
50 Spring St
Ramsey NJ 07446
(201) 934 8500

Bose Corp
The Mountain
Framingham MA 01701
(617) 879 7330

Boston Acoustics
247 Lynnfield St
Peabody MA 01960
(617) 532 2111

Bozak Inc
326 South St
New Britain CT 06051
(203) 225 0555

Calibration Standard Instruments
PO Box 2727
Oakland CA 94602
(415) 531 8725

Celestion Industries Inc
Kunnholm Dr Box 521
Hollision MA 01746
(617) 429-6706

Cerwin Vega
555 E Easy St
Simi Valley, CA 93065
(805) 584 9332

Cetec Gauss
9130 Glen Oaks Blvd
Sun Valley CA 91352
(213) 875 1900

Clarity
1111 Industry Ave
Roanoke VA 24013
800 962 6009

Community Light & Sound
333 E 5th St
Chester PA 19013
(215) 876 3400

Compact Monitor Systems Corp
PO Box 1965
Studio City CA 91604
(818) 763 8000

Eastern Acoustics Works
59 Fountain St
Framingham MA 01701
(617) 620 1478

Eden Electronics Inc
1st St
PO Box 338
Montrose, MN 55363
(612) 675 6350

Electro-Voice Inc
600 Cecil St
Buchanan MI 49107
(616) 695 6831

Emilar
1365 N McCan St
Anaheim CA 92806
(714) 632 8500

Environmental Sound
31220 La Baya Dr Blvd
Suite 110
Westlake Village, CA 91362
(818) 706-0228

Fostex Corp of America
15431 Blackburn Ave
Norwalk, CA 90650
(213) 921 1112

Fourjay Industries Inc
3400 Stop Eight Road
Dayton OH 45414
(513) 890 6444

Frazier A Div of Sound-Craft Systems Inc
Petit Jean Mountain Rt 3
Box 319
Morrilton, AR 72110
(501) 727 5476

Galaxy Audio
625 East Pawnee
Wichita KS 67211
(316) 263 2852

Harris Corp Oracon Division
809 Calle Plano
Camarillo, CA 93010
(805) 987 9511

Intersonics Inc
3453 Commercial Ave
Northbrook IL 60062
(312) 272-1772

J W Davis & Co
3030 Canton St
Dallas, TX 75226
(214) 651-7341

JBL Professional
8500 Balboa Blvd
Northridge, CA 91329
(818) 893-8411

Klark Teknik Electronics Inc
308 Banfi Plaza N
Farmingdale, NY 11735
(516) 249-3660

Klipsch & Associates
PO Box 688
Hope, AK 71801
(501) 777-6751

Len Finkler Co
80 Alexdon Rd
Downsview, Ontario
Canada M3J2B4
(416) 630-9103

MacPherson Loudspeaker Inc
3750 Wood Rd
Lansing, MI 48906
(517) 371-4148

Martin America
PO Box 5139
Chatsworth, CA 91313
(818) 718-1031

McCauley Sound Inc
13608 94th Ave E
Puyallup, WA 98373
(206) 848-0353

Meyer Sound Laboratories Inc
2832 San Pablo Ave
Berkeley, CA 94702
(415) 486-1166

MG Electronics
32 Ranick Rd
Hauppauge, NY 11788
(516) 582-3400

MISCO/Minneapolis Speaker Co
3806 Grand Ave
Minneapolis, MN 55409
(612) 825 1010

Motorola Inc /Ceramic Products
4800 Alameda Blvd NE
Albuquerque, NM 87113
(505) 833-8801

MTX Loudspeakers
The Mitek Group
1 Mitek Plaza
Winslow, IL 61089
(815) 367 3000

DHM
Distributed by
C-T Audio Marketing
3050 SW 14th Pl Suite 3
Boynton Beach FL 33435
(305) 738 0622

Drevox Corp
512 35th St NE
Auburn, WA 98002
(206) 735-0220

DWI Inc
1160 Mahalo Pl
Compton, CA 90220
(213) 638-4732

Panasonic Industrial Company/Ramsa
6550 Katella Ave
Cypress, CA 90630
(714) 895 7272

Paso Sound Products
14 First St
Pelham, NY 10803
(914) 738-4800

Peavey Electronics Corp
PO Box 2898
Meridian, MS 39301
(601) 483-5365

Poly-Planar Inc
50 Graphic Place
Moonachie NJ 07074
(201) 641 2206

Portland Instrument
1101A Air Way
Glendale, CA 91201
(818) 500-0137

Professional Audio Systems (PAS)
1224 West 252nd St
Harbor City, CA 9071D
(213) 534-3570

Projected Sound Inc
469 Avon Ave
Plainfield, IN 46168
(317) 839-4111

Quam-Nichols
234 E Marquette Rd
Chicago, IL 60637
(312) 488-5800

Red Acoustics (USA) LTD
1231 Roth Dr
Lansing, MI 48911
(517) 694-3618

Renkus-Heinz Inc
17191 Armstrong Ave
Irvine, CA 92714
(714) 250 0166

Ring Group of North America
230 Community Dr
Great Neck, NY 11021
(516) 489-0250

Rockustics Inc
41 E Main St
Bayshore, NY 11706
(516) 665 6497

Ross Systems-Division of International Music
PO Box 2344
Ft Worth, TX 76113
(817) 336-5114

Shure Brothers Inc
222 Hartrey Ave
Evanston IL 60202
(312) 866-2200

Sonic Systems Inc
737 Canal St
Bldg 23B
Stamford, CT 06902
(203) 356-1136

Sound Development Industries
428 Ft Denaud Rd
La Belle, FL 33935
(813) 675-0100

Sound Products/3M
3M Center 225 S 10
St Paul, MN 55144
(612) 733-0447

Soundscape Speakers Inc
4405 Vineland Rd
Suite C-8
Orlando, FL 32811
(305) 423-2363

SpeakerCraft
3615 Presley Ave
Riverside, CA 92507
(714) 787-0543

Speco Div, Components Specialties Inc
1172 Rt 109
PO Box 624
Lindenhurst, NY 11757
(516) 957 8700

Spectra Sonics
3750 Airport Rd
Ogden, UT 84405
(801) 392 7531

St Louis Music/ Audio Centron
1400 Ferguson Ave
St Louis MO 63133
(314) 727 4512

Tannoy North America Inc
300 Gage Ave Unit 1
Kitchener Ontario
Canada N2M 2C8
(519) 745 1158

Technical Audio Devices (TAD)
Pioneer Electronics (USA) Inc
2265 E 220th St
Long Beach, CA 9081D
(213) 835-6177

TDA Electronics Inc
480 Carlton Court
South San Francisco CA 94080
(415) 588 2538

Turbosound Inc
611 Broadway #841
New York NY 10012
(212) 460 9940

University Sound
Electro Voice Inc
600 Cecil St
Buchanan MI 49107
(616) 695 6831

UREI
8500 Balboa Blvd
Northridge CA 91329
(818) 893 8411

Valcom Inc
1111 Industry Ave
Roanoke VA 24013
(703) 982-3900

INTEGRATED & PORTABLE SYSTEMS

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance / Axial Sensitivity/ 1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
ALTEC LANSING CORP.												
937	2	12" Cone	—	Horn/driver	3 k	8Ω	99	150 w	70-15 k	110 x 60	24" x 18" x 16⅛"	63.8	$844.00
APOGEE SOUND INC.												
AE-2	4	2-8" cone	—	2-1" horn	5k	16Ω	—	100	65-19k	165 x 40	10¼" x 16" x 8"	40	$1025.00
AE-3	2	10" cone	—	1" horn	5k	8Ω	—	200	70-18k	85 x 40	16⅝" x 12⅜" x 10⅛"	42	620.00
AE-5	2	12" cone	—	1" compress	1k	8/8Ω	—	400	53-17.5k	90 x 45	23¼" x 14 x 16¾"	78	2045.00
AE-6	2	12" cone	—	1" compress	1k	8/8Ω	—	400	52-17.5k	45 x 90	10" x 23¼" x 14¼"	78	2065.00
AE-10	2	2-15" cone	—	—	100	8/8Ω	—	800	38-140	Omni	22⅝" x 32 x 24⅜"	135	1625.00
AE-12	2	2-18" cone	—	compress	100	8/8Ω	—	800	35-140	Omni	30¼" x 45" x 22⅝"	165	1910.00
3 x 3	7	2-18" cone	2"	4-1" horns	1k, 8k	8/8Ω	—	1100	65-19k	70 x 40	45" x 29" x 30"	265	3825.00
BAG END LOUDSPEAKERS												
TA12-A[1]	2	12" cone	—	4 x 6 horn	3.5k	8Ω	103	400 w	70-19k	90 x 40	23" x 18" x 14½"	55	$539.00
TA12-B[2]	2	12" cone	—	4 x 6 horn	3.5k	8Ω	103	400 w	70-19k	90 x 40	23" x 18" x 14½"	55	619.00
TA12-C[3]	2	12" cone	—	4 x 6 horn	3.5k	8Ω	103	400 w	70-19k	90 x 40	23" x 18" x 14½"	55	539.00
TA12-D[4]	2	12" cone	—	4 x 6 horn	3.5k	8Ω	103	400 w	70-19k	90 x 40	23" x 18" x 14½"	55	619.00
TA12JR-C	2	12" cone	—	4 x 6 horn	3.5k	8Ω	101	300 w	70-19k	90 x 40	24" x 14" x 11"	43	439.00
TA12JR-D	2	12" cone	—	4 x 6 horn	3.5k	8Ω	101	300 w	70-19k	90 x 40	24" x 14"x 11"	43	439.00
AF1-M1[5]	3	18" cone	12" cone	4 x 6" horn	125-3.5 k	4Ω	103	1200 w	40-19k	90 x 40	42" x 22" x 18"	140	1280.00
AF1-M2[6]	3	18" cone	12" cone	4 x 6 horn	125-3.5k	4Ω	103	1200 w	40-19k	90 x 40	42" x 22" x 18"	140	1050.00
[1] Floor wedge monitor, Black textured finish													
[2] Floor wedge monitor, 13 Ply birch, hand oiled finish													
[3] Rectangular Cabinet, Black textured finish													
[4] Rectangular Cabinet, 13 ply birch, hand oiled finish													
[5] Black Birch Road with wheels and cover													
[6] Basic Black Poplar with two handles and protective covers													
BES/BERTAGNI ELECTROACOUSTIC SYSTEMS, INC.												
RB-301	4	—	—	—	500/5k	8Ω	93	75 w	35-20k	360 x 360	49" x 22" x 6.5"	55	$1000.00
4000	8	—	—	—	800	8Ω	96	300w	45-19k	360 x 360	73" x 36.5" x 3"	45	1000.00
BOSE CORP.												
802 Series	2	w/electron.	—	—	—	—	8Ω	92	240 w	50-16k	120 x 100	13½" x 13" x 20½"	31	$826.00
402	2	w/electron.	—	—	—	—	8Ω	93	120 w	90-16k	120 x 60	23¼" x 7¼" x 8¼"	15	508.00
Acoustic Wave®[1]	1	wave-guide	—	—	125		8Ω	90	150 w	25-125	Omni	150" x 10.5"	55	1400.00
[1] Used with dedicated controller														
CALIBRATION STANDARD INSTRUMENTS														
MDM-TA3	4	2-6½"	3½"	¾" Dome	1.8k, 7k	8Ω	91	160 w	45-20 k	120	16" x 19" x 11¾"	35	$745.00
MDM-TA2	2	6½"	—	¾" Dome	2500	8Ω	87	160 w	60-20 k	120	16" x 11¾" x 9¼"	20	595.00
MDM-4	3	2-6½"	—	1-3½"	1500	8Ω	89	160 w	60-17 k	90	13" x 19" x 9¾"	25	545.00
CELESTION INDUSTRIES, INC.														
SR Systems	3	SR-2	SR-1		150[1]	8Ω	96	1000 w	40-20 k	140 x 70	11.8" x 21.7" x 18.1"	42	$900.00

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/ 1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
[1] SR-1 also used alone in full-range mode (50-20 k) SR-1/SR-2 uses SRC1 Controller		2-18"	2-8"										

CERWIN-VEGA

L-36	1	horn, 18"	—	—	—	8Ω	104	400 w	32-300	Omni	36" x 24" x 36"	188	$850.00
SW-18	1	vented, 18"	—	—	—	8Ω	98	500 w	28-500	Omni	36" x 24" x 24""	156	700.00
B-36A	1	horn, 18"	—	—	—	8Ω	103	300 w	40-400	Omni	36" x 24" x 24"	123	700.00
BG-215	2	vented, 2-15"	—	—	—	8Ω	100	300 w	40-4k	60 x 30	43" x 27" x 20"	88	600.00
B-119	1	vented, 18"	—	—	—	8Ω	101	300 w	40-2k	60 x 60	36" x 24" x 16"	93	500.00
V-43	3	horn, 18"	2" horn	horn/twt	300, 3k	8Ω	108	400 w	40-16k	100 x 60	48" x 24" x 25"	188	1,300.00
V-35C	3	vented, 18"	1" horn	horn/twt	1.2, 7k	8Ω	105	300 w	50-16k	90 x 40	36" x 24" x 20"	125	1,000.00
PD-18B	3	vented, 18"	12" cone	horn/twt	300, 3k	8Ω	100	300 w	30-16k	100 x 70	43" x 27" x 20"	125	750.00
V-37C	2	vented, 18"	—	1" horn	1.2k	8Ω	103	300 w	40-15k	90 x 40	36" x 24" x 16"	107	700.00
V-31C	2	vented, 15"	—	1" horn	1.2k	8Ω	105	150w	50-15k	90 x 40	32" x 24" x 18"	100	600.00
V-30X	2	vented, 15"	—	horn/twt	2.4k	8Ω	101	150 w	50-16k	100 x 70	32" x 24" x 16"	84	500.00
V-15	3	vented, 15"	horn	horn/twt	2.5, 5k	4Ω	100	200 w	35-20k	100 x 70	29" x 18" x 17"	52	400.00
DSM-200	3	—	2" horn	1" horn	200,3.5k	8Ω	111	300 w	200-20k	90 x 40	24" x 36" x 17"	136	1,200.00
SSM-200	2	—	2" horn	1" horn	200,3.5k	8Ω	108	150 w	200-15k	90 x 40	22" x 35" x 16"	70	750.00
D-32C	4	2-12" cone	1" horn	twt	150,1.2k	8Ω	106	250 w	150-16k	60 x 40	36" x 23" x 19"	103	900.00
DMI	2	vented, 12"	—	horn/twt	2.5k	8Ω	103	100 w	150-16k	60 x 60	14" x 21" x 7"	76	325.00
CMH-1	1	—	—	1" horn	3k	16Ω	107	50 w	1k-15k	90 x 40	12" x 20" x 1"	23	425.00

CETEC GAUSS

7258	1	15" co-ax	—	—	1200	8Ω	96	400 w	40-18 k	40 x 40	29" x 24" x 192	116	$1585.00
5350	3	15"	10"	tweeter	800,3 k	8Ω	98	400 w	45-20 k	60 x 40	21$ " x 32" x 14 $	87	1495.00
7228	1	12" co-ax	—	—	1600	8Ω	91	400 w	40-18 k	40 x 40	212" x 13" x 162"	73	1480.00
5280	2	18"	—	horn	1500	8Ω	101	400 w	45-15 k	100 x 50	34" x 24" x 164"	100	1215.00
5220	2	12"	—	horn	1600	8Ω	98	400 w	60-15 k	100 x 50	19" x 28" x 13"	661	1165.00
5225 (wedge)	1	co-ax	—	—	1500	8Ω	100	400 w	80-15 k	40 x 40	16" x 23"" x 16"	561	990.00
5226 (wedge)	2	12"	—	tweeter	3600	8Ω	101	800 w	80-20 k	60 x 60	16" x 23"" x 16"	50	805.00
5180	1	18"	—	—	—	8Ω	101	400 w	40-2500	—	34$" x 24" x 162"	67	640.00
5150	1	15"	—	—	—	8Ω	101	400 w	45-2500	—	34$" x 24" x 162"	60	540.00

COMMUNITY LIGHT & SOUND, INC.

RS440	4	1-15"	1-6½"	1-1" comp	380,1.1k, 1.2k	8Ω	104	500 w	45-18k	80 x 40	32¾" x 25½" x 24"	135	$1199.00
RS327i	3	1-15"	1-2"	2-PZT	450,3.5k	8Ω	104	500 w	45-18k	60 x 40	32" x 19" x 18"	98	730.00
RS325i	3	1-15"	1-2"	2-PZT	450,3.5k	8Ω	104	500 w	60-18k	60 x 40	24½" x 18½" x 14½"	65	665.00
RM325i	3	1-15"	2"	2-PZT	450,3.5k	8Ω	104	500 w	60-18k	60 x 40	25⅛" x 18¾" x 22⅜"	85	765.00
VB664	2	2-15"	—	—	—	4Ω	108	600 w	45-1k	90 x 60	32¾" x 25½" x 24"	140	1080.00
VB790	1	1-18"	—	—	—	8Ω	104	500 w	45-800	Omni	32¼" x 25½" x 24"	140	1010.00
CSV70	3	4-12"	2-2"	3-PZT	700,4000	4 Ω	105	1500 w	45-18k	90 x 30	26¾" x 33½" x 18"	135	988.88
CS70	3	4-12"	2-2"	3-PZT	700,4000	4Ω	105	1500 w	45-18k	90 x 30	26¾" x 33½" x 18"	135	899.00
CS60B	1	4-15"	—	—	150	4Ω	105	1500 w	35-800	Omni	33½" x 33½" x 22	150	888.00
CSV52	3	1-15"	1-6.5	1-PZT	500,5k	4Ω	98	500 w	40-20k	90 x 60	33½" x 18" x 18"	82	615.00
CS52	3	1-15"	1-6.5	1-PZT	500,5k	4Ω	98	500 w	40-20k	90 x 60	33½" x 18" x.18"	82	549.00
CSV50B	1	1-18"	—	—	150	8Ω	98.5	500 w	35-500	Omni	33½" x 26¾" x 18"	100	609.00
CS50B	1	1-18"	—	—	150	8Ω	98.5	500 w	35-500	Omni	33½" x 26¾" x 18"	100	550.00
CSV4S	2	2-12"	—	3-PZT	3000	4Ω	101	500 w	50-18k	90 x 40	33½" x 18" x 18"	80	549.00
CS4S	2	2-12"	—	3-PZT	3000	4Ω	101	500 w	50-18k	90 x 40	33½" x 18" x 18"	80	490.00
CSV38M	2	1-15"	—	1-PZT	2500	8Ω	99.5	375 w	60-18k	90 x 60	17½" x 17½" x 25	41	389.00

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
CS38M	2	1-15"	—	1-PZT	2500	8Ω	99.5	375 w	60-18k	90 x 60	17½" x 17½" x 25	41	349.00
CSV35	2	15"	—	1-PZT	2500	8Ω	99.5	375 w	60-18k	90 x 60	23¾" x 17½" x 13½"	43	358.00
CS35	2	15"	—	1-PZT	2500	8Ω	99.5	375 w	60-18k	90 x 60	23¾" x 17½" x 13½"	43	319.00
CSV28M	2	12"	—	1-PZT	3000	8Ω	97.5	250 w	70-18k	90 x 60	13½" x 15" x 18½"	30	335.00
CS28M	2	12"	—	1-PZT	3000	8Ω	97.5	250 w	70-18k	90 x 60	13½" x 15" x 18½"	30	297.00
CSV25	2	12"	—	1-PZT	3000	8Ω	97.5	250 w	70-18k	90 x 60	18½" x 15" x 13½"	32	299.00
CS25	2	12"	—	1-PZT	3000	8Ω	97.5	250 w	70-18k	90 x 60	18½" x 15" x 13½"	32	269.00
LFR118	1	18"	—	—	—	8Ω	98.5	400 w	35-1k	Omni	33½" x 26⅝" x 17⅝"	100	509.00
LFR215	2	2-15"	—	—	—	4Ω	103	600 w	50-2.5k	Omni	33½" x 26⅝" x 17⅝"	80	469.00
LFR115	1	1-15"	—	—	—	8Ω	100	300 w	50-2.5k	Omni	33½" x 17⅝" x 17⅝"	73	369.00
LFR150	1	1-15"	—	—	—	8Ω	99.5	300 w	50-2.5k	Omni	23⅞" x 17⅜" x 13⅜"	40	291.00
COMPACT MONITOR SYSTEMS CORP.													
CMS-1200TA	3	12"	2.5" Horn	Super Twt	800, 5k	8Ω	102	600 w	40-20 k	—	15" x 15" x 20"	95	$1195.00
EASTERN ACOUSTICS WORKS													
FR102	2	1-10" vent	—	Comp Twt	3.5 k	8Ω	98	250 w	45-20 k	120 x 60	19.75" x 11.75" x 9.5	30	$335.00
FR122	2	1-12" vent	—	2" Hard Dome	2.8 k	8Ω	97	300 w	35-22 k	130 x 100	24⅝" x 14⅝" x 11¾"	48	475.00
FR152T	2	1-15" vent	—	Horn-Driver	900	8Ω	101	400 w	35-19 k	100 x 50	24⅝" x 19¾" x 19"	76	705.00
DS123C	3	1-12" vent	1-7" Cone	2" Dome	450, 3.5 k	8Ω	101	350 w	90-22 k	130 x 100	14⅝" x 24⅝" x 11¾"	74	615.00
FR153	3	1-15" vent	1-7" Cone	2" Dome	450, 3.5 k	8Ω	98	450 w	35-22 k	130 x 100	24⅝" x 19¾" x 19"	83	740.00
FR183	3	1-18" vent	1-10" Cone	2" Dome	250, 2.8 k	4Ω	99	800 w	30-22 k	130 x 100	29¾" x 24⅛" x 19¾"	116	995.00
FR253	5	2-15" vent	2-7" Cone	Horn/driver	450, 3 k	4Ω	103	900 w	28-19 k	100 x 50	41½" x 24⅛" x 19¾"	157	1375.00
JF500	3	1-15"Horn	1-10" Horn	horn/driver	250, 1.8 k	8Ω	108	500 w	45-19 k	100 x 50	50⅛" x 24½" x 29¾"	232	1975.00
KF600/SB318 (1-18" Vented)	4	1-15" Slot loaded vent	1-10" Horn	horn/driver	100, 250, 1.8 k	8Ω	101	500 w	25-22 k	60 x 40	33¼" x 20" x 19¾"	180	1995.00
KF550	4	2-15" Horn	1-12" Horn	horn/driver	250,1.6k	4Ω	109	1000 w	45-19 k	90 x 40	32½" x 53¾" x 29¾"	320	4125.00
KF850/SB850	5	1-15" horn 2-18"vent	1-10" horn	horn/driver	100, 250, 1.8 k	4Ω	109	2000 w	25-22 k	60 x 40	42" x 27" x 29¾"	230	5700.00
ELECTRO-VOICE, INC.													
FR12-2	2	12"	—	1.5" dome	1.5 k	8Ω	96	100 w	80-18 k	100 x 100	25.5" x 16.5" x 8.7"	45	$535.20
FR15-2	2	15"	—	1.3" Horn	1.5 k	8Ω	97	200 w	50-15 k	90 x 40	28.4" x 31.5" x 16.6"	96	924.00
Interface I	2	8"	—	1.5" dome	1.5 k	8Ω	92	50 w	56-18 k	125±30°	11.4" x 21.2" x 9.7"	23	220.00
Interface II	2	10"	8"	1.5" dome	1.5 k	8Ω	92	50 w	47-18 k	125±30°	13.7" x 24.2" x 10.7"	25	284.00
Interface III	2	12"	8"	1.5" dome	1.5 k	8Ω	92	50 w	40-18 k	125±30°	14.7" x 25.2" x 13.1"	33	328.00
S-1803	3	18"	VMR™	Tweeter	600,4 k	8Ω	99.5	200 w	50-16 k	120 x 80	35.5" x 28" x 19.4"	134	1242.00
SH-1800	1	18"	—	—	—	8Ω	100	400 w	48-250	360	32.8" x 24.8" x 24"	102	930.00
SH-1810	3	18"	10"	1" Horn	250,2.5k	8Ω	105	300 w	48-20 k	60 x 40	47.6" x 24.8" x 24"	153	2052.00
SH-1810S	3	18"	10"	1" Horn	250,2.5k	8Ω	105	300 w	48-20 k	60 x 40	modular	187	2190.00
S-200	2	12"	—	1.5" dome	2 k	8Ω	100	300 w	50-20 k	100 x 100	24" x 15" x 8.5"	36	667.20
100S	2	12"	—	1.5" dome	1.5 k	8Ω	96	100 w	80-18 k	100 x 100	24" x 15" x 8.5"	28	513.00
FM-1202	2	12"	—	1" Horn	1.5 k	8Ω	101.5	300 w	75-20 k	90 x 40	19.4" x 19.4" x 24.4"	65	618.00
FM-1502	2	15"	—	1" Horn	1.5 k	8Ω	102	300 w	65-20 k	90 x 40	28" x 22.5" x 28"	72	786.00
S-1202	2	12"	—	1" Horn	1.5 k	8Ω	101.5	300 w	75-20 k	90 x 40	24.7" x 19.1" x 11.7"	66	667.20
SH-1502ER	2	05"	—	1" Horn	1.5 k	8Ω	102.5	200 w	62-20 k	90 x 40	31.9" x 24.7" x 16"	81	580.00
SH-1512ER	2	15"	—	1" Horn	1.5 k	8Ω	100	200 w	55-20 k	90 x 40	31.9" x 24.7" x 16"	75	610.00
S-1503	3	15"	VMR™	Tweeter	600,4k	8Ω	100	200 w	62-16 k	120 x 80	28.7" x 24.4" x 13.8"	105	992.40
Sentry 100A	2	8"	—	1.5" dome	2 k	6Ω	91	30 w	45-18 k	160 x 140	17.2" x 12" x 11.1"	28	318.00
Sentry 11EL	2	8"	—	1.5"dome	2 k	6Ω	91	50 w[1]	45-18 k	160 x 140	17.2" x 12" x 11.5"	33	654.00
Sentry 500	2	12"	—	1.5" dome	1.5 k	8Ω	96	100 w	40-18 k	110 x 60	23.7" x 27" x 13"	70	624.00
Sentry 505	2	12"	—	1.5" dome	1.5 k	8Ω	96	100 w	40-18 k	110 x 60	1/4 Space Monitor	60	624.00

INTEGRATED & PORTABLE SYSTEMS

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
MS-802	2	8"	—	1.5" dome	2 k	6Ω	91	80 w	45-18 k	160 x 140	17.2" x 12" x 11.1"	27	561.00
CM12-2	2	12" Co-ax	—	1.5" dome	1.5 k	8Ω	97	60 w	90-18 k	110 x 70	12.9" x 16" x 14.5"	24.5	422.40
TL-606DW	2	15"	—	—	—	4Ω	100	800 w	40-3.5 k	—	39.5" x 22.5" x 17.6"	108	888.00
TL3512	1	18"	—	—	—	8Ω	99	400 w	34-3.2 k	—	39.5" x 22" x 22.5"	108	846.00
MTH-4	3-Way	4-10"	4-2"	4-1"	160, 8k 1.6k	2x4Ω 8Ω	107-113	—	150-20 k	60 x 40	36" x 36 x 30"	367	4675.00
MTH-4P (same as above for fixed installation)													4495.00
MT-4	System	MTL-4	MTH-4	—	—	—	—	—	—	—	—	630	7325.00
MT-4P (same as above for fixed installation)													7000.00
MTL-4	4	18"	—	—	—	2x4Ω	102	1.6 kW	40-225	—	36" x 36" x 36"	263	3390.00
MTL-4P (same as above for fixed installation)													3180.00
TL806AX	1	12"	—	—	—	8Ω	98	300 w	72-5.2 k	—	21.5" x 14.1" x 10.2"	43	450.00
TL806DX	2	12"	—	—	—	4Ω	101	600 w	70-5.2 k	—	33.5" x 16.6" x 10.9"	78	722.40
TL606AX	1	15"	—	—	—	8Ω	100	400 w	54-3.2 k	—	27" x 18" x 16.3"	62	505.20
TL606DX	2	15"	—	—	—	4Ω	103	800 w	50-3.2 k	—	39.5" x 22.5" x 17.6"	110	936.00
EMILAR													
ELC-15D	Co-axial	1-15"	—	2" Driver	900	8/16 Ω	106	600 w	20-22 k	90	15¼" x 7"	40	$780.00
ELK-12D	Co-axial	1-12"	—	1" Driver	1000	8/16Ω	101.5	500 w	30-20 k	90	12⅛" 6¾"	23	470.00
ELK-12J	Co-axial	1-12"	—	1" Driver	1200	8/16Ω	102.5	400 w	40-20 k	90	12⅛" x 6¾"	23	470.00
ELK-10J	Co-axial	1-10"	—	1" Driver	1500	8/16Ω	102.5	300 w	40-20 k	90	10½" x 6"	21	430.00
FOSTEX CORP. OF AMERICA													
SPA-11	2	2-4"	—	—	—	8Ω	92	100 w	60-18 k	—	7⅛" x 13¾" x 8¼"	16.5	$349.00
SP-7	1	4"	—	—	—	8Ω	88	120 w	120-20 k	—	4.7" x 7.4" x 4.9"	5.3	99.00
SP-11	2	2-4"	—	—	—	8Ω	92	100 w	60-18 k	—	7⅛" x 13¾" x 8¼"	12	240.00
GALAXY AUDIO													
Pro Spot	6	Cone 15"	Cone 2-5"	—	330, 10 k	8Ω	97	200 w	80-20 k	90 x 60	19" x 27" x 13½"	42	—
Hot Spot	2	Cone 15"	Cone 2-5"	—	—	16Ω	101	120 w	100-18 k	—	6¾" x 10.94" x 6"	8	—
INTERSONICS, INC.													
SDL-5	—	—	—	—	—	4Ω	134	1000 w	32-125	—	45" x 45" x 22"	280	—
SDL-4	—	—	—	—	—	4Ω	135	1000 w	40-125	—	30" x 41" x 22"	220	—
2-15	—	—	—	—	—	4Ω	—	600 w	35-125	—	19" x 22" x 25"	60	—
2-18	—	—	—	—	—	4Ω	—	600 w	30-125	—	20" x 22" x 33"	90	—
J. W. DAVIS & CO.													
PA-150	2	15"	—	1" Horn	750	8Ω	96	150 w	35-15 k	90 x 45	37¾" x 34¾" x 24"	270	$2950.00
PA-70	2	10"	—	1" Driver	2 k	8Ω	95	70 w	55-18.5 k	90 x 45	15½" x 23¼" x 18⅞"	56	600.00
DX-80	3	12"	5"	3" Twt	650, 2 k	8Ω	93	70 w	40-15 k	180 x 170	26" x 19" x 14½"	70	370.00
DX-40	3	10"	5"	3"	650, 2 k	8Ω	93	50 w	49-15 k	180 x 170	23" x 13½" x 11½"	39	320.00
DX-20	2	5"	—	3"	3 k	8Ω	85	30 w	90-15 k	180 x 170	12½" x 9" x 7"	13	167.60
DW-30	2	8"	—	3 x 7 Horn	3 k	8Ω	93	30 w	80-12.5 k	180 x 170	10" x 19" x 12"	20	247.50
C-50	2	12"	—	3 x 9 Horn	2 k	8Ω	90	50 w	80-17 k	—	26" x 19⅞" x 12½"	43	224.40
JBL PROFESSIONAL													
G 730	2	12" Cone	Driver	90 x 40 [1]	2 k	8Ω	102	400 w	70-17 k	90 x 40	22" x 18" x 12"	45	$447.00
G 731	2	12" Cone	Driver	90 x 40 [1]	2 k	8Ω	103	400 w	70-17 k	90 x 40	16" x 18" x 22"	47	468.00
G 732	2	15" Cone	Driver	90 x 40 [1]	1.5 K	8Ω	104	400 w	45-17 k	90 x 40	33" x 25" x 18"	77	597.00

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
G 733	3	10" Cone	8" Cone	90 x 40 [1]	3 k	8Ω	102	400 w	50-17 k	90 x 40	20" x 26" x 13"	52	549.00
G 734	2	15" Cone	Driver	90 x 40	1.5 k	8Ω	102	400 w	50-17 k	90 x 40	26" x 20" x 13"	53	498.00
4612B	3	2-200mm	—	100 x 100 [1]	3 k	8Ω	97	400 w	60-21.5 k	100 x 100	—	45	597.00
4628B	3	E145-15"	21188"	2404H	800, 3 k	8Ω	98	400 w	35-21.5 k	100 x 100	30" x 20" x 19"	108.5	849.00
4691B	3	E140-15"	2370 [1]	2425J	1.5 k	8Ω	103	400 w	40-20 k	90 x 40	30" x 20" x 19"	109	849.00
4698B	3	E155-18"	E110-10"	2404H	500, 3 k	4Ω	103	800 w	35-21.5 k	90 x 40	40" x 30" x 19"	169	1098.00
4699B	4	E155-18"	E110-10"	2370	500, 2 k	4Ω	103	800 w	35-20 k	90 x 40	40" x 30" x 19"	185	1299.00
4602B	2	E120-12"	—	2402H	3 k	8Ω	103	300 w	50-15 k	40	20" x 16" x 15"	57.25	597.00
4604B	2	—	2370 Horn	2425J	1.5 k	8Ω	103	400 w	40-20 k	90 x 40	30" x 20" x 19"	105	849.00
[1] Bi-Radial™													
KLARK-TEKNIK ELECTRONICS, INC.													
Jade MKII Linear Phase	2	Neoflex cone 8"	—	1.25" dome	2.5 k	n/a	107	113 dB	55-17 k	—	21" x 9.69" x 15.35"	48.4	$1995.00/pair
Self-powered monitors with line-level inputs 20k ba ./10 unba .													
KLIPSCH & ASSOC.													
KP-450	3	2-15" port	—	2" Horn	650	8Ω	104	300 w	45-20 k	100 x 85	56" x 28" x 18"	190	$1815.00
KP-450LF	2	2-15" port	—	—	—	8Ω	104	300 w	45-650	—	44" x 28" x 18"	140	908.00
KP-450HF	1	—	—	2" Horn	—	8Ω	104	30 w	650-20 k	100 x 85	13" x 28" x 18"	50	907.00
LSI	3	15" Horn	1.5" Horn	1" Horn	400, 6 k	8Ω	104	200 w	45-17 k	85 x 75	36" x 24" x 25"	151	978.00
KP-301	3	15" port	1.5" Horn	1" Horn	650, 7 k	8Ω	101	200 w	45-20 k	85 x 75	33" x 21" x 17"	82	719.00
KP-250	3	12" port	1.5" Horn	1" Horn	700, 7 k	8Ω	101	150 w	65-20 k	85 x 75	23" x 17" x 14"	49	552.00
KP-201	3	12" sealed	1.5" Horn	1" Horn	700, 7 k	8Ω	96	100 w	50-20 k	85 x 75	23" x 17" x 14"	38	392.00
KSM (slant)	2	12" port	—	1.5" Horn	825	8Ω	103	150 w	85-15 k	75 x 60	16" x 20" x 22"	48	435.00
KSM-1 (slant)	2	12" port	—	1.5" Horn	650	8Ω	102	200 w	50-15 k	75 x 60	18" x 20" x 25"	59	529.00
KSM-2 (slant)	2	15" port	—	1.5" Horn	650	8Ω	102	200 w	50-15 k	60 x 75	24" x 26" x 20"	75	549.00
MWM	2	2-15" Horn	—	—	—	4Ω	108	300 w	45-400	—	33" x 68" x 45"	288	1082.00
MWM-S	1	15" Horn	—	—	—	8Ω	104	150 w	45-400	—	17" x 68" x 45"	151	595.00
MSSM	1	10" Horn	—	—	—	8Ω	108	150 w	250-1.1 k	—	14" x 37" x 37"	89	583.00
MSM	4	—	4-2" Horn	—	—	16Ω	109	125 w	500-6 k	70 x 50	14" x 37" x 37"	93	942.00
MTM	5	—	—	5-piezo horn	—	4Ω	106	30 w	6 k-20 k	120 x 70	15" x 8" x 8"	13	203.00
MMTM	4	—	—	4-1" Horn	—	4Ω	106	40 w	6 k-16 k	40 x 20	9" x 11" x 14"	25.5	442.00
LEN FINKLER CO.													
BL-75	5	4-6½"cone	—	horn & driver	2000	8Ω	95	100 w	30-18k	100	60 x 40 x 30	16 kg	$249.00
MACPHERSON LOUDSPEAKERS, INC.													
One	4	15"	2-7"	1"	250, 2 k	4Ω	102	400 w	55-15 k	100 x 60	18" x 29" x 17"	105	$1465.00
1S	3	15"	10"	1"	—	4Ω	103	700 w	55-15 k	100 x 60	48" x 29" x 17"	110	1995.00
1B	1	15"	—	—	—	8Ω	—	—	40-250	120	48" x 29" x 17"	85	970.00
All models include active electronics package.													
MARTIN AMERICA													
RS1200	6	2-15" Horn	12" Horn	2" Horn + Tweeter	200, 1.5 k, 7 k	8Ω	108	1500 w	35-20 k	50 x 35	46" x 40" x 31"	419	—
RS800	3	2-15" Horn	12" Horn	1" Horn	200, 1.5 k	8Ω	106	1000 w	35-20 k	75 x 35	46" x 40" x 31"	269	—
VRS800	3	18" Horn	12" Horn	1" Horn	200, 1.5 k	8Ω	106	1000 w	35-20 k	75 x 35	23" x 52" x 32"	229	—
RS802	2	—	12" Horn	1" Horn	1.5 k	8Ω	105	400 w	200-20 k	70 x 50	23" x 26" x 23"	101	—

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
BSX	2	2-18" Reflex	—	—	—	4Ω	101	1000 w	28-150	—	46" x 24" x 36"	194	—
S2	2	2-15" Horn	—	—	—	4Ω	105	1000 w	28-500	—	33" x 45" x 36"	287	—
McCAULEY SOUND, INC.													
823	2	1-15" vent	—	CD 1"/2"	1.2 k	4-8Ω	102	500 w	45-20 k	90 x 40	25" x 22 x 18"	90	$770.00
824	2	15" vent	—	CD1"/2"	1.2 k	4-8Ω	102	500 w	40-20 k	90 x 40	33" x 20" x 24"	100	918.00
814	3	—	2-12"vent	CD 1"/2"	1.2 k	4-8Ω	103	700 w	70-20 k	90 x 40	33" x 24" x 16"	123	1038.00
840	2	2-15"vent	—	—	—	2-4Ω	99	800 w	38-800	—	33" x 24" x 24"	130	801.00
850	1	1-18"vent	—	—	—	4-8Ω	100	450 w	30-500	—	33" x 24" x 24"	110	711.00
830	1	15"vent	—	—	—	4-8Ω	100	400 w	45-800	—	20" x 20" x 24"	54	405.00
System 25	3	15"vent	1-12"	CD1"/2"	200,1.2k	4-8Ω	103	800 w	38-20 k	90 x 40	45" x 20" x 24"	152	1208.00
System 28	3	18"vent	1-12"	CD 1"/2"	200,1.2k	4-8Ω	103	850 w	35-20 k	90 x 40	45" x 20" x 24	162	1341.00
System 35	3	15"vent	1-12"	CD 1"/2"	200,1.2k	4-8Ω	103	800 w	45-20 k	90 x 40	45" x 20" x 24	135	1140.00
System 40	7	2-18" vent 2-15"vent	2-12"	CD 1"/2"	80, 250, 1.2 k	4-8Ω	103	2.4 kw	30-20 k	90 x40	45" x 57" x 32"	470	3181.00
System 42	4	2-15" vent	1-12"	CD 1"/2"	200,1.2k	4-8Ω	103	1200 w	35-20 k	90 x 40	37" x 30" x 24"	186	1431.00
System 43	4	18" vent	2-12"	CD 1"/2"	200,1.2k	4-8Ω	103	1.2 kw	30-20 k	90 x 40	37" x 33" x 24"	195	1571.00
MEYER SOUND LABORATORIES, INC.													
MSL-3	3	2-12" Cone	4" Horn	2 x 4 piezo	800 [1]	4,8Ω	—	—	75-20 k	70 x 60	21½" x 56¾" x 30"	254	$4590.00
UPA-1A	2	12" Cone	—	3" Horn	1.6 k [1]	4,8Ω	—	—	55-16 k	80 x 60	14" x 22⅜" x 14½"	67	2490.00
UM1-A	2	12" Cone	—	3" Horn	1.6 k [1]	4,8Ω	—	—	55-16 k	60	14" x 14" x 22½"	67	2350.00
500RW	2	15" Cone	—	3" Horn	1 k [1]	8Ω	—	—	40-16 k	90 x 40	20" x 26¾" x 17½"	74	1550.00
500R	2	15" Cone	—	3" Horn	1 k [1]	8Ω	—	—	40-16 k	90 x 40	20" x 32" x 14"	91	1450.00
500C	2	15" Cone	—	3" Horn	1 k [1]	8Ω	—	—	40-16 k	90 x 40	20" x 32" x 14"	100	1250.00
[1] All units use an active electronics processor													
MTX LOUDSPEAKERS - THE MITEK GROUP													
Pro 110	3	10" cone	5" cone	1.5 bullet	—	8Ω	94.8	100	75-21k	—	18" x 14" x 12"	42	$349.95
Pro 115	4	15" cone	5" cone	1.5 bullet	—	8Ω	96.6	200	60-21k	—	29" x 21" x 16"	85	599.95
Pro 210	5	10" cone	5" cone	1.5 bullet	—	8Ω	98.6	300	70-21k	—	18" x 23" x 12"	65	449.95
Pro 215	5	15" cone	5" cone	1.5 bullet	—	8Ω	99.2	400	50-21k	—	46" x 18" x 16"	132	699.95
OHM/DISTRIBUTED BY CT MARKETING													
MR228	2-Way	2-8"	—	Horn	—	8Ω	—	300 w	80-22 k	—	18" x 12.5" x 14.5"	30.8	—
PANASONIC INDUSTRIAL COMPANY/RAMSA													
WS-A10 [1]	1	4.75" cone	—	—	—	6Ω	88	80 w [2]	80-16 k	90	6⅛" x 9¼" x 6⅛"	5.34	100.00
WS-A70	2	8" cone	—	TB Horn	2000	8Ω	87	80 w [2]	50-18 k	120 x 120	16⅜" 10¼" 9¼"	14	200.00
WS-A80 [1]	2	8" cone	—	TB Horn	2500	8Ω	92	80 w [2]	65-18 k	60 x 40	11⅛" x 17" x 9¼"	16.5	250.00
WS-A200 [1]	2	12" cone	—	TB Horn	2500	8Ω	98	125 w [2]	70-20 k	60 x 40	15¼" x 22" x 10¾"	35	475.00
WS-A240 [1, 3]	1	12" cone	—	—	Sub Woof	8Ω	91	400 w [2]	35-150	180	15½" x 22" x 10¾"	35	349.00
All models available in white or black						½ space							
[1] These models include injection-molded enclosure which can be adapted for outdoor installation													
[2] Power capacity measured via E.I.A. RS-F426A													
[3] Subwoofer requires WS-SP2 Subwoofer Processor ($175)													
PEAVEY ELECTRONICS CORP.													
3020HT	6	2-15"	2-10"	HT-94	250,500, 1.2 k	4Ω	103	400 w	45-20 k	90 x 45	36½" x 38⅜" x 18¼"	161	$899.50

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
118INT SER II	3	1-18"	3-22A	HT-94	300,1.2 k	8Ω	99	400 w	40-20 k	90 x 45	26⅜" x 36¾" x 20½"	133	599.50
SP-2	2	1-15"	2/22A	—	300,1.2 k	8Ω	101.5	300 w	60-16 k	90 x 45	23¾" x 31" x 17"	93	470.00
PROFESSIONAL AUDIO SYSTEMS (PAS)													
CX12-2	2	12"	—	1"	—	8Ω	102	200 w	100-15 k	—	—	55	$595.00
CX152/M	2	15"	—	1"	—	8Ω	102	200 w	60-15 k	—	—	70	665.00
CX15-3	3	15"	15"	1"	—	8Ω	101	300 w	60-15 k	—	—	115	875.00
RED ACOUSTICS (USA) LTD.													
R500A	8	4-8"	—	4-1" Dome	—	—	—	—	40-18 k	—	27¼" x 20¼" x 14"	130	$3850.00
R250A	4	2-8"	Passive	2-1" Dome	—	—	—	—	40-18 k	—	13¼" x 19¼" x 13"	70	1495.00
R150A	2	8"	—	1" Dome	—	—	—	—	40-18 k	—	13¼" x 19¼" x 13"	36	995.00
RENKUS-HEINZ, INC.													
MR-1	3	—	2.4"driver	2-2" driver	1	4Ω	112	400 w	—	80 x 60	48¼" x 27" x 24¼"	156	$4200.00
SR-2	3	2-15" Cone	—	2" driver	1	4Ω	108	400 w	—	95 x 55	23¾" x 51" x 16¾"	120	2520.00
LR-2M	2	2-18" Cone	—	—	1	4Ω	105	600 w	—	—	48¼" x 27¼" x 24½"	175	2270.00
LR-2	2	2-18" Cone	—	—	1	4Ω	105	600 w	—	—	48¼" x 27¼" x 24½"	175	2170.00
SR-1	2	15" Cone	—	2" driver	1	8Ω	105	200 w	—	95 x 55	19¾" x 30" x 16¼"	70	1576.00
W-1	2	15" Cone	—	2" driver	1	8Ω	105	200 w	—	55 x 95	33¼" x 15" x 19¼"	71	1576.00
FRS-152DB	3	2-15" Cone	—	2" driver	1.2 k	4Ω	106	400 w	—	95 x 55	20¼" x 48¼" x 18¼"	125	1560.00
BJ-6W	3	2-12" Cone	—	1" driver	1.6 k	4Ω	104	400 w	—	110 x 70	41" x 17" x 17"	82	1500.00
FRS-152B	3	2-15" Cone	—	1" driver	1.6 k	4Ω	104	400 w	—	95 x 55	20¼" x 48¼" x 18¼"	121	1450.00
SR-121	2	12" Cone	—	1" driver	1	8Ω	103	200 w	—	90 x 50	15¾" x 24¼" x 14¼"	44	1398.00
W-121	2	12" Cone	—	1" driver	1	8Ω	103	300 w	—	90 x 50	28¼" x 15¼" x 17½"	54	1398.00
W-121H	2	12" Cone	—	1" driver	1	8Ω	103	200 w	—	90 x 50	15¾" x 16¼" x 25"	50	1398.00
LR-1	1	18" Cone	—	—	1	8Ω	102	300 w	—	—	22½" x 27¼" x 22½"	85	1370.00
FRS-151DB	2	15" Cone	—	2" driver	1.2 k	8Ω	—	200 w	—	95 x 55	20½" x 30¼" x 16¼"	79	1190.00
FRS-151B	2	15" Cone	—	1" driver	1.6 k	8z	103	200 w	—	95 x 55	20½" x 30¼" x 16¼"	75	1080.00
FRS-121B	2	12" Cone	—	1" driver	1.6 k	8Ω	102	200 w	—	110 x 70	15¾" x 24¼" x 11¾"	42	996.00
[1] Active electronics Smart Processor™													
ROCKUSTICS INC.													
Rocky Jr.	2	6.5" Poly	—	1" Dome	3 k	4Ω	90	100 w	58-18.5 k	180	20" x 16" x 10"	65	$325.00
Rock Deco	2	6.5" Poly	—	1" Dome	3 k	4Ω	90	100 w	58-18.5 k	180	20" x 16" x 10"	65	325.00
Stonehenge	3	8" Poly	5.4" Poly	1" Dome	950, 4 k	8Ω	89	100 w	53-18.5 k	180	17" x 28" x 10"	86	1500.00
Hillside	3	8" Poly	5.4" Poly	1" Dome	950, 4 k	8Ω	89	100 w	58-18.5 k	180	26" x 13" x 18"	110	500.00
ROSS SYSTEMS-DIVISION OF INTERNATIONAL MUSIC													
H-218CD	5	18"	CDM™ 8"	1"	300, 4 k	4Ω	104.5	500 w	35-18.5 k	90 x 40	39" x 39" x 18"	—	$1149.95
H-215CD	5	15"	CDM™ 8"	1"	300, 4 k	4Ω	103	400 w	37-18.5 k	90 x 40	39" x 36" x 18"	—	1049.95
H-118CD	3	18"	CDM™ 8"	1"	300, 4 k	4Ω	102	325 w	40-18.5 k	90 x 40	38" x 32" x 18"	—	799.95
H-115CD	3	15"	CDM™ 8"	1"	300, 4 k	8Ω	101	275	45-18.5 k	90 x 40	38" x 26" x 18"	—	699.95
T-183HS	3	18"	CDM™ 8"	1"	300, 4 k	8Ω	100.5	325 w	40-18.5 k	90 x 40	30" x 24" x 17"	—	599.95
T-153HS	3	15"	8"	1"	300, 4 k	8Ω	99.5	275 w	45-18.5 k	90 x 40	28" x 23" x 16"	—	529.95
T-153	3	15"	8"	1"	300, 4 k	8Ω	99.5	175 w	45-18.5 k	90 x 40	28" x 23" x 16"	—	429.95
T-152HS	2	15"	—	1"	3 k	8Ω	100	250 w	56-18.5 k	90 x 40	24" x 18" x 11"	—	379.95
T-152	2	15"	—	1"	3 k	8Ω	99.5	150 w	60-18.5 k	90 x 40	24" x 18" x 17"	—	329.95
T-122HS	2	12"	—	1"	3 k	8Ω	98	100 w	62-18.5 k	90 x 40	21" x 16" x 16"	—	249.95
T-122	2	12"	—	Tweeter	3 k	8Ω	97	75 w	265-16 k	60 x 60	21" x 16" x 16"	—	199.95

Model	No. of Components	Low-Frequency-Type & Size	Mid-Frequency-Type & Size	High-Frequency-Type & Size	Crossover Frequencies	Nominal Impedance	Axial Sensitivity/1 watt - 1 meter	Maximum Power	Frequency Range	Dispersion	Dimensions	Weight	List Price
RSPA	2	12"	—	Tweeter	3 k	8Ω	97	75 w	120-16 k	60 x 60	20" x 19" x 9¾"	—	279.95
SHURE BROTHERS, INC.													
3200	2	12" Cone	—	1" Driver	2 k	8Ω	98	120 w	60-13 k	120 x 60	25" x 16⅜" x 12⅜"	38	$450.00
SPECO DIV., COMPONENTS SPECIALTIES, INC.													
DMS-3TS	3	4"	2"	1" Dome	—	8Ω	—	50 w	55-20 k	—	7¼" x 4½" x 4⅜"	—	$79.95
DMS-3/3A	3	4"	2"	1" Dome	—	8Ω	—	100 w	55-20 k	—	7¼" x 4½" x 4⅜"	—	94.95
DMS-6	3	5"	2"	1" Cone	—	8Ω	—	120 w	55-20 k	—	7¼" x 4½" x 4⅜"	—	149.95
ST. LOUIS MUSIC/AUDIO CENTRON													
ACH101S	3-Way	15"	10"	Tweeter	—	8Ω	108	400 w	40-20 k	—	—	—	$650.00
AC15EV	2-Way	15"	CD Horn	—	—	8Ω	106	400 w	40-16 k	—	—	—	575.00
ACH15HP	3-Way	15"	4x10 Horn	Piezo	—	8Ω	108	250 w	40-20 k	—	—	—	350.00
ACH2030T	4-Way	2-15"	2-10"	Horn/Twt	—	8Ω	108	400 w	40-20 k	—	—	—	750.00
AC1012H	3-Way	12"	10"	4x10 Horn	—	8Ω	106	200 w	60-16 k	—	—	—	300.00
ACH15	2-Way	15"	Horn	—	—	—	106	300 w	40-16 k	—	—	—	450.00
TANNOY NORTH AMERICA INC.													
B-50	2	12"-reflex	—	2" Horn [1]	2.2 k	8Ω	94	250 w	50-20 k	90	19" x 14.25" x 16"	46	$798.00
ML-50	2 x2	8"-reflex	—	1" Horn [1]	1.8 k	4Ω	96	100 w	57-20 k	90	13.4" x 15.75" x 14"	42	829.00
Cougar (wedge)	2	15"-IB	—	2" Horn [1]	1.8 k	8Ω	98	150 w	100-20 k	90	18.75" x 22" x 17"	50.6	1098.00
Cub (wedge)	2	12"-reflex	—	2" Horn [1]	2.2 k	8Ω	98	250 w	50-20 k	90	—	—	948.00
T-300	2	15"-reflex	—	—	170	4Ω	101	500 w	45-170	360	42" x 19" x 20"	181	1698.00
L-300	1	15"-TT	—	—	90	8Ω	101	250 w	48-90	360	42" x 19" x 20"	114.4	1198.00
C150	1	15"-TT	—	—	110	8Ω	97	250	45-110	360	28½" x 16¾" x 23"	74.8	1118.00
P-200	2	15"-Horn	—	2" Horn [1]	1 k	8Ω	103	150 w	80-20 k	60	28½" x 28½" x 20"	118.8	1438.00
J-200	2	15"-reflex	—	2" Horn [1]	1.8 k	8Ω	94	250 w	35-20 k	90	28½" x 28½" x 20"	96.8	1168.00
P-100	2	15"-reflex	—	2" Horn [1]	1.8 k	8Ω	95	250	50-20 k	90	28½" x 19" x 16"	68.2	998.00
[1] Dual concentric format IB-Infinite Baffle TT-Tandem Tuned													
TURBOSOUND, INC.													
TMS-3	6	2-15"	2-10"	2-1"	250,3.7k	4, 8Ω	108	775 w	55-19 k	60 x 40	33" x 40" x 23"	295	$4283.00
TSE-211	4	—	2-10"	2-1"	250,3.7k	8Ω	108	275 w	250-19 k	60 x 40	33" x 19" x 17"	100	2538.00
TMS-4	3	18"	10"	1"	250,3.7k	8, 16Ω	105	450 w	45-17 k	60 x 40	45" x 19" x 28"	165	2354.00
TSE-111	2	—	10"	1"	250,3.7k	16Ω	105	150 w	250-17 k	60 x 40	19" x 17" x 14"	65	1340.00
TSE-118	1	18"	—	—	250	8Ω	102	300 w	45-250	—	27" x 19" x 28"	100	1161.00
All speakers are proprietary Turbosound Loudspeakers and drivers.													
UNIVERSITY SOUND													
PI15-3	3	15"	mid	ST350	600, 4 k	8Ω	98	100 w	50-16 k	125	24½" x 13½" x 28"	108	$715.00
PI12-2	2	12"	—	ST350	3 k	8Ω	97	100 w	75-16 k	125	21" x 11½" x 18½"	66	450.00
Musicaster 1	1	12" Co-ax	—	Tweeter	1.5 k	8Ω	99	60 w	70-18 k	130	17½" x 17½" x 8½"	25	282.00
MLC	2	—	—	—	—	8Ω	106	15 w	150-15 k	80	12" x 9" x 10"	11	146.00
UW-30 (underwater)	1	—	—	—	—	8Ω	—	30 w	100-10 k	Omni	7½" x 2¾"	8	222.00

BOOK REVIEW

by Ted Uzzle

A Look at Acoustics and Drama Theatres

Talaske, Richard H. and Boner, Richard E., eds., *Theatres for Drama Performance: Recent Experiences in Acoustical Design*, New York, American Institute of Physics, 1987, xxxviii + 122 pp., $15.00, paper.

This volume is the third in a series published by the American Institute of Physics for the Acoustical Society of America. Each began as a poster session at an Acoustical Society conference. Acoustical designers were invited to prepare posters with photographs, graphs, data tables, and other information on major projects, all in a uniform format. These were displayed throughout the conference, and afterward collected and published in book form, with two facing pages devoted to each project.

Previous volumes dealt with concert halls (reviewed in *Sound & Communications*, 31:5, May 1985) and with houses of worship (reviewed in *Sound & Communications*, 31:8, August 1985). This new volume is in the same format, but expanded somewhat with the addition of a series of introductory essays. Appropriately, this volume is the first to show TEF™ displays, which we may expect will become a routine inclusion in future volumes.

There is always a subtle tension between the technical requirements of acoustics and the aesthetic requirements of architecture. This becomes much more complicated when there are additional technical requirements involved with the theatrical machinery (lights, scenery) and additional aesthetic requirements demanded by dramaturgy. The theatre is one of the most complicated types of buildings, and always the product of negotiation. The best theatres are the best comprised among conflicting needs; the worst theatres become bowling alleys or storage warehouses shockingly quickly.

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*.

An essay by S. Leonard Auerbach opens this book. He likens theatre-making to writing a script (the feasibility and programmatic work), followed by the performance (the actual detailed design and the construction).

The next short essay is a vital and vigorous piece by one of those forgotten men: the end-users. It is by Dixon Bond, manager and president of the Ordway Music Theatre in St. Paul (of which a highly whimsical artist's rendering graces the cover of this book). We in the sound business tend too often to think of end-users as mere plankton, the bottom of the food chain. Bond tells us professionals—architects, theatre consultants, acoustical consultants, general contractors and specialty contractors, and ultimately manufacturers—just how we look to outsiders, and it's an image we'd do well to keep before us always.

There is an essay by Stewart Donnell, who is a consultant in construction cost management. This discipline has only recently been recognized as an important, legitimate specialty. We have here no bean counter with green eyeshade and ink-stained fingers. Rather, this is an acutely sensitive psychologist, who can spot the exact moment the architect begins to fall in love with a High Concept, and be sure to nip in there and inject a dose of financial reality first. He includes a flow chart of the needed stages beween the gleam in the eye of a building donor, and the turning of the first spade of earth. Anyone involved in building construction, whether an acoustical consultant or a sound contractor, would do well to slip a copy of this flow chart into each and every project file he opens.

Paul Anthony Saporito has contributed a difficult but important essay on theatre architecture. Who cares about theatre architecture? Everyone who comes along and sweeps up after the architect should. Saporito may be too hard on architects; after all, there are some superb theatres being built. This discerning description of what may go awry in theatre architecture offers neither practical solution nor palliative, but does show that architectural depredations are not random disasters but symptoms of cultural ambivalence about the physical icons of buildings and the social interactions that go on in them.

Some speculations about the theatre sound system of the future are contributed by R. K. Thomas of Perdue University, which seems to have a whole department devoted to theatre sound design. Someday, sound opertors will sit at an 88-key wooden keyboard, with a CRT instead of a music rack. And multiple combinations of these 88 keys will perform all the functions of today's largest and most complex mixing consoles, which have hundreds and hundreds of knobs and switches. This idea is arresting in its stark simplicity and fitness; the wonder is that no one has implemented it yet.

"These two-page capsules on theatres are like salted peanuts: you just can't stop, once you start looking at them."

A final essay by Robert Wolff of Artec Consultants reviews the panoply of services an acoustical consultant can provide a theatre design project.

Then follow the theatres, 49 of them, big, small, proscenium or thrust stage, community, university, high school, commercial, non-profit.

Each theatre is depicted with plan and section drawings and several interior photographs, as well as a table of internal volume, surface area, and such characteristics. In addition, most of them include charts such as reverberation time, and a few of them show the extensive use of TEF equipment

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Installation Profile

THE MULTI-PURPOSE MUSIC AND PAGING SYSTEM AT bloomingdale's

BY MAIL LTD

Where's the speaker? Twenty-six Soundsphere No. 110 loudspeakers are located throughout the warehouse.

PHOTOS BY NELSON HOYT

The Bloomingdale's By Mail Distribution Center in Cheshire, CT, is 256,000 square-feet long.

A warehouse is a warehouse is a warehouse. Not much glamour in this type of building. That is to say unless the customer is Bloomingdales. With their aggressive entry into the mail order business recently and with their prevailing philosophy, anything is possible.

According to "Bloomies' " Ralph Paladino, group manager of quality assurance and liquidation, "Our ideas come from an attitude that an open mind is the first key to any success. Just because it hasn't been done before does not mean it shouldn't be looked at."

As an existing communications supplier to Bloomingdale's retail store in Stamford, CT, Muzak of Southern Connecticut was asked to provide a proposal for the multi-purpose music and paging system at the new 265,000-square-foot Bloomingdales By Mail Distribution Center in Cheshire, CT.

Without allowing ourselves to be intimi-

by Karen Tappan-Demuth and Nelson Hoyt

dated by the sheer size of the facility, a traditional distributed sound system using generic paging horns would seem to be a pretty straightforward concept. However, with an entire facility built around a computer controlled, merchandise locator and conveyor system, it just didn't seem right to think "traditional." This, coupled with the fact that Bloomingdale's wanted to use the system to provide its employees with classical music programming, led us to look at something other than the typical paging horn type system. Besides, we felt if we could provide an efficient system with *quality* sound, we wouldn't walk in three months later and find speakers disconnected, cov-

The sound system includes two separate cabinets: the top one contains Muzak 1600 tape decks and zone volume controls, and the bottom one includes TOA A-912 mixer amplifiers. This was done so that the customer need only have access to the top cabinet to change tapes or adjust volume levels.

ered with cardboard, or stuffed with rags! We've all been down that road before!

Another sound contractor submitted the traditional distributed system type of approach and their proposal was sure to be an expensive undertaking due to the sheer size of this building not to mention the question of "will it work?" Due to hard surfaces, 30 foot ceilings, and 85 dB ambient noise levels in some areas, this project was a real challenge.

By throwing in the client's desire to use a classical music format in the building,

(continued on page 66)

THE PROS SAY A FEW WORDS ABOUT THE MANY COMPONENTS OF JBL.

High-quality components teamed up with results-oriented engineering. That's how JBL Professional helps the pros achieve superior sound for specific applications. Here's what JBL means to five leading professionals— all with vastly different requirements:

"JBL products are very reliable and efficient, and that's why we've used them for 16 years here at Abbey Road Studios. We have JBL equipment in many locations throughout the studios, and these products give us the sound uniformity we really need. We can count on JBL for professional, solid, great-sounding products."
Ken Townsend, General Manager
Abbey Road Studios, London, England

"In the concert sound business, we don't get any second chances. If the sound system doesn't perform, the audience can't come back next week when we've got it right. That's why we chose JBL. JBL products offer professional dependability and great sound—and that's how we define quality in our business. JBL really cares about making their products the best."
Roy Clair
Clair Brothers Audio

"You can't create a truly outstanding soundtrack without being able to hear everything accurately. That's why JBL's clarity was the first thing that impressed me. And with JBL, I can rest assured that our soundtrack will sound just as good in the theaters as it does in the studio."
John Bonner, Chief Engineer
Goldwyn Sound Department
Warner Hollywood Studios

"We first installed JBL equipment when we were selected as the boxing venue for the 1984 Olympics. Our P.A. system brings great consistency and clarity to all our sporting events, including wrestling, motor sports, track meets, and basketball. JBL components deliver outstanding sound regardless of your seating location or the size of the crowd."
Glenn Mon, Acting Director
Los Angeles Sports Arena

"We chose JBL equipment because of its great reliability and transparency. All the worshippers in our 7,000-seat sanctuary must be able to hear equally well. JBL horns accomplish this without coloration. The sound is very clear and natural no matter where you're sitting."
David Taylor, Director of Media
First Southern Baptist Church
Del City, Oklahoma

At JBL Professional, we believe that components should match your application, not the other way around. To hear more about what sound professionals see in us, contact your JBL Professional dealer.

JBL Professional
8500 Balboa Boulevard
Northridge, CA 91329

Several months ago I received a call from a long time friend and business acquaintance, Bill Raventos of Crown International in Elkhart, Indiana. The call seemed innocent enough. He wanted to know if I had any time open on my calendar for the last part of July and the first part of August. When I penciled in the dates, I was not aware that I would be embarking on one of the most rewarding and difficult projects I have ever worked on.

Tom Durell is an independent consultant in North Hollywood, California. He has coordinated and directed the sound reinforcement for last year's Liberty Weekend and the 1984 Olympic Games.

The proportions of this project began to be apparent after Bill and Chuck Gushwa—Crown marketing vice president—and myself first met with the Special Olympics executive team. It was clear that sound for the July 1987 International Summer Special Olympics Games at Notre Dame University was going to be quite a task! The number of events that would require sound support appeared to be in the area of 200 over a seven-day period. Not an impossible task by any means—just a busy week. The final count was almost 325 sound jobs in seven days!

The task at hand was obvious though the proportions perhaps a bit understated. What we had to do was gather enough equipment, knowledgeable or dedicated (or a combination such as we ended up with) people, define all of the needs for sound support, put this all together and then make plans for the wrap party. . .well almost.

Rounding Up Equipment

Crown International decided to become the major sound sponsor providing funding, Crown equipment, human resources, and me. In addition to microphones, amplifiers, test equipment, etc., we had to procure speakers, processing equipment, consoles, microphone stands, speaker stands, miles of cable, small mixers, portable mixer-amp combinations, radio communications, A.C. generators, transportation vehicles, warehouse space, and *most important of all—gaffers tape*!

It was clear that even though Crown

The Many Venues of the Special Olympics

by Tom Durell

Left: db Sound donated its services for the opening ceremonies of the Special Olympics which was broadcast on ABC-TV.
Below: Equipment is packed-up the day after the opening show.

had committed to this project, a major effort was going to have to be made to obtain donations for the use of a lot of other hardware. Enter Crown's director of PR Margo Sousley. Early on in this project, Bill and I worked up a list of needed equipment. We then came up with a list of companies for Margo to call that we felt might be willing to help out with a donation of the use of their equipment.

I have never seen such willing and immediate cooperation and generosity from so many people. Every company contacted was willing to help out. I was particularly impressed to see that all the normal rules were set aside. No one restricted us by saying their equipment had to be exclusively used, or for that matter, made any other demands or

restrictions.

The Special Olympics is unique in that there is no admission charge to any event. The only way this event happens is through donations—and that is what makes the donations so important. Here is a list of some companies who deserve some recognition and thanks: Lexicon, DDA, Klark Teknik, White Instruments, Belden, Atlas/Soundolier, S. I. Carrol, Proco, Electro-Voice, Tascam, Shuford Mills (gaffers tape), Crown International, D. B. Sound, Cetec Vega, General Electric, Star Case Co., Community Light & Sound, THEOS Software, and Micro Innovations (more on THEOS and Micro Innovations later in the article).

Volunteers in Droves

One of the puzzle pieces was in place. We had the equipment with which to do the event . . . now for the people to run it. Of course we were told there would be hundreds of volunteers for us that were knowledgeable about sound—you know the words—"no problem." Well, the plot thickens. Bill and I had put together a list of local volunteers we both knew who would also be willing to help. We even gave our list of volunteers to the volunteer coordination people within the Olympic Committee so our people could receive tickets to events and the other perks volunteers receive. Imagine our surprise when we found that our much needed sound volunteers were being assigned duties of cheer leading and crowd control!

It was close at times, but we did end up with an army of sound operators that really made this event happen. Some of these "heroes" were professional sound people that graciously gave us a week of their time, many were people from the Crown factory (including our 3 "supervisors"—Tony Sateriano, Jim Baumgardner, and Tom Linniniger), some were students, some were even from JTP (job training program). Many were people that had never plugged in a microphone or a speaker cable in their lives, but before the event was over, they were all sound pros—a sound army unequaled in ability or enthusiasm.

Innovations

Now, let's talk about all the innovations we came up with. Here is the part of this article where I should show you copies of graphs and charts from TEF machines and one line diagrams of all the special systems we had to come up with. I think a system curve or two would be in order to show how flat the systems were or how great the coverage was. Now if I did all of that *and* had a picture of myself at a mixing console looking at a script or at a stage with both hands on the faders—now *that* would make a complete article! I hope you don't think I am being too sarcastic, but a story about the Special Olympics Games is not a story of technical innovations; it is a story about people and companies and their dedication and commitment to help others.

Of course we had TEF machines there—but they were used to let the athletes "see their voices" and get a souvenir "voice print." We did make good use of two RTA-2 third octave analyzers (the last two off the production line) in many systems. We designed a sound system for the opening ceremonies to fill Notre Dame stadium while interfacing with the television people and not acoustically getting in their way—complex, but not new. We got to use some of the new Crown concert series hand held mics. I could give you a one line diagram of how we interconnected five soccer fields for announcements, while giving them each separate play by play—but again no big deal.

We did replace (in an existing system) three Altec 165 watt tube amplifiers with several new Crown MA 1200's and we did have the good taste to bypass the passive crossovers in this system—but that's about it.

Software Runs Event

Now I am not saying we did not use some technically innovative things. For example, we did use a software package from Micro Innovations in Winter Springs, Florida. This is a piece of software designed to completely operate a rental company. It does equipment tracking, reservations, all the financials, technician scheduling—in short it completely runs a company. We used its complete facilities (except the billing portion) to run the event.

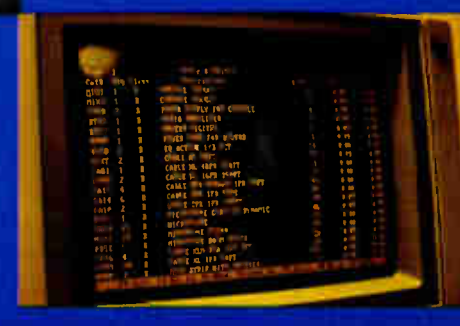
With it we were to keep a complete inventory of equipment (necessary for insurance coverage as well as shows), and to schedule both equipment and personnel to their best abilities. We were also able to know immediately if anything was missing as the system generated bar code labels with which everything was checked in and out every time it left or returned to our warehouse!

This software also took the potential disaster of those last minute calls for a sound system (we had around 30 of these during the course of the event) into an easily solvable situation. We always knew what equipment and who was available to fill these needs. We even survived a 3 p.m. call on the day of opening ceremonies when the voice on the other end of the phone said "where is the sound system for the VIP reception." Innocent enough question—but the reception for *five thousand people* was in our computer system for the next day! By 4:15 p.m. we had set up and had operating a reinforcement system for an orchestra that covered an outdoor area about 200 feet by 600 feet! Complete with delay clusters, etc. Except for the fact that there were 30 people dripping with sweat on the sidelines, no one would have known that it wasn't planned that way all along.

In conclusion, I can only say that this was a very rewarding project to have worked on and as I have said it wouldn't have happened without the assistance of some very special companies, some truly dedicated people, and even some new technology. I am looking forward to the winter games and meeting and working with some new heroes. ■

PHOTOS BY BRADLEY • TONNER AGENCY

A huge warehouse was the home of the donated equipment that included (left) rows of Atlas Soundolier mic stands and (above) Electro-Voice Entertainer mixing boards. Right: Durell used a Micro Innovations software program to bar-code and keep inventories of every piece of equipment.



PRODUCTS IN REVIEW

Graystone Systems' Video Interphone

Graystone's video system includes interphone headsets that incorporate electronic address/switching circuits as well as parallel controls. A black and white wall monitor requires an installation depth of 85mm inside the wall and includes a 24-hour or 12-hour LCD digital clock. Both units are installed in a flush-mounted box with a matching cover.

Circle 1 on Reader Response Card

Alpha Communications' Videovox® Intercom System

When the Videovox® is activated by a lobby button, an electronic chime tone alerts the resident. Within a matter of seconds, the Videovox® television monitor activates automatically. Conversation begins by lifting the handsets and depressing the conversation switch on the side of the handset. This switch enables the Videovox® to work properly even if handsets are left "off-hook" in one or more apartments. The electric door release may be activated by pressing the red button on the face of the monitor.

Circle 2 on Reader Response Card

Blonder-Tongue's Filtered Processor

Blonder-Tongue's SAVP is a heterodyne processor used to put off-air broadcast VHF and UHF channels onto CATV, SMATV, and MATV systems. Standard SAVP output channels are VHF (2-13), Midband (A-I) and Superband (J-W).

A notch trap is used for adjustment of the aural carrier level

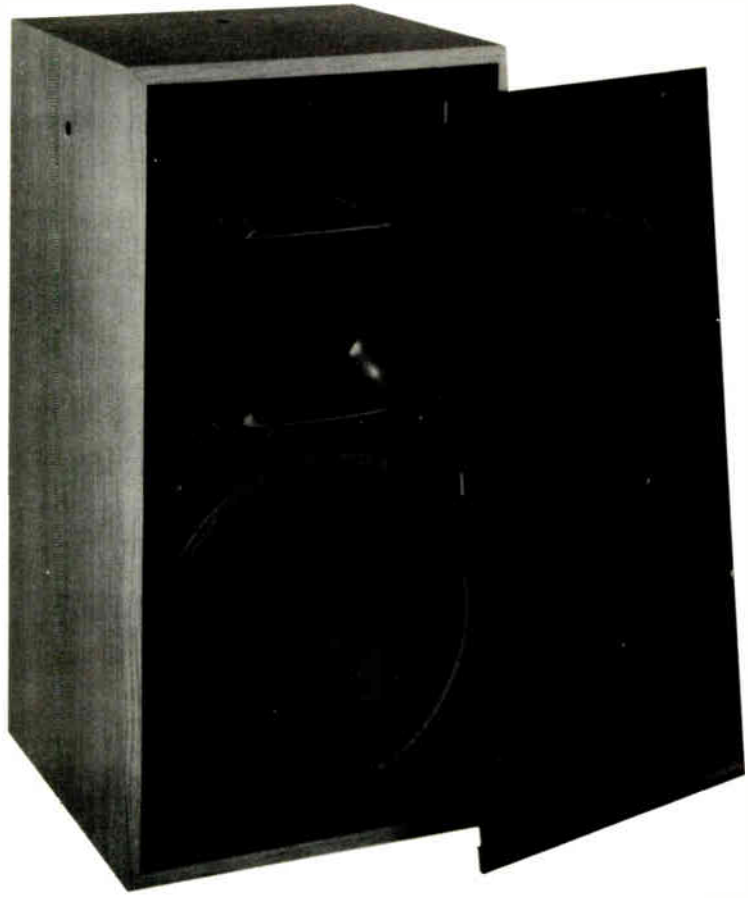
Dual SAW filters are used to provide a high degree (typically 70 dB) of adjacent channel rejection. The SAVP has external I.F. loop thru which permits the insertion of scrambling equipment for highly secure premium programming applications.

Field replaceable heterodyne converter boards make it possible for qualified service personnel to change input and/or output channels of the SAVP quickly and simply.

Circle 3 on Reader Response Card

a closer look

by gary d. davis



Community Adds New Loudspeaker System

Designed for fixed installations such as in hotels, schools, churches, or anywhere else where aesthetics and quality sound reinforcement are priorities, Community Light & Sound's new model CSV52 loudspeaker system represents the latest addition to their CSV Series of components. Also suited for home high fidelity and audio/video applications, the CSV52 combines high sensitivity and power handling capabilities with smooth response and low distortion to produce a three-way design operable between 40 Hz and 20 kHz.

Constructed using rigidly-braced particle board, the enclosure is laminated with a Finnish Oak Formica, and sports an acoustically-transparent brown grille. To simplify installations, "T" nuts have been provided, while steel mounting brackets (model WB-1) are optionally available.

At the low-end of the system, a 15-inch bass transducer is outfitted with an overhung edgewound voice coil in a symmetrical fringe-field magnet gap to insure long linear excursion. Midrange frequencies are handled by a 6½-inch cone driver coupled to a short compound horn for clear, intelligible sonic reproduction. Like the bass transducer, the midrange driver is ferro-fluid cooled to increase reliability, linearity, and power capacity. For high frequencies, a PZT driver mounted on a Community wide-angle Pattern Control Horn assures uniform coverage and accurate flat response up to 20 kHz.

Like all other CSV Series models, the CSV52 incorporates fuseless protection circuits to guard against excessive input levels (power handling is rated at 200 watts RMS, 500 watts program). To insure mirror-image stereo and correct spatiality while operating the unit either vertically or horizontally in pairs, provisions have been made which allow the HF/MF module to be rotated 90° in either direction.

The suggested retail price of the CSV52 is $608. A black carpet-covered version of the same cabinet ideal for live sound reinforcement and monitoring/playback situations (model CS52) can also be purchased for $549.

Comments: Community Light & Sound has produced commercial loudspeaker systems for many years. The three-way CSV52 has a 15-inch low frequency cone type driver, a 6½-inch midrange cone type driver and a piezo electric tweeter. Crossover frequencies are at 500 Hz and 5 kHz. The system employs a technique Community popularized, with a direct radiator midrange driving a horn. This ostensibly reduces distortion compared to a compression driver midrange because there is no narrow throat and consequently none of the turbulence-induced distortion common to such designs. Their choice of a low frequency driver with an overhung voice coil is a choice which favors linearity (low distortion) over efficiency. The efficiency is lower because a portion of the voice coil is always well beyond the voice coil gap (the idea is that the same percentage of an overhung voice coil is supposed to remain in the gap at all times, thus assuring linear conversion of signal to motion as the cone moves in and out).

It would seem that Community designed this system to provide high fidelity sound. On the other hand, it is not a "hi-fi" loudspeaker. Its horn-loaded configuration and Formica™

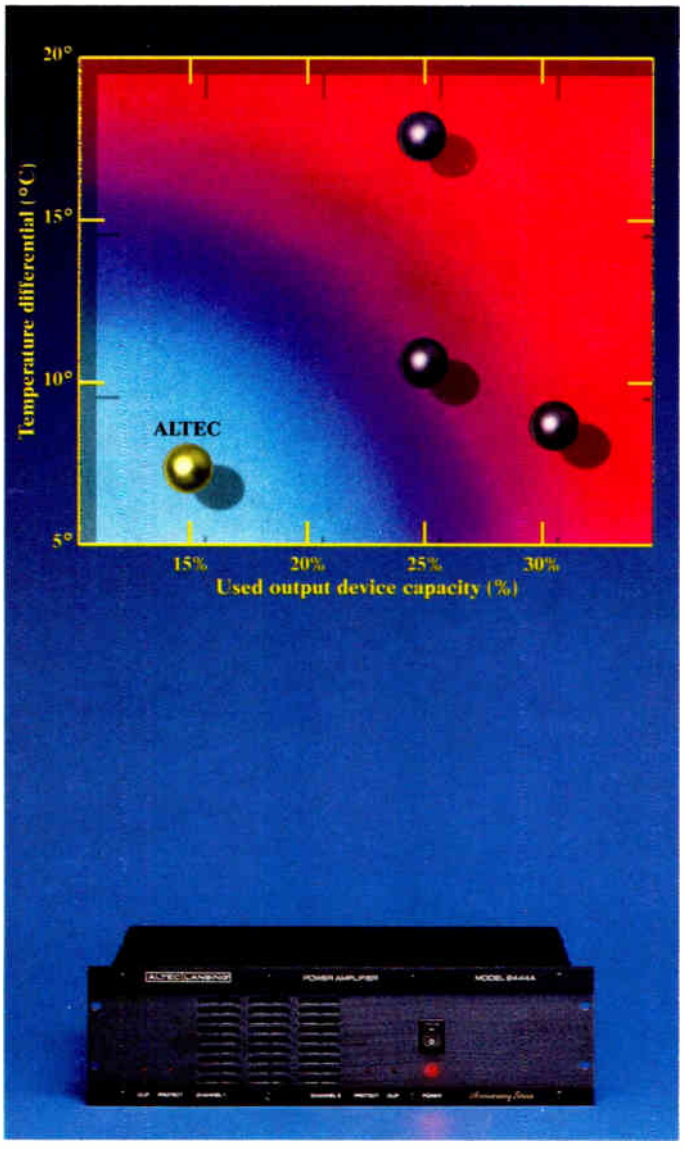
(continued on page 66)

In power amplifiers, less heat equals longer life. It is also correct to conclude that the reliability of a power amplifier often comes down to the reliability of its output devices. At Altec Lansing we compiled a detailed study of these devices in terms of their sturdiness and thermal behavior. We found that two criteria appear to have been ignored in the past.

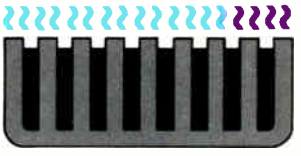
First, we know that output semiconductors must work together in order to produce accurate, distortion-free power. Therefore, any environmental variation among them varies the stress placed on each device. This poses the possibility that some devices will perform differently, and that those under greater operating stress are more likely to fail.

Altec Lansing engineers sought to reduce the variation in operating temperature from one output semiconductor to the next. We designed an asymmetrical heatsink that helps compensate for temperature differences between the transistor closest to the cooling fan and the one farthest away. This reduction in the temperature gradient evenly distributes the thermal stress placed on the devices. Our advanced heatsink has been incorporated into the design of the new Altec Lansing model 9444A power amplifier.

By means of this heatsink, a temperature differential of only 7.4° C is achieved, which is lower than that of any of the other popular, quality, fan-cooled power amplifiers tested. The vertical axis of the graph shows the results. The greater this temperature mismatch, the greater the amplifier designer's failure to reduce the thermal stress differential among output devices.



The second often overlooked consideration we studied at Altec Lansing is what our engineers call dissipation headroom. This is the percentage of the rated power dissipation of the output semiconductors which is actually used at the rated amplifier output.



Reducing the temperature gradient distributes thermal stress more evenly.

The Altec Lansing 9444A uses sixteen output devices, each rated at 250 W. This means the total rated power dissipation at the output stage is 4 kW, of which 600 W is used as audio output. Thus, only 15% of the rated power dissipation is used, leaving 8.2 dB of dissipation headroom. This is significantly more than was found in other amplifiers, as shown.

What is the benefit of thermal uniformity and dissipation headroom? Our semiconductor manufacturer applied their mean time between failure (MBTF) criteria to these factors. All other factors assumed equal, they computed the output devices in the Altec Lansing 9444A to have a normalized lifetime 18.15 times longer than amplifiers without these provisions. Attention to these details means longer life in service, a vital criterion for sound systems designed by audio contractors and consultants.

Fact.

In Power Amplifiers, Less Heat = Longer Life

ALTEC LANSING®

P.O. Box 26105 · Oklahoma City, Oklahoma 73126-0105 USA · 405-324-5311

SUPPLIES•SERVICES•SUPPORT

Weather Resistant Acrylic Adhesive

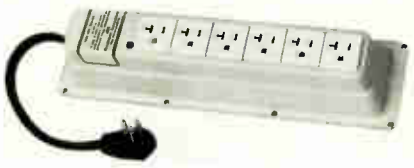
A new cable tie mount with weather resistant acrylic foam tape adhesive backing has been announced by Panduit Corp. The mount is made of black weather resistant ABS material for greater resistance to ultraviolet light.

The acrylic adhesive is also designed for use at higher temperatures: continuous use up to 158 degrees F.

The new Panduit ABMM-AT-O mount will support a maximum weight of .30 pound. It is ¾-inch by ¾-inch and is designed for use with miniature and intermediate cross section cable ties to provide secure mounting of wire and cable.

In a related issue, a price increase for wiring products has been announced by Panduit Corp., Electrical Group. Prices will increase by three percent to six percent on most items effective November 9. Included in the price increase will be cable ties and accessories, terminals, power connectors, identification products, wiring duct, stainless steel products and foam tape.

Circle 6 on Reader Response Card



ESP's 20 AMP Filter/Suppressor

Electronics Specialists has expanded its Kleen Line Classic Filter/Suppressor line to include 20 amp capability. Featuring 39,000 surge amp, 413 joule suppression, the 20 amp Kleen Line Classic also incorporates a 100 kHz to 200 mHz wide band, balanced-pi filter to help eliminate AC line electrical noise and interference.

Options available include a remote switch to permit desktop activation and power fail interrupt for automatic shut-down in the event of the AC power loss.

Circle 7 on Reader Response Card

Klein Tools Helps Keep You Organized

A new kit containing an assortment of 20 types of insulated, bellmouth terminals and connectors is available from Klein Tools. The kit also contains a Klein crimping tool for both insulated and non-insulated terminals and connector sizes from 22 to 10 AWG.

The versatile crimping tool has cushioned-comfort handles.

Circle 8 on Reader Response Card

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.

FOSTEX
Pro Sound Division

15431 Blackburn Ave., Norwalk, CA 90650
(213) 921-1112

Circle 217 on Reader Response Card

FACES AND PLACES

MICHAEL E. LAMM

Lamm Joins J.W. Davis

Michael E. Lamm has joined J.W. Davis & Co. as chief engineer. He is in charge of new product development and quality control. Prior to joining J.W. Davis he was with Dove & Note Recording as a specialist in location recording of classical music. Past designs include the Titan microphone stand and various multi-boundary PZM arrays for special applications. Lamm has written several articles and papers on location recording and the use of boundary layer effect microphones. His memberships include the Audio Engineering Society, Classical Music Association, and Syn-Aud-Con.

Quanz Becomes Director of Marketing, Advertising

Harry Quanz has been named director of marketing and advertising for Aiphone Corp. He will be responsible for national advertising, marketing, public relations and trade show programs.

Quanz has been with Aiphone since December, 1986. Before that, he was an executive vice president for Goodman Quanz, Inc., an advertising and public relations agency. He has more than 20 years experience in the advertising/graphics industry.

REP NEWS

Aiphone has appointed **Graham/Davis Inc.**, a commercial sound and security firm based in Houston, Texas. The company, which has a branch office near Dallas, will cover Texas, Arkansas, Louisiana and Oklahoma. The principals of the firm, Jim Graham and Herb Davis, each have more than 20 years experience in the sound, signal and security industry.

Apogee Sound Inc. has announced that AKG Philips has been appointed the Canadian representative for Apogee Sound Inc. Apogee also announced that **Tom Lee Music Company Ltd.** is now the exclusive representative for the company in Hong Kong.

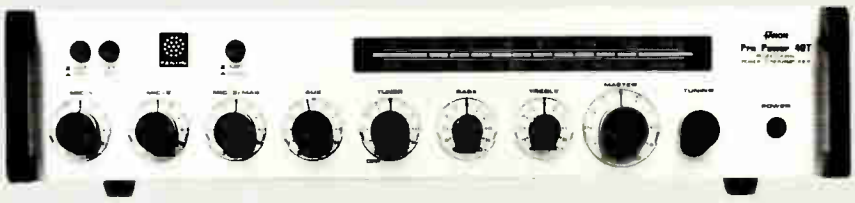
Panduit Corp. has appointed **Electrical Products** of Oklahoma City, OK, as its exclusive sales representative of the product line. Electrical Products will represent Panduit in Oklahoma and the Texas panhandle.

COMMERCIAL SOUND PRODUCTS

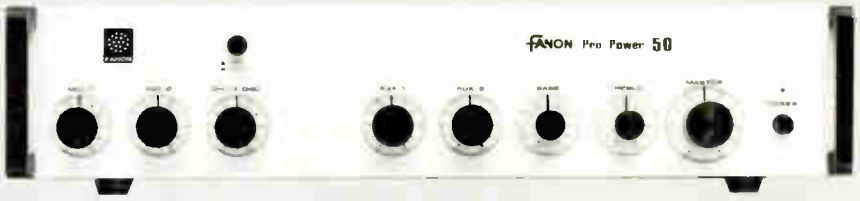
FANON®

PRO POWER SERIES.. PROFESSIONAL PA and BACKGROUND MUSIC AMPLIFIERS

PRO-20T



PRO-40T



PRO-50

PRO-120

PRO-T

- Professional, rugged P.A./ Background music systems
- Built-in custom features
- Balanced or unbalanced, high or low impedance microphone inputs. No matching transformers required.
- ALL CANNON lock-in microphone connectors
- *TRUE RMS* Power ratings
- Efficient integrated circuit construction. Lowest noise microphone preamps in any P.A. line
- Rack Mount construction
- Overload Protection built in
- Equalizer Input feature in all models except PRO-20T
- Up to *FOUR* Microphone inputs
- PRIORITY PAGING Feature
- AM-FM Tuner accessory unit (Model PRO-T)
- Background Music AM-FM Tuner built-in (Models PRO-20T, PRO-40T)
- Phone-type jacks for speaker connections
- Traditional Fanon Quality construction and advanced engineering
- Full Fidelity—Factual, guaranteed specifications
- Custom Styling
- "Soft Gold" Anodized front panels
- Four step-up Power Ratings: 20 watts, 40 watts, 50 watts and 120 watts.
- More Watts per dollar

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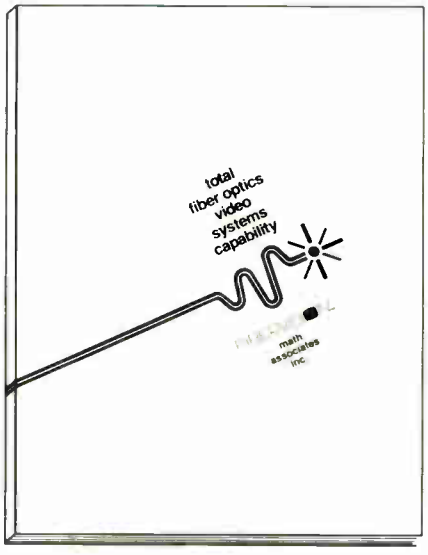
DATAFILE *info.sources/new literature*



Math Associates Updates Fibervision

A new, enlarged updated 288-page catalog, *Fibervision, Total Fiber Optic Video Systems Capability*, is now available from Math Associates, Inc. Included are sections on designing a fibervision system, video transmission modules, controllers, cameras, fiber optic accessories, fiber optic cable, terminating equipment and fiber optic test equipment.

The Fibervision™ line of products is designed to produce high quality, reliable video fiber optic products for CCTV applications in the video market place.

Circle 4 on Reader Response Card

Samtec Full Line Catalog Released

Samtec has released its new full-line catalog F-188. The connector catalog has 100 pages of ordering information and specifications on thousands of variations and standard options of interconnects.

The catalog is organized into the following major product sections: precision machined socket and terminal strips, .025 inch square post socket and terminal strips, stamped socket strips, pin grid array sockets and adaptors, dip sockets and dip adaptors, IDC strip and plug assemblies, soldered cable assemblies, loose lead sockets and terminals, and custom interconnects.

New products include low profile, bottom mount, elevated, high density, zigzag and .045 inch square post designs.

Circle 5 on Reader Response Card

Meyer Sound

500 Series Loudspeaker Systems

- Finally. Fully integrated sound reproduction systems. With no compromises, and no complications.
- *The Meyer Sound 500 Series.* A family of full-range professional loudspeakers, and a matching 1200 watt stereo amplification unit with built-in complementary phase equalization and driver protection. It's an unbeatable combination, packing all the performance that any professional could dream of.
  - Effortlessly smooth, flat frequency response
  - Unrivalled phase accuracy
  - Vanishingly low distortion, even at extreme sound pressure levels
  - Dynamic range exceeding that of 16-bit digital audio
- Until now, excellence like this was beyond the range of most budgets. But through a combination of unique design innovations, the 500 Series achieves a significant breakthrough in price performance. And by making full use of the advantages of integrated system design, the 500 Series offers a new level of elegance, simplicity and reliability.
- The Meyer Sound 500 Series incorporates loudspeaker models suited to virtually all professional applications—from stage to studio, cinema to church. And all are fully compatible with the 500 Stereo Integrated Amplifier.
- For more information on this remarkable new line of loudspeakers, contact your pro audio dealer or Meyer Sound.

Meyer Sound

Meyer Sound Laboratories, Inc
2832 San Pablo Avenue
Berkeley,
California 94702

Circle 218 on Reader Response Card

BOOK REVIEW

(continued from page 49)

during the installation and proof of performance of the sound system. A couple of paragraphs of history and present status completes the entry on each theatre. This information fills two facing pages for each theatre, except that a few of them spill over onto a third or even fourth page, where the material is especially complete.

Among those scrutinized is the venerable Schubert Theatre in New Haven, a half-block from the Yale campus, where shows on the way to Broadway have been tried out and doctored for decades. It closed in 1976, but in 1983 the Schubert was thoroughly renovated, including a new sound system, designed by Jaffe Acoustics, and extensive acoustical work to eliminate an echo, and other problems.

There are several examples of one of today's happier architectural trends: the recycling of beautiful old movie palaces into performing arts centers. Another example is the fine old Ohio Theatre in Columbus. The cinema, built in 1928, was renovated in 1984 to restore former glory and also to enlarge technical facilities for modern presentation of symphony, opera, ballet, and other events. Peter George Associates were the designers.

The editors have concluded the book with a bibliography of books, periodicals, and articles touching on the subject. This is a welcome addition to the Acoustical Society casebooks, and includes a number of little-known references intriguing enough to look up.

Your reviewer makes a wage with the Gentle Reader: bet you can't flip through this book without stopping to read it. Bet you can't turn past one of the theatres described without being drawn into the photographs, reading the graphs and tables, skimming (at least) the descriptive copy. These two-page capsules on theatres are like salted peanuts: you just can't stop, once you start looking at them.

This new book is not only a fit companion to the two previous volumes, but clearly has learned from them. Readers who own and have benefitted from the previous volumes will want this one also.

Not available in bookstores, *Theatres for Drama Performance* can be purchased from the Acoustical Society of America (335 E. 45th St., New York, NY 10017), for $15, postpaid. Readers involved with theatre sound will find few other $15 investments as useful.

CCTV

(continued from page 30)

To understand why more information is obtained at lower recording times, we must first understand how a time lapse recorder operates. With a normal consumer type VCR, if we wanted to record TV shows of a long duration, up to eight hours, all the recorder has to do is reduce the speed at which the tape travels. The slower the speed, the longer the recording duration. However, there are limits to this method. In time lapse recorders, recording times can vary anywhere from 2 to 999 hours. In order to "squeeze" so much recording time onto a single VHS tape, bits of information must be left off. What happens is that the VCR will turn the recording mechanism on and off with a predetermined time interval between sequences. The longer the selected recording mode, the longer the interval or off-time between pictures. If the off-time is too long, you may miss a piece of important information.

CCTV COMPONENTS

So far I have discussed only the CCTV products themselves, but what about the advances that have been made to make the CCTV components easier to install? Some years ago, single cable cameras started to show up in the marketplace. Their circuitry allowed them to use a single coaxial cable for both power and video, thus saving the installer precious installation time and wiring costs. However, it seems that the industry never took the single cable camera too seriously. Some of the reasons were that they offered poor resolution and a high degree of signal noise. This was due primarily to transmission problems inherent in those early single cable systems. Back then, the single cable cameras were never considered as part of a system type CCTV installation, where a group of cameras were fed through a switcher for viewing on a single monitor. In many cases you could not

(continued on page 76)

CLOSER LOOK

(continued from page 58)

finish (optional carpet finish) are obviously not intended for the average living room. What then qualifies it as a professional system?

Well, the power handling (500 watts program or 200 watts continuous average sine wave—per AES method) is excellent, but power handling alone doesn't mean much. I was concerned about absolute output level, and that involves sensitivity. I would expect low sensitivity, given the overhung woofer voice coil, but Community's John Strand tells me the system is rated at 98 dB/1 watt/1 meter, which is fairly respectable for a basically cone-type system. Frequency response is down 6 dB at 45 Hz and 18 kHz, which is a very broad bandwidth for an SR speaker. The polar response of the midrange horn is nominally 90° by 60° (at 2 kHz), and since the MF and HF horns can be rotated 90° in the enclosure, the dispersion can be adjusted to the requirements of the space, regardless of whether it is convenient to mount the enclosure horizontally or vertically.

Speaking of mounting, I was concerned to see the provision of "T" nuts (top, bottom and sides) on a box which is made of particle board. After all, particle board is not the strongest material around, and hanging an enclosure can involve considerable risk. John Strand stated that of course Community recommends the use of All-Thread across the top of the box, then hanging it with the extra bracing to ensure a sturdy mount.

The bottom line with any speaker system is sound quality, and that you will have to determine for yourselves. However, given its unconventional design and impressive specifications, I think the CSV52 rates your *closer look*.

Circle 3 on Reader Response Card

BLOOMINGDALE'S

(continued from page 52)

it was quickly apparent that we would need to take a hard look at what type of equipment would provide a quality sound, yet give the customer a good value.

The Design

Chief Engineer Nelson Hoyt approached the design from two directions, one using Soundspheres from Sonic Systems, the other using 15 watt paging horns. As we progressed, we quickly became convinced that the concept of using Soundspheres made a lot more sense for a couple of very

(continued on page 74)

There can be no compromise!

Tour the premier recording studios of the world — from London to New York to L.A. — and you'll find they have one thing in common: "no compromise" recorders from Studer of Switzerland.

Sure, their Studer multitrack mastering decks are a big investment, but you can make an equally sound choice for your production needs for a whole lot less. You can own a two-track production recorder with the same Studer heritage — a machine that has many of the same production features, the same uncompromising audio performance and the same level of manufacturing perfection that has made Studer Revox recorders the world standard — THE REVOX PR99 MKII is the machine!

Like its "big brothers" in the top studios, the PR99 MKII is a professional machine built for long-term performance. From the solid diecast aluminum transport chassis and head block to the servo capstan motor and the modular electronics, everything is milled, drilled and mounted with Swiss precision. The parts fit together right — and stay there.

PR99 MKII Real Time Counter and Autolocator.

The PR99's professional features are perfect for efficient, accurate tape production: • Real-Time counter that reads both plus and minus hours, minutes and seconds; • *True* Auto Locator allows precise, automatic search-and-cue to any preselected address point; • Zero Locate to return the tape to the zero counter location — EXACTLY! • Auto Repeat to continuously replay a tape segment of any length.

Plus: • Built-in, front-panel varispeed; • Self-Sync; • Input and output mode switching; • Edit mode switch; • Tape dump; • Calibrated and Uncalibrated "+4" balanced and floating inputs and outputs; • 10½" reel capacity.

As for sound quality, the Studer heritage again allows no compromise. We think you'll find the Revox PR99 MKII to be sonically superior to anything in its price range. Audition the Revox PR99 MKII at your Studer Revox Professional Products Dealer, or contact: Studer Revox America, Inc., 1425 Elm Hill Pike, Nashville, TN 37210; (615)254-5651.

STUDER REVOX

Looking back at SOUND & COMMUNICATIONS

30 Years Ago

In the November, 1957 issue of *Sound & Communications*

Among the new products introduced was the Atlas Sound Corp.'s Model WM-1 Speaker Support that came complete with all the hardware to attach the speaker to any automotive window. No tools were needed and there was no damage to the vehicle's paint finish or window glass. Although no target market was announced, it is believed that this device was popular with bosses who would cruise their employees' neighborhoods on nice, sunny days when workers would phone into work sick, calling them back to their jobs.

The sound system to the Pershing Auditorium in Lincoln, Nebraska was examined. Altec Service Co. designed, fabricated and installed the equipment that included two Altec Lansing 1530 amplifiers, two Altec Lansing 530-A power supplies and a 1511-A phono amplifier.

20 Years Ago

In the November, 1967 issue of *Sound & Communications*

Among the new communications equipment was the "Airmike" from Industrial Communications, Co. It permitted two-way radio communications for firemen or other personnel in toxic areas. The product made earphones unnecessary and was installed on an airmask in 30 seconds. Remember that the next time you drive though your neighborhood toxic waste site.

Wonder how MTV started? It may have been when ETV stations were permitted to broadcast music during non-program periods under the FCC's waiver of Section 73.651(c) (Which in case you're interested provided that the aural transmitter of a TV station shall not be operated separately from the visual transmitter, except for certain purposes). Five educational TV stations were authorized to accompany their visual transmission of slides, films, or other visual images with music during scheduled breaks in their in-school programming schedule.

15 Years Ago

In the November, 1972 Issue of *Sound & Communications*

Among the new products introduced was the WE-130A Sound Level Meter which was a simplified electronic device designed to measure noise pollution in factories, construction sites and other high noise areas. The hand-held, battery operated unit permitted an untrained person to monitor the sound level by pressing a button and reading a meter.

CONSULTANT'S COMMENTS

(continued from page 10)

worked with owners and should be able to sell a design concept to an owner.

Unfortunately, too many salesmen are commission driven and may select equipment more for this reason than for appropriateness in the design. (And who can blame them, considering what many salespeople are paid?) While some salesmen have a good working knowledge of sound systems and some experience operating them, many do not, and most have limited exposure to the different requirements of users with varying operational programs.

A contractor's engineering and installation staff usually has a strong technical background. They have attended seminars in system design, and know what is required to interface different types of equipment. More importantly, this group of technical people has the most familiarity of what is easiest to install; and because labor is frequently the largest cost component in a project, and the least well controlled, this is a significant factor. Of course, like the salesmen, an engineer's experience with different types of systems may be limited. Although he may have an excellent knowledge of high powered dance playback or rock and roll systems, how much experience does he have with the requirements of Broadway type touring productions or dramatic theatre? Although the concepts of audience coverage, frequency response, SPL, and intelligibility are universal among sound systems, different types of users have different needs for the location of systems, interfacing, and operational features of equipment. The designer must be familiar with these requirements and the engineer may not be.

Manufacturers and their representatives are another resource for design information. The technical support group of larger manufacturers especially are familiar with the way their equipment is being used in the field. Smarter manufacturers have been doing extensive research with consultants, contracts, and users before introducing new products. These people will be more familiar with the special requirements of different applications and programs. Many staff members will have expertise and experience in one or more areas of sound system usage and can be helpful. The contractor should beware, however, of a design that depends entirely on one manufacturer's equipment. Only two or three manufacturers make enough equipment to construct a complete system, and even so, there are many manufacturers who specialize in particular types of components that can be more appropriate for many applications.

The last resource for a design-build contractor may be surprising to some—how about hiring a consultant? This can take the form of a design contract, a joint venture, or a speculative percentage agreement. Think about it—the design experience of a consultant with many manufacturers, numerous types of programs and users, and many dozens or even hundreds of facilities, combined with the extensive engineering and installation experience of the contractor. This would be a formidable team, capable of evaluating the needs of the user and the cost of installation—their joint proposal would be a strong one. And for once, contractor and consultant can be on the same side in a non-adversarial rela-

(continued on page 73)

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.

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

ARIZONA
Tuscon: Temple of Art and Music, 2,A. Contact: Robert Lorelli, Brannigan-Lorelli Associates, Inc., New York, NY; (212) 420-8787.

CALIFORNIA
Concord: Automatic Data Processing, 1,D. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Los Angeles: Ketchum Communications, 1,D. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Los Angeles: Simon Wisenthal Center, 3, A. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.
Menlo Park: Raychem Corp, 1,A. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Milpitas: Sun Microsystems, 1, A. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Modesto: Trinity Presbyterian Church, 1,D. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Oakland: East Bay Municipal Utility District, 1,A. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Oceanside: Oceanside City Hall, 3,B. Contact: Neil A. Shaw, Paul S Veneklasen & Associates, Inc., Santa Monica, CA; (213) 450-1733.
Ojai: Ojai Valley Inn, 5,D. Contact: Neil A. Shaw, Paul S. Veneklasen & Associates Inc., Santa Monica, CA; (213) 450-1733.
Palo Alto: Kleiner, Perkins, Caufield, Buyer, 1,C. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
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 Diego: UCSD Graduate School of International Relations, 1,A. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Francisco: First Interstate Bank of California, 1,C. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Francisco: Kleiner, Perkins, Caufield, Buyer, 1,A. Contact: Craig E. Park, Peoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Francisco: Portman Hotel, 1,D. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Jose: Ford Aerospace, 1,A. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Jose: McDonnell-Douglas, 1,B. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7620.
San Jose: San Jose State University Recreation and Events Center, NA, D. Contact: Edward McCue, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
San Jose: St. Joseph's Cathedral Center, 1,B. Contact: Craig E. Park, Paoletti/Lewitz/Associates, San Francisco, CA; (415) 391-7610.
Santa Monica: Santa Monica Bay Hotel, 5,B. 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: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

FLORIDA
Miami: Bayfront Park, 2,D. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.
Miami Beach: TOPA, 3,A. 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.

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

MARYLAND
Ocean City: Isle of Wight, NA, A. Contact: Chuck McGregor, Jaffe Acoustics, Inc., Norwalk, CT; (203) 838-4167.

MASSACHUSETTS
Boston: Hayden Hall, Boston University, 2,C. Contact: Chuck McGregor, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.

MINNESOTA
Minneapolis: Minneapolis Armory, NA, A. Contact: Steve Orfield, Orfield Associates, Minneapolis, MN; (612) 727-2557.

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

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Astoria: American Museum of Moving Images, NA,C. Contact: Wade Bray, Jaffe Acoustics, Norwalk, CT; (203) 838-4167.
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EDITORIAL

(continued from page 6)

tomers demand high quality distributed sound systems. That's where the sound contractor comes in.

The opportunity is there. Every sound contractor can now supply any kind of music using a foreground music system, and he doesn't have to give up his sales to a radio station to do it. It's no longer a monopoly. Because he has the software side taken care of, the contractor can concentrate his expertise on his customer's most substantial need... a quality sound system. The contractor, no matter what his other areas of business, has the ability to take advantage of the additional opportunities this new market offers. The superior sound quality that these systems require has created a whole new technology and has led to new products from manufacturers of speakers, amplifiers, signal processors and accessories.

With over 400,000 existing background music subscribers rapidly discovering foreground music, and thousands of new businesses opening every year, the potential offered by foreground music for the sound and communications industry is enormous. I believe the future growth of foreground music will continue to offer exciting opportunities for those manufacturers and sound contractors who take advantage of them.

Kilroy Hughes
EMS/MUSIC President

Sound & Communications offers this space to those who wish to voice their opinions on issues that are pertinent to the sound and communications industry. Write to: Editor, Sound & Communications, 25 Willowdale Ave., Port Washington, NY 11050; or call (516) 767-2500.

CONSULTANT'S COMMENTS

(continued from page 71)

tionship. Each might learn a little more about the other and how he operates, which would be quite useful when the usual relationship is in force. A number of consultants have done "turnkey" operations for their clients—designing a system and then subcontracting a sound system contractor to do the work. I suggest that the opposite situation would work equally well in a design-build proposal application. I would be interested in what readers think of this proposal.

SALES & MARKETING

(continued from page 14)

age plan primarily to church sound contractors."

For serious individual contractors who would like to publish their own professional newsletter but lack the time and finances to plan, prepare and pay for it, Sound Advice Institute offers the use of their newsletter, *Sound Advice*, for a fraction of what it costs to produce it. The newsletter is a slick, professional quarterly that focuses on general and technical news, trends, ideas and helpful suggestions to individuals and churches who are involved in various aspects of sound system technology. ■

THEATER CENTER

(continued from page 20)

tect and owner were advised that there was a request for proposal imminent, and both agreed to review it, provided that there were no additional engineering fees attached. It was also duly noted and emphasized that the chances of the sound system budget being expanded were slim to none.

Don't be left out. Send all your information on supplies, services and support to:

Debra A. Pagan
Managing Editor
Sound & Communications
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But they were not prepared for what was finally presented—a *zero cost change order.* Some suggested that this was a mix-matching of terms, like military intelligence or jumbo shrimp.

Basically, both JAI and ACC wanted these changes to be made, because they had a common goal—the best sound system possible. Both companies invested some of their own time in the process and that goal was achieved through mutual cooperation. This kind of working relationship should be extended throughout the industry, because in the end, the sound system designer and the sound contractor are the only ones who know how much a good system will affect the audience.

Test Concerts Scheduled

As part of the commissioning of the Wortham Theater Center, a series of test concerts were scheduled to tune and verify correct operation of the acoustical elements of both theaters—orchestra shells, pit absorption, variable draperies in the Cullen and, of course, the sound systems. Unfortunately, inspections and acceptance testing of other systems often delayed ACC from performing final testing of the sound system. At one point, repeated testing of the Halon fire extinguishing systems kept the sound contractor out of the rack room for several days. After working out a few last minute problems in wiring, some preliminary tuning, and some creative patching, the Brown Theater system was turned over to JAI consultants Chuck McGregor and Beningson about six hours before the scheduled sound system test concert.

Because the system nearly worked flawlessly at this point, there was plenty of time to make subjective listening tests, set the crossovers, signal delays, and relative levels of the various subsystems, and still accommodate the pre-show sound check. Two days later, the Cullen system was tuned up and operated with only one problem—an AC power conditioner, which had not been operating reliably for some time, tripped its internal breaker at some point after a sound check 10 minutes before showtime. The unit was repeatedly reset until it did not trip. Fortunately, it did not trip during the show and has since been repaired.

There were a number of events over the summer months which had served to acquaint the technical staff—and the audiences—with the Wortham Theater Center. Of course, like any other new facility, there will be a breaking-in period as audiences, musicians, singers, dancers, other performers, and the production people become familiar with the capabilities of all the aspects of the hall. However, early indications are that the Brown and Cullen Theaters will serve their major users and audiences as well. Certainly, the sound systems will be major contributions towards the success of the Wortham Theater Center. ■

BLOOMINGDALE'S

(continued from page 66)

good reasons: first, we would use fewer speakers and achieve a greater coverage; secondly, by using fewer speakers, our labor costs would be reduced proportionately; and finally, we would be able to reproduce a quality of sound not found in typical horn-type loudspeakers.

The Soundsphere No. 110 loudspeaker was chosen because of its unique dispersion characteristics (270°

vertical X 360° horizontal). The No. 110 loudspeaker, rated at 35 watts RMS and 8 ohms, achieves crisp voice announcements and quality reproduction of hi-fi music in highly reverberant environments. It has a maximum sound level stated as 89 dB @ 1 Meter, 1 Watt.

In this case we wanted the Bloomingdale's job for the feather-in-cap aspect of serving a well-known name; further we felt that we knew how to obtain this job, specifically a better system for a better price.

Instrumental was the design itself engineered by Nelson Hoyt. "I had utilized Soundspheres in a few instances of smaller proportion and had been well pleased with the results. This larger application was an opportunity to utilize the 'less is best' theory that had worked for me in past project," he said.

While we were convinced that this was the way to go, the final decision would have to be made by Bloomingdales. A demonstration for comparison was arranged, and after listening to the Soundsphere for a matter of five minutes, the consultant for Bloomingdale's was not only convinced, "but I think they were genuinely excited about this 'new' approach to the sound system," said Hoyt.

Moving Ahead

Once the decision was made as to which avenue we would pursue with regard to speakers, the next step was a meeting with *Sedlak Mgmt. Consultants*, the project management team in charge of the installation of the complex conveyor system. At this meeting, the layout, operation, personnel placement, and expected noise levels were discussed, and actual speaker locations were determined.

Proper placement allowed us to use transformers tapped at 16 watts for each speaker, and a total of 26 Soundspheres were used in the shipping, receiving, and warehouse areas. The entire area was subdivided into seven zones, powered by four TOA A-912 mixer amplifiers. The extensive use of mixer amplifiers was to provide for expansion and maximum flexibility throughout the system. In addition, individual volume controls for each zone were centrally located in the equipment rack.

The remainder of the facility including executive offices, customer service, telemarketing, computer processing and the cafeteria are likewise an integral part of the system. For these areas, 74 ceiling speakers were provided and volume controls in strategic spots such as private offices. This was a classic example of "one-stop shopping" for the client and our abilities for versatile management in supplying a total system concept was very appealing to the Bloomingdales people. For these areas, two (2) TOA A-903 amplifiers and one (1) TOA 906 amplifier were utilized.

In addition to music programming and three-zone paging capability, other features of the system include: two music formats (contemporary/classical) via two Muzak 1600 dual cassette decks, Music on Hold, back-up microphone paging, dual channel seven day programmable Tone signaling, relay operated priority volume controls, and a stand-by emergency back-up power supply.

The actual installation was a chief engineer's dream come true. Take Bloomingdale's progressive attitude and a willingness to look beyond the "tried and true," couple that with ef-

fective planning and superb cooperation among the various contractors and project managers, and you've got all the ingredients for success. Amazing but true, we were able—with a high-lift and two technicians—to complete the warehouse installation in just five days.

Bloomingdale's has also taken their "anything is possible" outlook into future expansion. One wall of the warehouse area is totally removable to allow for doubling the size of the building. This wall is comprised of an aluminum sandwich material with foam insulation.

All the shelving and other mechanical components near the area were initially set-up to be moved as necessary. Alignments of the footings and supports were designed to allow for the eventual expansion. In fact, with care, this wall can be *re-used* as the permanent wall when the new area is completed. A warehouse is certainly not a warehouse when it comes to Bloomingdale's. ■

Karen Tappan-Demuth is Muzak's general manager and Nelson A. Hoyt is Muzak's chief engineer.

CCTV

(continued from page 66)

lock these type cameras to the AC phase or externally drive them with a sync generator. Without these features, the picture would vertically roll every time a camera was switched onto the monitor. Today's single cable cameras come very close to equalling the performance and features of their standard CCTV camera cousins. They offer a high signal-to-noise ratio and some allow for mounting a great distances from their respective control box. The single cable cameras are available in both pickup tube and solid state chip models, in both black and white, and color. Many are "line-lockable" and some camera power control boxes will even supply their own vertical drive output to synchronize the other system cameras.

I have only been able to touch on a few of the new CCTV products currently available. The new CCTV technological advances and the thousands of system application options appear infinite. This article was aimed to provide you with additional CCTV knowledge in order to assist you in your purchasing decision. ■

Ad Index

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Communication and Education

Recently the stock market went through some rather unusual trading sessions. The frantic trading was escalated by communications. Partially to blame was the complex computer trading network. These mindless machines are programmed to dump stocks and other commodities when prices start sliding below prescribed limits—much faster than any human could. In today's world of communications it is said that, "When America sneezes, the rest of the world catches pneumonia!"

Communications has become the essence of the economic base of the world we live in. Digital data, the written word, and the spoken word all get around to a lot more people quicker than ever before. The information-based economy thrives on this type of communications—much the same that even small businesses depend on.

Computers play an important role in our every day lives as well as in our profession. Computers, however, cannot think for themselves. The recent stock market events certainly serve as a reminder that the computer can only be as smart as the program that told it what to do. Furthermore, computers are not capable of reacting to situations with the kind of logic that humans do. Until artificial intelligence advances to the point where it is easily and economically included in micro-computer hardware/software, we still have to do a lot of thinking on our own.

Computers are great tools for automating a variety of tasks. Implicit in this concept is the fact that computers speed up manual operation(s) and are support tools. The software programmer and the user/operator must understand the basics of what he is automating before he can automate. Whether it is stock trading, medicine, or audio, the basics must be solidly understood. If someone is analyzing my medical chart he better know medicine!

Education is the point. All the computers in the world are useless without good software written by people who understand the basics. Software needs to be distributed to powerful users who realize the potential pitfalls so they can be corrected and improved upon.

Some time ago sound reinforcement was the topic of intensive scientific research. Unfortunately, there is not this kind of research, nor the kind of educational programs, for computer users. However, it is true that much of what is necessary to research has been completed and much has been written about. There are many products available off the shelf to fulfill our customer's needs. Perhaps then, it is up to the manufacturers to educate those that design and specify systems. In the allied electronics industries this is standard procedure.

Over the years audio manufacturers have published applications and technical bulletins and some have conducted seminars. Recently, *Sound & Communications*' contributors Richard Feld and Marc L. Beningson attended one such seminar conducted by JBL Professional held at the Warner Center Marriott, Woodland Hills, CA.

With just over 300 contractors, consultants, and reps in attendance, there was an atmosphere created for information exchange between those at the manufacturer level and the specifiers and users in the field. Attendance was not exclusive to JBL dealers, reps, or specifiers of JBL products. Workshops were also held in audio measurements and video projection.

Educational services, such as these, are sorely needed in this industry and in the business world of communications today. Standards and education is what will excel us both as an industry and as individuals.

Jesse Klapholz
Technical Editor

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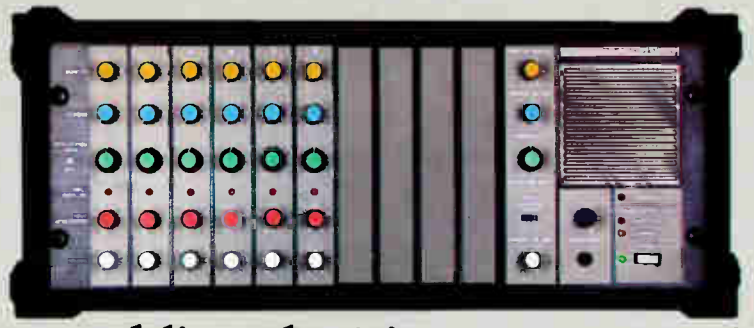

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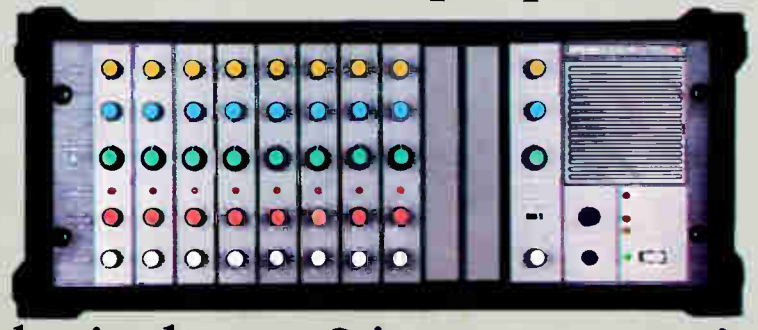

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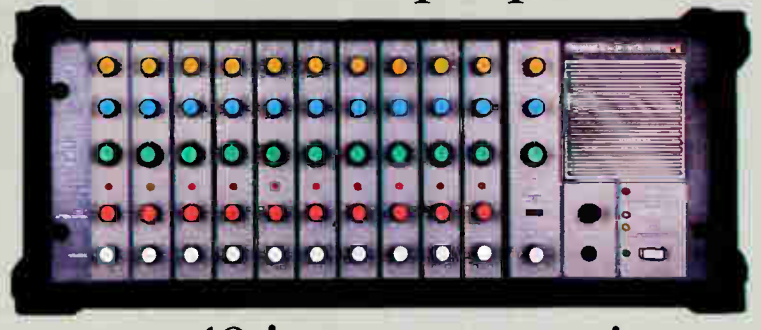

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