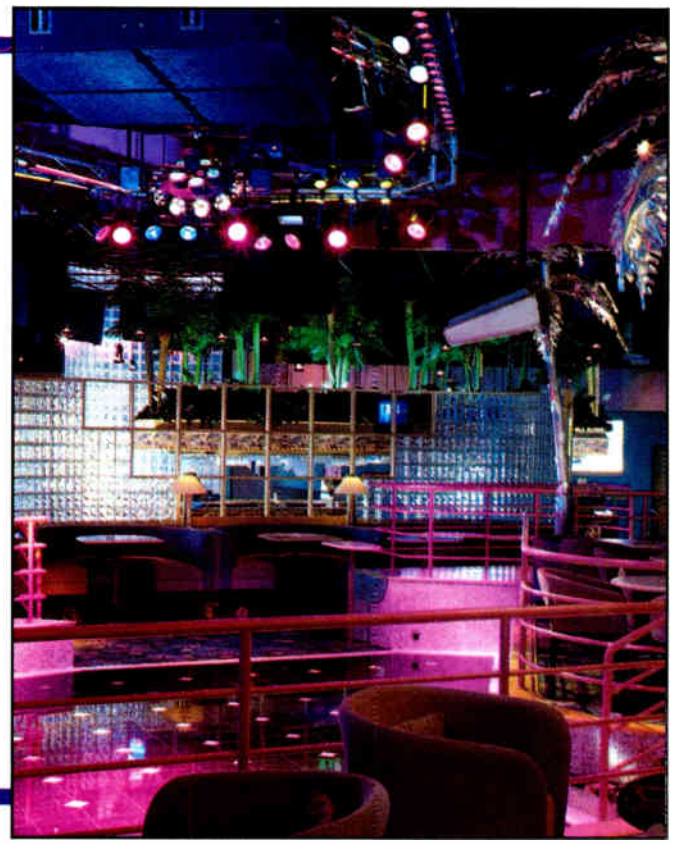
SOUND & COMMUNICATIONS

ber 5 May 1989

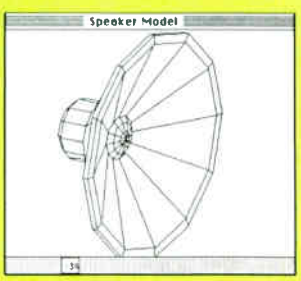
OCEAN CLUB

for Applied Audio: working with completed architectural and mechanical designs that had made little or no provision for the 8000 pounds of hardware and 155,000 feet of wiring they would be required to install during this $4 million night club construction project. The plans, which could not be altered, involved a 140,000 cubic foot prefab steel building with a 22-foot high steel deck (and no ceiling treatment), an interior design that called for black granite and marble flooring, glass block walls, 14-foot-high suspended sofitts, and carpet-on-concrete aisles. To add to the design troubles, no provision had been made for an equipment room and there was no space on the dance floor for subwoofers. How did Applied Audio meet these challenges? 42



AUDIO ARCHEOLOGY

While technology has been changing at an exponential rate since its original sound system was installed nearly 40 years ago, the acoustical challenges at Pearce Memorial Church remain the same. When CSE Audio was called in to replace the system, they discovered that innovative design solutions do not have to be limited by available technology—design ingenuity, then and now, calls for creative thinking. 26



SPEAKERCAD™

We review SpeakerCAD, the second program in the Sound System Software series from Bose Corporation. From hardware requirements to final printout, here's a close-up look at this powerful tool. 60

NSCA EXPO '89: CONVENTION PREVIEW

The 1989 National Sound and Communications Association (NSCA) Conference and Exposition will take place May 25, 26, and 27 at the Opryland Hotel in Nashville, Tennessee. Over 4500 industry people, including nearly 300 exhibitors, are expected to be in attendance this Memorial Day weekend for what promises to be the biggest show yet. Seminars, demonstrations, extended exhibit hours, NSCA-TV News—here's what you need to know to get the most from this year's show. 54

You can't build a better mousetrap unless you know your mice.

For years, those of you who wished to enjoy the many benefits of processed speaker systems had to endure one major drawback: loss of sound quality when the system switched into the protect mode.

The new DeltaMax™ electronically controlled loudspeaker systems put an end to such frustration.

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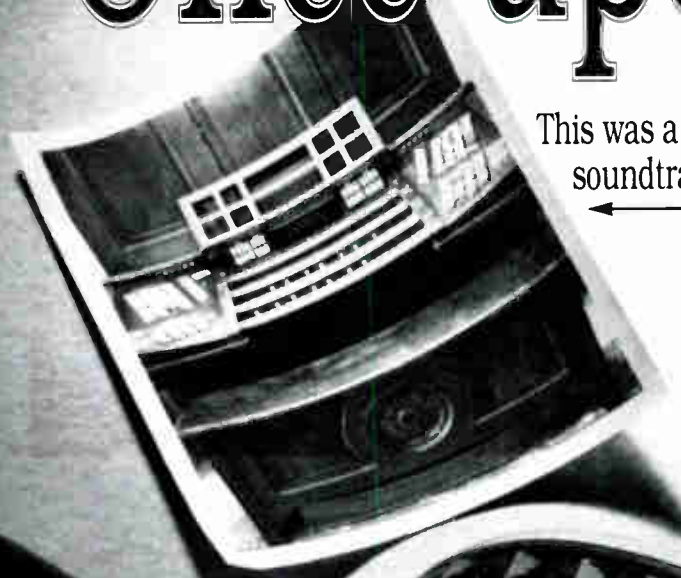
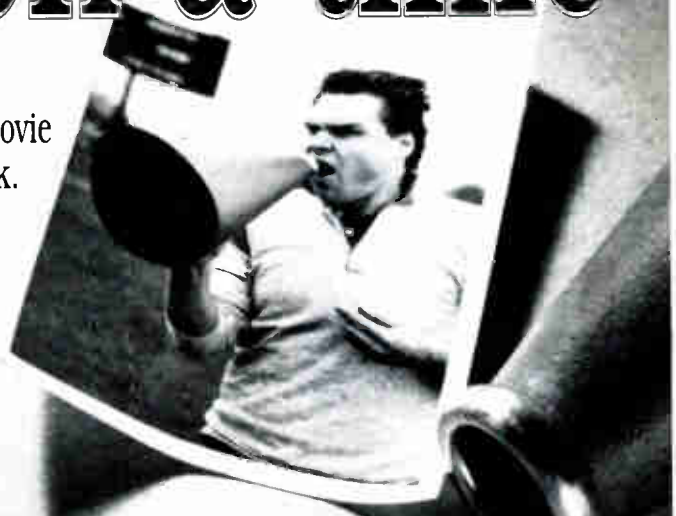
Once upon a time

This was a movie soundtrack.





And this was an amplifier

In their day, they were the state-of-the-art. The theater organ (or piano) provided all of the sonic textures required to completely involve an audience with the film on screen. The megaphone was reliable, but its limitations quickly became obvious. Its frequency response was rather limited, and its direct dependence on input level made it usable only by oral athletes.

With man's undying need to to expand his ears' horizons, the film soundtrack came to replace live accompaniment. Sound reinforcement came to span everything from audio in the home, to rock and roll in the arena. As the quality of these mediums grew, the need to surpass the limitations of existing amplification became apparent.

Ashly's MOS-FET Power Amplifiers represent our ongoing dedication to exceeding these boundaries. They feature an open, modular design with a Class-A, full-complementary, two-stage front end for stability and speed; MOS-FET output devices which contribute to both high sound quality and near-perfect reliability; a self-protection mode under virtually any conditions including short and open circuits, reactive loads and high frequency overdrive; perfect overload and square wave response with no extra transients or ringing; and they're stable into any load, including inductors, capacitors and resistors. The result; Amplifiers that are powerful and quick, delivering unrestrained, uncolored sound quality with remarkable accuracy.

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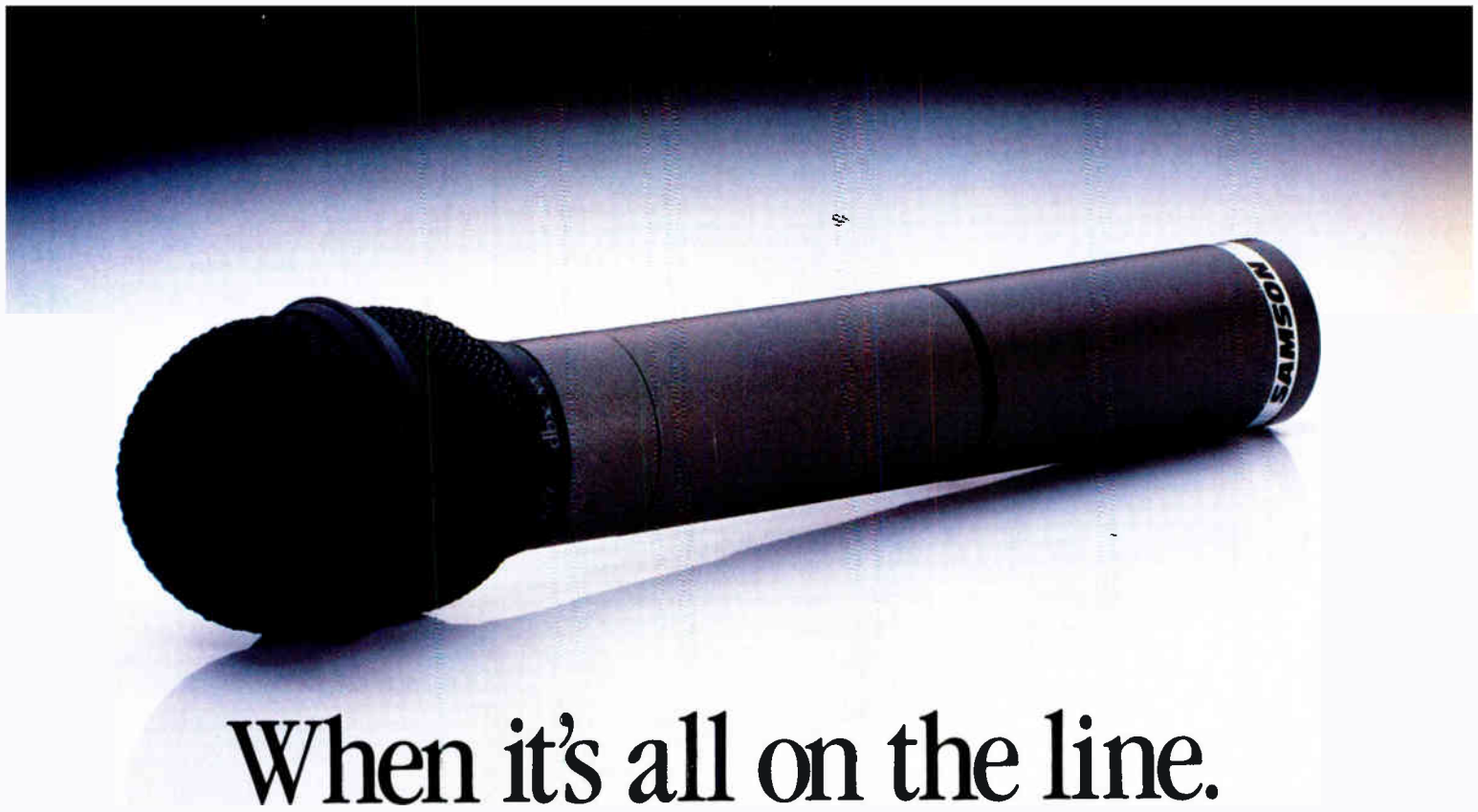
SOUND COMMUNICATIONS

 Sound & Communications (U.S. P.S. 943-140) is published monthly by Sound & Communications Publications, Inc., 25 Willowdale Avenue, Port Washington, N.Y. 11050. 516-767-2500. President, Vincent P. Testa. Subscription rates: U.S.—3 years $37.50, 1 year $15.00. Canada and Mexico—3 years $48.00, 1 year $18.00. Foreign and South America—3 years $60.00, 1 year $25.00. Second-class postage paid at Port Washington, NY and at additional mailing office. POSTMASTER: Send address changes to Sound & Communications, 25 Willowdale Avenue, Port Washington, NY 11050.

Coming in June...

We take a look at the latest in MIDI technology, and its applications for sound reinforcement. And the next installment of our software review series: Umbulus, from North Star. Don't miss it!



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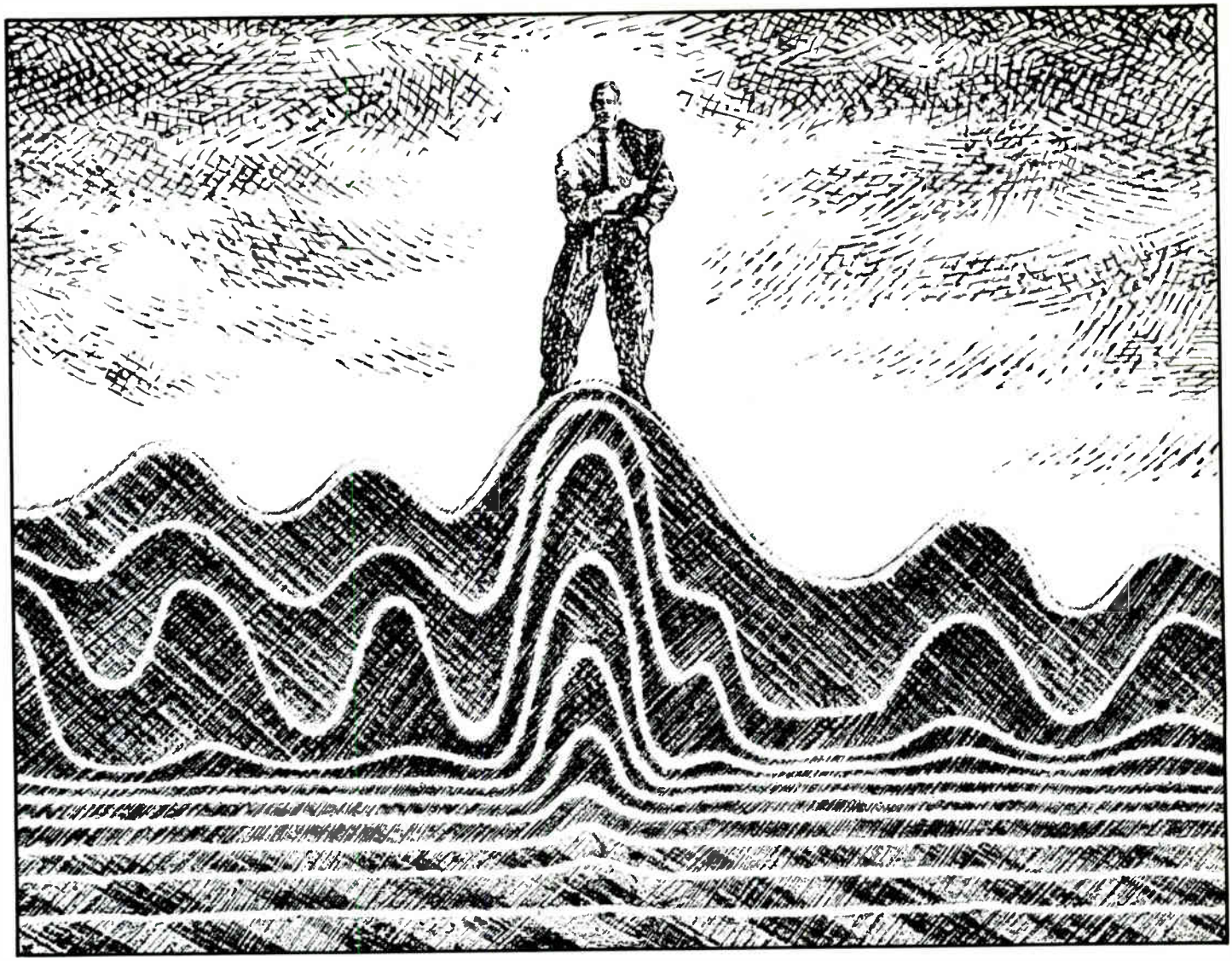

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Overlooked History; More On The SPL War

I read with great interest Mary Gruzska's article on Jack Mullin and his activities as they relate to tape recording (*Sound & Communications*, February 1989). Unfortunately, important information regarding the history of magnetic recording is often overlooked, such as the part played by the then Brush Development Company, who together with the Cleveland Graphite Bronze Company formed the Clevite Corporation. Clevite was subsequently merged into Gould.

The Brush Development Company was truly a pioneer in offering commercial magnetic recorders in the United States, under the name of SoundMirror. The first U.S.-built tape recorder similar to those now used today (though not as compact) was sold in quantity in 1946.

I mention this because the many contributions which were made by the Brush team have too often been disregarded. The SoundMirror, using magnetic powder coated tape, was indeed the first type magnetic recorder in use by U.S. broadcast stations. Though the SoundMirror was a relatively inexpensive machine, it was well recognized for quality and performance even in Europe.

Incidentally, AC-biasing, to which Ms. Gruzska makes reference, was first discovered in Japan in 1937. It was widely employed in the many different magnetic recording machines built by Brush for the Armed Services during the war.

S.J. Begun
Auctor Associates, Inc.
Cleveland Heights, Ohio

I agree 100 percent with the position taken by Jesse Klapholz in his column "Are You Holding The Smoking Gun?" (*Sound & Communications*, January 1989) and I congratulate him for speaking out on what is often an unpopular topic. Gary Davis' column "The SPL War" (*Sound & Communications*, October 1988) and Mort Altshuler's subsequent letter of agreement (*Sound & Communications*, December 1988) made me glad to know that I'm not the only person in the sound industry who abhors excessive SPL.

I hope you're familiar with the Ward v. Rock Against Racism case pending before the U.S. Supreme Court. Essentially, a music group is claiming the right to present their music just as loud as they see fit, with no maximum level set by any governmental agency (in this case the City of New York).

Frankly, I'm quite alarmed by this case, and I'm asking everyone I know to make their voices heard (no pun intented). I support the musicians' position that a sound mixing operator is part of the creative production, and therefore, must have complete control of the mixing consoles, including overall sound pressure level. However, the artists' First Amendment rights to freedom of expression STOP when their presentation jeopardizes the health and safety of the audience. As you know, OSHA already has rules designed to protect the hearing of industrial workers, but they're really not concerned with the general public. (I complained to OSHA about a nightclub once, and they simply said that unless they get a complaint from an employee, they have no reason to investigate.) And of course the OSHA standards use the "A-weighted" dB SPL scale, even when measuring levels above 85 dB. (I measured an increase of 15 dB when I switched from "A" to "C" weighting during a sound check for a Michael Jackson concert at Madison Square Garden last year.)

So even though I am for creative freedom, I am also for regulation to prevent dangerously high sound levels. This may put me on both sides of the Supreme Court case, but I think it's the only appropriate solution. In his closing address at the AES International Conference on Sound Reinforcement last May, Cliff Henricksen said, "We are too loud." That very sentiment has been expressed at other AES conventions in the past, but no one in the industry seems willing to put the words into corrective action! Dr. Altshuler said we "may be fighting a losing war," but I can't give up so easily. After all, what prevents visual artists from pointing powerful lasers at an audience in the name of artistic expression? Surely we can protect our eardrums as well as our retinas!

Kevin T. Cornish
High Bridge, New Jersey

As a veteran of "The SPL War," I would like to salute Gary Davis (*Consultants Comments*, October 1988) for his accurate depiction of one of the more unsavory aspects of sound reinforcement. As a footnote to Gary's comments, I would like to make readers aware that the Morrison

Center for the Performing Arts is investigating a rather unique approach to excessive SPL levels.

It is our position that occurrences of uncomfortable volume levels, similar to those described by Davis, may constitute "defamation of character" to the center, as an audience generally perceives such instances to be the fault of the hall's otherwise excellent acoustics and/or a callous attitude on the part of management. In an effort to avoid an unjustified reputation within the local community, it is our intention to contractually place a monetary assessment on the promoter in the event the sound company (contracted by him) generates SPL levels that cause acoustical overload of the hall.

As mentioned above, the Morrison Center is currently investigating not only the contractural legalities, but also a viable method of determining where and how to draw the line on unacceptable levels. It is my belief that moving excessive SPL out of the realm of health and safety and into one based on acoustic interaction, and subsequently, the subjective comfort levels in a given space, has some merit. With the intent of establishing an industry-wide standard, I invite communications with any interested parties.

David Jensen
Sound Coordinator
Morrison Center
For The Performing Arts
Boise, Idaho

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NEWSLETTER

SUNDSTRAND SELLING SUBSIDIARY TO SONY

Sundstrand Corporation (Rockford, Illinois) and Sony USA Inc. have agreed in principle on the purchase by Sony of Trans Com Systems, a division of Sundstrand Data Control, a wholly owned subsidiary of Sundstrand. The purchase is subject to the execution of a definitive agreement, and approval of the boards of directors of both corporations, Sundstrand said. Trans Com Systems (Costa Mesa, California) is a supplier of airline passenger audio and visual entertainment systems.

YAMAHA APPEAL MOTION DENIED

A Federal Judge denied a motion by Yamaha Corporation of America that would have paved the way for an early appeal of a Federal Court's ruling allowing a grey marketer to import Yamaha products. In December, Federal Court Judge Ronald S.W. Lew upheld the rights of the grey marketers — ABC International Traders — to import products manufactured by Yamaha but intended for other overseas markets. Yamaha had asked Lew to " certify" his December opinion so an appeal could be pursued, said David Lu, an attorney for Yamaha.

While ABC International is hailing the Lew's denial as a victory, Yamaha's attorney downplayed the decision. "It's no big deal, there are a lot of motions being made during this process,' said Lu. Still, Yamaha's next chance to appeal the grey market ruling will come after a countersuit filed by ABC is concluded, Lu said.

ABC's suit claims that Yamaha's initial lawsuit constituted unfair competition and violated anti-trust laws, said ABC's attorneys.

INTERLUDES CHOSEN BY MUZAK

The International Planned Music Association recently approved an exclusive distribution agreement with Interludes Productions Corporation, a division of Audiocom, Inc. The agreement, which calls for Interludes to provide " messages on hold" productions to the 150-plus participating Muzak dealer base, is only the third vendor agreement in the Association's 35-year history. Under the agreement, Interludes will provide services including copywriting, professional voice talents, complete audio production, and support in the areas of marketing and sales.

PEIRCE-PHELPS A/V DIVISION RESTRUCTURED

The Audio/Video Systems Division of Peirce-Phelps, Inc. has been restructured. Charles Moore, former manager of the Audio Division, now heads the Systems Group, Michael Dillon manages the Product Sales Group, and Bob Seidel is responsible for the Communications Systems Group. The reorganized groups that comprise the A/V Systems Division are an outgrowth of the Video Systems Division.

APHEX TO LICENSE NEW, LOW-DISTORTION VCAtt

Aphex Systems Ltd. is making what it calls its " proprietary new ultra-low distortion" voltage control attenuator available to others through a no-cost license. The VCA 1001 VCAtt has already been incorporated into all of Aphex's component audio signal processors. The device is designed for use in high-performance audio products where standard VCA or VCAtt circuits have previously been unacceptable, though it can be used in other electronic products as well, according to Aphex. The VCAtt may be licensed to manufacturers for incorporation into any devices other than stand-alone signal processors.

BLONDER-TONGUE LABORATORIES, INC., SOLD

After more than 38 years in the telecommunications business, Issac (Ike) S. Blonder and Ben H. Tongue, chairman of the board and president, respectively, of Blonder-Tongue Laboratories, Inc., recently sold the company to a group that intends to continue to operate and develop the business from the Old Bridge, New Jersey headquarters. Retaining the company name and rights, the new organization does not plan to

NEWSLETTER

alter Blonder-Tongue's format and will initially concentrate on developing and expanding penetration into the master antenna, cable, MMDS, satellite and home television reception markets that Blonder-Tongue has serviced. The investment group has named James A. Luksch as president and Robert J. Palle Jr. as executive vice president of the new organization. Marketing, sales, and distribution of Blonder-Tongue products will remain unchanged under the new leadership.

NEW QUARTERS FOR TECHNICAL PUBLISHER

Gary Davis & Associates, a firm that produces technical manuals and collateral literature for audio and other electronic products, has moved to new and larger quarters. The company's new offices are in Santa Monica, California.

INTERCOM DIVISION

J. Bushfield's, Inc., based in Redmond, Washington, has announced the formation of Telecall America, its intercom systems division.

APPROVAL FOR JBL

JBL Professional's 2450J compression driver for THX theater installations has been approved. The company reports that this is the first neodymium compression driver in the industry to be approved for THX installations.

Also, two JBL representative companies were recognized for their 1988 sales achievements. Receiving the award for Representative of the Year for JBL and UREI products was Plus Four Marketing, located in Walnut Creek, California. The award for Representative of the Year for Soundcraft products was presented to Star Enterprises of Yorba Linda, California.

FRAZIER APPOINTEE

HBL, importer of U.S. lines of sound contractor and pro-sound equipement, with offices in Stockholm and Uppsala, Sweden, has been appointed distributor of Frazier loudspeaker systems.

FIRMS FOR HM ELECTRONICS

HM Electronics, Inc. (HME) recently appointed Derek Allen Associates (Burbank, California) and HP Marketing (Littleton, Colorado) to handle the company's pro audio product line of cabled and wireless intercom systems and wireless mics. Derek Allen's territory will be Southern California, Southern Nevada, and the entire state of Arizona; HP Marketing's territory will include Utah, Colorado, Wyoming, New Mexico, Southeastern Idaho, Eastern Montana, Northwestern Nebraska, and Western Texas.

THROCKMORTON SCORES

In recognition of its sales of Community Light & Sound's products, R.J. Throckorton Sales Company (Ballwin, Missouri) was recently selected as the loudspeaker manufacturer's Rep Firm of the Year. Throckmorton Sales services client accounts in Missouri, Nebraska, Iowa, Kansas, and Southern Illinois.

REP FIRMS APPOINTED BY AMERICAN DYNAMICS

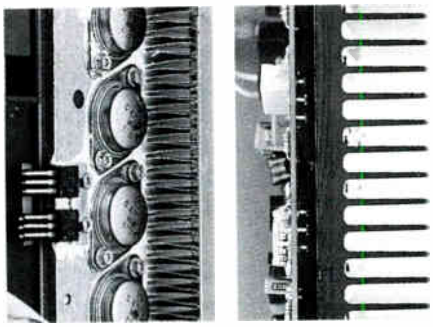
American Dynamics has announced the appointment of 16 representative firms, located throughout the U.S. and Europe, who will handle sales of all American Dynamics CCTV products for surveillance and security appliations. The representatives announced included: LMS Marketing, Columbus, Ohio (Ohio, West Virginia and western Pennsylvania); Bruce Dawson & Associates, Louisville, Kentucky (Indiana and Kentucky); Keith Parker & Associates, Northbrook, Illinois (eastern Wisconsin and northern Illinois); F. M. Valenti, Inc., headquartered in Nahant, Massachusetts (New England and upper New York State); The Crockett Sales Co., Dallas, Texas (Texas and Oklahoma); H & H Enterprises, Albuquerque, NM (New Mexico); R. P. Sloan Associates, Clarkston, Michigan (Michigan); and Capco Associates, Denham Springs, Louisiana (Louisiana, Arkansas, and Mississippi).

Warning: To Avoid Risk Of Shock,

Ignore This Amp-To-Amp Confrontation.

Let's be frank. We're out to change your idea of what—and who—makes a professional power amplifier. So if you just bought a Crown MacroTech, turn the page — this comparison won't be a polite one. But it will stick to the facts.

A look inside these two amps will give you a better idea of why BGW amps like the GTB Grand Touring Amplifier are built like no others in the world. And raise some questions about Crown MacroTechs.



Left: *The MacroTech uses mostly air to dissipate heat, not metal. The closely spaced fins are vulnerable to airborne dust and dirt.*

Right: *BGW uses ten pounds of aluminum to absorb thermal transients, extending power transistor life.*

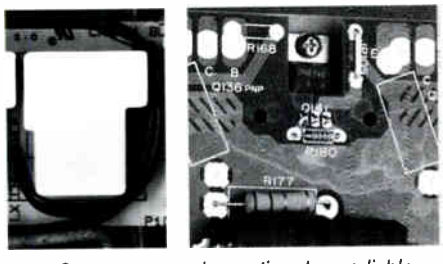
TAKING THE HEAT

If the MacroTech heat exchanger reminds you of an air conditioner, you've grasped its design. This approach works, at least until dust and dirt clog the fins. But as soon as the air flow slows or stops, temperature rises. Soon after that, the Crown shuts off — it could even fail.

The GTB uses massive extruded aluminum heat sinks with widely spaced fins. The mass of metal absorbs thermal transients without straining the fan. And without quick changes in transistor temperature. That's important: Transient musical loads put the worst kind of stress on power transistors. The effects of thermal cycling fatigue may not show up until after the warranty, but they can destroy lesser amps. Meanwhile, BGWs keep right on delivering clean, reliable power.

REAL SPEAKER PROTECTION

Most amps today are direct coupled, so a blown output transistor (the most common failure) connects the power supply directly to the speakers. Earlier MacroTechs had no protection against DC. Now Crown has learned their lesson — or have they? The sensing circuit and relay they now use shuts off the power transformer, but allows the filter capacitors to discharge stored DC energy directly into your drivers — risking real damage.



Left: *Crown uses a slow-acting, less reliable relay. It can allow the filter capacitors to discharge stored energy directly into your drivers.*

Right: *BGW's modular power output section protects your speakers against DC damage with an instantaneous Thyristor Crow Bar. And the module is easily replaced in the unlikely event of failure.*

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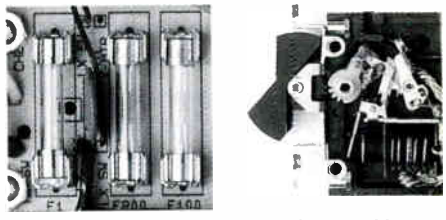
BGW pioneered DC speaker protection in 1971. We stopped using relays years ago, when they no longer met our reliability standards for BGW amps. The GTB, like all BGWs over 200 Watts, uses solid-state Thyristor Crow Bars to keep DC from ever reaching your valuable speaker cones or compression drivers.



Left: *Time is money, and with Crown's MacroTech you can lose plenty of both: You have to pull it out of the rack every time a fuse blows.*

Right: *The GTB's power switch is also a rocker-actuated magnetic circuit breaker. You can reset it in a second if power lines hiccup.*

MAKE YOUR OWN COMPARISON

Before you buy or spec your next power amp, call us at **800-468-AMPS** (213-973-8090 in CA). We'll send you tech info on BGW amps and the name of your nearest dealer: He can arrange a demo of any BGW model against any amp you choose. Then you'll be able to appreciate the advantages of BGW engineering with your ears, as well as your eyes.

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Entering The Security Market? Distributors Can Help

By David Cohen

Whenever you sell or install sound or communications systems, you have an excellent opportunity to add an electronic security system to the sale. Music, intercom, telephone, and alarm systems all use similar low-voltage wiring techniques. It is less messy and less costly to have all these functions installed at a single time.

Although many sound contractors are aware that they can easily increase their sales and profits by selling and installing electronc security systems, they are concerned about what products to use and how to install them. You have an excellent resource to help you get started in the alarm business—the alarm equipment wholesale distributor. Take advantage of the numerous services offered to you by many distributors.

WHY DISTRIBUTORS?

There are more than 200 companies that manufacture electronic alarm products. They cannot afford to maintain and staff local offices and warehouses in every urban market. It is more cost-effective for the manufacturer to sell through wholesale distributors. The distributors, in turn, sell to those who will actually install the systems—and sound contractors should be among that group.

Most distributors stock the products of many competing manufacturers. Thus they are in ideal position to give you unbiased advice as to which products are best suited to each specific installation.

PHYSICAL DISTRIBUTION

Wherever the individual distributor is located, however large or small the region served, the distributor has the ability to maintain a much larger and more diverse range of products than most contractors are able to carry at one time. This kind of depth allows sound contractor or dealer to avoid the high cost of financing large inventories. Dealers also save the cost of storage space, the cost of obsolescence, handling costs, and numerous other hidden costs. Most distributors offer immediate pick-up, and many have convenient toll-free numbers for ordering by phone.

Most alarm equipment distributors try to stock everything that the dealer will need for any alarm installation. One-stop shopping is convenient and efficient.

First and foremost the distributor carries a full complement of burglar alarm equipment: the various sensing devices that detect an unwanted intrusion, the reporting devices that sound a local alarm or transmit an alarm signal to a remote location, and the control panel that interconnects and supervises the overall system.

Alarm equipment distributors also carry a wide range of other security products, such as access controls, electromagnetic locking devices, closed circuit television, and fire alarms. They also stock batteries, power supplies, wire and cable, along with a variety of other tools and accessories.

TECHNICAL ASSISTANCE

If you are just starting out in electronic security, many distributors have qualified personnel who can help you with component selection and instruct you in installation techniques. Many have had extensive alarm system installation experience. This experience helps them to help you more effectively when you are planning an installation and selecting products. And again, because most distributors sell products made by many competing manufacturers, they can offer unbiased advice and a broad range of technical support.

In addition, many distributors offer training courses and seminars on acontinuing basis to help both new and experienced dealers. Manufacturers often send their own staff professionals to these seminars, professionals who share their expertise through practical demonstrations and by teaching dealers what they need to know about security industry technology and products.

Most company catalogs are designed to permit the dealer to compare product opinions conveniently and quickly, and then easily order the selected products.

SALES ARE BOOMING

The demand for electronic security is booming. Sound contractors can get their share if they seek it effectively. Take advantage of the services offered by alarm product distributors. They are waiting to help you. ■

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Speech Intelligibility: Conceptual Difficulties

by Steven J. Orfield

In his recent book, *A Brief History of Time*, the brilliant theoretical physicist Stephen Hawking discusses at length Einstein's theory of relativity with regard to perception of movement. In an interesting way, the theory of intelligibility has a somewhat parallel set of considerations. A few examples may serve to illustrate this phenomenon.

Upon installation, an audio engineer may evaluate a new church sound system by testing its intelligibility. By performing an STI test at different positions in the room, she may state, "This system has a minimum STI intelligibility level of 0.60." Unbeknownst to the audio engineer, an acoustical consultant may visit the same room and may, by the same STI method, evaluate the unamplified church at the same positions and find that the minimum STI value is 0.75. A third technician may, via the same test taken later in the day and under higher environmental noise conditions, evaluate the sound system and room combined at an STI level of 0.55. A fourth engineer with a moderate sinsorineural hearing loss may use a Modified Rhyme Test to evaluate the sound system at a 0.40 level on intelligibility. Finally, a recent immigrant sitting in the church may only understand 15 percent of the words, suggesting a 0.15 rating.

Interestingly, these individuals may all be correct. A number of questions result from this variation in results:

1. What is "intelligibility" rating?
2. Under what conditions is the rating issued?
3. How can a sound system that reduces intelligibility be rated with a positive number?
4. Does intelligibility, in any absolute way, rate the performance of product?
5. How does intelligibility deal with time-based variations in its variables?

A simple and increasingly common answer may suggest that in appropriate intelligibility testing, all variables are held constant, and certain conditions are placed on the sound source, the listener and the environment. Unfortunately, as with most models, this set of conditions may remove the concept of intelligibility from the real world, and the results of these tests will be both accurate and trivial. Another view of this problem may suggest a new look at some of its variables.

To begin with, in the use of this concept, we are attempting to rate the talker, the transmission path, the listener, or any associated electronic enhancement devices (amplifiers, filters, and so on). Secondly, what are the reasonable limits of variable fluctuation in the circumstance under test? Many of the readers of this magazine have found themselves victims of this set of issues, in that they may have installed a sound system in an acoustically poor new space with high background noise levels and with low resultant intelligibility. Many other readers may have benefitted from this same set of circumstances by installing a poor sound system in a room which is high in acoustical quality: the reduction in intelligibility due to the sound system may have left a reasonable margin of intelligibility.

Since intelligibility, in this context, is usually the basis of some decision to add or change something, it might be suggested that the concept be applied to the change under consideration. Thus, it may be beneficial to rate products and processes which intend to increase intelligiblity by their delta or change value. This may result in an audio engineer testing the same church sound system that we looked at earlier and stating, "The minimum intelligibility value of this sound system is minus 0.25 STI."

In looking at another underlying assumption within the field of intelligibility, most testing assumes that the goal of intelligibility is to replicate close to 100 percent of the near field intelligibility (1 meter from the talker) of the speaker.

If this is true, some devices may be considered to provide more benefit than 100 percent replication. For example, in a high-noise environment, the talker may have only 20 percent intelligibility to a listener who is one meter distant. Via the use of an intercom, the intelligibility to that close

Orfield is president of Orfield associates, Minneapolis, MN.

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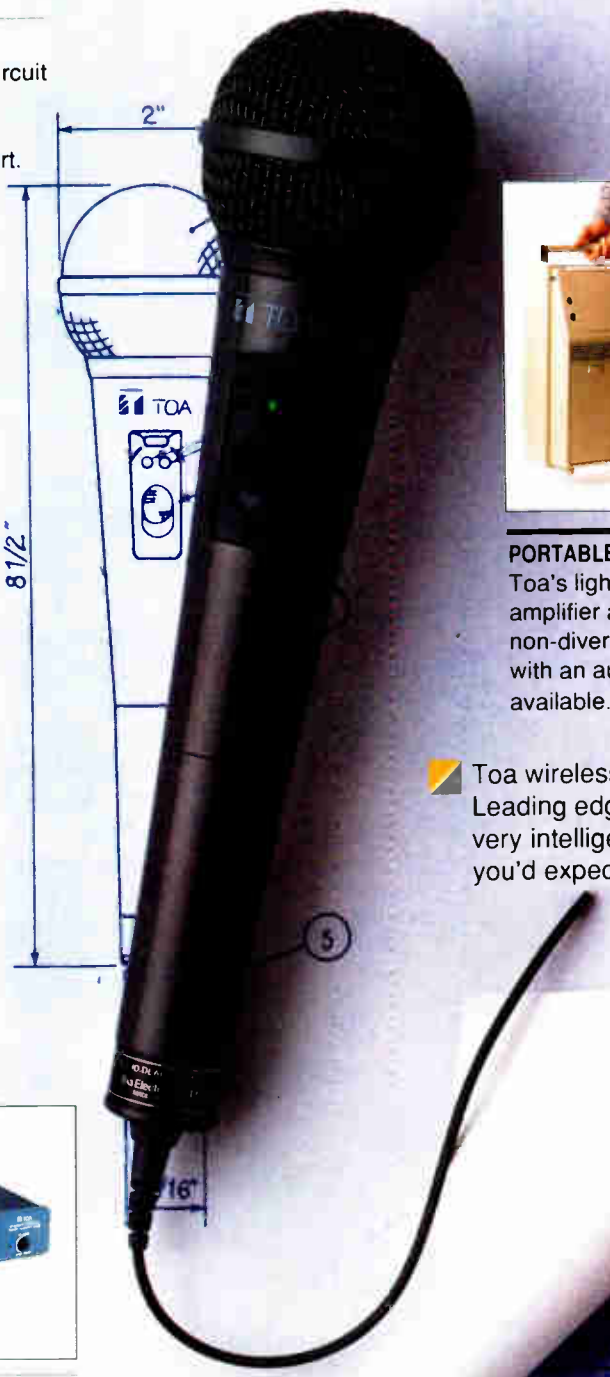

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listener may be 60 percent. Thus, the listener has a 300 percent increase in intelligibility when compared with the actual unamplified talker. Does this suggest that the system is intended to provide a 3.0 intelligibility rating? While this concept of intelligibility ratings above 100 percent and below 0 percent is somewhat troubling, it does begin to deal with these two undisputed facts.

1. Some acoustic and audio solutions actually degrade talker intelligibility when compared to a listener standing next to the talker or at other listening positions. (e.g., reflectors, echoes, poor sound systems).
2. Some acoustic and audio solutions actually increase talker intelligibility when compared to a listener standing next to the talker or at other listening positons. (e.g.: hearing aids, intercoms).

While this discussion is certainly a cursory view of a complex concept, it would be well to remember that:

1. Intelligibility may be a rating of process or product and it may be relative or absolute.
2. It can be used to evaluate the net change in addition to the so-called absolute value (i.e.: %Alcons, etc.)
3. It is only useful to the degree that it models the relevant context in both its qualities and in its time-based variations.
4. It generally tells us nothing about the qualities of the talker, the listener or the message, all of which are often important to it success.
5. Its value is qualitative rather than diagnostic; it gives little information regarding a casual explanation of its value.

Many sound systems fail due to the limited or negative significant difference which they provide; others fail due to their inability to interface their performance with the limits of the environment. It is interesting to note that most of our preliminary and diagnostic church sound system tests indicate that intelligibilty is increased in about one half of the space and decreased in the other half by the use of the existing sound system versus using no system at all. This, in fact, has been the basis of our broad concern regarding the use of this concept. Any well-though-out concept must be able to explain both the benefits and the losses provided by changes in process and product. ■

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Ask Dr. Wokka

by Dr. Wilhelm Wokka

Dear Dr. Wokka,

I built your "Sweet 1600" loudspeaker, a pair for stereo, gutted the barn and installed them. I have amplifiers and everything, including a state-of-the-art CD player, and am ready to hook them up. I went to Radio Shack and got some speaker wire, but I thought I might check with you before hooking it all up. For instance, how much wire should I use, which goes to the plus and so forth. Please let me know because I want to start listening to my Anthrax CD's soon. Thanks, Doc.

Rupert Kneefe
Nome, Alaska

Dear Mr. Kneefe,

Well, you've opened up the Pandora's Box or whatever they call it this time. Where do I start? On digital and God? On wiring? On the need for only one Sweet 1600 for stereo? On polarity and the meaning of Life itself?

Let me solve your immediate problems. First, sell one of the Sweet 1600's. How many times must I say this—you only need one Sweet 1600 for 3-D stereo! Clear the sale with me at the Philadelphia Medical College of Musical Knowledge first—we can't let this kind of equipment get into the hands of the unwashed and uninformed of the world, much less these "jazz" musicians you see on the streets every day. Given the amount of U-238 you used in the Sweet 1600's, you can probably get a pretty penny from the U.S. government. Don't sell it to any other government!

Second, get rid of your CD player, even though you only have medical lectures to listen to. As any PMCMK student, graduate, or professor knows, God has been eliminated from music and speech in the process of digitizing and reassembly. Of course, the Philadelphia Church of the Living Sound presents this doctrine every Sunday at Penn's Landing. Anyone can tell you that only analog recordings preserve the essence of God's Spirit in music and speech; digital is the work of Satan and this is the reason you feel weak after listening to a CD recording. Buy the most expensive turntable, cartridge and preamplifier you can. Dump the CD.

Lastly, listen as I explain The Only Way to Wire Your Loudspeakers. The connection of your speakers to your amplifier is the most crucial step in the setup of your system. No other single component in your sound system has a greater audiovaculary effect on the system's sound than the sound of the system's system of sound wiring. I'll repeat, no other...well, never mind. Just remember what I just said and consider it your mantra for this month. Anyway, get rid of the Radio Shack wire and stay out of those kinds of stores. They'll sell you anything, including CD players, real cheap. Don't you know why CD players are so cheap...ah, I must stop now. At this point, I'll do more harm than good. I will reveal The Truth on this matter later, when my spirit has calmed down.

Anyway, get rid of that silly wire and listen. Wire materials and length are crucial to a proper hookup. Wire manufacturers will tell you anything to make a sale, all kinds of things that everyone wants to believe because they are so hopelessly misinformed. These ruthless wiremonger/gangsters will tell you that, for instance, "skin effect" is to be avoided. Nonsense. Skin effect is to be encouraged. How do you think we get information to our brain so quickly? That's right: skin effect.

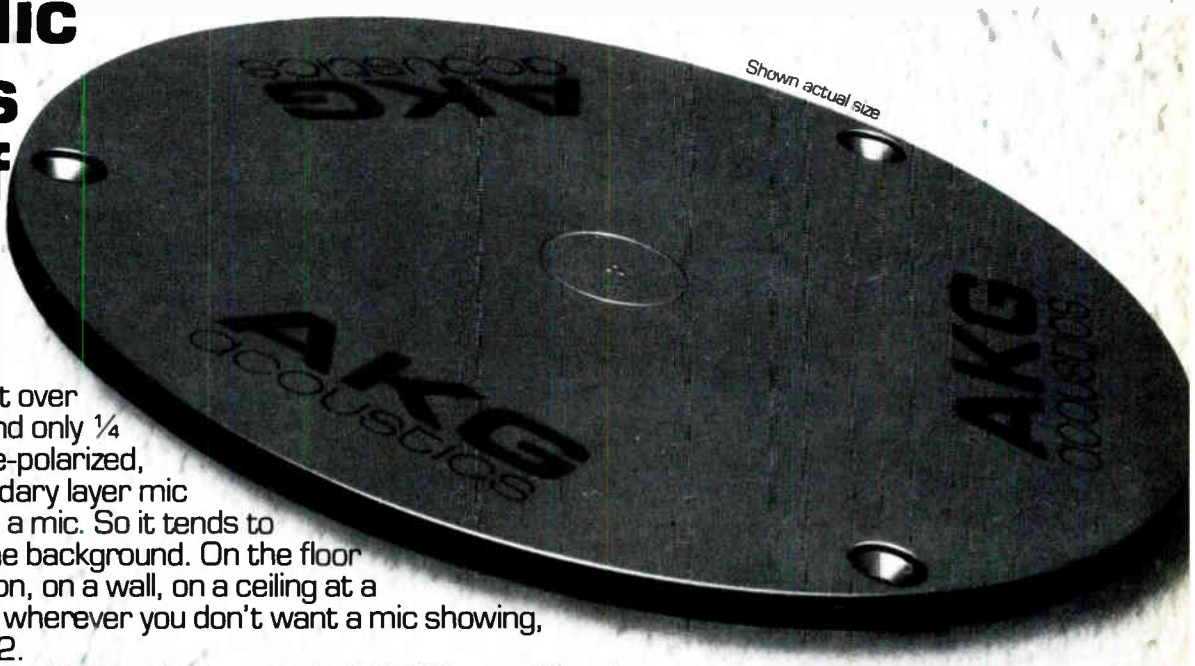
Electrical impulses travel most quickly through nerves in our skin, so that high frequencies are transmitted through skin effect. The slower, higher intensity impulses (like those associated with eating and playing football) travel through our inner nerves and through our bone marrow. Of course medical students like yourself know this, but the general readership of this magazine probably doesn't. (By the way, I'd love to hear your Anthrax lectures—please tell me which series you have, but buy records next time.) Also, the human body is about 66 inches long, on the international average. Why do you think? Well, it's the proper length for transmission of the frequencies normally encountered in real life. You can derive this from the General Equation of Sound and Life, found in any of my books, and the neurological speed of transmission speed of living flesh.

What does this all mean? It means we should construct our connection cables from the example of the Perfect Signal Conductor, the human body. Roll up your sleeves and get ready. Here's what you need to do. Get the following ingredients for each super-conductor:

- 5 pounds of # 60 bare aluminum wire.
- 5 pounds of # 67 bare gold wire.
- 5 pounds of # 80 bare iron wire.
- 5 pounds of # 99 bare copper wire.

Dr. Wokka is an instructor and mentor at the Philadelphia College of Musical Knowledge.

AKG's C 562. The Mic That's Out of Sight.



Take its size. Just over 6 inches wide, and only ¼ inch thin, this pre-polarized, condenser, boundary layer mic looks nothing like a mic. So it tends to disappear into the background. On the floor at the stage apron, on a wall, on a ceiling at a conference— or wherever you don't want a mic showing, you need a C 562.

How does it sound? Amazingly natural...high SPL capability, low rumble and wind noise and no disturbing comb filter effects. It's hemispherical polar pattern is designed to pick up sound with incredible presence for a mic that's practically invisible.

And its ultra-widefrequency response doesn't miss a nuance. When all you need to "see" is the sound— all you need to use is the C 562.

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5 pounds of # 73 bare silver wire.
11 pounds of pure saline jelly.
20 feet of 5/8 inch copper tubing.
1 heavy-duty vise.
1 roll of .010 thick polyethylene sheet.
3 stainless steel hose clamps with worm drive.

Cut the copper tubing in thirds, fill each with saline jelly and crush the ends shut with the vise. Bundle the filled tubes together with the hose clamps, three inches from the ends and in the center. Spool out all the various wires at random, one strand at a time, and wrap them helically around the tubing bundles, applying saline jelly liberally to each application of wire. Allow the gold wire to extend about three inches from each end twist these together at the ends of the bundles. These will be the connections to the ends of these conductors. When the entire saline jelly-and-wire bundle is completed, apply an extra coat on the outer surface and cover with the poly film, sealing it all with duct tape.

There will be no further mechanical augmentation needed and the described assembly will hold up quite well on its own. For each speaker you will need two. Thus, for the sweet 1600 you will need 3200, more or less. Better make a few extra just in case. Connecting all these to the amplifier is a bit of a mechanical challenge, but it's worth it.

As you can tell, these fabulous super-conductors are a good approximation of the human body's very own nerve system and will make any system sound as if you lifted a wet blanket from in front of the speakers. Even my Aunt Norma, who is 84, remarked about where all the extra musicians came from, or something to that effect. Don't continue to be fooled by any of these "miracle" wire manufacturers and their trumped-up sales claims. You just can't hear the difference between their overpriced criminally inferior non-conductors and the # 22 speaker wire you got at the Radio Shack store. You must trust me on this fact. Armed with these secrets of the sound system super-conductors, your audio life will transform from night to day.

Go forth. Use this information bravely and wisely. I hope I have saved you from an excruciatingly traumatellic audiophonical psychophonogenic experience. And do not ever refer to me again as "Doc." I have done too much for you, not to mention the entire industry, to be treated with such irreverence. *Great Men of Audio Science* are simply not referred to as "Doc." ■

NEXT MONTH: Analog versus Digital, or God versus Satan

THE IEQ WITH Smartcurve™

Not Just Another Programmable Equalizer With MIDI™

The IEQ with Smartcurve™ is a programmable, high performance graphic equalizer that includes a video output. For those who wish to enjoy the video output of the IEQ, ART makes the IEQ Video Monitor.* Smartcurve™, proprietary software developed by ART gives you instant actual frequency response as easy as the push of a button.

The IEQ Family consists of both the 2/3 octave and the 1/3 octave graphic equalizers. Both types come in two varieties, Controllers and Satellites. A Controller is a self-contained programmable intelligent graphic equalizer capable of controlling 15 satellites at once. IEQ Satellites are exactly the same unit except the front panel controls are eliminated.

IEQ Model Specifications:
Controller & Satellite
- 128 battery backed presets
- MIDI
- Frequency Response 20Hz-20kHz ± 0.5dB
- THD - ≤ .009% @ 1kHz, 0dBM typical
- Dynamic Range - ≥ 100dB typical
- Balanced inputs and outputs

***IEQ Video Monitor Features**
- 19" rack mountable
- NTSC compatible monochrome monitor
- 4 Selectable inputs
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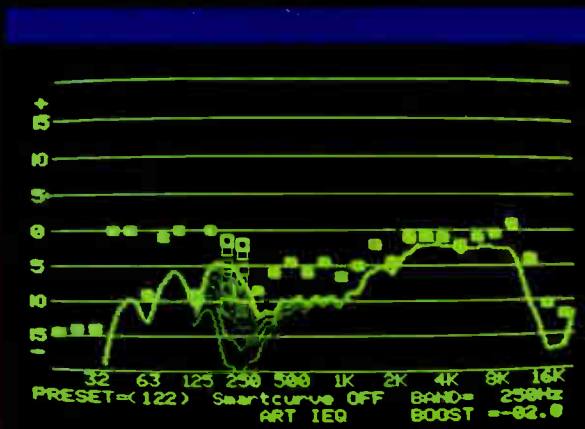
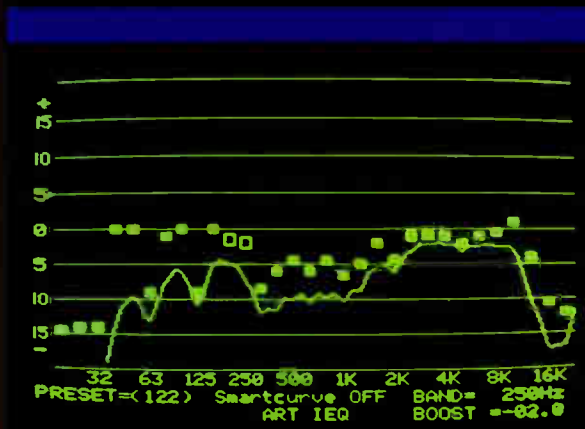


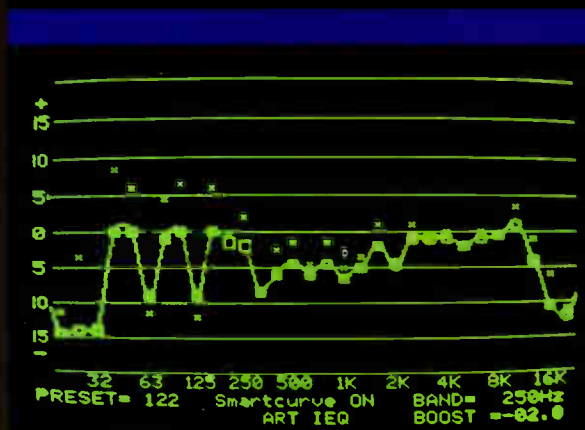
1 See the Sound

This is a video output of the IEQ as the unit is being adjusted. The sliders can be moved ± 15dB in 1/2dB steps to get the exact response you need. With the simple push of a button, complex equalization can be done in seconds with incredible accuracy.



2 Hear the Sound

The power of the IEQ readily becomes apparent as the video display plots the frequency response due to the slider settings. The IEQ offers high quality constant "Q" equalization. The video graphic display shows the correlation between the sliders and the frequency response.



3 Perfect Sound

Turn Smartcurve™ on and perfect equalization is at your fingertips. Note the difference between the second frame, (Smartcurve™ OFF) and this frame. The position of the sliders represent the actual frequency response of the EQ. Interaction between bands is virtually eliminated. Incredible! Just think, now when you adjust the EQ you get exactly what you need. The "perfect" EQ? Let your eyes and ears decide.

PEARCE MEMORIAL: TRANSFORMING THE STATE OF THE ART

BY BRIAN WARNER

Entering this 2500 seat sanctuary, I would never have guessed that this stately Pearce Memorial Church housed one of the nation's finest state-of-the art sound systems. No wires were visible. No huge mixing consoles could be seen. No monstrous speakers flanked the podium. Were it not for the sight of a lonely cluster of Tannoy speakers peaking out from under a rafter, I would have assumed the pastor must be blessed with extraordinary lungs.

What was hidden from me and the parishioners of Pearce Memorial Church was a sound system of unusual fidelity and flexibility. This well-disguised system boasts more than 30 stage inputs, four discrete stage monitor systems, time delays, building-wide signal distribution, multi-track tape recordings—even custom-designed radio loops for the hearing-impaired.

Pearce Memorial Church retained the services of professional audio consultants CSE Audio, Rochester, NY. CSE specializes in custom-engineered sound installations. From the Dolby Surround Sound Studios of Kodak to recording studios around the nation, CSE Audio is no stranger to tough audio challenges.

This system replaced the original system, installed in 1950. But this is not

The Pearce Memorial Church, Rochester, New York, with ceiling cluster of Tannoy loudspeakers visible at center.

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While other companies come and go, Architectural Acoustics has the unyielding Peavey commitment to customer service and follow-up support. Year after year, you can depend on Peavey Architectural Acoustics.

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State of the art: 1950. The original equipment, much of it custom-made, was of excellent quality.

just another tale of a maimed and limping system put out to pasture. What makes this story interesting is that the system being replaced was one of the most unique, innovative, and state-of-the-art systems of that period that we have yet unearthed. The acoustical challenges then were no different from now: but the solutions to those challenges in 1950 were very different from today's solutions.

"This system really deserves to be in a museum. No disrespect intended," said Craig Fennessy, owner of CSE Audio. "They essentially did the system right back in the 50s. It was very good. State-of-the-art."

Fennessy explained: "First, they used point source sound. They used two horns located about 45 feet above the main podium. These were enhanced with a couple of cabinets located in the organ lofts, to reinforce the low end."

As good as the system may have been in 1950, after nearly 40 years it was time to upgrade. "We wanted to get rid of the honky, mid-range sounds of the horns. Because of their directionality, horns tend to create hot spots as well. For better intelligibility, and more even coverage through the church, we opted for full-range, duel-concentric speakers," said Fennessy. CSE selected Tannoy for the main cluster. "We used four cabinets, housing four duel concentric speakers. High voice intelligibility is a price concern. Duel concentrics fit the bill. Because all the program material is essentially in phase, problems of back splash and early reflections are minimized," according to Fennessy.

"Fidelity also played a roll in the selection of the main system speaker cluster," he added. "With Tannoy's studio-like sound, the fidelity was greatly enhanced over the old system. Having full-range speakers in the overhead cluster eliminated the need for the low frequency cabinets in the organ lofts. This helps both fidelity and intelligibility."

Beyond quality of sound, duel concentrics were also selected for superior coverage. "We selected the duel concentrics because they have conical dispersion, unlike horns. Further, their coverage approached 90 degrees of dispersion. To play it safe, we calculate a full bandwidth dispersion of 60 degrees," said Fennessy. "With the height of the ceiling about 40 to 45 feet, and the 60 degree full-frequency dispersion, four speakers were adequate to cover the main part of the sanctuary, and most of the balcony." Installation of the Tannoy speaker cluster was a logistic challenge. A custom bracket was designed and fabricated from heavy gauge steel. A special hydraulic "Genie" lift was used, with special rigging to hoist the 500 pounds of speakers over 45 feet above the floor. It took a crew of five to operate the equipment and guide the

State of the art: 1989. The quality and flexibility offered by the new equipment will carry Pearce Memorial through the 90s.

Warner is a free-lance writer in Rochester, NY.

speaker cluster into place. The cluster was then bolted into and through the beams. New wire was snaked through 50 feet of conduit concealed in the ceiling.

Hiding the wiring from view was one of Fennessy's primary concerns: "It is really amazing how all the wiring is totally concealed. Every wire runs in conduits; there are no wires stapled anywhere. The floor receptacles are all custom punched brass units, designed to blend with the church decor. Though totally invisible, the stage houses over 30 inputs, and 40 monitor systems."

The church anticipates expansion to multi-track recording, and eventually to television broadcasting. In anticipation, the flexibility this expansion would require was built into the system.

THE BALCONY

The extensive overhang of the balcony created the biggest obstacle for adequate coverage. The balcony juts into the auditorium some 40 to 50 feet.

Those sitting under the balcony were shielded from the direct sound of the overhead cluster. To compound the problem, this section was nearly 120 feet from the front podium. That works out to a time delay of about 120 milliseconds, very noticeable to the human ear.

This time delay problem also faced the designers of the original system, vintage 1950. Their solution was nothing short of stunning. A "pre-digital era" time delay was created by taking 120 feet of metal tubing and curling it up (reducing the physical space requirements), then placing a speaker at one end and a microphone at the other. The time-delayed audio was then fed into the speaker system under the balcony. This was truly state-of-the-art for 1950.

Despite this innovation, people still hated to sit under the massive balcony. Fennessy pointed out, "The sound was very, very dead—muted by the acoustic tile." The unnatural sound was solved with a modern zoned system created by CSE.

The central cluster of Tannoy loudspeakers being assembled.

CSE's system called for a digital delay unit to feed a new bank of high fidelity speakers mounted in the underside of the balcony. Since the speakers would only be 5 to 6 feet above the heads of the parishioners, CSE Audio put a quality compressor/limiter in line. This creates a comfortable listening environment under the balcony, regardless of the dynamic range on the podium, from whispers to shouts.

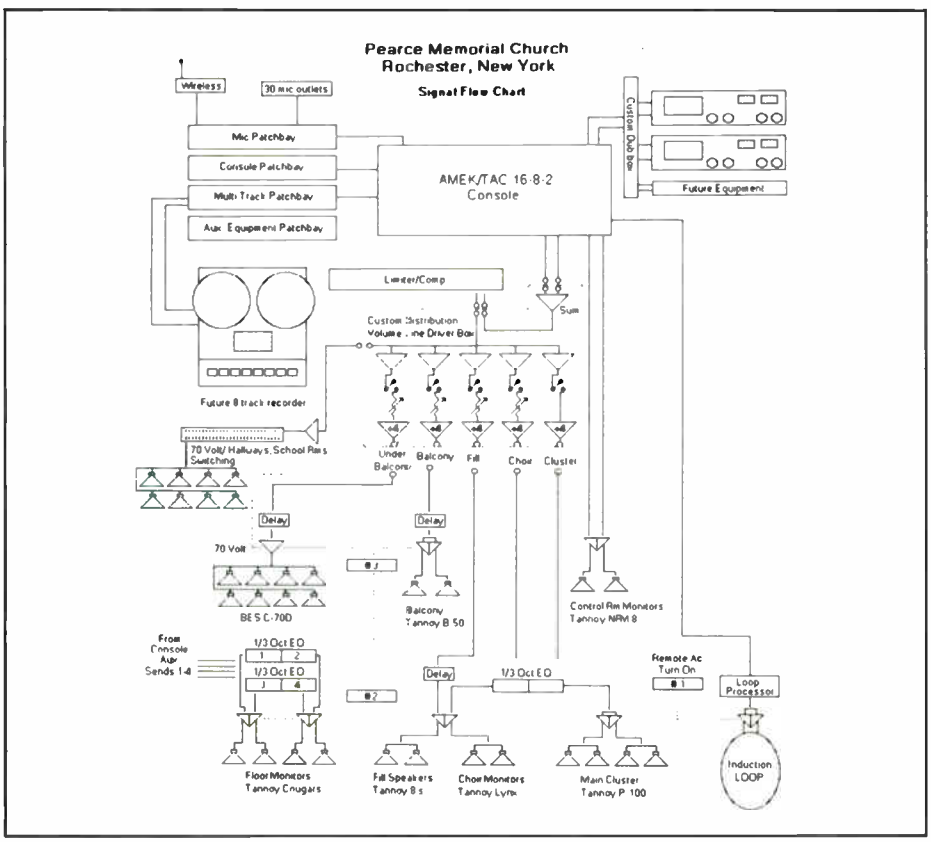
The under-balcony speakers are driven by their own Ashly power amp. Levels are pre-set in a distribution rack, custom built by CSE Audio. This distribution system also fed an additional time delay system atop the balcony. This custom-built distribution and pre-set level system can be easily over-ridden by a knowledgeable operator, but can be returned to "CSE specifications" with the flick of a switch.

UPPER BALCONY

Another zone booster system was needed atop the balcony to combat a noisy, prehistoric air conditioning system. If the blower was not on, the main cluster provided adequate coverage for the entire balcony. When the blowers were on, the main cluster was drowned out.

The problem was solved with the installation of matching Tannoy speakers mounted on the side walls. Firing directly at the problem area, these Tannoys inoffensively overcame the noise build-up. The balcony booster system was also fed by the time delay, and a custom level-distribution system which could be turned on or off as needed by the operator. The system was driven by a dedicated Ashly power amplifier.

With the balcony blockage and the air conditioning noise problem solved, coverage was clean and even throughout the entire church. Gone were the myriad of notch filters and outdated tube equipment which had impeded sound quality. The goal of full-range full-coverage was achieved. But problems still awaited solutions in the control room.



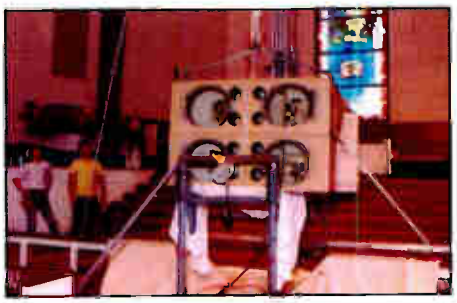
This block diagram illustrates the flexibility offered by the system as designed by CSE Audio.

CONTROL ROOM

As stated, the original equipment was of excellent quality considering it had been installed almost 40 years ago. Much of the equipment had been custom made, and the control room had been filled with tube equipment. Compressors, equalizers, and notch filters were used to maximize the gain, as well as to mask room resonance and system noise. Though every "room problem" that had been addressed by CSE had also been addressed by their 1950s counterparts, the original system had sounded quite unnatural, and far from full range.

CSE specified a very flexible Amek Console. Normally found in recording studios, this console has the sonic and mechanical integrity to remain state-of-the-art well into the 90s. The console afforded 16 inputs, 8 outputs, (for multi-track), 4 monitor sends capable of 4 distinct mixes, and stereo out.

The CSE system boasts an extensive patch bay system. Without any patch cords plugged in, the system can be run by the novice capable of turning on the



Special rigging was required to hoist the 500 pounds of speakers over 45 feet above the floor.

master power. Yet the experienced operator can simply and quickly create any custom configuration through the patch bay. Every piece of equipment and every microphone line goes through the patch bay.

The control room monitoring system is a pair of Tannoy NFM-8s driven by another Ashly power amp. The control room houses a cassette recorder used for documenting the worship services. A rack of time delay, compressor/limiters, and distribution units are also housed in the main control room.

The control room also houses two other systems. A church distribution system, which sends audio throughout the church to classrooms, offices, nursery, and the like. A closed loop system for the hearing- impaired was also installed. Any hearing-impaired person, with the appropriate closed loop hearing aid, can hear the service clearly without the burden of wires.

Fennessy states, "This is just one more state-of-the-art enhancement that

A special "Genie" lift was used to bring the cluster into position.

Pre-digital time delay, circa 1950. One hundred and twenty feet of metal tubing was used to solve the problem of under-balcony delay.

will keep this system in service for years to come."

With today's "out-in-the-open" philosophy, was it a mistake to have a "behind-the-glass" control room? "Admittedly, the preferred set-up for an operator is out-in-the-open, rather than behind the glass," replied Fennessy, "but there were other needs to consider, for instance sound for television and multi-track recording capabilities. Also, the church leaders felt a sound system should be heard and not seen. This is not an uncommon requirement for many churches." Fennessy feels that staying responsive to the needs and requirements of the client is extremely important, and that consideration for the client is one of the guiding principles by which CSE conducts its business.

It's Not Just A Phase We're Going Through.

The tremendous success of the Tannoy PBM series of reference monitors is by no means coincidental. Since the introduction of the world renowned NFM-8 nearfield monitor, much time and effort has been spent on discerning the needs of the mixing engineer and the applied requirements of "playback monitors". The PBM Line exemplifies this commitment to excellence in reference studio monitoring. These compact loudspeakers sport robust poly cone mid-bass transducers utilizing efficient long-throw, high power voice coils. The low frequencies are carefully controlled by optimumly tuned ports located on the rear of the loudspeakers. Hi frequencies are provided by Hi Power ferro fluid cooled polyamide dome tweeters which extend H.F. bandwidth beyond 20KHZ. The driver accompaniment is knitted together by means of a precision hardwired crossover unit, utilizing robust low loss components, and heavy-duty input terminals which will accept standard 3/4" spaced banana plugs and the majority of high quality, specialist audio cables. Transducers and crossover assemblies are neatly housed in a stylish, high density, partical wrap cabinet, specially designed to minimize unwanted cabinet resonance, and high frequency reflection. In summarizing, we have left the best feature of all for last "price versus performance."

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A view from the podium, showing the "problem" balcony and control room.

"Besides installing a sound system that flat out sounds great, we install to the highest professional standards of our industry," according to Fennessy, who is quite proud that his company belongs to HIS, a consortium of select audio installers that subscribes to set standards of quality and performance in the selection and installation of equipment. Members must also demonstrate proficiency in actual field installations.

"Audio is an art," said Fennessy. "It is also a science. It is also a skill. The combination of art, science, and skill the engineer used in the 50s was so innovative and inventive it actually pushed us to new levels of excellence in our present undertaking. This installation has been so rewarding for us." ■

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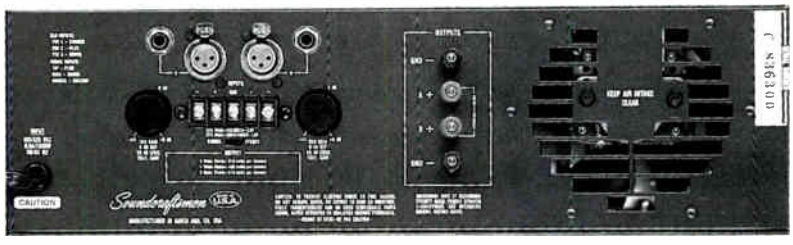

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MATCHING POWER AMPLIFIERS TO LOUDSPEAKERS

BY GARY D. DAVIS

When choosing an amplifier for a loudspeaker system, we must consider a number of factors.

Unless the system will be used only at low levels, it is important that the amplifiers power rating not be too low. Otherwise, we won't be able to utilize the full SPL potential of the loudspeaker. An amplifier with inadequate power capability can, in fact, damage loudspeakers by stressing them more than a larger amp (the smaller amp will be driven into clipping, which produces a dense harmonic structure and artificially steep waveforms; this can overheat high frequency driver voice coils by feeding them more power than the program would otherwise have provided.)

On the other hand, it is unwise, especially in professional applications, to choose an amplifier that is significantly more powerful than the loudspeaker can handle because it becomes too easy to destroy the loudspeaker thermally (with excess power) or mechanically (with excess excursion). The amplifier must also be able to handle the load that the loudspeakers present. In order to avoid excessively loading the amplifier when multiple loudspeakers are connected to a single output, we need to know the impedance of each individual loudspeaker, and we must calculate the net load impedance.

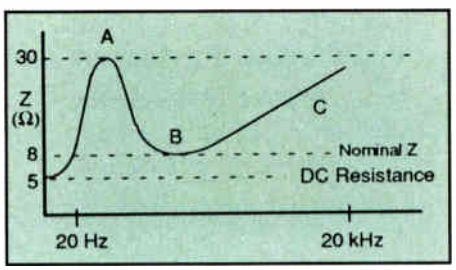


Figure 1. Typical loudspeaker impedance curve.

POWER RATINGS

A typical loudspeaker power rating might read as follows:

Power Handling:

Continuous	120 watts
Program	240 watts
Peak	480 watts

What size power amplifier should be chosen to work with this loudspeaker? In order to answer the question, we need to know precisely what each of these ratings means.

Continuous power handling refers to the level of long term average power that the loudspeaker will handle. It is usually measured using a sine wave or weighted noise input. Properly used, the continuous power rating is a worst case specification, and represents maximum heating of the component voice coils.

Program power handling is measured using a test signal that approximates a real world program signal. Actual program signals have less long term heating effect for a given power level. Peak power handling refers to the maximum instantaneous, short term power that the loudspeaker will handle. In this usage, short term refers to time intervals under a second (generally, no more than 1/10 second).

The structure of this power handling specification is designed to correspond to the characteristics of actual program material:

The "continuous" power level corresponds to the long term average heating power of typical program material.

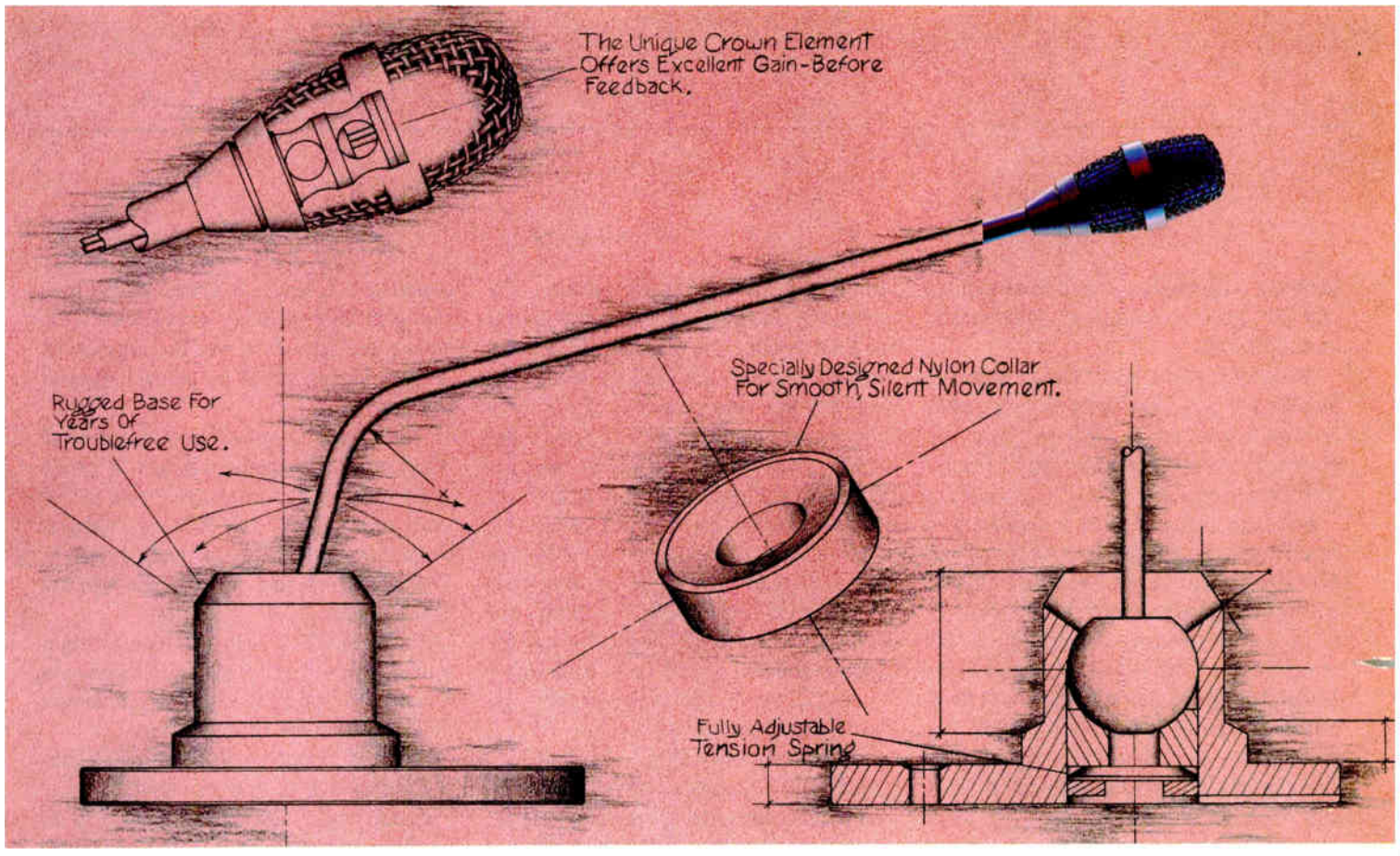
The "program" power level corresponds to maximum average levels of program material as they would be measured over medium term averaging periods (say, up to a minute).

The "peak" power level corresponds to peak levels in the program, which invariably last less than a second.

Some would say that this loudspeaker should be used with an amplifier rated at 480 watts per channel into 8 ohms. The philosophy behind this choice originates in hi-fi—the idea being that use of a high power amplifier allows undistorted (unclipped) reproduction of musical peaks.

At home listening levels, this may be fine. But in a professional application, the continuous SPL demand on the loudspeaker will besignificantly greater. In fact, this 480 watt amplifier may be running no more than 6 dB below clipping (120 watts) on a long-term average basis. The amplifier could certainly clip on musical peaks—and the loudspeaker would then be asked to handle 960 watts! The proper choice for this loudspeaker is an amplifier rated in the neighborhood of 220 watts per channel. This allows the full undistorted power of the amplifier for loud musical passages, while making certain that the peak power applied to the loudspeaker does not exceed its power

Davis has been a technical writer and audio consultant since 1974, and is president of Gary D. Davis & Associates, Topanga, CA.



Specific problems demand simple, elegant solutions.

The most intelligent design, in any discipline, is often regarded as "inspired". The acclaim stems from the designer's ability to recognize and solve the problem at hand, simply.

Podium mikes have in the past exhibited a number of flaws to the installer and to the end user. Crown engineering set to the task of defining those flaws and eliminating them. Further, we wanted to incorporate new ideas necessary to make the LM™ series everything a podium mike must be.

In consulting experienced sound contractors, we determined that to be aesthetically appealing and unobtrusive in use solves only a part of the problems of past designs; long-term client satisfaction and ease of installation and maintenance are as important as the need for excellent gain-before-feedback and natural, uncolored sound. So is meaningful shock isolation. And there is more . . .

In the LM series, a unique method of keeping proximity effect under control is employed for predictable performance and uniform intelligibility at all distances. Coupling this with thorough shielding and increased RF protection, the LM series is, as usual for Crown, at the forefront of this technology. That's where we want to be, that's our inspiration.

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handling capabilities. Similar reasoning can be applied to other loudspeaker specifications.

If a loudspeaker specification does not include a "program" power rating, but only gives continuous and peak, then the choice must be made by interpolation from those ratings.

For example, consider a loudspeaker rated to handle 200 watts continuous and 400 watts peak. clearly, we must choose a 200 watt power amplifier, in order not to exceed the peak power rating. On the other hand, a loudspeaker rated to handle 100 watts continuous and 400 watts peak can be driven by a 200 watt amplifier as well, since we can reasonably assume that the system will be run with at least a 6 dB margin between the long term average level and the short term peak level.

If power handling, and the method used to determine this specification, is not clearly indicated, the loudspeaker should be considered unsuitable for professional applications.

IMPEDANCE CALCULATIONS

The impedance of a loudspeaker is the total opposition to AC current flow that it presents to the output of the power amplifier.

The amount of power extracted from the amplifier by the loudspeaker is inversely proportional to its impedance. The lower the impedance, the more power the loudspeaker will dissipate for a given signal voltage (assuming that the amplifier has that power to give). For this reason, amplifier power ratings are usually given at two or more load impedances, and the 4-ohm power is usually close to twice the 8-ohm power.

The load impedance seen by an amplifier must always be greater than zero. If it were equal to zero, the amplifier output would be shorted and the current demand would be infinite (since I = E/Z, as Z approaches zero, I approaches infinite current).

Practically speaking, the load impedance on an amplifier should never be less than 4 ohms. While some amplifiers are rated for 2 ohm operation, it is not advisable to load an amplifier this heavily in professional use. Not only will the amplifier be stressed, but the loudspeaker cable will have to be exceptionally large in size, particularly over long runs, since any resistance in the cable will constitute a larger percentage of the load impedance, and will therefore waste a larger percentage of the amplifiers power.

Loudspeaker specifications will always include a figure called "nominal impedance," given in ohms. Some may also give an impedance curve such as is shown in Figure 1. Here, the impedance of the loudspeaker is plotted against frequency.

Note that the impedance is not at all constant with frequency. In fact, it varies quite widely. The impedance rise in the low end (a) is due to the natural resonance of the low frequency driver. The shape of this rise is affected by cabinet loading.

Following the rise is a trough (b), then a long rise (c). The nominal impedance is normally specified to be the minimum impedance at the trough (b).

Standard values of loudspeaker impedance are 4, 8, and 16 ohms.

Connecting a single loudspeaker to an amplifier output is a simple affair. What happens, though, when we wish to drive two or more loudspeakers from that output? How will this affect the net impedance seen by the amplifier?

There are two basic ways to connect multiple loudspeakers to a single output: in series, and in parallel. These are shown in Figure 2. When loudspeakers are connected in series, as shown in (a),

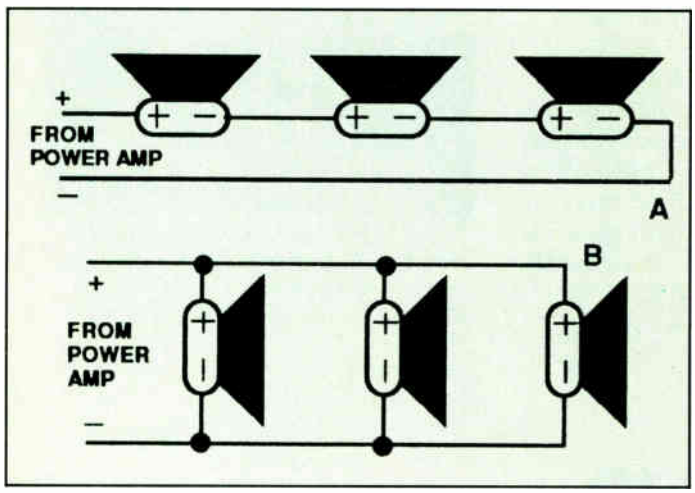


Figure 2. Series (A) and parallel (B) connection of loudspeakers.

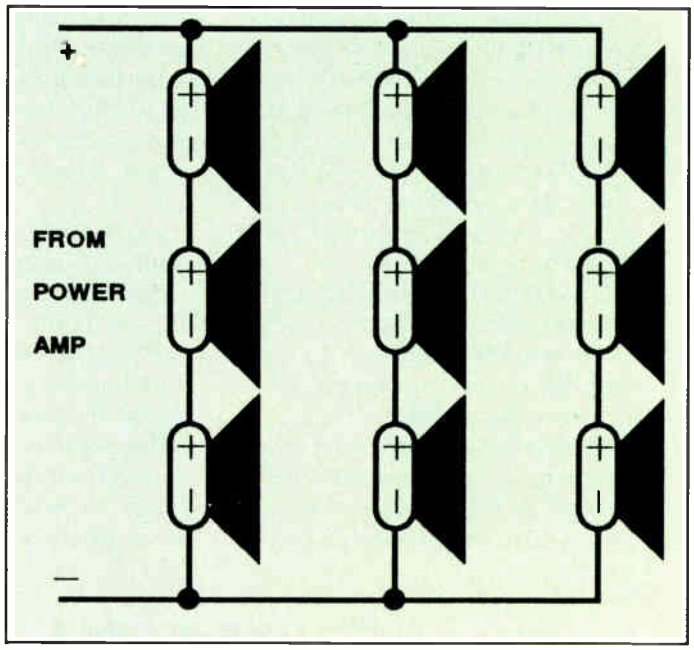
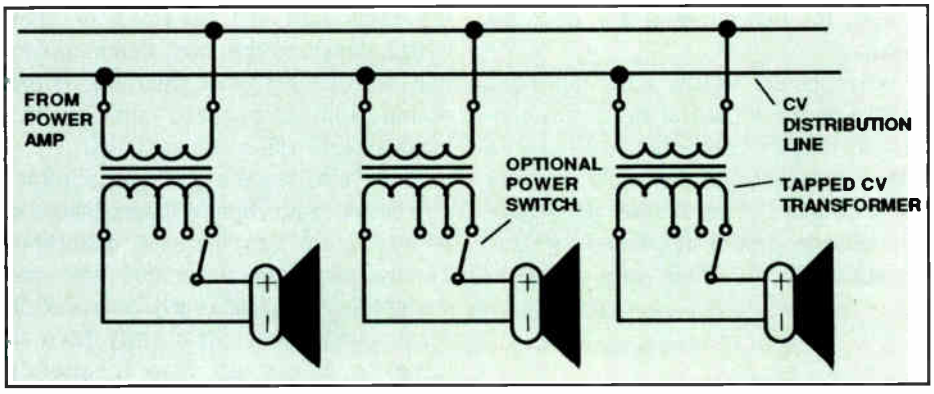


Figure 3. Series/parallel connection of loudspeakers.



Constant voltage distributed loudspeaker system.

current from the amplifier passes serially through the loads, and the net impedance is the algebraic sum of the individual impedances. If we connect three loudspeakers with impedances of 8, 8, and 4 ohms respectively in series across an output, the net impedance will be:

$$Znet = Z1 + Z2 + Z3$$
$$Znet = 8 + 8 + 4$$
$$Znet = 20 \text{ ohms}$$

When loudspeakers are connected in parallel, as shown in (b), the net impedance is a bit more complicated to calculate. It is described by the equation:

$$Znet = \frac{1}{{}^{1}_{Z1} + {}^{1}_{Z2} \ldots {}^{1}_{Zn}}$$

Where n = the total number of parallel elements.

Luckily, in the special case in which we connect two loads of equal impedance in parallel, the complexity of the calculation is reduced. The net impedance is half the impedance of either one. If we connect two 8 ohm loudspeakers in parallel, the net impedance is 4 ohms. Where the impedances are unequal, or more than two loads are paralleled, then the equa-

tion above must be used to calculate the net impedance.

HINT: If more than two loudspeakers are connected in parallel, so long as all are the same impedance, then the net impedance of the load is equal to the impedance of one loudspeaker divided by the number of loudspeakers. For example, with three 8-ohm loudspeakers in parallel, the impedance is 8/3, or 2.667 ohms.

What are the relative advantages and disadvantages of parallel and series connection? Series connection results in a higher impedance. If our loads are very low impedance, then the net impedance can be made greater by connecting them in series. On the other hand, if one of the loads fails and becomes an open circuit which is the most common way that loudspeakers fail then the entire connection is broken, and all the loudspeakers will cease to function.

There also tends to be more interaction between functioning loudspeakers in series, which can increase distortion. Finally, damping factor for any one loudspeaker is significantly degraded in series connections, which may have an adverse effect on low frequency reproduction.

By contrast, parallel connection inevitably results in a lower impedance. We are thus limited in how many loudspeakers we can connect in parallel before the impedance drops below the minimum that the amplifier will handle. If one loudspeaker fails, though, the others will keep working, and damping factor is not seriously degraded.

Parallel connection is thus by far the most reliable, and is for this reason the most common method of wiring professional speaker systems.

Finally, both series and parallel connection can be combined, as shown in Figure 3. This is called series/parallel connection. The net impedance of such a load must be calculated by first calculating the impedance of each branch of series-connected loudspeakers, and then calculating the net impedance value of these parallel-connected branches.

By employing series/parallel connection, a large number of loudspeakers can be connected to a single amplifier output, with the total amplifier power being shared among them. This method is only used in certain special circumstances in sound contracting, and is seldom used in sound reinforcement for several reasons.

First, it allows for only a small proportion of the total amplifier power for each loudspeaker. Second, it places a large part of the overall sound system at the mercy of a single amplifier; should that one amp fail, you can kiss the sound goodbye. Last, the connection is inherently complicated, which makes it both difficult to duplicate in portable ap-

plications and a real bother to troubleshoot.

Sound reinforcement professionals generally rely on parallel connection of loudspeakers. In the case of low frequency drivers, two drivers per amplifier channel is the norm. In high frequency drivers, as many as four may be paralleled across a single output (if each is 16 ohms, which is a common impedance for compression drivers). In all cases, the net impedance is held to 4 ohms or higher.

NOTE: Be sure to use the actual impedance of the loudspeakers when calculating the impedance of multi-speaker (especially parallel) loads. At least one popular series of 16 ohm compression drivers is known to have an actual impedance of about 12 ohms in the frequency range of operation. This means that 4 in parallel would measure 3 ohms, not 4 ohms, which couldoverload a power amp rated at 4 ohms minimum.

CONSTANT-VOLTAGE DISTRIBUTION SYSTEMS

A method for connecting a large number of loudspeakers to a single amplifier output that is more reliable, and thus more widely used, than series/parallel connection is so-called constant voltage (CV) distribution. While CV systems are almost never used in live performance sound reinforcement, they are quite common in distributed paging and foreground/background music systems.

The constant voltage system relies on an amplifier whose output voltage is constant over a very wide range of load impedances (down to a practical minimum, usually 4 ohms). In the days of transformer coupled tube amplifiers, an output voltage that was independent of load was a rarity, and special design techniques had to be employed to implement CV systems. Modern professional transistor amplifiers generally deliver a load independent output voltage. As shown in Figure 4, the CV system employs transformers wired in parallel across the signal distribution line. The transformers present a relatively high impedance to the line, and are provided with taps to vary the voltage delivered to each loudspeaker.

Because the amplifiers output voltage remains constant (more or less) as the load impedance changes, loudspeakers in different zones may be connected or disconnected at will, without appreciably changing the level at other locations. Moreover, since taps can be adjusted at each loudspeaker, the sound levels can be locally tailored to the environment without the use of unreliable, expensive and power-wasting pads— and without having to use individual power amps for different areas. And since there is higher voltage and lower current, resistive loss

(continued on page 116)

INSTALLATION PROFILE

THE OCEAN CLUB

BY SETH E. WALTZ

We get many calls from people who say they want "the best sound and lighting" for their nightclubs. In most cases, the budget allows for home-made speakers and a mirror ball, and we politely bow out. The call from M.T.B.B. Associates in July of 1988 turned out to be a bit different.

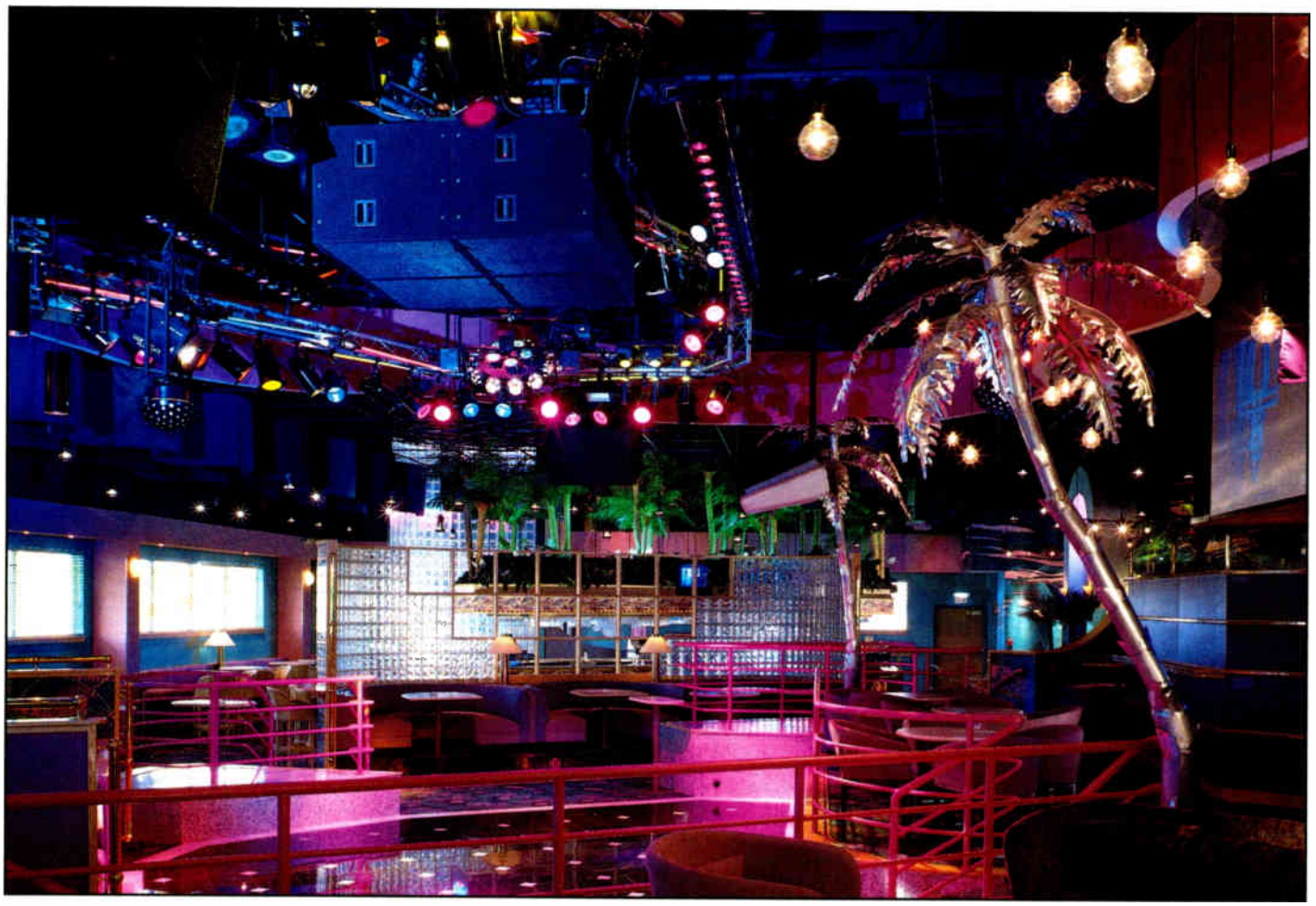
The associates, Mike Spoleta (owner of Spoleta Construction, the general contractor), Tony Wilson (a well-known local developer), Bob Sweet and Bob St. George (co-owners of Greenstreets, a successful restaurant/nightclub) were talking serious nightclub, almost $4 million dollars worth of nightclub.

Needless to say we were interested, and after deliberations our company, Applied Audio, was retained as the designer/contractor for the audio, video, and lighting systems at the Ocean Club.

By this time, the architectural and mechanical design aspects of the building were already completed. This was unfortunate but not unusual. What was unusual was that the owners had few preconceived ideas of what they wanted, and little provision had been made in the mechanical/electrical design of the structure for the 8000 pounds of hardware and 155,000 feet of wire that would eventually be installed.

Fortunately for us the building was designed by SDS design, a Spoleta subsidiary, and the project manager, Nic Colasurdo, was extremely cooperative.

His help and the on-site aid of Dave Spoleta, construction supervisor, proved to be a life saver in what turned out to be a fast-track construction job where the blueprints changed as quickly as the



The main dance floor at the Ocean Club.

weather.

The structure was to be a 140,000 cubic foot pre-fabricated steel building with a 22-foot-high steel deck roof and no ceiling treatment. Interior treatments that had already been decided on, with no possibility of alteration, were the black granite and marble flooring, glass block walls, 14-foot-high suspended sofitts, and carpet-on-concrete aisles. To add to the design troubles, there was no equipment room (the owners had originally planned all the equipment to be in the DJ booth), and no space on the floor for subwoofers.

DESIGN

Our first task was to steal an office space on the second floor for our equipment room. A stroke of Nic's pen and "Office" became "Equipment Room." This being accomplished, we would have to design the system around what would fit in this 10 x 6 foot space.

AUDIO

The dance floor was the key to the overall audio system approach. We wanted to avoid the phase problems of multiple speaker designs, but still have the redundancy and high SPL capacity. High fidelity sound was a given requirement. The solution was the Electro-Voice MT4 Manifold Technology system. The Manifold Technology speakers utilize drivers per frequency range (4 way) coupled in such a way as to create a single acoustic source and provide minimum phase error between the drivers. We demonstrated an MT4 system to the owners who enthusiastically approved the concept.

The critical issue now was the speaker location. The direct/reverberantratio would be important even though this was to be a music system (remember the all-steel building). Fortunately the MTH cabinet exhibits pattern control of 150 degree maximum down as low as 200 Hz, and a pattern of approximately 60 degrees x 40 degrees from 500Hz - 16 KHz. Utilizing the Bose Modeler software, we calculated direct field sound energy as well as the reverberant field. This function allowed prediction of the average SPL bleed by frequency from the dance floor system into other areas of the club. In this manner we determined the optimum mounting height and angle to provide direct field coverage and minimal reflections with only two MTH cabinets. That's right, true stereo and a drop in level of 10 dB just four feet off the dance floor.

Now if we could only match that feat at 50 Hz. One MTL cabinet would provide enough level, but not enough directivity control. The decision was made to fly four MTL subwoofers in a cluster, down-firing 14 feet above the dance floor. The cabinets would couple up to the 160 Hz crossover point to provide significantly higher on-axis sound on the dance floor.

QSC power amplifiers were chosen for the job due to their reliability in pastinstallations. The two rack space QSC MX 1500 was the logical choice due to the limited space availability. Allowing one space between amplifiers we still could squeeze 12 amplifiers in one tall rack. Because of the MT4's efficiency, we decided to underpower the speakers with only 18,000 watts (6 dB below rated maximum power).

So much for the dance floor, on to the surround sound systems. The club was to have three bars, each with separate audio systems. The reverberant field was going to be a problem due to the steel ceiling and we were given a minimum height of 16 feet for the surround speakers. We would need a speaker with exceptional fidelity and high SPL capability. After testing numerous 3-wayspeakers, we decided upon the Eastern Acoustic Works FR 153. Power was provided by more QSC MX 1500's. And that put us into the second rack.

The Ocean Club, Rochester, New York.

Sound for the outside canopies, lavatories, offices, and foyers was to be handled by Bose 102 speakers. The UL fire-rated enclosures and ease of installation has made Bose our choice for plenum ceilings.

Discos are often considered non-critical when it comes to processing, but we do not follow this school of thought. Phase error, ground path, noise floor (real life), and that ambiguous "sound quality" were all considered in our equipment choices. The Rane MP24 mixer was chosen for the disco mixer. The speaker system crossovers would be the EV MT4X units, which are delay and phase compensated as well as equalized for the MT4 system. The additional equalization required for the dance floor system would need to be of two types: Rane PE 15 Notch filters for the nasty nodes we expected from the center room location of the subwoofer systems, and 1/3 octave Industrial Research Transversal equalizers for overall equalization.

Waltz is vice president of Applied Audio, a division of Brighton Lites, Inc., Rochester, NY.

Surround systems would be equalized with Audiologic SC 31's. Remote volume control for the zones is accomplished with Oxmoor DCA-2's.

The speakers in the system did not need protection, but the clientele might. To avoid an overzealous DJ killing someone with the 135 dB average levels the system can produce, we installed limiters in four sections at the crossover outputs.

The audio system design was finished, and we'd only used up two racks. That left two whole racks for everything else.

LIGHTING

Disco lighting has always bored the author. Flashinglights, spinning gadgets, and all the rest. But the Ocean Club wanted something different.

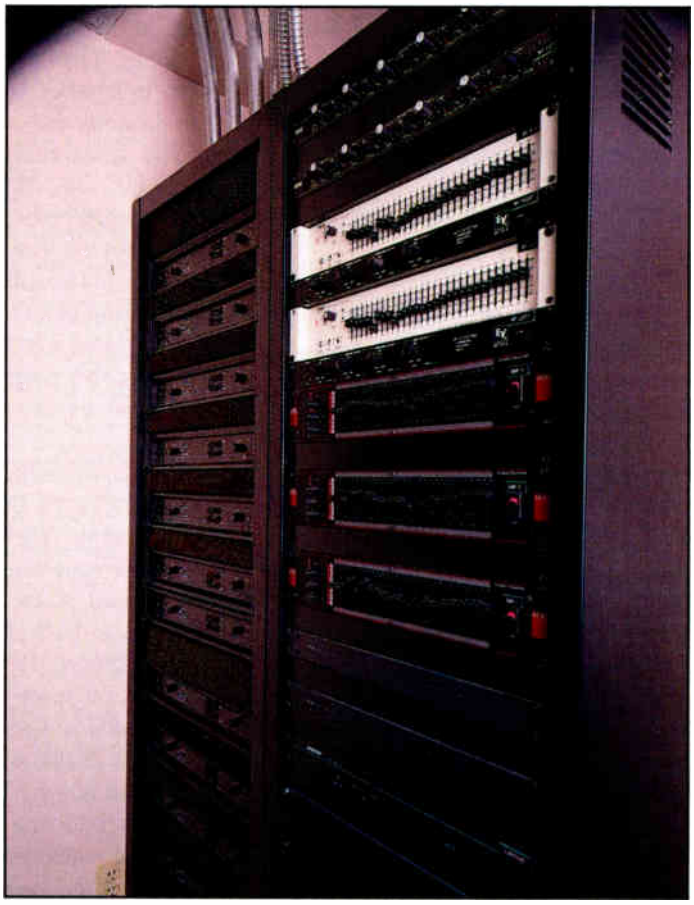
Something tasteful. A challenge not to be taken without significant amounts of coffee and many late nights.

Our approach was more akin to theater and touring lighting. The key difference between typical disco lighting and professional lighting is scene capability and dimming. Moods can be created with light as well as with rhythms. The decision was made to employ an Electronic Theater Control ETC Vision lighting computer as the main lighting controller. The Vision allows precise combinations of lights with sequences programmed for real time access, or (at a later date) SMPTE-synchronized with video for totally programmed shows.

The Vision would be set up with 96 channels driving 96 1200 watt Spectrum OX 12 dimmers and 72 custom SCR non-dim controllers. So much for the remaining two racks. Programming would be made simple with a 96 channel Spectrum EVO analog manual console piggy-backed on the Vision. The programmer could then manually initiate a scene with analog faders, and have the Vision record the cue, or manually control a show if he wanted to use more than the one finger the Vision requires for the "go" button.

The actual lighting effects are too numerous to mention; suffice to say there is over 100,000 watts of lighting. One noteworthy innovation in Ocean Club's lighting systems (beside the Vision) is the use of elevator systems. Elevator systems have been used before in discos, but most are nasty 220 V European scissor lift types. Ugly, expensive, and not good for rotating effects. To avoid the European elevators, we adapted a made in the U.S.A. Hoffend & Sons light lifter, a tubular aluminum

The dimmer equipment rack.



The audio equipment rack.

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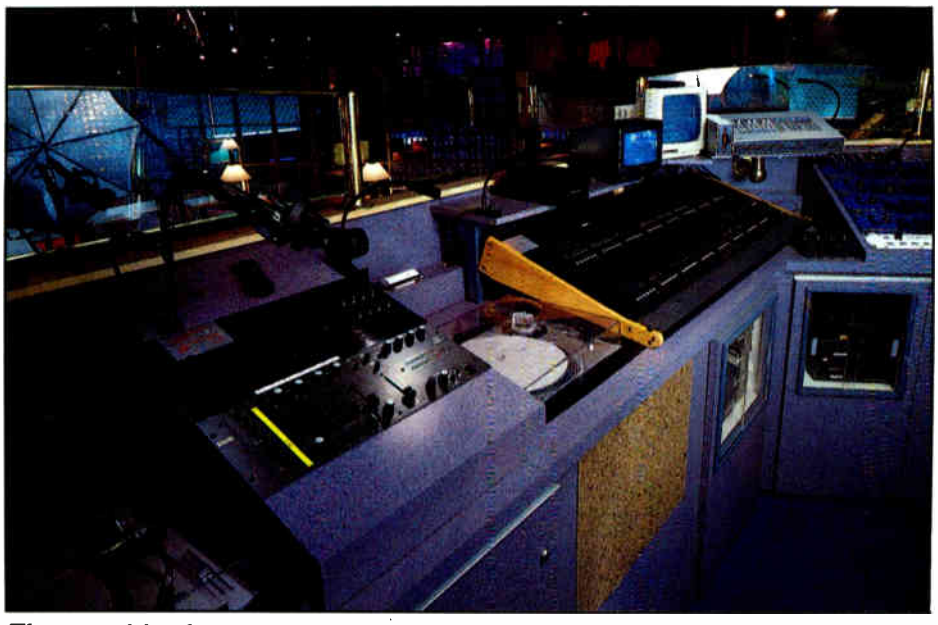
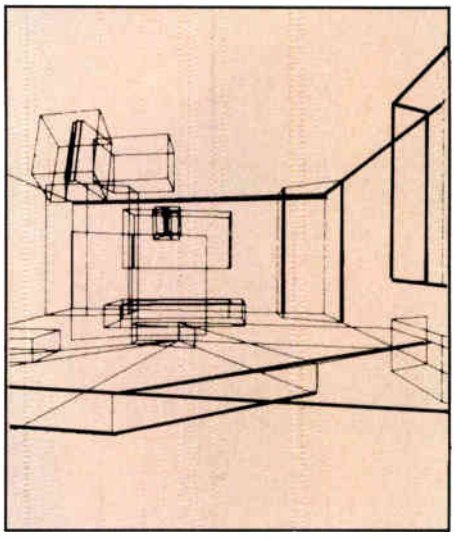


The control booth.



Bose SpeakerCAD software was used to generate perspective room views.

device that is used for stage and studio lighting automation.

The advantage of the elevators is twofold: they offer the ability to raise big, gnarly things out of the way during the happy hour buffet, and the excitement of having the big, gnarly spinning things with their lights on descend out of the fog on top of the dancers. The Hoffend Unit allows descentof up to 30 feet.

The last step in the lighting design process was the layout of all the hardware. We decided to utilize an aluminum truss assembly in two levels, a hexagon with one open side at 14 feet and an X truss 18 feet off the floor.

This would provide safe symmetrical mounting for all the lighting instruments. The elevators would come down between the subwoofers and the trusses. We included two Rosco 1500 smoke machines in the truss (The truss foggers have fan systems to force a cloud of smoke to descend on the dance floor), and two in the dance platforms.

VIDEO

Last but not least was the video system design. We originally proposed fully SMPTE video with 0.75-inch machines, but the budget had to be trimmed. The SMPTE would come later. The video system would be of an ambient nature, utilizing 12 Proton 27 inch monitors and one JBL large screen projection system. The video systems are broken down into four zones. Each zone may be controlled from the booth with a proton tuner/switcher.

INSTALLATION

We were to be intimately involved with every contractor on the project, since our equipment was in the way of most everything. Co-ordination would be interesting, so to save some abuse we hired the electrical contractor Percon Electric to do our conduit, junction boxes, and to pull our wire. Now they could be in everyone's way on our behalf. In the meantime we were busy getting the building ready for the equipment we were going to hang. The rigging for Ocean Club would be a major part of the work, since we were going to fly 4 tons of gear. Our resident rigging expert Dan Sullivan (It's times like this that we're thankful he has 13 years of rigging experience) went to work solving the basic problem, this being the fact that the building was not designed with us in mind.

The steel truss purlins were not rated for the loads to be hung in the usual manner. Dan had decided early on to install our own Unistrut grid between main steel, and to sandwich the trusses where we hung from them with unistrut above the truss, below the truss, and threaded rod in between. This may be overkill, but we like to sleep at night.

With the grid in place, the installation proceeded smoothly. Our site foreman Howard Seaman and crew (Tim Snyder, Barbara Koert, and the author) kept the job cranking right along. Our controller Lou Calarese and purchasing agent Matthew Leary kept the equipment arriving as needed at the site (no easy task with over 25 vendors on our part of the project).

The real interesting part started when it was all in place and being debugged. The first problems were with the audio system. We faithfully execute proper (the one we decided to believe in) grounding procedure, and expect silent systems. In the shop, as expected, the racks were silent, no buzz, no hum, no nothing. At the Ocean Club, things were different.

We had carefully specified a separate 600 amp 3 Ω service with independent ground for just our equipment. Unfortunately, due to the fast track construction, no one noticed the neon lights (with dimmers), ceiling fans (with speed controls), fluorescent light (with dimmers), and tivoli lighting (with dimmers) being

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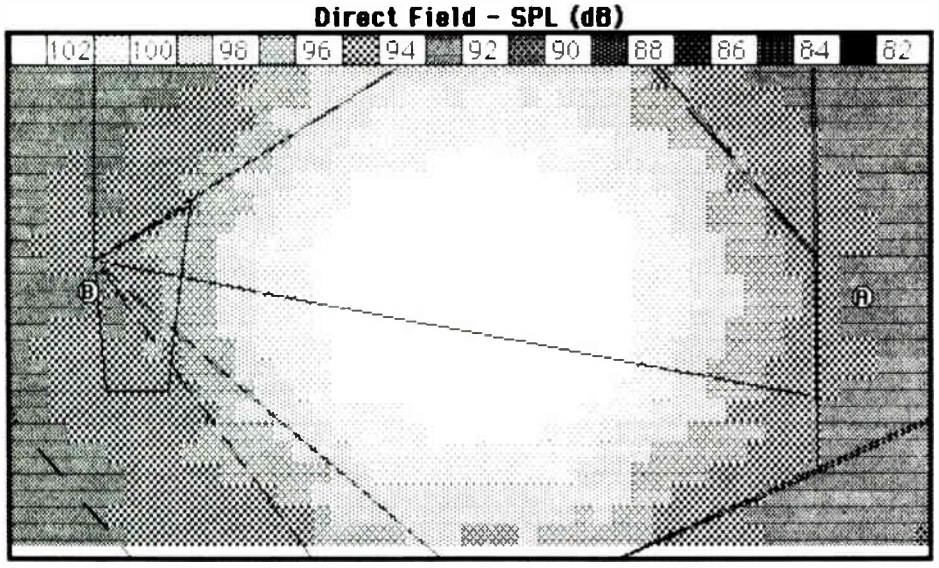


This gray-shading map of the room's direct field was generated by Bose Modeler software.

wired to our panels. Only when all of these have been switched off does the audio system gets quiet. (This never actually got fixed, since with the dance floor turned up you can't hear the low level noise anyway).

The only other real problem in audio was the subwoofers. They worked well, maybe too well. During testing we literally exploded some lighting fixtures off the walls 30 feet away. Needless to say the limiters were set soon after this occurrence.

Our next major adventure was the light lifters. The UFO's (big, 42-inch diameter, 85-pound, gnarly things) kept wanting to make the elevator disassemble, letting the units descend to a six foot level, instead of the 9 foot safety level. Since they are not usually used to

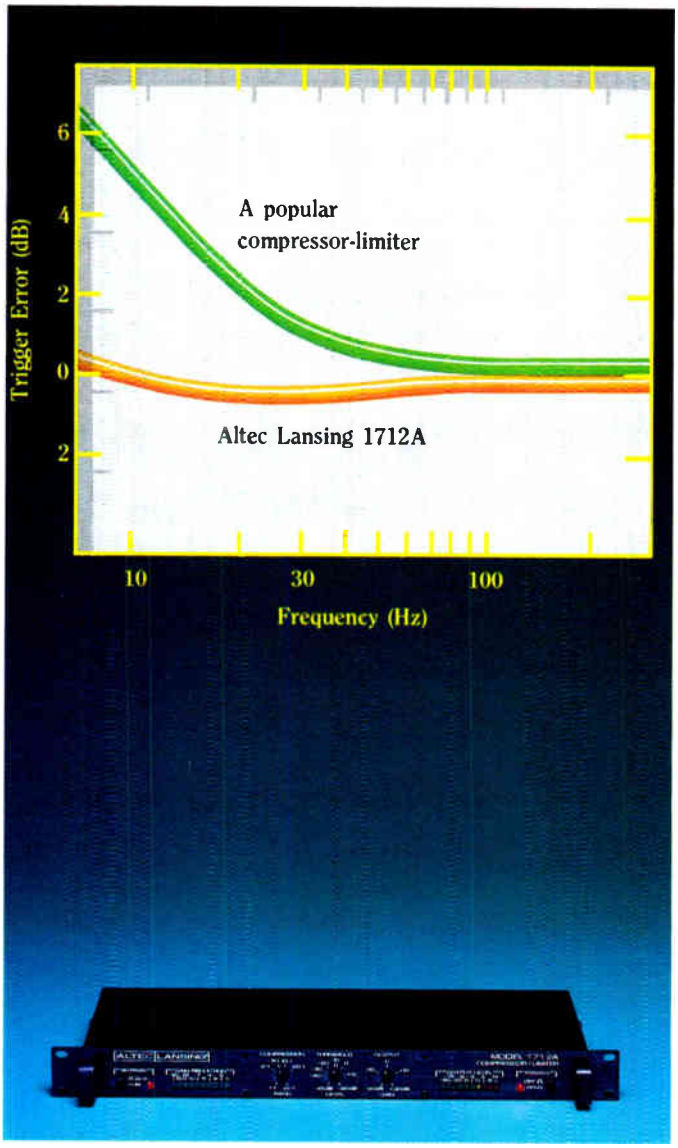
In compressor-limiters, peak reversion equals audible pumping. One major reason for dissatisfaction with limiters in sound systems is the way many of them initiate limiting action at inappropriate times: they change the sound level unexpectedly, when the signal dynamics don't require it. This false triggering is called pumping, and is very audible.

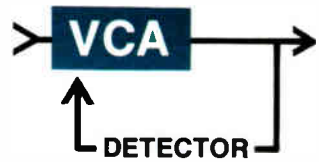
The problem of audible pumping is a complex one, and its cause is often not apparent on the test bench. It is sometimes impossible to duplicate the triggering heard in dynamic sound system use, with tones or with pink noise. And yet the pumping goes on.

Altec Lansing research has discovered the cause of pumping in many contemporary limiters, and prevented it in the new model 1712A.

Compressor-limiters use detector circuits that monitor the envelope of the audio signal passing through. Limiting action is controlled by this detector. Not only must the frequency response of the audio circuit in the limiter be flat, but the detector itself must have a flat frequency response. Otherwise, it would trigger limiting action at different levels for different frequencies. If the unit is excessively sensitive at some frequencies, signals at levels that the limiter should ignore cause unwanted action.

The popular limiter shown in the graph has an excellent frequency response for the audio signal passing through it. However, its triggering is more sensitive at all frequencies below 100 Hz, and 5 dB more sensitive at 10 Hz. It has reverted from r.m.s. to peak detection: peak reversion. Who cares about 10 Hz? You will, if subsonic junk is making your limiter attenuate all frequencies at unexpected and unwanted times.





When envelope detection comes after limiting action, tracking accuracy suffers.

Altec Lansing engineers also decided to control the limiter by detecting the incoming signal. Many limiters detect the signal after their own limiting action. These limiters must detect tenths of decibels to control tens of decibels. The new Altec Lansing 1712A compressor-limiter uses the much more robust feedforward system.

In compressor-limiters, the benefit of peak reversion correction is reduced false triggering and audible pumping. The benefit of feedforward control design is greater tracking accuracy.

Fact.

In Compressor-Limiters

Peak reversion = audible pumping

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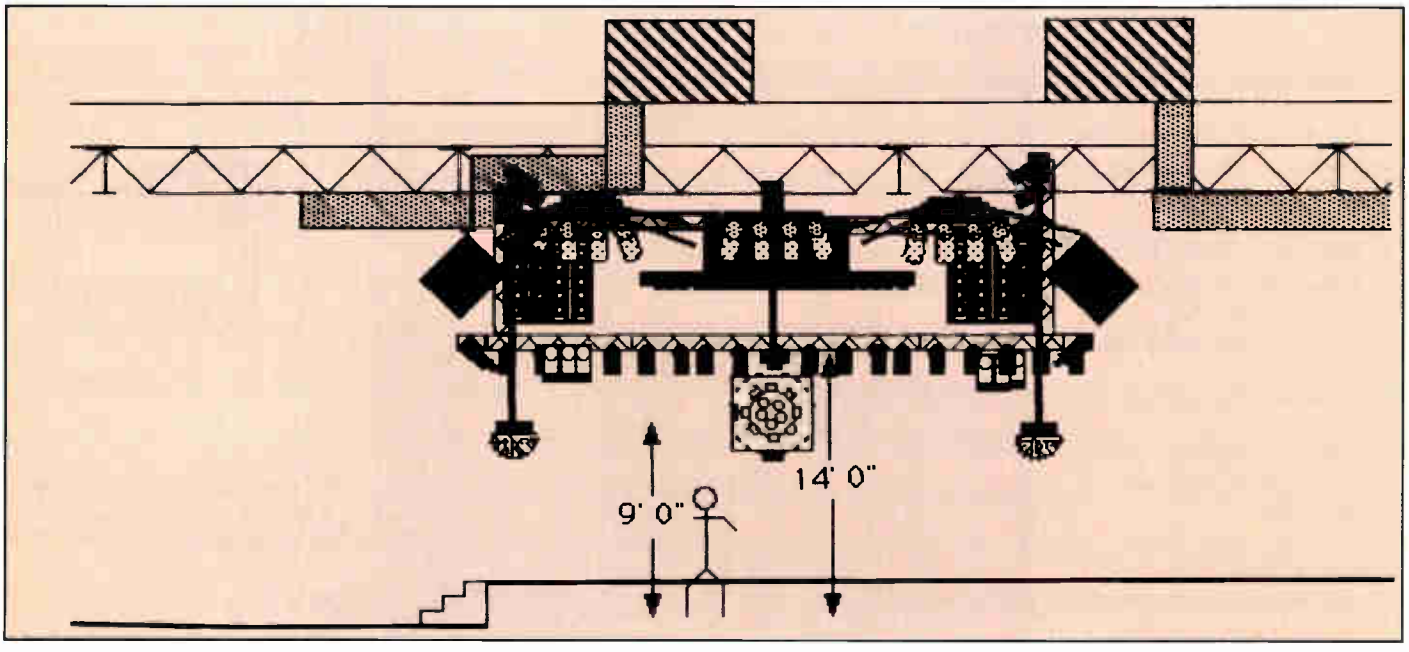
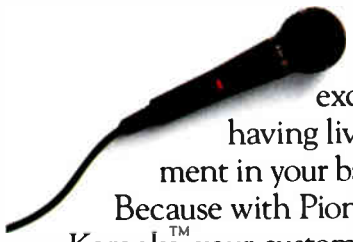


A cross-section of the rigging plan.

Fill the house with the sights and sounds of Laser Karaoke.



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Pioneer Laser Karaoke puts your customers in the spotlight, singing songs to the finest recordings imaginable. Hundreds of songs, all fully orchestrated and reproduced by laser optics for superior audio and video quality. Quality that will make everyone feel like a star.

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At the touch of a button, you can select the song, change the key and add digital echo. There's a main volume setting as well as individual controls to adjust music volume, microphone volume and overall balance.

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tunes are available. And new discs are constantly being released all the time.

Small and compact, the Pioneer Laser Karaoke

System can be installed almost anywhere. And it comes in individual machines as well as a complete system. The video LaserDiscs themselves never wear out, because there's no contact between disc and pick-up. With care, even the most popular songs will always sound as good as their first play.

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To get in on the act, contact Pioneer Laser Entertainment, Inc., 22010 South Wilmington Avenue, # 201, Carson, California 90745, or call (213) 518-4531.

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raise and lower rotating flying saucers, the mechanical stops in the elevators were wearing from the rotational stress induced. Hoffend & Sons was extremely helpful in solving the problems by fabricating (in two days) an ingenious electrical stop systemand field-installing it onto the end of the motor shaft. This ended the possibility of close encounters with the dancers.

During electrical testing prior to dimmer rack power-up we discoveredan uncomfortable low impedance of 2 between neutral and the Y phase of power. It took six hours but we found the problem. A grey hot had been swapped for a light grey neutral (we ran out of white) on a lighting circuit. Easily done after spending 110 hours in one week working in a dark junction box. This problem was

OCEAN CLUB EQUIPMENT LIST:

AUDIO:
1 - Rane MP 24 Mixer
2 - Rane PE 15 Parametric EQ
2 - EV MTX 4 crossovers
2 - IRPI DE 4023 eq
3 - Audiologic SC 31 eq
2 - Oxmoor DCA -2
4 - Benchmark DOA -1
4 - Alesis Microlimiter
1 - Symetrix 501
15 - QSC MX 1500
2 - EV MTH4 loudspeaker
4 - EV MTL4 loudspeaker
8 - EAW FR 153 loudspeaker
4 - EAW FR 122 loudspeaker
1 - EV ND 408 mike

VIDEO:
12 - Proton 27" monitor
4 - Proton tuner switcher
1 - JBL video projector
1 - 12' diagonal Draper screen
1 - JVC VHS Hi Fi deck
1 - Sanyo CCD color camera
1 - Pelco motorized zoom lens
1 - Pelco pan tilt

LIGHTING:
1 - ETC Vision computer
1 - ETC Response D/A converter
96 - Sepctrum 1.2 K dimmer (OX 12)
1 - Spectrum EVO 96 channel console
1 - Diversitronics 4 channel controller6 - Meteor ABC controllers
3 - Meteor RAM 20 controllers
1 - Meteor colorscan controller
2 - Meteor Super Titan UFO
2 - Meteor Shooting Star
2 - Meteor Moonflower
12 - Meteor Colorscan
2 - Meteor Pro BeamII
4 - Meteor Can Can
4 - Meteor Light Batten
24 - L & E Par 64
66 - Par lighters
48 - Paradise Design lazersticks
4 - Diversitronics Model 50 Strobes

90 ways to depart from the straight and narrow.

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To be specific, it has 11 graphic EQs, four parametric, three tone configurations, five band pass/band reject filters, six dynamic filters and one multi-notch filter configuration, plus up to 738 ms of delay per channel.

But, in the Yamaha tradition of never leaving well enough alone, we did some expanding of our own.

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Since we're on the subject of output, it's equally important to mention that, in the opinion of many critical users, the DEQ7 produces an open, natural-sounding EQ. Which means that you can create extreme EQ settings without creating extreme anxiety.

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NSCA CONTRACTORS' CONFERENCE AND EXPO '89

The 1989 National Sound and Communications Association (NSCA) Conference and Exposition will take place on May 25, 26, and 27 at the Opryland Hotel in Nashville, Tennessee. Contractors, manufacturers, consultants, reps—over 4500 industry people, including nearly 300 exhibitors, are expected to be in attendance this Memorial Day weekend for what promises to be the biggest show yet.

According to Bud Rebedeau, executive director of the NSCA, feedback from attendees at last year's Expo was very positive. "Getting to Reno might have been a problem for some," Rebedeau said, but once there everyone settled in for a great show. Transportation to this year's show promises to be somewhat easier to arrange: Rebedeau indicated that nearly 50 percent of the attendees expected at NSCA Expo '89 live within 500 miles of Nashville.

In response to many requests for more time on the show floor, exhibit hours have been extended. On Thursday and Friday, May 25 and May 26, exhibit hours will be 10:00 am to 6:00 pm, an increase of six hours from last year (exhibit hours on Saturday, May 27, will be 9:00 am to 12:00 pm). And booth size this year has been increased from 8 x 10 feet to 10 by 10 feet.

The two days prior to the actual start of the Expo will again be devoted to the NSCA's Basic and Advanced Sound Design and Estimating Courses for salespeople. Both courses are scheduled to run from 8:00 am to 5:00 pm on Tuesday and Wednesday, May 23 and 24. And this year's educational program will again feature four

The NSCA Contractors Conference and Expo '89 will be held at Nashville's beautiful Opryland Hotel.

seminar tracks: audio, management, sales, and specialty. These seminars will be presented from 10:00 am to 12:00 pm on Thursday, May 25, and from 8:00 am to 12:00 pm on Friday, May 26.

The Expo will again "kick off" with the rep-sponsored Contractors' Caper at 6:30 on Wednesday night in the Governor's Ballroom, featuring a live performance by MCA country recording artist Patty Loveless (brought to you courtesy of the NSCA, the reps, and Conquest Sound). Other special events include a business/pleasure cruise aboard the General Jackson Paddleboat: for contractors the business is a demonstration of sound system CAD techniques in the below deck theater; for your spouse and kids the pleasure is an "Ice Cream Social" featuring a live band. And don't miss the annual Customer Appreciation party sponsored by West Penn Wire (at 6:00 on Friday night in the Presidential Ballroom).

In addition, the publishers of Sound & Communications magazine will once again present NSCA-TV News, written and edited by the editorial staff of Sound & Communications. The news program will provide convention attendees with up- to-the-minute, immediate coverage during all three days of the Expo. NSCA-TV News will be on the air 24 hours a day in all attendee's rooms at the Opryland Hotel and on large screen TVs on the exhibit floor.

The following schedule of events and exhibitor map will help you plan your time at the Expo more effectively.

All information was complete and accurate as of press time. Please consult your show programs for any changes.

SCHEDULE OF EVENTS

Tuesday May 23

8:00-9:45 Advanced Sound Design and Estimating Course

10:00-1:45 Systematic Sound System Selling
Vic Hall

1:00-2:45 CAD: A Practical Guide For The Sound Contractor
Jerry Davis, Jeremiah Associates

3:00-5:00 Sound Masking And Related Architectural Acoustics
Joel Lewitz, Paoletti Lewitz Assoc.

8:00-9:45 CAD For Sound System Design
Basic Sound Design and Estimating Course

10:00-11:45 Behavior Of Sound Outdoors
Dave Marsh and Rusty Mack,
Pelton March Kinsella Associates.

1:00-2:45 Layout And Estimating System Check-Out, EQ, and Measurements

3:00-5:00 Sound System Selling for The New Salesperson
Mike Bradley,
Chambers Electronic Communications

Wednesday May 24

8:00-9:45 Advanced Sound Design and Estimating Course Selling Strategies
Mike Bradley,
Chambers Electronic Communications

10:00-11:45 Wireless Microphones And Their Appplications

1:00-2:45 Automatic Microphone Mixers
Dan Dugan, Dan Dugan Sound Design

3:00-5:00 Behavior of Sound Indoors
Dave Marsh,
Pelton Marsh Kinsella Associates.

5:00-6:00 Reception Meet the course instructors.

6:30 Contractor Caper/Patty Loveless Concert
Governor's Ballroom

Thursday May 25

Exhibit Floor Open: 10:00 - 6:00

8:00-9:00 Keynote Speaker, NSCA Opening Session

9:00-10:00 NSCA Business Meeting

Audio Track:

10:00-11:00 Microphones: Not Just For Hammering Nails Anymore
Neil Shaw, Veneklasen & Associates

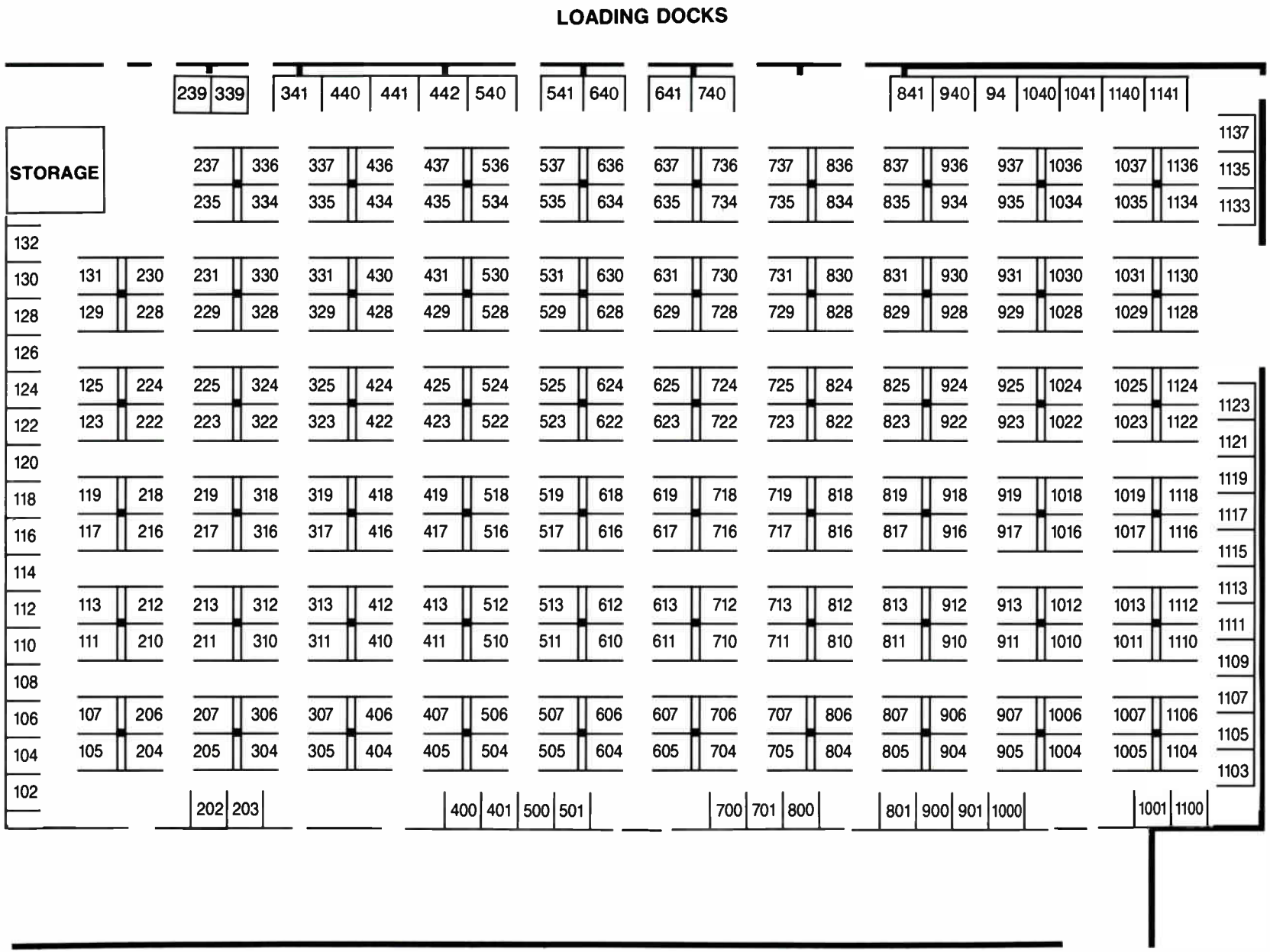
Management Track:

10:00-11:00 A 401K Program In Your Company
Fred Billin, Ascom

11:00-12:00 Profitability Of A Service Department
Harold George, Indiana Electronics

(Schedule of events continued on page 666)

NSCA Expo '89 Exhibitor Map



LIST OF EXHIBITORS AND BOOTH NUMBERS

AB International (311)
Acoustone Grille Cloth (118)
Advantage/Biamp (128)
AEI Music Network (337)
Aiphone Intercom Systems (1001)
Akai Professional (229)
AKG Acoustics (828)
Alarmco (636)
Alesis (613)
Allen & Heath Brenell USA (618)
Alpha Audio (239)
Alpha Communications (1137)
Altec Lansing (1139)
AMX (716)
Anchor Audio (130)
Andersen Manufacturing (428)
Aphex Systems (610)
Apogee Sound (1106)
Ariel (835)
Aries America (1122)
ART—Applied Research and Technology (112)
ARX Systems (324)
Ashly Audio (640)
ATI—Audio Technologies (710)
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Audio Control Industrial (111)
Audio/Digital (540)
Audio Logic (211)
Audio-Technica US (323)
Auditel Systems (442)
Auth Company (436)
AVL Systems (231)
B.E.S.T. (1107)
BCE/Edcom (114)
Beyer Dynamic (819)
BGW Systems (305)
Biamp Systems (129)
Blonder-Tongue Laboratories (905)
Bogen Communications (1103)
Bose Corporation (1040)
Brejtfus Environments (731)
Brooke Siren Systems (1116)
Bruel & Kjaer Instruments (406)
BrystonVermont (519)
Bunting (541)
Burle Industries (706)
Cal Switch (506)
Canare Cable (1121)
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Case Component Network (823)
Celestion Industries (922)
Cerwin-Vega (217)
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Communications Co. (202)
Community Light & Sound (1141)
Comtek (110)
Connectronics (916)
Conquest Sound (901)
Consolidated Electronic Wire & Cable (234)
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Creative Light & Sound (537)
Crest Audio (108)
Crest Electronics (1136)
Crestron Electronics (318)
Crown International (704)
DDA (Klark Teknik) (306)
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Dis Brahler USA (531)
Diversatronics (500)
DOD Electronics (310)
Door Alarm Devices (424)
Drive-Thru Intercoms (417)
Dukane (717)
Dynacord Distributor (331)
Dynasound (1006)
Eastern Acoustics Works (435)
Edcor (629)
Eden Electronics (701)
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Elkay (619)
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Galaxy Audio (805)
Gauss (611)
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Gentner Audio (317)
Gentner Teleconferencing (319)
Ghielmetti (334)
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Gold Line Connector (910)
Gotham Audio (928)
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Hitachi Denshi America (1140)
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Industry West Electronics (616)
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Intelix (Division of Full Compass) (1118)
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Jaydik Communications (123)
JBL Professional (410)
Jeron Electronic Systems (1105)
Juice Goose (Whitenton Ind.) (735)
KDM Electronics (730)
Klark-Teknik Electronics (304)
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Lectrosonics (528)
Louroe Electronics (711)
Lowell Manufacturing (1117)
Lyntec (810)
MacKenzie Laboratories (1115)
MacPherson Speakers (734)
Mag-Tags (423)
Marlee Electronics (316)
Marsh Products (225)
McCauley Sound (429)
MDS (529)
Mehlichh Electronics (806)
Mellotone (330)
Meyer Sound Labs (105)
MG Electronics (431)
MicroAudio (907)
Middle Atlantic Audio (116)
Misco/Minn. Speaker (904)
Mitek (628)
Music Supply (1007)
Mystery Electronics (712)
N.E.A.R. (219)
Nady Systems (737)
Nakamichi America (607)
Nasca Systems (812)
Ness Imports (223)
Neutrik USA (1112)
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Numark Electronics (513)
OAP Audio (1017)
Omnimount Systems (1124)
Orban Associates (205)
Orbit Systems (325)
Otari (504)
OWI (1005)
Oxmoor (236)
Panasonic Ind. CCTV (728)
Panasonic/Ramsa Industrial (924)
Parasound Products (834)
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Peavey Electronics (120)
Peerless Sales (813)
Pelco Sales (612)Petcom (631)
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RPG Diffusor Systems (122)
RTS Systems (941)
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Samson Technologies (512)
Sanming Sound (1100)
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Sentex Systems (617)
Sescom (822)
Shure Brothers/Sound Reinforcement (405)
Shure Brothers/Professional Products (407)
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Sound Control Technologies (210)
Sound Stream Technology (634)
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Soundsmith (1029)
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Stentofon Communications (740)
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TOA/Electron. Intercom (705)
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Winegard (635)
Winsted (1013)
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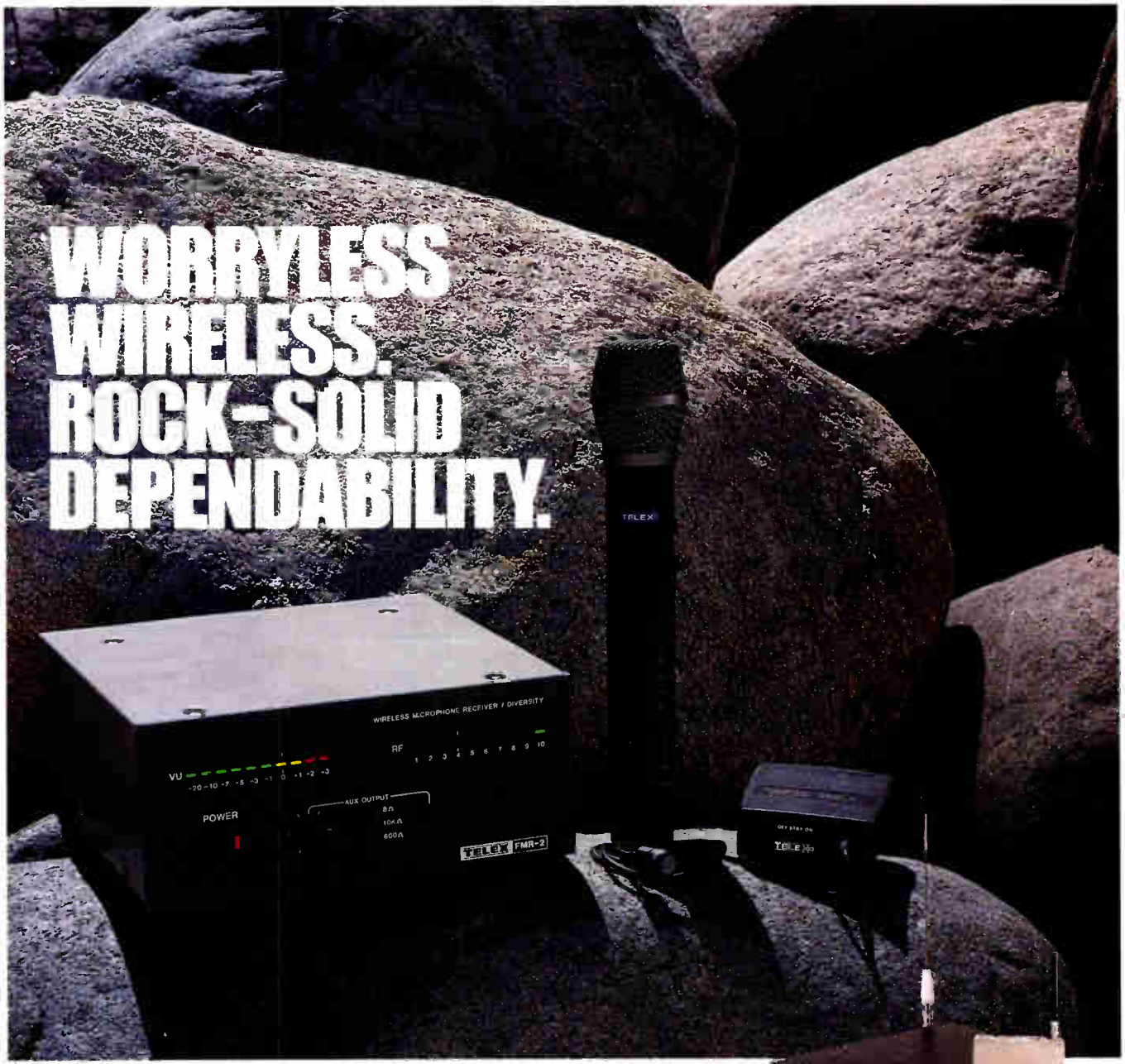

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TELEX

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SPEAKERCAD™: A REVIEW

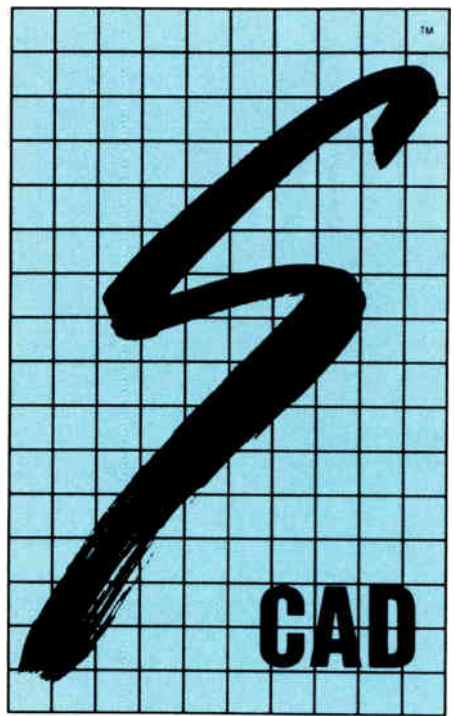
BY MIKE KLASCO

The SpeakerCAD™ Graphics Program is the second program in the Bose Corporation's Sound System Software series, and is designed to provide direct communication with the Modeler design program (Reviewed in Sound & Communications, March, April 1989). SpeakerCAD is a unique tool for the mechanical design of loudspeaker hanging systems and an effective tool for showing clients how the proposed sound system will actually appear once installed.

One of the criticisms leveled at Modeler at its introduction was that it lacked any mechanical design function within the program to depict the speaker cluster configuration. Some paint and drawing programs have file interchange with Modeler, but this is limited to pulling up the image, erasing the image, or drawing on it. Rotation or other manipulations of the image were not possible.

SpeakerCAD fills in this gap in Modeler. While SpeakerCAD is a standalone program, it can import designs from Modeler, configure (or reconfigure) clusters within the room model, check for collisions (or otherwise physically impractical configurations), let you select and "install" specific rigging hardware on the speakers, locate center of gravity, locate speaker acoustic centers, automatically calculate the total weight of the speakers in the cluster, and enable the user to take "photos" of the cluster from within the room model. SpeakerCAD is a high-resolution, fully three-dimensional program offering rotation, zoom, and other manipulations of the objects, as well as relatively sophisticated techniques such as hidden line removal and architectural scale printouts.

Klasco is president of Menlo Scientific, Berkeley, CA.



This first release (1.0) of SpeakerCAD has a few shortcomings—it cannot export the revisions you make back into Modeler, and it does not have file interchange with AutoCAD. File export back to Modeler would be useful if you find that some components collide and the speaker coordinates within Modeler need to be revised. The problem is that arrays of speakers have different characteristics than do individual speakers. The actual composite directivity of an array cannot be computed from the individual speaker elements alone, but the cluster must be measured as an entity. Even so, the software developers at Bose might consider adding the ability to export speaker coordinates and providing the automatic calculation of the separate speaker elements.

File interchange with AutoCAD would enhance efficiency, eliminating any duplication of effort when merging SpeakerCAD/Modeler-generated designs into prints prepared by the architect. Export into Mac AutoCAD would additionally enable export to MS-DOS IBM-compatible AutoCAD. Moreover, SpeakerCAD lacks support for a graphics tablet that would let you enter the corner points quickly from existing drawings (using a crosshairs puck or stylus) even if you could not import the drawing directly.

HARDWARE/SOFTWARE

As with Modeler, SpeakerCAD runs on the Apple Macintosh computer. All the current Mac models are compatible with the program. The program is distributed on an 800K floppy disk. It can also be installed on a hard disk. For users with accelerator cards or co-processors, SpeakerCAD is also included in the floppy disk, and this version manipulates the 3-D images 25 times faster than the standard version of SpeakerCAD. SpeakerCAD is licensed by Bose to qualified users for one year at a cost of $500 and yearly maintenance fee of $50.

SpeakerCAD operation is designed around three windows; the speaker model window, the array model window, and the room/design window.

The speaker model window is where graphic representations of loudspeakers are created, recalled, edited and saved. If you want to enter a product that is not presently in the file library, this is the window to use.

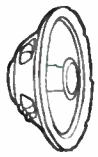
The array model window is where individual loudspeaker models, along with the appropriate rigging materials, are configured into arrays according to the information you input (individual speaker

sound power

AP 15 (T)
AP 30 (T)

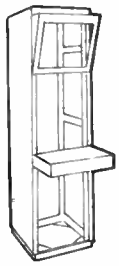
Commercial Sound Loudspeakers

Loudspeaker Baffles and Enclosures

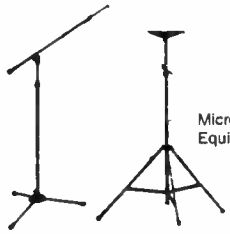


Professional Sound Loudspeakers

Voice/Tone Loudspeakers



Cabinets, Racks and Consoles



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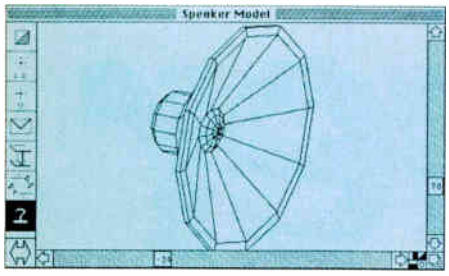
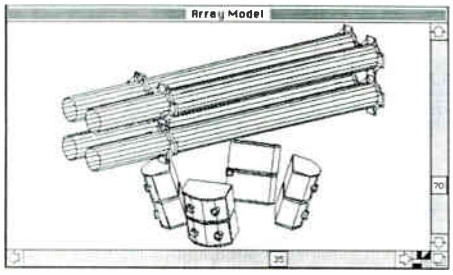
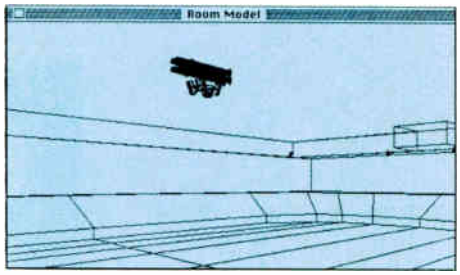


Graphic representations of loudspeakers are created in the speaker model window.



The array model window is where the individual loudspeakers are configured into arrays.



Perspective views of the system can be generated from any observer's position in the room model window.

location and orientation, array center of gravity, array weight, and so on). As in the Speaker Model Window, hidden lines can be removed for a more realistic visual model of the configuration. And each array can be stored for later recall and editing.

The room/design window is where complete sound systems and room models createdin the Modeler Program are imported. Here perspective views of the systems as they appear in the room can be generated from any observer's position in the room.

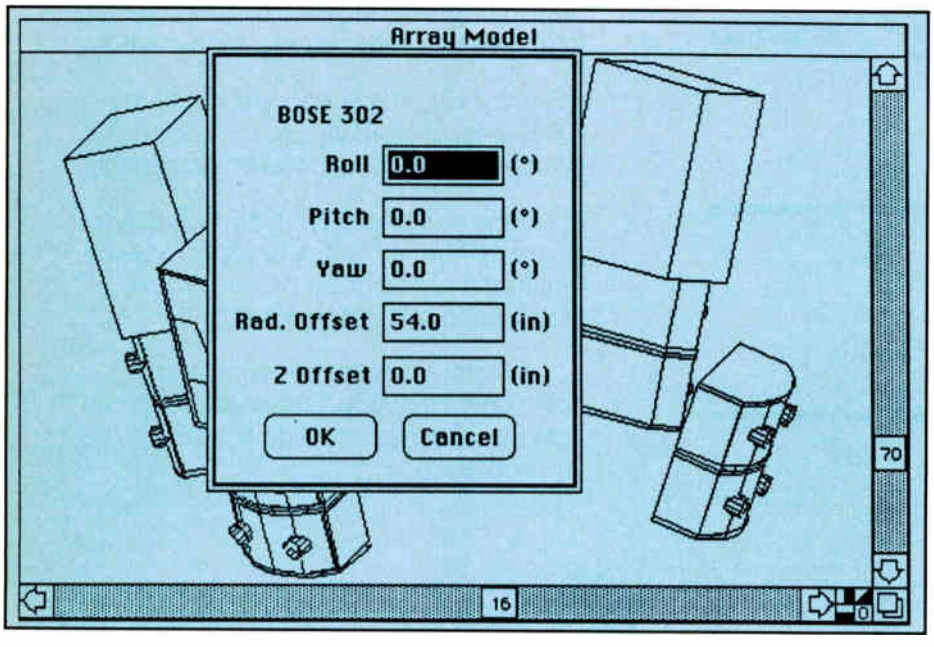
DOCUMENTATION

The manual is clearly written and well-designed. The introductory practice session is helpful, although it would be beneficial to have a more complex design example as well. Beyond the manual, other support material is available, including a job proposal prepared using Modeler, SpeakerCAD, and Rackmaker.

HARDCOPY

SpeakerCAD directly supports the Apple Imagewriter II and the Apple Laser writer. Speakers, arrays, and system designs can all be printed. Orthographic views of an array, in user definable scale can be printed. Both Apple printers are narrow carriage (8.5 by 11 inches). This is a little small for complex clusters, especially if the printouts contain the coordinates for each speaker. If SpeakerCAD had file interchange with AutoCAD, then the comprehensive printer and plotter support of AutoCAD could be used (even if you don't have a large format plotter, there are service bureaus that will accept AutoCAD dxf format files by modem, or floppies by mail, and send you your D or E format prints by return mail.

An alternative is to use the Imagewriter LQ wide carriage printer. The Orange Micro LQ interface cable with the JDL 850 printer is compatible with this driver. The JDL 850 24 pin printer produces C size plots (11 x 17 inches) and can be used as an office printer as well. Even if your specification package is 8.5 x 11 inches, double pages can fold out so the scale does not have to be too small to conceptualize clearly. Another possibility would be for SpeakerCAD's developers to provide a C or even a D size capability by the Imagewriter II by producing printer output in "strips" which could be taped together to form a large format print and sent to the blueprinters. While not elegant, this would be an inexpensive solution.



Once the individual loudspeakers have been chosen, they can be aimed using this pull-down menu.

ARRAY CONSTRUCTION

Once a speaker model has been created or recalled (from the speaker model library), a loudspeaker array can be assembled. If the speakers are already in Modeler, than the user can proceed directly to the model/design window and access the appropriate

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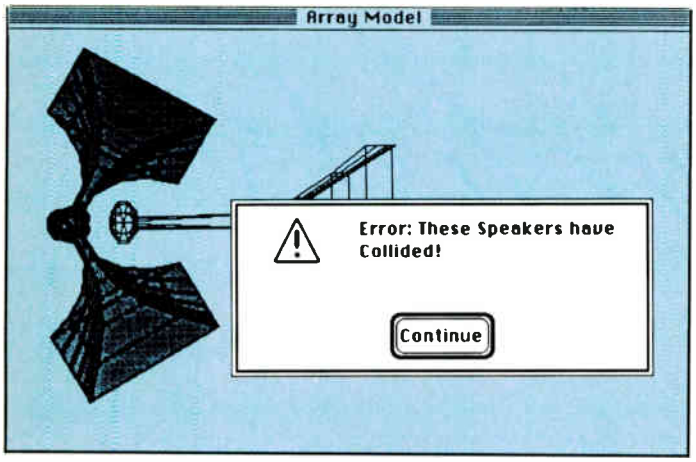
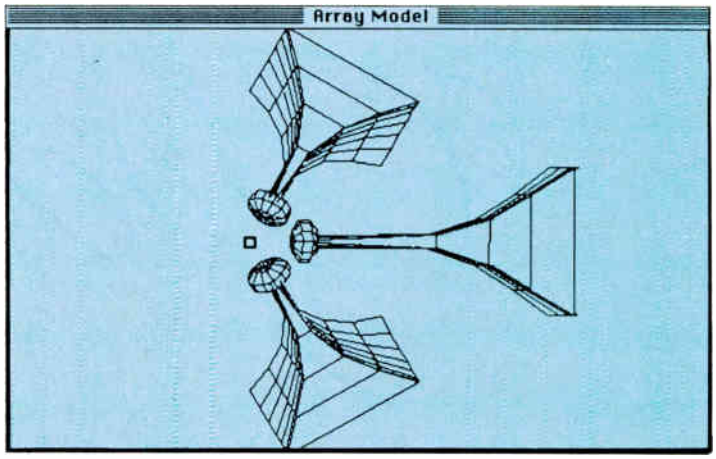


SpeakerCAD will warn you if the speaker position you have chosen is physically impractical.



The problem corrected.

Modeler design file. If you want to get a look at a possible array before taking the time to prepare performance simulations in Modeler, or if SpeakerCAD is used as a stand-alone program, then the user will start with the array model window.

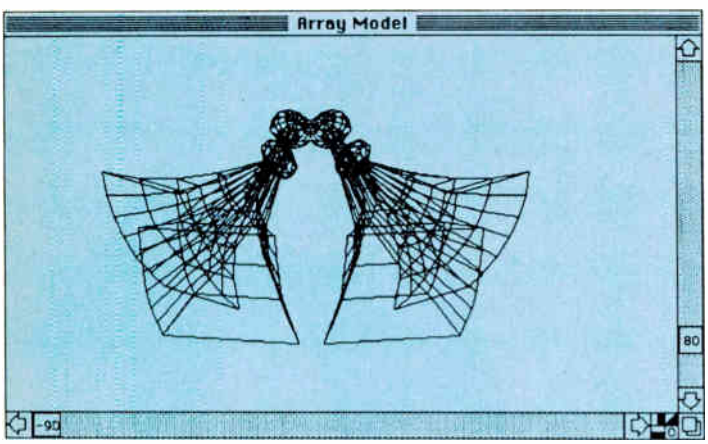
The program contains a comprehensive library of speaker models from Altec, Bose, Community, EV, and JBL. You can select from this database (this is covered in detail in the manual, under Using SpeakerCAD). The drawing tools for creating the new components are more sophisticated than the drawing capabilities in Modeler.

From the data library you create a speaker "short list" from which you will create your array. As many as 10 different models can be used in an array, which can consist of up to 25 speakers.

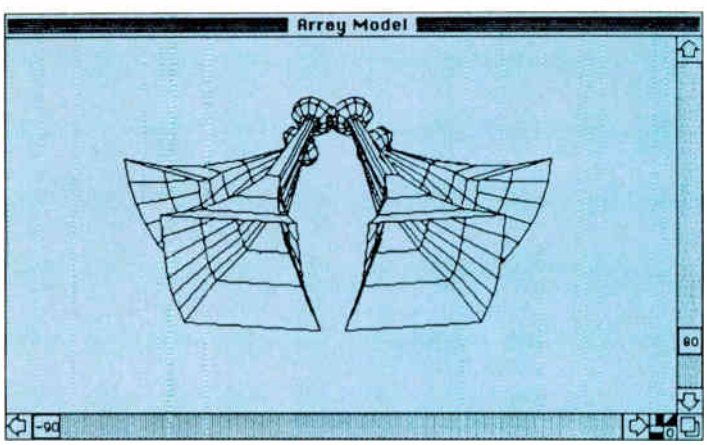
Within the speaker database are also files for a scoreboard, scaffolding, and a truss. At least at first glance, a separate database for speakers and hardware might be more appropriate, not just for calculation of center of gravity and total cluster weight, but also for generating the bill of materials.

After the speaker short list has been selected, the speakers can be aimed. Roll, pitch, and yaw are the same as in Modeler, and if you have previously specified these parameters in your room model in Modeler then these will be picked up by SpeakerCAD.

SpeakerCAD also introduces some new parameters not used in Modeler. Radial offset, for example, which is the distance from the center of the array to the speaker reference point. This is an important real-world factor in aiming speakers and accurately achieving the intended coverage. Knowing the acoustic center will enable you to set the time delay (to align the woofers and compression drivers without using test equipment). The other new parameter, Z of-



An array of horns displayed with all lines visible presents some difficulty in visualizing the actual appearance.



The same array with hidden lines removed — a much more realistic graphic representation.

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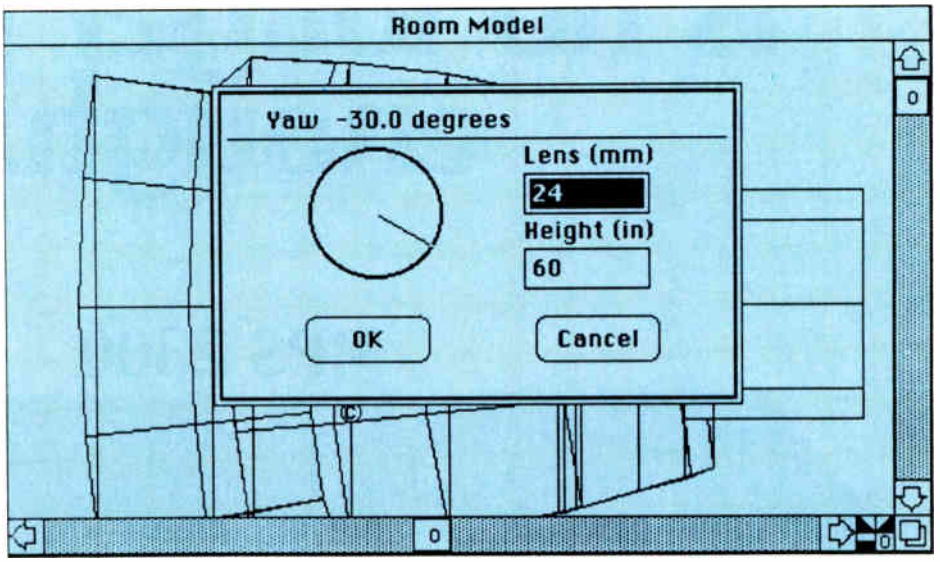
fset, is the amount of offset along the Z axis

from the center of the array. This is the upward or downward displacement of one speaker to another. The manual would benefit from a sketch depicting this.

These factors, along with the rigging point marking, collision indication between components, center of gravity, and total cluster weight separate SpeakerCAD from the all-purpose drafting programs.

Arrays can be saved to disk for later recall, and for editing into future jobs. A significant benefit of these programs is the development of a library of complete job files. When similar jobs must be modeled, previous job files can be quickly edited and new simulations re-run.

In addition to rotating the array,



Using this pull-down menu, the "camera" lens can be manipulated to provide a wide variety of perspective system views from within the room.

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Chromachip II™ color camera breakthrough.

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The Chromachip II's image is best summed up in a single word: beautiful. *Even under tough lighting conditions where a CCD's picture falls apart due to flare and "channeling."*

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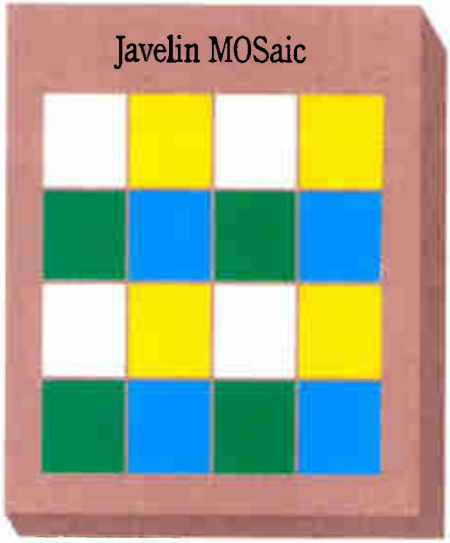

Javelin MOSaic chip: Interleaved white, yellow, green and cyan sensors give superior color fidelity and resolution.

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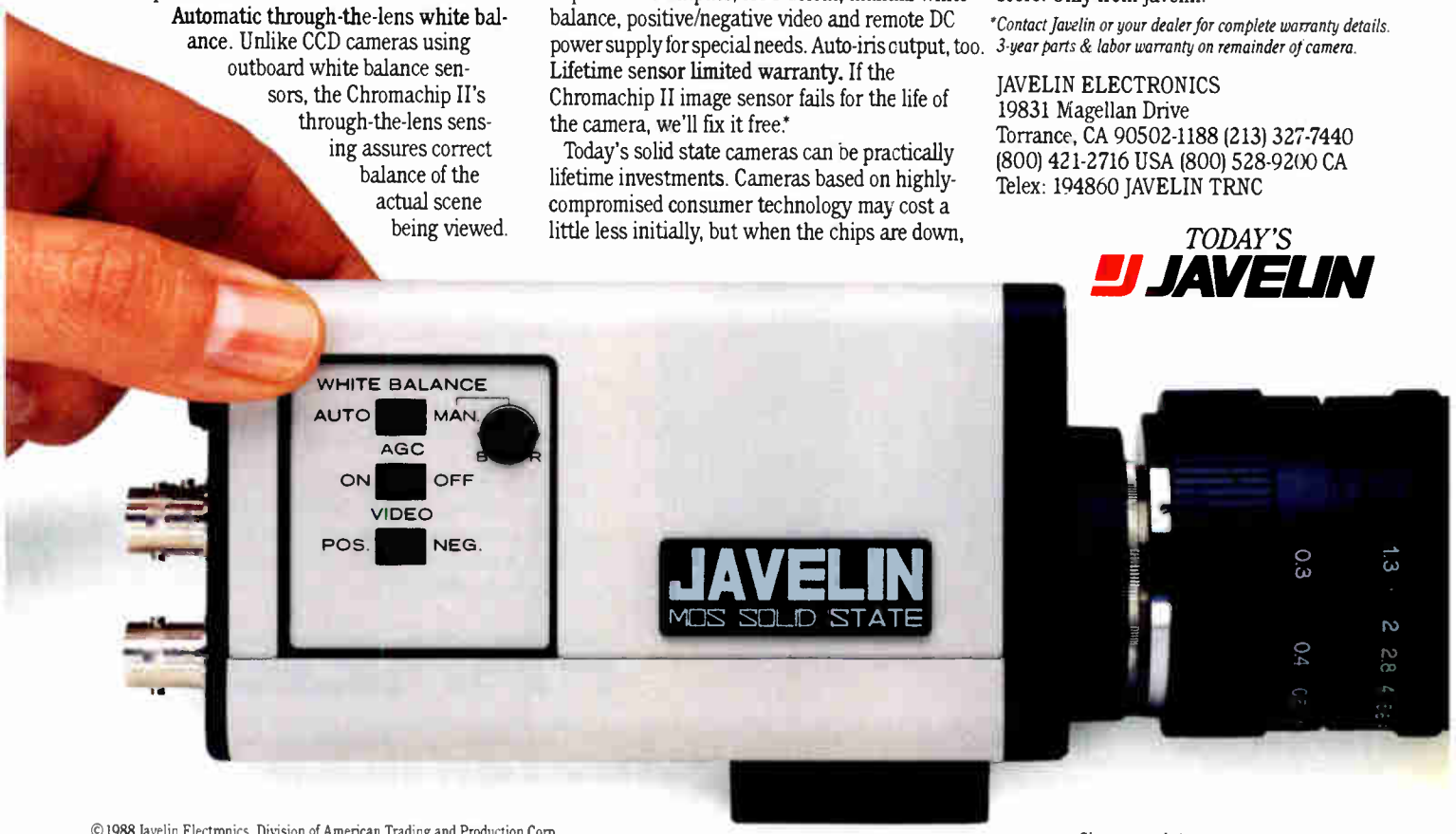

Shown actual size.

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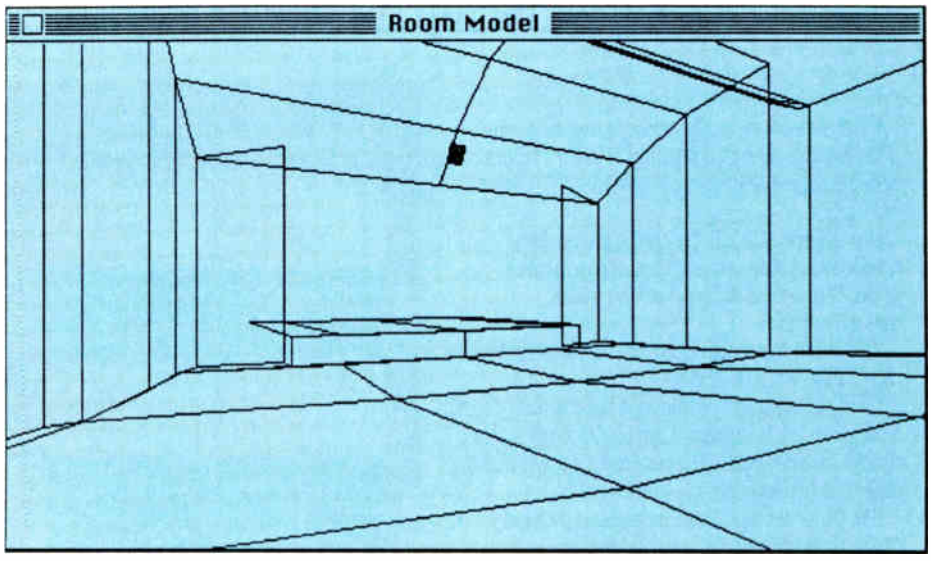
SpeakerCAD also allows for "dragging" of the array (using the mouse) to a new location. This is much more convenient and faster than determining the new coordinates for each component in the array, as is required in some other programs. Even after aiming angles of the array are set, the separate elements of the array can still be re-aimed.

RIGGING

Six different hanging hardware choices are available. The manual does not describe this hardware, nor suggest sources nor provide references for the application of rigging hardware.

Umbulus, (a design program from North Star Sound, Inc., which will be reviewed next month) offers two functions that I would find handy to have in SpeakerCAD; the preparation of



Once the viewing parameters are set, the pull-down menu is "clicked" off the screen, the system is viewed from the selected perspective.

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specifications for the linkages to hang the components in the desired cluster shape, and a compress/expand function allowing the user to either tight-pack the array or open it up to improve serviceability.

PERSPECTIVE VIEW

How the sound system will appear in the room is often a sensitive issue with the client. SpeakerCAD provides a powerful visualization tool both for the sound system designer and the client. The sound system can be viewed as it will appear in the room from any viewer's perspective. The user selects the room design option from the window menu, and a design box appears. The viewer's height and direction are selected, and the "camera" lens is specified. Different lenses can be specified, and you can zoom in on a specific area, or get a wide angle view of the room. Aiming the "camera" lens is easily accomplished by moving the mouse. The angular position (" yaw ") is indicated by a digital readout on a pull-down menu superimposed on the room view.

While Modeler allows you to generate the facility model and view this 3-D wire frame model externally from different perspectives, you never could quite get past the front door. With SpeakerCAD, the user can actually enter the room and view it from the listener's perspective.

CONCLUSION

SpeakerCAD is a powerful adjunct to Modeler, and is a very useable program by itself. Its practicality and efficiency would be enhanced with the addition of AutoCAD file exchange, direct support of wide carriage printers (such as the Applewriter LQ), and the ability to print-in strips for paste-up to large format prints.

SpeakerCAD is a new category of mechanical design program, a kind of "smart" drawing program, a program that actually knows a few things about what it is drawing. Lines on the paper are not just lines, but speaker enclosures with acoustic centers, center of gravity, weight, rigging points, and all the rest.

The program reviewed is a very early version of 1.0. Later releases will provide the benefit of an expanded manual and some of the operation enhancements mentioned in this review.

Future articles in this series will include a section featuring advance news of the progress of new releases, product updates, and the arduous process whereby vaporware is transformed into software. ■

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A VALUABLE ADDITION

BY CLIFF HENRICKSEN

LOUDSPEAKER AND HEADPHONE HANDBOOK
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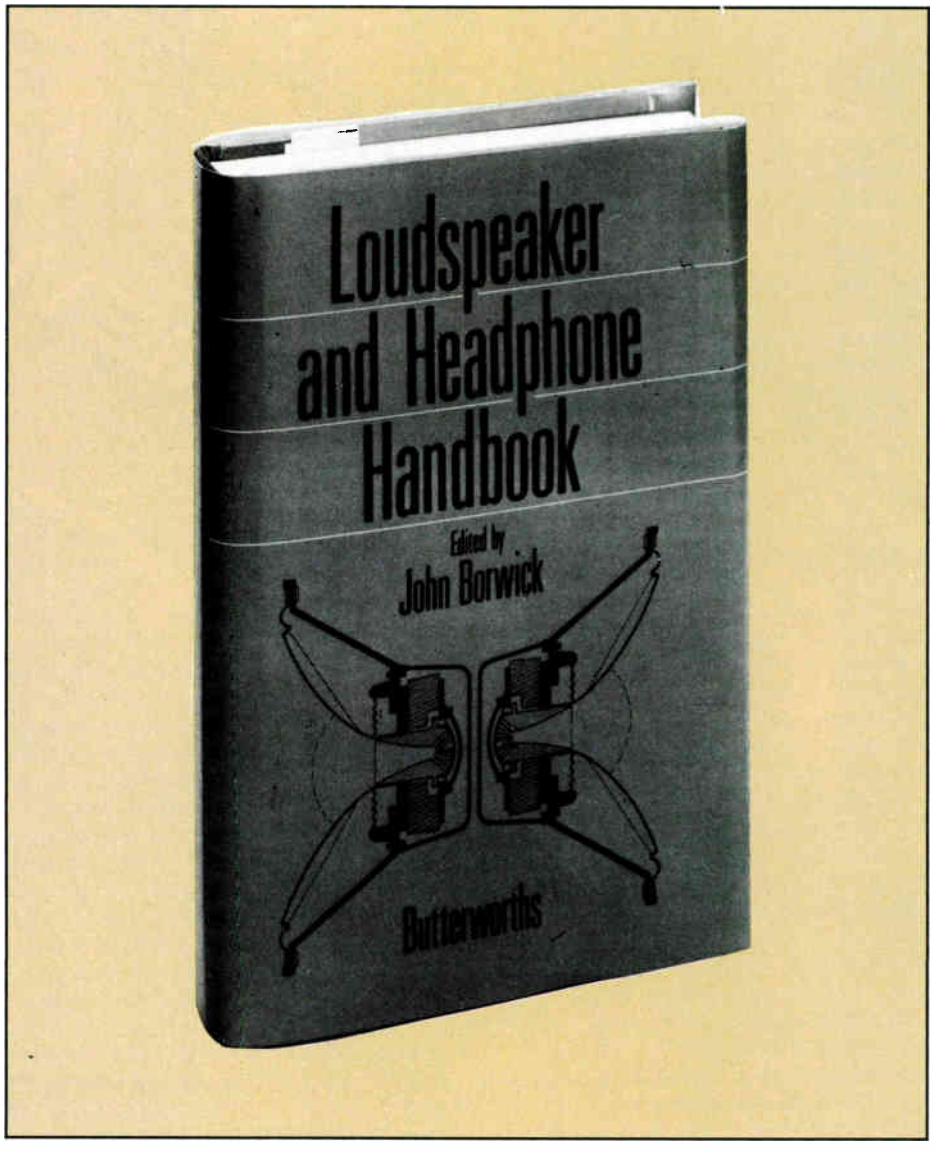
Illustrated. 573 pages.
Butterworth Publishers, $95.00



This new book is intended to serve as a comprehensive textbook on loudspeakers for students, technicians, and engineers. The editor maintains that "every aspect of loudspeaker and headphone theory, construction, operation, measurement, and application is covered in sufficient depth to equip students and practitioners alike with a solid working knowledge of the subject."

Not so, in my opinion. However, the book does have great merit, covering some important gaps in the existing literature on this relatively esoteric subject.

As a student, an enthusiast, and a practitioner of this mysterious art, I welcome the publication of any new work in this field. I own what I believe to be a complete collection of the most relevant textbooks and references on the subject to date: *Acoustical Engineering*, by Harry Olson (autographed, now out of print); *Acoustics*, by Leo Beranek (an ASA reprint); *Acoustic Design Charts*, by Frank Massa (out of print); *The Audio Cyclopedia*, edited by Howard Tremaine, out of print); *The Handbook for Sound Engineers, The New Audio Cyclopedia*, edited by Glen Ballou, and including a loudspeakers and headphones section authored by yours truly (published by Howard W. Sams & Company); *Sound System Engineering*, by Don and Carolyn Davis (Howard W. Sams & Company); *Musical Acoustics*, by Arthur Benade (Oxford); several early paperbacks on speaker craft by Abraham Cohen, Don Davis, and Alex Badmaieff, and a raft of old catalogs and brochures collected over the years from various manufacturers' dusty back vaults and forgotten passageways. Aside from AES and ASA papers, this about covers it for definitive texts in our field.

Olson has the best acoustical elements and acoustical radiation sections, however Beranek is also quite complete and in many ways complements Olson.

You need both for theoretical work and for sorting out the units for solving real-world problems; this is a nightmare for the beginner. The old *Cyclopedia* has

Henricksen is director of engineering for U.S. Sound, Inc., Lumberton, NJ.

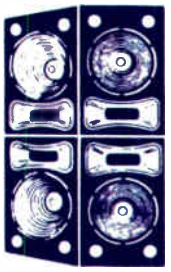
Arrays, Arcs & Point Sources

Sound reinforcement systems use multiple loudspeakers to increase the power of sounds, so that artists can communicate with large audiences.

To perform accurately, a reinforcement system must act like a single sound source, radiating a coherent arc of sonic energy. The only way to do this is with a *curved array* in which the speakers combine acoustically to produce a single wavefront.

Coherence By Design

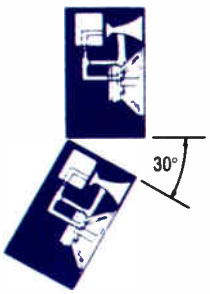
In 1980, Meyer Sound created the first curved loudspeaker arrays. And spawned a host of imitations. Today, curved arrays are everywhere. After all, arranging loudspeakers in an arc is a pretty simple chore.



The compact UPA-1A allows controlled coverage of wide areas in theaters, clubs and concerts.

But making a loudspeaker array perform coherently requires extremely complicated engineering. The intricate dynamics of arrays dictate absolutely linear phase and frequency response from every component. Horns must be designed to work together smoothly and efficiently. Crossover frequencies must be selected to preserve consistent directivity within tight tolerances. And each unit in the system must combine seamlessly with the others under all circumstances.

When every one of these conditions is met, the curved array becomes a virtual point source. And only one manufacturer has mastered all of these criteria — Meyer Sound.



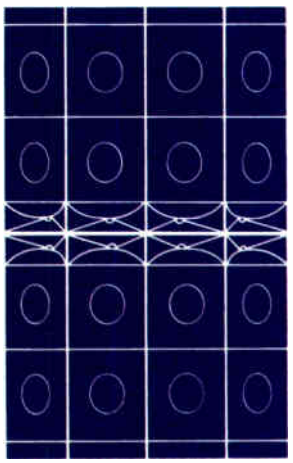
UPA-1A in typical vertical configuration.

Theory & Practice

Every audio professional knows the difference between promotion and real-world performance. With so many manufacturers claiming arrayability, how do you judge the truth of our claims? The same way that you should judge everyone else's: with your trained ears. When you walk across the hall, does the sound of the loudspeaker system change? Do you hear phasing, flanging or comb filtering? Does the sonic image shift dramatically? Are the lyrics drowned in a sea of reverberation? If so, then the array is not functioning as a coherent point source.

Both the UPA-1A and MSL-3 deliver high sound pressure levels with ultra-low distortion, for maximum intelligibility and fidelity. Efficient, high-powered, rugged and reliable, their specifications meet the most demanding professional needs.

Meyer Sound's proven loudspeaker arraying techiques have resulted from the most thorough research and analysis in the industry. They produce dependable point-source arrays in environments ranging from free-field to the most difficult performance venues.



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Carnegie Hall A coherent array of UPA-1A loudspeakers, supplemented by MSL-3s and 650-R2 subwoofers (not pictured), is permanently installed for live performance reinforcement..

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great historical pictures (priceless, some of them) and the new one (be careful with conflict-of-interest here, Clifford) has great new pictures as well as excellent sections on all aspects of real equipment used today. Don and Carolyn Davis pretty much have the system design business taken care of in their book, although the systems section of the new *Cyclopedia* is an excellent complement. Horn and box design is covered everywhere, but the best horn coverage, especially on impedance prediction, is in Olson. Use Beranek's approximation for the (Bessel function) mouth impedance and Olson's finite conical horn section as a differential element in a computer program. It works.

Some work in one area, some work in other areas, but no single one of these books offers a complete body of information on developing and engineering sonically successful loudspeakers. There is still a gaping hole in the available literature in terms of directly usable information. The information exists, but it doesn't seem to be readily accessible to those who want or need it. This new book, while presenting a clearer overall view, is still incomplete. Loudspeaker engineers still do not have their equivalent of *Strength of Materials or The Joy of Cooking*. Given that no single book has, as yet, given the entire picture, the *Loudspeaker And Headphone Handbook* should be reviewed relative to the existing body of knowledge on loudspeakers, with a look at how it covers the gaps in that body of knowledge.

The first few sections cover loudspeaker elements; radiation, acoustical impedances, horns, types of transduction methods, types of speakers, polar radiation patterns, magnets, etc. Standard fare, but a good review and discussion. The section on magnet design was especially well done. In the case of ribbon loudspeakers, the author fails to explain the major power output limitation: heat transfer from the ribbon (at high power they simply vaporize). The photo of the Decca/Kelly "London" ribbon-driven horn was a first for me. Vertical directivity should be on the order of 20 degrees at 12 kHz and 10 degrees above 20 kHz, judging by what looks like 4-inch tall "throat."

One of the real jewels of the book is the next section on electrostatic loudspeakers, by Peter Baxandall. It's everything you ever wanted to know, with a lot of emphasis on developments at Quad. One design, the Quad ESL63,

is a very complicated, intricate, and fascinating invention, both physically and electrically. I would like to have seen more "detailed" photos of other designs (like the Acoustat), but the author spent a lot of effort in revealing problems and solutions of a little-known and understood area of speakerdom. I especially appreciated the discussion of directivity of these typically large radiators. This cleared up a lot of suspicions I always had about their stereo imaging; large electrostats always seemed to me to have a much wider "sweet spot" of stereo listening than direct radiator and horn systems, which exhibit polars that come from a "point." The "geometric" polars presented explain this nicely. The entire electrostatic section is excellent and the most complete I've ever seen.

The next section of the book is on all the ways of dealing with the problems of multiple loudspeakers in a system. Laurie Fincham's (mostly theoretical) discussions are enlightening, however the study of vertical lobing at crossover was limited to one polar only, that for an 18 dB/octave Butterworth. The "minimum lobe" Linkwitz/Riley and a few other commonly-used filter characteristics could have really improved the discussion. These are definitely in the literature. The section on spacing amplifier/speaker interface was also informative, providing an excellent tutorial on how non-ideal (real) loads react with amplifiers, how system response changes, and so on. Motional feedback schemes for getting around this received lots of attention, but how does it sound? How did it work? Good information anyway.

The section on room acoustics is routine, but contains some unusual displays of measurements of room modes. The example of the reverberation characteristics of the Decca International Recording Centre showed a "flat" decay time of some 200-300 ms from .1-10 kHz. After a lengthy discussion of all kinds of absorption/diffusion methods, the author, Glyn Adams, did not also present the acoustical design of the room. It's probably a great-sounding room and I'm sure there are many who would benefit from a description of how this was accomplished, so they could set up their own rooms similarly.

It's always a benefit to start from something that works well and then go on from there. An amusing (for me anyway) table in this section differentiates between the sound absorption

characteristics of "person standing" and "musician sitting," which I preferred to see more as a differentiation between "musician" and "person."

The section on sound reinforcement and public address was the usual, in a way. What ruined it for me was the author's treatment of and apparent affinity for column speakers. Is this my American provincialism showing through? Have I become spoiled by listening to big, expensive, excellent-sounding systems? I am of the opinion that column speakers plain don't work, even though they cost "a third" of what a large CD horn cluster costs (they cost far less). I have heard that column speakers are still widely used in the UK and Europe, but always thought "nah...that's 20-year-old information." But here it is, in print—bad witchcraft from the past still in practice. Time to get out the pitchforks and torches, brothers and sisters. Read Don & Carolyn Davis and the new Cyclopedia for more relevant advice on this.

Mark Gander's section on studio and stage systems provides interesting historical commentary and the most visually entertaining part of the book. As compared to this part of my own section in the new *Cyclopedia*, it provided a different philosophical view in general and explored some different aspects in particular, like the examples of coil failure. Everyone loves a good catastrophe! Graphic detail! Voice coils from hell! Missing in this section (and in my own) are England's own Turbosound products, certainly internationally successful sound reinforcement gear. I would also have liked to see the KEF104, the Yamaha NS10, the Genelec monitor and my favorite, the massive installation in the PUK Studio, Denmark. Lots of JBL photos however...

John Borwick's section on measurement, Floyd Toole's section on subjective evaluation (scary monsters here, chart-and-curve readers) and C.A. Poldy's section on headphones complete the book. Coupled with the early section on electrostatics, these all add up to make the *Loudspeaker and Headphone Handbook* a very valuable reference by the simple act of filling a giant gap in the available or accessible literature. Mr. Borwick's measurement section shows some excellent environment-independent loudspeaker frequency-response curves (life after TEF) and an excellent, timely update on modern measurement methods of all kinds. Mr. Toole provides great food for thought on finding out how to survey people and find out how they perceive a speaker's output. Does it matter? It sure does if you can sell more by finding out. (Will the AES disown me for suggesting such a thing?) I believe that loudspeakers are ultimately art forms that work in collaboration with music. The designer

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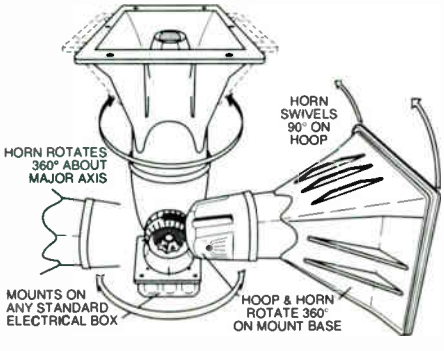

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works with the musician/artist in a roundabout way to give you modern music or any music which is reinforced or played back. Subjective evaluation of loudspeakers is like art appreciation. I believe that subjective evaluation is the New Frontier, and Mr. Toole makes a courageous and informative statement here.

Mr. Poldy (from AKG) presents an excellent and complete section on headphone theory, examples of all types , practical manifestations and all kinds of problems of getting the "right" frequency-response, listening problems ("the missing 6 dB") and lots of in-depth "color." As usual, I would have liked to have seen more photos, but I know they're expensive to put into print. I also realize that not every technical reader is a catalog nerd.

All things considered, the *Loudspeaker and Headphone Handbook* is an excellent reference book, and it adds a great deal to the available literature in the areas of electrostatic loudspeakers, measurements, subjective evaluation techniques, and headphones (the first and last mentioned here are, in my opinion, the real jewels of this book). I found many lengthy narratives which provided very useful background, giving valuable insight into the practical search for solutions to specific problems with all types of devices.

Derivations of equations in the relevant sections are complete and very well explained. The book is well thought out, and it presents the various sections, authored by specialized experts, in a logical manner. It is well-crafted, attractively printed, and a convenient size and weight. However, the book does not do a good job of guiding the reader through real designs with real numbers, leading to predictable and documentable (measurable) performance. It is here that the book fails to fulfill its intended purpose. I could only find a few practical examples worked out with real numbers and a numerical solution. Such an inclusion would be of great value to many engineers or practitioners; a little handholding and ice-breaking goes a long way, for both new learners and experienced veterans who are trying to learn new subject matter for the first time. This is my only major complaint with the book.

This book is not perfect, but neither is any other single work in the existing literature. They all have sections that are "jewels," and this one is no exception. Audio reference books of this caliber don't come along all that often, and they seem to go out of print before many of us can get a copy. If you're interested in this subject area, the *Loudspeaker and Headphone Handbook* will give you a lot of fascinating information which is not available anywhere else. It should be a part of your library. ■

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Circle 222 on Reader Response Card

INNOVATIVE ELECTRONICS, INDEED

BY JESSE KLAPHOLZ

In order to survive in today's marketplace, manufacturing products and systems that are not "frozen" technologically is almost mandatory. Innovative Electronic Design (IED) of Louisville, Kentucky, has assembled an unparalleled team of hardware and software engineers and designers. The hardware-based, software-driven components they create operate successfully under several different system architectures and in varying applications, from the conference room to gigantic stadiums and convention facilities.

Starting with small purpose-built modules, the IED approach has been to build components to solve problems that were not being addressed by other manufacturers. Along with these modules larger systems evolved, and it was apparent that extensive use of microprocessors and software would be necessary. Therefore, audio design engineers, digital circuit designers, and software programmers were assembled to design and build these products under one roof.

Hardy Martin, one of the company's founders, sought the best talent available in each specialized discipline. Martin was lucky to have almost in his backyard an advanced Naval Ordinance Center, where he found engineers well- trained in advanced digital and software engineering. Designing missile guidance systems can be very challenging, but audio design has always had a special aura about it. Hence, IED quickly assembled a top-notch team of highly specialized and experienced engineers.

AIRPORT SYSTEMS

The hardware team, headed up by Hardy Martin and Bob Ponto, first got involved with building an airport announcement system. The first two systems were for Port Columbus International, in Columbus, Ohio, and for Charlotte/Douglas International, in Charlotte, North Carolina. These two installations required the design of digital hardware and the software to run it. This became the beginning of the IED systems family.

IED developed a digital audio solid-state recorder that would record and play- back these announcements in proper queue. The first airport this was installed in was Port Columbus—the first airport to use such a system.

The requirements set forth through the work at Columbus led to the development of the first IED Model 500 ACS Announcement Control System. This system has since set a standard in the airport announce business, with more than 15 successful installations (as of Fall 1988).

John Johnson, of Naval Ordinance Center fame, was the first programmer on board at IED, and the first project he worked on was Charlotte Airport. Most of the system cards were basically as they are now, and the system(s) were using an 8080 microprocessor. Johnson had the ability to program with a little touch pad and display. Johnson then started on the Hoosierdome, using the Sony computer (the first such project for any sound system). "The Hoosierdome has an ACS system which is also the first place we had the Sony computer controlling everything," Johnson recalled. "We did away with the little key pad and the little display, and provided what at the time was a state-of-the- art display."

The people of Innovative Electronic Design.

Klapholz is an acoustical consultant in Philadelphia, PA, and is the former technical editor of this magazine.

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The IED Production Department (left to right): Steve Young, Kent Gardner, Jim Meade, and Trevor Roebuck.

IED technician David Martin tests a piece of equipment during production.

The IED Testing Department (from left to right): JimPaul, Dan Schneider, Rob Stinebruner, and David Martin.

Johnson did the programming for the Sony and for the ACS.

Since then the company's programmers have refined and expanded the software's capabilities, power, features, and flexibility. Just about anything a facilities manager can ask for today is already a standard feature in the "off-the-shelf" program.

The Hoosierdome, which opened in the Spring of 1984, was the first stadium/arena and convention center in the world to use a computer-controlled sound system. The computer controls all paging (assignments, routing, emergency), selection of stage locations with delay patterns and allows individual speakers and/or clusters to be turned on or off. And it was the first facility in the world of its kind to use a computer-controlled monitor/test system. The monitor system allows visual and audible monitoring of all power amplifier outputs and testing of the signal path to all power amplifier outputs. This system uses the Sony computer.

Over the years IED has fulfilled many different requirements for their clients. One of the more unusual demands was the redundancy required at the Los Angeles Airport, which features two 4-way ACS systems. The Sony computer monitors the operation and decides if one of the systems has quit and uses its bank of 64 relays to switch the system from one ACS to the other. With the proven reliability of computer electronics, redundancy of this nature is rarely called for today.

Johnson worked for over 10 years in gunfire control at the Naval Ordinance Center. He designed digital computerized servo-control systems for gun mounts and radar directors. He has experience in real-time software as well, which has some unique characteristics. At IED, Johnson does a lot of the computer interface design work: "I know the software and the digital circuitry,

and decide what jobs you'll do with software and which ones with hardware," says Johnson. Bob Ponto does all the audio design work. He can do digital design as well, and in fact does much of the microprocessor interface.

The first project Johnson worked on was ACS. It uses an 8080 processor single-board computer with assembly language programming. The original program was about 8K and it used a keypad for user interface. ACS was the original IED computer product. Since it's a computer controlled system, ACS had to come as a complete system—a single-board computer, and all the mic input, mixing, matrixing, control, zone output, etc. Development of the ACS was done on a Starflex computer—now collecting dust. (Starflex is a government development system for the 8080 processor.)

MESSAGE ASSEMBLY

IED's DRP today actually assembles messages from pre-digitized phrases. Many messages may be transmitted depending on a specific contact closure. Say there's a priority alarm, a specified section is spliced in, "...all fire crews are to report to..." The system is capable of splicing any combination of sections, depending on the closure, or command. That project used a standard computer, with new software. This system has now evolved into a standard product. Applications can include multi-lingual systems, which repeat the same assembled message in more than one language.

The DRP itself has a single chip computer for which IED wrote the software. In more recent applications the computer is not fast enough to handle all the data transfers. The hardware in the computer oversees it, and will execute tasks for a certain length of time, then the processor interrupts and tells it what to do next. The DRP can do four things at once. It actually records the user's channels and queues channels for specific time into the same array of dynamic memory.

One of the more unusual sights one would encounter on a tour of the IED plant is their recording studio. Another side-line of IED is a fully operative, commercial recording and video production business. It has two rooms: one is a small synthesizer studio that features a Synclavier system, and the other is a small vocal booth where all of the voice announcement recording is done.

PLATFORMS

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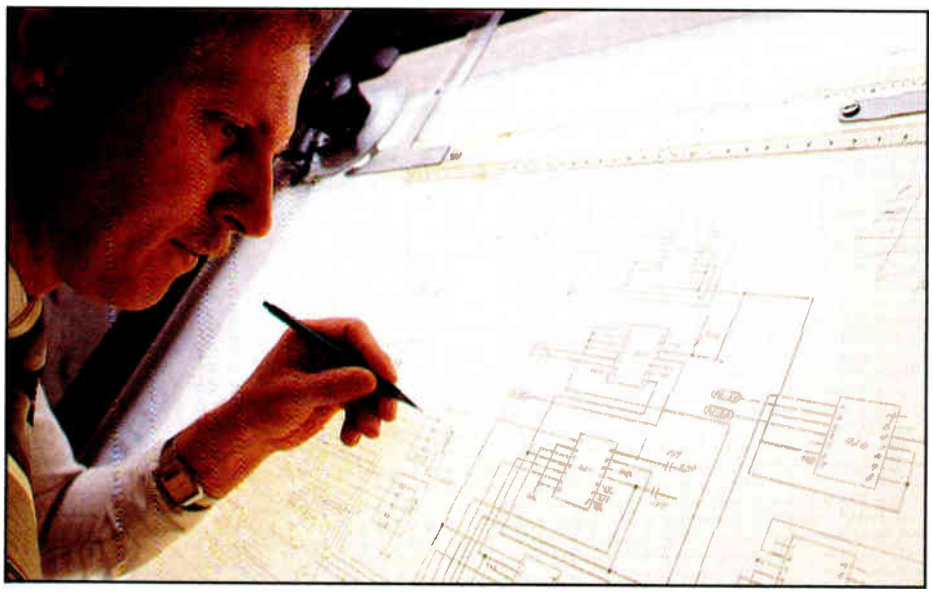


Engineer David Wathen at work in the documentation support department.

company engineers can begin improving the software and increasing its capabilities. In other words, as new products are released, new platforms for future development are established—mostly in software. As far as digital and computer control are concerned, the ACS was the company's flagship. Airport control has been the special application of ACS, but IED is expanding their scope into race tracks, such as Canterbury Downs, Burlington Park, and the Hong Kong Jockey Club, all of which have their own unique requirements. While the engineers say they haven't got a cruise ship yet, they'd all like to work on one.

Custom software is written for those installations that require unique solutions. These custom aspects can later be developed onto what IED calls, "generic software modules." Over the years, these custom applications have kept the software team busy developing a large library of software. This library offers the systems engineer more support for new designs, and offers the client more for his money.

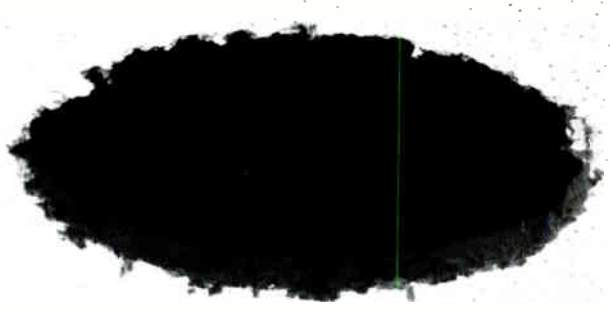
SYSTEMS DEVELOPMENT

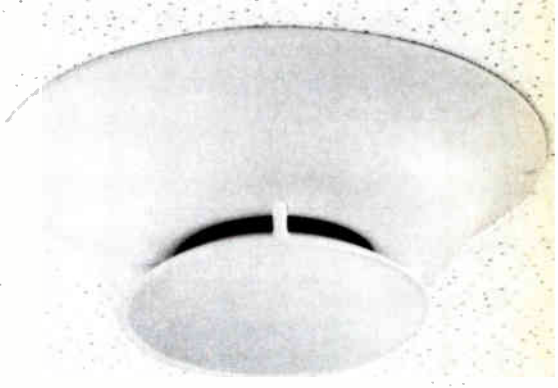
IED's engineers use editors and assemblers on IBM-compatible computers to write the software. Then they use simulation techniques—download the software, run it in the target device, and burn-in the EPROM.

Although Johnson has the experience to program just about any task, there are projects in which he has little or no involvement: "You can't just pick up someone else's program and start messing around with it. So we generally tend to have everything broken up according to software packages." Often a hardware design will lend itself to self-test most of its functions through its on-board micro. This allows for easy integration into the 596 monitor system. It also allows for streamlined manufacturing.

In those systems featuring a master computer "watching" things, all of the sub-systems can actually run without the master. For example, with the 540, once the system is set up the main computer plug can be disconnected—It will still operate because it's got it's own computer. ACS is the same way. Sever the main computer link and it will keep on running. The ACS does not have non-volatile memory, so if power is lost, it automatically comes back up (re- boots), to a default configuration in EPROM.

The QM-300 Speaker Has An Unholey Advantage.





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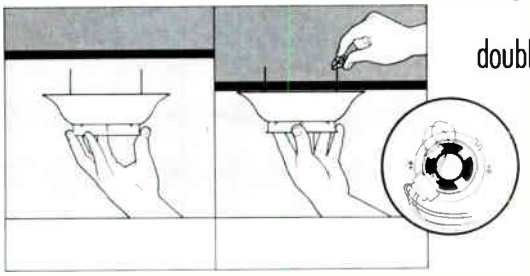

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Visit booth #722 at the NSCA Show.

Circle 233 on Reader Response Card

These systems are unique in that there are whole series of audio-related tasks that are individually performed by discrete audio modules, each with its own digital control. Some of these modules are analog, and some are digital. Nonetheless, all of these modules are under the control of individual microprocessors. This scheme could really be considered as a distributed processing system which in turn is under the master control of a larger computer.

Basically the 590 computer controls the operation of the entire system. It controls the way in which individual computer-controlled components and subsystems operate. Software controls each section, and software controls the overall system. Therefore each sub-system, and master-system can be updated with new features by writing new computer code and installing the new feature(s) with inexpensive EPROMs or ROMs. That's why IED is still using the same ACS boards they were using six years ago.

Many of the IED systems now include graphics of the facility layout. Therefore, if the operator understands the layout and operation of the facility, he can easily walk his way through the "bank-teller like" menus. It is the combination of easily-designed systems that are built in a mainframe/plug-in card fashion that allow one to build large and complex systems easily.

The most common failure in audio systems is usually power-related. In almost every IED system there are modular redundant power supplies—if one fails the second picks up. In larger systems UPS (uninterruptible power supplies) are used. This not only ensures uninterrupted service due to power outages, it also ensures totally clean power to be fed to the system. While UPS can be used with any system, since the IED systems use centralized power supplies for many functions, the total amount of required power is usually comparatively low.

When an IED computer goes out it has no disks in it. There is no moving storage of any kind. It's all done from a static-RAM-card with non-volatile memory. A user can run the program from RAM, and they can change the system configuration with that program. One of the things IED is going to be doing, starting in Minneapolis Convention Center, is using a modem in the system. IED engineers can then call up an installation and request diagnostic information for example, and *(Continued on page 114)*

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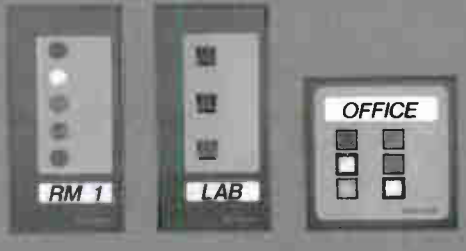

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Circle 221 on Reader Response Card

HOW TO READ AND INTERPRET SPECIFICATIONS

BY GARY DAVIS & RALPH JONES

Specifications help us understand how an item works, be it a microphone, mixing console, amplifier, loudspeaker, signal processor, or even a length of cable. Specifications can provide insight into the quality of design and construction, and can guide us as to the suitability of the item for a given purpose. In a legal sense, once a manufacturer specifies a piece of equipment to perform in a certain way, he is responsible to make sure it does, at least when first sold. Likewise, so may the sound contractor be held liable if specified system performance criteria are not demonstrable. Clearly it is important to understand the meaning of specifications.

Unfortunately, specifications are all too often unclear themselves. We suspect that if the design engineers were responsible for publishing all specifications and sales information without regard to product sales, specs would be a lot easier to comprehend, but the reality is that every manufacturer wants his product to appear as good as possible. For this reason, specs are often listed in such a way as to emphasize the strong points and overlook the weaker points of a product.

If specifications are honestly measured, you may think, and if the product legally is supposed to meet those specs, then can they really be "twisted" to favor a product? Yes, because there are many ways to measure a specification, and many ways to present it, all of which may be accurate insofar as they go, but not necessarily useful at best, and possibly misleading at worst. Mind you, this is not always intentional. Some people in engineering, sales and marketing really don't understand subtle aspects of product design, performance and specification. We recall one prominent ad where the console's output level was specified as "plus/minus 24 dBm." Giving the manufacturer the benefit of the doubt, we assume the ad agency slipped—or maybe there really was a switch to toggle the console's maximum output level between 252 milliwatts (plus 24 dBm) and about 4 microwatts (minus 24 dBm). Hopefully, you will take it upon yourself to learn enough to avoid such pitfalls.

Frequency Response:	30 Hz to 20 kHz
Harmonic Distortion:	Less than 1%
Intermodulation Distortion:	Less than 1%
Output Noise:	Better than −90 dB
Input Impedance:	600 ohms
Input Sensitivity:	0 dBV
Maximum Output Level:	+24 dBm
Output Inpedance:	10 kohms
Crosstalk:	Under 60 dB
Dimensions:	19" W x 3½" H x 8" D
Weight:	10 pounds

Figure 1. An inadequate signal processor specification.

SPECS THAT SHOULD BE DOUBTED

The specifications in Figure 1 describe an imaginary piece of signal processing equipment. They have been stated so as to appear useful, yet every single one is either misleading or completely meaningless. Can you tell why?

Seems like this is a reasonably well made item, whatever it does. Fairly low distortion, typical professional levels, low noise, standard rack mount size: nothing very special here or is there? This series of articles will explain, category by category, why a little healthy skepticism is in order.

In general, a specification should provide sufficient information to enable any competent technician, using standard test equipment, to measure the equipment itself to verify the specification. If an elaborate test load was connected to the amplifier in order to obtain a specification, that load should also be explained in the spec. If the amplifier was measured at minus 10 degrees Farenheit, then that, too should be stated (after all, it might do wonders for the power rating to operate the amplifier in a freezer). For input noise specs, it makes a difference whether an input is shorted or connected to a specific impedance. For output level specs, the load is significant. The bandwidth is significant for impedance, noise and level specs. You get the idea. A very simple spec may be easier to read, but it is also easier to "fudge."

The editors would like to thank Gary Davis for permission to use material from The Yamaha Sound Reinforcement Handbook.

"No one can repeal the laws of physics. The challenge is to make them work for you."

KENTON FORSYTHE
Director of Engineering; Co-Founder

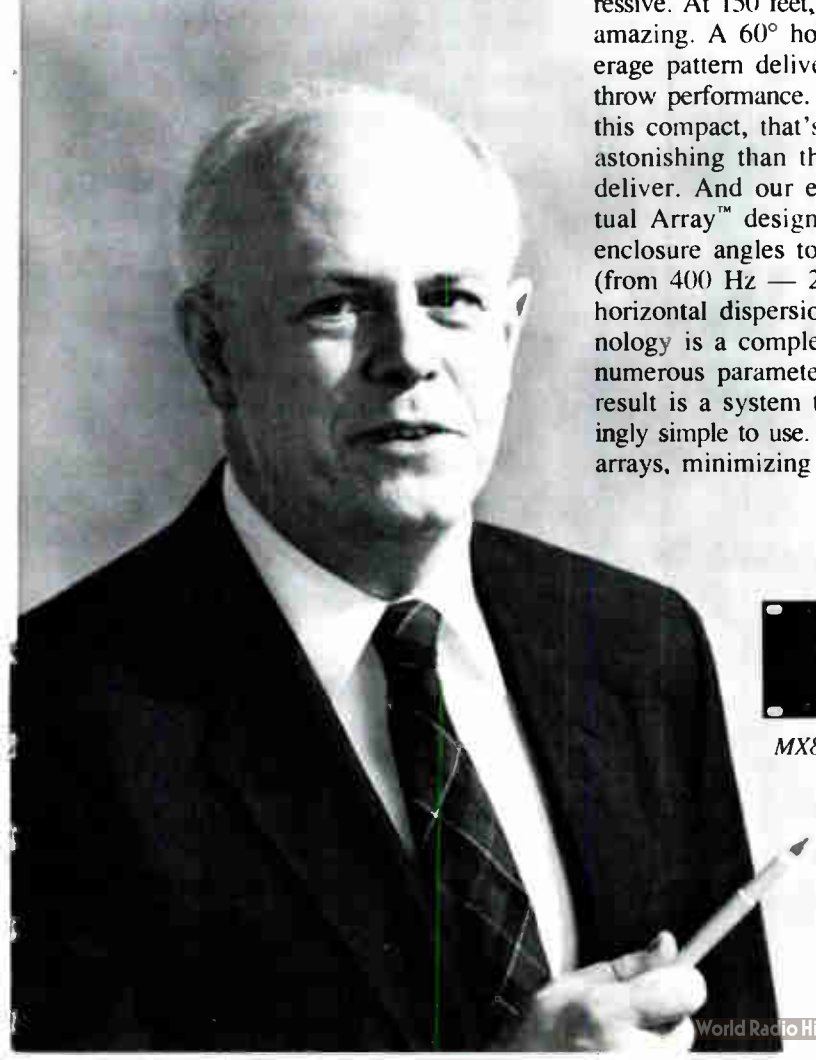
Case in point: The KF600, EAW's newest system for performance applications. It measures just 33" high and 19 3/4" on a side. Yet KF600s produce 130 dB, averaged from 65 Hz — 20 kHz.

A principal factor behind that small miracle is our unique Transverse Geometry™ low frequency subsection. In this ingenious example of physics at work, the woofer faces *sideways*. Yet its entire output is frontally focused. The design uses dual chambers (one tuned, the other acoustically open) to accomplish this acoustic rotation while maintaining high woofer efficiency.

At 15 feet, KF600s sound impressive. At 150 feet, they're simply amazing. A 60° horizontal coverage pattern delivers true long throw performance. From speakers this compact, that's even more astonishing than the SPLs they deliver. And our exclusive Virtual Array™ design matches the enclosure angles to that constant (from 400 Hz — 20 kHz) 60° horizontal dispersion. VA™ technology is a complex balance of numerous parameters. But the result is a system that's amazingly simple to use. With KF600 arrays, minimizing interference and eliminating lobing or hot spots is virtually automatic.

We're known for innovative enclosures, but we also know the value of electronics. So we've developed KF600 modules for our MX800 Closely Coupled Electronic Processor™. The MX800 provides four-way asymmetrical crossovers, time/phase compensation, individual driver protection and high frequency power response equalization, along with LF excursion control and equalization. All functions are precisely adjusted — through TEF™ analysis and real world testing — for optimum effectiveness.

If you have an application that demands unlimited sonic performance while providing limited space and setup time, audition KF600s. You may have a little trouble believing your own ears — most people do. But what you'll hear is real: No magic, just the laws of physics, artfully applied.



MX800 CCEProcessor — an integral part of the KF600 system.

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Circle 234 on Reader Response Card

This month's article goes into a fair amount of detail with regard to the proper means of measuring and evaluating the frequency response of various equipment, and the power bandwidth of amplifiers. Here we will quickly review the difference between power bandwidth frequency response and frequency range, and then cite a few pitfalls in their measurement and specification.

The term frequency response is a description of the ability of a device to accurately reproduce, at its output, the signals which appear at its input. With microphones, this describes the relationship between the acoustic pressure at the diaphragm and the electrical signal at the mic connector (i.e., dB SPL to dBV, dbu or dBm). With preamplifiers, mixers and power amps, frequency response describes the power or voltage waveform's amplitude relationship between input and output connectors, and so forth. There are at least two important aspects to such a specification: one, the extremes beyond which response falls off unacceptably or becomes too erratic to be considered useful, and two, the degree of deviation (tolerance) within those extremes. There are instances where specifying a "frequency response" makes little or no sense.

If a device is intended to alter the spectral balance of a sound, then specifying its frequency response, per se, may be useless. For example, what is the frequency response of an electronic music synthesizer? We could examine the keyboard and look up the fundamental frequencies corresponding to the notes but then, there are harmonics and variable frequency oscillators and so forth, so how can we really know? Well, we could simply measure the maximum and minimum frequencies that could possibly be produced at the most extreme settings of the instrument for every note on the keyboard. Of course, the real issue here is that this is generating original sound, not reproducing anything, so the whole concept of frequency response goes out the window. Instead, the term frequency range is appropriate. Here, if we do, in fact, measure the highest and lowest frequencies that might be generated, we can then specify these as follows:

Synthesizer Frequency Range:
16 Hz to 22 kHz

In the special case of power amplifiers, frequency response may be extremely flat, with wide bandwidth, at low power levels, but may be substantially degraded at higher power levels. In fact, this is usually the case. Therefore, the frequency response of an amplifier is generally measured at 1 watt output (or some other low level). In order to see what the amplifier does at higher power, the power bandwidth is described; this

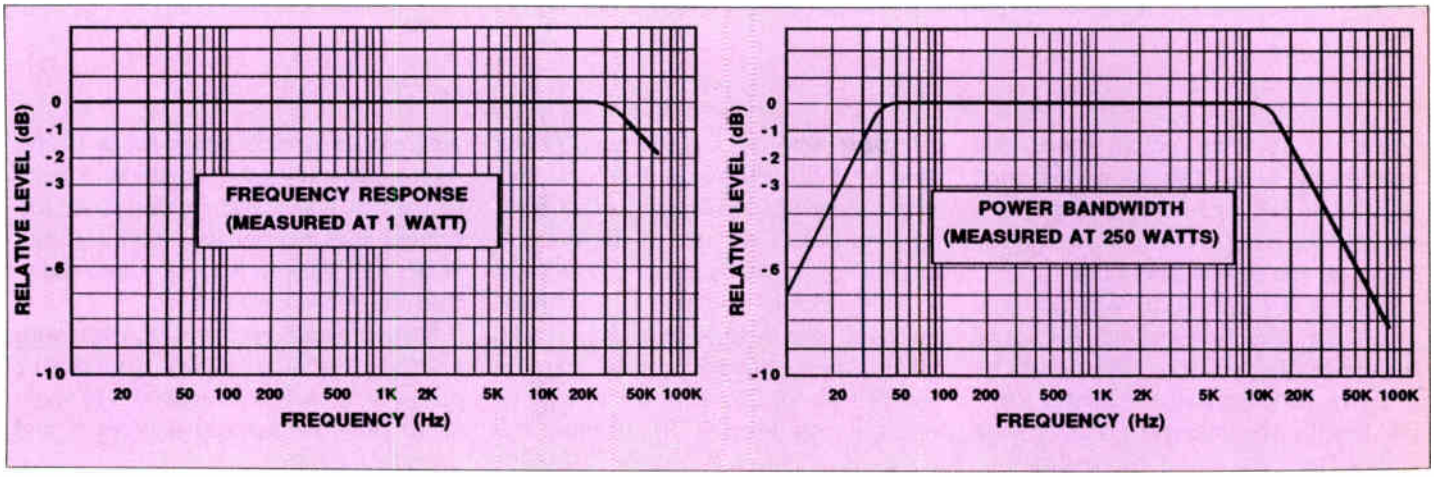


Figure 2. Frequency Response (left) and Power Bandwidth (right).

specification tells the number of Hz between the points where the output power drops by 3 dB (half the power) relative to the midband (typically 1 kHz) when the amplifier is developing its maximum rated power. The following examples might be given for a properly specified, realworld amplifier:

Frequency Response:
10 Hz to 50 kHz, + 0 dB, —1 dB
(at 1 watt output into 8 ohms)

Power Bandwidth:
25 Hz to 8 kHz (250 watts into
8 ohms, 0.1% THD,
both channels driven)

Observe that the power bandwidth is considerably less than the frequency Response bandwidth. Also note that no tolerance is required on the power-bandwidth spec because by definition the spec merely tells us where the power drops 3 dB relative to the midband power of 250 watts (i.e., to 125 watts).

Figure 2 illustrates the actual response curves for the above printed specifications.

GRAPHIC VERSUS PRINTED SPECS

As you can see from the preceding examples, specifications may be presented graphically, as well as in typed form. In fact, most frequency response specs are first plotted on a graph and then the written specs are generated from the graph. Wherever possible, it is

better to see the graph, since this provides far more information about what is happening between, and even beyond, the extreme ends of the stated frequency response and power bandwidth.

Looking at Figure 2, for example, you will notice that the low end frequency response actually doesn't fall off one bit at 10 Hz, although from the printed spec, you might have guessed it was down 1 dB. True, the high end response does drop by 1 dB at 50 kHz. Why was this amp not specified to below 10 Hz? Well, for one thing, it's not a DC-coupled amplifier, so it's not supposed to go down to DC (which is the same as 0 Hz AC). Since 10 Hz is well below the audio range, there simply was no point in specifying it to, say, 8 Hz (which may be where it was down 1 dB). Besides, the graph paper used did not go below 10 Hz, so response any lower would have been difficult to document. In this case, the printed spec did not hide anything, and in fact was apparently more conservative than the actual performance.

Remember, however, that even with graphic plots of frequency response or power bandwidth, it is important to know such things as the load impedance and operating level.

Quiz: Now, do you know why the frequency response spec in Figure 1 is meaning less? If you said, "no tolerance (no + or — so many dB) was stated," you're correct. If you said, "no power level is given," you would also be correct, assuming this were a power amp. In the absence of a stated output level, 1 watt is generally assumed for measuring power amplifier frequency response.

A GOOD FREQUENCY RESPONSE SPEC

With any spec, "good" must be judged in the context of the application, the balance of the system's performance and cost versus benefits. If this sounds like hedging, it is. There is no one answer. Certainly, the flatter and wider a frequency response spec, the more accurately a system can reproduce sounds. However, it is pointless to have amplifiers and loudspeakers that are flat to below 30 Hz when there is no program material present below 40 Hz (which is generally the case in a sound reinforcement system). In fact, it is often desirable to restrict low frequency response to block mic rumble and wind noise, and to protect woofer cones in the event a mic is dropped.

If the sound system is to be used for paging, then the low frequency response need not go much below 200 Hz. Similarly, it is pointless to have power amplifiers and loudspeakers that are capable of flat response to 18 kHz in such a system; the human speaking voice simply doesn't generate frequencies that high, so all the system would do is reproduce hiss and noise above 5 kHz or so. In this kind of

application, a frequency response spec of "150 Hz to 10 kHz, plus/minus 6 dB" would be considered excellent—and actually preferable to the proverbial "20 Hz to 20 kHz" idealized spec. In fact, let's examine that "20 Hz to 20 kHz" syndrome. For many of us, those numbers have been ingrained as the gospel of required response in a "decent" sound system. Where do they come from? Well, a long time ago research demonstrated that young ears can detect sounds as low as 20 Hz and as high as 20 kHz, and not much beyond that. Below 20 Hz, we begin to feel the sound instead of hearing it. In fact, there is almost no musical signal below 30 Hz except for the lowest organ notes on large pipe organs, the thump of a very large drum, or an occasional synthesizer tuned down an octave below the keyboard. While a few very sensitive adult ears can hear a few thousand cycles above 20 kHz (characteristic ally recording engineers or musicians playing non-amplified instruments), most adult humans in today's civilized, Western cultures cannot hear much above 16 kHz—at best. And the only natural sounds that go up that high are the very highest harmonics of high pitched musical notes. Given this information, a system exhibiting "flat" response from 25 Hz to 18 kHz would give most listeners a breathtaking, very pleasing experience. Even a 35 Hz to 16 kHz system would sound very good to most people.

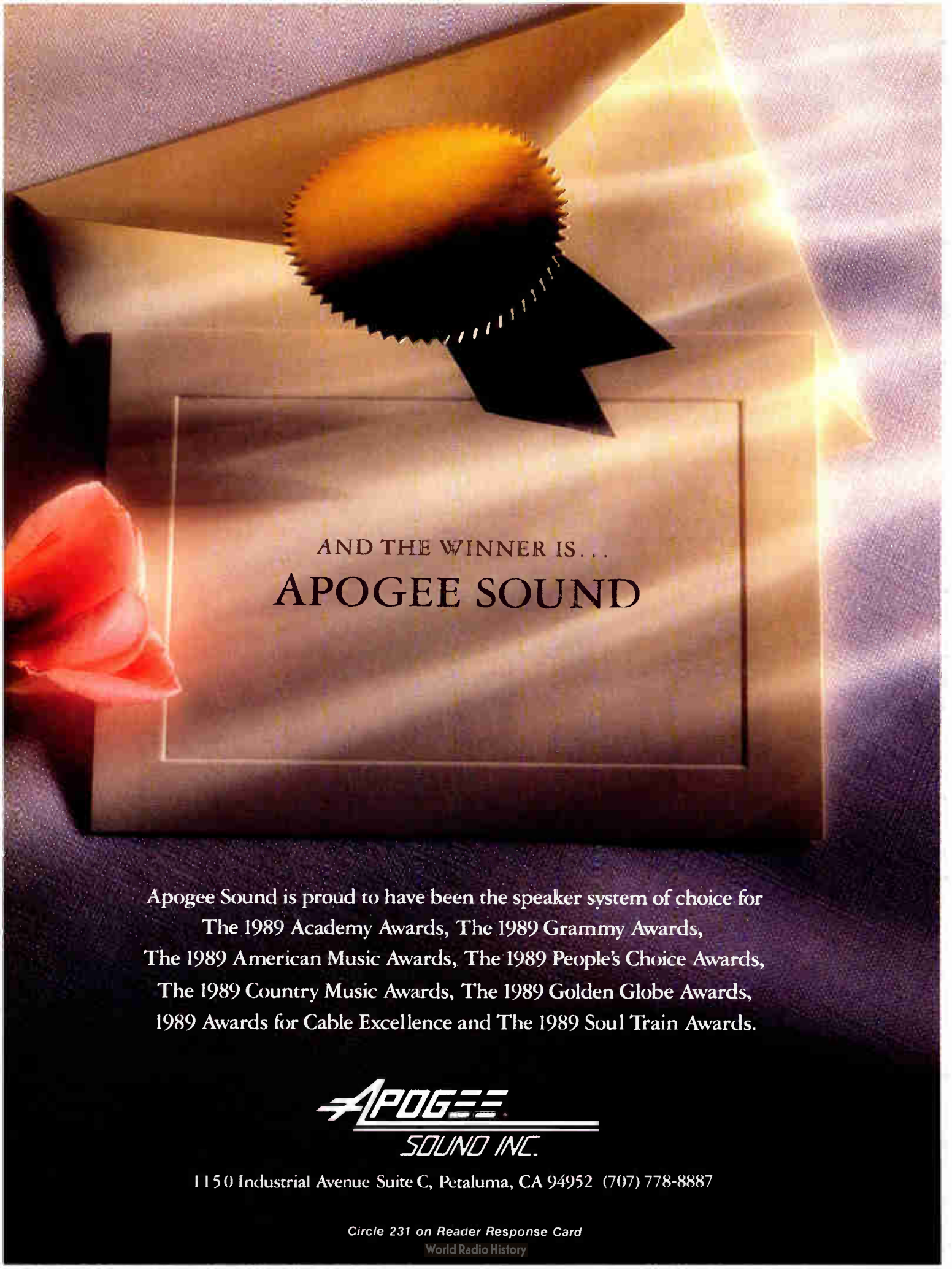
If we examine recorded or broadcast music, there are other considerations. In records, high pass filters often restrict the lowest recorded frequencies to 40 Hz or 50 Hz (occasionally there is some program with frequencies below 50 Hz, but records almost never go below 20 Hz). In compact disks or digital tapes, the highest frequencies may "hit a brick wall" due to very steep filters at 17 kHz to 20 kHz. The best FM radio broadcasts seldom have any energy below 30 Hz (because the source material has no frequencies that low), and since the stereo pilot tone is at 19 kHz, their high frequency response is restricted to some thing below 18 kHz—often as low as 15 kHz. In any case, "flat" response beyond these limits is, in itself, of no virtue. The only real justification for extended frequency response is that it suggests flatter phase response within the desired audio passband, and that flat phase response (if its exists) may improve the sound quality of the system.

This last point raises another issue; specs are often interrelated. If one spec is terrible, then something else is probably suffering, too, whether apparent or not from the other specs listed.

NOISE

One definition of noise is akin to the definition of a weed. What's a weed? It's

(continued on page 116)



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U P D A T E

Contracting Close-up

Reports From Novaworks, Advance Sound & Electronics

Divine Sound

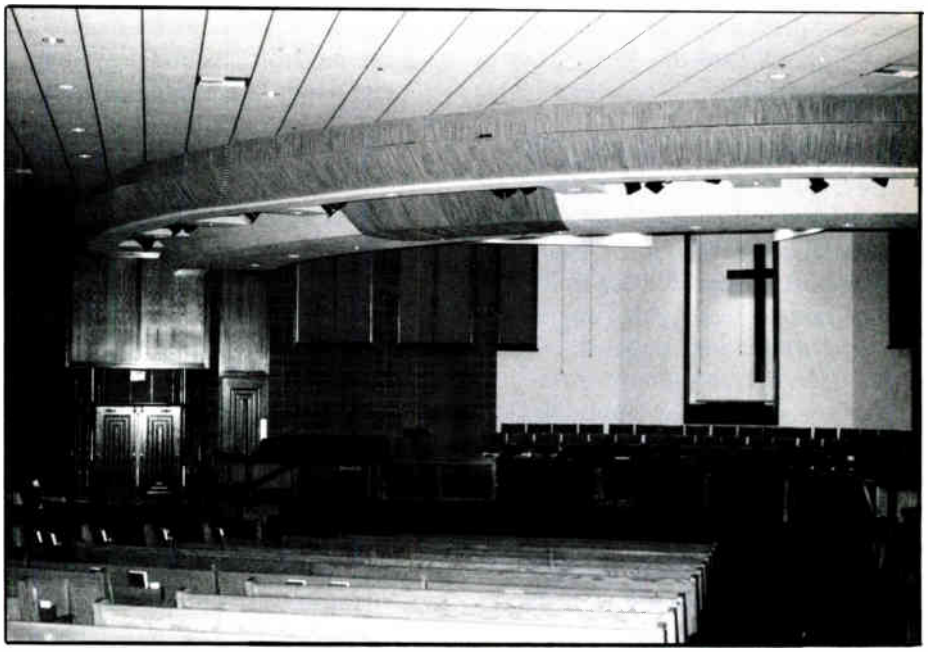
Four Sacramento-area churches have recently installed Altec Lansing systems with the help of Advance Sound & Electronics. The contractor, also Sacramento-based, designed and built systems for Grace Evangelical Free Church, St. Ignatius Parish Gymnasium, St. John the Evangelist Church, and Sun River Baptist Church. All of these jobs were either the second or third Altec sound system installed in each facility.

The three church structures are similar in design, with wrap-around seating of 180 degrees or more. The Grace installation, designed by Walt Bryant, features a 24-channel stereo mixing console with Altec Incremental Power Amplifiers driving the time-aligned main cluster and platform fold-back system. Separate equalizers were provided for the main cluster, separate left and right foldbacks and overflow areas.

The St. John the Evangelist structure is designed by Dan Becker, Advance Sound's president, as two-thirds of a circle with the chancel platform extending into the center. The doughnut-shaped seating area required a customized speaker system to achieve the necessary 230 degrees of horizontal coverage. Components for the system include dual Altec Automatic Microphone Mixers (12 inputs) three 8127 LF enclosures with three MR 931-12 Mantaray horns with 908-8B drivers, two 1590E power amplifiers and one 1653 equalizer. Also, eleven Altec 409-8T satellite speakers installed in the narthex and corridors. This system is the second major sound installation for the St. John's parish by Advance Sound. All of the original Altec systems are still functioning, says Becker.

network, an 9872-8A compact speaker system (choir foldback), eight 409-8T satellite speakers, one 1653 B equalizer and one Altec 1269 D.C. amplifier. A 16-channel Yamaha board was provided for mic mixing. Because the architect wanted the speaker cluster hidden, a circular wedge-shaped proscenium was built above the chancel with light blue pleated grill cloth covering the cluster as well as creating a decorative trim around the circumference.

The rapid growth of Sun River's congregation brought on the need for a larger sanctuary structure, thus allowing their former quarters to be converted to a multipurpose room/gym. The Altec system in this building consists of two 8256 L.F. systems with MR94A horns, 290 series drivers, an 8-channel mic mixer, and one 1653B equalizer, driven by an Altec 1269 D.C. amp.



The Sun River Baptist Church

The Sun River Baptist Church, another 180-degree structure, has its choir situated behind the altar. Completed in December of last year, the church's newest system is made up of one Altec 8227 LF enclosure with two MRII594 Mantaray horns with 299-16A H.F. drivers, one N-1285-8B dividing

On the same campus, Sun River's original church is still in use as a chapel, with its Altec-Lansing sound system still in use. The Grace church, St. John's, and Sun River utilize their original church structures as gyms/multipurpose rooms. Advance Sound recently completed a new system in the multipurpose room/gym of St. Ignatius Parish that consists of two MRII594 Mantaray horns, one 8156 L.F. speaker system, one 1268 direct coupled amp, one 1631A dividing network, a 1653B equalizer and a 1700B mixer. The same sound rack contained a meeting room sound system that is a side room to the complex. Sound is provided by an Altec Anniversary series 1701B mixer amp, and a 8551A microaudio equalizer with eight ceiling speakers. Each church has an active athletic program, and the facilities are used for activities like sports events, aerobics, and jazzercise classes.

This Spa Pampers The Ears, Too

The Doral Saturnia International Spa and Resort, a Florida getaway whose praises have been sung by everyone from *The Washington Post* to Robin Leach, boasts five gyms, an indoor aerobics swimming pool, a beauty salon, a beauty treatment area that specializes in mud baths and the like, 26 private massage rooms, a running track, sunbathing decks, and health and testing facilities. Guests can choose from 48 suites that consist of a bedroom, a living room, and at least two bathrooms equipped with things like full body showers and whirlpools.

Obviously, no ordinary system would do. So Steve Novak of the New York City-based Novaworks was contracted to provide state-of-the-art sound and entertainment systems throughout the spa and rooms, says Larry Nickerson, vice president of purchasing for Doral Hotel and Resorts Management Corporation.

Novaworks designed a central system that feeds music to all public areas of the spa building. In addition, there are 11 sub-systems located in each separate spa facility, from the aerobics gym to the massage rooms, which feed music to speakers in each respective area. In addition to a local cassette deck, each subsystem can select from one of two program sources fed from the main system.

Guest suites are equipped with living room-located stereo systems that feed music to flush-mounted speakers in the living room, bedroom, and both bathrooms. Each room has a separate wall-mounted volume control. Novak knows of no other hotel/resort facility that has a system of this scope and quality for its guest rooms.

With the aid of Miami Audio Visual (MAVCO) on installation and technical assistance, Novaworks installed five Bryston 270 70v power amps, one Bryston 12B preamp (modified), two Rane GE-14 graphic equalizers, two Protech 15208 line distribution amps, two Fostex 6301 line monitor speakers, one Mitsubishi DP-409 multiple compact disk changer, one Onkyo TA-RW99 dual cassette deck, one Onkyo T-4057 FM/AM tuner, and 32 Sonance III flush-mount speakers with E.V. TR5 70v transformers for the main house system.

A typical example of the local zone system would include one to three Bryston 370 or 470 70v power amps, a Bryson BP4.2 preamp (modified), a Rane GE-14 or GE-27 graphic equalizer, an Onkyo TA-R22 or TA-RW99 cassette deck, and from eight to 58 Sonance III flush-mount speakers with E.V. TR5 70v transformers.

One challenge of the installation was to meet the requirements of a multi-function theatre and meeting room. The video projector had to be ceiling mounted, although the ceiling was barely nine feet high. The motorized projector had to be installed in a coffet that was seven feet high. To avoid significant keystoning of one picture, the projector had to be able to lower from one ceiling about 18 feet when in use, and raise up flush with the ceiling when the room was used for other functions. The ceiling was solid concrete slab, so nothing could be recessed into it. With the help of Don McKay of MAVCO, a reverse-motioned scissor lift device that could be entirely surface-mounted was designed and fabricated from scratch. "After a few minor malfunctions, the unit now functions perfectly," says Novak, adding that the unit is now encased in some very fancy woodwork.

Other problems were encountered when the electricians who were contracted by the client to pull wires to Novak's specifications repeatedly failed to get the lines in place. Finally, after 90 percent of the walls and ceilings were closed, crews from Novaworks and MAVCO had to pull the lines— with minimum cut-outs.

Obviously, no ordinary system would do for the Doral Saturnia International Spa and Resort.

People

Peirce-Phelps moves; Altec's new director

Peirce-Phelps' New West Coast Office

Robert N. Vendeland has been appointed general manager for the new San Diego office of the Audio/Video Systems Division of Peirce-Phelps, Inc. The office is being established to enhance the presence of the company in the audio- and video-teleconferencing marketplace. Since Vendeland's retirement in 1987 from Dynair Electronics, where he was vice president of marketing, he had been a consultant to a number of audio, video and communications products manufacturers.

Robert N. Vendeland

Altec's New Director of Manufacturing

Frank McMullen has been appointed director of manufacturing at Altec Lansing (Oklahoma City, OK). His responsibilities include purchasing, production control, production, shipping, quality control and customer service.

John Shepard, Altec's manager, design engineering, has accepted an invitation from Underwriters Laboratories Inc. to become an industry Representative of UL's Industry Advisory Conference for Commercial Audio Equipment.

Clark D. Nail, manager of production engineering at Altec, has been inducted in *Who's Who in the South and Southwest for 1988/1989.*

Caldero Promoted

Yamaha Electronics Corporation, USA has promoted Steve Caldero to national sales manager for Concert Systems and video products. He will hold national responsibility for the company's concert and video regional sales managers and rep network. Caldero joined the company in 1985 as western regional sales manager for home audio.

Steve Caldero

Additions At New England Digital's UK Office

New England Digital/Europe, based at Harman Audio UK, Ltd. (London), has announced several staff appointments: David Whittaker, who had served as New England Digital product sales manager at Harman Audio UK, now joins NEDC as European technical sales manager; Paul Beckett has joined the New England Digital group at Harman as customer service representative; Doug Daniel has joined Harman Audio as sales manager; and Chrystin Lyons has been appointed office manager.

Taylor New VP-Southeast, Anixter

Anixter Bros., Inc. has announced the promotion of Marlowe Taylor to regional vice president-Southeast Region. In his new position, Taylor will manage Anixter's distribution business for the ten service centers in the region, including Atlanta, Orlando, Birmingham, Charleston, Fort Lauderdale, Huntsville, Jacksonville, Melbourne, Nashville, and Tampa. Formerly vice president of operations for the company's West Region, Taylor joined Anixter in 1984 as operations manager of the Seattle location.

Anixter Cable TV has appointed Wendall Woody to fiber optic applications manager. Woody has five years of experience with fiber optic technology, and is an officer of the national board of the SCTE and Region V director for the Society.

Cooper Joins HAVE

Mary Cooper has been appointed as equipment sales and marketing representative at Hudson Audio Video Enterprises, Inc., which is based in Hudson, New York. Hudson comes to the company after spending five years in production with Heritage Broadcasting in Albany, New York.

Silver Anniversary For Cornett

Roger Cornett, president of Belden Wire and Cable, recently became a member of the company's 25-year club. Although he has been the company's president since 1986, Cornett is considered a Freshman in the club, which has 18 officers with more than 40 years of employment.

Roger Cornett

Caloz Now President

Jack W. Caloz, P.E., has been elected president of Electronic Systems Associates (ESA), a subsidiary of Syska & Hennessy, Inc., Engineers, a mechanical and electrical engineering firm. Formerly regional vice president of ESA, Caloz is now responsible for the expansion of the firm. Caloz joined Syska & Hennesy in 1983, after having worked at Flack & Kurtz, Texas Instruments, and Johnson Controls. He received his engineering degree from the Milwaukee School of Engineering and earned an MBA from Fairleigh Dickinson University.

Started nearly 20 years ago as a small design group within Syska & Hennessy, ESA is a consulting and engineering firm that specializes in the design and implementation of voice, data, video and satellite telecommunications systems; building controls; and security systems. The firm provided the electronics design for the Jacob K. Javits Convention Center and is currently working on new facilities for Salomon Brothers Inc., Morgan Guaranty Trust Company—both in New York City—and American Express' Information Processing Center in Phoenix, Arixona.

Aritech Appointments

Aritech Distribution, Montreal distribution center has announced that Arthur Konak has been appointed branch manager, and Marquis Jacques has been appointed distribution sales manager for Eastern Canada. Konak has five year's experience in sales and branch management in the security industry, and Jacques has been with Aritech for four years.

The Detroit distribution center's new branch manager is Jeffrey Mitchell, who has 12 year's experience in sales, installation and service with several Detroit-area alarm dealer companies.

Telex Reorganizes

The sales and marketing staff of Telex Communications, Inc. (Minneapolis, MN) has been reorganized. Dan Dantzler was promoted to vice president of sales for the company's professional audio, aviation and RF communications products as well as OEM sales. Don Mereen was appointed executive director of marketing. This new position governs new product and market planning, marketing services and technical customer service for all business segments except the company's hearing instruments group. Mereen will also serve as acting director of strategic planning and corporate development. Ted Nemzek was named senior director of sales for the audio-visual products group.

Products

Shure's new mics; New consoles, more

Shure's Beta Mics

The Shure Beta 58 mic is intended for vocal music applications, while the Beta 57 is meant for miking of musical instruments, particularly drums, cymbals, horns and instrument amplifiers. Shure claims that both mics have a

gain-before-feedback capability that maximizes PA and monitor output when onstage sound levels are high. The transducer designs of both microphones incorporate a neodymium magnet that provides output voltage for working distance flexibility, without console overload problems, say the company's engineers.

The Beta 58C features a chromed pop filter grille, while the Beta 58M has

a matte grill finish like that of Shure's SM58. The Beta 58 and Beta 57 feature pneumatic shock mount systems designed by Shure to minimize transmission of handling and stand noise; they have die-cast metallic-blue handles, steel grilles, and permanently sealed connectors.

Circle 10 on Reader Response Card

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8-Channel Stereo Distribution Amp

Wheatstone Corporation's SDA-82 is an 8-channel stereo distribution amp that can be used in a single-input/16-output or stereo-input/8-stereo output configuration. Each of the inputs and 16 outputs has its own 3-pin gold con-

nector to allow load and source changes after installation. Each output is individually active balanced, and capable of delivering +26 dBm. The unit's 16 individual output gain controls compensate for load dependent gain shifts, says the manufacturer, adding that the product has a typical THD of .002% and a dynamic range of 115 dB.

Circle 11 on Reader Response Card

Bose Commercial Loudspeaker

The 102P Passive loudspeaker, to be used in distributed sound systems when the benefits of active equalization are unnecessary, is available from Bose in both flush-mount and surface-mount configurations. The product can also act as an extension or retrofit into non-Bose systems. Each enclosure style is available in 70-volt and 4 Ohm versions.

Circle 12 on Reader Response Card

Q-Series Mute Modules

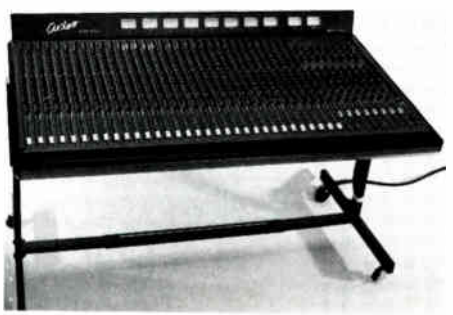
DDA has introduced a new series of modules to expand the capabilities of the Q-Series consoles. The modules are designed to enhance audio control in sound reinforcement applications such as concert halls, auditoriums, theaters and churches. The mute group includes both input and master modules. The input modules are based on the standard Q-Series units while expanding their capabilities with some added features. The new modules have eight mute group select switches with LED indicators. Ten segment LED level indicators are also included; the new input units offer large, illuminated input channel cut switches.

Also new in the Q-Series Mute Group is the Master Mute Module which provides for eight master mute switches. The consoles have eight individual bus assigns, eight aux buses and a direct output with level control. The direct out allows the operator to mix sound for the house while providing a direct output from each input for other purposes such as live multitrack recording of an event.

Circle 13 on Reader Response Card

Aries Sound Reinforcement Console

The Aries Astrid is a sound reinforcement console available in both 24- and 32-input mainframes. The output section offers eight effects returns and a

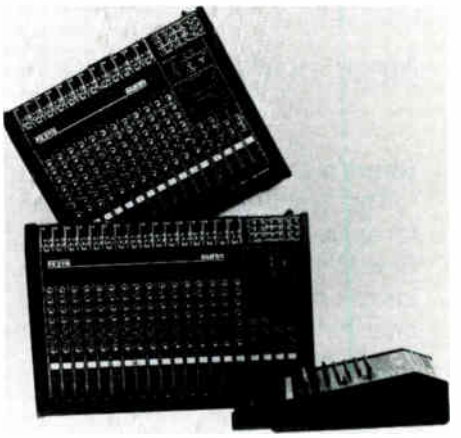


3-band EQ assignable to the group outputs or the effects returns. An 8-channel expander unit is also available.

Circle 14 on Reader Response Card

Here Come The Sunns

Sunn's three 250-watt stereo mixing consoles—the 8-channel PS 2108, the 12-channel PX2112, and the 16-channel PX2116—are meant for most medium-sized requirements. Individual channels feature 3-band EQ, high and balanced low inputs, pan and trim controls, peak LEDs, dual-channel patch points, and aux, eff/rev and monitor channel sends. The master



section includes 2 LED bar graph monitors, main and monitor faders, a dual 10-band graphic EQ, and a switchable compressor.

The 8-channel MX 4108, the 12-channel MX4112, and the 16-channel MX 4116 are of Sunn's economy line of mixing consoles, and are appropriate for a range of sound reinforcement applications. Each features a 3-band EQ, pan and trim controls, peak LEDs, high and balanced low inputs for each channel, etc.

Top-of-the-line pro mixing consoles by Sunn include the 8-channel MS 4208, the 12-lchannel MX 4212, and the 16-channel MX 4216. They include cue, 3-band EQ, trim and peak LEDs, and high and balanced low impedance inputs for each channel, as well as additional input and output options. The consoles feature effects/reverb, monitor, aux, two stereo busses, etc.

Features like selectable 6/12 dB cut or boost, balanced XLR and .25-inch jacks, and high pass filters are available in the SP-3215, a dual 15-band, 2/3 octave graphic EQ; the SP-3200, a single 30-band, 1/3-octave model; and the SP-3202, a dual 30-band, 1/3-octave model.

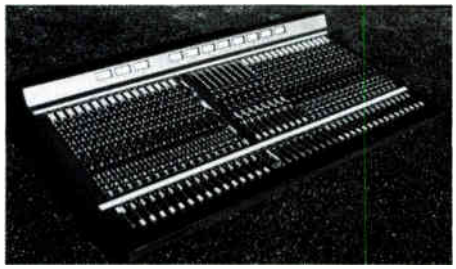
Two stereo crossovers—the 2-way ST3322 and the 3-way (4/5-way for mono use) ST3323—feature balanced .25-inch and XLR input and output

jacks, Linkwitz Riley 24 dB per octave slope, and crossover frequencies variable from 50Hz to 5kHz. They are rack-mount ready.

Circle 15 on Reader Response Card

Consoles And More From Soundtracs

The Soundtracs SPA console comes in 32- and 48-channel versions. Access points to all audio, VCA and mute busses are available on rear-panel connectors, enabling two consoles to



be linked—thus providing up to 96 inputs. Designed primarily as a front-of-house desk, the SPA can be reconfigured via a switch on each group to double as a monitor desk.

The FMB is an on-air console for community and local radio; it offers similar facilities and specs to conventional broadcast consoles. It is available in 16- and 24-channel configurations.

The FM AFV, an audio-follows-video controller, enables up to eight channels of audio on an FMX console to be controlled from any video editing system with either BVE or general purpose interfaces. It is available factory fitted or as a retrofit.

Circle 16 on Reader Response Card

Take It With You

HM Electronics, Inc. is introducing the System 8100, a wireless intercom system. It contains a base station, two Communicator transceiver units, a battery charger and batteries. (A Communicator will operate eight hours on one battery.) The portable base station

can be wall-mounted or set on a table, and a number of additional Communicator units can be added to this system. The Communicator features two communication channels, the first allowing communication to others wearing a Communicator, the second allowing communication through a monitor speaker or a talk-back speaker.

Circle 17 on Reader Response Card

Affordable Amp

SoundTech Systems' A300 stereo pwer amp takes up two rack spaces and features a 4 Ohm rating of 150 watts per channel. It's dual LED ladder-type displays on the front panel

indicate output level and clip condition. Another dual-color LED indicates normal and protect modes. Balanced XLR and unbalanced .25-inch phone jack inputs, a stereo-bridged mono switch, a ground lift switch and dual banana plug speaker outputs are located on the rear panel. The amp can be run in a conventional stereo setup, or the user can choose between bridged mono inputs with parallel mono outputs or bridged mono inputs with bridged mono output.

Circle 18 on Reader Response Card

Mod Modules, Options

New modules are available from Soundcraft for the SAC 200 radio console. They consist of the 'simplified' versions of the input modules and new Source Select module. These input modules remove various operational functions from the front panel while keeping them accessible on the circuit board, says soundcraft.

A new Source Select module allows the expansion of input selection capability of the stereo modules and, if needed, the monitor circuits. It provides a dual 8-input stereo selector with all connections to interface to the necessary parts of the console.

A new option for Soundcraft's Series 8000 sound reinforcement console is a variation of the House input module to include LCR (left-center-right) panning facilities. The manufacturer claims this enables audio sources to be positioned precisely within the left, center and right coverage areas. The new input module incorporates the addition of a center bus as well as a modified panpot, which includes the same design already used on the Series 6000 console.

Circle 19 on Reader Response Card

Cassette Playback Equipment

The RG-11 autoreverse industrial-grade cassette playback machine, new from Paso Sound Products, Inc., plays standard stereo cassette tapes and provides a mono output. It can be remote powered by 12VDE and features front-panel cassette loading, track selection controls, dual-LED track- in-use indicators, rear-panel output level control, and rack mounting with optional 27/2469B kit.

Circle 20 on Reader Response Card

Tel-A-Talker

The Tel-A-Talker by Nel-Tech Labs, Inc., is designed to provide recordable messages on hold, providing user capability to record natural voice, voice over music or music announcemnts over telephone systems' music-on-hold circuits. It plugs into any music-on-hold circuit and provides an internal monitor speaker, user recordability, and message lengths from half a minute to four minutes. It uses digital solid state technology.

Circle 21 on Reader Response Card

Three From Peavey

Peavey's new CS-400 has been redesigned in the same tradition as the CS-800 and features the same performance as the other CS series power amps. This unit delivers 200 watts per

channel and delivers 400 watts RMS mono bridge capability into 8 Ohms.

The APB 32 is a .25-inch rack-mounted patch bay. Each of its 16 patch channels feature Switchcraft .25-inch connectors; the front panel jacks are all normalled for direct feed-through when not patched (this normalling can be user-defeated and restored).

The PMA 200 is a dual 100-watt-per-channel power amp designed for recording studio and broadcast applications. It comes in a 19-inch rack mount configuration and requires 5.25 inches of rack space.

Circle 22 on Reader Response Card

RF Transceivers

Harris Corporation's Business Communication Systems Division has introduced a group of RF transceivers that includes the Harris Model 2421/6331 and Model 2452/2401A up/down converters. The transceivers, which can be used in a range of data transmission and videoconferencing applications, upconvert and downconvert multiple signals between 70 MHz and Ku-band. The transceivers downconvert signals from Ku-band to 70 MHz. Ideal for outdoor mounting requirements, these high-reliability units are designed for high-gain, high-stability operation.

Circle 23 on Reader Response Card

The people who brought you the most advanced wireless mic systems . . .

These multi-channel wireless systems represent the latest state of the art RF design. The trend is multi-channel and no one does it better than Lectrosonics.

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The 19" rack mounted MAP system includes modules for:

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- Active 2 way crossover networks
- Active 3 way crossover networks
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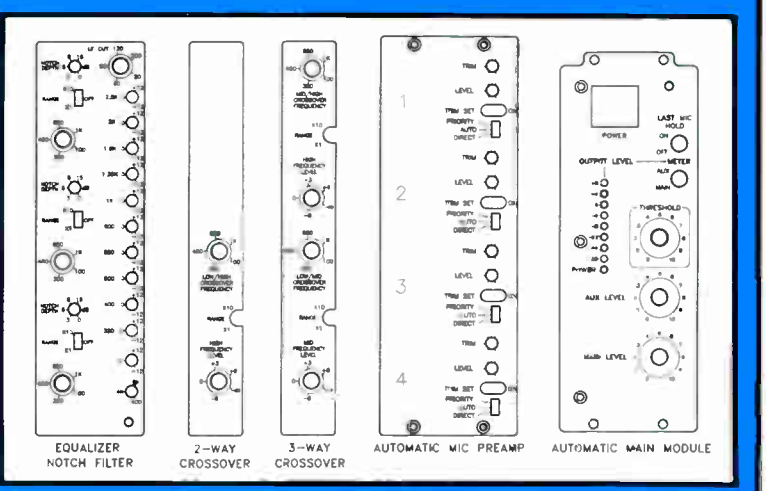

The Lectrosonics MAP system will be demonstrated at NSCA EXPO '89 in Nashville.

Call for more information:
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Circle 214 on Reader Response Card

A Closer Look

The Klipsch KP-600 Modular Loudspeaker System

by Gary D. Davis

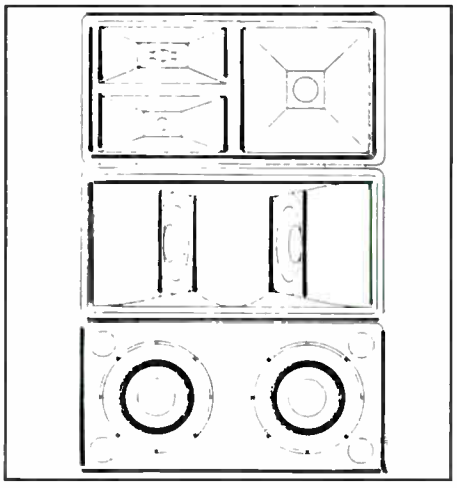
This month's Closer Look focuses on the KP-600, a new modular speaker system from Klipsch & Associates, Hope, Arkansas. Described by Klipsch as "a modular loudspeaker system with very high output and power handling capability for the largest and most demanding professional sound reinforcement applications," the KP-600 is suitable for large live music clubs, arenas, and outdoor concerts.

PRODUCT DESCRIPTION

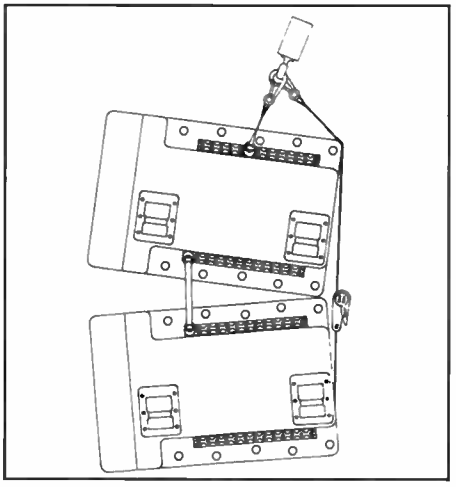
The KP-600 Series comprises three parate cabinet modules—the KP-650-HF high-frequency section, KP-650-LF low-frequency section, and KP-680-SW subwoofer section—together with the optional (but recommended) KP-600-EC active crossover/processor. In its standard configuration, the KP-650-HF combines a midrange/tweeter (MT) module and a mid-bass (MB) module mounted side-by-side in a single cabinet. The MT module is a two-way system comprising a two-barrel midrange horn with 2-inch compression drivers, a two- barrel tweeter horn with 1-inch compression drivers, and a passive crossover. The MB module utilizes a 10-inch mid-bass driver coupled to a symmetrical horn. The KP-650-LF low-frequency section contains two 15-inch cone drivers coupled to a horn. The KP-680-SW subwoofer holds two 18-inch cone drivers, mounted in a vented enclosure and operating as direct radiators.

A standard KP-600 System combines the three cabinet modules in a stacked configuration, forming a five-way system with active four-way crossover. Specified frequency response for this system is 43 Hz to 17 kHz + /-3 dB (-10 dB at 32 Hz), with an average beamwidth of 60 degree horizontal by 50 degree vertical. Driven by appropriate power amplifiers with the KP-600-EC crossover optimally set, the system is capable of 133.5 dB SPL at one meter

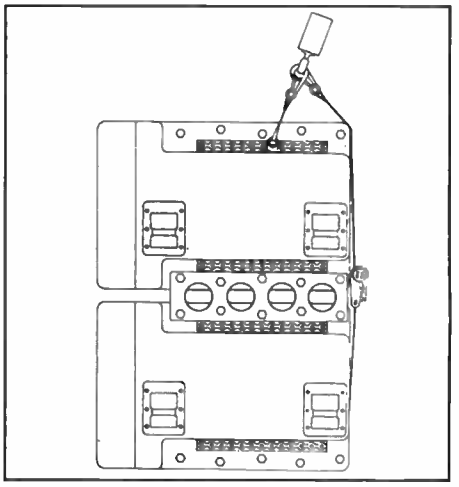
Davis has just moved his business from Topanga to Santa Monica, CA. He has been a technical writer and audio consultant since 1974. Along with his associate, Ralph Jones, he authored the Yamaha Sound Reinforcement Handbook.



Standard configuration.



This is a side view of two system cabinets equipped for flying application.



The same cabinets, now equipped to form a "one box" system.

with music input, or 131.5 dB SPL with pink noise.

Each cabinet section is identical in size and trapezoidal in shape. Molded of a lightweight composite material, the cabinets measure 25.5 inches high by 30 inches deep by 48 inches wide at the front face, and range in weight from 160 to 190 pounds. (The standard full-range system stacks up to a height of 75.5 inches, at a total weight of 525 pounds.) The cabinets fittings, carrying handles, and grille cloth panels.

An "A" cabinet version, which includes recessed flying hardware and internal metal reinforcement, is provided for touring applications. The "B" version, which omits these amenities, is recommended only for permanent installation in a stacked format.

Klipsch offers a range of options tailored for the touring sound market, including mating flying hardware, connecting web straps, and wheel systems.

COMMENTS

The KP-600 Series combines two heretofore divergent philosophies: the classic multi-bin modular approach (best exemplified by the large Martin concert systems of the early 70s), and the newer "one-box," full-range, flying array approach that is now in vogue.

Klipsch has addressed in this design most of the major features that reinforcement professionals have come to expect. The cabinets are trapezoidal 30-degree sections that form curved arrays when placed side circular array, for 360-degree coverage. The dedicated crossover/processor is tailored to the characteristics of the cabinets. Flying hardware is well thought out and very flexible. All of these features conform to the "one-box" flying array philosophy.

Klipsch provides an extraordinary measure of modularity and flexibility in the KP-600. By separating the system into three different component sections, theSeries allows users to configure a wide range of systems with varying coverage, acoustical power, and bandwidth characteristics. At the critical high frequencies, the KP-650-HF even permits rotating the midrange/tweeter module to swap vertical and horizontal polar characteristics. Special cabinets containing only MT or MB modules may be made up to provide greater forward power and longer throw.

The KP-650-EC, as well, is exceptionally adjustable for a dedicated processor. Crossover frequencies may be independently selected to adjust power distribution across the system. Independent gain controls are provided for each section, along with separate phase reversal switches.

All of this flexibility offers substantial potential for tailoring loudspeaker systems to suit special requirements. One may double-up on or delete specific sections within an array. Individual sections (or section arrays) can be placed to accommodate architectural concerns. The downside of this approach, of course, is that increased flexibility also means greater potential for error. Putting together a modular, multi-bin system with consistent phase and optimal crossover settings is no simple task. A fair amount of design knowledge and testing capability is therefore required to make full use of the potential of the KP-600 Series.

This is not a system for the amateur user. Not only does it require substantial design knowledge, but it also is capable of prodigious sound levels that must be handled with care. In a club that seats less than 100 people, this system could be downright dangerous. In the hands of competent, well-equipped professionals, however, the KP-600 looks like a powerful tool for large-scale sound reinforcement. If it sounds as good as the specs suggest, it should yield excellent performance in a wide variety of applications, and certainly deserves your Closer Look. ■

Correction

In last month's column, A Closer Look: The Ghielmetti Crossbar Distributor *(*Sound & Communications, March 1989, *pages 62 and 63), five lines of type were incorrectly placed, causing two paragraphs to become garbled. Those paragraphs, on page 62, should have read:*

"Still other Ghielmetti systems use a 6mm (about 0.25 inches) grid, and are suitable for loudspeaker lines; their maximum voltage is 220, or the 100 volts at 300 watts. These larger contacts have about 0.5 to 0.7 milliohm contact resistance, or half that per pair of contact bars per hole pitch. Insulation resistance of a parallel pair of contact bars across 10 plug positions is about 6 picofarads, or 4 pf for two crossed pairs of bars.

The space required for a jack socket in a balanced circuit is only 12 times 12mm, so up to 32 sockets can be accommodated across a 19-inch crossbar front panel. By arranging the contact bars in tiers, Ghielmetti makes it possible to connect several jack sockets in series without having to use patch cables."

Our Apologies To Ghielmetti, Inc., And To Mr. Davis.

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December we bring you our *Economic Report,*
keeping you aware of economic trends and developments on their effect on this industry.

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Every August is *Blue Book* month,
this industry's only complete directory of manufacturers, their products and key personnel.

■

Special pull-out sections —
on everything from mixing consoles to alarm and security devices — that provide the sound contractor with the concise and definitive information needed for intelligent and informed product selection.

■

Look for these special features and more in upcoming issues of Sound & Communications.

Literature

Corning Fiber Optics; Video tips

Outside-Plant Engineers' Queries Answered

"A Fiber-Optics Primer for the Outside Plant," by Douglas J. Eccleston, manager of North American applications engineering for Corning's Telecommunications Products Division, provides an overview of optical-fiber technology and its uses in feeder and distribution applications. The article, reprinted from *Outside Plant* magazine, discusses fiber strength and fatigue issues, and different fiber manufacturing processes and their relation to fiber design, features and benefits.

Circle 26 on Reader Response Card

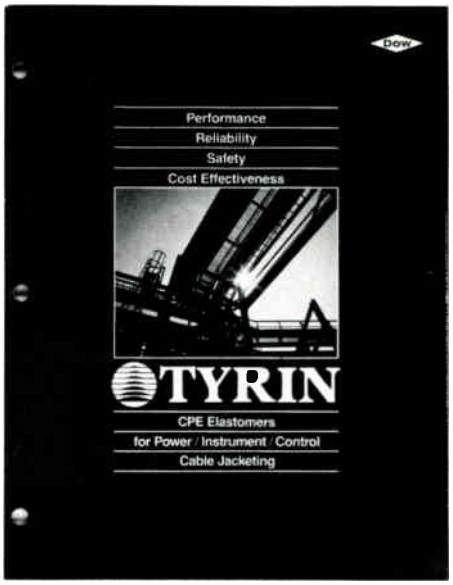
Easy-To-Follow Catalog

A catalog featuring the Mark IV line of Cinema products has been issued. In it, each product is represented by a large picture and a detailed description, including such specifics as size and weight of product and recommended room size for installation. All detailed specs are provided, in tabular form, within the catalog's back pages.

Circle 27 on Reader Response Card

Cable Jacketing Applications

A new 20-page, full-color brochure featuring performance properties of Tyrin CPE for power/instrument/control cable jacketing is available from The



Dow Chemical Company. Durability, weatherability and dimensional stabillity, as well as chemical and ignitiion resistance, are discussed. Information regarding temperature properties, heat distortion, water absorption rates and circuit integrity time is also included.

Circle 24 on Reader Response Card

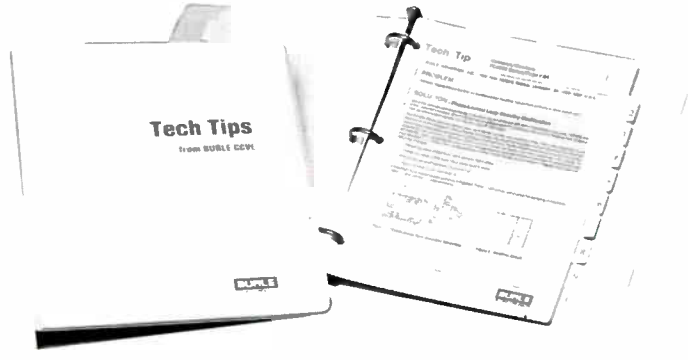
Video Surveillance Operations Tips

BURLE INDUSTRIES, INC., Security Products Division, has published a new *Tech Tips Guide*, which was written to answer technical and installation questions in all areas of video surveillance system operation.

Tech Tips is a supplement to the installation and operating instructions packed with each BURLE CCVE product. The guide is organized in ten sections, providing information on cameras, monitors, lenses, remote positioning devices, housings, sequential switchers, controllers, coaxial control systems, matrix switcher/controllers, videocassette recorders, and special video equipment.

Each section is further divided to correspond to a different area of technical expertise. The General section offers advice on topics applicable to all models within a product category. The Set-Up section contains dos and don'ts in the area of product installation, and the Problem/Solution section addresses specific items that may be encountered in the operation of a piece of equipment.

Circle 25 on Reader Response Card



CALENDAR

Upcoming Events

MAY

National Council of Acoustical Consultants (NCAC): Toronto, Canada. Contact: 201-379-1100. May 20-22.

Meeting of S1 Acoustics, Meeting of S3 Bioacoustics, Metting of S12 Noise : Syracuse, New York. Contact: 212-661-9404. May 25.

National Sound and Communications Association Expo and Conference '89: Nashville, TN. Contact: 312-593-8360. May 25-27.

JUNE

National Presentation Expo: New York City. Contact: Barbara Stockwell, Ass. V.P., Knowledge Industry Publications, 800-328-5474, in New York State, 914-328-9157. June 6-8.

National Association of Music Merchants (NAMM): Chicago, IL. Contact: 619-438-8001. June 17-20.

American Society of Mechanical Engineers (ASME): Pittsburgh, PA. Contact: 212-705-7057. June 18-22.

International Security Conference/ Central (ISC): Chicago, IL. Contact: 312-299-9311. June 27-29.

JULY

Electronics Technician Association (ETA): Boise, ID. July 20-22.

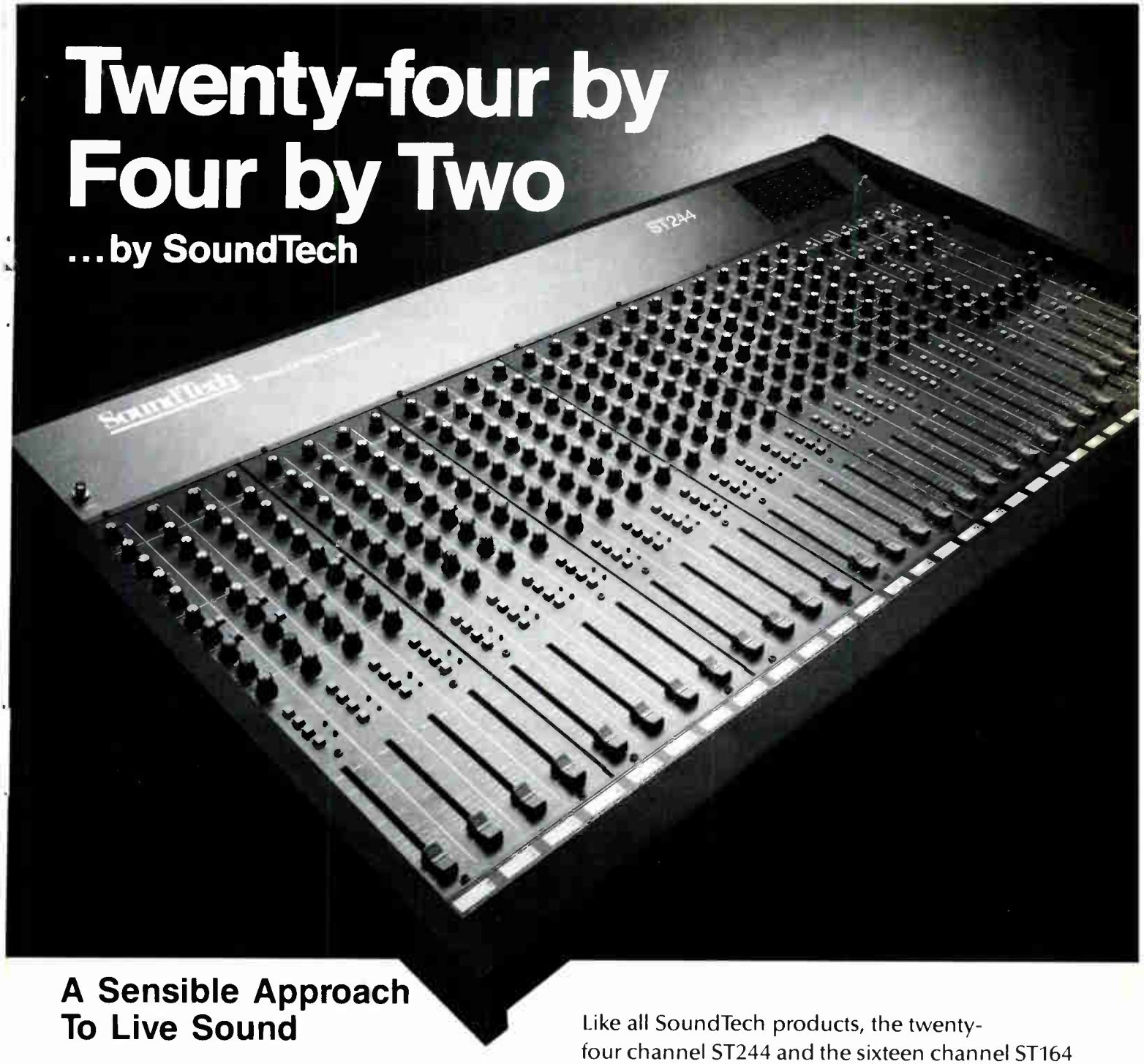
International Association of Auditorium Managers (IAAM): Reno, NV. Contact: 914-683-1000. July 29-August 1.

AUGUST

International Society of Certified Electronic Technicians (ISCET): Tuscon, AZ. Contact: 817-921-9101. August 6-12. ■

Twenty-four by Four by Two

...by SoundTech



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Circle 224 on Reader Response Card

NSCA SCHEDULE OF EVENTS *(continued from page 55)*

Sales Track:

10:00-11:00 Recognition Of Customer Types
Bud Rebedeau, NSCA

11:00-12:00 New Markets For Sound Contractors
Sponsored by Sound & Communications Magazine

Specialty Track:

10:00-11:00 Microprocessor Nurse Call Systems
Sponsored by Sound & Communications Magazine

11:00-12:00 Power Conditioning: Transient and Overvoltage Protection
Allan Rebeck, Translector Company

Friday May 26
Exhibit Floor Open: 10:00 - 6:00

Audio Track:

8:00-9:00 Pros And Cons of Wireless Mics
Sponsored by Pro Sound News

9:00-10:00 CAD Sound Sytem Design
Mike Klasco, Menlo Scientific
Sponsored by Sound & Communications Magazine

10:00-11:00 Speech Intelligibility

11:00-12:00 Barrier Microphones
Sponsored by Pro Sound News

Management Track:

8:00-9:00 Training The Trainers
Bob Adams, Joiner-Rose Group

Sales Track:

8:00-9:00 How To Sell Teleconferencing

Combined Sales/Management Track:

9:00-12:00 "You Can Negotiate Anything"
Roger Dawson

Specialty Track:

8:00-9:00 CCTV Infrared
Sal Raia, Richards Electronics

9:00-10:00 Fire Alarms: Smart/Hardwire/Multiplex
Allen Fritts, Notifier

10:00-11:00 NEC and Wire
Lou Valente, West Penn Wire

11:00-12:00 MATV: Basic System Design

600-8:00 Customer Appreciation Party,
Presidential Ballroom
Sponsored by West Penn Wire

Saturday May 27
Exhibit Floor Open: 9:00 - 12:00

Paddleboat Cruise aboard the General Jackson: CAD demonstration, live band, more.

All information has been supplied by the NSCA and is accurate as of press time. Please check your show programs at the Expo for changes.

CLASSIFIEDS

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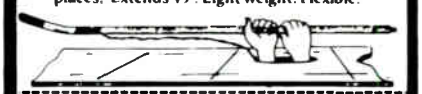

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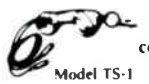

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T-30	150Ω/150Ω/600Ω +30dbm	$35
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COMPANY PROFILE

(continued from page 86)

make changes from home rather than fly out to each project. It is this kind of hardware and software support that has allowed IED to be installed in many major facilities. Their attention to detail sometimes goes unnoticed in the background. For example, DOS-clocks are notoriously inaccurate. So IED decided to build their own. Furthermore, each clock is burned-in over a period of weeks while synced, via radio, with the national time standard. Both its ease of use, support, and future growth is apparent in IED's operation.

Everyone seems to have a good time working at IED. It is a cooperative group effort—both within the company itself, and with outside consultants and dealers. The pride that the people of IED take in their work shows both in their products and in their support. ■

POWER AMPS

(continued from page 41)

voltage and lower current, resistive loss in the cables is reduced, so smaller gauge wiring is sufficient over long distances, reducing overall system costs.

CV systems are not often used in reinforcement for several reasons. First, the power available to each loudspeaker is limited—not only because the total amplifier power is divided among many units, but also because a transformer capable of high power would be very large and costly. Second, the operation of a large number of loudspeakers again depends on the reliability of a single amplifier. Finally, CV transformers (particularly inexpensive ones) exhibit a widely varying impedance that can approach zero at low audio frequencies. The ability of a CV system to handle low frequencies is thus quite limited except with the most costly transformers. In fact, if the signal is not band limited, low frequencies may cause the amplifier to fail because it will be trying to drive what is essentially a short circuit.

Where the program bandwidth is limited, and SPL demands are low, CV systems offer a cost-effective solution to the problem of sound distribution. For this reason, they are commonly employed in paging and background systems such as one might find in hotels, department stores, sports stadiums, and airports. ■

SPECIFICATIONS

(continued from page 93)

the flower you didn't plant and don't want to grow. What's noise? It's the sound you didn't intentionally create and don't want to hear.

Actually, while the above definition is hardly technical, it does get the point across. Noise is important to quantify (and generally to minimize) in electronic circuits because it can mask portions of the program, thereby reducing available dynamic range. High noise levels can be very annoying and fatiguing to the listener and can actually color the sound. Finally, noise can waste amplifier power, increase effective distortion and hasten loud speaker failure by generating unnecessary heat.

On the other hand, some types of noise are very useful as test signals for calibration of electronic equipment, frequency response alignment of speaker systems, or music synthesis.

When the old man walks in on his teenagers, who are listening to the latest rock group at unnaturally high levels of distortion, and says "what's that noise you're listening to?" he's not discussing the kind of noise we're concerned with. We're more interested in the scientific aspects of noise.

In technical terms, there are many kinds of signals that qualify as noise, and these are given convenient names like white noise, pink noise, hum, buzz, static, popcorn noise and so forth. Of these, only the first two types (white and pink) are intentionally created—for use as test signals (in this case, the noise is more like the flowers). The other types of noise are basically unwanted, of no value for any practical purpose (the weeds). White and pink noise are both comprised of a random signal, with all audio frequencies present, over time, and at various signal levels. Such noise is generated by the random thermal motion of electrons, and is therefore called random noise. When this thermal noise is amplified, we perceive it as hiss.

In the next installment of this article, we'll discuss the different types of noise, how noise can be used for testing, and how to interpret output noise specifications.

OCEAN CLUB

(continued from page 52)

fixed, so we tested again and fired up the dimmers. All power went out for miles (just kidding).

Opening day was coming fast, and we were testing and programming the lighting system when some of our dimmers began ghosting. Upon checking the equipment room we discovered a temperature of almost 120 F with the door open and the ceiling panels removed, in the dead of winter. The year-round air conditioning for the room had been left out (the lighting dimmers and audio system provide an impressive 40,000 BTU's of heat, enough to heat a small building). The general contractor remedied this with an intake and exhaust system that keeps the room a cool 82 degrees F. All of the equipment was thankful. The system at The Ocean Club took its maiden voyage on VIP night, February 1, 1989. Everything worked flawlessly. The sound system was loud and smooth, and the lighting system consistently drew oohs and aahs, the kind you get on the 4th of July. Since opening, the club has become the talk of the town.

Even with this success, the Ocean Club's owners are talking about more lighting. Maybe a real UFO that descends through the roof with real aliens? ■

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AD INDEX

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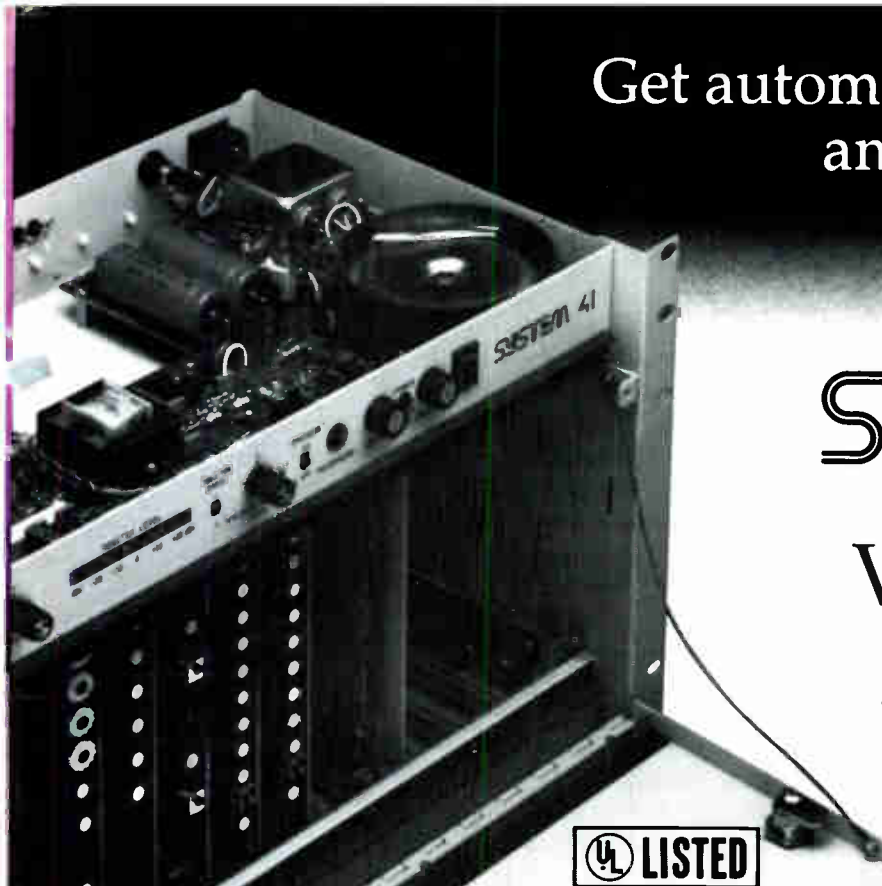

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Two new Voice-Matic microphone mixer modules add automatic flexibility and operating performance to System 41 installations. The DJ-4114 Voice-Matic Microphone Mixer Module and DJ- 4115 Voice-matic Master Module offer noise-free interconnection and total compatibility with all other System 41 components.

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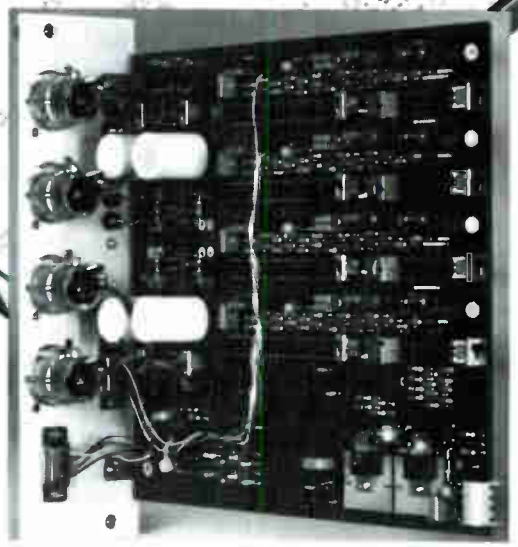

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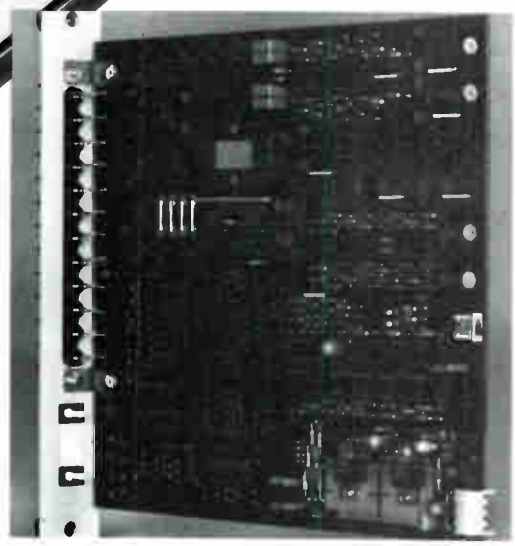

Model DJ-4115
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The DJ-4115 Voice-matic Master Module mixes the microphone signals from all DJ-4114 Modules in the system along with any auxiliary input signals. Various remote controls are optional.

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What To Look For When You Listen To A Power Amplifier.

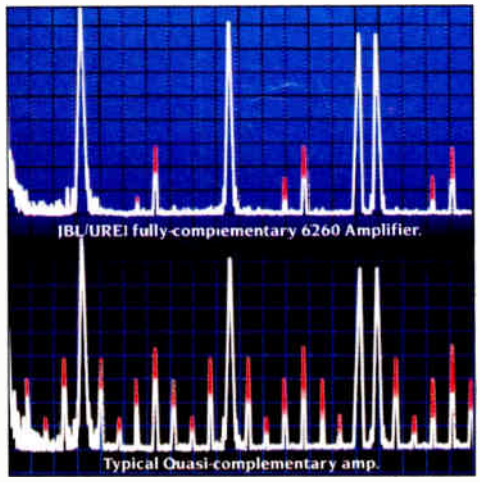
When it comes to evaluating amplified sound, seeing is believing.

In fact, when engineers judge the sound quality of an amplifier, they often rely on *two* precision instruments: the human ear, and the industry-standard Transient Intermodulation Distortion Test, because when measuring sound with T.I.M. what you see is what you get.

And what you see can be eye-opening. Amplifiers that seem to square off evenly spec. for spec., often perform very differently under the scrutiny of T.I.M. Pushed to their limits, many produce brittle, edgy or distorted sound especially during high frequency passages and sharp transients.

Many manufacturers deal with distortion by using massive amounts of feedback through a single overall feedback loop, placing greater demands on the amplifier and producing an inferior sound.

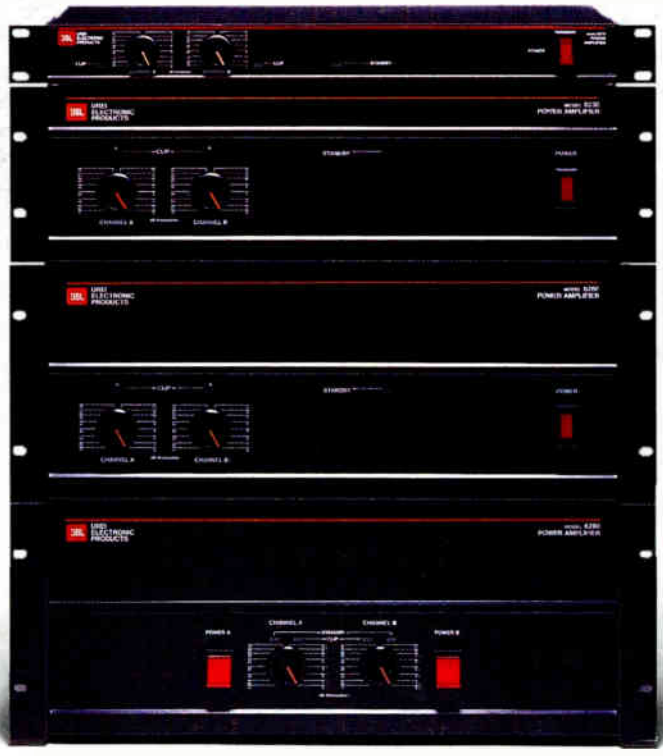
When we built our new JBL/UREI Amplifiers, we committed ourselves to designing the industry's purest-sounding amps that would not only score highest marks on the T.I.M. Test, but deliver the truest amplified sound ever heard.



Red spikes in the TIM *Spectrum reveal the dramatic differences in distortion output.*

Instead of sloppily force-feeding massive amounts of output signal back into input stages, and congesting it all into one circuit loop, we've established operating points at *each* gain stage. This allows signal purity to be maintained along the entire circuit. And permits optimized use of the type and amount of feedback for each individual gain stage.

In a simple analogy, the new JBL/UREI Amplifiers do each signal track right the first time, so that you don't have to fix it in the mix. The result is sound far cleaner than typical quasi-complementary and fully-complementary output stages only. And far more pleasing to the ear.



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