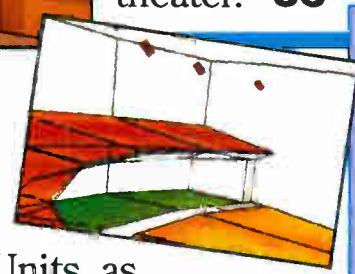
SOUND & COMMUNICATIONS

Volume 39 Number 10 October 26, 1993

RESIDENTIAL INSTALLATION

When a living-room theater brought shudders from one-half the family, a basement room was appropriated. Clear thinking and knowledgeable people made the small room into a sonically and visually charged home theater. **36**



DELAYS IN THE REAL WORLD

Real-world applications of Signal Delay Units, as our series continues. What are the criteria; what are the measurements? And how we set up a testing procedure. **16**

IN THIS ISSUE

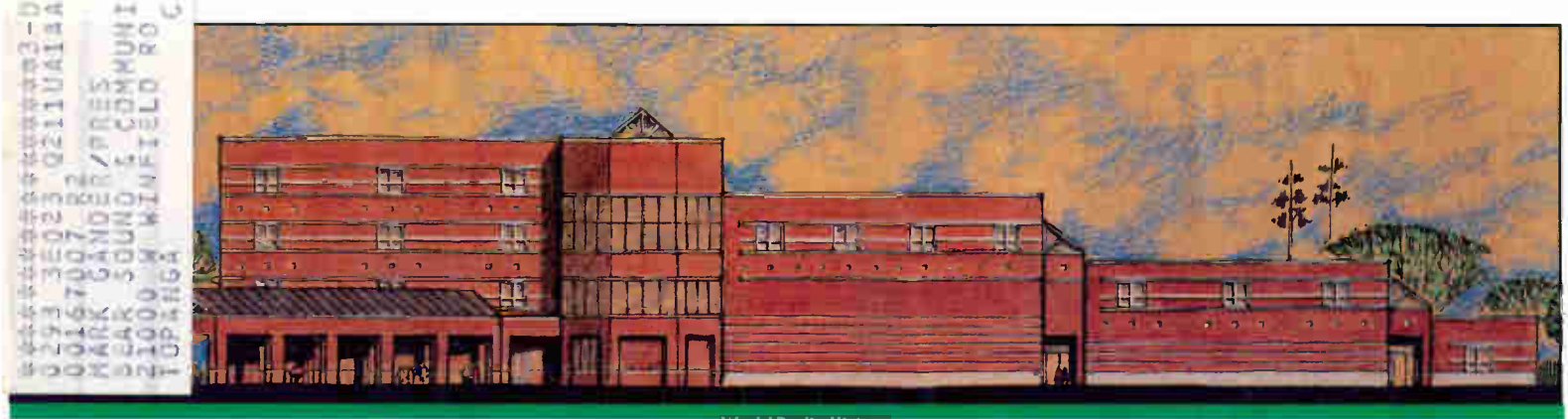
• **SOUND SYSTEM DESIGN**
The rate of development may have slowed down, but new features and versions are continually making these design programs more useful. What's new on the sound system design scene? **54**

• **DR. WOKKA — ON BECOMING A CONSULTANT**
Dr. Wokka's inimitable and unassailable views on the nature of an acoustical consultant are offered to one of his readers who wants to be a consultant. As a contractor, the reader is "sick of being a second class citizen at AES." Dr. Wokka offers his advice. First — "you must be rich." **13**

• **MULTIMEDIA FORMATS**
New technology is making its way through the marketplace. What commercial applications are in store for — for example CD-ROM, MiniDisk, CD+G, PhotoCD, CD-I and so on. What's important? What can we look forward to? **42**

EDUCATIONAL MEDIA

ıer Middle School is using media with a , with recent upgrades to its 400-seat auditorium s use of educational software. With a plethora of equipment including VCRs, Laser 's and still video recorders, the system is managed, scheduled and used. **30**



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6 Reasons Why The PA430T Will Save You Time And Money

1 Economical

The PA430T's design offers significant savings in installation cost and features a patented mounting system that can be installed to any standard electrical box. Further savings can be realized because of the PA430T's constant directivity pattern, which typically requires 20% fewer horns than the competition to cover the same area.

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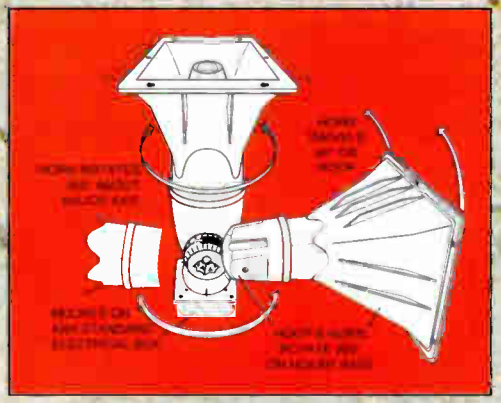

3 Rugged Construction

Constructed of polycarbonate and nylon, the PA430T is rugged like metal horns, however, it is resistant to environmental extremes and will not rust or dent.

4 External Power Tap

Offering selectable taps of 25V, 70.7 V and 100V, the power settings may be changed on an installed unit without disassembling the horn.

5 Versatile Swivel Mount

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University offers full-time technical support with a direct line, 800-950-2368. Rigorous quality control standards are also maintained and we promise on time delivery with products shipped from stock. The PA430T also features a five-year warranty against malfunctions due to workmanship and materials.

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When it comes to getting the right mix, your toughest critics aren't the promoter, the audience or even the guy on stage with the full-body tattoo.

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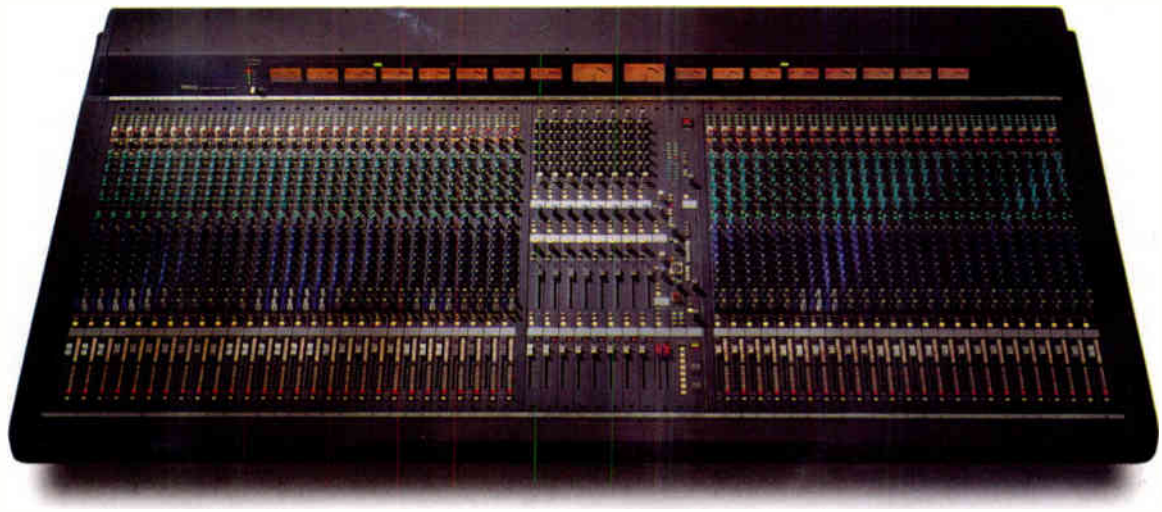
Which is reason enough to check out Yamaha's PM4000 pro mixing console and our companion monitor mixer, the PM4000M.

Both include the same features which made the PM3000 the best-selling pro audio mixer in the world. Plus a few extras that may sound familiar, because we listened to your feedback while designing our latest console. The result is sound so clean it's like getting a new pair of ears.

For more information, call Yamaha at 1-800-937-7171, Ext. 110. You'll find out just what the PM4000 is really capable of.

Which will please your critics for a while, anyway. YAMAHA®



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INTRODUCING THE PEAVEY CS®-X SERIES

For many years, the Peavey CS® Series has lead the field in high performance power amplification. The CS Series has become legendary for ruggedness, dependability and superb performance with completely unmatched patching/plug-in capabilities. Now, Peavey is proud to announce the new CS-X Series with dramatically improved performance specifications at no increase in price! This startling achievement is made possible by Peavey's high volume production, state-of-the-art manufacturing, and advanced audio technology.

CS®1200 X

X-TRA POWER.

The new CS-X Series power amplifiers reliably drive two ohm loads to extremely high power levels while maintaining current four and eight ohm ratings. For example, the industry leading CS-800 now delivers 600 watts RMS per channel into 2 ohms!

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- 840 W RMS into 8 ohms
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CS 1000 X

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CS 1200 X

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- 1260 W RMS into 8 ohms
- 1800 W RMS into 4 ohms (bridged)

X-TRA PERFORMANCE.

Along with increased power, the new CS-X Series maintain awesome industry standards for bandwidth, slew rate, distortion specifications and overall performance excellence and versatility.

- DDT® compression with LED indicators and defeat switch
- Slew Rate: 40 V/microsecond, stereo mode, each channel
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- Auto 2-speed fan cooling
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- Transient free turn on / off
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- Single XLR & dual phone plug inputs each channel
- Phone plug inputs are quasi-electronic balanced
- XLR input can be transformer balanced
- Dual phone plug and 5-way binding post outputs each channel
- DDT activation LED & power LED each channel (1000X and 1200X feature a power LED array and thermal indicator each channel)
- Rear panel DDT defeat & bridge mode select slide switches

Peavey's CS® Series ▶ plug-in modules offer you utmost patching flexibility allowing biamp and triamp configurations with various crossover points available

CS® 1000 X

CS® 800 X
World's Best Selling Power Amplifier

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NEW!

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NO X-TRA COST!

Incredibly, all the extras have not increased the cost of these world-standard amplifiers (the CS 800 X is still only one dollar per watt)! Only from a company with nearly thirty years of power amp experience could you expect this. A company with the power of high volume production and advanced manufacturing technology...

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CONTENTS

Volume 39 Number 10

October 26, 1993

30

36

48

FEATURES

16 **DIGITAL DELAYS, PART THREE**
By Neil Shaw
Our saga continues with an in-depth look at two real world applications that require the use of signal delay units.

30 **21st CENTURY SCHOOL MEDIA**
By Mark Miller
In the education market audio is "driven by the educators." That's what made Ruffner Middle School a fun project for Ambassador Enterprises. Since all a/v equipment is accessed through a computer network, the days of the a/v cart may be over.

36 **RESIDENTIAL REAPPROPRIATION**
By William A. Kanner
How do you turn a $2,400 nightmare into a $24,000 miracle home theater?

48 **COLUMBUS' CONVENTION CENTER**
By Jesse Walsh
Columbus, Ohio's architectural marvel is a spectacular add-on. Standardization was the sound solution for a system in which flexibility, easy operation and service were paramount.

DEPARTMENTS

9 **NEWSLETTER**

12 **LETTER FROM THE EDITOR**

13 **DR. WOKKA: HOW TO BE AN ACOUSTICAL CONSULTANT**
By Dr. Wilhelm Wokka III

42 **A CLOSER LOOK: MULTIPLE FORMATS — IS THERE SOMETHING HERE FOR COMMERCIAL SOUND INSTALLATIONS?**
By Mike Klasco

54 **CAD TOPICS: MORE OF WHO'S DOING WHAT IN SOUND SYSTEM DESIGN PROGRAMS AND AURALIZATION**
By Mike Klasco

64 **NEWS FROM AROUND THE INDUSTRY**

69 **CALENDAR**

70 **PRODUCTS**

75 **LITERATURE**

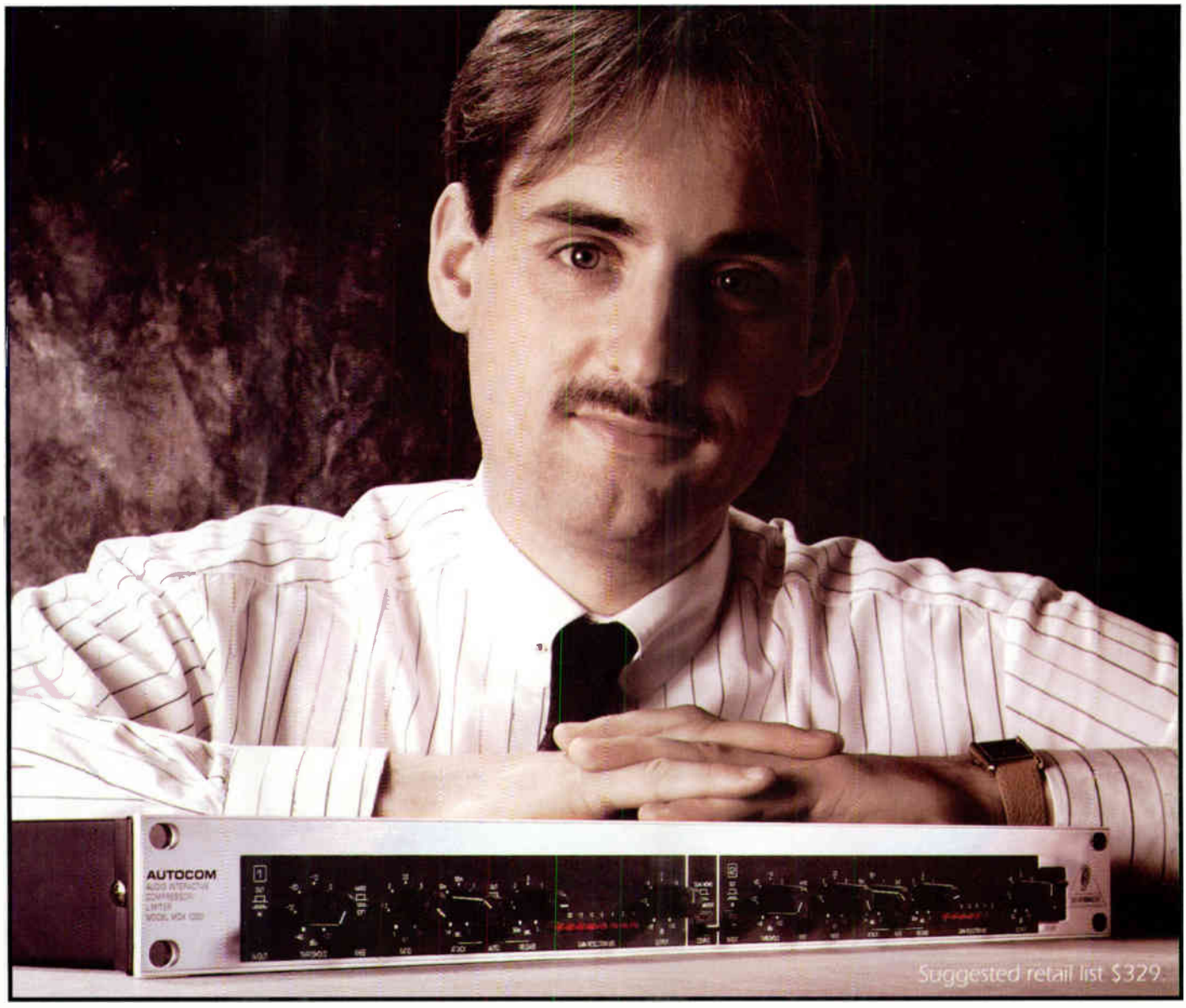
75 **PEOPLE**

76 **AD INDEX**

76 **MARKETPLACE**

78 **PRODUCT CHECK: BARS AND CLUBS**

World Radio History



THE SOUND OF OUR COMPRESSION IS MUSIC TO *THE EAR.*

Introducing the new AUTOCOM from Behringer.

Uli Behringer knows great sound when he hears it. Nicknamed "The Ear" since childhood, his special gifts as a musician and engineer are reflected in every one of his products.

So it makes perfect sense that his new AUTOCOM Compressor/Limiter produces the smooth, musical sound that immediately distinguishes Behringer processing in any setting.

But Behringer also wanted to make the AUTOCOM incredibly easy to use. So he developed an intelligent "AUTO" processor that automatically sets attack and release times based on the dynamic content of the program material, without any "pumping" or "breathing."

He also included manually adjustable attack/release times for more sophisticated control over the compression. And a switchable Soft/Hard Knee function that lets you vary the AUTOCOM from softer, "musical" compression to a harder, limiter-type effect.

For added flexibility, the AUTOCOM operates in dual mono or true stereo. Endowed with Behringer quality down to the smallest detail, it features servo balanced inputs and outputs and a five year warranty.

The new AUTOCOM from Behringer. The Ear for musical compression.

THE PERFECT EAR.

BEHRINGER

For more information about Behringer Signal Processing, please call 1-516-932-3810 or write to Samson Technologies Corp., P.O. Box 9068, Hicksville, NY 11802-9068.

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It is
the exact
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traditional
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ELF.

Experts believe that "ELF" (extended low frequency) is such a revolutionary new bass technology - it will eventually become the industry standard for all low frequency sound reproduction.

The Bag End ELF-1 utilizes a patented *dual integrator* to operate the driver *below resonance*. The traditional *"above resonance"* speaker design is limited in the low range, offers clumsy phase shift and delay from the use of equalizers and filters, favors the notes near resonance, and requires a large box to reach the low range notes. Whereas, the ELF system delivers perfectly flat frequency response down to 8 Hz (more than an octave lower than the lowest musical note), naturally uniform phase response and dynamic driver protection, all within a very small enclosure.

The Bag End ELF-1 is the exact opposite of all traditional thinking. It is power *and fidelity*. It will change your basic thinking about bass sound forever. Call today or contact your local Bag End dealer and check out for yourself the biggest little new kid in town.

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NEWSLETTER

WINTER CES INCREASES

The Winter CES (International Winter Consumer Electronics Show) has announced that it is "headed for a total sell-out." The expanded show includes a new pavilion structure added to the videogame area. CES says there has been a 17.7 percent increase in applications submitted and a 24.6 percent increase in exhibit space. The show takes place at the Las Vegas Convention Center, Hilton, Mirage, and Sahara Hotels January 6 through 9, 1994.

The EIA, sponsor of the Consumer Electronic Shows, has announced that it has reached an agreement with Guazzelli Associados of Brazil to produce the first annual CES South America in Sao Paulo, Brazil next August.

SONY PERIPHERALS FOR VIDEOCONFERENCING

Sony Electronics Inc. has announced the introduction of two computer peripherals for personal computer based multimedia and videoconferencing applications. The PCS-V2 integrates a color video camera, microphone and speaker in a single unit that fits on top of a desktop computer monitor. The PCS-4 incorporates all of the features of the PCS-V2, plus full duplex echo cancellation. Leo Flotron, Sony marketing manager for videoconferencing, said, "The beauty of both modules is that the required audio and video components are integrated into a single, compact unit." Flotron added that likely system integrators/resellers using this equipment include computer companies, telecommunication companies, and communication solution integrators. The PCS-V2 will be delivered during the fourth quarter with a suggested list price of "under $1,000." The PCS-V4 will be ready for delivery in 1994.

HOME THEATER ASSOCIATION EXHIBITS

The Home Theater Center, sponsored by Dolby Laboratories and the Home Theater Industry Association, was presented at the Video Software Dealers' Association convention in Las Vegas. Participants included Atlantic Technology, Bose, Cerwin-Vega, Denon, Fosgate, Harman-Kardon, Harman Video, Infinity, JBL, Now Hear This, Yamaha, Monster Cable. Ken Furst, HTIA's acting executive director, also organized exhibits at Cedia and at the furniture show in High Point, North Carolina.

INLINE ACQUIRED BY EXTRON

RGB Systems (dba Extron Electronics) has acquired Inline, Inc. According to RGB, the move by the United States Bankruptcy Court of the State of California approved the sales and turned over the stock in Inline to Extron and its president and ceo Andrew Edwards, for a credit sale of $300,000 to be applied towards a $7.5 million judgment against Jack and Semyon Gershfeld. Mikhail Gershfeld has resigned from Inline.

TEKTRONIX EXPANDS PRESENCE

Tektronix has expanded its presence in the audio market with the introduction of the first of a planned family of products, along with an exhibit at the AES convention,. The Tektronix AM700 is a high performance audio test and measurement instrument comprising analog and digital generators, analog and digital acquisition units, internal control, display, processing, and storage. Shipment is expected by the first quarter of 1994. Additional products in the family are expected to include hand held units.

SYN-AUD-CON WORKSHOP PRE-NAMM

Synergetic Audio Concepts is cosponsoring the Fifth Live Sound Reinforcement Workshop on January 17 through 19, 1994 in Orange, California at the Chapman University Campus. Registration fee for the workshop is $650 per person. The staff will include Will Parry of Signal Perfection, M.L. Procise of Showco, Albert Lecesse of Audio Analysts, and Dave Scheirman of Concert Sound Consultants. Advanced classes will be conducted by Kenton Forsythe and Mick Whelan. The workshop is cosponsored by Pro Sound News.

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NEWSLETTER

CONFIDENCE DOWN FOR THIRD QUARTER

According to the National Association of Wholesaler-Distributors, confidence in the economy's likely performance during the third quarter has deteriorated from earlier 1993 levels, according to a survey by the Association of wholesale distribution industry business executives. The executives' confidence index decreased from 105.0 to 103.0 for the third quarter. The index operates on a base of 100, recorded in the fourth quarter of 1989 when the index was begun.

STANDARDS FOR VIDEO CD

Matsushita, Philips, Sony and Victor Company of Japan (JVC) have announced that they have established the basic specifications of the "Video CD" format, including two optional features, and have agreed to cooperate closely on promoting the new format. They have also created a common logo mark that signifies compatibility in any hardware and software based on this format. The "Video CD" is based on the Karaoke CED format that JVC and Philips established as a standard in March 1993. The two optional features include two levels (normal and high resolution) of still picture playback functions and playback control. The format can store 74 minutes of audio and digital full motion pictures based on the MPEG1 standard on 12 cm CD.

MARK KNOX NAMED TO SAMSUNG

Mark G. Knox has been named national marketing manager for its Audio and Laser Disc player products. The announcement was made by John Garrison, video president of marketing. Knox most recently was product manager, home/specialty audio for Denon America. Prior to that he held various product management positions with Matsushita.

COHERENT AND ANIXTER SIGN AGREEMENT

Coherent Communications Systems Corporation has teamed with Anixter to "make Coherent's conferencing products more available to end users" according to the company. Anixter has signed a North America distribution agreement to resell Coherent's ConferenceMaster product line. The ConferenceMaster is a full duplex portable teleconferencing unit with Sculptured Sound.

PIRELLI RELOCATES

Pirelli Cables North America has announced the relocation of Pirelli Cables' North American headquarters and the "streamlining of its central management structure." The streamlining creates a consolidation of the administrative functions from the corporate headquarters, the energy division offices, and the communications division offices into a new office in the Columbia/Lexington, South Carolina area.

FERROFLUIDICS ANNOUNCES LAWSUITS

Ferrofluidics Corporation has announced that two actions have commenced in the United States District Court, District of Massachusetts, that name as defendants the company and some of its officers. A shareholders' suit was previously brought against the company. According to Ferrofluidics, the suits allege violations of federal security laws and that certain statements were false and misleading. The company "intends to vigorously defend these lawsuits."

PIONEER FORMS NEW GROUP

Pioneer New Media Technologies has announced the formation o the Broadcast and Professional Group to handle marketing, sale and support for a line of products designed for the broadcast and video production professional, with the Pioneer VDR-V1000 Rewritable Videodisc Recorder at its heart. Jim Burger is national sales manager for the group.

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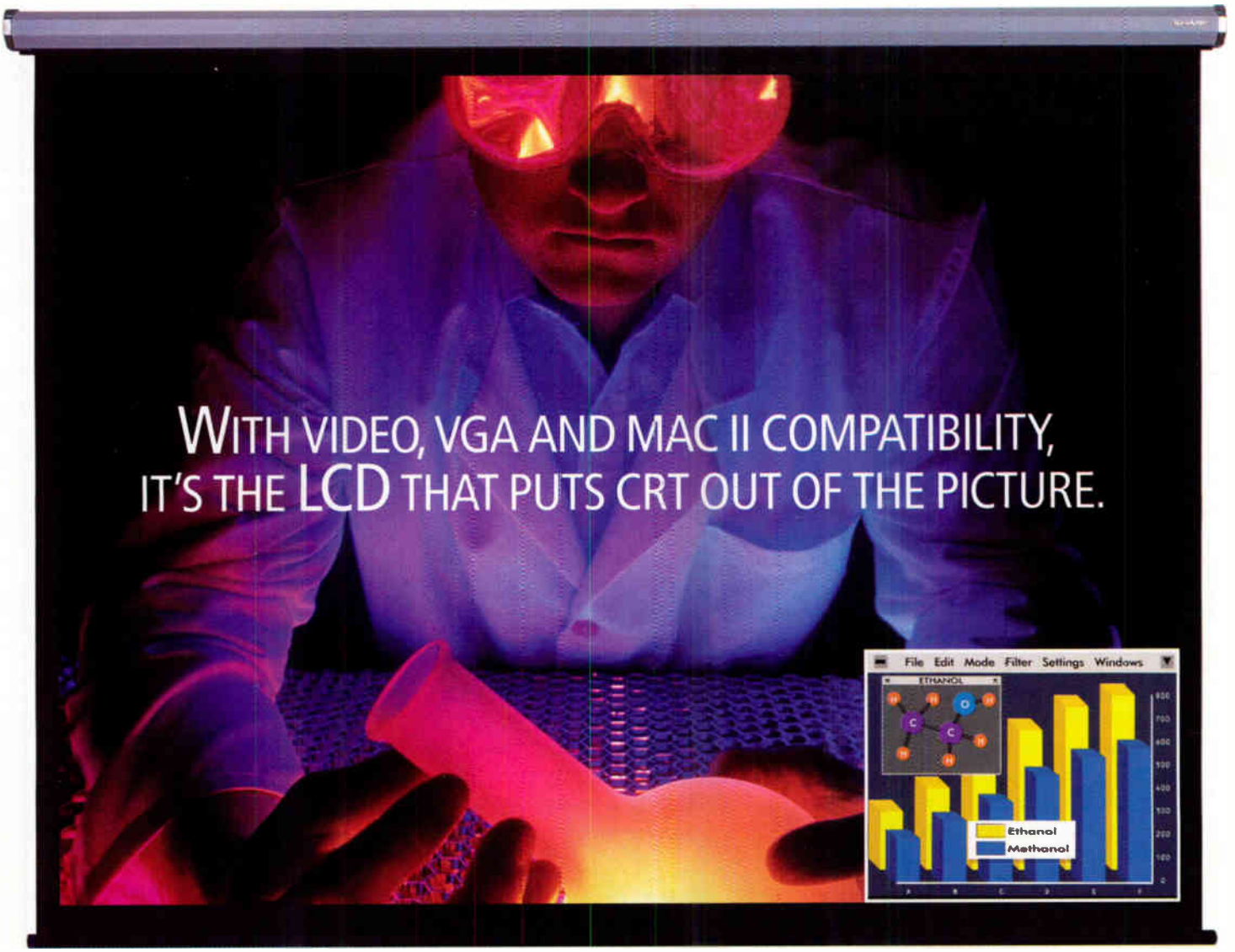

INTRODUCING THE SHARP XG-E800U.
THE WORLD'S FIRST FULL-COLOR MULTIMEDIA LCD PROJECTOR.

Now, the leader in LCD brings you all the solid state advantages of LCD video projection plus direct computer compatibility. Sharp's latest breakthrough in TFT Active Matrix technology, the XG-E800U, gives you exceptionally bright, high-resolution video images up to an incredible 560 lines. And computer projection with full 640 x 480 pixels. Just connect your video and VGA or MAC II computer directly into the projector for dramatic, full-color multimedia presentations. The XG-E800U also gives you a built-in power zoom lens that delivers large screen images up to 200 inches measured diagonally. And you have the flexibility of tabletop, ceiling mount, or rear projection. There's even a convenient wireless backlit remote plus a built-in audio system. What's more, at just 30 lbs., the convergence-free XG-E800U is easy to set up and extremely portable. So contact your local authorized Sharp Industrial LCD Products dealer for a demonstration. Or call 1-800-BE-SHARP Ext. 444.

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LETTER FROM THE EDITOR

Mics and Acquisitions

Some months ago we wrote in these pages that Harman International was in negotiations to buy a "microphone company." Those of you clever enough to figure it out or hardy enough to call us found out that the microphone company was AKG, and was actually more than just a mic company. We had been asked by both companies involved, which are both public, to hold off printing the whole story. And, rightly or wrongly, we did so. On September 24, the acquisition became official as GiroCredit handed over its AKG controlling stock to Harman International Industries. According to the official press release from AKG, the move will mean layoffs ("reduction of personnel") and consolidation, along with a move from the red for AKG.

Harman issued its own official press release and has offered its management for interviews.

Meanwhile, other microphone news has made its appearance, as Soundfield has been sold by AMS/Neve to Drawmer and is being set up as a separate company, SoundField Research Ltd.

But amidst all this movement and countermovement, the bottom line is — how will the industry fare? Does any or all of this make any difference on the front lines of installation? Despite what the stock market does or the media print or the pundits predict, the only thing that matters in the end is how you people — our readers — are affected. What products will be available, at what cost?

As far as Harman is concerned, the company has been on an acquisition binge, recently acquiring Audio Access and Phoenix Systems, as we wrote about at the time.

Harman, KH, and other companies such as Tannoy and Atlas/Soundolier, not to mention the Japanese giants such as Sony, Panasonic, JVC, etc. have been proceeding on two fronts — the professional front and the residential consumer electronics front. Many of our readers are facing the same actions. Although some observers with whom we keep up claim that sound contractors are showing less inclination to deal with residential jobs, others are saying the opposite. From a personal standpoint, I see a lot of snobbism in the industry — from both ends. Contractors are apt to tell

me they are loathe to get into residential work because they don't want to deal with the small homeowner. And residential specialists are apt to look down at the contractor who "deals only with low bid" and is presumably not an *artiste.*

Needless to say, either of these attitudes is foolish. The aim is to put together media systems wherever they are needed, and to make a living doing it.

Best regards,

Judith Morrison
Editor in Chief

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World Radio History

DR. WOKKA

HOW TO BE AN ACOUSTICAL CONSULTANT. . . AND HAVE IT ALL

By Dr. Wilhelm Wokka III

Dear Dr Wokka,

Look, I really appreciate your column and the advice in it. I loved the last one about the vocal techniques used to correct pink noise curves. This has saved me tons of money already. However, you have to help me solve a major bummer in my life. You see, I have been a sound contractor for 25 years now and I am sick of it. My family never sees me because I am permanently "out on the job site." I am sick of tearing my flesh on CD horns, sick of nuts and bolts and barrier strips and wire cutters, sick of crimping things and wearing "work" clothes with the company's logo on it, sick of being looked down upon as a second-class citizen at AES shows. If I look at another Allied or Newark Electronics I think I'll die. I'm sick of bid specs, sick of the company work van, sick of Dunkin' Donuts, sick of barrier strips, sick of wire strippers, sick, sick, sick. What do I do? I don't want to be a sound contractor. I want to take the high road, Doc. I want to be like you and others and be an *acoustical consultant.* These guys have the life. Revered, respected, all-knowing, rich. I want to know how I can start my own acoustical consulting business.

Vito Pickanozzio
Burt and Mary's Audio Contracting and TV Repair
Fenton, Missouri

Dear Vito,

While I can relate to your wanting to be like me, this is often not possible. On the subject of acoustical consultants: Yes, I am one, taking on only the most meaningful of all projects and leaving the rest to the others in the business. However, regarding the acoustical consulting business at large, it is possible to start your own business, much the same as it is possible for a cobbler to start his or her own bank. Yes, this is America and these things do happen, but the road is a steep and uphill one. Let me explain:

First of all, there are very few acoustical consultants in the world today, for good reason. There are plenty of jobs for this kind of work, bordering on the overabundance level. However, for the same reasons that there are few candidates for heads of state, there are few acoustical consultants available to do the jobs. Thus, those many jobs unable to afford or even attract an acoustical consultant merely fall by the wayside, only to be butchered by huxters in music stores, radio/tv repair shops and, the worse, manufacturers. Let me explain the latter:

Manufacturers of sound equipment are basically run by their engineering departments, which are populated by narrow-minded nerds who think that life revolves around science experiments and the Radio Shack store. Any sound system that has a manufacturer involved in it is doomed to failure. The engineering department takes the task like so many kids in the toy store and they sit around endlessly trying "wouldn't this be neat . . . " exercises. In the end, the marketing department makes them specify at least twice the equipment required and the whole thing becomes a disaster. Of course, the engineers rationalize this, wanting to complicate any project whenever and wherever possible.

In contrast, acoustical consulting is the purest form of audio engineering and consultants are the real altruists in our industry. To be one, you must be rich, because this noble endeavor must rise above the dirty task of "making a profit." It is this attitude that allows a consultant to maintain an air of confidence and authority over any sound system project. The client knows that the consultant doesn't need the fee but is glad to pay it out of respect. Here, money is used the way it should be. People are born rich, and people are born to be acoustical consultants, plain and simple. This is the first real qualification you need to start your own consulting business. You must also understand the business. To do this, I must explain how various consultants are grouped by regions of the world.

There are a variety of "camps" of acoustical consulting in the world today. All but one are true purists of the trade, as they all have their own built-in quirks in how they go about the trade. This is often the direct result of where they live and what they eat. I won't go into the gory details of this. One big camp of consultants is in Eu-

Dr. Wilhelm Wokka III heads up the Philadelphia Medical College of Musical Knowledge, 106 Penn's Landing, Philadelphia, PA 19001. Dr. Wokka is a pseudonym.

World Radio History

rope and much of their time is spent finding a million new uses for column speakers and measuring speech intelligibility with archaic and confusing equipment that no one else could possibly operate. And they spend a lot of time encouraging each other to remark about how superior they do things compared to the Americans, and also the English.

The Germans and the French and especially the Swiss are the most vehement, all for different reasons. When considering "breaking into the business," forget trying to do anything in Europe. They'll spot you in a minute.

An interesting subset of European consultants are the English. This is divided into two distinct subcultures, the BBC Ancient Acoustical Society and the hippies. The former have decided on one (two-way direct radiator) loudspeaker for every possible use and all belong to some kind of "Explorers' Club." These clubs are housed in ancient and abandoned architectural droppings from old English aristocracy, and the AAS members usually sit in Harris Tweed jackets, around a peat fire, smoking awful things, making sounds of persons at the latter stage of emphysema. The only thing moving are their overgrown beards and mustaches.

The latter, the hippies, have all been somehow involved in some kind of touring company or English art band, and just have fun, and do nothing. To their credit, they occasionally set up big rock festivals, which unfortunately takes months to accomplish. The second camp of acoustical consultants worth mentioning is in Australia. Of course, these persons are all crazy homicidal academics and are always having fist fights with one another (the typical Australian way of resolving matters) over the various merits of speakers and concert halls and over who will be the next consultant for the Sydney Opera House.

In Japan, there are no acoustical consultants, as the manufacturers all run the country and thus have control over all the acoustical designs in every venue in Japan. Here, a sound system design takes three to five years and will invariably not work. Of course, no one will acknowledge this and the Japanese continue to operate these technically complicated acoustical nightmares so as to not have the specific manufacturer lose face or become dishonored.

There are many camps of acoustical consultants in America. These are closest to the mark. You would probably do well to start your business in one of these areas. The first is in New England, centering on the Hollywood of New England, Boston, and the intellectual center of Boston, Cambridge Mass. Consultants here are rich sons of early New England bankers and liquor traders. They think they know it all because they went to Harvard or MIT. They specify loudspeaker systems that consist of ". . . AR3 or the equivalent . . . " direct radiator systems and play classical music only to evaluate the results of their work. Others of these insist on bouncing sound off walls, this being the best way to "meet spec" using pink noise. This has been covered extensively in this column and is a totally viable technique.

PHILADELPHIA IS WHERE YOU SHOULD START YOUR CONSULTING BUSINESS. FORGET THE REST OF THE WORLD.

The second American camp, a huge one, is in Texas. These consultants are similar in their modus operandi to the Australians, only they use guns to settle differences. Although they all wear suits in polite company, when they are home they all look and talk like movie cowboys and shoot real guns up into the air at random. They are all sons of oil millionaires and, in keeping with the relative size of their state, they tend to design sound systems for the hugest stadiums and arenas, packing them with as much sound equipment as possible. Bigger is better seems to be their motto.

The third US camp is in Los Angeles and these consultants tend to specify systems that are variations of movie theater systems. They all wear French clothing, cravats, sunglasses and berets and are more concerned with how they look than actually doing their jobs. There is a small but powerful group of acoustical consultants in the Pacific Northwest. Basically sons of wealthy lumberjacks and coffee importers, the consultants in this area, including Vancouver and beyond, get distracted by making sure the speaker systems and acoustical environments are crafted of oiled oak. Also, they insist that all sound installations be somehow linked to saving the whales. Because of this, they usually forget what their real job is.

Lastly, there is a treasure of acoustical consultants in the Philadelphia area. These wise and omnipotent servants of the living sound all have some lineage to Benjamin Franklin and are the most intelligent and resourceful in all of the business. They are also great inventors and generally put the rest of those in the business to shame. Of course, they are altruists for audio, so they tend to be bad businessmen. Many have been trained at the Philadelphia Medical College of Musical Knowledge and are subscribers to the Church of the Living Sound. Given a choice, Philadelphia is where you should start your consulting business. Forget the rest of the world.

In the next two installments: Do you qualify to be an acoustical consultant? Answer this challenging series of soul-searching questions. Then, The Big One: setting up your business, developing your marketing plan and securing clients. ■

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Digital Delays, Part Three

Real World Applications for Real World Delay Units

BY NEIL SHAW

In the second installment of this series, we looked at some real world signal delay units and presented the results side by side. The measurements of these real world signal delay units were then compared to the "ideal" signal delay unit discussed earlier in Part one. The real world units were seen to vary in performance from one to the other, which is really no surprise. What is surprising, though, is that if you relied only on the published specifications, the amount that these signal delay units would appear to vary would be very small! With that in mind, let's look at two real world applications that require the use of signal delay units. There will be a little acoustics and electroacoustics to describe what we want and then a discussion of the selection criteria for the signal delay units. Note that these examples are just a few of the ways in which signal delay units can be, and are, used in sound reinforcement system designs. The discussion of the acoustics and electroacoustics is very abbreviated and simplified.

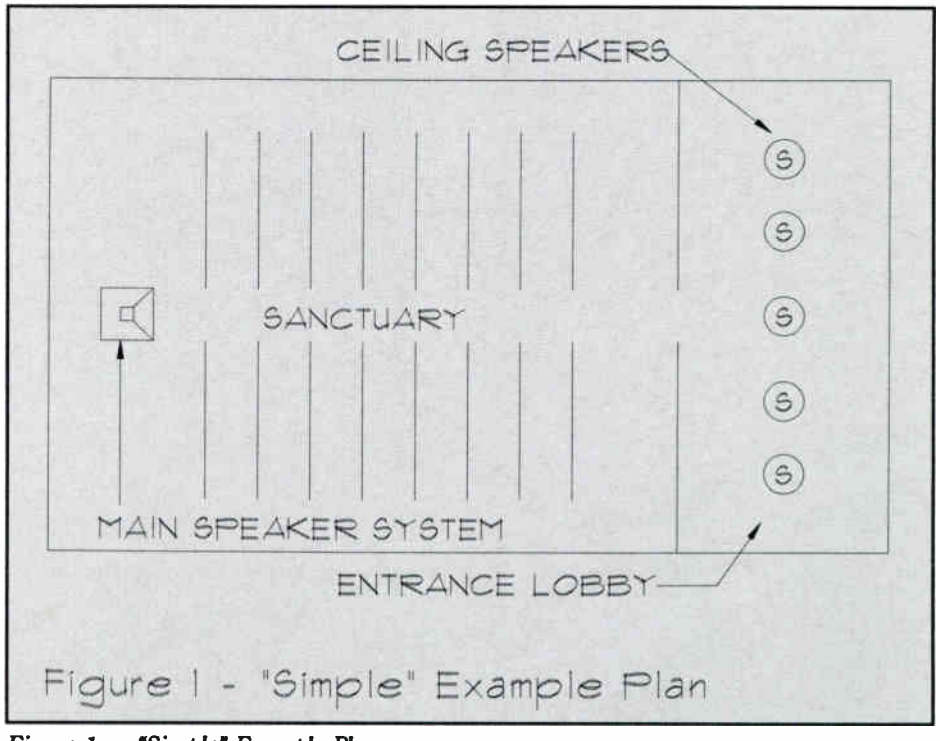

Figure 1 — "Simple" Example Plan.

In review, from the discussion in Part one, among the objective measures that can be used to describe the performance characteristics of any two-port electronic device (a two-port device has an input and an output) include:

- Frequency response of the unit — output voltage amplitude versus frequency for various input signal levels.
- Phase response — "degrees from 'zero'" versus frequency for various delay settings.
- Residual noise — output noise voltage versus frequency.
- Distortion — percent or dB distortion versus frequency. This test should also include a look at any modulation and/or spectral contamination effects that a unit may exhibit.
- Deviation from linear phase — degrees deviation from linear phase versus frequency.
- Inter-channel phase difference —

Neil Shaw is a partner at Menlo Scientific Acoustics in El Segundo, California.

World Radio History

difference in phase for output channels relative to a reference output versus frequency.

• Square wave response — how does the square wave look at the output relative to the square wave input? This is a simple test to see the transient response of a device.

• Minimum transit time — what is the minimum time for a signal to transit the device?

All applications depend on a physical characteristic of the signal delay unit, which is of importance in the actual "systems integration" of a system. In fact, based upon cost considerations, this may be the paramount specification of the unit. This is, of course, the number of inputs and the number of outputs that a piece of equipment offers. The devices that were reviewed in Part two of this series offer inputs/outputs combinations that include one one-input one-output device, four one-input three-output devices, and three two-input two-outputs/input devices. The three two-input two-outputs/input units can also be configured as one-input four-output devices. The two-input delay lines are useful in applications where you have two-channel stereo signals that need to be delayed. In addition, by configuring these devices that are shipped configured as two-channel devices in to a one channel device, you can realize four outputs. One more benefit, in complex systems, is that you can use one type of delay unit, appropriately configured, for both the monaural and the stereo signals encountered in the system.

In addition, by configuring these devices that are shipped configured as two-channel devices in to a one channel device, you can realize four outputs.

A "SIMPLE" APPLICATION

For this first "simple" use, let's look at a facility where there is a main assembly hall with doors that open up into a waiting or entry area. For this example, let's look at a place of worship that is long and narrow, with an entrance lobby at the end of the sanc-

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tuary opposite from the altar. A main sound reinforcement system might be located above and near the altar in the sanctuary. (See figure 1.)

In many facilities of this type, there are loudspeakers mounted in the ceiling of the entrance lobby. We want the main system and the auxiliary feed in the entrance lobby to function without contention between the two systems, whether or not the doors between the sanctuary and the entrance lobby are open. We want there to be a seamless transition when moving from the entrance lobby in to the sanctuary, and also when exiting the sanctuary. If there is no signal delay unit in the signal chain for these entrance lobby loudspeakers, there will be an area where the sound from the entrance lobby arrives first and the sound from the main system arrives a short time later. This is not good, as this transition area always is inside the sanctuary where, due to Murphy's law, the most sensitive (and vocal) members of the congregation sit. We know that the transition area will be located at a place that is a function of both the sound levels of the systems relative to one another and the distance between the two systems.

For a seamless transition, I usually locate this transition point at the door(s) between the sanctuary and the entrance lobby. (See figure 1.)

Placing a signal delay unit in the signal chain prior to the power amplifier powering the ceiling loudspeakers in the entrance lobby will delay the signal to these loudspeakers. (Figure 2 shows a portion of the system block diagram for this facility and the placement of the signal delay unit.)

It is not only important to match the timing of the sound arrival from the entrance lobby loudspeakers relative to the main system at the door location, but also to match the sound levels. A person walking into or out of the sanctuary should hear no abrupt change in level or apparent direction of the sound. Also note that in actual practice, a simple 6 dB/octave high-pass filter, set somewhere between 150 Hz and 500 Hz, is also used in the signal chain for the entrance lobby subsystem and is placed before the power amplifier. The exact frequency corner is set in the field.

With that short account of the design objectives and acoustical considerations for this application, what characteristics does the signal delay unit to be used here require? First, for the entrance lobby system, let's state that the loudspeakers, their mounting and location, and the amplifier are chosen so that they are appropriate for the use described. Let's further assume that we want the maximum sound level at a person's ear due to the entrance

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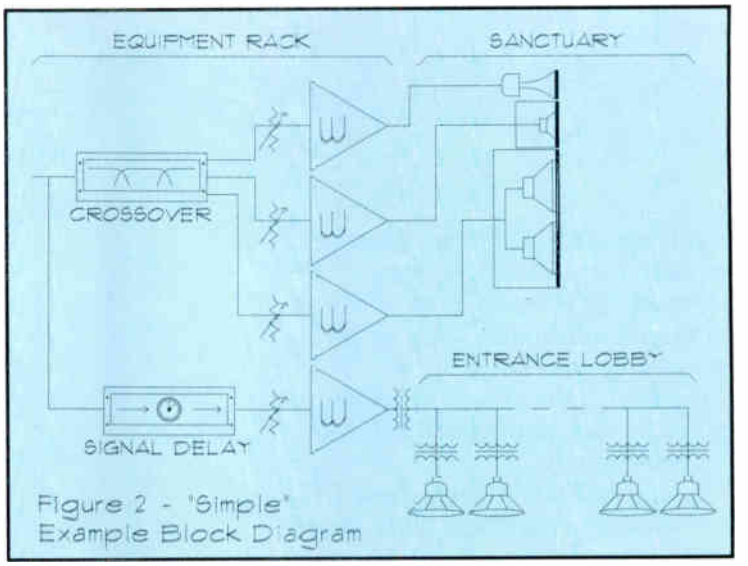

Figure 2— "Simple" Example Block Diagram.

lobby loudspeakers to be 75 dBA, so that the sound levels from the main system and entrance lobby system match. With a 12 dB peak factor for speech, we would then have 87 dBA peak sound level in the entrance lobby. If the lowest required sound level in the entrance lobby is 40 dBA, we see that the minimum dynamic range required for the signal delay unit is 47 dB. Further, we would also want any music that is reinforced in the sanctuary to be recognized as such through the entrance lobby system. The signal delay unit also needs to have a fairly good, but not great, frequency response. We can now ask the following about the signal delay unit performance criteria for this application:

Frequency Response. The entrance lobby system requires that the frequency response be linear from full rated output (FRO) down to about -50 dB re FRO, based upon the minimum and maximum levels specified. Note: Humans are able to extract information even though the signal to noise ratio may be less than unity. In this application, there is not much sense to requiring that a reinforced signal be below the 40 dBA level since the area is not a critical listening area. The frequency response of the selected signal delay unit should be relatively flat from about 100 Hz to around 10 kHz, which would exceed the frequency response performance of the ceiling loudspeakers, even if you use a very good one.

Phase Response. The phase response of the unit is of secondary importance

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in this application. Phase response is important when multiple transducers are used in close proximity to one another and are intended to be used a compact system.

Residual Noise. The application requires it to be more than 60 dB below the peak output.

Deviation From Linear Phase. This performance characteristic is of secondary importance in this application. This is important in applications when we want the amount of "time" in the signal delay unit to be constant across the frequency range. As will be shown below, phase is equivalent to time!

Distortion. Any of the units tested have acceptable distortion performance for this application. As we saw in Part two, at 0 dB output and above, most of the units tested have acceptable distortion specifications. So if the system levels are set correctly, we can get the best performance a unit can offer. Of course, at lower levels, the distortion will increase, but, in this application, the distortion should not be perceived.

Inter-channel Phase Difference. This is not applicable here as we are only using one of the outputs.

Square Wave Response. Again, this is of secondary importance here. Remember that this test is used to determine transient response characteristics of the input and output filters and sampling rate limitations.

Minimum Transit Time. Since the distance from the main loudspeaker system to the entry lobby is more than several feet, this should not be a concern. Typical minimum transit times vary from about 3 microseconds to about 370 microseconds.

Finally, we need to look at minimum delay step size available. In this application, even a 1 millisecond step size would be more than adequate, as you would only be "off" by one-half the minimum delay step in your setting. In this case, a 500 microseconds delay time setting up or down from the optimum setting would not be perceived by even the most critical and trained listener.

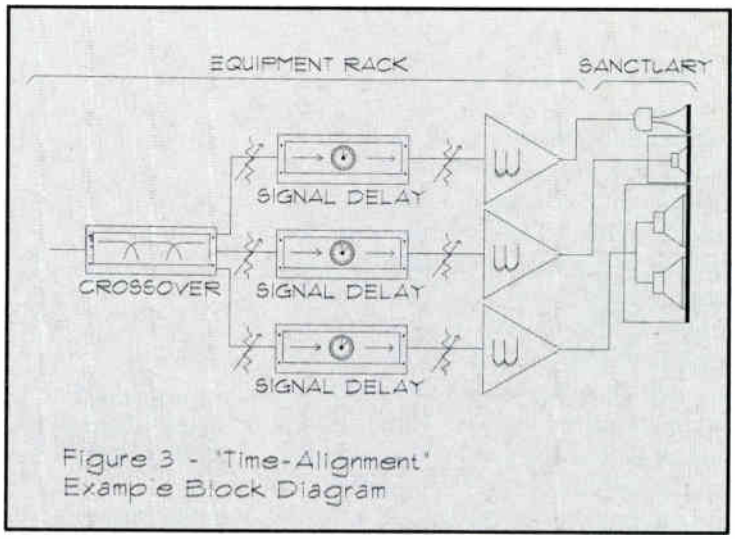

Figure 3 — "Time-Alignment" Example Block Diagram.

The above parameters are not too demanding in terms of performance for the signal delay unit that we would choose to use here. Reviewing the performance characteristics of the units tested in Part two, we see that all the units meet or exceed the needs for this application. Our choice is then by how much do we want to exceed the needs for this job, and how much do we want to pay?

Basically, any of the lower cost units described previously in Part two would do the job. Therefore, for example, choosing either the IRP unit or TOA unit would be a toss-up in terms of performance. If you only have need for one delayed output for the signal send, the one-input one-output IRP unit is clearly the leading choice. If, however, there is a need for up to three delayed outputs for this signal, such as for distribution to other offices and a feed to the hearing assistance system, as well as the one delay output for the entrance lobby system, then the TOA unit would be the choice.

At this point, after we have narrowed our selection down to several units that meet the price and performance objectives, practical end-user experience with the units selected is the final criterion used in making a final selection. If you are not familiar with a unit or units, then listen to speech and music through the candidate signal delay units, using the loudspeakers to be installed in the entrance lobby to help with the selection.

Now, the above may seem like a lot to go through for such a simple application, but as we'll see, the example that follow uses the same steps for the selection of the signal delay unit to be used.

A "TIME-ALIGNMENT" EXAMPLE

For this example, let's look at the main loudspeaker system that is used in the sanctuary for the preceding example. This is a three-way loudspeaker system, consisting of a horn and compression driver, a mid-frequency cone-type driver in a box, and, a bass box with two cone-type drivers. In this example, we want to align the acoustic centers of these drivers so that a coherent wave front is produced. While the technique used by consultants and loudspeaker designers to achieve this "time-alignment" is beyond the scope of this article, the determination of the parameters required by the signal delay unit to be used for this time-alignment procedure is not.

In a very basic way, what we are aligning in "time-aligning" a system, for a specific area in the listening area, is to line up the acoustic centers of the transducers. We'll see that to do this, distance is equivalent to time, and that time is equivalent to phase. To show this, let's look at the distance a sine wave will travel in 1 millisecond.

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From

$c = f\lambda$

where

c is the speed of sound, 1087.7 ft/s (331.6 m/s) at standard temperature and pressure,

f is the frequency, in Hz (which has units of 1/seconds), and,

λ is wavelength (which has units of feet or meters, depending on which system of measurements is being used), we can find out the distance travelled in one millisecond. From the speed of sound times one millisecond, (1087.7 ft/s) * (1/1000 seconds), we see that in one millisecond sound travels 1.088 feet. Now what is the wavelength for a signal with a frequency of 1000 Hz? From the above equation, we see that $\lambda = c/f = (1087.7)/(1000) =$ 1.088 feet! In one millisecond, a 1000 Hz tone will travel 1.088 feet, and in that one millisecond, only one wavelength of the 1000 Hz tone will have travelled past that 1.088 feet. Now in one wavelength there are 360° of phase, so in that one millisecond, for a 1000 Hz tone, 360° of phase will also have travelled 1.088 feet. (Figure 4 illustrates this.)

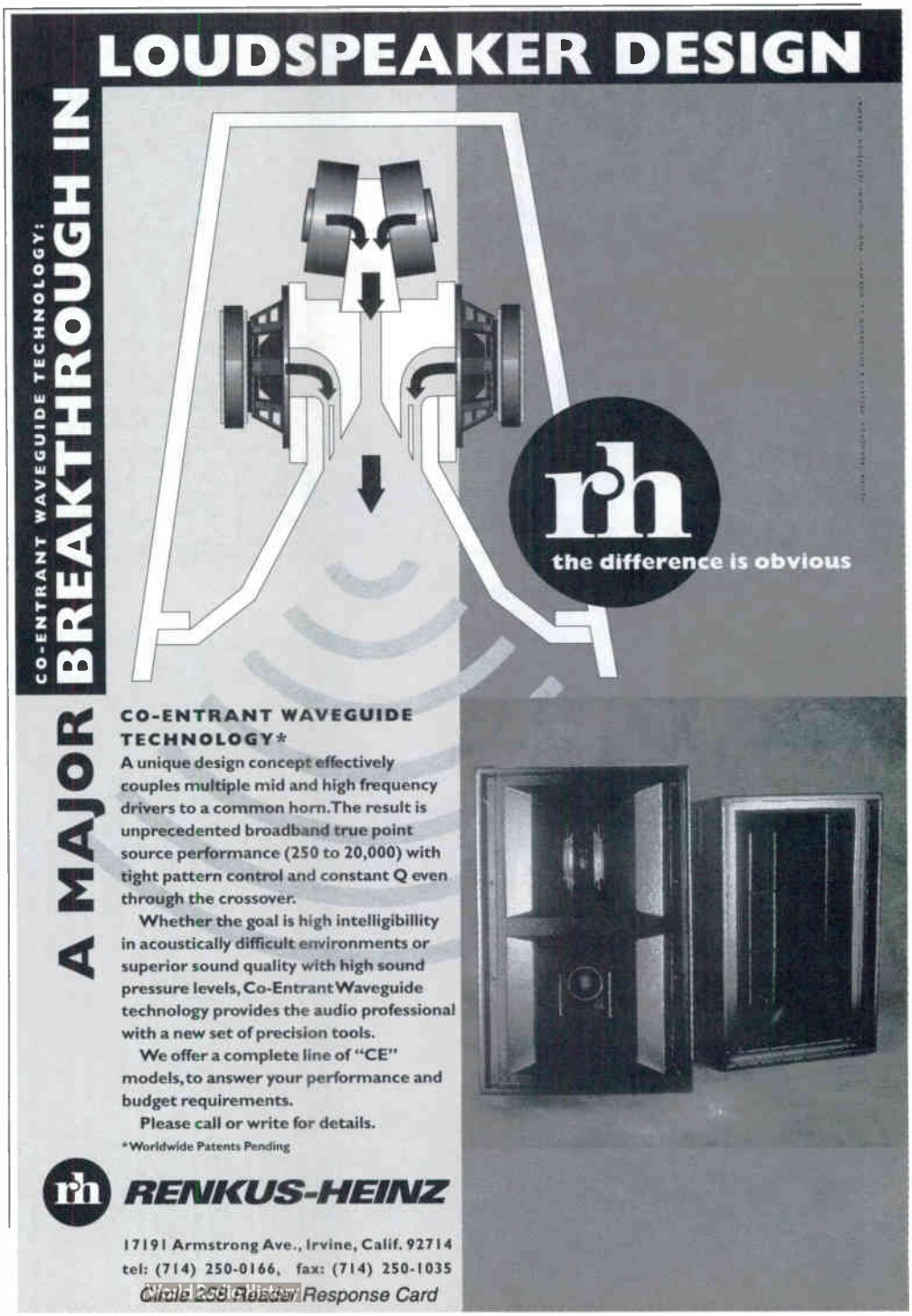
We can see, therefore, that time, distance and phase are related, and, in this case, equivalent to each other. This gives us the basis to "time-align" loudspeaker systems, where we want to add time (phase) based upon length differences. So "time-alignment" of a loudspeaker system adds time, and therefore phase. This added time /phase translates into distance, specifically the actual distance between the acoustic centers of the various transducers, as shown schematically in Figure 5.

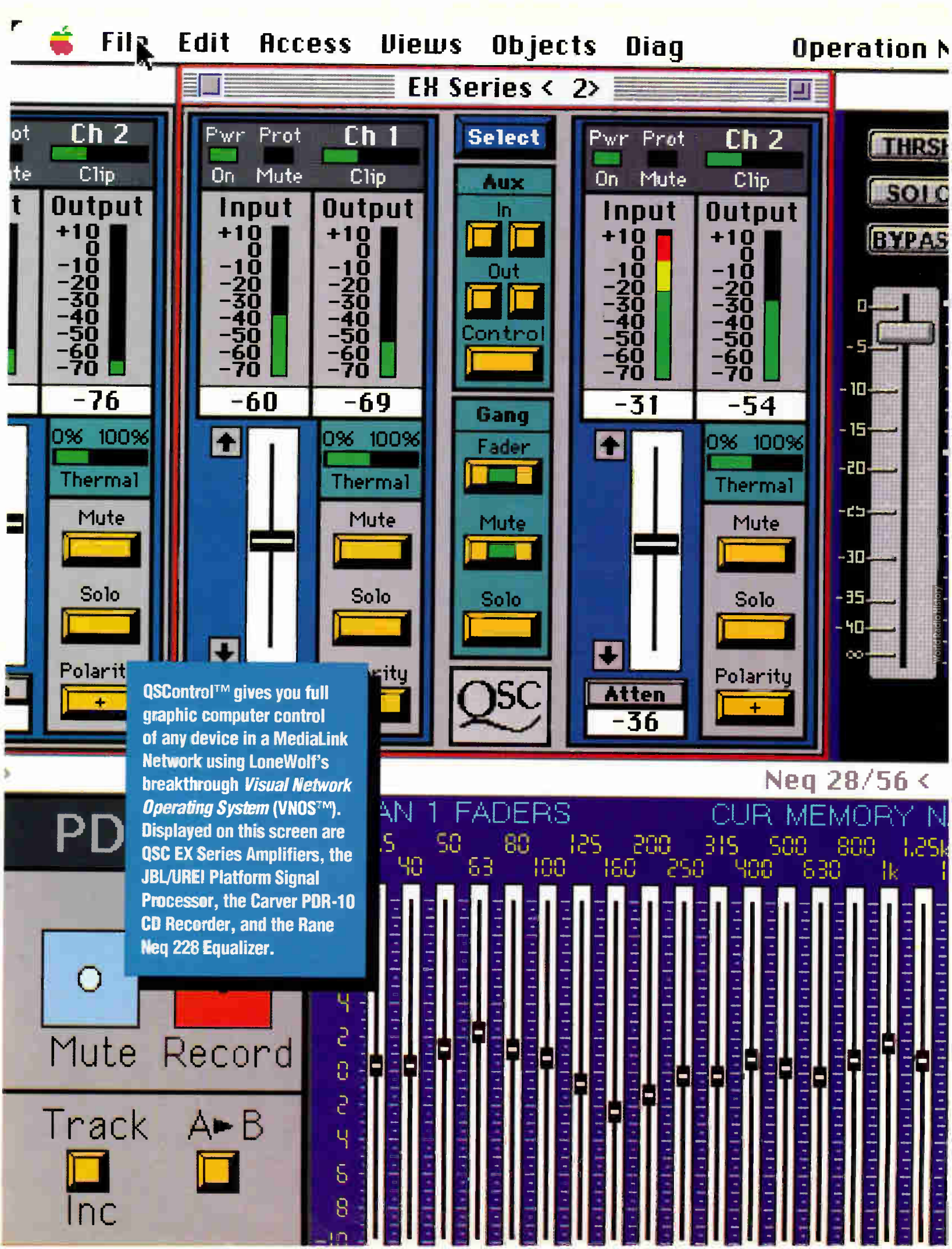
Once again, please note that the foregoing is a very abbreviated and sketchy discussion of the acoustic and electroacoustics used in "time-alignment."

Well, if you're still with me, let's look at the performance criteria parameters that a signal delay unit should have for this application:

Frequency Response. Since this is the main reinforcement loudspeaker, and it is a three-way design, it's obvious that we want to use the full frequency spectrum that the transducers allow. Therefore, we want the signal delay unit to have very wide bandwidth. We also want this wide bandwidth to be uniform from FRO and on down in output level. Note that if we are dealing with orchestral music and speech only, we can consider a signal delay unit that uses pre-emphasis, such as the T.C. Electronic of Denmark.

Phase Response. The phase response of the unit is of primary importance in this application. As noted in the previous example, phase response is important when multiple transducers are used in close proximity to one another

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and are intended to be used a compact system. (See Deviation From Linear Phase, below.)

Residual Noise. Let's assume that we need the maximum level close to the loudspeaker to be such that we have a maximum level of 75 dBA at the rear of the sanctuary. If the distance from the loudspeaker to the rear of the sanctuary is about 60 feet, we could have about 25 dB falloff due to distance. So we need about 100 dBA maximum, 112 dBA peak, at the loudspeaker, without any compression of the signal at this level, and no clipping in the signal chain. If the ambient level in the sanctuary, with air-conditioning on, is about 32 dBA, we see that the dynamic range required is more than 82 dB! We want the noise floor to be at least -82 dB re FRO.

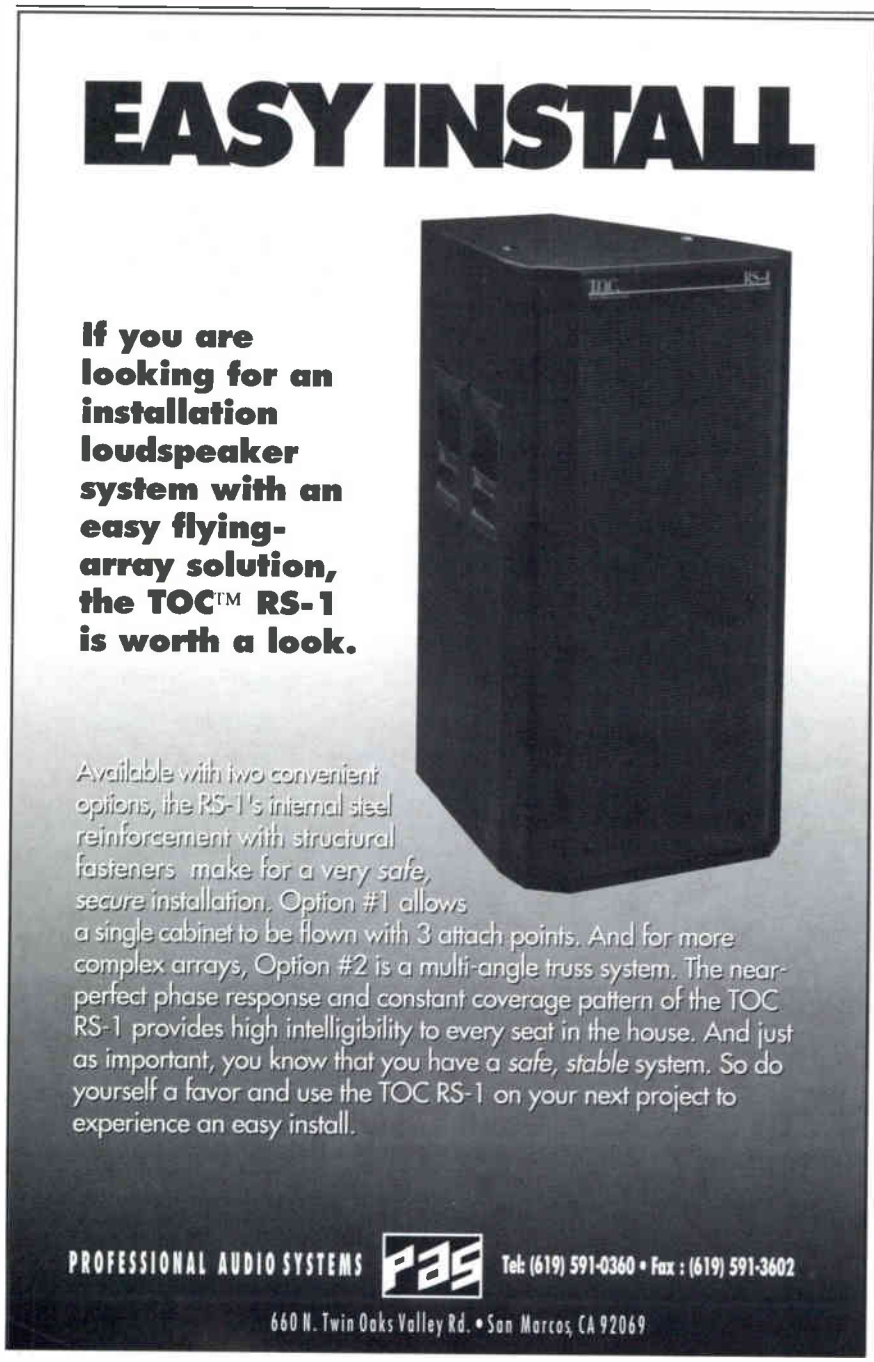
Deviation From Linear Phase. This is a performance characteristic that is of primary importance in this application. As stated above, this is important in applications when we want the amount of "time" in the signal delay unit to be constant across the frequency range. Remember, phase is equivalent to time! Any non-linearities in the deviation from linear phase will effectively move the transducers forward or backwards as a function of frequency.

Distortion. Any of the units tested have acceptable distortion performance for this application. Here, the BSS and T.C. Electronic units are exceptional in their performance compared with the rest of the units tested in Part two.

Any non-linearities in the deviation from linear phase will effectively move the transducers forward or backwards as a function of frequency.

Inter-channel Phase Difference. This is not applicable here, as we are only using one of the outputs per input. In the process of "time-aligning" this system, we, hopefully, will correct for any differences between units by fine tuning the selected delay times. In any event, these differences will not be apparent to us.

Square Wave Response. This will be apparent in the listening. As you get higher in frequency with square waves in digital devices, the output start looking more and more sine like. Listening tests to determine the applicability of the "sound" of any digital unit is imperative. Remember, the end user here is not a computer-based measurement system. The end users here are



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Automated Testing

By John P. Lawson

I was approached by the author of the accompanying article about testing of the delay units for Part two this article. In the interests of efficiency and repeatability, an automated test procedure was contemplated for the delay unit survey project. So we reluctantly set aside our trusty graph paper and contemplated the gospel according to Audio Precision. (Let it be said here that without the concerned cooperation of the folks in Beaverton, especially Ms. Debra Brimacombe, we would never have been able to produce this test series as easily as was done. Thank you all.)

John P. Lawson is the Chief Engineer at MGM, Santa Monica, California.

It was felt that the test series should be designed on a production-like basis, to reduce operator induced variables to as few as possible. Therefore, the system procedure is scripted to prompt the tester for the proper cable hookup and initial level setting. Since we postulated a semi-intelligent operator (Mr. Shaw or myself), leveling and unity gain setting is done visually via the Bar-Graph display facility of the System One. Once unity gain is set, the Procedure accomplishes the test series sequentially, producing and saving the relevant data as graphs for later printout. (The procedure follows the objective measures in the main article.)

Operator intervention is then limited to a cable swap or two and resetting of the device's front panel controls, as prompted by the procedure. The script for this Procedure is available as a listing or diskette file for those interested in performing similar testing or unit evaluation. The script may then be modified to suit local requirements. Future revisions might include tabular data output for further processing, or modification to incorporate the Audio Precision Switcher module options (to facilitate multiple unit testing and auto channel switching).

Other modifications might use the digital output port of the Audio Precision DCX module to automatically program units that have digital interface facilities. Carefully designed automated tests of this kind can go a long way toward providing a fair and balanced look, despite the jungle of marketing-driven "specsmanship" occasionally encountered in today's commercial audio field. ■

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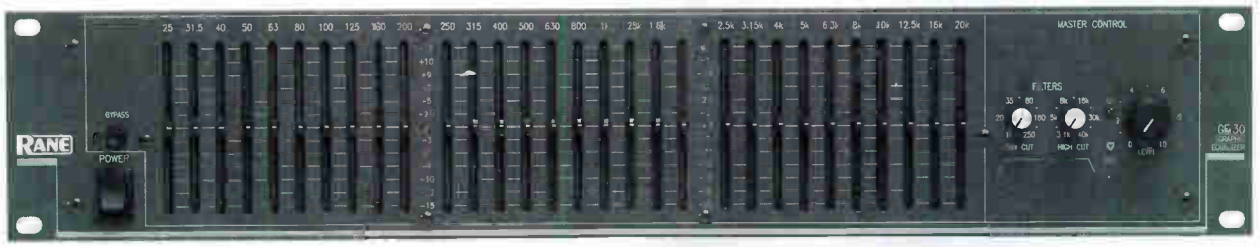

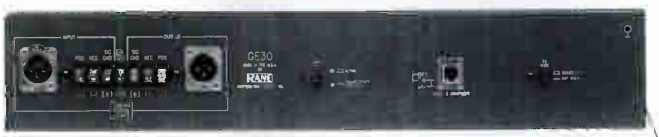

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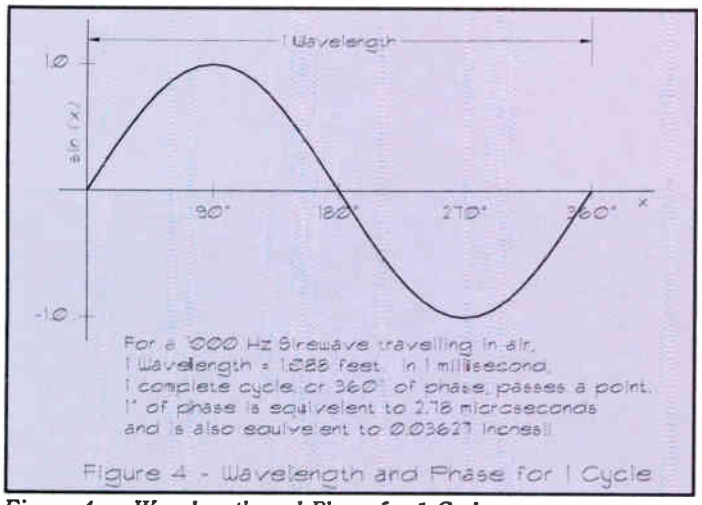

Figure 4 — Wavelength and Phase for 1 Cycle.

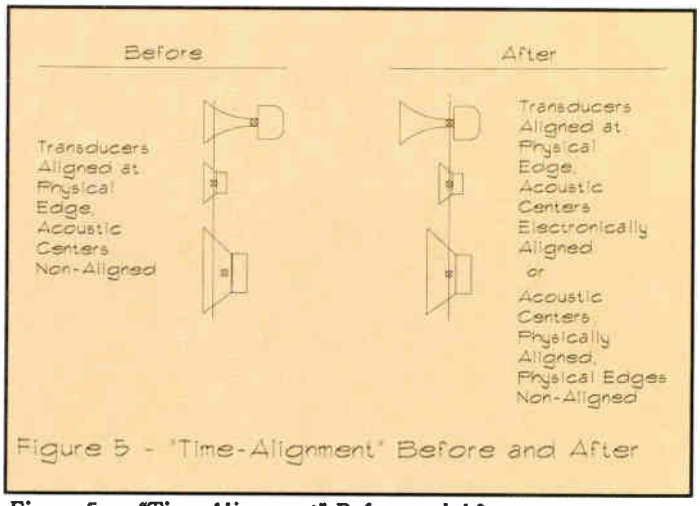

Figure 5 — "Time-Alignment" Before and After.

human! Note that this test is used to quickly determine the transient response characteristics of the signal delay unit.

Minimum Transit Time. Depending on the required time offsets for the "time-alignment" of the loudspeaker system, we may or may not need to put the reference, or "no delay," signal through a signal delay unit. For example, if we have offsets of 270 microseconds and 540 microseconds, and the minimum transit time is greater than 270 microseconds, we will need to put the "no delay" signal through a signal delay unit set for zero time.

Finally, we see that we need at least three independent signal delay input paths. Why? Each output of the active crossover is different from the others, and each needs its own amount of offset (one of the offset is zero). If we can afford it, we could take a second output from the low frequency signal delay unit and route it to its own amplifier so that each low frequency unit can have its own time offset. In this example, first preference for use would be given to the BSS 804 unit based upon its frequency response, FRO to residual noise performance, and distortion performance. Following closely would be the T.C. Electronic unit which, due to the pre-emphasis used, may cause distortion at high frequencies at high levels, but its distortion from linear phase performance is better than that of the BSS. Either of these units have a minimum delay step size that would allow alignment to within about one-eighth of an inch.

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CAVEATS AND GOODBYE

In the limited space available in the three parts of this article, the ideal performance of digital delay units was reviewed, actual performance measurements from eight signal delay units were presented, and two examples of the three main ways in how one designer uses signal delay units were reviewed. The main thrust of these articles was to show how a designer uses a standardized testing procedure to evaluate signal delay units, with consideration of the theoretical limitations imposed upon any "ideal" unit, and then how these performance measurements are used in the selection process for a signal delay unit for use in a system.

In Part one of this article, I said I would discuss three ways I use signal delay units. Well, in a forthcoming article (Part 3a), I will cover the last use described in Part one, and discuss one more. ■

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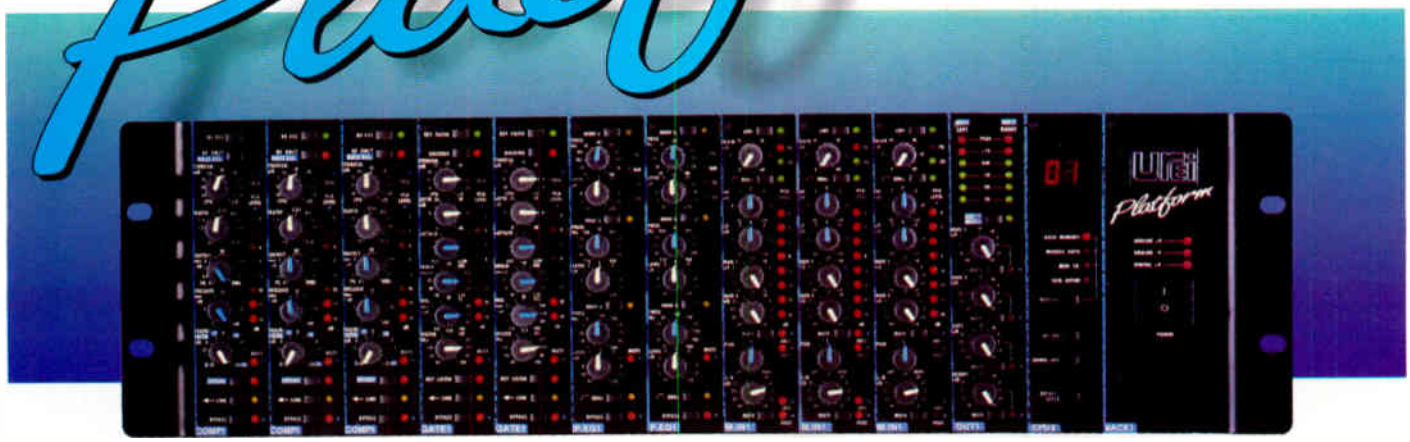

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Ruffner Middle School

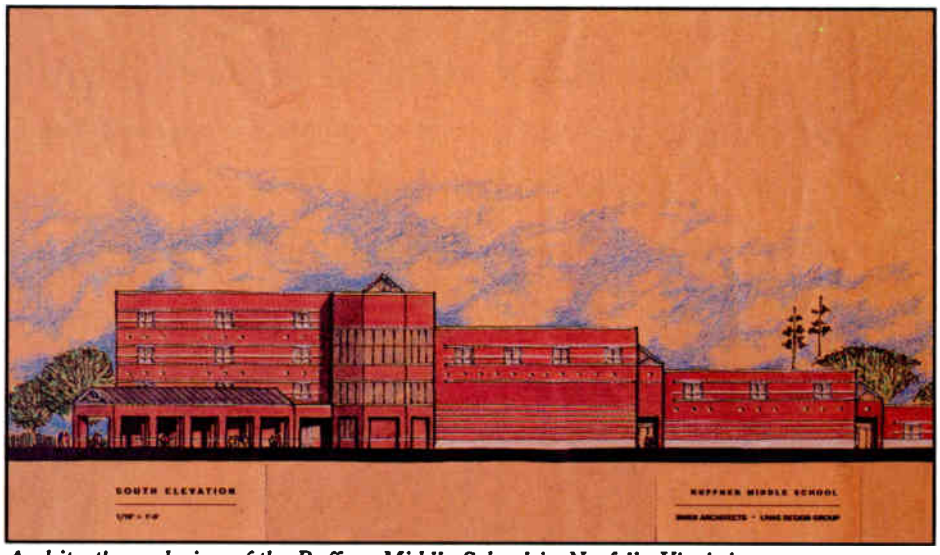
Media for the 21st Century

BY MARK MILLER

Ambassador Enterprises had a busy summer at Norfolk, Virginia's Ruffner Middle School, breaking boundaries in the education market by installing the Rauland-Borg Ranger Media Management System. "The technology in this school is the whole experience," says Jerald R. Vaughn, President of Ambassador, based in Portsmouth, Virginia. The firm was brought in on the project a year and a half before construction began this past spring.

"What I love about the education market in audio is that it is driven by the educators," says Vaughn, "not contractors or consultants. We sat down with the school board, and they said 'We want our school to do this, what do we have to do to get there?' That makes educators fun to work with; they create new challenges for the market." The challenge of the Norfolk Public School Board was met by Ambassador largely by implementing the Ranger System. The system links different forms of media together and makes them all accessible in an educational setting.

The standard audio-video equipment of a middle school usually spends its time on a rolling cart, going from room to room. At Ruffner, it all stays in a central Media Center and is all accessed through a computer network. This centralized media is linked to a personal computer, Windows-based media management software, and specialized hardware to provide control of media sources and destinations. At Ruffner, the system allows for remote operation by multiple users of media devices. Teachers can use up to 10 VCRs, six Laser Disc players, four still video player/recorders as well as two agile and five fixed modulators for cable TV, as well as one agile and one fixed satellite dish to teach any topic in their classroom.



Architect's rendering of the Ruffner Middle School in Norfolk, Virginia.

Educators lay out a lesson plan and then research what types of media are available dealing with the subject matter (using the network's database and searching for author, subject matter, applicable age group, keywords, title or media type). The database is continually expanded as new resources are purchased by the school district.

Teachers can automatically schedule the media source and courseware

Mark Miller is a freelance writer based in New York City.

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All switching is controlled by a digital microprocessor with proprietary algorithms for instant, seamless operation, far superior to older analog designs. By using digital control the AT-MX341 SmartMixer also offers TTL logic output control signals that can be used to turn speakers on or off, control cameras, light tally lights, or whatever else is needed. And it can easily interface with the Audio-Technica DT100 Teleconferencing System as well. Because the logic is in a socketed EPROM, a new IC from A-T can quickly revise or update the programming at any time.

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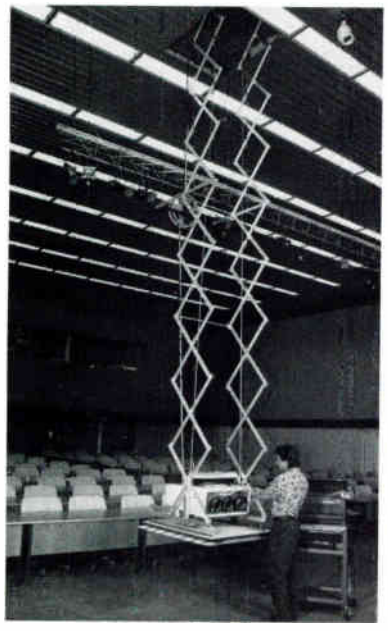

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DAVE ONEY

Education Technology Specialist Wade Mathias at the classroom wall panel.

through E-Mail or Voice Mail. The information about the availability of the requested resource is immediately printed out. If the information is available, the system schedules it for the proper day and time.

"A teacher can run as many of these media as he or she wants as long as there's no overlapping with other classrooms for the same media source," says Vaughn. There are 40 different media sources in the center and 60 different classes running.

A separate part of the program allows teachers to place their multimedia lesson plans on the network and get feedback from other teachers.

Each classroom has been equipped with a control panel on the wall as well as a remote control unit to control the Ranger System from the classroom, allowing the teacher to switch from one media source to another on a 27-inch Mitsubishi monitor screen with the flick of the switch. The teacher can manipulate everything from volume to fast forward and rewind.

The user can also move from resource to resource, stopping and starting each device when appropriate. "You can have five different sources applicable to the subject matter loaded up and ready to go," says Vaughn. "The teacher knows that he or she has that available, and about as fast as a kid can think, with that remote control, the teacher can flip to another source and interact with the student.

"It's proven that through interactive media you can teach considerably better than you ever could before," Vaughn continues. "The retention rate is about 75 percent, as opposed to about 20 percent, and educators know that. That is the reason for the explosion of technology in education."

During daily usage, in the Media Center, a steady stream of media is placed in the arsenal of machines and a record of how the system is being used is printed out. These statistics, including teacher usage, courseware usage and media device usage, can help the school in the management and growth of their electronic media program. The statistics can help in the development of maintenance and personnel strategies.

"The center is made up of mainly school staff," says Vaughn, "but there will be some student once the scheduling takes place. Everything comes up on a screen showing what machine is next, what needs to be loaded; students will help with that."

In addition to the 65 classrooms equipped for the system, there are 46 areas (including offices, the gymnasium, etc.) that do not have permanent

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The Rauland-Borg Ranger headend as operated by Betty Wright, Ruffner's media distribution system operator.

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A custom "teacher's panel" for accessing the data network and the Ranger system (fabricated by RCI).

monitors and wall panels. For these areas Ambassador has designed and installed a wall jack plate with a circular plastic connector to accommodate one of three "roll-up" Ranger carts, each containing a monitor and a control panel.

Ambassador also wired each classroom for a Macintosh and a Compaq computer. These computers can also use the telephones from the Rauland Telecaster V intercom system with a modem in each room. The firm also wired the school's four computer labs, made up of 40 Macintoshs, 30 Apple 2Gs, and 32 Compaqs. They are all on the network.

The 400-seat auditorium drew on Ambassador's 23-year history as a pro sound contractor. The sound system consists primarily of an all JBL central cluster, two JBL Control 12s for proscenium speakers, Crown amplifiers, and a Soundcraft Spirit 163 mixing console.

The system and the school district are completely geared for the future. "It allows for a lot of options," says Vaughn. "I don't know of anything in the horizon that can't be put on this system and run." Ambassador is currently preparing to bid on another middle school in the district, with plans to implement the Rauland-Borg Media Management System.

Some apprehension could be expected to such bold moves and so the district asked its teaching staff to reapply for their positions. There was about a 15 percent turnover, according to Vaughn. The new team worked with Wade Mathias, Ambassador's Education Technology Specialist for three weeks before the school year to learn the capabilities of the system.

"We've gone to great lengths to see that our teachers are well-prepared and trained to take advantage of the system in the school," says Dr. J. Frank Sellew, Acting Superintendent of Norfolk Public Schools. "That program will put the school on the cutting edge and take us into the 21st Century." ■

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Residential Reappropriation

Turning a $2,400 Mistake into a $24,000 Miracle Home Theater

BY WILLIAM A. KANNER

"This is really a story about how I turned a $2,400 mistake into a miracle — and I did it by only adding another $24,000," said David Duncan. "I had wanted a large screen TV or video projection system for years and bought a Mitsubishi 35-inch model. I was thrilled. A few days later, my wife and I went out for dinner and, at an appropriately romantic interlude," Duncan said, grinning, "she told me that she was miserable with the 'monstrosity' in the space we had allocated. Being a considerate husband — and one who has been married to the same woman for more than a few years — I knew when I was licked.

"'Then, we'll just have to get rid of it,' I replied."

The home theater in its finished state looking toward the monitor.

SOLVING THE PROBLEM — AND SAVING THE MARRIAGE

Duncan's solution was to move the large screen TV downstairs to a basement room he had used as a home office. There it sat — on sawhorses — for about a week until he decided to make a few phone calls to discover if he could turn this cozy, 12.5-foot x 14.5-foot space into the home theater he really wanted.

Enter Vincent Piazza, president of Designed Media Systems. Piazza considered the size of the room a challenge, grinned, and started talking to Duncan about the theater, what it would include, how it would be used, and how it would integrate with the other music and video systems in the house.

Duncan was a music lover. He had a major audio system upstairs with the equipment located in a solarium off the living room, where the only sign of its existence was the pair of KEF speakers flanking the grand piano. While movies would, of course, be a major attraction in the home theater, Duncan knew that concert videos and operas were also of prime importance.

To Piazza, this meant that the theater's audio system had to be more than a sonic adjunct to the screen. It had to be true high fidelity and it had to be versatile.

As Piazza walked through the house with the homeowner, facets of the system became clearer. "Dave Duncan was an ideal client," Piazza says. "He is hands-on, with a real love for the equipment. As we talked and bounced ideas back and forth, his needs crystallized and the system took shape."

Unlike many homeowners, Duncan felt no need for the system to extend to the bedrooms and was initially unsure of whether he really wanted any-

William A. Kanner is vice president of Daniel S. Roher Inc., a public relations agency in New York City.

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Exterior of the house.

thing more than the home theater system and a way to relate the upstairs system to the downstairs. However, as he and Piazza talked, the system expanded. "Dave had created a small music system in the kitchen for his wife," Piazza says. "He had taken an unused car head unit, built a small wood cabinet for it and mounted it under a kitchen cabinet. The car stereo's speakers became kitchen speakers and a small transformer power supply operated the system. It was clever and adequate to his wife's needs," says Piazza. It would stay.

"But we also decided to add a set of in-wall speakers in the kitchen's eating area," Piazza says. A switch would allow the Duncans to access either the main upstairs audio system or the system in the home theater. The kitchen car audio speakers were also put on a switch for selectable access.

"We added a Yamaha DSP-E1000 five-channel amp/surround sound processor to the M-85 stereo amp in the upstairs equipment stack, and a pair of rear speakers to the living room, giving it a more concert hall ambience. And downstairs we added a pair of speakers in a playroom to provide additional audio options," Piazza says. A Yamaha MCX-10 Master Zone control module was also added to the main equipment stack so that zones and systems could be easily switched.

All home theater electronic components are mounted on sliders.

DESIGNING THE THEATER

Duncan was not prepared to simply start from scratch; he wanted to mix-and-match and recycle as much of his upstairs system as was practical for the home theater. "Luckily, a lot of his equipment could be either retained or re-used in a different location, so in addition to the Mitsubishi TV, we could bring down his Yamaha CDV-1100 combi laser disc player, YV-1000 VCR, K-1020 cassette deck, and T-85 AM/FM tuner," Piazza says.

A switch would allow the Duncans to access either the main upstairs audio system or the system in the home theater.

Piazza also concluded that with the small size of the room and the client's interest in movies *and* music, Yamaha's DSP-A1000 Digital Sound Field Processor Amplifier was the key electronic component for the theater.

The DSP-A1000 is a 7-channel DSP amplifier capable of delivering realistic movie theater sound in a small space and also able, through its digital sound field settings, to "expand" and shape the space to meet the client's music listening taste. Since Duncan was clearly committed to Yamaha components, had heard the DSP-A1000 and liked it, and since it matched his existing equipment — that became an easy sale.

The next problem Piazza had to look at was the room itself and how the equipment would attractively fit in. The room decor reflected a 1950s look, with thick knotty-pine paneling which the Duncans wanted to keep. In one corner a built-in bookcase could be reconfigured to form an equipment cabinet, and a panelled 2-inch x 4-inch wall separated the home office from the furnace, utility, and laundry behind it.

Other architectural features of the room included duct work around the perimeter of the acoustical paneled ceiling and a long unused, but attractive, fireplace on one side wall. In addition, there was a closet containing shelves and plumbing built out from one corner of the room. The Duncans had to maintain the closet for the plumbing, and were prepared — read

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eager — to change the ceiling, but wanted the fireplace to remain.

To make all of this work, Duncan brought in Ivan Siff of New York's Siff & Kennedy Cabinetmakers. There were now three skilled heads working on the project: Duncan, Piazza, and Siff. Once the parameters of the client's needs were established, Siff and Piazza coordinated and presented Duncan with a detailed plan of what the system would look like and how it would operate.

Piazza and Siff decided to reorient the room and put the TV monitor and the front and center speakers in the "false" wall separating the utility area from the room. They could set the monitor and the main left and right speakers into and through the wall, and thus apparently increase room size. They also decided to build hinged rear boxes for the monitor and the speakers which would provide easy access to the equipment and at the same time protect the gear from any dust produced by the furnace.

The monitor, the centerpiece of the room, needed to be flanked by two large speakers and at eye level when seated on the couch or in the easy chair which would be across from it. In addition, a center channel speaker and subwoofer needed to be either attractively situated or camouflaged.

In order to adequately house the equipment, retain the fireplace, and design an attractive room, Siff hit upon the idea of an asymmetrical, teardrop shaped pedestal for the monitor and two large Yamaha NS-A1035 speakers. The shape was dictated by the need to maintain access to the fireplace and insure that neither the base, nor the equipment it contained, received too much heat from the fire.

The shape was dictated by the need to maintain access to the fireplace and insure that neither the base, nor the equipment it contained, received too much heat from the fire.

Siff designed a black pedestal base into which he built two drawers devised specifically for videocassettes and video discs. While the drawers appeared identical from the outside, in reality the cassette drawer was two-tiered and the disc drawer's rear panel was angled so that the discs could be easily sorted through. The Yamaha YST-SW100 subwoofer was concealed in the narrow part of the teardrop, to

"Your best bet is the Jumbo Mount from Peerless," he told me.

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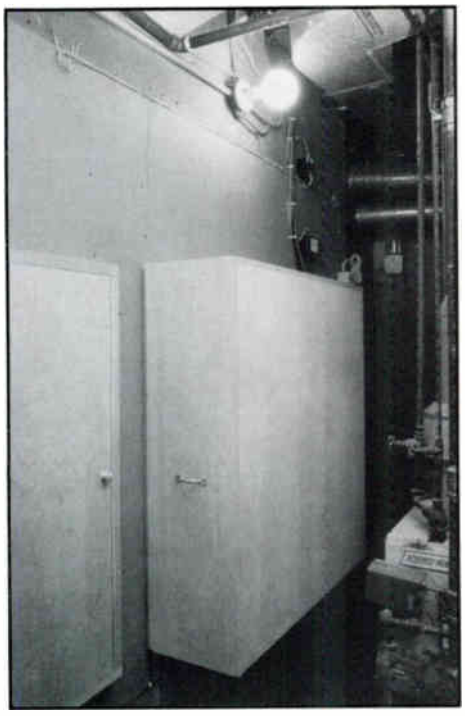

Enclosures were built to protect the monitor from dust and the speakers from the furnace and other possible dirt; and provide quick access for adjustment, removal and repair.

the left of the two drawers which occupied the right side. The pedestal was topped in black marble.

Above this base, Siff built a second tier pedestal to house Yamaha's NS-C110 center channel speaker which Piazza angled up. Above the entire construction, the Mitsubishi 35, formerly on sawhorses, now sat elegantly.

In order to take full advantage of Yamaha's "70mm Cinema DSP," Piazza positioned on-wall NS-A102 effects speakers above and slightly behind the plane of the two main tower speakers. To complete the effects channel quadrilateral, Piazza mounted a matching set of NS-A102 effects speakers on the opposing wall, above and behind the couch.

Siff used the closet area, which now had the couch sitting next to it, to house the control component stack of equipment. The half-door which had swung open above the desk when the room was an office, was replaced with a matching knotty pine full-door to provide easy access to the rear of all components. Siff then built sliding shelves in the closet for the components, so they could be easily operated by someone sitting on the couch.

At the same time that Piazza and Siff were working out the details of the home theater, the Duncans were making final decisions on the redecoration of the room itself. The dropped plastic-panel ceiling was replaced with finished sheetrock and recessed lights. The carpet was ripped up and replaced, along with the couch. And a new easy chair and coffee table were purchased to complete the room.

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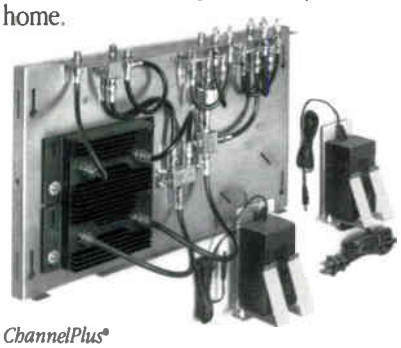

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Coaxial Cable Panel delivers excellent picture quality to up to 8 TVs, features all needed components to amplify and balance signals, minimizes installation work.

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The breakfast eating area with Yamaha in-wall speakers placed in ceiling (upper right) and Yamaha control sensor (left side of pass through).

THE CHALLENGE MET

The combination of three creative minds and the infusion of cash had not only turned a mistake into a miracle home theater, but had also added to the enjoyment of music and movies throughout the house for the whole family.

Duncan and, as importantly, his wife were thrilled. An ugly duckling of a functional but not overly attractive home office had magically been transformed into an intimate, highly personal, and versatile home theater. According to Piazza, the challenge had been met on all fronts. "We were able to take a room with severe acoustic limitations and create a sonic environment that at the touch of a few buttons gives incredible presence and reality to music, movies, and sports events." ■

Yamaha in-wall speakers were also installed in the playroom.

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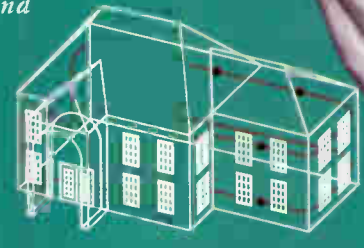

A single SmartBus™ cable distributes audio, telephone, and control data to every room. Simply plug-in and daisy chain to each hidden room controller.

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MULTIPLE FORMATS — IS THERE SOMETHING HERE FOR COMMERCIAL SOUND INSTALLATIONS?

By Mike Klasco

One development in consumer electronics that can be seen in all the magazines and trade shows is "multimedia" and "enhanced CDs." How all this new technology will be useful in commercial sound remains to be seen. There are over five new CD formats, most of which will not work with each other nor deliver their expanded capabilities with existing CD players.

JVC has a CD system that adds full motion video to the sound; just add TV monitors. JVC is pushing this format for Karaoke installations. Another Karaoke format is CD+G, which is being offered as an option from Denon on the latest version of their DN2000F *dual* CD player used in many dance clubs. CD+G is an unofficial standard for Karaoke, with products available from Nikkodo and quite a few others. CD+G stands for CD + Graphics, but much of the time, only text to the words of the music are encoded on the CD, with the video image being some sort of visuals provided by a video tape recorder. Kodak's PhotoCD allows photos to be recorded on a CD and played back on a video monitor like a slide show. CD-R machines record audio on special CDs that can be played back on any CD player. CD-I is Philip's interactive system for both electronic games and education. And Sony's new MiniDisc uses 2.5-inch discs that are immune to jarring and can record. All of these different systems can be useful for entertainment systems for clubs, theme parks, museums, board rooms, audio visual systems, and the like. This month we will take a quick look at each of these new formats.

Mike Klasco is the Technical Editor of Sound & Communications magazine.

CD + G

CD + G has been around for years, but has the greatest acceptance with Karaoke systems. As we mentioned, the G stands for graphics, as the original intention was for still photos of the recording artists to be played back during the playing of the CD (still-motion MTV). But instead, CD+G is used with Karaoke players and many CD+G discs are available, in every imaginable language. As the music plays, the words are displayed on a TV screen, with the words to be sung highlighted, sort of like the Tele-Prompter used on TV news. Some other video source, along with a video mixer/switcher is needed for the background visuals.

PHOTO CD

Eastman Kodak first introduced PhotoCD almost three years ago, expecting everyone to immediately take all their photos and rush to their photo store to transfer the pictures to disc. To Kodak's surprise, the average consumer did not want to have to buy a special CD player and go to their television when they wanted to look at their pictures. Originally, the special PhotoCD players were pricey, but Kodak cut the cost almost 30 percent this year, so retail starts at about $350. A fancier model is also offered, along with a CD changer version, and at the Summer CES, Kodak introduced a portable PhotoCD player for $450. Since the PhotoCD player also functions as a normal CD player, the pricing is very reasonable. For DJs and clubs, the Kodak PhotoCD is an excellent way to replace slide projectors and provide still images on video monitors. All the models have a wireless remote control, but none are rack mount (Middle Atlantic offers rack adaptor kits that will fit the Kodak players). The cost of processing each photo onto the disc is only a buck or two, and 100 photos can fit on each disc. Using the five-disc changer, 500 photos can be run automatically, repeating when

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the cycle is over. This ought to be infinitely more reliable than slide projectors.

Catering halls can offer a service where the theme of the event (sweet 16, wedding, or other celebration) can be highlighted by a still video montage. Museums, theme parks, world fair presentations, and other audio/visual exhibits also will find PhotoCD useful. If the facility has a projection TV, these presentations can be dramatic, as the PhotoCD has very high resolution, including S-Video (S-VHS) outputs. For Karaoke clubs, PhotoCD can provide custom images for the visuals to go with the words to the songs provided by CD+G. PhotoCD, aside from providing audio from conventional CDs, and photos from PhotoCDs, will soon be able to provide some sort of audio in conjunction with the still visuals, but Kodak is not clear on the quality or time of this yet to be delivered feature. I suspect the sound quality, when the PhotoCD is also displaying still video, will be narration quality. Alternatively, Kodak is promising to provide the capability of adding text and graphics to photo CD discs, and this may be very useful for club and karaoke applications.

KODAK IS PROMISING TO PROVIDE THE CAPABILITY OF ADDING TEXT AND GRAPHICS TO PHOTO CD DISCS.

Until recently, Kodak was the only outfit pushing the PhotoCD format, but Technology Integrated Products of Santa Clara, California has announced three multimedia packages that provide PhotoCD capabilities. All three kits allow users to input and manipulate still visuals, but instead of using Kodak's CD player, a CD-ROM (XA type) computer drive is used with a plug-in sound card in a personal computer. Aside from working with the Kodak CD players, and CD-ROM (XA) multimedia drives with computers, the PhotoCD discs will also work with the Philips CD-I system.

MINI DISC

Of all the new disc formats, MiniDisc is the only type that does not physically fit into a conventional CD player. Actually, MiniDisc includes

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two entirely different types of discs that work with the same player. One disc is almost identical to the conventional CD, except that it is the MiniDisc size of 2.5-inch diameter (half of the 5-inch CD). This disc only plays back, with about the same time capacity of a regular CD. The second type of MiniDisc is unique in that it can be recorded on, using the MiniDisc recorder. Blanks are offered in 60 minute and 72 minute lengths. Although MiniDisc machines are available both as playback only and record/playback models, most users we know will want the record capability. Prerecorded MiniDiscs are hard to find and very few titles are available, at least for now. Unlike regular CD recorders (CD-R) which cost over $5,000, a MiniDisc record/playback unit costs about $700. But, like CD-R recorders, blank discs are expensive, over $15. Sanyo and Sony have shown home record/playback MiniDisc decks, but right now only Discman style portables and auto sound models are available, with Kenwood promising a compact home deck soon.

At the National Association of Broadcasters show this year, Sony displayed a broadcast cart machine style MiniDisc product that looks interesting for club and commercial sound use. And as the recording medium for Digital Audio Workstations (instead of a hard disc, but in conjunction with software and a personal computer), this ought to be a real hit for home studios. We will take a closer look when it becomes available.

OF COURSE, THE QUALITY OF THE SOUND BOARDS VARY, WITH SOME SYSTEMS OFFERING ONLY 8 BIT AUDIO.

MULTIMEDIA

The baloney factor is running high in Multimedia, but when you have a system that includes a CD-ROM player that can play regular and special CDs, a computer plug-in card that samples music, synthesizes music, and interfaces with MIDI (a control system for audio and musical instruments), interfaces with personal computer software, and plays back both still and full motion video from the CD-ROM player on computer monitors, something hot ought to be able to be cooked up from all this, sooner or later! A whole crop of multimedia PCs are hitting the stores now, with built-in CD-ROM drives and sound card plug-in boards. Of course, the quality of the Sound boards vary, with some systems offer-

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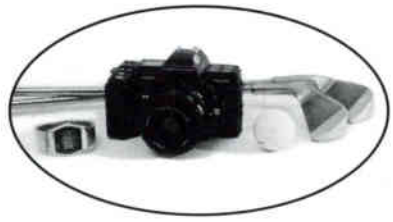

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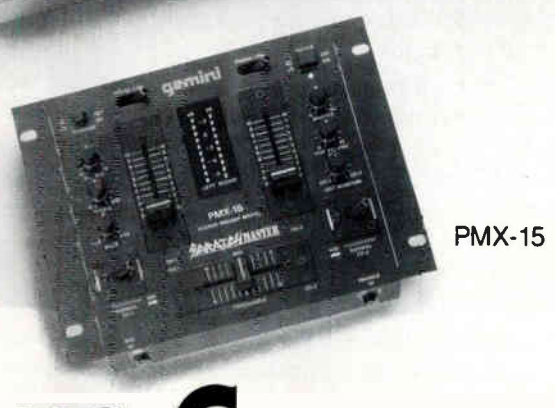
GEMINI MIXERS

#1



WITH THE WORKING CLASS.

Let's face it, this business isn't about sitting at home.

It's about working—getting gigs, being out there where you can be seen, heard...and hired.

That's why the smart DJ who wants to stay in the "working class" relies on Gemini mixers.

Ranging from 10" rack-mountables like the PMX-15 ScratchMaster, to 19" rack models like the PMX-3500, our mixers are designed to deliver the performance and flexibility today's jocks need to keep the gigs coming.

Whether it's our new PDM-7008 with 8 second digital sampling and four 2-second memory banks, or our PMX-3500 with sound effects and echo (both with 2 phono and 5 line inputs), you can rest assured that our mixers have what it takes to keep you busy. Of course, if you want to go outboard with out going overboard budget-wise, check out the DS-8, our new 8 second digital sampler, compatible with any mixer.

Our mixers are also designed to deliver. Case in point, our mixers have in-demand features like rack mountability, 1/4" and XLR mic inputs, assignable and removable crossfaders, DJ booth output, auto mute talkover, cueing, XLR lamp adapter and more.

Which should come as no surprise when you consider they're by Gemini—the leader in affordable, high performance DJ and sound equipment.

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ing only 8 bit audio (less than 50 dB S/N!) while other systems are 16 bit (90+ dB).

There are going to be hum, buzz, and grounding problems when interfacing computers and plug-in sound cards to high quality sound systems. Expect to face these problems when you begin to be use multimedia computers in your jobs.

One interesting combination is PC Karaoke, the first multimedia karaoke software. Both the music and full motion video can be seen on the CD-ROM discs which are provided, along with a mic. PC Karaoke is available from Sirius Publishing of Scottsdale, Arizona.

Not all CD-ROM drives are the same format, especially in the video game and interactive video markets. One outfit that has made a lot of noise is 3DO, which has backing from Panasonic (Technics) and other companies, but for all the hype, they have not shipped any product yet. Sega's CD-ROM for their popular Genesis game does not work with other systems either.

Philips introduced CD-I a few years ago as an interactive (video still-motion) CD medium for education and games. Philips' CD-I is also sold in Radio Shack Stores as the Tandy "VIS" system, but with limited success, perhaps due to lack of software and the overall confusion of so many standards. The other partners in CD-I, Sony and Panasonic, appear to have backed off (especially with Panasonic who has already put their weight behind 3D0). On the positive side, Gold Star has begun to ship a CD-I player and the CD-I format can be used with Kodak's PhotoCD discs.

PHILIPS HAS PROMISED A "FULL MOTION VIDEO" ADAPTOR FOR $250, WITH INTRODUCTION LATER THIS YEAR.

Philips has promised a "full motion video" adaptor for $250, with introduction later this year. The software will include music videos as well as feature films. Since Philips owns Polygram, there will be popular software available for CD-I.

To further establish CD-I, and of special interest to clubs, is that some of the music videos will be interactive and the DJ will be able to manipulate and recompose the songs (Video Remix!!). The first to try this is Todd Rundgren with No World Order.

In the coming months we will begin hands-on testing and club field testing of CD-I, Photo-CD and CD+G products. ■

Double Speed Technology is Coming

Almost every type of CD category is starting to take advantage of double speed CD mechanisms. No, this does not mean that the music plays twice as fast, and the various CD formats obtain different benefits from double speed operation. To confuse the issue, I will just mention that none of the CD formats actually run at a constant speed, rather, as the laser tracks the signal (from the inside of the disc outward), the amount of data per rotation changes because the diameter of the data track is increasing on its outward path. A servo system monitors that data rate and controls the speed. With "double speed," this data rate is doubled. In the case of MiniDiscs, the double of data is taken advantage of by redundancy, while CD-ROM uses the higher data transfer rate for faster screen image updating. Let's take a closer look.

The MiniDisc, a new 2.5-inch CD that does not work with conventional CD players, works at double speed to provide shock memory. The laser (which has the function of the phonograph cartridge in turntables) reads the audio signal from the double speed CD in half the time needed to play the music. This signal is first placed in the MiniDisc's computer buffer memory, which stores about four seconds of music, which is constantly being read out at normal speed. If the player is bumped and the laser skips, the memory continues to feed the sound system, while the laser assembly frantically moves to get back to the location where it was dislodged. Since the memory is longer than the track access time of the player, if all goes well, no one will know the MiniDisc was jarred. Of course, if whatever caused the skip continues to shake the player, this scheme won't work — it only covers for occasional bounces with some recovery time in between.

Essentially an identical arrangement is offered in Sanyo, Fisher, and Sony portable Discman players. Overall, this is a neat idea, but no alterative for a decent vibration isolation suspension in a pro CD player.

CD-ROM drives also are moving to double speed; in fact, almost all of the new drives offer this. But with CD-ROM, the purpose is to achieve animation and full motion video effects for use with computers, not shock memory. By doubling the speed of the CD-ROM drive, the data rate that can be read from the CD is increased, and this allows motion video, although the results that I have seen are not smooth — but good enough for interactive video games.

Well, I am afraid that I have not made everything clear, but that is because everything is not clear in this market yet. On an ongoing basis, we will get hold of all these products and see what might works for commercial installations. Stay tuned. ■

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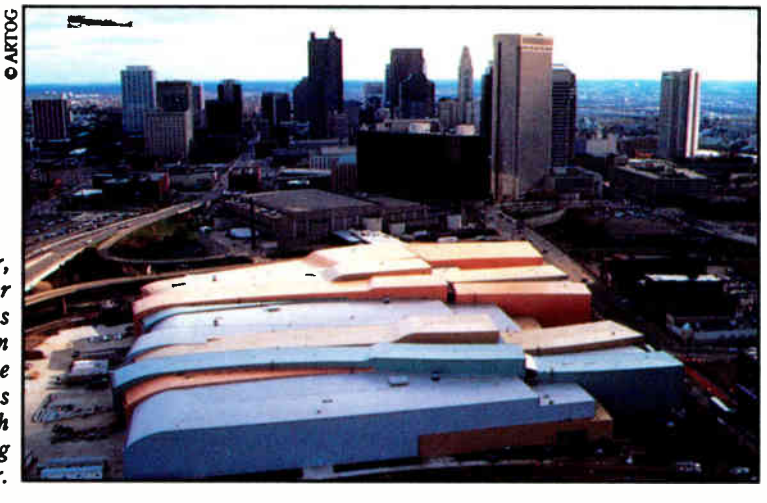
The Greater Columbus Convention Center

Upgrading the Sound and Connecting the Buildings

BY JESSE WALSH

Visually, from the front, the new addition of the Greater Columbus Convention Center is best described as "out of this world." Its unique bright orange and pastel blue exterior is a combination of blocky shapes and odd angles with almost a surreal appearance. From the air, the center looks like colorful sections of Play Dough overlapping each other. The building is truly an architectural marvel, and has already received worldwide acclaim for its design.



From the air, the Greater Columbus Convention Center looks like colorful sections of Play Dough overlapping each other.

Directly south of the festive addition lies the original building. Once known as the Ohio Center, it previously served as the city's primary facility for conventions, trade shows, concerts and sports. Built in 1979, the original center features 70 meeting rooms and Battell Hall, a 90,000 square-foot, split level arena with 60,000 feet on the main floor and 30,000 in the balcony.

Deciding that they required more room to attract major conventions, the center's management staged a contest among a number of architectural firms for the design of a new facility. Since the addition would exist between the metropolitan downtown area and the historic village known as the "Short North," the center's intentions were made clear that the facility should visually bridge the two styles. Strict time constraints for the prints and an early deadline on the ground breaking would also serve to make the project highly challenging, so local community supporter and *The Limited* CEO Les Wexner contributed $100,000 as an incentive for the winner. The Columbus firm of Trott and Eisenman came up with the design that best satisfied the center's intentions, and within three months construction had begun.

Completed in March, the addition features a 216,000 square-foot exhibition hall that can be divided in half to simultaneously host two separate shows. Also housed in the addition are a 25,000 square-foot ballroom and 54 small meeting rooms, some with removable partitions allowing for room expansion.

Since its first show this March, the Columbus Auto Dealers Association "A Vroom With a View" Auto Show, the facility has also held such conventions as the Inter-Governmental Technology Communications (IGTC) computer and phone line show and the International Industrial Fastener trade show, the world's largest fastener show.

The entire facility, including the

Jesse Walsh is the President of Jesse Walsh Communications in Buchanan, Michigan.

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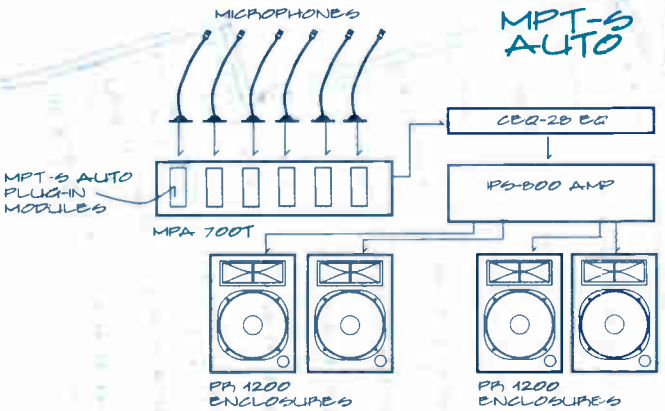

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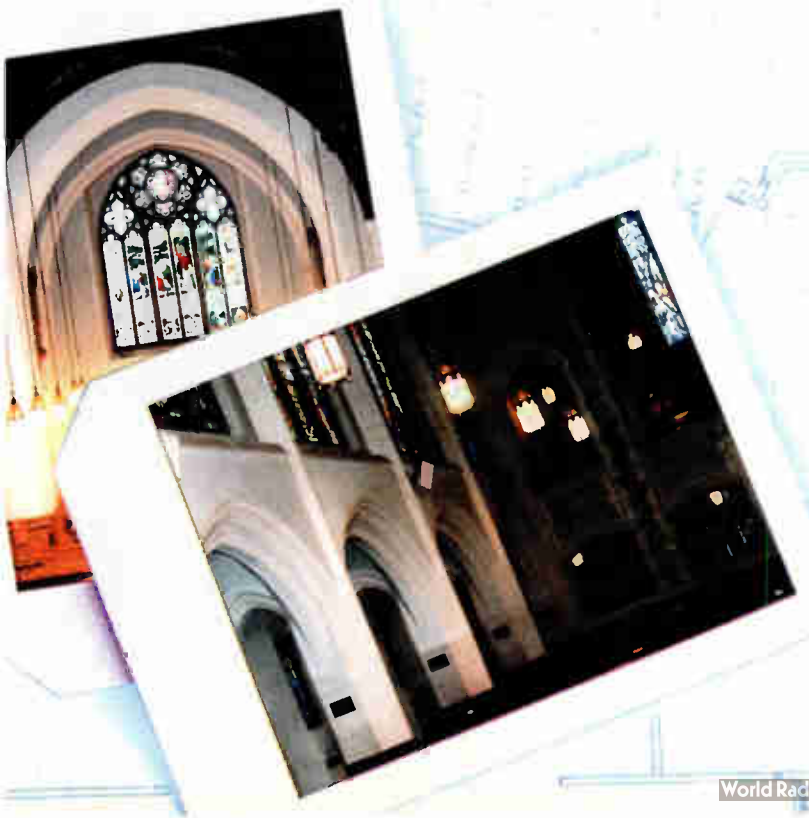

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North view of the concourse.

original Ohio Center, is now referred to as the Greater Columbus Convention Center. The buildings are attached through a second floor connector spanned over a set of railroad tracks that divide the two sections. Although Battell Hall is still occasionally used for trade shows, it is predominantly used as an arena for concerts and sports, including basketball, soccer and wrestling.

THE AUDIO DECISION

"When deciding on a sound system for the new exhibition hall, I had several specifications in mind," describes Phil Webb, manager of technical services for the Columbus Convention Center. "I wanted a major manufacturer with a good reputation and warranty, as well as to find equipment that would be highly compatible with the exhibition hall's environment. Often times things look great by themselves on paper, but when you put it together, it doesn't always work.

"The Ohio Center was somewhat of a learning experience for us. We found things that worked and things that didn't. Therefore, this time I also had some very specific requests. I felt there should be at least 110 dB available in the ballroom and exhibition hall. I had particular frequency levels I wanted to achieve, as well as the fact that I required a distributed system instead of a central horn cluster. I additionally felt that all of the audio lines should be run to a central recording room. We really required a very flexible system because there would be such a diversity of events held here."

Before any construction had begun, a number of local contractors and reps assisted Lorenz and Williams, consulting engineers of Dayton, in preparing a specification list which met the center's requirements. After going out to bid, Industrial Communication Company (ICC) of Hilliard obtained the project through Romanoff Electric, the prime electrical contractor of whom ICC was a supplier. Craig Buchholz, branch manager at ICC, then submitted a proposal to change the equipment list to predominantly Altec Lansing product. Buchholz felt that standardizing the products throughout the facility would make the audio system's operation and service much easier. Webb agreed and the plan was accepted.

Today, both the ballroom and the exhibition hall have their own separate sound control rooms, while seven audio racks are individually located in service corridors behind each main grouping of meeting rooms. All the audio lines from each of these locations run to a central recording room in the heart of the building, home to the amplifiers and EQs for the background music system and paging equipment. These systems run through Altec microphone mixers to control areas such as the kitchen, loading dock, main concourse and the second floor walkway connecting the two buildings.

LOUDSPEAKERS

An impressive total of 547 Altec 920-8B 12 inch, two way, full range, Duplex loudspeakers with horn and compression driver are used in all areas of the building. Housed in four cubic foot Lowell enclosures with round, white baffles, the speakers were chosen for their high fidelity, excellent low frequency response and high power handling for all types of reinforcement, from paging to music. Sixty-two Altec 409-4T eight inch, Duplex ceiling loudspeakers with four watt, 70.7 volt transformers are also used in all of the building's restrooms.

AMPLIFIERS

Requiring only seven inches of rack space, a single Altec 2280B Incremental Power mainframe amplifier is housed in each of the meeting room equipment racks. The seven amps are equipped with 2271 78 watt power amp modules that provide 70.7 volt amplification for each meeting room, as well as with 2273 blank card modules.

Chosen because they provided high, broadband power with very low distortion, 81 Altec 9444B/SA and three 9446A dual channel, direct output power amplifiers are used in the ballroom and exhibition hall as well as with the background music system. Each 920-8B loudspeaker in the ballroom receives 200 watts, while receiving 150 watts in the exhibition hall.

Exhibition Hall sound racks. Conduits are for AC feeds for each rack.

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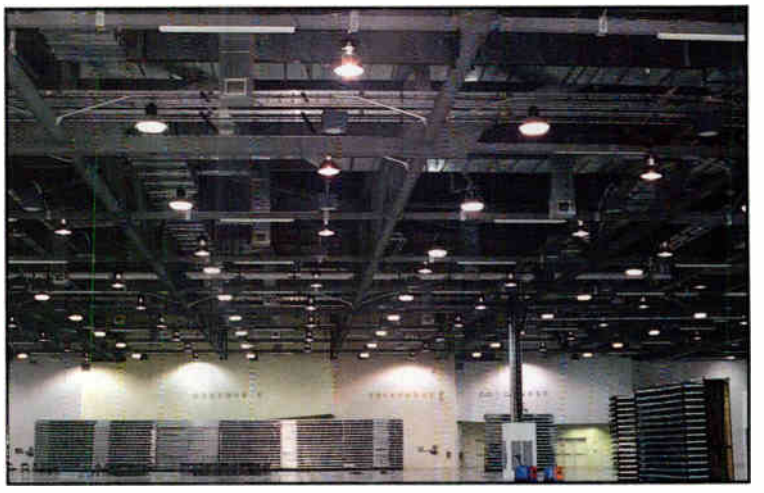

Partial view of the small exhibit hall. Note the speakers hanging between the lights.

MIXERS

A total of eight Altec Lansing 1700C mixer/power amplifiers are housed in the sound room of the exhibition hall and the central recording room. The 1700Cs' multiple outputs feed out to various concourses, connectors, cafeterias and restrooms around the building and control background music, paging, and emergency announcements. Extensive use was made of the programmable functions and outputs in setting up a hierarchy of what signals would override another.

Featuring Dan Dugan gain sharing circuitry, 48 Altec 1678C automatic microphone mixers are also employed throughout the new building. Operating without gates or thresholds, they prevent speech from becoming clipped off if it were to drop below a preset threshold. The automatic mixers are performing transparently through a number of FSR ML112 room combining systems.

ELECTRONICS

A switch closure accesses stored EQ settings for different room applications on 22 Altec 8553B dual channel, programmable, one-third octave equalizers and five Altec 8551B single channel equalizers. Used throughout each of the equipment racks, they are programmable only with a handheld programmer or laptop computer to prevent unauthorized adjustment of the center's set EQ levels.

To provide absolute, peak-stop limiting at maximum power, 80 Altec 14712A plug-in hard limiters were used on all of the amplifiers. In the exhibition hall, 61 Altec 15525A 600 watt, 70.7 volt transformers accompany each hard limiter, while seven

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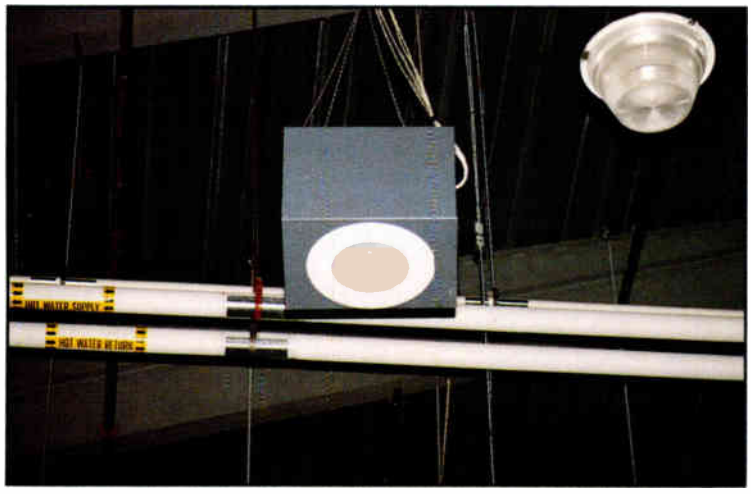


As seen in the loading dock: The Altec Lansing 920-8B in a four cubic foot back can. The back can is the Lowell DX 1612 and the baffle is Lowell's WB-12.

Altec 1712A compressor/limiters are also being used for compression on the overall mix in the ballroom and exhibition hall.

The ballroom also features a delay matrix custom built by Industrial Communication Company to control Audio Digital ADD-3 digital delays. This allows speaker delay zones to match microphone locations with the push of a button. A custom graphic panel and LEDs are all color coordinated, making the system very easy to use. Industrial Communication Company additionally designed the special A/C power distribution used throughout the facility.

REASONS FOR CHOICES

When asked why so much Altec equipment was used, Buchholz responded, "Because of the quality and durability of the product. Not only did it meet the needs of the project, it was very flexible, cost effective and yet provided the superior audio quality that a building of this magnitude requires. After the Altec equipment was installed, I went from room to room checking each of the various systems and spaces. Everything came up very consistent and predictable as to what we expected, and that's exactly what we were looking for."

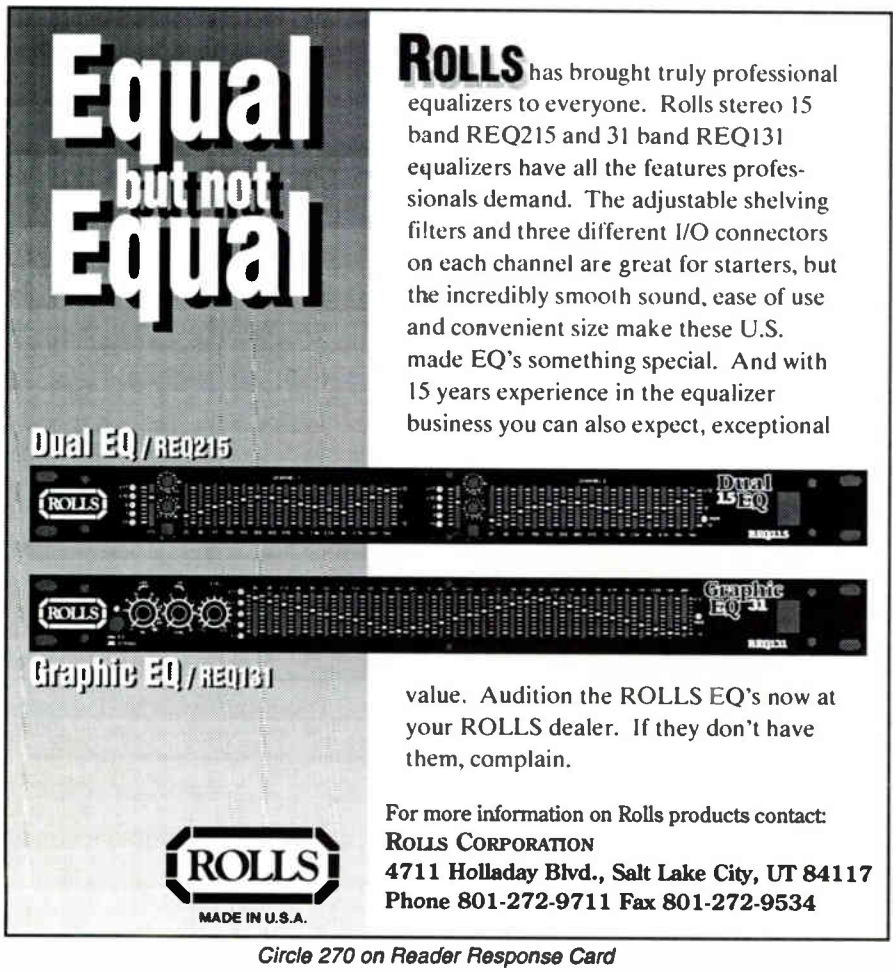
Webb had also had good previous experiences with the manufacturer. "I had rented Altec equipment in the past and always felt that they manufactured a very good product," he says. "I feel that it's also very reliable."

At one point during the decision on an audio system, another manufacturer's coaxial loudspeakers that the Ohio Center had previously used had been considered in place of the Altec 920-8B. Buchholz comments, "We performed a number of side-by-side demonstrations of each speaker's abilities, and in a blind A/B listening test, we chose the Altec speaker for its sonic quality. We showed the staff at the convention center the quality of the speaker's construction and several of its features, including the field replaceable, high frequency diaphragm (where the loudspeaker doesn't need to be removed from the enclosure to be changed), and they simply decided that this particular product offered several advantages to what they had been using before."

TROUBLESHOOTING

Because the exhibition hall is essentially a huge open room with concrete surfaces, the environment was somewhat "audio unfriendly." "The huge space above the speakers essentially created a giant bass bin," describes Webb. "We had a lot of bass to roll off in the 125 to 160 Hz region. There's a natural reverberation of 160 Hz for the whole room."

In addition to performing pink and white noise checks, we also shot off a starter pistol several times to check the acoustics of the room. The shots gave us a lot of information on reverberation and delay time. Our checks



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allowed us to develop several different EQs for the room, depending on the use. For example, a general trade show has so much carpeting, booths and people that most of the sound waves get absorbed. But when we get shows in there where most of the surfaces are concrete, the EQ settings have to be dramatically different. I tweaked the EQs over a few of our first functions to the point where they're fairly ideal. There are six settings at the moment that are built into the EQ that can be easily dialed up to handle anything from volleyball games and boxing arena situations to full-blown convention center setups. Three of the settings provide equalization for the full hall while the other three are for half hall applications, since the exhibition area can be divided in half to simultaneously run two separate shows."

Currently, in terms of audio, the two buildings function independently from one another. However, Webb has plans to incorporate tie lines between the two sides for the background music system later this year. Future goals also include a major upgrade of the original facility's system. "I've submitted it on this year's budget as something that's going to need to be done in the next five years," says Webb. "Although it already sounds ten times better with the upgrading we've performed so far, there are still some things I feel we need to work on and replace." He mentioned that Altec equipment would naturally be seriously considered.

CONCLUSIONS

Webb comments on the new sound system, "I've been really pleased with the whole setup. People at the center and who come to the shows, including outside sound companies and contractors, have all been quite impressed with the sound, especially in the ballroom and meeting rooms. ■

Equipment List from Altec Lansing:

48	1678C eight channel automatic microphone mixers
22	8553B dual, 1/3 octave programmable equalizers
5	8551B 1/3 octave programmable equalizers
7	2280B Incremental Power mainframe amplifiers
45	2271 78 watt power modules
12	2273 blank card modules
547	9208B 12 inch, Duplex ceiling loudspeakers
8	1700C mixer/power amplifiers
35	1781AT transformer balance input cards
35	1794 screw terminal input modules
9	1783 line output modules
9	1786 output isolation transformers
7	1712A compressor/limiters
80	14712A power limiters
61	15525A 70.7 volt output transformers
81	9444B/SA power amplifiers
3	9446A power amplifiers
62	4094T eight inch, Duplex ceiling loudspeakers

'PEOPLE HAVE SAID IT HAS IMPROVED THE SOUND 100%'

Recounting the incredible history of the Virgen De San Juan Del Valle Shrine in San Juan, TX helps to understand this new contemporary church. When the original Shrine was dedicated in 1954, the ornamentation it contained was described as "lavish". Special bells by La Savoy of Paris, a massive crucifix carved in wood and murals followed the tradition of European Cathedrals by Bartolome Mongell of Spain.

In October of 1970, all of this splendid architecture and art was destroyed when a low flying airplane exploded into flames on the roof of the Shrine. In a matter of minutes the fire was out of control and the Shrine was a total loss except for the tower.

In 1980, an estimated 50,000 people from the U.S. and Northern Mexico converged upon the small community to witness the dedication and opening of the new edifice. This church, which holds 3,000 for mass, has a simple interior design to augment the beautiful 40ft mosaic on the back wall of the Shrine with Jesus presenting His Mother. It is the focal point of the contemporary interior. It is estimated that 15,000 people visit the Shrine every week.

After many years of using two different approaches to the loudspeaker utilization, the pastor was unhappy with the lack of intelligibility. It was equally frustrating to worshippers. Herman Gorena of Circle Industries, Inc. offered a three week demonstration of three Soundsphere Q-12 Speakers. The results warranted the installation of permanent fixtures achieving clear voice announcements for the congregation. The Pastor, Fr. Peter Cortez, states, **"People have said it has improved the sound 100%.** I am very pleased with this system."

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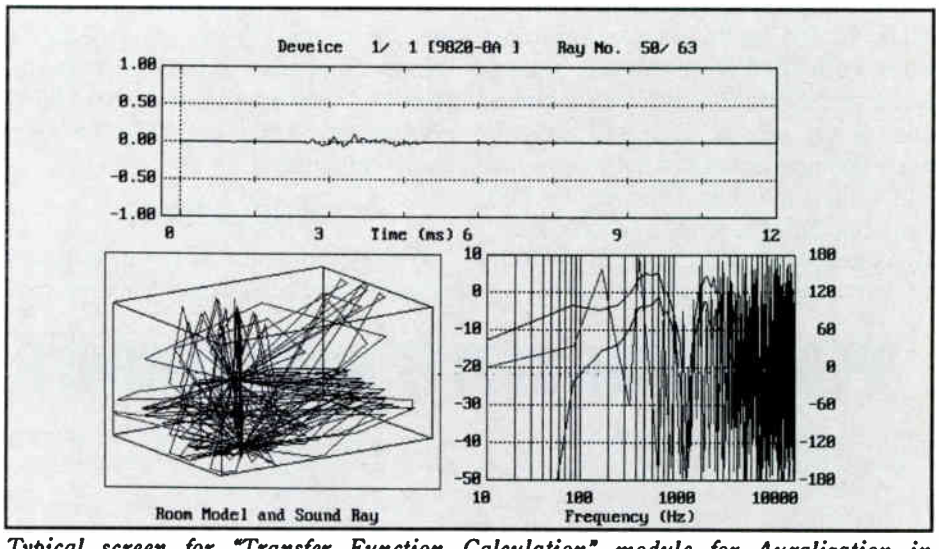
MORE OF WHO'S DOING WHAT IN SOUND SYSTEM DESIGN PROGRAMS AND AURALIZATION

By Mike Klasco

For what seems like a great deal of activity, it is also apparent that the amount of money, effort and energy spent in the development of this sound system design software has definitely slowed down over the last few years.



Typical screen for "Transfer Function Calculation" module for Auralization in AcoustaCADD 2.0; available next spring.

To some extent, speaker manufacturers have been feeling the economic pinch, and luxuries like these programs have had their funding cut. Users of most of these software programs will have noticed that the factory liaison person for the software is either gone, or the job function is now shared with other duties. Software releases tend to be less comprehensive, but to be fair, the bugs, limitations, or glaring omissions are not anywhere as serious as in previous generations.

More serious is the lack of the development of file conversion utilities for speaker directional files taken at different resolutions, the lack of an industry standard for directional measurements, and the lack of an "open architecture" of the speaker databases within each program. While there is movement in these directions, it is to my dismay that we are generally going backward! Bose once offered one of the widest speaker databases, but when they began to modify (and improve the accuracy) of their measurement technique, they lost compatibility with most other speaker manufacturers' data. Both AcoustaCADD and CADP2 use extremely high resolution measurement techniques, with neither compatible with anyone else, so even with open speaker databases, it would be unlikely that most other manufacturers would expend the effort to generate the necessary data. (Actually, EAW has prepared speaker data and CAD drawings for EASE 1.2 and 2.0, Modeler, and CADP2).

Perhaps the limited penetration of these sound system programs is due less to the lack of active promotion by the manufacturers, and more to the hesitation of spending a grand or so on a software design program that does not support most of the speaker lines the contractor prefers to design with.

As a consultant, I find that I tend to use two or more manufacturers speaker products within most jobs, and certainly at least three or four speaker manufacturers products in all my work. Some jobs must be cheap, others outdoors, or long throw, or very high output, or very sensitive size or appearance. I believe that many sound contractors might commit funds for a single program that covers both quick estimating design efforts to fully funded soup-to-nuts projects, for all their product lines. But when sound contractors figure out that they must buy and learn two or more programs to cover the speaker products that they sell, and most likely they cannot

Mike Klasco is the Technical Editor of Sound & Communications magazine.

World Radio History

mix the products they intend to use on the same job, the sizzle of these design aids fades quickly. All of this is too bad, and everyone is losing here. A few years ago, through the AES, I tried to get the software developers together to at least work on file transfer capabilities between programs, but because of corporate ego, as well as the attrition of personnel who worked on these projects, I am sad to say not much has been accomplished.

If anyone is to be let off the hook, I would say that Renkus-Heinz with EASE ought to get points for trying to deal with everyone's speakers and directional files. John Prohs is coming back with PHD2, and this program will also feature a practical open architecture. Again, I should also mention EAW's efforts with its "Acoustical Partnership Program," but all the duplication of effort to fit into everyone's file systems is a little crazy. I hope that the entire industry will have a change of heart and embrace not just file conversion, but measurement standards, as this will motivate the vendors of acoustic test gear to put more effort into supporting directivity measurement techniques.

Measuring directivity is not trivial for signal components or speaker systems, and arrays are extremely messy, yet the accuracy of all these sound system programs would be greatly improved if the actual array directivity characteristics could be entered rather than the discrete speaker elements (*i.e.* horns). Don't count on Techron TEF, Bell Labs/Ariel SYSid, or DRA MLSSA providing three or four sets of directivity measurement software packages, one for each sound system design program's pet standard.

As long as I am moaning about this, I would also mention that the resolution used in some of these programs does not seem sensible to me, especially when production tolerances are not as tight as the data. And when you consider the inaccuracies that result when real speakers are arrayed, the effects of less than perfect coherent adding between different models (90 x 60, 60 x 40) of horns within even the same series, thermal effects (hot ground, cold air or vice versa), stadium lighting near the speakers, and a half dozen other parameter shifters, the assumptions used to determine what the significant figures needed just do not pass my sniff test.

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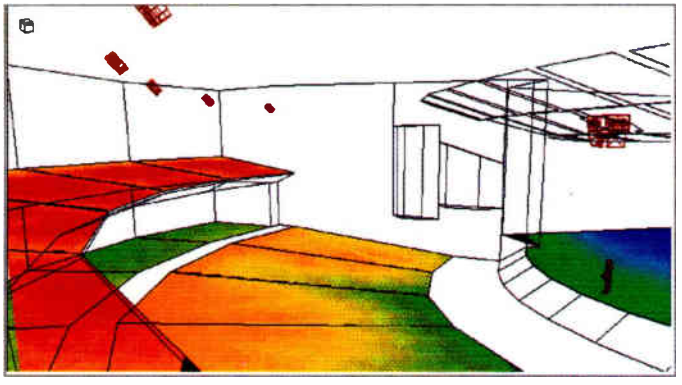
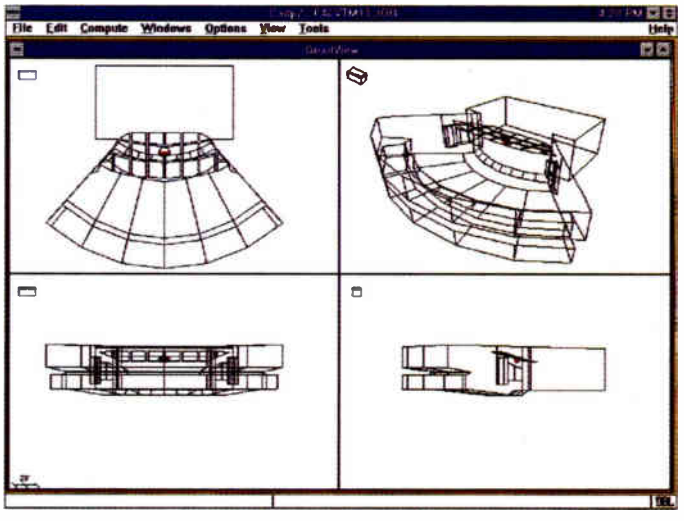


Zooming into the perspective port, in CADP2, can place the viewer inside the room with all of the arrays in place and calculation paint levels displayed.



CADP 2's QuadView screen allows the user to make view adjustments of room drawing changes in any of the four view ports.

I would be more than happy with five degree resolution and complete file compatibility and industry standard database directivity measurement techniques.

RENKUS-HEINZ EASE 2.0 AND EARS

EARS, Electronically Auralized Room Simulation, is a software program intended to be used with Version 2.0 of Renkus-Heinz' EASE. EARS is an application-specific Binaural Auralization program that eliminates the need for exporting the room's impulse response to Hypersignal-Acoustic.

Version 1.0 of EASE was reviewed a little over a year ago. I found EASE 1.0 a very powerful program that was capable of modeling complex rooms and providing comprehensive and useful information to the sound system designer. The complete speaker file library contains many speaker manufacturers, and the "no strings attached" licensing policy is a breath of fresh air, but the awkward program interface and the confusing data entry procedures for entering room coordinates were serious weaknesses. I have worked with EASE JR. and found this "cut-down" second generation version of the program much easier to work with. Version 2.0 of EASE operates in a Windows-like manner with pull-down menus, and overall operation is intended to be more intuitive and user friendly. The room modeling coordinate method that I disliked has been replaced with a new approach that is promised to significantly reduce the time it takes to model even complicated rooms. Many other improvements, from better graphics to additional printer drivers, are also in the works.

Dr. Ahnert's present plans are to complete Version 2.0 of EASE and then move on to completion of EARS. The new release of EASE was previewed at the San Francisco AES (at the Renkus-Heinz suite) and Dr. Ahnert gave a paper on EARS.

ACOUSTA CADD 2.0

Altec Lansing's AcoustaCADD Auralization will be an optional function for AcoustaCADD 2.0. Like AcoustaCADD's competitors, the cost of the auralization option has not yet been determined. Altec's Dr. Mochimaru has been refining the auralization capabilities of AcoustaCADD and gave a paper on taking into account Binaural Auralization considering the direction of the listener's face, along with other considerations such as the loudspeaker's off-axis transient response. Altec has also been working with Dr. D'Antonio on the effect of the diffusion scattering response of reflecting surfaces characterized as a transient response.

AcoustaCADD 2.0 will include a template program that I have had the opportunity to play with for awhile. This presently includes a number of churches and other facilities, but without the dimensions. The user need only "plug-in" his job's dimensions into the template and... instant model! This template idea is a Godsend and I would expect to see this ingenious idea "adopted" sooner or later by AcoustaCADD's competitors.

JBL'S CADP2

JBL's Jeff Long told me that they have been busy putting the finishing touches on release 1.1 of CADP2, with the release happening as you read this. CADP2 is a Windows format program. Release 1.1 has cleaned up essentially all of the initial release bugs, along with numerous program enhancements. For example, the user can now save and recall arrays. With this feature, simple or elaborate systems can be constructed and saved in the exact configuration to a data file. You can

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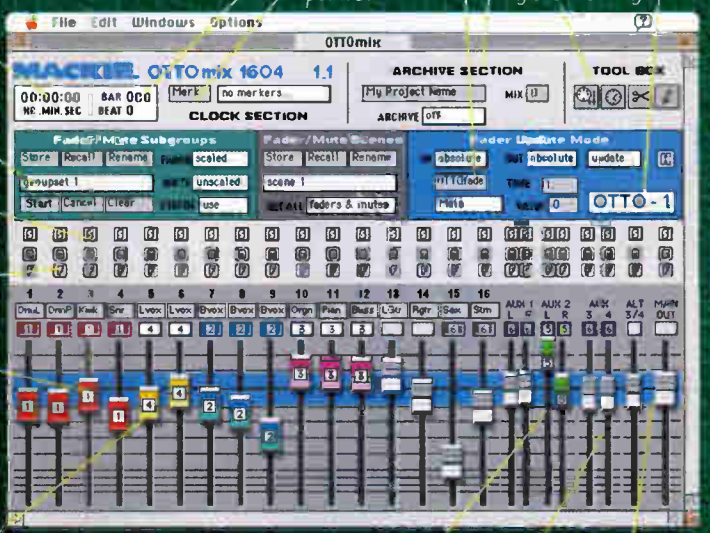

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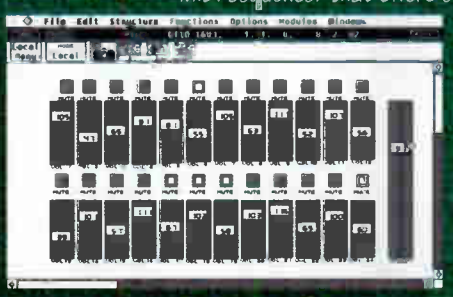
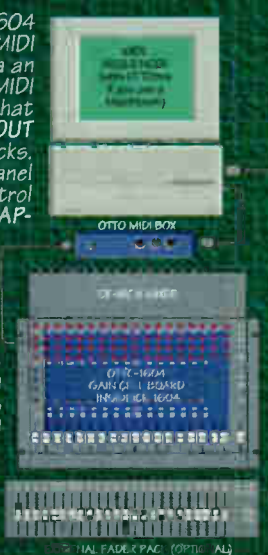


Shown above: Cubase faders in Classic or Color

OTTO-1604 connects to MIDI sequencers via an outboard MIDI connection box that includes IN, OUT and THRU jacks. Front panel buttons control LEARN, SNAPSHOT MUTE and BYPASS functions. You can also add an external fader pack for hands-on control... and daisy-chain up to three OTTO-ed CR-1604's (via Mixer-Mixer) for 32 or 48-channel automation!



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then duplicate this array for remote locations or for use in other jobs. Furthermore, an array can be defined as a speaker device, *i.e.*, a composite speaker. This has a distinct advantage when utilized with multiway speakers products (such as JBL's own Architectural Series or other one-box systems). Instead of the product being measured and stored as a single entity, the components of a multiway, when saved as an array, can now be manipulated separately for adjustments to their drive levels and frequency band selection. Yet the array can be positioned, aimed, and controlled as a single unit.

For auralization, CADP2 1.1 will provide room impulse response file export to Hyperception. This takes the form of an ASCII text file of the information contained in the echogram. This can be used with third party programs such as Hypersignal. Once in Hypersignal, the user can perform the auralization process, assuming that a suitable DSP board (like the Ariel DSP-16) is available.

FOR AURALIZATION, CADP2 1.1 WILL PROVIDE ROOM IMPULSE RESPONSE FILE EXPORT TO HYPERCEPTION.

BOSE

At the 91'st AES Convention, Morten Jorgensen, Christopher Ickler and Kenneth Jacob presented a paper on a prototype audible simulation system. While the paper discussed the promise of audible simulation in effectively communicating acoustical results, the authors astutely pointed out that none of the existing auralization systems had been verified as accurate. There is no scientific evidence showing that listeners' responses over these simulation systems were comparable to their responses in the actual room.

They concluded that:

"A major distinction must be made between a plausible audible simulation and a realistic one, since in the former case only similarity is needed while in the latter quantitative proof of realism is required. For an [audible simulation] system to be an effective design tool, therefore, it must be proven scientifically to yield [responses from subjects] which match those obtained from real rooms."

In the intervening year, Bose has concentrated its effort in three areas: binaural impulse response synthesis algorithm efficiency, synthesis algorithm diagnostics, and simulation system authentication. The present thinking at Bose is that specialized processors (a DSP board, for example) will be required to achieve the responsiveness that designers will demand. Unlike the other software and hardware discussed in this report, Bose has based its sound system engineering software on the Mac platform. Unfortunately, not all the Mac computers have a slot for a plug-in board, although the Mac's external SCSI port could be used for an outboard DSP processor.

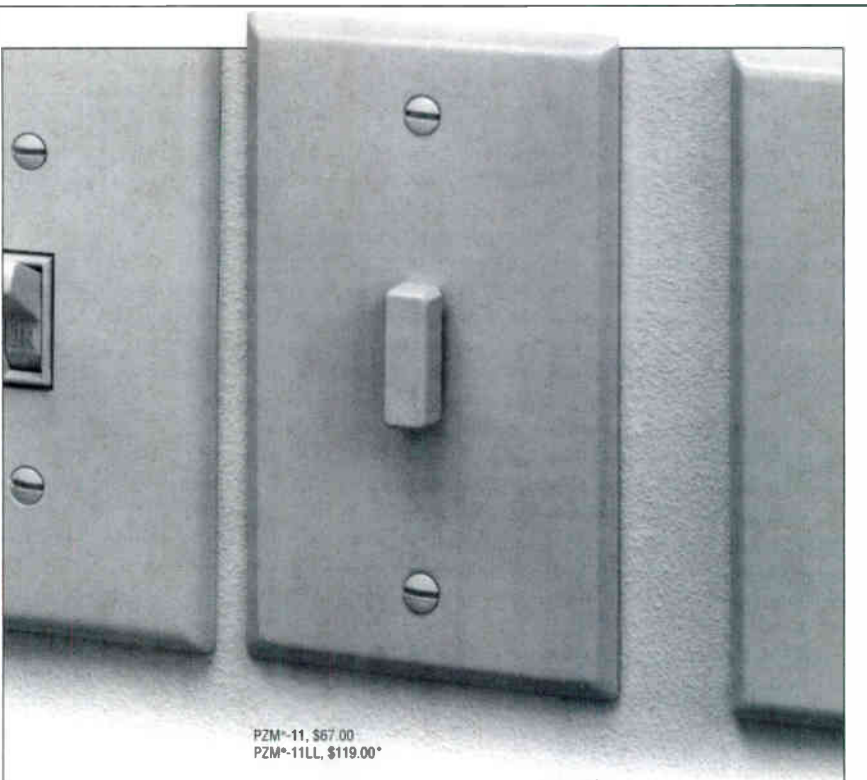
In their diagnostics work, Bose has made binaural impulse response measurements and binaural recordings in different auditoriums. Synthetic binaural impulse responses have also been computed using Bose's Modeler software and their prototype auralization system. The goal of this research is to find any obvious and correctable errors in the binaural impulse response synthesis algorithm. Listeners were unable to tell whether A or B was synthetic, indicating that the simulations were at least as convincing as binaural recordings.

A full scale authentication experiment is planned to test the ability of their auralization system to simulate the speech intelligibility of sound systems in large rooms. The experiment will use a variety of sound system types and rooms and will compare the speech intelligibility scores obtained from the simulator to those obtained in the real rooms.

As to Bose's plans to commercialize this work, that will depend on the outcome of the research outlined here.

DISC PROJECT

Dr. D'Antonio's DISC Diffraction Developments: About two years ago it became apparent to me that the lack of standards for speaker directional characteristic files, room modeling coordinate files, and surface materials (both absorption and diffusion) was a serious impediment to the progress of sound system design programs. Through the AES, I initiated a meeting to begin to try to coordinate these efforts. From this meeting, the



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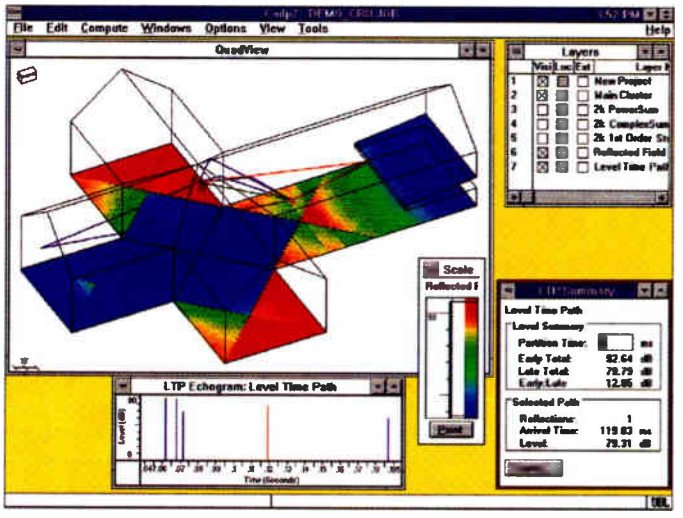

Using the reflected field calculation to locate possible trouble areas and then the LTP calculation (Level/Time/Path) to analyze a specific location is aided by CADP2's active echogram window.

AES Subcommittee On Acoustics was formed, with myself as chairman and David Klepper as vice chairman. One of the working groups created to develop standards was Characterization of Acoustical Materials with Dr. Peter D'Antonio as Chairman. Dr. D'Antonio's main effort has been to develop way to characterize diffusion with his DISC Project (DIrectional Scattering Coefficient).

It may seem hard to believe, but there is no standard for measuring or specifying the characteristics of a diffuser, whether it is one of Dr. D'Antonio's RPG devices or just a row of wood slats on a theater wall. Let's say you actually end up with one of the new auralization programs, design your room, auralize, and find that you have a serious slap-back flutter echo from the rear wall. Additionally, your project is a church and the congregation participates in singing in the services, but the congregation is not strong-lunged, so you do not want to absorb their vocal efforts.

Presently, there is no way for you to tell the sound system design/auralization program that you would like to install some sort of diffusing element on the back wall. And the reason for this is the lack of standards for characterizing diffusion, that is, the random-incidence absorption coefficients. Nor is there a database of directional scattering coefficients for the commonly used architectural materials — which gets us back to the purpose of Dr. D'Antonio's DISC Project. The goal is to determine the necessary directional scattering coefficients, as well as computational algorithms which utilize these data in image model/ray tracing programs. Dr. D'Antonio gave a paper at the ASA and we will report on his progress in the pages of Sound & Communications.

HARDWARE FOR AURALIZATION OUTBOARD PROCESSORS

AcoustaCADD and others have demonstrated auralization techniques using the Lake FDP 1 Digital Audio Convolution Processor from Australia. This is a very high power processor that allows the room's impulse response to be superimposed on the dry music in real-time. Cost of the Lake FDP 1 has recently dropped in price to about $10,000, as the souped-up FDP 1+ has just been introduced, but both are still too expensive for sound contractors.

PLUG-IN DATA ACQUISITION DSP BOARDS

Conventional data acquisition DSP boards contain a/d (analog to digital

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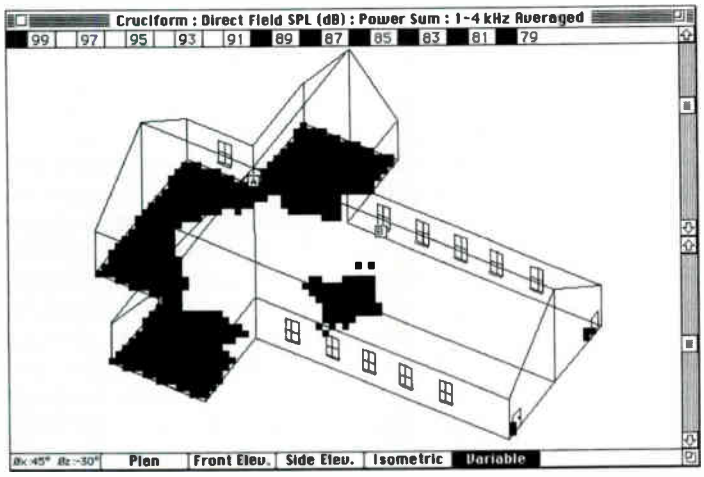
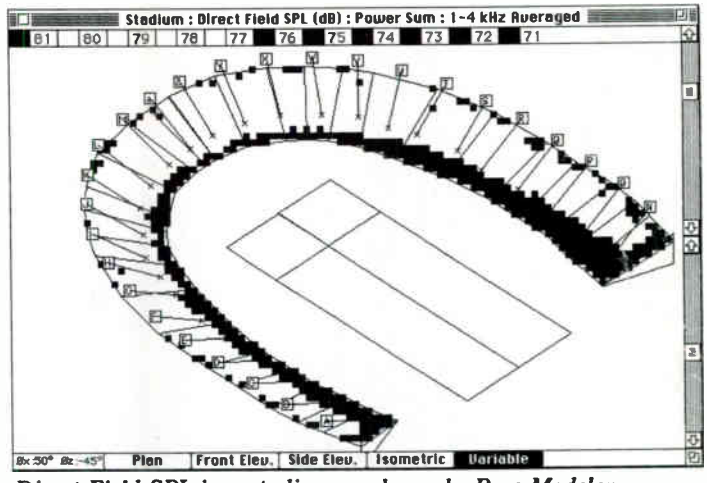


From Bose Modeler: Cruciform — Direct Field SPL.



Direct Field SPL in a stadium as shown by Bose Modeler.

converters), some memory, DSP (digital signal processor), and d/a (digital to analog converters). Unlike the pricey Lake processor, they cannot play back and superimpose the room's signature (impulse response) in real-time. Instead, the dry program material must be saved to hard disk, post-processed in the DSP board, and saved as a new file. Renkus-Heinz estimates that 20 seconds of music will take about 15 minutes of processing time.

The Ariel DSP-16+ is a popular choice as it is not too expensive (about $3000, depending on the software bundled with it), and can double as your acoustic analyzer for speaker and sound system testing when used with the Bell Labs SYSid software, also available from Ariel. Dr. Jont Allen of Bell Labs and Dr. Sunil Puria of Ariel /MIT Research Labs gave an interesting paper on the concepts and functions of SYSid at the ASA.

An alternative is the TEF 20 HI acoustic analyzer, which (like the Ariel board) is supported by Hypersignal Acoustic. HypersignalAcoustic Version 3.4 from Signalogic Hypersignal-Acoustic has often been used as the software/hardware interface for sound system programs to provide auralization. Hypersignal can process a dry stereo audio signal (such as music recorded in a pseudo-anechoic environment) with the derived impulse response of a room — such as from EASE, AcoustaCADD, or CADP2. The result is a simulation of what the room will sound like at a specified seating location, very handy if the room, or the modified room, only exists within the sound system design program. The Hypersignal software supports a lot of hardware, including almost all Ariel products and the Techron TEF 20 HI.

RENKUS-HEINZ ESTIMATES THAT 20 SECONDS OF MUSIC WILL TAKE ABOUT 15 MINUTES OF PROCESSING TIME.

Hypersignal is much more than auralization, and since this program was reviewed over a year ago in Sound & Communications, many functions have been enhanced. These include improvements in real- time data acquisition, hard disc recording and playback (you can use your hard disc as the playback source for auralization), waveform editing and more. For auralization, the maximum convolution sizes have been increased to permit a greater extent of the reverberant decay tail to be processed. We should have a comprehensive review of Hypersignal-Acoustic 3.4 ready by this Spring.

MULTIMEDIA BOARDS

In my discussions with the developers of EASE and AcoustaCADD, I find they are considering some sort of inexpensive hardware alternative for implementing auralization, at least as a starting point until the user decides to up-grade to a "CD" quality data acquisition board.

One possibility is to use Multi-Media "sound boards." Quite a number of "sound boards" such as Sound Blaster and the Covox Speech Thing are both commonly available and cheap (less than $200 wholesale). But most of these inexpensive boards use 8-bit encoders and decoders, which limits the signal to noise ratio to about 48 dB, not quite adequate for auralization. If the sound quality of the hardware is inferior, then the fine nuances of the processed sound during auralization will be lost, such as the ability to discern the difference between a direct radiator and a horn speaker.

Recently a couple of 16 bit multimedia sound boards have hit the market, such as Multisound by Turtle Beach Systems, but these wholesale for about $600. Another alternative is the Ad Lib board which boasts a 12 bit dynamic range (72 dB), and costs about $300 retail. We will keep you posted on these developments. ■

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Crown in Cleveland; Noise Cancellation and Koss

Crown Powers Grand Prix

Crown Macro-Tech MA-2400 and MA-3600VZ amplifiers provided the audio horsepower for a widespread audio system at the Cleveland Grand Prix auto race. The system, which was utilized primarily for constant public address throughout the entire race, was designed to bring high-quality audio to grandstands that stretched for more than a mile along the race course and seated more than 50,000 people. The system was also configured to supply audio to trackside suites as well as the timing and scoring areas of the track. The MA-2400s and MA-3600VZs were remotely located at the .25, .50, and .75-mile points of the grandstand and supplied power to over 100 University Sound paging horns mounted throughout the race site.

Crown has also introduced a customized mobile educational facility fully equipped with the company's complete line of amps, mics, and IQ System computer control products. The facility is built into a semi-tractor trailer, and is designed to allow the company to take its information directly to the field. A travel schedule for the facility will be released in early 1994.

Noiseless Headphones?

Koss Corporation has announced that it will supply stereo headsets to Active Noise and Vibration Technologies Inc. of Phoenix, AR., for use on a new consumer-targeted device developed to cancel noise. The new model NQ100 is targeted for delivery by ANVT later this fall and is designed to allow the listener to cancel outside noise while listening to their music using an ultra-lightweight version of Koss' model CD/4 stereophones. The company also announced that it will begin marketing a Koss branded version of the ANVT system through Koss' retail base this autumn.

Karaoke's Greatest Hits

Pioneer Electronics has introduced its 1993 line of Laser Karaoke players for home use, including the CLK-V940, CLK-V840, and CLK-V740. All three models are designed to accommodate CDs and LaserDiscs, and include a three-mode digital signal processor that provides a choice of music, theater, or karaoke sound fields to create the preferred ambience for any song. In addition, Pioneer is also offering a special edition LaserKaraoke disc which features a total of 53 selections.

The collection includes songs ranging from pop hits of the 50s, 60s, 70s, and 80s to country hits and songs made famous by artists such as Elvis Presley, The Beatles, Madonna, and Frank Sinatra. Three bonus tracks — Auld Lang Syne, Happy Birthday, and America the Beautiful — are included for special occasions. The disc is multiplexed, allowing users the option of singing with or lowering the recorded lead vocals.

BSS Hits the Left Coast

Both the Mark Taper Forum in Los Angeles and the Terrace Theater in Long Beach have added new BSS signal processing components or new capabilities to existing ones for their sound reinforcement systems.

The Mark Taper Forum is a 750-seat theater that hosts a varied dramatic and musical repertoire. The set-up features 4 BSS 926 Varicurve Digital Programmable Equalizers and 3 BSS 804 Digital Programmable Delays. The Varicurves will be used in stereo pairs, while the 804 Delay units will be used to delay the sound to certain portions of the house so that everyone in the theater can hear dialogue at the same time and in sync with the actor's lips.

The Terrace Theater will soon add Level Control System computer automation to its audio system which will automate scene changes for EQ and delays. The Theater already utilizes 6 Varicurve Equalizers, six 804 delay units, and two 803 delays.

New President For EISC

Steven T. Ross, president of Ross Marketing Associates, has been elected president of the Electronic Industry Show Corporation, and will head the planning for the 1994 Electronic Distribution Show and Conference, to be held in Las Vegas, April 26-28. The Show Corporation Board of Directors also elected Gerald M. Newman as Executive Vice President succeeding the late David L. Fisher. Other new officers elected to serve with Ross are Vice President Arnold Rosenblun, President of Cole Flex Corporation, West Babylon NY, and Secretary-Treasurer Wesley S. Sagawa, President of Capstone Electronics, Englewood CO.

EDS '94 will be held at the Las Vegas Hilton Hotel. Exhibitor information will be in the mail to the industry as a whole in September.

Gentner Appoints Dimtrex, Limited

Gentner Communication Corporation has announced the appointment of Dimtrex, Limited as the Company's exclusive distributor for its teleconferencing products in Canada. Dimtrex will be responsible for the management of Gentner's dealer network throughout Canada for the GT700, GT300, TI7200, GTS700 and GTS300 teleconferencing products.

The GT products include a built-in microphone mixer and power amplifier and are designed specifically to accommodate small and medium-sized boardrooms. These products are available with a 3.3 kHz bandwidth, as well as a 7 kHz bandwidth. The TI7200 includes the 7 kHz bandwidth in addition to a bridge connector for a "phone add" and a longer acoustic echo cancellation span that is needed for larger boardrooms.

Korg's Audio Gallery

Korg has introduced its Audio Gallery Multimedia Music Systems. The Audio Gallery group consists of two versions: the AG-101 for Windows Software and the AG-102 for Macintosh computers. The Systems combine an AG-10 sound source module, sequencer software, music library, start-up

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driver software, and a serial interface cable. Both models come equipped with a General MIDI/ Standard MIDI File song data disk containing 30 songs.

The AG-10 module comes with 128 GM sound programs and four drum programs. With the addition of a mouse or a keyboard it is possible to record data using "step" increments. The AG-102 also features editing software that can be used to change MIDI channels, adjust velocity, quantize or humanize to give the music a more "human" feel.

Avid's Version 2.0 of Media Suite Pro

Avid Technology has introduced Release 2.0 for Media Suite Pro, a desktop video production system for the corporate, educational, industrial, and government markets. New features of the program include improved image quality via a 60-field option, optional outputing of an edit decision list, and additional effects such as motion control and user-definable picture-in-picture effects.

Avid has also announced that the company's Media Composer digital nonlinear editing systems are being used to produce two upcoming CBS television specials: a "60 Minutes" 25th anniversary special; and a news documentary on the year 1968, which will be anchored by Mike Wallace.

ICA's Incoming Board and Officers

The International Communications Association recently announced the election of new Board Members and Executive Officers. Board Members are elected to three-year terms while executive officers serve one-year terms. The new officers are: President — Lawrence Gessini, Agway, Inc.; Senior Vice President — E.W. "Gus" Bender, The Travelers Corporation; Vice President, Finance — Lance Ede, Electronic Data Systems; and Vice President, Administration — Robert Harrold, ARI Network Services, Inc. New Board Members are: Director, Conference Programs — William Miller, State of Nebraska; and Director, Member Services — Jeff Hafer, GPU Service Corporation.

In addition, ICA and the Atlanta-based firm of Deloitte and Touche have released the results of a survey of more than 3500 North American companies to determine the status of organizational structure and spending patterns within telecommunications departments. Findings include: corporate telecommunications departments have experienced relative immunity regarding corporate organizational changes resulting from the integration of disparate technologies; there has been a dramatic increase in telecom managers involved in corporate strategic business planning; and on average, only half of corporate telecom function resources are under the direct control of the telecommunications manager.

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Emotia Price Reduction

Extron has lowered the list price of the Emotia from $1795 to $1495. The Emotia is a VGA and Macintosh to NTSC or PAL Scan Converter, which utilizes no software to provide flicker-free scan conversion of VGA and Mac PCs running 640 x 480 resolution to NTSC (or PAL). Housed in a metal enclosure, Emotia features a Freeze-Frame and Overscan/Underscan switch, Interlaced/Non-interlaced switch, Automatic Anti-Flicker Filter, Horizontal/Vertical Centering, Horizontal Width control and Three Output Configurations: RCA (NTSC or PAL), 4-pin din S-VHS and BNC Red, Green, Blue and Sync.

Xing's Video Encoder Board

Xing Technology has introduced XingIt!, a real-time 30 frame-per-second MPEG video encoder board for personal computers. The new unit features real-time video capture, filtering, and MPEG compression plus software-only MPEG video playback through Microsoft Video for Windows, synchronized with WAV or MPEG audio. XingIt! operates with Intel 386, 486 and Pentium compatible ISA bus personal computer systems.

Xing has also introduced the commercial edition of Picture Prowler, an image management software utility for Windows capable of capturing, compressing, and organizing thousands of color and greyscale images. Picture Prowler is an image database management program that creates thumbnail sketches of JPEG images and decompresses them for fast, real-time, full screen viewing. The program includes a file association feature that allows cataloging and playback of video and audio files.

Broadway Video's New Suite

Broadway Video has added a new digital graphics production suite designed to offer numerous functions including paint, typography, rotoscoping, re-touching, digital effects, 3-D animation, and cel animation within one integrated environment. The room is built around a DP/MAX Video Workstation from ColorGraphics, that offers simultaneous integration of multiple external audio and video sources. The system's 4:4:4:4 (YUV) internal processing produces high quality images and provides a digital matte signal for each element created.

Broadway Video Digital Off-Line has also recently completed post-production on "The Best of the Blues Brothers," a one-hour show produced in conjunction with Dan Aykroyd's Allied Action Research Corp. The special will air on the Disney Channel on September 26 in the evening.

Howard Schwartz Meets "Rockline"

Howard Schwartz Recording in New York recently played host to rock 'n' rollers Pete Townshend, Donald Fagen, and Steve Miller on "Rockline," a syndicated program of the Global Satellite Network. Miller's appearance on the show featured five live solos including overdubs of two pieces recorded before airtime.

Howard Schwartz Recording features nine audio-for-video studios, SoundNet, a Time Code DAT Editing System, satellite uplink and downlink, and a large stock music library.

Spectral Innovations' NuMedia

NuMedia, from Spectral Innovations, is a single board audio product designed for users who need to incorporate CD-quality sound in their professional presentations, educational and training applications, and multimedia showcases.

The NuMedia hardware includes a floating-point digital signal processor and audio input and output. The system uses 16-bit stereo analog converters that can record and playback sound at up to 48 kHz. It also includes digital input and output connections for commercial equipment featuring AES/EBU fiberoptic options. A stereo microphone input allows the user to apply voice-over tracks to multimedia presentations.

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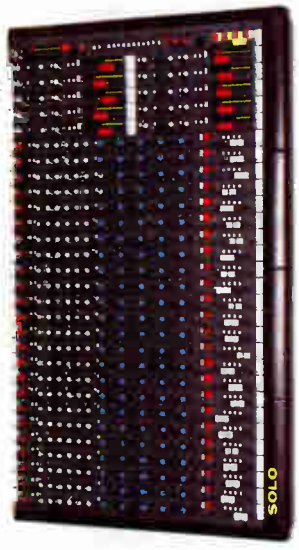

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Anti-Smoking Rap

Nikkodo's recently held "rap-off" at Raging Waters amusement park in San Dimas, CA, featured kids between the ages of 12 and 21 rapping about the health risks of smoking and chewing tobacco. Nikkodo co-hosted the event with KPWR Radio and the California Department of Health Services.

Participants sent in an anti-tobacco rap song on a cassette with a lyric sheet to one of the eight stations promoting the event. Each station selected seven finalists to perform their songs before a panel of judges. Entries were judged on originality, persuasiveness, and overall anti-tobacco message. The first place winner from each station received a CDG Ninja karaoke unit. Regional contest winners will automatically qualify for the statewide competition and a chance to win a trip to MGA/Universal Studios Hollywood.

MultiLink Expansion

MultiLink has recently expanded its corporate offices, merging its corporate facility (formerly in Lynnfield, MA) with its manufacturing plant (formerly in Bow, NH). The new office occupies 50 percent more space than the combination of its previous locations. Office space will be expanded by another 25 percent in September, 1993. These changes come one year after the consolidation of MultiLink's New England facilities.

MidiMan's MiniMacman

Midiman has introduced the MiniMacman, their latest Macintosh MIDI interface.MiniMacman is a 1-in/1-out interface with MIDI indicator and power LED's. The new unit carries a suggested retail price of $40.

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Insulated Tools Price Decrease

Willi Hahn Corporation has announced a price decrease on its Insulated Screwdriver Series. The cuts represent an average decrease of 21% on these products, which are available in both Slotted and Phillips styles. The blade insulation is molded directly onto blade for permanent bonding. The blades are high alloy chrome-vanadium-molybdenum-steel, and are salt bath hardened. The handle is manufactured from cellulose-acetate and is impact resistant, shatterproof, cadmium free, and oil and grease resistant.

Ampex Carries Load

Vermont PBS affiliate WETK-TV, in Colchester, is planning to use its Ampex ACR-225 Automated Cassette System to change their on-air operations. Within the next year, the unit will be loaded with all of the station's short-length (under 30 minutes) educational programming material that is broadcast to Vermont and New England regional schools.

Using AutoResolve software, the ACR-225 can automatically recognize and correct conflicts and errors. The composite digital system handles up to 256 32-minute cassettes and has the capacity to store over 10,000 30-second spots, on line. The multi-tasking ability of the unit allows it to simultaneously play on-air, record new program material, and edit playlists.

ICSC Figures

Retail sales at large shopping centers across the nation are continuing to move upward in 1993, according to the Consumer Shopping Index, a new measure of the country's economic health produced by DRI/McGraw-Hill and the International Council of Shopping Centers. As measured by the CSI, sales per square foot at the nation's shopping centers were up ½% in the first quarter of 1993, despite bad weather conditions compared with the same period in 1992. These conclusions are reinforced by the Census Bureau's Advance Monthly Retail Sales Report for June, which is a preliminary indicator of national shopping trends.

Monterey Blues Uses JBL

The 8th Annual Monterey Blues Festival which took place at the Monterey Fairgrounds utilized a full JBL Array Series concert system and a 40 input Soundcraft Europa front of house console. Featured artists at this year's festival included the Neville Brothers, B.B. King, Ruth Brown, Etta James, and Clarence Carter. Sixteen JBL 4894 speakers were used for main left-right flown clusters; two 4892s were used for center fill cluster; and an additional six 4892s were used for delay systems. Other recent shows using the Array Series include The Beach Boys in Hawaii and the upcoming Mt. Hood Jazz Festival in Oregon.

Confusion From Soundtracs

Kuljit Bhamra, a leading composer and producer of Indian pop music in the UK has added a 48 channel Soundtracs In-Line console to his recording stereo, "Red Fort." At the studio, Bhamra has hosted a number of Western artists including Bronski Beat, Suede, the Auteurs, and the Oyster Band. Bhamra's latest album — "Confusion" — is a mix of many dance music styles current in Asian music today.

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CALENDAR

Upcoming Events

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Rigging Seminars: McLean, Virginia. Contact: (812) 995-8212. October 25-27.

Visualization '93: San Jose, California. Contact: (510) 422-1657. October 25-29.

Professional Loudspeaker Workshop: Pasadena, California. Contact: (714) 895-7221 ext. 701. October 28-29.

Viscomm '93: New York, New York. Contact: (203) 852-0500. October 29-31.

SMPTE: Los Angeles, California. Contact: (914) 761-1100. October 29-November 2.

NOVEMBER

Rigging Seminars: Secaucus, New Jersey. Contact: (812) 995-8212. November 1-3.

TeleCon XIII: San Jose, California. Contact: (800) 829-3400. November 8-10.

DECEMBER

Video Expo/Image World: Orlando, Florida. Contact: (800) 800-5474. December 6-10.

JANUARY 1994

ShowBiz Expo East and East Coast Theatre Conference: New York, New York. Contact: (213) 668-1811. January 6-8.

Consumer Electronics Show: Las Vegas, Nevada. Contact: (202) 457-4919. January 6-9.

NSCA Owners and Managers Conference: Amelia Island Plantation, Florida. Contact: (800) 446-NSCA. January 20-23.

National Association of Music Merchants: Anaheim, California. Contact (800) 767-6266. January 21-24.

The New Product Showcase (ICIA): Atlanta, Georgia. Contact: (703) 273-7200. January 21-22.

FEBRUARY

Association for Research in Otolaryngology: St. Petersburg Beach, Florida. Contact: (515) 243-1558. February 6-10.

National Hearing Conservation Association: Atlanta, Georgia. Contact: (515) 243-1558. February 17-19.

World Radio History

XTA'S Real-Time Analysis; TOA Wireless

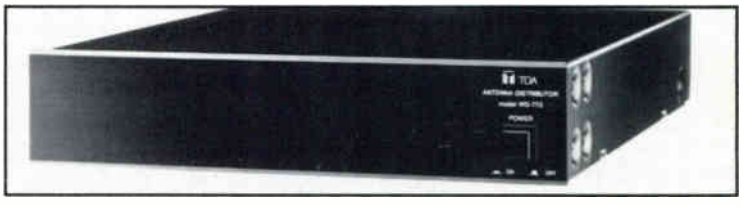
XTA's RT1

XTA Electronics has introduced the RT1 Real Time Analysis System. The RT1 combines .33 octave analysis, true SPL meter, RT60 analysis, and a Swept Frequencer analyzer in a 2u high, 19-inch rackmount housing. The system features simultaneous bar and peak displays with separately adjustable time constants, and a completely independent SPL meter display. The LED display provides comparative readings between two memories, or between a real-time measurement and a memory. Other features include A-weighting, Rear Panel Mic Input, Manual or Auto Range Control, and Sine Wave Output. A Delay Finder function is also included as a free software update, allowing simple time delay calculations for multiple source installations.

Circle 1 on Reader Response Card

TOA Has the Password

Designed to bring added versatility to the Password Series of wireless microphone systems from TOA Electronics, the new WD-770 antenna distributor is capable of mixing up to two antenna inputs and distributing the mixed input signal to four outputs. The unit is able to operate in conjunction with a variety of antennas and offers installers the option of mounting the antenna(s) in remote locations from the receiver frames within a system. The WD-770 is finished in black, comes with its own AC/DC adaptor and weighs under four pounds.



Also new from TOA is the MP-1216 multi-channel monitor panel. Designed to facilitate visual and aural monitoring of up to 16 channels, the system can also be daisy-chained with a second unit to supply monitoring for up to 32 channels. The MP-1216 is finished in black and occupies 2 rack spaces.

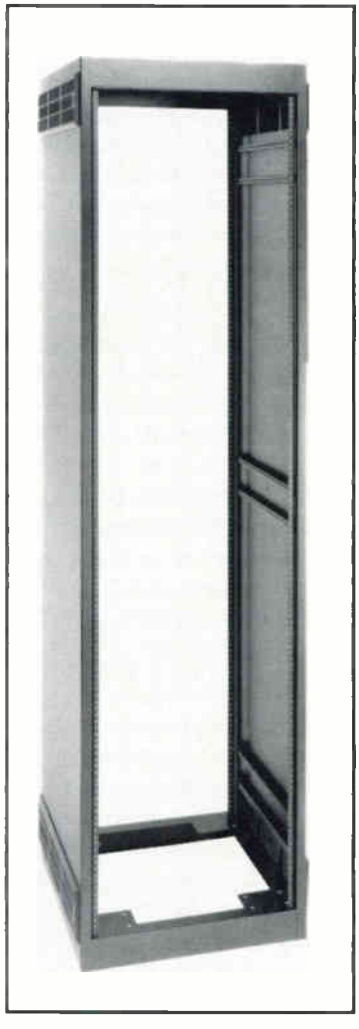
Circle 2 on Reader Response Card

Slim-20 From Middle Atlantic

The new Slim-20 electronics enclosures from Middle Atlantic Products feature 14-gauge steel tops and bottoms and 16-gauge steel sides. Offered as knock-down or factory-welded units, the four models which comprise the line range in height from 77 inches to 47.25 inches. All units are 21.125 inches wide and 21 inches deep.

Internally, each model is buttressed with .25-inch structural steel braces. Fully adjustable 10-gauge threaded rack rails are installed at the front and back of each enclosure, along with electrical knock-outs in three areas. An opening for cable entry is supplied at the bottom. Also included are a built-in skirted wheelbase and rear doors.

Circle 3 on Reader Response Card



Carlsbro's Beta Series

Carlsbro Electronic's Beta 112 PA enclosure was designed specifically for vocalists. The unit delivers 300 watts into 4 ohms via

Circle 278 on Reader Response Card

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World Radio History

a single 12-inch cast chassis driver. The tuned and ported enclosure is protected by a kick proof metal grille and the system is covered in black vinyl. Other features include XLR inputs and outputs, heavy duty corners, recessed bar carrying handles, and an integral stand mount adaptor. The Beta 112 can be used on its own, while the 8 ohm version may be connected to Carlsbro's D300X or D600X enclosures for increased bass performance.

Circle 4 on Reader Response Card

Javelin Intros New Camera

The JE7742 CCD, by Javelin, is a monochrome .33-inch camera. The new unit features 380 TVL horizontal resolution and .3 lux minimum scene illumination.

The electronic sensitivity con trol automatically adjusts the shutter speed of the CCD imager as scene illumination changes, eliminating the need for an auto iris lens. Javelin provides a three-year warranty on the JE7742 CCD and a lifetime warranty on the sensor.

Circle 5 on Reader Response Card

A Personal Sentry

Aiphone Intercom Systems has introduced The Door Sentry, a multi-feature Video Entry Security Intercom System for home or business entries. The boxed Door Sentry set includes a door camera with a wide-angle lens, audio/video room station, and power supply. Features include automatic backlight control, a door release button for optional electric door strike, a monitor button allowing the user to check the entry area undetected, and two-stroke electronic door chime.

Circle 6 on Reader Response Card

Nady's Duet System

Nady has introduced the Nady Duet, a two-channel VHF wireless system with two independent wireless microphones designed specifically for karaoke applications. The system includes a compact wireless receiver module with two separate VHF high band channels and two Nady HT-10 handheld wireless microphone transmitters.

The Duet system is also available with Nady wireless lavalier microphone transmitters, instrument transmitters, and a faceplate that allows the Nady Duet receiver to be rackmounted.

Nady has also announced the introduction of the 950GS UHF Wireless System. Available with 40, 100, or 160 user selectable channels, the receiver is a rack mount, True Diversity unit with user selectable channels arranged in groups for easy access. Other features include switchable balanced level out (line/mic), 115/220V AC power, 20-25V DC power option, bass boost, monitor volume control and front or rear mounted antennas.

Circle 7 on Reader Response Card

Interface With Extron

Extron Electronics has announced the introduction of the RGB 120, a computer-video interface. The RGB 120 is a wide bandwidth 200 MHz, Universal Analog Interface. Features include Horizontal and Vertical Centering, Variable Level Control, a Peaking switch, and separate Horizontal and Vertical Sync outputs. Compatibility includes VGA, Super VGA, XGA-2, MAC, Quadra, SUN, and all other Analog PCs.

Circle 8 on Reader Response Card

Nagra-D Accessories

Nagra has announced two new accessories on their Nagra-D Digital Field Recorder: the ND-LIA Line Input Attenuator and the ND-PP Potentiometer Protection Bar.

The former is a 600 ohm, 26 dB attenuator designed to match the line input of the Nagra-D to the output of a standard mixing console. The use of the ND-LIA with the Nagra-D raises the maximum input level to +23 dBm.

The ND-PP protects the potentiometers from being moved accidentally during a recording and provides a hand rest when making fine adjustments to the potentiometers. It is secured to the machine with two screws that are specially designed so that it can be fitted and removed without the aid of tools.

Circle 9 on Reader Response Card

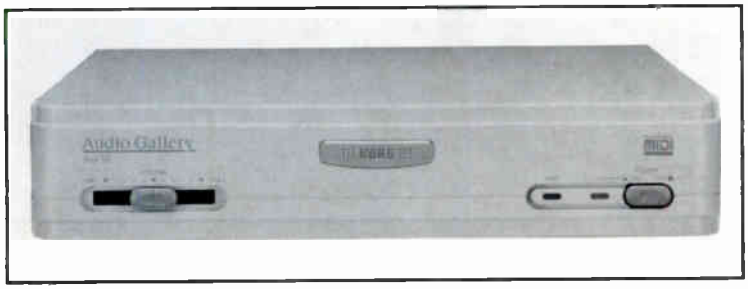
Microwave Logic's PacketBERT-200

The PacketBert-200 is a bit error rate tester which features the capability of Bert performance measurements optimized for the packet or cell oriented technologies found in B-ISDN, FITL, TDMA, Wireless and Satellite communications. The system offers a "mixed mode" in which a pseudo random bit sequence is inserted into the payload portion of the signal which simulates worst case pattern sensitivity evaluations for the LAN and WAN market.

The programmable word pattern has a depth of up to 256kbit. Seven PRBS patterns are provided. Measurements include total bit errors, BER, propagation delay, and clock frequency. The instrument can also measure the data bit "eye-width" up to 32nS automatically.

Circle 10 on Reader Response Card

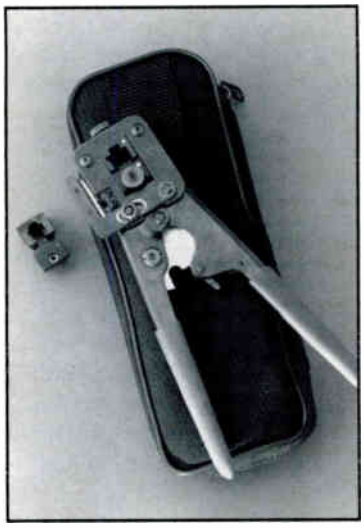
World Radio History



Korg's Multimedia

Korg has unveiled its Audio Gallery Multimedia Music Systems, sounds designed for multimedia computer systems. The Audio Gallery consists of two versions: the AG-101 for Windows software and the AG-102 for Macintosh computers. Included are an AG-10 sound source module, sequencer software, music library, start-up driver software, and a serial interface cable.

Circle 11 on Reader Response Card



Crimp With Siemon

The PT-908 from The Siemon Company is a 3-in-1, rachet-style crimp tool that lets you create EIA/TIA-568 compliant patch cords in the field. The tool allows one to cut, strip, and crimp round, twisted-pair cable. Features include a new parallel action die set that maintains accurate alignment of the crimp teeth with the plug contact, and an 8-position die set for crimping any 4-pair keyed and nonkeyed modular plug. The tool can be ordered with a padded carrying case that attaches to a technician's belt and includes storage compartments for carrying spare die sets, blades, and modular plugs.

Circle 12 on Reader Response Card

Gaining Control

Crown's AMB-5, the latest addition to the IQ multiplexer family, is designed for use as an ambient control system. The AMB-5 features the capability to compensate for ambient noise.

It includes five intelligent mic/line inputs and one output, with an additional input for an ambient sensing microphone In addition, the unit functions as a passive 6 x 1 mixer that is outputed independently to channel two. The AMB-5 can also reconfigure itself through downloadable software called "Algo Packs," which allow programming of specific capabilities into the memory and processor of the unit.

Circle 13 on Reader Response Card

Wireless Tours

Vega's TG-1 is a Tour Guide System designed for situations where a roaming speaker must be heard by several listeners. The system consists of a Vega T-17 bodypack transmitter equipped with a Vega LM-206X omnidirectional electret condenser lapel microphone as well as four Vega PL-2 miniature receivers.

The T-17 offers 50 mW of power, is constructed of ABS plastic, and accepts numerous lavalier or headset microphones in addition to the LM-206X. The PL-2 employs multiple RF tuning stages, and is designed for noisy environments. It's two-channel design allows the user to receive either of two separate transmissions.

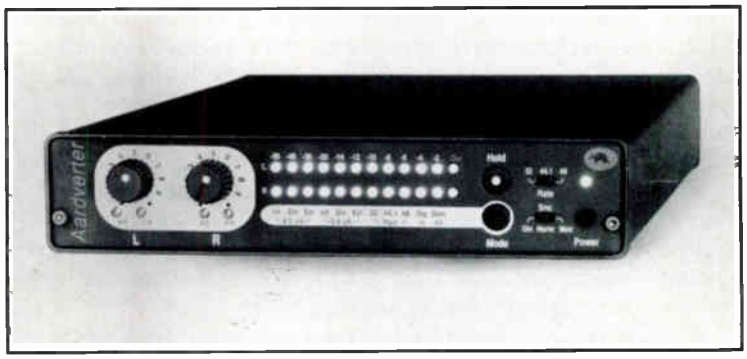
Circle 14 on Reader Response Card

Convert With Aardvark

Aardvark Computer Systems has introduced the Aardverter, an A/D-D/A converter. Measuring 7 x 12 x 1.5 inches, the unit's on-board DSP comes with a variety of digital features, including DC off silence, set removal, bar graph PPM, 1 kHz tone and Smart Diagnostics display.

Back panel XLR connectors accommodate balanced analog signals and professional AES/EBU-92 digital audio. Using optional RCA adaptors, they will also accept unbalanced audio and S/PDIF digital signals. Both the input and output levels are adjustable via recessed trimmer screws, and input levels can be set using front-end panel knobs.

Circle 15 on Reader Response Card



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Mixing with Ross

Ross Systems has introduced the RCS1402 rackmountable mixing console. The unit features six balanced mono line inputs, six studio-grade mic inputs incorporating discrete mic preamps, four stereo line inputs, two stereo aux returns, and a stereo tape in. Each input channel includes an input trim control, two post fader and post EQ auxiliary sends, a three-band equalizer, pan control, and gain control.

The output section provides left and right balanced/unbalanced main outputs, left and right tape outputs, two auxiliary sends, and a stereo headphone out. Other features include LED bargraph displays for output level or input gain monitoring, +48VDC phantom power for all mic inputs, rack ears, and an internal power supply.

Circle 16 on Reader Response Card

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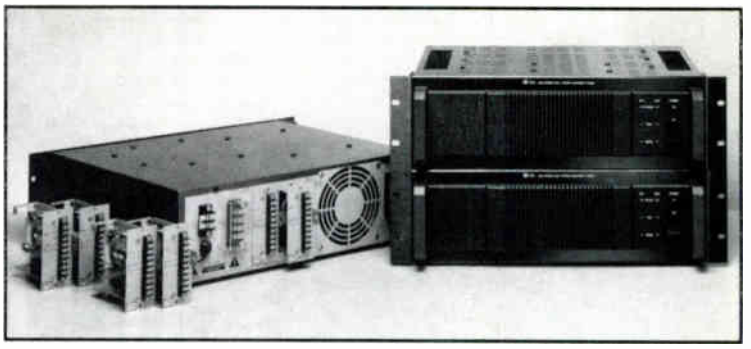


TOA and MediaLink

MediaLink technology has been introduced for TOA's P-1000 series of amplifiers. Capable of providing remote control and monitoring capabilities, the technology works in both Windows and Macintosh environments with Lone Wolf's VNOS software.

The monitoring and control functions available include the ability to review the on/off status of each amplifier within a given system, monitor and adjust channel input and output levels, mute specific channels, and reverse signal polarity. The system can also display the status of protective circuitry.

Compatible with any P-1000 input module, MediaLink technology can be physically interfaced within a system by using connections raging from fiber optic cabling to others employing MIDI, RS-232, PA-422, DMX, RF, and hard wiring. Systems developed using the technology are additionally compatible with any other MediaLink-equipped device.

Circle 17 on Reader Response Card

Scene Stealer

Dubner International has introduced an automatic scene detector and videotape logging/cataloging system called the Scene Stealer. The unit consists of a PC/AT circuit board and software that automatically detects and marks scene cutpoints in videotape while grabbing and storing black and white images.

Once stored on the hard disk of the computer, images can be reviewed at computer speed, annotated, printed, exported to a database or graphic program, and archived. When video is continuous, Scene Stealer can grab video at set intervals and durations. In addition, a software option allows audio grab and play.

Circle 18 on Reader Response Card

Flat and Square

Javelin Electronics has introduced the CVM14 and CVM-15PAL monitors. The units each have a 14-inch flat and square tube, and come equipped with a built-in speaker for enhanced applications. Other features include over 400 TV lines of horizontal resolution, automatic degaussing at power on, and S-video input/output connectors permitting use with an advanced VCR or camera having Y/C separated output.

Circle 19 on Reader Response Card

Background and Foreground

CDK International has introduced a line of background and foreground ceiling speakers, consisting of the SMP602, the CX-801, and the CX-802. The SMP602 is a 6.5-inch Coaxial with a .5-inch soft dome tweeter, polycone woofer, and a response of 65Hz to 20 kHz. The CX-801 is an 8-inch infinite baffle coaxial with a .5-inch soft dome tweeter, with a response of 85 Hz to 20 kHz. Finally, the 802 is an 8-inch coaxial with a long throw polycone, a high-efficiency dome tweeter, and response of 45 Hz to 22 kHz.

Circle 20 on Reader Response Card

World Radio History

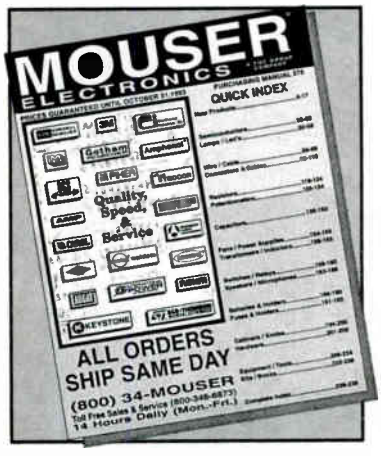
LITERATURE

Electronic Components; Korg's CD-ROM

New Catalog From Mouser

Mouser Electronics has published their latest industrial electronic components catalog. The 240 page catalog features a Quick Index on the front cover and a comprehensive index of both manufacturers and product categories. The new catalog contains over 42,000 in-stock, factory-authorized product selections from over 90 manufacturers.

Circle 21 on Reader Response Card



Korg Goes CD-ROM

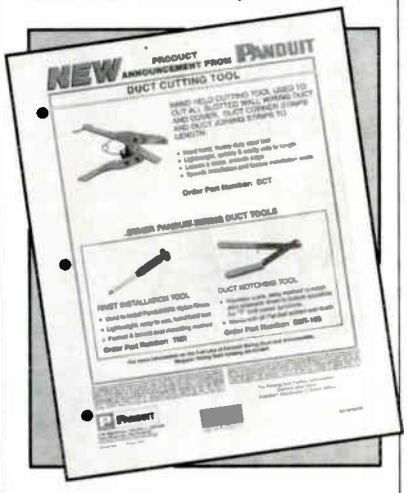
Korg has introduced a CD-ROM brochure for the new X3 Power Music Workstation. The mixed-mode X3 CD includes eight music tracks playable on any CD player plus a CD-ROM track for Macintosh computers featuring a visual showcase of the music workstation's capabilities. The CD-ROM track is divided into to parts: an on-screen remote control for the music tracks including animated graphics and comments from each composer, and a guided tour of the X3 Workstation that explains and explores its features.

Circle 22 on Reeder Response Card

Duct Cutting Bulletin

A duct-cutting tool, designed for use with Panduit Panduct wiring duct, corner strips and joining strips, is described in a bulletin available from Panduit Corp., Electrical Group. The handheld, heavy-duty tool can be used to cut Type F, E, NE and PE slotted wall wiring duct to length.

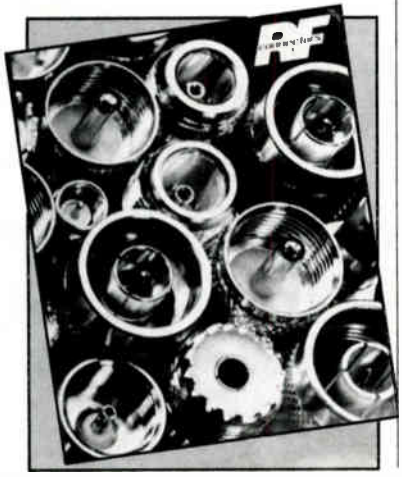
Circle 23 on Reader Response Card



Coaxial Connector Catalog

RF Industries has announced a 36-page catalog of coaxial connectors including 150 additions. The catalog contains coax products including cable assemblies, connector kits, Unidapt, and Celludapt universal adapter products.

Circle 24 on Reader Response Card



PEOPLE

Coviello Advances; Denon Expands

Celestion Promotes

Celestion Industries Inc. has announced the promotion of Brian Coviello from national sales manager Pro Division to sales and marketing manager.

Coviello

Denon Management Team Expands

Denon America, Inc. has announced that Ryusei Takahashi has been named Chairman of the Board and Chief Executive Officer of the American operation, and Director of Sales Stephen Baker has been promoted to Vice President of Sales and Marketing.

Takahashi, who has worked for Denon parent company Nippon Columbia for more than 30 years, has a great deal of international experience. Baker is responsible for all sales and marketing activities for the company's three consumer electronics hardware divisions (Home Audio, Specialty Audio and Car Audio), as well as for Professional Audio.

Bullard Joins Extron

Jim Bullard, former IBM Audio Visual liaison to the large-screen projection manufacturers, has joined the Marketing efforts of Extron Electronics. He worked with IBM for 30 years before joining Extron Electronics, a manufacturer of high resolution computer-video interfacing products, as well as video test generators and scan converters.

Bullard

Microlog's New Senior VP, Sales

Microlog Corporation has announced the appointment of Thomas P. Mangan to the new position of senior vice president of sales. His responsibilities include management of Microlog's sales activities including pre and post sales, target market strategy, and third party reseller development. Mr. Mangan previously has held senior management positions with Avanti Communications and Sprint.

AMS Addition

American Management Systems announced that Daniel J. Altobello has been elected to the company's Board of Directors.

Mr. Altobello is currently Chairman of the Board, President and CEO of Caterair International Corporation, a leading provider of airline catering services. Prior to joining Caterair, Mr. Altobello was with Marriott Corporation in senior management and Georgetown University, where he also held senior management positions.

Marra at Sound Associates

Tony Marra has been appointed to head up the new service center at Sound Associates. Marra is factory trained and authorized by BSS, DDA, Dynacord, Klark-Teknik, Midas, Milab, Neve, Soundcraft, Trident and Yamaha. In addition, he is an authorized technician for Akai, Biamp, Carver, Fostex, Rane, Ramsa and Roland.

Marra has 19 years of technical experience for companies including Electrotec Productions, Soundcraft, TLM Electronics and Klark-Teknik.

World Radio History

AD INDEX

Company	Page	RS #
Applied Technical Systems	77	232
Ashly Audio	18	254
Atlas Soundolier	41	217
Audio Technica	31	201
Bag End	8	209
Behringer	7	205
Cal Switch	55	259
Conquest Sound	43	260
Crest Audio	47	218
Crown International	59	251
DOD Electronics	CIII	219
Electro-Voice	CIV	214
Exchange National Funding	77	230
G&H Industries	74	279
Gemini Sound	45	202
Gold Line	28	273
Heliotrope General	77	234
JBL Professional-UREI	29	—
Mackie Designs	57	215
Menlo Scientific Acoustics	68	253
Merdian Communications	77	231
Multiplex Technology	40	269
Music Supply Company	77	236
Neutrik USA	65	250
One Power/Whitenton	69	280
Opamp Labs	77	235
Pacesetter Electronics	33	213
Peavey Architectural Acoustics	49	220
Peavey-Architectural Acoustics	4/5	208
Peerless Sales Company	38	257
Phonic Ear	44	252
Professional Audio Systems	26	261
QSC Audio	24/25	206
Rane	27	249
Raxxess Metalsmiths	60	286
Renkus-Heinz	23	258
Roadie Products	77	237
Rolls	52	270
Sabine Musical Manufacturing	51	248
Sam Ash	60	287
Samson Audio	35	203
Sharp LCD	11	212
Shure Brothers	15	211
Sonic Systems/Soundsphere	21	255
Sonic Systems/Soundsphere	53	256
Soundtracs	67	204
SVS	32	271
t.c. electronic (east/west)	77	233
Tascam	17	246
Tektone Sound & Signal	39	247
University Sound	CII	210
Whirlwind	34	272
White Instruments	58	274
Winsted	70	278
Yamaha Pro Audio	3	207

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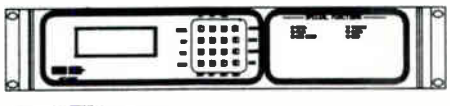

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World Radio History

PRODUCT CHECK: BARS AND CLUBS

Products most frequently used in bar and club installations...

. . . NOW IN PROGRESS

PRODUCTS	1	2	3
Speakers	JBL	ELECTRO-VOICE	BOSE
Subwoofers	BOSE	JBL	COMMUNITY
Power Amps	CROWN	TOA	CREST
Audio Tape Players	YAMAHA	TEAC	SONY
CD Players	SONY	DENON	TEAC
Microphones	SHURE	ELECTRO-VOICE	AUDIO-TECHNICA
Portable Consoles	BIAMP	TOA	RAMSA
Racks	ATLAS/SOUNDOLIER	MIDDLE ATLANTIC	RAXXESS
VCRs	PANASONIC	JVC	SONY
Video Monitors	SONY	JVC	NEC
Signal Processing	RANE	FURMAN	DOD
Mixers	RANE	TOA	STUDIOMASTER
Power Conditioning	FURMAN	JUICE GOOSE	TRIPP LITE
Video Projectors	SHARP	SONY	JBL
Video Screens	STEWART FILMSCREEN	DA-LITE	DRAPER

. . . IN LAST SIX MONTHS

PRODUCTS	1	2	3
Speakers	JBL	ELECTRO-VOICE	BOSE
Subwoofers	BOSE	JBL	COMMUNITY
Power Amps	CROWN	TOA	*CREST/YAMAHA
Audio Tape Players	TEAC	YAMAHA	TECHNICS
CD Players	SONY	DENON	YAMAHA
Microphones	SHURE	ELECTRO-VOICE	AUDIO-TECHNICA
Portable Consoles	BIAMP	TOA	ELECTRO-VOICE
Racks	ATLAS-SOUNDOLIER	MIDDLE ATLANTIC	RAXXESS
VCRs	PANASONIC	JVC	SONY
Video Monitors	JVC	SONY	PANASONIC
Signal Processing	RANE	*FURMAN/DOD	YAMAHA
Mixers	RANE	TOA	STUDIOMASTER
Power Conditioning	FURMAN	JUICE GOOSE	TRIPP LITE
Video Projectors	SHARP	SONY	JBL
Video Screens	STEWART FILMSCREEN	DA-LITE	DRAPER

SURVEY METHODOLOGY

1. The sampling pool for the survey consists of sound and communications contractors from Sound & Communications' subscription list. Only contractors within the United States and Canada are called.
2. In a telephone survey, contractors/installers selected at random are asked to identify what brand they used for various products in installations completed in the past six months and those in progress. A different type of installation is highlighted each month.
3. On completion of the survey, results are tabulated and the product brands are ranked on a scale from one to three, with number one having the most votes. Separate rankings are made for installations occurring in the past six months and for those in progress.
4. An asterisk (*) denotes a tie for that ranking.

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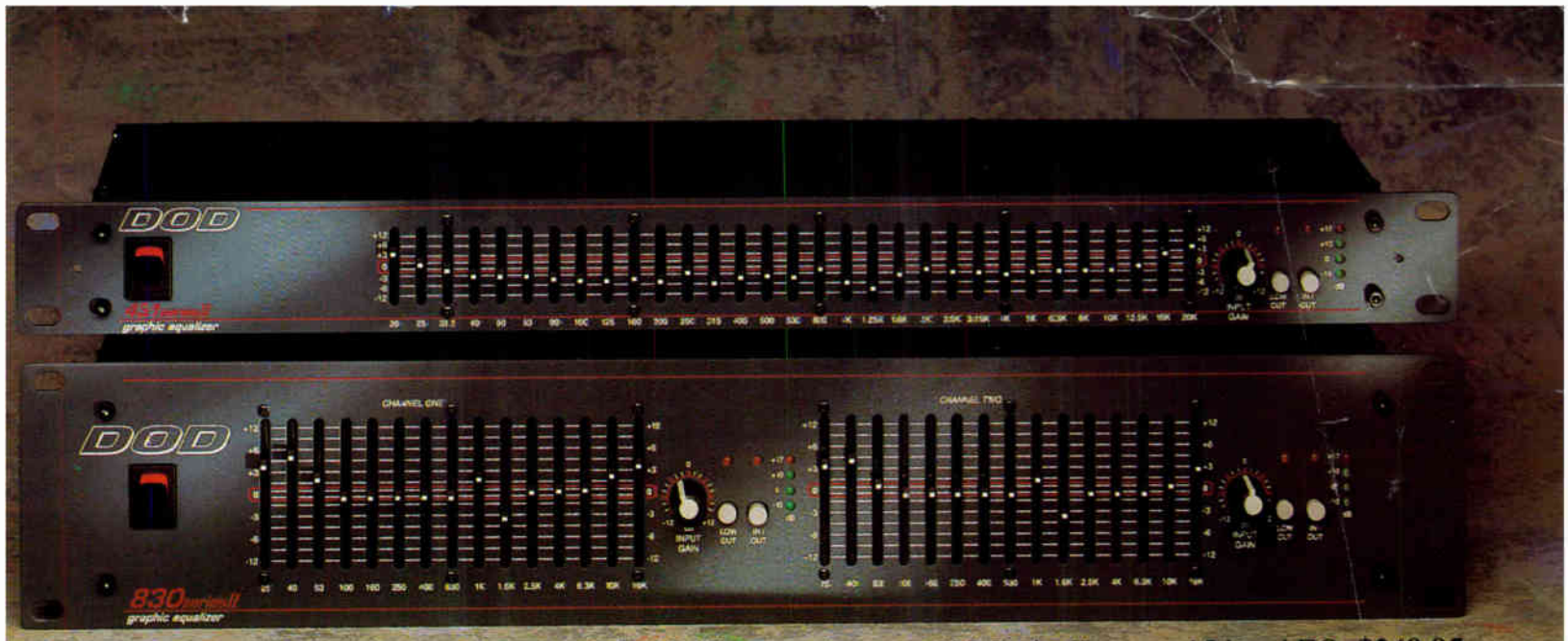

top: 431 SeriesII 31 band single rack unit EQ **$249.95** bottom: 830 SeriesII stereo 15 band EQ, **$249.95**

Fill your rack without emptying your pockets.

We build more equalizers than anyone else in America, and we sell them all over the world.

And now we're introducing the new SeriesII, with 5 EQ's and 5 signal processors. More than just a new look and feel, DOD SeriesII EQ's are engineered and built "smart", using the latest Computer Aided Design techniques, and the highest manufacturing standards.

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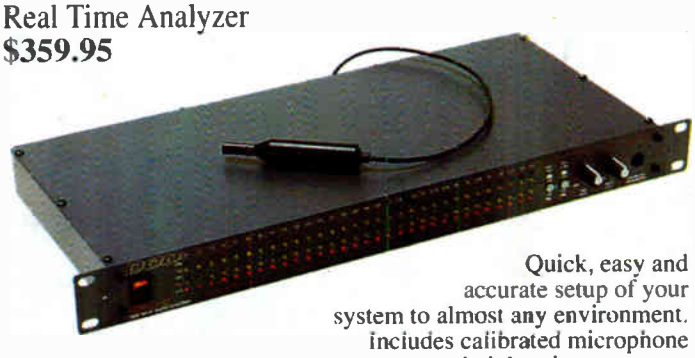

Quick, easy and accurate setup of your system to almost any environment. Includes calibrated microphone and pink noise generator.

These new models offer 12dB of boost & cut on ISO standard center frequencies, and FET switches for the low-cut and bypass functions to eliminate annoying 'thumps'.

With a signal-to-noise ratio greater than -90dB, and harmonic distortion less than .006% @ 1kHz, they're ideal for PA, club, or lounge installations, or for your studio recording projects.

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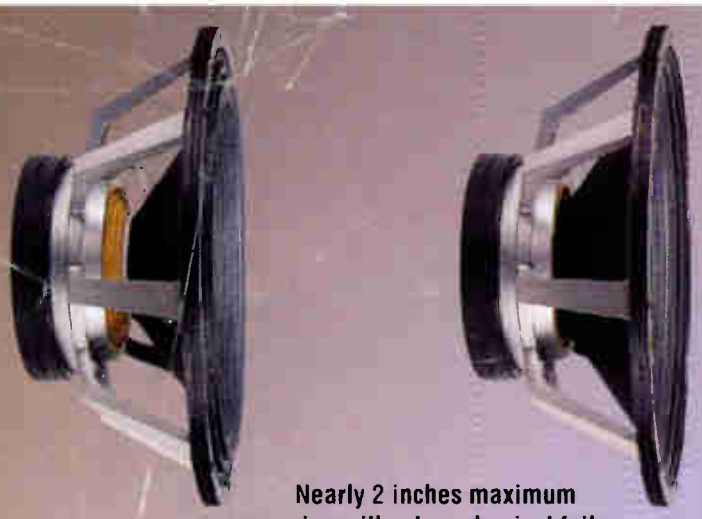

Nearly 2 inches maximum excursion without mechanical failure.

An all-new, long-span cloth surround offers high axial stability and freedom from coil rubs.

What a difference an "A" makes...

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Our 1000-watt EVX woofers were subjected to five years of rigorous field testing and research into failure modes not revealed in normal lab testing. The result: **the new EVX-150A and EVX-180A high-power woofers** are the finest woofers currently available.

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