

SOUND COMMUNICATIONS

Volume 36 Number 9

September 17, 1990

A MESSAGE TO OUR READERS

The magazine you are holding is SOUND & COMMUNICATIONS. Yes, it's slicker looking, more commanding, contemporary, easier on the eye, and yet challenging to the mind.

As always, SOUND & COMMUNICATIONS is

- the one that conducts the annual Contractors Survey.
- the one that has produced — for 30 years — the Blue Book industry sourcebook.
- the one that creates and produces the only TV newsprogram for contractors (NSCA-TV News).

• the first — and continuing developers (at the NSCA show) — month after month — software.

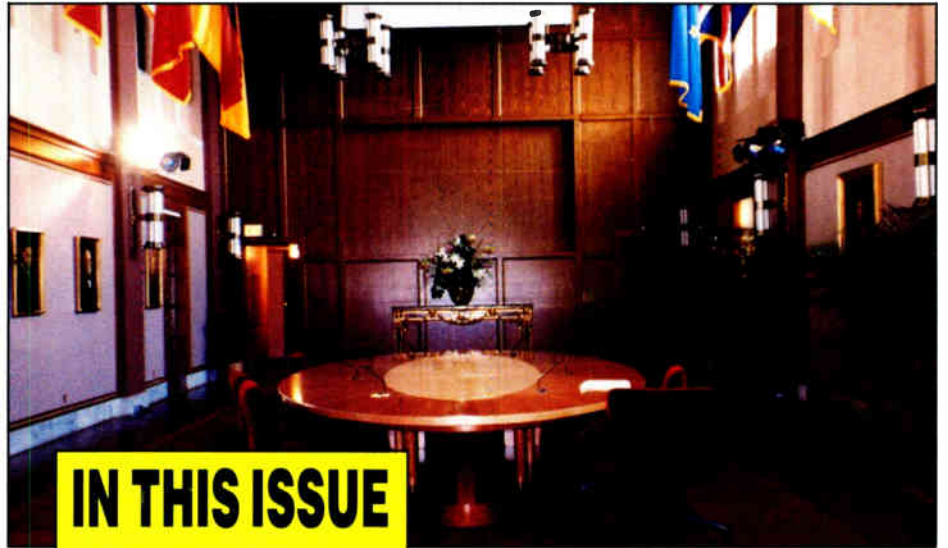
It's the 35th anniversary of being in this market. We continue to bring you new exciting ideas for its

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SOUND FOR A WORLD SUMMIT

At the Houston Economic Summit, the translation services had to be perfect. Security was tight; and the large international press corps had to be served. The facilities were spread out; the deadline was short. But there wasn't a hitch, and the world leaders were able to talk to and hear each other.

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IN THIS ISSUE TESTING:

Digital Multimeters

The lowly multimeter is often taken for granted. But smaller packages and higher tech have changed the way they're used and what you'll pay. The analog multimeter has gone the way of the slide rule. What's up in digital? **46**

The TDR

The Time Domain Reflectometer has traditionally been a pricey piece of equipment requiring an operator with an engineering degree. New developments have led to equipment that is user friendly, cheaper and very valuable in finding cable faults. **50**

BINAURAL AUDIO

The use of binaural audio techniques can validate theory and stimulate interest. New technologies may increase the level of innovation. Psychoacoustic cues can be offered that are similar to real life. But nothing's perfect. **24**

SOFTWARE REVIEW

CADP version 4.53 has been released by JBL. Mike Klasco reviews the products — and finds some fine improvements. **56**

LA

The Theater of Chicago had special constraints and innovative requirements. The system is on-line and working. We trace the project and the results. **42**

SOUND





A wireless microphone you can trust.

A growing number of churches are turning to Vega Ranger true-diversity wireless microphone systems.

They know that Vega's a name synonymous with quality and reliability the world over. After all, we've been building wireless microphone systems for nearly three decades.

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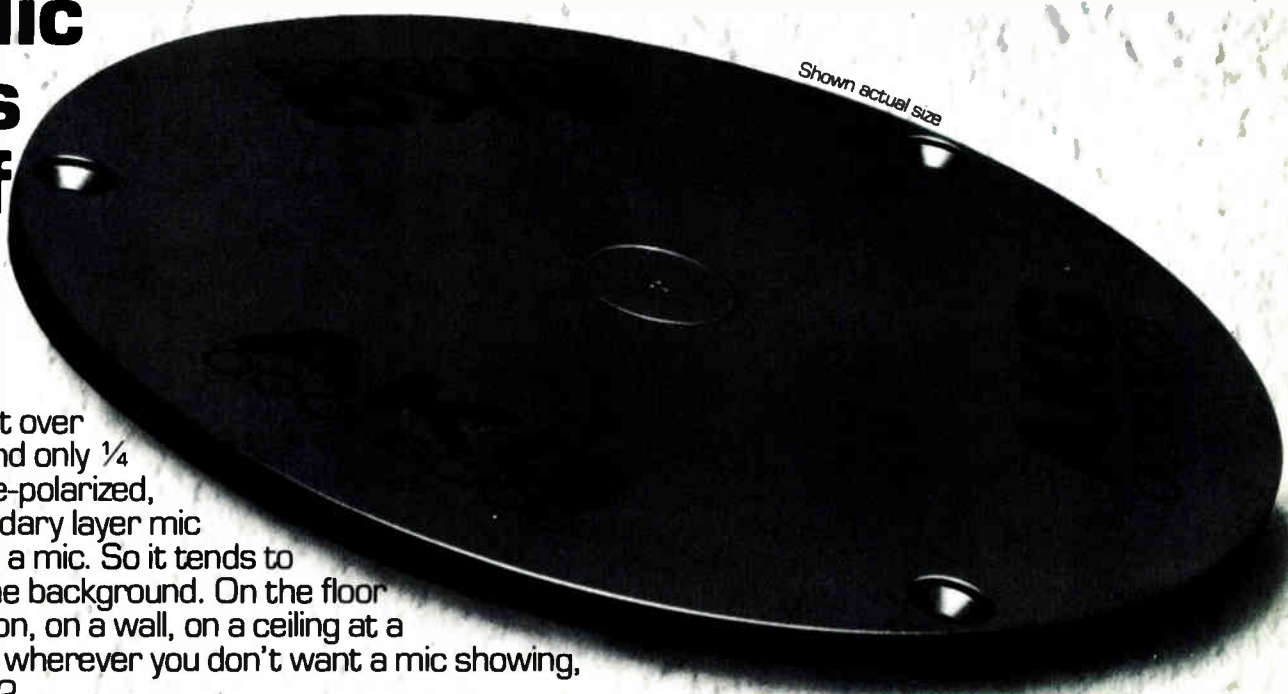
Worldwide History

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SOUND
COMMUNICATIONS

LETTER FROM THE EDITOR

AES — L.A.

Autumn comes early this year. At least it does if you tell time the way we do — by yearly business travel. This year's Audio Engineering Society moves up to a September date and thus doesn't conflict with other events. And following the AES bicoastal policy instituted a few years ago, this September we meet in Los Angeles at the Los Angeles Convention Center.

Sound & Communications magazine is there of course, reporting on the exhibits and sessions of special interest to the sound contracting community. Our report will be published in our November issue.

More immediately we at Testa Communications are again producing Crosstalk/AES-TV News, available for viewing in convention hotel rooms and on the exhibit floor. The convention television operations of Testa Communications now encompass seven shows a year — all directly involved with the businesses our publishing endeavors are involved in. The television news shows are now produced during NAB, NAMM, NSCA, CES, and of course AES.

Since the same editorial staff that puts together Sound & Communications also reports and writes the scripts for our TV shows, we have an unusual and welcome opportunity to know what's going on in other aspects of the business.

This year's AES-TV News will offer expanded coverage from the exhibit floor in addition to our traditional technical discussions. Some of the news we see at press time includes an expanded Studer offer-

ing, fresh from the company's purchase by a Swiss conglomerate and its acquisition of Dyaxis. Fostex will be introducing a new portable DAT. (DAT of course continues in the pro market despite its fits-and-starts on-again off-again introduction to consumers.) Electro-Voice shows new DeltaMax product. JBL has a bevy of new speakers. And by AES time we're sure we'll be inundated with news of the innovative, the brilliant and the never-to-be marketed.

The theme of this 89th convention is "Creating Illusions in Sound — the Fusion of Art, Technology and Imagination." Convention chairman Ron Streicher and the rest of the movers and shakers have put together a program with special pockets of interest for readers of Sound & Communications.

The Audio Engineering Society convention once again is a special event devoted to the scientific, along with the practical, aspects of sound technology. Watch for our report on what we've seen.

If this issue of Sound & Communications looks a little different, it is. We've updated the graphics and put the size into a friendlier recognizable format. We view our readers as people with taste, and our aim is to provide useful information in an easily readily format.

Best regards,



Judith Morrison



An overview of the Los Angeles Convention Center, site of the 89th AES Convention.

SOUND COMMUNICATIONS

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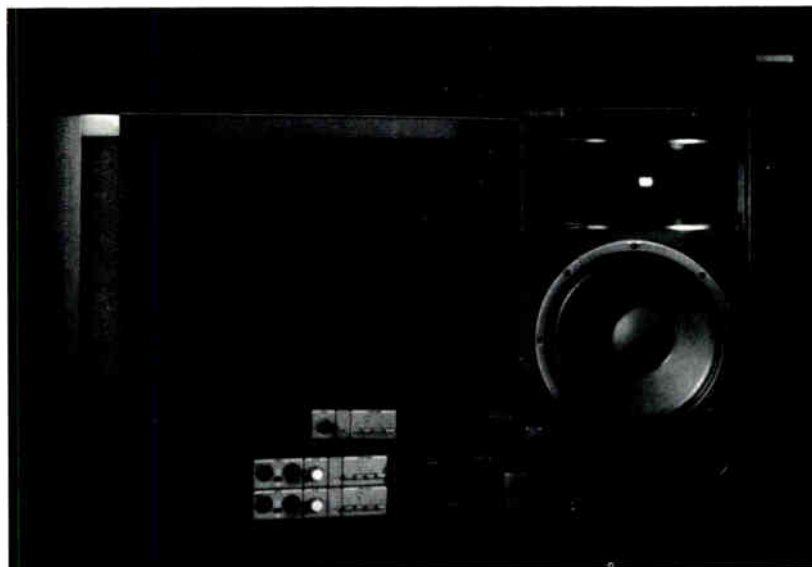
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DIMENSIONS:

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Apogee is proud to be recognized by the audio professionals who nominated our AE-4 speaker system in not one, but two categories of the 1990 TEC Awards. We thank the nominating committee for this honor, and we also thank the consultants, contractors and sound companies who specified and installed AE-4 systems throughout the world.

The AE-4 loudspeaker is a two-way, electronically coupled system providing high acoustic output, smooth response and very low distortion. Designed for use with the new generation Advanced Technology P-4 Processor, the AE-4 system is a versatile performer fulfilling a wide range of music and speech reinforcement applications.

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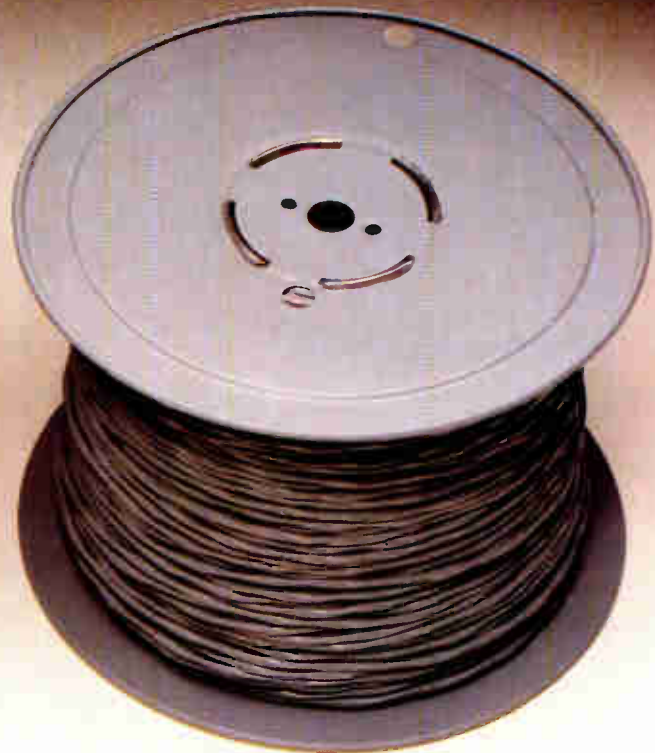
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World Radio History

THE WIRE GROUP
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NEWSLETTER

EDGETECH TO AKG

It has been learned by Sound & Communications that AKG Acoustics Ltd. has acquired a controlling interest in the Edge Technology Group Ltd., together with its subsidiary companies Turbosound Ltd., BSS Audio Ltd., and Precision Devices Ltd. Product lines BSS and Turbosound were previously distributed in the U.S. by Klark-Teknik, and will presumably switch to the AKG banner. According to Jack Kelly of Klark-Teknik, new markets will be opened up for his company. Further details were unavailable at press time.

RILLING TO B.E.S.T.

Gary Rilling, previously marketing manager/Europe for Altec Lansing, has moved to B.E.S.T. as director of marketing.

JOHANSEN TO AMX

Eric Johansen has been named director of sales and marketing at AMX.

EASE PROGRAM AT RENKUS-HEINZ

Renkus-Heinz has signed an agreement with Dr. W. Ahnert of Berlin which gives Renkus-Heinz worldwide distribution responsibilities for the English version of the EASE acoustic design software program developed by Dr. Ahnert. Siemens AG of Germany has a similar agreement covering the German version. EASE (Electro-Acoustic Simulator for Engineers) is designed for use on IBM and compatibles.

STATE REGULATION DANGER

New Jersey contractors alert others to beware of state regulations that could hamper business. New Jersey regulations on the books since 1965 but previously not enforced stipulate that any electrical work over 10 volts be performed by electrical contractors. New lobbying by the interconnect suppliers to revamp other parts of the law have opened up the question of 10-volt work. New Jersey contractors The Service Company and db Electronics are spearheading lobbying efforts directed toward the New Jersey regulators, but no formal organization has picked up the banner as of yet.

IN MEMORIAM

Bud McKinney, one of the founding members and past president of the National Sound and Communications Association, died on August 12, 1990. McKinney had been an active and respected leader in the industry for many years. Expressions of sympathy can be sent to Lloyd McKinney Associates, 25350 Cypress Avenue, Hayward, California 94544. A memorial service was held at the Neighborhood Church in Castro Valley, California. The NSCA has sent a donation to the Twain Heart Evangelical Church in Twain Heart, California on behalf of NSCA members.

TELEX ACQUISITION

Telex Communications, Inc. has acquired the central matrix intercom and audio distribution system product lines from McCurdy Radio Industries, Ltd. of Toronto. Jeffrey S. Wetherell, president of TCI, said, "This is another in a series of strategic acquisitions and product developments positioning Telex as a primary intercommunication source." Telex acquired RTS Systems last year. According to the company, the addition of McCurdy's digital central matrix products gives the company point-to-point communications for systems of all sizes up to 600 x 600 and with capabilities beyond. The McCurdy product line will be managed out of the RTS division in Burbank. Financial details of the acquisition were unavailable.

NEWSLETTER

STENTOFON NAMES GREEN

Stentofon AS has named Joseph V. Green president of its USA subsidiary Stentofon Communications, Inc. (SCI). Green is well known to the industry through past affiliations with Altec Lansing, Yamaha and TOA. Green takes over full responsibility of all of Stentofon's U.S. operations including the introduction of several new Stentofon intercom and related product lines. New product introductions are expected by the end of the year.

NEW TIME LAPSE

Gyyr has introduced nine new time lapse products, including a half-load single field playback deck that records up to 720 hours on a single two hour video cassette. Built on an industrial chassis, the model has an anticipated pre-overhaul life of 8600 hours.

NEW YORK TIMES REVIEW

A new sound system in New York's Central Park passed muster with the music reviewer for the New York Times. Reviewing the first concert presented in the Carlos Mosely Music Pavilion, critic John Rockwell said the "new system passed the test handsomely." The reported \$3.385 million portable shell and sound system was designed by Peter Wexler with acoustical consultation by Christopher Jaffe and includes 24 speaker towers.

PERSONNEL AT VAUGHN

Vaughn Duplication Services, a division of Vaughn Communications, has added three sales representatives to its Florida and New York offices. Barbara Hummel and Rick Mabeus have joined Vaughn's Tampa office. Lloyd Dorfman has joined Vaughn Duplication in New York.

EDS PLANS

David McCoy of Cartright & Bean in Norcross, Georgia has been elected president of the Electronic Industry Show Corporation, and is spearheading the planning process for the 1991 Electronic Distribution Show and Conference to be held at the Las Vegas Hilton April 28 through May 1, 1991. McCoy succeeds Charles Poncher, president of Hawk Electronics. Changes in the EDS show will reportedly include a new focus on educational programs and presentations on niche market opportunities. A forum for manufacturers will also be introduced.

SCHARFF WEISBERG ACQUIRES

Scharff Weisberg Inc. has acquired VSC Presentations from Video Services Corporation. VSC Presentations, a staging company, will operate as the staging division of Scharff Weisberg, the company owned by Peter Scharff and Josh Weisberg, and founded in 1979 as an audio equipment rental company. A/T Scharff was acquired by VRI in 1989. As VRI Scharff Rentals, it has been purchased by Scharff Weisberg. Scott Schachter continues as head of audio rentals.

NEW INSURANCE

CIGNA Property and Casualty Companies has assembled a team of underwriters and loss control experts specializing in insurance for the communications industries to include radio and television, cable services, film and video production, cellular communication, telephone operations and publishing.

FIBEROPTIC TELECONFERENCE

Metropolitan Fiber Systems subsidiaries MFS of Los Angeles and MFS of San Francisco are providing fiberoptic network services to Union Bank for video teleconferencing. MFS is providing the local access portion of the video transmission to connect the bank with its long distance carrier. MFS is providing 384 Kbps circuits. The Los Angeles network consists of 966 fiber-miles. San Francisco's network is 916 fiber miles long and serves customers in 15.4 million square feet of office space.

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LETTERS

Sound Masking; Crown Amp

The majority of the mail and calls in response to our June issue concerned Raleigh Perry's article on sound masking. Comments range from outraged ("you missed the technical issues") to laudatory ("the best thing I've read on sound masking"). Most of the mail was favorable. —Editor

MASKING CAUTION

Raleigh Perry's article "The Marketing of Sound Masking" in the June 15th issue of Sound & Communications should not go without some serious cautions from the acoustical consulting community.

While I applaud Mr. Perry's marketing attitude and savvy, I suspect the reluctance of many sound contractors to market sound masking systems is well founded. The achievement of a "successful" sound masking installation is a very sensitive subject, involving a number of subjective and objective acoustical parameters, only one of which is the proper electrical design, wiring and installation of the sound masking system components. An analogy can be made between acoustical satisfaction in an open plan office to that of a concert hall. Both are very dependent upon the end user making subjective judgments regarding his/her perception of acceptability. No matter how much or what kind of technical data one can generate to show "compliance with generally accepted acoustical criteria" — and other similar projects, if the client isn't satisfied — he/she isn't satisfied.

Even for acoustical consultants working many years in the field, the achievement of good open plan acoustics can be a difficult and challenging endeavor. While some (I suspect very few) audio contractors may truly understand the principles of open plan acoustics, the majority certainly do not. A crash course will not do it.

It takes years of experience, a thorough

understanding of the theoretical principles of architectural acoustics and psychoacoustics, and practical experience on many open plan projects to become expert in knowing when a sound masking system is appropriate and when it is not; how much it can help to provide acoustic privacy; and what are its limits; what are the building construction details that can get you in trouble (*e.g.*, open return air slots in the ceiling); what spaces should get masking and what shouldn't, especially where both open plan and enclosed spaces coexist and transitional areas must be determined.

Acoustical consultants know that sound masking is only one parameter which may help in accommodating acoustic privacy in an open plan space.

I believe sound masking system design and open plan acoustics is an area for acoustical consultants; and sound contractors should tread very cautiously.

Dennis Paoletti
Acoustical Consultant
Paoletti Associates, Inc.
San Francisco, CA

SOUND SOUND MASKING

My compliments to Raleigh Perry for the fine article on sound masking that appeared in the June 15, 1990 issue. Mr. Perry hit the masking sound issue squarely on the head on all counts. I was particularly impressed with his assessment that most of the systems are installed by "furniture dealers." While they do have the inside track with the specifier, they traditionally have little experience or technical expertise with acoustics in all forms, much less something as advanced as masking sound. Unfortunately, their inexperience may eventually, if not already, give masking a bad name. Terms such as white noise, by themselves, denote negative connotations and must be eliminated from conversation about masking sound. The situation is akin to the bad name that prefab houses got after World War II. The product was excellent. Poor marketing and those interested only in making something "cheap" nearly ruined an otherwise good idea.

I spent 17 years with Owens Corning Fiberglas, who provided acoustical environments for office interiors. Our research and marketing department demonstrated that proper use of acoustical materials and background masking could provide confidential speech privacy, even in an open office. Unfortunately, all this effort went for naught when greedy corporate raiders forced OCF to exit the interiors market. Had this not happened, Mr. Perry's observation regarding a lack of knowledge about open office acoustics and masking sound may not have ensued. OCF had plans to reintroduce to the market a complete interiors package including background masking sound, ceiling systems, space dividers, and ancillary products. The program was scrapped when the entire OCF Interiors Division was dismantled overnight to go back to basics (*i.e.*, thermal insulation). Those of us that nurtured and promoted the technology were bluntly released.

As a result of greed by the money mongers, great technological advances have been lost. For example, considerable research spawned a background masking speaker that substantially reduced the individual unit cost and allowed speakers to provide spatial uniformity with a wider spacing. This system was carefully designed to complement efficient glass fiber ceiling boards and eliminate the need for TL backings and dual or quad tracks. Because of the OCF downsizing this system was lost to the industry.

As an individual, I have launched a, so far, unsuccessful quest to find someone to bring the system back to the market. Having been developed for the Federal Office Building Program of the 1970s and early 1980s, this system has been proven in billions of square feet of office space at a price tag that is half that of the systems Mr. Perry cites.

As a keeper of all the technology relating to this system, I am most interested in finding someone willing to join forces and return this efficient system to the market. Maybe we can even renew and expand the market opportunity and industry expertise by providing a proven product at a reasonable price that was designed to work best with acous-

tically efficient ceiling systems. Is anyone out there interested — or listening?

One detail that Mr. Perry did overlook was the fact that the American Society of Testing and Materials (ASTM) Committee E-33 on Environmental Acoustics has finally adopted a series of test procedures and standards that deal with both background masking systems and open office acoustics. I helped introduce these specifications over ten years ago. Unfortunately, the long time required to obtain industry consensus for these specifications has dulled interest. Had they been adopted five or six years ago, we may not be facing the situation that Mr. Perry accurately assessed.

Until now, the only procedures were published by the Public Building Service of the USA General Services Administration. PBS C.1 and C.2 were written by Dick Hamme of Geiger and Hamme Laboratories. While technically accurate and very innovative, the language used was ponderous. The base premise for the ASTM documents was adopted for the family of ASTM procedures. Masking sound technology is now an industry standard. We also have proven equipment. Now all we need is someone to market the systems intelligently and educate specifiers, users and installers on how to utilize proper open plan office acoustics techniques. The "magic" has been reduced to a legitimate technology. With Mr. Perry's insight into the market opportunity and marketing strategy, there seems hope that background masking sound can be rescued from a bad name syndrome.

David Harris
Principal
Building and Acoustic
Design Consultants
Rolling Hills Est., CA

MASKING DISAPPOINTMENT

I have just read the article by Raleigh C. Perry in the June 15th issue entitled "Sales and Marketing: Sound Masking."

Frankly, I am disappointed that you would include such an article, which does nothing to increase your readership's knowledge of what sound masking is, and where it is needed.

As an acoustic consultant, I find per-

suading clients that a sound masking system would be a positive benefit to a working environment a difficult task. Articles like the one written by Mr. Perry, offer no help, and are likely to retard progress, if anything.

Sound masking should be used as part of an integrated interior design. It is by no means a simple subject. I have recently reviewed a prospective new book on the subject, which runs well past 200 pages! Failure to integrate the design of furniture systems, interior acoustics, office layouts and air conditioning systems with the use of sound masking can lead to a complete waste of money.

Simply adding sound masking to an office space to increase privacy is not the answer in every case. More often than not, changes to the workstation design and density are required.

The challenge, therefore, is to educate

the design professionals: the interior designer and architect. This will not be done by ill conceived, conversational articles, as written by Mr. Perry.

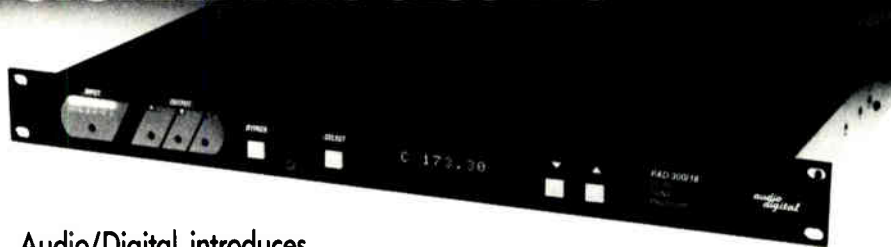
Stephen G. Lindsey
Cerami and Associates, Inc.
Long Island City, NY

Mr. Perry's article was intentionally not directed toward design professionals; it was designed to speak to sound professionals and was in our view a serious marketing piece alerting the industry to where it's missing the boat.
— Editor.

CROWN MODEL

On page 44 of our June 15, 1990 issue, a caption misidentified the model number of a Crown amplifier. The correct model number is the Crown Com-Tech 1600. Our thanks to Sam Helms of Sigmnet Corporation for calling the error to our attention.
— Editor

AUDIO/DIGITAL PRESENTS AFFORDABLE 18 BIT DIGITAL SIGNAL PROCESSING



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FIRST PERSON

CONFERENCE ELECTRONICS AT THE 1990 ECONOMIC SUMMIT

By Susan Davis

The 1990 Economic Summit of Industrialized Nations, held in July in Houston, was an event of international importance, replete with red carpets, pomp, and circumstance.

The meetings were hosted by President Bush, and were attended by the leaders of the United Kingdom, the Federal Republic of Germany, France, Italy, Canada, Japan, and the European Community. The presence of the eight leaders of the industrialized world demanded intricate planning, high security and perfection in every detail. For DIS-Brahler USA, contracted to provide microphone systems and simultaneous interpretation equipment for the meetings, the Summit presented a unique challenge to our engineers' skill, flexibility and ingenuity. And with a little less than six weeks between the day the contract was awarded and the day the installation began, there was no time to be lost in our planning and preparation.

Simultaneous interpretation is instantaneous oral translation from one foreign language to another using high-level interpreters and specialized electronic equipment. The Summit had five official languages (English, French, German, Italian and Japanese); the heads of state and their ministers spoke and listened in their own languages, and their words were interpreted into the other four official languages by teams of interpreters. Because a clear and uninterrupted sound feed is essential for interpreters, a micro-



The Heads of State table at Rice University.



Infrared emitters at the press room of the George R. Brown Convention Center.



Infrared receivers at the press room of the George R. Brown Convention Center.

Susan Davis is Director, Language Services for DIS-Brahler USA in Silver Spring, MD.

phone system integrated with the interpretation system was indicated for all meeting rooms.

Rice University, the first of the two venues outfitted by Brahler ICS, was the location of two and a half days of high-level meetings. Four meeting rooms were used, accommodating sessions for the heads of state, their foreign secretaries and finance ministers as well as a large plenary session. Each room had a custom-designed conference table, ranging in size from eight to twenty-four seats. To ensure the best quality sound, each table was equipped with a Brahler Digimic computerized microphone system. At each delegate position, a gooseneck microphone was installed. A channel selector with volume control was also mounted at each position, along with a headphone jack, so that each delegate could select the language that he or she wished to listen to. Since any failure

of the system during the meetings would be a diplomatic embarrassment to the United States, installation of both the microphones and the channel selectors was done two weeks in advance of the ac-

A MICROPHONE SYSTEM INTEGRATED WITH THE INTERPRETATION SYSTEM WAS INDICATED FOR ALL MEETING ROOMS.

tual meetings, to allow ample time for testing and adjustment. Because of cable restrictions at the adjoining tables, the delegates' advisors, known as "sherpas," were equipped with infrared wireless channel selectors/receivers; they received the interpretation via infrared transmission. The high ambient light levels from nearby windows necessitated the use of new high-

power infrared emitters to ensure noise-free reception.

In each meeting room, interpreters were seated in modular soundproof booths, especially designed and handcrafted in Denmark for interpretation. Esthetics were of great concern to the U.S. organizers, and the rooms' architects went to extraordinary lengths to create the illusion that the booths were permanently built in. In two rooms, walls were built in front of existing balconies, with windows cut out at the precise location of the booths' windows. The foreign ministers' meeting room had no space for booths at all. Since interpreters must see the delegates in order to interpret for them, Brahler ICS installed the booths in an adjacent room, and set up video cameras in the meeting room itself; interpreters watched the proceedings on 25-inch video monitors.

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In addition to the Rice University meeting locations, Houston was host to the International Press Center, housed in the George R. Brown Convention Center several miles away. At the Convention Center, we faced somewhat different problems — a 36,000 sq. foot press room and a General Assembly Hall that seated upwards of 800 people. Both of these sites needed the capacity to transmit interpretation of the press conferences and Final Communique for 2200 members of the foreign press, and provide press mult access in any of the five official languages. At both sites, interpretation was transmitted via an infrared system, using high-power 10-watt emitters to “illuminate” each room so that interpretation could be received with a wireless infrared receiver at any point in the rooms. These emitters were suspended in clusters from lighting trusses for optimum coverage without

phase-shift. Interpreter booths were installed on platforms at the rear of the General Assembly Hall; the interpretation was fed through special telephone lines from the General Assembly Hall to the press room. When a press conference was held, those members of the press who did not have access to the General Assembly

INSTALLATION WAS DONE TO ALLOW AMPLE TIME FOR TESTING.

Hall could use our infrared receivers to hear what was being said.

The press mult requirement presented us with a challenge of size and scope: in order to afford access in any language in either press location, we were asked to provide 55 multilingual press mults, each with 50 jacks, for a total of 2750 total con-

nectors in five languages. Since Brahler ICS had never before been required to provide this many mults, our engineers designed the mults themselves and supervised their manufacture. As with the interpretation systems, the mults were linked by special lines provided by the telephone company.

One of the biggest factors in servicing the Summit was organization of on-site staff during the two-week installation period. In addition to our advance installation team, Brahler ICS sent 16 engineers and technicians to Houston. Each staff member was assigned to a specific team (interpretation, microphones, press mults, or video) according to his area of expertise, as well as a job site (Rice University or the Convention Center). Once their own tasks were completed, team members provided backup support to other

(continued on page 63)

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TESTING AND MEASUREMENT

THE ACOUSTIC TRIAD

By Don Davis

Time, energy and frequency describe TEF. The questions that naturally follow are: What time? What kind of energy? What kind of frequency?

WHAT TIME?

There is astronomical time which has little meaning to acoustic measurements. There is the supposed exact moment something is supposed to have happened, but nothing is instantaneous and events have a time span. There is causality to consider. Causality simply means that there was no result prior to a cause. One constraint in relation to time in acoustics is:

$$f \cdot t = 1.0$$

That is, if you choose a frequency span, it will dictate a minimum time span.

$$f = 1/t$$

and then:

$$t = 1/f$$

When utilizing our present mathematical system, these relationships are a law. There is the time a signal takes to travel from a sound source to an observer. This time is referred to as signal delay because while time elapsed, time was not delayed; only the signal experienced delay. There is a normally expected minimum signal delay and there can be, on occasion, an excess delay in addition to the expected delay.

If the signal has a frequency of 1000 Hz that means that it requires 1/1000th of a second to produce one wavelength. That interval of time (*i.e.*, the time to produce one wavelength) is called the primitive period.

Don Davis is President/Owner of Syn-Aud-Con.

FREQUENCY WHAT?

It is far better to ascertain the wavelength of an acoustic signal rather than its frequency. The relationship between frequency and wavelength depends upon the velocity of propagation in the media.

$$f \lambda = c$$

$$\lambda = \frac{c}{f}$$

$$f = \frac{c}{\lambda}$$

Frequency is defined as the number of revolutions in phase per second and is the rate of phase change. One thousand Hertz is 360,000 degrees of phase revolution (2000 π radians) per second.

The dimensions of a space determine room modes, and these dimensions remain relatively stable, thus insuring that the wavelengths remain the same for a given mode. The frequencies associated with those modes can change with temperature because temperature changes the velocity of sound. This means they are not standing wave frequencies but rather standing wave wavelengths.

WHAT KIND OF ENERGY?

The question of energy is the difficult question. What proportion of what we observe is potential energy (energy due to position) and what proportion is kinetic energy (energy due to motion)? (Dick Heyser used to illustrate the difference between potential and kinetic energy with the following illustration: A profile view of his head with a bowling ball on a cable and touching his nose. He then asked the question, "Am I in any danger?" The answer, of course, depended on whether the picture was of potential or kinetic energy. If it were potential, the bowling ball was just hanging there. If it was a photo

of kinetic energy, then the ball was at maximum velocity and within microseconds of knocking Dick flat on his back.)

One of the great gifts of the TEF analyzer from Techron is its ability to show you this partitioning of energy in the free field of a sound source by means of the Nyquist display.

In acoustics, the energy of interest to us is the "energy density." Energy density is the energy per unit of volume (*i.e.*; Joules/M³). In audio, we satisfy ourselves with the voltage amplitude and the power. In acoustics, we usually work with sound pressure level squared and some estimation of the total sound power.

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The Basic Terms Electrical

Name	Symbol
Voltage	E
Current	I (E x I = W)
Resistance	R (I x R = E)
Impedance	Z
Phase	e
Power	W
Velocity of Propagation	c

The Basic Acoustic Terms

Name	Symbol
Sound pressure in pascal	P
Sound velocity in Ft/sec or M/sec	c
Characteristics acoustic impedance in RAYLS	pc
Sound power in watts	w
Sound intensity in watts per square meter	I
Directivity factor (dimensionless)	Q
Distance from sound source in Ft or M	r (or D _s)

$P_{r\theta\phi}$ represents the sound pressure at some distance r from a source and at a horizontal angle θ and a vertical angle ϕ .

$$P_{r\theta\phi} = \sqrt{\frac{WQPc}{4\pi r^2}}$$

Since we use sound pressure squared into an acoustic level in dB, we can separate the constant and write:

$$(P_{r\theta\phi})^2 = K\left(\frac{WO}{r^2}\right)$$

Since $(P_{r\theta\phi})^2$ is analogous to E^2 electrically, we then have a relationship acoustically that is as useful as Ohms law is electrically. The sound pressure squared at your listener's ears for direct sound is directly proportional to the total sound power and the directivity factor of the sound source and inversely proportional to the square of the distance from the source.

Sound power, W , is, in acoustics, like the total power available from an electrical wall socket just before the breaker actuates. Acoustic sound intensity is like the power

developed within some individual components in an electrical circuit. Acoustic sound pressure is analogous to an electrical voltage across some individual component.

Now let's apply these ideas to something as familiar to us as an old shoe.

LOUDSPEAKER SENSITIVITY VS. EFFICIENCY

One of the loudspeaker specifications most often called for is its sensitivity. Perhaps the most common version in use today is the sound pressure squared level in decibels measured at a distance of one meter when the loudspeaker is driven by a voltage across the nominal impedance that equals one watt.

In the case of an omnidirectional loudspeaker measured at 0.283 meters the numerical values of sound power level, L_w , sound intensity level, L_I , and sound pressure squared level, L_p , are the same number, namely 120 dB.

For example, if we had two 100-percent efficient loudspeakers, but one of them was a $Q = 1.0$ and the other a $Q = 10$ and both were measured at 0.283 meters, then the sensitivity of the omnidirectional loudspeaker would be 120 dB/W/0.238m.

The loudspeaker with a $Q = 10$ would have a sensitivity rating at the same distance of

$$120 + 10 \log Q = 120 + 10 = 130 \text{ dB/W/0.283m.}$$

Since sensitivity figures are not given at 0.283 meters let's adjust our special case to 1.0 meter.

$$20 \text{ Log } \frac{(0.283\text{m})}{1\text{m}} - 11 \text{ dB}$$

Therefore, the omnidirectional loudspeaker would be:

$$120 - 11 = 109 \text{ dB/W/m}$$

and the $Q = 10$ loudspeaker would be:

$$130 - 11 = 119 \text{ dB/W/m}$$

Since the common reference distances are four feet, 1m, 10m, 30 feet, we can

provide the following references for omnidirectional loudspeakers:

$$\begin{aligned} \text{four feet} &= 1.22\text{m} = -12.7 \text{ dB} & (2) \\ \text{30 feet} &= 9.14\text{m} = -30.2 \text{ dB} & (3) \\ &1.0\text{m} = -11 \text{ dB} & (1) \\ &10\text{m} = -30.9 & (4) \end{aligned}$$

The correction values for Q are:

$Q = 1.0$	0 dB	$Q = 50.0$	17 dB
$Q = 5.0$	7 dB	$Q = 55.0$	17.5 dB
$Q = 10.0$	10 dB	$Q = 60.0$	18 dB
$Q = 15.0$	12 dB	$Q = 65.0$	18 dB
$Q = 20.0$	13 dB	$Q = 70.0$	18.5 dB
$Q = 25.0$	14 dB	$Q = 75.0$	19 dB
$Q = 30.0$	15 dB	$Q = 80.0$	19 dB
$Q = 35.0$	15.5 dB	$Q = 85.0$	19 dB
$Q = 40.0$	16 dB	$Q = 90.0$	19.5 dB
$Q = 45.0$	16.5 dB	Please call us; a breakthrough has occurred.	

Where should you measure sensitivity? Certainly not at one meter, since it is difficult to locate the exact acoustic origin without elaborate measurement tools. The easiest way to handle this problem is to back far enough away from the acoustic origin that uncertainty as to its location becomes a minor variation. (The acoustic origin is the point in space dictated by the signal delay between excitation of the driver electrically and its reception at the measurement microphone acoustically. Depending on the velocity of sound the acoustic origin is

Distance to origin = velocity of sound/signal delay

or

$$d = c/S_b$$

For example, if we choose 30 feet or 10m (note how nearly identical the corrections are for these two distances—certainly near enough for “government work”) and we misjudge where the acoustic origin is by four inches (i.e., 1/3 foot) then the error involved would be:

$$20 \text{ Log } \left(\frac{30 \text{ feet}}{30^{1/3}\text{-feet}} \right) = 0.1 \text{ dB}$$

In fact, most reputable manufacturers do measure at such a distance and then calculate the shorter distance equivalent

(continued on page 63)

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World Radio History

BINAURAL AUDIO PART ONE: THEORY, BENEFITS AND APPLICATIONS

By Steven J. Orfield

There are four distinct and major forces that make up the prime constituency and moving force behind audio product and systems development; these are the acoustic consulting, the professional audio engineering, the manufacturing and the consumer communities.

Many other market segments fall under these main groups. Much as the professional audio community has increasingly become a research resource in acoustics and psychoacoustics, the consumer community now may be the prime force, directly and indirectly, in the newest audio revolution, binaural sound, based both on consumer audiophile interest and on product manufacturers' interests in binaural consumer market research.

In early 1989, the AES Journal published a series of articles on binaural sound; these articles covered a range of subjects from basic theory and alternative views to discussions of the theory and practice of binaural loudspeaker reproduction. In November and December of that same year, the consumer magazine, *Audio*, published a series of articles providing a look at many current theoretical and applications issues (these articles cited the

AES Journal papers among their references). Also published was a discography of many currently available binaural recordings (even noting the type of head and torso simulation system used for each recording).

In addition to the growing consumer interest in binaural audio, the consumer is the basis for much ongoing testing and research in the manufacturing community (autos, appliances, etc.). This research employs binaural recording and consumer listening juries to establish both consumer based "annoyance" and "acoustic quality" ratings for residual product noise (for example, the preferred sound of an auto exhaust system). Thus, both consumer marketing and consumer audio interest may be the basis for the increasing use of binaural audio.

Adding to this interest in binaural audio is the longstanding interest of the acoustical consultant in what constitutes the minimum acoustic basis of a good performance space; Leo Beranek discussed this at length in his "Music, Acoustics and Architecture," and his work, along with that of many other seminal investigators, led directly to the interest in the newer psychoacoustic descriptors of the "stereo effect" of great halls. Such current terms as "lateral fraction," "correlation coefficient," "early time delay gap," along with "C" and "U" values ("early to late ratio" and "useful to detrimental ratio") are part of the result of that and other research. [See Psychoacoustics Part I and II *Sound & Communications* December 1987, January 1988.]

Finally, while there has been an interest



Figure One: Typical Binaural Recording System

Steven J. Orfield is President of Orfield Associates, Inc. in Minneapolis, MN.

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KENTON FORSYTHE
Director of Engineering; Co-Founder



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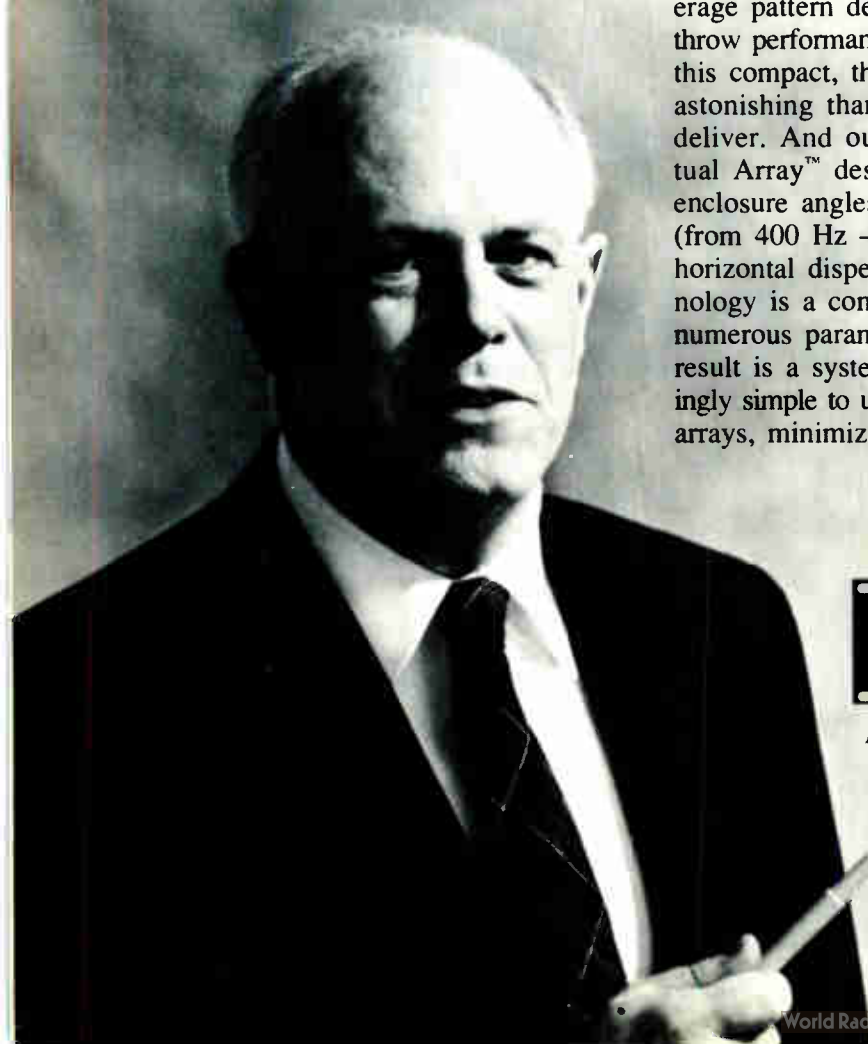
subsection. In this ingenious example of physics at work, the woofer faces *sideways*. Yet its entire output is frontally focused. The design uses dual chambers (one tuned, the other acoustically open) to accomplish this acoustic rotation while maintaining high woofer efficiency.

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in binaural technique throughout the history of audio, newer audio and acoustic component technologies (R-DAT, CD, programmable EQs, etc.) and newer measurement techniques (TDS, sound intensity, probe tube, instrumentation torsos, etc.) have defined the current time period as the point of major potential innovation in this field.

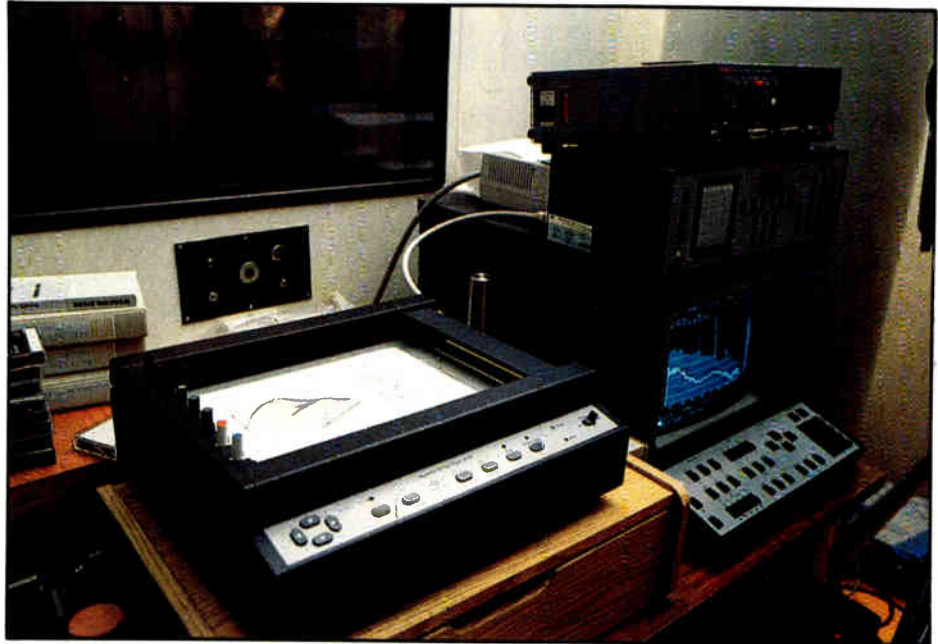
Part One of this series of articles will provide a look at the theory, benefits and applications of binaural audio. In Part Two, we will explore the actual basis for assembling a recording system. Rather than a history and survey of the field, these articles will discuss the specifics of the problem of actual binaural recording along with the verification of its accuracy. Underlying this work is a cooperative research effort underwritten by Bruel and Kjaer, Yamaha, TEAC and Orfield Associates.

BINAURAL ACOUSTICS AND AUDIOLOGY

Binaural audio is described by the methods of recording and playback employed. In its simplest application, it is the use of "head and torso simulators" for recording, and high quality, specially equalized headphones for playback. (While



Binaural torso with eight track recorder.



Digital Plotter



Figure Three: Low Noise Microphone

there are many variations on this theme, the simulator and headphone use are the dominant current embodiment.) A signal from this simulator is routed to a two-track recorder, preferably a digital R-DAT machine, and a direct, two-track recording is made.

(There is a second torso type, the instrumentation torso, which is generally used for measurement rather than recording, and this will be discussed later.)

The resulting recording is affected by a series of acoustic reflections in the near field sound path and by the polar sensitivity of the particular simulator (along with the choice of microphones). Both these

reflections and the polar sensitivity are greatly influenced by the artificial pinna or outer ear installed on the simulator. This recording method thus intends to provide the same psychoacoustic cues from the

Figure Two

Binaural Verification Equipment

- Instrumentation Torso
- Low Noise Microphones
- Dual Channel Real Time Analyzer
- Intensity Analyzer
- Instrumentation R-DAT
- Digital Plotter
- Audiometer

listening environment as one would receive if actually situated in that environment. These are principally aural localization cues. While typical recording microphones have particular polar patterns, these patterns and the off-axis behavior of the microphone do not resemble that of the human ear.

Additionally, the frequency response changes imparted by the pinna are significantly different from that of conventional microphones. To complicate this problem further, the pinnae of each listener's ears are different from those of other listeners and are different left to right for the same listener. Thus, binaural recording is attempting to provide a set of psychoacoustic cues to the listener that would be similar to that provided by the environment. To the degree that the listener is simulated by the recording torso and electronics, this does, in fact, occur. (There are many other cues that the listener uses to establish the localization in a space, the strongest of which is visual; thus there is never a comprehensive replication of the environment.)

PROBLEMS AND VERIFICATION OF BINAURAL AUDIO

Since there are no established procedures for the application of binaural recording or playback, the control and replication of the live performance is totally in the hands of the recording engineer, and the accuracy of his hearing, binaural balance and monitoring equipment can strongly influence the quality of the recording process. While normal recording methods do not try to "reference" the result to the ear (this is not its intent), binaural recording has a definite vested interest in the "validity" of the product, as its most important claim is one of three dimensional replication of the performance.

With verification in mind, the binaural process can become quite complex, in that a number of items of testing equipment are either necessary or highly useful in this verification.

An instrumentation torso is a measurement torso with built-in ear simulators that is calibrated for its frequency response, its

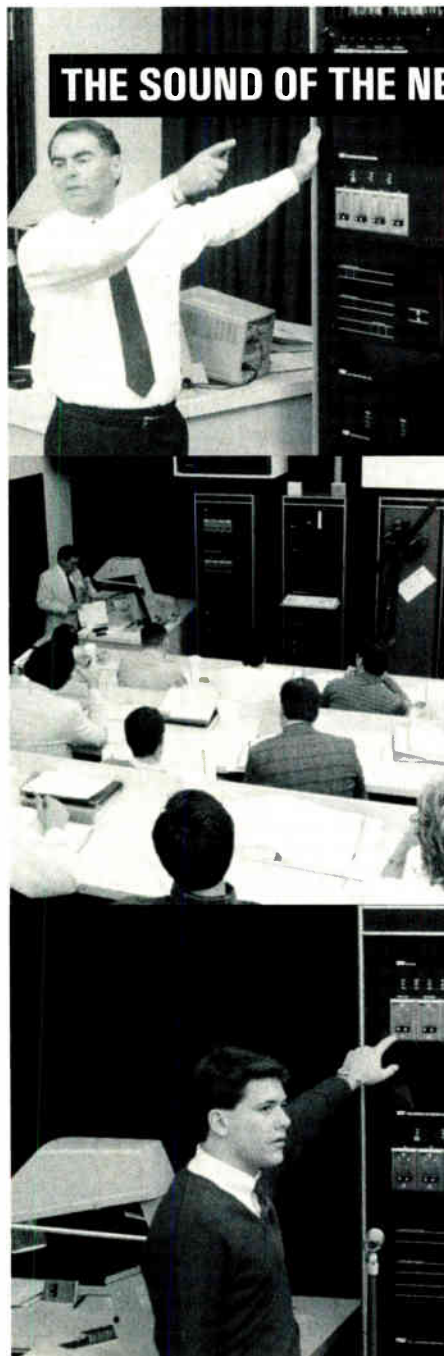
sensitivity and its on-axis and off-axis response. This torso will allow the engineer or researcher to verify the quality of the recordings from the recording torso and to test the equalization of headphones.

The low noise microphone is an extremely sensitive microphone that can determine the minimum sound level range of the torso in use. The one that Orfield Associates uses is noted in Figure Three.

Figure Four

B & K 4179-2660 Low Noise Mic Limits

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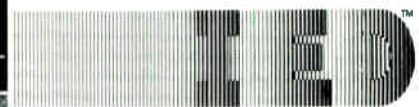
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The dual channel analyzer (with extremely tight phase match) is fed the signal from the instrumentation torso for measurement purposes. It must be a highly accurate measurement system with known calibration in order to verify the results of acoustic research.

The use of an intensity system is not basic to torso research but is quite useful in order to map the performance of the simulator head and torso under varying conditions of use, such as clothed and non-clothed. This acoustic localization and its accompanying visualization of the sound field makes dealing with questions of geometric effects of the torso itself far simpler.

The instrumentation R-DAT receives the same information as the other two analyzers for later alternative processing, and the digital plotter provides the resulting data and numeric plots for final illustration.

Finally, the audiometer is used to determine the hearing acuity of the persons involved in the recording process or involved as listeners on "binaural juries" listening to product noise; in binaural recording as in all recording, hearing loss will provide significant difficulty to the engineer or researcher involved.

THE RECORDING PROCESS

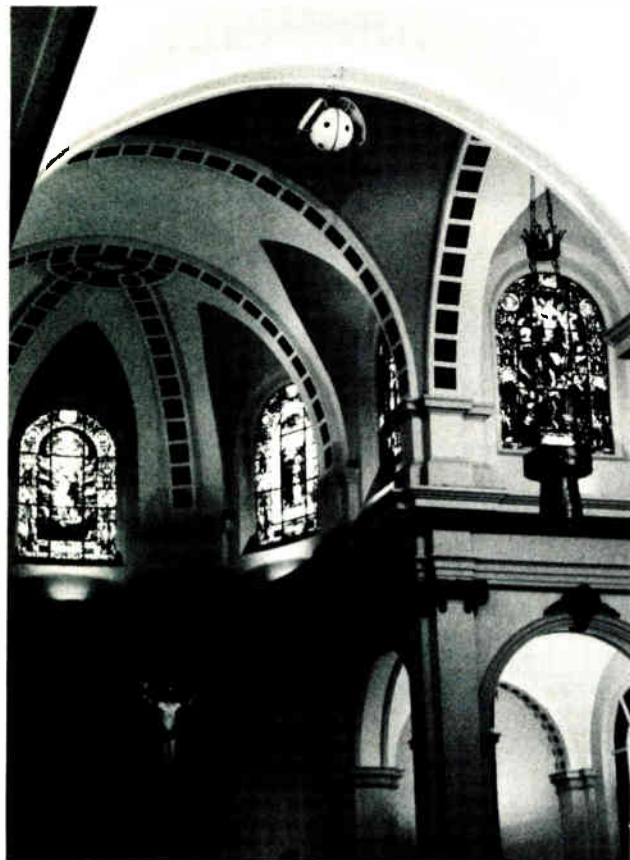
Unfortunately, the typical recording and mixing process is quite dissimilar to that of binaural recording. While one is based on multi-track recordings and extensive later mixing, the other is a two-track process with little ability to mix out problems later. Thus, for example, the placement of the simulator is critical; if the position chosen is not a good listening position, it will be a poor recording position also. For this reason, many binaural recordings are accompanied by the use of other micro-

phones for a later mix between the simulator and other more conventional microphone uses. (This multiple microphone binaural method has its own problems of time and phase accuracy.) This potential binaural problem is accompanied by a rather simple solution in many cases, and this is the listener checking out the position by occupying it for a short time.

As the recording engineer monitors these recordings, it is very important that his headphone system or his loudspeaker system are equalized properly. Additionally, loudspeaker listening will normally require a cross-cancellation audio component to provide separation between the channels.

As to the benefit of this type of recording, there is one very clear benefit other than the sound quality. While a recording engineer must extensively equip for conventional recording and mixing, it is possi-

"I WOULD RECOMMEND THE SOUNDSPHERE SYSTEM TO ANYONE.."



Built just after the turn of the century, St. Mary's Church in Monroe, Michigan recently completed an extensive repair and rebuilding program. Fr. Brian Chabala, pastor of St. Mary's, was faced with a completely obsolete sound system since the new facility incorporated a vaulted ceiling. People complained constantly, and various sound adjustments did not make any difference. Echo was a large problem, especially with the people who were seated in the rear portion of the church building.

The sound problem was eliminated totally after the installation of one Soundsphere #2212-2 upon completion of the renovation project. Fr. Chabala stated, "I would recommend the Soundsphere system to anyone having sound problems. I can't speak highly enough about it...in fact since its installation there has not been a single complaint about hearing, even when some of the softest readers serve as Lector at Liturgy."

Last July, former Miss America Kay Lani Rafko was married at St. Mary's before an overflow crowd in the refurbished church. The sound operated perfectly and the Soundsphere helped contribute to the beauty of the occasion.

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ble to achieve extremely high quality recordings at a similar or lower total cost via the binaural method (as compared with multi-track recording). (Two mics, two recording channels, all portable equipment.) As is true with the more conventional methods of recording, the quality increases with equipment quality and price, but at the professional level, binaural recording can be less expensive.

BINAURAL APPLICATIONS

The use of the binaural process may provide excellent recording in many settings, but it is especially suited to situations in which there are normally clear acoustic localization cues. Perception of localization is reduced by extremely complex sound fields and by very high noise fields; its most effective cues are in limited mid and higher frequency ranges. Thus, loud rock band performance, for example, may provide limited localization cues from the binaural method. Binaural recording is currently being emphasized in situations where localization cues would be conceptually logical, such as recordings of a chamber orchestra, where the concert patron would "know" where the violin section of the orchestra is placed and would therefore have redundant perceptual verification. In addition to classical music recording, other similarly "clear" musical recordings (such as jazz, new age, solo and ensemble performances) will benefit from this process.

Other types of listening which benefit from presence and accuracy will benefit, and one of the most obvious of these applications is the use of listening juries. Juries are typically an assemblage of consumers or researchers who are attempting to compare varying acoustic phenomena. For example, both the engineering team and the automotive consumer will respond positively or negatively to the sound of an automobile exhaust (*e.g.*, the tuned Miata Project) or to the sound of a car stereo system. While it may be possible to have each member of this jury drive the car in question and write down his opinions, quick, consecutive listening to five or 10 samples of alternatives is far more

useful in developing actual comparisons. (The memory and other bias precludes accuracy of perceptual opinions after a very short time.) Also, this method allows consistency of comparison (*i.e.*, all cars at 50 mph on a smooth road) or graded comparisons (one car at 40, 50, 60 mph). Similarly, this method can be used for evaluations of in-home products such as appliances, with accurate replication of am-

bient environmental noise (*e.g.*, TV, HVAC system, people talking, etc.).

Finally, these same binaural comparison tapes can be used in a marketing sense by placing them in the hands of product marketers, advertising agencies and retailers. Over the near term, this type of binaural evaluation has the advantage of being paired with other cues, such as
(continued from page 60)



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Clair Brothers

A Top Machine in Touring Sound Pulls Onto the Contracting Racetrack

BY CHRISTOPHER R. BERGER

Perhaps you could say it was inevitable. Though contracted and touring sound have their own unique sets of challenges, they do effectively seek the same result — providing a client with a sound system that meets all needs and falls within budget and time constraints. Therefore, consider the feasibility of an extremely successful touring sound company entering the contracting race. A race whose leading cars have been on the track for a long time, constantly using their experience to gain the edge that will put them a half-length ahead at the checkered flag.

Clair Brothers Audio is one of the largest and most successful touring sound companies in the world. That's a bold statement, considering an industry that garners a plenitude of fierce competitors. We're also talking about a company, though, with a client roster listing some of the most successful artists on the road: Madonna, Janet Jackson, Elton John, Bruce Springsteen, U2 and many others.

How is Clair Brothers going to apply its experience and resources to another industry — sound contracting — that is entirely different in many ways? How did they get to this position? How does Clair continue to secure its top-notch client list? These are some of the questions this exclusive article, on one of the audio industry's most secretive companies, intends to answer.

A HISTORY

Clair Brothers Audio began in 1967 as a fledgling PA company entering into a

“professional” field that was in the embryonic stages itself. Competition consisted of other audio hobbyists who were willing to subject themselves to the mental and physical torture involved with lugging around oversized equipment in an under-sized vehicle for extended periods of time — which is par for the course if you've ever started your own audio production company. However, this was a day in which education came 100 percent from experience. These were the pioneers of the mobile audio business.

Drawn by a desire for their hobby to become a successful career, Gene and Roy Clair launched their pioneering efforts (a unique approach to speaker systems design) and dove in. The first big break came with Frankie Valli and the Four Seasons. Moving into the early seventies, as a plethora of national acts set out on tour, Clair got the nod from the heavyweights: Elvis Presley, Blood Sweat and Tears, Yes, and the Moody Blues to name a few.

Through a quest to be known as the company who could be the best while beating the odds, Clair took on a new level of audio challenge — the stadium tour. Significant recognition came with the success of Peter Frampton's “Frampton Comes Alive Tour,” which served as a showcase for the new Clair custom speaker system. This predecessor to the S-4™ was a four-way system consisting of a W-Bin, a 12-inch driver horn-loaded box, a horn-loaded compression driver and a super-tweeter section all in separate enclosures. This was prior to the days of the flying cabinet with rigging, so muscle

and towering stacks took the place of chain hoists and harnesses.

In the latter part of the seventies, as certain artists were selected as prime “stadium artists,” so was Clair selected as the premier stadium touring sound company. Tours pivotal to the rapid expansion of Clair included The Police and Bruce Springsteen. As the company became more successful, Clair began to accumulate an inventory of sound equipment that few competitors could rival. Key elements of this inventory included the Clair folding mixing console and the now signature S-4 single-box speaker system.

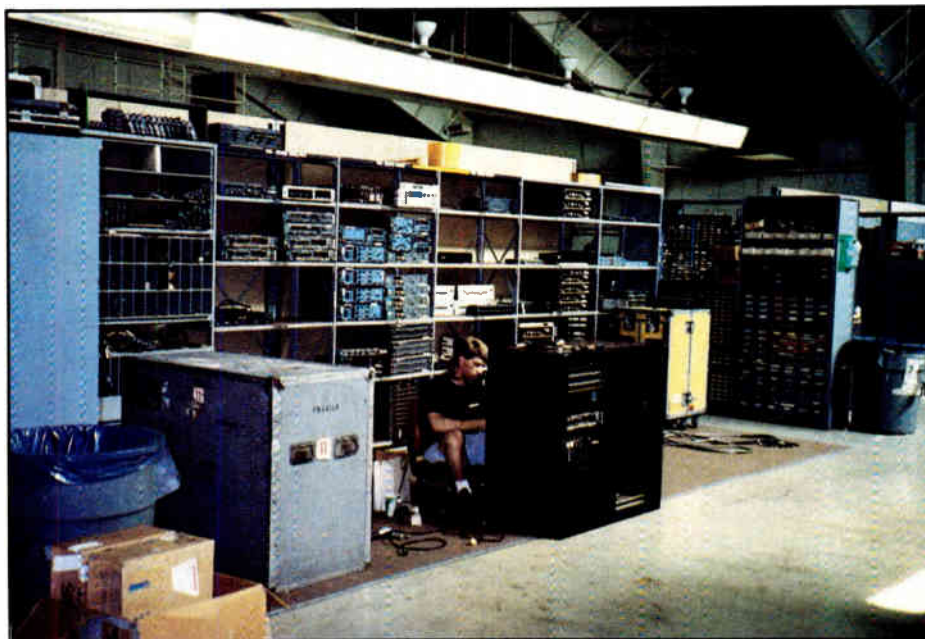
The eighties found Clair supporting what were becoming known as “mega-artists” and “mega-tours.” Groups such as Michael Jackson, U2, Bon Jovi and Madonna took Clair on the road with them through arenas and stadiums all over the world. There were even the “mega-events,” such as Live Aid, which was a logistical nightmare demanding not only audio for 100,000 plus, but a live feed for one billion people world-wide as well. In 1985 Clair introduced the S-4 Series II, which could be custom-configured for optimum performance and projection — an issue critical to stadium sound. The success of this technology, along with the artists, tours and events, synergistically brought Clair to the position they have today.

THE PEOPLE

As the touring division grew, people became a critical element to the foundation. The first long-term management

member to join Roy and Gene was Greg Hall, a Penn State grad who arrived with application in hand in 1978. Now coming into his thirteenth year with Clair, Greg handles new client acquisition, assists with personnel resources coordination and serves as General Business Manager. An average day might include finding out that their biggest tour (in terms of resource drainage) just extended by three more weeks, leaving a gaping logistics hole for the next tour, one he sold and booked six months previously. According to Greg, this is all part of the job. "Following through on bookings can vary from pitching in to load and test speakers in the wee hours of the night, to chartering a jet to get the gear and personnel there on time." Greg adds that: "Over the years, Clair Brothers consciously developed a horizontal management style, where all of management is accessible and there are no issues about who reports to whom. For instance, although Troy leans toward shop personnel management and I tend to focus on touring personnel, we will often consult one another before making employee decisions. You could say we exemplify the family-run business of the 1990s." Greg is backed by Deb Paparo, who handles receivables, computer systems management (including data storage) and the phone. The computer system (detailed later) that Deb manages uses custom software, and each terminal is set up for the user's particular needs.

Responsibility for overall resources allocation and management falls on Troy Clair, Director of Operations. Joining the company full-time in 1982, Troy originally utilized his degree in Business to perform the duties of equipment manager. Now responsible for the daily operating decisions of the company, he bears ultimate responsibility for the day-to-day crises typical to today's touring company. This includes negotiating for time, resources and money (not necessarily in that order). In addition, Troy has spearheaded the company's daily exercise regimen. An avid volleyball player himself, he has brought the sport in as a three times-a-day stress relief program. Those who visit the facility, from clients to manufacturer's reps,



The rack loading area at Clair Brothers.



A front view of the Clair complex.

find this is often the first way they get to meet the people behind the company (shorts and protective gear aren't mandatory; however they're highly recommended). In addition to their passion for daily volleyball, I also found it interesting that both Troy and Greg have fax machines in their homes. This acceptance of a twenty-four hour job reduces the time barriers common to conducting overseas business. Troy is backed by David Powell, who handles equipment management.

The most recent addition to the Clair management staff is Barry Clair, who presently handles management and quality control for the processor assembly department. In addition, he oversees accounting for the systems department. Seven months on the job, Barry at the moment is overseeing the upgrade/replacement of all processor cards (with new versions) in all of Clair's monitor amplifiers.

In terms of overall employees, there are

114 total at the time of this writing. Included are 10 road engineers, 7 in-house engineers and 6 road service technicians.

THE FACILITY

Someone once said, "In order for one to succeed, one must have the facility to succeed." It's likely that whoever that person was, he had no idea that saying would come to have two meanings. As most know, today's industry demands that a successful company operate from one or more well-planned buildings. Clair Brothers is no exception.

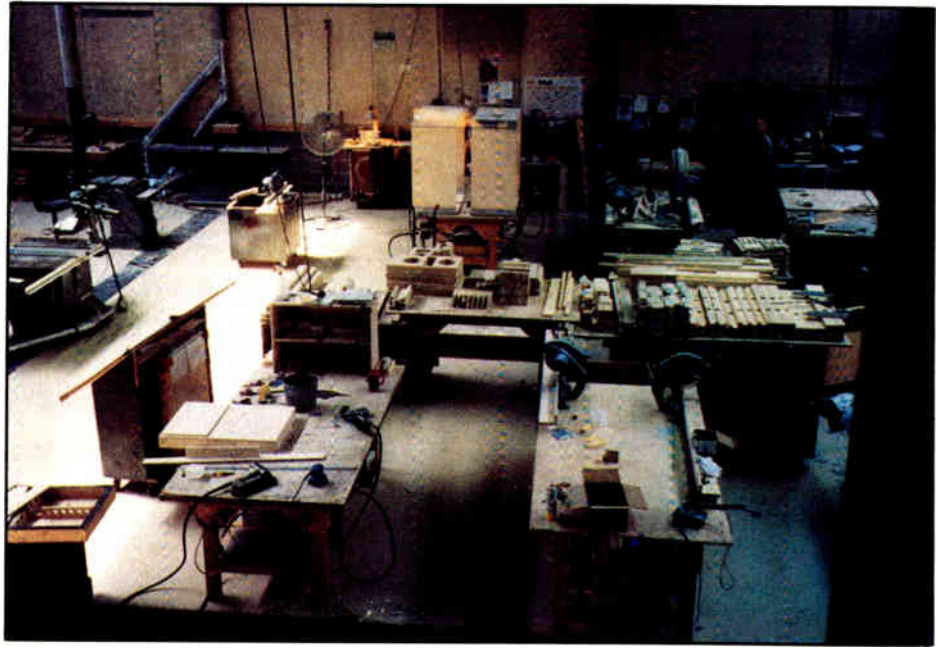
Originally a tennis barn, their two-story facility saw the rapidly expanding company move in nine years ago. Since that time, the entire building has been renovated and a 9,000 square-foot wood shop added as a built-on addition. Now spanning a total of 48,000 square feet, the facility still gives one the distinct feeling of being in a health club as you enter its reception area. That

is, until you look through the massive windows onto the courts below. Rather than tennis players swatting it out in air-conditioned comfort, you see production and shop crews wheeling back and forth literally tons of sound equipment — in air-conditioned comfort. Not to take any credit away from them, they're still sweating.

Walking through the facility, it is obvious that some long-term planning was involved. The open-air offices of Roy Clair, Gene Clair and Greg Hall (flanked by a 30 feet x 6 feet "Production Board") indicate that not only is this one of the centers of management activity, but an open environment to employees, as well.

The Contracting Division's office is centered around Gene Pelland and conveniently located close to the stairs, which lead to the first floor, where the physical work takes place. Before walking down the stairs, one can stop and view the first floor production shop or a majority of the wood shop area, through still more strategically-located window areas. At the bottom of the stairs on the right, is the new wood shop, where all cabinetry is made. Further down the hall, on the right, is one-half of the first floor court area. This area is used for staging speaker cabinets during their building or reworking phase, in addition to space for layout of truss, servicing chain motors, staging cases, and playing volleyball. (The official-size volleyball court is laid out complete with permanent net and painted court area.)

In this same area of the building is the second center of management activity — Troy Clair's office. Positioned in front of Troy is his personalized 386SX terminal with custom software. It appears obvious that the closed-in modern office area allows enough room for substantial expansion. Adjacent to Troy's office is the Recreation Room, fully equipped with various game tables such as ping-pong, a punching bag and a wide assortment of weightlifting equipment. Above Troy's office is the restricted second level, where the engineering department is located. In this notoriously secretive department, talented engineers such as Greg O'Sheara are pressing hard to complete the digital console project.



The Clair woodshop.



Gene Pelland, General Manager for Systems Installations.

Walking back out into the hallway, like the "Rec Room," there is another sign of concern for employee welfare — a miniature cafeteria complete with free soda fountains, coffee (a staple in the industry), snacks and a refrigerator stocked with milk for the coffee.

Continuing down the hallway, one finds the other half of the lower floor court area. This area houses the Console Department, the Electronics Racking Area, the Processor Assembly Area, the Cabling Area, the Rack Testing area and the Hardware Area (roughly the size of a small hardware store).

The walk-through of the facility revealed some additional facts. For instance, the entire production department has been de-

signed to produce, inspect and repair every piece of equipment used on a Clair Brothers tour. No outside vendor roadcase or cabling system is used on a tour. All road cases are custom engineered and built by the wood shop. S-4 cabinets, also manufactured in the woodshop, are fabricated with all major joints steel-reinforced. All cabling systems are built in-house to Clair specifications using bulk cable. All major components of the rigging system (except for chain motors) are fabricated in-house, with all trusses custom-designed.

The Processor Assembly Area hand builds Coherent Transfer Systems processors for all of Clair's 12AM and S-4 speaker systems. There are 250 of the 12AM monitors in inventory. Then there's the Speaker Refurbishing and Assembly Department, which can inspect, refurbish (including painting/regrilling), reload and sweep as many as eighty S-4 cabinets in two days.

Also learned from the walk-through was: For each of the 10 touring engineers on the road, there is at least one shop technician in-house supporting the equipment being sent out. Some of these employees, both on the road and in the shop, have been with the company for 15 years.

SECONDARY FACILITIES

There are two additional Clair facilities at this time and both are overseas. In the United Kingdom there is Clair Brothers Audio Limited. In the fall of 1989, the doors were opened to Japan with the



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christening of Clair Brothers Audio Japan — quarterbacking from offices in Tokyo and warehousing in Yokohama. No immediate plans for additional facilities were revealed at this time.

CLAIR TECHNOLOGY

Recognizing that the profits of their initial success could be invested in people as well as equipment, Clair began to build a staff of engineers early on. Efforts were focused on improved versions of the S-4, in addition to its own rigging system and Coherent Transfer System processor. Through the years, Clair has developed its own house console, a compact monitor system, and lightweight Clair/Carver amplifiers. Recently, seven tours were equipped with a new automatic equalizer system developed in conjunction with TC Electronics.

The legendary "S-4" speaker system was for quite some time both a trademark and a highly guarded secret for the company. Recently, with the advent of a new contracting and manufacturing effort, the veil has come down somewhat. Known to be "built like a tank," the custom cabinet measures 48-inches x 48-inches x 22-inches and weighs in at 380 pounds. With an operating range of 20 Hz-20 kHz, it has a maximum output of 130 dB. The S-4 Coherent Transfer System processor performs crossover, limiting, time-alignment and phase correction. The S-4 rigging system is notable for its extremely adjustable vertical and horizontal distribution.

We talked for awhile with Gene Clair.

GENE CLAIR

What was the first big break for Clair Brothers Touring?

One of the bigger breaks was Woodstock. But not for the reasons you'd think. We got some great opportunities because some serious competitors went to work on that project. As a result, we experienced an unexpected expansion.

What would you say were the key factors in your stadium success with the Peter Frampton Tour, which brought so much at-

tention to Clair Bros.?

The fact that we could do back-to-back shows (we moved the system in and out fast), we did fill the stadium with sound and it did sound good.

What was the effect on promoters?

They took notice because they could book more shows and make more money in a shorter period of time.

Were there any other turning points for Clair?

It's just been a combination of little things. Technically we keep improving on things. It's those little steady improvements over time that pay off...

With this new business [contracting/manufacturing] I think we'll start advertising. With the new products we'll be coming out with, you'll see there's some nice technology we're developing. We have a staff of seven design engineers.

Looking back over the company's history, what do you see as the significant technology breakthroughs Clair has contributed to the industry?

Well, there's the S-4, which is a full-range box in a nice sized package. We've also developed a hanging system that allows us to hang the boxes quickly. We can usually go into a venue and have a full-size system flown by lunch-time. This time frame was ahead of the industry for a while, but now everyone else is catching up. The next thing we're going to do is come out with a state-of-the-art console. Recently we've developed a limiter/processor that's being made right now. We have an automatic equalizer. There are seven on the road right now and we plan to equip all of our tours with them. These are all examples of some of the technical things we do.

When was the first S-4 processor used?

It was half-way through the Michael Jackson Tour a year and-a-half ago. Now we have S-4 processors out with all our systems and the second generation of those is coming along.

Why did you choose to go to a processor?

To compensate for speaker deficiencies. Time-Alignment and other important issues were what we went for and the box now sounds a lot better. Electronics is now our focus.

Is the new console going to be available to other sound companies for purchase or lease?

We have thought about that. We are going to incur a large development cost on this one.

I can imagine your R & D must be a little steep on this one.

We've had two engineers for two-and-a-half years now on this — plus now there's the other engineers who just finished up on the processor and who are going to go over and work on the console.

And the new Clair console will revolutionize mixing?

Methods of mixing. As things are now, it's gone from one console for the microphone inputs to two consoles for the microphone inputs to now three consoles, one of them for the opening act. With the new board, we should be able to drop back to one again, because it has memory — it will remember all settings. When the main act does their sound check, they can just commit it to memory.

Will the signal still be analog?

Yes, digital isn't quite good enough for live yet.

Because of headroom.

Yes. It's not quite as good. For recorders and that type of thing it's ok, but there are a lot of people out there who don't like digital sound.

Another obvious benefit would be that cabling is cut down.

Yes, actually part of the unit will be backstage, since it's two-piece.

What prompted the decision to proceed with the console project?

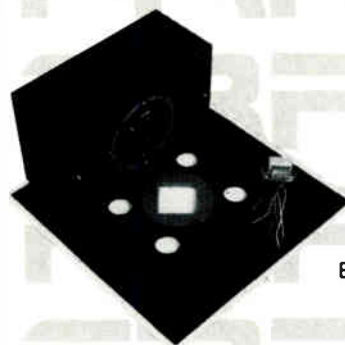
When we came out with our first console in 1978, on the Fleetwood Mac tour, that gave us a big advantage in the touring business. Ten plus years later, that board's still out working and doing a good job. On this new console, one of our employees actually came to us and said, "Don't you think we should be doing a new one?" We thought about it and thought about it and decided to go for it. We didn't want to build just another board — there's a lot of other good boards out there, like the Yamaha PM3000. You gotta do something different, so that's why we decided to go all the way with digital control.

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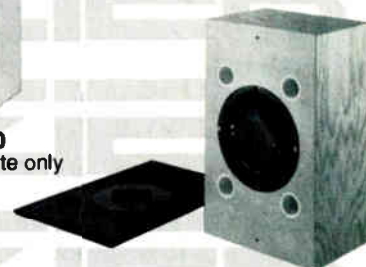
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Why did you start Clair Bros. in the first place?

It started as a hobby. You turn a hobby into something you do for a living.

What's kept you with it?

I like the fact that it's something different every day. I still like concerts. I just got back from seeing the Madonna show, and from Europe, where I saw Midnight Oil.

Is that something you do on a regular basis, for quality control?

We never used to that, but we do now. It's easy for someone to tell you everything is going fine, but it's nice to go out and make sure. It always been important to me that I did go out on the road and did understand the problems — so that you take a better approach of fixing the problems. I just did a tour last year. I did the Who tour and the year before that I did a good part of the Michael Jackson tour. My responsibility was to set up the entire sound system for each show.

What would you like Clair Brothers to be known for?

The best and the largest sound company in the world.

What's your view toward competition?

We get along. One thing we did notice over the years with our competitors is they always thought we were the second-best sound company. So if we're second best on everyone list, that means we're pretty high up there. Overall we get along with everybody. It's a small business, you kind of have to.

If there's work out there that you want, say an act that you feel would work extremely well with a Clair system — would you go after that act?

Yeah, we will. That's Greg Hall's job. He try's to figure out what would be good accounts, what acts would sound good on our system. And if he does, he'll contact them and tell them we're interested.

What sort of role do you see the Clair Touring division playing in Clair's new installation division?

A lot of engineering and design, some management. We'll also be bringing our road experience as well.

Do you think your present engineering staff can support two divisions if multiple large projects from both divisions were to

ONGOING INSTALLATION PROJECTS:

- Starlake Amphitheater —
Pittsburgh, PA Lawn Sound
Reinforcement System
- Lewisham Theater —
London, England Sound
Reinforcement System
- Carousel Mall —
Syracuse, NY . . . Distributed Sound
Reinforcement

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Clair Product:

- 12AM Wedge Monitor . .65Hz-18kHz,
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(also very low profile, high output)
- 200 Series Monitor
Amplifier Rack600W/ch LF,
465W/ch HF (drive 8 mon.)
- 400 Series Monitor
Amplifier Rack600W/ch LF,
465W/ch HF (drive 16 mon.)
- Clair/TC 1128C EQ . . .digital control,
analog signal
- Clair/TC Control Head features MIDI
hardwire remote
- Clair Portable Power Dist. .no details
available at this time

come down the pike at the same time?

We can handle that. We would actually be over-staffed right now if the special projects weren't under way.

Was the decision to start-up with this new division based partly on the assumption that it would be moving into full-swing (thus increasing the load on engineering) at roughly the same time the new console would be complete?

Yes, that was part of the plan. We knew that all of the engineers would be able to switch once the big project was completed.

We've been wanting to get into the installation business. We almost got into it many a time, but we [the touring division] can't do it. That's when Gene Pelland came and we had someone that could be devoted full-time to it. Roy and I are in-

FACILITY FACTS AND FIGURES

Total square feet	48,000
Woodshop	9,000
Computer System	IBM AS400 minicomputer
Terminals	286 & 386 (4 total, 2 more in near future)
Plotter	Houston Instruments DMP-60
AutoCAD	Hewlett Packard workstations
Design/Mapping Program	JBL C.A.D.P. on PC's
Audio Measurement	TEF 12
Manufacturing/Assembly . .	Speakers/ Electronics/Rigging/Cabinetry
Machine Shop	yes
Welding Shop	yes

TOURING INVENTORY:

S-4 House Speakers*	n/a
Amplifiers (House & Monitor) . .	n/a
12AM monitors*	250
other monitors	300
CBA House Consoles*	10
other House Consoles	17
Monitor Consoles	30
Cabling*	121.68 miles
Road Cases*	450
CBA Power Distro*	14
Clair/TC Electronics Eq System* . .	7
Total Major Components	2750 (approx.)

* custom Clair Product

Note: figures are based on inventory at writing.

capable of doing it because we're involved in this one [touring division] too much.

You obviously have no plans of slowing down.

Nope. We have youth. My son, my son-in-law and my brother's son are in it now. The whole family's here.

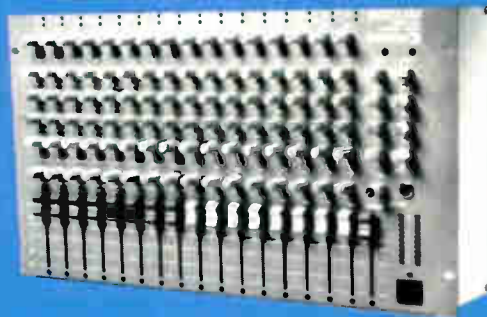
And now, it's safe to say that my son, Troy, runs the day-to-day operation of the business.

Is Clair going to continue to strive for this level of yearly growth?

We have turned down tours this year, perhaps slowing growth down in that area. The last two years' growth has been significant. We will continue to grow overall in the future, but we're changing our direction a little bit.

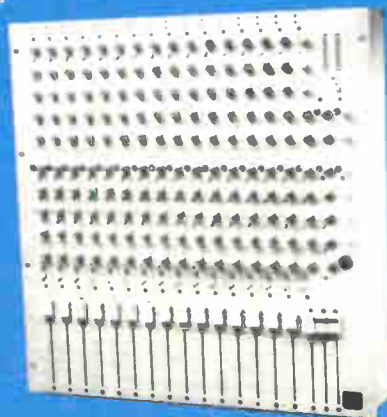
(continued on page 52)

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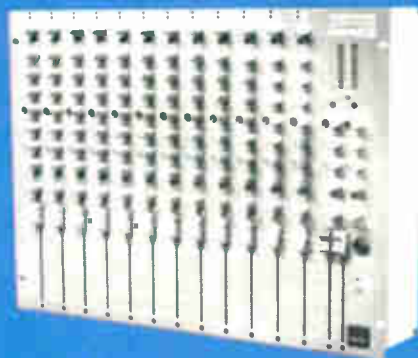
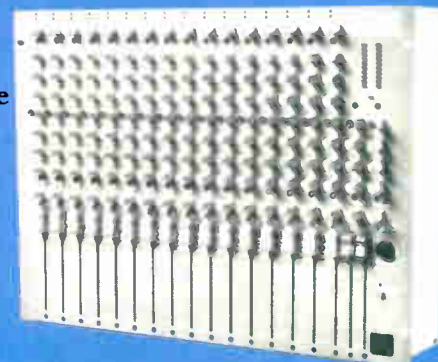


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Summer's Over

But The Melody Lingers On — Two Outdoor Music Festivals

BY KEITH BOSE

Each year in June a 22-foot trailer brings a load of sound equipment to a giant tent at the foot of Hunter Mountain in the Catskills of New York State. The tent, "longer than a football field," will be the scene of unique annual ethnic music festivals that draw many thousands of citizens from the Northeast. This year the season started with the Italian festival, then the three week German Alps Fest featured musical entertainers brought from Germany. There is a Ukrainian Festival, then the wail of Celtic bagpipes challenges the sound installation. There's a colorful Polka Festival, a Country Music Festival, the big band festival with the Glenn Miller Orchestra, then, closing Labor Day weekend, are the American Indians.

A crew of technicians from Specialized Audio-Visual, Inc. (SAVI) of Clifton Park, New York, makes the yearly installation in two or three days. Two sound technicians remain to operate the mixing board, the monitor boards, and perform routine maintenance. "Dust is a big problem here," Tod Butler, SAVI operations manager, says. "The filters on the cooling fans clog. By the end of the summer the tent takes on a reddish cast from the red dust from the mountain."

The center of the big tent holds a 40 foot stage. At each side of the stage is a raised four cabinet cluster. Each 110 pound ported cabinet is a SAVI "K4" proprietary design originated by Mike Cusick, SAVI's president, and a colleague. Several K4 cabinet combinations are also located

around the sides of the tent. The K4 cabinet holds four 8-inch low end cones which have been modified to fit very closely together in a star pattern. This yields' according to SAVI a tightly controlled low frequency directivity pattern with a 1200 Hz crossover capable of a combined power of 800 Watts in biamp mode.

The high frequency section of the K4 is a 90-degree "flat front" constant directivity horn and 1-inch compression driver. (Both of these are also from JBL.) The 1200 Hz crossover results in ± 3 dB response up to 16 kHz. Using the same speakers, drivers and other equipment provides redundancy for quick replacement. The high end of the K4's in the tent are driven by 10 Crown DC 300's. The cones are driven with Carver PM 1.5's. Two Crown PSA-2 subwoofers are located under the stage with the unobtrusive speaker grilles the same color as the sides of the elevated stage.

The crew tunes the system flat when the installation is complete, then retunes as humidity and general wear changes the system response. Throughout the series of festivals the technicians on duty at the Yamaha PM3000 house board will retune the crossovers for the different acts and adjust for the capacity of the tent crowd and other acoustic conditions such as a wet tent. During peak attendance, usually the second weekend of the German Alps Fest, several thousand people will wander in and out of the crowded giant tent. Entertainment is almost continuous 12 to 14

hours each day; some will be dancing on the floor in front of the stage and waitresses will scurry with large cups of beer and ethnic food.

The unique variety of ethnic music reveals something about music. Tod Butler says, "The Celts and Germans, for example, will run a high of 90 dB a hundred feet from the stage. Country music runs as high as 110 dB at the same location, and that puts wear on voice coils and cones."

The Hunter Mountain season only marks part of the festival season for SAVI. This year, the day after the installation at Hunter Mountain is complete, Mike Cusick, president of SAVI, is in personal charge of his full crew at the Newport Jazz Festival in Saratoga Springs, New York. He is armed with a walkie-talkie to keep in touch with the installation crew. It is the first part of a jazz festival which will continue all day. At 7:30 AM a crowd already has formed to wait for the gates to open. There are two sections to the festival. Small groups perform outdoors under a raised gazebo. The main series is in the "big house," the crew's name for the amphitheater.

The amphitheater of the New York State Performing Arts Center was built in 1965 with acoustical advice from consultant Paul Veneklasen. The covered amphitheater is designed with louvered acoustical sides to give the effect of a concert hall with standard theater seating in a semi-ellipse. Surrounding outside is a berme. A permanently installed group of speaker housings project the stage sound to the grassy



Mike Cusick, President of Specialized Audio-Visual, Inc. at the house board. Throughout the day several engineers will man the board.



The microphone patch panel is set up in the switching of mic channels for each act. To the right is a CCTV camera pointing downwards a clipboard that gives the numbers of each mic channel.

area. This is done with a relay system with reverberation included to simulate the ambience of the hall. Within the amphitheater is a separate sound installation. The jazz acts require a completely different mic

setup, with different EQ settings for each instrument or vocal. Mike Cusick's crew has until noon to solve that problem. Promptly at noon on this day, the first act kicks off with a Steinway grand piano and

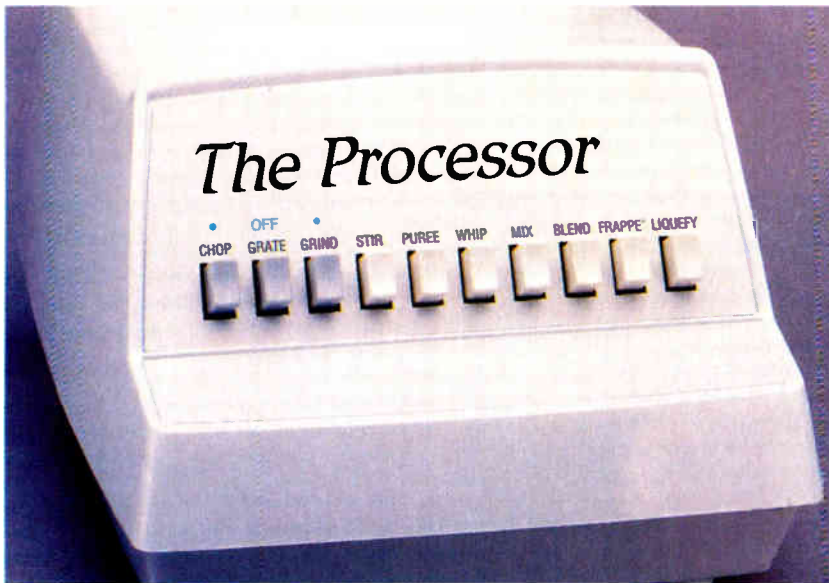
four musicians with a variety of electronic instruments and pet sound demands. Then follows a succession of completely different groups on exact schedule.

A rock concert with its own sound setup ended the previous night at midnight. Mike Cusick's crew began at 7:00 AM. By noon the crew must set up the sound for eight novel jazz groups ending at midnight with Lionel Hampton's large jazz group. Each act is "premed" so that in 10 minutes the stage and microphone setup can be completely changed for the next act with customized EQ readings. Behind the back curtain each following act is set up on risers with mics at specified locations on the risers. At the end of one act the back curtain opens and stage hands push the risers with the next act onstage. The mics are then connected to specified jacks.

A CCTV monitor, fed from the camera, is placed at any location where information is required.

The next trick is to set up the house board so that each mic jack has its customized crossover settings and the board operator is able to identify each mic. Each mic jack is snaked under the stage to a patch panel located behind the stage-right side curtain. Next to the patch panel, a CCTV camera is focused downward to a note board. The note board holds a printed form filled out for each performing group. A CCTV monitor, fed from the camera, is placed at the house board or any location where information is required. This indicates the mixing channel that controls each mic. The board operator marks the respective controls "vocal, guitar, acoustic banjo, electric banjo," etc. The operator can merely glance at the CCTV monitor to identify a mic channel.

By 10 AM the system speakers are in place and the hiss of pink noise fills the hall. A technician is pacing an outer semicircle of the hall where the house board is located. He carries an acoustical



Processed?

Processed speaker systems use a dedicated line-level electronics control unit ahead of the power amps. Typical signal processing senses the power amp outputs, and includes band pass filters, EQ, delay for offset transducers, and limiting for speaker protection.

Let's examine half space axial response recordings of a typical processed system at various input levels, beginning at 10 watts output at 300 Hz from the LF amp, increasing in 3,5,6 and 7 dB increments, equal to 20, 30, 40 and 50 watts in a linear system.

At 10 watts, the response was ± 4 dB from 65 Hz to 14 kHz. At +3 dB, the limiters reduce the low and high EQ. Above +3 dB, limiting has flattened the EQ and is gain-reducing the LF and HF bands independently, raising the low pass, and lowering the high pass frequencies.

At these modest levels, the LF and HF overlap, rather than cross-over. Because the LF and HF sum coherently where they overlap, dynamic expansion results. For a 7 dB increase in input level, the lows increase 4 dB, highs only 2 dB, but the mids increase 13 dB.

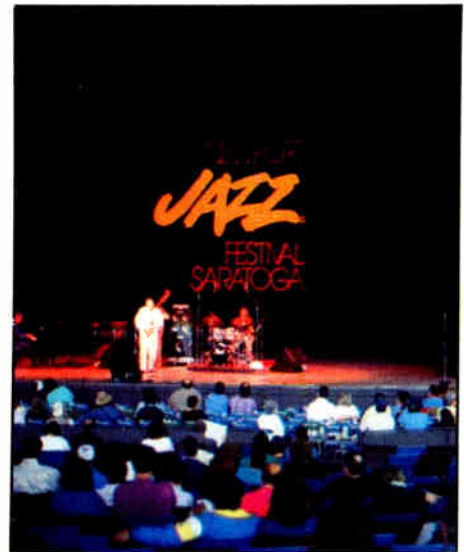
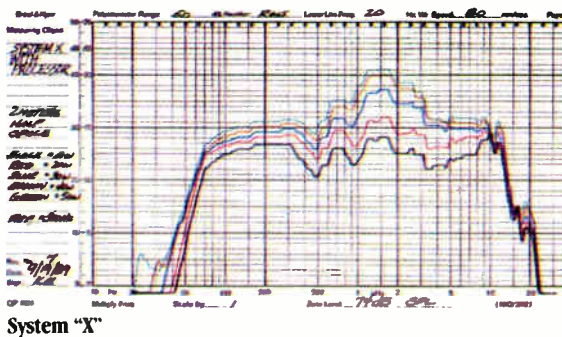
This non-linearity is the result of conflicting design objectives.

High SPLs need high efficiency, but high efficiency needs lots of

EQ for extended response in compact systems. The EQ improves response at low levels, but jeopardizes speaker survival at high levels. Limiting doesn't provide use protection for the speakers — limiting actually operates the components closer to thermal damage risk limits.

Here, limiting sacrifices dynamic linearity and consistency of sound quality to protect the speakers by defeating the EQ needed to make the system sound acceptable in the first place.

Slice, Dice, Mince, Chop, Grate or Puree?



Musicians perform on 6-inch high risers with rollers.

analyzer and stops each time at the house board to make an adjustment. Mike Cusick has placed eight portable speakers with pickup mics evenly spaced on the stage. Each speaker is fed with noise and the house is tuned flat by mixing each speaker.

By 10:30, the gates to the Performing Arts Center open and jazz fans rush to claim a spot on the grass surrounding the amphitheater. They carry tarps, drink coolers, blankets and pillows; some read books during the long day. The area toward the gazebo is filled with regular camping tents hand carried into the grounds by ticket holders.

With the system tuned flat to pink noise, the sound crew tunes the system from the monitor board behind to suit each performing group if necessary. By noon the first act comes on, exactly on schedule. Throughout the morning the sound crew has worked fast without confusion. Now it will only be necessary to man the house board and monitor boards, and a technician will handle the patch board for each act. She has a stage map for each group, from which she has already filled out the form which will be placed under the CCTV camera during the respective performance. Stage hands also have a map for each group. Groups will be pre-mixed by setting mics on the risers with the instruments.

The back stage of the amphitheater consists of offices, dressing rooms, meeting rooms and ballet facilities. SAVI is assigned a room here to hold equipment and tools. By noon the sound crew drifts in and out of the lunch room, ready to take care of emergencies. The crew is familiar with the permanently installed sound components of the Performing Arts Center and will make several setups throughout a season. The permanently installed outside speaker housings still have the original components, but the relay system has been changed by SAVI. Within the hall speakers are set up to suit the event.

Sound technology has advanced since 1965, and each year sees improvement both at the Hunter Mountain festivals and at the Performing Arts Center. The first festival at Hunter Mountain was the German Alps Festival 16 years ago. The tent was much smaller then, but the oompah bands, German beer and "gemeutlichkeit" each year began to draw many others who become honorary Germans for a day or two. Now the other ethnic festivals offer the same traditional atmosphere from the many lands of America's forefathers.

The ethnic festivals at Hunter Mountain, New York and the music festivals at the New York State Performing Arts Center at Saratoga Springs reveal much about the relationship of music and electronics. Mike Cusick points to an inconspicuous speaker cluster permanently installed above center stage. "That's all they let me use for classical concerts and opera. They want as much natural sound as possible." Recalling the 110 dB sound of contemporary American country music compared to the lesser volume of traditional ethnic music, which evolved before electronic reinforcement and equalization were invented, one is made aware of the important role of electronic sound in contemporary music. On the other hand if we consider electronics as part of the instrumental, the sound engineer and technician can claim a part in the art. Whatever the case, and whatever is one's taste in music, the summer festival season can be a busy time for sound contractors. ■

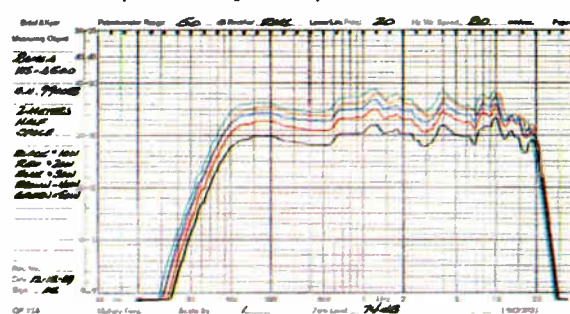


Non-processed.

True Sound, on the other hand, requires a speaker system that will render an accurate acoustic replication of its electrical input. No less, but no more.

A truly accurate speaker system does not interpret electrical signals. It has no personality, no characteristic sound. It neither adds, nor detracts from the program input. It doesn't compensate for anything—accuracy isn't negotiable at various sound levels. A speaker system is either accurate, or it is not.

Accuracy in a loudspeaker system calls for transducers that are manufactured to



precise tolerances, to be sure. But it also demands that the loudspeaker systems be configured so that the transducers operate within their inherent electro-mechanical limitations.

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September 1990

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World Music Theatre

The 28,000-seat Outdoor Facility Gets a Powerful Lawn System

BY JOHN PARRIS FRANTZ

When investors began planning the “nation’s largest outdoor music theater,” they relied on the past experiences of a concert sound contractor to custom design the lawn sound system.

The 28,000-seat World Music Theatre in Tinley Park, Illinois, which opened with Cher last June, has a powerful lawn speaker system. Twenty-six speaker cabinets with six speakers each and powered by 24 amplifiers is the design of dB Sound, the Des Plaines, Illinois-based company.

In the music concert industry, sound companies who travel with pop groups are expected to provide the stage PA system and all the peripheral gear.

But not all sound companies travel with lawn systems, especially when the majority of their pop group’s tour stops are enclosed arenas. So when WMT owners Discovery South Group Ltd. led by the consultation of dB Sound owner Harry Witz, local promoter Jam Productions, and other firms experienced in the concert business decided to put together a world-class outdoor theater, the lawn system sound was a top priority.

What Witz and others set out to accomplish was a lawn system that covered every inch of lawn, but without too much spill into neighboring communities.

The secret behind uniform coverage and minimal spill is devising a speaker directing system that allows for easy and flexible adjustments. Witz’s system is simple, but convenient and cost-efficient. Attached to the underside of the pavilion roof nearest the lawn area is a parallel pair of 3-inch-wide angle iron approximately two feet long. Each angle iron has a series of holes running its length for varying speaker direction with chains that support the cabinets. Additionally, each cabinet has adjustable slots mounted on its side allowing further direction calibration. The speakers hang with four chains (two per side), but a combination of shortening and lengthening chains or switching angle iron holes or slots in the cabinet hardware allows the installer the flexibility of aiming the cabinets any desired direction.

“The brackets allow us to adjust the speaker angle horizontally,” Witz explained. “We picked two point sources, one on each side of the stage where the PA originates from, not the center of the stage,” Witz said. “Basically the cabinets [on the roof] are on a straight line from where the PA originates and the brackets we used allow us to adjust the speaker angle horizontally on that axis.”

Further complicating the lawn coverage directional calibration is the pavilion roof’s three angles. The three sides of the

pavilion facing the lawn resemble any three connected sides of an octagon.

dB divided the lawn into two zones—a far and near zone. “If we had aimed a cabinet so it covered the entire area, we would have had time delay problems from the top of the hill to the bottom. With two zones, every other cabinet is aimed either at the far zone or near zone.”

The speaker brackets were specified by Witz to extend beyond the cabinets and provide a $\frac{3}{16}$ -inch hole for mounting a speaker. “If some big act wants it, they can bring their own lawn system; they can just go on the catwalk, rig right to it, and come down and bypass the house system,” Witz explained.

Since many of the country’s music sheds have mono mixes for the lawn, WMT wanted also to provide stereo. To accomplish the feat, Witz divided the lawn into an invisible checkerboard of left and right channels. “As you move laterally across the lawn you pass through alternating left and right patches. The near zone is the exact opposite in that as you move up and down you pass through left and right patches. So no matter where you sit on the lawn, you should hear stereo,” Witz said.

The effect isn’t true stereo, however, but it does add a spatial effect rather than just plain mono. “You really don’t hear

true stereo, but you hear some shifting because no matter where you're at on the lawn you're hearing sound from two to three cabinets at any given time," adds WMT Sound Department Head, Steve McCarthy. "If anything, it gives a spatial effect especially if they [the sound company] do something with exciters or delays."

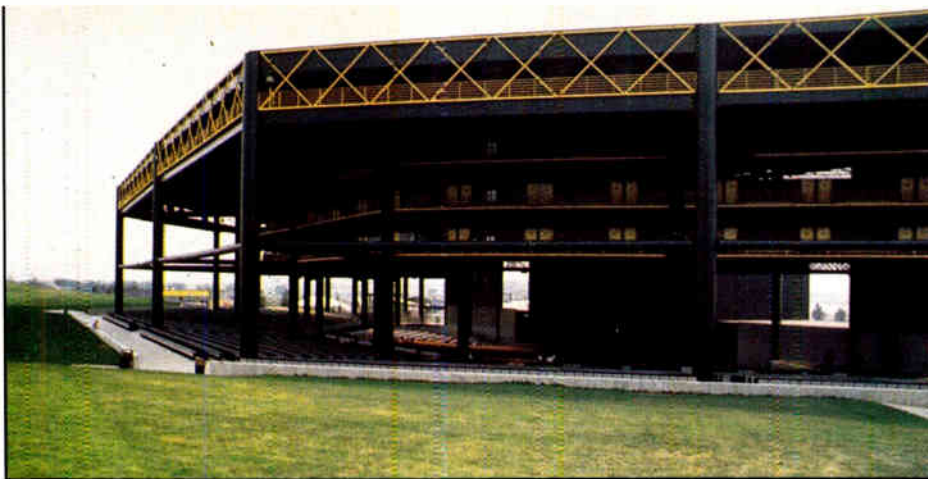
Each of the 26 three-way cabinets use four different JBL components. Two JBL E-130 15-inch speakers handle the low end while the high end is accommodated by four custom manufactured JBL bullet tweeters with ring radiators and slot diaphragms to accentuate the high end response. The midrange frequencies are handled with combination JBL 2385 horns and JBL 2445 drivers.

There was little doubt as to whether the speaker configuration would work since dB's touring division had used a similar design on concert tours a few year ago with groups such as Kansas, REO Speedwagon, Heart, etc. Additionally, the 16-year-old dB Sound leased similar lawn speaker systems to outdoor theaters—Marcus Amphitheater, Milwaukee; and Poplar Creek, Hoffman Estates, Illinois.

Cabinets for the lawn system speakers are HP-3s manufactured by R & R Cases in Des Plaines. dB assembled the units in its 20,000-square-foot facility.

Since stage PA systems provided by touring sound companies are expected to provide 100 Hz and below, the lawn system was designed to roll off at 80 Hz. The pavilion acoustics, generated by the stage PA sound, reverberate the low end out into the lawn area complementing the lawn system and completing a full frequency spectrum. "The lawn system itself reinforces what's coming out of the pavilion, which is about 100 Hz on down," Witz said. "The lawn system itself will sound pretty good if you play a CD through it, but it doesn't have the low-end punch. But when you couple the lawn system with the house PA, there's no reason why it shouldn't sound good."

Amplifying the lawn speaker system is four racks of amplifiers each with two Crown Macrotech 2400s and four Macrotech 1200s. The two 2400s power



A simulated stereo effect can be heard from any position on the lawn of the WMT.



Twenty-six three-way speaker cabinets are used to house four different JBL components.

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Four chains are used to hang the speakers, but flexibility in the chains and the angle iron allow the cabinets to be aimed in any direction.



Steve McCarthy, sound department head of the World Music Theatre has heard many compliments from sound companies that have come into the theater.

wouldn't infringe on neighbor's rights.

In addition to the Crown amps, each rack has one Audio Digital ADD-2 signal processor to delay and subsequently coordinate sound between lawn zones.

For the right and left channels, the system has two White 4650 graphic equalizers.

Acoustically, the pavilion of the WMT is providing easy sound mixing for the touring sound companies contracted to provide stage PA sound for the house. "From the easy access for bringing in equipment to the acoustics, we've heard nothing but compliments from sound companies that have come in here," said Steve McCarthy, sound department head for the World Music Theatre.

Even the stage access area allows

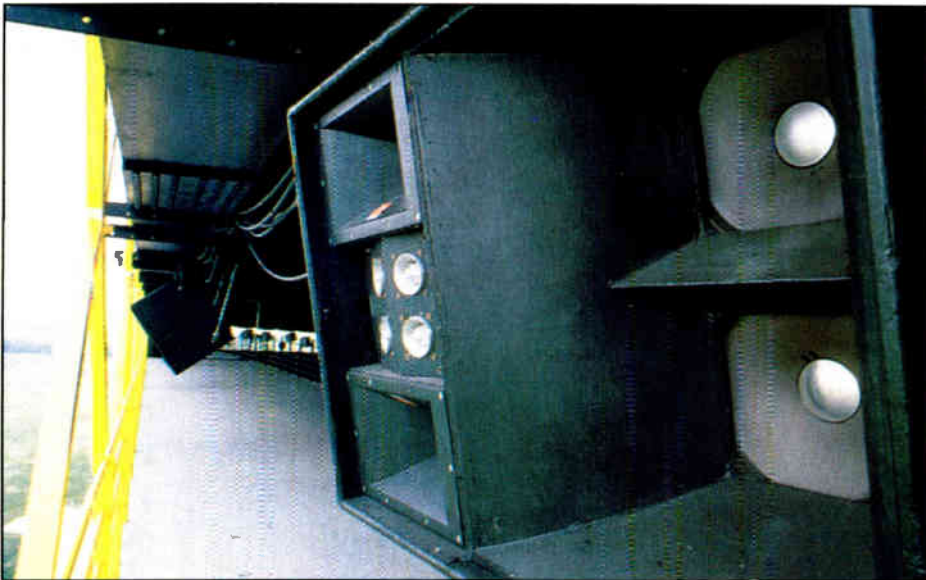
The general acoustics have been applauded by the local press and touring and sound reinforcement firms.

several semi-trucks at one time to unload, which was important for high tech production groups such as David Bowie, whose production is transported by 10 semi-trucks.

As with all new installations, refinements are currently being considered to curb several minor problems.

While the general acoustics have been applauded by the local press and touring sound reinforcement firms, McCarthy and his staff are looking into solutions to correct reverberation at 6 to 8 kHz that's noticeable only near the open, but private, skyboxes near the top of the pavilion. It's not a large enough problem so that complaints from ticket holders have been filed, but the theater has included the problem in its refinement itinerary. Thus far, the problem is being solved through equalization; however, ideally, a permanent solution is preferred.

Another quick fix has been directing



Cabinets built by R & R Cases were used to house two JBL E-130s (low end), four JBL custom bullet tweeters (high end), and JBL 2385 horns and 2445 drivers.

the JBL E-130s and the 1200s power the horns and tweeters.

The system's crossovers, four Brooke Siren Systems FDS-360s, have built-in limiters to safeguard against both damaging the system and raising the decibel level

above the Tinley Park zoning code of 105 dB. The crossover points are 80 Hz, 1.4 kHz and 8 kHz. "All my calculations were based on 100 dB at the lawn's far edge," said Witz, who attended village meetings to assure local politicians sound levels

high end speakers toward the upper balcony seats to add intelligibility with higher frequencies. "You have to remember this is a big cavern so the reverberation we do get isn't too much of a problem," McCarthy said.

Some residents as far as two miles away lodged complaints during the theater's first concerts.

But to solve the problem, McCarthy is looking into everything from insulating the shed's reflective corrugated steel ceiling to hanging absorption panels in strategic places. Although the verdict is still out on

the solution, spraying the ceiling is not advisable since the extreme temperature changes throughout the year could lead eventually to adhesion problems. And hanging absorption panels would tend to sway in the winds that whip through the pavilion and might scare people below, McCarthy noted.

Another unanticipated problem is sound spill outside the lawn area. Although the WMT is surrounded by vacant land, some residents as far as two miles away lodged complaints during the theater's first two concerts.

In adjusting the long throw speaker cabinets, McCarthy found a few were directed a little high and sound spilled over the sharp incline of the lawn area.

Another factor in the lawn spill was unseasonably high winds of 35 mph and higher during the Kiss concert. McCar-

thy took a dB reading from the lawn of one complainant and found the 54 dB music reading was lower than traffic noise from a nearby interstate highway.

The pavilion acoustics, generated by the stage PA sound, reverberate the low end out into the lawn area.

The solution could be contained in the WMT's original plan now being reconsidered, which called for the erecting of a wooden fence with more sound blocking characteristics than the existing cyclone fence. ■

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The Digital Multimeter

Higher Tech In Smaller Packages

BY MIKE KLASCO

The multimeter is a handy instrument, one which is often taken for granted. Multimeters are used to measure voltage, current and resistance, although once you go beyond the low end models, capabilities such as frequency counters, capacitance, and temperature are offered. And like most electronics products, its price has gone down while the performance and flexibility has increased.

In the mid-1970s when the first digital multimeters (DMMs) were introduced, the typical choices were desktop bench instruments that were pricey and bulky. Handheld field instruments eventually followed. Before DMMs were analog multimeters, but these have almost disappeared, as they cannot compete with DMM designs for accuracy, reliability and cost. If you were to open up a typical low-end \$50 DMM, you would find a single IC chip that not only provides the measurement function (probably with auto ranging!), but also drives the LCD display. The first multimeters were analog, based on d'Arsonval movements which were vulnerable to overload, shock, temperature, as well as having inadequate input impedance. Analog multimeters have just about disappeared, although most DMMs not only display the measured value digitally, but also with an "analog" graduated bar display which is a more intuitive way of judging amplitude fluctuations.

SELECTING A DMM Determining Specs

Before shopping for a DMM, you should take a few minutes and consider how you are going to be using it. Is it for lab use where you need those extra digits of accuracy? Or field use, for audio? video? both and more? How about production testing?

A DMM should measure dc voltage (Vdc) down to 20 mV to measure contact voltage drops in switches, etc. If you do video work, the DMM should measure to 40,000V for TV monitor picture voltages. For measuring microphones; an ac voltage (Vac) down to 20 mV or less will be needed; an upper ac range of 500V RMS to measure 440 industrial power V lines. The bandwidth of the DMM should be beyond 20 kHz and ideally well beyond for audio work. Resistance of wire runs, contact resistances, circuit board shorts require a 2 ohm scale, *i.e.*, that counts to 1.99 ohms and can resolve to .01 ohm. Video work also requires resistances of 200 M ohm or more. For ac current a range of 100 A or more is useful for power line measurements.

Capacitance

For incoming inspection of electronic component parts and service work you need a capacitance meter. It is a lot less expensive to spend a little more to get capacitance capability in your DMM than to buy a capacitance meter, and one less

item to have to fit into your tool box. The lower end of the capacitance range will be typically less than you will need for audio, but the upper end should be a few hundred thousand microF for checking out power amp electrolytics. Ten microF and 100 microF ranges will come in handy in checking out passive speaker crossover networks.

Inductance

If you think you will be measuring power transformers, speaker crossover network coils, or even the inductance of crossover network capacitors, then you may also want an inductance range, but this will cut your choices down somewhat. A comfortable inductance range is 200 mH (milliHenries) to 2 H.

Frequency

Frequency counters are also available built into some DMMs. My first frequency counter was "larger than a breadbox," but now this function is a switch position on a number of handheld DMMs.

Aside from measurement types and ranges, accuracy should be considered. Cheap (less than \$100) field DMMs have limitations on accuracy, both with temperature and time. A rule of thumb is to assume you will be getting not much better than 5 percent accuracy under most field conditions.

Averaging or True RMS?

Averaging DMMs are best for steady tones, such as checking levels from a test oscillator or measuring voltage off a power line. For arbitrary or distorted signals, such as pulses, square waves, audio signals or noise measurements, a true RMS DMM is the better choice. True RMS meters cost a slight premium and you will not find this circuit in the least expensive meters.

WHAT FORM-FACTOR?

Bench

For lab use, the bench configuration is the most comfortable. Given the larger control panel space, the instrument designer can lay out the controls more conveniently and use a larger and brighter display.

Handheld

Most field units are worn in a holster and are designed to be comfortably handheld. In the last few years, due to surface mount components on the circuit boards, the thickness of handhelds has been reduced.

Clamp-on

Clamp-on DMMs are usually the same size as handhelds, but can be clipped or hung onto whatever they are measuring (or other handy place). The "jaws" of the meter function as a transformer, to measure voltage without piercing the conductor.

Probe

By combining the DMM with the probe, a very small instrument results. Usually some functions are given up in the miniaturization process.

Computer-Based

Although not common, a number of manufacturers have offered DMMs on a plug-in circuit board for personal computers. These have tended to be high performance units that also take advantage of the data logging capabilities of the computer using the hard disk as well as the large monitor screen and hardcopy printout.

*The Leader LCD 100
DMM/Storage
Oscilloscope.*



Fluke 80 series multimeters.



Cretec's SC04 is a hand held DMM, with a full digital storage scope and frequency counter.

WHAT ABOUT PROBES?

Perhaps probes can be compared to car tires—the ones that often are supplied as original equipment should be thrown away. When you are working with your DMM, you will spend much of your time handling the probes rather than the meter. In researching this article I came across a description of an engineer's "dream probe": a miniature and sturdy, 3-inch long probe handle to fit down narrow terrain; ultrathin tip to probe narrow pitch IC leads, and the tip sturdy enough to stay where it's inserted. Of course, while this probe would be nice for circuit board analysis, I

do not think I would be checking 100 Amp power lines, so depending on the work you do, another set of probes for high current, and also high voltage could come in handy. Quality probes can cost about \$100; nearly as much as a field DMM.

FANCY MULTIMETERS

There are an endless number of generic DMMs for less than \$100. The cheapest DMMs, priced around \$50, will lack accuracy (perhaps worse than 5 percent), have poor ac measurement bandwidth (usually less than 1000 Hz), and not have a breakproof case. You can count on tacky probes. As you spend closer to \$100 you will find more DMMs with recognizable names (Beckman, B & K Precision, Fluke, etc.), closer to a few percent accuracy (although this spec tends to be optimistic), and ac bandwidth to maybe 5 kHz. If you are willing to spend more, you will find that an extra few hundred dollars will get you a lot of action. Not only does performance get better, but capabilities are expanded.

Since Fluke was one of the most popular names in our contractor survey, I took a look at their upscale model 87 for \$290. The LCD is readable with a backlit display and has 4½ digit resolution with a fast analog bargraph. Operation is 20 kHz ac. Frequency counter and capacitance capability meters with autoranging (which can be disabled). Audible alert when an input signal is beyond the limits of the meter (such as very high voltage).

A number of DMMs now offer voice synthesis. This is not the gimmick it seems; just wait until you are hanging from the rafters measuring some cable or speaker, and cannot handle a flashlight to read the display. One vendor of voice announcement DMMs is Omega.

Another unusual handheld DMM, which B & K Precision has nicknamed Test Bench Jr., is their model 377. It combines the functions of the traditional DMM with

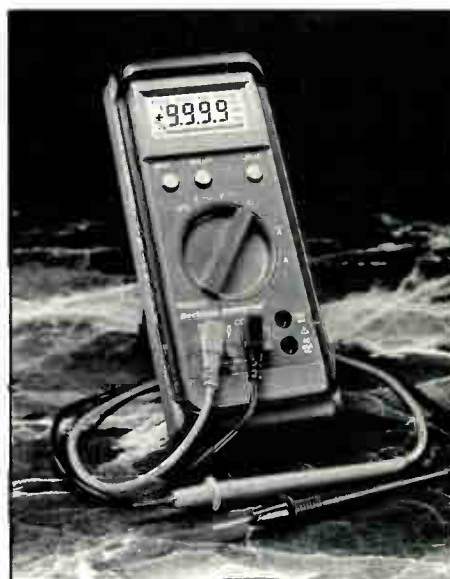
a 3 megasample per second digital scope. The LCD display for the DMM doubles to displays the waveforms. Up to six waveforms can be stored.

Try to top that! Actually, a few super DMMs have been introduced that do just that. Leader has the LCD 100 and LCD 200, which are handheld DMMs plus digital scopes. However, the most tricked out DMM yet is the Createc SC04, a handheld DMM with a full digital storage scope and frequency counter. The DMM is 3½ digit with true RMS, the scope is 10 MHz and accuracy is high. The SC04 will drive a printer directly and interfaces with a personal computer. For all this high tech, you will pay \$3,400.

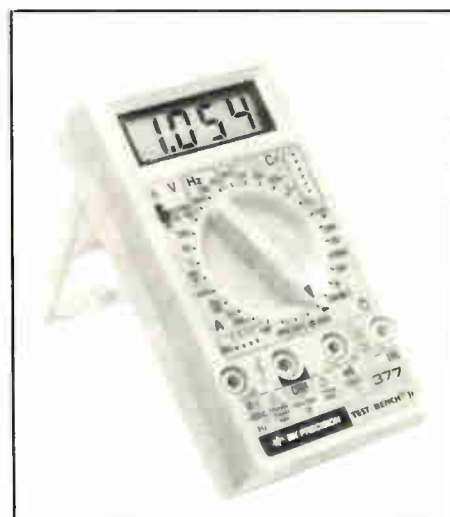
Next month's Sound & Communications test equipment section will return to acoustic analyzers with our in-depth review of the Ariel Sys-ID acoustic analyzer test system.



The B&K Precision Model 350 Clampmeter.



The Beckman Industrial RMS225 DMM includes probes and a strap for vertical hanging.



The B&K Precision Model 377 Test Bench Jr.

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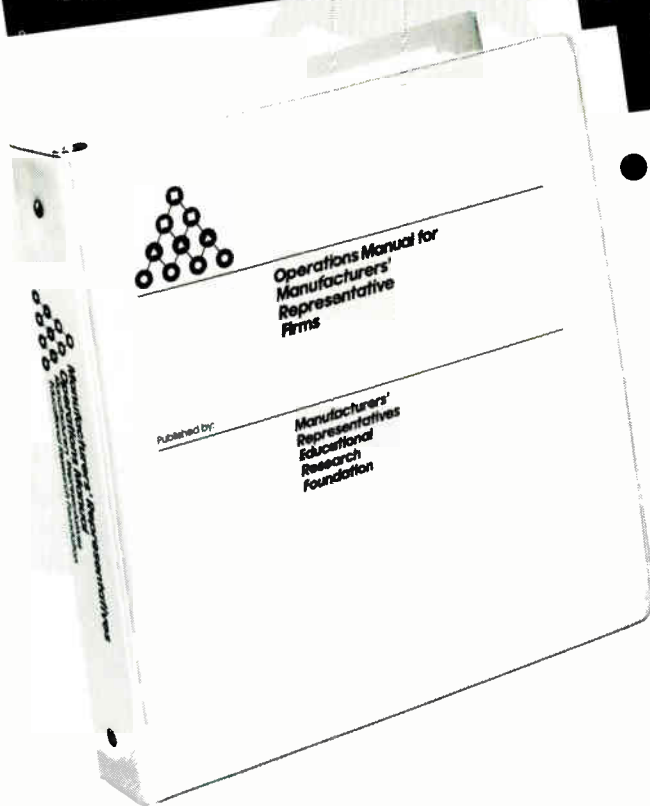
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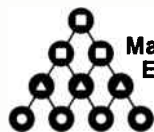
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MAKING FRIENDS WITH A TIME DOMAIN REFLECTOMETER

By Walter "Duff" Campbell and Mike Klasco

Finding a break or loose connection in a wire or cable is now easier, thanks to an instrument you may not even be familiar with!

A "Time Domain Reflectometer, Cable Fault Locator" is an instrument used to locate cable faults. In the past, the high cost and complexity of the instruments has prevented their widespread use. TDRs historically have been reserved for larger cable systems and higher level engineers. A steady progression toward more user-friendly equipment has resulted in a new generation of lower priced, simplified, time domain reflectometers which are gaining popularity in many new industries including sound and communications.

YOU HAVE A FAULT IN A CABLE, BUT WHERE? TDR TO THE RESCUE!

A fault in a cable can be a frustrating and time consuming problem. Many times even your best efforts to pinpoint the location of a problem ultimately results in the replacement of the entire cable because the specific location of the fault could not be determined. A TDR can help prevent these costly replacements.

Time Domain Reflectometry is the most accurate way to pinpoint the location of a fault in a cable. A TDR can help locate problems such as opens, shorts, pinched cables, loose connections, water in the cable, rodent damage, or any cable prob-

lem which causes a significant change in the impedance of the cable.

THEORY OF OPERATION

A Time Domain Reflectometer operates on the same principle as radar. The instru-

ment generates a pulse which travels down the cable. As the signal travels, a fraction of the pulse is reflected back to the instrument from any impedance discontinuities encountered along the way. The type and severity of the fault encountered deter-



The Riser-Bond model 1210 time domain reflectometer.



The Riser-Bond model 2901 B+ digital time domain reflectometer.

Walter "Duff" Campbell is the Director of Sales and Marketing for Riser-Bond Instruments.

mines the size and shape of the reflection returning to the instrument. From the information received by the instrument, the distance and type of fault can be determined. Because a TDR operates on the pulse/reflection technique, it is best if both ends of the cable are disconnected from any other equipment. A termination will absorb the pulse of the TDR, preventing a return reflection.

A VIEW FROM THE TOP

Although all TDRs work on the same principle, there are two basic ways you can view the information that is displayed: The more traditional Waveform Type TDR displays the actual signature of the cable. The display (CRT or LCD) shows the instrument generated pulse, the reflected pulse from the end of the cable, and any other cable imperfections in-between. Reflections can be caused by splices, taps, splitters, and system components, or by faults such as loose connections, bad splices, or damaged cable.

From the displayed waveform, you then must calculate the distance between the beginning pulse and the reflection you wish to measure. A few TDR models calculate this distance automatically; however, most models require the operator to adjust the instrument settings to determine the distance to the fault. This type of instrument will read maximum distances from 25,000 to 50,000 feet with accuracy from .01 percent to 3 percent. Many models include a printer for a permanent record of the waveform. Prices range from approximately \$3,500 to \$6,500.

The second, more simplified Digital Type TDR, displays only a numeric distance reading to the fault. Although this type of instrument receives the same information as its more complex counterpart, the digital model interprets the waveform for you and calculates the distance to the first major reflection (fault). Generally, these instruments will not include a printer or waveform display, although some models do have the capability to be connected to a standard oscilloscope for viewing the waveform. This type of instrument has a shorter

maximum readability, but may have accuracy as good as the more complex models. Prices range from approximately \$700 to \$1500.

While the waveform type TDRs give you more information and versatility, they also are more complex and higher priced. The simplified digital models are smaller, less expensive, and easy to operate, but do not give you as much information. Both types are very helpful in determining problems in your cable.

TDRs HAVE BEEN RESERVED FOR LARGER CABLE SYSTEMS AND HIGHER LEVEL ENGINEERS.

ALMOST ANY TYPE OF CABLE CAN BE TESTED

A TDR will test any metallic, paired cable. Audio, video, plenum, and computer cables; twisted pair, multi-conductor, coaxial, hook-up, etc., can all be tested with equal success. Aerial cables, buried cables, cables in conduit or behind finished walls, also can be tested. In the case of hidden cables, a cable tracer or locator may be needed in conjunction with the TDR. A measuring wheel or tape measure is also helpful.

VELOCITY OF PROPAGATION

Each individual type of cable has a known Velocity of Propagation (VOP) which determines the speed at which a signal can be transmitted through the cable. The VOP of a cable is determined by the dielectric material which separates the conductors. The VOP is expressed as a percentage of the speed of light in a vacuum. A cable with a VOP of .90 can transmit a signal at 90 percent of the speed of light.

The VOP of the cable you are testing is programmed into the TDR for increased accuracy. Each type of cable has its own VOP number. Foam coaxial cables have a VOP of between 80 and 90, while twisted pair cables have a VOP between 60 and 70. The faster a cable can transmit a

signal, the higher the VOP number will be.

The loss or attenuation factor in a cable also determines the maximum cable length that can be tested. In other words, the greater the cable loss, the shorter the length of cable that can be tested.

HELPFUL HINTS

As with any type of new test equipment, familiarity with the instrument improves your chances for success. We are all guilty of trying out a new instrument without first reading the instruction manual, only to end in failure (through no fault of the instrument). Read the operator's manual first, and save yourself some time and trouble in the long run.

Once familiar with the instrument, a few simple procedures can help cut down your troubleshooting time and increase your accuracy. If your TDR indicates a fault at a particular distance, first go the distance indicated and look around. There may be an obvious answer to your problem, such as a new drywall nail through your cable, a loose connection, or a splice gone bad.

SHOOT TWICE

If a problem is not obvious, mark the distance to which you measured, then test the cable from the opposite end. Again, measure the distance indicated by the second reading. If your two readings indicate a problem in the same place, you have pinpointed the problem. If you get a reading indicating a fault in a different location, you may have two separate faults, or the VOP of the cable may be wrong, or the cable route you are measuring is wrong.

Testing a cable from both ends is always advisable. A small fault, too far away for your TDR to indicate, may be easier to spot from the opposite end (closer to the fault).

As in golf, it is hard to get a hole-in-one on your first shot, but the closer you get to the hole, the easier it is to succeed. The same is true with a TDR. If you get an indication of a fault a long distance away, move yourself closer (at a break-out point) to the fault and re-test. The closer you get to the suspected fault, the more accurate your readings will be. ■

CLAIR

(continued from page 36)

TROY CLAIR

What do you see as Clair Brothers' greatest asset, one that has been shown in Touring and that will be offered to Contracting?

It's not the S-4 or other such achievements people usually talk about, it's consistency. Like the overall design of the S-4 or our rigging, all details are thought out top to bottom. We don't focus on one aspect or piece of equipment, rather on how can we make every component the best and then carry it through

all aspects of the whole system. When we provide our service, we strive to maintain consistency from all angles — including the people behind the equipment.

In terms of providing Clair people, how many resumes do you receive per year on the average?

Two hundred, from all over the country. This enables us to make the decision to hire the best person for the job, whether they're local or from California.

It was mentioned that you originally came into the company full-time as equipment manager. Just how many major components does Clair have in touring inventory?

There are roughly 2,750 major components in inventory, which I still manage

as part of my Operations responsibilities.

As part of the group who measures and works to improve the sound of Clair's touring systems, what instrumentation do you prefer?

We do use the TEF extensively, to get the system close to where we want it; however, the ultimate test instrument is the human ear. After all, that's what the people who come to the concerts use. All of us at Clair strongly believe that to get a sound that people will enjoy, use electronic tools to get it close — then use your ears for the final measurement.

GENE PELLAND

In spending some time with Gene Pelland, the leading force in Clair's contracting effort, we discover key details about personal background, company resources, capabilities and goals. Though discussions with the General Manager for Systems Installations started off on the marketing foot, we then moved onto another level of hard facts and figures (I am greatly appreciative for all of the data he provided, while he was knee-deep in a number of time-critical projects). Combining these data with solid insight on the company's personality, we begin to see what sort of impact Clair Brothers could make on the Communications Contracting Industry.

A NEW DIVISION IS BORN

When did Clair officially open their doors as a contracting company?

November of 1989.

How did the idea for an installation division develop?

Roy and I have been discussing the possibility of an install effort for many years, considering Clair's technology abilities. We talked back and forth for four or five years before we came to the agreement we have now.

What was the turning point for making the decision to proceed?

Clair Bros. looked at what directions they wanted to take in the new decade of the 90s and decided diversification was the important issue and that contracting and manufacturing were the two key paths to take.

We realize contracting is difficult to break into and it will take a long time to get a foot-hold in that industry. We are dedicated to it and intend to proceed.

What is your background and what made

	
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you decide to work with Clair Brothers?

I had worked with Clair all through the 70s on tour and maintained my contact with them throughout my experiences in the contracting industry. When I left Clair after the seventies, I worked for a pro audio firm called Dimension Five. The firm I joined after Dimension Five was Moorefield Communications, a contracting firm with whom I worked for nine years. That was a very positive experience for me. As I gained a certain level of experience, I simply felt the need to work with a larger firm with greater engineering and large-contract execution capabilities. It was my opinion that Clair had potentially the best background to pursue national and international contracting.

Was there a field of other candidates for the job?

Yes. I believe a good part of Clair's decision to select me was based on trust, a very important element to their management style. They had worked with me before and knew what they could expect from me in terms of loyalty, a critical issue to a technology-driven company.

FORMING A MANAGEMENT TEAM AND A PLAN

Who are the administrators of the new division, and what are their backgrounds?

Aside from myself, there is Gene and Roy Clair — founders of the overall company and administrators for the touring division; there's Troy Clair — whom Gene Clair spoke of — and there's Barry Clair, a recent college graduate who has been with Clair Brothers for nine months and who is Roy's son. All of us are on the board of directors.

Who actually runs the day-to-day operation of the installation division?

I do, with long-term issues being discussed among all of the administrators.

What is your initial market and job size focus?

We're looking at focusing on performance-type venues such as large sophisticated nightclubs, large theaters, stadiums, auditoriums, worship centers and conference centers. Our number one priority is to let people know we are in the business of contracting and manufacturing. Those people are consultants, contractors and system end-users/buyers. Our clients could range from a Casino in Atlantic City or Las Vegas, to a nightclub in Nashville.

RESOURCES

What is the financial commitment of Clair Brothers as an overall company toward achieving the install division's goals?

Clair Brothers Touring Division is in a position to back the installation division, if a time of need were to arise during the original growth period. Although, with the amount of business we have generated so far, we have kept our head above water.

What existing Clair facility/personnel resources are or will be available to the install division?

All areas of our touring systems shop including its personnel will be available for pre-fabrication, service and field installation. We have equipped six field technicians with complete tool kits, etc. We've also equipped an installation van and we have other trucks available as well. On the engineering side, we have four design engineers available for installation work and of course we have both AutoCAD workstations and the JBL CADP program on PCs. For lab or field TEF work, we have three TEF technicians.

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What is the current size of the install division sales force?

Day-to-day sales for the install division are handled by myself, Troy Clair, Barry Clair and Dan Wood (specializing in Custom Home Installations).

Dan Wood has a business degree and a background in hotel management. He spent several months in the Clair shop before moving into the sales division.

In terms of sales force expansion, what do you see in the upcoming year?

Upcoming sales effort expansion will include developing "Satellite Offices" throughout the U.S. and Canada and eventually world-wide. These offices for the most part will be existing contracting firms interested in utilizing the expertise, reputation and resources (including purchasing, engineering and prefabrication) of a company such as Clair Brothers. [At the time of this interview, Phoenix was up and running and other locations were in the works.]

EXTENT OF INSTALL SERVICES

What will be the extent of your install services?

We'll offer design/build services, both negotiated and bid. We'll provide comprehensive installation and fabrication services. Sub-contracted will be conduit installation and some rigging work.

Are you ready for audio-visual and teleconferencing design and install?

Presently we are not in the field of A/V and teleconferencing, but we plan to be by the end of this year.

How are you handling overseas installations?

We have our existing U.K. and Japan offices for support.

TESTING THE WATERS

What work has been completed in the first seven months of operation?

Work performed so far includes some nightclubs, a theater and some worship centers.

Ongoing projects?

At this time we're in the midst of installing an amphitheater [shed] lawn system in Pittsburgh, which is owned by Pace Concerts. We also have bids in at this time on some other sheds. We see the shed business as an area where we would really be able to help the customer out. We also have some projects going on with consulting agencies.

What are your opinions on your experiences so far?

This is a time where we feel a lot of people are testing our waters and we're testing their's. We've lost a couple of bids — the contracting business is very competitive. I'm surprised at the number of companies who aren't as profit-oriented as they should be. I hope that doesn't hurt the customer.

Aside from installation sales, what other efforts will be put forth in the near future?

A fair amount of time and budget will be spent in the upcoming year on marketing and selling the new Clair products.

What is the scope of your present range of Clair-manufactured products?

Right now we're introducing the 12AM monitoring system, with the 200 and 400 series drive racks for that system. These drive racks are equipped with Clair/Carver amplifiers with internal processor systems. Following shortly will be the outboard processor for the 12AM system, which will allow the user to power the monitors with his own amplifiers.

We hope in the next six months to introduce our own house speaker system as well. At this time we are looking at several prototypes but we have yet to nail one down as of this date. The speaker will be of a more compact nature than the S-4. We understand that the club, theater and stadium owners/clients will be interested in a more compact package that has very controlled directivity patterns. We're also shooting for a box with rigging capabilities for the fixed install while allowing for a small touring company to take it on the road and fly it. We will be offering complete rigging hardware packages with the systems.

What is your manufacturing marketing plan?

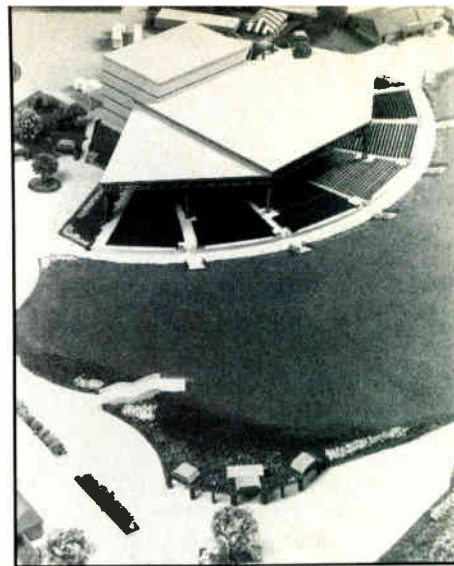
We'll be advertising and, as you know, we did the promotional demonstration of the 12AM system at the Trump Plaza with Jay Paul. That demonstration, which was open to all of the casino sound engineers, created quite a bit of interest and I'll be returning there very soon with that monitor.

What about distribution of product?

Right now it's direct from the manufacturer.

What's your target market for the 12AM?

Small and large touring companies, night club owners, amusement facilities and of course casino entertainment facilities.



The Star Lake Amphitheatre, which is located outside of Pittsburgh was installed by Clair Brothers.

IN CONCLUSION

Now for the big question: What unique capabilities does Clair Brothers Audio Systems have to offer to the contracting industry?

There are two things that I see immediately. Dealing with the sound consultants — who are doing an excellent job designing systems for customers — they can benefit from our hands-on experience. I'm working with a consultant now who has come to us and asked for us to work with him on a project because of our experience in fabricating systems that are custom-designed for a customer's specific needs. In this situation the systems would be tied into venues where there will be sophisticated acts involved. In other situations, I can see Clair benefitting consultants because of its ability to fabricate systems on time and on budget — something Clair is well known for. The second unique Clair ability is that if a customer were to come to Clair for a fabricated system, Clair's extensive design and engineering resources would be of great assistance. This level of service is not easily supplied by many of the contractors out there, and is a something I see us being able to offer to them as well.

Clair has always been in a service-oriented business, the sound business; therefore Clair is a service company. In addition to fabrication and engineering abilities, Clair's commitment to the customer will be behind all of our installations and installation follow-through — which is extremely important to the customer.

[At this point, someone entered the room and informed Gene that it was "volleyball time," which concluded the interview.] ■

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JBL's CADP Revisited

The New CADP 4.53 Takes A Bow

BY MIKE KLASCO

In late 1983, JBL introduced CADP (Central Array Design Program). The program was unique in that it was an integrated approach rather than consisting of various utilities. And CADP did not require external physical design aides such as plastic spheres, overlays, etc. CADP was the first widely distributed computer-based program and can be credited with being an important factor in popularizing the CAD approach to sound system design. Therefore it was appropriate to start this series of software reviews (in January, 1989) with CADP release 2.0. Although the review was generally positive, CADP's low resolution got in the way of viewing the room model, caused visual artifacts in the simulations that appeared as performance asymmetries and precluded the use of the cluster mechanical design module for client presentations. A second criticism was that while the performance predictions were fairly comprehensive, CADP was weak in providing the designer with an intuitive feel for horn aiming and layout. The program was useful for "testing" your design, but not as strong as an aid for preparing the initial rough cut. Both of these areas — resolution and intuitive feel — have been effectively addressed in this release.

Just over a year ago, at the 1989 NSCA, JBL previewed CADP release 4.50. JBL's Drew Daniels (now with Disney's WED group) and Bruce Olson developed this enhanced version of the program. I com-

plimented this revised program at the time [Sound & Communications, June 1989, CAD Topics]. Debugging the program took Bruce Olson more time than he originally anticipated, but 4.53b has been shipping for the past few months. I have worked with the preliminary pre-release version from the 1989 NSCA as well as the final release copy.

HARDWARE REQUIREMENTS

CADP runs on IBM MS-DOS compatibles. The program is not memory intensive nor computationally rigorous, so that users of plain vanilla XT class computers will achieve efficient operation. Although the program will work with a single 360K 5.25 inch floppy drive, 4.53 now is far more flexible than previous releases in that it is easily set up to work with multiple floppies and hard drives.

Setup parameters now include assigning individual directory (and sub-directory) paths to the program, speakerfile library, and sound system "jobs." Installation to your hard drive is automatic and painless.

Originally only low resolution CGA color was supported. CGA, EGA, and even high-resolution 16-color VGA resolution is now supported. The increase from four-color CGA is important in enhancing the clarity of the simulations by allowing assigning of various colors to differentiate reference lines from seating areas, and color keying performance results (more on this later). The program checks your hard-

ware's graphics capability and sets itself up automatically, a nice feature.

Still another improvement is math coprocessor support, which is automatic. A math coprocessor is not required, but will speed most calculations two times or more. Epson compatible printers are supported, but I recommend buying a print utility such as Pizazz Plus. Print utilities provide comprehensive hardcopy capability such as color printouts, control of printout size, compatibility with a wide variety of printers (such as 24 pin, inkjet, and laser printers), and even screen capture to disk capability (more about the benefit of this feature with CADP in this review).

SOFTWARE LICENSING REQUIREMENTS

CADP is licensed to authorized JBL dealers and is also available to acoustical consultants. A one-time licensing fee of \$600 covers updates and a quarterly newsletter. Release 4.53 was developed by Bruce Olson, an independent software developer. With JBL's blessing, he is selling this enhanced version of CADP, but only to licensed users of the program. The additional cost of 4.53 is \$144 (including shipping), a real bargain. To further sweeten the deal, JBL will be offering a full credit on trade-ins of the original CADP program toward their second generation program CADP2 (of course the \$144 for Bruce Olson's enhancement is omitted). By the way, in an upcoming issue we will

preview CADP2 and will follow with an in-depth review early next year after the program is formally released.

USER INTERFACE

To operate CADP you use multi-layer menus to step through its various functions and modes. Graphics screens and menus are separate. What this means is that you must leave a graphic screen and return to the menu in order to change a value or location, etc. This can disrupt the flow and is a bit awkward. As you leave the graphics the tendency is to lose the focus of what you were tweaking. JBL's own second generation program CADP2 uses Microsoft Windows. With a windows scheme you typically have pull-down menus, often selected by a mouse, as well as occasionally having menu windows appearing in portions of the screen. If this sort of user interface is important to you, then perhaps you should wait for JBL's new program (at least from the press release teasers, it seems to have some very appetizing features).

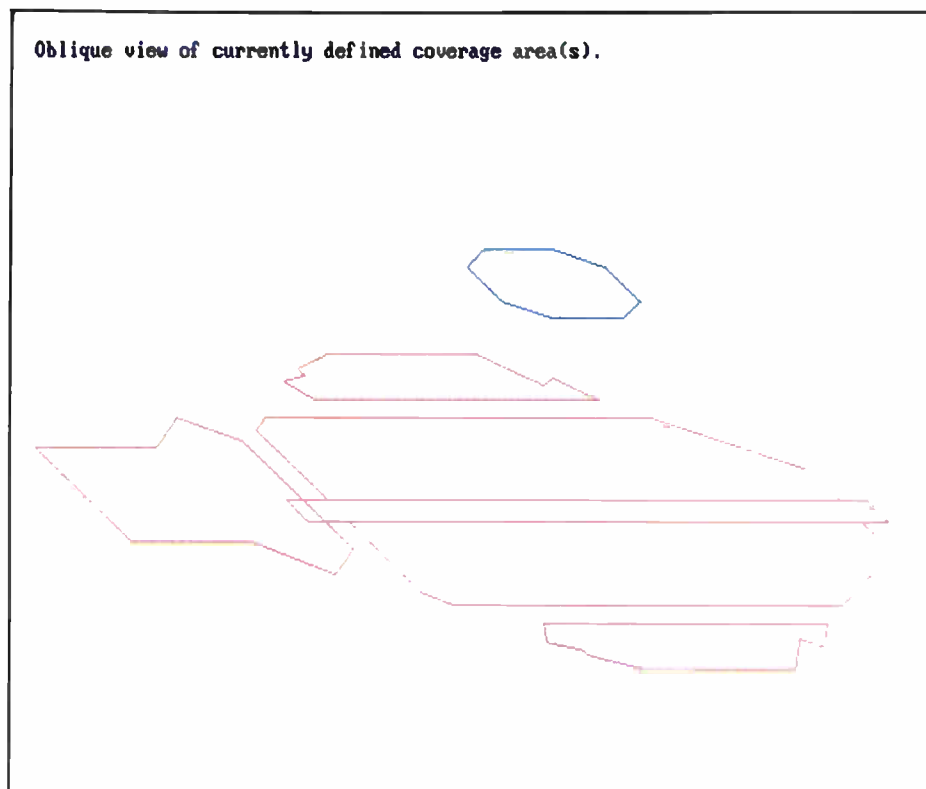
While user interfaces can enhance the feel of the program, CADP 4.53 is still very workable. Since our review in our January and February 1989 issues, most of the quirks of the program have been ironed out. Worksheets can now be printed out from within the program using the DOS shell commands. There is no support for a mouse, nor are the special function keys taken advantage of except that the ESC (escape) key now also can be used instead of the O key for returning to previous menus, which is actually more useful than it might sound. Also, directory listings of files are easily accessed without the extra keystrokes previously needed. These are really useful refinements to the everyday use of the program, eliminating just about all of its minor but irritating idiosyncrasies.

DOCUMENTATION AND SUPPORT

CADP is provided with an adequate manual and a quarterly newsletter. The manual provides some specific examples and the diagrams generally help clarify procedures. An addendum is provided with

4.53 which details new capabilities, and a recent CADP newsletter also discusses the many new features. When I originally reviewed CADP, I commented on the lack of an example job file and how this would be helpful to new users. 4.53 includes a very basic job file.

space without modification of the decor or addition of surface treatments. Yet there are signs that acoustical treating facilities will become more common in the 1990s, and for the most knowledgeable sound contractors and acoustical consultants CADP 4.53 is not as good of a choice as



Multi-plane seating areas (red) with reference lines in blue.

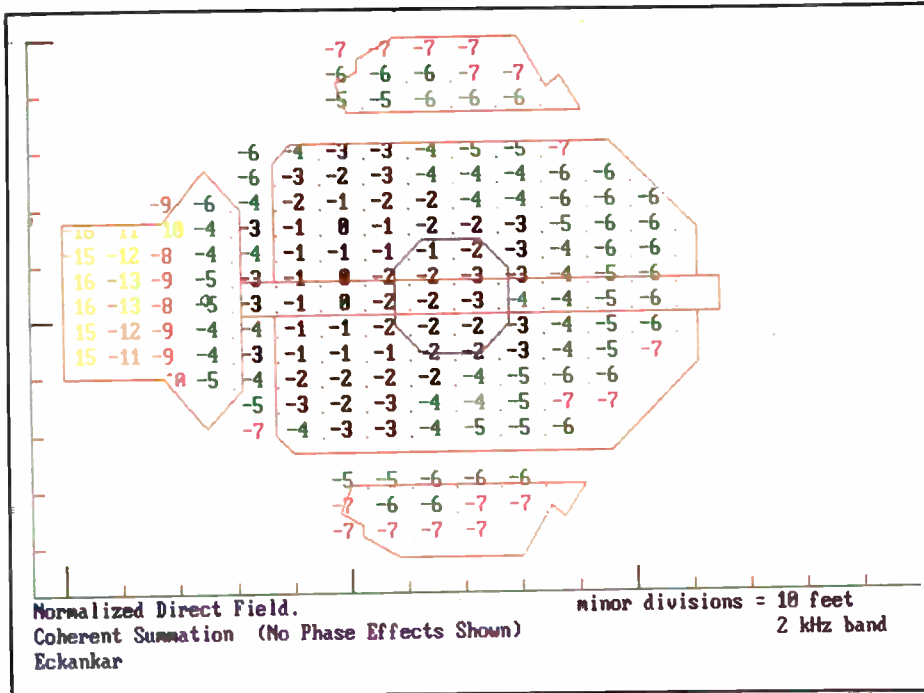
ROOM MODEL

CADP representation of the room model is limited to the floor plan and seating planes, ignoring walls and ceilings. CADP's (4.53) floor plan room model is manually entered by keyboard without mouse support. It is not possible to mirror the room, that is, draw half of the room and tell the program to mirror, such as is possible with the Bose Modeler. When I first reviewed the program last year I objected that it was time consuming, but CADP is still faster and far less complex to work with than most 3D model programs. I would guess that for the vast majority of jobs the sound contractor is not given the choice of changing the acoustics of the room and often the customer only wants to be quoted on a sound system that is appropriate for the

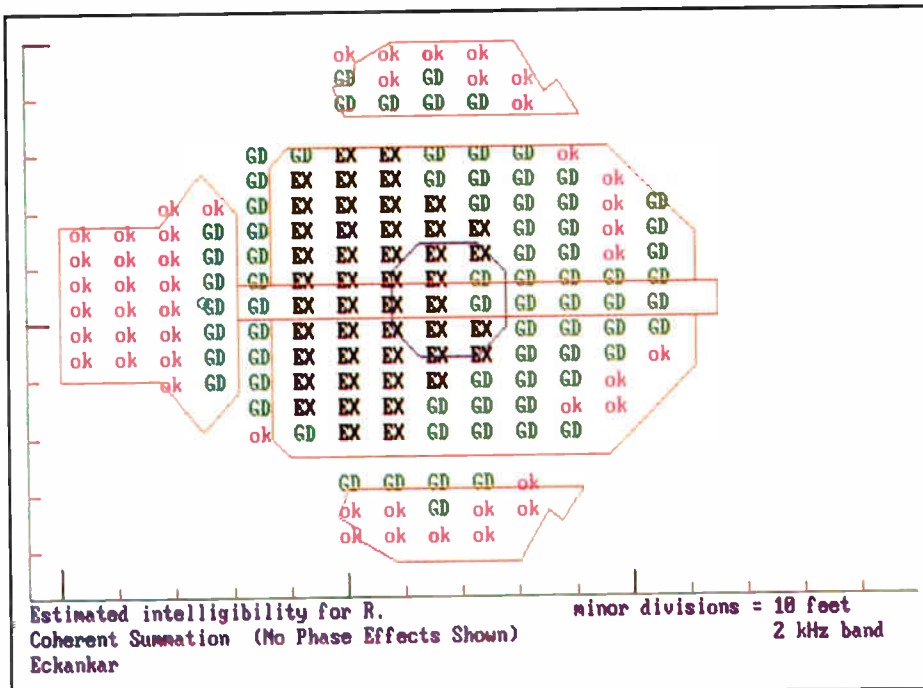
the newer, more acoustically sophisticated programs.

AIMING SPEAKERS AND LOCATING CLUSTERS

Speaker coordinate entry is still by program query and user response. This technique is tolerable, but a spreadsheet or mouse/point-click approach would be faster. In the course of designing a sound system the operator will likely want to try moving the entire cluster. CADP still does not allow you to directly move speakers en masse. Neither does AcoustaCADD, while Bose Modeler and the PHD program handle this task easily. JBL suggests that the floor be moved instead, or alternatively, Sidekick (a memory resident program) can be used to edit the speaker coordinates



Uniformity of coverage — note performance is color-keyed to aide visualization.



Estimated intelligibility for empty room in seating areas.

spreadsheet style, externally from the program.

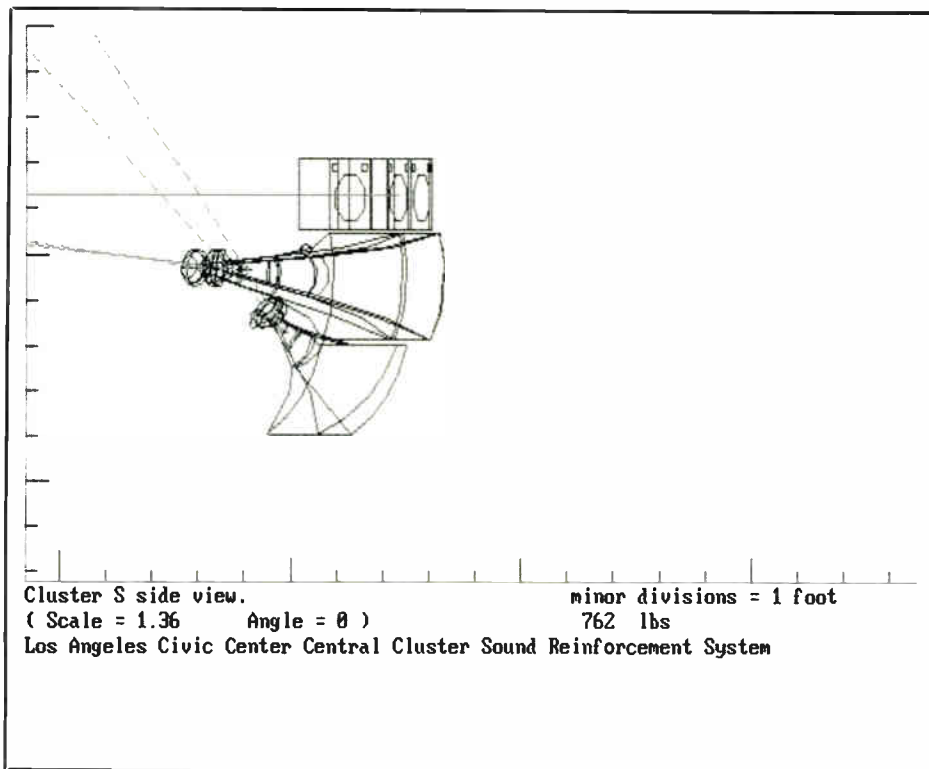
SOUND DESIGN PROGRAMS AS INTUITIVE DESIGN AIDS

Intuitive feel for horn coverage has been dramatically enhanced by the addition of color keying sound level intensity. The effect of the numerical ratings in dB, which also are scaled in color, is to combine the strengths of contour/intensity mapping graphics with numerical indication. Although the idea appears simple, it has not been done before (to my knowledge) and perhaps is the program's most insightful contribution to the art.

THE SIMULATIONS

The performance simulations are conceptually unchanged, but many useful improvements have been made. The simulations include uniformity of coverage, direct-to-reflected ratio, intelligibility, and maximum sound level. The user has a choice of seeing phase effects factored into the response in all the simulations. The direct/reflected ratios and the intelligibility simulations can be run with the room empty and then full (worst case/best case). This is a smart feature, one I did not give enough credit to when I first reviewed the program. Usually, with other programs, you must reenter the absorption coefficients for the seating areas, or at the least, climb through layers of menus to reset the audience conditions.

Using VGA resolution increases the data points from 180, available in CGA, to 475. This not only eliminates the time consuming chore of zooming in on a specific seating plane in order to achieve adequate resolution, but essentially eliminates the asymmetry idiosyncrasy that occurs in CGA resolution. The problem was that when a symmetrically aimed speaker was aimed, the results would typically show about a 1 dB asymmetry. This was caused by the area (sometimes called patch or tile in other programs) and the horn not being exactly centered with the tile boundaries. While the tiles are fixed, the horn locations are up to the user, *i.e.*, arbitrary. Since CGA split the screen into 180 tiles, but VGA has smaller tiles (475), the asym-



High resolution cluster — side view — aiming rays on.

metry effect is greatly minimized. It is also possible to look at the data with the inclusion of a small dot indicating where on the seating plane the calculations were made for each data point. The Data Location display feature can be turned on or off by the user.

The intelligibility simulation is based on AL%cons which is articulation loss percentage. The limitations of this measure have been discussed elsewhere, and 4.53 has not changed the algorithm from 2.0. Bose Modeler, CADP II, AcoustaCADD, and EASE are all introducing sophisticated intelligibility measures, although (with the exception of Modeler) AL%cons is still one of the measurement options in most programs.

We are preparing a comprehensive survey of predictive software and test instrumentation for reverberation and intelligibility measurements for an upcoming issue and developments in this field will be explored in detail.

CADP does not save simulation results as data, nor the screen image. If you want



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to save the screen image you can use Pizazz, which has a screen "grab" utility. Another use of Pizazz is mixing text, such as your design proposal, with the simulation results.

The rudimentary reverberation utility provided within CADP remains unchanged. There are quite a few reverb utilities that can be used to supplement CADP, including Lemker's "RT60," TPM's OPTORT60, and HYPAS software's DYNAM.

MECHANICAL DESIGN MODULE

CADP provides a mechanical design module which automatically prepares the prints of the speaker array(s). In CGA resolution the results look sad, but in VGA high resolution the results are more presentable. Aside from the increase in resolution, the ray from each speaker can be turned on or off, the printout size can be calibrated for correct scale, and the

description printed on the print can be more detailed. This is another feature that perhaps I did not appreciate enough when I first reviewed the program. On the down side, hidden lines cannot be removed and the cluster frame cannot be shown. CADP I can be used with XLATE, another third party CADP utility, to export to AutoCAD. Once in AutoCAD, hidden lines can be manually removed, large format prints prepared and so on.

CONCLUSIONS

Although it was introduced about seven years ago, it still deserves consideration. For most contractors who have no intention of fiddling with the room's acoustics and simply want to layout a design, check uniformity of coverage, maximum sound levels, get a prediction (AL%cons) with the room empty and full, as well as a high resolution cluster print without any extra effort, CADP 4.53 is well worth checking out. Considering its reasonable price, wide library of brands that are available, automatic high resolution cluster mechanical design utility, and enhanced intuitive feel, (i.e., the color coded uniformity of coverage contours), CADP 4.53 is still a viable program, even considering its present competition. ■

THEORY AND APPLICATIONS

(continued from page 29)

visual (video), olfactory (odor machines), tactile (mock-up car, vibration) etc., to provide extremely accurate simulational experiences. Thus, the experience of a product evaluation may be moving inexorably from the dull (and questionably useful) practice of focus group research to the level of accuracy and realism of current aircraft simulators.

This type of shift in market research, from qualitative to quantitative, is supported by much current and ongoing academic research into the marketing process.

Finally, the acoustical consulting and the audio engineering communities have long been in the position of recommending very expensive applications via extensive and

complex reports; often, an accurate demonstration of the significant benefit of a recommendation is a powerful ally in this process. Additionally, once the consultant has heard a binaural tape of his proposed before/after condition, he may stop and rethink the accuracy and benefits of his work.

SUMMARY

After experiencing high quality binaural audio, it becomes clear, very quickly, that a new age is approaching for some types of listening experiences. Recording of many types can be accomplished inexpensively and more accurately at the same time. The benefits of the process, unlike the claims for so many audio products and processes, are conceptually and perceptually obvious (the listener does not need to be an expert). In a world where most changes are modestly incremental and most claims for quality need such amenities as calibrated listening environments, the binaural process provides some clear potential benefits to the user, and the listener and the researcher. (Next month, a discussion of specific system development will follow.) ■

Useful Reading

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Berneke, Leo, "Music, Acoustics and Architecture," McGraw Hill

Cremer, Lothar and Muller, Helmut, "Principals and Applications of Room Acoustics," Applied Science Publishers, 1978

Orfield, S.J., "Psychoacoustics and Performance Sound, Part I: Theory" Sound & Communications, December, 1987

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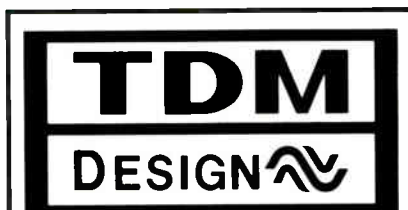
Orfield, S.J., "DAT Recording of Acoustic Measurements," Sound & Communications, June, 1989

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Sunier, John, "Binaural Overview: Ears Where the Mikes Are, Part I" Audio, November 1989

Sunier, John, "Binaural Overview: Ears Where the Mikes Are, Part II" Audio, December 1989

Studebaker, Gerald A and Hochberg, Irving, "Acoustical Factors Affecting Hearing Aid Performance, University Park Press, 1980



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Circle 290 on Reader Response Card

TESTING & MEASUREMENT

(continued from page 22)

(primarily so that the person reading the specification gets a large number in a competitive world).

What sensitivity do I prefer? I like the EIA standard of dB/0.001W/30 feet.

Why? Because the EIA rating can be directly added to the power amplifier output power in dBm with the result that you have the maximum level at or near critical distance in a majority of auditoriums.

The difference between one watt and one milliwatt ratings is:

$$10 \text{ Log } \frac{0.001\text{W}}{1} - 11 \text{ dB} = -30 \text{ dB}$$

Therefore, any of the ratings given so far can be made EIA ratings by merely subtracting 30 dB for power and 19 dB for the 1.0 meter distance (19.22 dB to be tediously exact).

Taking the 109 dB/W/m rating we find

$$109 - 49 = 60 \text{ dB EIA}$$

If we drive this loudspeaker with a 100 watt amplifier (+50 dBm), then at 30 feet we would have:

$$L_p = +50 \text{ dBm} + 60 \text{ dB} = 110 \text{ dB}$$

The reason that you can add electrical levels directly to acoustic levels is because they are both referenced to the same electrical power, namely one milliwatt or 0.001W.

These are some of the ABCs of electroacoustic knowledge. If you don't have them, how do you get them?

LEARNING AUDIO FUNDAMENTALS

Learning is a highly individual activity that goes on in the private closet of the mind. No one can teach anyone to learn. Teaching can take many forms but, if successful, the end result is motivation of another individual to make the effort to learn something. Once the motivation is present, then the teacher has the opportunity to help guide the student to the useful tools he or she might need to optimize the learning effort. A teacher who truly knows the subject to be learned by the student is capable of measuring where the particular student is relative to other students, thus providing a useful scale for measuring progress.

We sometimes hear the term "He is a self-taught individual." What is usually meant by this statement is that he found his teacher in a book rather than in a classroom environment. What's far more common is to encounter the "self-mistaught individual" who has acquired a remarkable amount of half truths, advertising hype, and opinions of friends and fellow workers. It is this last category who is in the most trouble because he doesn't know that he doesn't know. "The broadest statements are made by the narrowest minds."

WHY PAY FOR TRAINING?

A reasonable question to ask is if learning is so individual, why pay for training if you can do it on your own? One reason is that the example of an experienced, skilled teacher can often expose you to areas of knowledge in your field that you have never even heard of before and by so doing motivate you to acquire it as your own. The experienced, skilled teacher will usually have the professional tools at hand so that you can both see them and see how they are properly used. The experienced, skilled teacher can measure where you are at and point out the fundamentals you *must* practice if you are to gain any progress from your learning efforts. I recently discovered that 40 years of intensive practice of the wrong things counted for little compared to one year of practicing the correct basics in terms of my progress as a recreational shooter. How come? I had the opportunity to take a class with the top teacher in the field.

AUDIO AND ACOUSTIC FUNDAMENTALS

Fundamentals that underlie any serious endeavor in audio and acoustics are listed below. Audio fundamentals are those involving electromagnetic propagation rates. Acoustic fundamentals are those that involve the velocity of sound in various physical media. That in itself is a fundamental that has to be continuously kept in mind.

<u>Audio Fundamentals</u>	<u>Acoustic Fundamentals</u>
Wavelength vs. frequency	Wavelength vs. frequency
Audio levels vs. voltage amplitudes	Acoustic levels, pressure vs intensity vs. power
Impedance	Impedance

Audio Fundamentals

Polarity vs. phase vs. signal delay
S/N

Minimum phase response
Ohms law and Kirchoff's law

Acoustic Fundamentals

Polarity vs. phase vs. signal
Sound fields (direct early reflected, reverberant, ambient noise)
Signal synchronization
Hopkins Striker equations

These fundamentals, once mastered, constitute a good start. These two lists are not exhaustive or complete, but if you truly understand even this limited list, you are then capable of meaningful self-instruction and, with a minimum of guidance, rapid progress.

An individual can get along in the sound business without knowing what he is doing if he or she has a pleasant personality and is receptive to learning from those around him but, progress will be slow, uncertain, and subject to frequent need of purges of "what you know that isn't so." You will be much like the hard disk in a computer that has become highly fragmented through unorganized use. A short course with an experienced, skilled teacher in the presence of a group of your peers can be an effective defragmentation experience. ■

FIRST PERSON

(continued from page 18)

teams. All of this, of course, occurred under the tightest security imaginable.

Providing conference electronics to the Economic Summit was certainly DIS-Brahler's largest undertaking to date, and a technical challenge made even greater because there could be no mistakes and no second chances. By the time the actual heads of state arrived in Houston, we must admit that many of us never wanted to hear the words Summit, protocol or security again! But when the meetings started, and we knew that the heads of state were able to converse freely, each in his own language, we were all pleased to have been part of such an historic occasion. The experience our staff gained in serving the most important clients in the world is valuable to our company and, we hope, to all of our future clients. ■

Power Amp Survey

Part 3

Multi-Channel and Consolidated

BY PAMELA MICHAEL AND MIKE KLASCO

To conclude our three-part survey of trends in amplifier design, marketing and applications, we'll take a look at the multi-channel (more than two channels) consolidated amp, an increasingly utilized installation component.

As most professional installations these days are biamped or triamped, the impetus to get everything in one chassis is a natural outgrowth of the technological advances that brought about the previously discussed trends toward smaller size and higher output capabilities. [Sound & Communications, June 15, 1990 and Sound & Communications, July 18, 1990]. As a result of these advances — new shrinking techniques; switching power supplies; more efficient output sections; unique packaging and heat dissipation techniques — more and more manufacturers have jumped into the multi-channel and mainframe market. By "mainframe" we mean a rack mount chassis with slide-in circuit cards, an approach that allows the contractor or consultant to define the system configuration.

One of the first manufacturers to develop a multi-channel amplifier was Spectra Sonics, known in the 1970s mainly for its pro mixing boards. Almost 20 years ago they introduced a rack mount chassis with more than two channels and

the power supply built into the case. Altec Lansing followed with a high power, programmable incremental amp which featured a number of modules that could be combined in a variety of ways. Both these amplifiers were slow to catch on, even though they offered the sound contractor of the day quite a few advantages. In the last few years, in response to all that extra space created by new amplifier design and construction technologies, it was inevitable that someone would say, "Let's put more in the box." Thus, there has been an additional trend toward providing signal processing in the same chassis.

The benefits of these integrated function amplifiers are considerable—more equipment in less space, of course, and quicker, cleaner installation and maintenance. The unit can be configured and tested in the shop, rather than on site. With internal signal processing you reduce external wiring and lessen the chance of interference and RF pickup. There is also more likelihood the system will be completely compatible in terms of signal levels and loading, etc. because all the modules are designed to hook together. Many of these systems also offer the benefit of improved security with limited user control or contractor defined levels of control ac-

cess. Also common is remote control (and/or computer control).

Multi-channel amplifiers are often used full range for medium power applications, such as distributed systems in churches, airports, factories, etc. In some applications, multi-channel amplifiers are also used for midrange and highs, with separate amplifiers for the bass.

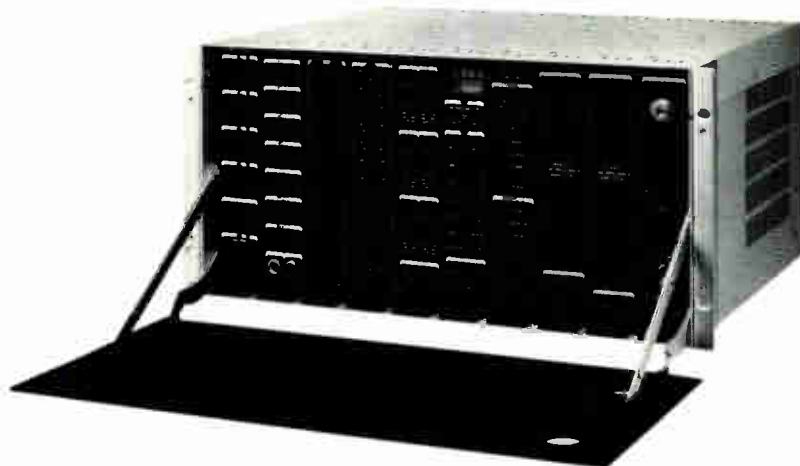
What follows is a brief look at some of the current players in this expanding field.

Spectra Sonics, the ground breaker, is still a contender. Its multi-channel amp, Model 701, uses modular card design and affords bi, tri, quad or individual applications. As is typical for this configuration, the mainframe has an integral power supply. As the amplifier modules are medium power, they can be bridged for higher output. One of the slots may be used for Spectra Sonics' electronic crossover card.

Ivie was also ahead of its time with the 5000 Modular Series, introduced in about 1980. Known mostly for test equipment, Ivie's 5000 modular mainframe system found its initial acceptance in movie theaters, but is now used in many applications from sports arena sound systems to noise masking. The 8¼-inch high rack mount unit provides 10 slots — one power module and nine functions card slots. The power module includes the cooling fan and

sends AC to the other modules as well as remote control functions. Slots can hold signal processing, of which Ivie has a full complement. These include 1/3 octave and octave equalizers, 1/10 octave feedback notch filter, electronic crossover, noise masking source, automatic mixer as well as "manual" mixer. An interesting aspect of these modules is that they are remote controllable. This is in line with the philosophy that the unit should be locked up, and only relevant controls should be accessible via remote to the end user. The power amplifier modules are 100 W in to 70 volts, with up to nine modules in a mainframe. Amplifier modules may be bridged, in a master-slave configuration, with up to nine modules at 900 watts. Each amplifier module has its own power supply. Multiple mainframes can be easily interfaced, so any number of signal processor cards and amplifiers can be used.

Altec Lansing introduced the 2200 in-



Ivie 5001 mainframe with automixer, mixer, 1/3 Oct. EQ, Oct. EQ, Notch Filter, Comp/Limiter, Dual 50 watt amplifier, 100 watt amp, 100 watt slave, and Power Module.



The MA 6 multi-channel amplifier from Rane.

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FET-1500:	300	200	200	600
FET-1000:	190	120	120	380

EIA Specification

**5
YEAR
WARRANTY**

**UL LISTED 35E5
COMMERCIAL
SOUND EQUIPMENT**

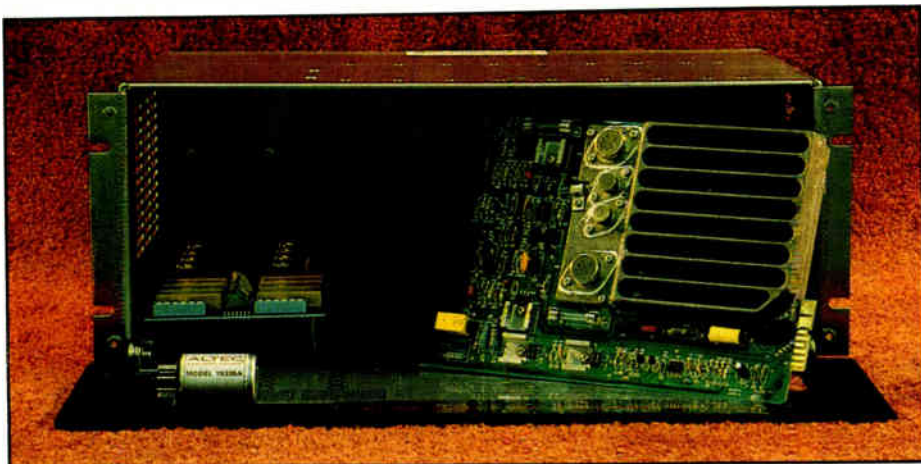
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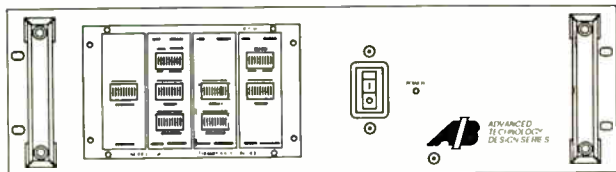


Circle 251 on Reader Response Card

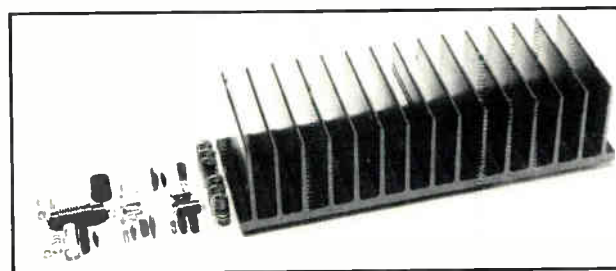


Altec Lansing's 2280A incremental amp with 2271 (large module).

AB International's 713A is a complete triamp system.



Spectra Sonics' multi-channel amp, model 701: uses modular card design.



cremental amplifier in 1976. Current offerings are the 2200A and the 2280A. The 2200A mainframe is a 7-inch high rack mount which can hold up to eight 75 watt or four 150 watt amplifier modules. Other locations are provided for balanced or unbalanced inputs, electronic crossover, and matrix switching. The Incremental Power System allows bridge, bridge/parallel, 70 V operation and numerous other combinations. By combining modules, a maximum of 600 watts can be obtained from the mainframe. The 2280A consists of up to eight channels of 70 volt, 78 watt power amplifier modules.

IED was the first to offer multi-channel in one case under computer control, over 10 years ago. In the first part of our amplifier survey we discussed IED's unique computer controlled system (and though we indicated that Macintosh was used, we were in error — only IBM/MS-DOS computers are now used with IED systems, although Sony computers were used initially). IED's 6000 series amplifier system is also quite advanced, using a rackmount mainframe, and plug-in class D (switching mode, or as it is sometimes called, "digital") amplifiers. The built-in power supply is also a high efficiency switching type. The mainframe contains a fan for cooling. The mainframe can be

ordered to hold either four amplifier cards or eight amplifier cards, in only four rack spaces (7-inch). Each channel (plug-in circuit card) is 200 watts into 8 ohm load, or direct drive 70 V versions are available. For higher power, the amplifier channels can be bridged, with the added benefit of balanced output.

IED does not include signal processing within their power amp chassis. Many of their systems are integrated packages often with automated control, such as automatic mic mixers and pre-programmed messages. Typical applications are for airports, sports facilities, convention centers, amusement parks, and the like.

BGW's SPA-3 signal processing three channel (200 watts x 3) amplifier is targeted at biamp and triamp systems. Signal processing includes an electronic crossover, a parametric equalizer and time alignment delays. Compact size (5 1/4-inch rack height) is achieved through the use of a toroidal power transformer, which is smaller, more efficient (less heat) and radiates less of a field so the low level electronics can be packed looser without hum pickup. The SPA-3 uses dense "dedicated" mechanical packaging, rather than a mainframe.

Soundcraftsmen has recently introduced the 300 x 4 MOSFET power amplifier.

Rack height is 5 1/4 inches. The user can select either two channel, three channel, or four channel operation. In four channel operation, each channel has 210 watts, or two of the channels can be bridged for 600 watts. In two channel operation, the output will directly drive a 70 V line. The 300 x 4 has two independent power supplies and fan cooling.

AB International offers the Advanced Technology Design series IV which offers a combination of signal processing with integral electronic crossovers, shelving EQ (for horn/compression drivers), and time alignment delay. Also in the ATD series is the 713A, which is a complete triamp system, including bass, mid, and high frequency amplifiers in a 5 1/4-inch rack space.

First introduced in 1984, the Rane Model MA 6 reflects a design decision to pack more into space instead of trying to get lower rack height. Rane's 5 1/4-inch high rack unit has a conventional power supply that is common to all channels. Each channel is (internally) a separate 100 watt module which can be bridged to the adjacent channel for a total of 300 watts x 3.

Sharp eyed readers will notice that we have not covered signal processing mainframes, such as the IRP 41, that provide low level signal switching, EQ, etc. which will be covered in an upcoming issue. Also included in the signal processing survey will be the new digital multi-processors from TOA and Yamaha.

CONCLUSION

Expect the trend toward increased power density (higher output, more channels and/or smaller size) to continue. Not only will more amplifiers with switching power supplies appear, but expect to see "digital" switching amplifiers to appear in the next year or two. And count on expanded functions and flexibility, such as more signal processing, perhaps even digital signal processing. Remote control by computer interface will begin to find application in a greater number of jobs. Configurable amplifiers, for 70 V or low impedance outputs, more channels or higher output through bridging, will become more common. ■

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Miking the Dolphins; On-Site Testing

Sea World Studies

The Sea World Audio Communication System being implemented by Sea World of Ohio is an attempt to communicate with dolphins and whales via a "separate language." The language consists of three basic tones and three frequencies. A vocabulary of more than 1,000 words can be created. The computer commands to the dolphins and whales are generated from a terminal in an office or via a pool-side keyboard. Underwater speakers are installed in the pools. The animals communicate via hydrophones and a visual menu on a "lexigram."

Benchmark Tests

Benchmark Associates/Downtown Design of New York is now offering on-site acoustic testing and measurement using a portable 386 computer and the MLSSA analyzer.

Special Recognition

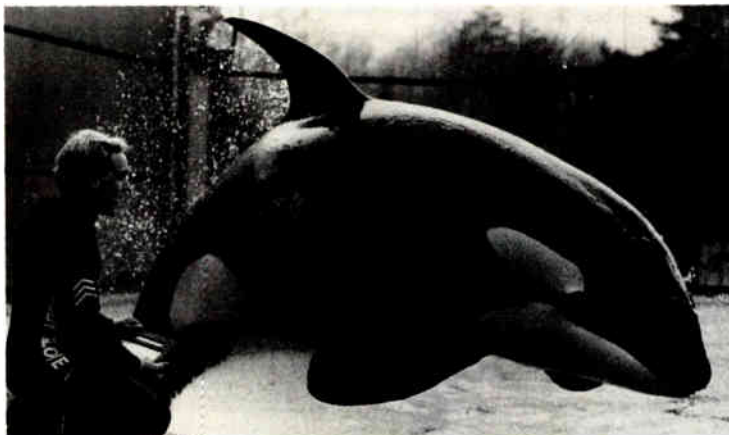
The International Teleconferencing Association has presented CSX Technology with its Special Recognition Award for CSX's application of Videoconferencing Systems' Computer Data Link. CDL, according to the company, allows conference participants interactive access to information systems at more than one location.

AKG Moves

AKG Acoustics has consolidated its U.S. operation in a new, 77,000 square foot facility in San Leandro, California. According to Richard Ravich, company president, "The recent acquisitions of dbx Professional Products and Orban, Inc. and the steadily increasing growth of AKG Acoustics, necessitated the move."



Staff and dignitaries open new AKG facility.



Poolside keyboard and underwater speakers allow communication with dolphins and whales at Sea World.

Agreement to Market

Burle Industries has announced an agreement with Racon, Inc. entitling Burle to exclusively market and sell Racon's microwave video communication systems, the Micropass product line, for worldwide security markets under the Burle name. The Micropass products are to be handled by Burle manufacturers' representatives.

New Board Members

The International Communications Association has elected three new members to serve on its Board of Directors. Larry Gessini, manager of telecommunications of Agway, Inc. serves as vice president administration. Bob Harrold of AgriData Resources, serves as Director member services. Jim Weiss of System One Corporation is director academic development.

Sonance Celebrates

Sonance has begun a year-long celebration of its fifth anniversary. To launch a series of celebrations, the company took its top 200 dealers on a boat cruise on Lake Michigan during the Consumer Electronics Show in June. In 1985 Home Technology Systems, a custom installation company, split off its in-wall speaker division and became Sonance. This year Sonance moved to a new 17,000 square foot complex in San Clemente.

The West Coast Division of the Business Communication and Marketing Association has presented awards to Sonance and its advertising agency (Erickson, Koppes, and Lecca) in two categories — Excellence in a Four-Color Standard Size Spread Advertisement and Campaign Excellence — Budget \$500,000 to \$1,000,000.



A Lake Michigan cruise was the first event in a year-long celebration of Sonance's fifth anniversary.

Canceller Chosen

Coherent Communications Systems has announced that its AC-1200 Acoustic Echo Canceller has been chosen as the audio system for the Compression Labs Inc. modular video conference systems.

Korean Install

Gauss loudspeakers have been installed in Olympic Park in Seoul, Korea. The installation is located in the eight-acre art garden of the park and is primarily used for synchronized shows. Sixteen each of Gauss 4580n woofers, 4060 drivers and 8242 horns were splayed 360 degrees in two clusters. There are eight of these systems in a two-tier arrangement per cluster. Each cluster is located at the top of a 30-foot tubular steel column. The system is used nine hours a day.

Singapore Sounds

Christian Hugener of Thomas Gregor Audio was in Singapore this summer engineering the "Spectacular Jubilee Celebration" for Singapore's 25th Anniversary Show at the 60,000 seat Singapore National Stadium.

Adams Acquires

David Adams, principal of David L. Adams Associates, the Denver-based acoustical and theater consulting and design firm, has announced that the firm has acquired the Hawaii firm of Darby & Associates, Acoustical Consultants. Ronald A. Darby continues as Director. The Hawaii firm now operates as a wholly owned subsidiary of David L. Adams Associates. Adams said, "This acquisition ... provides an ideal stepping stone to our growing business along the Pacific Rim."

Kentuckiana Expectations

A record number of exhibitors are expected at the Kentuckiana Sound & Security Seminar October 1 and 2 at the Indianapolis Holiday Inn. Representatives sponsoring the event are: Bruce Dawson & Associates, Elmarcon, Inc., Kingston Sales Corp., Maish Sales, Midwest Representatives Inc., Monfort Electronics Marketing, Pat Norman Sales, Repptronics Inc., and Sunrise Sales.

Air Force Contract

Burle Industries has been awarded a \$10.3 million multi-year contract by the United States Air Force for high resolution solid state CCD cameras to upgrade the Air Force's current perimeter surveillance system. The Electronic Systems Division at Hanscom Air Force Base was the contracting agency.

Symco Adds

Symco has added Steve Czubara to represent it in upper New York state. The manufacturers representative represents video products including For-A, Fujinon, Hitachi Denshi, NEC, Philips and others.

REP NEWS

IED

Innovative Electronic Designs has appointed Steffey Marketing Company of Northbrook, Illinois as IED representative for Illinois and eastern Wisconsin. Bill Steffey, Randy Stenson and Lester C. Murin have completed IED's training program. IED has also appointed The Sound Department Ltd./Askew Crescent Workshops in London as representatives for IED in the United Kingdom and Ireland.

Dekoron

The Dekoron Specialty Products Division of Furon Company has assigned the following reps: Meyer Marketing for Florida; Adams & Associates for Georgia, Mississippi, Alabama and Tennessee; Burhan/Burhan for Kansas, Missouri, western Iowa and eastern Nebraska; and Atronix/Marble for Arizona, southern California and southern Nevada.

Atlas/Soundolier

Atlas/Soundolier has named Pass Associates of Langhorne, Pennsylvania, Rep of the Year. The recognition was earned, according to Atlas/Soundolier, by outstanding promotional and sales results averaged over a three-year time span. Other firms in contention were LSM Associates, RW Sales, and Graham/Davis Inc.

International Electronic Wire & Cable

Design Factors has been named by International Electronic Wire & Cable Co. as its 1989 "Sound & Communications Rep of the Year."

OAP

OAP Audio Products has added two representative firms for the Composite Series line. John Miller of Nova Marketing is covering northern California and northern Nevada. Greg McManus of GMS is covering Minnesota, Iowa, Nebraska, North Dakota, South Dakota, and western Wisconsin. OAP has also added Kansas to the territory of Mike Thorpe of MIPA Sales.

Eaton Sales

The sales representative firm of Eaton Sales & Marketing has been formed to serve the upstate New York territory. The company is handling regional sales for DOD Electronics, Fostex, Gallien-Krueger, Anatech, Raxxess and Mackie Design. Charlie Eaton, president of the new firm, was formerly with Darmstedter Associates.

Bird Electronic

Pro Nova Messtechnik of West Germany has been named exclusive sales representative for all product lines of Bird Electronic Corporation.

Belden Wire and Cable

Belden Wire and Cable has named its outstanding distributors of the year with the presentation of the fourth annual Eagle Awards. The recipients are: Cumberland Electronics, U.R.S. Electronics, Cal Switch & Signal, Carlton Bates Co., Wire & Cable Specialties Corp., Americable, and Federated Purchaser, Inc. Belden channels 74 percent of its U.S. sales through its distributor network.

Phonic Ear

Phonic Ear has appointed Bill Maurer as Territory Manager for New Jersey, Maryland, Virginia, West Virginia, Delaware, the District of Columbia, and parts of New York and Pennsylvania.



Bill Maurer

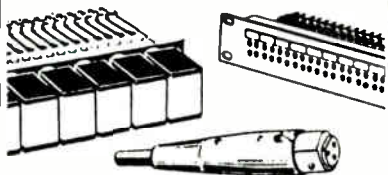
RF Technology

RF Technology has appointed Ron Yokes as sales representative for the Midwest Region.

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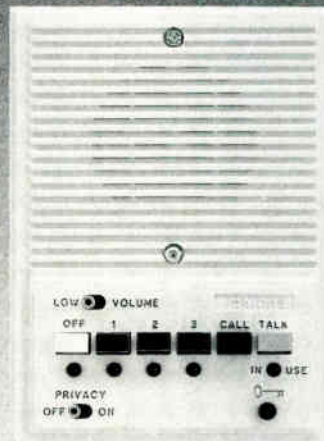
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Circle 291 on Reader Response Card

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Circle 273 on Reader Response Card

AKG Promotes Roudebush; Calvert Joins Shure

Roudebush Named Marketing Manager



Roudebush

David Roudebush has been promoted from Worldwide Marketing Manager for Orban Professional Products to U.S. Marketing and Sales Manager for AKG Acoustics, Orban, and the dbx Professional Products Division. Roudebush is responsible for aspects of marketing and sales in the U.S. for AKG, Orban, and dbx, and for heading advertising and public relations efforts. Prior to joining AKG Acoustics, Roudebush held a succession of sales management positions with dbx and Otari Corp.

Shure Names Calvert

Nancy A. Calvert has been appointed Manager of Advertising and Public Relations for Shure Brothers Inc. Calvert comes to Shure from the Electro-Motive Division of General Motors, where she was manager of sales promotion and customer publications as well as director of public relations and advertising.



Calvert

VP At Mark IV

Hans Tschernig, President of Dynacord in West Germany, has been appointed to the additional position of Vice President of Mark IV Audio, Inc.



Tschernig

Tschernig, who has been a part of Dynacord management since 1971, will continue to run Dynacord as a separate com-

pany, although he will "keep an eye on opportunities for improved mutual results from Mark IV as a whole," according to Robert Pabst, President of Mark IV Audio.

Sales Director At Niles

Niles Audio has named Paul Collins to the position of National Sales Director. Collins has overall responsibility for Niles' marketing and sales services. His firm, Paul Collins and Associates, represents Niles Audio in California.

Collins has worked in the consumer electronics industry for 18 years, running his own rep firm for seven of them. He has also held managerial positions with Pacific Stereo and Federated Group.

TSI Appoints Fogel

Steve Fogel has been appointed Director of Sales at TSI. His responsibilities include sales training, developing new business partnerships, guiding the TSI sales team, and client relations.

Executive Officers At Alpha

Alpha Wire Corporation has announced the appointments of Grant McLennan, President and Chief Operating Officer; Edward Gowett, Vice President of Sales and Marketing; and Larry G. Myers, Vice President of National Accounts/Director of Marketing.

McLennan, who reports to Chairman and CEO Philip R. Cowen, will be responsible for all of Alpha's operations. McLennan joined Alpha in June, 1988 as Director of Marketing, and prior to that was Vice President of Marketing for the Grow Group, a manufacturer of professional and household products.

Allen and Heath Appoints Steffens

Allen and Heath has announced the appointment of Vic Steffens to the position of Product Specialist and Customer Support. Steffens has long been associated with Allen and Heath as a product development consultant. However, this appointment represents the first formal relationship between the two parties.

Steffens will directly interface with dealers who support Allen and Heath upper end consoles and will direct projects to raise the visibility of the entire Allen and Heath product line.

Research and Development At Gentner

Gentner Electronics Corporation has announced the appointment of Mr. Kelly K. Hannig as Director of Research and



Hannig

Development. Hannig's responsibilities include coordinating product ideas, obtaining customer input on new or updated products, and overseeing all R&D products. His primary responsibility is to match product development with customer requirements.

Hannig joined Gentner in October, 1988, as a Product Line Specialist. His previous experience also encompasses seven years of broadcast engineering including studio and transmitter construction.

Product Manager At AKG

Dave Ogden has been promoted to



Ogden

Product Manager for AKG Acoustics, Inc. In his new position, Ogden serves as chief liaison between the U.S. and AKG headquarters in Vienna.

Since joining AKG in 1986, Ogden has worked as Sales Manager of the Digital Products Division; Sales Manager of Pro Audio, M.I., and Broadcast; and Western Regional Manager.

Sales and Marketing At Faraday

Faraday Technology Limited of Newcastle, England appointed Callum Craig to the newly created position of Sales and Marketing Manager. Craig comes to Faraday from Matthey Electronics, where he worked since 1970. He most recently held the position of Senior Technical Representative.

Tascam Names Prada

Chuck Prada has been named to the post of Field Sales Manager/Music Products Group for Tascam. His responsibilities include overseeing sales activities of the company's regional sales managers, sales representatives, and dealers. Prada

is also responsible for developing local sales promotion events, coordinating local and regional advertising, and managing sales training programs.

Prada began his career at Tascam 16 years ago as a sales rep for the Mid-Atlantic territory at Lineau Assoc. Inc. While working at Lineau, he founded and managed the pro audio division of Tascam. He has also served two and a half years as a Tascam regional sales manager of the Mid-Atlantic, New England, and Southern California territories.

CEO At Multilink

The Board of Directors of MultiLink, Inc. has announced the election of J. Edward McAteer as President and Chief Executive Officer of the company.

McAteer joined MultiLink from D&M Associates, a management consulting firm. Previously he acted as Chairman and President of Action Communications Systems and Tempo Computers. McAteer is also a former Vice President of the GTE Corporation.

Stanfill Named At Mark IV

Gary Stanfill, President of Vega, has been named a Vice President of Mark IV Audio. Stanfill has served as President of Vega for the past seven years.



Stanfill

Engineering Team Addition At Apogee

Apogee Electronics has announced the addition of Rick Porter to its engineering team. Porter was most recently involved in the research of astronomical data at the University of Arizona's Lunar and Planetary Lab. Prior to that, Porter was an applications engineer covering digital audio at Burr Brown.

Marketing And Sales At Gauss

Paul V. Hugo of Gauss Loudspeakers has been promoted from National Sales Manager to Marketing and Sales Director of the loudspeaker manufacturer. He has also been appointed to the operating and management staff of Gauss.

Before joining Gauss, Hugo was a co-founder and Vice President of Audio Reinforcement Technologies, Inc., of Miami, Florida.

VP At Otari

Otari Corporation has recently promoted John Carey to Vice President of Sales and Marketing. Carey began his career at Otari in 1981 as Product Manager and went on to become Sales Manager and, later, Marketing Manager. He reports to Jac Soma, President of Otari.



Carey

Senior Staff Engineer At ATTC

James M. DeFilippis has joined the Advanced Television Test Center (ATTC) as Senior Staff Engineer. DeFilippis' primary responsibilities will be the engineering implementation of the technical plant developed by the Test Center to permit analysis of new ways of transmitting better television pictures and sound.

DeFilippis comes to ATTC from Capital Cities/ABC where he held a variety of technical development and systems engineering positions. Previously, he has participated in projects including the systems engineering of the network's central switching and control facilities and the development of ABC's satellite interconnection.

VP At Missing Link

Robert A. Posner has been named Vice President of Sales and Marketing at Missing Link Computer Technology. Previously, Posner served in sales and marketing positions for companies including Rockwell International, Syntellect, Inc., RCA Global Communications, and ITT Corporation.



Posner

Physical Optics' New VP

Ryszard Gajewski has joined Physical Optics Corporation as Vice President of Research and Development.

Gajewski oversees POC's government and commercial R&D products and devises programs for the development of new products and services. His responsibilities include governing the use of R&D contract funds, coordinating research and development efforts within the company, and managing the R&D technical and support staff.

Prior to joining POC, Gajewski spent 13 years as director of the division of Advanced Energy Research at the U.S. Department of Energy, while concurrently serving as program manager for the DOE Small Business Innovation Research Program for five of those years.

European Sales Manager At Infinity

Infinity Systems, Inc. has announced the appointment of Allan Coleman to the newly created position of European Sales Manager. Coleman will head up Infinity's

new European office based in Cambridgeshire, England.

Previously, Coleman held management positions with Acoustic Research and, most recently, Mission Loudspeakers. His responsibilities there also included the build-up of European and world distribution.

Stadlen Forms New Firm

Ed Stadlen has recently left his position as Acoustic Research's Sales Manager in order to begin Value Added Marketing, his own rep firm in New England. His partner in this venture is Chuck Schneider.

President At Innovative Technology

Innovative Technology Inc. has recently appointed Jules DeVigne to the position of President.

Previously, Mr. DeVigne was Senior Vice President of Sales and Marketing for Netrix Corporation. He also spent 20 years at IBM in a variety of management positions.

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Circle 271 on Reader Response Card

PRODUCTS

Telecall Intros Intercoms; A.R.T.'s New Controller

Intermixable and Paging Intercoms

Telecall America has introduced the 95 Series Intermix Open Voice Intercom System and its new paging intercom, Market Page.

Three master stations (3-call, 6-call, and 10-call) and seven substations are all intermixable on the 95 System, and paging through master stations is a built-in feature.

The Market Page features four talk channels plus a separate paging channel, 60 station capacity, and automatic music mute.

Circle 1 on Reader Response Card

System Controller

A.R.T.'s new MDC 2001 is a signal system controller for audio applications requiring compression, limiting, expansion, noise gating, de-essing, signal enhancement, sibilance correction, or any related functions. The MDC 2001 was designed to be used as a master controller for live sound reinforcement, vocal or instrumental tuning or enhancement, or a final level controller/signal enhancer for tape mastering.

The unit offers two channels of stereo processing with over 45 LEDs to monitor all functions and level variations. The compressor features independent control of all needed functions. A switchable detector loop is available for keying, gating, or ducking functions should the user want external control.

Circle 2 on Reader Response Card

Modular Processor

Rane Corporation has introduced the Flex Series modular processor, the model FPL 44 Quad Program Limiter. In addition to using the Servo Lock design included in the DC 24, each channel can independently be switched to a special function called Auto Slave. This links the side chains of selected channels so that they all respond identically to the limiting demands of any one channel. The FPL 44's applications include use in actively crossed-over speaker systems and multi-channel live sound reinforcement.

Circle 3 on Reader Response Card



New Products from BSS

BSS has announced four new products that will be introduced in September: The DPR-901 Dynamic Equalizer, which is an analog audio processor which integrates parametric equalization with dynamic expansion and compression processes; the TCS-803 Multitap Time Corrector which implements proprietary converter technology and advanced industrial design; the TCS-804 Dual Time Corrector which is similar to the TCS-803, but also provides a previously unavailable combination of stereo, dual-tap delay processing with advanced control functions and state-of-the-art remote control options; and the DPR-404 4-Channel Compressor/De-Esser which provides four independent channels of compression and HF de-essing, stereo linkable in pairs.

Circle 4 on Reader Response Card

Hypercardioid Microphone

Audix has introduced the OM3xb, a transformerless dynamic hypercardioid microphone. The microphone provides 144 dB-SPL handling, a uniform pickup pattern, and a 38 Hz to a 21.5 kHz range.

Circle 18 on Reader Response Card



Gate Operators

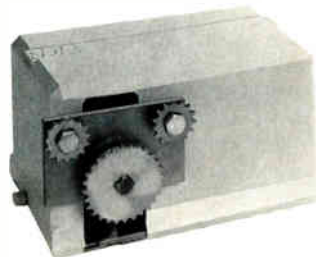
Burle Industries has announced the addition of the RSL Series of gate operators to its line of security products available from their Robot Access Control Hardware Skill Center. The RSL-F8 is a sliding gate operator designed for use in medium duty and medium frequency commercial and residential applications.

The RSL-F8's mechanical features include quick disconnect to allow manual operation in the event of power failure, an

irreversible reduction gear which prevents back drive by pushing the gate by hand, and an oil bath clutch operation.

Electronically, the series is capable of interfacing with all external accessories. It can maneuver a maximum gate weight of 500 pounds at 60 ft./min. gate travel speed.

Circle 5 on Reader Response Card



Function Generator

The B&K Precision Division of Maxtec International Corp. has introduced the Model 3011B, a 2 MHz function generator. The Model 3011B's capabilities include a variable duty cycle as an accurate signal source for sine, triangle, and square waveforms, as well as TTL and CMOS pulse signals. Special features include coarse and fine-frequency controls, a separate TTL and CMOS pulse output, and external sweep source capability.

Circle 6 on Reader Response Card



Voice Paging System

Clarity has announced its Talkback Product Line including the STBA-2 talkback control unit. The STBA-2 can be used on a PABX loop start trunk port, a C.O. line position of an EKey or 1A2 key system, a 600 ohm two-way page port with contact closure or a single line telephone.

Circle 7 on Reader Response Card

Boundary Layer Microphone

Georg Neumann GmbH, of Berlin, Germany, announced the availability of the GFM 132 boundary layer microphone. Its features include: identical, uniform frequency response in the diffuse and free fields; frequency independent hemispherical directional pattern; 6 dB higher output voltage because of pressure doubling at the boundary.

Two design advancements are incorporated into this microphone. The first is a new condenser capsule specifically developed for this application. The pressure transducer has an active diameter of only 10mm corresponding to half the sound wavelength at 17 khz.

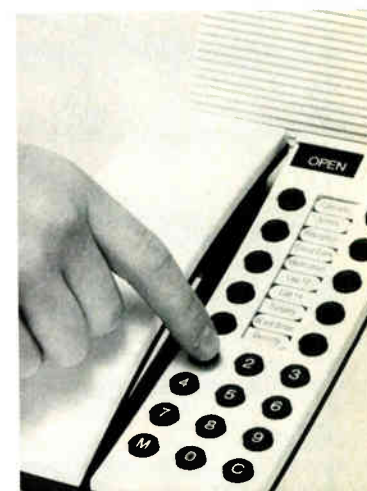
The microphone plate is the second advancement. By using computer aided design, the plate is said to eliminate angle dependent colorization in the vertical and horizontal plane.

Circle 8 on Reader Response Card

New Communication System

Stentofon has introduced a new communication system called Touchline. Features include: one touch paging that can be answered from any extension; a display showing names and numbers of many people that the user can quickly scroll through (which allows many forms of paging, group conferences and automatic relaying of calls); voice alarms in case of smoke or fire; a queuing facility allowing priority to certain calls; and a display telling the switchboard operator if a person is unavailable, absent or out to lunch.

Circle 9 on Reader Response Card





Wireless System

Samson has introduced the UHF Series of wireless systems. The units include dbx noise reduction and are available in belt pack (lavalier) and handheld versions.

The True Diversity rack mount receiver, model UR-4, features cavity tuning and dielectric filtering. The UR-4 features either balanced or unbalanced output and can deliver a signal level of +10 dBm without clipping. Both the belt pack and handheld transmitter are available with a variety of mic elements and lavaliers.

Circle 10 on Reader Response Card

Computer-Video Interface

Covid, Inc. has announced the release of the EZPIX Computer-Video Interface. The unit is designed to connect data projectors and monitors to over 90-percent of all PCs and video cards available.

Two features of the EZPIX are a digital frequency centering function and an LCD scan frequency readout. Other features include: digital/analog input selection; color/monochrome detection; sync polarity; sync stripping from green; and sync on green output.

Circle 11 on Reader Response Card



Powered Amplifier

Electro-Voice has introduced the 7600 stereo powered amplifier. The amplifier delivers 400 watts per channel at eight ohms and 600 watts per channel at four ohms from 20 Hz to 20 kHz at less than .1 percent THD, with both channels driven. It also delivers 850 watts per channel at two ohms, at less than one percent THD under the same conditions. The 7600 also offers Neutrik Speakon connectors as well as octal sockets for crossover and EQ modules.

Circle 12 on Reader Response Card



Multi-Services Test Unit

Wiltron has announced the availability of the Model 9964 Multi-Services Test Unit (MSTU). It features a direct TL1 interface combined with a plug-in test systems controller (TSC) that allows it to act as a testing partner for digital cross-connect systems (DCSs) in an open architecture environment. The unit may be provisioned with up to four test ports. Three MSTU's may be combined together in a system to provide up to 12 test ports off of a single test access digroup from a DCS. The MSTU may be controlled through either a Centralized Maintenance Test System (CMTS) test controller or other TL1 operations systems such as SARTS or ITS.

Circle 13 on Reader Response Card

Mic Splitting Systems

Whirlwind has announced two additions to its product line, the Concert 32 and Concert 42 Mic Splitting Systems. The Concert 32, with 24 inputs and eight returns, and the Concert 42, with 32 inputs and 10 returns, are prepackaged sound reinforcement systems that provide complete interconnection for house and monitor consoles.

Mic inputs are wired directly to a main out multipin and through transformers to a second multipin (Split Out). Each input has a ground lift switch on the Split Out, and return lines are hardwired to both outputs. Parallel splitting without transformers is an option.

Circle 14 on Reader Response Card



Half-Load Deck

Gyrr has introduced the TLC1800, a half-load deck that plays back red-head, brown-head, or VHS compatible tapes. The TLC1800 features single-field playback, which allows the recorder to increase the recording density on a tape up to 50 percent. The unit also offers 400-line resolution with standard VHS tape for easy suspect identification and can record up to 720 hours (more than 30 days), on a single two hour videocassette.

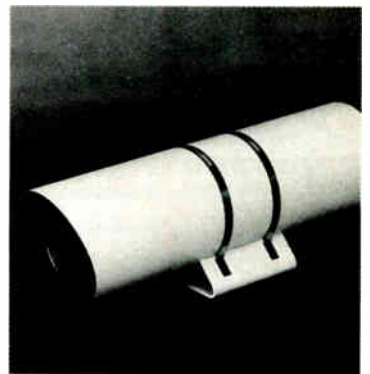
Circle 15 on Reader Response Card

CCD Camera

Javelin Electronics has introduced its Ultrachip CCD camera which is designed to perform over a wide range of lighting conditions.

The Ultrachip camera is aperture correction selectable, has selectable gamma (.45 or 1.0) and a pixel array of 818 (H) x 512 (V) over 400,000 pixels. The camera is available with eight selectable electronic shutter speeds, from 1/60 second to 1/10,000 second.

Circle 16 on Reader Response Card



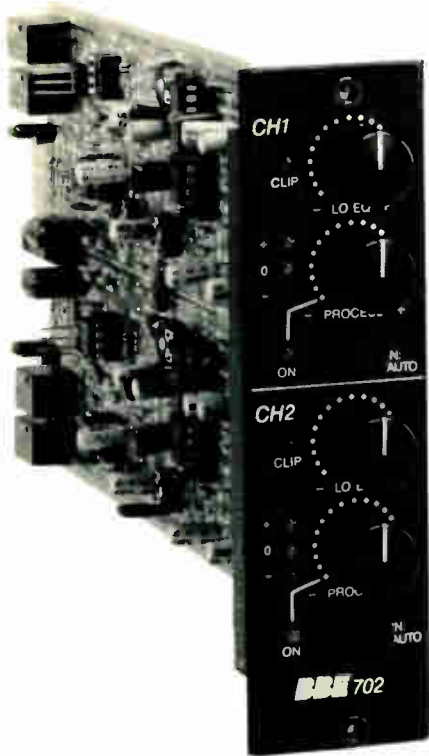
Loudspeaker Systems

The Professional Audio Division of Yamaha Corp. unveiled the second generation of "Club Series" Loudspeaker Systems. This series consists of seven loudspeaker models with newly designed cosmetics, componentry, and cabinetry.

All models feature an integral high-frequency level control and dual parallel 1/4-inch input jacks for cascading speaker connections, and have a normal impedance of 8 ohms. The line consists of 4 front-of-house loudspeakers (S115MTII, S115HII, S112HII, and S110HII) and three slant-front stage monitor systems (SM115HII, SM12HII, SM10HII).

Circle 17 on Reader Response Card





Two Channel Plug-in Module

BBE Sound Inc. has introduced the BBE Model 702, which is designed to fit the dbx 900 series of modular mainframes.

The model 702 is a two channel plug in module which installs in one or more of the module input ports on the front of the dbx mainframe. It comes with front panel adjustments for process and lo EQ, switchable modes of operation to accommodate listening levels, process and clip indicators, and a hardwire bypass switch to compare the processed sound to the original sound.

Circle 19 on Reader Response Card

Videoconference System and Controller

The Videoconferencing and Satellite Systems Division of Sony Corporation of America has announced the Sony Compact Videoconference System and the PCS-S1100 system controller.

The system integrates Sony's single chip cameras and cubic monitors, and the system controller incorporates features found in videoconferencing rooms.

The PCS-S1100 controller allows split-screen continuous presence display as well as manipulation of both the sender's and the receiver's cameras in order to insure the speaker is always on camera and in focus.

Circle 20 on Reader Response Card

Sound Diffusor

RPG has announced the first patented two-dimensional broad-bandwidth (QRD) sound diffusor, called the Omniffusor, which scatters incoming sound from any direction uniformly into a hemisphere.

The Omniffusor consists of a two-dimensional array of square cells with a four fold rotational symmetry. The depth of the wells is based on a two-dimensional quadratic residue number theory sequence which claims identical diffusion performance in the horizontal and vertical planes.

The Omniffusor is available in 2-inch x 2-inch and 2-inch x 4-inch architectural acoustic panels which can be clustered on a wall or used as lay-in tiles in standard suspended ceiling grids.

Circle 21 on Reader Response Card



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FAX (415) 526-8087

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Yamaha Worship Guide; Brochure from Scantek

How-To Book for Worship

The Professional Audio Division of Yamaha Corp. of America has introduced its non-denominational "Yamaha Guide to Sound Systems for Worship." Yamaha describes the book as a "how-to" generic sourcebook for churches, synagogues, temples, and other places of worship.

The Guide's contributing authors include Curt Taipale of Soundcheck Magazine, Chris Hinkle of the First Baptist Church of Orlando, Paul Ingebretsen of Williams Sound, as well as many contributors from Yamaha.

Circle 22 on Reader Response Card

Sound Analyzer Brochure

Scantek, Inc. introduced a 20-page brochure describing the Norwegian Electronics Type 110 Sound Analyzer, which, according to Scantek, combines the features of an integrating sound level meter, sophisticated environmental noise analyzer, frequency analyzer, graphic level recorder, and reverberation time analyzer in a single portable instrument.

The Type 110 conforms to ANSI and IEC requirements for Type 0 performance. The Time Mode option turns the Type 110 into a paperless graphic level recorder capable of profiling noise histories. The analyzer is used in occupational health, airport, and community noise, as well as the development, testing and field evaluation of automotive vehicles, consumer products, and all types of industry machinery noise.

Circle 23 on Reader Response Card

Supplement Available

A new supplement to the Contact East General Catalog is available at no charge. In this update are new products in areas including: linear power supplies; analog/digital oscilloscopes; inspection products; soldering/desoldering equipment; temperature/humidity chart recorders; and static protection products.

Circle 24 on Reader Response Card



Security Systems Brochure

Northern Computers Inc. announced the introduction of a fold out brochure on the company's Integrated Facility Management System. The literature details the functions of the Integrated Facility Management System which synthesizes elements of security systems, such as access control; video image display, CCTV, alarm monitoring, audio, and more, into one cohesive operation. Functions are then further reduced to a comprehensive overview of all system features.

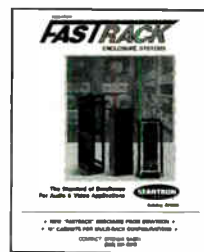
Circle 25 on Reader Response Card



Catalog for A/V Applications

Stantron, a Unit of Zero Corp., has published a new four-page catalog outlining its new FastRack Enclosure System for audio and video applications. The brochure details the three series of heavy gauge steel cabinets and racks available in the line.

Circle 26 on Reader Response Card



Microphone Accessories Catalog

Atlas/Soundolier has issued a free eight-page catalog illustrating their selection of microphone stands and accessories for music, recording, and performance applications.

Circle 27 on Reader Response Card

Electronic and Acoustic Product Catalog

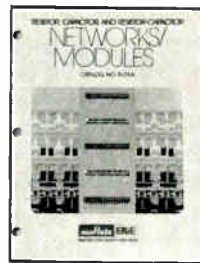
Altec Lansing recently released its new product catalog. The catalog features a mix of electronic and acoustic products including the addition of 20 new products. The 40-page catalog explains Altec Lansing's approach to the fixed installation market.

Circle 28 on Reader Response Card

Networks and Modules

A new 20-page catalog describing Murata North America's new line of resistor, capacitor, and resistor capacitor networks and modules is now available. The catalog includes complete dimensional and electrical specifications as well as circuit diagrams and application information.

Circle 29 on Reader Response Card



Circuit Protection Catalog

USD Products now offers a 12-page Circuit Protection Devices Catalog that includes specifications, ordering information, photographs and illustrations on the USD line of circuit protection devices. The catalog includes an overview of general operating principles and applications of thermal breakers as well as the need of assemblies for use with multiple circuit breakers and the custom capabilities of USD.

Circle 30 on Reader Response Card



Catalog from Regal

Regal Electronics has just made available a new 36-page Connector Products and Cable Assemblies catalog. The catalog includes a selection of D-Subminiature, Centronics, DIN, IDC, Card-Edge, DIP, PCB connectors and parts, gender changers, jumpers, SIMM sockets, and IBM and Apple adapters.

The catalog also features a "Design-A-Cable" guide which enables customers to specify their own round or flat cables for quotation. Also available from Regal are component catalogs on telecommunications products, speakers, power supplies, and transformers.

Circle 31 on Reader Response Card

CALENDAR

Upcoming Events

OCTOBER

NORTHCON: Seattle, WA. Contact: (213) 772-2965. Oct. 9-11.

Society of Motion Picture and Television Engineers Convention: New York, NY. Contact: (914) 761-1100. Oct. 12-17.

ISHM '89 (Int'l Society of Hybrid Microelectronics): Symposium & Expo: Baltimore, MD. Contact: (703) 471-0066. Oct. 15-20.

EIA Fall Conference: San Diego, CA. Contact: (202) 457-4900. Oct. 16-19.

1990 International DJ Expo: Atlantic City, NJ. Contact: (516) 767-2500. Oct. 23-25.

INTER COMM '90: Vancouver, B.C., Canada. Contact: (604) 669-1090. Oct. 23-26.

E I East (Electronic Imaging): Boston, MA. Contact: (800) 223-7126. Oct. 30-Nov. 1.

NOVEMBER

Urban Jam: Tampa, FL. Contact: (813) 963-1170. Nov. 1-3.

PASIC: Philadelphia, PA. Contact: (217) 367-4098. Nov. 7-10.

National Fire Protection Conference: Miami, FL. Contact: (617) 770-3000. Nov. 12-15.

Comdex/Fall: Las Vegas, NV. Contact: (617) 449-6600. Nov. 12-16.

Wescon: Anaheim, CA. Contact: (213) 772-2965. Nov. 13-15.

Lighting Dimensions: Orlando, FL. Contact: (212) 353-1951. Nov. 17-19.

Acoustical Society of America: San Diego, CA. Contact: (212) 661-9404. Nov. 26-30.

North America Broadcast Security/World Association for Christian Communication (NABS/WACC): Ft. Lauderdale, FL. Contact: (716) 458-4250. Nov. 26-30.

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COPY PROTECTION

By Mike Klasco

In the past I have not commented on the use of copy protection. This topic is quite a sensitive issue with some software publishers.

In one case the publisher was insistent (to put it mildly) that its use of copy protection not be mentioned. Nevertheless, this issue and a few of the implications will be discussed here.

My general feeling is that copy protection is an unpleasant added burden to the already complicated undertaking of computer-aided engineering. The software developers who use copy protection point out that they must protect their investment or further efforts would not be possible. In the past I have gone around and around on this and apparently neither side has convinced anyone of anything. In any case, this column will be on the levels of copy protection, not the pros and cons.

The lightest level of copy protection is a serial number "recorded" on the floppy disk. When using the program the serial number is checked and if found the program is able to proceed. This technique is known as "key disk." The serial number is recorded in a location that normally cannot be duplicated if you try to copy the disk. Actually, if any of the commonly available backup copy programs are used, then this protection scheme is bypassed. When a hard disk is used, the "key disk" must be still be located in the floppy drive. Overall, this approach is not excessive and does not really get in the way of the program's operation. JBL uses this approach with CADP, while Bruce Olson has not used any form of copy protection on his updated version.

A more intrusive serial number type scheme was used with the otherwise excellent woofer box design program Leap

3.0 (happily this is not being carried over to the soon to be released 4.0 version). The protection system required "deinstallation" and reinstallation of the program each time the user wanted to do a disk optimization. Disk optimization is performed by utility programs to more efficiently arrange data on your hard disk for faster accesses. It is good practice to set up the disk optimization each time you boot up your computer, and the copy protection system on Leap 3.0 precluded this.

Another variation of using "serial numbers" is a "hardware lock" which usually plugs into a parallel port of the computer. The serial number is looked for by the program and as long as the "hardware lock" is plugged in, everything is ok. On the plus side, you can make as many backup copies as you like, and hard disk operation does not require a floppy key disk; but you lose the use of a parallel port. This is a problem, especially for portable computers. AutoCAD briefly tried a hardware lock a few years ago, but the reaction from users was so adverse that it was quickly dropped. More recently, a digital filter design program has been introduced that uses a hardware lock for the Mac version, but no copy protection for the IBM release.

The next level (into Dante's Inferno of software protection schemes) is the "time bomb." One very popular sound system design program uses an auto-destruct clock. The thinking is that old versions of the program should not be floating around, and legitimate users will have already received the next release before the old program self destructs. Policies of software distribution vary. The cost of the software development and support are such that most companies lose money on their software projects and view their efforts as part of their marketing programs. From this perspective, they want to limit the use of their programs to their dealers and


acoustical consultants who they hope will spec in their components. By charging an initial fee and yearly update renewal fees, the software developer/equipment manufacturer hopes to control the use of the program to currently authorized dealers. With the countdown clock, ex-dealers with old releases of the program can be "unplugged." I guess I can accept this, but the dealers' perspective may be a little different. Dealers drop brands (or are dropped) for various reasons. If a sales manager is making his sales goals he may put pressure on his reps, who might get carried away with opening up distribution too wide.

The case of a software program offered by a large viable company is one situation. On the other hand, I have recently received a speaker box design program from a one-person operation which also has a count-down clock. Considering that the program is expensive (almost a grand), the software effort is a part-time project, and the long term viability of this endeavor is questionable, I do not think that this is a reasonable or responsible tactic. Even if the individual has the best intentions of supporting the software, accidents beyond anyone's control happen.

Copy protection and "intellectual property" are sensitive issues, and in the final analysis the software developer has the right to take whatever measures he desires to protect his investment. On the other hand, the buyer (or "licensee") has the right to full disclosure of what measures have been taken by the software developer. And I do not mean some cryptic mention buried in the manual after, he or she has bought the program, but clearly stated in the sales literature or at least on the order form. In the reviews I will not mention copy protection, so it is up to you to ask about this when you select your software. Caveat emptor — let the buyer beware! ■

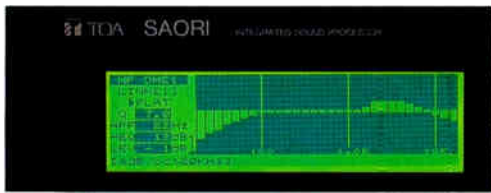


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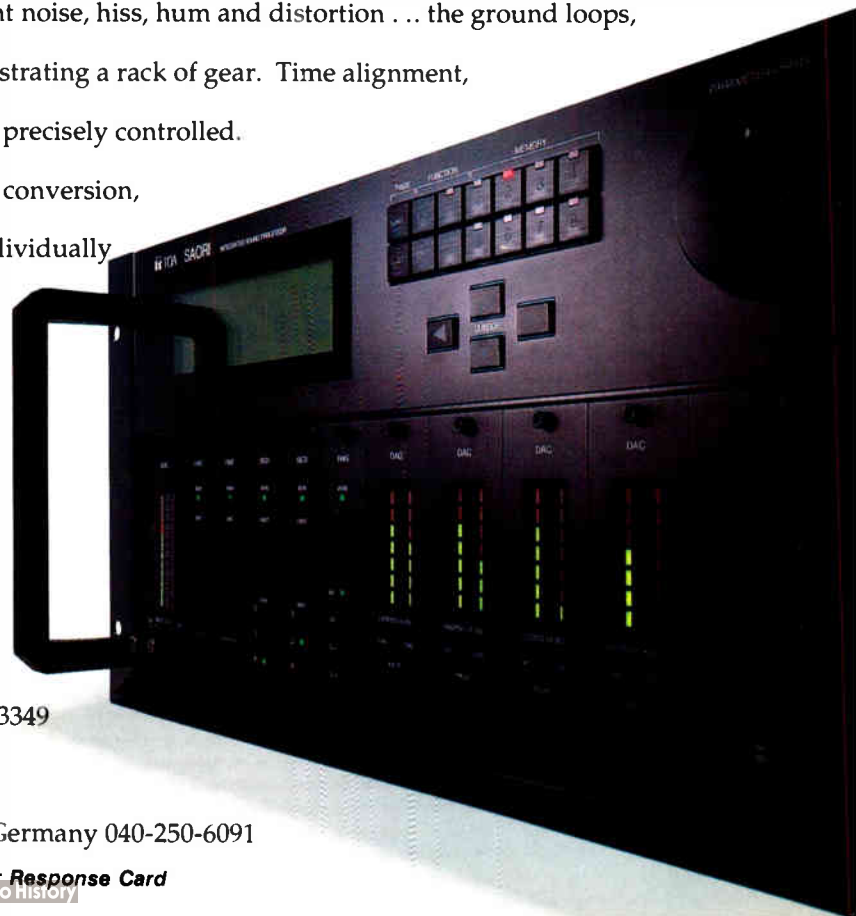
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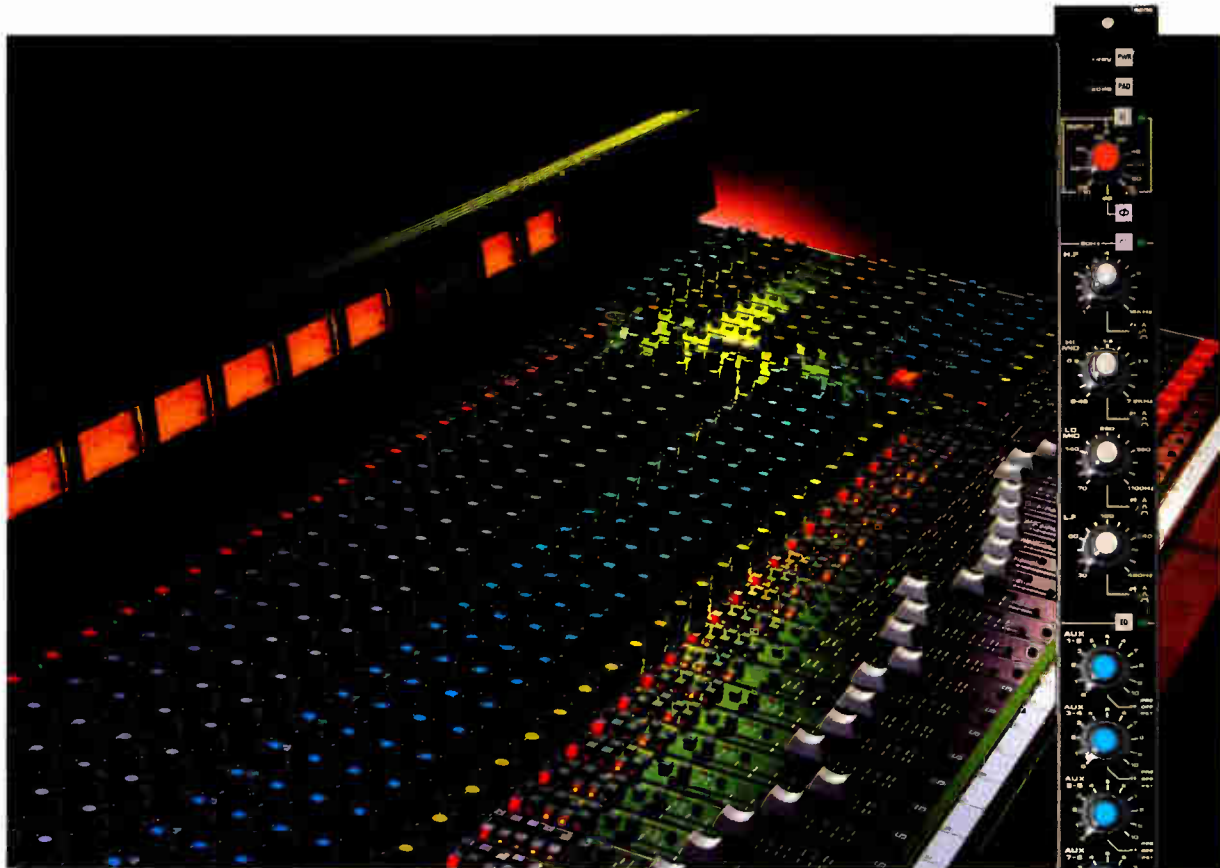
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World Radio History



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Soundcraft 8000

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