

SOUND COMMUNICATIONS

Volume 39 Number 1

January 28, 1993

SPECIAL EVENTS

Thirty events occur on five acres of land during Michigan's Folklife festival. Sound and video require special designs and accommodations. And everything is then archived — with consideration for future interactive museum programs. Consultants for the festival talk. **28**



REFURBISHING BROADWAY'S "CATS"

Retaining the musical design while replacing the equipment. The digital age has changed the methods of sound design. Long-running shows take on the status of fixed installations requiring upgrades and updates. **25**



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RACKS, PART ONE — POWER STUFF

These racks are made for working. The gear to protect the gear is working its way into the rack. Our three-part series on racks begins with a discussion of "power stuff" — line conditioners, power supplies, controllers, protection devices. **14**

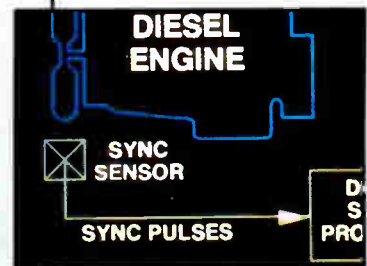
IN THIS ISSUE

• EVERYTHING ABOUT LOUDSPEAKERS

Our popular series continues. Everything You Ever Wanted to Know About Loudspeakers turns this month to some of the things its author, Mike Klasco has been investigating, particularly fluid-cooled speakers. **54**

• ACTIVE NOISE CANCELLATION

Someday it will probably have a major impact on room acoustics. For now, there's a lot of research going on — and some new products coming on line — to make active noise control relevant to the sound contractor. **42**



PERFORMANCE

THE PEAVEY PERFORMANCE SERIES™



The Performance Series™ 3680 Sound Reinforcement Console is the result of ongoing research by Peavey to meet the rigid requirements of today's sound engineers. Many technological advancements have been included with this new console, but we have also kept in mind the most needed and most often used features that are common to virtually every sound reinforcement application.

The totally modular concept, coupled with performance, function, features, and exceptional specifications, has offered to the sound engineer a console that is "tailor made"... and affordable!

ULTRA LOW-NOISE DESIGN

The input stage is discrete and contains the lowest noise transistors that are currently available. The signal-to-noise spec of the Performance Series 3680 input stage has approached the theoretical limit at -133 dB while maintaining 60 dB of gain.

DIFFERENTIAL SIGNAL ROUTING

All bus signals are differential to eliminate crosstalk and annoying ground conduction.

GOLD PLATED INTERCONNECTS

Gold plated connection contacts are used throughout for lowest noise and maximum reliability. The highest degree of signal integrity is maintained with all signal interconnects to provide "low-noise" operation.

IC SOCKETS

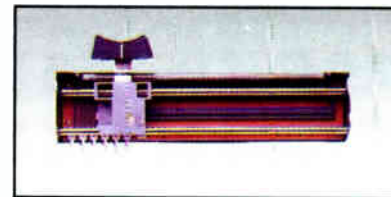
All ICs are individually socketed for ease of service as opposed to ICs that are soldered directly to the circuit board.

INPUT CHANNEL FLEXIBILITY

Now available in 24 and 36 channel versions, channel options are unlimited for the future and for special applications requiring more than 36 channels.

ELECTRONICALLY BALANCED INPUTS

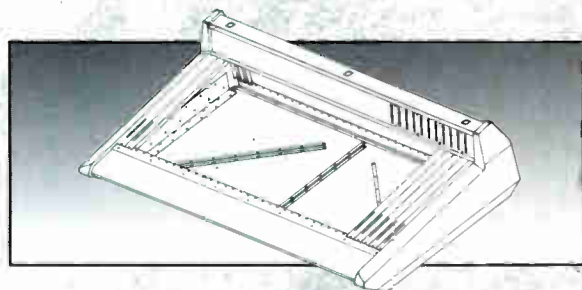
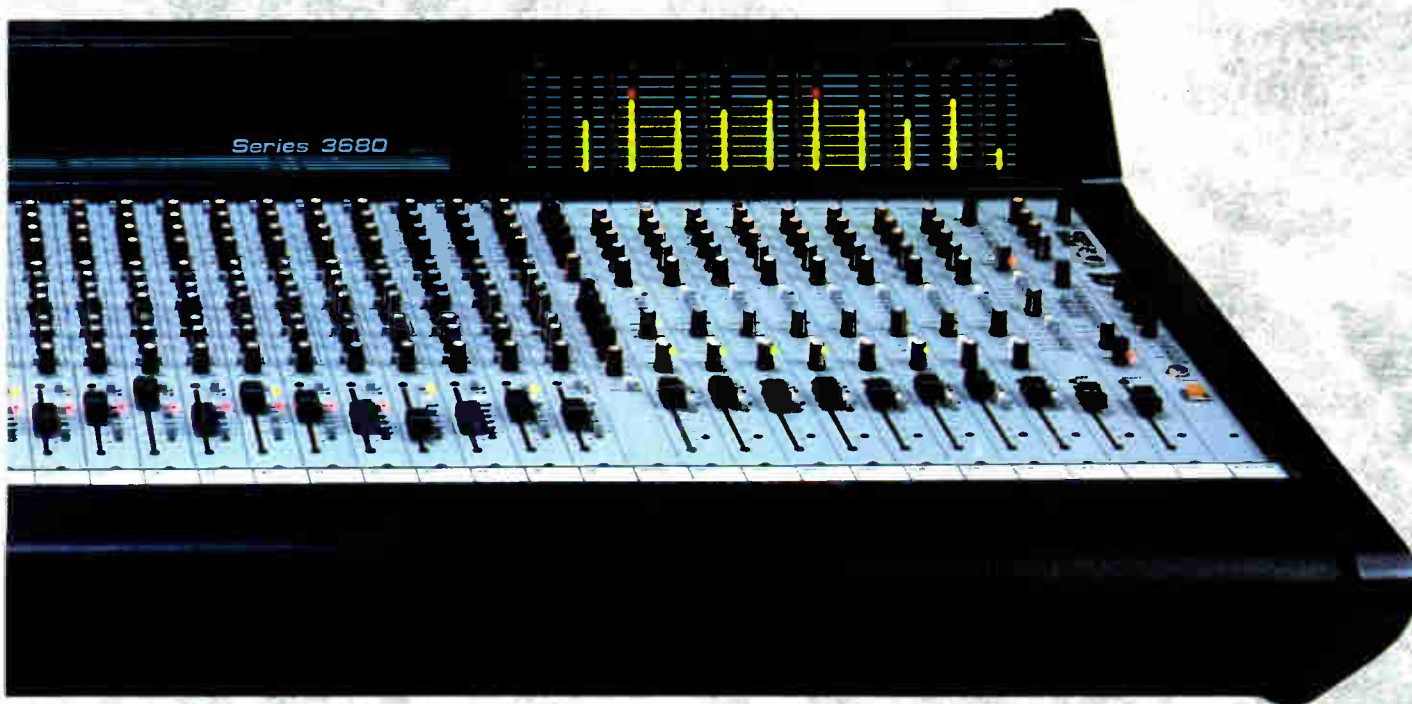
New electronically balanced input circuit offers 100 dB of common mode rejection, allowing the console to operate in most any environment without interference.



PREMIUM FADERS

Rails are center ground and highly polished to match perfectly with nylon bushings for a silky smooth feel. The shaft is offset to prevent dust and debris from entering the fader mechanism.

ENGINEERED... SOUND REINFORCEMENT CONSOLES



MONOCOQUE CHASSIS CONSTRUCTION

A unique monocoque chassis construction has been selected for maximum rigidity and resistance to "flexing" of the chassis mainframe. This super-strong chassis design minimizes electronic problems due to the mechanical "bending" of the console chassis during transportation, set-up, and tear-down.



EXTERNAL POWER SUPPLY

Rugged external power supply mounts in standard 19" rack and occupies only two vertical rack spaces.



TOTALLY MODULAR CONCEPT

The Performance Series 3680 is a totally modular mixer from the standpoint of numbers of channels, and because channels may be removed separately. Each channel stands alone from the input to the 100mm fader. Removing the channel module also removes the entire array of input jacks and all patch points for that particular channel. From a service standpoint, the channel may be easily checked out on the bench or outboard from the main mixer housing since the input patch panel is part of the channel module.

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Slander as the Ethics of the Nineties

The other day someone called someone in this business "incompetent." (It didn't concern this magazine, so you can keep reading our more-than-competent articles.)

The motivation for the slander over which I'm currently obsessing was that ancient business drive called CYA, or blowing smoke rings around the slanderer's client.

We've written many times in these pages about the parameters and specifications that frequently put the sound contractor into a position of seeming to perform badly where he has actually done superhuman work.

We're talking about the information you get on which you act in your professional capacity. The information comes from the facility manager, the acoustical consultant, the sound designer, the performer. There may be written specifications; the information may be verbal. You go with what you have. If a venue has been planned to exclusively accommodate musical performances, you optimize the sound for music. If in fact the focus is changed after the install — well we know who gets the blame: the last man in. Enough people have told us horror stories in which the sound contractor has been blamed for the foul ups of the facility manager or the consultant. Garbage in, garbage out, as they say. When you're fed wrong information, when a scapegoat needs to be found, when the true story will endanger another project . . . well you get the picture.

Dr. Wokka, our foremost authority who writes frequently in these pages, has written extensively on this subject. His advice: take the money and run. The truth is, Dr. Wokka is so often so close on the mark that he has been taken to be quite serious by some of our readers. So I must alert you: Dr. Wokka's columns are satires meant as comical interludes in what can be a grueling business, and much of what he states is, well, overstated. If the good Doctor didn't insist on anonymity I could tell you that his much admired sound systems will be appearing under the marque of a major electronics company. Which proves



the opposite of the gist of this column: nice guys and hard workers sometimes do end up admired and capitalized.

Which brings us in a very roundabout esoteric way to the subject of Kurzweil. Some of you may remember our profile on Mr. Kurzweil himself. In this issue of *Sound & Communications*, we talk about Kurzweil the hardware and how it has in a sense identified a musical sound. When the Broadway production of *Cats* became a long-running show, it essentially became a fixed installation. Since the music for the show was composed for very particular electronic instruments, when an overhaul of the electronic system was necessary, those original musical sounds had to be matched. It's the nineties version of the Original Musical Instrument movement.

That's enough for rambling this month. Read this issue, and enjoy.

Best regards,

Judith Morrison
Editor in Chief

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Installers Respond; Spec Expressions

WHAT DO WE THINK OF THEM?

In response to Kathleen Lander's "What Do They Think of Us" story in your October issue, I offer the following:

Designers have every right to expect excellence from installers, but only if they're willing to pay excellent prices to people they have taken time to select carefully. Excellence doesn't come from the lowest bidder. To make the low bid, the installation contractor either made a mistake or cut the bid price. In either case, the contractor's investment in the project, which is related to his profit, will get cut. Wave bye, bye to excellence!

OTHER TIMES, DESIGNERS' HANDS WERE STUCK OUT FURTHER THAN PROPRIETY ALLOWS.

The problems that some designers complain about result when they hire inexperienced system installers because such installers come a lot cheaper than qualified ones. In this way, designers can pocket the difference, or if the contractor is set up to deal directly with the client, the designer manages to get a commission about which the client knows nothing. Having made too small a profit on the job, due to his inexperience in quoting and doing, it's not surprising that the contractor loses his taste for the job. So in the end, the client never learns how to operate the system, and no one is satisfied.

We've lost jobs because others promised more for less and the designer or client went for it. Their later regrets are scant consolation. Other times, designers' hands were stuck out

further than propriety allows.

When this business was started in 1959, we did only residential work. It was the designers who turned me off so hard that we went into commercial work, where clients were interested more in how it sounded than in how it looked. After many years, designers, with their clients' prodding, became interested in function as well; so we returned to residential systems, which now account for nearly half of our work.

Even though we are careful to point out to designers the specific pitfalls in going for the cheaper, we often fail and I don't know what more can be done about this. Designers sometimes prefer to go with their "hope" that the job will be done well enough for less. Sometimes they interfere in the system design and needlessly get involved in the choice of equipment, where their expertise is lacking. In some ways, designers are much like audio engineers in that they're more interested in the creative technical aspects of a project than the business aspects. Though both are important, designers' efforts need to be more focused on choosing the right contractor and then working with him to integrate the design harmoniously.

I don't feel sorry for designers and clients who've been burned as a result of opting for shortcuts. Today, more than ever, residential electronic system installers specializing in shortcuts abound. In large population centers like New York they abound even more, which accounts for the author's geographic findings.

There are no shortcuts! Only a trained, experienced contractor who is versed in the languages of the designer, architect and customer, and is ethically grounded, can successfully perform the complex tasks required to

everyone's satisfaction. Such contractors cost more, but how can that be put into the specification? You pay your money, you take your pick.

**Alexander Rosner, President
Rosner Custom Sound, Inc.
Long Island City, New York**

DUBIOUS EXPRESSIONS

Alan Gable's informative article, "Challenging the Great Outdoors" in the October issue, and his mention of "indirect burial cable" reminded me of another dubious expression that one finds from time to time in specifications.

SOMETIMES THEY INTERFERE IN THE SYSTEM DESIGN AND NEEDLESSLY GET INVOLVED IN THE CHOICE OF EQUIPMENT, WHERE THEIR EXPERTISE IS LACKING.

Alan mentioned the possibility of using indirect burial versus direct burial cable, which brought to mind the specs I have seen which seem to always call for "long-life emitting diodes." Think of the poor manufacturers of those short-lived L.E.D.'s, whose products are frozen out of consideration whenever such a specification appears.

Maybe the makers of indirect burial cable and short-lived L.E.D.'s should get together and join forces, or perhaps consultants should proofread and edit the specification given to them by salesmen.

**Thomas W. Donohoe
Senior Sales Representative
RCI Systems Inc.
Rockville, Maryland**

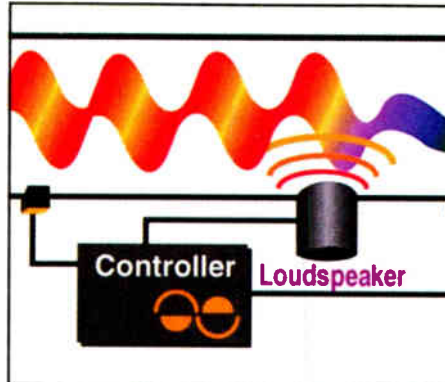
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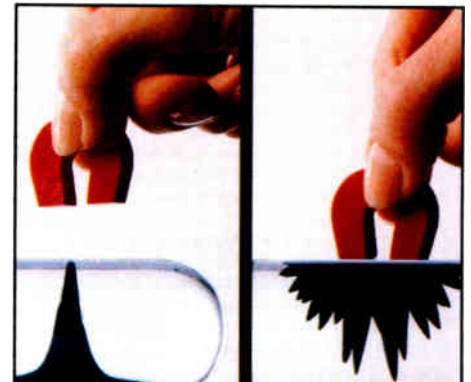
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FEATURES

14 ALL ABOUT RACKS, PART ONE

By Mike Klasco

What do line conditioners, uninterruptable power supplies, sequential turn-on controllers, and other AC power filtering, protection and regulation devices do? A look at rackmounted protection and regulation equipment.

25 REFURBISHING CATS

By Jeff Ader

After ten years, Broadway's "Cats" is both an institution and a permanent sound installation. One of the main considerations was replacement of equipment without altering the original sounds.

28 THE FESTIVAL OF MICHIGAN FOLKLIFE

By Wendy J. Duch

Each year, the Festival of Michigan Folklife comes to the campus of Michigan State University for two weekends of traditional arts entertainment. From field equipment to video the needs are varied at such a special site.

42 THE FUTURE OF SILENCE

By Daniel Sweeney

In years past, noise control devices never generated much excitement in our industry: it was a staid, boring, low tech business. Then, from out of nowhere, came active noise control, along with parallel processing and recursive filter functions. What is happening, and what does it all mean?

54 BACK TO BASICS, AGAIN

By Mike Klasco

Our "Everything You Ever Wanted to Know About Loudspeakers" features continue with an esoteric discussion on Ferrofluids: microscopic coated magnetic particles suspended in a synthetic lubricating oil used to remove heat from a speaker's voice coil to improve power handling.

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THE SECRET'S OUT

...your mixer is about to become obsolete!
The New Panoramic™ Mixers from SoundTech

John Oram
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John Oram has a secret. For him, its another achievement in a long line of audio accomplishments. For you, its the next mixer *you'll want to buy!* John's brilliance in design work began in the early 60's building Vox amplifiers for The Beatles and continued through the 70's and 80's designing the legendary range of Trident consoles, heralded for their sonic quality. He is considered by many to be "The Father of British EQ" and has been a major factor in defining the "British Sound". His work as a Chartered Electronic Engineer includes designing for such prestigious clients as the BBC!

John Oram has designed the new "Panoramic" line of mixers for SoundTech and he can't wait to unveil them!

16, 24, 32 and 40 channel models jam-packed with features at about *half the price* you'd expect!

Features:

- Ultra low-noise *padless* mic pre amps, 70dB of gain
- Mix mic and line/tape in the same channel at the *same time*
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Specifications:

- Frequency response 20Hz to 20KHz (± 0.5 dB)
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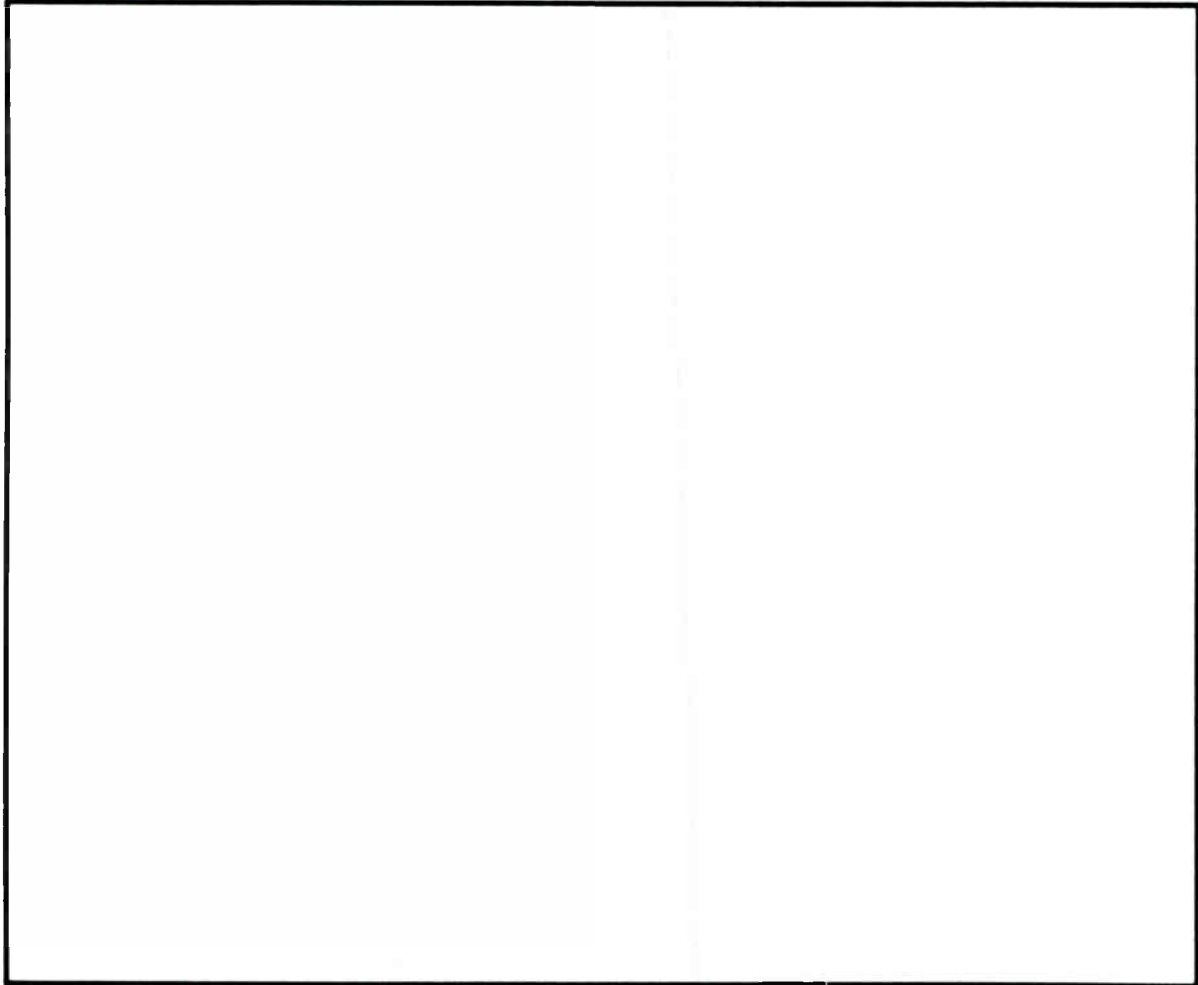
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NEWSLETTER

PINNACLE AUDIO TO CLOSE; EV AND NEW ENTITY TO DISTRIBUTE PRODUCT

Pinnacle Audio, which had distributed the Klark- Teknik, DDA and Midas lines, along with some Dynacord product, in the U.S., will be closed by March 1 by its parent company, Mark IV Audio.

Effective immediately, Electro-Voice (another Mark IV company) will provide U.S. distribution of Dynacord music electronics products. In addition, a new venture has been established for U.S. distribution of Klark-Teknik, DDA and Midas products. All involved companies are wholly-owned subsidiaries of Mark IV Audio, Inc. Dynacord products will be distributed by EV under the joint brand name of EV/Dynacord. The U.S. distribution of K-T, DDA and Midas products are to be directed by former EV Concert Sound Marketing Manager Ivan Schwartz, who has been named general manager and reports to Paul McGuire, president of EV. This new venture, called the Mark IV Pro Audio Group, will be headquartered at a new facility currently under construction in Buchanan, Michigan. The Mark IV Pro Audio Group will also distribute EV Manifold Technology and DeltaMax concert speaker systems to the U.S. concert touring market. Altec Lansing continues to distribute the Dynacord ELA electro-acoustic line.

CASH AWARD CONTEST FOR NSCA

A cash award contest for members has been approved at a meeting of the NSCA Board of Directors, according to Jack Toerner, president of NSCA and of American Sound & Electronics. The awards, developed to stimulate generation of technical and sales tips, will be presented to three contributors in each category for each issue of the NSCA newsletter, Electronic Contractor.

"The recognition for contributors will take two forms," said Miriam Evaslin, chairperson of the Bud McKinney Scholarship Committee. "The three submissions in Technical Tips and in Sales Tips judged best each issue will each receive \$100. Contestants will also be eligible to receive a free trip to the next NSCA Expo as part of the Bud McKinney Scholarship activity."

CARVER CORPORATION RESTRUCTURES MANAGEMENT

Carver Corporation has announced a major restructuring of its sales, marketing and product development "management team." Mark R. Friedman has resigned his positions as director and senior vice president of sale and marketing of the company. Patrick Mountain has been appointed director of sales and marketing/consumer audio. Charlie Boornazian, east coast regional sales manager, also assumes the role of national sales manager/mobile audio.

William Lewis has rejoined Carver as director of marketing/professional audio and shares responsibilities with Steve Payne, national sales manager/professional audio. Jim Croft has joined the company as director of product research and marketing development. Tom Graham remains president and ceo of Carver. Dean Standing is national sales manager/consumer audio. John McCready is director of product development and planning.

CMS RETAINED FOR FREEDOM FORUM

CMS Innovative Consultants has been retained as the Audiovisual and Acoustical Engineers by The Freedom Forum for the design and development of the new First Amendment Center in Nashville. The multi-purpose meeting and presentation facility will include audio, video, and audiovisual systems. CMS says that AV contractors interested in bidding on the job should forward information to CMS at 1120 Old Country Road, Plainview, New York 11803.

EAW APPOINTS CANADIAN REPRESENTATION

Eastern Acoustic Works has appointed Contact Distribution Ltd. to represent its professional loud-speaker systems throughout Canada. Frank Loyko, EAW vice president of sales, said, "Contact Distribution will handle contractor/consultant relations, rental company sales and other marketing functions throughout Canada." Contact Distribution is based at 38 Thornmount Drive Unit #1 Scarborough, Ontario M1B 5P2. Contact president Bill Coons said, "We are proud to add EAW's

NEWSLETTER

professional speaker systems to Crest Audio, BSS, Countryman, Technical Projects, Gaines Audio, and Middle Atlantic. EAW's innovative engineering, quality construction and outstanding factory support make them highly competitive in the Canadian market."

NEW PRESIDENT AT CTI

Milo Kosich has been named president of CTI Audio, Inc. The announcement was made by chairman of the board Bill Ross. CTI manufactures CAD microphones and mixing consoles, Equitek studio microphones and Astatic commercial/industrial microphones. Kosich has held marketing positions at Audio-Technica and at Electro-Voice.

A-1 AUDIO BUYS TASCOS US ASSETS

A-1 Audio has announced the purchase of capital assets from Tasco Sound, Ltd. based in Camarillo, California. The company has handled full-service sound rental, sales and installation from its Hollywood and Las Vegas locations for 25 years. Tasco U.S. is thus separated from its former relationship with the founding company of the same name based in England. The deal meshes equipment, staff and rock-tour clients from Tasco with A-1 Audio's operations, which include Broadway productions, corporate theater and trade shows, showroom entertainment, symphonic work, plus pop and rock concert events. According to A-1 Audio founder and president Al Siniscal, the deal expands A-1's rental inventory and client base, while establishing a new Arena Division to offer one-stop shopping for full-service tour production. Paul Newman has joined A-1 as vice president of the new Arena Division.

UNGAR AFFILIATES WITH ACENTECH

Acentech Incorporated has announced that Dr. Eric E. Ungar will work for the company in a part-time capacity as chief engineering scientist. He continues his primary employment as chief consulting engineer for Bolt Beranek and Newman, Inc., where he has worked since 1958. Ungar is an authority on vibration and structure-borne sound.

INTERNATIONAL JENSEN AND FERROFLUIDICS FORM VENTURE

International Jensen Incorporated and Ferrofluidics Corporation have announced the formation of a research partnership to develop noise reduction technologies for automobiles, aircraft and other products. International Jensen's Corporate Technology Group and Ferrofluidics' Fluids Division will work in concert to develop transducer devices specifically designed for active noise reduction applications.


NSCA TENTATIVELY APPROVES BAR CODE

The Board of Directors of the National Sound and Communications Association has tentatively approved Code 39 and a three-line package marking format as a voluntary bar code standard, according to Mark Dundas, chairman of the Bar Code Committee of NSCA. The final approval is subject to industry input. Among the points made in the committee report: Code 39 is the most cost effective code for the industry because it is a full alphanumeric symbology with 43 basic data characters and 128 (full ASCII) possible; it can be printed on conventional dot matrix or laser printers; it can be read with a \$200 optical wand; it can be integrated easily with standard PC or mainframe software; it is widely accepted. The three lines of the bar code would include the manufacturer's name, the serial number, and a 25-character description.

BEHRINGER OFFERS FULL LINE

The full line of Behringer Specialized Studio Products, which was shown for the first time at the fall AES convention, include operational amplifiers, a failsafe relay. The line includes the Studio Denoiser, the Composer (a full function compressor), parametric EQ, Intelligate, the Dualfex and Ultrafex, the Suppressor, Headphone Amplifier, and the Pre-Q, a servo balanced stereo mic preamp.

Eclipse.



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All About Racks, Part One

New Purposes for Rackmounted Protection and Regulation Equipment

BY MIKE KLASCO

Line conditioners, uninterruptible power supplies, sequential turn-on controllers, and other AC power filtering, protection and regulation devices have become increasingly popular and necessary components for sound system installations. What do they do? When and why are they needed? Who makes what? Where do they go? How are they specified? Do some of these units combine functions? The answers to these mysteries and more will be this month's quest for inquiring minds.

Although I have segmented these products into groups, the sound system specifier must take a systems approach. Protection from both internally and externally generated power disturbances is prudent. The designer should insure that transient voltage suppression devices with high power ratings are used at the main power distribution panel, in addition to the local regulation/protection components discussed in this report. Externally generated voltage transients can arise from breaker operation on the utility lines, lightning strikes, or whatever. Internally generated distur-



OnePower's LM-15A Power Distribution System.

bances, such as high frequency noise, can be caused by your installation — from switching power supplies, digital clocks in DAT (or other digital tape machines), CD player/recorders, DSP effects processors, or computer equipment. This can be carried on feeders and branch circuits within the installation and enter the digital logic circuits of the rest of your system if adequate preventive measures are not taken.

The gear discussed here is all rack-mount (or I will otherwise note the form-factor). Since there are just too many outfits that make these devices to cover them all, I have picked out some of the more representative units. But be sure to check in the Sound & Communications Blue Book directory for a more comprehensive listing.

SEQUENTIAL TURN-ON CONTROLLERS

We will start our tour with sequen-

tial turn-on controllers. These gizmos will turn on equipment with a time delay, with some of the power outlets being activated before others. About 10 years ago a number of high performance audio integrated circuits began to appear that had fairly decent sound quality and specs, but when they were turned on, they would send garbage through their outputs for the first second or two after they woke up. Today, this problem still exists with many of the analog ICs that design engineers would prefer to use. Since many audio components have very tight design budgets, there often is not enough money to buy both the high-performance ICs (with the nasty response to their wake-up call) and a relay or other turn-on mute for the output. So often it is a race to see if the installation's amplifiers will turn on before the audio mixer's, and before the signal-processing-electronics are done belching. If the turn-on junk

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

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MORE.

THEY DO IT

BETTER.

THEY DO IT

FOR LESS.

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Unique Interactive Knee Control circuitry combines the musicality of soft knee compression with comprehensive hard knee control. Special Interactive Gain Control Peak Limiter circuitry enables simultaneous Clipper and Program limiter functions while serving as a zero attack, distortion-free absolute gain threshold.

INTELLIGATE The Intelligate is an Expander/Gate/Ducker with Ultra Transient Response circuitry for instantaneous attack. Proprietary high performance Class A VCAs provide exceptional audio quality. Precise key filters permit frequency-sensitive keying.

Like the Composer, the Intelligate includes Interactive Ratio Control Expander circuitry to eliminate "chatter" on or around threshold. Both units feature servo-balanced Neutrik 1/4" and XLR inputs and outputs, precise metering and a 5 year warranty.

Behringer. When you listen, the message becomes clear.

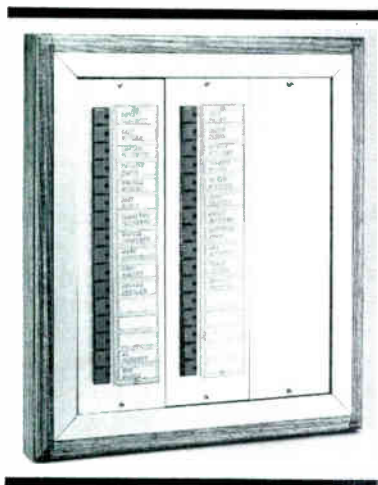
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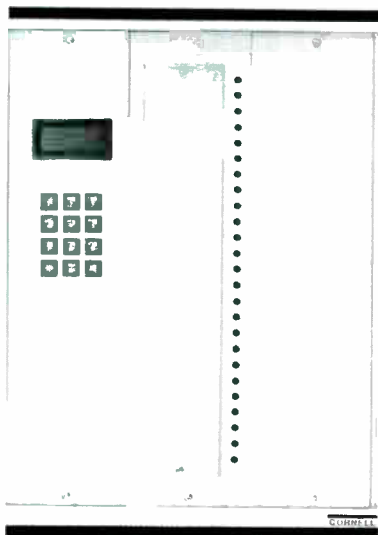
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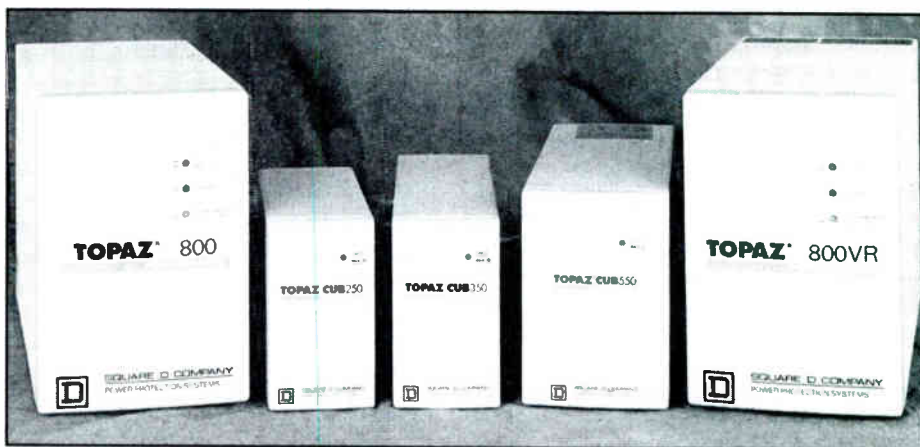
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Circle 268 on Reader Response Card



Topaz' Uninterruptible Power Supplies (UPSs). The Cub family is shown.

makes it through the amplifiers, then the sound system's speakers are in for a rough time, excessive wear and tear and perhaps even premature failure. The potential for tripped circuit breakers, blown fuses or voltage spikes caused by the simultaneous power application is also avoided.

Atlas/Soundolier offers the SACR-191, a six-circuit sequencer designed to sequentially activate the SACS-1 and SACS-5 power outlets. Atlas/Soundolier also offers isolated ground versions of the SACR-191. Aside from powering up and down a chain of equipment in the desired order, added flexibility is incorporated by providing a 24 volt (DC) output and switch closures on each circuit that can be used for additional control options. The delay is adjustable for up to 10 seconds and a remote start up/shut down switch can be connected. The system is ideal for sound reinforcement systems, electrical and electronic systems and controls, and other signal chains that require sequential power up and power down.

FSR Inc. offers a range of line sequential AC power switchers to handle small rack applications as well as Colosseum-type sound systems. FSR's sequencers feature solid-state, zero crossing AC power switching, surge suppression on all AC outlets, short-circuit protection for all control inputs and outputs, as well as sequential switching. The SP-ES provides sequential switching of three circuits — rack AC, amp AC and an external power supply. Status and fault indicators for the AC outputs are provided. Multiple expansion units (model SP-2ES) may be added. The SP-3R sequentially switches three circuits.

Furman added the PS-8 Power Sequencer to their line of power conditioners and line regulators last year. The PS-8 absorbs spikes, surges, and RF interference. It also powers up a rack full of equipment in a pre-determined three-step delay sequence, with the sequence reversed for power-down.

The Sonance AC1 Sequential Power Switcher is a multi-function device combining sequentially switched AC outlets, automatic power-up when the AC1 senses an incoming line level signal, an audio distribution amplifier with four outputs, and AC line protection, conditioning, and filtering. Additionally, the AC1 has relay contact closure for control of slave units (AS-1/s and AL-1S) for screens, mechanisms, lighting, etc., although a separate power supply option is required.

Whitenton Industries pioneered power conditioning for proaudio with their Juice Goose products. For the permanent installation commercial sound market, their OnePower line is quite comprehensive. The CQ15A sequenced power system features remote control capability, 11 outlets on the rear of the chassis, and a total of 15 amps capacity. The CQ family can be remotely activated with a progressive delay of 2 seconds per unit. Five sequenced turn-ons are provided, with two outlets each, with the last outlet unswitched. All outputs have both surge and spike protection, as well as noise filtering. Power-up sequences and power-down sequences are mirror image. A BNC connector is provided to power a work light.

Z-Line, from Pulizzi Engineering also offers multiple time delay power-up/down sequencing equipment.

Small Wonder

ASHLY was founded in 1972 with the stated goal of producing professional audio equipment that would set new standards for sonic excellence and reliability. The Company originally manufactured large mixing consoles with on-board signal processing for touring sound systems. Later, the consoles' built-in processing components were offered as separate rack-mounted units. The initial product line consisted of limiter/compressors, parametric equalizers, and a full selection of electronic crossovers. ASHLY added power amplifiers to its product offerings during the late '70's, and soon gained a solid reputation for the amps'

outstanding sonic performance and incredible reliability.

Building on this background of success and technological innovation, ASHLY has set out to expand its amplifier product line to encompass new markets. The new model SRA-120 professional stereo amplifier has been developed toward this goal, and offers superior sonic quality, rugged construction, and many useful features in a single rack space chassis. The compact SRA-120

is suitable for full-range applications, such as small control room monitor systems or as an ideal headphone distribution amp. With its excellent signal bandwidth, the SRA-120 is also well-suited for driving the high-end of a bi-amplification sound system setup.

The amplifier will deliver 60 watts per channel into 4 ohms stereo, 45 watts per channel into 8 ohms stereo, or 120 watts total into 8 ohms mono-bridged. Its design is based on "Class A" voltage amplifier stages with a complementary bipolar output section for low distortion and excellent overload behavior. Features include turn-on delay circuitry and instantaneous turn-off to eliminate any transients to the speaker. Each channel will also independently turn off its output if an over-heated condition occurs.

This model also features rear panel switches to select between two choices of input sensitivity, stereo or mono operation, or normal or bridged mode. Rear panel input connections may be made via 1/4" balanced phone jacks or barrier strips with ground lift provision. Level attenuators for each channel are provided on the front panel, along with a stereo headphone jack. Status L.E.D.'s on each channel include signal present, clip alert, and "protect-mode" indication.

The SRA-120 is approximately 10" deep and weighs in at under 20 pounds, yet has performance characteristics and features typically found only in larger, more costly competitors. All Ashly amplifiers are covered under the company's exclusive Five Year Worry-Free Warranty program, offered at no extra cost to the user.

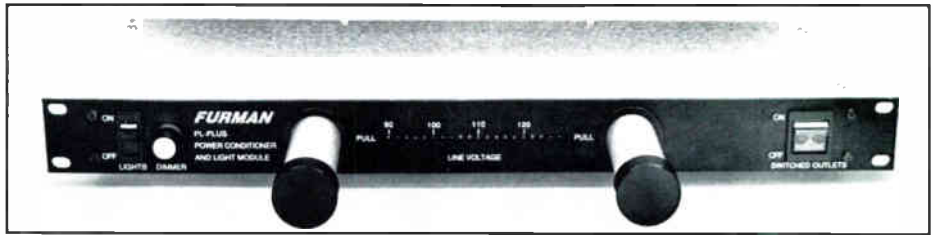
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ASHLY

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Furman's PL-Plus Power Conditioner and Light Module.

UNINTERRUPTABLE POWER SUPPLIES

With conventional power supplies with big electrolytic filter capacitors feeding analog electronics, a little burp in the power line could usually be tolerated. But with switching power supplies and digital logic and microprocessors in every CD player, preamp, effects processor and what not, disturbances and interruptions on the AC line can be disastrous. Uninterruptable power supplies ("UPS") first became popular for personal computers, but now generic types, versions for audio applications, and even for specific mixing boards are available.

Commercial Sound Labs (CSL) provides automatic standby power for all

types of sound systems. The CSL 500 provides rack mounted standby 120 volt AC power from a 12 volt DC backup battery by using a switching power supply. The system can be expanded by increasing the number of storage cells, which increases the "up time." The AC current available is 12.5 amps, with each system protected by a main circuit breaker. On the CSL 500 rear panel are six outlets that switch instantly and two that are not backed up. There is also an optional sequencer that has eight outlets, two that are switched instantly, two on a 1.8 second delay, two delayed 2.8 seconds, and two that are not backed up. The delay circuitry is useful for han-

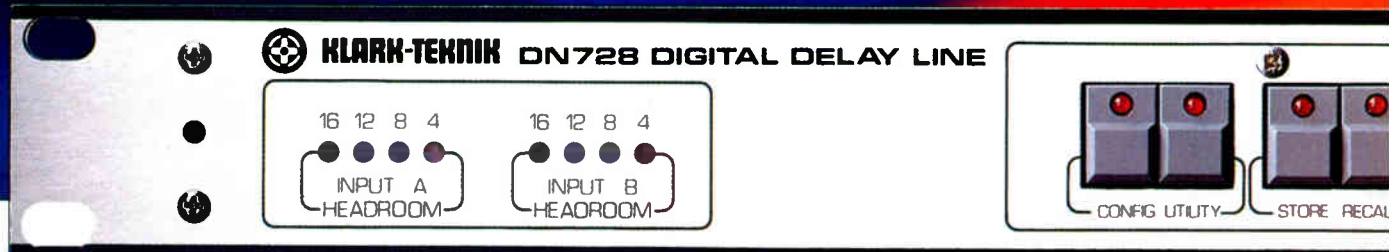
dling high current amplifiers. After the AC returns, the CSL 500 restores its battery source automatically, using a dual battery maintenance system. It uses two chargers, one a high-current charger to bring deep-cycle batteries up to 80-percent capacity quickly, and the second a tickle charger to complete the remaining 20 percent slowly.

Furman announced the UP-600 rack-mount battery powered backup AC power supply that promised 600 watts of protection from power outage. But Furman decided not to ship the UP-600s because it could only supply full power of 5 amps for 15 minutes, which they felt was not enough for the \$700 to \$800 the unit would have to retail

DN728

DIGITAL DELAY LINE

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Klark Teknik's new DN728 gives you more power and adaptability than any digital delay, ever.

It's equipped with true 18-bit linear processing for matchless audio quality.

More important still, it provides a superb palette of user-configurable input and output options to simplify a huge variety of applications.

Using the two inputs and six outputs, you can

configure the DN728 precisely to suit the day's task. Choose 'Stereo' for three ganged stereo outputs. 'Dual' to define memory splits and assign each of six outputs to either input. Or 'Mono' for full memory allocation and all six outputs assigned to one input.

It's an easy choice with all options quickly set on the clear LCD display in time, distance or video

fields. In distance mode, there's even a temperature compensation facility.

What's more, you can save frequently used set-ups in 64 user memories - each storing the settings of every single parameter. And there's no need for security covers - a control lock-out system and password protection prevent unauthorised access.

for. Furman is hard at work trying a different approach that will provide power for a longer duration.

Twecomm offers redundant power supply adaptors for the Yamaha PM-3000, PM-1800/2800 and Ramsa mixing consoles. Should the mixing console's power supply fail, then a seamless, instantaneous, noise-free change occurs. The adaptor is not another power supply, but a monitor that will switch over to a second power supply. Since critical installations usually keep a spare power supply for the console, this is an excellent method of efficiently backing up and maintaining failsafe power for the console.

Square D's Topaz brand offers the Powermaker, a range of UPS systems specifically intended for computers

and telecommunications equipment. (The Powermaker series' products are freestanding, not rack mount.)

Among the other suppliers of UPS systems are Sola, SL Waber, and Tripp Lite.

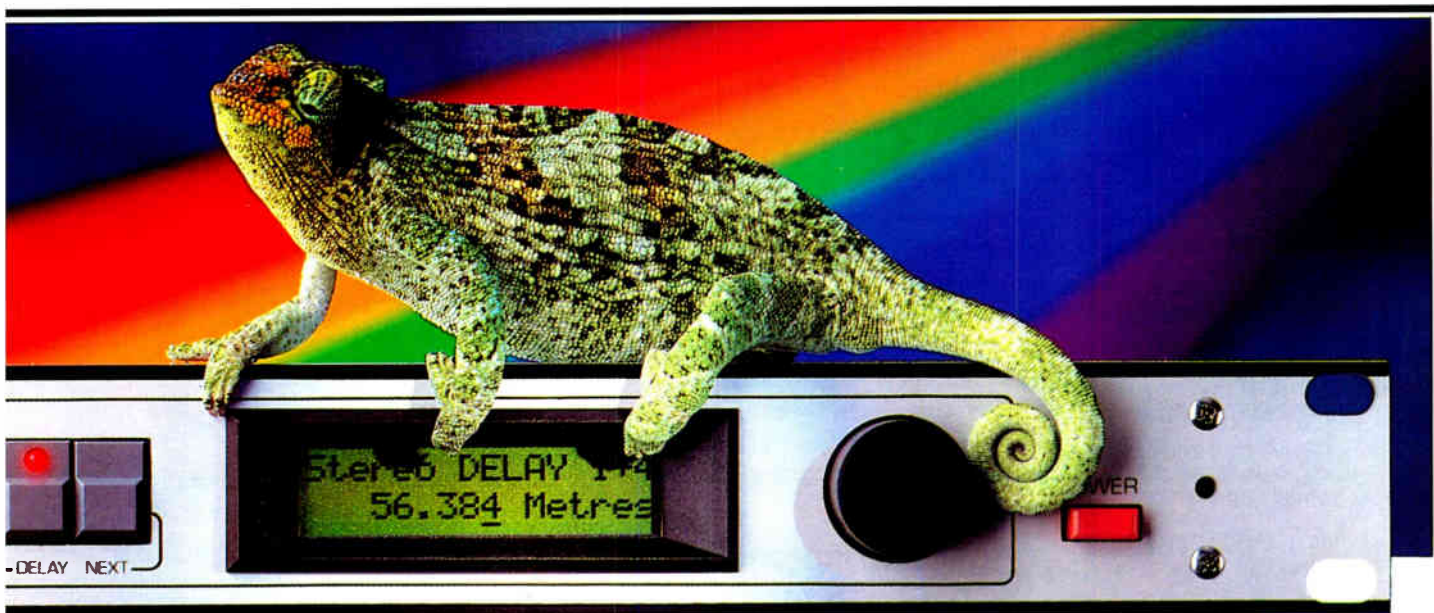
REGULATORS

Voltage regulators are used for protection from problems caused by power line sags, brownouts, or over-voltages.

The OnePower VR-20A voltage regulation devices provide 120v output ± 3.5 percent with a voltage input of 90V to 135V. Capacity is 20 amps with 120V input, with minimum capacity of 15 amps with 90v input. A BNC connector is provided for a gooseneck work light. Sixteen outputs are provided

along with a nine-LED input voltage meter. Varistor spike protection, along with EMI and RF interference filtration is included for all power outputs.

Furman offers the AR-Pro Voltage Regulator for single phase input AC from 88 to 134 volts (and a similar acceptance range for 220V), with output at 120V (or 100V). Loads up to 30 amps can be handled with 120 V input, with derating for lower voltage input. Twelve outlets are provided on the rear, with another two on the front panel. All outlets are regulated, spike-suppressed, and filtered against RF interference. Two bar-graph meters indicate input voltage and output current. Furman also offers more modest regulators in their models AR-117 and AR-230 (for 220V range).



For quality, it combines true 18-bit linear processing with an effective 200kHz sampling rate, giving all the benefits of a 108dB dynamic range, flat 20Hz-20kHz phase and frequency response – and a

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Ideal for synchronising multiple signal distribution systems and multi-way speaker systems, it's equally formidable when delaying

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World Radio History

POWER CONDITIONERS

Power line conditioners have become very popular because of the sensitivity of computer and digital equipment (including digital effects processors) to even very short term power spikes. While they drop electrical noise on the line, be careful that to check that the units are not acoustically noisy.

Furman's PL-8 combines power conditioning with a light module. The lamps have a dimmer and slide out for rack illumination. Protection and conditioning include a 10 amp circuit breaker, RF interference filtering, varistor spike and surge protection. Eight power outlets in the rear are controlled by a front panel switch. An upgrade model PL-Plus includes a volt-



BGW's FS series; front and back view.

age monitor that reads from 90V to 128V, improved RF filtering and a 15 amp rating.

Square D Company's Topaz brand offers the ESCORT Power conditioners, which are available in freestanding and wall mount, but not rack mount.

ETA's PD9, one of six models available, includes power conditioning and protection with eight outlets on the rear and an additional outlet on the front.

OnePower offers the Mark Series Venue Resident line conditioners designed for permanent hard wired installations. This series stabilizes voltage and minimizes line noise by the use of isolation transformers.

Other comprehensive sources for power line conditioners are Z-Line from Pulizzi Engineering, SL Waber Inc., and Tripp Lite.

GROUND ISOLATORS

The Sonance AGI-1 is an audio ground isolator. The device eliminates many of the ground hums and buzzes experienced in audio/video installations. The AGI-1 isolates the line-level audio input signal ground from the output signal ground. Different components often have different voltage potential present on their grounds. When connected by an audio patch cord, the signal travelling over the cord passes

along interference with its audio signal, causing a ground loop. The AGI-1 breaks the "ground loop" and thus eliminates the associated interference.

Sonance also offers the RFG-1, a passive radio frequency ground isolator. The RFG-1 is used to eliminate ground interference problems found in coaxial cable and antenna RG distribution systems.

The signal travelling over the cord passes along interference with its audio signal, causing a ground loop.

Finally, an interesting combination of circuit breaker, power distribution, noise filter and rack cooling fan system is available from BGW in their FS series products. Of course, aside from power amps, BGW offers not only a wide variety of rack accessories, but also rack mounted computers.

Next month our epoch saga of *rack stuff* will focus on hardware accessories for racks: fans, security covers, patch bays, trays, perforated panels and whatnot. Finally, our trilogy will terminate with a survey of what is new with racks themselves. ■

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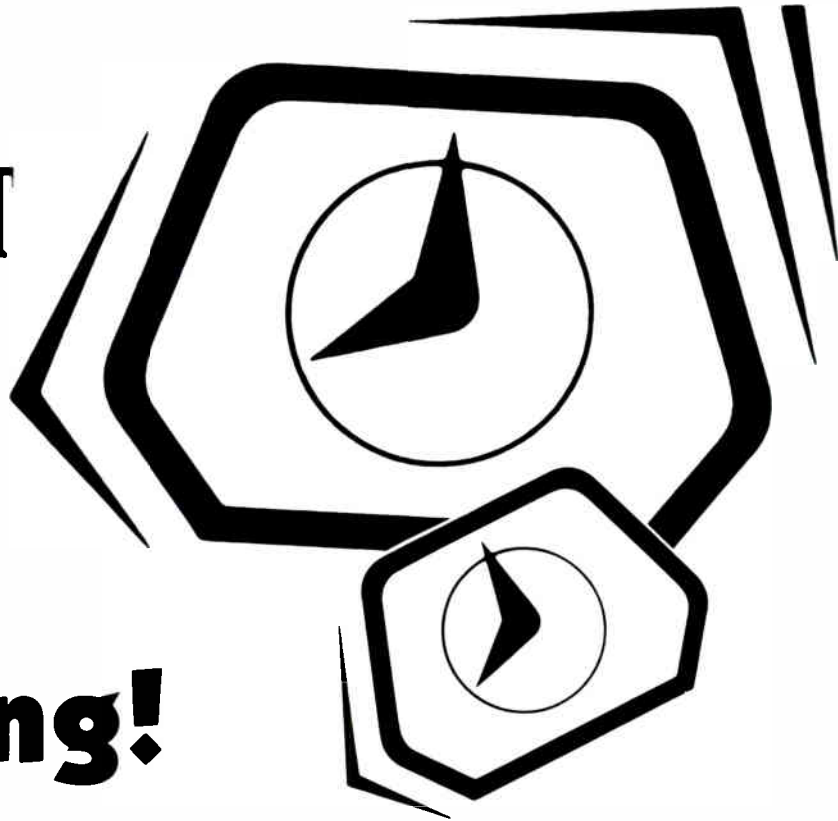
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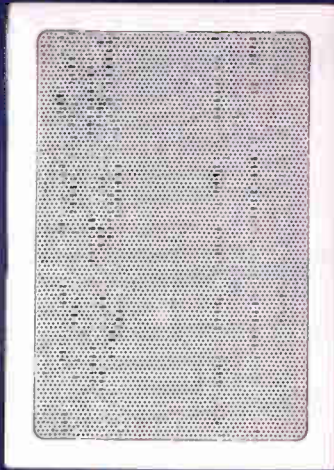
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Refurbishing Broadway's “Cats”

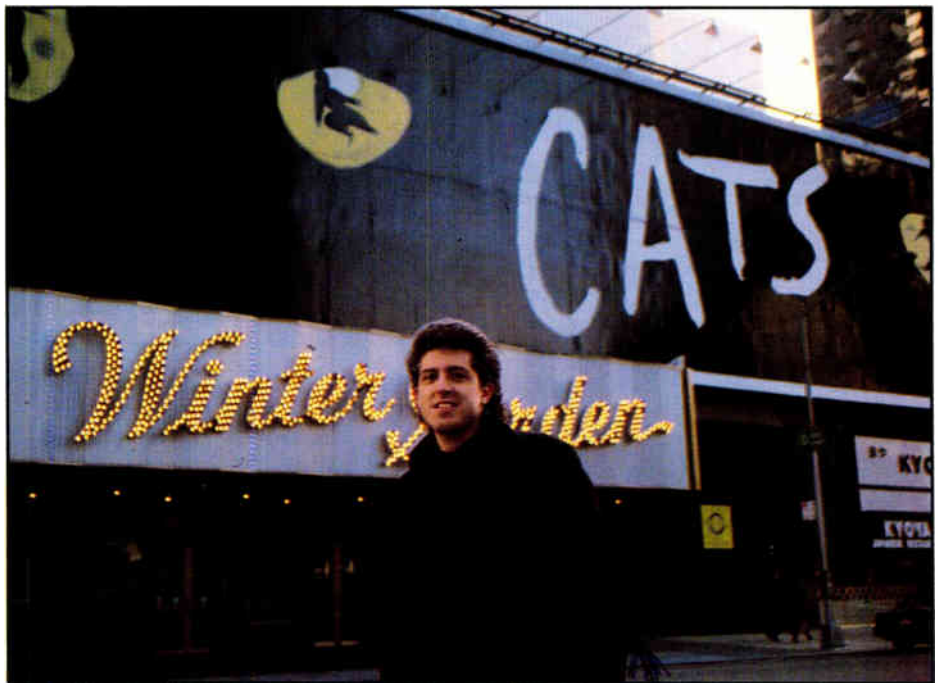
Retaining the Musical Design in the Digital Age

BY JEFF ADER

When a show has been running for ten years on Broadway it is regarded as an institution. The sound reinforcement equipment becomes a permanent installation. In regard to the popularity and success of the show, the sound design deserves a major portion of the credit. How well do the components hold up? What happens if a piece of gear goes down? How do you replace a piece of equipment without altering the sound if you can't get the exact same make and model number?

These were some of the problems faced by Dan Tramon, Chief Engineer of Sound Designers Studio in New York City, when the keyboard synthesizers controlling all of the musical sound effects for the hit Broadway Show “Cats” had to be replaced. Dan has considerable experience as a musician and sound designer. A musical background is quite helpful these days, since the advent of MIDI. After initially studying piano under Grace Castagnetta, Dan spent nine years at Juilliard and then majored in music at Columbia University for four years. He studied multi-track recording and sound design at the Institute of Audio Research. During the past five years at Sound Associates Inc. he has de-

Jeff Ader is a writer and consultant in the sound and communications industry.



Dan Tramon in front of the Winter Garden theater.

signed sound effects for such shows as “City of Angels,” “Cat On a Hot Tin Roof” and “The Will Rogers Follies.”

Gerald Schoenfeld, President of the Shubert Organization, one of the producers of “Cats,” contacted a number of sound designers asking for bids and proposals for this project. The job went to Richard Fitzgerald.

He and his brother Peter have been involved in Broadway sound design for over 40 years as Sound Associates Inc. and are partners with Bernard Fox and

Gene Perla in Sound Designers Studio. Their unique talents as engineers, musicians and sound designers gave Dan Tramon the technical support he needed to find a device that would fit the bill of particulars needed for this job.

When the show first opened, the synthesizers being used were Prophet 5s. The electronic, surreal quality of the sounds fit well within the fantasy that is “Cats.” Five years later, in 1987 when the Prophet 5s were starting to

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The cast in a scene from "Cats."



Dan Tramon with
the Kurzweil K2000.

feel their age, the decision was made to transfer their sounds into the Casio FZ-1 series of synthesizers. These could not only sample any sound introduced to them but could create sounds internally by using a built-in waveform generator. Now, in 1992 a new device had to be found to take over for the Casio FZ-1s.

The Sound Designers Studio team went into high gear researching and testing possible candidates. They found that a new entry in the market place, the Kurzweil K2000 keyboard, had all the features they needed. It has a full sampler/audio processor with high quality, full bandwidth capabilities. Due to its expandable architecture (V.A.S.T.), it is compatible with samples from other manufacturers' libraries, can hold over 12 minutes of sampled sounds at full bandwidth and supports up to 64 megabytes of memory.

In the "Cats" orchestra there are three "chairs" for keyboards. Previously, each musician had two keyboards to play and operate. Each "sound effect" had a program number. The musician, while playing one keyboard, would be punching up a program number for the next sound on the other keyboard, manipulating volumes with separate foot pedals. With the K2000, each chair is now played from one multi-split keyboard, with each patch sequenced from one data pedal or one panel keystroke; there is no longer a need to punch in all those program numbers. One keyboard has 170 changes, another 140; the third has approximately 40 and includes an acoustic piano program.

With the helpful advice of David Caddick and Ed Robinson, the musical directors of the show, Dan was able to preserve many of the original Prophet 5 sounds and augment or improve others. In several cases, new sounds were created to further enhance the process, some layered with internal K2000 waveforms. The K2000 could read samples from the Akai S-1000, which has been used extensively by Sound Designers Studio for the creation of sound effects of numerous Broadway shows. It has an extensive array of internal processing features such as EQ, delays, reverbs and filters to add color to the sounds. The Prophet sounds used were copied to DAT and then transferred to the sampler where they were then edited and manipulated.

The next problem to overcome was the replacement of equipment. The K2000s were programmed outside of the theater and installed during a three hour period one afternoon. By curtain time that evening they had to be ready to perform. Young Chang America Inc., the parent of the Kurzweil line, has been very supportive during this whole process and has already supplied program updates. Tramon says, "The system is less cumbersome now (only one keyboard each for two of the chairs) and so much easier to operate that a substitute musician can come in cold and read the score immediately, simply hitting the data pedal at the appropriate time."

With all of its unique capabilities the K2000 just might outlive "Cats" in this new keyboard re-incarnation. ■

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Folklife Sound Tradition

*Thirty Events on Five Acres Require Ingenuity
and Intelligence for a New Tradition*

BY WENDY J. DUCH

Living history is kicking its heels up in East Lansing! Each year, the Festival of Michigan Folklife comes to the campus of Michigan State University (MSU) for two jam-packed weekends of traditional arts entertainment as a featured affiliate of the annual "MichiganFest! Festival of Festivals." Through efforts spearheaded by the MSU Museum Folk Arts division's Michigan Traditional Arts Program (MTAP), over one hundred musicians, artists, dancers, cooks, storytellers and assorted craftspersons are assembled on MSU's Landon Field to demonstrate skills representative of Michigan's regional, ethnic, occupational and religious groups. The 1992 folklife festival focused on minority groups directly affected by Columbus' discovery of the Americas: Latin, African and Native Americans. A regional Native American Pow Wow was premiered on a separate site. Thanks to the cooperative efforts of MSU's Native American faculty and staff, it looks as if this is to become an annual festival offering.

Wendy J. Duch is a freelance audio writer who has been involved in live sound reinforcement for the past 13 years. Duch currently resides in East Lansing, Michigan.

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© THE MICHIGAN STATE UNIVERSITY BOARD OF TRUSTEES.
Overview of main Folklife Festival site, 1990.

The life of a society is derived from the vitality of its traditions, inasmuch as those traditions are kept a living part of social practice. It is the sharing of these traditions with the general public that engender an acceptance of and an appreciation for the cultural differences of America's melting pot society. Sharing is what the MSU Museum is all about. When it comes to cultural documentation, cooperative effort is the name of the game. Con-

tracted Folk Arts consultants assist ethnomusicologists, folklorists, cultural anthropologists, historians and other subject specialists associated with MTAP to survey and document Michigan's living traditions. This research yields a deluge of field reports, taped interviews and photo graphs from which traditional artists are selected for exhibition. In addition to hosting the annual folklife festival, MSU Museum activities include spe-

cial traveling exhibits which are often accompanied by interactive multimedia computer presentations, as well as educational outreach programs and a multitude of special publications.

Festival co-designer Peter Holben Wehr also designs multimedia presentations. He got his start in museum work while pursuing a graduate degree in American Studies at MSU. He helped put himself through school by working as a stagehand for the International Alliance of Theatrical and Stage Employees (IATSE) Local 274. This background made him a natural choice to coordinate the technical end

We loaded two Ryder rental trucks full of stuff left over from the Smithsonian's festival and hauled it back to Michigan

of the folklife festivals. He serves to bridge the gap between academia and technical theater. As such, he often must translate the envisionment of scholars into something that will work. This involves compromise, which is not always an easy task.

Fellow Folk Arts staffer Chantel Cummings is in charge of archival documentation and collection services. She deals with mile after mile of magnetic tape on a routine basis, as it is collected by field workers throughout the year. Her festival duties include the coordination of several volunteer recordists, who are primarily employed as tape loggers.

David Vick is the proverbial jack-of-all-trades. He got his start in audio 12 years ago, running sound for what he politely calls "bar bands." He has been affiliated with IATSE Local 274 for the past eight years. The decision to become a union rigger was arrived at about seven years ago. It has served to put Vick in high demand. He



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Peter Wehr constructing stage for 1989 Festival of Michigan Folklife.

is a handy person to have around when dealing with circus big tops, or just about any other technical thing imaginable.

The following interview was conducted a few weeks after the 1992 Festival of Michigan Folklife. Having put the '92 festival to bed, the participants were busy at work with plans for '93.

Sound & Communications: How did the folklife festival get its start?

Wehr: It started in 1987 as a spin-off of the Smithsonian's Festival of American Folklife [which is held annually on the National Mall in Washington, D.C.]. That year, Michigan was their featured state. Part of the way we obtained funding [for a similar festival, to be held in Michigan] was that we would take the Smithsonian's presentation and bring it back to Michigan as part of our state's sesquicentennial celebration — The Michigan Festival. [The folklife festival] was thought of from the beginning as an integral part of this larger celebration.

Sound & Communications: Was it originally planned to become an annual event?

Wehr: We had the idea in the back of our minds, but weren't totally sure. We didn't have a lot of experience with festivals. We loaded two Ryder rental trucks full of stuff left over from the Smithsonian's festival and hauled it back to Michigan to restage the event. It was real successful, so at that point

we decided to pursue it as an annual event.

Sound & Communications: You have obviously acquired an impressive amount of equipment since 1987. What criteria have you based your equipment purchases upon?

Wehr: We have what Dave [Vick] and I refer to as our rules of two and four. If we can buy something for twice as much as it costs to rent it for a year, we don't even think about it — we buy it. If it's something we can recoup in four years, we will still generally buy it, although we'll think about it first.

Sound & Communications: How has this influenced your cash flow?

Wehr: It allows us to spend more money on material culture presentations. We also do more elaborate stagings of various participant areas, to make it look more natural. It's hard to take someone who does a craft in their basement, stick them in the middle of a tent and make it look like that's what they really do.

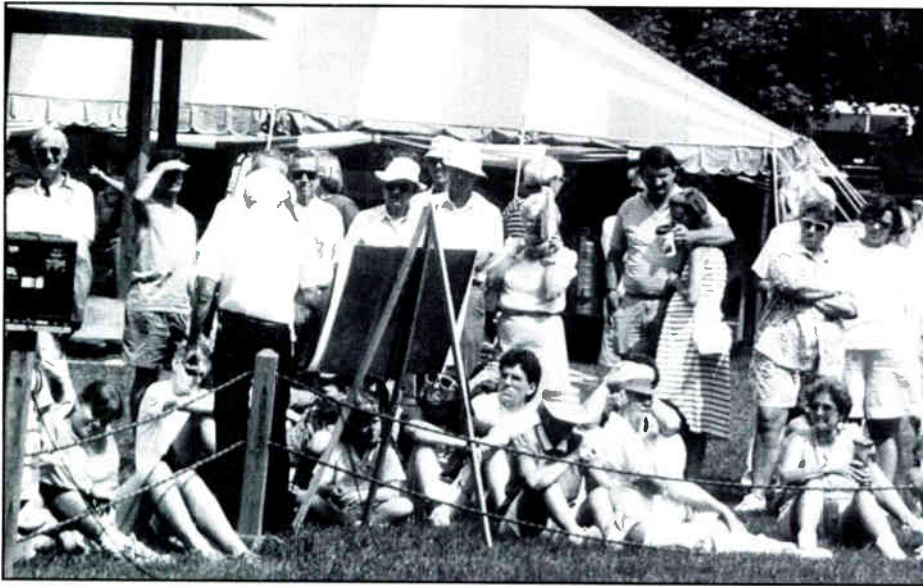
Sound & Communications: What type of equipment have you invested your purchasing funds in?

Wehr: In terms of audio equipment, we started with things which would allow us to do our fieldwork.

Vick: We like the Sony TCD-5M analog deck. If we had the money, we'd like to get our hands on a TCD-10 ProDAT deck. Instead, we'll probably go with a DAP-20 from Tascam. Or we'll pick up a few more analog decks. In addition to using the TCD-5M stereo decks, we also use TCM-5000 mono decks for field recording.

Wehr: The festival is a research-based animal. We send a crew of scholars out to find people who are practicing traditional arts compatible with whatever that year's theme is to be. They start by recording conversations or music, and by taking photographs.

Most of our field workers have their own 35mm cameras. That's something I've never figured out, why they feel compelled to spend a lot of money on



1991 Logging Diarama from a presenter's perspective. Jack Nordine using a single microphone to feed six battery-powered Peavey Solos daisy-chained to work in tandem.

photography equipment and insist that we furnish them with tape decks. It's a mystery to me.

Cummings: We don't own a lot of photographic equipment, because we hire professional photographers. Our field workers do their own kind of photography, which is seldom very good. Now they're starting to hire [profes-

sional] photographers to do their field work for them. Some of these [professionals] have become people we now hire regularly for festival photography.

Sound & Communications: So you bought tape decks instead.

Wehr: That was the most immediate need. We concentrated on buying field recorders and microphones. We also

kept in mind that microphones are useful for reinforcement as well as for recording. Some of our choices were biased in favor of equipment that could obviously be used in both arenas.

Vick: We'll generally send a portable deck out with an SM-57 or SM-58, depending on what they're going to record. We also use Crown Sound-grabbers. We're buying a *bunch* more SM-57s and 58s.

Sound & Communications: They're cheaper by the dozen!

Wehr: We [also] quietly started acquiring equipment for our smaller stages and smaller venues. We don't ever intend to handle the equipment needs of our larger stages, but our smaller [performance] stages and narrative stages are all pretty much done with our own in-house equipment.

Vick: For the past two years, our

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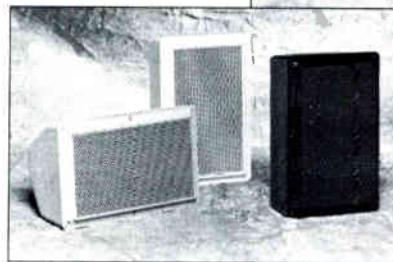
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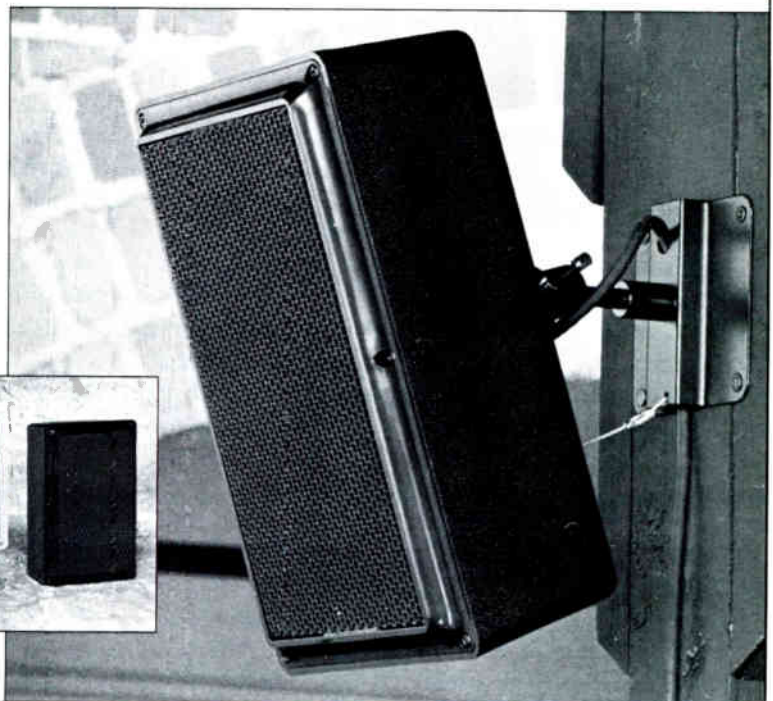
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contracted sound company has been MacPherson Loudspeakers, from right here in Lansing. I can't say enough good stuff about Dave [MacPherson], his people and his equipment. From Day 1, he was really hip to what we were trying to convey. He was especially into the concept of doing sound-in-the-round for the [Native American] Pow Wow.

Sound & Communications: Have you done much with video?

Cummings: We did a bit more with videotaping this year than we have in the past, primarily because we had a lot of food demonstrations — which are difficult to document well using strictly audio or still photography. Also, we've started doing more with video since we bought our own camera.

Sound & Communications: What did

you buy?

Wehr: A Sony Hi-8.

Vick: It's a Sony CCD-220V. We bought it because it's got digital audio processing capabilities. We saw DAT coming down the pipe and thought it would be good to be able to use digital audio in conjunction with video. We also do a lot of computer development in this office. The medium lends itself well to that.

Sound & Communications: Computer development?

Wehr: Yes. We do a lot with interactive multimedia in conjunction with museum exhibits. Sometimes we'll just take the raw field recording, match it to still images or even use Quicktime video images on a Mac, and play it back to try to re create a sense of the artist in exhibit. If you don't have the artist's point of view, something is lost.

What is more exciting is that we can use the computer to simulate museum exhibits. We're working with it as an outreach tool for the schools. The [MSU] Museum's Education division has come up with a computer simulation of the whole museum, using a combination of Hypermedia and a realtime walkthrough computer program.

Sound & Communications: How will this be used?

Wehr: In the past, teachers have tended to book museum tours at the end of the [school] year, when they're exhausted. No one gets much out of the experience.

This way, teachers will know what the museum is like before they get there. They can adapt class periods both before and after their visit and integrate the experience more fully

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The Newsday corporate offices and printing plant are in a large building in Melville, N.Y. It contains the largest color offset operation in the country with ten printing presses. While they operate at the highest efficiency, the collation and inserting operations could not be stopped quickly when problems were encountered. The insert machines could not be turned off resulting in improperly collated newspapers.

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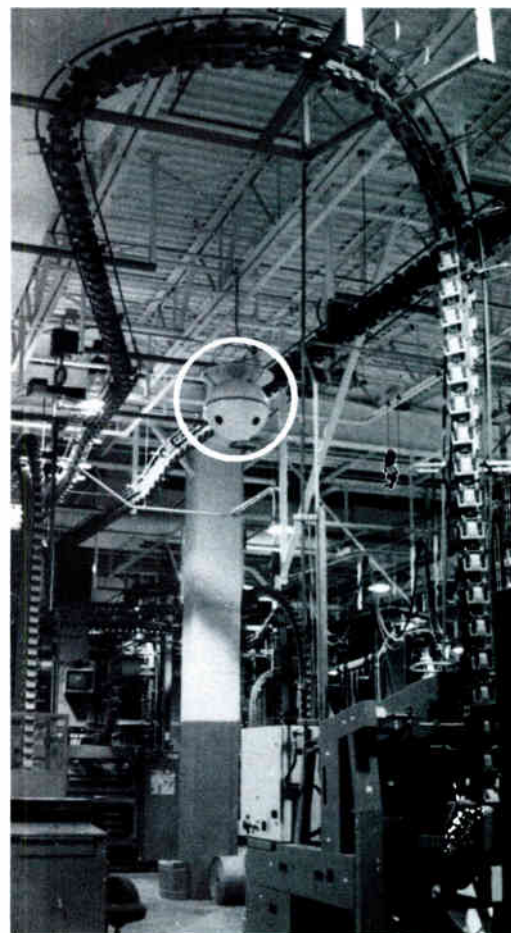
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into their normal work. We've done enough field testing to be convinced that it's worthwhile.

Sound & Communications: Sounds wonderful!

Wehr: We've also been approached by the Thai government to help them integrate multimedia into their cultural affairs. It's a multi-ethnic country. In a lot of ways, they have the same interpretive problems that we have, and are interested in using interactive multimedia to help present traditions of the many Thai cultures when in exhibit.

Another big project we will be using multimedia for is an exhibit on Ethiopia. We'll be sending documentation crews over there and hopefully, given the funding, do various computer components for that. We might also do a festival unit on Ethiopia. As they say in the computer business, it's fun being on the bloody edge!

Sound & Communications: What is involved in designing a folklife festival?

Wehr: The festival is strange, because you're designing as many as 30 theater-type events, all happening simultaneously on one small plot of land.

Vick: It should be noted that the festival takes place on a five-acre field at the north end of MSU's campus. We are surrounded by lovely acoustic surfaces such as brick-walled buildings. When we design the festival, we have to consider what types of noise we'll have to deal with and focus various sound-producing areas so that their wash isn't going to interfere with adjoining space.

Wehr: Once you've committed yourself to "x" number of stages, you've got to place them in such a way that they don't sonically compete. Then, we ask ourselves how this optimum stage layout will work with traffic flow, presentation flow, or any of a number of things that might go on. Sometimes you just can't come up with an ideal acoustical placement. It wouldn't make any thematic sense. So you make com-

promises and hope it all works out. You never know...

Vick: We're slaves to the weather. What works on a sunny day when we have 30-40,000 people absolutely does not work on a rainy day when there are no bodies around to absorb the sound. It's a balancing act.

Sound & Communications: I hear you had to put up quite a few stages for the 1992 festival. How many were there?

Vick: Depending on how you define things, we had a total of five performance platforms [on the main site. An additional performance area was set up on a separate site for the Native American Pow Wow.] Stage 1 featured Latino programming. There were 32 channels on the system. I don't know how much power MacPherson was running through the mains, but it

We also didn't anticipate the quality of the musicians. They drew much, much more heavily than we had thought they would.

was a very loud, very efficient system that pretty much had its way with everybody!

Wehr: Well, it was pretty predictable that it was going to be loud.

Vick: Stage 2, at the opposite end of the field, was dedicated to African American programming. The first weekend, it ran African diaspora genres — String music, Gospel, Rap...

Sound & Communications: Rap?

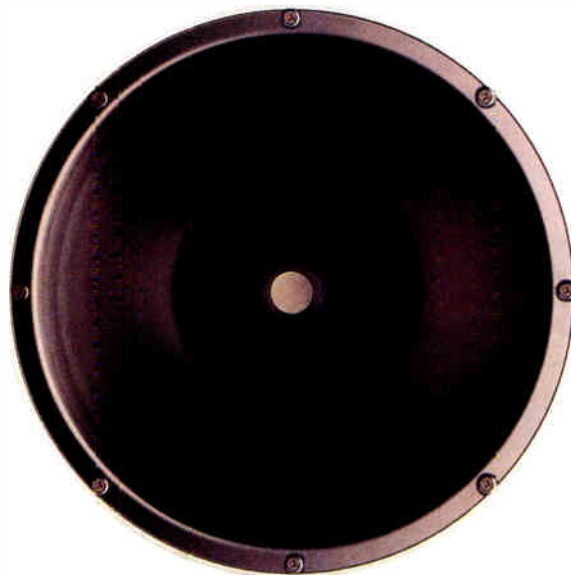
Wehr: The decision to include Rap drew criticism from purists. It's not as if Rap per se has been around long enough yet to be called a tradition, but it embodies a lot of other African American traditions and is seen as their continuation. It worked — it was

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popular.

Wehr: The second weekend was devoted to a variety of Detroit-based Blues artists.

Vick: Stage 3 was the Native American performance area, which was unfortunately about 50 yards too close to Stage 2. But what can you do [with five stages] on five acres?

Wehr: The sound design for the Native American Stage was quite straightforward; the actual stage was not. It was a drum arbor, the structure that Pow Wow drummers sit under. Most Native American presentational genres are done in the round. To simplify things, we cut the sonic circle in half, with the stage facing south. Still, we had a wide . . .

Vick: . . . dispersion area to cover.

Wehr: We also didn't anticipate the

quality of the musicians. They drew much, much more heavily than we had thought they would.

Sound & Communications: Did it create problems?

Wehr: All sorts of problems are caused by using a traditional architectural form to present a natural performance setting. It's much easier to control what's going on under a tent than it is under a pole structure [whose roof is] covered with cedar boughs, while the whole roof is swaying (he chuckles at this) in the breeze. That was interesting!

Sound & Communications: And moving right along . . .

Vick: The fourth stage was our Narrative Stage, where groups of participants from all over the site would be asked to come and explain who they



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Dave Vick logging a videotape at GospelFest 1991.

are, what they do, *why* they do what they do, and why they do what they do the *way* they do it. It's primarily a documentation tool, but it's kinda cool.

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cooking tent. Basically, we present culinary arts from different cultures under a tent. You set up the [sound] system, give lavaliers to the participants so they can cook with both hands and still be heard, and hope that nobody drops an ECM-66 into their Ragu.

Wehr: It comes off looking a lot like a TV cooking show, except they're cooking Menudo, or

Wehr/Vick: (in unison) Barbacoa(!),

Wehr: or Muskrat . . .

Cummings: There were also people with wandering microphones, making noise with little portable amplifiers.

Wehr: They were minor. Not minor in importance, but minor in the amount of gear they take.

Vick: Our "sound on a stick." We've taken a small, battery-powered instrument amplifier — in our case, a Peavey Solo — and plugged in an SM-58 or [more commonly] some Radio Shack mike, handed it to presenters and off they go to do their special demonstration. We use that particular genre of reinforcement because it has a very wide dispersion pattern — you can cover 180 degrees — but it's very limited in its depth of coverage, only going five-six people back. It makes it possible to have two special demonstrations within 50-70 feet of each other without either one having too great an impact on the other.

Sound & Communications: Have you ever gotten experimental with them?

Vick: Yes, we have. The theme for our 1991 festival was logging. We took half of the site and made a diorama out of it. We devised a timeline: from standing timber, to the logging industry, to skidding trees to the mill, to taking milled lumber to the carpenters to be made into whatever — in our case, a lawn table and a gazebo. We wound up using six Peavey Solos wired in parallel at various strategic points along the timeline, with one mike feeding the whole thing. What we came to refer to as "the long gray line" could cover an awful lot of linear

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space, but didn't interfere with presentation activities at the other end of the timeline 100 feet away. It was a really cool thing. An experiment that worked very, very well.

Wehr: We could have accomplished the same thing with a more conventional sound system, but really didn't want to risk more expensive equipment under falling logs!

Sound & Communications: Tell me about the Pow Wow.

Wehr: Well, if you've never been to one, it's a little hard to describe. Basically, you have this [open-sided] pole structure constructed in the middle of a big, open circle. The structure is called an arbor; some people call it a ramada. It's a multi-sided circular log structure topped by a roof covered with cedar boughs. The dance area is

fairly large. The sound has to travel up and over the dancers, finally hitting the audience 120 feet away. There is really only one sound source — the active drum. The singers/drummers in the group all face toward the middle

Located 18-24 inches above the drum, [the SM-58] gives a fairly balanced image.

of the drum. All you can do is try to keep things simplified.

Sound & Communications: How was the drum group miked?

Vick: [MacPherson] hung an SM-81 from the roof to pick up ambient sound. Then there was an SM-58 on a

boom off to one side of the active drum, pointed up toward the roof. It was positioned in the middle of the drum, with the boom situated in some unobtrusive spot. The mike was there primarily to pick up the voices [of the singers], although a fairly hefty drum image tends to come through the backdoor of the 58. Located 18-24 inches above the drum, [the SM-58] gives a fairly balanced image.

Sound & Communications: What about loudspeakers?

Wehr: [MacPherson] put M2s at the four cardinal points of the arbor. That was not a complete solution in and of itself. So he used M4s to fill in the dead spots. When the system was fired up, you could walk around the entire circle and there wasn't a seam to be heard. It worked out well. [Mac-

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Mighty Low Riders, Mexican-American conjunto on Stage 1, 1991 festival.

Sound & Communications: So the Pow Wow was a success?

Wehr: It's always interesting to do something like this. The people whose culture is being represented tend to assume that [their traditions] are common knowledge. They've grown up with it, and don't realize how ignorant most people in mainstream society are about everybody else's cultures! The Native Americans, in particular, were very flattered. They enjoyed the opportunity to present their traditions. Yes,

the Pow Wow was a real success. We're going to do it again.

Sound & Communications: Okay! So we've got this huge festival with all of these events going on at the same time. Everything needs to be documented and archived. Where do you begin?

Cummings: Well, first we have to get a schedule. Then — well, [in 1992] it was the three of us who sat down and . . .

Vick: . . .after a couple of margaritas . . .

Cummings: . . .decided what we thought really, absolutely, positively *had* to be taped. In the past, we've taped absolutely everything. It's not really useful to have 40 copies of [repeats of] the same performance. And when it comes to cooking demonstrations, it's not useful to have an audio tape of food preparation when you

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1992 Native American Pow Wow Site. MacPherson M-2 and M-4 loudspeakers are suspended around the perimeter of the drum arbor.

have to see . . .

Wehr: . . . what they're talking about.

Sound & Communications: There are some out there who might debate the issue, claiming that no two live performances are ever the same.

Wehr: Well, there *is* that! I mean, the natural inclination is to capture every possible moment. The flipside of that is not so much the actual recording aspects, but the amount of time it takes to process everything once we get the tapes back. Someone has to log all of those tapes, enter them into the computer. It's just a lot of work.

Sound & Communications: What can you tell me about the recording aspects?

Wehr: We generally take a two-track tap off of the mixer. Sometimes it works well. Normally, if we were in a one stage setting, we'd use our SASS-P system or some other stereo miking technique. But there is so much ambient noise during the festival that those sorts of things just don't work. So we use two-track line taps. It will work better for some things than others. The Latino stuff, for instance, with all of the horns and percussion barely going through the system at all, just doesn't sound right.

Sound & Communications: But I imagine it works well for dialog.

Wehr: Well, yes. Which isn't what anyone wants. Everyone wants the music. And you have to spend a lot of time doing postproduction [processing] to it. We're getting there, but aren't really set up to do that yet.

Sound & Communications: Do you

make voice transcriptions of your dialog tapes?

Cummings: We're starting to do more of that, yes. It's expensive. We have students do it. We have to do a lot of this type of thing using student labor.

Wehr: We're keeping an eye on all of the voice recognition work being done with computers, most notably developments at Apple. We're hoping we'll get to the point where we can use the computer to do the transcriptions for us! Right now, it's exceedingly labor intensive. I can't imagine the computer making any more errors than human transcribers.

Sound & Communications: How are archival tapes processed?

Cummings: When the festival is over, I collect all of the tapes and bring them back to the office. Then it takes me about three weeks to access all of the material, write up a basic index for each tape and, ideally from there, duplicate them for transcription.

Sound & Communications: How does your operation compare with the Smithsonian?

Wehr: The Smithsonian has a little more money for documentation than we do. Legend has it that they used to have two boards at each [performance] stage and split the [line-level] feed between them. But the recording engineer started arguing with the house engineer about microphone placement so much that they finally did away with the recording engineer altogether. Now they do a lot more with two-track line taps. They've really

upgraded their field equipment. So, they're getting better! When their field workers are in the field, they're getting production-quality stuff. They aren't relying on festival documentation. This is the direction we want to head in. It's a lot more sensible.

Sound & Communications: It sounds like you've learned a lot working with them.

Wehr: We maintain a fairly close relationship with the Smithsonian. Several of us actually work on both festivals throughout the course of the year. Sure we've learned a lot from them, but using the little [battery-powered] amplifiers on the National Mall was our contribution. I frequently get last-minute phone calls to borrow them.

Sound & Communications: Do you do much equipment-sharing with them?

We're trying to help communities document their own cultures by providing advice, equipment loans, and helping communities set up archival structures for their own use.

Wehr: Some. Mostly microphones. They have an excellent microphone locker. You really have to see it to believe it. We've also borrowed several engineers from them over the years. [In 1992] we only borrowed one. I shouldn't say "borrow" — we paid him! When we met him at the airport, he had half of their microphone locker, a mixer, and a couple of amps stashed away.

Sound & Communications: And you return the favor.

Wehr: And we return the favor. More importantly, though, we have the tal-

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ent going back and forth. So the technical development of the two festivals is comparable. When one of us makes a major breakthrough somewhere, the others snarf up the idea real quickly!

Sound & Communications: So where does it all go from here?

Wehr: We're getting more personally involved with community structures.

We're trying to help communities record their own traditions. In the past, academics have imposed themselves on the traditions — running in to do all of the recordings. Most [museums] think of themselves as being the repository of knowledge, instead of the living cultures themselves. We're trying to help communities document

their own cultures by providing advice, equipment loans, and helping communities set up archival structures for their own use. In this respect, museums and other archival-type institutions might not be needed anymore.

Sound & Communications: How is the '93 festival shaping up?

Vick: The site map was roughed in two-three months ago.

Depending on who you talk with, it was a success or it was a nightmare.

Wehr: Yeah, but that will get heavily altered.

Vick: Yup. As we know who's coming, we'll change where they're going to be and figure out our technical needs from there.

Wehr: Then we'll start costing everything out. You can get a feel for what things are going to cost by what the theme is. This year, we have a lot more flux in the budget than last year. We'll try to encourage some sort of material culture extravaganza. It doesn't look like we'll be doing as much music as we did [in 1992]. [The 1992] festival was a compromise.

Sound & Communications: A compromise?

Wehr: Pretty much all of the people on the technical end had grave reservations about whether we had enough acreage to accommodate the number of sound platforms that we wound up with. Depending on who you talk with, it was a success or it was a nightmare.

Vick: It was a successful nightmare.

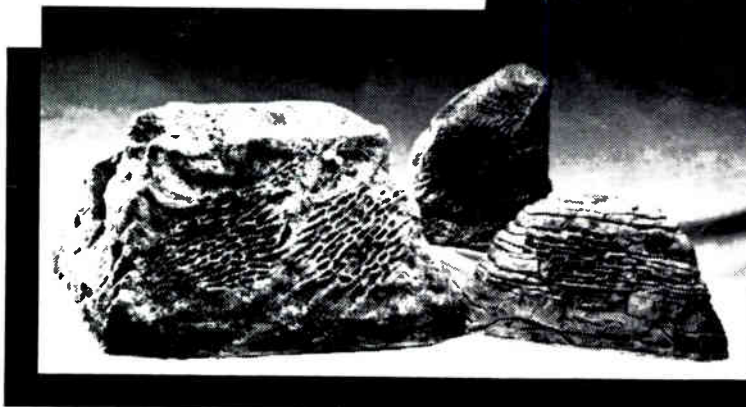
Sound & Communications: What advice do you have for others who are involved in productions of this nature?

Wehr: The biggest philosophy is to put your money into capital goods and not into disposable items when you're first starting up. You'll save more in the long run and be able to do more every year.

Vick: That, and it helps to have a superb grants writer or two around! ■

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The Future of Silence

Active Noise Cancellation and the Professional Sound Contractor

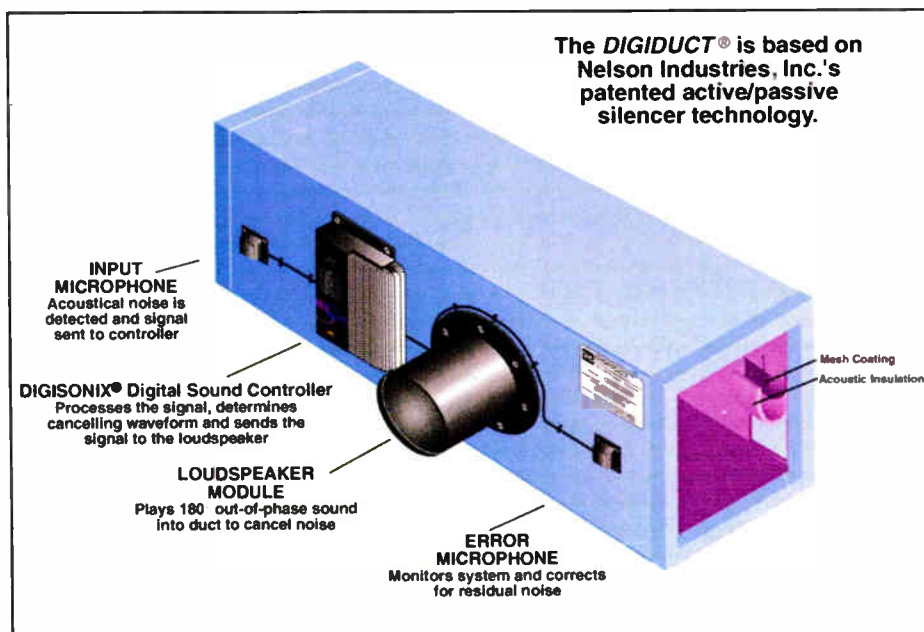
BY DANIEL SWEENEY

In years past, noise control devices never generated much excitement in our industry. The egg crate foam slabs and cumbersome fiberglass panels that were the principal products of the noise control industry were regarded at best as necessary evils — expensive eyesores reluctantly employed as palliatives in bad rooms and noisy environments. And the companies that supplied the stuff were equally humdrum, and were certainly never going to be covered in Megatrends. All in all, it was a staid, boring, low tech business.

Then, from seemingly out of nowhere, came active noise control, which might just as well be termed activist noise control. Instead of sheet metal benders and fiberglass stuffers, you suddenly get guys in lab coats wearing Phi Beta Kappa rings and rattling on about parallel processing and recursive filter functions. What is happening, and what does it all mean?

In fact active noise control, in most of its current manifestations, represents a special use of digital signal

Daniel Sweeney is a freelance writer living in Burbank, California.



Digisonix, currently sells active duct silencers including the Digiduct.

processing, and promises ultimately to have as large an effect upon room acoustics as digital processing is already having on loudspeaker design and deployment. It is a segment of the audio industry undergoing very rapid expansion and technological change, and the products under development by this segment of the industry promise to change the way contractors perform installations.

WHENCE IT CAME

Most people in sound contracting have a general understanding of the principle behind active noise control — which is simply addressing the offending sound with anti-noise, that is, phase reversed sounds that are the mirror images of the sounds to be suppressed. And it's not a terribly new idea. The first patents for the use of destructive interference as a noise

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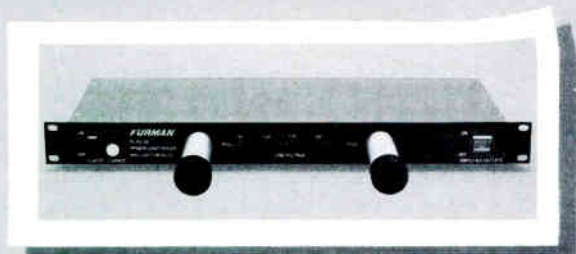
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suppressing technique date back to the nineteen thirties, and various researchers — mostly academic — have been experimenting with the technique ever since.

Unfortunately, until just a few years ago, active noise control never went much beyond the experimental state. By the late eighties the concept was being publicized in the popular press, but on the professional level nothing was available. You simply couldn't buy a noise cancellation device for any application. Recently, however, due primarily to advances in digital signal processing, the still tiny active noise control industry has begun to go beyond the laboratory and address the marketplace with real commercial items. There's still a lot more promise than product, but several practical implementations of the technology are already in production, and many more are in the planning stage.

THE PROMISE AND THE PRODUCTS

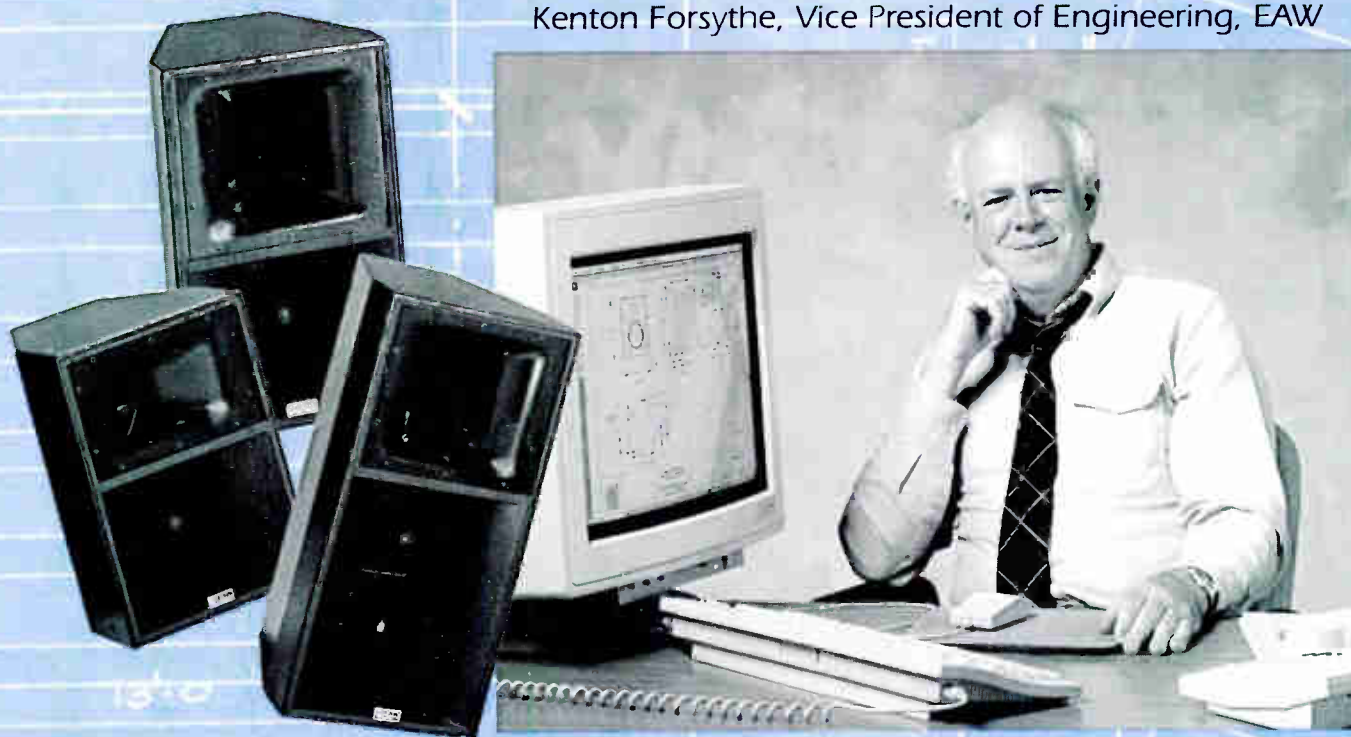
Current practical applications of active noise control are only three in number, all of which have direct relevance to audio professionals.

The first of these is climate control system duct silencing. This is one of the first areas investigated by engineers in the field of active noise cancellation, and it was the first area where a major technological breakthrough was achieved. One company, Digisonix, currently sells active duct silencers, and the Digisonix product has already been on the market for several years.

The second application is the noise cancelling head set which is currently sold by Bose, Sennheiser, David Clark, Telex, and NCT (Noise Cancellation Technologies) and soon to be introduced by AVMT (Active Noise and Vibration Technologies). Basically an alternative to passive ear protectors, the noise cancelling headphone is to be preferred to earplugs or ear muffs insofar as it can simultaneously used

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for two-way communication, and because of its effectiveness in the region below 500 Hz, and its ability to be designed to operate only at low frequencies, thus allowing the user to hear conversation. Most of the noise cancellation headsets currently on the market are aimed at the aviation industry and have no direct relevance for sound contractors and music industry professionals yet. NCT, a relative newcomer in the business, does however make a model for use by MRI patients, coincidentally the world's only true digital noise cancelling headset, and priced at a cool \$25K.

The third current application of noise cancellation technology is the suppression of room modes and early reflections in a control room environment. This application is currently represented

in a single product, the AEC 1000 processor by Cambridge Signal Technologies.

Future applications promise to be much more comprehensive. Active cancellation systems could be used to silence whole rooms, thus eliminating the need for massive construction techniques in noise controlled environments. Furthermore, active noise cancellation devices don't care about flanking paths or air seals at doors and windows. In fact active noise control can be performed effectively in a completely open environment with no walls at all. One is almost reminded of the force field shields in old science fiction movies.

Active noise control techniques can also be used to silence noisy machinery at the source. Structure borne vi-

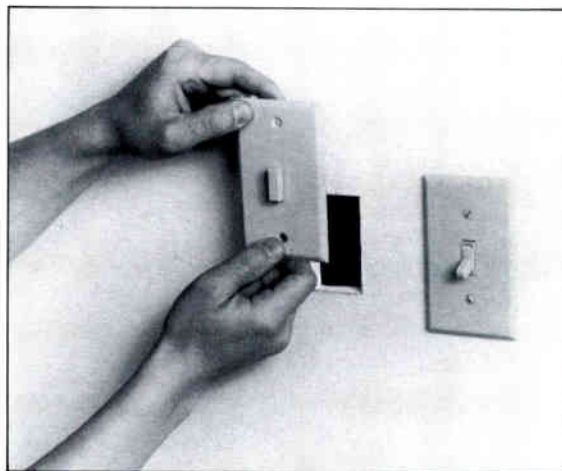
bration can be attacked as well as airborne noise, and in time active noise control enclosures may be common items on many types of motorized heavy equipment. Conceivably, the technology could even be used to squelch cabinet talk in loudspeakers or isolate microphone stands.

Furthermore, the technique could be used to shape the acoustical environment as well as just reducing unwanted background noise. Reflections off wall surfaces could be cancelled for improved intelligibility or for the effective alteration of loudspeaker directivity patterns. One could even envision a system that would cancel a sequence of reflections selectively so that the signature of the room was made to resemble a larger or smaller space. Or cancellation could be made frequency

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dependent to tame excessively bright rooms.

THE PROBLEMS

If active noise cancellation is — as it appears — such a brilliantly simple means of dealing with noise in the environment, why has it been such a long time in coming? Why are we still hanging up foam?

In the case of the noise cancelling headphone, which, except for the NCT example, uses fairly simple analog circuitry, the rather belated appearance of product is somewhat puzzling, but in the case of more ambitious schemes the answer is simple. In the real world, the cure posited by the active cancellation approach — namely the noise cancelling loudspeaker or actuator — has always proven worse than the dis-

ease, at least until very recently. And this problem bears examination:

On the most elementary theoretical level, noise cancellation is embarrassingly simple. You mike the offending noise, phase reverse the mic signal, feed it to a loudspeaker, and zap the noise with destructive interference. What could be easier?

But a little reflection on the matter will compel you to acknowledge several very considerable difficulties in implementing the scheme. Loudspeakers, it turns out, have two major liabilities insofar as the active noise cancellation engineer is concerned.

First of all, their rise and settling times as well as the transit times through the loudspeaker's circuitry are relatively very slow. If the loudspeaker is used to deal with a random

or impulsive noise, the matter is almost hopeless at frequencies over 1 kHz. The speaker simply can't respond fast enough to do any good.

This first problem appears to be fundamental, and except in cases where the noise is of a known and determinate character, it can't be overcome. For this reason active noise control as a practical solution tends to be confined to the lower frequencies.

The second problem is no less obvious to the observant. Loudspeakers, for the most part, are omnidirectional in the lower frequencies, precisely the range where they are going to be used in an active noise control system. That means the system is going to feed back at the microphone — if a microphone is used to sample the noise, which isn't always the case.



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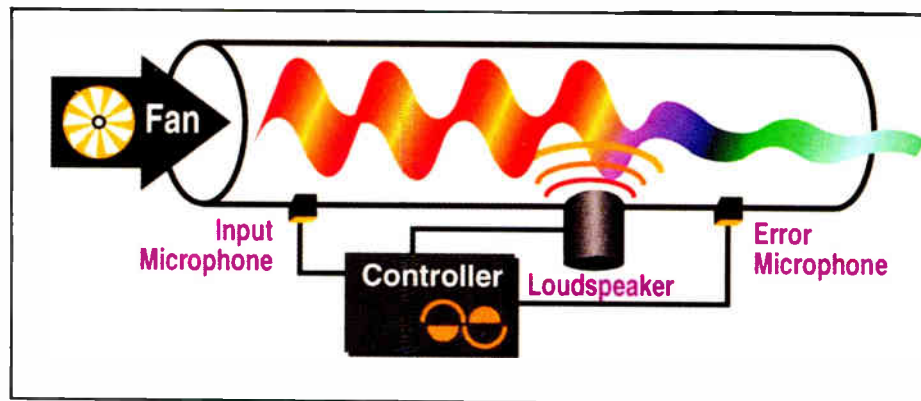
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The real solutions to these problems awaited the development of cost effective DSP modules and the completion of a great deal of modelling and theoretical work by the principal researchers in the field. The problems proved highly resistant to easy solutions, but relatively early on researchers were able to outline a general strategy for DSP based noise cancellation. Basically the signal processor must generate an antiphase signal that works upon the noise that the system is intended to suppress, and then it must process that antiphase signal such that changes in both the noise and the antinoise signal are predicted in the time the system takes to process and transmit the antinoise signal through the cancellation loudspeaker. Such processing is only feasible in the digital domain, and practically requires FFT analysis and adaptive filters. Developing an effective processor was principally a matter of determining the correct filter function to utilize, although that one task entailed years of investigation on the part of the handful of research teams attacking the problem in the seventies and early eighties.

Several different algorithms have been devised for the purpose of noise cancellation, and a discussion of their respective merits and liabilities is too involved for inclusion here. Surely more will follow in the next few years. At the same time, two basic hardware approaches have been developed for producing an accurate antinoise signal. Both hardware implementations are designed to track changes in the waveforms of the noise over time, as well as distortions to the antinoise signal in the course of its passage through the system, but in the details of their respective operations, the two approaches diverge considerably.

The first approach is only feasible with repetitive noise of a highly regular and determinate harmonic structure, such as engine noise. Engines, quite providentially, tend to emit very



A schematic of Digisonix' Digiduct system.

uniform patterns of noise regardless of engine speed or loading, and so a very accurate model of the noise can be programmed into the processor. A simple sensor such as a tachometer can register a key independent variable on which all other variables will be dependent, and the shape of the noise can be predicted on the basis of just that single variable. Thus no microphone and no complex multichannel processing need be employed to develop the anti-noise signal. All that is required besides the main sensor is a feedback microphone in the cancellation zone which will register offsets and provide the basis for final correction. This approach forms the basis for the design of electronic mufflers where loudspeakers cancel out the low frequency engine noise passing through the muffler, and the same approach has been found to work with certain kinds of ventilation systems where the fan produces a sine wave output rather than broadband noise.

Random noise presents a much greater challenge both because the processor must perform significantly more analysis, and because the problem of feedback becomes critical. Essentially a noise cancellation system addressing random noise must sample the noise with a microphone continuously at one point in space, derive an appropriate antiphase signal from the microphone feed, and then produce the antinoise at another point in space whose distance is at least as far from the point where the noise is sensed as sound will travel in the time required for the generation of the antinoise. In essence correction takes place within a feedforward system. In addition, a

second microphone will be required at the point of cancellation to register offsets and permit the generation of a second feedback correction signal. Because the loudspeaker output inevitably feeds back to the first microphone, the setup introduces a problem not present in the first approach, and one not susceptible to any easy solution.

As a practical consequence, random noise cancelling systems have to be able to analyze both the noise itself, and the output of the cancellation loudspeaker. Now this may not seem like a terribly tall order, but if we look at the example of duct noise, which, compared to some other noise sources, represents a reasonably distinct and predictable phenomenon occurring in a limited and well defined space, we begin to appreciate the magnitude of the problems which faced the pioneering researchers of a decade ago.

First of all, due to the transit time through the total system — microphone, signal processor, power amplifier, and loudspeaker — several milliseconds are required for the noise cancellation system to generate a corrective antinoise output. Even in the case of low frequency random noise, that's not nearly fast enough if sensing and cancellation are going to occur at the same point.

Of course in a duct you have one way of getting around the problem. Since the plane wave representing the noise is essentially confined to the duct for several feet or yards, you can position the cancellation loudspeaker at the mouth of the duct and cancel the noise wave just as it is emerging. As long as the path through the duct is at



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least four feet, a system utilizing modern high speed processors will have time in which to work.

By this simple tactic the irreducible lag in the system can be accommodated, but several additional problems must still be overcome in order for the system to work reliably.

First the behavior of the plane wave in propagating itself must be accurately modelled. The initial characteristics of the noise at the sampling microphone are apt to be modified as the wave propagates down the duct due to heat, turbulent effects, and the resonant properties of the duct itself, and the processor needs to be able to predict what is going to happen en route. The best way of constructing such a model is to program an adaptive filter function into the DSP unit, and equip

the system with a second microphone near the cancellation loudspeaker.

In addition, the noise sampling microphone must be able to reject the contribution of the loudspeaker and measure only the duct noise, and designing such a feedback-proof system proved especially difficult. The first proposed solution to the feedback dilemma was to arrange a series of loudspeakers in a phased array such that the loudspeaker cluster became highly directional, and so that less of the correction signal leaked back to the microphone. The idea was appealing in theory, but apart from the cost of using multiple transducers, the isolation afforded to the microphone was never sufficiently high to prevent feedback, since the microphone was still subject to structure borne feedback in the low

frequencies. The real solution was much more complex, requiring a second computer model which would fully characterize the output of the loudspeaker and subtract it from the data being analyzed in the processor.

The same basic techniques for random noise cancellation may be used in other fairly well defined, self-contained systems such as vibrating panels and walls, though even in the case of vibration damping, the complexity of the cancellation system required may exceed that for duct silencing by orders of magnitude. Typically real physical objects exhibit complex vibratory modes with many strong, localized resonances which must be sensed and addressed individually. That tends to require multichannel processing.

The complexity will increase still

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further if appreciable crosstalk exists between or among channels, or if actuator outputs create significant noise throughout the vibrating system. In such cases the multiple interacting variables can make terrific demands on the processor.

But perhaps the knottiest problems lie in the area of whole room silencing, arguably the biggest challenge facing the active noise control industry today. In order to silence a room, obviously microphones must be distributed in many places in the room, as must cancellation loudspeakers. Unfortunately when many cancellation loudspeakers are used simultaneously, the noise problems in the system become nearly overwhelming. Unlike the case of a duct where the disturbance itself issues primarily from the mouth of the

duct, and the cancellation loudspeaker's own output can be confined to the duct itself, in a whole room silencing situation, hundreds or thousands of cubic feet must be blanketed with antinoise, and the cancellation loudspeakers themselves become contributors to the noise, since a cancellation signal will only achieve a null within a limited space, and elsewhere in the room the wavetrain will beget all manner of reflections and ambient noise. As one wag in the industry put it, "It's like an octopus conducting a boxing match with itself."

But can whole room silencing really be done at all?

"We think it's years away, and that it may require parallel processing," relates Digisonix's marketing manager, Stephen Weiss. Others are more

sanguine, however. Both NCT and AVMT claim to have developed prototype systems which are purportedly capable of silencing the cabin of an airplane. The NCT system, which the company has described in some detail in a promotional video, actually creates multiple small zones of silence confined to the spaces occupied by seated passengers, and may not fit the strict definition of whole room silencing, since outside of these nodal areas the cabin remains noisy. Of course it must be kept in mind that the noise in an aircraft cabin is repetitive in nature, and thus the antinoise output can be synthesized based on an internal model without the need of sampling the noise directly. That's a very different situation from trying to silence a studio control room in an urban envi-

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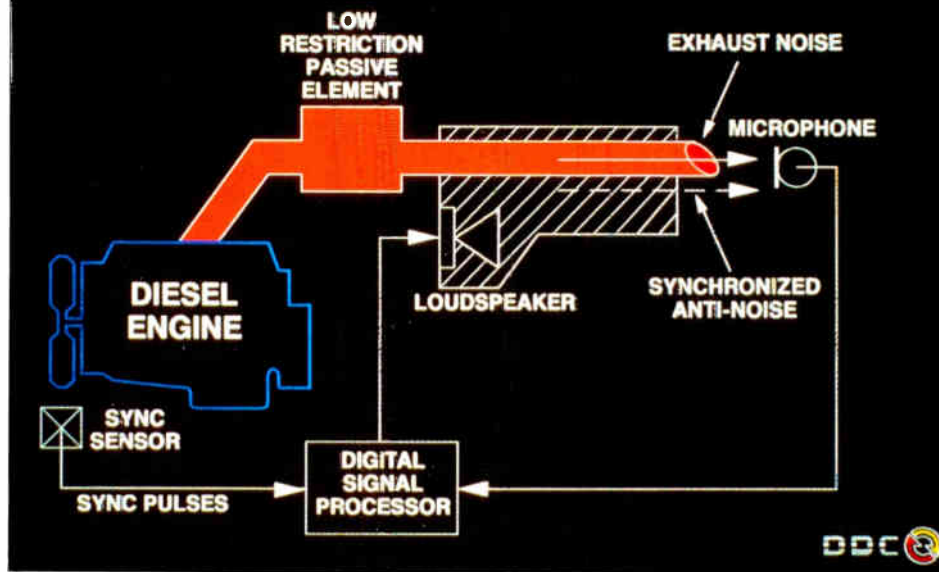
Digisonix's duct silencing systems are already in use in an estimated 50 recording studios throughout North America, and could be used in concert halls and theaters where HVAC noise is a problem, though at around \$10K the system is very expensive. In the future, however, the cost of such equipment is likely to descend so that the contractor can begin to specify it for clients with tight budgets.

Noise cancellation headsets have been sold for a number of years by Bose, Sennheiser, Telex, and David Clark. Existing product has relatively little application in the sound contracting field, and is more aimed at the industrial noise control market. In the coming year that will change because Telex, AVMT and NCT all have plans for introducing headsets which will permit an engineer or musician to hear



Noise cancelling headsets are manufactured by companies including Noise Cancellation Technologies, Inc.

SCHEMATIC - ACTIVE MUFFLER SYSTEM



A schematic of an active muffler system from Noise Cancellation Technologies.

direct microphone feed while simultaneously cancelling out most of the ambient sound including the low frequencies. In a recording or performing situation, the individual will be able to monitor at safe, moderate levels at the ear canal while enjoying a high degree of protection from even very excessive sound pressure levels in the ambient field.

Another product of more immediate application in the music and broadcast industries has been developed by Digisonix, but not yet offered for sale. The system maintains a zone of silence around open microphones and rejects ambient noise while passing speech sounds. Because of the high cost of the system compared to existing analog devices for accomplishing the same thing, Digisonix has no immediate plans for marketing the system, though Digisonix's Steve Weiss claims performance exceeds that of any analog competitor.

In the further future are several intriguing devices from NCT. The company claims to have developed an antinoise window glazing with transparent piezoelectric sensors and actuators to resist diaphragmatic flexing at low frequencies. The company claims that similar devices could also be applied to wall panels, and that a room could be very effectively isolated from structure borne vibrations as well as outside noise, and one envisions control rooms using only active devices and dispensing with double wall con-

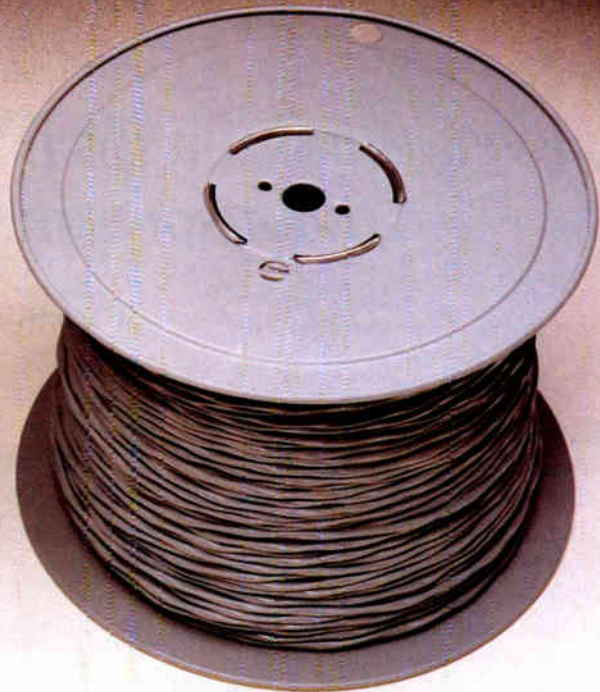
struction and other brute force passive construction techniques.

Finally the use of active noise cancellation to alter modal and reflective patterns in a listening space appears to be immanent. The Sigtech device alluded to earlier is already on the market, and Bowers & Wilkins, and Harman International are laboring to introduce similar devices.

Beyond such obvious applications, speculation becomes difficult regarding the ultimate impact of active noise cancellation in the professional sound environment. Amortization costs are high for this kind of technology, and such costs have tended to be borne by relatively small entrepreneurial companies with an urgent need to recoup those costs. Their natural tendency is to market the new technology to heavy industry where noise control is of increasing concern and the dollars are available to pay for extremely costly installations. A second major market is the automobile industry where passenger cab quieting, active engine mounts, and electronic mufflers have aroused the interest of several major manufacturers. Studio and theater applications are most likely to be spin offs initially, and thus the introduction of such powerful techniques will be slow.

But, as with other emerging technologies, the savvy contractor will anticipate actual product introductions and prepare his or her business to exploit the new technology and secure the competitive edge. ■

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Back to Basics, Again

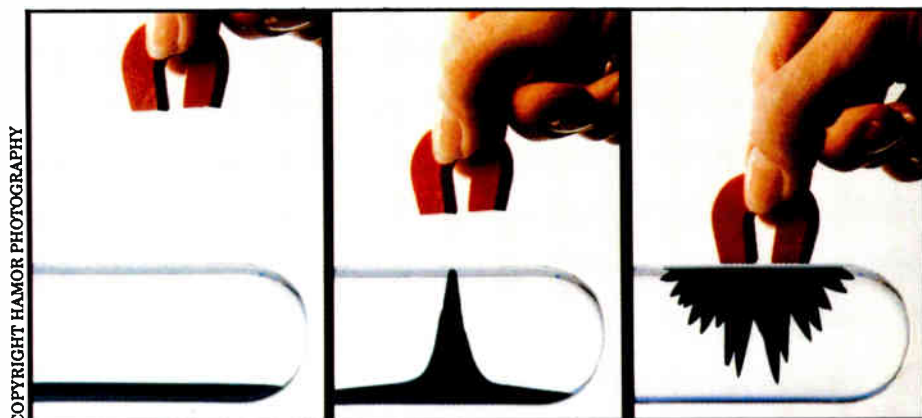
Everything You Ever Wanted to Know About Loudspeakers — Continued

BY MIKE KLASCO

This discussion may be a bit esoteric for a sound contracting magazine, but considering the enormous reader response to the hard information on speakers in the last few issues, I think most readers will find this topic of equal interest. During the next few months, this space will explore new loudspeaker technology, from speaker voice coil materials and fabrication techniques, to new loudspeaker magnetic geometries that will revolutionize pro audio speaker design this year. I promise a series of informative articles, and the reader will learn a good deal, not just about ferrofluids and voice coil materials or magnetic design techniques, but also about what really goes on in a speaker when it reproduces music.

In recent months, I have been working with Ferrofluidics Corporation and have learned a great deal about the properties of ferrofluids. Since the words “fluid cooled” are now showing up in some speaker ads and specs, I thought our readers might be interested in some of what I’ve learned.

Ferrofluids are microscopic coated magnetic particles suspended in a syn-



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A three-sequence shot of a bottle cell shows ferrofluids' responsiveness to a magnetic field.

thetic lubricating oil. The primary function of ferrofluids is to quickly remove the heat from the speaker's voice coil to improve power handling. Secondary benefits are lower distortion, improved transient response, enhanced voice coil centering and increased stability of operation.

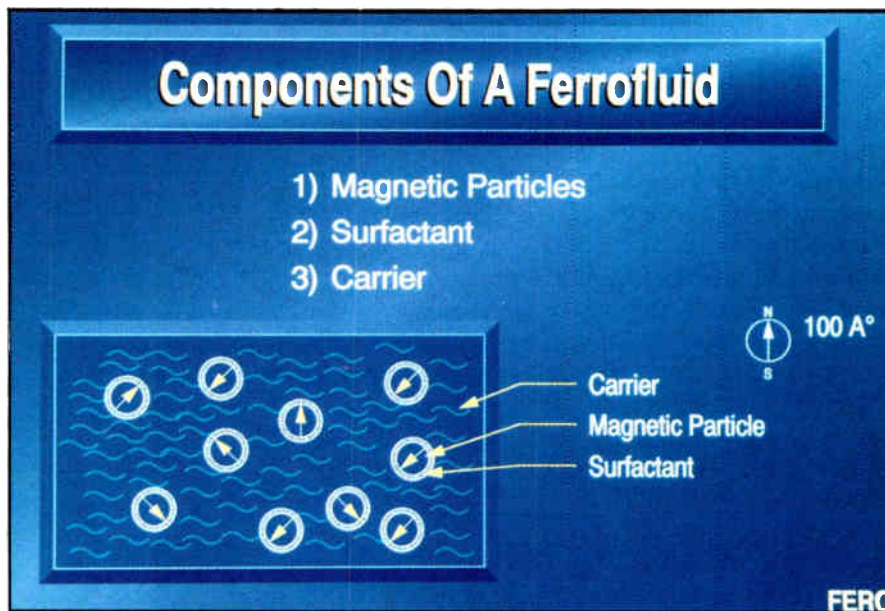
Ferrofluidics Corporation was founded in 1968 with a license from NASA to research the technical and market development of magnetic fluid technology. After a decade of research, the initial efforts to use ferrofluid in speakers concentrated on its use in tweeters during the late 1970s. Some of the most popular bookshelf speak-

ers of the time offered small size at the expense of efficiency. Previously, this meant that the listener traded off high sound levels for a compact sized speaker enclosure. But in the late 1970s popular music demanded higher sound levels (especially in college dorms!) regardless of box size. Receivers were also going through a power output war, with each new crop offering more watts. In general, the high output receivers of this time were not well behaved. The increasing demands of the market forced design engineers to push transistor output stage SOA (safe-operating-area) margins very close to the

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

edge. Protection circuits often protected the amplifier at the expense of the speakers. Speaker manufacturers blamed the amplifier companies, while the amplifier companies blamed the speaker manufacturers' own inflated power ratings. The customer and dealer were caught in the middle. By 1978 the problem had reached epidemic proportions, with one manufacturer repairing more burned out speakers weekly than they were building new! It became apparent that if adequate sound levels were to be achieved with low efficiency speakers, than speaker power handling had to increase.

With this background, Ferrofluidics Corporation introduced magnetic fluid to the audio industry. Numerous speaker companies experimented with



Components of a ferrofluid.

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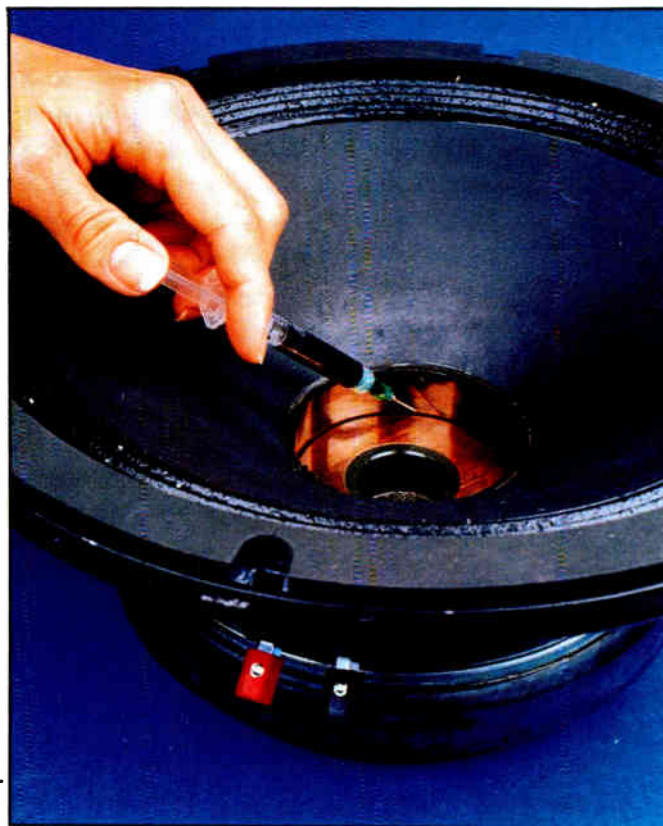
the magic substance, but at first there were problems. Ferrofluidics Corporation employees were specialists in chemical science, while most speaker designers were mechanical and electrical engineers. Design factors were not always communicated. Early ferrofluids interacted with glues, voice coil materials and other factors, resulting in production problems that traumatized more than a few production engineers. Still, the appeal of ferrofluid was strong enough for ongoing research. Peak power handling improved 2-4 times. Distortion, resonances and transient response characteristics all improved.

In the late 1970s a number of technical papers were published about the application of ferrofluids to improve speaker performance. From the early 1980s to the present, the application of ferrofluids to tweeters has become progressively more straightforward with a significant number of the popular hi-fi models using this enhancement. To date, over 200 million speakers have been treated with ferrofluid, with the present production rate of 40 million treated speakers per year.

Pro-audio speaker designers have always been desperate for any possible way to improve power handling. But early attempts to use ferrofluids in high power speakers were not always successful. For example, the temperature capacity of the fluid was limited for long-term operation to only 200 degrees F until only a few years ago. This was less than the temperature capacity of the bobbin and voice coil materials. In early designs, if the speaker was overdriven, the ferrofluid would boil and congeal. (Current audio grade ferrofluids from Ferrofluidics Corporation can operate reliably at 400 degrees F, the same temperature conditions that equal or exceed the wire insulation limits.)

Another limitation was the high viscosity of the early ferrofluids. High viscosity fluid helps damp resonance and dramatically reduces distortion,

Ferrofluid is applied to the voice coil of a woofer using a syringe. The fluid is drawn to the gap due to magnetic force and then distributes itself around the gap.



and is especially useful in quality mid-range drivers. But when used in woofers or compression drivers, too much sensitivity is lost. Viscosity once ranged from about 1000 centipose to 10,000 centipose, but today typical viscosities range from a few hundred, down to below 25 centipose (for headphone elements). With such low viscosity there is no change in the speaker sensitivity in its useful operating range.

Community has used ferrofluids successfully both in its compression drivers and woofers for years. Meyer Sound and Apogee Sound both use ferrofluids in compression drivers with reliability greatly exceeding the industry levels for the same drivers (that do not use ferrofluids). About three years ago Apogee pioneered the application of ferrofluids in subwoofers, and this enhancement has also contributed to their high level of reliability. With the introduction of application-specific ferrofluids for woofers and for compression drivers, along with detailed design support programs for these types of transducers, many more pro-sound speaker manufacturers have engineered ferrofluids into their designs (expect to see many of these introduced at the NSCA).

SPEAKER CONSTRUCTION

To understand why ferrofluids improve speaker operation you must first have a clear understanding of a speaker's construction. Basically, a dome tweeter consists of a magnetic system and a dome diaphragm attached to a voice coil. (See Figure 1.)

The magnetic system is comprised of a ceramic ring magnet (a "donut"), sandwiched between a steel backplate and a frontplate. A steel rod is located down the center of the ring magnet and is attached to the backplate. The magnetic force radiates from the ring magnet, travels through the steel backplate, into the pole piece and "pushes through" or jumps the gap between the pole piece and the top plate. This completes the "circuit." Magnetic circuits are similar to a flashlight circuit where the battery wire carries the voltage through a wire and then pushes through the bulb filament to the wire hooked up to the other end of the battery.

Back to our tweeter. The dome diaphragm of the tweeter is where the sound is radiated. The dome is attached to a split tube, known as the bobbin, which has a coil of wire glued to its outside. The bobbin and voice coil are centered in the magnetic field

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gap by a suspension on the outside of the dome. The two ends of the coil are connected to the terminals on the tweeter and wired to the crossover network inside the speaker enclosure. The inputs of the crossover network are the terminals you see on the back of your speaker box. When an ampli-

Magnetic circuits are similar to a flashlight circuit where the battery wire carries the voltage through a wire and then pushes through the bulb filament to the wire hooked up to the other end of the battery

fier sends an audio signal through the wires, the speaker receives a signal that has an alternating current following the pattern of the music signal. The signal causes the coil to vibrate in a pattern analogous to the electrical signal. As the voice coil is attached to the dome, the compliantly suspended diaphragm moves to the music, and sound is reproduced. So now you are a speaker engineer.

VOICE COIL HEATING AND POWER COMPRESSION

Unfortunately, there are some problems. Like a light bulb, the main product of a speaker is heat, with the intended purpose (sound) only a secondary side effect. If 100 watts are sent into the tweeter, roughly 1 watt is acoustic output, with the remaining 99 watts being wasted heat. Heat is the enemy of speakers. In the case of the common light bulb, 98-99 percent of its output is heat, with the remaining percentage being light.

As the voice coil heats up, the speaker's characteristics begin to

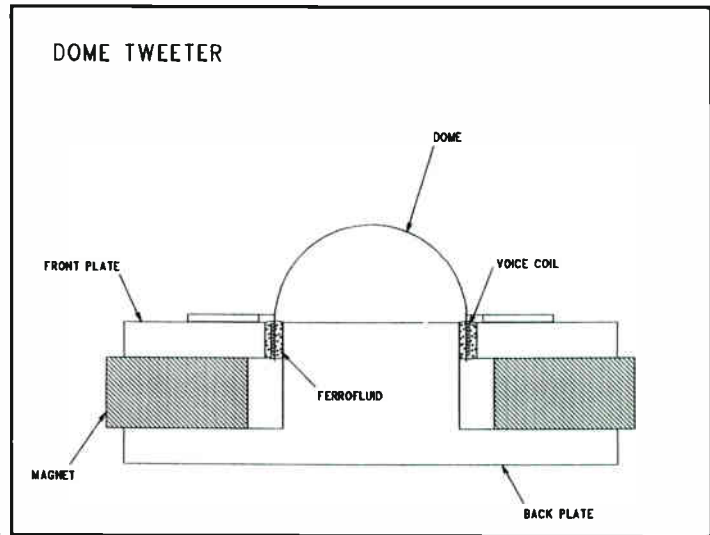


Figure 1.

change. The voice coil expands with heat, but the top plate does not. The clearances between the outside of the coil and the inside of the top plate get closer until the coil scrapes against the top plate. Initially this causes a buzzing sound, but if high output operation continues; then the coil may become permanently deformed and the rubbing will continue until the voice coil insulation is scraped and the speaker fails.

Far more insidious is power compression. As the coil heats up, its resistance also increases. If the impedance is 8 ohms when cold, then at high output it is not uncommon for the speaker's impedance to double when it heats up. Of course, when the speaker cools down, again the impedance drops back to the original rating. The problem with this phenomenon (power compression) is that the speaker's sensitivity and frequency response change with level and time, usually with the top end response suffering the greatest attenuation. Even more serious is the interaction with the crossover network. Crossover network component values are painstakingly selected and the capacitors and inductors carefully measured for precision and repeatable response. But as the speaker's impedance can double when it heats up, the crossover point can shift almost an octave!

In a speaker that does not use ferrofluid, air is sucked through the voice-coil gap as the cone or diaphragm moves. If the air velocity is too high, then a whistling noise, or other form of modulation distortion, is created. This modulation noise masks the

nuances of the music and is one of the factors that separate a high definition speaker from a mediocre speaker. Ferrofluid works to seal the voice coil gap preventing whistling noises.

Ferrofluid also acts as a liquid bearing, suppressing the rocking motion of the voice coil and diaphragm. This helps avoid buzzes and scraps from the coil touching the pole piece or top

The magnetic system acts like a large heat sink.

plate, as well as to reduce leadout wire failures. Torsional bobbin resonances are also damped which otherwise would be transferred to the diaphragm. Torsional effects can be caused by imbalances created by the coil leadout wires, rocking of the suspension, and other mechanical instabilities in the speaker. Dampening these resonances reduces harmonic distortion.

The sealing and liquid bearing effects are significant attributes of ferrofluid. Applications where ferrofluids are also used include exclusion seals in almost all computer hard disk drives and fluid film bearings in precision scientific instruments. Still another application is in viscous inertia dampers to reduce settling time and torsional vibrations in robotics, plotters and printers. Of course faster settling time (faster transient response) and suppressed bobbin torsional resonances are also benefits for loudspeakers.

HOW DOES IT WORK?

Ferrofluid is located in the speaker's gap. Ferrofluid has a much lower ther-

mal resistance than air. Therefore, the heat is able to be pulled off the voice coil through the ferrofluid and transferred to the magnetic system much faster than through the air in the gap. The magnetic system acts like a large heat sink. Think of the ferrofluid as a high quality cable, and the air as a thin narrow gauge cable. The thermal efficiency of ferrofluid is four times better than air in transferring heat from the coil to the magnetic system.

Why does ferrofluid stay in the speaker's voice coil gap? Ferrofluid is a fluid that has magnetic properties. The speaker's gap has an intense magnetic field. The ferrofluid is held in the gap by the magnetic field. Still, careful design is required by the speaker manufacturer to insure that

the ferrofluid is not forced out of the gap by trapped air cavities behind the dome (or diaphragm). This had been an early problem, with fluid splashing out during large excursions. Air that would have been trapped behind the dust cap (or tweeter dome) would be forced through the gap during backward strokes. Proper venting techniques have been developed. (Ferro-fluidics Corporation provides a testing service for all speaker manufacturers to insure stable operation.)

RECENT DEVELOPMENTS

As we discussed earlier, the most recently introduced woofers used in pro audio have begun to use ferrofluids. Venting of trapped air behind the dust cap cavity, between the magnet and the pole piece, and behind the spider

is preferred. Although these techniques are not complex, they are new to many speaker engineers and require manufacturing changes in tooling. Yet the benefits for woofers are even more dramatic than for tweeters, especially in preventing coil rubs during large excursions, such as with the new Aura magnetic technology. (But that is the subject for another article in this series.)

Perhaps the next time you see "fluid cooled" in a speaker ad you will not discount it as techno-babble, but recognize some of the real benefits in power handling, improved transient response and lower distortion that ferrofluids provide.

In the next installment, our "Parts Is Parts" speaker series will examine high performance voice coils. ■

SOUNDSPHERE SPEAKERS LOOK & SOUND CHOSEN BY CUB FOODS STORE CHAIN

While Soundsphere Loudspeakers have been utilized in Cub Foods stores in Eden Prairie, Cottage Grove, Bloomington and Plymouth, Minnesota, the most recent installation has been at the newest 120,000 sq. ft. store in Apple Valley. Twenty-five Soundsphere #110A speakers with transformers tapped at 7.5 watts were installed to gain quality music and voice page.

Craig Streich, the Store Manager, takes advantage of the music quality and added efficiency of clear voice page when reassigning workers to various tasks in the expansive store.

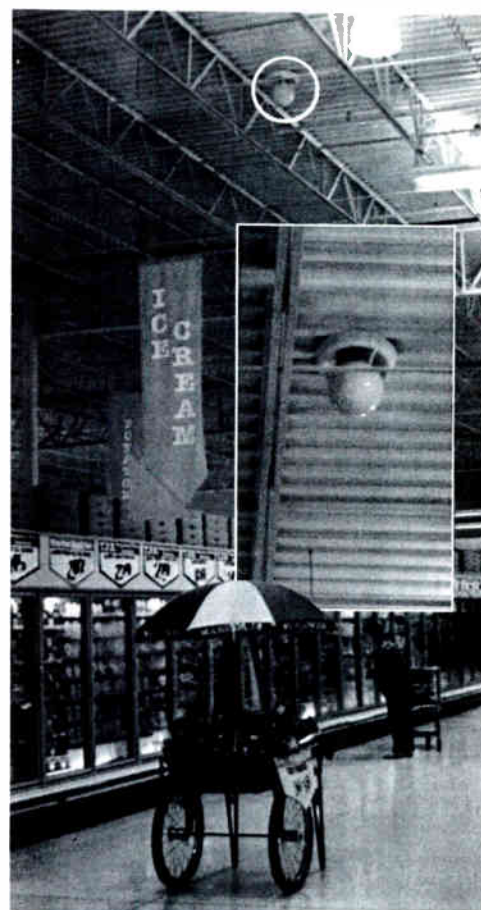
Scott Miller, Manager of Pro Sound at Muzak of Minneapolis, notes that the Cub Foods executives selected parchment-colored #110 Soundspheres to meld with the ceiling color and felt that the shape and color were highly compatible with the contemporary interior design esthetic.

Write or call direct for further information.

SOUNDSPHERE A PRODUCT OF
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Circle 260 on Reader Response Card



UHF's time has come.

With the introduction of the Samson UHF* Series, we thought it might be helpful to provide you with new information about this technology.

1. UHF gets better reception.

Yes it does, in the sense that UHF operates at the higher frequency range of 902-952 MHz. There is a lot less *traffic* up in that bandwidth. And, more importantly, less RF interference and noise.

2. New UHF technology has recently been made available.

For the UHF Series, Samson put four of our finest wireless engineers on the case. Using up-to-date developments like Di-Electric filters, Gas-Fet and new cellular technologies, they were able to bring UHF up to a higher level of performance.

3. UHF sounds better.

A dangerous generalization perhaps, but it *does* have wider RF dynamic range. And because we're the first to use dbx[†] Noise Reduction in UHF, the resulting audio quality is even more impressive.

4. More frequencies are available.

Samson offers seven UHF frequencies that can be used simultaneously. If you're already running a lot of VHF on stage, you can place our UHF frequencies on top of these without any interference.

EIGHT THINGS YOU SHOULD KNOW ABOUT UHF

5. Samson UHF offers more microphone options.

The all brass UH-4 hand-held transmitter is available with an incredibly wide variety of the industry's most popular mic elements. The streamlined UT-4 belt pack transmitter comes equipped with a broad range of high quality lavalier microphone capsules.

6. Samson UHF antennas set new standards.

Custom made so they are acutely sensitive to our bandwidth, Samson's high efficiency cellular antennas can be either front or rear-mounted. Because they are positioned at a 45° angle to the front panel, several UHF systems can be cascade-mounted in a single rack with all antennas in the clear.

7. UHF is more expensive.

Until now. Because of robotics assembly techniques and surface-mount technology, Samson was able to make UHF a realistically priced option for a whole new class of users.

8. Write for a free Samson UHF White Paper.

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*In case you were reading too fast, we wanted to remind you that this ad is about UHF, not VHF wireless. †As long as you are reading our ad this closely, we thought we'd tell you who they are: Yukinaga Koike, Doug Bryant, Takao Horiuchi, Susumu Tamura. †dbx is a registered trademark of Carillon Industries.

Circle 215 on Reader Response Card

World Radio History

Refurbished Coca-Cola; Increased Commitment to Contractors

RMA Refurbishes Coca-Cola Auditorium

A renovation of the audio system in Coca-Cola's 500-seat USA Auditorium has been completed by Ron Montgomery and Associates of Atlanta. The focal point of the system is the 32:8:2 DDA "Q" Series audio console. For local reinforcement the DDA Q drives a nine-way Surround System via Tannoy Studio Monitors and OAP subwoofers. Additionally, the DDA console is used to feed signals to a multi-language translation system, a video production studio and various interface panels. Intelligibility and zoning of the completed system is maintained through the use of Klark-Teknik digital delays and equalizers. Carver, ClearCom, Shure, Symetrix and Tascam products, along with Canare cable were used throughout the project. RMA is now beginning renovation of the video and projection systems, for which designs have been approved.

JBL Announces Increased Commitment to Contracting

JBL Professional has issued a press release announcing increased "commitment to the contracting market." According to the press release, since its formation over a year ago, the JBL Systems Group, under the direction of Gary Hardesty, has worked with consultants and independent contractors regarding the implementation of completed JBL sound systems for all types of reinforcement applications. Gary Hardesty is quoted as saying, "The Systems Group has the resources to respond to the requests that often begin before a job is specified and continue through to job completion." According to the release once a facility has chosen a consultant and subsequently a dealer, the JBL Systems Group supports both

dealer and consultant in the use, application and delivery of JBL products in the job.

Desktop Editor Line from Paltex

Paltex International has introduced EDDiSX, a self-contained A/B-roll Desktop Video Editor. According to Roger L. Bailey, chairman and managing director of the company, "EDDiSX combines the utility of a dedicated editing system with the power of a PC and the simplicity of a Windows-based graphical user interface." In addition to A/B-roll VTR and serial video switcher control, EDDiSX features direct serial control of the NewTek Video Toaster and Panasonic WJ-MX50; 999-line EDL memory with edit list management and EDL Ripple; EDL Import and Export; Animation and Auto-Assembly modes; integral 40 Mb fixed and 3.5-inch floppy disk drives; and the ability to run other Windows and DOS-based software.

Spatializer on Batman

Spatializer, the 3-D audio processor introduced at AES in October, was used in an episode of Batman on the Fox network. The episode, which featured a com-



Tom Maydeck (Spatializer is on the console, foreground)



puter-created world of virtual reality, used the joystick-controlled Spatializer model. Prototype Spatializer technology has been used by Tom Maydeck's Monterey Post for the past three years for the music scores in Warner Bros.' "Tiny Toon Adventures," "Tazmania" and "Batman: The Animated Series." Maydeck said, "We move character voices so that they sound as if they come from offscreen." Spatializer is a real-time processor that allows the placement and movement of individual sounds in three-dimensional space. It uses standard stereo playback. The finished product is mono- and surround sound compatible and requires no decoding.

Apogee and Cello Collaborate

Apogee Electronics Corp. and audio equipment manufacturer Cello, Ltd. have announced plans to manufacture special versions of Apogee D/A and A/D converters for introduction into Cello's music systems. The converters and corresponding power supply, to be released as the "Series 8" line, will be targeted to high end residential listeners. Apogee will incorporate Cello-specified analog circuitry, three-pin Fisher connectors, and a front plate bearing the name Cello Music and Film Sys-

tems in the "Series 8" units. Among the features of the units will be a low jitter clock that enables both Toslink and coaxial inputs to "outperform other available components with AT&T glass connections," according to the company. According to Apogee, Mark Levinson, the audio designer and president of Cello, became interested in Apogee after noticing that many of Cello's professional clients used Apogee converters in their studios. The Series 8 converters will list for \$4,500 each with the power supply \$1,000.

Standards Available

An expanded 120-page catalog of all standards, specifications and other publications of the Electronic Industries Association (EIA) and its affiliated groups and divisions has been published and is available without charge from Global Engineering Documents of Irvine, California. The new EIA catalog includes publications of the Telecommunications Industry Association, the Joint Electron Device Engineering Council, the EIA Tube Engineering Advisory Panel, and other EIA segments. It also includes joint standards developed in collaboration with IPC, ANSI, and NEMA. Over 1,000 items are listed. Global's phone number is 800-854-7179.

Vidfilm Installs VHS Duplications

Vidfilm, the post production facility in Glendale, California, has purchased a pre-fabricated turn-key Sony Select System for real time VHS tape duplication. Sony's Systems Integration Division supplied the system. Twelve racks of VHS duplication equipment were pre-assembled in Sony's Sunnyvale, California facility prior to the system's installation. The system consists of 96 SVO-960 VHS Hi-Fi duplicators, controlled by Sony's SVRM-960 bidirectional remote control unit. Ray Mitchell, director of engineering at Vidfilm, said that the new system has improved the facility's productivity. "We can now receive orders for 100 to 1,000 VHS cassettes and fulfill them in one or two days," he said.



Loomis Opens New Sales Office

Crestron Electronics has announced that Loomis & Associates has opened a new sales office in Denver, headed by Claude Kleiman. According to Crestron, this expansion will "offer better support for Colorado, Utah, Wyoming, eastern Montana, east-

ern Idaho, Texas (El Paso Country) and New Mexico."

Portuguese Distributor Named

Apogee Electronics Corp. has appointed Valentim de Carvalho CI SA as exclusive distributor of its product line in Portugal. Apogee has also recently designated new representatives in Australia, Belgium, Denmark, Israel, Japan, Mexico, New Zealand, and Switzerland. Within a few weeks of taking on the Apogee line, Valentim sold 40 Apogee digital audio converters to Televisao Independente, a private TV station which will use the converters on the inputs and outputs of a Pro-Bel Series digital audio routing switcher.

CEDIA Plans Expansion

Chris Stevens, newly elected president of the Custom Electronic Design & Installation Association (CEDIA) has stated his desire to see CEDIA expand its membership and its horizons. "The recently named Systems Integration Council is a step in that direction," he said. "Custom installers must be capable of handling all kinds of electronic systems in the future. We have emphasized audio/video systems, but there are others which can and should be considered as elements of a total, unified, house systems." Security, lighting, HVAC, and telecommunications are elements viewed as part of an integrated electronics approach. As the association's third president, Stevens sees some differences, but not a great contrast in his leadership from that of Tom Doherty, who preceded him. The recent CEDIA conference in Dallas was the association's "largest and most successful conference." Dallas is booked for the 1993 conference also. In addition, Stevens suggests the possibility of regional seminars.



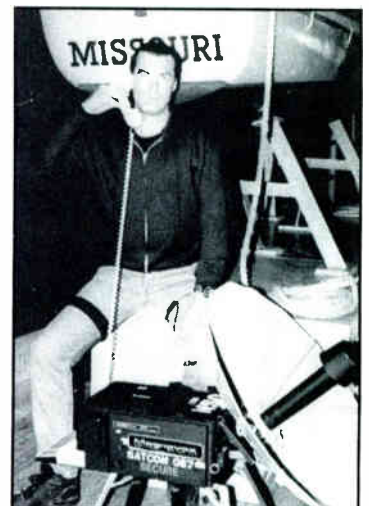
New Toaster Desk

The Winsted Corporation has introduced a "Toaster Desk" designed for desktop editing. The black desk is an integrated workstation with three equipment shelves adjustable in one-inch increments. A recessed monitor well and extra deep back panel which includes two wire management trays are among the features. Casters and leg levelers are included. Winsted says the new unit will "accommodate all major brands of editing systems."

Satcoms on Silver Screen

Magnavox has announced that its portable satellite terminal, the MagnaPhone, appears in "Under Siege," the movie released by Warner Brothers in which co-producer Steven Seagal stars. The MagnaPhone "provides the hero's only link with the outside world and plays a critical role in preventing nuclear disaster." Neil Saldin, vice president and general manager of Magnavox/Nav-Com, said, "Although the movie is fiction, it does fairly represent the

real-world capabilities of the MagnaPhone." The MagnaPhone is a suitcase-sized Inmarsat-A satellite terminal that provides real-time telephone, data, fax and telex communications. It weighs under 50 pounds and can travel as airline luggage. It can be used to send studio-quality audio, photographic images and compressed video at data speeds up to 64,000 bits per second.



Steven Seagal using the MagnaPhone on the set of "Under Siege."

Boston Acoustics Listed by Forbes

Boston Acoustics has, for the sixth straight year, been listed in Forbes Magazine's annual list of the "200 Best Small Companies in America." To compile the list, Forbes considered more than 4,400 companies nationwide with annual sales between \$5 million and \$350 million. Firms were ranked according to their five-year average return on equity. Boston Acoustics is number 62 on the list; the company's return on equity has averaged 21.8 percent over the last five years. The five-year earnings-per-share growth rate of the company's stock, which is traded on NASDAQ, has been 25 percent, Forbes reported. The debt-to-equity ratio is zero. Frank Reed and Andy Petite

founded Boston Acoustics in 1979 to build high fidelity loudspeakers for home and automotive use. Reed, chairman and CEO of the company, said, "Acceptance by key retailers has been crucial to Boston Acoustics' growth in both good economic times and bad."

Router Modules Released

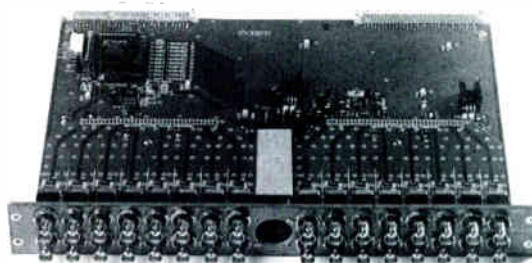
Leitch Incorporated has announced the "impending release" of a series of 143 to 270 Mbs serial digital router modules for the company's Hedco X-plus Router Series. The Video Serial Router modules operate in D1, D2 and D3 formats for both NTSC and PAL. All modules, including the 16 x 1 matrix, offer equalization and re-clocking. The 16 x 16, 8 x 16, and 8 x 8 matrices may also be standards-independent, and the 8

x 8 matrix offers dual outputs. All modules will be available for shipping in the first quarter of this year.

Michigan Tech Uses Crown IQ

The Ice Arena on the campus of Michigan Technological University has a new audio system equipped with Crown IQ System 2000 computer control software. Installation and design of the audio system was performed by Mavri, Inc., Jenison, Michigan. Larry Walburg of Media Design Consultants, Byron Center, Michigan, was commissioned by Mavri to provide independent sys-

tem mapping and proving. IQ software for both Macintosh and PC is employed, lined to the arena's Crown Com-Tech amplifiers via Crown IQ-P.I.P. cards. The IQ System performs in conjunction with a TOA SAORI system that allows for setting of equalizers, time delays and notch filters. Max Krueger, project engineer for Mavri, said, "We are currently using eight presets so the audio system can be configured at the touch of a button for events ranging from hockey games to general skating to commencement exercises. The IQ System was very necessary for this installation."



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Circle 287 on Reader Response Card

THE INS & OUTS

ROLLS has 3 new rack units the RA62HA headphone amplifier, RM81 and RM83 mixers. The RA62RH will power 6 pairs of headphones with six 1/4" headphone outputs, 1/4" stereo input on the front, right and left 1/4" inputs on the rear, and 6 bypass jacks. The front panel controls

include 6 VOLUME, and 1 PAN controls, MONO/STEREO and power switches. The RM81 is an 8 ch mike/line mixer with phantom power. The controls include 8 VOLUME, 8 TONE and MASTER VOLUME controls. The RM83 is a basic stereo mixer with all 1/4" ins and outs.

The controls are 8 VOLUME and MASTER VOLUME. There is a channel muting feature for remote muting of any or all channels. The RCA jacks can bridge several RM81s or RM83s together. All this at a cost of \$200, \$290, and \$290.



RA62HA Features

- 6 Headphone outputs with level controls
- Up to one watt output per jack
- Stereo/Mono switch and Pan control
- DC to 30KHz response for accurate sound

ROLLS RM81 MIXMAX Features

- Aux/Buss INs and pre-fade OUTs

- 8 XLR mike inputs and phantom power switches

- 8 1/4" jacks that can be jumpered to either line in or line outs
- Wide range tone controls on each channel

ROLLS RM83 MIXMAX 2 Features

- 8 stereo inputs and RCA bridging jacks, stereo outputs

- Standard 19" X 1.75" EIA rack chassis
- 8 mute pins for remote muting of any or all channels



ROLLS CORPORATION
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Midvale, UT 84047
801-562-5628
Fax 801-562-5655

Circle 270 on Reader Response Card

DCC Tape Delivered

BASF became the first blank tape supplier to ship Digital Compact Cassette (DCC) tapes when it delivered initial samples and in-store displays to Tower Records in Chatsworth, California. Tower Records will feature the BASF product at its stores nationwide.

In other news, BASF contributed blank chrome tape in pancake form for the "Sampler for AIDS Relief" album introduced by San Francisco FM radio station KKSF and duplicated by Music Annex. All sales from the pro bono project go to AIDS education and prevention, coupled with services for those with HIV and AIDS. The samplers are sold at major record chains including Tower and Warehouse, as well as by mail order directly from the station. Featured artists on the Sampler 3 album include Sting, Al Jarreau, Bonnie Raitt, Dave Stewart, Bob James, David Sanborn, Dave Grusin, Lee Ritenour and others. Royalties were waived for the benefit project. Terry O'Kelly, BASF Director of Professional Sales, said, "When we heard that Music Annex was donating its duplication services and Michelex was providing C-zeros, BASF quickly decided to join this worthwhile project." All net proceeds, a minimum of \$3.50 per cassette, are contributed to the San Francisco AIDS Foundation.

"Mega-Amphitheatre" in Design

Jaffe Holden Scarbrough Acoustics has announced that it is currently working on a new "mega-amphitheatre" in San Bernardino, California that will seat up to 80,000 people. Completed projects include the Cynthia Mitchell Pavilion in Woodlands, Texas; the Blockbuster Desert Sky Pavilion in Phoenix; the Blockbuster Charlotte Pavilion in North Carolina; the Starwood Pavilion in Nashville; and Starplex Music Pavilion in Dallas.



Left to right: Steve Nikkel, Tower Records; Christiane Rohde, BASF Merchandising Manager; Andrew DaPuzzo, BASF Director of National Sales.

Classic Tube Microphone

Georg Neumann GmbH has announced the production of a small number of the classic U67 tube microphone. The microphone will be identical to the original U67 in that it will have the same EF 86 tube, capsule and transformer. The package will include the microphone, power supply, suspension, cable and rosewood box.

In addition, Neumann has announced availability in May 1993 of a new version of the TLM 170 microphone. The new TLM 170-R will have the option of remote selection of the polar patterns via a separate power supply/controller N-48 R-2. The remote control-

lability will be accomplished via standard, three-conductor XLR type cabling.

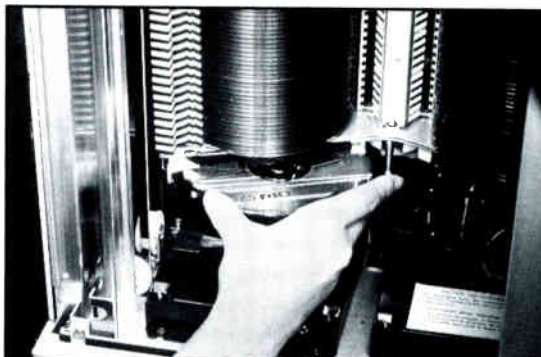
Pioneer Laser Exhibits at Hotel Show

Pioneer Laser Entertainment exhibited laser disc entertainment hardware and software, with special emphasis on how hospitality industry locations can profit from "applying the new technology on-site" during the Hotel/Motel & Restaurant Show in New York. Among the demonstrations were LaserKaraoke and a new professional line of LaserKaraoke sound equipment; the automated 50-disc combination laser disc, CD and CDV changer; the 300-disc CD autochanger; and music videos available on laser disc by subscription service. Bud Barnes, director of marketing for PLE, said

the units "are designed to stand alone or work as complementary components and with a location's existing audio/video system, so the applications are really limitless." Among the venues using Pioneer equipment recently are New York's Hard Rock Cafe which has the 300-disc CD autochanger interfaced with a touch screen computer. Pioneer reports that P.F. Flyers Restaurant in Cleveland has tripled their weekend business with Laser Karaoke and "creative promotions." And at the Cheers Bar in the Detroit Marriott, highly mobile Turn-Key Systems are being used which can be moved to other locations in the hotel or off-site. Barnes added, "We see great potential for this entertainment as a sales tool for meeting managers when marketing their properties to meetings and convention groups."

There are four turnkey or TKS systems in the Pioneer line. The TKS-50 features a 50-disc autochanger. The LC-V200 unit players all laser entertainment formats and has two built-in playing heads for zero wait-time between songs, and a computer control interface. It can hold up to eight advertising messages.

Pioneer has also introduced the ProKaraoke Systems, a line of speakers, amplifiers and subwoofers for sound professionals. ProKaraoke is EIA-spec rack mountable; speakers have high impact cabinets, additional drivers, circuit protection devices and multiple terminal connections.



Pioneer 300-CD autochanger.

This Is Just A Convention Like Woodstock Was Just A Concert.



If you're involved in multimedia or broadcasting in any way, don't miss the NAB MultiMedia World Conference and Exhibition in Las Vegas, April 19-22, 1993.

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We'll feature the world's most respected experts in hands-on product demonstrations, debates and discussions to enlighten and inform you. At NAB MultiMedia World, you'll also have full access to all NAB '93 conferences and exhibitions.

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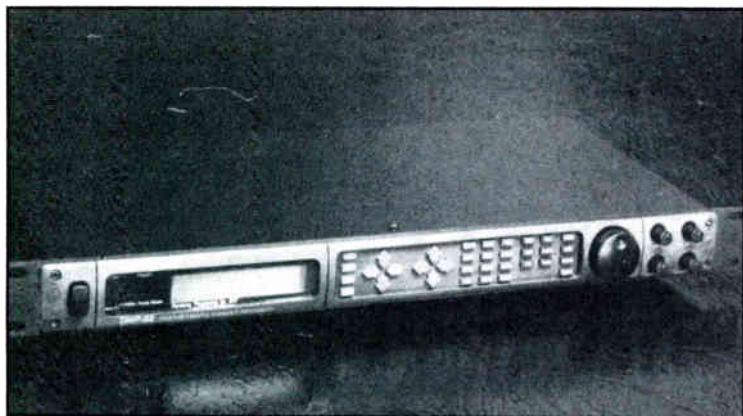
Circle 210 on Reader Response Card

World Radio History

PRODUCTS

DigiTech Processing; Infrared Hearing

By Steve Jacobs

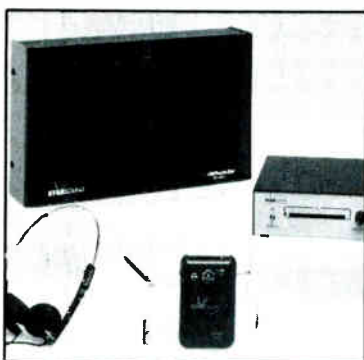


Harmony Processor

DigiTech has introduced the DHP-55; a five-part oversampled harmony processor for sound reinforcement, live instrumental and studio applications.

The unit features oversampling analog-to-digital technology for eliminating phase distortion. The DHP-55 also features an algorithm that allows chordal pitch shifting. It also recognizes chords from a MIDI keyboard and allows full MIDI control of harmonies and effects.

Circle 1 on Reader Response Card



Infrared Hearing System

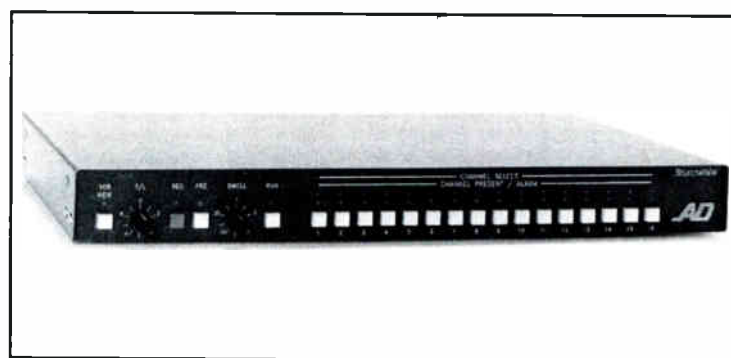
Phonic Ear has introduced StarSound, an infrared hearing system. The system is designed

Steve Jacobs is the Associate Editor of Sound & Communications.

for those that have some degree of hearing loss who have stopped attending facilities that are not designed to overcome the problem.

The broadcast begins with an infrared transmitter that picks up a sound signal from an existing PA. The transmitter converts the PA signal to a safe invisible infrared light that is sent to emitters aligning the room. The emitters then send the light signal to listeners wearing wireless, pocket-size receivers. An optical lens in the receiver receives the light and converts it back to sound.

Circle 2 on Reader Response Card



Sixteen on One

American Dynamics has released the AD1484SL16 'SelectaView II' multiplexer for recording up to 16 cameras on a single VCR (timelapse or realtime). During playback of a recording or during viewing of a live video

the SelectaView II provides either a full-screen display of a camera or a sequence of all cameras.

The unit provides the capabilities of earlier models plus the "Priority Camera" feature for faster updates of designated cameras.

Circle 3 on Reader Response Card

Display Panels

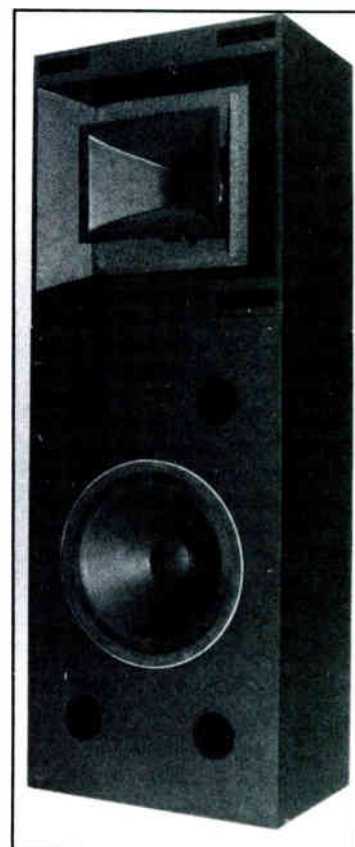
nView Corporation has announced products for projection of computer and full-motion images in presentations, meetings, education and training. The Luminator is a multiple source LCD color projector that uses a metal-halide lamp to display computer and live video from up to four sources simultaneously. The resolution is 640 x 480 in over 250,000 colors.

The ViewFrame Spectra C is an active-matrix LCD projection panel that acts like an electronic transparency when connected to a computer and placed on an overhead projector.

Circle 4 on Reader Response Card

are 25 1/2-inches deep, 22 5/15-inches wide and available in three vertical panel space heights (61 3/8 inches, 70 1/8 inches, and 77 1/8 inches).

Circle 5 on Reader Response Card



Coax/Subs

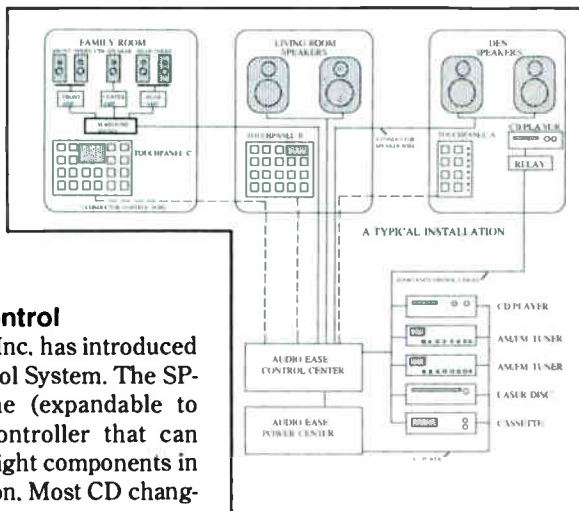
Frazier has introduced two subwoofer systems to the CAT 60 family. The two piece model F1630, 90-degree x 40-degree controlled directivity system is a high output, full range system capable of handling 400 watts at 34 Hz-17 kHz ±3 dB.

The model F1620 is a 60-degree x 40-degree controlled directivity system with similar characteristics over a narrower coverage angle than the F1630. Both systems feature a dual-horn coaxial module combined with a matched systems subwoofer.

Circle 6 on Reader Response Card

Mounting Deep Amps

Atlas/Soundolier has introduced a line of extra-depth, enclosed cabinets for mounting deeper-sized amplifiers. The WA202A Series is an addition to the Standard series 19-inch-wide floor cabinet line. The additions



Six-Zone Control

AudioEase, Inc. has introduced the SP-2 Control System. The SP-2 is a six-zone (expandable to eight) A/V controller that can control up to eight components in any combination. Most CD changers can be used.

Each zone is equipped with a 70-watt per channel stereo amplifier with connections for external amps. The SP-3 is supplied with six AudioEase A+ Touchpanels, with a number of options available.

Circle 7 on Reader Response Card

Digital Effects Camcorder

Panasonic Broadcast & Television Systems Company has introduced the AG-195U two-hour VHS camcorder, with features for professional, corporate and institutional applications.

The unit incorporates features

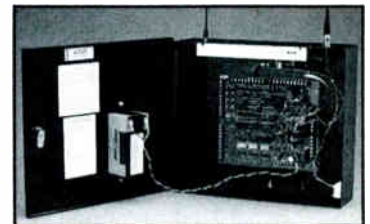


a 8X power zoom lens with 100X and 12X zooming. The AG-195U also offers digital effects including digital gain-up, mix strobe, still, tracer, and wipe.

Circle 8 on Reader Response Card

Access Addition

The N-4700-CTR transceiver has been added to Northern Computers' SpreadCOM wireless spread spectrum access control



product line. PC-based access control is enabled by incorporating control panel functions within the N-4700-CTR, eliminating the need for control panels.

The unit sends and receives signals from transmitters and transceivers connected to proximity, magnetic stripe, and Wiegand swipe readers as well as door and window contacts.

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Circle 278 on Reader Response Card



Fiber Optics for CCTV

The SR-2000 from Meridian Technologies is a fiberoptic communications command center in an EIA 19-inch x 5 1/4-inch subrack that holds up to 18 cards and one 250W switcher. Cards include three-channel video (AGC), FM video with two channels audio, video data transceivers (PTZ), or data only are available.

The unit features SpectraSmart, a microprocessor-based preventative maintenance network management system with graphics display and access keypad.

Circle 10 on Reader Response Card



Improve Conductivity

DeoxIt by Caig Laboratories inc. is a deoxidizing solution that cleans, preserves, lubricates and improves conductivity on metal connector and contact surfaces. The formula contains deoxidizers, preservatives, conductivity enhancers, anti-tarnishing compounds, arcing and RFI inhibitors, and a temperature range of 34-200 degrees C.

Bench Meters

B+K Precision has made two additions to its Test Bench series of multi-function digital multimeters. The DMMs offer the capabilities of a voltmeter, ammeter, ohmmeter, frequency counter,



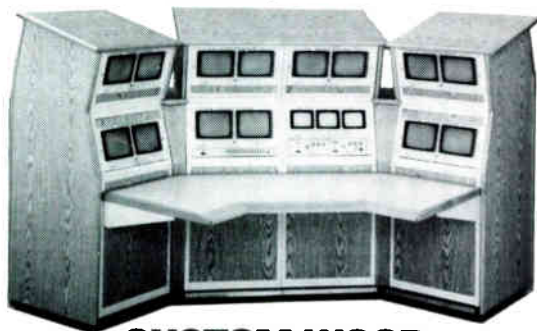
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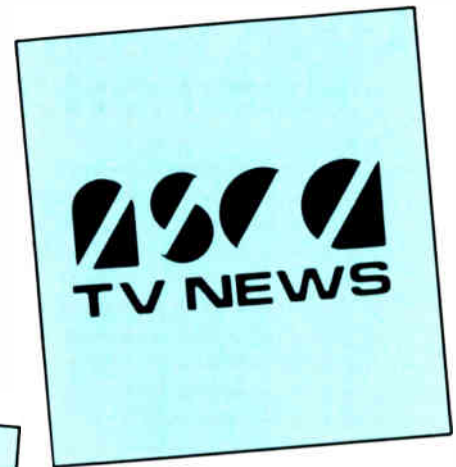
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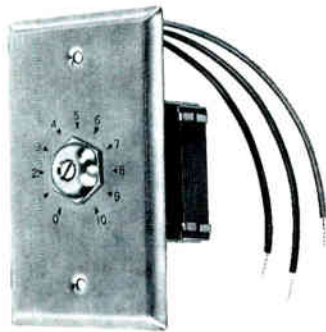
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Cable Duct Cutter

Cablematic Division of Ripley Company has introduced the models DC100 motorized tool for cutting smooth or corrugated cable duct. A blade guide controls the depth of the cut. A cutting guide permits circumferential and longitudinal cuts around the duct. The battery-operated saw handles nonmetallic wall thicknesses of up to $5/16$ inch and duct diameters of $3/4$ inch to 2 $1/2$ inches.

Circle 13 on Reader Response Card



Site-Wiring Quality Monitor

PermaPower Electronics has introduced a Site-Wiring Quality Monitor with integral power line surge suppression. This product provides continuous monitoring of the ground to neutral resistance from the wall outlet to the branch circuit distribution panel, and sounds an alarm when the resistance reaches 2 ohms.

Called the "Socket Sentry," the model RTQ-610 is a surge suppressor that also warns of reversed line and neutral wires, as well as neutral-to-ground voltage that exceeds a preset level.

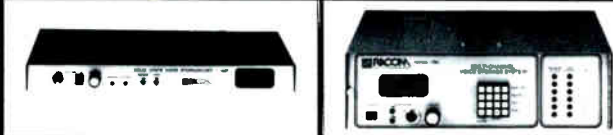
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Monochrome CCD

Burle Security Products has upgraded its TC350A monochrome CCD camera so that it requires 0.1 lux scene illumination for usable video. A CCD imager is responsible for the increased sensitivity and enables the unit to maintain 576 lines of resolution.

Other features include a variable gain AGC circuit for low light levels, genlock operation, low power consumption, variable speed electronic shutter with seven operating speeds, gamma selection, back focus and "C" or "CS" lens mounting capabilities.

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Time-Lapse Video Tape

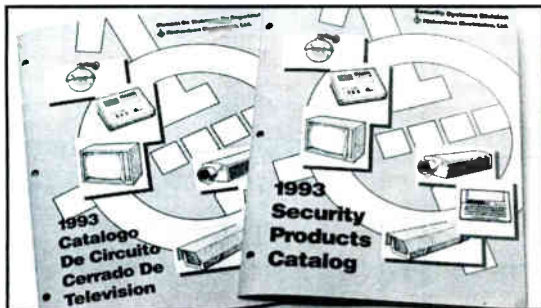
Techtron Systems, Inc. has released its E-200 video tape. The E-200 is designed to meet the requirements of time-lapse recorders.

The tape is manufactured with a gamma ferric oxide magnetic particle compound. The binding process is designed so that the tape particles adhere to the tape surface and don't flak off. The housing includes a case, a recording log and two sets of peel-off face labels and spine labels.

Circle 16 on Reader Response Card

LITERATURE

Richardson Security; EIA Standards



Security Systems

Richardson Electronics' Security System Division has released its 1993 product catalog. The catalog features approximately 30 categories of equipment containing components to create a complete system. The 1993 catalog is available in English and Spanish. The catalog contains product guides and product comparison charts.

Circle 17 on Reader Response Card

Standards and Publications

An expanded 120-page catalog of standards, specifications and other publications of the Electronic Industries Association (EIA) and its affiliated groups and divisions has been published. It is available from Global Engineering Documents of Irvine, California.

The EIA catalog includes publications of the Telecommunications Industry Association (TIA), the Joint Electron Device Engineering Council (JEDEC), the EIA Tube Engineering Advisory Panel (TEPAC), and other EIA segments.

It also includes joint standards developed in collaboration with IPC, ANSI and NEMA.

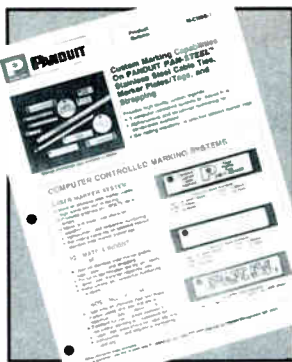
Circle 18 on Reader Response Card

Stainless Steel

A Product Bulletin is available from Panduit Corp., Mechanical Group. The bulletin describes the company's custom marking services available for Pan-Steel stainless steel cable ties, marker plates and tags, and stainless steel strapping.

The company offers custom legends produced with one of

three computer-controlled systems including laser marking, dot



matrix indentation and embossing. Alphanumeric and sequential numbering for serialization is available, along with bar coding on selected marker tags.

Circle 19 on Reader Response Card

Conduit Bending

Greenlee Textron has added its Conduit Bending Handbook and Bending Calculators to the product line catalog for on the job reference.

The Conduit Bending Handbook presents a pocket-size reference format. Three Slide Rule Bending Calculators are also included in the catalog.

Circle 20 on Reader Response Card

Ethernet Tutorial

Lantronix has introduced a full-color 8½-inch x 11-inch booklet that has diagrams illustrating Ethernet 10BASE2, 10BASE5, and 10BASE-T networks, plus others showing the use of terminal servers, print servers, repeaters and transceivers.

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<p>CES-TV NEWS at the Consumer Electronics Show January 7th-10th, 1993 in Las Vegas June 3rd-6th, 1993 in Chicago</p>	<p>NAMM-TV NEWS at the National Assn. of Music Merchants January 15th-18th, 1993 in Anaheim</p>	<p>NAB-TV NEWS at the National Assn. of Broadcasters April 19th-22nd, 1993 in Las Vegas</p>
<p>INFO-TV NEWS at INFOCOMM January 14th-16th, 1993 in New Orleans</p>	<p>NSCA-TV NEWS at the National Sound and Communications Assn. April 2nd-4th, 1993 in Orlando</p>	<p>AES-TV NEWS at the Audio Engineering Society October 12th-15th, 1993 in New York</p>

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PEOPLE

Yamaha Promotes Caldero; BSS Worldwide Sales

Caldero Named VP

Steve Caldero has been promoted to Vice President of Sales of Yamaha Electronics Corporation, USA. Prior to his promotion Caldero was National Sales Manager of the Home Audio Group. Caldero joined Yamaha in 1985 as Western Regional Sales Manager for Home Audio and was named National Sales Manager for Concert Systems and Video Products in 1989.



Caldero

Before joining Yamaha, Caldero held marketing positions with JBL, Loranger and Nautilus Recordings.

Dunlop to BSS

BSS Audio has appointed Ralph Dunlop as Sales Manager to work on the consolidation and expansion of the UK and worldwide distribution network for BSS products.

Dunlop joins BSS from Bruel & Kjaer where he was responsible for the sales and marketing of pro audio products in Europe.

Allen & Heath Names Charles

Michael Charles has been named U.S. sales coordinator for Allen & Heath. In his position, Charles is responsible for coordinating and implementing Allen & Heath sales efforts in the U.S. He is also responsible for customer service, technical support and budgetary functions.

Charles comes to Allen & Heath with experience in the music retail industry, and as a musician.

AKG Product Specialist

Joey Wolpert has been appointed Product Specialist for AKG. Wolpert has done extensive product specification and customer contact work at

Speck Electronics of Fallbrook, California.

Wolpert's engineering credits include Natalie Cole's "Unforgettable" album, as well as albums and soundtracks for Bette Midler and Aretha Franklin.

JVC Appoints Sansone

Mary Sansone has been appointed national sales administrator of JVC Professional Products Company. In her position, Sansone is serving as a liaison for the branch offices in the United States and managing the administrative functions.

Previously, Sansone served as assistant to the vice President of JVC Professional Products, and has been with the company for 16 years.

Soundstream Additions

Soundstream Technologies has made two additions to its sales and marketing staff. Larry Harrison has been named National Sales Manager — Car Audio and Mark Spinella has joined as Marketing Manager.

Harrison has sales experience with Kenwood and Yamaha. Spinella comes to Soundstream from AudioControl, where he was employed in a similar marketing capacity.

Wimmer at Panduit

Jeffrey A. Wimmer has been named National Distributor Marketing Manager at Panduit Corp. In his position, Wimmer is responsible for distributor training, strategy and programs.

Wimmer has 27 years of experience in the electrical industry. His most recent position was Vice President, Sales Central Area for the Thomas & Betts Corporation.



Wimmer

Letizia Joins HP

HP Productions has appointed Luke Letizia to the position of Account Executive for the video and multimedia production firm. Letizia is responsible for expanding HP Productions' sales and marketing endeavors. He is also cultivating corporate, government and association accounts. He has five years of experience in video production, direction and instructional systems design.

MultiLink Names Sergeant

MultiLink, Inc. has named Randall W. Sergeant national sales manager. Sergeant has over 15 years experience in sales and sales management with a heavy concentration in the communications industry.

Sergeant has held positions

with Witel Business Networks, MCI Communications, Inc., Omni Communications, Inc., R.F. Hammond Associates, Inc. and ITEK Corporation.

Raudabaugh and Maddock Appointed

Michael Raudabaugh has joined Northern Computers, Inc. as West Coast Regional Manager where he is servicing current accounts and manufacturer's representatives. Raudabaugh was previously with Cardkey Systems and Pinkerton Control Systems. In addition, T. Sean Maddock has joined Northern Computers as Midwest Regional Sales Manager. Formerly, Maddock was president of a security distribution firm, and has also served as Project Manager for an alarm company.

CALENDAR

Upcoming Events

FEBRUARY

ComNet: Washington, D.C. Contact: (508) 879-6700. February 1-4.

Image World: San Jose, California. Contact: (800) 800-5474. February 1-5.

Association for Research in Otolaryngology: St. Petersburg Beach, Florida. Contact: (515) 243-1558. February 7-11.

ISC West: Anaheim, California. Contact: (708) 390-2462. February 16-18.

National Hearing Conservation Association (NHCA): Albuquerque, New Mexico. Contact: (515) 243-1558. February 18-20.

MARCH

National Association of Music Merchants (NAMM): Frankfurt, Germany. Contact: (619) 438-8001. March 3-7.

Audio Engineering Society (AES): Berlin, Germany. Contact: (212) 661-8528. March 16-19.

Image World — The Government Show: Washington, D.C. Contact: (914) 328-9157. March 17-19.

United States Institute for Theatre Technology (USITT): Wichita, Kansas. Contact: (203) 325-5020. March 17-20.

Fiberoptic Splicing and Termination

Workshop: Washington, D.C. Contact: (508) 347-8192. March 22-26.

Rigging Seminar (Syn-Aud-Con): Atlanta, Georgia. Contact: (812) 995-8212. March 23-25.

Fiberoptic Splicing and Termination Workshop: Dallas, Texas. Contact: (508) 347-8192. March 29-April 2.

InterMedia: San Jose, California. Contact: (203) 352-8243. March 30-April 1.

Rigging Seminar (Syn-Aud-Con): Anaheim, California. Contact: (812) 995-8212. March 30-April 1.

APRIL

National Sound and Communications Association (NSCA): Orlando, Florida. Contact: (800) 446-NSCA. April 2-4.

National Association of Broadcasters (NAB): Las Vegas, Nevada. Contact: (202) 429-5300. April 18-22.

MAY

Fiberoptic Splicing and Termination Workshop: Washington, D.C. Contact: (508) 347-8192. May 10-14.

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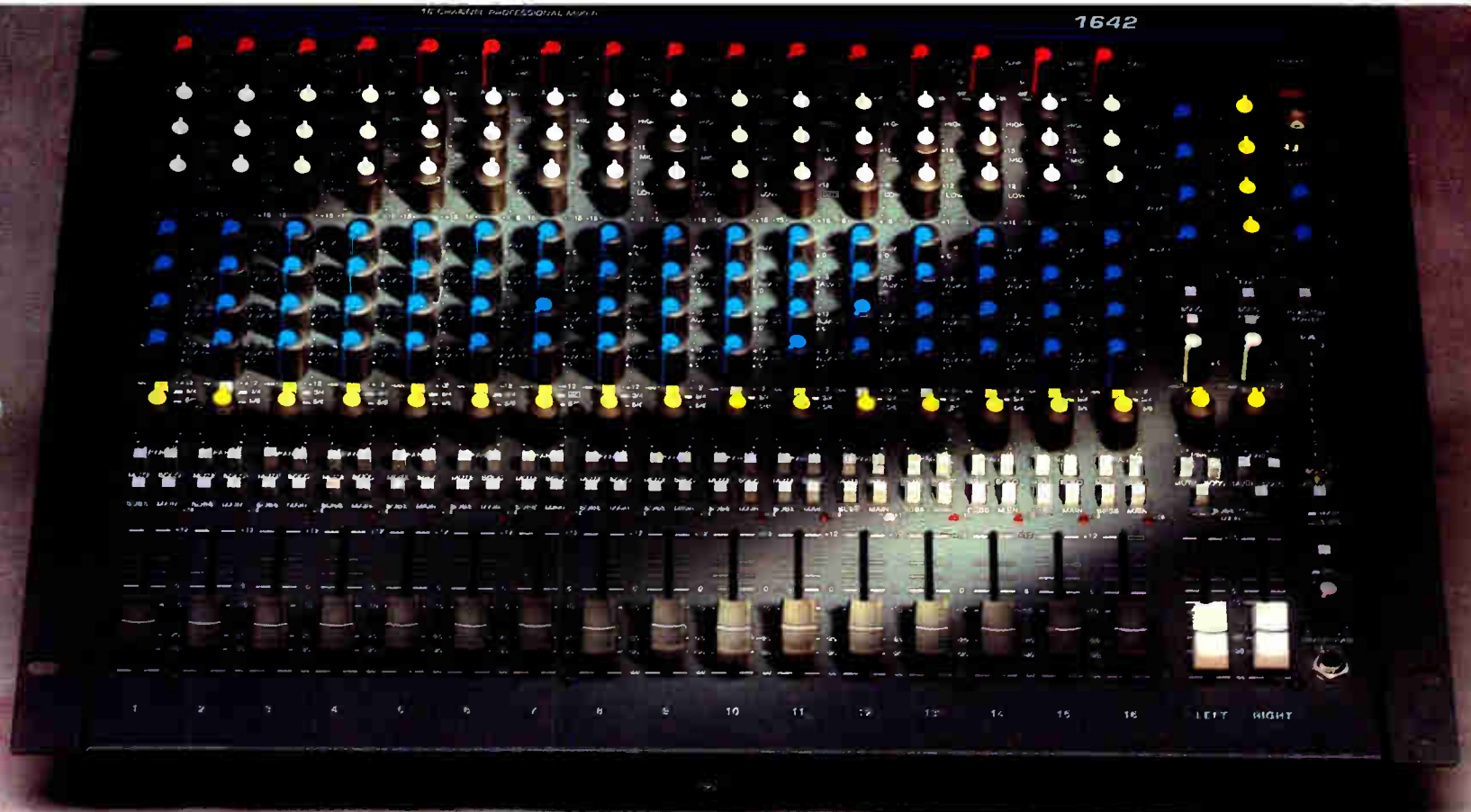
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Speakers	QUAM-NICHOLS	BOSE	TOA
● CD Players ●	PIONEER	● TECHNICS ●	● CARVER ●
Tape Players	TECHNICS	JVC	TASCAM
Amplifiers	CROWN	TOA	QSC
Tuners	PIONEER	BOGEN	CARVER
Mixers	TOA	ALTEC LANSING	CARVER
PA Systems	TOA	TELEX	BOGEN/PEAVEY*
Video Monitors	PANASONIC	TOA	JVC

* Indicates tie

SURVEY METHODOLOGY

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

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