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DECEMBER 1979

VOLUME 10 — NUMBER 6

Recording engineer producer

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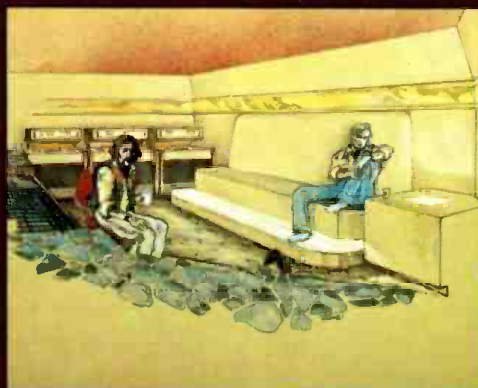
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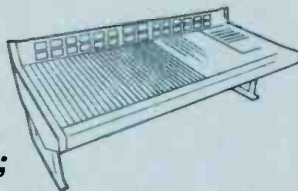
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CLEAR SELECT

CHANNELS SELECTED TO TRACK

01	02	03	04	05	06	07	08
09	10	11	12	13	14	15	16
17	18	19	20	21	22	23	24
25	26	27	28	29	30	31	32
33	34	35	36	37	38	39	40
41	42	43	44	45	46	47	48
49	50	51	52	53	54	55	56

CHANNEL		TRACK	
1	2	3	
4	5	6	
7	8	9	
0	STEP		

AUX 1	AUX 2	AUX 3	AUX 4
CUE 1	CUE 1	CUE 1	CUE 1
CUE 2	CUE 2	CUE 2	CUE 2
CUE 3	CUE 3	CUE 3	CUE 3
CUE 4	CUE 4	CUE 4	CUE 4
AUX 1	AUX 2	AUX 3	AUX 4
REV 1	REV 1	REV 1	REV 1
REV 2	REV 2	REV 2	REV 2
REV 3	REV 3	REV 3	REV 3
REV 4	REV 4	REV 4	REV 4

Neve

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STUDIO ON **CUE 1** **CUE 2** **CUE 3** **CUE 4** **CUE 5** **CUE 6** **REV 1** **REV 2** **REV 3** **REV 4**

STUDIO **MONITOR** **MONO** **STEREO** **QUAD** **DIM** **CUT**

4T 1 **4T 2** **2T** **MONO** **TAPE IN** **TAPE OUT**

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The 8108 Range.

Just introduced to the world at the AES Exhibition in Los Angeles in May 1979, this thoroughly new console range received much praise for the quantum leap in sound recording technology it represents. Building on their computer/digital experience earned through the successful NECAM Computer Mixing System, Neve engineers have developed the technically superior 8108 range. The console is in production and early deliveries are now being made to several West Coast top name studios. The 8108 Range is available in 56/48, 48/32 or 32/24. Join the Neve world of excellence. Please call or write for our beautiful 8108 brochure.

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All track (bus) assignment is performed at the Central Assignment Panel, allowing up to 56 inputs to be switched to any (or all) of up to 48 tracks. Digitally controlled FET switches provide super reliable routing steered by a powerful micro-processor. Solid state memories can store complete track assignments for up to four different recording sessions, available for recall on moments notice. Days, weeks, months or even years later, input to track switching from memory for a 56/48 console is accomplished in about 2 seconds.

Instant Interrogation.

With the increased number of inputs and tracks being used in studios today, making it difficult to quickly realize track assignment during operation, Neve devised a unique Assignment Interrogation System which enables the engineer to instantly realize assignment, either *from* an input or *to* a track. "Finger close" buttons are mounted below the faders in a recessed area. Assignment indication is cleverly provided both below the faders and on the Central Assignment Panel, simultaneously readying this panel for reassignment of inputs and tracks.

Simultaneous VU/PPM.

The 8108 Range features operator selected mode of metering. Dual column high resolution bargraph meters can provide VU only, PPM only, or VU/PPM simultaneously. Additional bargraph meters may indicate reverberation send or return. Conventional VU meters available on mixdown output.

NECAM or VCA Grouping.

The 8108 Range gives you the widest choice in fader systems. VCA Grouping is standard. NECAM Computer Assisted Mixing may be added to bring the ultimate touch to the 8108 console. Manual faders may also be fitted.

Serviceability.

No other console provides the serviceability and reliability like the 8108 Range consoles. Computer-wiring is used virtually throughout, with solid state switching cards replacing hundreds of mechanical switches. Channel strips are easily removed, in turn with readily removable subassemblies. It is the finest and most advanced console system ever introduced. Please call or write. The Neve 8108 Range is in your future!



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— the magazine produced to relate . . . Recording ART to Recording SCIENCE to Recording EQUIPMENT.



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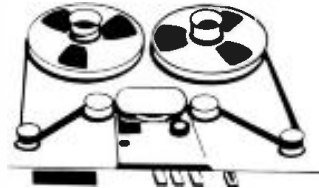
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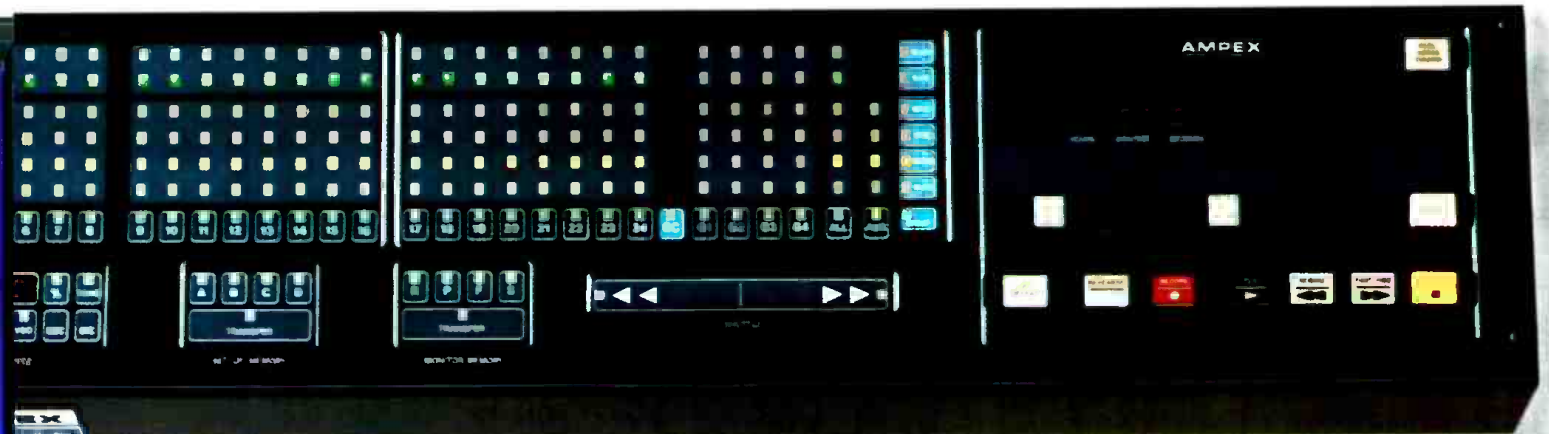
Another outstanding studio shot from photographer *Robert Walsh's* portfolio. This one of *Aura Recording's* (N.Y.C.) newest control room. The console: an *Amek M-3000*.

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from the future: ATR-124.

to the standard output, there is an optional auxiliary output with each channel that enhances flexibility. So don't think that ATR-124 is going to

Memory, and Record Mode diagnostics. The point is this: If you like the ATR-100, you're going to love working with the ATR-124.

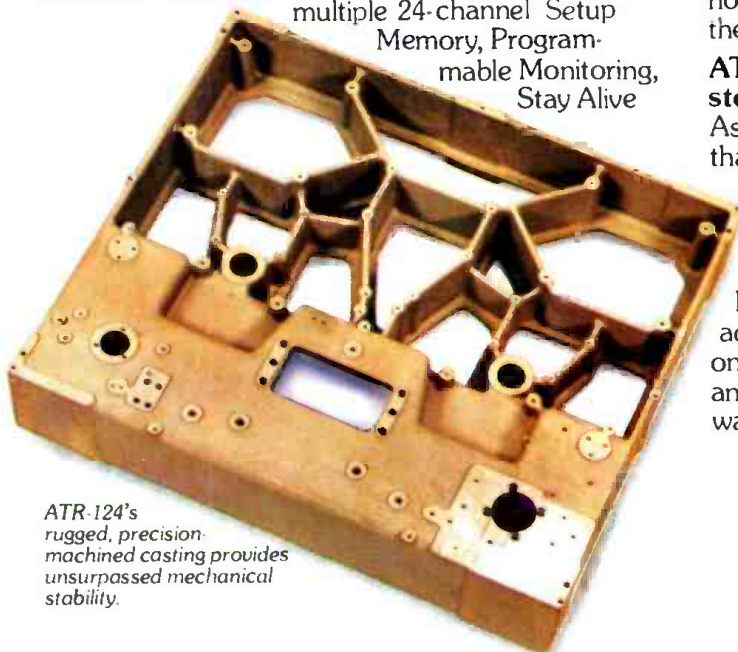


ATR-124's Control Panel. Speed and accuracy at your fingertips.

replace anything that you do. On the contrary, it's going to improve the skills you have, if not help you develop some new ones.

ATR-124 picks up where ATR-100 leaves off. It's only natural that the people who brought you the ATR-100 should be the ones to bring you something better. ATR-124 offers you 24 channels instead of 4. You also get many new and exclusive features. The kind that have set Ampex apart from the crowd for the last 30 years. Features like balanced, transformerless inputs and outputs; a patented flux gate record head; 16" reel capability; input and output signal bus for setup alignment; membrane switch setup panel; fingertip-operated shuttle speed control; and microprocessor-based synthesized Varispeed -50% to +200% in .1% steps or in 1/4 tone steps. ATR-124 also features microprocessor-based control of Channel Grouping, multiple 24-channel Setup

Memory, Programmable Monitoring, Stay Alive



ATR-124's rugged, precision-machined casting provides unsurpassed mechanical stability.

ATR-124 options.

As impressive as the ATR-124 itself.

With the addition of a built-in Multi-Point Search-To-Cue (MPSTC), you can rehearse edits and control five tape-time actuated events and be compatible with SMPTE time code. Separately controlled auxiliary output amplifiers with each channel provide simultaneous monitoring of normal and sync playback as well as all other monitoring modes. A roll-around remote control unit can also be added to the ATR-124 which contains all control features normally found on the main unit.



ATR-124's Multi-Point Search-To-Cue (MPSTC). Provides 100 cue locations.

ATR-124. Your next step is to experience it firsthand.

As you scan the points we've covered, remember that you're scanning just a small portion of ATR-124's story. We haven't even begun to discuss the accessibility of key components for easy servicing and minimal downtime, or the features we've built in to give you greatly improved tape handling. To find out more, write to us at the address shown below. We'll send you a brochure on ATR-124, our latest audio effort. Better yet, call us and we'll set up a demonstration. It's really the only way to listen to the future.

ATR-124. Pure 24-Channel Gold From Ampex.

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Letters

— **Studio Design & Acoustics** —
from: **Jan Setterberg**
Tal & Ton Musik & Elektronik
Goteborg, Sweden

After having read various articles and letters in *R-e/p* (my favorite audio magazine) it is very easy to get the impression that acoustics is an American invention, patented by Sierra Audio and Hidley.

It is with embarrassment I read how Mr. Duncan and Mr. Hidley, in several *R-e/p* articles, take credit in how they constructed and built the ABBA Studio, in Stockholm, Sweden. The reason for my embarrassment is that I, myself, together with other Swedish companies did the job, not Hidley.

It all started after my completion of Marcus Music, in 1977, where ABBA did 90% of their recording of "The Album." As Marcus Music was a design that ABBA seemed to like I was contracted by them as a general studio consultant as well as to look after the acoustics. At this time ABBA had paid Hidley a design fee.

After some time I realized that ABBA wanted a more unique design, so I prepared some basic design suggestions in order to give ABBA an idea of what I felt should be the ideal

design in this environment. These design ideas were so appreciated by ABBA that all design work was taken care of by myself and their architect, Mr. Borowski. Other companies involved in the design team were WO-consultants, who handled all work with electric powering, and Lindals Consultants CO who handled the air conditioning.

The layout of electronic interface was made by myself and Mr. Leif Mases, ABBA's studio manager. Much credit should be given to Mr. Mases, whose experience as balance engineer as well as a brilliant electronics engineer gave us great help to bring this big project to a happy ending.

I especially remember his design of ABBA's quite unique communication and foldback systems. We, together, also developed a new noise reduction switching system, built into 19" rack space that can handle 24 tracks of any of the three noise reduction systems. (The TTM noise reduction unit.)

The general contractor of building the ABBA Studio was Goran Mellberg Constructions, Ltd., a small company which already had experience in studio building from other studios I had designed.

Due to good cooperation between ABBA,

the contractor, myself, and everybody else involved in the project, the building of this highly complicated project was made on schedule — in 16 weeks. The quality from the builders is also of a kind so far, to my knowledge, not seen in this business.

There can be a lot more said about the studio, but I think I would like to end this letter by presenting my company.

Tal & Ton AB, in which I am the president, is today a leading company in professional audio. We are a major importer and distributor of professional audio in Sweden like dbx, JBL, MCI, Master-Room, BGW, Soundcraft, etc. We also make a lot of consultancy work in Europe for the audio field. Studio designs, so far, involve 35 projects including the new Marcus Music Studios, in London.

The company has, like Westlake Audio, a small studio of its own where clients can try out the equipment we are handling, as well as feel the benefit of modern studio acoustics.

— **Stylus to Preamp Interface** —
from: **Ron Jasinski**
Consultant
Hollywood, CA

A big thanks to Mr. Isenberg on his article of "Stylus To Preamp Interface — The Weakest Link In The Audio Reproduction Chain." Mr. Isenberg has indeed given me much insight as to why a disk playback does not sound like a master tape. Of special interest to me was the flux looping of the phono cartridge.

In referring to the Figure 4 in Mr. Isenberg's article; note the rise time and overshoot of the squarewave. If those measurements were that of a microphone transformer, for instance, most engineers would replace the transformer as fast as they could heat up their soldering iron. Yet such undesirables are happening in most disk playback systems and go generally unnoticed or are generally accepted because "that's the way it is." What Mr. Isenberg has given us is a more precise way of analyzing the phono cartridge.

Granted there are mechanical resonances as well as electrical resonances; but with Mr. Isenberg's analyzing techniques the two problems can be separated and each examined. Most of us know what resonances do to the sonics of the sound, none of it being good. Apparently these electrical and mechanical resonances are "tricked out" to yield a fairly flat playback response in the reproduction system. These resonances are one reason why two phono cartridges having approximately the same overall frequency response characteristics sound different.

In flux looping some of the newer phono cartridges it's evident some manufacturers are becoming more conscious of such problems. Improvements have been made in the coil assemblies yielding better squarewave response and with less problems due to

... continued overleaf —



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Ron started as a singer in Philadelphia. He worked the board at several major festivals during the late '60s before entering the studio in England during the early '70s. Along the way, he began producing. As a producer and/or engineer, Ron has worked with The Who, Led Zeppelin, Bad Company, Dave Mason, The Babys, UFO and many others. His most recent project was with The Jefferson Starship.

ON MULTI-TRACKING

"I go for the whole thing. I would rather not do anything for two days than have to take the band down to three pieces and have to build it back up again. I'd rather piece the tracks together than piece the band together. I mean, there'll still be overdubs and things like that, but rock'n roll is so much a feel situation, you know?"

ON DIPLOMACY

"A lot of times, people will stand around and everybody will think the other guy likes it. Nobody will say 'Well, I don't like it.' It won't be till after a while that they find out that nobody ever liked it. They just never wanted to say anything. Now, I'm the guy who goes in there and gets it all out of them—what they like and what they don't like—so there's none of that.

I can be the bad guy, sometimes. I'm just real frank and rough. If somebody's not doing something, I like to say it right then and there, so one of the band members doesn't have to say it. It might be a shock, but none of it is taken out of the studio."

ON MUSICAL STYLES

"You know, hard rock stuff is the hardest thing to record. People whacking the hell out of the drums. Guitars turned up to ten. Everything is distortion. People screaming down microphones. The harder the rock, the harder it is to record."

ON TAPE

"Consistency. That's the most important thing. You know, you can work all day for that one thing and you put that tape on and it drops out or it does something. You stay with it until it cracks up. Then you use somebody else's. And I did that a lot. I've used everybody's tape. I've been using 3M tape for five or six years, exclusively. They happen to use the same tape I do, here at The Record Plant. But if they didn't, I would have my own tape in in a second."

SCOTCH 250

WHEN YOU LISTEN FOR A LIVING.



**RON NEWSON
ON TAPE**

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3M

Letters

capacitive loading. Also, mechanical resonances that are smaller in amplitude and higher in frequency. While not perfect yet; it's progress in the right direction.

One additional test I would like to suggest is the flux looping of the phono cartridge with a swept sine wave and observing the phase tracking between left and right channels. If any phase shifts are found comparing right and left channels; listening tests will sound like the center is walking or is smeared or diffused instead of pinpointed.

Lastly; I would like to mention that the flux looping of a tape recording head with a triangle wave results in the same sort of squarewave information as with phono cartridges. Most tape playback heads face the same cable interaction problems as do the phono cartridges. Interesting!

One last test is to sweep the flux loop with a sine wave on a multitrack head and observe phase tracking on an oscilloscope.

Once again: Thanks to Mr. Isenberg for sharing with us his expertise.

— **Low Frequencies for Apocalypse** —
from: **Stan Polinsky**
Los Angeles, CA

After reading the article, "Generating Low Frequency Audio Energy for Apocalypse Now," in the October/November issue of *RE/p*, by John Meyer and Terry Tomaselli, it seems as though a correction is in order. The

writer states that a demonstration was made by Dolby that they "... could accurately reproduce and track bass and that this was not a sense-surround type rumble device that simply injected low frequency monotone noise at predetermined intervals with a toggle switch type on/off response curve. Dolby Labs, not wanting to be a limiting factor in the playback chain, took about a week and redesigned their system so that it was flat down to 30 Hz."

First of all, Universal Pictures' Sensurround* system is by no means a simple "rumble device" "toggle switch" type of system. It appears that the writer has not seen or heard the dramatic impact that Sensurround has to offer in a battle sequence. The system goes down to 18 Hz at high acoustic output, and is "acoustically coupled" to the viewer's body both physically and psychologically. It is a multi-channel system (screen front and auditorium rear) which has been refined many times through the years.

The process by which we dub a Sensurround format picture is complicated and contains many proprietary techniques which are used in order to enhance the product. Once you've heard an explosion in Sensurround in the theater you will usually not come close to that experience again unless that explosion happens to be real and within a few yards of where you are. A further advantage of Sensurround is that it is a system with so much control available that it does not render dialogue unintelligible like other low frequency enhancement systems seem to do.

When the next Sensurround picture is released in this area, I suggest the writers see for themselves what dramatic impact with a

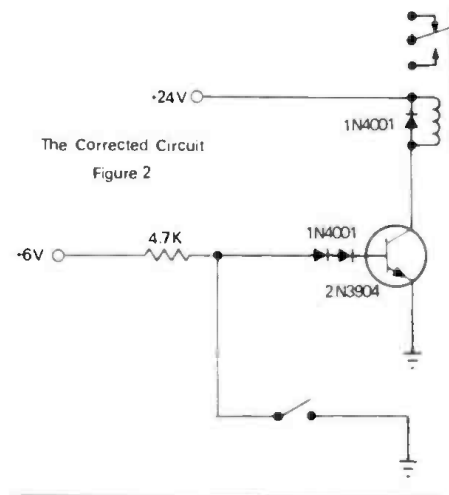
soundtrack is all about.

* Sensurround™ is a registered trademark of MCA Systems, Inc.

— correction —

Inadvertently Figure 2 illustrating Ben Harris' fine article "Turn-Ons" for *Audio Engineers*, appearing on page 116 of the October 1979 issue (Volume 10 - Number 5) was drawn incorrectly. Though the text describes two 1N4001 diodes in series with the B+ power supply, these were omitted from the drawing.

Mr. Harris points out that if the circuit is to be used with the relay or load normally relaxed the switch should be of the push-push variety, normally closed.



The Sound Workshop Series 1600 recording console.

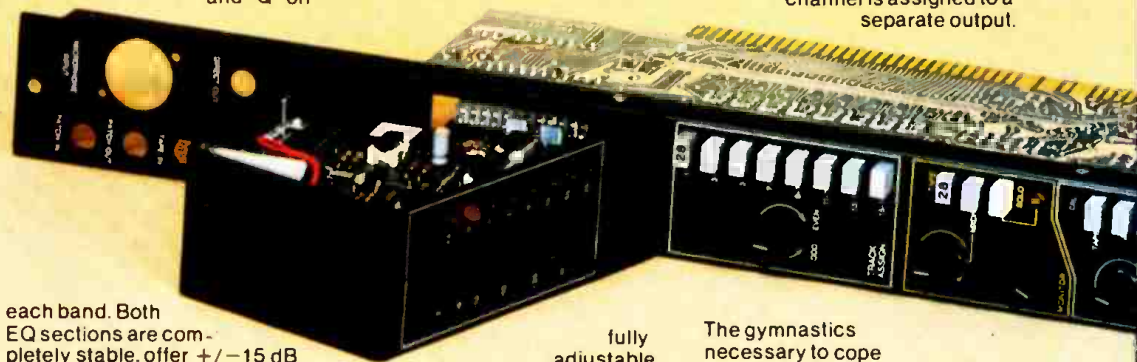
As technology advances at an ever increasing rate, it has become easier to design and build recording equipment that yields "professional" specifications. But specifications alone do not define a product. As we conceived the Series 1600, we saw the need for a "true" professional console that would be at home in major multi-track installations, yet offer the cost effectiveness that other manufacturers promise.

The Sound Workshop Series 1600 employs a modular design philosophy, allowing numerous initial configurations, and the ability to add features and function as need dictates and cash flow allows.

The Series 1600 is available with our standard transformer coupled mic-pre or our new transformerless design which features the TRANS-AMPLZ* amplifier module.

Two equalizers are offered: the standard 3-Band 12-Frequency;

and the optional full parametric which offers complete control of frequency, boost/cut, and "Q" on



each band. Both EQ sections are completely stable, offer +/- 15 dB range, and include an 18 dB/octave switchable low-cut filter as well as LED status indication for EQ IN and LOW-CUT IN.

The standard level indicator is an LED column which can be ordered with or later retro-fitted with Peak reading capabilities. Our new High Resolution Meter Module offers the convenience of

LED metering with even greater resolution than standard meters. All of our LED indicators feature

fully adjustable intensity to compensate for ambient light conditions, and accept our Spectrum Analyzer which adds Real-Time Analyzation to the Series 1600. Standard Vu Meters are available on special order.

Our VCA Grouping Package permits assignment of each input channel to up to 3 Input Sub-

groups allowing from two inputs to the entire console to be controlled by one fader, even if each channel is assigned to a separate output.

The gymnastics necessary to cope with today's complex mixes are handled by ARMS Automation, leaving the engineer and producer to return to their art; music and creativity. ARMS is a true computer based system featuring INDEPENDENT MUTE WRITE (if you are considering other automation systems, don't buy one that can't write mutes independently!!!), Auto-nulling,

*Registered trademark of the Valley People, Inc., Nashville, Tennessee.

— **Audio Education** —

In response to the numerous letters we receive inquiring about schools that teach various aspects of the recorded arts we have collected the following information.

The schools listed are only those that responded to our published request (April 1979) for curriculum information. Without doubt there are others of equal quality in this country and throughout the rest of the world. The schools that responded can be broken down into basically three groups.

The first are schools which have recording programs as a part of a full university or college system. These schools offer full accredited degrees in various fields. In some cases the recording programs are extensive and directly related to the degree title. However, in many cases the recording courses are electives within the Music Department.

The second group are private schools that have a full recording program and related courses. Almost all of these schools offer some form of certificate of completion. However, with but one exception the time spent at these schools is not transferable to a four-year program. For the student who has no interest in all the other courses that must be taken to get a degree, then these specialized private schools might be a better choice.

The third type of schools are those that offer a few selected courses covering one particular aspect of the business.

The length of these courses can range from a few hours over a weekend to hundreds of hours stretched over a number of months. The cost can vary from under a hundred dollars for some seminars and abbreviated classes to

many thousands for extensive private or university programs.

In assessing a school one should not rely solely on the information supplied in the catalogue. This information can give you an idea of which program seems to suit your particular needs, but there are a number of other points you should ask the school that generally will not be included in the brochure.

You should find out who is going to teach the classes which you are interested in. What background have they had in that field, and are they current with the industry. Don't be afraid to request resumes of the instructors in question. And get a commitment from the school that that person will be teaching the course and not a last-minute, possibly less-qualified substitute. You should try to sit in on a lecture or two by the person you're interested in teaching you. Find out from the students currently in the class whether or not the instructor is not only qualified, but has the ability to convey what he knows.

A potential student should also check the school's references with people in the industry who might have some knowledge of their operation, and with past students who have completed the course. These people can best tell you if what you're going to learn will actually help you once you've completed the program. Find out if there is a student organization. If there is, the student in charge can possibly give you a realistic job placement figure, as many schools make claims that are not thoroughly substantiated.

The lab facility used for hands-on training should be contemporary, if not state-of-the-art. Again, this course should be taught by

someone active within the industry who has a good knowledge of contemporary requirements in the area being taught.

The student should clearly understand the school's "hands-on" approach. How much time does each student have with each particular piece of equipment? Additionally, the student should have assurance from the school regarding the maximum number of students per lab, since one person extra in the control room is more than one person too many.

Regarding labs in particular, how much you pay closely follows what you get and what you should expect since the facilities used for these labs are expensive to build, operate, and maintain.

There are two specific types of educational opportunities which don't fall into these three categories for permanent school. The first of these are the franchise schools. These are usually run by studios, with the chief engineer as the instructor. These courses basically follow a prescribed curriculum as outlined and provided by the Recording Institute of America. Once again, the quality of the instruction is as good as the person doing the instruction. The second program is a home study course. It involves no contracts and is sold on an individual lesson basis through the Professional Recording Institute, P. O. Box 473, Van Nuys, California 91408.

The important thing is understanding what you're getting for your money. If the first or second session of a course doesn't seem to be what you expected, then withdraw immediate-

... *continued overleaf* —

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Letters

ly since most schools have refund schedules which return significantly less after the first two or three weeks.

To the student: Anyone entering this business should clearly understand that the competition for jobs is fierce, and that there are already countless qualified applicants looking for work. Attending any school regardless of how good it is will not insure a position.

Nor are schools the best avenue for pursuing a career in this industry, they are only one of many ways. Few will dispute the value of experience gained from working up through the industry's job structure. A great many people now at the top of the totem pole started in the mailing room, or setting up studios for others. Secondly, even if the school is of the highest caliber in every way, a student will only get out of the courses what he puts into them. They should approach these classes as if they were positions in the industry. The student should realize it is not at all uncommon for engineers, producers, and all the others who make records to work 12 and 14 hour days, and they as students need to be dedicated. While the student is attending school he should equally pursue any and all extra-curricular activities related to his particular interest. Thirdly, the biggest complaint heard by industry executives who do the hiring is that many recording school graduates are over confident about what they think they know, and that they are not willing to accept low-paying, menial, entry-level jobs. A student

must realize that attending a school is not the same thing as work experience, nor is it paying dues in the record industry.

Accredited schools that offer an Associate Arts, Bachelor of Arts, or Master of Arts in recording or a field related to recording:

- Georgia State University
College of General Studies
Department of Commercial Music/Recording
University Plaza, GA 30303
- Middle Tennessee State University
Department of Mass Communications
Box 51, Middle Tennessee State University
Murfreesboro, TN 37132
- Five Towns College
2350 Merrick Avenue
Merrick, NY 11566
- Berklee School of Music
College of Music
1140 Boylston Street
Boston, MA 02215
- Music Industry Program
Fanshawe College
Box 4005, Terminal C
London, Ontario, Canada N5W 5H1
- McGill University
Masters of Music in Sound Recording
Faculty of Music
555 Sherbrooke Street
Montreal, Quebec, Canada H3A 1E3

- University of Miami
School of Music
P. O. Box 248165
University of Miami
Coral Gables, FL 33124
- The University of Tennessee
Department of Music
Knoxville, TN 37916
- University of Rochester
Eastman School of Music
26 Gibbs Street
Rochester, NY 14604
- Golden West College
Commercial Music Program
15744 Golden West Street
Huntington Beach, CA 92647

Broad curriculum private schools:

- College For Recording Arts
665 Harrison Street
San Francisco, CA 94107
- The Recording Workshop
455 Massieville Road
Chillicothe, OH 45601
- Dick Grove Music Workshops
12754 Ventura Boulevard
Studio City, CA 91604
- Institute of Audio Research
64 University Place
Greenwich Village
New York, NY 10003
(On completion of this course 28 units are transferable to the New York University Music Department. On completion of an additional 110 units of work a degree in Music Technology is awarded.)


- Sherwood Oaks Experimental College
6353 Hollywood Boulevard
Hollywood, CA 90028
- Trebas Institute of Recording Arts
1 Place Ville Marie, Suite 3235
Montreal, Quebec, Canada H3B 3M7
- University of Sound Arts
6671 Sunset Boulevard
Suite 1508
Hollywood, CA 90029

Abbreviated or selected courses in or related to recording:

- Andrew Productions
(Courses in recording)
264 Fairfield Avenue
Fairfield, CT 06430
- The Banff Centre of
Continuing Education
School of Fine Arts
Box 1020
Banff, Alberta, Canada T0L 0C0
- Nassau Community College
(Courses on record business)
Contact: Aria Productions
952 E. Thirteenth Street
Brooklyn, NY 11230

- The Recording Center
(Courses in recording)
25 Van Zant
East Norwalk, CT 06855

TOWARD BETTER UNDERSTANDING ...



The Model 4240 Active Equalizer is a hybrid of ONE-SIXTH octave filters, which are concentrated in the *speech intelligibility* region between 250 and 2000 Hz, and broader bandwidth filters on either end. The intended application of the Model 4240 is the equalization of sound reinforcement systems employing *voice* as the main program material as in corporate boardrooms, meeting halls, legislative chambers and courtrooms.


Extremely high Q room modes which cause feedback, ringing and loss of intelligibility are excited by these mid-range frequencies. Equalization to suppress these modes using one-third octave or broader bandwidth filters can attenuate other frequencies necessary to *voice intelligibility*. Loss of intelligibility can not be compensated by increased gain.

By comparison the ONE-SIXTH octave filters used in the Model 4240 have TWICE the resolution as one-third octave filters. It is possible to equalize a sound system and affect only HALF as much program material.

The Model 4240 Equalizer is highly cost-effective for these applications since it is built on the same chassis as our one-third octave models. It has 27 filters like the one-third octave units, but 19 are ONE-SIXTH octave and concentrated in the midrange. The broader bandwidth filters on either end are more than adequate to shape the extreme low and high ends of the spectrum.

Our new System 200 Signal Analyzer features field interchangeable, plug-in filters and may be equipped to match the Model 4240 Equalizer making ONE-SIXTH octave adjustment as convenient as one-third octave.

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... continued on page 118 —

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America Area 1 Studio Maintenance Services, California. Tel: 213-877-3311 **America Area 2** Sound 80 Inc., Minneapolis. Tel: 612-721-6341 **America Area 3** Winteradio Companies, Parma, Ohio. Tel: 216-886-5536 **America Area 4** Empirical Audio, New York. Tel: 914-762-3089 **Australia** John Barry Group, Sydney. Tel: 61-2-439-6955 **Belgium** Naybies, Brussels. Tel: 32-2-734-31-38 **Canada** La Salle Audio Products Ltd. Montreal. Tel: 513-342-2511 **France** Lazare Electronics, Paris. Tel: 33-1-878-62-10 **Germany** Peter Struven, Hamburg. Tel: 49-40-801028 **Holland** Cadac Holland BV, Hilversum. Tel: 31-35-17722 **Italy** Audio Products International, Milan. Tel: 392-273-896 **Japan** Continental Far East, Tokyo. Tel: 81-3-583-8451 **South Africa** Leephy (Pty) Ltd., Johannesburg 2092. Tel: 010-48-3821 **Spain** Neotecnica S.A.E., Madrid. Tel: 34-1-242-09-00

for additional information circle no. 7

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STUDIO UPDATE

Northeast:

■ **LEMANS SOUND STUDIOS** (Somerville, New Jersey) announces the completion of their new 24-track facility in suburban Hillsborough, New Jersey. The studio features a Loft 800 series 26 x 24 console, an MCI 24-track recorder with AutoLocator III, two Ampex 2-track recorders, a Loft delay system, and monitors by Altec with Master Lab Crossovers. Other equipment includes AKG reverb, Crown amps, and microphones by AKG, Beyer, Sennheiser, and Electro-Voice. Owner **BERNIE GOYDISH** reports that current projects include a new single for the **ROCKIDS**, one for **R-BAND**, and a new LP by Polish-Canadian star **JAN LEWAN**. 331 Triangle Road, Hillsborough Twp., Somerville, New Jersey 08876.

■ **THE MIXING LAB** (Newton, Massachusetts) has upgraded to 24-tracks with the installation of an MCI 24-track recorder complete with AutoLocator. The machine will be fed by the studio's custom 28 x 24 console, which is equipped with VCA, group faders, quad/stereo echo, and full parametric EQ for all modules. Outboard equipment features a Marshall Time Modulator, Kepexes, a de-esser, a flanger/phaser, multiple compression, and five separate monitoring systems. Past clients include **GEORGE THOROGOOD**, **JOHN SEBASTIAN**, and the **CBS TELEVISION NETWORK**. 100 Bellevue, Newton, MA 02158. (617) 964-8010.

■ At **RBY RECORDING STUDIO** (Southbury, Connecticut) owner/engineer **JACK JONES** reports that **VASSAR CLEMENTS** dropped in to do some overdubbing on the upcoming **TURKEY FOOT BAND** album, while **CHARLES COLLINS** and **BOB BABBITT** just completed a side featuring **RICK COLLINS** for **A&M Records**. *R.D. #1, Main Street, Southbury, CT 06488. (203) 264-3666.*

■ **SOUND IDEAS STUDIOS** (New York City) is where **JAMES BROWN** has been cutting basic tracks for his new album for **POLYDOR**, produced by **BRAD SHAPIRO**, and where **RONNIE DYSON** has been recording his new single ballad for Love-Zager Productions. Saxist **CLARENCE CLEMENS** has also been in Sound Ideas with **THE E STREET BAND**, backing singer **NORMAN SHELDON**. 151 West 46th Street, New York, NY 10036. (212) 245-8221.

■ **MUSICOR RECORDING STUDIO** (Philadelphia, Pennsylvania) has upgraded its 8-track facility with the addition of a new line of Sony dynamic and condenser microphones, as well as a TEAC/Tascam Model 2 mixer. The studio houses a Tascam 80-8 recorder with dbx noise reduction and a Pioneer Graphic Equalizer. The jazz trio, **PIECES OF A DREAM**, has just completed recording and mixing a number of sides at Musicor with chief engineer **ARNOLD TERRY** and assistant **CURTIS BRACEY**. Also in the studio is jazz vocalist **CAROL HARRIS** recording with Bracey. 2539 West Columbia Avenue, Philadelphia, PA 19121. (215) 763-0741.

■ **RPM SOUND STUDIOS** (New York City) announces the installation of a new Neve 8068, with Necam, while recording in the studio are **PICTURES** with **NEAL TEEMAN** at the board, assisted by **DOMINICK MAITA**, **PHILIP D'ARROW** with **JACQUES LEVY** producing for **POLYDOR**, and Teeman and Maita behind the console, and the **DAVE LIEBMAN QUARTET** with **HUGH DWYER** engineering, assisted by Maita. Producer **ROB HEGEL** is remixing **SARA DASH**, with Teeman assisted by Dwyer. 12 East 12th Street, New York, NY 10003. (212) 242-2100.

■ **AURA SONIC REMOTE RECORDING** (Flushing, New York) has been doing all the live broadcasts in the Tri-State area over **WPIX-FM**, with engineer **STEVE PRINIAS** at the board. Other clients have been **PBS-TV**, **BBC-TV**, and **WNEW-FM**, and acts have included **MOON MARTIN**, **THE POLICE**, **JERRY LEE LEWIS**, and **CHRIS RUSH** for his live LP on **MIDSONG RECORDS**. The truck is equipped with a 40-channel splitter, video hookups, Auratone and JBL monitors, and recorders from 2- to 16-tracks with 24 available upon special notice. 140-02 Poplar Avenue, Flushing, NY 11355. (212) 886-6500.

■ In **MAGNAGRAPHICS STUDIO** (New York City) are **CHRIS STEIN**, of **BLONDIE**, **MICHAEL SAHL**, and **RON MUTZ** working with chief engineer **BOB PREWITT** on the soundtrack to the upcoming motion picture, "Union City." 72 Bedford Street, New York, NY 10014. (212) 691-2333.

■ **FRANKFORD/WAYNE MASTERING LABS** (New York City) has completed construction of Mastering Room E, according to **TOM STEELE**, president and chief engineer of the firm. The room is equipped with the latest in digital pitch and depth control computers designed by engineer **GERRY BLOCK**. This system claims to add 40% more time and level to the disk. The room also contains multiple monitors, custom equalizers and limiters, and a sit-down console designed by **RANSTEELE AUDIO**, of New York. Room E is Frankford/Wayne's fifth mastering room and will be operated on an appointment only basis. 1697 Broadway, New York, NY 10019. (212) 582-5473.

■ **TWAIN RECORDING** (West Milford, New Jersey) has completed its expansion to 24-tracks, according to owner **BOB BETH**. The facility now has an MCI 24-track recorder, a Speck 800 24 x 24 console, and 30 channels of dbx noise reduction. Outboard gear includes a phaser, a flanger, and a Harmonizer, all by Eventide; Roger Mayer noise gates, and dbx limiters. Also available are a Kawai grand piano, a Fender Rhodes, and other instruments. Beth shares engineering chores with **KAREN KOEHLER**. 18 Hiawatha Pass, West Milford, New Jersey 07480. (201) 697-7540.

■ **OMNI RECORDING STUDIOS** (Morristown, New Jersey) has just finished cutting a single for **THE TONE CONTROLS**, scheduled for local release shortly. The studio is also finishing up on radio spots for **RITTER-BRAU BEER**, handled by **THE RAMS, LTD.**, agency. 44 Abbett Avenue, Morristown, NJ 07960. (201) 539-8804.

■ **INTERMEDIA STUDIOS** (Boston, Massachusetts) has installed a UREI Time Aligned monitoring system and an Apex Aural Exciter. The first projects using the new system include mixing a live **WAYLON JENNINGS** concert and **LYNN ANDERSON'S** Utah State Fair performance for the **ABC RADIO NETWORK**. Manager **TOM CROSTHWAITE** also announces the addition of **FRED TORCHIO** to Intermedia's engineering staff. Among his credits are work with **JOHNNY WINTER**, **DICKEY BETTS**, **GREAT SOUTHERN**, and **CURTIS MAYFIELD**, and time behind the boards in New York's Record Plant, Miami's Criteria, and Curtom, in Chicago. Currently in Intermedia are **NEW ENGLAND** recording their second album for **INFINITY**, with **MIKE STONE** and **JOHN FANNON** producing and **JOHN BRAND** behind the console. 331 Newbury Street, Boston, MA 02115. (617) 267-2440.

have you?

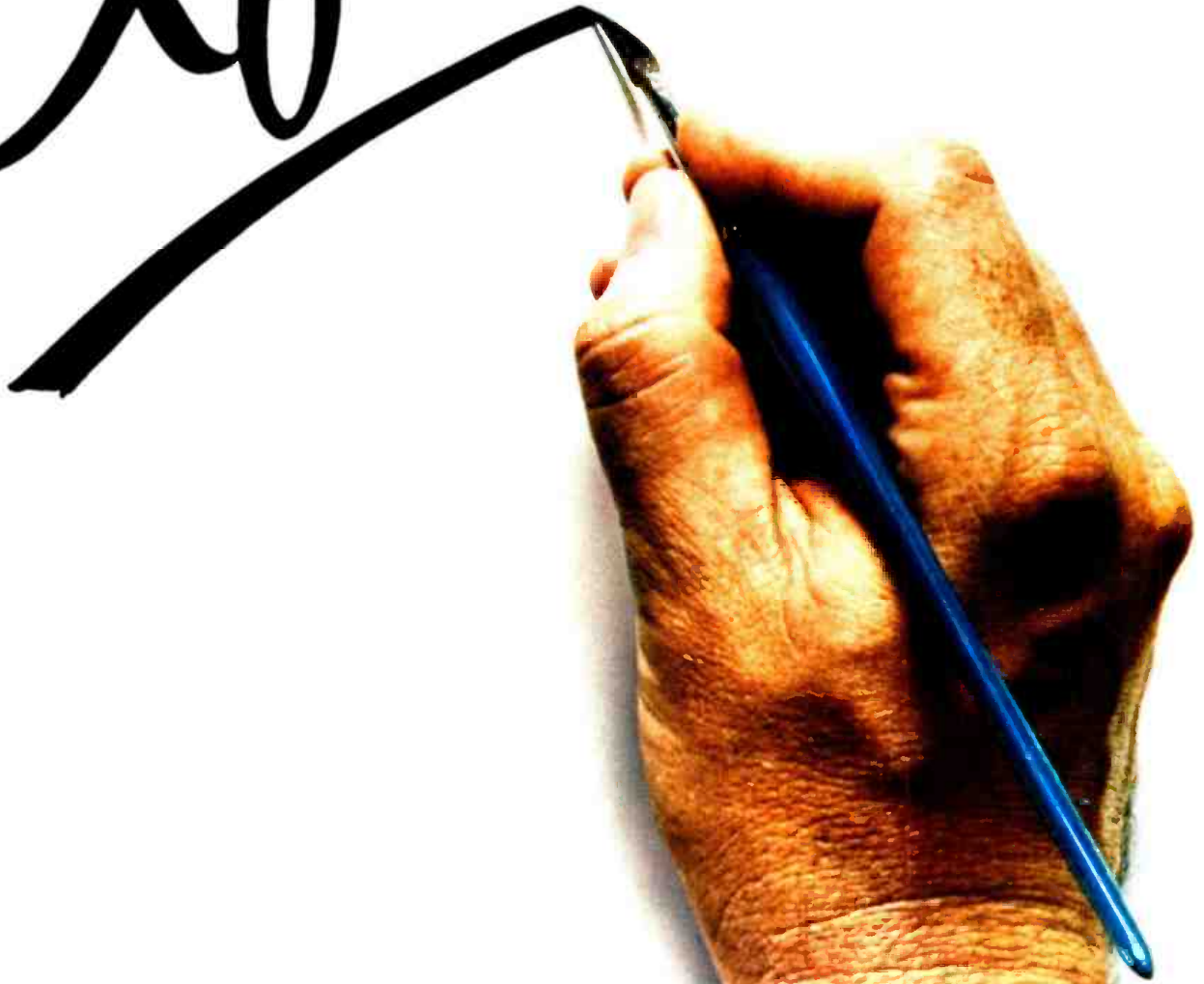
- **Increased track capacity — gone 24, 16, 8 •**
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these are some of the interesting news items that can be announced in the next available issue. Write:

R-e/p STUDIO UPDATE

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STUDIO UPDATE

■ **SOUNDMIXERS RECORDING STUDIOS** (New York City) has named **PAUL SLOMAN** executive director of studio operations. Sloman comes to Soundmixers following a three-year tenure as general manager of The Record Plant, in New York City. The announcement was made by studio president **HARRY HIRSCH**. The facility has also just installed a BTX Microprocessor/Programmer designed to enable filmmakers to produce film mix ingredients and transfer them directly to optical. The new equipment was recently used by Lucas/McFaul to produce a complex 30-second music track for J. Walter Thompson and Ford Ltd. 1619 Broadway, New York, Ny 10019. (212) 245-3100.



Planet of the Tapes

■ **PLANET OF THE TAPES** (Brunswick, Maine) is recording **DUAL SPACE ORPHANS**, a veteran of Maine's **SAME BAND**. The album is being co-produced by **MARK WAINER** and has a working title of "With Friends Like These..." Orphans is the first artist to use the studio's 16-track facilities for an album project. Other work at the studio includes singles by **WAYNE KENT** and **STUART BRAGG**, remote concert recording at Bowdoin College, and demo sessions by **JASMIN**. P. O. Box 212, Brunswick, Maine 04011. (207) 729-4581.

■ **CENTURY III RECORDING STUDIOS** (Boston, Massachusetts) commissioned **SUGARLOAF VIEW** to design its new video facility in the heart of Boston. The new complex, **CENTEL VIDEO**, occupies a three-story building on Beacon Street and features sophisticated video production and complete support facilities. Sugarloaf View had created two previous projects for Century III owner **ROSS CIBELLA**: the Century III Recording complex on Boylston Street, used primarily

for advertising work, and the re-designing of Intermedia Studios, also in Boston. 545 Boylston Street, Boston, MA 02116. (617) 267-9800.

■ **NATIONAL RECORDING** (New York City) selected **SUGARLOAF VIEW** as design consultant for its new recording complex in the former West Side Airlines Terminal Building, at 42nd Street and 10th Avenue in New York City. Sugarloaf worked in conjunction with National's **HAL LUSTIG** and **IRVING KAUFMAN** to create the 24-track facility designed to accommodate the company's advertising and film clientele, as well as record dates. **HARDY HOLZMAN PFEIFFER ASSOCIATES**, supervising architects, and National also consulted Sugarloaf View on a series of smaller voiceover and dubbing studios within the building and on two full-scale film and television shooting stages. The multi-million dollar project was created under the auspices of the **42ND STREET DEVELOPMENT CORPORATION**. 730 Fifth Avenue, New York, NY 10019. (212) 757-6440.

Southeast:

■ **ALPHA AUDIO** (Richmond, Virginia) has recently completed recording and mixing of the new **ROBBIN THOMPSON** LP, which was produced by **KEN BROWN**. Assisting on backup vocals were **TIMMY SCHMIDT**, of **THE EAGLES**, and **RICK ROBERTS**, lead singer for **FIREBALL**. The album took in excess of 330 hours to complete, and was the first session anywhere to utilize the Lexicon 224 digital reverb, which was used extensively with a Lexicon Prime Time. Thompson was previously a full-time staff writer for Alpha's jingle division, Candyapple Music. 2049 West Broad Street, Richmond, VA 23220. (804) 358-3852.

■ **OMEGA RECORDING STUDIO** (Kensington, Maryland) has recently upgraded its facility with the addition of an API 32 x 24 console with Allison Fadex Automation and, in the main studio, an MCI JH-114 24-track recorder with dbx noise reduction. An Audiotronics "Grandson" console is available in their production studio with Studer and MCI machines. Processing equipment at Omega includes EMT Stereo Echo, the H-949 Harmonizer, and six LA-4 limiters. Westlake monitors are in the large studio, with JBLs in the small one. The main control room was designed and tuned by **JOHN W. GARDNER, INC.**, of Nashville. Engineers are **BILLY BRADY** and studio manager and owner **BOB YESBEK**. 10518 Connecticut Avenue, Kensington Shopping Center, Kensington, MD 20795. (301) 946-4686.

■ **dgp STUDIOS** (North Miami, Florida) announces the upcoming expansion of their existing 8-track studio with the addition of a complete new 16-track facility. In addition, **DAVE GRAVELINE** and **JIM RUDD**, of dgp, have been appointed to the Mayor's Task Force 101 as part of the recording industry in North Miami. The body of business community representatives will be working to develop South Florida as a center for audio, video, and film production. Plans include re-naming 149th Street to Bee Gees Boulevard as part of a theme for South Florida's recording district. 1975 N. E. 149th Street, North Miami, FL. (305) 940-6999.

■ **TRIAD RECORDING STUDIOS** (Ft. Lauderdale, Florida) has upgraded its equipment with the addition of UREI 813 Time Aligned Studio Monitors, Lexicon Digital Reverb, a UREI LA-2A Tube Limiter, and four additional AKG 414 microphones. Artists recording at the studio include **THE RENEGADES**, with engineers **MICHAEL LASKOE** and **KURT SAXENMEYER**. **THE LOYD ELLORY BAND**, engineered and produced by Laskow, and **CARL DRIGGS & THE NEWZ** with producer **BOB DOVO** and engineer **ERIC SCHILLING**. Driggs, formerly of **FOXY**, wrote and recorded that band's platinum hit, "Get Off." 5075 N. E. 13th Avenue, Ft. Lauderdale, FL 33334. (305) 771-1431.

■ At **BAYSHORE RECORDING STUDIOS** (Coconut Grove, Florida) **BOB SEEGER** has been in recording his latest LP for **CAPITOL**, with producer **BILL SZYMCZYK**, who just completed production at Bayshore of **THE EAGLES** latest album, "The Long Run," for **ELEKTRA-ASYLUM**. Szymczyk has also been producing the latter labels' **JOE VITALE**, at Bayshore. **THE OUTLAWS** have been in the studio as well, mixing their new LP for **ARISTA** with **JOHNNY SANDLIN** producing and **KURT KINZEL** engineering. 2665 South Bayshore Drive, Coconut Grove, FL 33133. (305) 856-5942.

■ **CENTURI RECORDING STUDIO** (Coral Springs, Florida) has just completed a master by artist **JOE ANTHONY PULLEN**, of Detroit, Michigan. The tape was recorded and mixed by **FRANK GIARDINO**, who is currently involved with a new album by Los Angeles screenwriter/artist **QUAY HAYS**. Centuri is a 16-track operation with plans to go to 24 in the near future. 11460 West Sample Road, Coral Springs, FL 33065. (305) 753-7440.

■ At **CRITERIA RECORDING STUDIOS** (Miami, Florida) **ANDY GIBB** has been working on his upcoming LP for **RSO** with **KARL RICHARDSON** engineering. Jazz pianist **MONTY ALEXANDER** is producing his own new album for the **PABLO** label with Criteria president **MACK EMERMAN** engineering with **STEVE KLEIN**, and **BLACK SABBATH** is cutting tracks for any LP for **WARNER BROTHERS**, engineered and produced by **MARTIN BIRCH**. **THE OUTLAWS** have been in mixing their upcoming **ARISTA** album. Mastering work out of Criteria of late includes **KENNY LOGGINS'** latest single, "This Is It." The studio's remote truck has also been active, recording separate concerts by **THE KNACK** and **THE POLICE** at Miami's Gusman Hall. 1755 N. E. 149th Street, Miami, FL 33181. (305) 947-5611.

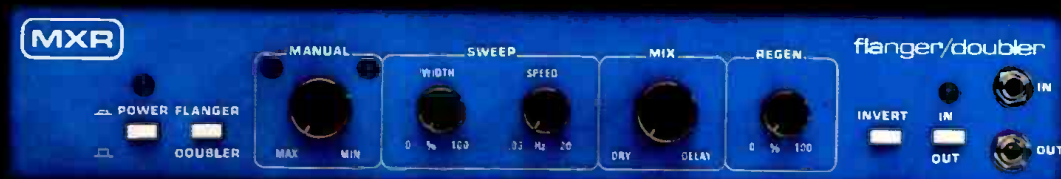
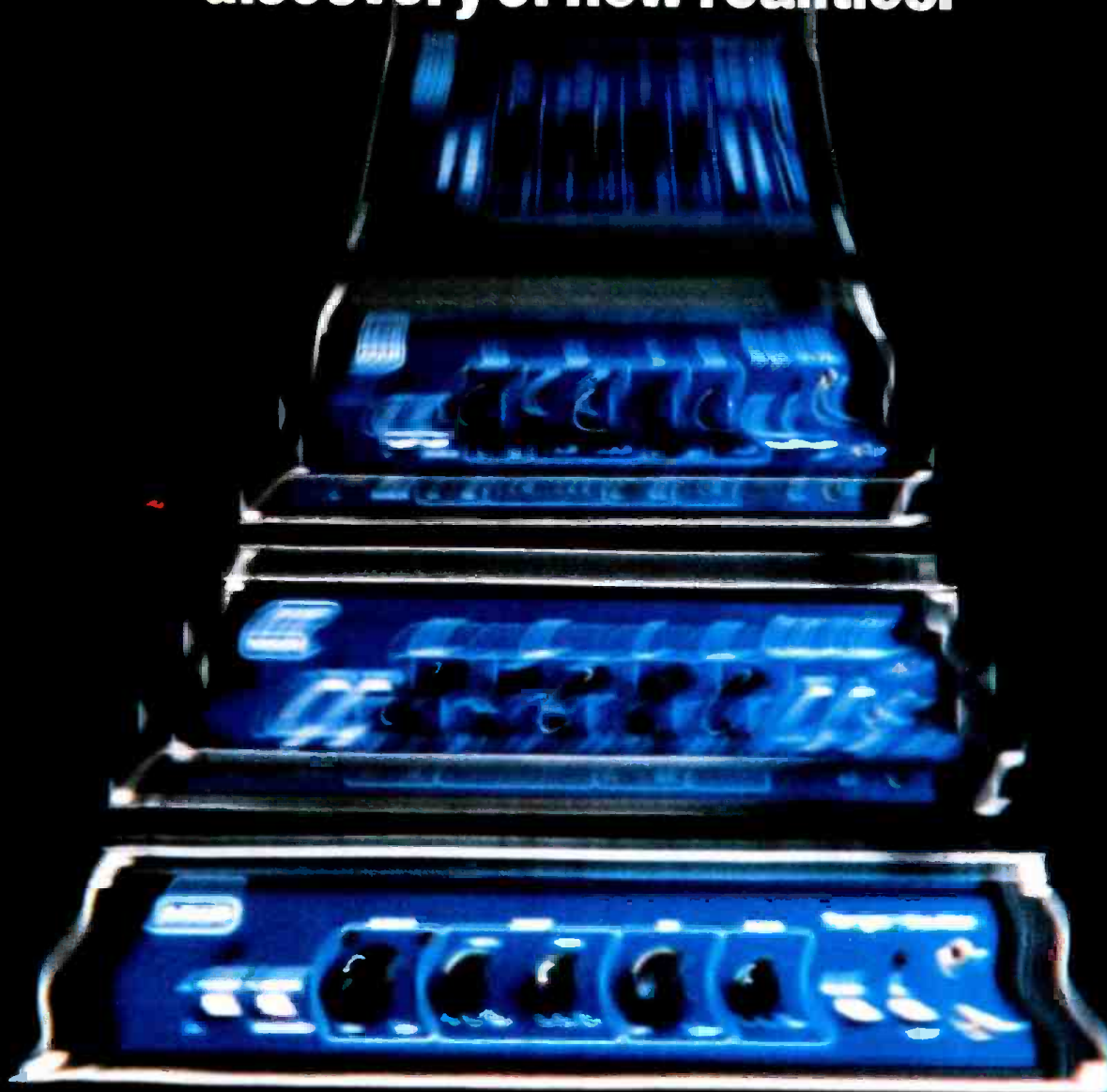
South Central:

■ **OMEGA AUDIO** (Dallas, Texas) has expanded its remote recording operations with the addition of a second, larger remote truck. The new truck is 25 feet long and 8 feet wide, and is equipped with a custom built 32 x 24 console with

— continued on page 24 . . .

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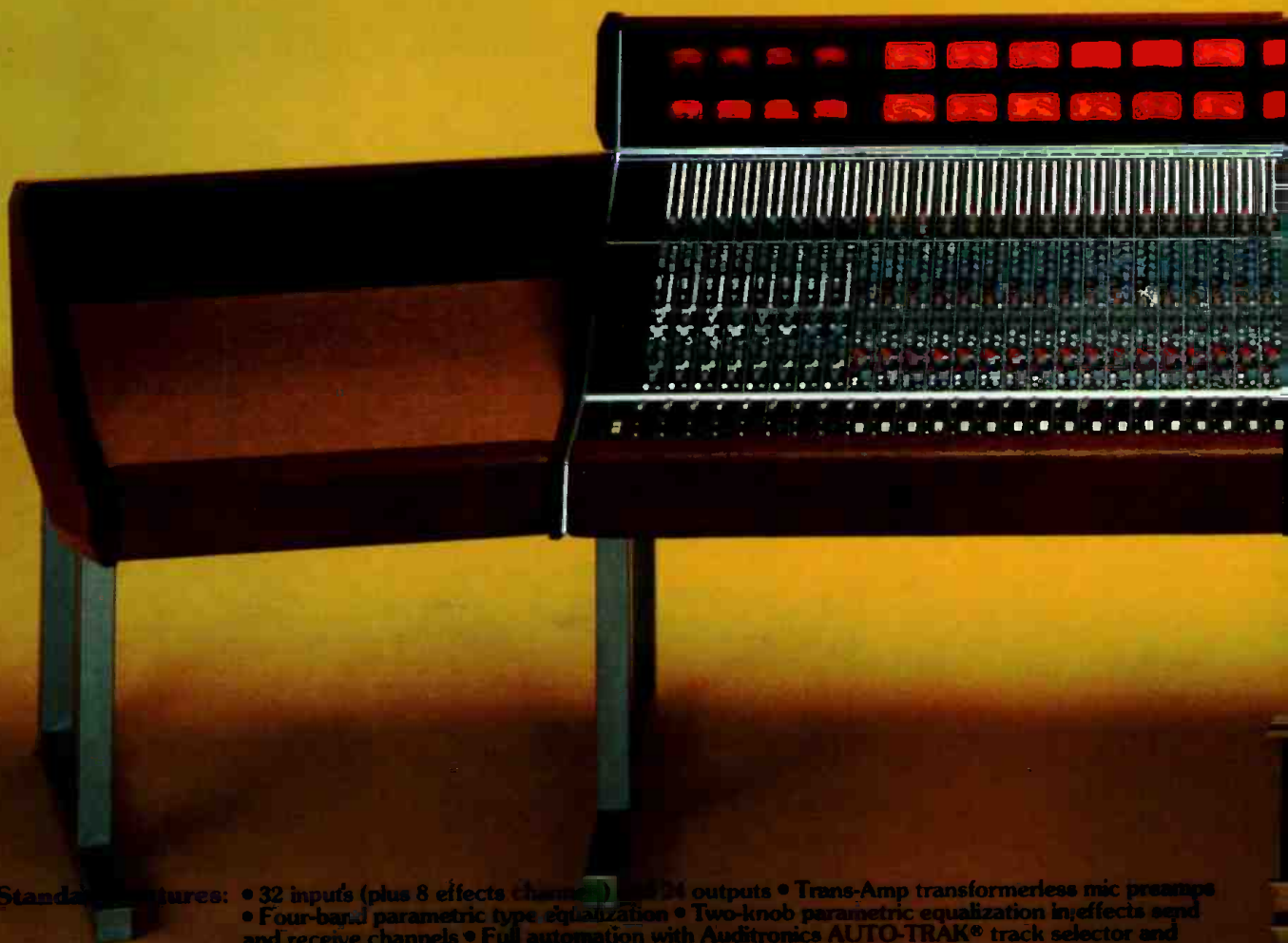
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STUDIO UPDATE

... continued from page 20 —

parametric equalization on each IO module. The console is specially built for video support and can drive up to 12 external sources as well as 24 main busses. The Otari MTR-90 24-track recorder is fitted with microprocessor-assisted auto-locator, and monitoring is via JBL 431s with UREI 539 1/3-octave graphics for room tuning and the usual Auratones. Also available is a compliment of over 40 microphones, Lexicon 224 digital reverb, dbx noise reduction and limiters, and Delta Lab's DL-1 digital delay. Recent artists have included **BLONDIE**, **SAMMY HAGER**, and **HALL AND OATES**. 2805 Clover Valley Drive, Garland, TX 75041. (214) 226-7179.

■ In **JACK CLEMENT RECORDING STUDIOS** (Nashville) **DEBBIE BOONE** has been working on her new album for **WARNER/CURB** with **LARRY BUTLER** producing and **BILLY SHERRILL** filling the role of engineer. Also in Clement, the New York rock group, **THE SMASHERS** cut their first album with **PHIL SIGAL** and **MICHAEL SNOW** producing with **GARY LANEY** engineering. Other activity includes sessions by **SAUNDRA STEELE**, **DIANE PFEIFER**, and French recording star **EDDY MITCHELL**. 3102 Belmont Boulevard, Nashville, TN 37212. (615) 383-1982.

■ **YOUNG 'UN SOUND** (Nashville), formerly Studio One, announces the completion of its studio and control room upgrading. The studio now has a string porch, vocal booth, and drum room with electric windows for separation. The control room is now equipped with a Sphere Eclipse "C" 32 x 32 console fully automated with an Allison programmer. There are two Ampex 24-track recorders with 16-track capability, and a BTX sync generator to link the two machines. Outboard gear includes Lexicon digital echo, an Eventide Harmonizer, and an assortment of limiters. Work at the studio has included sessions by **JERRY REED**, **LARRY GATLIN**, and for the soundtrack to the film "The Hamster of Happiness," starring **ROBERT BLAKE** and **BARBARA HARRIS**. **CHIP YOUNG** is the owner of Young 'Un Sound, and staff engineer/producers are **STAN DACUS** and **GLEN RIEUF**. 114 17th Avenue, Nashville, TN 37203. (615) 244-5656.

■ **ARDENT RECORDINGS**' (Memphis) projects this past fall included **ZZ TOP** completing their new album for **WARNER BROTHERS**, with **BILL HAM** producing and **TERRY MANNING** engineering; **LARRY RASBERRY'S** first LP for **MERCURY RECORDS**, produced by **RALPH MURPHY** and engineered by **JOHN HAMPTON** and **JOE HARDY**; and **SHAUN CASSIDY** putting the finishing touches on his upcoming album with **MICHAEL LLOYD** producing and Hardy engineering. 2000 Madison Avenue, Memphis, TN 38104. (901) 725-0855.

■ **ALPHA STUDIOS** (Austin, Texas) opened its doors this past fall with a full 16-track Ampex studio. The facility features a variety of outboard equipment, including an Eventide Harmonizer, digital delay, and dbx. A 1,000 square foot apartment is available on the premises for out-of-town artists. **DAN B. UZZELL** is the owner, and **LAMAR PERCORINO** is the studio manager. 1700 East 12th Street, Austin, TX 78702. (512) 472-6151.

■ **BUFFALO SOUND STUDIOS** (Ft. Worth, Texas) has named **LARRY WALLACE** to the post of chief production engineer. Wallace, a former classical guitarist, joined Buffalo Sound after serving for four years as chief engineer of Autumn Sound, in Dallas. The studio has recently added a 38-channel fully automated MCI console to go with its 24-track MCI recorder. Owner **JIM HODGES** has also had installed a UREI Time Aligned crossover network to the control room monitoring system. 910 Currie Street, Ft. Worth, TX.

■ **ROYAL SHIELD'S RIVER CITY RECORDING STUDIOS** (Baton Rouge, Louisiana) opened its doors this past summer after three years of planning and construction. A Harrison 2824 console with Allison 65K Automation is in the control booth along with an MCI 24-track recorder and MCI 2-track machine, with Dolby "A" noise reduction. Monitors are by Altec, JBL, MDM, and Auratone, while microphones are by Sennheiser, AKG, Shure, and Electro-Voice. Studio space can handle recording an orchestra, and musical instruments include a Prophet-5 Synthesizer. Recording at River City have been such artists as **GEORGE PERKINS**, **CYNTHIA SHEELER**, and **LOUISIANA LAROUX**. Royal Shield Incorporated, its record company and subsidiaries, is headed by **HOMER J. SHEELER, SR.** River City is managed by chief engineer **HAL ELLIS**, and senior engineer is **RONALD DOBBS**. P. O. Box 3157, Baton Rouge, LA 70821. (504) 383-8671.

■ **BEN JACK RECORDING STUDIO** (Fort Smith, Arkansas) has updated from 8- to 16-track with the addition of an Audiotronics Model 501 26 x 16 console and an MCI 16-track recorder with auto-locator. Also installed recently were a plate echo chamber and a new JBL monitoring system. This is the 13th year of the studio's operation. 5707 Jenny Lind, Fort Smith, AK 72903. (501) 646-7731.

Midwest:

■ **ACKERMAN & MC QUEEN ADVERTISING** (Oklahoma City, Oklahoma) has produced its first advertising campaign in its new 24-track Golden Voice studio. The series of five spots were for **C. R. ANTHONY COMPANY**, a junior department store chain with over 300 stores. Musical arrangements for the jingles, ranging from country/western, to MOR, to disco, were composed by A&McQ staff members **MARK KELLER** and **BILLY PANDA**. 5708 Mosteller Drive, Oklahoma City, OK 73112. (405) 843-9451.

■ **CREATION AUDIO RECORDING** (Bloomington, Minnesota) announces the completion of its upgrading to 24-track, this on their fifth anniversary. Owners **STEVE WIESE** and **TERRY GRANT** have interfaced their parametric 28 x 24 Syncon console with a new MCI JH-114 recorder with AutoLocator III. The studio also features Ecoplate, AKG BX-10, and Mic MR II reverberation, an Eventide Harmonizer, and two DeltaLab digital delays. Recent sessions include singer **SUE ANN CARWELL** produced by **JAMES WALSH**, and **LIFESONG** recording artist **NINA KAHLE**. 5002 West Old Shakopee Road, Bloomington, MN 55437. (612) 881-6020.

■ **SHADE TREE STUDIOS** (Lake Geneva, Wisconsin) has added **DAVID PINKSTON**, formerly of **CAPRICORN RECORDS**, to its engineering staff. Pinkston has been involved with 34 album projects, working with such artists as **THE MARSHALL TUCKER BAND**, **WILLIE NELSON**, and **THE CHARLIE DANIELS BAND**. He also has live sound experience with the likes of **SEA LEVEL** and **B. B. KING**. The announcement was made by Shade Tree owner **ANDY WATERMANN**. P. O. Box 168, Lake Geneva, WI 53147. at the Playboy Resort. (414) 248-2400.

■ **LANSING SOUND STUDIOS** (Okemos, Michigan) has added to its 24-track operation with the installation of a 3,000 cubic foot natural reverb chamber, a Lexicon 224 digital reverb unit, a Marshall Time Modulator, and an Eventide Harmonizer. Lansing is equipped with a Neotek III mixing console and an MCI 24-track recorder. It is owned and operated by **BOB BALDORI**. 2719 Mount Hope Road, Okemos, MI 48864. (517) 351-6555.

Golden Voice's Panda. Anthony's Ron Cawthon



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STUDIO UPDATE

■ **STREETERVILLE STUDIOS** (Chicago) has just completed installation of a BTX SMPTE in their re-mix suite. The new unit will allow producers to sync the studio's U-Matic video machine with 24-track tape machines. The room is also equipped with an automated Harrison, and once the mix is achieved, a producer can update audio parts to correlate with the visual program without having to do another mix. 161 East Grand Avenue, Chicago, IL 60611. (312) 644-1666.

■ **5TH FLOOR RECORDING STUDIOS** (Cincinnati) recently recorded the debut album of **DAYTON** for **UNITED ARTISTS RECORDS**. The LP is being produced by **RICH GOLDMAN** and **SHAWN SANDRIDGE**, with **GARY PLATT** engineering. Other recent activity includes **EMI** recording artists **BREATHLESS** broadcasting a live radio concert from 5th Floor over **WEBN-FM**, in Cincinnati. Engineering was again by Platt. 517 West 3rd Street, Cincinnati, OH 45202. (513) 651-1871.

■ **STAR TRACK STUDIOS** (Tulsa, Oklahoma) has been booking sessions for about six months since its move from Little Rock, Arkansas. The studio consists of a Tascam 16-channel board, an Otari 8-track recorder, noise reduction, and equipment by Ampex, Crown, Shure, and Sennheiser. **AURAL EXPLORER** artist **KEITH SLANE** has been in the studio recording tracks for his next album, which will be all synthesizers. Star Track is owned by **ROD** and **SALLIE SLANE**. 2004 East 14th Place, P. O. Box 4873, Tulsa, OK 74104. (918) 592-3838.



Audio-Video Recorders

Southwest:

■ **AUDIO-VIDEO RECORDERS OF ARIZONA, INC.** (Phoenix) has updated their studio A with the installation of an Ampex MM-1200 16/24-track recorder, a Spectra Sonics console and power amps, 24 channels of Dolby, Studer and 3M 2-tracks, stereo EMT and live chambers, and other outboard gear. The studio measures 66' x 44' x 20' plus isolation booths. Other facilities include disk mastering, high speed cassette duplication, and complete Sony video facilities. 3830 N. 7th Street, Phoenix, AZ 85014. (602) 277-4723.

Mountain:

■ **NORTHSTAR STUDIOS** (Boulder, Colorado) reports that **FIREBALL** is in cutting final tracks for their forthcoming album on **ATLANTIC**. **DUANE SCOTT** is at the controls co-producing the band. 1831½ Pearl St., Boulder, CO 80302. (303) 442-2001.

(Boulder, Colorado) recently provided their mobile 24-track recording unit for a two-night engagement in Omaha and Kearney, Nebraska, by **WAYLON JENNINGS**, **THE WAYLORS**, and the original **CRICKETS**. The Sanborn mobile was engaged by **BACKSTAGE, LTD.**, of Cambridge, Massachusetts, to record the concerts for a future **ABC RADIO** country music series. **GREG EDWARD** engineered with **LARRY MARTIN**. **LARRY SCHWARTZ**, and Sanborn president **CARL FROST** assisting. 1280 28th Street, Suite 10, Boulder, CO 80303. (303) 443-2372.

Northern California:

■ **TEWKSBURY SOUND RECORDERS** (Richmond, California) have added to their equipment list with the purchase of an AKG tube microphone, MXR flanger and phaser units, UREI limiters, an AKG 414EB, and an RCA BA6A. In the studio, **PSYCOTIC PINEAPPLE'S** first album is nearing completion with **DAN ALEXANDER** and **RICHARD VAN DORN** behind the console during mixing. **THE MUTANTS** are putting the finishing touches on their next single, and the Jamaican reggae unit, **THE SOUL SYNDICATE**, were in doing work on their own album, as well as backing **JACK MILLER**, **JOHN NELSON**, and **RON RHOADES** on their projects. 6026 Bernhard, Richmond, CA 94805. (415) 232-7933.

■ **MYSTIC ISLE RECORDING STUDIO** (Sacramento, California) is finishing up **HORSEPOWER'S** first LP featuring **BOB PEARCE** and produced by **BOB WILLIAMS**. The album master soon will be put on the market by **THE NETWORK GROUP**, who is looking for an interested label. P. O. Box 160281, Sacramento, CA 95816.

■ **HEAVENLY RECORDING STUDIOS** (Sacramento, California) has completed its expansion from 16- to 24-tracks by installing an MCI recorder with full dbx noise reduction to go with the studio's Quad-Eight 28 x 24 console. Other equipment includes a Marshall Time Modulator, an Eventide Harmonizer, UREI limiters, Quad-Eight expanders, and three monitoring systems. The first session on the new equipment was engineering by **LARRY LAUZON** for **X-CALIBER**. **MARTIN ASHLEY** is chief engineer. 1020 35th Avenue, Sacramento, CA 95822. (916) 428-5888.

■ At **THE AUTOMATT RECORDING STUDIOS** (San Francisco) recent sessions have been by **JOURNEY** recording their new album for **COLUMBIA** with **KEVIN ELSON** and **JEFFREY WORKMAN** co-producing and engineering; and **CON-FUNK-SHUN** recording with **SKIP SCARBOROUGH** producing and **LESLIE ANN JONES** engineering, and **TASMANIAN DEVILS** working on their first LP for **WARNER BROTHERS** with **ERIK JACOBSEN** producing and **MARK NEEDHAM** engineering. 827 Folsom Street, San Francisco, CA 94107. (415) 777-2930.

■ **MUSIC ANNEX** in Menlo Park, California has recently completed Studios B and C, to become one of the most comprehensive facilities in the Bay Area. Equipment includes Amek M2000 consoles, MCI 24 track machines, as well as EMT 140 and 240 echo. Future plans call for modification of Studio A by Everything Audio. (415) 328-8338.

Southern California:

■ **WALT DISNEY PRODUCTIONS** (Burbank, California) did the re-recording work on their new science fiction film, "The Black Hole," using their new Harrison Post Production Console. The 48-input board was installed and interfaced last May by **ELECTRO-MEDIA SYSTEMS**, and the microprocessor-based console has been involved in a heavy schedule under the hands of **JOHN VAN FREY**, **BOB HATHAWAY**, **FRANK REGULA**, and **NICK ALPHIN** to ready the film for its December release. 500 S. Buena Vista Street, Burbank, CA 91521. (213) 845-3141.

■ **RUSK STUDIOS** (Hollywood) was the site of pre-recording sessions for **DONNA SUMMER'S** upcoming **ABC TELEVISION** special. **JUERGEN KOPPERS** engineering the sessions for **ERNEST CHAMBERS PRODUCTIONS**. Also at Rusk, producers **ELTON AMI** and **GLORIA JONES** are mixing **RICARDO DECAMPOS'** upcoming album on **CASABLANCA**. **JOEY CANZANARA** and **DAVID STEVEN D. SMITH** are engineering. 1556 N. La Brea Avenue, Hollywood, CA 90028. (213) 462-6477.

■ **TRACK RECORD** (Los Angeles) has expanded to 16-track with the addition of an MCI recorder, a custom built Op-Amp Labs console, and new UREI 813 Time Align monitors. Outboards include a DeltaLabs acousti-computer, a UREI 1176 limiter, Kepexes, and a U-47 tube-type microphone. The studio is also expanding its physical space by adding two new rooms, offices, and a tape library. Track Record is owned and operated by **BOB SAFIR** and **TOM MURPHY**, with **TONY BRAITHWAITE** as second engineer. 5249 Melrose Avenue, Los Angeles, CA 90038. (213) 467-9432.



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Todd Rundgren

on the
AUDIO/VIDEO
fusion
&
other subjects

interview by
TOM LUBIN
photography by
Art Rex

R-e/p (Tom Lubin): Along with your record production you have, over the last couple of years, gotten more involved with video. I believe you've recently completed RCA's first video disk.

Todd Rundgren: That's true.

R-e/p (Tom Lubin): You've undoubtedly spent a fair amount of time thinking about the audio/video marriage and the direction a recording act should take to get into video as a part of their audio production.

Todd Rundgren: For most people who are unacquainted with techniques about video, they're as good as beginners in a whole new medium, so that being successful as a recording artist does not automatically qualify them for success once they start working in the visual area as well. Anybody who has an interest in video should begin by re-educating themselves about the techniques that are available. It's much more sophisticated and complicated and expensive than sound recording. You can't just assume that you will just go into a video studio and be successful in the same way that you were making records. I went through a long period of experimentation before I arrived at the point where I can do something that I feel is adequate both technically and artistically, so that it can be released for public distribution. Up until now everything I've done has been more-or-less experimental. I showed RCA an extremely crude demo of the project I wanted to do. It was on the basis of that demo that I got the project. It was not because I was a recording artist or a producer.

"... recording is not the vital medium it once was ... when I got involved with music it was the most vital art form happening ... nowadays the heroes are from TV ... everybody nowadays is more influenced by TV than records ..."

R-e/p (Tom Lubin): How did you put together the demo?

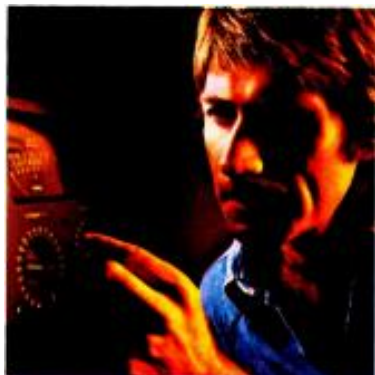
Todd Rundgren: It was something I had done for Utopia's show. We had been doing some video, transferring it to film and then interspersing it in our live show.

One of the bits that I had done was a piece of music, "The Planets As Realized by Tomita," composed by Holst. I had done the first seven to ten minutes of the record's first side. I had a variety of other things that I showed them, but that was the one that they responded to. They were looking for someone to put together a demonstration disk, to show people that the real potential of video disk is in what appears on the disk, and not necessarily the hardware. Ultimately, existing catalogs will be exhausted and all the possible movies that have been made over the past fifty years will be available and then people will want new programming. RCA wanted to convince people that there will be artists ...

R-e/p (Tom Lubin): Musical artists ... ?

Todd Rundgren: Well, not necessarily musical. This is a musical project, but the disk has as much emphasis on the visual as on the musical. A lot of people think the music was made for the visuals, though it was the other

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" . . . being a successful recording artist doesn't automatically qualify them for success in video . . . "

way around. The particular piece of music that I used allows a lot of visual latitude because it has a lot of synthesizer and passages of abstract noise that aren't in the normal musical composition. I utilize those parts of the music to fill out story line and emphasize the visual more than the music.

R-e/p (Tom Lubin): Do you think that video disks with musical artists is something that will only be developed with well-established recording acts? Or, do you think that the record companies will get into full blown productions with new acts?

Todd Rundgren: I think that it is going to have to start from scratch. As I said, people may be successful in music but that doesn't qualify them for success in terms of the video/visual medium. They may not have good ideas or they may not have the temperament to work in the medium, or whatever. In order to find those successful artists, people who can operate within the medium, there will have to be a starting over.

Possibly there will be pairings of people who are successful in music and people who are successful in visuals. The two talents will get together and realize a concept together. The video artists will be familiar with the language and techniques of the video studio and be able to bring that reality to the process, and the musicians will bring their particular sonic vision to the project. In pre-production they can establish what the concept is, what they intend the focus to be at any one point. Subsequently the music can be made/composed to complement the visual. And the visual will be made/composed/performed to complement the music. Ultimately there may be some people who will be adept at both, who can be functional in both technologies, which is quite a challenge. Video is much more complicated to me . . . much more than sound. It's a more rapidly developing technology for one thing. It is closer to computer technology. Digital applications have been in video for a number of years now, but it's just now being introduced for sound.

R-e/p: How far away is the wide distribution of video disk hardware?

TR: Nobody wants to guarantee that . . . to say how long it will take or when it will happen. The point is that it will, the concept is already here with video tape. It's the concept of using programmable software and a device that allows them to do that programming.

I was talking to Gregg Calby, at Sterling Sound, the other day and he said that strictly audio products are already spinning off the video disk technology.

R-e/p: Such as the 5" Philips Audiodisk System?

TR: Yes. It's very small, but it will hold an hour on each side without any surface noise whatsoever and never wear out. He predicted that in three to four years what they're doing now at Sterling will be obsolete. From a technological standpoint it already is. The development of the video disk has done that. All they had to do was leave the picture off. From a practical standpoint, how long will it take for all the existing machines to be replaced by new ones is hard to say. My personal feeling is that the technology that they have announced today will be replaced in five years. It doesn't matter whose system . . . Philips, MCA, RCA, or whoever else has a system that is available now . . . it will be technologically obsolete in five years. When it will be practically obsolete, well, it's anybody's guess.

I think eventually it will be centrally operated, you won't have to own a reproducer. It will cause an overall revolution in systems of communications — your television, music, telephone . . . everything will be tied together. You will have your own computer in your house. There are systems like this already in operation like C-Fax, in England, View-Data Systems, and things like that where you can dial into a central computer bank with your telephone. The terminal in your house is fed from the telephone lines.

Someday all recordings could be placed in a giant bank and you could just load it out. When somebody completes their audio they could

take it down to the central CPU, make it into digital information, and store it on a disk somewhere. That's how they store it now. I don't know how they will do it in ten years. The technology advances are so rapid, it's impossible to speculate what will be possible then. It's just incredible.

R-e/p: As more and more consumers acquire video and video/audio playback hardware will the analog phonograph disk systems decline in popularity and be phased out?

TR: I think the emergence of the video disk is going to happen faster than the decline of the phonograph record. The reason why is related more to the software of the two rather than the hardware. Recording is not the vital medium it once was.

I think it's because of the rapid expansion of television into other areas. There are other reasons as well. When I got involved with music ten or fifteen years ago, it was because I thought it was the most vital art form happening. Most of the people my age also felt that way. The people I knew were constantly buying records, listening to and absorbing what they heard. They tried to respond to the recording artist and emulate what they learned from the record. To a certain degree that phenomenon is still prevalent, but the heroes of nowadays are The Fonz, and Mork and Mindy, people that appear on television. A few years ago anyone who was in *Sixteen* magazine was in a rock n' roll band. Now 95% of the people in *Sixteen* are in TV programs, and that's because everybody nowadays is more influenced by television than by records. They buy records purely for entertainment value, and nine times out of ten it's background music to accompany other activity, or to fill in periods of silence and boredom in between other activities which are more important to them.

R-e/p: Do you think there will be a problem with video burn-out? Won't people become more rapidly bored with the video than the audio portion of the program?

TR: I don't think so. Besides, they can always do what they do now . . . not look at the picture or turn off the sound. A lot of people will interpret the video disk as being some extension of something they have already seen on television. I think that by the time the hardware has reached practical proportions the software won't be anything like that. Artists are going to take a much more serious approach to the medium . . . it won't be enough just to stand there and play a song or run around in sped-up or slow motion like the Monkees. It's going to be a challenge for people to interpret their ideas visually. There will be a lot of experimentation and a wide open feel of interpretation because nobody is going to have the same qualifiers as to what is supposed to appear on their TV screen once they stop watching network programming as much.

R-e/p: Which seems to be happening with cable TV.

TR: It's happening now. For instance, in New York you can get your own TV show. For \$25, plus your production costs, you can be on cable TV. You have half-an-hour to do anything you want. You can just stand there and have people look at you. I understand that some people are doing just that. They have no idea what to do with their own TV show.

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"... some who sell lots of concert tickets don't sell so many records... like us... we almost always do sell-outs... I'm not a gold album artist..."

R-e/p: I understand you are setting up a full video facility in Bearsville (New York).

TR: Yes.

R-e/p: Do you think the designers of new audio studios need to include at least the essentials required for video?

TR: I think they have to. They have to be prepared to interface with each other. They will have to understand video procedures as well. When you are recording just the sound you will always have to put time code on the tape, and everything will probably be done according to it. You may have segments of video recorded before the sounds, and do the equivalent of sync sessions in order to get certain aspects of the sound and visual linked up.

R-e/p: You've talked about video and video tape. The film medium is getting much more sophisticated as well.

TR: Yes, particularly in the presentation of sound. Further, the only way that film can compete with video at this point is to utilize video in some form so the film process can run more efficiently. A lot of film people use a beam splitter or some kind of process by which they can video tape and film through the same lens. They do this so they can re-play the scene on video tape to see if it's right, to prevent re-shoots and processing film that's not happening. The single advantage of film at this point is that it's big. It won't maintain that advantage when people start seriously dealing with flat, large screen television and things of that nature. It won't be a faster scan process any longer, once they get digital flat screen video walls that directly interface to a computer. It won't need to have defined parameters as a television does. That's the advantage of computers, their flexibility. Some people have this idea that computers take over things, but that's not what computers do. Computers are stupid. Trying to get them to do something other than what some human has originally told them to do is virtually impossible. They can do things very quickly and have the ability to do a great variety of jobs, but only within the programmer's parameters.

R-e/p: How do you proceed when you want to create a video production for a music piece which already exists?

TR: I study the music extensively and collect my visual ideas. Then I actually script it out, time out the musical segments, give them scene numbers and script out action for each one, story board the whole thing, then go into pre-production. Then I proceed to tape it. The way we tape it, it's more like film, we don't have a deadline in terms of how long it's going to take to get a scene.

One of the things I've noticed about video probably has its roots in that industry's infancy when it was all live. Even now that they have video recorders the whole approach continues to be efficient and expeditious. You do it as if it were live, though it's not.

R-e/p: Because of the cost of production?

TR: Yes, and other associated factors, and partly tradition. In any case, when we did our taping we might spend all day working on a three-second scene. Some of the scenes may need special effects and may require as many as a dozen visual overlays done at different phases along the line.

R-e/p: In your case, how did the music producer/engineer develop into a video producer as well.

TR: The first thing I did was about four or five years ago. It was a TV commercial I did at WNET for an album of mine. I had seen the Electric Company, on WNET, and they were using a lot of video synthesizer. It became a fascination of mine and I got more involved with it. I invested in some equipment — a couple of video cassette machines, a couple of synthesizers, switching stuff, cameras, and started to do my own experimental tapes about four years ago. We incorporated some of them into a few of our live shows, others were used for promotional tapes for Warner Brothers/Bearsville. Ultimately, when video disk became a practical thing, I figured that I should make the plunge. I didn't think that anybody at that point had the chutzpah to make a commitment to the software aspects of the video disks; which is to say actually building a studio for that purpose.

There isn't another studio that has the vocabulary that this studio has in terms of modern visuals. We have a two channel "squeezoom." It's a two channel digital video manipulation unit that cost about \$130,000. A Rutt-Etra synthesizer, a Spectre, a Chromaton, and a computerized paint box. We have a collection of things that no one else has, to give us the broadest range of visual possibilities.

R-e/p: You mentioned that you have used video in your live act.

TR: When we did it it was a bit of a headache. You never knew if it was going to work right or not. We had to use a special dual system. The soundtrack was on one machine running at the standard 24 frames per second (standard film speed), and the projection machine ran at 30 frames per second. Because we had done the things originally in video, the optical transfer had to be done at 30 frames per second instead of the usual 24. Some video doesn't matter if you transfer it to 24, but when you do synthesized video it looks strange.

R-e/p: Live presentations in general have become more and more visual. When you go out on tour you are very visual.

TR: Sometimes... lately we are mostly music, we jump around a lot. We don't take much stuff out on the road.

R-e/p: What do you feel is your major technological problem on the road?

TR: Our last problem was with lighting companies. For some reason they are not always together.

R-e/p: How is your sound on stage?

TR: Our own sound is a super-controlled situation, which doesn't vary. We don't use big amplifiers, we use a rather small set-up. We have extensive monitoring instead. I have a separate guitar and a vocal monitor that I can control the level of independently. They both go through a graphic equalizer so I can get any kind of EQ or sound level I want. Roger has a special monitor for his keyboards that he controls independently, and he has a vocal monitor that has not only his voice but the other background singers as well. I don't like to listen to any of the other vocals... I sing a lot of lead and find it distracting.

R-e/p: Do you carry your own PA?

TR: Lately we have a sound company do it. We don't have our own sound system. If you don't do a lot of touring it's impractical; it's too much to maintain, you have to have your own trucks, etc. We don't tour that much.

R-e/p: Do you carry your own monitors?

TR: Yes.

R-e/p: How important do you think getting out on the road is to sell records?

TR: I don't know. I think that they used to be very interconnected, but nowadays I'm not sure. Some people who have sold lots and lots of records don't sell concert tickets. Some people who sell lots of concert tickets don't sell so many records... like us. We always do fairly well at concerts. We know what size gigs to book... we almost always do sell-outs. We haven't had a record out for two years. Nor am I a gold album artist.

R-e/p: You've been spending time producing other acts — Patti Smith, Meatloaf, The Tubes, and Alice Cooper.

TR: Rick Derringer.

R-e/p: They're on the road quite a bit.

TR: Sure, they make their living on tour and I make mine producing their records. I don't have to make a living from being on the road. We do a certain amount of road time to keep our corporation afloat and to keep our fans satisfied. Touring is not our main thing, most of us in Utopia would rather work on other projects... like video. I'd rather the band have a TV program than have a tour. The nature of a tour is very debilitating psychologically and physically. When we do a tour, we optimize so that it isn't like that. I have a 1980's-and-beyond value system. We don't go out on the road or get drunk every night and party. It's just to mainly communicate with the people who buy our records.

R-e/p: Do you make suggestions on the stage presentation of the acts you produce?

TR: Not usually. In most cases they don't want it. They usually will have their stage act together, and won't want the producer to tell them about it if they don't. They want me to tell them about their records. I don't always agree with the way the acts I produce present themselves on stage, but that's not my job.

... continued overleaf —

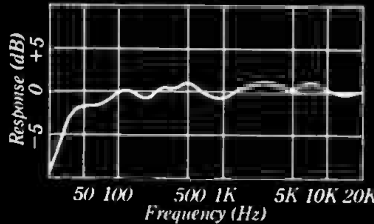
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TR: Utopia Sound

R-e/p: When you are producing someone else or getting ready to, how do you approach them?

TR: I almost always answer their question with another question or a group of them. I'll ask them what it is they didn't have with their other records that they think I can give them. I need to know because I may not be the one who can give them the record they want. Material is a big question. If there is adequate material. Also, it's best for me if the band is rehearsed and ready to go into the studio.

R-e/p: Do you work with them during rehearsals?

TR: If necessary.

R-e/p: On the material?

TR: The number one variable is the material. You can produce the shit out of really bad songs and be successful sometimes, but for me I won't undertake a production if there is not enough good material. But there are exceptions to every rule.

R-e/p: When you are in the studio, do you work long hours?

TR: I like to finish records as quickly as possible. I don't go into the studio without expecting to do some work. If a session is not going well . . . we either move on or call the session in most cases. I don't feel that anything is accomplished by putting in the extra hours, when you're not confident that you are going to get a take out of it. I really look for something to happen within the opening rounds or I don't feel the people came into the studio with the right attitude. I don't like treating it as if it were a drudgerous job.

R-e/p: Do you usually keep your sessions at six or eight hours?

TR: Yes, almost never longer than eight hours. Utopia sessions can be really short. Sometimes we may have a two hour session because we will have decided we are going to do just one

" . . . producing? . . . I ask them what they didn't have with their other records . . . that I can give them . . . "



song. The way it usually works for us in our studio is that we rehearse there as well. Normally I don't stand for that if I'm recording another act. I don't want them rehearsing at the time that we are supposed to be recording. I do that with Utopia, it fits into my lifestyle. We will work out and rehearse a song one day and record it within an hour the next day.

I don't like to do night sessions. I used to do late night sessions but those are bad, too. I can remember myself falling asleep on the console. That's a drag. Most all of the albums I've worked on recently have been day sessions unless the scheduling is real weird.

R-e/p: When you produce your own records — when it's just you and the machine — how do you do that?

TR: I do the basic track first, drums, or whatever it is. The first thing I lay down is the piano, so I have an engineer.

R-e/p: Do you work off a metronome?

TR: Sometimes. I sometimes have an engineer help me with that. The rest of it I do in the control room.

R-e/p: Do you sing in the control room?

TR: Yes . . . that way I can operate the machine. It's much quicker than using an engineer; you always know where you want to be.

R-e/p: Do you have any problem with the control room machinery noise?

TR: No, not usually. The kind of music that I do is too loud . . . so you can't hear the little noises.

R-e/p: Were you an engineer before you got the success that you have as a performer?

TR: I was a performer before I was an engineer . . . originally with a band called the Nazz. I produced their second album, that was how I got my first production thing happening. It was at the Record Plant in one of the first rooms that they had built. They had a new console in there. None of the engineers knew how to use it; most of them had been using 4- and 8-track. We were doing a 12-track album at the time, a Scully 12-track. I went through a few engineers with no luck, so I did it myself. That's how I got into engineering.

R-e/p: How do you handle engineering and producing at the same time?

TR: For me . . . that's the only way to do it. I very seldom use an engineer, I would spend most of my time yelling at the engineer. Usually no one touches the console except me.

R-e/p: Do you use a large microphone selection?

TR: I can deal with any microphone. I get the sound I want. It doesn't matter which ones I use. Very rarely do I have to change the mike.

R-e/p: When you are working in the control room and playing guitar do you run it direct or feed a line back out to your amplifier?

TR: I've done both. Sometimes I use a direct out of my amplifier output. That makes for an extremely "buzzy" sound that you have to do a lot of EQ on.

R-e/p: Do you usually mike far away?

TR: No, not really. I usually do close miking on everything and synthesize the distance that I want to get. Utopia records in a very small room that's not acoustically treated. I've found

the amount of compression I put on something will determine the kind of ambience picked up. If you don't compress the drums a lot, they can sound very tight and dry. It's the same thing with most other instruments.

R-e/p: Do you usually use active direct boxes or passive ones?

TR: We usually use passive ones. Our studio, Utopia Sound, is at this point all unbalanced high impedance, which is unusual for most studios. When the studio was built approximately eight years ago, I had the board built without on-board EQ. Instead there are large graphic equalizers that were designed for room EQ on every channel.

R-e/p: Have you had trouble with the high impedance aspects of the board?

TR: The thing took a little longer to set up, but it is so much easier doing everything unbalanced. We don't have the hum problem like a lot of the other studios have. We have no phasing problems in this system because there's no balanced lines to get mixed up. The microphone levels are low impedance, until after they leave the preamps, then everything from the preamps on is high impedance.

R-e/p: Is Utopia Sound also in Bearsville?

TR: No, it's out at my house, a little farther down the road from there. I have two buildings, the house I live in and a studio. Utopia Sound is being totally re-built as a computerized 24-track facility, and with a digital synthesizer. The new board will probably be a low impedance system.

R-e/p: Have you been using a lot of boards that are automated?

TR: Not too many . . . one or two. My personal feeling is that they have been over-complexified in order to increase the price. So we are building our own system. The computer that I have at home costs about \$2,000. With everything it couldn't cost more than six or seven thousand dollars. It has all of the hardware capabilities that anyone could use in a computer mix situation. With a system costing less than ten thousand dollars in hardware and writing the software ourselves, we will have a system that will not only compute and control mixdown functions, but will also control a digital sound synthesizer system. It will be able to keep track of all the studio paperwork.

The computer's digital synthesizer will let us work on a project outside of the studio somewhere on a special composition device with a disk memory.

Rather than plugging in patch cords and turning knobs to get what you want . . . you simply give it numbers. It can figure itself to be any synthesizer patch that you want. What it's doing is creating the sound rather than treating it by putting it through filters. It's creating the sound digitally and mathematically computes the sound that you want to hear, from millisecond to millisecond. You can create a score for however many instruments you want; write out a program that will synthesize the instruments; activate the recording machine; assign the instrument to a track; perform the passage; go back and do another instrument; perform the designated line; and then continue to do all of this automatically. To make something louder in a certain section, all you have to do is change that, and it will go through and adapt.

. . . continued overleaf —

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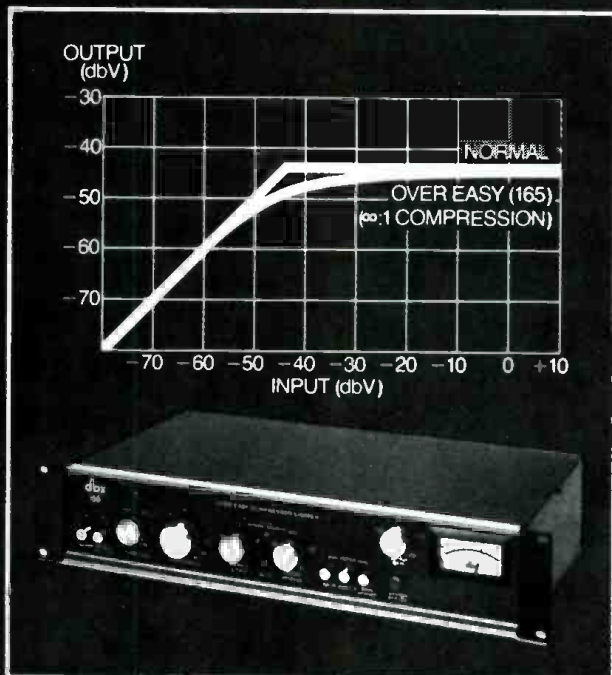
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R-8/p 35

Todd Rundgren

Many computer mix consoles are able to control levels every time you run it, but they won't perform any other proprietary functions. When you are buying a piece of hardware that's capable of doing a lot of other things, you are paying for software. The hardware to do the original computer mixdown functions is powerful enough to do many other things as well. When you ask for a computer mixdown . . . that's all the software you get. They will convince you that in order to get it to do other things they have to charge you an incredibly large sum of money. What you need to do is learn how to program a little bit, or get somebody in your studio organization to learn programming. Most boards are controlled by a microcomputer. They have eliminated your ability to put in anything except certain basic pre-structured commands which are stored on little chips. You could replace the chip with a keyboard, an extra memory, or re-program it.

R-e/p: Many of your album cuts are theatrical and thematic and would be good audio/visual projects. Cuts like "Singing And The Glass Guitar."

TR: We wrote that piece of music to use as a performance vehicle . . . a theatrical presentation. We wanted to give everyone a solo spot. We wanted the solos to have some meaning, and it also gave us something to do in the show visually. The song is a series of little vignettes to set up each solo. A lot of the material on the Utopia records has been designed as a performance vehicle, which is why it sounds visual on the record.

R-e/p: Do you produce your albums with a concept in mind?

TR: Usually one evolves. We don't start out to make a concept album . . . it just turns out that way. It's the nature of the music that I deal with; it is not style-oriented. It draws on a greater variety of influences than what is currently popular.

R-e/p: Do you take longer to produce your own albums?

TR: They don't take longer. The solo albums are the quickest of all the albums that I do. They take usually two weeks to a month, if I'm dallying around.

R-e/p: Do you have all your material ready to go before you go into the studio?

TR: I won't start an album until I have seven or eight songs. I have to have a substantial part of the album written first. Once I start recording something happens and it becomes easier to come up with material once the process has begun. That has always been a problem for me, and why I end up with double albums a lot of the time. I start out to do a single album.

R-e/p: Do you look for material? I know on a few of your albums you have used material besides your own.

TR: Usually not. I look for influence. I may hear a piece of music I like . . . listen to it, try to figure out what it is I like about it, and try to write something.

R-e/p: When you work on your own albums, how do you get some sort of perspective. Do you bring in other people?

TR: Never. I never ask people's opinions of

what I'm doing. It's an extremely personal thing for me. My solo records are as personal as I get in any aspect of my life. I very rarely sit down and pour out my heart to anybody. It's the only time I really express things. I have a lot of subject matter that I can talk about, but I feel it has to have a certain amount of poetry to it . . . so it's not exactly straight from the hip. In order for it to retain its artistic value it has to have a certain amount of poetry. The musical part of it is as close as I ever get to divulging my inner self to anybody. I don't feel it's my obligation to be objective while I'm involved in it. I feel it's my obligation to be subjective, and to really expose parts of myself, some parts that I'm not proud of or that I may want to get out in the open so I can be rid of them.

R-e/p: When you are working on your records do you become very introspective?

TR: To a degree . . . it doesn't make my lifestyle more introspective. As a matter of fact, it's very cathartic so I usually feel pretty good when I'm in the process of making a record.



" . . . the number one variable is the material . . . you can produce the shit out of really bad songs . . . and be successful sometimes . . . not for me . . . "

R-e/p: Do you feel that way when you are working with another artist?

TR: Not all the time. When you work with another artist you have variables out of your control. You can't be assured that the project as a whole will successfully meet it's objective.

R-e/p: As a producer are you influenced by reviews and comments from others outside of the studio?

TR: There have been a few times. I don't read record reviews expecting to learn anything. I think most record reviewers are uneducated musically. For a writer to be credible he has to get printed, which doesn't prove he knows what he's talking about musically. To be a recording artist or producer you need people

to respond to what you do or you don't stay in the business. Someone has to buy the records. The fact that a reviewer can get his opinion printed doesn't necessarily make his opinion an accurate representation of the truth.

R-e/p: Do you think record companies are influenced by them?

TR: I don't think so anymore. I think to a degree they can be influenced by a great outpouring of bad press. I see a lot of reviews that are written because the author thinks the artist is "hip," not because the record is any good.

R-e/p: What do you think about the quality of record pressings?

TR: The quality of record pressings is so erratic. There is no standard at this point. A few people will get their records to be a certain quality; but, in the main, even if you insist on a good pressing the ultimate results are going to be very erratic. The quality of raw material has gone down. The general efficiency level of the industry is down considerably. The quality level of American manufacturing is down, and continues to degrade.

R-e/p: Do you think the emergence of the specialized gourmet record is going to become more prominent?

TR: All this stuff is just temporary until the ultimate practical implementation of new technology is achieved. The possibility of laser disks, never having to worry about surface noise, or packing density of sound. I think between now and that time there may be some improvement. However, most people are not listening or paying enough attention to notice surface noise.

R-e/p: Many of your albums utilize some very interesting packaging concepts.

TR: I used to believe in records as the vital medium. I came from a town where people would play the records backwards to get secret messages, and would study every square centimeter of the cover looking for some meaning in it. It was that important to them, whether the meaning was there or not . . . they would create the meaning. I want something to be there that has a meaning. I don't want the cover to be merely a piece of salesmanship, which is the way most people package album covers nowadays — like a poster, billboard, or advertisement in a newspaper.

R-e/p: You seem to think that now the entire creation of a record package is a lot more structured and dogmatic than it used to be.

TR: Everything about making modern recorded music is more structured. From thinking about that first note, down to paying out that last cent from the accounting office. It's all got a system and a structure that you can follow.

R-e/p: What would you suggest to someone who wants to know more about visuals?

TR: I have no bibliography of sources to go to. It's a question of being attuned to it. If you are at it you have to re-atune yourself to all the possibilities.

R-e/p: What do you see for your future?

TR: I see myself becoming more involved in visuals than records. A year from now I will hopefully be producing more video disks than record disks. □ □ □

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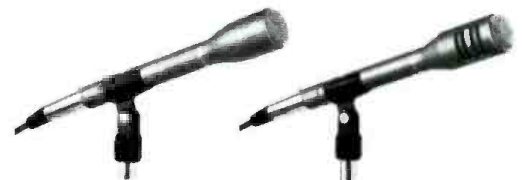
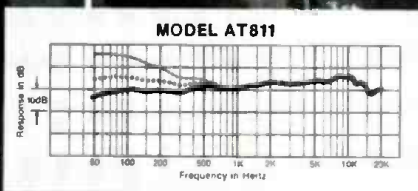
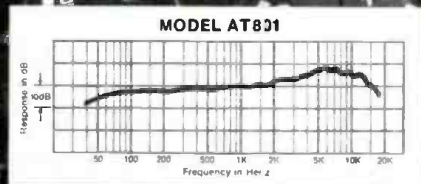
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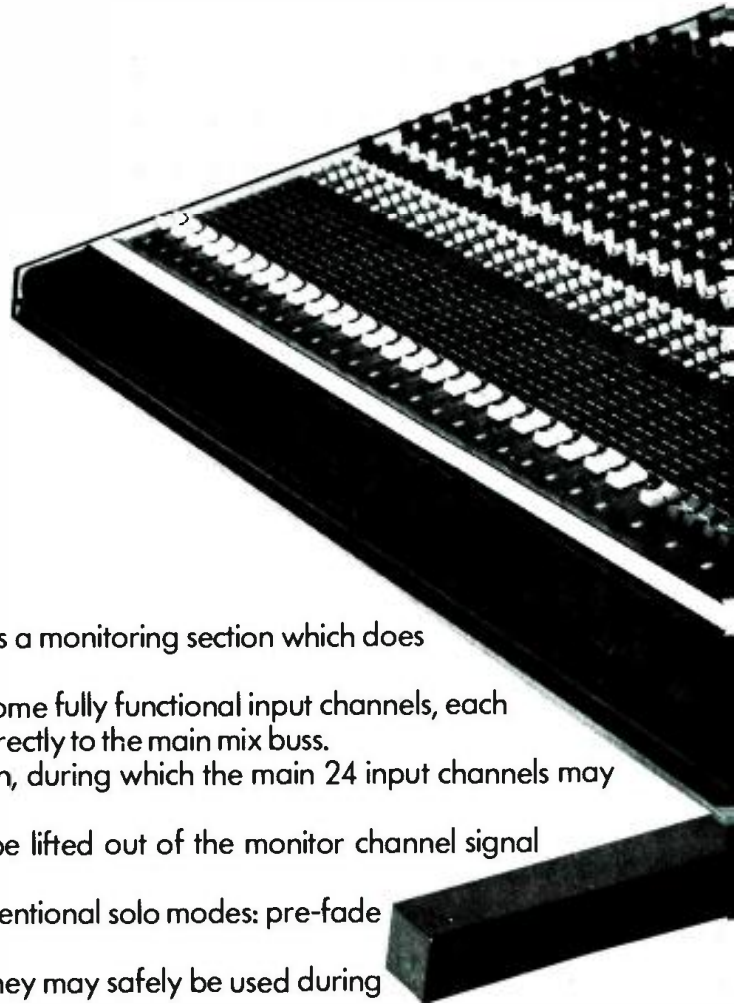
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R-e/p 37



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R-e/p 39

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acoustic effects of Space & Materials

by
 Martin Clifford

Acoustics is defined by The American Heritage Dictionary of the English Language as the "scientific study of sound, especially of its generation, propagation, perception, and interaction with materials," and is further described as "the total effect of sound, especially as produced in an enclosed space." Acoustics, though, is as much an art as it is a science. There are many subject headings for acoustics: psychoacoustics, engineering acoustics, architectural acoustics, electroacoustics, and musical acoustics. But for our purposes acoustics is the effects of space and materials on sound.

We can have two extremes. The first would be an anechoic chamber in which we have direct or dry sound only and in which all possible reverberant sound energy is totally absorbed. In an outdoor situation or an anechoic chamber, SPL decreases by one half, a 6 dB drop, every time the distance from the sound source is doubled. If the SPL is 90 dB 6 feet from the sound source, at 12 feet it will be 90 dB - 6 dB or 84 dB. Technically, sound

measurements should be made with no individual in the chamber. Anechoic chambers do not resemble real life situations and are constructed solely for the purpose of making dry sound measurements. We do have a comparable set-up in outdoor concerts where there is no backdrop and a minimum of reflecting surfaces. However, music produced in an open air environment is usually less pleasing than the same composition played by the same orchestra in an enclosed environment, taking into consideration noise distractions produced by planes, pedestrian, or vehicular traffic. The inference we can draw from this is that the human ear finds a correct combination of dry and reverberant sound to be more pleasing. Why this should be so more properly falls in the realm of psychoacoustics.

The other extreme would be the recording or reproduction of sound in an echo chamber, a room completely free of any sound absorbing substances, with the walls, floor, and ceiling made of some hard materials with their surfaces having maximum sound reflectivity. Anechoic and echo chambers are used for testing mikes and speakers, but in real recording and playback situations it takes a finite amount of time for sound to be absorbed and reflected, with the time dependent on frequency and the kinds of acoustic materials used. Since the acoustic character of a room, whether used for recording or playback, depends not only

Martin Clifford has a Bachelor of Science Degree from City University of New York where he majored in electrical engineering. He has taught Communications, and Math, as well as practiced engineering including five years with Sperry-Gyroscope. He has written numerous books and articles, including "Microphones: How They Work and How To Use Them."

Studio Designers' Notebook

by BRIAN CORNFIELD
 Everything Audio

On an ongoing basis we have for some time been looking into new types of building materials as they apply to recording studio construction. We recently used such a material while working on a project for Bread's David Gates. Designed specifically for sound attenuation and manufactured by U.S. Gypsum, RC-1 resilient channeling can be used with wood or metal stud construction to dramatically improve wall and ceiling isolation in confined areas.

The thickness of a typical standard studio wall system is a minimum of 8" to, in some cases that we've seen, 5'. This new method requires a maximum of 8 1/4" including the finish. Specially, RC-1 is used between the sheetrock wall paneling and the wall or ceiling studs. With wall thickness as a consideration, this new design achieves excellent transmission loss. It is particularly well suited for mobile facilities and home studios since ceiling space and room volume are always at a premium in these situations.

Further, the home builder should know that this improved design can be implemented without substantial increase in building costs. In fact, RC-1 is also the lowest cost means of improving transmission loss through a wood frame wall or ceiling.

... continued overleaf —

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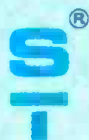
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Martin Clifford acoustic effects of Space & Materials

on its size, but on its shape and on the type of materials used in its structure, no two rooms, unless identical in every respect, will affect recording or playing in the same way.

When sound strikes a surface, such as that of a wall, some of the sound is reflected, some is converted to heat energy, and some of the sound passes through. A hard, smooth surface will supply optimum sound reflectivity; a material that is acoustically transparent, such as the grille of a speaker, will permit passage of most of the sound. Aside from its frame, an open window is acoustically transparent.

Some of the sound is reflected and absorbed by the person hearing it, but the

area of the human body is small compared to the combined surfaces of walls, floor, and ceiling, and it is from these that we get the greatest amount of reflected sound. Further, the clothing worn by people tends to be more absorbent than reflective. The continuous reflection of sound in an enclosed space or reverberation is defined as the time it takes for a given instant of sound to decrease by 60 dB, or one millionth of the original sound source intensity, and is known as reverberation time. Reverberation time is sometimes written as RT₆₀. The number 60 refers to 60 dB.

Reverberation Time

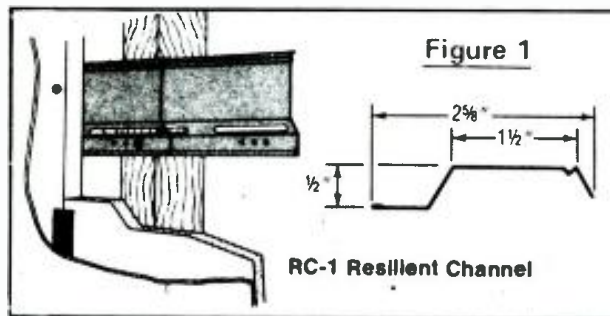
Reverberation time is a function of room volume and sound absorption. It is directly proportional to the volume of an

... continued on page 46

Studio Designers' Notebook

Description of Materials

RC-1™ Resilient Channel (Figure 1) is made of 26 ga. galvanized steel and has pre-drilled holes 4" on center in the flange for screw attachment to the framing studs.



The channeling's facing material is attached with screws. The channel is 1/2" x 2 3/8" and comes in 12' lengths. It weighs approximately 200 lbs./1,000 feet.

Method of Mounting

To use resilient channeling for walls, RC-1 should be attached at right angles to the wall studs with the attachment flanges facing

downward. 1 1/4" type screws or 6d coated nails with 1/4" flat heads should be driven through the flanges for attachment. The channeling should be securely fastened to the studs at each intersection.

Mount channels no more than 2" up from the floor, no less than 6" from the ceiling, and no farther apart than 24". Extend all channels to the corners of the room. If splicing is required it should only be done at a stud, and should be an overlap and not a butt joint. It should also be secured with screws at the ends of each overlap.

To use resilient channeling in ceiling systems, attach RC-1 at right angles to the joint. Use 1 1/4" type W screws when attaching to a ceiling that has a single layer of sheetrock and a 1 1/2" type S screw if there are two layers. Nails should not be used for overhead fastening.

Attaching the Sheetrock

The most common method for securing sheetrock is with nails. Often many more nails than usual are used to insure a minimum of defects due to loose sheets. Adhesives such as Durabond 200, 300, or some other multipurpose compound, can also be applied to the framing and used to supplement nailing. This approach will achieve a good wall bond with a minimum of face nails.

The finest interior surface can be obtained in double layer installations by using a laminating adhesive such as Durabond 210 joint compound between the first layer and the second. The lack of nails not only cuts down on finishing time, but minimizes surface defects.

Again, screws must be used in overhead applications. They provide a very tight means of attaching sheetrock and are recommended for wood frame and required for steel frame work. Electric screwdrivers are very useful, but a standard drill with a screwdriver bit works fairly well.

The sheetrock should be mounted perpendicular to the floor or, in the case of ceilings, parallel to the studs. This reduces the total length of unsupported seams by 25%. It places the strongest dimension of the sheetrock board across the framing members. It's easier to bridge problems of odd spaces, and it gives the wall more strength because each board is tied to more of the framing members. Plus, all the

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Studio Designers' Notebook

horizontal joints are at a more convenient height for finishing. The seams of each layer should be staggered and caulked with sealing compound. There should be no unspecified cracks or openings of any kind.

Two Examples

Figure 2 shows a generally accepted method of wood stud construction that would normally yield an STC* reading of 52. When the isolators are used the results are in the area of STC 59. For comparison Figure 3* shows a number of other wall systems and their STC rating.

The system consists of two layers of $\frac{5}{8}$ " sheetrock over 2" x 4" wood studs. The wall cavity is filled with R-11 insulation. The sheetrock and isolators should be positioned, caulked, and secured as earlier specified. This system will weigh 13 lbs. per Sq. Ft.

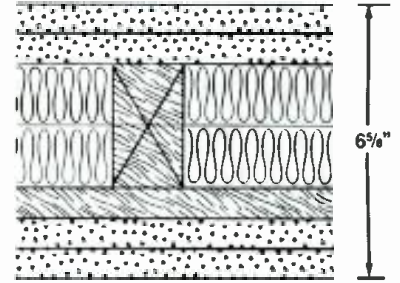


Figure 2: STC = 59; Weight = 1,316/ft².

Figure 3: Transmission Loss of Representative Types of Frame Wall and Concrete Wall Construction.

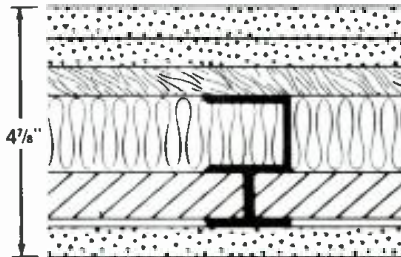
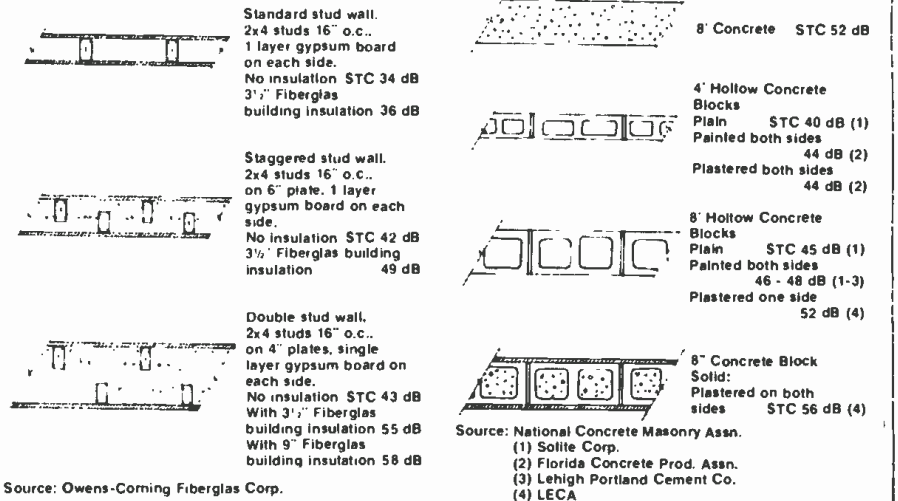


Figure 4: STC = 57; Weight = 1,216/ft².

Figure 4 illustrates a metal stud environment that results in an STC of 57. Without the isolator an STC of 54 would be obtained. The system uses CH metal studs (24" on center), 2 layers of $\frac{5}{8}$ " sheetrock mounted on the resilient side of the isolator, and one layer mounted on the opposite end. Also, a 1" gypsum liner is placed on the "H" side of the studs, and R-11 insulation in the "C" area. Since it is metal construction, screws are required. The sheetrock should be positioned, caulked, and secured as previously mentioned. This system will weigh approximately 12 pounds per square foot.

While working with this new material on David Gates' studio our contractor, Gerald Simon, was assisted by U.S. Gypsum's local representative. We suggest if you are considering this material in your future plans that you contact the representative in your area. □ □ □

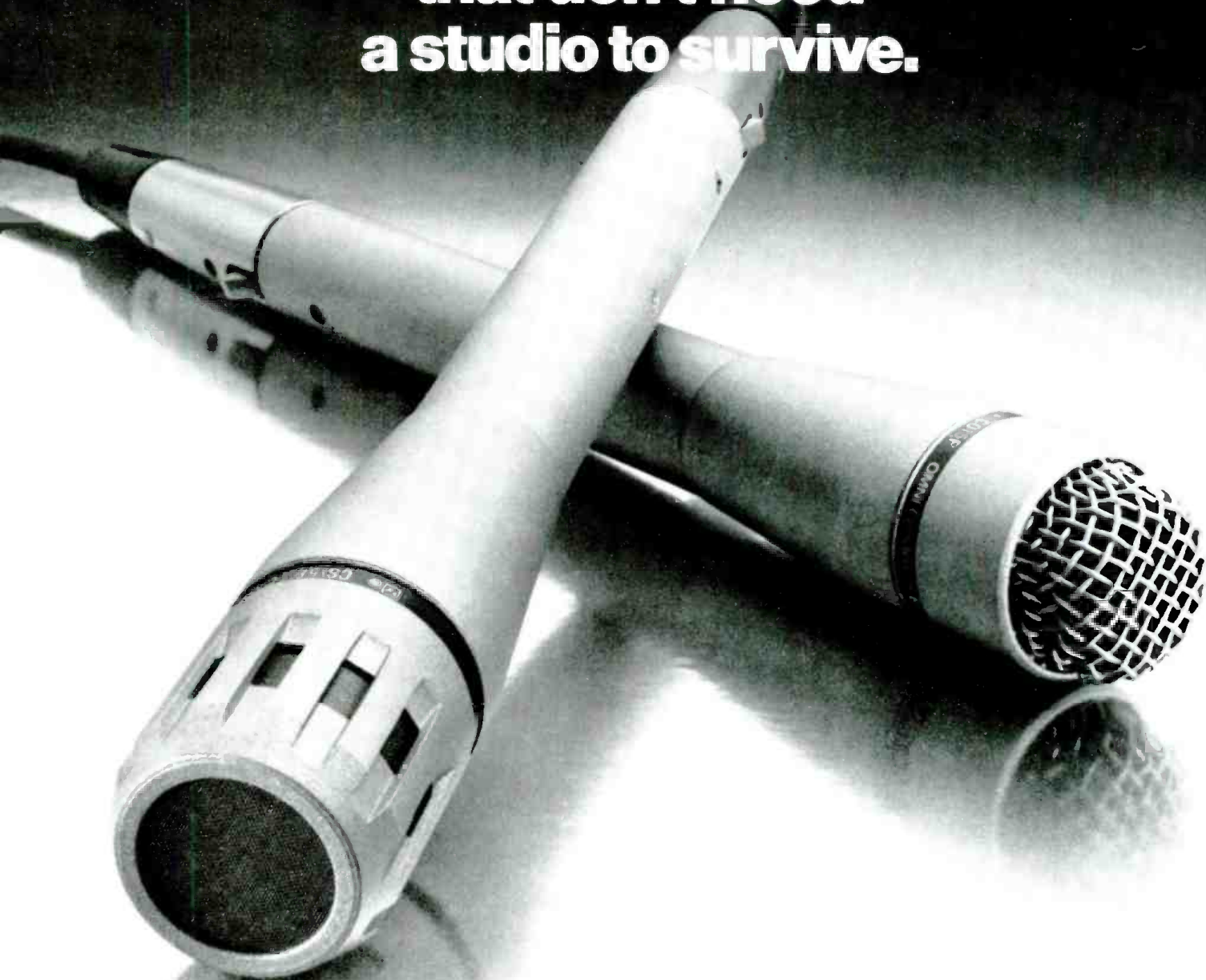
* STC, or Sound Transmission Class, is measured on a third octave analyser using a random generated pink noise with a bandwidth of 113 to 4,450 Hertz. Average sound levels in the receiving room are subtracted from the sound levels in the source room, and the differences are recorded as transmission loss values. These values are plotted on frequency band paper and compared to a standard criterion curve. The STC is determined by adjusting the standard criterion curve vertically until the decibel total of those frequency bands on the test curve that are below the standard curve do not exceed 32 dB. Secondly, no point on the test curve can be more than 8 dB below the criterion curve. Then, with the criterion curve adjusted to meet these standards, its transmission loss at 500 Hz is taken as the STC.

Lastly, each addition or subtraction of STC levels by 3 is equivalent to multiplying or dividing the actual power transmission by approximately 2.

Reference:

Everest, F. Alton: Handbook of Multichannel Recording, p. 261, Tab Books.

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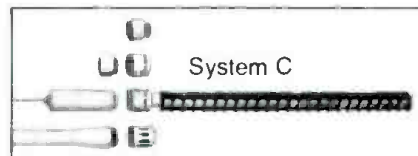
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Continued from page 42 . . .

enclosed space, such as a recording studio or an in-home listening room, and inversely proportional to the total amount of sound absorption in that enclosure. Reverberation time is not the same for all frequencies. The formula for calculating reverberation time, developed by Professor Wallace C. Sabine, in 1895, indicates average reverberation time and does not take frequency into consideration.

$$T_{60} = 0.05V/S^{\Delta}$$

In this formula, T_{60} is the reverberation time in seconds; V is the volume of the room in cubic feet, and S^{Δ} is the total equivalent of sound absorption in sabins per square foot of surface material.

When sound moves through air some of its energy is absorbed, with high frequencies absorbed more than low frequencies. Very little sound is absorbed by air at frequencies below 1.5 kHz.

This first formula uses the English system. In the metric, the formula appears as:

$$T_{60} = 0.16V/(A + a_vV)$$

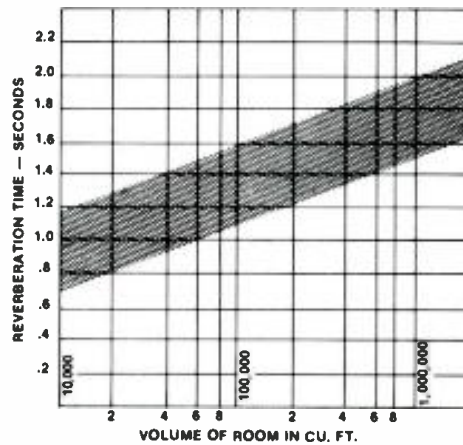
The reverberation time, T_{60} , is still in seconds, but V is the volume of the room in cubic meters, A the total equivalent of sound absorption in square meter sabins, and a_v is the absorption coefficient of air. Air absorption is important only in the calculation of concert halls or auditoriums. For the space occupied by a recording studio it can be ignored.

In both formulas we are concerned only with the volume of the enclosed space and the amount of sound absorption. Note that neither formula takes the velocity of sound into consideration.

Absorption

To calculate the value of sound absorption, it is necessary to multiply the area of each room surface by its coefficient of absorption. The amount of sound absorption not only depends on the type of material, but on its surface area. The larger the area, the greater the absorption. The total value is the sum of all these products, plus any absorption in the room due to chairs, rugs, drapes or curtains, and people. The acoustics of an in-home listening room, hall, auditorium, or recording studio is subjective. However, we generally tend to associate long reverberation times with large enclosures: cathedrals, churches, and auditoriums. Such a long reverb time conveys an impression of spaciousness.

Conversely, you would expect chamber music, as its name implies, to be played in a small, intimate room. The graph (Figure 1) is an indication of acceptable reverb times.



The sound absorption coefficient of materials varies with frequency. The following chart indicates that plywood, a common building material, provides a shorter reverb time at frequencies below 500 Hz, but tends to level off in the region above 2 kHz (Figure 2).

The limits of sound absorption coefficients are 0 and 1. 1, or 100%, would indicate a substance that absorbed sound completely, and is the goal of construction materials used in anechoic chambers. 0 or 0% indicates that the material does not absorb sound at all. This does not necessarily mean total reflectivity. An open window, for instance, (or rather that portion of it that constitutes open space), can be regarded as having no reflectivity. In an echo chamber the surfaces may have extremely high values of reflectivity.

Frequency (Hz)	Sound Absorption Coefficient
125	0.35
250	0.25
500	0.20
1,000	0.15
2,000	0.05
4,000	0.05

A cement floor has an absorption coefficient of 0.015 or 1.5%. This means that sound striking such a floor will dissipate 1.5% of the sound as heat, or slightly less, depending on how much of the sound will pass through the material. 98.5% of the sound will be reflected.

Absorption coefficients of building materials are often supplied as an overall range, without indicating the effect of frequency.

Material	Sound Absorption Coefficient
Linoleum on concrete floor	0.03 to 0.08
Upholstered seats	0.05
Ventilating grilles	0.15 to 0.50
Brick wall painted	.017
unpainted	.03
Carpet unlined	0.20
felt lined	0.37
Fabrics, hung straight light, 10 oz. per sq. yd.	0.11
medium, 14 oz. per sq. yd.	0.13
heavy, 18 oz. per sq. yd.	0.50
Floors concrete or terrazzo	.015
wood	.03
linoleum, on concrete	.03 - .08
Glass	.027
Marble	.01
Openings, stage, depending on furnishings	0.25 - 0.75
Deep balcony, upholstered seats	0.50 - 1.00
Grilles, ventilating	0.15 - 0.50
Plaster on brick	.025
on lath	.03
rough finish	.06
Wood paneling	.06

For some materials, the absorption coefficient increases with frequency, with others it decreases, while for some it remains relatively fixed (Figure 3).

As an example, consider the calculation of the total sound absorbing characteristics of a studio measuring 40' x 30' x 10'. The total volume is the product of these numbers and is 12,000 cubic feet. Figure 4 shows the absorption values for each acoustic component.

Material	Frequency in Hz					
	125	250	500	1,000	2,000	4,000
Glass window	.35	.25	.18	.12	.07	.04
Lightweight drapes	.03	.04	.11	.17	.24	.35
Heavy drapes	.14	.35	.55	.72	.70	.65
Wood floor	.15	.11	.10	.07	.06	.07
Carpet (on concrete)	.02	.06	.14	.37	.60	.65

Material	Dimensions (feet)	Area (sq. feet)	Absorption Coefficient	S
Cement floor	40 x 30	1,200	0.015	18
Carpeting	40 x 30	1,200	0.57	684
Wood panel walls	40 x 30 x 4	4,800	0.05	240
Plaster (ceiling)	40 x 30	1,200	0.025	30
Velour (curtain)	20 x 10	200	0.5	100
Seats (10)			0.25	2.5
				1,074.5

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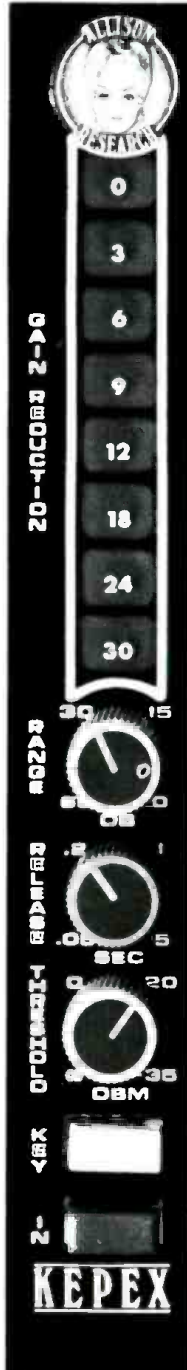
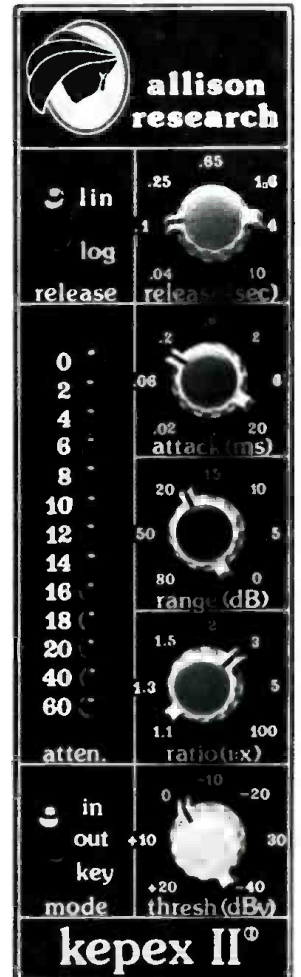
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All control parameters of KEPEX II are derived from voltage controlled, or logic controlled elements. This simple statement has immense implications. Computer programmed parameters are possible, as is remote control, and a host of other potential control methods. Additionally, the employment of these voltage controlled elements results in a vastly increased accuracy and resolution of the parameter curves, with respect to conventionally configured equipment.

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The total absorption value is of the studio, with no one present. 4.05 sabins can be allowed for each person who will be in the studio. With ten persons present S_a will be 1,074.5 plus 40.5 or 1,115 sabins.

The reverberation time of this studio will be:

$$T_{60} = 0.05V/S_a = (0.05 \times 12,000)/1,115 = 600/1,115 = 0.54 \text{ second}$$

(The absorption of a larger room is given in Figure 5.) The chart (Figure 1) shows that for a room of this volume the reverberation time is not acceptable. The wall-to-wall carpeting is the main factor contributing to this result. The large velour curtain is another cause of low reverb time. In this case, using a carpet measuring 30' x 20' would reduce the total absorption to 773 sabins and would increase reverberation time to 0.78 seconds, a more acceptable figure.

RT₆₀ vs. Frequency

Neither the metric nor the English formula for calculating reverberation times takes frequency into consideration. To get a more accurate representation of reverberation time, the formulas should be worked for a series of frequencies starting at about 125 Hz and continuing through 4 kHz. A curve can then be plotted and drawn to show the effect of frequency on reverberation time. To be able to do this we would need to know the sound absorption coefficients of all the materials in the studio for each spot frequency from 125 Hz to 4,000 Hz. In a room that is properly treated acoustically, all sonic frequencies will have the same reverberation time; that is, the decay time of the reverberant sound will be independent of frequency. The room can then be considered to have a 'flat' response.

In a room having hard, smooth, rectangular walls, it is possible for sound reflections to travel back and forth, but with the absorption of sound always at some specific groups of frequencies. This selective absorption results in the presence of some frequency ranges that continue after the rest of the sound has

been completely absorbed giving the room a distinctive sound coloration. The effect is most prevalent in small rooms. The goal should be to have the reverberation time the same for each octave of sound.

A wood paneled room is more sound energy absorbent for bass tones; a carpet for treble. When you have a situation using pure sinusoids, a room that is both carpeted and paneled will not distort the sound. But, except for very quiet flute notes, music consists of a fundamental plus a number of harmonics. A carpeted room will not only absorb treble tones, but the harmonics of lower frequency notes. This results in an unclear bass since it is the harmonic content of a tone that gives it a distinctive character. Such bass tones sound 'unclear' or 'muddy.' For example, if a room is carpeted EQ might be used to compensate for the loss in harmonics. However, it will have no effect on decay time. SPL in the bass region has been altered by the equalization process, but reverberation still remains a function of frequency.

Direction Intelligibility and Definition

The location of sound is determined primarily by the sound that reaches the ear first, that is, direct sound. Once we have determined its location, the sound source can move, but it takes time for us to become aware of the new location, an acoustic phenomenon known as 'precedence' or 'Haas' effect.

Reverberant sound isn't 'single source' sound, but is a mixture of all reflected sounds, supplied by areas which are huge in comparison to dry sound sources. The ear cannot identify the location of such sound and so, for reproduced reverberant sound to approximate the original, it too must be 'location unidentifiable.' This highlights one of the problems in sound reproduction which, in the home and most studio applications, is typically supplied by two speaker systems. Both direct and reverberant sounds are supplied by these speakers, which are generally positioned in front, and since such sound is position identifiable, even if only approximately, there is a lack of realism in the reproduction. A better arrangement would be to

have the front speakers supply direct sound, with pairs of speakers at the sides and the rear furnishing reverberant sound. The character of this sound would then supply the necessary ambience, that is, the sum total of reverberant sound and would supply a sonic illusion as to the kind of hall or auditorium in which the music was performed.

With these factors in mind it's clear that almost all acoustic environments are non-linear. Unlike an amplifier capable of supplying within a given dynamic range a flat frequency response, not only over the audio spectrum but well below and above it, reverb sound generally suffers treble loss. Hence, this sort of sound has a much narrower bandwidth than dry sound. Further, the outer ear, the pinna, is shaped so as to favor direct sound and hinders the reception of sound from the rear. Reverberation also has a considerable effect on the intelligibility of speech. If the reverb time is too long someone close to the speaker may understand the articulation, but there will be places in the listening room where the speech will sound garbled. The same effect takes place with music when instruments seem to lack clear definition.

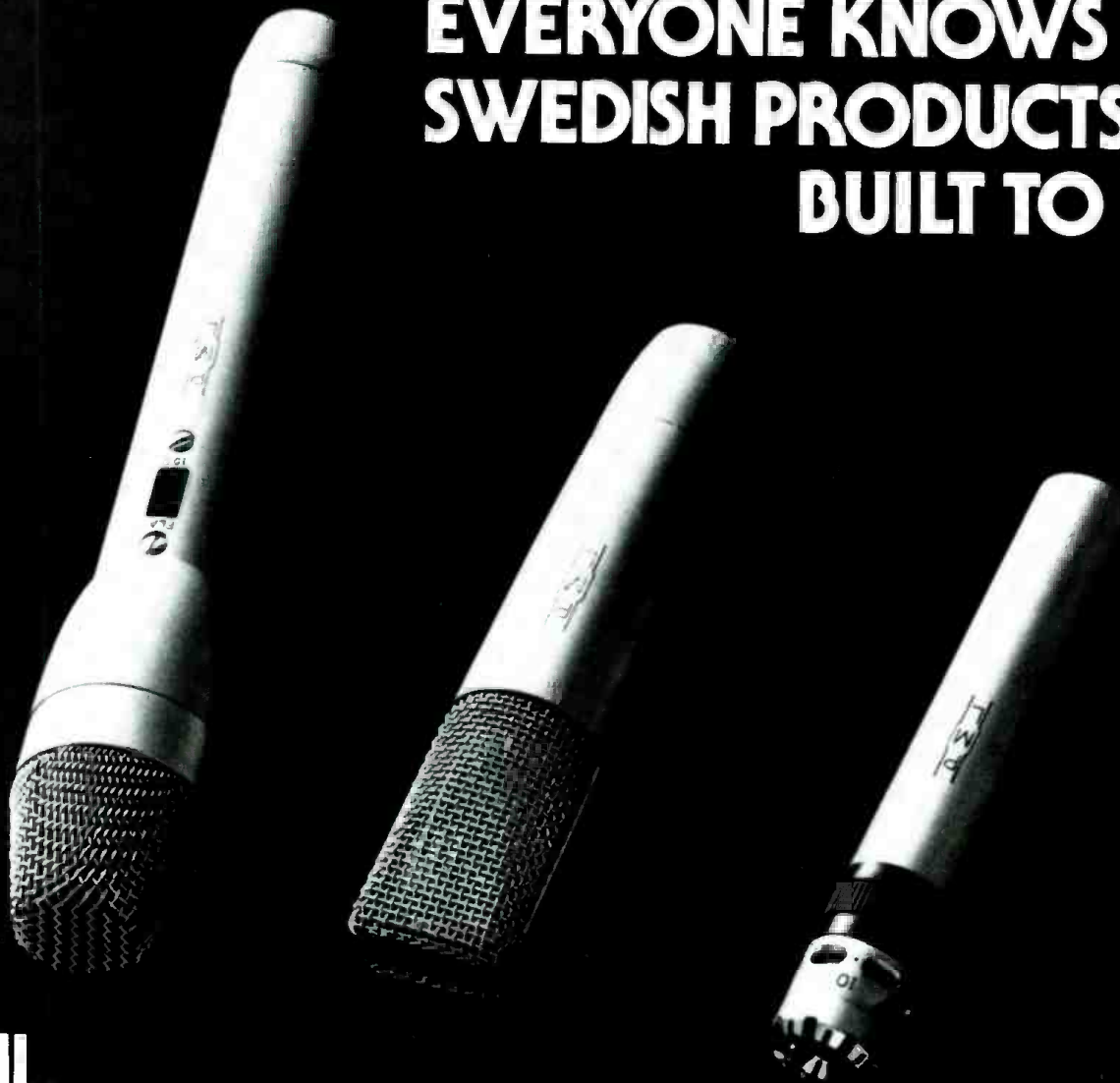
The shape of the reflecting surface also has an effect on the distribution of reverberant sound. A surface that is concave focuses the sound and so this kind of shape is unsuitable for recording situations. A shape that is convex distributes the sound over a large area, much larger than that of a comparably sized flat surface.

A more specific type of reverberation, echo, is a sound which has been reflected, but its strength and time of arrival at the ears is such that it is recognizable as a repetition of the original sound. Generally, this sort of echo is undesirable except under specific controlled conditions. Ordinarily, reverberant sound should form an indistinguishable composite with direct sound. The delay time of a sound for the formation of an echo is about 50 milliseconds or more. We can also get multiple echoes when the echo is repeatedly reflected from other surfaces.

A number of methods have been devised to create reverberation artificially. They include vibrating springs, through the use of a reverberant live chamber or metal plate, by an endless magnetic tape loop, and by analog or digital electronic methods. The purpose of any of these artificial reverbs in recording is to supply an ambience that is missing, and create the illusion of a concert hall, auditorium, cathedral, or any other space associated with particular kinds of music. However, some modification of the ratio of dry to

Material	Dimensions (feet)	Area (sq. feet)	Absorption Coefficient	Equivalent Absorption (sabins)
Floor, cement	56 x 112	6,272	.015	94
Walls, wood panel plaster	8 x 336	2,688	.06	161
Ceiling, plaster	20 x 336	6,720	.025	168
Curtain, velour	56 x 112	6,272	.03	188
	39 x 20	780	0.5	390
Total absorbing power, bare room				1,001
Plus 800 upholstered seats at 0.25 sabin				200
Total absorbing power, no one present				1,201

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DC-73 CARDIOID CONDENSER MICROPHONE

Cardioid condenser microphone for 48 volt Symsi powering. Features an integral electrical "pop" filter which has no effect on high frequency response, and a built-in shock resistant elastic suspension to reduce hand noise to a minimum. A large diameter circular condenser element provides full natural sound in highly rugged package with a steel mesh protective grille. A two position slide switch on the case permits selection of either flat response or 100 Hz high-pass for vocal work.

Excellent hand-held vocal microphone. Also for brass or percussion where cardioid pattern is demanded. Studio, broadcast and especially recommended for live performance. \$295

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The DC-96 is a cardioid condenser microphone for 48 volt Symsi powering. The DC-96 employs the unique rectangular dual membrane capsule similar to the DC-63 and ST-8 Stereo microphones with FET pre-amplifier. Features: very low noise, high output level and extremely smooth frequency response both on and off-axis. The small size of the DC-96 further enhances its use where larger mikes become obtrusive.

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The VM-40 (Omni-directional) and VM-41 (Cardioid) condenser microphones both feature a 1.5 cm diameter circular condenser element. Small in physical size and very rugged, they operate on 48 volts Symsi power. A four position ring switch is incorporated to permit selection of either full range frequency response or 100 Hz high-pass and for each position there is a 10 dB pad.

All high quality studio and broadcast work, but particularly impressive for close range brass, strings, percussion, and close to medium distance orchestral pickup. \$360

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reverberant sound (although not to such a great extent) can be made without resorting to artificial reverb. Whether a recording will sound dry or reverberant depends not only on the size and shape of the room and its total absorption properties, but on other factors such as the working distance of mikes, amount of sound reinforcement or stage monitoring on live recordings, the settings of tone or equalizer controls, and level controls. Obviously, reducing the working distance of the mikes will increase the ratio of dry to reverberant sound.

Acoustic Resonances

Any enclosed space that has reflective surfaces is capable of supporting not only one, but a number of resonances. Resonances at the fundamental frequency can cause sound pressure levels to increase by about 10 to 20 dB. Resonances are due to reverberant sound having an in-phase condition with the direct sound. Naturally, there can also exist dips where they are out of phase. Resonances can occur at even order and odd order harmonics of the fundamental frequencies.

Sound cancellation, or nodes, and sound reinforcement, antinodes, become less significant as values of reverberation time become lower and do not appear at all in anechoic chambers. At nodal points in the room we have relative freedom from the vibratory motion of air molecules. At room resonances, also called standing waves or eigentones, low frequency rumble picked up by the microphone will be accentuated if it is positioned at an antinode.

Standing waves can be modified or eliminated by room furnishings: chairs, couches, tables, lamps, and even by people in the room. No object in the room should be permitted to vibrate, and while furnishings are helpful in breaking up resonance conditions, a room having a non-uniform shape is better: a bay window, an alcove, walls not parallel to each other. To eliminate flutter effect, a repeated echo caused by strong transients, materials having a high absorption coefficient; i.e., scatter rugs or wall coverings could be tried.

Nodes and antinodes can be close to each other in frequency. Room resonance varies directly as the velocity of sound in air and inversely as the various dimensions of the room are multiplied by two. The average velocity of sound in air can be considered as 1,117 feet/second

or 766 mph. Sound velocity can be calculated from:

$$V = 49 \sqrt{(459.4 + F^\circ)} \text{ feet/second}$$

$$V = 20.06 \sqrt{\frac{\text{or}}{(273 + C^\circ)}} \text{ meters/second}$$

V is the velocity in feet/second or meters/second; F° is the temperature in degrees Fahrenheit; C the temperature in degrees Celsius.

The velocity of sound isn't affected by frequency, somewhat slightly by humidity, much more so by temperature, and varies considerably depending on the material through which it moves. In solid substances such as brick or steel the velocity of sound is far greater than in air. In air the velocity of sound increases by about 2 feet per second for each increase of one degree C. At the freezing point, 0°C or 32°F, the velocity of sound in air is 1,087 feet per second, increasing to 1,147 feet per second at 30°C or 86°F.

Velocity Of Sound In Air

Deg. F	Speed (ft/sec)
32	1,087
50	1,107
59	1,117
68	1,127
86	1,147

Deg. C	Speed (meters/sec)
0	331.32
10	337.42
15	340.47
20	343.51
30	349.61

The average speed of sound in air, 1,117 feet/second or 340.5 meters/second can be regarded as the time lag of dry sound. Someone positioned 11.17 feet from the original sound source would hear the sound 0.01 second later than someone positioned right at the source. For larger distances the time lag of dry sound is proportionately greater.

Room resonances can be calculated by dividing the average speed of sound in air by the length, width and height of room surfaces. These dimensions are multiplied by 2 since the resonances occur at one half wavelength. Further, there are also resonances at the harmonics of the calculated resonant frequencies.

In a room measuring 40 feet long by 30 feet wide by 10 feet high it would be possible to have these resonance conditions:

$$1,117 / (2 \times 40) = 14 \text{ Hz}$$

$$1,117 / (2 \times 30) = 19 \text{ Hz}$$

$$1,117 / (2 \times 10) = 56 \text{ Hz}$$

Since resonances also occur at the harmonics of these frequencies, we would have for the first example: 14 Hz,

NOISE GATE GT-4

The remarkable low cost noise gate that is so simple and economical to use that people are finding new applications for them every day.



Use one channel for each mike in your P.A.

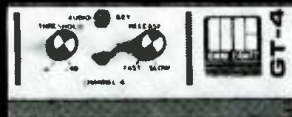
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28 Hz, 42 Hz; for the second we would have 19 Hz, 38 Hz, 57 Hz, etc., and for the last we would have 56 Hz, 112 Hz, 168 Hz, and so on. We then have a series of resonances: 14 Hz, 19 Hz, 28 Hz, 38 Hz, 42 Hz, 56 Hz, 57, 112, and 168 Hz. Also note that the frequencies of resonance are rather close to each other. Resonances were calculated only through the third harmonic.

When room dimensions are supplied in meters, some resonances can be calculated from:

$$f = 170.25/L$$

This simplified formula is derived from:

$$f_{abc} = 1/2V \sqrt{(1/L_a)^2 + (0/L_b)^2 + (0/L_c)^2}$$

Those terms with the number 0 in the numerator drop out and the equation becomes:

$$f_a = 1/2V \sqrt{(1/L_a)^2}$$

and this, of course, is:

$$f_a = 1/2V \times 1/L_a = 1/2 (340.5) \times 1/L_a = 170.25 \times 1/L_a$$

corresponding to the equation previously supplied.

The resonant frequencies, sometimes referred to as natural or eigenfrequencies, are for a rectangular room having smooth, hard walls.

The numerator, 170.25, is one half the velocity of sound in meters (340.5/2) while the denominator is the length, width, or height of a reflecting surface. A room 40' x 30' x 10' would be 12.195 m x 9.146 m x 3.04 m.

$$f = 170.25/12.195 = 14 \text{ Hz}$$

$$f = 170.25/9.146 = 18.86 \text{ Hz}$$

$$f = 170.25/3.04 = 56 \text{ Hz}$$

You can expect slight difference in results between the English and metric systems, but these aren't significant.

Since standing waves are the result of sound reflections they become weaker as sound absorption is increased.

Because recording studios often must make use of available commercial space not particularly acoustically desirable, it is frequently not easy to make acoustic modifications which can produce substantial changes in reverberation time. Even when a hall, theater, or auditorium is constructed with an effort at obtaining best acoustic results, the finished product can sometimes be a

sonic disaster. And, unlike a bottle of wine, the acoustics of any given enclosure do not improve with age.

The advantage of reverb units is that they can change what is essentially a fixed quantity, the reverb time of a room, to a variable. Further, with a reverb unit, time delay can be made to accommodate particular recordings and professional sound reinforcement needs.

In closing, a study of acoustics is based on the assumption that the recording and/or transmission of sound will take place in a studio or mobile truck. However, when the sound engineer is left without the facilities of the control room to which he is accustomed, he must then work with headphones. The difficulty is that headphone sound is so different from speaker sound. To meet this problem one company, Beyer, is now supplying its LSE-1 headphone which they describe as a 'loudspeaker simulating earphone.' The unit is set up so that soundwaves originating from the headphone system are made to be identical with soundwaves which the ears would have heard when listening through speakers. A built-in amplifier simulates speaker reproduction and the timbre of sound and location of the sound source correspond exactly to the sound produced by speakers. □ □ □

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Ursa Major's new SPACE STATION is a true breakthrough in audio technology—a digital reverb so versatile it can create virtually any pattern of direct sound, early reflections and reverberation, yet which costs only a third of what you would pay for a single-function reverb system. This easy-to-use unit will take your dry tracks and put them into an endless variety of reverberant spaces, from tiny rooms to concert halls to parking garages and sci-fi locales. And the SPACE STATION does even more: its Multi-Tap Delay and built-in mixer give you totally new pure delay effects, while feedback of a single tap provides simultaneous echo or resonance effects.

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... the **SOUNDMAN'S GUIDE TO VENUES** is a new series being compiled by R-e/p's sound reinforcement consulting editor, **Pat Maloney**, whose full time profession is as an internationally recognized sound reinforcement engineer/mixer. The new series is the result of a questionnaire Pat developed to be sent to performance venues in anticipation of beginning a tour. The information returned by the venue is considered vital to planning the tour. At the end of each year R-e/p will offer an updated collection of these reports. — editor

SOUND MAN'S GUIDE

TO VENUES

(#1 in the series)

BERKELEY COMMUNITY THEATER
 2246 Milvia Street
 Berkeley, CA 94704
 (415) 644-6863
 (house and backstage)

Facility

Totally enclosed concert hall/auditorium. Open weekdays 9 a.m. to 5 p.m. Call during week for weekend entry. Show must end by 12 midnight. Main floor seats 2,400. One balcony located 100' from stage against back wall seats 1,091.

Level proscenium stage is 50' wide, 55' deep and is 3' 4" above orchestra floor.

Orchestra pit is 53' wide x 16' deep and can be raised to stage level. First row is 6' from apron when seating in pit.

Stage to grid height, 65'. Stage to proscenium height, 30'.

Sixty-five removable pipes are available above stage.

Possible speaker location areas in front of fire curtain on either side of stage measure 9' wide x 6' deep and block sightlines of approximately 150 seats if used. Risers are available, hold 400 lbs. each, come in 6" increments from 6" to 24" and are 3' x 6'.

Acoustics

Slightly on the live side, some bass build-up but overall quite good. Some slapback from balcony due to hard surfaced parabolic-shaped balcony back wall. Take care when aiming speakers here.

Reverb time — estimated at 1 · 1½ seconds R160 full bandwidth.

All seats are padded.

Loading

Loading door located at sidewalk level on Allston Way, ½ block East of Grove. Double door size 10' H x 7' 3" W. Opens onto stage. Truck parking available on street next to loading door.

Set Up

It is not possible to hang speakers in front of stage.

Area reserved for mixing console in the audience is located in left center section of orchestra level. Rows X, Y, Z, AA, seats 15 -25, and is about 60' from edge of stage.

Two-hundred-fifty feet of cable needed to reach center stage via fire marshall approved routing. Closest grounded AC circuit is 40' away.

Sound System

- house speakers -

Two moveable side clusters, stage level containing 4 Altec 815A bass bins, 4 dual throat Altec horns with Altec 291-16B drivers. Altec active crossovers. Older center cluster overhead contains 2 Altec 815A bass bins, 6 horns of various make and model.

- monitor -

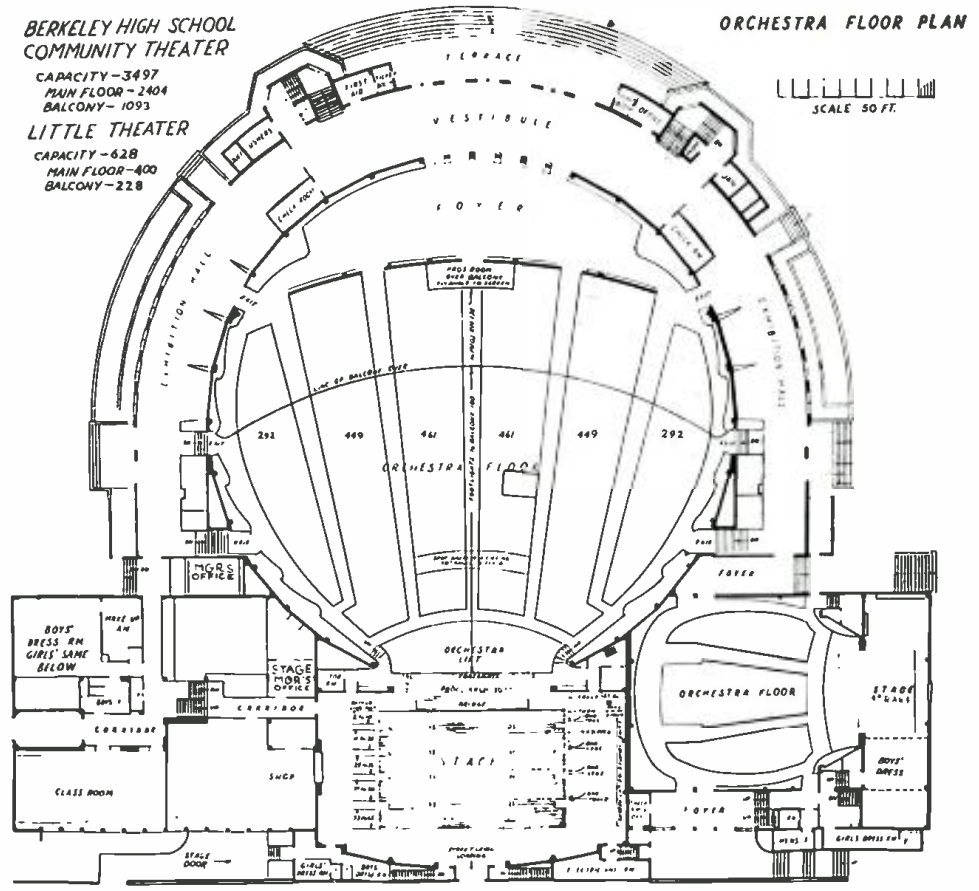
Two slant floor speakers, bi-amped. Custom built.

BERKELEY HIGH SCHOOL COMMUNITY THEATER

CAPACITY - 3497
 MAIN FLOOR - 2404
 BALCONY - 1093

LITTLE THEATER

CAPACITY - 628
 MAIN FLOOR - 400
 BALCONY - 228



- house amplifiers -

Four Altec 400 amps. Each contain four channels rated at 400 watts each.

- monitor -

Altec 1594B amps.

- console -

Altec 1220 customized. Twenty-five inputs x 3 out with graphic EQ on outputs. Will accept balanced line level signal with XLR 3-pin connector. Monitor mix is done with this console as well.

- microphones and stands -

Eighteen Shure SM-58, 12 Shure SM-56, 4 AKG C451E. Various Atlas stands.

Electrical

Service into building is 3-phase, 4-wire, 400 amps per leg. Main breaker box is 5' from stage and requires lug connectors. Six 20 amp, 115 volt circuits are available on stage.

SCR lighting system does not interact with sound systems.

Personnel

Union house, departmentalized. Same crew can load trucks.

Piano tuner is available: Richard Moody, (415) 566-0786.

Building Manager: Judson Owens.

Traveling Soundman Reaction:

"The house seems bigger than a typical 3,500 seater, and takes a larger PA to fill than you might expect. A little boomy, but the sound when empty is very similar to when it is full. Nice open stage sound with no monitor problems." **Jerry Pfeffer**, Sound-On-Stage, San Francisco. (*The Clash*, Keith Jarrett.)

"Some low frequency build-up, with peaks in low mid range. Fair amount of slap back from house during high SPL situations. Requires fairly wide PA coverage due to size of the house, which is physically larger than most other venues of similar seating capacity. We were allowed time to run our snake under the floor to the house mix position. Good house crew. Pay special attention to center fill when they are seating in pit area. Stage area very good, not overly hollow or resonant. Overall a nice, enjoyable place to do PA in. Responds best to a moderately loud, tasty act." **Steve Neal**, F.M. Productions, San Francisco. (Various Bill Graham productions.)



THE SP SERIES

When Peavey introduced the SP-1 in 1976, it was technically years ahead of its time. The SP-1 offered the touring musician and soundman advantages that were available only in the larger, and much less portable "black box" enclosure while creating a few of its own such as ultra-wide dispersion, high efficiency and extended range. Today Peavey is proud to present two new additions to the SP Series: the SP-2 and SP-3.

The SP-2 features most of the performance characteristics of the SP-1 in an even smaller

package! While capable of delivering the sound pressure levels, frequency response and dispersion needed for sound reinforcement, the SP-2 offers extended bandwidth performance necessary for playback and monitoring situations.

The high frequency section of the SP-2 consists of a newly designed 800 Hz horn coupled with our 22A driver for maximum efficiency. A 15 inch Black Widow transducer in a tuned and ported enclosure make up the low frequency section. Together they demonstrate very wide

bandwidth capabilities (60 Hz - 13 kHz) in the normal mode. The enclosure design allows the system's frequency response to be extended (40 Hz - 13 kHz) when extreme highs and lows are necessary. The system features bi-amp connections and is supplied with a telescopic mount, cabinet flange for fast, easy stand mounting.

Our latest addition to the SP Series, the SP-3, has been created for general purpose sound reproduction with special emphasis in the vocal range (300 Hz - 3 kHz). The SP-3's excellent dispersion characteristics

insure high intelligibility and audience coverage making it an ideal system for high level vocal reproduction.

The SP-3 high frequency section features the Peavey 22A driver coupled to a 800 Hz horn. The low frequency section is horn-loaded and vented, featuring a special heavy-duty 15" transducer.

We invite you to compare our SP Series spec for spec against the competition,...you'll see why incredible values are still a reality at Peavey.

	SP-1	SP-2	SP-3
FREQUENCY RESPONSE	60 Hz - 14 kHz	60 Hz - 13 kHz	65 Hz - 13 kHz
NOMINAL IMPEDANCE	8 Ohms	8 Ohms	8 Ohms
POWER HANDLING			
PROGRAM	200 W	300 W	200 W
CONTINUOUS	100 W	150 W	100 W
SOUND PRESSURE LEVELS			
1 Watt, 1 meter on axis	104 dB	100.5 dB	102.5 dB
Rated Power, 10 ft. on axis	114.5 dB	112.5 dB	112.8 dB
DISPERSION	90° H x 45° V	90° H x 45° V	90° H x 45° V
CROSSOVER FREQUENCY	500 Hz	800 Hz	800 Hz



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for additional information circle no. 28

R-e/p 53

SOUND MAN'S GUIDE TO VENUES

(#2 in the series)

Name:
PALACE THEATRE
 Location:
**12 East Sixth Street
 Cincinnati, OH 45202**
 Phone:
(513) 579-1222

Driving Directions from Airport:
 I-75 North to Cincinnati. Approximately 8 miles. Take Downtown exit to Sixth Street.

Facility
 Totally enclosed concert hall. Old classic theatre, newly restored.
 No regular hours of entry. Contact theatre for appointment. No closing time restrictions.
 Permanent level stage. Additional section can be built to extend over audience seats.

- dimensions -

Stage to grid height - 57' 10"
 Stage to proscenium height - 26'
 Width of proscenium opening - 42'
 Apron from curtain line - 6'
 Curtain line to back wall - 29' 6"
 Pit is 3' 8" deep, 7' 6" at widest point, and 36' 4" long. Seats 18 - 20 musicians.

- seating -

Total seating - 2,584. 1,404 in orchestra and the rest in the single balcony which includes boxes extending down the sides of the theatre. Front edge of balcony is about 60 feet to edge of stage. Seats begin 3' from edge of pit. Pit can be filled in with difficulty. Limited speaker riser areas in front of live curtain. Hanging speakers in front of stage may be a future possibility.

Acoustics

Very good, according to Festival Productions which puts on concerts in the hall. Was originally an old vaudeville theatre and has been fully restored. Padded seats except for last rows in balcony.

Some bass build up on main floor under balcony due to ceiling dome. High frequency slap back from balcony audible on stage. Otherwise an even sounding room. No RT60 measurement available.

Loading

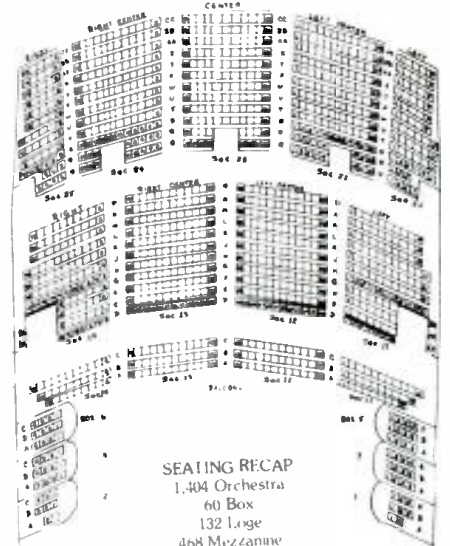
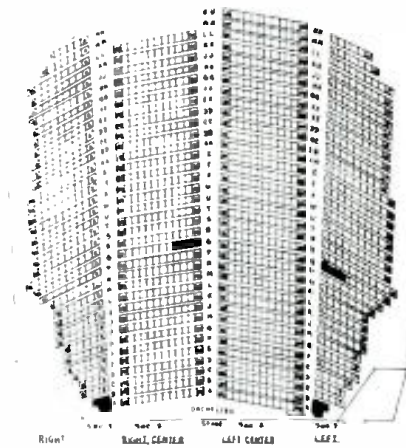
Loading entrance located in alley between 6th and 7th Streets. Dock door measures 8' (h) x 7'6" (w) and is at street level. Door opens into back stage area. (Approximately a one foot drop.) Use ramp from truck directly onto stage. Truck parking is limited to an alley entrance.

Set Up

Area reserved for mixing console is in audience on orchestra floor. Center section, Row Q, seats 102, 104, 106, 108. Alternate area is house left section Row Q, seats 1, 3, 5, 7.

100' cable needed to reach center stage. Closest AC grounded circuit is 75' away at stage.

Mixing Positions shaded areas



SEATING RECAP
 1,404 Orchestra
 60 Box
 132 Loge
 468 Mezzanine
 520 Balcony

House Sound

- house speakers -

Two speaker stack located at sides of stage, stage level. Tri-Amped. Composed of:
 - 2 JBL 4520 13' folded horns w/2205A JBL loudspeakers.
 - 2 JBL 4560 bass bins w/2220B JBL loudspeakers.
 - 2 JBL 4560 bass bins w/2205B JBL loudspeakers.
 - 4 JBL 2350 90° radial horns w/2470 JBL horn driver.
 - 2 JBL 2395 45° lens plates w/2470 JBL horn driver.
 - 2 Altec 203 40° long throw horns w/288 Altec horn driver.

- monitor -

8 JBL two way monitors each w/JBL K130 loudspeaker and JBL horn. Side fills on request are 2 JBL 4590 bass bins w/2205 loudspeakers. 2 JBL 2350 90° radial horns w/2470 JBL horn driver.

- house amplifiers -

1 BGW 750C, 1 Crown 300, 1 Crown 150, 1 SAE Mk III, 1 Crown D-60.

- monitors -

2 BGW 750C, 2 BGW 250.

- house consoles -

Yamaha PM1000 (16x4). Can accept balanced line level signal using male XLR 3 pin connector.

- monitor -

1 Teac Model 10 (16x4). 1 Teac Model 5 (8x4) for a total of 20 in, 8 out.

- microphones and stands -

6 Shure SM58, 2 E-V 1751, 4 Shure SM57, 2 Sennheiser MD441, more on order.

Electrical

4 wire, three phase, 400 Amps per leg. Main breaker box located down stage right. 10 - 20 amp, 117 volt circuits on stage. Lighting equipment is SCR type. Strand-Century Micro Q System.

Personnel

Union house, non-departmentalized. Separate loading crew must be called. Forklift and operator needed if truck has no ramp.

Building Manager: Brian Hansen (513) 579-1222.

Sound Engineer: Ray Kennedy with Festival Audio (house company) (513) 321-6688.

Chief Electrician: Tom Dignan.

Traveling Soundman Reaction:

"A live room, needs a minimum of amplification. The area under the balcony is very live. Full house needs some bass boost and a little extra high end as compared to empty house. Newly installed transformers in house audio system help alleviate RF problems caused mostly by house SCR dimmer system. House sound system powered off same AC leg as lights." *Tom Lane, House/Union sound man. (Cleo Lane, John Dankworth)*

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MAINLINE employs analog and digital technology to create a unique "time domain multiplexing system" specifically designed for high quality audio reproduction. The system contains two modules connected by a standard microphone cable. The eight channel input module is located on stage. This stage module encodes and transmits data to the output module (at the console) which decodes the signals and feeds the mixer. There are three different MAINLINE encoder designs. One for balanced lo impedance microphones; one for hi impedance instruments; another for mixer output signals. The decoder module has output levels that accommodate all mixers and/or amplifiers. The MAINLINE comes standard with a 100 foot cable. It is calibrated to operate with cable lengths of 25 to 600 feet without sacrificing performance (MAINLINE could be adapted to perform at any distance).

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. . . It means you can send all the guitars and keyboards from the stage to the mixer on one line of your existing microphone snake. MAINLINE eliminates costly balancing transformers and tons of additional cable. You save money, time, and hassle. It's simpler, more reliable, and most important, the music sounds much better!

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. . . It means an engineer can now run a stereo tri-amp sound system with the cross-overs located at the mixer allowing balance control during performance. The six separate line sends can be carried by any one channel of a microphone snake, with two sends to spare!

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The Second Engineer

by
James Riordan
and
Tom Lubin

Photos by *Merrilyn Mohr*

A session is in progress. The musicians are playing, the mixer is mixing, and the producer is producing. A casual observer comes into the control room to see how things are going. He might be from the label, or the management company or just a friend of one of the session participants. When there is a break in the action, the visitor is introduced to those in the control room. The producer or the artist making the introduction knows the first and last name of everyone involved, that is with the exception of the person back by the machines. At that instant, the mixer will jump in and introduce his second. If the mixer is a guest engineer he may also have trouble with second's full name but he can usually come up with a first name. In the course of a session this can happen often. Those at the session will remember the producer, mixer, and the players by name, but



Larry Rebhun

not necessarily the person who assists the engineer and who helps with the general flow of the session.

The lack of identity and recognition that a second engineer receives is in part caused by the very nature of the job. It requires constant attention to detail and immediate assistance when required while at the same time staying out of everyone else's way artistically as well as physically. In a majority of cases it's only the first engineer who truly recognizes the value of



Carolyn Tapp

a gifted second. This is understandable since almost all mixers were seconds before they operated the board.

The first sessions mixed by most seconds will usually be in the middle of the night, or demos, or sessions that none of the staff mixers are interested in or have the time for.

When a second begins to sit at the board they will often be expected to continue their normal session assignments, fitting in the mixing as time permits. If they complete a successful demo which is picked up by a label, their future as a mixer is still not assured for without question someone connected with the



Erik Zobler

act will suggest they get a "heavy" engineer for the "real" recording. If they are able to weather all the storms and the act is a success they emerge like butterflies from cocoons. After what could be years of hard work, their goals are beginning to be realized.

Hiring A Second

Because this position has an over abundance of qualified applicants, studios can be very selective when they hire someone new. Major studios will only hire those who have had a great deal of prior experience in sound reinforcement or experience at a less prominent studio. A classified ad describing a position opening is seldom seen since literally dozens of people apply at major studios every day.

If an ad were written that candidly described the position it might go something like this: Wanted — Bright, alert, yet laid back person with some experience in electronics, music and sound required to train as an engineering assistant. Must be agile, quick with hands, and able to react quickly but without overreaction or anticipation. The candidate must think on his feet and say the right thing in politically sensitive conversations. Work tireless hours. Have an ego which can accept someone else's taste above his own. Must not be easily bored even after hearing the same solo for the



Carla Fredrick

hundredth time. Must always be first to arrive at the studio, and will invariably be the last to leave. The applicant must be able to survive long periods of time without eating and when food does arrive the applicant should be able to consume anything, no matter how cold it is or what it might look like, regardless of how many cups of coffee might have preceded it. The candidate must also reject the concept of day and night, and be able to sleep no matter when they go to bed. Additionally they must be alert, pleasant and not make mistakes regardless of how little rest they get. Time off for holidays is seldom. Two day weekends are infrequent and can never be planned on since Friday nights



John Weaver

often bring with them a last minute booking for a Saturday or Sunday marathon session. The remuneration: A bare minimum. Not only is overtime expected, but it's the only way many seconds can provide all their necessities. The intangible rewards, though the most illusive, are also the most intriguing.

The candidate will often participate on projects which are commercially successful while having the opportunity of working in the music industry with people they like, admire and respect. Attitude and self control will be required as the job will sometimes entail working on sessions that never end, recording music not to your taste by people you might

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not like. Most of the time the activities will be confined to a box 20 feet square. There are one or two large windows but they generally look into an adjoining box. One more thing. At 3 a.m. when it seems a session is complete and you are looking forward to going home for a few hours sleep before returning to the studio for a morning session, the producer might request a dozen or so cassettes that he claims he must have by 9 a.m. This is also part of the job, and without hesitation or grumbling you will make them for the client.

If this sounds bleak, sometimes it is. The job is difficult and demanding. But it is also exhilarating with potential toward advancement that knows no bounds. It is the simple reality that second engineers are the lowest on the recording totem pole, and everyone else is sitting on their heads. They are paying their dues while working toward their own personal goals.

Who becomes second engineers, what are their jobs and what are their lives like? R-e/p asked second engineers from Village Recorder, Cherokee Recording Studios, Westlake Audio, and Rusk Sound Studios to participate in a group discussion of the role of the second engineer.

Larry Rebhun from Cherokee defined the role of the assistant or second engineer as "an interface between the engineer and the equipment. The studio I work at caters to independent engineers so we have a lot of people who have never been there and are not familiar with the equipment. As a second you set up mikes, do all the paperwork, and run the equipment. Some engineers prefer to do their own punch-ins and -outs. The extent of the job depends on the engineer and the tone he sets

almost be reduced to being part of the equipment or at the other extreme become tremendously involved in the session and very nearly co-engineer the project. I don't go in with any preconception of what's going to happen but, if it's at all possible, I try to get as involved as I can. If all you're doing is just babysitting a project and making sure that nothing goes wrong, it's not very fulfilling. If you're not involved then you're just like a stranger in the room, and I don't think that anyone's comfortable with that. That's the first thing I try to overcome. I don't want a feeling of distance between myself and the client. I try to make everyone feel comfortable with my presence and, hopefully, at some point, they will ask for input from me."

At Village Recorders where Carla Frederick is a second engineer, "We don't have staff engineers so we do everything from waitressing to engineering. There are a lot of things involved that have nothing to do with the studio which take up a good quarter of the time you spend there." She thinks one of the most delicate aspects of the job is sensing the attitude of the session. Carla added, "The producer walks in for the first time and you don't know who he is or who the engineer is and it's up to you to relate to them. They don't have to relate to you. They can just be whoever, or whatever, they want to be and you have to totally cater to them. You have to smile and say yes, yes; and on top of that you have to make sure everything runs smooth. The producer doesn't need to turn around. He can just sit there and stare out the window and that's it. Three hours after the session begins he might say 'We're going out to dinner now, would you mind staying and tidying up?'"

learn more about."

Seconds agree that intuition is a valuable asset for doing the job well. Often they have to sense when to stop and start the tape machine or know which are preferred takes though no verbal communication would have occurred.

Then there is the situation where the clients are trying to take advantage of the studio and the second engineer may be the only studio representative on the premises. Reports of producers requesting down time so they can take their personal phone calls or asking the seconds to run personal errands for them are not exaggerated.

"The studio has to be willing to support the second engineer in a lot of situations," added Larry. "There are some times where you get somebody that is really unreasonable and it's important for the seconds to know that the studio will listen to reason and not without question take the side of the client. I mean I had a producer who wanted to send me next door to get parts for his toilet and it's good to know that the studio will say that kind of thing is not part of my job."

"The bottom line," John stressed, "is remembering who you are working for. You want to have the client like you because developing a rapport is a big part of the job. But, at the same time, if you do anything that violates the code of ethics or rules laid down by your studio you're cutting your own throat."

"At times conflicts between the artist, producer or engineer can occur with the second inadvertently in the middle," says Erik. "The engineer can say don't give out any copies to anybody and then the artist might tell you he wants some copies. So you tell him the engineer told you not to give your copies, but then the artist reminds you that he is paying for the record, not the engineer, and if he wants a copy he should get it."

Being the representative of the studio during a session can lead to other problems. For instance, during the heat of a session someone's temper flares and it looks as though physical violence may break out. What is the second supposed to do? They must walk a thin line, as it is their responsibility to protect the studio's equipment, and somehow continue to maintain a good rapport with the clients.

"We had one," said Carolyn, "where they weren't even arguing but just fooling around, shoving each other and somebody pushed too hard and all of a sudden all this equipment started going all over. I had to jump across the room and grab everything I could. To make matters worse it was falling toward the window. About all you can do in that situation is pick the things back up. You just can't turn to them and say, 'you shouldn't be doing that,' because that's not your place."

One of the more difficult duties of a second can be reminding clients that their time is up and they must get out of the studio.

"Sometimes that has to be done really diplomatically," Larry said. "In my head I know that a particular client is going to need forty-five minutes to get out of the studio so forty-five minutes before the end of the session I'll ask him if he wants cassette copies rather than

" . . . I don't equate the money I'm making with the value of my contribution to the project . . . I'm more concerned with making records . . . what I've dreamt of doing . . . " John

for the session. This is especially true in a session where the engineer and the musicians are not that familiar with each other or the room. Another thing the second engineer sometimes does is let everybody else get as stoned or screwed up as they want and still make sure the session turns out right. I know I sit there at the end of a session and everybody's having a party but I've got to clean up."

Carolyn Tapp is a second engineer at Rusk Sound and is one of two females on our panel. She defines her role in part as "relieving the engineer of all the little things so he can concentrate on the music and the sound while I keep things somewhat together."

At Westlake Studios Erik Zobler commented, "I don't do much tape operating because all the engineers I work with have a 3M Selectake sitting right next to them so most of the time they do it themselves. The way I look at my job is that it has two faces. I work for the studio and at the same time I work for the engineer. I want him to look the best that he can. I'm always watching what he does to make sure that whatever he does is technically acceptable. As far as my opinions, if I know him and we've worked together in the past, I might say something to him. Otherwise I keep my trap shut and say nothing."

For John Weaver, also from Cherokee, "It can be one extreme or the other. You can

The Work Day

Obviously being a second engineer is not the easiest job in the studio but the most difficult aspect seems to be the incredible workload that seconds must maintain. "At Cherokee the second engineer stays on the project rather than just working set hours," says Larry. "I think it's that way at most studios although some seconds do work set hours and some studios change shifts."

Twelve hours a day, six days a week seems to be the consensus of the average second's workday. But sometimes it gets worse. "At Westlake," says Erik, "for a while there were three rooms with only two engineers and one maintenance man working the rooms. There were only three of us for 2½ months after the third room was opened. We were working eighteen hours a day. It was nuts. Since then we've hired people so I'm back to a sixty hour week."

Just as long hours are part of the job there are other hassles that a second engineer must deal with in the course of his or her workday. "It's difficult," says Carolyn of Rusk, "when the music is bad. You can't walk away from it and you can't let them know that you don't like it so you end up saying something like 'that take sounded better than the last one.'"

"In situations like that," Erik added, "I try to cue into what I can gain out of the experience, what aspects of engineering technique I can

" . . . right in the middle of a mix and the next client is pounding on the door . . . there's no way to be tactful . . . " Carla

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waiting until five minutes before the session is supposed to end." "What do you do," Carla asked, "when the session is supposed to be over and they're saying 'please give me fifteen more minutes. We're right in the middle of a mix,' and the next client is pounding on the door. There's almost no way you can be tactful in that situation."

In order to put up with hassles like these it is obvious that second engineers must love their work. "There are so many obstacles to normal living with this job," said Erik, "that if you do stay with it you've got to be passionately committed to it." "You've got to love it," agreed Carolyn, "There's a lot of sex in it. The feel, the intensity, the effort that's put into it . . . and the love. For a lot of musicians there's a lot more love put into their music than into their personal relationships. You have to love this job or you will not survive at it."

So what does it take to become a second engineer? Is it going to the right school or having an impressive resume? "I don't know anybody who got their job from having a good resume," said Larry. "That's secondary. It's being in the right place at the right time more than anything else. At Cherokee I'm the guy who looks at the job applications and if I see a resume of someone who's really qualified I'll remember them, but that's about it. I really feel awful about the whole situation. I wrote a letter to *Rolling Stone* a couple of years ago about recording engineer schools because I just wanted the people out there to know that there aren't that many jobs available. I felt the schools were just turning out all these people with expectations that were as high as mine. I felt like they were kind of getting set up to lose

" . . . one of the hardest things for me to give up was the concept of day and night . . . the concept of weekends . . . just forget about the calendar and the clock . . . " Larry

their money since few schools have the ability to place their graduates and they end up doing I don't know what."

"My feeling on getting the job," added Erik Zobler, "is that if a person strongly desires it, they'll do it. If they really, really want to do it, it will happen."

"It's attitude," agreed Carolyn. "when you go for the job interview you need to let them know that you really want to do this, but it's your attitude that will get you hired. It won't be because you've got a degree or some other piece of paper. And if you just send them a letter and never come in or follow it through it's just going to go right into the file and never be seen again. People call, and ask if they should come in. They should, and they need to be persistent. If someone tells you that such-and-such is looking for someone that may be all you need. That's how I got my job."

As far as educational preparation for the job, the consensus of opinion indicated a background in electronics, music theory and psychology would be valuable, as would learning to apply common sense to technical problems. Someone desiring to enter the field should start by working with home equipment and above all get into a studio, any studio, as soon as they can. Books such as the *Audio*

Cyclopedia, by Howard Tremaine, Robert Runsteins' *Modern Recording Techniques*, F. Alton Everest's *Handbook of Multi-Channel Recording*, and periodicals such as *R-e/p* magazine provide valuable information for the novice.

The Money

Second engineers are underpaid for the most part. The money pays the rent and that's about it but there is satisfaction in the work. "I don't equate the money, I'm making with the value of my contribution to a project," says John Weaver. "I'm more concerned with being involved in making records. I dreamt of doing this as a kid and having it happen makes the money less important for now." "There's something else to consider, however," said Erik. "You may like the job so well that you'll do it for practically nothing but on the other hand you don't want to sell yourself too cheap because if you sell yourself for nothing, that is what people will think you're worth."

The job of second engineer requires long and irregular hours that makes social and romantic relationships very difficult.

"There are very few people who understand our lifestyle," said Carolyn. "You almost have to have a relationship with someone who has a similar occupation for them to understand what you go through." "One of the hardest things for me to give up," commented Larry, "was the concept of day and night. The concept of weekends. Just forget about the calendar and the clock."

Because of their familiarity with a particular room, the second is often called upon to share this experience with the producer and/or engineer who may not have previously recorded at that studio.

If the facility does a lot of sessions which use studio musicians the second usually winds up introducing the players to the clients they're working for. Without a doubt the second can have a considerable effect on the feel of a session depending on his or her rapport with the other participants. "Sometimes after an artist gets a rapport with you he doesn't want to work with anyone else," said John. "It may be because he likes you or your work, or possibly because he feels insecure performing in the studio in front of someone he doesn't know."

The second engineer is, in almost all cases, responsible for the paperwork that goes into a major recording session. "The paperwork for tracking a session starts when the client books the time," explained Larry Rebhun. "We're not really involved with the initial phone call but the engineer usually lets someone in the office or in the maintenance shop know what kind of mikes they want to use or if they want to use a certain chamber. At some studios this might be handled by the traffic department but I always double check them anyway. The most hectic time occurs during a 30 ips tracking session. The tape goes by so fast that you barely have enough time to fill out the track sheet, the box labels, the edge labels, the cards for the tape library, and still make sure that

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everything is working right. Obviously, you have to write out the time the session started and stopped. If there is ever a problem you have to document the reason for the down time (i.e., trouble logs). You have an inventory log in the tape vault to keep track of how much tape you use and how much is returned at the end of the day.

Erik added, "Trying to keep an accurate record of incompletes and false starts can also be a difficult proposition. And it's very important because when they come in to hear a playback you don't want to rewind to a false start. That just lets everybody down and it doesn't make you look good. What makes it harder is trying to maintain accuracy and at the same time take care of some problem in the studio. When you return to the control room after changing a dozen headphones or some microphone you suddenly realize you've lost track of where the tape is at that moment or what take you're on because the mixer has gone back and recorded over the false starts."

"... sometimes being asked for your opinion can put you between the artist and the engineer or producer..." Erik

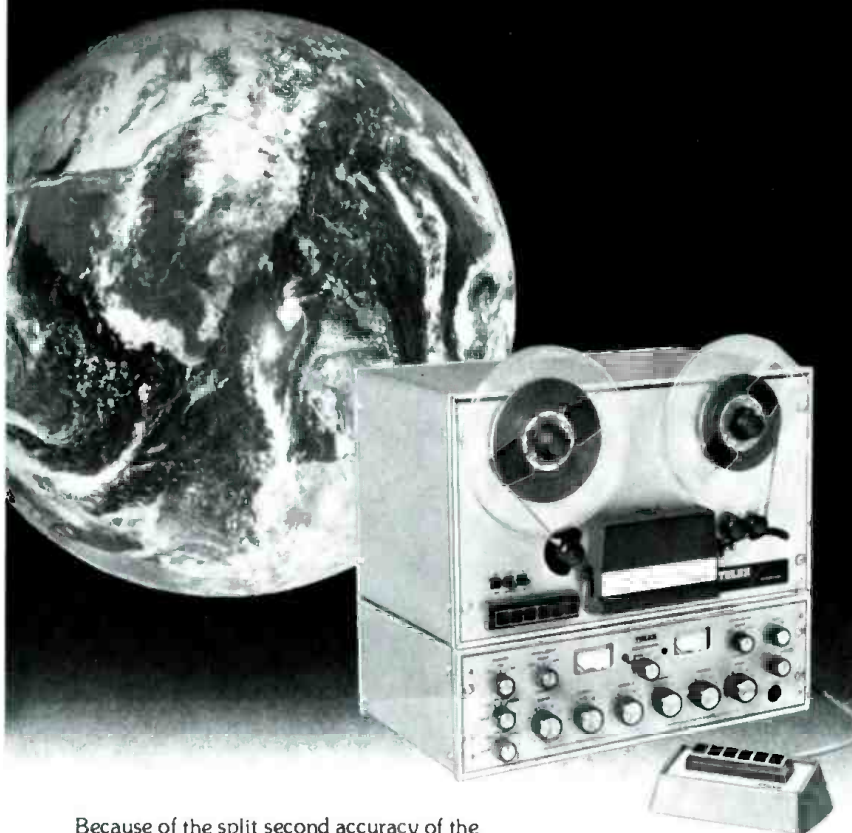
We asked Carolyn about the specifics of paperwork involved on a basic session. "You prepare a sheet which tells where each microphone is patched in and what instrument it is used on. Then you go to your daily workorder. This workorder has a number which is logged on all your tapes for that day. It tells what the session is, who it's being billed to, and the times involved. Then you must record how much tape you've taken out, extra equipment to be billed, and you've got to fill out all the tape boxes. With each tape recorded you include a list of all the instruments used on the basic, and what track they're on. With each subsequent overdub, you add the additional information and that has to be perfect, otherwise you might be responsible for someone accidentally erasing a master vocal or something like that."

"Getting the workorder signed," continued Carolyn, "is one of the worst problems since once the session's over they're gone. You are trying to get the tape off the machine and clean up so the next act can get into the studio and you see your client heading out the door. You end up running after them with the hope of catching them in the parking lot. If you miss them you try to have it signed the next day, but it's best to get it the same day so that any questions about the bill can be worked out while it's fresh in everyone's mind."

"However, the job is more than doing paperwork and the other aspects of a session that no one else wants to do. It is sometimes being a sounding board for the engineer or producer as many seconds find that their opinions are often solicited and valued. "I've been on projects where it's been just myself and one other person, the producer-engineer, working together," said John. "In those situations it's not unusual that you'll be called on for your opinion."

"I really like that situation," Erik responded. "It's great because you can really talk to the engineer-producer without worrying about anyone hearing what you have to say and usually it's appreciated. Sometimes being asked for your opinion can put you between

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the artist and the engineer or producer. How I deal with it depends on the situation. Sometimes you want to speak, at other times you have to say 'well I don't really have a say,' or 'I'm not really in a position to say.' Then a lot of times, they'll want to know what you think anyway. Then I'll tell them, having set them up that way. It sort of clears you, but it is a very touchy situation."

"What I usually do," added John, "if I know the client well and they finally get to the point where they ask me what I think, then I come out with it. At that point you have to assume that they've gotten as far as they can with their objectivity. Once they know you and respect your opinion they will listen to what you have to say and in many cases rely on it. Recording is a very intimate situation. It's basically the artist, the engineer, the producer, and yourself and if they ask you for your opinion they probably will consider it."

Women Seconds

Anyone in the business of sound recording knows that traditionally there have been few women engineers in this industry. However, the last couple of years have seen a dramatic increase in their ranks. The pressures placed on them are sometimes more severe than their male counterparts since they must gain acceptance and recognition in what is still a male dominated industry.

"One thing that's surprising for me," Carolyn Tapp replied, "is that I've had more snide comments from women than from men. More than once I've been told by another woman 'I never saw a second engineer that looked like you.' Basically, I know that during

" . . . basically I know that during the first few days of every project I'm going to have to prove that I can do this job . . . there's no way you would be doing the job if you weren't qualified . . . no matter how you look . . . " Carolyn

the first few days of every project I'm going to have to prove that I can do this job even though I happen to be a female. Once you get over those first few days with a client it's all right. There's no way you would be doing the job if you weren't qualified no matter how you look."

"I have no problem at the Village because there are four women and two men working as seconds so everybody there is used to it and they love it. We have a wonderful working relationship there and there's no animosity or discrimination whatsoever. But I spent four years in hell getting there. It was real bad. Getting stuck in a job because the guy thought I was a novelty, a token, and having to work my way through that. Now, I just say, 'to hell with it,' if they can't take a joke. I do what I do and I do it well."

"There's only been one session at the Village," Carla continued, "where they actually would not let a woman work on the date. They had locked the doors and they wouldn't let us in."

"Some men have the worst attitude toward women in the studio," Carolyn added. "They're so paranoid about being macho. They like having a woman in there because it's something nice to look at, but at the same time they're paranoid about you. I don't go in there

wearing a bikini. I always wear jeans and a loose fitting blouse. I'm not in there for a fashion show and I'm not looking for a pickup. I'm there to work. As far as the studios go I just wish that they would use the same criteria to hire a woman as they would a man. I think it's getting to the point where women are able to break in and get the experience. That's what the criteria should be — experience — not whether you're male or female."

"There was a lady I knew at Electric Lady Studios in New York," added Larry. "She was assistant engineer on two Stevie Wonder albums and a Jeff Beck album. There was a picture in *Rolling Stone* or something like that, and they showed Stevie Wonder, Jeff Beck and her standing around the console and the caption was something like 'Stevie Wonder, Jeff Beck, and unnamed woman.' (Ed. Note: *The lady was Joan DiCola.*) That was a couple of years ago but it made it really clear to me how hard it could be for a woman in this business."

"When I was beginning," said Carla, "four or five years ago, it was a little bit more difficult. The things you'd come up against, the cynicism and the rotten attitudes were enough to make you want to have babies for the rest of your life. But now I think it's probably a lot easier. The industry is beginning to accept women. However, at the same time a woman probably has to prove herself more. For some reason, though I don't know why, it's as though they're saying, 'I don't want that chick touching my tapes.' I don't know why but sometimes there's that attitude. And your feelings have to be prepared to accept that and not let it bother you."

"You can't do it through sexuality," added Carolyn. "You've got to prove to them that you can do it no matter what you are. I think it will get easier with each woman that breaks into the business but it's always in the back of your head that if you fail it's another mark against women."

"It is true that there are many women in the music business but not on this level. The majority of them work in offices, not in studios. Many of them get into this so they can be around the stars and the glamor. Unlike us they can go home at five o'clock. As was said earlier there are easier ways of meeting rock and roll stars and getting married. To do this job you have to have a professional attitude. You try to be one of the boys but you don't flirt. You make it clear that this is your gig."

Breaking In

There are over three hundred studios in the Los Angeles area and something like 120 of those are 24 tracks. Despite this vast recording market, assistant engineering jobs are very difficult to obtain. The best advice according to our panel is to move to L.A. or a similar recording center and start making contacts.

Once the job has been secured, what happens next, how long does it take for the career advancement to occur?

"When I first walked into Cherokee," John said, "I was willing to sweep the floor and be a

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gopher for as long as was necessary to eventually get in the studio. Fortunately for me it happened much sooner than I expected, in a matter of a few months. Everybody there was extremely helpful in terms of explaining what I needed to know to get started. When the time came I was thrown into the deep end and it worked out. That was over a year-and-a-half ago and lately I've been getting opportunities to engineer. So it can happen very quickly."

"It's been happening to me too," said Erik Zobler. "I've just started firsting in the last three or four months and I've been a second in the big studios for the last two-and-a-half years."

"You have to be prepared," said John, "to not go by any defined schedule as to what's going to happen. I came in with the minimum amount of professional experience and was thrown into it. I was constantly being confronted with situations where it was assumed that I could step into the engineer's chair and take care of anything he was handling. When this happened I just said to myself 'I've got to do it' and normally I knew if I didn't freak out, I could. People often ask me when will I stop being an assistant? I tell them when I can convince myself and somebody else that I'm ready. I think we've all been doing this long enough to not allow ourselves to get into

situations where we're completely in over our heads." Larry added, "I think a lot of the limitations are self-imposed. It is just a matter of accepting responsibilities for the creative aspects which you control as an engineer."

After a second attains the level of first engineer is it almost a forgone conclusion that they will want to become producers?

"Most engineers would like to be producers because the producer has the final control," said Carolyn. "Right now I just want to be the best engineer that I can. After that I might think about producing but for now I just want to be a good engineer."

"Without a doubt there can be more riches in producing," added Erik. "If you have a hit you can make a lot of money, but you can produce for years and if you have no hits you won't make much. As an engineer you can make thirty or forty dollars an hour whether it's a hit or not. I would like to engineer and produce. It's very, very difficult to do both. When you have two people, one guy can work on the music and the other guy can take care of the technical aspects. One person doing both is very difficult. While it's difficult, this is still the direction I would like to work toward. I have definite ideas of how I would want things to musically sound outside of the way they sound technically. Sure I'd also like to work with a

producer, but I have my own ideas as to how I think things should sound production wise."

"I have no desire to be a producer at this time," said Carla Frederick. "I've been asked that a lot because everyone assumes that all engineers want to be producers. I don't believe that to be true." "It seems as if your goals are defined as you go along," added John Weaver. "You set a particular goal and you go for that and once you achieve it, the next thing you should do becomes obvious. But there are stereotypes . . . cleanup guys want to be seconds, seconds want to be engineers, engineers want to be producers."

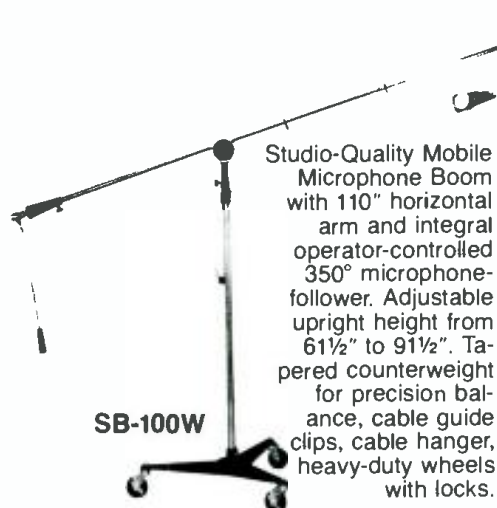
The job and life of a second engineer is an interesting but difficult one. It's tough but rewarding. But most of all it's a learning experience. Perhaps Erik summed it up best when he said, "it's very much like a musician. We're paying dues. Most second engineers aren't getting paid a lot for what they're doing while at the same time many of the people they're working with are making a great deal of money. But we get paid in other ways. We're earning experience which, if we keep at it, will pay us back later."

Author's Note

Since the time of this interview Larry Rebhun, John Weaver, Carla Fredricks, and Erik Zobler have acted as first engineer on several more sessions and Erik has also been named chief engineer for Westlake Audio. Carolyn Tapp is now working freelance second engineer at sessions in various studios in Hollywood, as well as assisting LeMobile (Quebec, Canada) with their remote recording truck. □ □ □

" . . . four or five years ago it was a little more difficult . . . cynicism and rotten attitudes were enough to make you want to have babies for the rest of your life . . . now its probably a lot easier . . . " Carla

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A FUSS ABOUT PLUS: Preservation Of Audio Signal Polarity In The Recording Signal Chain

by Peter Butt

The matter of the audibility of the absolute polarity of audio signals has been on my mind for a number of months. Actually it's been a number of years. Other, bigger windmills seem to have commanded attention for attack. Polarity seems to be only a minor matter in the course of the program chain. Most of us are a little surprised when the signals emerge at the ears of the end consumer in any recognizable form whatever.

The basis of this article is the assertion that absolute polarity is definitely not only audible but necessary to the achievement of a realistic acoustic experience of recorded sound. Because of the semantic confusion caused by the interchangeable usage of 'phase' and 'polarity' in general usage and the lack of polarity response specifications for the cases of magnetic recorder/reproducers and disk mastering systems, we are presented with a situation where polarity has been lost in a forest of phase. Determination of the polarity response of these critical links in the recording process are fundamental to the preservation of polarity response through the audio signal path up to the production of disk product. Before we can attack the problem of establishing polarity compatibility, we must first examine the problem to see where homework needs to be done. Proof of the value of such an undertaking is a necessary motivation. Another aid in the task is a re-examination of the definition of 'phase' and 'polarity' as a means toward sharpening our recognition of the phenomena contributing to the problem in the first place.

POLARITY: A DEFINITION

Let's define the term 'polarity' and attempt to distinguish it from the more widely used 'phase.' Excerpting from the work that re-aroused my interest in the polarity versus phase muddle most recently, Tom Lubin and Don Pearson have written: "Polarity and phase are relative terms. Polarity refers to the property that physical quantities have of being greater or less than some reference value that we may arbitrarily designate as the point of reference or 'zero.' A point on a line may be thought of as being closer to an observer than another point thought of as the reference; or farther away than that same reference point. Its position may be described as corresponding to a positive number in one case and to a

Peter Butt staged his auspicious entry into the professional audio community as a disc mastering engineer for a toy factory. From that position with Mattel Toys, he progressed to participation in the tape duplication industry, serving as chief engineer for the tape duplicating division of Superscope, Inc. He has since served in a technical capacity at Westlake Audio and Filmways/Heider, in Los Angeles. He is currently an electronics maintenance and engineering consultant to the Los Angeles area recording industry.

negative number in another. A voltage may be thought of as being positive with respect to one reference potential and another voltage may be observed to be negative referenced to that same potential. Both voltages may be either positive or negative when referenced to the potential of the earth which, by the way, may not be resting at zero with respect to the universe.

"Phase is a term that is implicitly linked to an ongoing time sequence of two or more series of events as observed relative to some common reference point in time. Events that are considered to be 'in phase' are events that have their time sequences of increase and decrease occurring simultaneously. Events that are said to be 'out of phase' occur in such a way that their increasing and decreasing sequences do not occur precisely together. The measure of the difference in phase is always expressed as a time relation, be it in terms of actual seconds, minutes, hours, etc., or as relative time in terms of increments or fractions of complete cycles of events, such as in units of degrees or radians. It is clear that two or more events may be precisely in phase with one another while being of either positive or negative polarity. Phase and polarity are related although one is not precisely identical to the other."¹

It is important to recognize that polarity and phase are not the same thing. It is common to hear the two terms used interchangeably. This rather careless usage obscures the meaning of the information intended to be conveyed. For example, it is possible for the phase of two pairs of signals to be identical while their polarities may be of opposite sign. Further, it is frequently observed by those who are prepared to accept such information, that two comparable systems present outputs that are perfectly in phase with one another while being of opposite polarity. Phase is an incremental concept. Phase may have assigned to it any numerical value within the bounds of positive and negative infinity. Polarity knows no magnitude. Polarity is either positive or it is negative. The abstract question of whether the quantity zero is positive or negative will be neglected for our purposes as one's ability to measure a value of zero varies with the dedication one may have to the resolution of the measurement being performed.

Polarity, further, could be imagined to exist without reference to time. A quantity may be observed to be a negative one all through the time frame of interest. It may not change its value at all within our ability to observe and may be considered to be invariant in time. In this situation, the concept of phase is not a useful one. To have value to our understanding, the concept of phase must necessarily involve a dynamic situation. Phase is meaningless without change. Like good taste, polarity may, indeed, be timeless. "Now, always and forever" has meaning for polarity only. None whatever for phase.

Why is this dead horse-beating so important to our discussion? It is simply because the desirability of phase agreement of multi-channel audio system components has long been taken for granted by all but the most naive. The importance of polarity, as a separate and distinct property from that of phase has only recently risen to general notice.

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audience as opposed to the same kick drum as heard by its player. An obvious difference between the sound as heard by the audience compared to the same acoustical impulse as heard by the player lies in their respective positions relative to the instrument producing the sound. They are on opposite sides of the drum membrane. The audience receives sound waves that are initially compressive in nature. The observer on the opposite side of the drum head receives sound waves that are initially rarified. The reason for this is that the motion of the drum head causes compression and rarification of the ambient atmosphere depending on which side is being observed during impact.

In fact, kick drums do sound different depending on the relative position from which they are heard. Brief inspection of the quality of drum sound heard from different positions surrounding a live drum performance will affirm that there is a distinct difference in sound quality that varies with the listener's position. Anyone who has had the opportunity to witness live drum performances in a live studio or rehearsal situation will doubtless affirm that this is true. This phenomenon is probably not restricted to drums but is likely also valid for most other instruments as well.

Given then that our goal is to reproduce the effect of the live performance from an analog recording of one form or another, it should not be unexpected that acoustic impulses that are observed as compressions in live performance should optimally be reproduced as compressions. It is likewise reasonable that live rarifications also be reproduced as rarifications. Not the other way around.

Those readers not having a resident band of musicians to experiment with are invited to try an alternative experiment to support the above assertions in the privacy of their own homes: A high quality recording is listened to on a properly phased stereo system and careful note is taken by the experimenter as to the subjective impression he has regarding the details of the recording, especially the experience of the bass portion of the spectrum as well as that of any percussive instruments in the recording. Having fixed a firm impression of the recording in his mind, the experimenter then reverses the polarity of both speaker connections of his reproduction system and repeats the audition of the recording. I believe that there will be a distinct difference in the perception of the recording between the two auditions. The better the reproduction system, the greater will be the difference. The listener will have a clear preference for the recording as heard with one polarity of speaker connection over the other. Remember now that the phase relationships of the reproducer have not changed. The only change is in the reversal of the speaker leads from one trial to the other.

ACCURACY OF REPRODUCTION

If accuracy of reproduction is desirable aesthetically, polarity would seem to be a non-trivial matter. The lengths taken to assure minimum distortion, maximum frequency response, and less casually obvious factors such as stereo imaging seem to indicate that predictability of consumer program reproduction is a desirable condition to the extent that considerable trouble and expense is tolerated in their pursuit. A quick scan of the advertising of the prominent studio design packagers among these very pages should serve as ample proof of this. In all this dedication to acoustical

and aesthetic purity, polarity is the one easily preserved factor that is left entirely to chance.

True, just about everyone in the professional recording biz has a microphone phasing fetish. Every technician worth his social security contribution has taken the trouble to ferret out polarity (vulgate: 'phase') reversals in his cables, patching system, ancillary equipment, ad nauseum. Less diligently sought after is the preservation of polarity as well as proper phase relationships in the connection of monitor speaker systems. Messrs. Lubin and Pearson, in the opening paragraph of their interesting two-part article assert that: "Phase and polarity have little significance as long as only one microphone picks up the sound and one speaker plays."² Gentlemen, I respectfully disagree. I and at least one other person, Mr. R. C. Heyser have publicly declared our beliefs, although Mr. Heyser's convictions predate mine considerably.^{3 4}

As mentioned in reference 3, the Mastering Lab has had its famous polarity reversal switch in the feed lines to their cutting system amplifiers for many years now, attesting to the significance of one polarity over another, at least with respect to the polarity conventions observed in their program and monitoring systems.

Where do things get lost in the program chain? Where and how does polarity drop through the cracks and become a matter, in effect, of a random series of coin flips? Both Mr. Heyser and, (ahem!) yours truly, have suggested that polarity standards be adopted for all of the various components of the audio signal chain, to wit:

1. Microphones.
2. All electronic signal processing devices.
3. Magnetic recorders and reproducers.
4. Disk cutting equipment.
5. Phonograph cartridges.
6. Long line transmission systems.
7. Broadcast transmitter modulators.
8. Broadcast receiver demodulators.
9. Amplifiers.
10. Speaker systems.

To be very precise, Mr. Heyser pleads for 'accountability of polarity.'⁵ In my comments, I made what could be a suggestion of possibilities for establishment of polarity conventions.⁶ In the words of one or more politicians, prominent and/or obscure, I was probably 'misquoted.' In view of the rather serious consequences of the interpretation of current United States anti-trust legislation by some, such a statement could amount to open advocacy of criminal acts by one or more persons, known or unknown. If anyone out there in Audioland may have taken me seriously, I want it known that I didn't really mean it if I actually said it. Of course, I never said it. After all, I don't want whatever protectors there are of the commonweal to come and take me away (Ha-Ha).

POLARITY OF MECHANICAL TRANSDUCERS

To further expand on the polarity wish list outlined above, it is necessary to state that the matter of polarity convention for the case of phonograph cartridges has been attended to by individuals safely outside the reach of our John Law. The Electronic Industries Association of Japan has adopted a standard for the polarity of phono cartridges for CD-4 applications that are generally adhered to for all stereo pick-ups manufactured there.^{7 8} Conversations with representatives of Shure

and Stanton and Ortofon indicate that they also, fortuitously and unknowingly, or course, obey the Japanese polarity convention. It is briefly, that an outward groove excursion will yield a positive-going output at the high terminal of the cartridge. (I wish to acknowledge my debt to Frits G. Nygaard of Ortofon for initially calling my attention to this fact.) Given that the cartridges are responding to groove excursions in a standardized manner, the die appears to have been cast for the cutter heads of the world.

I have occasion to maintain no less than six Neumann SX-68 and SX-74 cutting systems in the Los Angeles area. My investigations regarding polarity finds them in uniform disagreement with the Japanese standard. This is true even of systems operated in conjunction with Neumann signal input systems. It would seem that reversal of the input signal polarities would result in a beneficial enhancement of mastered product. That is, if everything else regarding polarity in the signal chain has been attended to prior to mastering.

Presuming that microphones, consoles, and ancillary equipment polarities are consistent, if not standard, within a given recording facility, we should be able to obtain a polarity — consistent recording from basic tracks, through overdubs through mixing, through master playback at the cutter, right? Wrong!

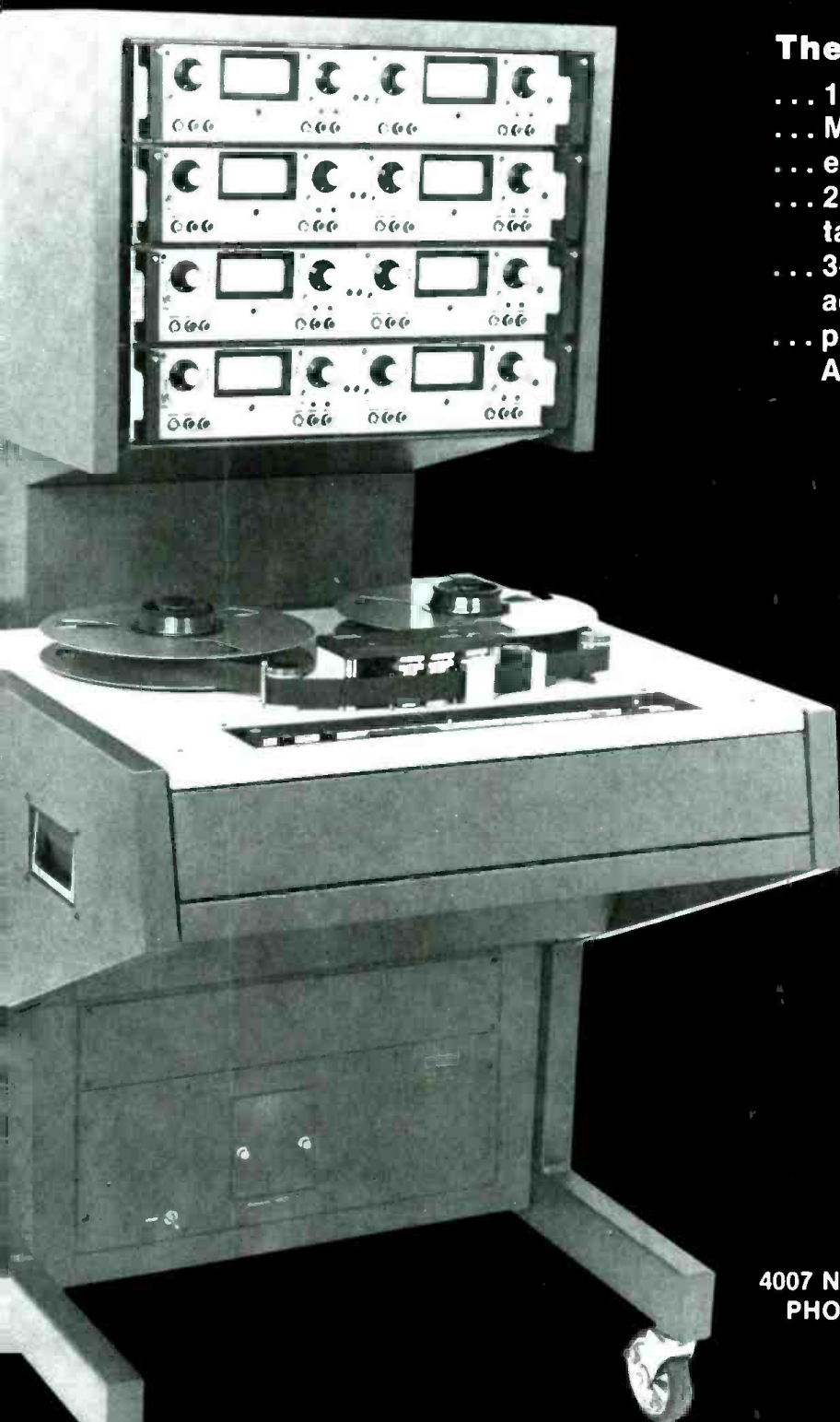
Even if all studios were not only polarity-consistent with themselves but polarity-standardized with each other, we would still be likely to lose track of the signal polarities. Analog magnetic recorders and reproducers have no polarity convention whatever except generally within units common to a given manufacturer.

Before we can intelligently decide on a polarity convention, we must first arrive at means of determining polarity in some consistent, easily repeatable manner. Coincident to my polarity dabbings, Mr. Scott Kent, of Wilmington, Massachusetts, has had similar ideas regarding the need for a polarity standard for magnetic reproducing heads.⁹ In a personal correspondence with John G. McKnight, president of the Audio Engineering Society, Mr. Kent outlines a standard and method for determining magnetic head polarity using, yes, friends, a flux loop. Evidently Mr. Kent also has not thought seriously about the value of his freedom. (As the reader can readily see, this conspiracy seems to be growing by leaps and bounds.) What Mr. Kent proposes is (not that I advocate this sort of thing you understand), adoption of a method for determining the polarity of magnetic tape heads. In the event I were to advocate a polarity standard, which I am not, it would seem more useful to establish the polarity of the recorded flux field in response to a positive-going transition at the recorder input terminals. It would appear to be more relevant to the solution of the problem at hand to specify that the polarity of the remanent flux recorded on oxide by a given machine be of the same polarity as a similar signal recorded on oxide by some other machine. The idea here would be to ensure that recordings made on the same piece of tape by different machines would be of uniform polarity as would reproduction of the same recorded signals by different machines.

The importance of this is rather significant to the recording industry as it now functions. Frequently a recording is made at more than

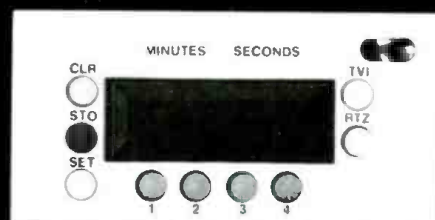
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one studio using more than one make of tape machine. Even if the polarity conventions adopted by all of the studios involved are consistent, the use of different tape machines for recording and playback offer opportunity for loss of the signal polarity. How often has an overdubbing session gone very well at one studio only to be judged deficient upon evaluation at another? How many rooms are equalized to yield a flat pink noise response, only to be judged 'bass-shy' upon subjective evaluation? The bass doesn't have the excitement, the emotional impact, it had at the time of recording. The studio, the microphones, the engineer, the monitors, the room, etc., ad infinitum are blamed. It is highly probable that the majority of multi-track master tapes contain polarity inconsistencies and could sound better than they do with less radical equalization. Many of the heated controversies concerning which tape machine sounds better could possibly be largely resolved if comparisons were made under conditions of uniform polarity.

How do we go about determination of a given tape machine's polarity. The determination technique I have been using is substantially identical to that independently proposed by Mr. Kent. A flux loop is constructed such that the electrical current flow through the coil turns are noted and indicated by a polarity marking. The reproducer to be checked has the loop installed in close proximity to its play head gap so that a positive current flowing through the loop passes from top to bottom (from track 1 toward a track of higher number). The loop is fed from a function generator set for an asymmetrical waveform such as a ramp or a short duty cycle pulse. The polarity of the

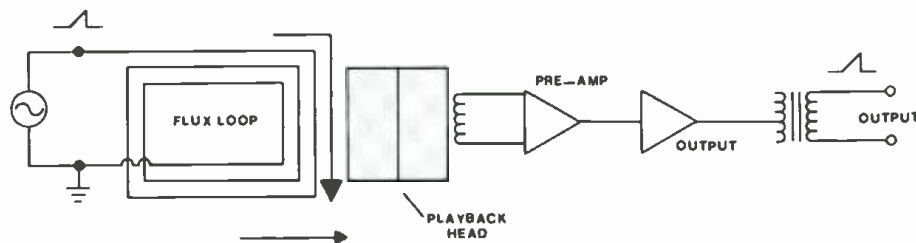


Figure 1: Schematic illustration of a method for magnetic reproducer polarity determination. The orientation of the induction loop is parallel to the reproduce head gap such that conventional current flow is taken as positive downward. Polarity inversions within the machine are neglected. The absolute polarity of the reproducer is the polarity of the output pulse emerging at the designated "HI" output terminal.

output signal of the machine is observed at its signal output port, keeping in mind the hi-lo output terminal designations.

This last point is important as there is no general agreement of which pins of the ubiquitous XL-type connector is to be considered the reference pin. The Europeans seem to prefer pin 2 high, pin 3 low, pin 1 shield. The Japanese seem to have adopted the reverse convention (pin 3, high; pin 2, low). Americans are ambivalent about it taking pin 3 high for most studio installations and pin 2 high for many stage applications. The only visible consensus is that pin 1 be assigned to shield. In deciding what the polarity response of a recording system is, it is important to keep in mind the intended polarity assignment at the signal input/output connectors was to be by

the manufacturer. Many spec sheets do not specify polarity at all and one may just have to arbitrarily select a reference and determine the results of interface with the system of interest.

Mr. Kent and I differ as to the point at which the polarity is to be determined. He suggests the head terminals while I opt for the machine interface connectors. The difference is not trivial as there is ample opportunity for polarity inversions within the boundaries of any given multi-track or mono tape machine. The bottom line is: What is the polarity of a recording of a positive-going transition applied to the input connectors as seen by the tape oxide? What is the machine response to a given polarity of oxide flux change as seen at the output connectors. What happens to the polarity within the skin of the machine is of parochial interest only, in my estimation.

Experience has indicated that Ampex machines, all models, AG-440A/B/C, ATR-100, MM-1100, MM-1200 show a positive-going transition at their output ports in response to my adopted conventional loop drive. Mincom M-79, M-56, M-64, M-23 machines show a negative polarity in response to the same loop stimulus. MCI JH-110 and JH-116 machines agree with Mincom as far as polarity is concerned. Scully 280A/Bs are the same stock. The 280As show a polarity inversion in 'line input' mode, and the 280Bs correct this deficiency. For all of these cases, XL pin 3 is taken as high as they are American machines. The Lyrec TR532 polarity is positive-going, taking XL pin 2 as high as it is a European machine.

All of the machines will preserve polarity against themselves as delivered from the factory. In other words, a positive pulse at the input is preserved as a positive pulse at the output upon playback. If the original heads have been replaced there is opportunity for either polarity reversal of the entire system or inversion between record and play functions. I must admit that I have not been in the habit of checking polarity of machines undergoing head replacement except for past months. How many others have been flipping coins on the polarity response as I have? How many machines have had their polarities flipped many times, making subjective comparison of recording and reproduction performance impossible? How many judgments of mastering quality acceptability are based upon comparisons made under conditions of uncertain polarity consistency? How many dollars, not to mention hard feelings, have been based on the chance polarity flips of who knows what audio chains that may not even be

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SOLUTIONS

Although the description of the problem sounds simple, the cure involves a little savvy on the part of the practitioner. The interface of system components must be examined with attention paid to the results of the two competing conventions for assignment of reference terminals for signal input and output ports. For example, a Neve console is to be interfaced with an MCI tape machine. The result of carrying XL pin 3 to 3 and 2 to 2 would result in a recorded tape that would play back correct on an Ampex or on a Lyrec machine interfaced to a mixing system where XL pin 3 is considered high. The monitoring system of the Neve/MCI system would have to be connected so as to have a positive transition at Neve monitor output pin 2 cause the monitor woofer cone to move toward the listening position, a polarity inversion by most speaker conventions. Any change in the input and/or output transformer provisions of a given tape machine should be empirically investigated to determine if removal or replacement of the transformer(s) will result in a single or double polarity inversion. The change in the recorded signal polarity and polarity response to recorded flux must also be examined, especially in situations where tape machines and consoles of different manufacturers are used and may be interchanged.

The polarity response of each monitor system within a given facility needs to be determined and adjusted for consistency with the polarity of acoustic impulse seen at the microphone diaphragm. The techniques

described by Lubin and Pearson should serve admirably for this task if it is kept in mind that polarity does indeed matter. Heyser suggests that a simple hand clap can serve as a stimulus of compressive nature for determination of microphone pressure response polarity as the hand clap impulse must necessarily be initially compressive in nature in the plane of the hands as they come together.¹⁰ It would appear that in a situation involving equipment of European and American manufacture, the practical possibility of re-wiring the least compatible minority of XL connectors, where used, to simplify polarity compatibility and eliminate the need for polarity reversals within the system cable harness must be considered.

The obstacles to polarity compatibility may well be considerably more involved than it may appear at first glance. The additional effort required to ensure compatibility even within a single system boundary may seem not worth the time and effort required. The proof of this, either way, lies in the doing. I do believe that the marginal improvement in monitoring accuracy will be beneficial at least through the disk mastering and ref audition process. In the event that the recording end of the music distribution business manages to get its polarity act together, the IHF may see fit to specify polarity inversions as part of consumer audio system specification literature so that the concerned hi-fi enthusiast will have the potential of properly connecting his home music system so as to enhance the probability that acoustic transients are reproduced as originally generated.

Of course, nothing in this article should be construed as advocacy that any standard for

anything whatever even be thought of, much less discussed. That would be conspiracy. Already Messrs. Ken, McKnight, several Japanese citizens, myself and possibly Richard Heyser and Frits Nygaard may be at the core of some dark plot to make plusses plus everywhere. Excepting those who are nonplussed, of course.

As I reflect upon my past secret ambitions to be the object of an anti-cartel suit, be rich and obscure, and to succeed in using sex to make a sale, I must elect to abandon the first in preference to the other two. With my vistas thus narrowed, I sit silently, awaiting the heavy knock at my door and the invitation to "come downtown and have a little talk with the Chief." □ □ □

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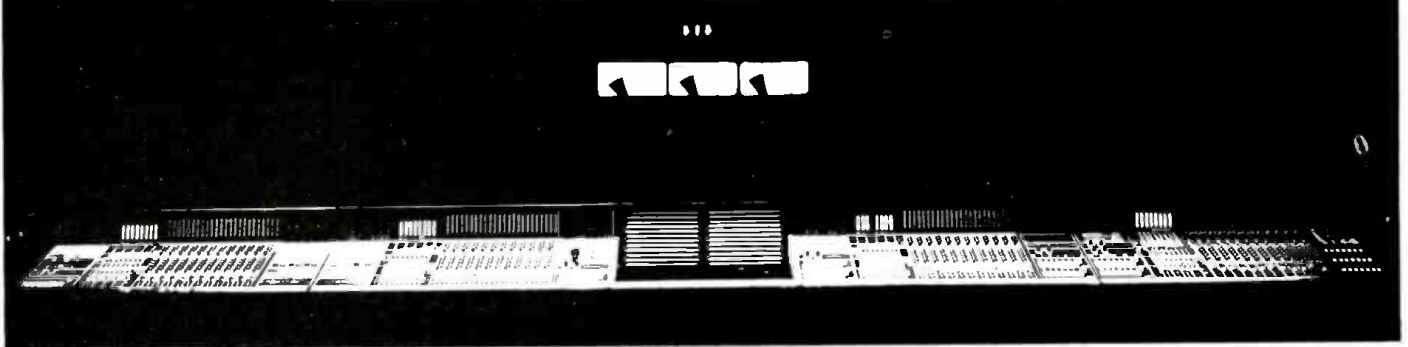
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by Levi Storm



Many record producers and engineers are surprised to learn that much of what has become standard practice in sound recording owes its beginnings to the film industry and the money it could afford for research during its boom period. Such breakthroughs as multitrack recording, playback, and overdub techniques were a part of films before they became standards of the music industry. It has only been in recent years that the music business has paved the way in sound technology, though film sound continues to advance. The most recent major development is automated mixing for film sound. To understand the impact of this on the movie industry it is necessary to understand the difference between film sound boards and music sound boards. Herb Taylor, head of the sound department at Disney Studios, comments on this difference.

"The standard recording board for a music studio is quite different from a film console in that we have to combine many more tracks of a different nature. On a music board you're mostly combining music and vocals. On this board we're combining dialogue, music, vocals, and sound effects. We use four mixers on our board. One man handling dialogue, one handling music, and the other two men handling sound effects. Another difference is that music boards are semi-standard. The same board might be installed in a number of studios. In the motion picture industry each studio does things just a little different, and we all have different requirements for our jobs. So there are quite a few additional units added to give us the control we need for the pictures we do. Of course, we mix entirely different than you would on a music board. When we record for a theatrical release we don't record the sound for sound alone. We record the sound to enhance the picture, so naturally the way we mix it down to get our final tracks is a great deal different than doing a record. We must work within a limited dynamic range and, of course,

with motion pictures we're very careful that the dialogue stands out over everything because if you lose your dialogue you lose the sense of your story."

Stan Polinsky, of Universal, also comments on this difference.

"It is our feeling that post production film mixing is vastly different from record mixing, and therefore has a whole different set of rules and requirements. The record will have a foundation, texture, and pulse that, once found, is usually maintained from start to finish. Of course, the mix is very complicated because of the moves, EQ changes, echo send changes, and on-off passages of the multitrack tape, etc. Automation has certainly helped the record mixer by giving him more hands and an infallible memory once he has set up his mix."

"On the other hand, the film mix is always changing," added Bob Hoyt, also of Universal. "Balance is always the final goal the dubbing crew tries to achieve. The number one rule is: can you understand every word spoken on screen. By weaving the music and sound effects around the dialogue, proper balance is obtained (balance is dealer's choice, of course, depending upon the taste of the producers or whomever is guiding the mix). What keep the mix alive and dynamic is the spontaneous interaction between the various elements of the dialogue, music, and effects at all times. When one element changes the overall balance is usually changed. When a dubbing crew has been together for a while, and is used to the console, room sound, and staff, the spontaneous changes take place without guidance from the backfield."

The film industry is particularly concerned about reliability since their down time costs are higher than in the music industry as Skip Pierce, of Quad-Eight Electronics, relates.

"Say you're doing a scoring session and you've got a hundred musicians making \$115.51 each for a minimum three hour session. What's going to happen if that console

goes down? The guy who's producing that score is going to be out maybe 13 or 14 grand, and he'll be looking to the studio for compensation. At one session at Burbank we figured out they would lose 30 thousand dollars if the console had broken down. And that sort of size and dependability is expensive. Such rooms are going for four or five hundred dollars an hour. Of course, nobody wants any down time, but the film people go out of their way. They will make sure that, every hour that room is open, there will be one — sometimes two, sometimes three — union maintenance men standing by just in case something happens."

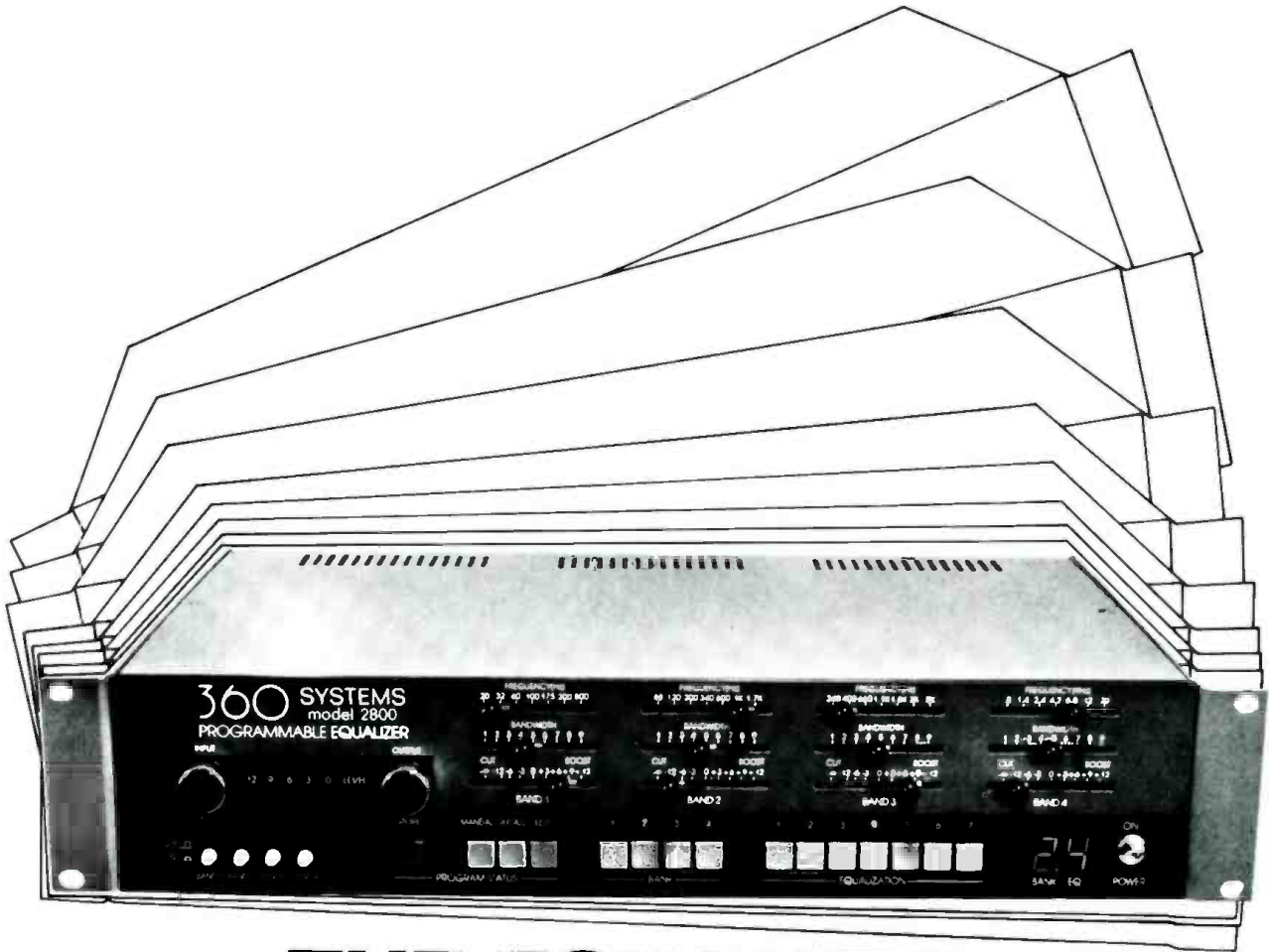
Automation

The advantages of automated mixing for film sound are tremendous. Disney's Herb Taylor describes some of them.

"The automation will save us a lot of time. We will be able to lay down many of the tracks directly to a final transfer whereas now, due to the number of tracks we have, we must do a lot of pre-dubbing. This will be particularly true with sound effects, where we have to do quite a bit of combining before we can make the final take. With automation we are able to pre-mix the effects, add whatever we want to the music and dialogue, and then just make one pass for the whole thing and have the job done. Also, regardless of how many times you go through manually there's always something that you do a little different than you did on the one before. With the automation, once we have it set the way we want, it will stay there. And, of course, you can update the automation if you so desire."

John Van Frey, head mixer at Disney, also feels the automation will prove a great aid to his work.

"I think maybe we're a little fussier than most film studios, as far as the degree of perfection that's requested by the producer. We're getting into projects that require the mixer to

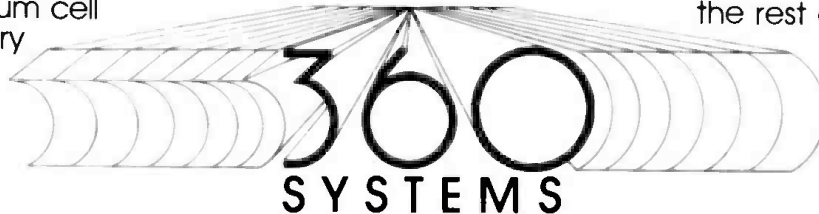


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do more and more. Previously the biggest reel might have eight effects tracks, these days the smallest reel might have twelve to fifteen. It's getting to the point where you can do only so much manually."

Stan Polinsky discusses automation: "As long as automation works for us and we don't work for the automation, it certainly has its place in Hollywood. It will give us the best of both worlds (able to record a playable pre-dub and being able to change any element within the pre-dub), manual and automatic. Automation will give us more flexibility and will allow us to change any track without having to re-do the overall recording. This will be possible at Universal Pictures' Dubbing 4 Theater because we will have 39 film transports with 75 audio channels, and 2 24-track tape machines on our electronic interlock system (with more if we need them) feeding the new 76 input, multi-bus (18 intra-mix busses), 6 track output Quad-Eight console. The console will have many output busses which offer various combinations of the mix. It has been designed for maximum flexibility in film formats . . . both now and in the

future. Some of the modes include mono 3-track, mono 4-track, stereo 3, 4, 3 into 5, and 6-track with and/or without noise reduction, Sensurround™, and some new surprises in film formats in the near future."

Richard Portman, last year's Oscar winning sound mixer for "The Deerhunter," talked about how automated mixing has effected his craft.

"With the automated board, instead of having to go through all the intermixes, I can start on line one and make a master as I go. It is just like a music mixdown. If I don't hear enough strings or fiddles, or, in my case, a car crash or a door opening, I can go directly to that particular line and update only that. All the other elements of that segment would stay the same and follow the automation. Or, you might have a group of sound effects that were just right within themselves, but against the music or dialogue they played too low. You don't have to go back and do the intermix over again. You can save it because you can re-program the overall mix at a higher level. Without having to pre-dub you can go directly to the final film process without any generation loss if you so desire. You can do your domestic tracks and then do one minus dialogue for your foreign track. You can come out of the mix sessions with every piece of soundfilm that is required by legal contracts without having to go back and re-do them. You can set up things automatically on a number of output busses,

you can run four recorders and have one of them receive nothing but the sound effects mix.

It can also be used to get special mute sequencing. For instance, a location sound effect on the dialogue track. In order to treat those two elements separately it's now necessary to make individual transfers. But by using two faders on the one track the automation can turn on one of them during the "door closing," and the other would be on only for the dialogue. It can save a great deal of time since it becomes no longer necessary to physically cut out the effect and move it to another unit."

One aspect that mixers really stress is the importance of keeping the board as simple as possible. Bob Budd, of Kagel Sound, and consultant to Quad-Eight, discusses this area.

"A custom film console looks simpler in some ways than your stock recording board. There appear to be fewer knobs, although there may be as many as they're spread out over a much greater area. A few years back there began a general trend to make boards complex with all sorts of extra controls. But we found that there was only so much that a person could do while watching a film in a dark room. If you took a typical stock recording board into a dark room with a picture and asked someone to make a great number of instantaneous changes to match cuts in the picture, they're not going to be able to do it.

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When you're designing a film console you lay it out in such a manner that a person can reach for a knob. And the size of the knobs are according to how often they are used. Universal Pictures requested that we custom mill the knobs for their new board in order to get the operation that they want. That's how important it is."

Portman describes the equalizers on the film sound board in agreement with Bud's comments.

"For motion picture work the equalizers are simple by necessity. Because, even with the computer assistance, you are not working within a time schedule that allows you to be fiddling around with them. You've got to get something that sometimes is a little rough but that the customers will accept in a hell of a

hurry. Sometimes you have enough time, but more often every fifteen days you have another film coming in. You're re-mixing about two hours worth of film theater sound every 15 days. So you have to get at it quickly."

John Stephens, of Universal, agrees. "Any dubbing console (be it automated or manual) should be designed as simple as possible . . . but with every device needed available at the push of a button. This way, not only track on and off's, level and EQ in/out's (and graphic EQ amounts) but device in and out's can be programed in or out to the frame as the film calls for it. Also, it would be desirable for multitrack tape address offsets or cart starts and stops to also be controlled by one central station or system. Automation gives us tools with which we can polish our projects with far

more detail and greater texture than ever before."

The Board Builders

There are two major firms developing and designing new film boards. Harrison Systems, of Nashville, Tennessee, and Quad-Eight Electronics, of Los Angeles, California. There are a few other boards available, but these two are the most prominent. John Van Frey, of Disney, talks about the Harrison console in use there.

"The Harrison console has a complete automation control for graphic equalization. Each slider on the graphic is treated as a fader would be, so any quick move is stored in the computer memory and then reproduced. Like all other automated consoles, the EQ on-off



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*See Modern Recording "Hands On Report," Sept. 1978.



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switches on the parametric units, are also automated but the equalizer settings or changes are not remembered."

Frey continued to talk about the Harrison: "You can get ahead of or behind the faders, you can gang them, you can make different faders sub-masters for other faders. There are four positions of twelve faders each, and eight sub-groups, and you can patch any fader into any sub. You can punch up into a numbered sub-group and send a control voltage to master a sub at the other end of the board. So I can control another man's level which is half the battle."

Richard Portman discusses the Lion's Gate Sound Quad-Eight board which he uses and which was built to his specifications.

"It allows me to edit my mix. The people who do motion pictures — the producers — change their minds constantly. This board allows me to really edit data since I'm able to move things around quickly. The reason why I picked Quad-Eight is that they designed the program specifically for me. It's a custom board and there may be features in there that I've requested that I wouldn't find in anyone else's board."

Skip Pierce explained, however, that if you did a mix at, say, Goldwyn and decided after the screening that it needed some changes, you probably wouldn't be able to go back to Goldwyn, they would be booked. But you

could take your film units and floppy disk of the mix to say MGM or Universal and make the corrections there. The mix is interchangeable on any Quad-Eight console.

Van Frey tells why Disney chose the Harrison model.

"One reason was that Harrison could deliver the board in the time that we needed. They came around when they decided they were going into the film console business and wanted to know what we wanted. We told them what we wanted and we said we've got to have it by the first of June, 1979. Quad-Eight couldn't guarantee us delivery by that time. Harrison is serviced by Metromedia Systems, which is an installation, sales, and service company, and they've been in here in an instant anytime we've had any problems. They were here the better part of eight weeks installing it. They answer any questions we have, and they give us good service."

Interestingly, Portman chose Quad-Eight for similar reasons to Disney's choice of Harrison.

"I've been on the receiving end of three Quad-Eight boards and I know the people. They also handle Magna Tech and the equipment is designed to work into the Magna Tech reproducing system. I felt it would be a lot easier, and smarter in the long run, to have one person put in the entire installation. Harrison doesn't put in the film chain themselves, and I want one person responsible for a sophisticated piece of equipment. I know Quad-Eight makes a professional piece of equipment that turns out work that has a distortion figure, and a quality, that is acceptable over a wide range and at the state-of-the-art within the motion picture community. Also, Quad-Eight is right

here. It's like Ampex. I can lay my hands on these people. My experience with the operation of the boards is a factor, too. I know the feel of them. It's like why do some people buy Fords and others buy Chevys?"

Gregg Davis, of Harrison Systems, talks about the features of his company's automated board.

"The strongest feature of the post production console is the incorporation of microprocessor technology in automating many of the controls on the console. All of the top panel switches, that are under microprocessor control, can change their function by simply re-writing the program stored in the microprocessor memory. No longer are you locked down to the hardware design of the system because most of the top panel switches are inputs to the microprocessor. By re-writing the program, you can incorporate new features into the console with minimal expense with just a plug-in memory change. The Disney console contains 77 microprocessors. Each microprocessor is a totally self-contained microcomputer. All of these microprocessors are able to operate together, and this is a feat that no other company we know of has been able to accomplish. By utilizing the microprocessor approach to system design, we are able to condense the hardware package and therefore incorporate many more features than were ever before possible."

Skip Pierce, Systems Engineering Manager at Quad-Eight, describes the Quad-Eight approach.

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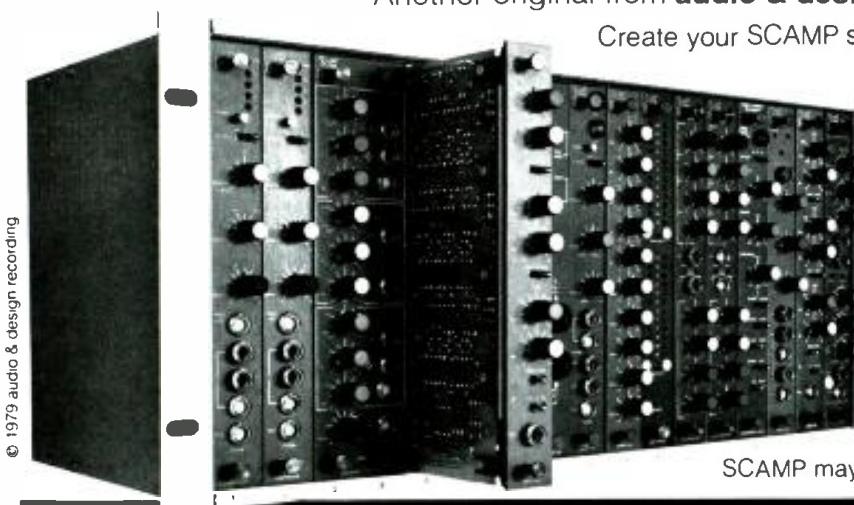
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without changing the hardware. Our fade module can be tailored for anything we want. We took a simple approach and looked at what we wanted to control and what the most reliable method of controlling it would be and we went that way. We thought about putting a microprocessor in each module, but we really deemed it unnecessary. There's not that many functions inside the module to be automated. We do provide a totally automated equalizer if you want, but that still doesn't require us to have a microprocessor in each module. Although microprocessors are reliable, we're dealing with people, the technicians and engineers, who feel much safer with some of their proven hardware. It has been Harrison's decision, obviously, to go with 77 microprocessors, and it was our decision not to. In each module they use an 8086 microprocessor chip which is a very powerful processor. I would imagine the processor in each of their modules is sitting there, idle, 99 per cent of the time. In my opinion that's hardware intensive. We would rather have the client spend his money in other places."

In a nutshell the Harrison console is an attempt at the ultimate film module with every possible automated function built into the board. The Quad-Eight model on the other hand is totally customized from beginning to end, thereby supplying all the functions that a specific customer would need. Bob Budd discusses other advantages of a custom board.

"One of the distinct advantages of having a custom recording console is that you can place things on the console wherever you want. You're starting from ground zero. Also, the nomenclature can be customized. There's a lot of different nomenclature that people have gotten accustomed to in different film studios. When you buy a custom board you dictate the nomenclature on the panels, the colors of the knobs, everything. A lot of that has to do with how the studio is layed out and the equipment that is already there. Often a board will be replaced and the good ideas of the old board will be duplicated in the new board, while other things will be designed. The flexibility of a particular in-line module type is limited. You might be able to eliminate a function by just leaving it off, but to move it to a different place on the module, or to swap things around entirely, requires a redesigned module."

Herb Taylor commented that their Harrison console had many features that they had not thought of. However, certain features were added to the Harrison console to suit the needs at Disney. "We had multiple outputs put on this board so that we don't have to mix a picture again for the foreign soundtrack. We also had it set up so that throughout the board we can insert any piece of equipment that we want."

"And it has a cue function built in," added Van Frey. "For our operation we need it because we edit a lot of narration and all the pauses are artificial. You don't really know when the narrator is going to come in, and it's impractical to use the footage counter. Also, since the sound editors compile everything before mixing begins — all the effects, dialogue, and music — they sometimes overbuild and you don't want to use all of the elements they've selected. With the cue function we can essentially delete whatever we want by hearing it before it comes in."

There is no doubt that the film industry is updating their consoles and automation figures heavily in their plans. Skip Pierce

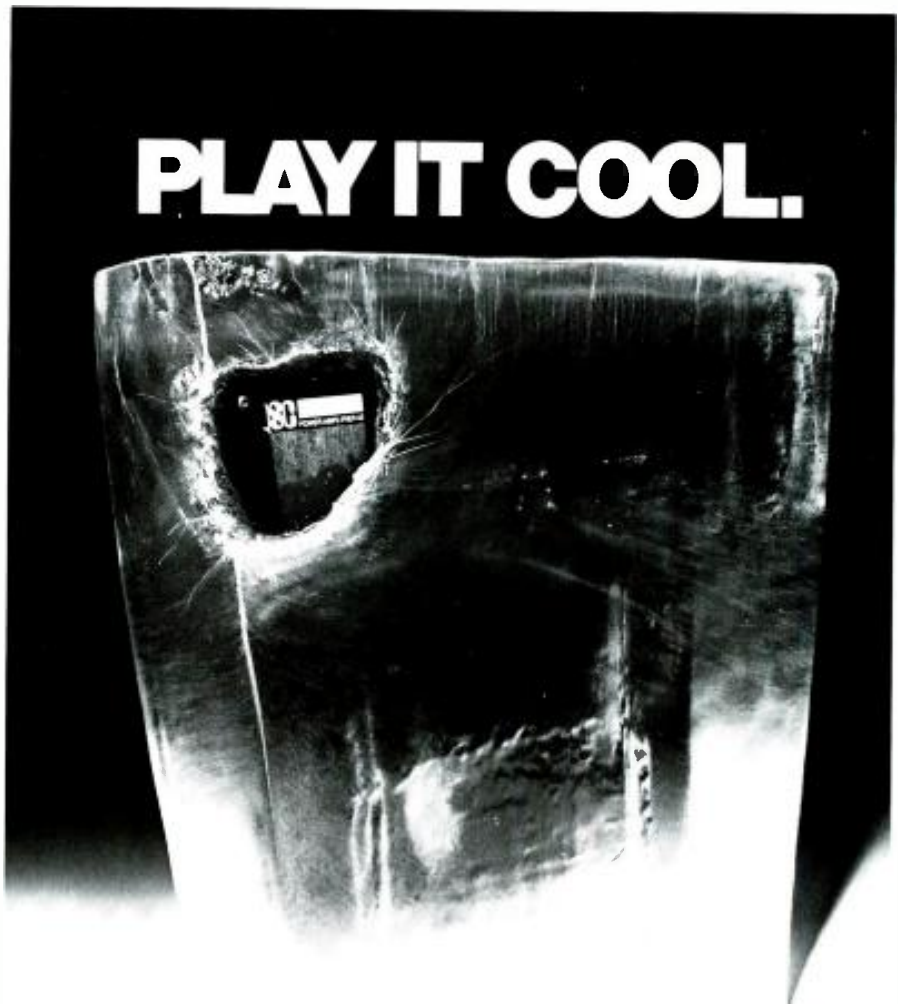
comments.

"We've done consoles for MGM, Goldwyn, Rider, Lion's Gate, and we're building two for Universal right now. It's interesting to know that the last time Hollywood updated was in the mid-fifties, and none of the companies that were building film consoles then have survived so there is a lot of new thinking in this area. Most of the studios are at least getting their boards automation-ready if they don't go with automation at this time. We've actually been into the computer controlled console since the beginning of 1972. Even before that we were building automated consoles for the film industry using discrete logic, and it's taught us a tremendous amount. Our system operates on four microprocessors as opposed to Harrison's seventy-seven. And we build

custom pieces of equipment that are tailored to people's specific needs."

Besides Disney, Harrison boards are being installed at Fantasy's new film re-mix studio in Berkeley, California.

Automation in film sound mixing is no longer the wave of the future. It has very much arrived, and it is possible in the next three or four years that pre-dubbing may no longer be needed in film sound. In that event the amount of time required to dub a film will be cut considerably. Savings will also occur since so much time will be saved in making revisions and foreign versions. And, lastly, the sonic quality, both technically and artistically, will be improved as finer detailing will be possible as the automation will remember previous manipulations. □ □ □



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Sound POWER vs. Sound PRESSURE

by MICHAEL RETTINGER
Consultant on Acoustics
Encino, California

Occasionally the terms sound power level and sound pressure level are not clearly understood or sharply differentiated in conversation. In noise control work and the acoustic design of rooms it is necessary, however, to make a definite distinction between the two quantities, particularly since they complement each other and together provide vital information about an enclosure as well as about a specific source of sound.

Sound power is, simply, the total sound energy radiated per second by a source. The unit is the watt, equivalent to 10^7 ergs/second. The direct measurement of sound power is complicated because it involves the assessment of the time integral of the product of the sound pressure, a scalar, and particle velocity, a vector. In the laboratory this is usually accomplished by a small pressure microphone next to a velocity microphone, each with its own amplifier, a phase correcting network to compensate for the phase relationships in the microphones and the amplifiers, and an electric power indicator (often a thermocouple).

Since the sound intensity is proportional to the mean-square sound pressure, it is more convenient to measure this quantity in the open about a hemisphere. As an example, assume one has an outdoor hemisphere S of 100 square meters (4m radius), which is to be referred to a reference surface of 1 square meter, and that the sound source whose power level is to be determined radiates energy more or less uniformly about this hemisphere and is located on the ground. One measures the sound pressure level SPL in the center of four equal areas of 25 square meters. The SPL of each area is then added to $10 \log 25 = 14$ dB. Thus, if $SPL_1 = 100$ dB, the sum comes to 114 dBp (where p refers to one picowatt, or 10^{-12} watts). The 4 power levels WL are then added logarithmically to obtain the total power level of the source. This measurement

procedure may be carried out at different octave or one-third octave levels to secure the sound power characteristic of the source, or one may measure the A-weighted SPL 's at the four different microphone positions and thus achieve the A-weighted power level of the source.

Reverberant Fields

One may also assess the power level of a source in the reverberant field of a room, but such measurements are often more complicated because of the spatial variation of the sound pressure level in an enclosure. Such tests require also the evaluation of either the reverberation time of the enclosed space or its total absorption, preferably at different frequencies when the sound power level characteristic is to be established. Some laboratories also employ rotating vanes or paddles in the room to "stir" up the sound for the purpose of reducing the interference effects in the reverberant field.

What are the uses of the sound power level of a source? Two examples will be given below.

1. Assume a pistol shot in the open produces a sound pressure level of 120 dB-A at 10 feet from the gun. If the same gun is shot off in a room of 5,000 cubic feet volume, with a reverberation time of 1 second in the mid-range of the audio spectrum, what will be the SPL in the reverberant field of the enclosure?

The pertinent equations for the purpose are:

$$WL = SPL + 20 \log R - 10 \log Q + .7 \quad (1)$$

$$WL = SPL + 10 \log V - 10 \log T - 29.3 \quad (2)$$

where

WL = sound power level referred to 10^{-12} watts

SPL = sound pressure level

Q = directivity factor of source. It is: 1

for a non-directional source; 2 for

a source radiating into a hemi-

sphere; 4 for a source radiating

into a quarter sphere, etc.

T = reverberation time

R = distance from source, feet

V = volume of room in cubic feet.

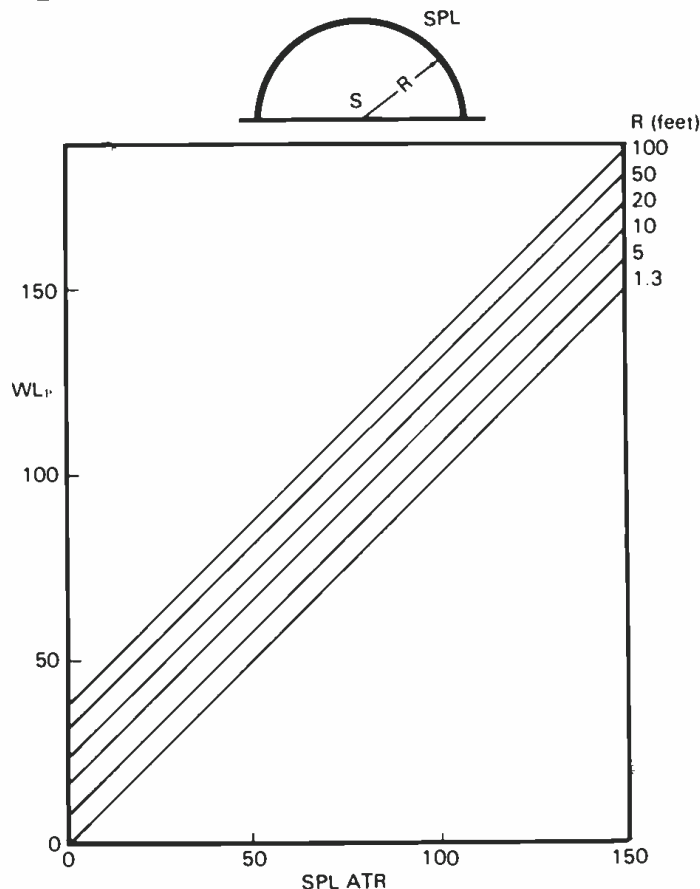
From equation (1) we learn that WL is 140.7 dBp. When this value is introduced in equation (2), the SPL of the gun shot in the reverberant field becomes 132 dB. This indicates that a much smaller charge should be exploded in the room to prevent possible damage to the microphone.

2. Assume an air conditioning system distribution fan was measured by its manufacturer to have a noise emission level of 8.5 bels, as measured with the A scale of the common sound level meter. The ISO Technical Committee 43 adopted this designation to prevent confusion between the similarity between sound power levels and sound pressure levels. Since 1 bel equals 10 decibels, we may write for the A-weighted sound power level of the fan under consideration $WL = 85$ dBp. This is the total acoustic power, so that at both the intake and the exhaust of the fan the sound power level is 3 dB lower, or 82 dB-A.

When the area of the duct which is to be connected to the fan is 10 square feet, the SPL at the duct opening is given by

$$\begin{aligned} SPL &= WL - 10 \log S + 10.6 \\ &= 82 - 10 \log 10 + 10.6 \\ &= 82.6 \text{ dB-A} \end{aligned}$$

It is seen that one of the advantages of expressing the noise level of a source in terms of its power level is that one does not have to note any distance from the source. A noise sound pressure level of, say, 85 dB-A is meaningless unless one also notes the distance from the source where the measurement was made.



The sound power level, WL , referred to 1 picowatt of a uniformly radiating source. S , located on the ground so that its directivity factor, Q , is 2 as a function of the sound pressure level, SPL , at a distance, R feet, from the source for various radii.

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**The Use Of
FERROFLUID
as a
Loudspeaker Component**

by Louis Melillo

Ferrofluids are rapidly becoming an integral component in the manufacturing of loudspeakers, and have been in production use since 1974. The benefits of using ferrofluids include; increased power handling, damping, voice coil centering, lower manufacturing costs, the reduction of magnet size, and the improvement of loudspeaker performance.

Development Of Ferrofluids

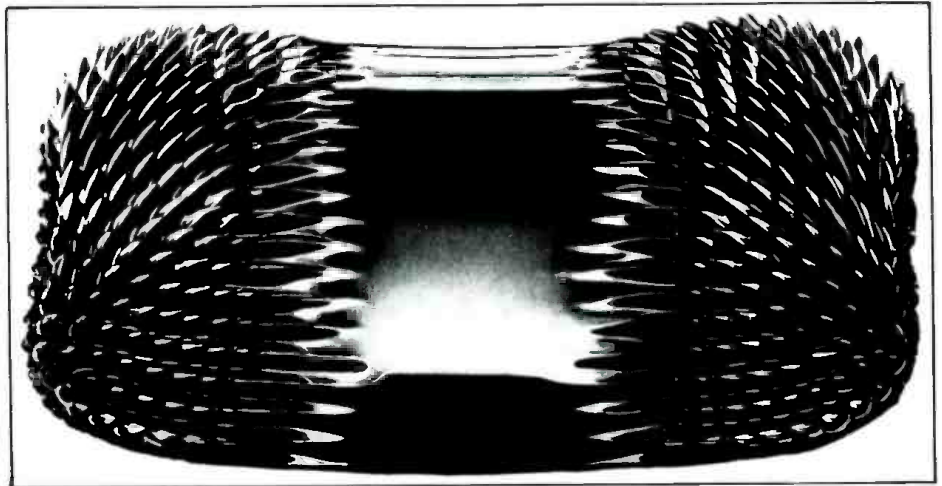
Ferrofluids (magnetic fluids) were developed during the pioneering days of the space program as scientists attempted to develop a system by which a rocket engine could be fed fuel in an environment of zero gravity. Magnetic fluids were considered to be a solution to the problem. This concept was abandoned with the introduction of

solid fuel propellants; however the knowledge obtained during those pioneering days was not lost.

Ferrofluidics Corporation, founded in January of 1969 by two of the scientists who were active in the early development of ferrofluids, began to apply this technology to solving difficult sealing problems in the vacuum process industry. Since the development of the Ferrofluidic™ rotary seal, uses for ferrofluids in a variety of applications have proven to be effective, including their use in loudspeakers.

Ferrofluid Properties

Simply stated, a ferrofluid is a colloidal suspension of ultrafine magnetic particles coated with a dispersing agent and suspended in a liquid carrier.



The fascinating, spike-like appearance of the surface of Ferrofluids under the influence of a magnetic field. Despite its rigid appearance, the material is completely fluid.

— the author —

Louis Melillo is Audio Products Manager for Ferrofluidics Corporation, responsible for applications engineering of ferrofluids in loudspeakers.

Prior to joining Ferrofluidics, Melillo spent four years at Becker Electronics, in New York, where he designed loudspeaker systems and transducers. He began working with ferrofluids as a speaker design component in 1976. In 1978, he became chief engineer of audio systems with responsibility for speaker design, production engineering and sales and marketing efforts.

He received his B.S. from Rensselaer Polytechnic Institute in 1967. While a graduate student, Lou received a research

fellowship and became active in thermodynamic studies of polyethylene, polytetrafluoroethylene and selenium crystal structures. He published several papers while continuing polymer research as a doctoral candidate at Rensselaer.

Since joining Ferrofluidics Corporation, Lou has established a sophisticated audio testing laboratory to assist in providing meaningful technical data to the audio industry. This facility is a tool in providing an experimental base of data to quantify the improvements in loudspeaker design and manufacturing using ferrofluids.

Lou has published several major articles based on his ongoing research into the behavior of ferrofluids in loudspeakers.

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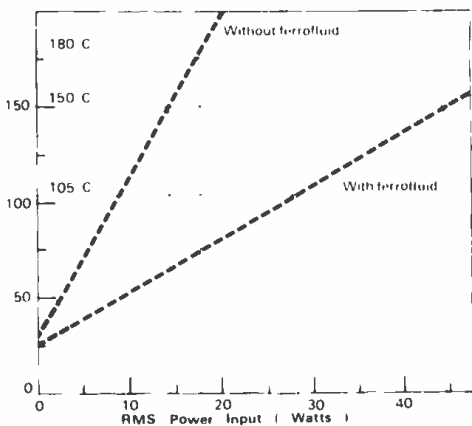


FERROFLUIDS as Loudspeaker Components

Figure 1 shows a plot of voice coil temperature versus power input for a woofer with and without ferrofluid. Examining the plot without ferrofluid and assuming a 150°C voice coil temperature, power input is then about 14 watts RMS. Assume an adhesive with a failure temperature of 180°C is used. Checking again with Figure 1, the power handling has been increased to 17.5 watts RMS, an increase of about 25% or 1.5 dB.

The last option remaining to increase

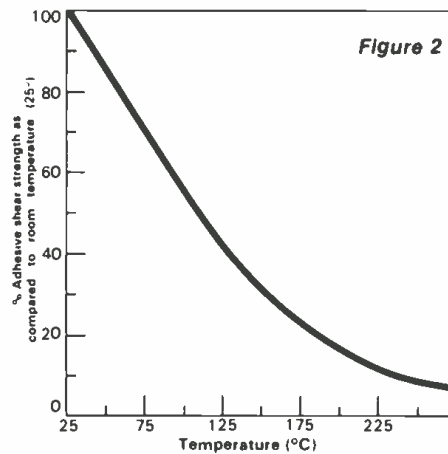
Figure 1



power handling is to somehow increase the thermal conductivity in the gap region. This can be achieved by replacing air in the gap region with a material of higher thermal conductivity. Obviously, this material can only be effective if it remains in the gap. Diester ferrofluid has about six times the thermal conductivity of air and its magnetic properties prevent migration. Referring again to Figure 1, the plot of voice coil temperature versus power with ferrofluid shows a much more gradual slope reflecting the increased thermal conductivity. Assuming a 150°C thermal failure temperature for the voice coil adhesive, the power handling capacity is now 45 watts RMS. This is a power handling increase of 320% over the identical driver without ferrofluid and a 250% increase over the driver with the high temperature voice coil. It should be pointed out again that this discussion centers on short-term powerhandling.

While ferrofluid will effectively handle short-term excursions to 150°C or higher it is not recommended for continuous use at these temperatures. However, even if the voice coil temperature in the test woofer was limited to 105°C, the powerhandling would still be increased by 200%.

It should also be pointed out here that adhesive shear strength is a function of temperature. Figure 2 shows the type of behavior of typical adhesives used to bond voice coil wire to bobbin. Adhesive strength drops rapidly with temperature and failures can occur at relatively low voice coil temperatures if acceleration is high. Figure 2 is not meant to represent the behavior of a



specific adhesive. Its purpose is to point out typical behavior.

A second important benefit occurs when thermal conductivity in the gap is improved. That improvement is the substantial decrease in voice coil resistance at a given power input. Referring again to Figure 1, and using Equation 1, the voice coil resistances at 20 watts RMS with and without ferrofluid are calculated to be 9.7 and 13.4 ohms respectively (assuming 8 ohms DC resistance at 25°C).

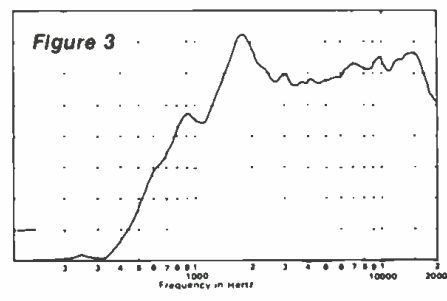
This means the excessive thermal compression of the music signal that normally occurs with power transients is greatly reduced. In this case an efficiency increase of nearly 2 dB is gained due to voice coil temperature lowering alone. This is a very important consideration when one is trying to design a system with optimum efficiency in an actual use situation.

Damping

The use of ferrofluid allows the designer to take advantage of a second property of the material, its viscosity. Since ferrofluid is available in a wide range of viscosities, viscous damping can be introduced when desired. Figure 3 shows the frequency response of an underdamped tweeter. In this case, the total Q is more than 2. The designer is left with only two options if a flat frequency response is to be achieved. Either reduce the electrical Q, (Q_e), or add mechanical damping to the system and reduce the mechanical Q, (Q_m). The following equation gives the relationship between the total driver Q, Q_t , and the mechanical and electrical terms.

$$Q_t = Q_e Q_m / (Q_e + Q_m) \quad (2)$$

When $Q_m \gg Q_e$, the total Q approaches Q_e . This is the case in many actual situations. Thus a simple way to reduce Q_t would be a motor redesign which would decrease Q_e .



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FERROFLUIDS
as
Loudspeaker Components

- It is important that the magnetic particles, such as magnetite, be very small, approximately 100 Angstroms, so that thermal agitation, Brownian motion, can act to keep the particles in suspension.

- The dispersing agent, also called surfactant, forms a coating around each magnetic particle. The coating keeps the particles from sticking to each other by forming elastic sheaths that keep the particles apart.

- The coating also serves to couple the magnetic particle to a substantial volume of liquid carrier, so that the entire liquid can react to an applied magnetic force.

The result is a permanent, ultrastable colloidal suspension of coated magnetic particles in a liquid carrier, so there is no settling due to magnetic, gravitational or acceleration fields. The magnetic particles immediately respond to a magnetic field with the force the magnetic particles experience being coupled to the liquid carrier. The liquid then acts as a homogeneous magnetic material that can be positioned, directed and controlled by magnetic forces.

A ferrofluid generally is characterized by viscosity and saturation magnetization value, and can be synthesized to design specifications within a range of viscosity and magnetization value. Typically, a low vapor pressure ferrofluid with a magnetic

saturation of 100 - 200 gauss and viscosities up to 10,000 centipoise are being used in loudspeaker applications. This wide range of available viscosities allows for the selection of ferrofluids to suit different speakers and meet specific design criteria.

Although there are many different types of ferrofluids, the type most commonly used in loudspeakers is a colloidal suspension of 100 Angstrom diameter magnetite in a synthetic chemical known as diester. This particular diester has a boiling point of nearly 237°C (460°F) and at room temperature its vapor pressure is a very low 10⁻⁶ mm of mercury. This material also has excellent thermal stability with respect to oxidation and chemical degradation, and is compatible with most industrial adhesives. Since the ferrofluid is a permanent colloidal suspension the magnetite particles will not "settle out" or separate under the influence of magnetic fields.

Initially, ferrofluids were used as a component in the manufacturing of high fidelity loudspeakers. In excess of 50 manufacturers of high fidelity loudspeakers, worldwide, now use ferrofluids. More recently, however, ferrofluids have become an integral component in professional sound products providing more efficient heat sinking and eliminating costly and unexpected voice coil burnouts.

Some of the users of ferrofluid in audio systems in professional systems are Electro-Voice (MI), Audio by Zimet (NY), Northwest Sound (OR), Showco (TX), and McCune Sound Service (CA). There are also

numerous manufacturers of high fidelity systems for home use who use ferrofluid as a speaker component in the U.S. and abroad.

Power Handling and Ferrofluid

In order to approach the subject of power handling it is important to know what occurs in the voice coil when audio signals are passed through it. For the sake of discussion it is assumed that thermal failure (not mechanical failure) is the mode of breakdown. As is well known, loudspeakers are inefficient devices converting only a small percentage of electrical signal to sound energy. This may vary from a fraction of a percent for low efficiency bookshelf systems to 25% for high performance professional horn transducers. The remainder of the signal is converted into heat in the voice coil (there are some losses in other parts of the loudspeaker but these are for the most part negligible). The heat produced in the voice coil will immediately manifest itself as a temperature rise in the coil. This rise will continue while power is applied until the voice coil is transferring energy to the surrounding magnet assembly at the same rate energy is received. In the case of a sinewave signal of given power, voice coil equilibrium temperature is usually reached within one minute from the start of application of power, (assuming a constant magnet assembly temperature). This occurs because the mass of the voice coil is quite small as compared to the magnet assembly and also because the voice coil is well insulated from the magnet assembly by the necessary gap. In most cases the gap is filled with air, a very poor conductor of heat. It has been shown previously^{1, 2} that the method of heat transfer in a typical transducer is almost entirely due to conduction, convection having virtually no contribution and radiation having only a small contribution. Thus the options to increase power handling other than a major redesign are: (a) increase convection or radiation transfer in the gap, (b) convert to adhesives capable of withstanding higher temperatures, (c) use a material other than air in the gap to increase the thermal conductivity. Since there is little that can be done to affect convection in the gap, this is not a viable option. Research on increasing radiation by blackening voice coil and pole blocks have lead to only marginal power increases.

In order to evaluate the effects of using a higher temperature adhesive it is necessary to look at the relationship of voice coil temperature to power input. For the sake of simplicity consider sine wave signals applied for two minutes to a 10" woofer with a one inch voice coil and 10 ounce magnet. Voice coil temperature was determined by monitoring voice coil resistance and using the following equation:

$$T_{vc} = 25 + (\Delta R / .00385 R_{vc}) \quad (1)$$

Where

T_{vc} = voice coil temperature in °C
 ΔR = change in resistance in ohms
 R_{vc} = resistance of voice coil at room temperature (25°C)

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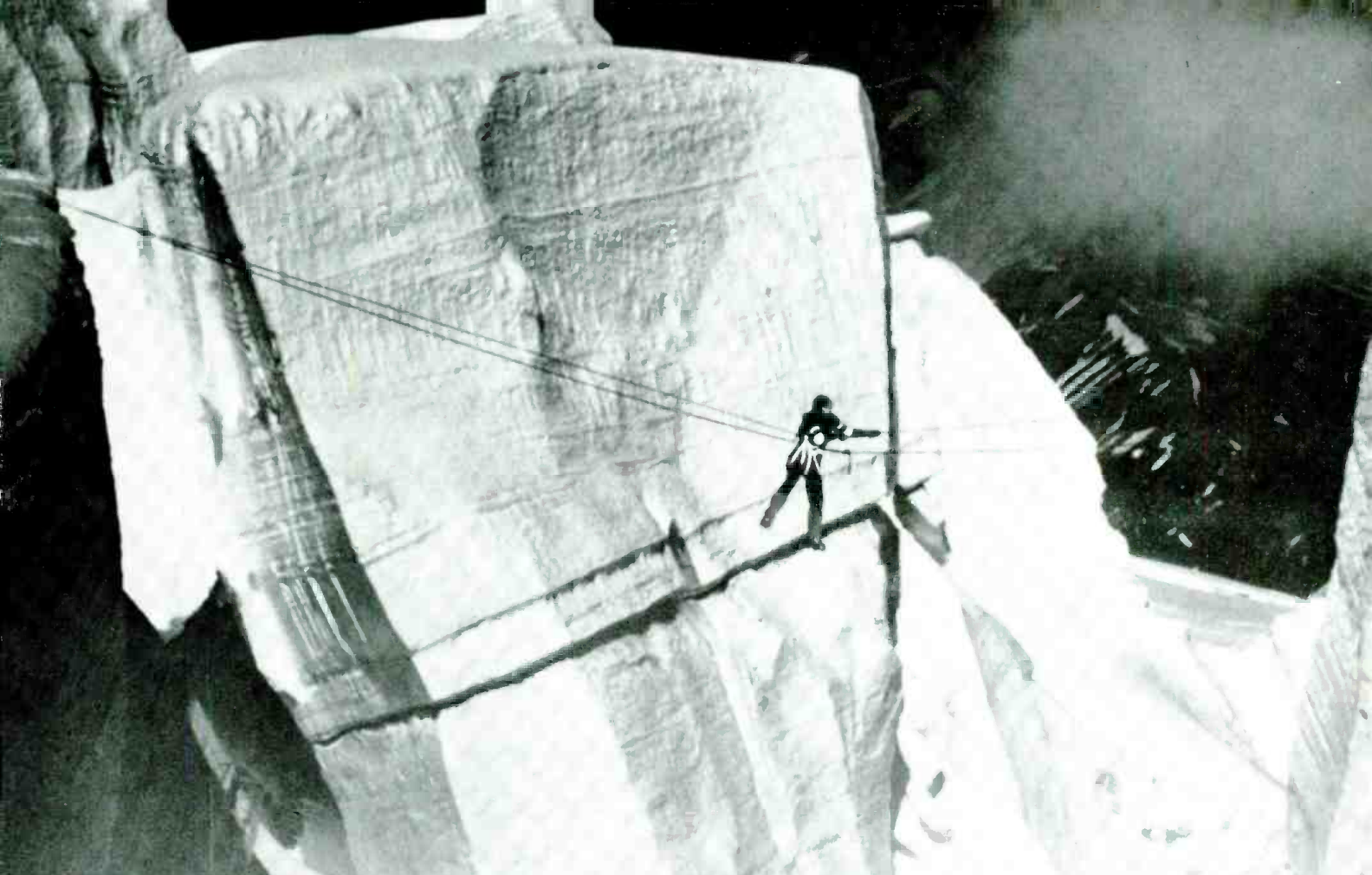
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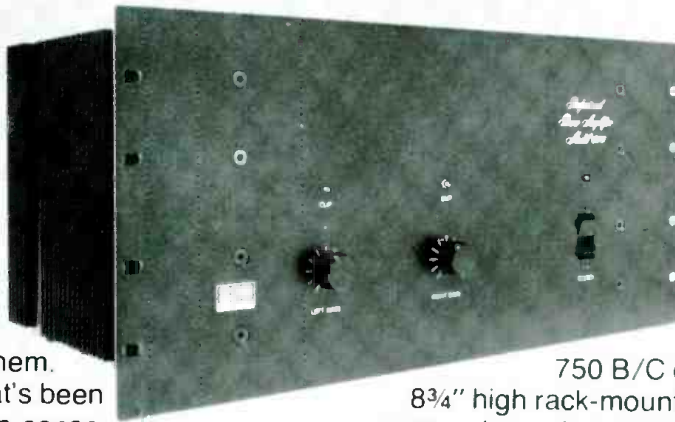
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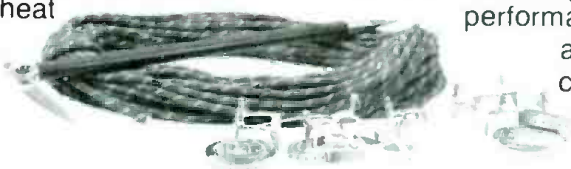


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FERROFLUIDS as Loudspeaker Components

In some cases this can be done by simply redesigning the voice coil usually at the expense of powerhandling. In other cases a larger magnet would be required and a considerable increase in materials cost would be incurred.

If, however, Q_M could be reduced enough, it could become the dominant factor in the

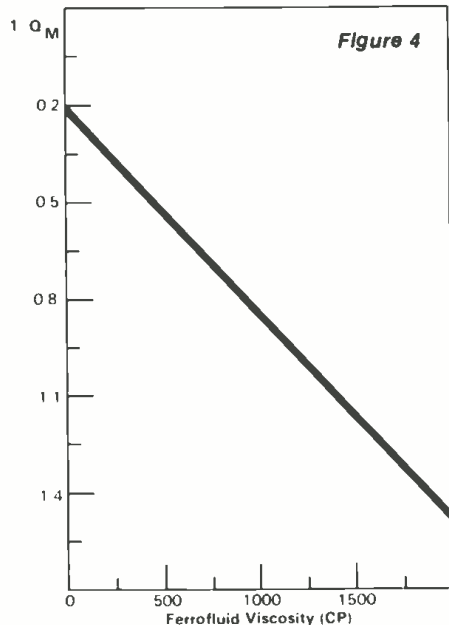


Figure 4

total Q . Figure 4 shows the relationship of $1/Q_M$ versus ferrofluid viscosity for a typical driver. This linear behavior is predicted by theory and has been observed previously.^{1,4} Thus, the proper choice of fluid viscosity can lead to a properly damped driver. Figure 5

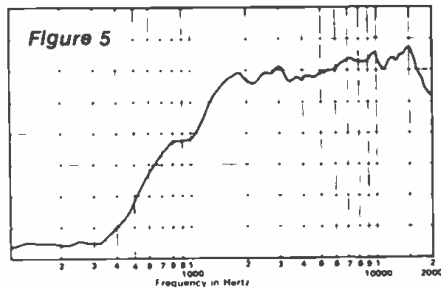


Figure 5

shows the frequency response of the tweeter shown in Figure 3 after the application of 2,000 centipoise ferrofluid. As can be seen from the response curve total Q has been reduced from over 2 to about 0.7 and the driver now has a flat frequency characteristic.

Another benefit realized by the viscous damping is a significant reduction in the magnitude of the impedance peak. Figure 6 shows the impedance trace of the tweeter with 2,000 centipoise ferrofluid. The characteristic impedance peak is virtually eliminated. This results in a driver with impedance characteristics approaching that of a resistive load. Design of the crossover network can in many cases be simplified because of the elimination of the impedance peak at resonance. This can result in both

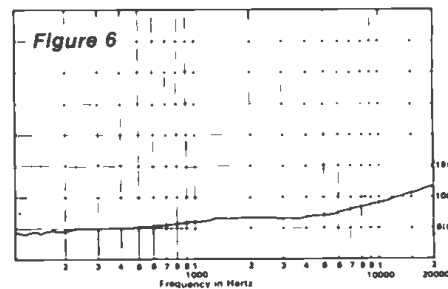


Figure 6

cost savings and improved performance.

Distortion

An additional benefit of improved damping in the resonance region is a reduction in distortion. Such a reduction is nearly universally observed for all types of drivers tested. Reduction in second harmonic distortion of 25 dB has been observed in the resonant region for both high fidelity and professional high frequency drivers. Reduction of higher harmonics is also commonly observed.

An unexpected benefit has been the observation of reduction in harmonic distortion over the rest of the frequency range of these drivers. Such distortion reduction has been observed in a number of professional horn tweeters. In some cases distortion reduction of 30 to 40 dB have been measured after ferrofluid has been applied to the gap region. The reasons for these dramatic decreases in distortion are not known. It is believed, however, that ferrofluid is acting to damp both radial and rocking modes in the voice coil. These modes definitely contribute to distortion at frequencies above resonance and are particularly difficult to control. In the case of rocking mode vibration, ferrofluid acts as a "second suspension" for dome radiators. In order for the moving assembly to rock, fluid would have to be displaced from regions of higher magnetic gradients (i.e.: close to the pole blocks). Due to the nature of ferrofluid, energy is required to displace fluid from regions of high gauss to regions of low gauss. In addition, viscous damping significantly reduces the rocking mode and the radial modes of voice coil vibration. Ferrofluids will reduce distortion when radial modes are coupled with vibrational modes of the diaphragm.

In addition to harmonic distortion effects, recent observations of intermodulation distortion reduction in woofers have been made. Again the mechanisms are not clear, but IM has been reduced 15 to 20 dB in some of the woofers measured. Research work is planned to further investigate these phenomena.

Design Considerations

There are a number of factors to consider when designing drivers with ferrofluid. The first is the compatibility of ferrofluid with the materials and adhesives found in the voice coil region. Diester ferrofluid has been found to be totally compatible with most of the adhesives used commercially in loudspeaker assembly. Exceptions include some rubber base adhesives and uncured resins and activators of a few reactive adhesives. When it is unclear whether compatibility exists, a test can be performed by simply placing the material in question in contact with ferrofluid at elevated tempera-

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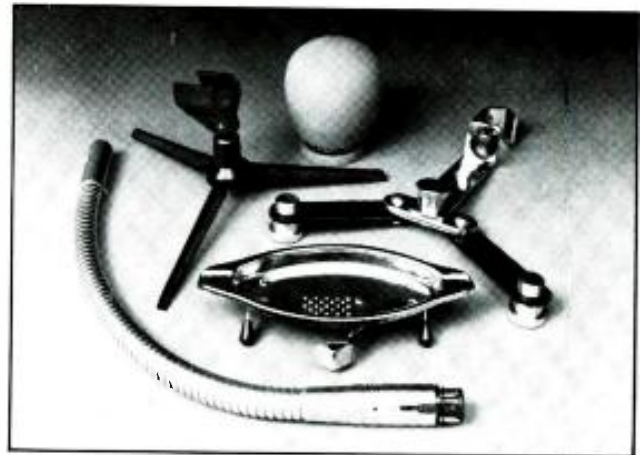
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tures (90°C) for 72 hours.

Ferrofluid magnetization, viscosity, and quantity are chosen from experimental and geometrical consideration. Fluid quantity is determined by calculating the air gap volume less the volume displaced by the voice coil. Optimum fluid quantity is then determined by multiplying the calculated volume by a factor of 1.5. Figure 7 shows the pressure differential capacity of a FerrofluidicTM voice coil seal. The passage of air through the fluid is not desirable because such a condition could produce increased distortion and possibly cause splashing of fluid. As Figure 7 clearly shows, maximum sealing capacity is not reached until fluid

Figure 7

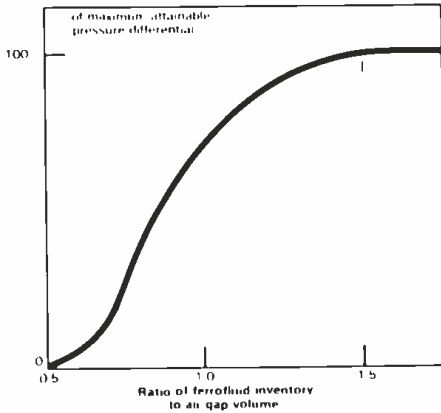
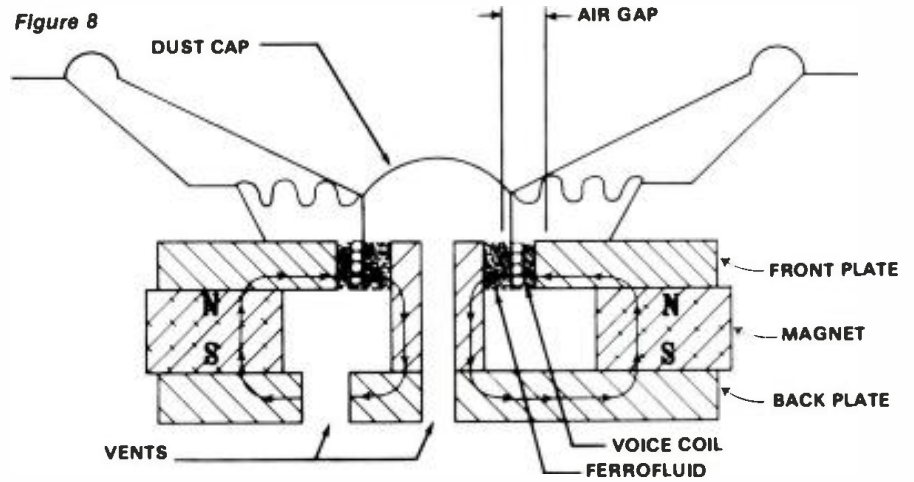


Figure 8



quantity approaches a factor of 1.5 over the calculated air gap volume.

Once proper fluid volume is determined, the choice of viscosity rests solely on the amount of damping desired. A viscosity versus Q_M plot can be made for a particular driver by measuring Q_M without ferrofluid and then measuring the same driver with a known viscosity ferrofluid. Once the Q_M — viscosity relationship is established, it then becomes a matter of choosing the viscosity that corresponds to the desired Q .

Choice of fluid gauss level in most cases means simply using 100 gauss material. If, however, splashing of fluid occurs it may be advisable to use higher gauss fluid. The 200

gauss fluid will have twice the pressure differential capacity of the 100 gauss fluid.

If splashing occurs even with high gauss ferrofluid, it may be necessary to vent the motor assembly of the driver. Figure 8 shows a possible venting arrangement used in woofers and occasionally in midrange units. In general most manufacturers have not found it necessary to vent tweeters. Midranges similarly have a low enough excursion that pressure differential problems seldom occur. Woofers, however, generate enough pressure differentials that venting is probably necessary for most units even with high gauss fluid.

Conclusions

Ferrofluid has been proven to be an important driver design component. Damping of troublesome resonances and control over impedance characteristics have given the design engineer an added degree of flexibility while meeting cost and performance objectives. The engineer is now able to design lower cost loudspeakers with higher performance by using ferrofluid as an integral component.

The dramatic improvement in thermal conductivity results in higher powerhandling capability and increased driver reliability. Thermal conductivity is the prime reason professional products manufacturers are using ferrofluids to solve their power handling and reliability problems.

The demand for smaller systems with higher performance characteristics will undoubtedly place ferrofluids as an important component in the future of professional loudspeaker design. □ □ □

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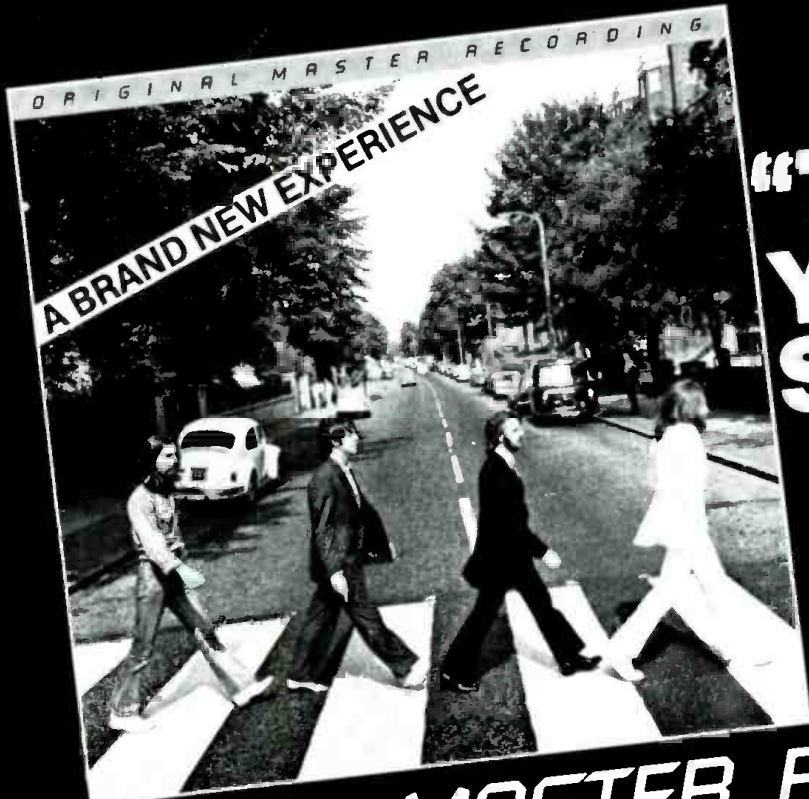
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The CALREC SOUND FIELD Microphone System

Theory and Description

by Tom Lubin

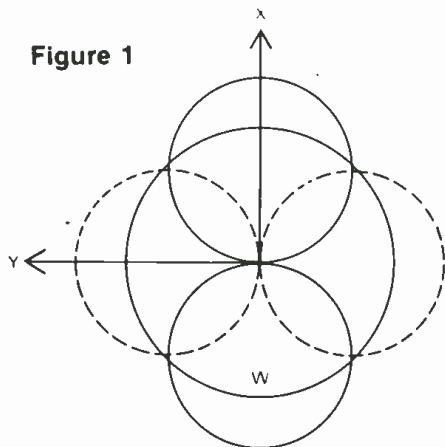
(Abstracted from Calrec literature)

The Soundfield microphone utilizes surround sound technology that enables the recording engineer to not only record the total sound and protect his recording from obsolescence, but through the use of ambisonics he can compare and dub down after the event to any conventional form, adjusting, panning, and steering his synthesized, truly coincident "microphone."

The Psychoacoustics

The theoretical analysis of surround sound psychoacoustics as they apply to the mechanism of human hearing indicate that below about 700 Hz, or that frequency where half a wavelength equals the distance between the ears, the directional information reaching the brain is derived from the sum and difference of the inputs to the two ears. At these low frequencies the

Figure 1



pressure component of the sound is respectively equivalent to an omnidirectional microphone (W). The velocity or pressure gradient component of the sound is equivalent to a figure eight microphone that is pointing sideways (Y). Since the head may be rotated, or raised and lowered, two other velocity components must also be available to create a "head-like" sphere. A forward pointing figure-eight pick-up determines direction (X) (Figure 1). The vertical velocity component that completes the Soundfield symmetry has its axis on the vertical plain and corresponds to an upward facing figure-eight microphone (Z).

The resulting vector sums of in and out of phase forwards and sideways velocity signals corresponds to the apparent sound direction according to Mikita's theory of sound localization by the ear.

At frequencies between 700 Hz and 5 kHz sound direction is determined by signal amplitude differences at each ear and

In Use, Recording Orchestra and Chorale at the new Utah Orchestra Hall

by Carson Taylor

In this day of rapidly expanding technology in the recording industry, sophistication in equipment is expected. Most new pieces of gear cause little stir among the experienced and satiated engineers. Periodically, however, something new and outstanding comes along. The new Calrec Soundfield Microphone is such a device. Most high quality capacitor microphones differ little in basic design. The Calrec is certainly an exception. Many of you have seen it at AES shows and possibly played with the controls of the master control unit, but few in the U.S. have had the opportunity to apply it to a large commercial production where it would be exposed to the serious and sometimes fatal conditions of remote recording in an environment not specifically designed for recording. I just completed such an assignment in which I used not one but two of these amazing instruments. The results, I believe, are outstanding.

Based on development and research carried on in England by Professor Fellgett, of the University of Reading, John Wright, of I.M.F. Electronics, and Michael Gerzon, of the Mathematical Institute of Oxford, under auspices of the National Research and Development Corporation, the concept is totally different than any other microphone of which I am aware.

Coincident stereo pairs are the basis for all the work I've done in studios and remote sessions over the last twenty-five years. There are several very excellent units in this category. The Calrec Soundfield is also a coincident microphone; however, there its similarity stops. It is a multi-capsule array mounted in a tight tetrahedron arrangement. This arrangement is based on the mathematical theory of the sampling on the surface of a sphere developed by Dr. Peter Craven and Michael Gerzon, of Oxford University.

The Control Unit

The output of these capsules after passing through proper head amplifiers is fed into a master control unit. This is the secret of the phenomenal variations possible in the pick-up of the entire sound source. Module number one contains four preamplifiers, one for each capsule. Individual mute buttons and a minus 20 dB pad provide the first controls. Module number two, called the Inverting Module, has two buttons. These provide straight through signals when the microphone is in the upright position and an inverting circuit when the microphone is in a hanging position. The third module contains a continuously variable pot for controlling input gain. Also, there are two switches which will provide 6 dB higher gain, 14 dB more, or when used together, 20 dB input gain. Module number four has a peak reading meter with a switch for reading the exact level coming from each of the capsules. There are buttons here to provide for test, a plus 20 dB button reduces meter sensitivity to check headroom, and a tape switch. Up to this point there is nothing very remarkable about this unit. It is well designed and well made.

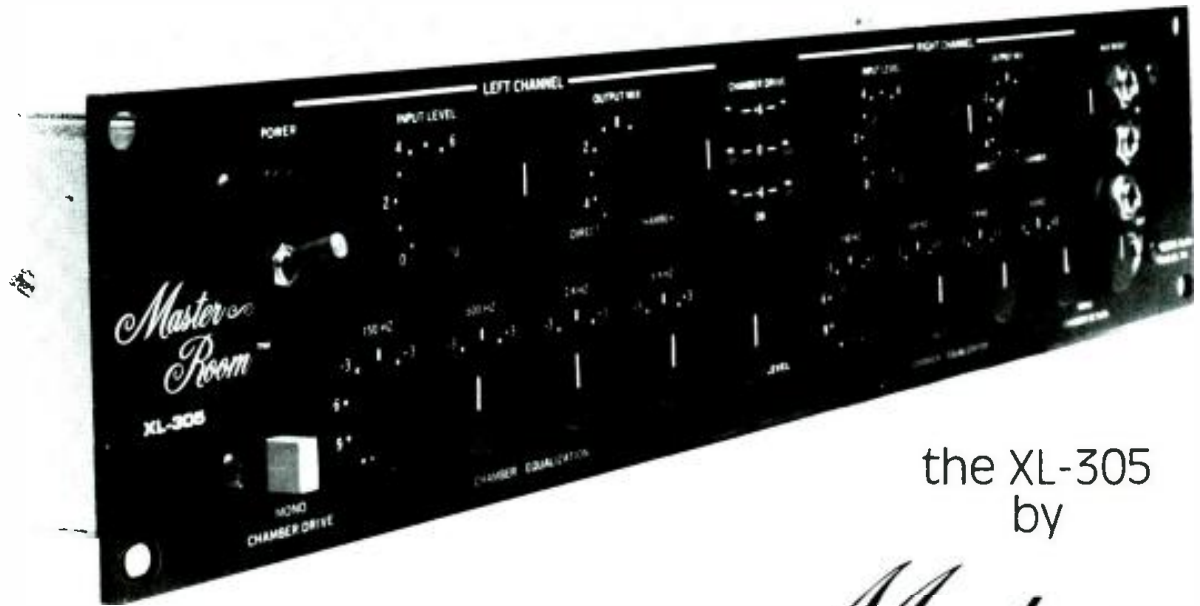
However, beginning with module number five it is a different story. Two controls



Carson Taylor has been in recording for forty years, twenty years with Capitol/Angel/EMI. He is now Vice President, General Manager of Audio/Video Rents, a division of Accurate Sound Corporation, San Francisco

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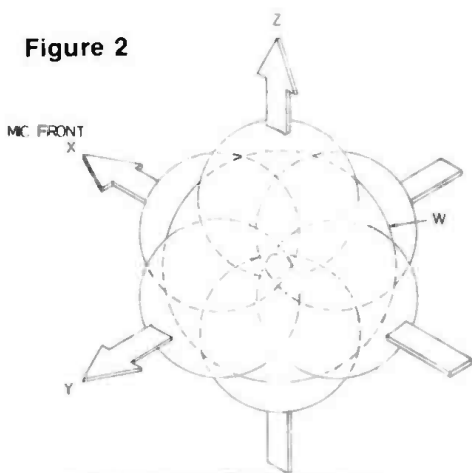
corresponds to an "energy vector" made from the vector components pointing from the sound source to each ear. The length of these two vectors are analogous to the energy reaching each ear.

Above 5 kHz the pinnae or flaps of the ear appear to offer directional information to the brain by differences in coloration they impose on the sound arriving from various directions. Further, it has been found that a listener's ability to localize direction is greatly assisted by moderately reverberant conditions particularly if the reverberation is uniform in distribution.

To take advantage of this additional ambient directional information it is necessary to pick-up the reverberation accurately and reproduce it uniformly around the listener.

These conditions for human directional hearing can be synthesized by ambisonically processing the pressure and velocity signal generated by the Soundfield's four separate coincident microphone capsules. Their discrete outputs are referred to as A-format, while the B-format is created by the ambisonic encoding and decoding process. It is in this form that special manipulations are possible (Figure 2).

Figure 2



appear here. One marked "azimuth" gives the operator the ability to face the microphone straight ahead or to the left, the right, or 180 degrees around to the rear. All without touching the microphone head. The other control will orient the elevation of the pick-up from straight to 45 degrees up or down. Number six module has one control marked "dominance," and two switches marked "up-down" and "front-back," respectively (Figure 1). This unit will cause the effective pick-up to move closer or farther away from the sound source in either the vertical or horizontal plane. It is extremely effective for controlling ambience and presence. The next module contains two controls.

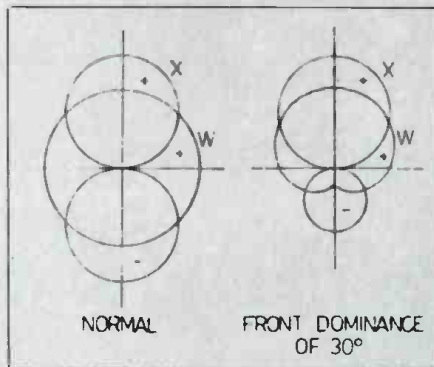


Figure 1. Effect of a dominance control on B-format components.

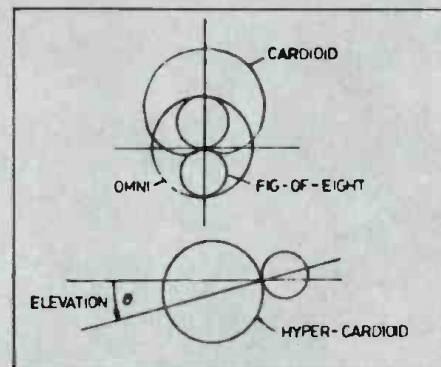


Figure 2. Mono Polar Patterns.

One selects a full range of polar patterns, while the other changes the angle of pick-up from virtually mono (all capsules straight ahead) to very wide angles for stereo (Figure 2). This is usually done by physically rotating the heads on a coincident stereo microphone, but in the Calrec Soundfield it can be accomplished at the mixing console. The eighth module has an output level control and a switch for mono-stereo, quadraphonic, or ambisonic decode modes. There is also a concentric control on this switch which will vary the output relationships for different configurations of loudspeaker mountings. The final module is a stereo headphone amplifier which allows separate control of headphone level and stereo width as perceived in headphone listening.

All of these controls may be used in making the original recording or, what is more remarkable, you may record the so-called B-format, which is the output of the four capsules through the preamplifier matrix. Then later on during remix do all the controlling of perspectives.

Sounds impossible, doesn't it? But it actually works.

The Recording

The recording took place in Salt Lake City, in the new Utah Symphony Hall. This was the first recording to be made in this structure and posed a number of problems. The auditorium is large, deep with no overhanging balconies. The entire structure inside is finished in hardwood (Figure 3). Only the chairs are upholstered. There is no carpeting on the floor. The stage shell is wood and well designed but is, in my opinion, too small. We were recording the Jay Welch Chorale (three hundred of the best voices from the Tabernacle Choir) and members of the Utah Symphony Orchestra.

... continued overleaf —

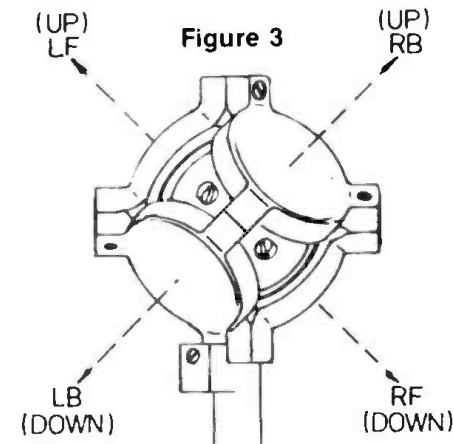
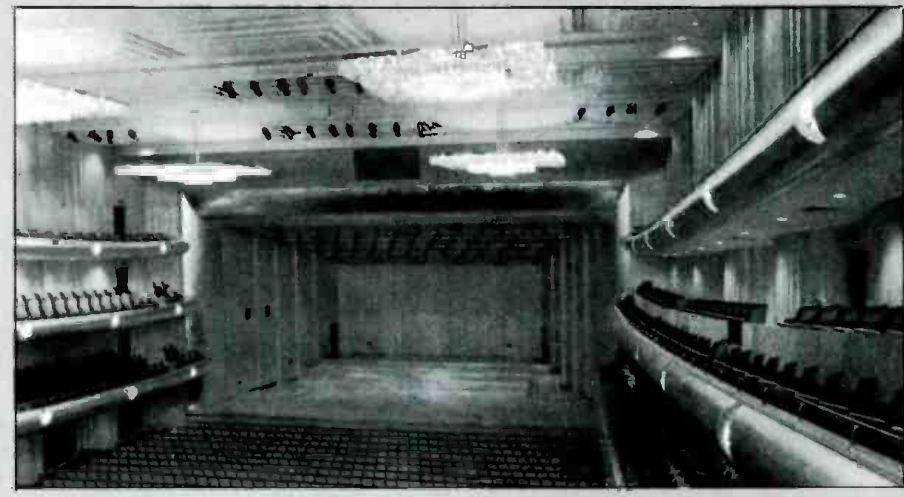


Figure 3

The Microphone

The four capsules are identical single diaphragm cardioids of proven design. Each has a very good axial frequency response and the response in other directions is regular when set up as a sub-cardioid. This means that the polar patterns are well defined at all frequencies. Further, each of

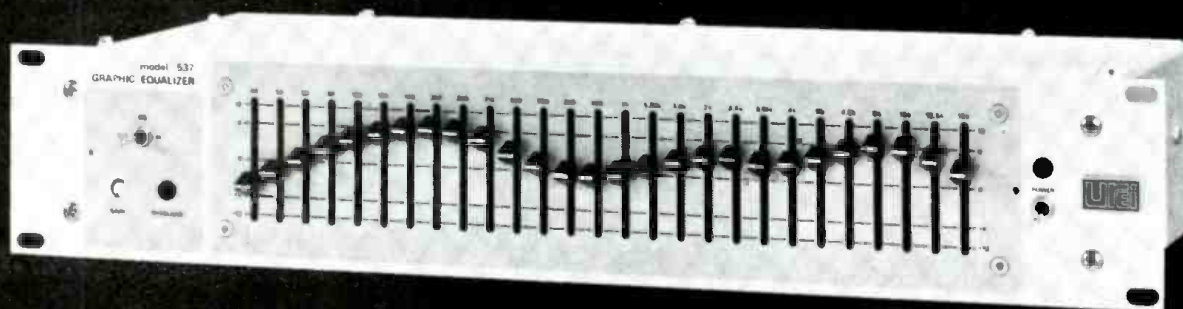


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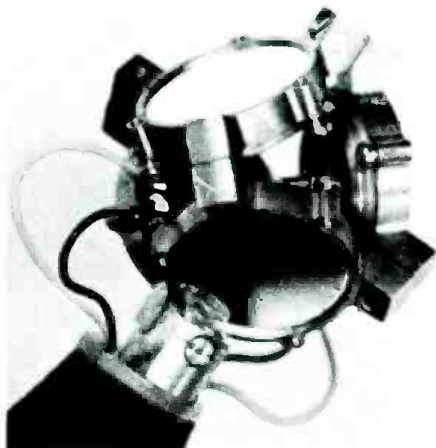


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the four capsules contribute an equal component to each of the B-format outputs. This allows the effective cancellation of endemic capsule variations from the ideal. It is particularly true in this case since the capsules are so well matched.



The design of the tetrahedral array has each pair of capsules tilted upwards and downwards thus allowing them to be paired along discrete axes. This greatly facilitates testing and alignment at frequencies where capsule spacing compares to audio frequency wavelengths (Figure 3). The capsules are paired in the horizontal plane as follows: Left Front Up and Right Back Up, Right Front Down and Left Back Down. Examination of each pair reveals that they are **symmetrically** tilted from the vertical so that if the output signals are subtracted within each pair, the two opposing cardioids will produce figure-eight patterns whose axes lie along 45° horizontal diagonals as shown in Figure 4.

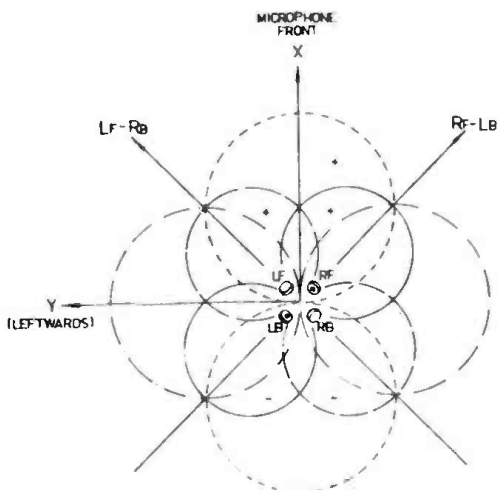


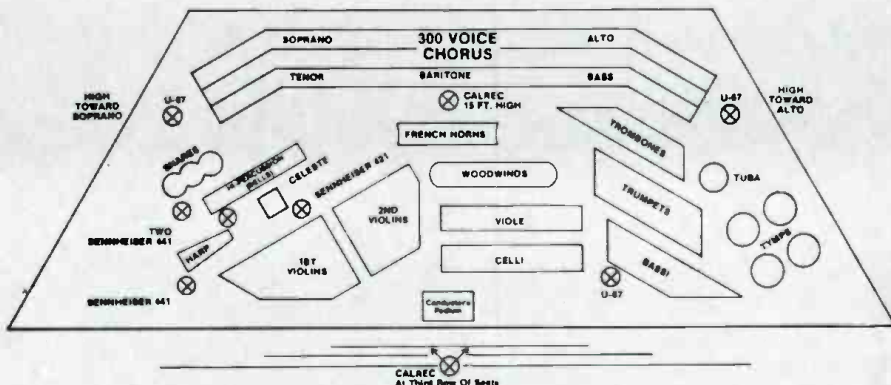
Figure 4

The amplitude of the figure-eight patterns thus produced will be reduced from the value obtained if the capsule pairs were back-to-back by $\cos \phi$ where ϕ is the angle of tilt of each capsule (35.3°).

It may be seen that if the 2 diagonal patterns are added, a figure-of-eight pattern facing forwards is produced, with an increase in sensitivity of approximately 3 dB ($2 \times \cos 45^\circ$). This corresponds to

$$X = LF - RB + RF - LB \quad (1)$$

The hall is extremely ambient, as you might imagine, and with the number of persons on the stage there was little room to move back from the choir with the microphones. Two Calrec Soundfield Microphones formed the basic pick-up of orchestra and chorus. The orchestra microphone was placed in the hall at the third row of seats. Patterns were set to hypercardioid, and the angle of spread approximately 135 degrees. The elevation was pointed downward to help eliminate choir pick-up, and the dominance control set partially forward to favor direct pick-up and exclude some of the excessive ambience in the hall. Azimuth was straight ahead.



The chorale Calrec Soundfield was about fifteen feet up and only about six feet in front of the singers due to lack of space. For chorale balance the sopranos were in the upper left quadrant, tenors in lower left quadrant, with altos upper right, and baritones/basses in right front. Two extra microphones were placed high and to the side for the weaker sections. However, these were not always needed, and the Calrec Soundfield supplied the major pick-up. The patterns were usually hypercardioid, or cardioid, and the angle very wide. Dominance was set to favor the rear to provide more distance in the pick-up, while elevation usually set high to favor the upper quadrants. Actually, almost no support microphones were used because the two Calrec Soundfields gave very excellent control of the situation. A harp microphone was the most predominant sweetener to add presence on this instrument which was placed behind the first violins. All other sweetener microphones on instruments were turned off since they were not necessary. These two microphones provided me with the greatest amount of flexibility in a difficult situation.

Criticisms

Only minor criticisms of the Calrec Soundfield system were found and they are being corrected. The most obvious is the lack of a shock mount, which is very necessary. We devised our own, but in a unit of this calibre it most certainly should be included. The instructions are extremely detailed and excellent, but from the standpoint of practical operations, they become a bit confusing. There is a great deal of math to plow through that takes too long for most mixing engineers to worry about. However, these are minor points, and the facts to keep foremost is this is a practical, functional, and very sophisticated microphone system. It gives the user maximum flexibility, very high quality, and should be a useful addition to the advanced technology of recording or broadcasting. Inherent noise is extremely low, and it is virtually impossible to overload it.

Some very obvious uses in pop multitrack recording are strings, horns, drums, etc., which can be recorded directly to four channels of the multitrack and processed by the matrices later to give greater mixdown flexibility. The many ways this microphone can be utilized will be limited only by the user's knowledge of its capabilities, and his or her imagination.

In this article all discussions of the quadruple and ambisonic theories have been deliberately eliminated. Not because they have no validity, they most certainly do. However, my intention here is to present a new and extremely useful tool which may be applied to sessions as you now know them. Both classical and pop multitrack.

The advanced thinking applied to this microphone system has potential far beyond what is currently conceived as "state-of-the-art." Height perception can be brought into the sound stage concept and many other qualities only vaguely understood by most professionals today. Suffice to note at this time, the Calrec Soundfield microphone and the Soundstream Digital Recorder produced a fantastic result in a very difficult situation.

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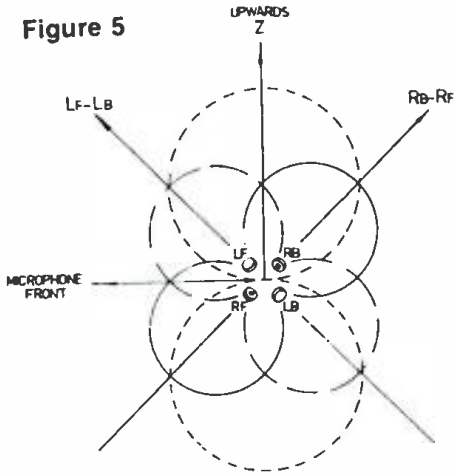
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Figure 5



Similarly, a leftwards figure-of-eight pattern is produced by subtracting the RF-LB figure-of-eight from the LF-RB one. This corresponds to

$$Y = LF - RB - (RF - LB).$$

$$\text{or } Y = LF - RB - RF + LB. \quad (2)$$

The derivation of an upwards figure-of-eight pattern is produced from capsule pairs LF-LB and RB-RF which produce diagonal figure-of-eight patterns as shown in Figure 5. This corresponds to

$$Z = LF - LB + RB - RF \quad (3)$$

The pressure or omni-directional component W is produced by adding the four capsule outputs in-phase so that

$$W = LB + LF + RF + RB \quad (4)$$

If the microphone is to be used inverted, e.g., suspended in a concert hall, it is necessary to reverse the phase of Y and Z only; X still points forwards and W remains omni-directional. This corresponds to

$$Y \text{ INV} = -LF + RB + RF - LB \quad (5)$$

$$\text{and } Z \text{ INV} = -LF + RB - RB + RF \quad (6)$$

The pressure-gradient components X, Y, and Z require a total boost of approximate 13 dB in order that the B-format signals match correctly at frequencies where the wavelength is long compared to capsule and array dimensions, e.g., 500 Hz. At very low frequencies, W requires some boost since it is made up of signals from velocity type capsules which characteristically do not have an extended LF response.

At frequencies where capsule spacing compares with wavelength, equalization circuits take effect to maintain apparent coincidence in B-format signal to about 10

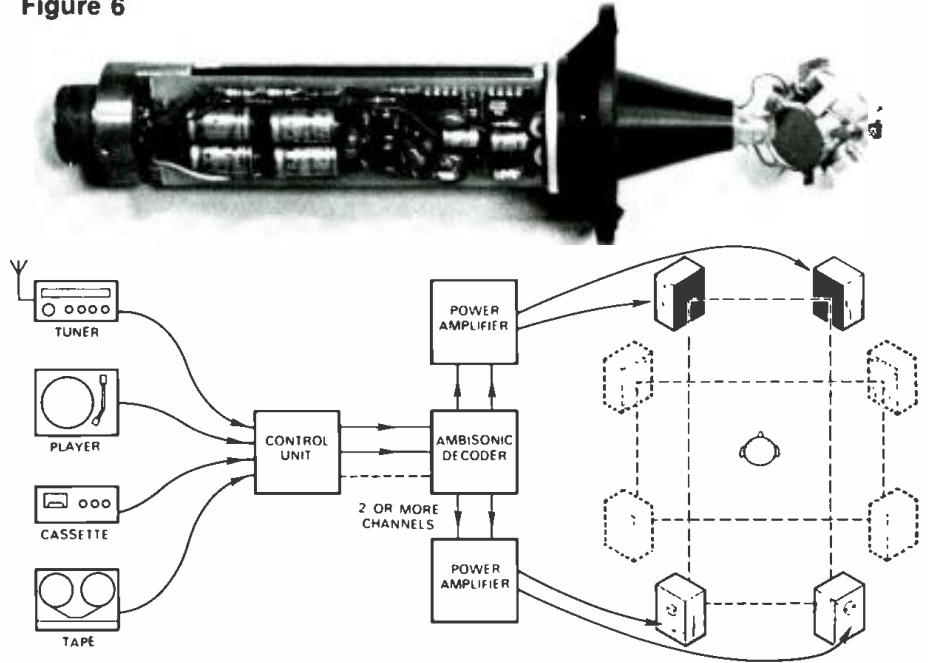
kHz. This contrasts vividly with conventional stereo microphones where capsule spacing restricts coincident signals to below 1.5 kHz. The overall microphone performance is extremely good to 20 kHz, beyond which the output is rolled off at 12 dB/octave.

All the necessary equalization circuits are contained in the A-B matrix module.

Microphone Amplifiers

The microphone body contains four identical head amplifiers mounted on two similar printed circuit cards (Figure 6). Each amplifier consists of a low-noise FET preamplifier with a gain of +11 dB. The FET stage drives two operational amplifiers in an electronically balanced configuration effectively adding a further +6 dB to make +17 dB overall. Each preamplifier is

Figure 6



Playback arrangements for Ambisonic encoded programme material

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phantom powered along its balanced output lines from the Soundfield control unit, each supply being separately stabilized within the microphone. Each circuit contributes to the polarizing of all four capsules so that any or all circuits polarize all capsules. This arrangement together with the stabilized supplies allows signal levels equivalent to 138 dB SPL at 1 kHz to be handled before clipping occurs. The capacitance of a full length (150 meters) of cables restricts the output to 134 dB SPL at 10 kHz, but this does allow an adequate margin over normal loud program which rarely exceeds 110 dB SPL (130 dB SPL corresponds to a very loud sound). At 138 dB SPL the microphone outputs are about 8 volts RMS (+20 dBm approximately). The microphone signal output level is, in fact, approximately 5 mV/microbar.

The arrangement of separating the pressure and pressure-gradient components into B-format allows each component to be compensated separately for frequency and phase response.

All of the microphone's parameters are remotely controlled from the 19" rack mount control electronics. It has nine different modules. Carson Taylor discusses each module's function in the companion article on classical recording using the Soundfield microphone.

The Ambisonic principles applied to surround sound recording will undoubtedly play an active part in the future of recording, as will the Soundfield microphone which provides unique recording signals with all their detailed advantages and a clarity, accuracy, and perspective, which is not easily achieved in any other way. □ □ □

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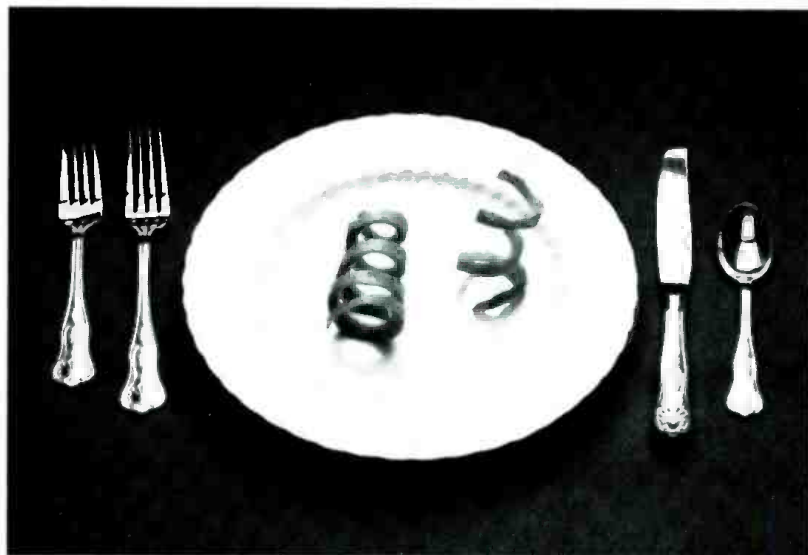
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New Products



MASTER ROOM ACOUSTIC CHAMBER SYNTHESIZER

The Master-Room XL-305 is a unique design approach in self-contained reverberation systems. This "Acoustic Chamber Synthesizer" incorporates new technology that stems from years of research and analysis of "live" chambers currently in use in the recording industry. Properties such as room volume, echo density, and reverberation time versus frequency were studied. The most desirable characteristics of these live chambers are incorporated into the XL-305. The result: The sound of a live acoustic chamber in a rack-mount package.

A live chamber does not have the boing, twang, and flutter that are normally found in compact reverberation units. The XL-305 produces none of these unwanted sounds. A percussive attack, or any transient signal, is

difficult for most compact reverbs to reproduce naturally. Under these conditions, a reverb is most likely to produce undesirable side effects. The performance of the XL-305 under transient conditions is said to be outstanding.

The XL-305 offers two channel stereo capability, and is easily switched to stereo imaging of a monaural signal or full mono operation. Each channel features an input level control, LED chamber drive indicators, and an output mix control to blend the direct and reverberated signals. Front panel output level adjustments are provided for easy adaptation to various operating levels of other equipment. Auxiliary inputs and outputs located on the front panel automatically defeat the rear panel connections, allowing convenient patching. An input/output transformer option (model XL-305T) is available for those systems that

require it.

A four-band equalizer allows each channel of the XL-305 to simulate the sound of reverberation plates, live chambers and large concert halls.. This peak/dip EQ has a control range of plus or minus 12 dB with center frequencies at 150, 600, 2 K and 6 kHz, thus providing the user with extreme flexibility and creative freedom.

Low acoustic susceptibility is said to permit the unit to be located in the same room with loudspeakers operating at high levels without acoustic feedback or mechanical interference. This, combined with the XL-305's rugged construction, lends itself to the rigors of road use without special handling. The unit is packaged in a 3½" rack mount unit that is easily installed and incorporated into any system.

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dbx INTRODUCES NEW VOLTAGE CONTROLLED AMPLIFIER

A new low distortion, low noise, high bandwidth Voltage Controlled Amplifier was introduced by the Professional Products Division of dbx, Inc., at the Audio Engineering Society Convention.

The latest development in dbx high technology, the new Model 2001 VCA is said to approach such low levels of intermodulation and total harmonic distortion independent of gain, input, or output levels, that they almost cannot be measured.

The all-discrete design boasts a minimum gain-bandwidth product of 50 MHz, resulting in full audio bandwidth at 60 dB of gain with complete freedom from slew rate related

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problems.

The gain versus control voltage characteristics of the dbx Model 2001 are an exponential function (20 dB/volt) allowing the user to easily and accurately program the amplifier gain directly in dB.

The dbx Model 2001 is a "current in, current out" device. By choosing appropriate input and output resistors, the VCA can be optimized to fit the needs of the user. Like all dbx VCAs, it is a complete unit requiring a minimum number of external components.

Technical specifications include: Power supply, Dipolar 12 V to 27 V; Gain control range, -100 to +60 dB; Gain control constant, -20 dB/V; THD at any gain any input or output level, less than 100 ppm, typically less than 30 ppm; IM distortion at any gain, less than 100 ppm; Output noise, unity gain, Rin - Rout - 13 K, -87 dBv (ref. 1 V RMS, 20 kHz bandwidth); Frequency response, ± 0.2 dB DC to 50 kHz, unity gain +), -1 dB DC to 20 kHz, +60 dB gain; Tracking accuracy, $\pm 1\%$; Control voltage feedthrough, less than 10 mV, typically less than 5 mV from -100 to +30 dB gain, less than 20 mV to +60 dB of gain.

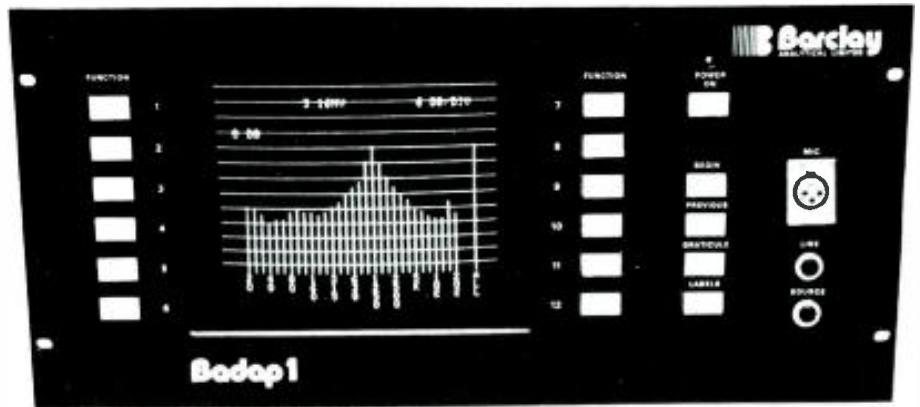
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**BADAP I AUDIO
MICROCOMPUTER INTRODUCED**

Introduced by Barclay Analytical, Ltd., Badap I is said to be the interface between the acoustical environment and the computer, a programmable audio test instrument. It is a full computer complete with input/output systems, memory registers, CPU and readout device. Badap provides measurement of third-octave response, room reverberation time, wow and flutter, critical distance, and noise. Applications include room EQ, spectrum analysis, disk/tape monitoring, audio system design, room acoustical treatment, multi-channel monitoring, among others.

Unique to Badap I is a full-color display, making for easier interpretation and comparison of data. Multiple memories permit storage/recall of all data. Controls are touch-



operated, with on-screen labelling. Badap I provides all necessary test signals; nothing else is required. There is sufficient memory to accommodate multiple measurement programs. Changes or additions to the programming are made by changing the ROMs (read-only memories) which takes only a few minutes. Customized programming is available for specific applications. The price is \$5,495.00.00.

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**ROOM EQUALIZATION FILTER SET
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The UREI Model 539 is an active filter set for room equalization. It is an advanced successor to UREI's Model 529. Signal-to-noise is better than 110 dB at maximum output. Optimized filter parameters produce excellent combining and minimum phase shift. +24 dBm output and superior signal-to-noise figure provides wide dynamic range. Band-end tunable high-pass and low-pass filters are 12 B/octave, with the low-pass (HF cut) switchable to 6 dB octave for band-end contouring and "house-curve" rolloff.

The 539 provides 0 - 15 dB of attenuation at each of 27 ISO 1/3 octave frequencies from 40 Hz to 16 kHz. High-pass (low cut) filter is continuously tunable from 20 to 250 Hz; the low-pass (high cut) filter tunes from 3.5 kHz to 20 kHz.

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Playback Frequency Response (MRL test tape): 31.5 Hz to 20 kHz ± 2 dB.

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minimum-phase LC networks whose skirts properly combine for minimum ripple and phase shift when used in combination. An adjustable front panel control provides up to 20 dB gain to make up attenuation of filters for maximum gain before feedback of the equalized system.

The 539 includes a self-contained power supply; operates from either 100 - 125 or 200 - 250 VAC, 50 or 60 Hz.

The unit is available at UREI dealers priced at \$824.00.

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The DMX 15-80S, originally designed to meet specifications laid down by the British Broadcasting Corporation for equipment to be supplied to them, is now available and offers two independent channels of delay.

To the studio manager, the economic attractions are obvious, the equivalent of two DDLs with the same quality as the widely respected DMX 15-80 at the right price.

The unit is engineered to the same high standard as the rest of the DMX range, and offers similar microprocessor controlled front panel facilities. This gives nine stores of delay settings for each channel allowing instant recall of accurate and repeatable delays.

Memory increments of 100 mS or 300 mS mean that a maximum delay time of two full seconds is available on each channel at 18 kHz bandwidth. Delays are programmed with a



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Straightforward design and superior sonic quality have enabled the Sound Workshop 1280 to be at home in many professional 16 and 24 track installations around the world. Its versatility and reliability make it well suited for production facilities and dubbing rooms as well. And it consistently passes a clean, noise-free signal.

The 1280 has gained the reputation as one of the finest 8-out boards in the industry. It is just one of a family of distinguished recording consoles including the 1600 and new Series 30 from Sound Workshop.

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resolution of one millisecond, and may be simultaneously entered into both channels to ensure phase coincidence.

Regeneration controls are provided on both channels, and switches allow inputs to be paralleled and/or outputs to be mixed for special effects.

The DMX 15-80S employs basic twelve-bit encoding, with three instantaneously switched gain ranges. This method of encoding, coupled with the AMS high integrity sampling circuitry gives the unit its truly transparent quality — 18 kHz bandwidth, 90 dB signal-to-noise ratio and typical distortion of 0.025 per cent at 1 kHz.

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MUSICIAN'S SUPER MICROPHONE INTRODUCED BY AKG

The top-of-the-line model, D-300BT, besides providing studio quality sound coupled with incomparable robustness and dependability, incorporates many essential features such as unequalled impact resistance, absolute handling noise rejection, "presence," and proximity effects controls on the microphone and plug-in modular capsule system replace-

ment.

The outer grille of the D-330BT is made of shock absorbing heavy stainless steel mesh to offer maximum impact resistance. Pop, breath, wind-noise, dirt, and moisture protection is ensured by a polyurathene foam and dispersion screen. The grille is fitted into a clamping ring which is secure and superior to solder or glue. The entire grille and filter is easily removable for replacement or cleaning.

A safety basket forms the super-structure beneath the grille which protects the transducer system module from head-on



impact damage and also repels deformation of the stainless steel grille.

The D-330BT capsule is precision-aligned in a mold to assure high stress resistance and uniform tolerances. Its polar characteristics are hypercardioid, providing exceptional directivity (through a narrower angle of sensitivity) than does the cardioid... resulting in more gain before feedback. Frequency range is 50 through 20,000 Hertz with superb transient response.

Microphones are often affected by electromagnetic fields caused by lighting, power cables and electrical equipment around the stage or performing area. Hum interference from all such sources have been eliminated by an integral hum-bucking coil in the D-330BT.

An unusual "floatation" device has been developed for the D-300 Series of microphones. Circumferential elastomer suspensions, equipped with dome-shaped protuberances surround the unitized capsule module, isolating the module from the microphone body uniformly in all directions. Increased forces brought about by striking or dropping the microphone causes the dome-shaped protuberances to compress in an increasing braking action until the harder body of the suspension acts as a bumper.

In addition to the inherent quietness brought about by the suspension, the D-330BT is equipped with a second transducer which is wired out-of-phase to nullify mechanical noise, resulting in an incredible added noise reduction.

A second elastomer suspension at the base of the D-330BT supports an internal receptacle

1280 Recording at home.

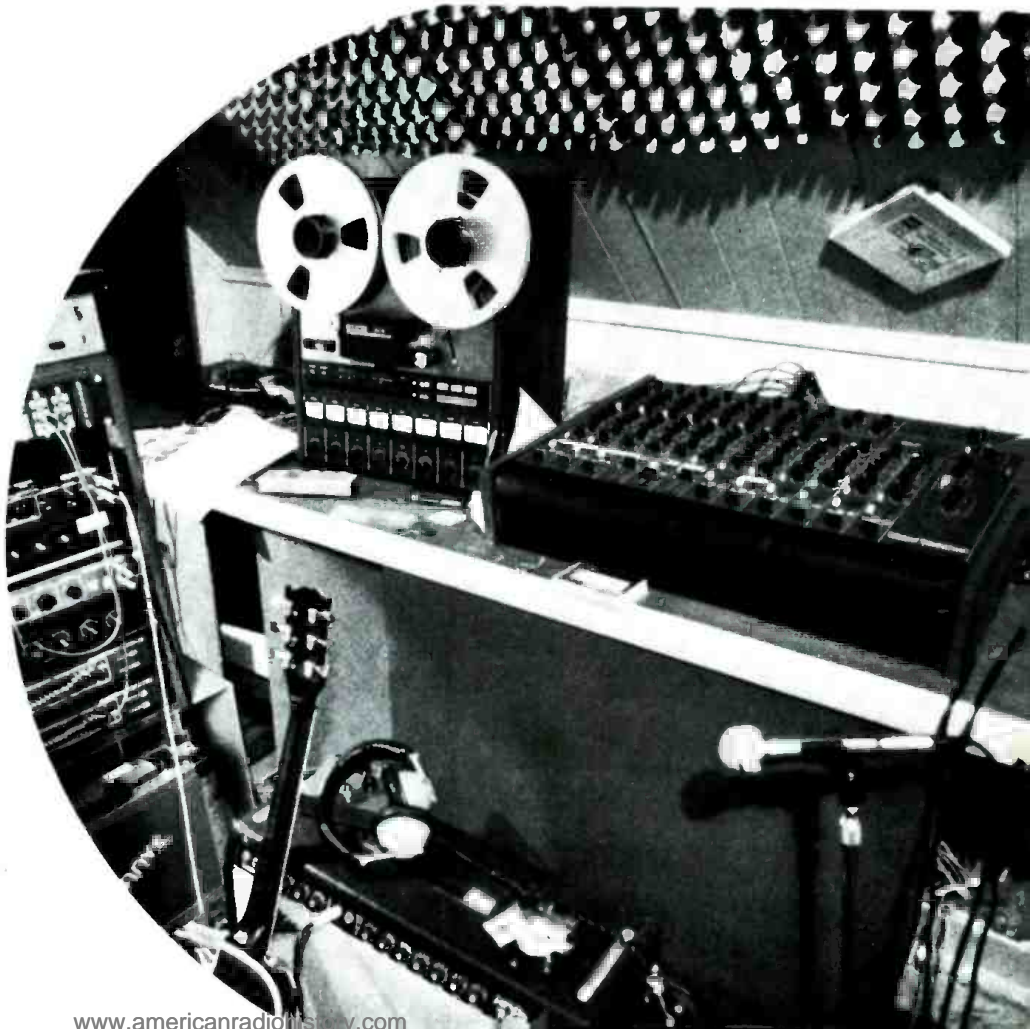
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Sometimes ideas can come at 3 A.M., and it's nice to be able to put them down on tape. Many creative recording people already know this. It's no wonder that the Sound Workshop 1280 has found its way into hundreds of home recording studios around the world.

Its compact size and flexibility make it perfect for home music production. And its superior sonic quality makes it the best performing board in its class. For a demonstration or more information see your professional audio dealer, or contact us.

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connector at the base of the transducer module as well as to effectively add to isolation and stability of the module.

The transducer system elements are contained in a completely unitized module comprising the primary capsule, hum-buckling coil, secondary noise-cancelling capsule, and equalizer switch . . . terminating in a keyed female connector. After the grille assembly is unscrewed, the entire transducer system module can be easily withdrawn without the need for tools.

Two recessed equalization switches are provided to permit the performer to "shape" the sound of the microphone to suit any vocal or instrumental style or mood. The upper three-position switch, in addition to "flat" response, provides two levels of "presence" . . . plus 2 and plus 4 dB from 3,000 to 15,000 Hertz. The lower three-position switch is used in controlling bass response so as to compensate for proximity effect when the microphone is used close to the sound source, and to prevent low-frequency feedback or exaggerated boominess. Neither the microphone impedance nor sensitivity is altered by the switch settings. Critical signal-to-noise ratios are maintained . . . an exclusive feature of this microphone.

The microphone housing is a sturdy, well-balanced and attractive zinc-alloy metal shell. The surface is etched and nickel-plated for durability and complimentary lighting reflectance. The microphone is unusually comfortable to hand-hold over long periods of time.

The wide frequency range of the D-330BT extends from 50 through 20,000 Hertz.

Nominal impedance is 200 ohms and sensitivity is -60 dBm. It weighs 12 ounces less cable.

Suggested list price for the D-330BT is \$185.00.

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**BRIGHT SIDE AUDIO
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The 990 is a discrete operational amplifier circuit which exhibits lower noise voltage, distortion, gain error, output impedance, and response time (delay).



It is said to exhibit higher slew rate, output voltage, output current, phase margin (stability), and gain bandwidth product than most IC opamps and earlier discrete opamps in common use for audio applications. The development involved a careful mixture of textbooks, laboratory collected data, and computer calculations and graphics. The 990 should be considered for applications where these parameters need improvement, including:

Input stage for any application where the source impedance is 2,500 ohms or less.

Line output amplifier for driving a 75 ohm load up to +25 dBv (Re. 0.775v) or 39 volts p-p.

Summing amplifier.

Active filters requiring high degree of stability.

Laboratory preamp for extending sensitivity of noise or distortion measurements.

At the heart of the module is the National Semiconductor LM394 super match transistor pair, chosen for its extremely low noise and matching characteristics. All resistors are metal film 1% tolerance, 100 ppm temperature coefficient (military style Rn55D). Capacitors are ultra stable with a 30 ppm temperature coefficient.

The modules reach an ultimate density of 43 parts per square inch and are automatically wavesoldered and lead trimmed. To ensure reliability all 990s are subjected to 24 hour active burn-in at 212°F (100°C) and subjected to rigid quality control.

Bright Side Audio, of Alto Pass, Illinois, is the exclusive distributor of the 990s that are packaged in a 1.125" square by .625" high clear epoxy. The modules are pin compatible with

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TELEX INTRODUCES AUDIOCOM INTERCOM SYSTEM

Telex has introduced the new Audiocom™, a closed circuit headset intercom system of exceptional versatility. Components may be selected for a single or multiple line intercom, suitable for small or large, indoor or outdoor, portable or permanent installations. The system provides clear two-way communications "behind the scenes" at concerts and stage productions, in film or TV studios, sports stadiums and race tracks, industrial, military, public safety, and security applications.

The Audiocom System is designed to interface with sound systems of other manufacture including simple interconnection with telephone type circuits. Paging, program feed and options such as light/ tone signalling are available. Headset intercoms are easily installed with simplex wiring and standard connectors for short or long distances, exceeding 5 miles (8 km). Wiring can be from station to station in "daisy chain" fashion or from the power supply to each separate station. Basic intercom power supplies and six-line power supply/switchboard with optional battery power pack are available. Conservatively rated, each line can include 30 headset-intercom stations or 8 speaker-intercom



stations or a combination of both.

Ruggedly designed to withstand the wear and tear of heavy daily use, the system is styled to blend with other professional sound equipment. Operational reliability and integrity is assured by several built-in safety factors. The system operates with very low power consumption at 24 Vdc but tolerates a wide range of supply voltage from 12 V to 30 V. Excellent RFI and EMI rejection prevents noise pick-up from telephone lines or even in the immediate vicinity of radio or TV antennas or SCR stage lighting dimmers. No damage will result from inadvertent phase reversal, a shorted line or if a headset is connected directly to the line. Inherent electrical noise is less than 129 dBv.

Controlled frequency response (voice shaped 200 - 5,000 Hz) limits the affect of

ambient noise and enhances maximum transmission of information. The system provides ample gain for clear intelligibility and gain levels do not change as stations are added or deleted. If a microphone or headset is disconnected the preamplifier shuts off automatically to prevent noise in the line.

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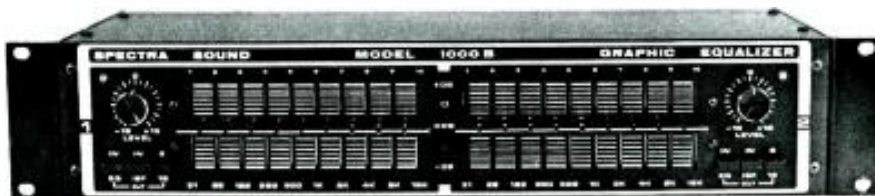
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Model 1000B. The Model 1000B was designed for studio and stage applications where low noise and distortion are desired. The Model 1000B features switchable equalization ranges (± 8 dB, ± 16 dB), infrasonic filters, input level controls, total channel independence, and LED overload indicators. This self-contained unit is provided complete with balanced and unbalanced inputs and outputs.

The Model 1000B is available for immediate delivery and the price is \$595.00 U.S. dollars.

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for additional information circle no. 78

TENSIMOUNT UNIVERSAL MICROPHONE MOUNTING AND ISOLATION SYSTEM ANNOUNCED

Tensimount is a simple, sturdy, unobtrusive and inexpensive device which accepts any microphone up to $1\frac{3}{8}$ " in diameter, providing more than 20 dB of mechanical isolation. The Tensimount converts the microphone to fit a standard $\frac{3}{4}$ " mike clamp, making it possible for the first time to completely standardize all stands and allow instantaneous switching of

microphones without altering stand setups.

In addition to its use as a universal studio mount, Tensimount can be used in a variety of other ways. It serves effectively as a floor-effect (stage) mike holder, a hanging mount, and a hand-held isolator. It is particularly useful for location and field recording where microphone isolation and placement is a major headache.



Tensimount has easily replaceable, inexpensive elastic elements which can be color-coded for easy microphone identification in the studio and on location.

BREWER INSTRUMENTS
P. O. BOX 163

NEWTON HIGHLANDS, MA 02161

for additional information circle no. 79

LEXICON ANNOUNCES SECOND GENERATION SOFTWARE FOR MODEL 224

Designated "Version 2 Operating System," the new software features two new reverberation programs, a new sub-program which significantly improves the decay characteristics of all programs and a comprehensive set of hardware diagnostics for maintenance analysis. Version 2 software is available in 2, 4, or 6 program versions.

The new reverberation programs include "Percussion Plate" which provides superb audio results with percussion and other fast attack instruments and a "Small Concert Hall-B" which augments the original program and provides highly natural and realistic sound. This program provides a very natural low coloration ambience to a sub-mix.

A new sub-program "Decay Optimization" can be applied to all reverb programs to significantly improve the smoothness and naturalness of the final decay. Version 2 software also has substantially improved the performance and naturalness of all current programs at a reverberation time below two seconds.

While the Model 224 has been designed to provide years of reliable service under continuous use, sophisticated electronics can require adjustments and components can fail. To ensure rapid field service of its high speed digital electronics by customer audio engineers or technicians, Lexicon has developed a comprehensive hardware diagnostic program which automatically performs several thousand checks on the

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Coast-to-coast the word is spreading that **ECOPLATE™** is the world's best plate reverberator.

ECOPLATE™ is the only reverb whose decay profile is expressly designed *not* to "get in the way" of the music. Yet it envelopes the music with an incredibly smooth, bright decay.

All this is achieved by new mechanical features found only in the **ECOPLATE™** and cannot be duplicated by other reverb systems no matter how much signal processing is used.

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simple exchange of plug-in IC memory chips with Lexicon's factory. Updates to the 6-program Version 2 Operating System software costs \$650.00.

LEXICON, INC.
60 TURNER STREET
WALTHAM, MA 02154
(617) 891-6790

for additional information circle no. 81

SONEX SOUND CONTROL FOR STUDIOS

Based on the anechoic wedge principle, Sonex Acoustical control foam is now in widespread use in the recording and broadcasting industry. Applications include recording studios, radio and TV stations, in-house video and A/V facilities, Sonex has even been installed in a number of discotheques.

Sonex is a lightweight foam that is easy to hang or attach to walls or ceilings. Although



most users attach the 4' by 4' Sonex panels directly to the walls with mastic or staples, some engineers have found that by installing them on moveable partitions they can quickly fine-tune a studio for special effects or for unusual conditions.

With its architecturally-shaped surface, Sonex not only looks good, but does an outstanding job of absorbing sound, creating a flat, non-reflective chamber around the studio. users report that Sonex has been effective in reducing and eliminating slap echos and standing waves. Performance has been rated as uniformly flat.

The acoustical properties of Sonex result from two factors: first, Sonex itself is an open-cell foam with inherent sound-absorbent characteristics; second, the already optimum absorbing quality is enhanced by the design of the patented, sculptured surface, which acts as an anechoic wedge to scatter and deflect the sound.

Sonex is available in blue, charcoal, brown and yellow with thicknesses of 2, 3, or 4 inches in the standard 4 x 4 foot panels. The price for the two-inch foam is approximately \$1.25 per square foot.

ILLBRUCK/USA
3800 WASHINGTON AVE. NORTH
MINNEAPOLIS, MN 55412
(612) 521-3555

for additional information circle no. 82

WHITE MODEL 4320 ONE-THIRD OCTAVE PASSIVE EQUALIZER

Passive equalizers add no noise and negligible distortion to the audio signal. Passive equalizers are highly reliable as they have no

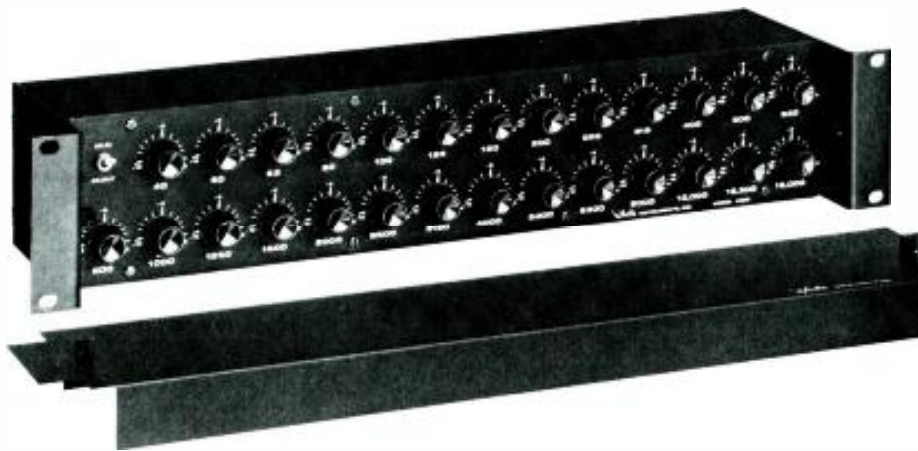
Eventide TM the new Harmonizer



The new Eventide model H949 Harmonizer gives you **pitch change** (one octave up, two down), **delay** of 400 ms on two outputs, **time reversal**, **flanging**, **repeat**, **randomized delay**, and **micro pitch change** for precise, stable settings near unison. Frequency response is 15 kHz, signal-to-noise ratio is 96 dB. See it at the AES Convention, or write for details.

Eventide Clockworks Inc. 265 West 54th Street New York NY 10019 (212) 581-9290

Harmonizer is a trademark of Eventide Clockworks Inc



power supplies or active devices to cause trouble. Passive equalizers have the speed, slew-rate or transient response approaching a "straight piece of wire."

White Instrument's new passive equalizer has no insertion loss. It is designed to look at a very low source impedance, nominally 100 ohms or less, and to be terminated with 10 kilohms. This installation is easily accommodated by most modern audio equipment.

The Model 4320 features 27 one-third octave filters on ISO centers from 40 Hz through 16 kHz. Each filter may be attenuated up to 10 dB. An EQ in/out switch is provided on the front panel. Two accessory octal sockets are provided on the rear panel: one for a bi-amp or tri-amp crossover network; the other for the insertion of a response shaping filter such as a

high or low-pass network. The chassis is brushed, black anodized aluminum. A matching security cover is furnished.

The suggested list price is \$550.00.

WHITE INSTRUMENTS, INC.
P. O. BOX 698
AUSTIN, TX 78767
(512) 892-0752

for additional information circle no. 84

**MOBILE FIDELITY OFFERS
 SUPERMASTER MACHINE
 FOR LEASE**

Mr. John Curl and Mr. Rod Herman, of JC Audio Laboratories, were commissioned to optimize analog record/playback technology. Operating with the proven Studer A-80 transport, the mechanical format for

Supermaster is 30 ips with 1/2" tape. The circuitry is one hundred per cent Class A, push-pull throughout. There are no ICs present in the audio path. All components are of military quality in construction and in performance.

Other special features include custom fabricated record and reproduce heads of low-noise design. Scanning is more than three times the tape width of conventional studio heads. The result is lower noise and greater envelope stability. Individually buffered power supplies for each channel prevent any possibility of interaction.

The recording electronics incorporate phase compensation and are buffered from the bias circuitry to prevent any potential TIM from being generated. The low frequency response of the design has been equalized to obtain flat response below 15 Hz.

While transformers are not used in the record/playback electronics, input and output transformers are available if necessary to interface with conventional studio patching.

The Supermaster package is available either as a complete system including the Studer A-80 transport, or may be purchased in a retro-fit package, adaptable to most existing transports.

Supermaster specifications include: Wow and flutter, .018% (weighted); Frequency response, ±1 dB 15 Hz - 30 kHz (-3 dB @ 40 kHz); Dynamic range, 3% distortion/CCIR (ARM) Noise = 80 dB; Reproduce equalization, 17.5 us; Square wave rise time, 10 us; Crosstalk, better than 40 dB (40 Hz - 20 kHz).

The complete package (with deck) is priced at \$30,200.00. The retro-fit package (with

You do the talking ... The Syntovox Vocoder does the rest

Introducing the intelligible and affordable Syntovox 221 Vocoder from Holland—a 20-channel analyzer/synthesizer which allows the creation of many exciting, new voice effects as well as speech analysis and synthesis. With the Syntovox, a voice input can be imprinted on any musical instrument or sound effect to create truly unbelievable "talking musical effects." Technical features of the 221 include the use of 8-pole filters with initial roll-off of 54 dB/octave, assuring high intelligibility, matrix patching of analyzer and synthesizer sections, and a built-in audio pulse generator for simple



and effective speech synthesis.

Musicians will love the Syntovox 222, a simplified, yet versatile adaptation of the larger studio vocoder. The 222 allows the performing musician direct vocal control over each note which is played. And *any* voice can be transformed to cover a range of many octaves when interfaced with a synthesizer keyboard. Choral sounds, percussion effects... the "triple-two" does it all and much more!

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heads), \$18,900.00. Delivery is quoted at 120 days. A 50 per cent deposit is required with order, or LC accepted.

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OLYMPIC VALLEY, CA 95730
(916) 583-2664**

for additional information circle no. 86

**NEW RUSLANG CONSOLES
FOR PROFESSIONAL RECORDERS**

Canted at a 12° angle for operator convenience, the RL 300 is designed to fit the new RL 350 rack base, and will accept any 19" by 15 1/4" tape transport. Its standard instrumentation overbridge is 19" wide and will accommodate whatever height is required. Like other Ruslang models, its easy-service tilt-up feature makes the electronics totally accessible.



The RL 350 rack is equipped with easy-rolling casters for portability, converting the two units into a roll-around console when used in tandem. The RL 300/350 is available as a combination, or individually. The RL 350 will accept Scully, Ampex, MCI, Otari and many other recorders.

**RUSLANG CORPORATION
247 ASH STREET
BRIDGEPORT, CT 06605
(203) 384-1266**

for additional information circle no. 87

**NEAL FARROGRAPH ANNOUNCES
ALL-IN-ONE AUDIO TEST SET**

A new multi-purpose instrument said to perform the full range of performance tests on tape recorders, audio amplifiers, preamplifiers, and turntables is available from Neal Ferrograph. Recorder test set RTS2 contains a low distortion audio oscillator, stepped attenuator offering 100 dB output range,



precision voltmeter, distortion meter, and wow and flutter meter.

An advantage of this single test instrument is speed and convenience of testing, as only a single input and output lead need be connected to the equipment under test. Setup for tests is rapid using front panel pushbutton switches. All results are read-out directly in per cent of dB without any translation or calculation. Although primarily intended for routine production test and service bench operations, the RTS2 can be used for analysis by attaching an oscilloscope, distortion analyzer, or other equipment to the output provided for this purpose.

Among the tests that can be performed by the RTS2 without any other instruments or accessories are: frequency response, signal-to-

noise ratio, distortion, wow and flutter, drift, input sensitivity, and gain.

The RTS2 weighs only 14 pounds and can easily be taken on location. It contains its own checking circuitry and can be calibrated in the field without reference to auxiliary equipment. The RTS2 is supplied with test leads and a test tape containing both NAB and CCIR test sequences.

**NEAL FERROGRAPH U.S.A., INC.
652 GLENBROOK ROAD
STAMFORD, CT 06906
(203) 348-1045**

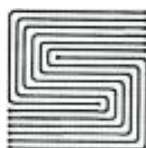
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R-e/p 109

STUDIO UPDATE

■ At **KENDUN RECORDERS** (Burbank, California) **QUINCY JONES** is producing **THE BROTHERS JOHNSON** for **A&M** in studio D with **BRUCE SWEDIEN** and **RALPH OSBORN** at the controls, **JIM SINTETOS** is working on the latest LP in studio 5 with **JEFF SANDERS** for **MCA**, producer **BRUCE JOHNSTON** has been working with **THE BEACH BOYS** in studio 2 tracking their latest for **CBS** with **STEVE DESPU** and **BOB WINARD** behind the console, and **FRANK ZAPPA** has been in re-mastering his "Joe's Garage" LP with **STEVE ALSBERG** and **JOHN GOLDEN**. 619 S. Glenwood Place, Burbank, CA 91506. (213) 843-8096.



Lamont Dozier, Reggie Dozier
at Scott/Sunstorm

■ **SCOTT/SUNSTORM RECORDING STUDIOS, LTD.** (Los Angeles) has opened in the newly refurbished complex which formerly housed ABC Records. The operation consists of three recording studios with custom-built consoles, a disk mastering facility with a Neumann Disc Mastering System, and a complete production plant, including tape and cassette duplicating, editing, and album assembly facilities. A video tape section will soon begin construction, and management and other services will also be offered to tenants. Ex-ABC executives **GENE MACKIE** and **ED CONWAY** are director of studio operations and financial director respectively, while former ABC technical heads **REGGIE DOZIER** and **LANKY LINSTROT** are engineering manager and mastering manager, also respectively. 8255 Beverly Blvd., Los Angeles, CA 90048. (213) 658-5990.

■ **SUNSOUND RECORDING STUDIOS** (San Diego, California) has been opened in the **PETERS CREATIVE CENTER** by Peters Productions, Inc. The new facility's control room is equipped with MCI JH-528 console, a Stephens 24-track recorder with auto-locator, and Westlake bi-amped TM-1 monitors driven by Threshold 400A amps. According to the company's president, **ED PETERS**, peripheral equipment includes

EMT gold foil and AKG BX20 chamber units. Trident parametric equalizers, UREI LA-4 and 1176 limiters, Allison Gain Brain, and an Eventide Harmonizer. The studio is equipped with an isolated drum booth, a seven foot Yamaha grand piano, and a Hammond BC organ. Two complete production rooms are available for voice commercials and radio production as well as mastering rooms for disk-to-tape mastering, and a complete tape system with 12 Ampex 440s. 9590 Chesapeake, San Diego, CA.

■ **ARTISAN SOUND RECORDERS** (Hollywood) long known for their mastering facilities, announces the completion of their new 56-input/48-track mixdown/overdub suites. Studio C features an automated MCI 556 console for 48-track work, and Studio B, with its 32-channel console, makes Artisan capable of taking any project from mixdown to completion. Acoustic design and monitoring systems are using high-transient TAD components and are by **SIERRA AUDIO**, of Burbank, California, which also re-designed and updated Artisan's disk facilities. **JO HANSCH**, formerly studio manager and disk mastering engineer at **KENDUN RECORDERS**, has been named studio manager of Artisan, where recent clients have included **SANTANA**, **DEBBIE BOONE**, **SHAUN CASSIDY**, and **SLY AND THE FAMILY STONE**. 1600 N. Wilcox Avenue, Hollywood, CA 90028. (213) 461-2751.

■ **SATISFACTION SOUND** (Newbury Park, California) has added 8-track capability with the purchase of a 3M Model 23 recorder and the installation of an Electrodyne 20 x 8 mixing console. Other equipment available includes a dbx 160 limiter, a Fairchild 459-A Reverbertron with built-in EQ and compression, and a JBL/McIntosh monitoring system. Microphones are by Electro-Voice, AKG, and RCA. The studio is currently recording the pop group, **MINX**. P. O. Box 611, Newbury Park, CA 91320. (805) 498-5040.

■ At **SALTY DOG RECORDING STUDIOS** (Van Nuys, California) artists such as **DOLLY PARTON**, **THE RAMONES**, and **BLONDIE** have been taking advantage of the new studio location. The 4,000 square foot facility is equipped with a 3M 79 24-track recorder, an MCI JH-528 console, and a complete array of outboards and microphones. 14511 Delano, Van Nuys, CA 91411. (213) 994-9973.

Sunsound Recording



MAINTENANCE PERSONNEL NEEDED

A distinguished Southern California recording studio is seeking mature, creative maintenance personnel. We require a minimum of 3 years previous employment by a multitrack, multistudio facility. Technical proficiencies must encompass repair of all studio electronics equipment, experience in studio systems installation, and a practical knowledge of the principles of acoustic, analog, and digital design. Ability to understand clients' needs is imperative. If you qualify we will provide travel expenses for a personal interview. Submit your resume in strictest confidence to Post Office Box #67134, Los Angeles, California 90067.

STUDIO UPDATE

■ **HOUSTON RECORDING** (Cucamonga, California) provided its remote truck for the video taping of Showtime's "60's Rock Scrapbook" at Six Flags Magic Mountain theme park, in Valencia, California. Artists included **THE MONKEES, THE GRASSROOTS, SPANKY AND OUR GANG, and CHUBBY CHECKER**. A multitrack recording with SMPTE time code was made for post-production mixdown. **RICH HOUSTON** engineered with stage crew **PAUL WESTERHOFF** and **TOM CLARKE**. 9340 Foothill, #32, Cucamonga, CA 91730. (714) 987-0379.

■ **MARANTHA STUDIO** (Santa Ana, California) is opening quality time to outside booking. The facility, usually used for in-house production, consists of two rooms of 1,500 square feet off a control room equipped with a 30 x 24 x 8 buss transformerless console feeding a Stephens 24-track recorder. Super Red monitors and employed along with an ATR-100, an AG-440, and a full compliment of outboards. The studio was designed by **JACK EDWARDS/PERCEPTION**, and has been in operation for one-and-a-half years. 2902 W. Garry, Santa Ana, CA 92704. (714) 546-9210.

■ **LOVE 'N' COMFORT STUDIOS** (Los Angeles) has been used recently by **STEVIE WONDER, NATALIE COLE, and THE EAGLES** for that group's LP, "The Long Run." The studio features an MCI 536 automated console, an MCI 24-track recorder, and two MCI 2-track machines. Support equipment includes an Eventide Harmonizer, Lexicon Prime Time digital delay, dbx stereo compressor/limiters, and monitors by UREI-Altec, Auratone, and Renaissance. JBL 4311s are available upon request. The studio is located at West Pico and Dunsmuir in Los Angeles. 5274 W. Pico Boulevard, Suite 202, Los Angeles, CA 90019. (213) 930-1131.

■ At **INTERNATIONAL AUTOMATED MEDIA** (Irvine, California) activity includes **DAN PEEK**, formerly of **AMERICA**, rehearsing for his upcoming tour; **TIM WEISBERG** mastering his latest LP, directed toward the audiophile market, using IAM's Soundstream digital mastering system, and IAM president **SKIP KONTE** and vice president **JERRY SHIRAR**, in Malibu, producing and directing the video tape press release for **STEVIE WONDER'S** "Secret Life of Plants." 17422 Murphy Avenue, Irvine, CA 92714. (714) 751-2015.

■ **THE PASHA MUSIC HOUSE** (Hollywood) has **SPENCER PROFFER** producing **O'KELSEY & THE PULSE** for **POLYDOR** with **BILLY THORPE** doing some guest guitar work; **ALBERT HAMMOND** working with Proffer on the new **SCOTT ENGLISH** project for **EMI, DREW BENNETT** producing and **JULIE JONES** engineering. Pasha engineer **RICK PORTER** is working in the studio with **DR. JOHN**. 5615 Melrose Avenue, Hollywood, CA 90038. (213) 466-3507.

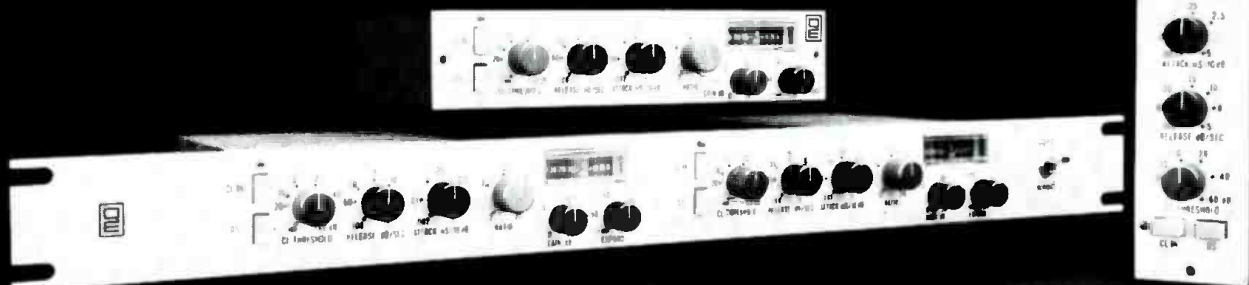
■ **EXCALIBUR STUDIOS** (Studio City, California) has just opened two freshly remodeled 24-track facilities. Excalibur I features an MCI 500 series console, an MCI 24-track recorder with Auto-Locator III, and a UREI Time Align monitoring system. Automation is available. This studio has recorded such artists as **THE RAMONES** and **CHICK COREA**. Excalibur II is a more cozy studio boasting an MCI 400 series board and an MCI 24-track machine with Auto-Locator II. This facility was recently obtained by Excalibur and upgraded from 16-track. **KEN WILSON** is studio manager. 11324 1/2 Ventura Boulevard, Studio City, CA 91604. (213) 761-0759.

■ **KITCHEN SYNC** (Hollywood) has expanded their operation to 16-track with new equipment including an MCI JH-114 recorder, a Sound Workshop 1600 console, an Omni synthesizer, and a new collection of microphones. **CODE BLUE** has been in the studio lately recording demos for prospective producers for their upcoming **WARNER BROTHERS** album. 5325 Sunset Boulevard, Hollywood, CA 90028. (213) 466-3035.

The Versatile Quad-Eight CL22 Can Make It Better

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At the heart of the most versatile signal conditioning device available lies an exclusive, advanced feed-forward VCA controlled circuit design. This helps to eliminate common control and distortion problems in ordinary, conventional compressors and limiters. Like all Quad-Eight precision modular products, the CL22 is available in 19" rack and standard 1-1/2" console configurations. Contact us now for more juicy details.



 For the Artist in Every Engineer.
Quad-Eight Electronics/Quad-Eight International, 11929 Vose Street, North Hollywood, California 91605, (213) 764-1516 Telex: 662-446

STUDIO UPDATE

■ **JOEY and LORRAINE GARCIA** have announced the opening of **SOUNDSATIONS RECORDING STUDIO** to serve the needs of the San Diego area. The 1,472 square foot facility, designed by Everything Audio is stocked with a Soundworkshop 1280B console with 1280 expander, Tascam 80-8 and Otari 5050B recorders, dbx, JBL 4333 monitors, Soundworkshop reverb, and Neumann, AKG and Sennheiser microphones. 5644 Kearny Mesa Rd., #F, San Diego, CA 92111 (714) 560-6214.

■ **CEDAR SOUND RECORDING STUDIOS** (Fountain Valley, California) has opened with the association of **EVAN WILLIAMS** and **MIKE** and **DON BAKER** in the 16-track facility. The studio features an MCI JH-100 16-track recorder, a Tangent 3216 24 x 16 console with semi-parametric equalization, Electro-Voice monitors, and a full array of outboard gear. Williams says that he is looking forward to using the studio for projects on his **DESTINY RECORDS** label, in addition to his teaching at Golden West Junior College. 10625 Ellis Avenue, Fountain Valley, CA 92708. (714) 963-8386.

■ **DUCHESS STUDIOS** located in Whittier, CA will be installing one of the first the new Amek M-2000A consoles before the first of the year in conjunction with a new control room design done by Everything Audio. Duchess is also proud of its quality tape duplication labs. 7923 Duchess Drive, Whittier, CA (213) 695-7715

Hawaii:

■ **SEA-WEST STUDIOS** (North Shore, Oahu, Hawaii) is offering a country location for recording on the islands with a studio fitted with an Ampex MM-1200 multitrack recorder, ATR-102 mastering recorder, a 32-channel mixing console with Neumann faders and mixdown logic, and monitoring by Altec/Mastering, JBL, and Auratone. Outboard gear includes stereo EMT and Master Room echo chambers, Lexicon Prime Time digital effects, UREI parametric EQ and filters, Gain Brain limiters, and a BTX SMPTE time code generator and synchronizer. Instruments include a Fender Rhodes, full studio drum kit, an ARP 2600 synthesizer, and an 1891 Haines honky-tonk piano. Sea-West also offers a mobile recording truck equipped with an Ampex 16-track recorder, JBL 4310 monitors, camera sync and SMPTE time code, and an Antares 20-channel console. **RICK KEEFER** is president and chief engineer. North Shore, Oahu, Hawaii. (808) 293-1800.

■ **AUDISSEY STUDIOS** (Honolulu, Hawaii) has been in operation for five-and-a-half years, and currently features a 16-track studio equipped with a 3M Series 56 recorder, Ampex and Otari 2-track recorders, a Spectra Sonics 20 x 16 mixing console, and Auratone and UREI Time Aligned monitoring systems. Peripheral gear includes UREI and dbx compressor/limiters, Allison Gain Brain, and Kepexes, SAE stereo parametric EQ, and an MXR phaser. Instruments include a Yamaha grand piano. Audissey is owned and operated by **SAM HOLT**, and also offers concert sound reinforcement and mobile recording. 679 Auahi Street, Honolulu, Hawaii 96813. (808) 521-6791.

Canada:

■ **LE MOBILE** (Ste-Therese, Quebec, Canada) is now offering its mobile recording facilities with the concept of recording in any location desired by the artist. The truck is equipped with a Neve 8058 console with 32 inputs, 16 groups, and 48 TK monitors (ready for Necam's computer system), two Studer 24-track recorders with full Dolby noise reduction and Auto-Locator, and a Studer 2000 tape lock system upon request. Monitoring is by a JBL/Crown tri-amped system, and

Amber 4400A: top studio performer.

AMBER 4400A MULTIPURPOSE AUDIO TEST SET. Designed for an industry where time is money, and maintaining top performance is essential. It saves you time by integrating virtually every test and measurement function you could need. It cuts setup time, and assures quality equal to or exceeding competitive equipment, but at a fraction of the cost.

With your oscilloscope, the Amber 4400A can plot the frequency response of a tape recorder or monitor system; measure the weighted noise of a console; plot the phase response of an equalizer or check the transient behaviour of a speaker; tune your room or measure the RT₆₀ of your studio. Optional interface lets you make hard copy plots with any XY recorder.

The Amber 4400A combines versatility with quality. It integrates sine function, sweep, tone burst and noise generator; autoranging digital dBm meter and frequency counter; multimode filter; spectrum analyser; frequency response and phase response plotter.



The Amber 4400A lets you make sure your product is always at its best.



Export:
Gotham Export Corporation, New York

Amber Electro Design Ltd.
4810 Jean Talon West
Montreal Canada H4P 2N5
Telephone (514) 735 4105

amber

STUDIO UPDATE

two Auratones, with JBL 4311s available upon request. Compressor/limiters are by UREI, dbx, and Neve, with other outboards including a digital delay, Harmonizer, and flanger, all by Eventide; a Marshall Time Modulator, and EMT digital echo. Parametric EQ is by Ashley and Helios, and the truck is also equipped with video link gear by Sony and Panasonic. 4 Carre des Bois, Ste-Therese, Quebec, Canada J7E 2R3. (514) 733-8166.

■ **MC CLEAR PLACE STUDIOS LIMITED** (Toronto, Canada) has acquired RCA Limited's studio facility on Mutual Street, in Toronto. The building houses two full-sized studios capable of handling big band music, film scores, and orchestrated jingles; and a third room is planned. The new principals, **BOB RICHARDS** and **PHIL SHERIDAN**, are retaining key studio personnel and have revitalized the recording operation. 225 Mutual Street, Toronto, Canada M5B 2B4.

■ **KENSINGTON SOUND** (Toronto, Canada) has now been in operation for five years and is currently a 24-track facility. Recent additions to the studio include a Midas 26 x 24 x 8 console, and MCI JH-110A ½-track mixdown deck with RTZ, Orange County outboard gear, and the first Lexicon 224 to be ordered in Toronto. Kensington has just completed recording the latest **TEENAGE HEAD** album, as well as mixing projects for **HARLOW** and **KIETH MCKIE**. 170A Baldwin Street, Toronto, Canada M5T 1L8. (416) 360-8339.

■ **OCEAN SOUND STUDIOS** (Vancouver, B. C.) announces that **DICK DRAKE**, formerly of Wessex Studios, London, England, has been appointed to the position of chief engineer at Ocean. 3127 W. 8th Avenue, Vancouver, B. C. V6K 2C4. (604) 733-3146.

Australia:

■ **AIRBORNE SOUND RECORDERS** (Sydney, Australia) has a new owner, **TOM DAVIDSON**, who is updating the studio to 16/24-track to specialize in film soundtracks and all stages of record production. New equipment includes Tannoy monitors, a Roland System 700 with MC8 microprocessor, and instruments such as a Prophet 5 synthesizer, a Kimball 4' 6" portable grand piano with a Helpinstill pick-up, and Camco drums. The facility was designed and constructed by **JACK METCALF** and **CHRIS NEALE**. Engineers on staff are Neale and **JEFF STELLAR**. 505 Pittwater Road, Brookvale, Sydney, New South Wales, Australia. (02) 939-1943.

■ **VIDEO TAPE CORPORATION** (Sydney, Australia) has updated from 8- to 16-tracks with the addition of an MCI recorder with auto-lock capability. Engineer **JOHN BEE** reports that the auto-lock reads SMPTE or EBU time codes and is used in conjunction with their Ampex 2000 and VPR video recorders to provide music to image and image to voiceover production. 382 Eastern Valley Way, East Roseville, Sydney, New South Wales, Australia. (02) 406-5355.

■ **HONEY FARM** (Sydney, Australia) has opened on a five acre estate outside Sydney and offers a 16-track recording studio equipped with a Tangent 3216 console, KEF monitors, a TEAC 16-track recorder, and instruments including a Yamaha upright grand, a studio drum kit, and a selection of synthesizers. Owner **RICK TURK** says that his goal is to create a relaxed atmosphere in which musicians can work. Mallowa Road, Duffy's Forest, Terry Hills, Sydney, New South Wales, Australia. (02) 450-1202.

■ **ALBERTS' STUDIOS** (Sydney, Australia) announces the opening of their fourth 24-track facility, which is equipped with a totally transformerless, all parametric 32-input automated MCI 600 console; an MCI 24-track recorder with Dolby

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STUDIO UPDATE

Noise reduction, two MCI 2-track machines, and UREI Time Aligned monitors. Chief maintenance engineer **COLIN ABRAHAM**s also reports the addition of an MCI Auto-Lock linking studios two and four together and giving 46-track capability to Sydney.

England:

■ **ODYSSEY RECORDING STUDIOS** (London, England) has opened its new facilities which offer 56-channel fully automated MCI consoles in both control rooms feeding MCI 32-, 24-, and 16-track recorders all equipped with Auto-Locator. The large main studio can accommodate 50 musicians and was designed and built for isolation with the concrete floor and inner walls of the entire studio "floating" on neoprene pads. Audicon monitors were designed by **AUDIO CONSULTANTS**, of Nashville, Tennessee, using JBL speaker units bi-amped and powered by BGW 750s. Full Dolby noise reduction is available, and outboards include EMT echo plates and a full range of limiter/compressors, equalizers, and time processors. Studio director **KEITH SLAUGHTER** did the acoustic design for managing director **WAYNE BICKERTON**. 26/27 Castlereagh Street, London, England W1H 5YR. (01) 402-2191.

Nigeria:

■ **NIGERIAN RECORDING STUDIOS** (Lagos, Nigeria) has been designed and is being constructed by **SUGARLOAF VIEW**. The major recording studio and pressing plant complex will be located outside of Lagos, Nigeria's capitol and largest city. This third world recording industry venture is being directed by former Manhattan Borough President **PERCY SUTTON** in conjunction with the Nigerian government. The ground-up complex will include executive offices, employee and artist lounge, a pressing plant, and a Sugarloaf View designed 24-track recording studio. The equipment package is currently being prepared by **HAM BROSIOS** of **AUDIOTECHNIQUES**, and will include computerized consoles. The Nigerian government sponsored project is designed to attract international recording artists and is expected to be operational by late 1980. Care of Sugarloaf View, 37 Union Square West, New York, NY 10003. (212) 675-1166.

West Indies:

■ **SHARC SOUND SERVICES** (Trinidad, West Indies) is operating its own recording studio in Chaguaramas, Trinidad. **SHARC STUDIO CENTER** is a 24-track facility utilizing MCI equipment with full Dolby noise reduction. Peripheral equipment includes an AKG reverb chamber, a custom designed seven second delay reverberation chamber, digital delay, limiters and microphones by AKG, Neumann, and Sennhsier. The studio complex also houses film facilities, and package deals are available. **GRACE STEELE** is administrative manager. Chaguaramas, P. O. Box 1010, Trinidad, West Indies. Telephone: 51021: Ext. 418, 62-26580. □ □ □

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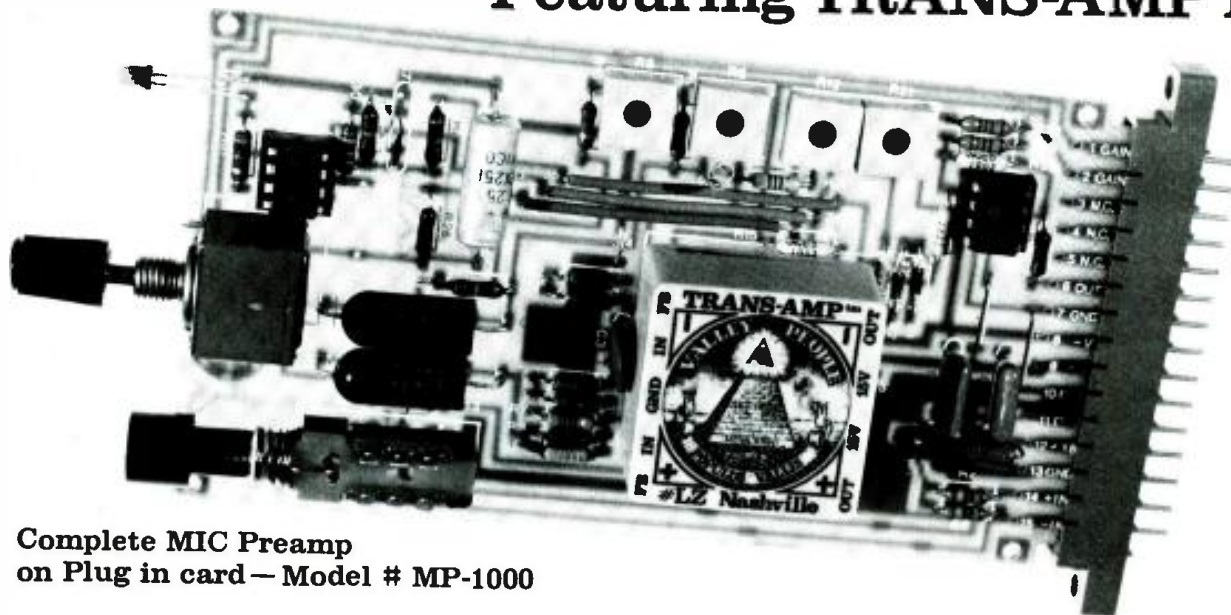
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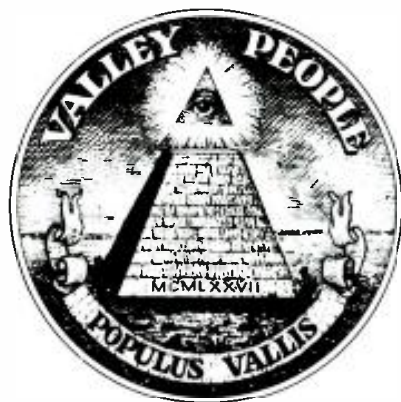


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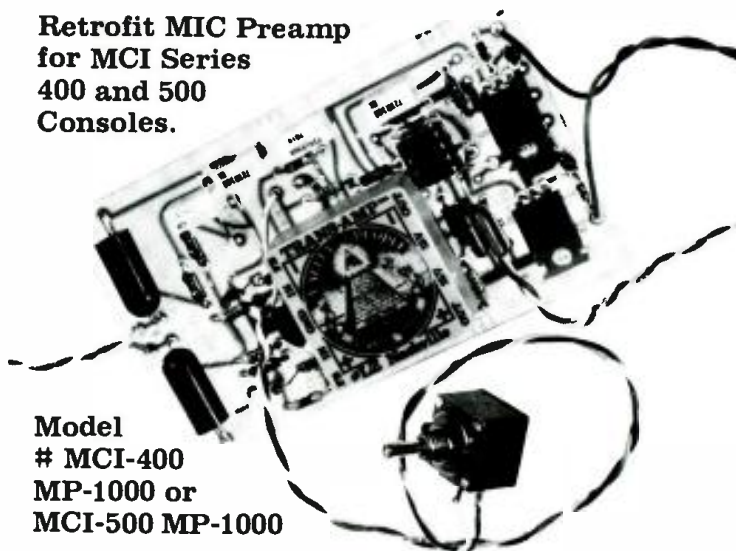
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AKG BX-5 REVERBERATION UNIT
 AKG has announced the availability of a compact reverberation unit utilizing their patented Torsional Transmission Line principle (TTL). The new BX-5 is the first

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In recording studios, it will find broad application as a primary reverb source, yet is economical enough to be placed in each control room for applications from mix auditioning to final mastering. In broadcast studios, it may be used with "live" voice to increase average modulation level, station "loudness" and to increase coverage area. It will also provide enhancement and special effects in the production of commercials.

The BX-5 is a single transmission line system with stereo inputs and outputs. Inputs and outputs are balanced, and level and impedances are fully compatible with those commonly used in broadcast and recording.

Superior reverberation quality is provided by the AKG patented Torsional Transmission Line system, with highly accurate reverberation characteristics made possible by a series of springs whose transmission properties have been controlled by statistical variations of the spring parameters. The Torsional Transmission Line system is, according to AKG, the only reverb device — including live chambers — which does not contain any of the dry input signal at its output. To maintain optimal reverb quality, the TTL system also provides a frequency-dependent decay-time characteristic. Truly balanced reverberation is obtainable at any decay-time setting.

The BX-5 has a number of features in common with the AKG professional reverberation units BX-20E and the BX10E2.

The unit is priced at \$1,195.00.
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(continued from page 17)

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Finally, we would be interested in other schools that are instructing in these areas, as we will attempt to not only make this list available to inquiries, but also to keep it up-to-date.

News

STUDIO SUPPLY OPENING CHICAGO OFFICE

Studio Supply, Inc., is opening a Chicago based office under the management of George Zraick formerly of Streeterville Studios, Inc.

Studio Supply's home office is located in Nashville, Tennessee and has been supplying audio equipment to recording studios all over the Eastern United States for the past eight years.

In announcing the new Chicago office, Studio Supply president, Tom Irby, states, "We feel that the Chicago and Midwestern entertainment industry will be growing rapidly in the next few years. We at Studio Supply are eager to be part of the process."

Studio Supply carries an extensive number of pro-audio lines, headed by the Harrison Systems line of audio consoles. According to George Zraick, "We can supply the industry with anything from a turn-key installation to a microphone."

Studio Supply/Chicago can be contacted at:
 (312) 644-1709

VALLEY AUDIO ANNOUNCES NEW BUILDING PLANS, NEW PERSONNEL APPOINTMENTS

"Due to the steady growth over the past five years Valley Audio has outgrown our existing quarters", this, according to company president, Bob Todrank, who continued, "... construction will begin in mid-October on a 3,000 square foot addition to our building, here in the Berry Hill section of Nashville." Included will be a 600 square foot service area. The new addition will also house increased inventory and production space as well as a dark room. Most important will be a product demonstration room to assist in quality control, and to enable clients to evaluate prospective purchases in an in-use environment.

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Audio has added key personnel to staff: Dan Dishner has assumed the new position of in-house sales manager, and Jack Smith has been named service and installation manager. Gary Carrelli will bear increased responsibilities as vice-president and technical director. Ms. Pam Satterfield, bookkeeper, and Ms. Paula Abbott, production manager, complete the management staff.

HARRISON CREATES QUALITY ASSURANCE DEPARTMENT, NAMES PAKUTKA SUPERVISOR

According to an announcement by executive vice president and plant manager, Tom Piper, "The new department, headed by Joe Pakutka, has been formed to make sure that the quality of the product that we ship to customers continues, in the future, to measure up to Harrison's 'No Compromise' philosophy, as it has in the past.

Piper - Pakutka - Buxkamper



Although we have experienced no difficulty with quality assurance integrated into production, we feel that it is prudent and wise to set up, at this time, an independent, autonomous department . . . that will insure that the product quality continues to meet our customers' expectations."

Pakutka was formerly head of the electrical testing group. He will be assisted by assistant supervisor, Margaret Buxkamper.

ENGBERG NAMED AMPEX AUDIO PRODUCTS MANAGER

Edwin E. Engberg has been appointed product manager of the audio products group in Ampex's Audio-Video Systems Division, it was announced by LeRoy C. Cochran, audio products' general manager.



"Ed brings a wealth of technical and practical experience to this position, that further strengthens our role in the professional audio marketplace," Cochran said in announcing the appointment.

Engberg is responsible for management of Ampex's full line of professional audio recording systems and accessories in his new position. He joined the Ampex research department in 1965 and has been involved in development work in optical processors, and electron beam and laser recording technologies. He was also project manager for the ESS electronic still store system.

Engberg was named manager of the audio engineering department in June 1977, and directed development of the ATR series of multitrack recorders.

NEAL FERROGRAPH SETS UP DIRECT U.S. DISTRIBUTION

Establishment of Neal Ferrograph U.S.A., Inc. has been announced by Alan J. Helliwell, managing director of the parent company Neal Ferrograph, Ltd., of South Shields, England.

"We have been importing tape recorders and test sets into the U.S. market through agents for over a decade," said Helliwell, "but we felt we could more effectively serve the needs of this large market and our coterie of Ferrograph owners by having a direct company presence here in terms of product warehousing and our own sales and service personnel."

The newly established factory branch operation is responsible for sales and service, as well as warranty service and parts. Neal Ferrograph U.S.A. is located at: 652 Glenbrook Road, Stamford, CT 06906. Telephone: (203) 348-1045

COMACHO NEW VP SALES, MARKETING AT DELTALAB

Richard DeFreitas, president of Deltalab Research has announced the appointment of James L. Comacho as vice-president, sales and marketing of the Chelmsford, Massachusetts manufacturer of digital audio signal processors.

Comacho was formerly director of corporate marketing at 'dbx'.

Phil Markham will continue as national sales manager, reporting to Mr. Comacho.

GOTHAM AUDIO PRESIDENT COMMENTS ON RECENT CHINA VISIT

Stephen F. Temmer, president of Gotham Audio and Gotham Export Corporation recently returned from twelve days in The Peoples Republic of China (Peking and Shanghai) as guests of the China Record Company.

Mr. Temmer gave four full days of seminars on recording techniques and new developments in the field of acoustics to some 25 engineers assembled from all over China, and visited the Broadcasting Administration of China in Peking and the factory of the China Record Company in Shanghai. From information supplied by his hosts, he was the first recording engineer to visit China since World War II.

According to Mr. Temmer, both the broadcasting and recording facilities are in the process of upgrading from the levels of technology formerly supplied by Russia prior to the Cultural Revolution of 1966. Plating and pressing equipment of the most modern type is

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in the process of installation. Disks presently sold in China are either 7" or 10" in diameter and are predominantly of the flexible sound sheet type, and only in mono, although stereo cutting facilities are already operational. The biggest problem is the manufacture and dissemination of record players of which only about 140,000 units were built last year.

Mr. Temmer plans to return to China next Spring, to continue the educational process which must precede meaningful purchase of facilities.

HARRISON LEASING CORPORATION FORMED

Formed as a subsidiary of Harrison Systems, Inc., the new company will be a vehicle for leasing high quality audio equipment

According to David Harrison, the company's president, "... this was a necessary step for us to take... unfortunately, banks and traditional leasing companies lack an understanding of the music and recording business, in general, and, specifically, the value of studio equipment. These institutions, consequently, have been reluctant to enter into equipment financing for audio products, leaving a substantial portion of studio owners without satisfactory financing arrangements.

"... we hope the success and acceptance of our leasing program will cause banks and traditional leasing companies to take notice and possibly become more receptive to the financial needs of the entertainment industry."

The Harrison Leasing program will not be limited to Harrison equipment. The company is encouraging package leases of studio gear, including high quality studio equipment manufactured by other companies.

SPARS ADOPTS PPM AS THEIR STANDARD FOR MONITORING LEVEL

At their recently concluded first membership meeting the **Society of Professional Audio Recording Studios (SPARS)** has adopted Peak Program Metering (PPM) as the standard their membership will use for monitoring level.

The meeting reviewed, in depth, the merits of Peak Program Metering versus the more traditional Volume Unit Metering (VU) as presented by a technical committee chaired by Robert Lifton (Regent Sound, N.Y.).

In commenting on the standard, SPARS' newly elected president, Sigma Sound's (Philadelphia and New York) Joseph Tarsia said, "... this will be extremely beneficial to everyone. This is the first of many recommended technical practices to be postulated by SPARS for the benefit of the entire industry."

EVENTIDE PRICE REDUCTION ANNOUNCED

Eventide Clockworks has announced a reduction in list price for their model H910 Harmonizer. A unit complete with digital pitch ratio readout and second output (delay only) will cost only \$1,500. The previous price was \$1,865.

The price decrease, according to the company, was made in part by a reduction in material costs, and partly by improved production methods, allowed by product standardization. Eventide expects to be able to deliver the H910 Harmonizer with readout and second output 'off-the-shelf'.



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