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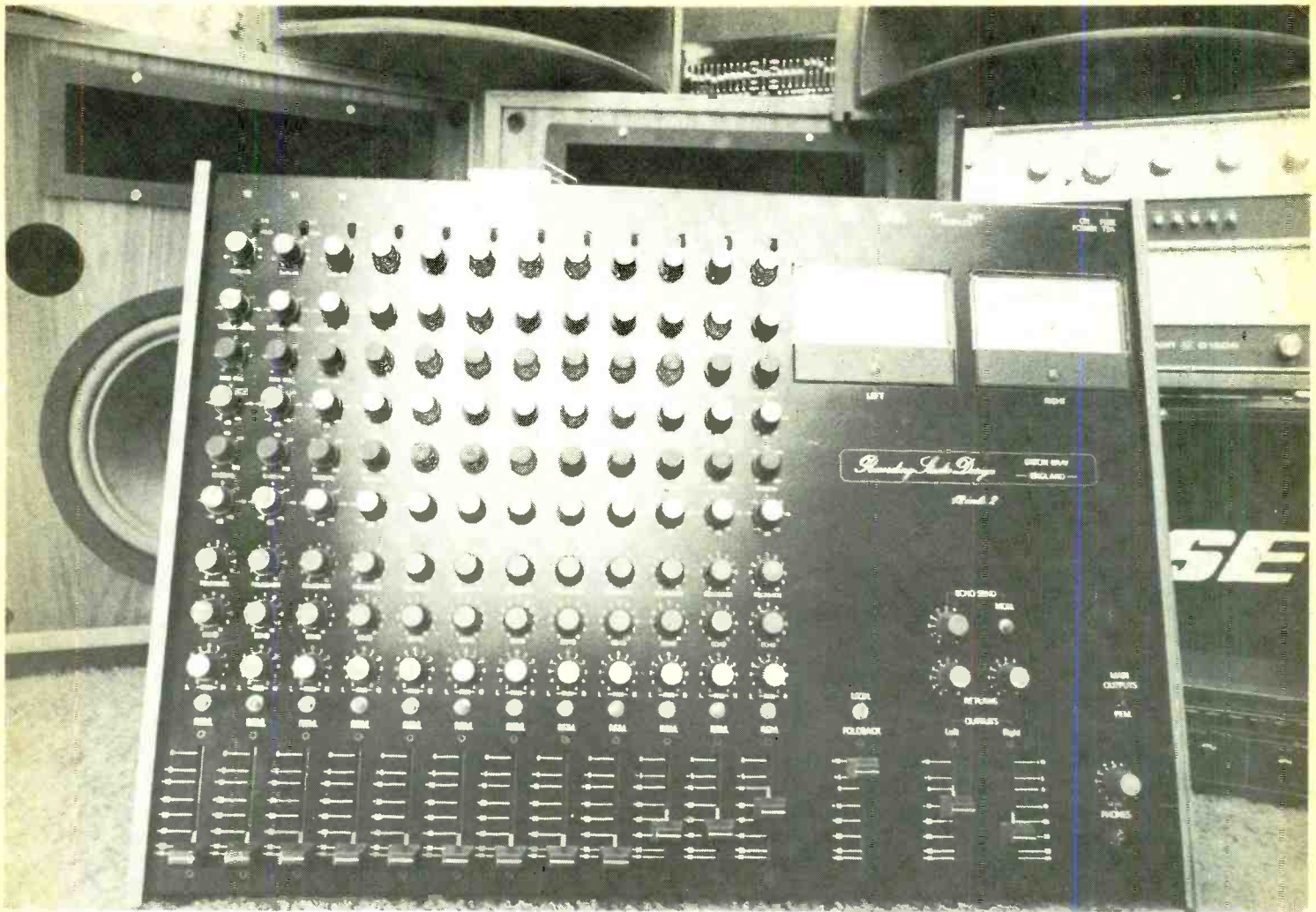


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# MODERN RECORDING

FEBRUARY 1978

VOL. 3 NO. 5

SERVING TODAY'S MUSIC/RECORDING-CONSCIOUS SOCIETY

## THE FEATURES

**LED ZEPPELIN "LIVE"  
—THE SHOWCO MUST GO ON** 42  
*By Gil Podolinsky*  
Our man Podolinsky is back at the Seattle "Kingdome," and this time it's for the Led Zeppelin concert. Take a look at how the Showco, Inc. sound company handles one of the most complex (and loudest) rock & roll bands in the business.

**A SESSION WITH THE  
JEFFERSON STARSHIP** 54  
*By Steve Whiting*  
The Starship has long been not only the very epitome of the "San Francisco Sound," but it has also been one of the cornerstones of American rock. Here we see the group operating in a unique system of priorities that puts the individual in a secondary position to the whole, overall sound.

**INSIDE A SOUNDMAN'S TOOLKIT** 60  
*By Brian Roth and Jim Ford*  
Oh mamma, can this really be the end? To be stuck in East Mobeetie with the toolbox blues again!?!  
If your idea of a properly-stocked toolbox is inserting one screwdriver into your back-pocket, . . . well, then we've got problems. But, don't panic. This article will certainly blow away your blues, and keep some band from giving you that much-dreaded one-way ticket to above mentioned mysterious place.

**COMING NEXT ISSUE!**  
*A Session with Lou Rawls*  
*Profile: Frank Zappa*



## THE STAPLES

- LETTERS TO THE EDITOR** 4
- TALKBACK** 20  
The technical Q & A scene.
- THE PRODUCT SCENE** 34  
*By Norman Eisenberg*  
The notable and the new, with a comment on new manufacturers' literature that is more than just hype.
- MUSICAL NEWSICALS** 38  
*By Fred Ridder*  
New products for the musician.
- AMBIENT SOUND** 68  
*By Len Feldman*  
Classes of power amps abound and most of us just can't keep up with what's right for our needs. Feldman (once again) lends a hand and leads us through the maze of the amp alphabet.
- LAB REPORT** 70  
*By Norman Eisenberg and Len Feldman*  
AB Systems Four-Ten Power Amplifier  
Sansui SC-5100 Cassette Recorder  
Pioneer RT-707 Reel-to-Reel Recorder
- HANDS-ON REPORT** 78  
*By Jim Ford and Brian Roth*  
Sound Workshop 1280 Series Mixer
- GROOVE VIEWS** 82  
Reviews of albums by David Sanborn, Eric Gale, Lionel Hampton, Davis Jansen and Sibelius.
- ADVERTISER'S INDEX** 104

Cover photo by Roger Ressmeyer

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manuscripts will be treated with care and must be  
accompanied by return postage.

# LETTERS TO THE EDITOR

## Ampex Does!

I'm desperate! Where can I buy drive belts for an Ampex PR-10 tape deck? There must be a company somewhere that handles replacement parts for these tape decks. Ampex doesn't.

You fellows sure got yourself a great magazine there. I just wish you had something like this available when I was starting out on a one-channel Webcor monster back in 1959. Everything we learned then was the hard way.

—Bill Stottlemeyer  
Carrol Recording Studio  
Trezevant, Tn.

*We can sympathize with your situation but hold on, for we have a solution for you. We spoke with Alastair Heaslett, a staff engineer for Ampex in Redwood City, California, and he informed us that Ampex most certainly does supply replacement parts (including your much-needed belts) for their tape machines, old and new alike. Considering your location in Tennessee, he suggested you either contact the Ampex sales office in Nashville (2131 Elmhill Pike, Apt. N-266, Nashville 37210, telephone number 615-256-4836) or their service center in Atlanta, Georgia (3135 Chestnut Drive, Suite 100, Atlanta 30340, telephone number 404-451-7122) for the parts you need.*

## A Phenomenal Person

This letter has been a long time coming, as I have been tempted to write *MR* on many occasions, but when I read the October issue, my course of action was finally decided. I couldn't believe my eyes! There was an article on Curt Knoppel, the man I have told hundreds of people about, but no one believed me. (See "The Aphex Aural Exciter—A Psychoacoustic Phenomenon," by Michael Gershman, page 56.)

I had the pleasure of meeting Curt at the New York AES convention in 1972 at a dbx exhibit. I was with an associate and spoke to Curt only briefly and arranged to meet him for dinner a little later. Unfortunately, conventions being what they are, when we returned to the Waldorf, he was gone and we had no way of reaching him. He had told us about the general effect of Aphex and invited us to a demonstration, but it never materialized. I had almost begun to believe he never existed, until I read your article. Now my faith is completely restored.

I would like to know how one goes about acquiring an Aphex unit or leasing it or at least seeing a demonstration, and am definitely interested in using it on some future productions.

—Frank Fisher  
AFP Sound Systems  
Pasadena, Ca.

*We're happy to have reassured you, for Mr. Knoppel most certainly does exist—much to the delight of all those who have benefited from Aphex's very special effects. For more information, write to Aphex Systems, Ltd., 7801 Melrose Ave., Los Angeles, Ca. 92173 or call 213-655-1411.*



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So to all those who are struggling to match Sony's quality, now you have to match our prices, too.



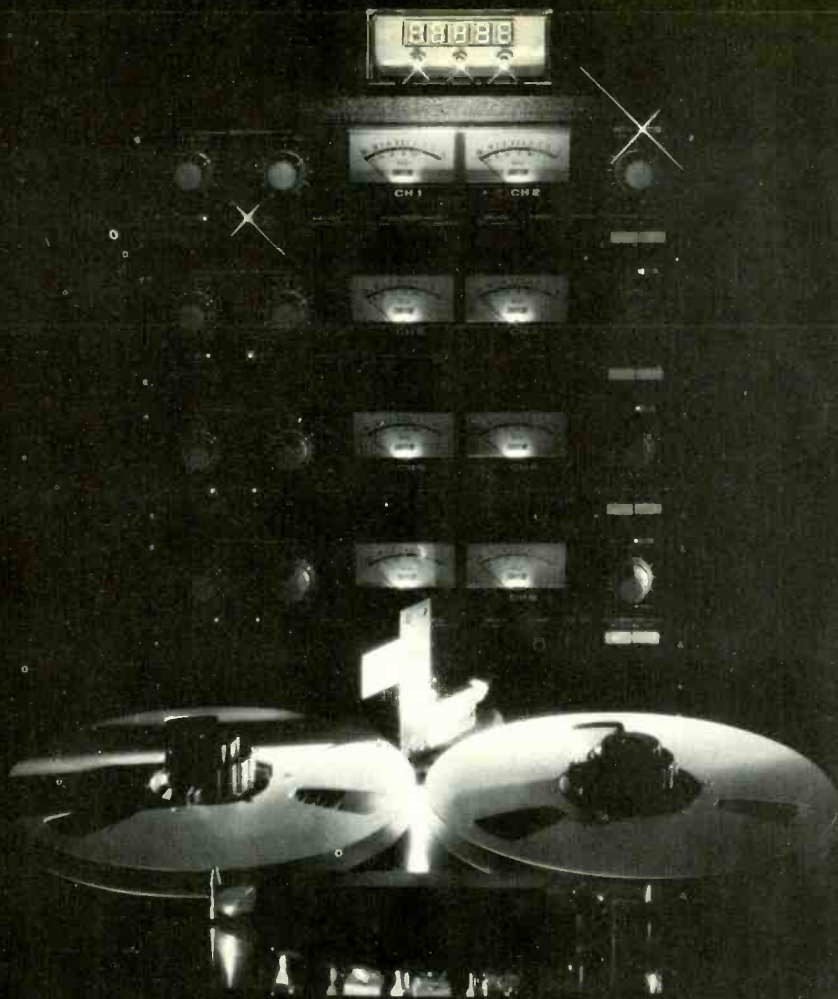
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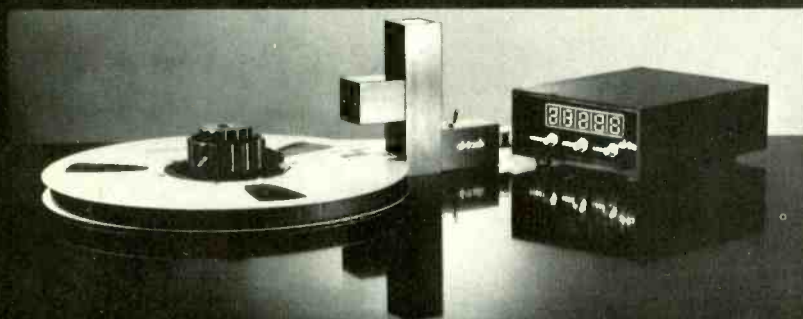
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### A Letter for Lexicon

In the October 1977 issue of *Modern Recording*, a Lab Report was written on the Lexicon Model 92 Digital Delay System (page 71). Since we are a working night club act in the central Ohio area and most interested in a more professional sound reinforcement effects section, we are considering the addition of a digital delay unit to our present sound system. The Lab Report was very impressive and mentioned the possibility of obtaining the manufacturer's application notes, AN-2 (for sound reinforcement systems) and also a 7-inch recording demonstrating the capabilities of the digital delay. We are most interested in obtaining the above items prior to purchasing the unit.

We are willing to absorb any mailing costs required. There are very few sound reinforcement dealers in our area so we would appreciate dealing directly with the Lexicon people. We would also appreciate a list of dealers in the central Ohio area that carry the Lexicon line.

—Stan Dixon  
Bottom Dollar Band  
Columbus, Oh.

[We forwarded your request to Ronald P. Noonan at Lexicon. The following is his reply.]

The Lab Report in the October, 1977 issue reviewed Lexicon's new Delta-T Model 92 Digital Delay System. In Norman Eisenberg's commentary he pointed out that the applications literature and demonstration recording provided with the equipment provided "a wealth of information about this new technique" of time delay signal processing.

Lexicon subsequently has received many inquiries both directly and via *Modern Recording* as to how this literature might be obtained without first buying the equipment. Please be advised that as a courtesy Lexicon will provide this material free of charge to studios, musical groups and other audio/entertainment industry organizations by a simple letter request on their organization's or group's letterhead addressed to: Lexicon, Inc., Professional Audio Dept., 60 Turner St., Waltham, Ma. 02154.

The letter should mention the *Modern Recording* article and the Application Note(s) desired. The material described in the Lab Report was the AN-2, an application of digital delay to sound reinforcement systems (a 14-page booklet on high quality distributed sound systems primarily for house PA applications)

MODERN RECORDING



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(Dealer inquiries invited)

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and the AN-3, a description of studio applications of time delay systems (a 24-page booklet on basic psychoacoustics and a "how to" cookbook for achieving audio effects with time delay for studios and performing groups) and the AN-3 demo disc, a 7-inch 33-1/3 rpm disc recording of selected musical excerpts demonstrating studio effects of delay described in the appendix to AN-3.

The above material, which is non-commercial and instructional in nature, will provide, we feel, a useful background to those members of the recording/performing community contemplating the use of modern, professional quality, digital audio delay equipment.

—Ronald P. Noonan  
President  
Lexicon, Inc.  
Waltham, Ma.

*[The booklets you requested were sent to you directly from Lexicon in Massachusetts. As for your request for information regarding dealers, Mr. Noonan told us that the closest distributor of the Lexicon line is located in Illinois.]*

## Missing Credits

We were a bit remiss in our January 1978 issue when it came to giving credit to our photographers. Photo credit for "Lou Reed—Mixing Binaural" goes to Richard Robinson. Michael Zagaris took the cover shots (supplied through the courtesy of Chris Charlesworth of Sir Productions) and Tom Hill the inside pictures which accompanied our feature, "A Session With Lynyrd Skynyrd." We thank these gentlemen for their fine work and offer our apologies for this oversight.

—Ed.

## Plan On Buying It

I am currently building a "live" performance sound reinforcement system. I would like to know if you know of a company (or some other source) where I can get a complete set of schematics for a 12 balanced input stereo mixer. If you have any idea of how I could purchase such plans, I would be most appreciative.

—Neill C. Porter  
Bastrop, La.

We couldn't think of a source for such plans immediately, so we placed a quick call to Brian Roth, who was also stymied. Most companies are not overly eager to distribute the schematics to the pieces they sell, although exceptions no doubt can be found. Not knowing your technical proficiency, Brian also



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In the past three years the semi-professional recording market has been buried with an avalanche of products. These products have been brought into the market to allow the budget studio to compete with the high overhead pro operations. However, none of the manufacturers of these devices have placed any emphasis on integrating these products into a professional working environment. As a result, the small studio owner is forced to place a substantial investment in the most unprofessional surroundings.

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157 2-channel simultaneous record/playback noise reduction system



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- Small package for ease of portability
- Excellent choice for the small studio or location recordist
- 30dB noise reduction with 10dB additional headroom
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- Work with both pro and semi-pro recorders
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raised the question of whether these plans would really be of any help to you. Building a mixer that doesn't hum, buzz or pick up your local radio station can be a tricky business. His advice was that you rethink your situation and consider buying at least this one piece of equipment.

### Completely Satisfying

Let me begin by saying that I have never written a complimentary letter to an organization of any sort, but in this case I must make an exception.

Your magazine is in a class by itself. You already pose a serious threat to *High Fidelity* and *Stereo Review* (I've cancelled my subscriptions to both publications) because you satisfy the recording enthusiast completely without neglecting other important aspects of sound.

I could go on and on, but let me just say that I'll be a subscriber for life.

—Ray Moran  
Yonkers, N.Y.

### A Good Report

I would like to know if you have any

plans to interview Ron Malo, engineer on *Heavy Weather* by Weather Report. I have been actively working at a four-track studio in Boston for the past six months and have never come even close to turning out such a well-engineered piece.

If there is ever anything I can do to contribute to the well-being of *Modern Recording*, please do not hesitate to call on me. It's a valuable part of the recordist's world.

—Ginny Frisby  
Boston, Ma.

*It just so happens that we have recently done a story on the phenomenal Weather Report. Written by Gil Podolinsky, it appeared in our November 1977 issue on page 32. The article featured interviews with keyboardist Joe Zawinul and soundman Brian Risner.*

*As for the second part of your letter—response from readers like yourself does contribute to MR's well-being. Thanks for making us a part of your world.*

### Whose Pots Are These?

In the Hands-On Report in the October 1977 issue (page 74), the authors, Jim

Ford and Brian Roth, praised the brand of pots used on the Tangent 1202 mixer. I was wondering if you could tell me what brand they are.

—Douglas Teague  
Brooklyn, N.Y.

*Since Brian and Jim were out of town when we received this letter, we placed a call to Will Haggerty at Tangent Musical Engineering in Phoenix, Arizona, who informed us that the pots are made by Alps, a European manufacturer who is distributed in this country by Electronic Components International (ECI) of El Segundo, California. For more information in the equipment they carry, you can call them direct at 213-322-7205.*

### An Address or Two

I have a minor problem that I hope you will be able to help me with. I have been looking for information on studio equipment made by Neumann and Alembic, but have been unsuccessful in my quest since I don't have the address of either company. Neumann has a fine line of mics that I'd like to learn more about and Alembic makes a great pre-

# Open for business.

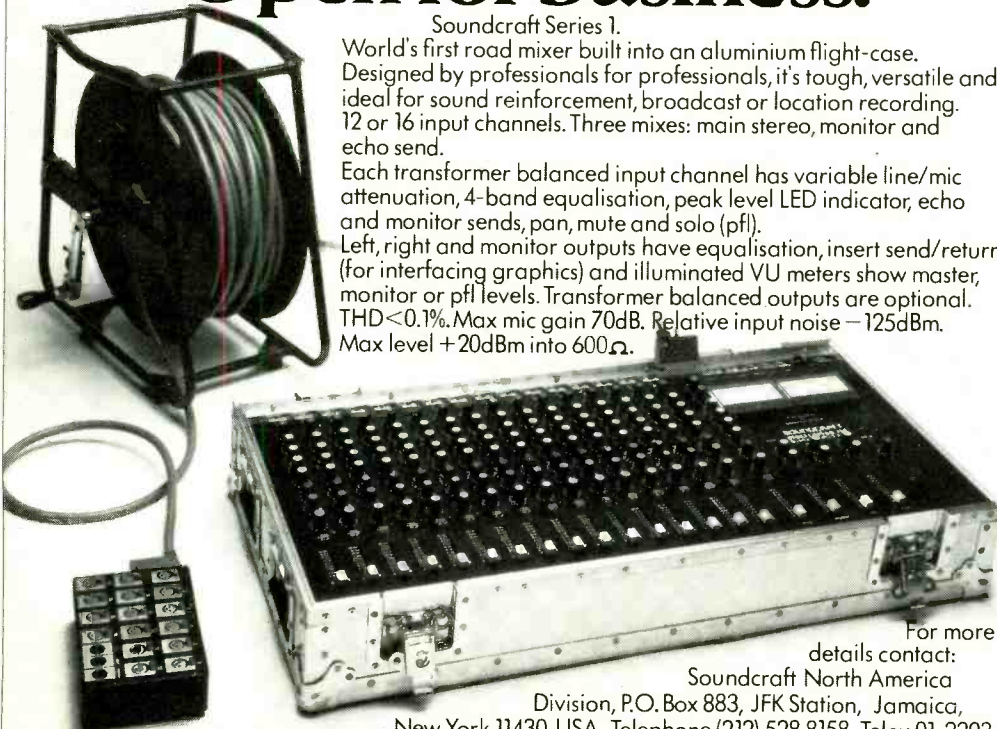
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For more details contact:

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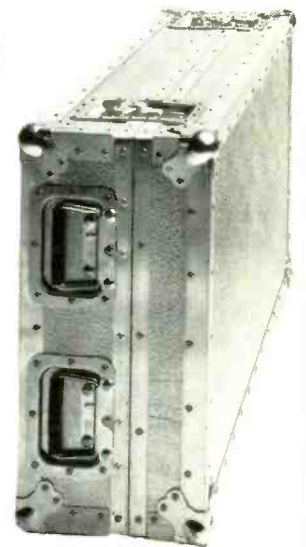
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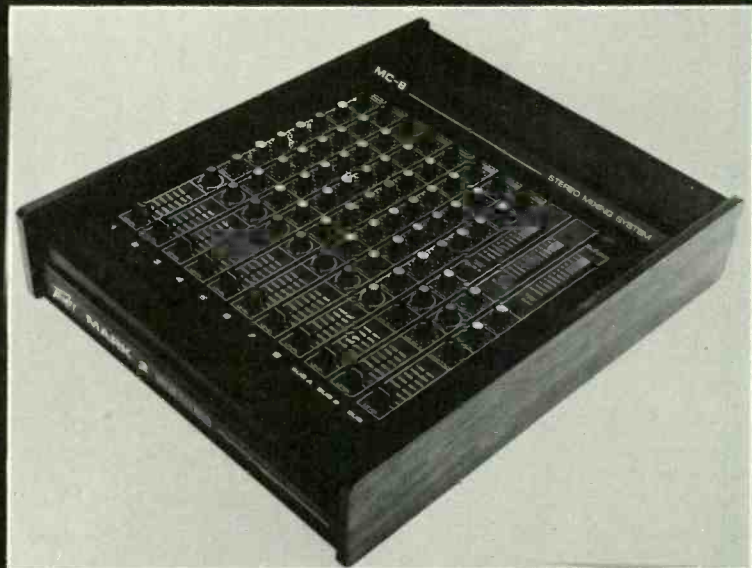
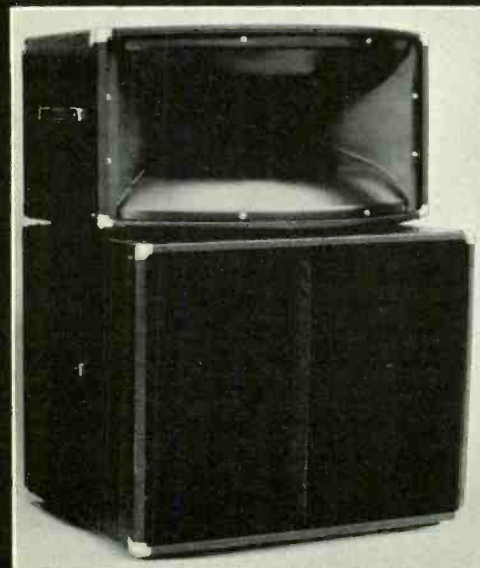
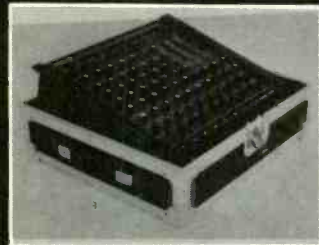
Creating professional, state-of-the-art products at reasonable prices is what Peavey is famous for. Musicians the world over have come to expect value and performance from equipment bearing the Peavey name. We're proud of that reputation. Our new line

of sound reinforcement gear reflects that pride.

See your Peavey Dealer. He'll show you why the Pros are buying Peavey's value and performance. We think you'll come to the same conclusions.



**Peavey Electronics Corporation**  
711 A Street / Meridian, Mississippi 39301



# PEAVEY

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amp (the AF2B) with which I'd like to acquaint myself. If you know the addresses of either of these companies, I would really appreciate you passing them on to me.

—Bruce Birnberg  
Brooklyn, N.Y.

You can write for information concerning Alembic products care of Rothchild Musical Instruments, 300 Windsor Road, Englewood, N.J. 07671. Facts about Neumann products can be had from Gotham Audio Corp., 741 Washington Street, New York, N.Y. 10014.

### An Educational Note

This letter is in regard to the letter written by Ramon Jorge Morales (See "Info on Engineering," October 1977, page 8) concerning schools offering a degree in record engineering.

I am currently enrolled in the University of Miami's Music Engineering program, which has been in effect since the fall of 1976.

The program is unique in the fact that it combines a Bachelor of Music (aimed at music production) with an engineering degree, producing a firm background in acoustics and electronics.

The program is headed by Bill Porter who has a number of gold LPs and singles to his name, having worked with and recorded the late Elvis Presley for a number of years.

Miami is also a little closer to Puerto Rico than the school in Ontario (Fanshawe College in London, Ontario, Canada) that you suggested.

By the way, you've got a great magazine goin'—keep it up.

—Rich Lavoie  
Fort Lauderdale, Fl.

*Thank you for bringing this information to our attention—it sounds like just what many of our readers are looking for. We will be sure to pass it on in the future, and we hope that this info reaches Mr. Morales in time, as well.*

### The Most Challenging Problem

As acoustics present the most challenging problems to both beginner and veteran recordists, it is commendable that *Modern Recording* has presented an article on "How Acoustics Affect Recording" (July 1977 page 36). I would like to add some points to that excellent article.

It was pointed out that the effect of standing waves is to increase reverb time at certain frequencies. However, it should also be said that the effect of absorption is to decrease the reverb time at the absorbed frequencies. I mention this because reverb time, and the way it changes with frequency, is the single most important aspect of a room's acoustic. Standing waves and absorption are entities that effect and shape the "reverb curve," but it must be appreciated that they are the causes and the reverb curve is the final result.

Secondly, I would take issue with the statement that a recording played back in a room with a .5 second reverb time will seem to have .5 second additional reverb. Even if the listener were sitting in the reverberant field of the room (as far as possible from the speaker) the effect would still be less than .5 second added reverb. This occurs because the reverb on a recording, being, of course, a decayed version of the direct sound, cannot excite the reverberant field of the listening room the way the direct sound does, because it simply isn't loud enough. I have demonstrated this fact experimentally in that a one second delay on a tape, when played back through a .5 second room, will result in a total decay of from 1.1 to 1.4 sec-

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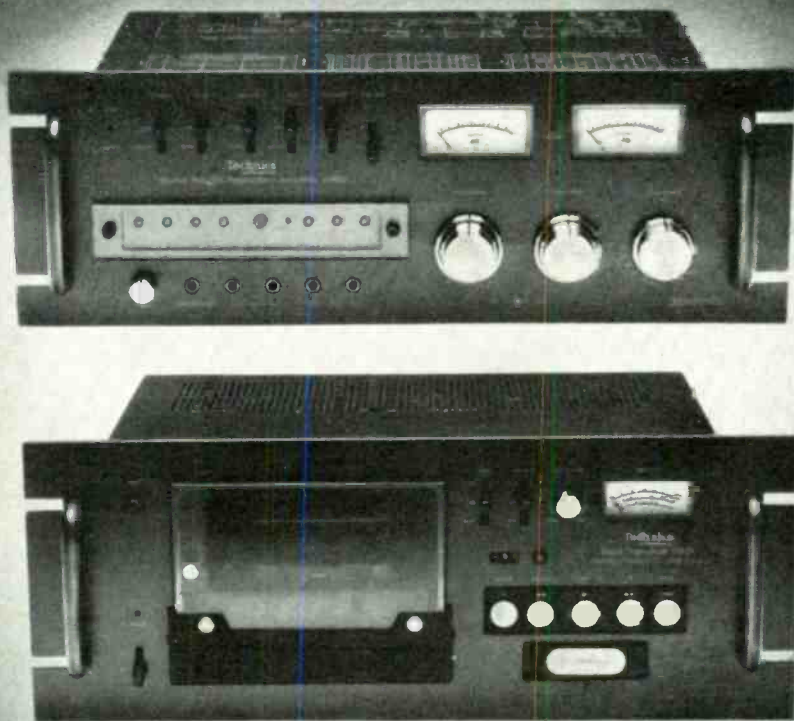
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CIRCLE 37 ON READER SERVICE CARD



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TRACK SYSTEM: 4-track, 2-channel record and playback. MOTOR: Direct-drive DC brushless capstan motor. 2 DC coreless motors for reel table drive. 3 HEADS: 2 HPF heads for record/playback. 1 ferrite head for erase. FREQUENCY RESPONSE (CrD): 25-20,000 Hz ( $\pm 3$ dB). WOW AND FLUTTER: 0.04% WRMS. S/N RATIO (Dolby): 67 dB. HARMONIC DISTORTION: 1.4% (160  $\mu$ Wb, 333Hz). SUGGESTED RETAIL PRICE: \$1,500†

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\*Dolby is a trademark of Dolby Laboratories, Inc.

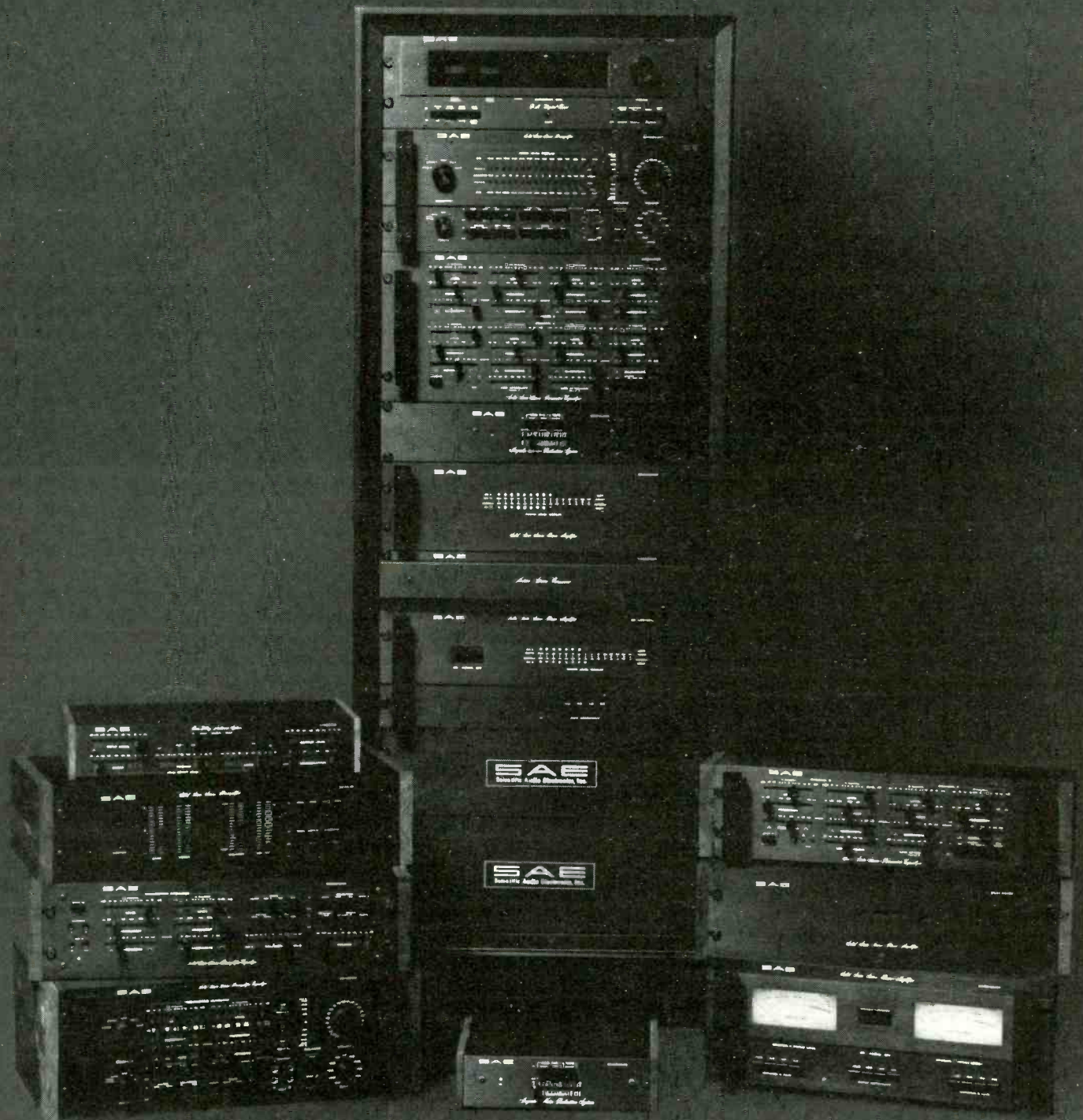
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But, it is not only uniqueness that sets SAE products so far apart from their competitors. It is a goal that SAE established long ago — a goal which states that it is manufacturing excellence as well as design that makes a product truly great.

The following points out the realization of this goal in our product.

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The complete line of SAE Stereo Power Amplifiers is the product of one heritage in both design and construction. The unique, fully complementary design system provides balanced amplification from input to output. This approach yields lower steady state and transient distortion as well as better overload recovery. To realize the full benefits of this unique design approach, every SAE amplifier is built with the same high quality materials throughout. The use of Mil-Spec parts, G-10 glass epoxy boards and hand selected critical components at every level ensures that the superior design results in superior products.

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A bold research and development program by our engineering staff has resulted in the introduction of the first integrated circuit (IC) designed specifically for audio applications. Extremely low distortion, low noise characteristics and fast overload recovery have made it ideally suited for preamp applications. To realize the full benefits of this innovative IC, a completely new phono circuit has been developed. This new multi-stage phono circuit requires less gain from each individual stage and results in lower transient distortion, more accurate tracking of the RIAA curve, and also provides much lower interface interaction with the phono cartridge itself. Besides sonic excellence, careful attention has been paid to human engineering — our preamplifiers provide the optimum in signal flow flexibility to complement their sonic excellence.

## PARAMETRIC EQUALIZERS

The parametric approach to tone modification stands as a revolutionary advancement in equalizers for consumer products. Our parametric equalizers control not only cut and boost, as in conventional systems, but also bandwidth and center frequency. This unique combination of controls provides for tonal modification never before thought possible.

## ASSOCIATED COMPONENTS

These components complement our line of amplifiers, preamps and equalizers. They include a digital readout FM tuner with linear phase IF filters and phase-lock multiplex; an Electronic-Crossover for bi-amplification, which will reduce distortion in even the best speaker system; an Impulse Noise Reduction System, the system that takes over where every other noise reduction system leaves off, by providing dramatic reduction of the impulse noises (clicks and pops) that occur in common playback of records; and our new Time Delay Ambience System, to recreate the live performance previously beyond reach in the home environment.

## CONCLUSION

As you can see, the goal of advanced design and manufacturing excellence has created the finest audio products in the world. The goal is supported by an ongoing R & D program and by a large modern production facility using the latest techniques in circuit board and mechanical fabrication. With constant supervision of assembly and testing, SAE products offer performance, value and consistency — functional, state-of-the-art, and without question, Components for the Connoisseur.

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onds, depending upon when in the room we measure.

Finally, actual reverb time is not usually measured with a gun, SLM, and scope. Most consultants use an electronic pink noise source and amplify it through the speakers in the room's amplifying system. Measurements made this way are more accurate in predicting the room's reverb in actual use with its amplifying system. And the actual measurement is made with a chart recorder or a digital read-out instrument specifically designed for reverb measurements such as the Acoustilog Model 232 Reverb Timer.

—Alan Fierstein  
President  
Acoustilog  
New York, N.Y.

[The following in Mr. Cooper's reply.]

I wish to thank you for your interesting comments. Because you have raised some important questions about areas that are commonly misunderstood, I would like to take the opportunity to address your comments in detail.

You have pointed out that the effect of absorption is to decrease reverberation time at the absorbed frequencies.

This of course is true. You have also stated that standing waves and absorption are actually causal entities and that the final meaningful piece of data concerning a room's acoustical properties is the *reverb curve*.

In light of your direct involvement with the sale of reverberation measuring devices, I can appreciate your familiarity with the need for documenting reverberation data. However, for the same reason, I feel you have overstated the case in favor of the importance of the reverb curve.

Firstly, the definition of reverberation time (i.e. the length of time taken for a signal to decay by 60 dB) has always been somewhat arbitrary. Initiated many years ago, it was originally intended to provide a simple numerical basis for the comparison of various acoustical environments. It has long been acknowledged that the reverb time alone, fails to take into account a great deal of pertinent information about the way in which a sound decays. Does it decay logarithmically? Is it characterized by rapid slope changes? By transient peaks? By nulls in amplitude? Are distinct echoes present? Each of these phenomena unquestionably contributes to a

room's acoustical properties. Yet the presence or absence of these effects is not communicated by a simple statement of reverb time.

It follows that the reverb curve, which is merely an accumulation of many reverb times at various frequencies, is largely an incomplete piece of data. Since the ear uses a multitude of decay information not communicated by the reverb curve to assess the acoustical properties of a space, it is easy to see how two rooms could have the same reverb curve and still sound drastically different from one another.

Thus, to conclude that "...the reverb time, and the way it changes with frequency is the single most important aspect of a room's acoustic" is largely inaccurate. The acoustical properties of a space are determined by a great number of complex factors; no one of which is singly important. It is impossible to measure these composite parameters with one electronic device, or to translate the results into a single, all-telling curve.

You note that the reverberation of a recording and a room are not directly additive and that experimentally you have proved this. Extensive research

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CIRCLE 77 ON READER SERVICE CARD



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*Bias can be re-optimized in seconds.*

As you compare the MX-5050 with other recorders, keep this in mind. The MX-5050 is not a hi-fi machine with a few professional features added later as an afterthought. It was designed from the ground up based on Otari's 10 year experience as Japan's leading manufacturer of professional recorders and high speed duplicators. It is a full professional machine with the performance, features, and field proven reliability that you expect to find only in the larger professional recorders.

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**Production Features:** Creative production is simplified with: Front panel edit to spill tape. Lift-up head cover to mark splices and clean heads. Built-in splicing block on head cover. Adjustable cue to defeat head lifters. Selective reproduce to add new tracks in perfect time synchronization. Two speed operation, 15 and 7½ or 7½ and 3¾ ips (field changeable in dc servo versions).

**Performance Features:** Headroom is +19 dBm, a full 15 dBm over the switch selectable fixed output of +4 dBm. This standard-reference-level output can be rear panel switched to -10 dBm to drive a PA system or power amplifier. S/N ratio is 69 dB full track, 65 dB half track. Crosstalk is 55 dB. Outputs are 600 ohm balanced. Line input and output connectors are standard three-pin XLR's.



**Operating Features:** Bias is front-panel continuously adjustable (not limited to fixed positions). With built-in test oscillator (not available on other compact professional recorders) bias can be optimized in seconds when changing tape. Record EQ and standard reference level are also front adjustable. Straight-line tape path simplifies threading. Capstan is located on back side of tape for improved tape life. An extra reproduce head is standard on all versions to allow playback of tapes in different formats. For pitch control and freedom from power line fluctuations, an optional dc capstan servo is available with a  $\pm 7\%$  correction range.



*Easy threading; capstan on back side.*

**Versatility:** Available in full-track (with extra half-track reproduce head) or half-track (with extra quarter-track reproduce head). Mounts in wooden case (standard), road case, floor console, or rack (optional). Universal power supply standard. Other options: balanced input transformers, remote control, and line adaptor cables.

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done by the BBC (Gilford, 1959) indicates that the reverberant signal of a recording is perfectly capable of exciting the reverberant field of a room, despite its relatively lesser amplitude. In general the effect is nearly additive for very short reverberation times ( $T$  less than .2 seconds), and becomes less pronounced as  $T$  increases. The cumulative addition of real and recorded reverberation disappears entirely for  $T$  greater than 1.5 seconds. Therefore, with a recorded reverberation time of 1 second and a room decay of .5 seconds, what you have undoubtedly been measuring is the cumulative effect at or near the limiting threshold.

Lastly, you point out that reverberation time is usually measured with a pink noise generator in conjunction with a room's amplifying system. In the context of the article to which we are referring reverberation time was defined as it applies to a broad category of spaces, ranging from living rooms to cathedrals. Monitor speakers and amplification systems are not usually incorporated into such facilities.

In *control rooms*, the making of accurate reverberation measurements is a much more difficult and demanding task, owing to the relatively short time between the arrival of the direct sound and the secondary reflections at the listening location. Since most reverberation measurement instruments presently available, including the Acoustilog Model 232, use multiplying techniques to estimate reverberation time, their accuracy is often less than we might like to think. Furthermore, the lag times that are commonly experienced in many measuring devices, while seemingly insignificant in large rooms, become strongly significant in smaller rooms, such as control rooms, where reverberation time may be only 100 milliseconds at some frequencies. Thus, measurements made in conjunction with a sufficiently loud broadband source, filtered as required, and taken directly from an oscilloscope display, are still among the most accurate currently available.

I hope I have been able to clarify some points. Once again, thank you for your interest.

—Jeff Cooper  
Hollywood, Ca.

[Jeff Cooper is an acoustical consultant who specializes in the design of recording studios and control rooms.]





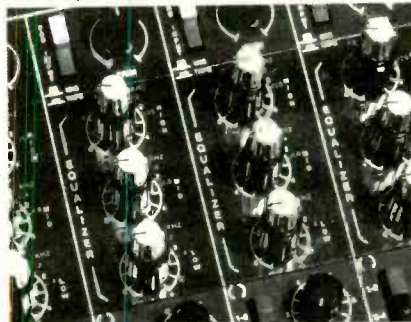
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The equalizer section of the 1280 provides  $\pm 15$ dB of shelving at 100Hz and 12kHz, and 15dB of peak and dip at 3.7kHz. **Super EQ** was developed for applications where 3 frequencies do not offer enough selectivity.

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The 1280B-8EQ shown with optional Meter Bridge, which works in conjunction with standard Tri-Lite LEDs.



1280B (balanced mic inputs)	\$3200.
1280B-8EQ (8 inputs super eq, 4 standard)	4000.
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1280B-EXP-12EQ (expander with super eq)	3700.
1280A (unbalanced mic inputs)	2850.
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# TALK BACK

"Talkback" questions are answered by professional engineers, many of whose names you have probably seen listed on the credits of major pop albums. Their techniques are their own and might very well differ from another's. Thus, an answer in "Talkback" is certainly not necessarily the last word.

We welcome all questions on the subject of recording, although the large volume of questions received precludes our being able to answer them all. If you feel that we are skirting any issues, fire a letter off to the editor right away. "Talkback" is the Modern Recording reader's technical forum.

---

## An Illuminating Issue

Your magazine is fantastic! It's the answer to a road crew's prayers!

Please consider commissioning an article or series of articles, similar to the "PA Primer," on the basics of stage lighting. Yes, I realize its not exactly your field, but let's face it, the same road crew that handles the sound also has to do the lighting in many cases. With your contacts within the music industry, it should be possible to get one of the great rock'n'roll lighting artists to give us the low-down.

Also, any books or magazines on this subject you can suggest would be greatly appreciated.

—John Pez, Jr.  
Tivoli, N.Y.

[While your statement regarding road crews may very well be true, we maintain that lighting and sound, although they are used together to such great effect, are diverse and ephemeral arts and should not be dealt with on a "part-time" basis. However, considering the

number of requests for information similar to yours that we receive and the predicament that many roadies must find themselves in, we did contact John Gates at Capron Lighting Company, Inc. of Needham Heights, Massachusetts. John's career successfully spans both media and he very kindly sent us this reply.]

I think you are quite right in limiting your area of coverage to the recording and sound industry; you cover it well in a very attractive, readable format. However, you are also right in trying to service other needs of your readers, in this case by sending them to reference sources for their other interests.

I have enclosed a list of books, magazines & one journal that should be of interest to your readers. *The Magic Of Light* is a very good source because of the many illustrations and pictures showing the use of light for dramatic effect. The author, the late Jean Rosenthal, was an acknowledged master of her craft and one of the first to be credited as a "Lighting Designer" for her work on Broadway and in the world of dance lighting. The practical knowledge in the book is limited to those areas of the entertainment business, but the concepts are valid in the concert field as well.

The only publication specializing in lighting for the entertainment field is *Lighting Dimensions Magazine* and that is less than a year old. They have published articles on Concert Lighting (I was a contributor) and they also include articles on equipment and systems design. This magazine shows every indication of continuing to be a good source of information for the lighting designer in every entertainment field.

The Illuminating Engineering Society

is primarily composed of designers and consultants involved in lighting spaces, but not necessarily (quite rarely) performance spaces. Their TTFL sub-committee, (Theatre, Television & Film), is composed of our kind of lighting designer and their recent Miami Symposium covered many bases including concert lighting related topics. However, the IES Journal, LD&A, (Lighting Design & Application) has only occasional articles on performance lighting, so I didn't include it on the list.

The books on theatre, television and film lighting I would recommend are: *The Art of Stage Lighting*, F. Bentham, Taplinger Publishing Co., 1969; *Essentials of Stage Lighting*, H. Sellman, Appleton-Century-Crofts, 1972; *Lighting The Stage: Art & Practice*, W. Bellman, Chandler Publishing Co., 1974; *Magic Of Light*, J. Rosenthal, Little Brown, (good theory and aesthetics with plenty of illustrations and pictures); *A Method Of Lighting The Stage*, S. McCandless, Theatre Arts Books, 1949; *Painting With Light*, J. Alton, Macmillan Co., 1949; *Scene Design And Stage Lighting*, W. Parker and H. Smith, Holt Rinehard, and Winston, Inc., 1968; *Selected "Still" Projection Apparatus For Scenic And Effects Projection*, M. Lipschutz, U.S. Institute for Theatre Technology, 1973; *Stage Lighting*, R. Pilbrow, Van Nostrand Reinhold, Co., 1970; *The Technique of Lighting For Television And Motion Pictures*, G. Millerson, Hastings House, Publishers, 1972, (excellent TV book).

The journal of the U.S. Institute for Theatre Technology (245 West 52nd Street, New York City, N.Y. 10019), *Theatre Design and Technology*, is also a good source of information.

Magazines to which you might wish to subscribe include the aforementioned



Lighting Dimensions, 9150 Galloway Rd., Suite 106, Miami, Florida 33176 and Theatre Crafts, 33 East Minor Street, Emmaus, Pa. 18049.

Hope this is of some help to you.

—John C. Gates

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### Help For The Harp

I handle the audio for a Canadian band called Nightriders, and I am experiencing difficulties in amplifying the harmonica. I have tried consulting various sources in Toronto in regard to the matter, but have received little or no useful results.

The sound we are after is similar to that of "Majic Dick" of the J. Geils Band. The setup we are now using is as shown (see figure 1).

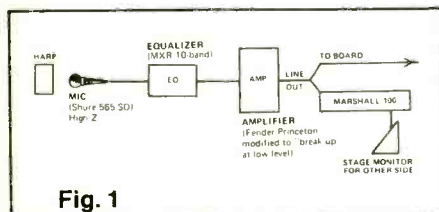


Fig. 1

The problems are as follows: Stage sound is being picked up up and amplified by the harp setup which breaks the signal up and sends it to the board, resulting in a "mush" coming through the PA at all times when the harp is not actually being played. Another phase of this problem is that a super cardioid mic cannot be used since when the harp player is performing he has to cup his hands around the mic to bend notes, etc. This converts the cardioid into an unstable omni, since the rear vents are obstructed.

The sound received at the board, when the harp is being played, is too muddy. When this is pumped up to rock SPL it is quite ear piercing, and lacking in quality and richness. This problem seems to arise from the Fender amp, since the distortion is only slightly variable. The amp was set up to distort by bypassing some of the power tubes and decreasing the actual output to about 10 watts. A pot was put in to control the amount of overdrive but it only slightly affects the amount of distortion. I would be very interested to know what the Geils band does at this end, since I am convinced our system is not the answer.

There is also an abundance of onstage

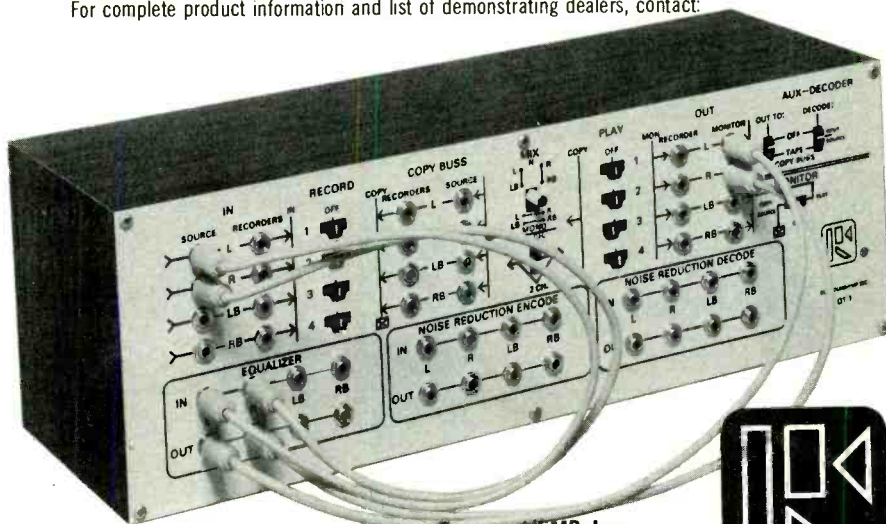
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If all this sounds good to you, call or write us. We have a lot more good things for you to hear.

Powering module and heads available separately. Prices subject to change without notice.

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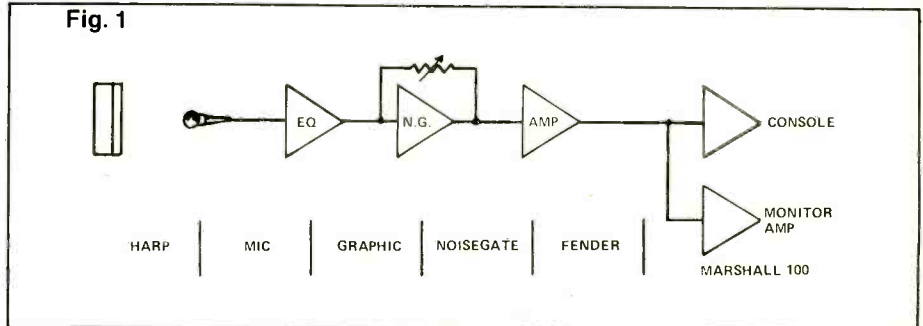
10 West 37th Street, New York 10018 (212) 239-0190

Manufacturing Plant: Bissendorf/Hanover, West Germany

CIRCLE 58 ON READER SERVICE CARD

feedback. This is reduced by the distance in which the amp can be placed from the source. But this is not always feasible since in the majority of clubs in which the band performs the stage is too small to facilitate all six musicians. This is where the EQ comes in. By decreasing the 1K and 2K sliders, the feedback is greatly reduced, but

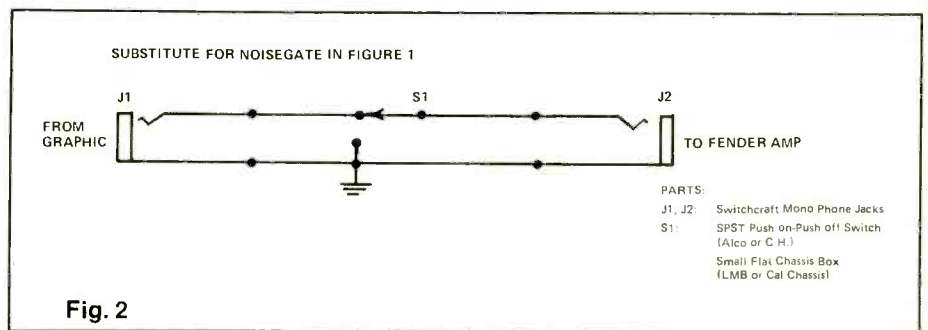
have switches on SM57s anyway) so I invested in a Kepex noise gate for the vocal subgroup on my Yamaha PM1000. Although this is probably beyond your current financial budget, the same idea will work on your harpist's mic. MXR makes a nifty little noise gate that you could insert between your graphic and the Fender amp (figure 1). Another,



along with it all of the punch which the harp player needs. Possibly a more suitable mic would help in this respect?

The only consideration which must be taken into account is cost, since we are on a reasonable budget. Any suggestions

less expensive solution would be to install a footswitch in the same place (figure 2). Either way, the harpist could turn off the mic when he wasn't playing. If you opt for the noise gate, you will want to play around with the



you may be able to offer would be gratefully received.

—Jeff Elias

Canadian Audio Systems  
Willowdale, Ontario, Canada

Although I don't do the sound for J. Geils, I have encountered many of the same problems you have mentioned in your letter.

While doing sound for the Jackson Five, I would get a great house mix on the band and orchestra, only to get a bunch of out of phase "mush" when I brought up the vocal mics (when no one was singing of course). My alternatives were to continuously ride gain on the vocals and take a chance on missing a cue after an instrumental break, or find some other way to shut the "extra" mics off when they weren't being used. I thought twice before asking the "Five" to turn their mics off when they weren't singing (they don't

threshold control to make sure the gate doesn't chop up the harp during more subdued passages. You should also instruct the harpist not to place the mic directly in front of another amp, as close proximity to very loud sound will trigger the noise gate to the "on" condition regardless of threshold setting).

I have found that ball type mics such as your Shure 565SD have a tendency toward tubbiness when cup miking a harmonica. A good substitute would be a Shure 545 or an AKG D190E wit with matching transformer. Both are easier to handle and seem to give a nice "edge" to amplified harp.

On your diagram you show the board and monitor feed coming from the line out of the Fender amp. I assume you mean the extension speaker jack unless the amp has been modified for a nominal +4 dBm line level output. If not, you must attenuate the speaker

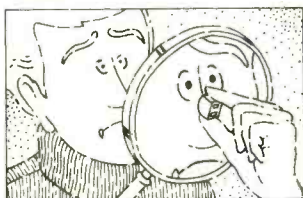


# ARE YOU BLAMING YOUR TAPE RECORDER FOR PROBLEMS CAUSED BY YOUR TAPES?

Every day people all over the country go into hi fi dealers with complaints about their tape recorders.

When in reality what they should be complaining about is their tapes.

Because the fact is, a lot of the problems that plague tape recorders can be attributed to bad tape.



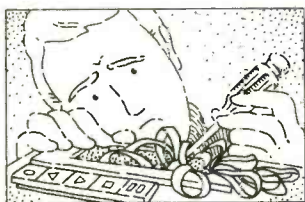
**HEAD WEAR IS CAUSED BY YOUR RECORDER. OR IS IT?**

If you have to clean your tape heads more than usual, for example, it could be your tape doesn't have a special nonabrasive head cleaner.

Maxell has one.

If your recorder jams, it can be any number of things. Maxell does something to prevent all of them.

We make our cassette shells of high impact polystyrene. And then so they won't crack



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**DROPOUTS ARE CAUSED BY YOUR RECORDER. OR ARE THEY?**

Maxell tape is made of only the finest polyesters. And then every



**POOR TRACKING IS CAUSED BY YOUR RECORDER. OR IS IT?**

step of the way it's checked for even the slightest inconsistencies.

So if you're having problems with your recorder, try a Maxell cassette, 8-track or reel-to-reel tape.

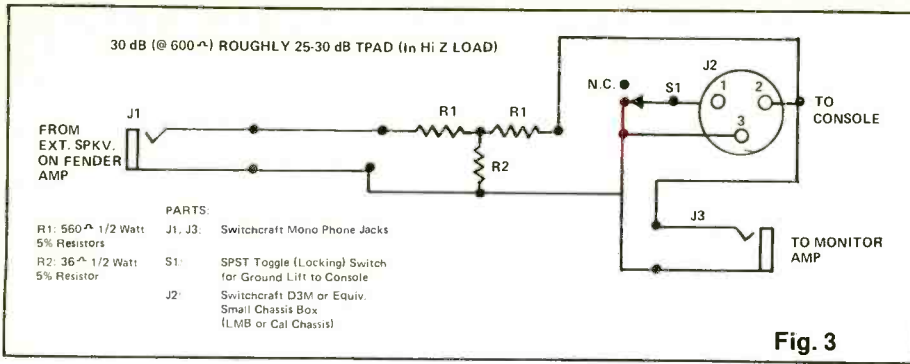
You might find there's really nothing wrong with your tape recorder, just with your tape.



**MAXELL THE TAPE THAT'S TOO GOOD FOR MOST EQUIPMENT.**

Maxell Corporation of America, 130 West Commercial Ave., Moonachie, New Jersey 07074.





level with a pad of some sort. A simple "T" pad will do the trick (figure 3). The illustrated network will drop the amplifier output level about 30 dB which will clean things up drastically. You cannot cleanly get a 5 to 10 watt signal to drive a mic or instrument input. Such a signal will cause gross amounts of distortion (the uncontrollable kind), cause system instability and alter the frequency characteristics enough to cause random feedback. (It can also damage your console pre-amps, line amps and power amps.) The piercing tonality is probably the result of the "Hot-Rodding" job on your Fender Princeton amp, especially when used in conjunction with the Mar-

shall 100 for monitoring. My advice here would be to restore the Fender to it's original condition (if possible) and use one of the mics I mentioned earlier. To overdrive the input, try using your MXR graphic as a frequency selective preamp and boost the controls in the harps' range to almost wide open. This should hit the amp pretty hard and yield a nice fat sound. If you must use the Marshall, try using the least sensitive inputs (the bottom ones, I think) and leave the tone controls as flat as possible. Marshall amps have a very hi-gain preamp which makes them pretty unpredictable for microphone reinforcement.

I realize that some of these sugges-

tions are reasonably expensive, but I think your main problem lies in the "line out" you are using for console and monitor feed. You can build the "T" pad for around \$10., and if you are presently using the extension speaker output, it will yield the greatest amount of improvement. The next step would be a switch setup for the mic and a new mic and last (but not least) try another monitor amp. I hope these ideas will prove helpful, and good luck with the Nightriders.

—Frank W. Fisher III  
Chief Engineer/Technical Director  
AFP Sound Reinforcement Systems  
Pasadena, Ca.

### A Costly Proposal

[The following is another response to the proposal made by Paul Beckwith in his question, "Locking Onto The Future," Talkback, December 1977, page 24.]

It is true that many recordists involved in semi-pro gear such as our TEAC Tascam Series are eagerly awaiting the announcement of "multi-machine SYNC" to be an added feature. We know the market is there, but presently

# Introducing the new Roland MicroComposer.

You've heard of word processing...and data processing. But have you heard of "music processing?"  
With the Roland MC-8 MicroComposer you can store...add to...delete from...re-

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But that's just the beginning. The list of additional possibilities fills an entire volume.

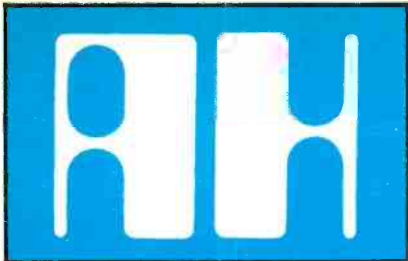
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it is not feasible in economic terms for either the recordist with his budget or the manufacturers with their marketing responsibilities to attempt it. The pricing structure for modifying and setting up two current stock machines such as our 80-8 would go as follows:

1) Two TEAC Tascam Model 80-8 Recorder/Reproducers for a total of about \$9000.00 without dbx interface (based on nationally advertised values, dealers determine their own pricing).

2) Between \$3500.00 and \$5000.00 for a third device which coordinates the two units (described below).

3) A few hundred dollars for an extremely high-powered audio amplifier as an independent supply for the 60 Hz signal used by the motors.

4) From \$500.00 to \$1000.00 in labor for required modification of the two decks enabling their transports to be independently regulated for synchronizing as well as the installation/interfacing of all three devices.

At this point you have what we affectionately refer to as a "kluge" which is very difficult to operate at best and may not work at all.

As you can see, the pricing as it stands now makes it questionable to do any-

thing but go ahead and get the 16-track unit in the first place. Now, the question of making the units at the factory such that they will be SYNC-ready comes into play. Truthfully, the pricing structure would not be much improved. Each machine would arrive pre-modified at the marketplace at a higher price, and everyone purchasing the unit would be paying for the option whether they intended to use it or not. The third device is still necessary. This provides the independent power for the motors as well as the SYNC-pulse regulating information. It also contains detection circuitry that recognizes the speed differential between the two machines and control circuitry to actually make the coordinating speed changes. This device may still run into several thousand dollars. Again, it doesn't make that much sense to go this route given the pricing breakdown when we already offer a 16-track unit with a nationally advertised value of less than \$14,000.00 (without dbx interface). And now, after all this, we must tell you that such a "multi-machine SYNC" system requires that each deck must give up one track for the SYNC-pulse information, making a total of 14 available

instead of the desired 16 tracks.

With all DC-servo controlled motors it does become somewhat easier. However, even a cost reduction of several hundred dollars is not very significant in that pricing category when it is so close to the 16-track unit already in production. And remember that with both DC and hysteresis-synchronous transport systems, the required modifications would necessitate expensive additional design changes and part substitutions in order to obtain UL-Approval for distribution in the United States, thus contributing to higher pricing.

The technology for this ability to synchronize tape decks was developed out of necessity by the film industry. From the beginning of movies with sound, there was a need to synchronize the film and audio equipment. It was a natural progression of research and development. However, we are not yet at the point where it can be applied to tape decks in this price range and still remain reliable and economically sensible.

So, you can see that we have considered it very seriously and would have incorporated it into our machines if it made practical and economic sense. But the question does bring the 16-track

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*Miserable acoustics, feedback, bland drum sound, hand held vocals, distortion. . . Sometimes it seems you can't win. You don't create these problems, but it's your job to solve them.*

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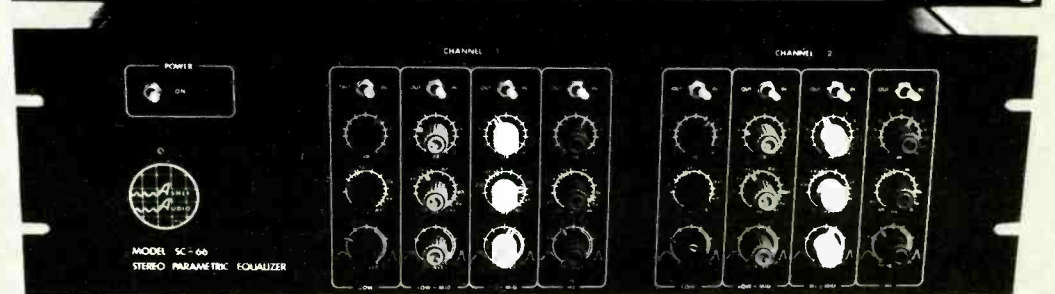
#### Model SC-50

**\$299** suggested list price



#### Model SC-66

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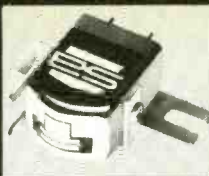
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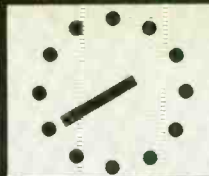




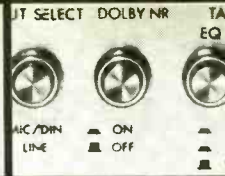
5 LED peak level indicators help eliminate distortion.



Long Life Sen-Alloy head improves performance, reduces distortion.



Automatic recording when you're not there.

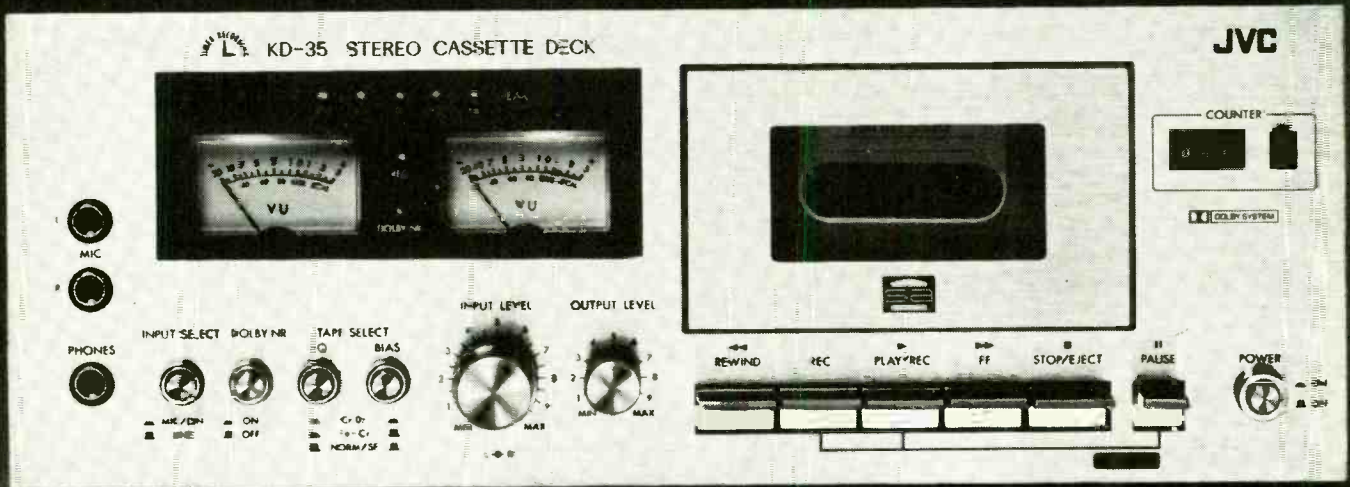


Dolby reduces tape hiss.



Bias and EQ switches for all types of tape.

# No cassette deck can give you better performance without all these recording ingredients.



Most quality cassette decks look pretty much alike on the outside. So at first glance you might take the new JVC KD-35 for granted.

But take a second look. You'll see something no other make of cassette deck has—five peak-reading LED indicators. With a faster response than VU meters, or even peak-indicating meters, they help you avoid under-recording and they eliminate tape saturation and distortion. It's as close as you can come to goof-proof recording.

Then there's JVC's exclusive Sen-Alloy head for record and playback. Designed to give

you the best of two worlds, it combines the truly sensitive performance of permalloy with the ultra long life of ferrite.

Of course, the KD-35 has many other features like Dolby, bias and equalization switches, and automatic tape-end stop in all modes. It's also possible to go from one operating mode to another without going through Stop. What's more, you'll never have to miss taping a favorite

broadcast because you're not there; just connect the KD-35 to a timer and switch to automatic record.

And yet, with all this built-in capability, the new JVC KD-35 is priced just above the least expensive model in JVC's new cassette deck lineup. Just imagine what our top model is like.

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machine into much clearer focus.

—Roy Kamin  
Consumer Relations Manager  
TEAC Corp. of America  
Montebello, Ca.

### Panel Pointers

The sketch below is of the recording system that I am currently in the process of assembling for my home. Inasmuch as I will primarily be using the system to record musical demos, I will also be using it to compile a musical cassette library. I am planning on housing all the components in a single console configuration with a master control board flush mounted somewhere in the console. (Note: control panel is indicat-

ed by black-ruled box.) I have several specific questions regarding the setup and would also appreciate any general advice.

As I plan on using mini plugs (male and female) for the control panel, I was wondering whether there is any advantage in using any one plug type over another (i.e. phono, RCA, mini, etc.)?

What type of cable should I use to connect the various units to their respective input jacks on the control panel?

Should I ground all the units together as indicated by the sketch?

I would like to purchase a separate amplifier to be used to power about six sets of headphones (for monitor purposes). Are there specific amplifiers made for this purpose?

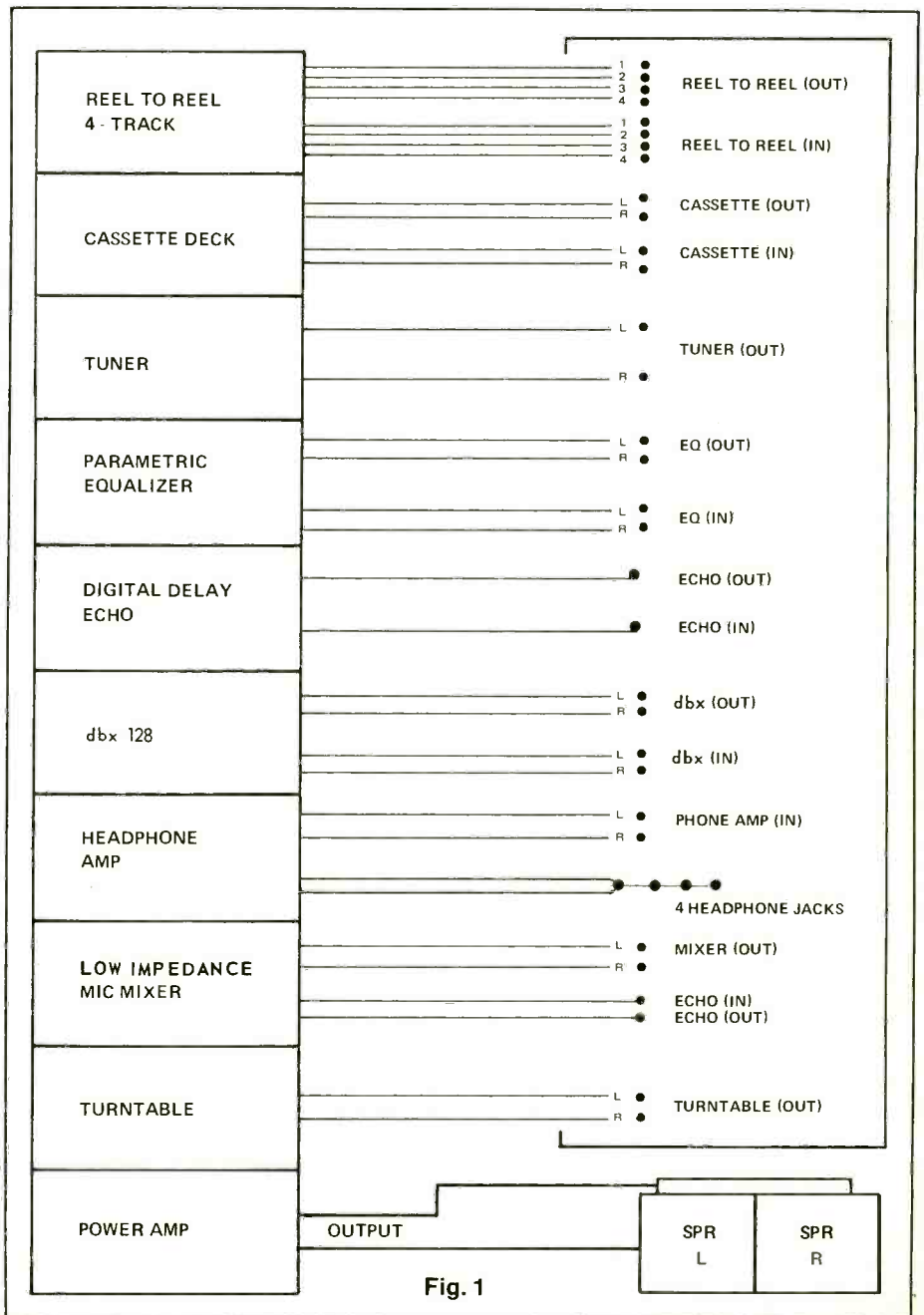


Fig. 1



# “EXPRESS yourself”

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dbx  
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Editall  
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el-tech  
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Soundcraft  
Sound Technology  
Sound Workshop  
Stanton  
Stantron  
STL  
Switchcraft  
Tangent  
Tapco  
Tascam Series  
TDK  
Teac  
Technics  
Tektronics  
Uni-Sync/TROUPER  
UREI  
White  
Yamaha



Can I utilize either the parametric equalizer or the mic mixer as a preamp to the power amp thereby avoiding the expense of buying a preamplifier? If so, will I be sacrificing sound quality?

In many cases, I will be remixing tapes back and forth from reel-to-reel to cassette. When using multiple effects at one time (echo, dbx, EQ, etc.), what is the logical order to connect these units?

I have noticed that the lights in my house have a tendency to dim and then flare (I assume this is due to inconsistent power flow or faulty wiring). What precautions should I take to insure that this will not interfere with the power going to my console? Should I have a new line installed directly to the console itself?

Thank you for any and all assistance you can offer in this project.

—Alex Lawryczenko  
Hoboken, N.J.

Your letter is of the nature that can best be answered point by point. The type of equipment that I will suggest is the type that I would personally use, keeping in mind the cost factor; that is, I would try not to use over priced equipment for first installation or expansion.

Your suggestion of using mini plugs—male and female—for the control panel is an excellent idea considering the alternatives (phono, RCA, etc.) because of their low cost and the fact you'll still have the ability to have breaking contacts on the plugs so that you can use "normals" in your patch bay.

I would suggest using small hookup cable of the single-ended type (one wire shielded). It is not necessary to go to the extra expense of rubber-jacketing since it will not be exposed wire. On your next point—should all of the equipment be grounded—yes, it should. Each individual piece of equipment should be grounded by a fairly heavy gauge, stranded wire connected to each piece of equipment. The next step in this process is to cut off the U-ground on all power plugs, if there is one, and then to eliminate the ground wire (the shield) on one end *only* of all the cables interconnected between this equipment or to the patch bay.

What type of amplifier should you use to power six sets of headphones? I suggest that you use a Crown D-60 or a BGW amplifier of the same power. These amplifiers will adequately power headsets without fear of overload.

You can utilize the parametric equalizer or the mic mixer as a preamp to your power amplifier. It is not necessary to buy a preamp for use between these units. In order to get the proper sensitivity and impedance match, try to match the output impedance of the equalizer or mixer to the input of the power amplifier. Normally the power amplifier has a fairly high input impedance and the output of the mixer or the equalizer has a low impedance, so would suggest using a matching transformer of about 50K to 600 ohms. This should give you plenty of gain and you will not sacrifice any sound quality.

On your next question, if you are going to use the three pieces of equipment you indicate in series, then I would suggest this order—first the equalizer, second the echo, and third the limiter. This seems to work best in the studio, if you are going to "series" these three components.

Finally, it is hard to tell why your lights flicker, dim, or flare, but the only practical solution to your problem is to get a power regulator and/or isolation transformer to completely isolate your system from the rest of your house and to regulate the power. This should take

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care of it, however, it is an expensive proposition and I would look into this carefully and weigh all of the problems that you have to justify the cost. Two reminders: 1) have a qualified electrician do all the AC work and 2) don't use ordinary household extension cords.

—Travis Turk  
Freelance Engineer  
Nashville, Tn.

### Crossover Considerations

I have a speaker rated at 40-2.5 kHz and another speaker rated at 50-8 kHz which I want to use in the same channel/enclosure. Must I use a crossover to separate the two speakers due to the difference in frequency response? They are both cone-type transducers.

The speakers are to be used for sound reinforcement. They are professional reinforcement speakers. Since there is no horn involved should there still be a crossover between the two speakers?

—Mark Di Colli  
Philadelphia, Pa.

The fact that "there is no horn involved" is not criteria by which to decide whether or not to use a crossover network.

Rather it is the operating range of the particular drivers or horns involved in the system design. The 50-8 kHz speaker may be ideal as a midrange unit in which case an appropriate crossover point would need to be determined and a suitable network designed. But, from the limited information given, it would be difficult to give a definite answer. Are the speakers 8", 10", 12" or 15" units? What is the impedance, sensitivity rating, and so on?

Since you are limited to an upper cutoff of 8 kHz, this would certainly not be a wide range professional reinforcement speaker system. Consider adding a tweeter to your system.

—Gary C. Gillum  
Manager, Industrial Division  
Klipsch and Associates  
Hope, Ar.

### Locking In New Capabilities

The following commentary is submitted in response to the contributions of Messrs. Wortman and Burns appearing in the December, 1977, issue on the subject of synchronization of tape recorders to provide added multi-track capability (see "Locking Onto The

Future," Talkback, page 24).

Reader Paul Beckwith wondered when someone would produce a sync-lock device to permit a pair of 8-tracks to be synched for added multi-track capability. He, along with Messrs. Wortman and Burns, will be happy to learn that it has already been done and the hardware is available.

The BTX Corporation, which is known primarily for video and audio editing equipment, introduced at AES a model 4500 synchronizer as an economical add-on accessory that uses standard SMPTE time code to synchronize any two recorders. The recorders may be of different makes and may even run at different speeds. The BTX system should be of interest to small studios who want to get into 16- or 24-track recording and who may only have one-half or one-inch recorders available.

Further information is available from the BTX Corporation, 438 Boston Post Road, Weston, Massachusetts 02193.

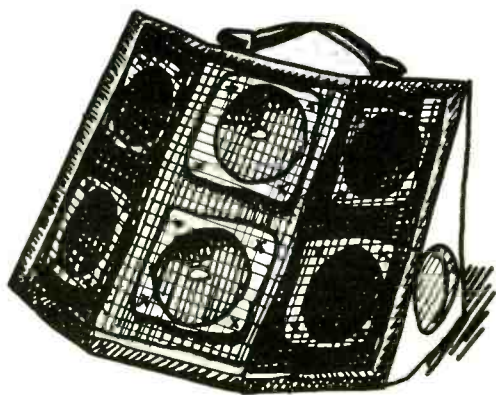
—Ronald C. Barker  
Director of Marketing  
BTX Corporation  
Weston, Ma.



# Whirlwind Audio Builds Quality

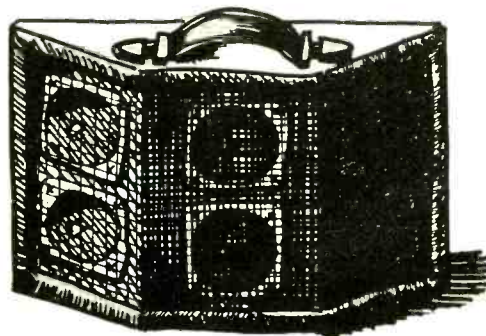
The

# GALE



The Gale speaker system (pair)—top performance in its price range for the semi pro musician—a perfect stage monitor for the strictly professional.

Each Gale cabinet comes standard with six 5 inch Altec drivers in each unit, or substitute two with JBL 2105 midrange drivers for greater brilliance. Triple angled speaker mounting gives maximum sound dispersion, and the Gale will stand up straight or lay back to 30° or 60°.



## Whirlwind Audio

P.O. Box 1981 Rochester, N.Y. 14603 716/663-8829

CIRCLE 55 ON READER SERVICE CARD



# Where superior technology makes the musical difference: Sansui's new DC integrated amplifier and matching tuner.

Sansui is proud to introduce the new AU-717 DC integrated amplifier and matching TU-717 tuner, designed for your greatest listening pleasure. We are proud of the superior specifications that our sophisticated research has achieved. The finest available at any price.

But the best specs alone don't always mean the finest music reproduction. And so we are proud that our precision engineering and superior circuitry design create pure and brilliantly clear sound quality that's distinctly superior.

Listen to what we offer. Frequency response of the AU-717 from main in, 0Hz to 200kHz (+0dB, -3dB), (the widest of any DC integrated amplifier available), gives you sharp, clean transients and greatly reduced phase shift problems. Total harmonic distortion is astoundingly low, less than 0.025%, from 10-20,000Hz. 85 watts/channel min. RMS, both channels driven into 8 ohms.

Dual independent power supplies provide true stereo separation and a large power reservoir. For uncorrelated stereo reproduction equalization is within  $\pm 0.2$  dB (20-20,000Hz, extended PIAA curve). And the calibrated

attenuator level control guarantees volume precision.

The matching TU-717 tuner features dual IFs and a wide bandwidth to let you select for lowest distortion (0.07% mono, 0.07% stereo) or maximum selectivity, 180dB. S/N is excellent: 50dB mono, 77dB stereo.

In addition, the AU/TU-717's are elegantly styled, offer rack mounting adaptors and are most attractively priced. Less than \$450\* for the AU-717 and less than \$320\* for the TU-717.

Listen to these brilliant new components at your franchised Sansui dealer today. When you hear the new Sansui AU/TU-717's, you will never again want to settle for less than the best.

Sansui. A whole new world of musical pleasure.

\*Approximate nationally advertised value. The actual retail price will be set by the individual dealer or his option.



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 Woodside, New York 11377 • Gardena, California 90247  
**SANSUI ELECTRIC CO., LTD.** Tokyo, Japan  
**SANSUI AUDIO EUROPE S.A.**, Antwerp, Belgium • In Canada Electronic Distributors

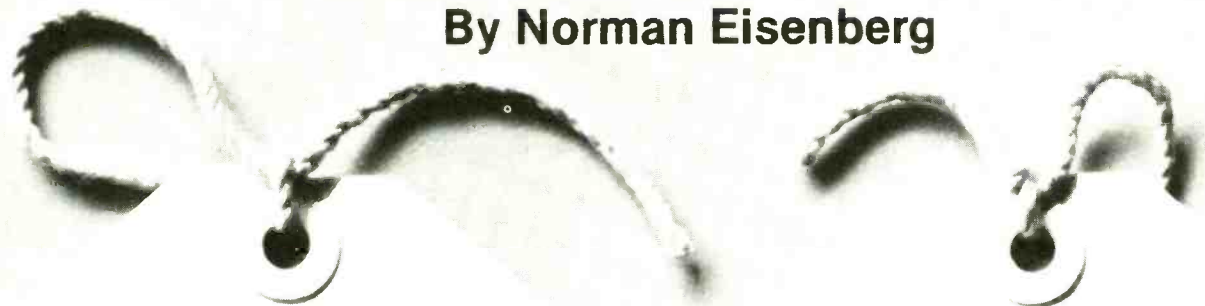
**Sansui**

CIRCLE 8 ON READER SERVICE CARD



# THE **PRODUCT** SCENE

By Norman Eisenberg



## TWELVE-BAND EQUALIZER

The EQ-12 from Musimatic of Decatur, Georgia is a monophonic graphic equalizer using twelve frequency bands with frequencies centered at 16, 24, 60, 120, 240, 480, 960, 1920, 3840, 7680, 10 K, and 15 kHz. Each band is designed as an 8 to 10 dB-per-octave slope, with  $\pm 15$  dB available at each point. The EQ circuit is a peak-and-dip type using tuned L, C, R circuits. Also included on the EQ-12 are a volume control and an in/out switch. Suggested retail price is \$197.31.



CIRCLE 8 ON READER SERVICE CARD

## "CLASS A PLUS" POWER AMP

The model SE-A1 from Technics by Panasonic is claimed to be the world's first 350-watt per channel Class-A DC stereo power amp. Circuit operation is described as "Class A plus" which is said to combine the virtues of traditional Class A (no switching or crossover distortion) with those of Class AB and B (higher efficiency). According to Technics, distortion at 1 kHz of full rated power is unmeasurable on the best modern measuring equipment. Each channel utilizes four power supply stages in this "bi-monaural constructed" amplifier. Yet, thanks to various design advances, the SE-A1 is no larger than a conventional amplifier of comparable output, and a cooling fan is unnecessary. Among its features are a peak meter, fade-in/fade-out muting, remote-controlled power switch, four sets of speaker terminals with independent level controls, and more. The amplifier weighs 112.2 pounds; dimensions are 1.7 inches wide; 9.8 inches high; 21.6 inches deep.

CIRCLE 12 ON READER SERVICE CARD

## NEW REVOX ANNOUNCED

Studer/Revox America, Inc. has announced the new model B77, a high-end open-reel deck with quarter-track or half-track head configuration. Speeds are  $3\frac{3}{4}$  and  $7\frac{1}{2}$  ips;  $10\frac{1}{2}$ -inch reels are accommodated. Signal headroom of 24 dB is claimed for both record and play. The bias oscillator frequency is spec'd at 150 kHz in order to keep oscillator harmonics well above the audible range even at the slower speed.

The recorder's bias is factory set for Revox 621 mastering tape, with which claimed response at  $7\frac{1}{2}$  ips is listed as 30 Hz to 20 kHz  $+2, -3$  dB. At  $3\frac{3}{4}$  ips the response spec extends to 16 kHz. However, says the company, similar response may be realized with other tape formulations via the recorder's easily accessible bias and EQ adjustments.

Other features include full electronic logic for transport control, large VU meters, LED overload indicators, built-in tape cutter and splicing block, muting circuit that disables signal electronics at start and stop of tape motion to prevent audible thumps, direct-drive capstan with frequency servo speed control for high accuracy in timing, and more. Suggested retail price is \$1,195.



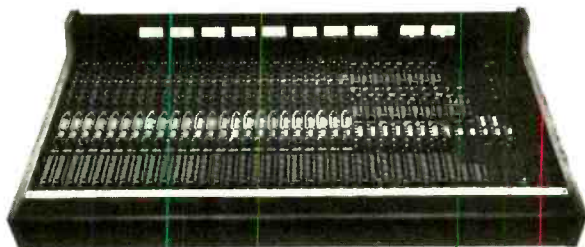
CIRCLE 11 ON READER SERVICE CARD



## TEAC DEBUTS NEW MIXER

Said to have been two years in research and development is TEAC's Model 15, a 24-in/8-out mixer in the Tascam series. The model 15 features new electronics, more head room and improved sonic quality. It grew, says TEAC, out of a need for more outputs for Tascam's 80-8 and 90-16 tape machines and "because feedback from the field zeroed in on such a unit."

Included in the model 15 are a switchable six-bank equalizer; new knob controls that allow pre- and post-fading for both cue and echo mix; two 8 x 2 sub-mixes that can be used separately or cascaded, and from which either bus or tape can be monitored and can be used for the control room and/or studio; new "feather-light" 100-mm sliding pot controls; etc. Plug-in modules are easily removed. The power supply for the model 15 is a separate unit. Advertised price is under \$9000 for the 24-in/8-out model; under \$7000 for a 16-in/8-out model.



CIRCLE 1 ON READER SERVICE CARD

## NEW AMPS AND CROSSOVERS

New rack-mountable power amplifiers and electronic crossovers have been announced by Quilter Sound Co. (QSC) of Costa Mesa, California. The amps—using circuits based on complementary pairs of epitaxial power transistors—are claimed to offer high reliability plus high performance. Power ratings range from 150 watts to 240 watts RMS. Typical distortion levels run to 0.25 percent THD, and 0.5% IM. A slew rate of 8V/usec is claimed for each model, plus thermal cutout, current-limiting short-circuit protection, and fused outputs.

The QSC electronic crossovers utilize full active high-pass filters with complementary low-pass drivers with a 12 dB/octave slope, and a Bessel filter response. As compared to the more common Butterworth curves, this circuit is said to provide optimum phase response and perfect high/low frequency matching. Two models are available: a stereo two-way, and a mono two-way with a built-in 70-watt (RMS) high-frequency power amp.

CIRCLE 4 ON READER SERVICE CARD

## SANSUI OFFERS NEW CASSETTE DECKS

The model SC-5100 tops the new Sansui line of cassette recorders, all of which feature "directomatic" front loading for convenience. The new format also permits visual checkout of the amount of tape remaining, plus direct access to heads. A "tape lead-in" feature permits the user to skip the beginning portion of a cassette to bypass the leader or that section where the formulation may not be



suited for optimum recording. The SC-5100 uses feather-touch solenoid controls, logic IC-coupled. Automatic memory, repeat and unmanned r/p in conjunction with an external timer are possible. The two-motor transport uses a frequency generator servo motor for capstan drive and a DC motor for winding. Separate bias and EQ switches are included, plus a Dolby system, mic/line mixing, peak-level indicator and built-in limiter. Response with CrO<sub>2</sub> tape is rated within  $\pm 3$  dB from 30 Hz to 14 kHz, and S/N before Dolby is listed as 57 dB. Advertised price is \$600.

CIRCLE 6 ON READER SERVICE CARD

## AIWA CASSETTE DECK HAS BIAS FINE ADJUST

A special knob for fine-adjusting bias when using LH tape is a feature of the new AD-6550 front-loading cassette recorder from AIWA. Another unusual feature is a meter that times the remaining tape and provides advance notice of how much longer it can be used. The AD-6550 includes Dolby noise-reduction circuitry; two-step peak-level indicators; oil-damped cassette eject and control button; memory-rewind; a 3-step bias and a 3-step EQ selector; and quick review/cue. Priced at \$450, the recorder is distributed by Meriton Electronics of Moonachie, N.J.

CIRCLE 3 ON READER SERVICE CARD



## MUSIC DISTORTION INDICATOR

Crown DC-300A and D-150A amplifiers now incorporate IOC (input-output compariator), a new system that analyzes the amplifier's input and output waveforms, notes the difference, and reports it via an LED display on the front panel. Whenever rated distortion levels are approached (THD or IM levels of 0.05%), the IOC is triggered. In this way, the user can detect while listening any overload or nonlinear behavior of the amplifier; a built-in correction signal then matches the output to the input again. The IOC option—which may be added to existing Crown amplifiers for \$50—is also claimed to increase S/N ratio from 100 dB to 115 dB. Another new Crown option for its D-150A and DC-300A amplifiers are handle/rack mount assemblies, priced at \$20 a pair.



CIRCLE 7 ON READER SERVICE CARD

## NEW SIGNAL GATE HAS MANY APPLICATIONS

Symetrix, Inc. of Seattle, Washington has announced its Signal Gate, a device designed to fill the need for a program or externally controlled audio gate in music and film recording, in sound reinforcement, and in broadcast applications. Its adjustable threshold noise gate is intended for the elimination of hum, tape hiss, effects-pedal noise, and so on. The signal gate can be used for tightening up drum and other tracks by eliminating excessive decay or reverb. An external control input also permits developing special effects, such as using one audio source to gate on and off another audio signal. This input also may be controlled by a low-frequency oscillator to create tremolo effects on any track fed through the gate. Controls include independently adjustable attack, release, range, and threshold, an in/out switch and the external control jack. Two front-panel LEDs show threshold status of the program or the external control inputs. Supplied in a 19-inch by 1¾-inch rack-mount, the Signal Gate retails for \$249.

CIRCLE 16 ON READER SERVICE CARD

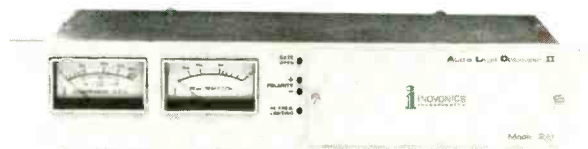
## AMPLIFIER USES THREE POWER SUPPLIES



The M-3030 stereo power amplifier recently shown by JVC features three separate power supplies—one each for the Class-B right- and left-channel power drivers, and one for the Class-A pre-driver stages. Construction is of the "twin mono" type to suppress crosstalk distortion. The M-3030 is rated to deliver 100 watts per channel, minimum RMS, into 8-ohm loads with no more than 0.05% THD from 20 Hz to 20,000 Hz. The frequency response at the 1-watt level is spec'd as within +0, -dB from DC to 100 kHz. The M-3030 weighs 42.2 pounds; dimensions are 16 5/16 inches wide; 11 13/16 inches deep; 6 5/16 inches high.

CIRCLE 10 ON READER SERVICE CARD

## NEW DEVICE OFFERS THREE FUNCTIONS



Inovonics, Inc. of Campbell, Ca. has announced its model 221 Audio Level Optimizer II which incorporates an automatic gain control, a compressor and a limiter. AGC is accomplished by a gated gain-riding amp circuit that compensates for long-term variations in program input levels over a ±10 dB range at a correction rate of 0.5 dB per second. Control over program dynamics is provided by a gated open-loop compressor. Limiting is handled by a fast peak action that prevents overmodulation with program-controlled phase inversion and adjustable limiting symmetry for AM, while for FM a separate 25-/75-microsecond high-F limiter is provided. Primarily designed for radio broadcast use, the model 221 is described as applicable to TV audio, as well as for dialogue recording and sound reinforcement. Price is \$760.

CIRCLE 13 ON READER SERVICE CARD



## LOGIC-CONTROLLED TURNTABLE

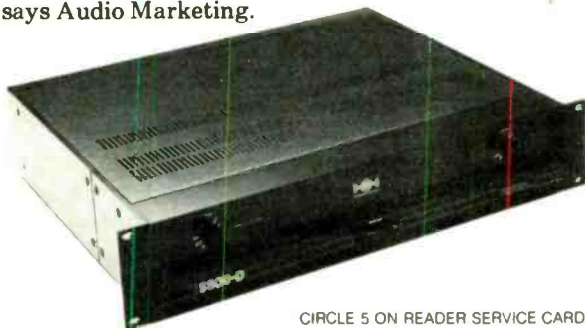
Not known particularly for turntables (up to now) the firm of Mitsubishi has announced its second model, the DP-EC2 priced at \$400. Logic-controlled and using direct drive, the new table comes with base and dust cover, and it may be used manually or automatically. Micro-switches govern all functions and a strobe reads out speed via LEDs. The tone arm uses butyl rubber in the counterweight for damping, and the one-piece headshell has a slide that accepts any cartridge.



CIRCLE 2 ON READER SERVICE CARD

## NEW HUSKY POWER AMP

The HH Electronics model S500-D two-channel amplifier—distributed in the U.S. by Audio Marketing Ltd. of Stamford, Conn.—is rated for 500 watts per channel. Dimensioned to fit a 3½-inch rack space, the S500-D is offered for PA applications. Its high damping factor is claimed to help extend speaker life by reducing over-shoot and doubling. The unit also is said to be 50 percent more efficient than conventional amps, and forced cooled dissipators keep it cool even with 2½-ohm loads. Its modular output section can be replaced in minutes, says Audio Marketing.



CIRCLE 5 ON READER SERVICE CARD

## SOME INTERESTING READING

Among the reams of literature from manufacturers we often come across a few choice items that go beyond product description and delve into basic theory or design philosophy. Expectedly, not everyone is going to agree with a particular approach or viewpoint, but studying these releases is edifying in itself and can lead to some probing discussions.

For instance, accompanying the literature on the new Studer/Revox tape recorder is a paper (prepared by Advertising Assistance, Inc.) titled "About This Business of Switchable Bias in Tape Recorders." This paper challenges the idea of offering front-panel switchable bias and explains why Willi Studer, who engineers the Revox, prefers bias and EQ adjustments to remain in the realm of the technically sophisticated. The same paper also pooh-poohs the use of test tapes as "another over-rated accessory."

In another product area, there's a brochure from Tandberg called "An Update Report on the Scandinavian Alternative." Primarily a technical rundown on Tandberg's series 2000 receivers, this publication goes into various performance specifications including some fairly recent areas of interest such as slew rate, phase linearity, dynamic intermodulation—explaining and relating them to overall audio performance.

From the Ken Schaffer Group, Inc. there's a paper dealing with "Wireless Phenomena Exploding in Rock" which deals with the use of wireless systems for "live" performers and makes the rather startling statement that, "Every single major musician now wireless is wireless with the Schaffer-Vega Diversity System."

The new manual/catalogue (\$3 price on this) from Community Light & Sound, Inc. of Philadelphia contains a good deal of carefully explained and beautifully illustrated technical basics in addition to product descriptions of various horns, cabinets, drivers and accessories, systems design, plus a section detailing comparative measurements with other brands.

Finally there's a series of updated booklets and brochures from AKG describing their microphones, reverb units, headphones, and phono pickups. These publications attempt to explain as well as sell the company's products; the booklet "Microphones and Accessories" contains an excellent section on interpreting mic specs.





# MUSICAL

# NEWSIGNALS

## ■ SOUND REINFORCEMENT ■

Ashly Audio is a respected name in professional sound reinforcement, and their SE series of top quality, portable mixing consoles should help spread and bolster their reputation. Physically, the SE series is designed for low weight and portability without sacrificing durability. Several configurations, up to a 32-in, 8-out model weighing only 130 pounds, are available for recording, PA or multiple-mix monitor mixing applications. Much effort was expended in the electronic design of the mixers to bring the noise and distortion to the lowest levels possible. Discrete transistor or hybrid circuitry is used in all low-level or noise critical areas rather than the more typical integrated circuit op-amps. Where ICs are used, in applications where discrete circuitry doesn't offer any advantage, they are state-of-the-art devices and are mounted in sockets. The input stage of the SE series consoles uses a shielded transformer and a low-noise preamp stage with LED overload indicator, and was designed for a 127 dB dynamic range. The summing amplifiers, usually a noise-critical section, are said to be within a few dB of the theoretical noise limits at about 100 dB signal-to-noise under operation conditions. Each input of the SE series mixers features a three band "semi-parametric" equalizer with continuously variable boost or cut and continuously

variable frequency; boost and cut range is  $\pm 15$  dB, and the curves are broad to prevent a "peaky" sound. Each sub-master channel has a built-in limiter to help control signal levels; the limiters have controls for attack, release and compression ratio, and may be bypassed if desired. The sub-masters and outputs each have four-band parametric equalization. Each equalizer band has a  $\pm 15$

dB equalization range, a 50:1 frequency range and a bandwidth which is variable from 3-1/3 octaves to 1/20 octave in width. Metering is by tricolored LED arrays which read either average level (much like a conventional VU meter) or true peak levels.

CIRCLE 4 ON READER SERVICE CARD



## ■ POWER AMPLIFIERS ■

Musimatic, Inc. was founded four years ago as an amplifier and electronics repair shop, and over the last two or three years the business has been expanded to include the manufacture of a complete line of PA equipment from mixers through speaker units and including the L500 Power



Amplifier. The L500 is a high-power, solid-state unit rated at 200 watts RMS per channel into 8 ohms (400 watts RMS per channel into 4 ohms). An unusual feature of the unit is its fully complementary circuitry, including the output stage which is rare in so powerful an amplifier. Mechanically the L500 is designed for maximum ruggedness. A reinforced aluminum front panel is used to enable mounting the amp in 7 inches worth of a 19-inch wide rack and two cast handles are provided for greater ease in handling the 44-pound unit. Both sides of the chassis are covered with heat sinks totalling over 1000 square inches of radiating surface, and thermal cutouts and a DC crowbar circuit are standing by to prevent circuit damage in case of



malfunition or improper connection. The power supply design includes a 1.5 kilowatt transformer, high-current rectifier bridge and computer-grade filter capacitors to provide plenty of reserve power for even a demanding, sustained, low-frequency signal. All connections to the Musimatic L500 are located on the back panel; inputs are ¼-inch phone jacks for convenience and outputs are 5-way binding posts (banana jacks) for their high current-carrying capacity and versatility.

CIRCLE 5 ON READER SERVICE CARD

## MONITOR SPEAKERS

Packaging of speaker cabinets has always been a problem since some sort of protection is necessary yet individual road cases would be too heavy, too bulky, and probably much too expensive. Amanita Sound, Inc. has come up with an interesting solution in their 1917 Series A Monitor Speakers. The secret of these wedge-shaped enclosures is that they are molded of that almost indestructible airline-approved low-density plastic and that they are designed to be latched together face-to-face in pairs forming totally-protected units. Each half of a Series A monitor pair contains an Electro-Voice EVM12L and an AmpereX soft dome tweeter whose baffle board is shock-mounted within the enclosure. The speaker may be placed in one of several positions for 90-degree, 70-degree or 30-degree orientation. Also available from Amanita Sound are the Series 3018 guitar and keyboard speaker cabinets which are rectan-

gular designs with latch-on protective covers.

CIRCLE 7 ON READER SERVICE CARD

## MIXING CONSOLES

Three new compact mixers using the latest BIFET integrated circuit technology are the products of Biamp Systems. These new-generation circuits significantly reduce TIM distortion and slew-rate induced distortion which are coming to be recognized as important factors in the overall sound quality of electronic devices. Biamp's model 6702 is a 6-input stereo mixer for rack-mount or console operation. Each input channel has low- and high-level un-

master section has master controls for left and right outputs, monitor, effects send, reverb level and pan and auxiliary level and pan. The models 8802 and 1282 are 8-input and 12-input stereo mixers with identical features, which include transformer balanced inputs, preamp outputs, three-band EQ, and linear faders in addition to the features of the 6702.

CIRCLE 10 ON READER SERVICE CARD

Low-cost, rack-mount mixers are proving to be among the most popular items in the PA field, and another new model is now available from Intersound. The 8 by 1 is a basic, 8-input mixer with provision for stacking to obtain more inputs. Each channel has



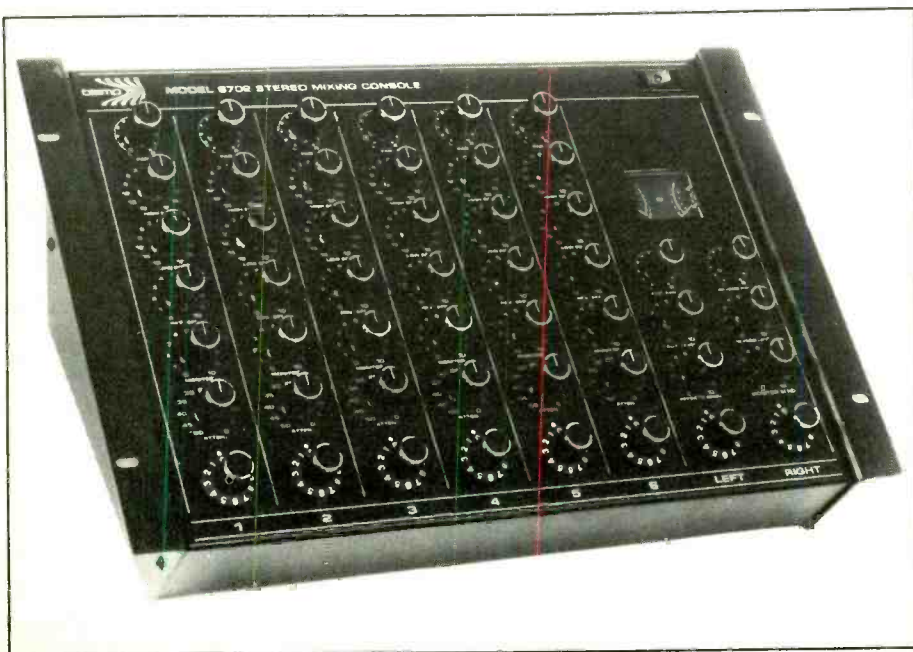
balanced inputs, attenuation control, pre-EQ monitor send, post-fader effects send, low- and high-frequency EQ, panpot and rotary fader, while the

low- and high-impedance inputs, controls for bass and treble EQ ( $\pm 20$  dB range), reverb send and channel volume. Total harmonic distortion is specified as less than .015% at a 7.5 Volt RMS output, maximum output is  $-22$  dBm and equivalent input noise is an excellent  $-129.5$  dBm.

CIRCLE 11 ON READER SERVICE CARD

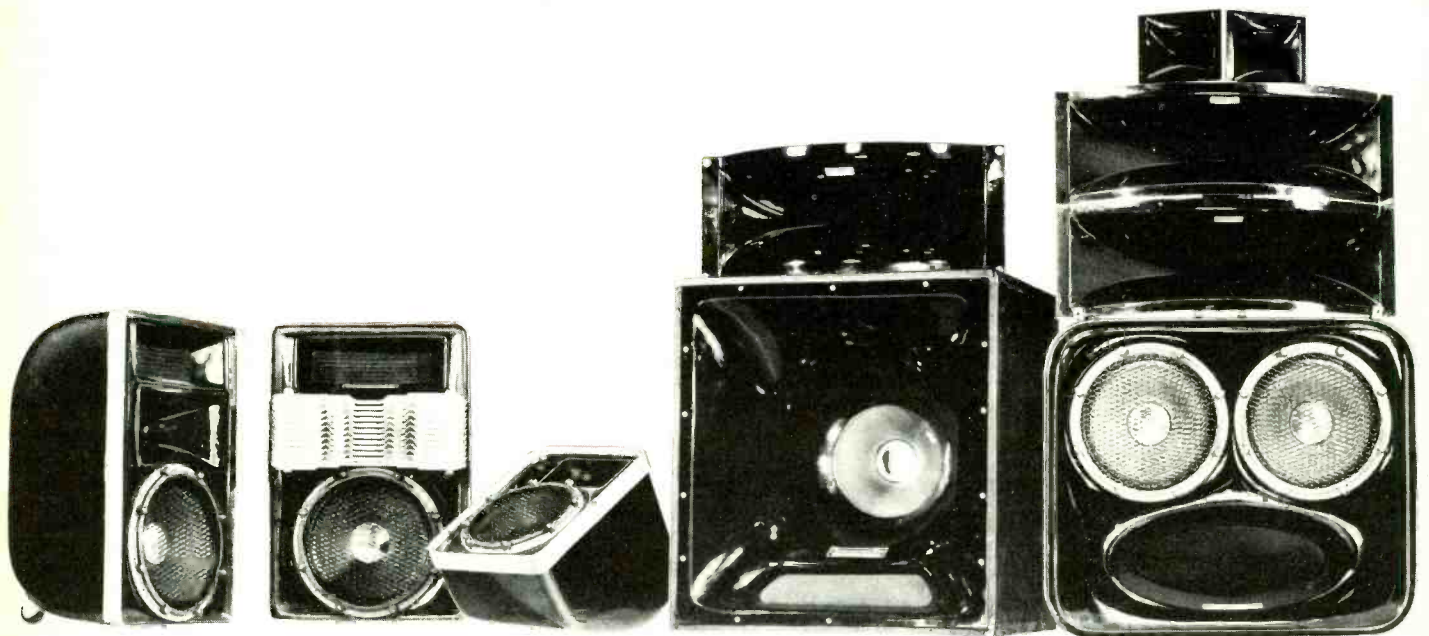
Audio Marketing, Ltd. has announced a new 12-in, 2-out mixer from the English manufacturers Allen & Heath, called the SD12-2. Each channel of the new model features low impedance microphone and line-level inputs, preamp gain trim control, four-band EQ, cue (or monitor) and echo sends, stereo panpot, solo switch and direct output jack. The output section includes a headphone circuit and illuminated VU meters as well as the customary master level controls. One of the most remarkable things about the unit is its size, which is a compact 20"x17"x3½", and the price, which is under \$1000.

CIRCLE 9 ON READER SERVICE CARD





# Come here, kid. I'm gonna make you a Star!



The soaring purity of a performance that takes your breath away, the crowd-catalysing thunder that starts a rush for the stage — that is not the sound of a little box stuffed with cheap components. Look beyond the spotlights and under the dirt and bruises of a hundred one night stands and you'll find Community, the equipment that professionals depend upon to electrify their fans in city after city. Why Community? Because it's the best there is.

We've devoted the last ten years to developing the ultimate in p.a. equipment for people who make their living by their sound: professional musicians, contractors, touring companies of all shapes and sizes and the up-and-coming

bands with smart management. We'd like to add you to the list. Too many talented musicians lose out because they're burdened with equipment that can never produce the professional power and punch that could put them over the top.

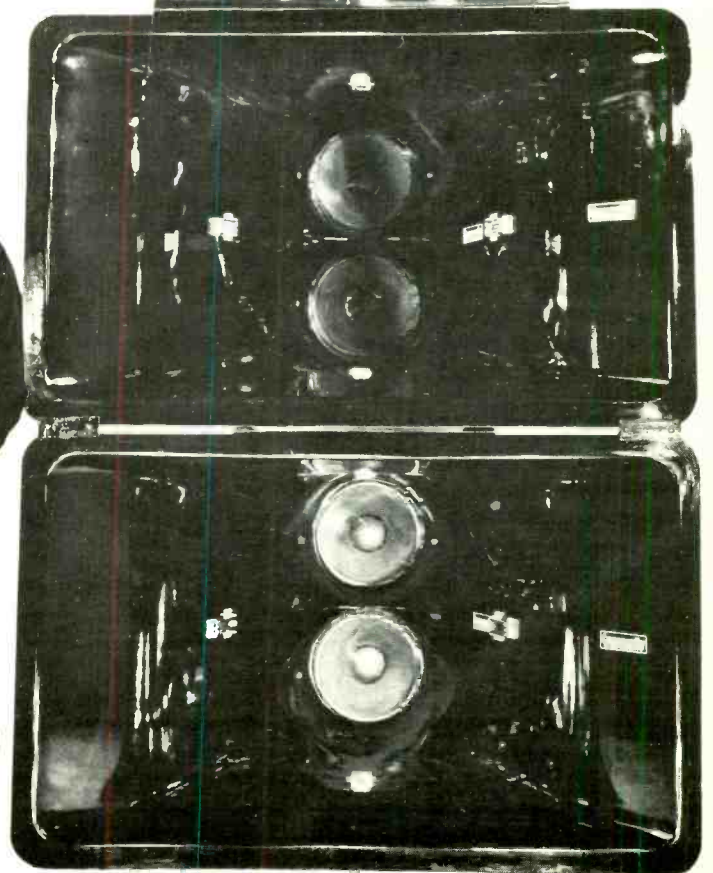
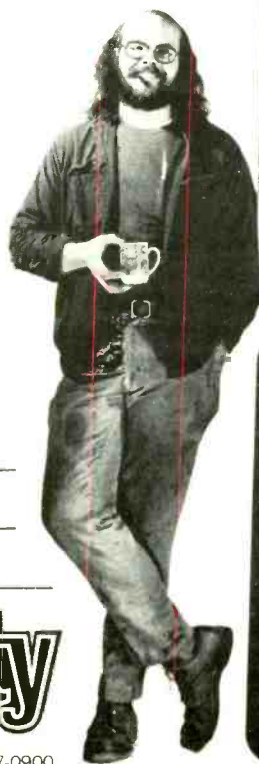
Your Community dealer can demonstrate a system for you that can start you on your way today. And tomorrow, when you've got fifty thousand ears to please, he'll be ready with another Community p.a. that will knock their socks off.

You know you're good.

Now it's time to tell everybody else.



Don't ever let anyone tell you that stars aren't made. It happens every day. And one item that can make it happen a lot sooner is professional sound equipment.



Want some more information?  
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CIRCLE 76 ON READER SERVICE CARD



# LEAD ZEPPELIN



Photos by Neal Preston



# THE SHOWCO MUST GO ON

By Gil Podolinsky

High volume is an essential aspect of the "live" Led Zeppelin sound, and therefore, the band requires a sound system capable of producing that high energy volume for upwards of 50,000 people a night. The Showco sound company has "done" Led Zeppelin since the group's first U.S. performance, and Rusty Brutsche, one of the three partners in Showco, has been their engineer. Both he and Keny Whitright, speaker design specialist with Showco, were at Seattle's Kingdome (for hall specs and comparative story on how Clair Bros. sound reinforced the same building, see *MR* December '77) for a sold-out concert of Led Zeppelin.

Showco, a full production company that employs 120 people, offers both lighting and staging in addition to sound reinforcement. Originally conceived by Jack Calmes in 1965 as a management company handling such acts as Bloodrock and Freddie King (as well as sponsoring the 1969 Texas Pop Festival), Calmes went into partnership in 1970 with Rusty Brutsche, who was then working for the Texas Instrument Company, and Jack Maxson, who was then operating a recording studio. Together they changed the emphasis of Showco to what it is today. The three had met in college, and played in a band together to work their way through school. With a degree in engineering, Rusty's hobby was tinkering with PA systems. He tinkered to the point where promoters began renting out his system.

Showco's first system, by Rusty's own admission, was "really crude," consisting of [Altec] A7s, Fender Showman bottoms, tube amps strung out everywhere and Altec mixers. As the system went into constant use it was updated with JBL equipment. They also asked JBL for advice in system design. JBL designed a 400-watt system with two single 15-inch rear loaded bass cabinets a side, a JBL lens horn and one radial horn bi-amped with a passive crossover. Showco had confidence in the system when they were contacted to provide the sound for a Mountain concert—until guitarist Leslie West rolled up with a semi full of Sunn amps and blew their PA off the stage. This immediately forced Showco to do its own research and development. "At this point (1970)," Rusty says, "people

hadn't the faintest idea what was needed for rock and roll."

## Showco Speaker Design

The man responsible for speaker design at Showco is Keny Whitright. He was an electrical engineer when hired, but the company needed work in the area of speaker design for they were still operating with two-way systems. At the time, Showco had no one qualified to deal with the problem so it was given to Whitright. He began what he fondly recalls as a tremendous learning period by reading everything that Paul Klipsch published, feeling that Klipsch is the primary horn advocate. What impressed Keny is that not only does Klipsch state that horns are good, but that he also tries to back it up mathematically. The published information enabled Whitright to understand how to mechanically design horns. With speaker design all fairly well documented, the concept as Keny saw it was to take the parameters of horn design, which were applicable to their needs in rock sound reproduction (i.e., high efficiency primarily), and to stack horns in such a way as to be able to control directivity.

The first design needing attention was the bass cabinet, where they began with a bass reflex, then on to a loaded horn and finally to a folded horn. The specific design utilized is that of a "W" box, modified to a size of 3' x 4', and thirty inches deep. Each box contains four 15-inch JBL K 130s and is designed to cover the 40-300 cycle range. Each box is powered by one bridged Crown DC-300A, driving 600 watts into an 8 ohm load. In designing the box Keny had the specific amp and load in mind. Everyone concerned was satisfied with the results because "we stopped blowing up speakers," which was part of the criteria for the design. It also fit the other characteristics Showco looks for in a box: (A), It fits in the truck, and (B), It is fairly portable. Seven-ply plywood is used in all Showco cabinet construction, held together with staples and glue. According to Whitright, the only thing a box won't withstand is a ten-foot drop.

With horns being the mainstay in the Showco philosophy, their four-way systems are broken down in terms of cycles in the following manner: low frequencies are 40-300 cycles; lower mid-



range or mid-bass cover from 300-800 cycles; 900-6,000 comprise the mid frequencies with the highs being 6,000 and up. The low frequencies are handled by the W box; the lower-mid by a long fiberglas horn they designed with a squeezed down throat, utilizing two 12-inch JBL K 120s per box, especially designed for high output and which functions like a compression driver; the mid and high frequencies are handled by three different kinds of horns. Showco uses the JBL 2350 90° radial, the standard of the industry; the JBL 2356, a fiberglas horn used for its long throw; and a long throw horn used indoors and designed especially for Showco by George Augsburg. The driver assembly of these horns is separate from the horn and is assembled at the hall. This allows the horns to be stacked up like paper cups, thus saving space in the truck and allowing ease of transport.

There are two applicable voice coil drivers for these horns, the JBL 2440 and the JBL 2482. The 2440 is lower powered but offers a higher frequency response. The 2482, originally designed by JBL to be a fog horn driver, has become the standard for this type of use. Its advantage over the 2440 is that it is able to take the power load because it has a linen cloth lens that's impregnated with phenolic. With this type of treated material it can take the pounding against the face plug of the compression driver and will not shatter like a 2440 will. For the high frequencies, Showco uses JBL 2420s and piezo tweeters. The 2420 is used on a lens horn, the JBL 2309, which Showco has bastardized by eliminating the lens and therefore achieving a shotgun effect as a result. To cover the highs on an outdoor system Showco built a smaller version of the Augsburg horn and stacks them four high to improve directivity.

Showco has discovered through experience that speaker cones are only good for one year—maximum—and are usually replaced twice a year, while the mid-range horns will last forever and the high end replaced once a year. Showco is utilizing a large number of high-end gear because of the Zeppelin power requirements, and because a lot of power is needed to push high frequencies out. The problem is one of the Catch 22 variety. In order to be able to handle high frequencies, the horn must be very fragile, but at the same time a horn or tweeter that fragile can't take the power-abuse necessary.

## High Frequency Reach and Temperature Variance

Keny pointed out that one of the problems involved in sound reproduction is the difficulty of accomplishing proper high-frequency projection. The more he looked at the problem, the greater the realization that air plays a major role.

"Sound evidently is affected drastically by thermal differences. Obviously the body heat of a crowd is much hotter *in* the crowd than two to three feet above it, and therefore layers are formed. If sound is down low, though while it appears to bounce off this layer, it is actually [being] focused upwards. In a hockey rink, for example, supposedly the opposite is true—sound will focus *down* on the ice floor.

The problem is similar to the illusion of water patches on the highway that disappear as you get closer. To eliminate the problem we wanted to get high enough to get above this angle and eliminate the total reflection. Our major concern when we started to put systems this high (30 feet) was the coverage down front. By tilting some cabinets down from that height we are able to project a lot of mids and highs in front of the protective barrier around the stage. After you've walked through a crowd during a show you notice that the mids and highs are a lot stronger when heard from a platform compared to what's heard at head height, so to compensate we've come down on the crowd so that the sound will not go over the heads of those close to the stage or in the infield."

## Monitor Design

A speaker column containing two 15-inch speakers, a 2482 mid-range driver and two 075 tweeters (all JBL) designed by Steve Desper for the Beach Boys several years ago has had quite an impact on the industry. Tycobrahe took the original design and hasn't changed a thing. Rusty Brutsche explains, "The concept of a full-range cabinet was pioneered by Tycobrahe who did it three-way. Clair Bros. took it one step further (four-way), but converted their entire system to it, which we didn't agree with because when you eliminate horns, you eliminate efficiency and you eliminate projection."

Showco's monitor cabinet is, by

their own admission, similar to Clair's S-4 cabinet. It's a four-way, full-range enclosure with twelve-inch speakers for bass, tens for mid-bass, Electro-Voice drivers for mid-range and JBL 075s for highs. They did alter the design, not liking some of Clair's components—"Everybody has his own idea on how a cabinet ought to be." Showco used to go with a three-way cabinet for monitor and front fill until discovering that four-way is the optimum. Rusty feels that the industry will stop at four-way, since five-way gains nothing and three-way is not adequate. Showco also developed the full-range box for use in small halls. An incredible amount of power has to be pumped into the cabinet before you get anything out of it, which is why Showco puts 2,000 watts in each. With a large system, for use in large halls, a greater sound level is obtained with much less power by picking up efficiency through the use of horns.

In order to increase the output capabilities of the cabinet, Showco changed the low-end drivers. Rather than using two 12-inch speakers for bass and two 10-inch for mid-bass, they use four each, which they feel, if nothing else, has increased reliability. They also went with Gauss 12-inch speakers.

Gauss is the first speaker company to claim to build speakers with wattage in the 150-200 watts RMS category (12-inch is 150; 15-inch & 18-inch are 200). Roy Clair was skeptical to non-believing when I asked him if this were true. Keny Whwright has tested the speaker for various uses. He began by explaining that in speaker evaluation there's a trade-off between power and efficiency. For greater efficiency the voice coil would have to be made with forty-gauge cable, which is impractical. The logical question then is: "Why not build better voice coils?" "You're limited by physics," Keny began, "you've got to be able to dissipate the heat of the voice coil and that seems to indicate having a very tight gap, and the tighter you make it, the more problems you have in a high-powered speaker because you've got to deal with the problem of excursion, so the tolerance has got to be enlarged slightly as the voice coil moves up and down. The wider the gap, the less power it will handle because the heat builds up.

"I did a series of tests a few years ago in search of the best way to get rid of the heat in the voice coil and came



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up empty. I discovered that speakers with cooling fins, like the Gauss or the Electro-Voice series they made for Kustom, tended to run cooler with the fins than without, over a two to three hour test. Gauss is on the right track for a high-powered voice coil because they used two spiders in the voice coil which help center it better and could tighten up a bit on the gap.

"We had a guy come by the shop two or three years ago who was winding his voice coil on a teflon bearing that actually slides up and down the pole piece of the speaker. It had good heat transfer ratio because it was virtually touching. He also eliminated the spider, which I thought was a good move because the spider limits the excursion of the speaker, *plus* a spring has non-linear portions. When you reach these non linearities, that's when the voice coil starts moving out of the center of the gap. If the spring is non linear it will also affect the sound. The other thing we're looking at are ferrol fluids, which offer a liquid base with magnetic particles. This forms a heat transfer medium to help dissipate heat. I'm not sure how effective it is, but the guys working with it claim almost double the power rating of the speaker. However, there seem to be other problems with it, like gathering dirt."

Showco uses regular lead guitar speakers in their full-range cabinet and then tune the cabinet so that it works in optimum condition. They feel that for a monitor, especially a vocal monitor, the cabinet is most effective, and that they can definitely tell that the Gauss speakers have added more volume to the output of the cabinet. Keny also discovered that by doubling the number of JBL ten-inch speakers in the mid-bass but keeping to the original column design in both height and crossover range of 800-1,000 cycles, the column became beamier than what was intended. To remedy the situation they broke the column in half and angled it, somewhat V shaped. Both the bottom and mid-bass are at 8 ohm while the mids and highs are 4 ohm. The mid-range is comprised of two Electro-Voice DH 1012 drivers mounted on a JBL horn that Showco is planning to replace with a design of their own.

But since the output of a cabinet is greater with Gauss speakers, wouldn't it be more efficient and capable of reproducing notes below forty cycles if Showco put 18-inch Gauss speakers in

their W box? "We tried that," Whitright explained. "There are definite limitations in what size speakers you can carry around. We've stopped our research because we've run out of truck space, plus we've reached a point where we're satisfied with the effectiveness of the system." Trucking, Keny pointed out, is a very expensive part of the business. With Showco doing up to eight shows at once—both sound and lights—they're forced to rent a fleet of trucks. Aside from the fairly high initial cost and high fuel cost, you end up with one more person on the road whose only trained function is driving a semi. Keny reminisced that before the sound business advanced this far, you did everything—designed the system, drove the truck, set up, etc. Now the extra cost is absorbed by the act and passed on to the ticket buyer. So, space is limited.

"Theoretically I guess some kind of horn that's made out of concrete and is twenty feet wide and ten feet high is probably the optimum for what we're looking for. Somewhere between what's currently available on the market and what would be theoretically optimum is where we're going to have to settle. We tried building a W box with four 18-inch Gauss, but the space requirements we gave to it—larger than the 3 foot by 4 foot with four 15-inch speakers we currently use—didn't give us any greater performance. It should go deeper (4x18" should reproduce lower frequencies than a 40 cycle note)."

The feeling at Showco is that while it is simpler to build a horn than a driver since mechanically a horn is a very simple device, the simplest being a funnel built out of wood, metal, fiberglass or anything that doesn't require a lot of technology, building a driver, on the other hand, requires a great deal of technical know-how and is something a company the size of Showco can't get into however much they would like. Whitright doesn't think their informal approach to horn design would work on driver design.

"We've seen a lot of good ideas going in that failed coming out. Our particular usage doesn't really justify building products just for us. It's like race cars vs. consumer cars. There are a lot of things that are really nifty on a racing car that the consumer just doesn't need. Some manufacturers will listen and improve their products. Again, using JBL as an example, the K series guitar speaker is a result of

higher power being used in the speaker; it is identical to the D series except that JBL started using epoxy glue about five years ago which made the voice coil much less sensitive to temperature."

Previously, JBL used a glue that hardened but did not set. By remaining slightly pliable (which they were evidently looking for), the speaker remained susceptible to heat. When rock musicians came in with huge power amps, the glue used to melt as the speakers heated up, separating the spider and causing the voice coil to slide around. By going to epoxy these problems were eliminated.

## The System

The system used for Led Zeppelin in Seattle's Kingdome is a combination of Showco's indoor and outdoor systems, and is the same system that has been used throughout the tour. The indoor system is capable of delivering up to 30,000 watts and is normally hung on a tri-level hanging rig with aluminum trusses. The outdoor system delivers more than twice that wattage-wise, utilizing a greater number of long horns which add greater power and efficiency. Combining the two will mean a system comprised of thirty 2356s; forty super high Showco horns with 2420 drivers; sixty to seventy mid-range drivers; fifty high-frequency drivers; fifty W boxes, each utilizing four 15s; and 36 mid-bass boxes each containing two twelve-inch speakers.

The radial horns from the indoor system are all double drivers, which enable you to get roughly 3 dB more output in the same size cabinet. The other way of doing it is to take the driver and put it on another horn, more efficient but for the fact that it will then take up twice as much truck space. So, the "Y" throat JBL serves as a good compromise. The radials are stacked three or four high to narrow down the vertical pattern. They are beamier and are able to hit the back of the hall.

In this 60,000 plus watt system designed to meet Zeppelin's overwhelming volume needs, half of those watts are used for bass, with the other half divided among mid-bass, mid-range and highs. The system is set up on a thirty foot scaffolding with levels of ten, twenty and thirty feet. The first two tiers are low frequency and are that way in order to improve the over-



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all height and vertical dispersion of the speakers, enabling the sound to be directed toward where there are people. Showco uses English scaffolding due to its strength and because it does not have awkward cross-bracing. They neither own nor set up the scaffolding, but rather spec and hire out. While the indoor system takes six to eight Showco personnel, this tour requires ten plus sixteen stage hands to be able to set up the system in eight hours. Since Showco incorporates four or five different size cabinets, they must use a fork lift. They are quick to credit Clair Bros. for their hoist concept which enables Clair to overcome the 30 foot high limitation of a fork lift and gain an additional ten feet. This is possible because Clair Bros. only utilize one type of cabinet in a show this size.

All equipment is stored and maintained at Showco's 40,000 square foot shop in Dallas. Since Showco usually ends up having to build something to order for each act, and since they handle fifty acts like The Who, Zeppelin, McCartney, Genesis, Ronstadt, James Taylor, Jackson Browne and Bad Company, as well as all CBS conventions, it's not to anyone's advantage to have a series of depots all over the country. As a result, everything must be driven out of Dallas. Eight semis are used to transport staging, lighting and sound for Led Zeppelin. The advantages in having to deal with only one company for everything related to concert production should be fairly obvious. The cost? It varies depending upon the mileage and the number of dates during a given period of time—and the deal Showco has with the group. Obviously it's cheaper if it's a tour rather than a one-night stand. While there was a rumor circulating that it cost McCartney \$100,000 to play the Kingdome last year, Brutsche was quick to say that the figure was an exaggeration and that the actual cost was less than half that amount.

## Power Amps

While the Kingdome can supply 600 kva, Showco will only need 20 kilowatts, or 100 amp single phase to run the system. Asked as to what brand(s) of amplifiers they use, Keny Whitright will grin and state that he feels that Showco is a walking ad for Crown. They tested a number of major and home-grown brands and found that for their needs Crown seemed to be the

most reliable. One of the features that Showco especially liked was the five pair of output transistors on each channel. Showco only uses the model DC-300A.

One of the main goals of Showco is standardization of its equipment so that the staff doesn't have to concern itself with several different pieces of equipment that perform the same function. So, with only one amp to inventory, the technicians know how to service one amp and the road crew knows how to set it up, making replacement simple. When you are limited time-wise in concert preparations, this approach makes for a near foolproof method.

Showco owns 500-600 Crown DC-300As, many of which are used in a mono capacity. Each W box uses one Crown bridged for mono so that it will deliver 600 watts a cabinet. In terms of durability Rusty Brutsche feels that the amp could last forever, citing a McCartney tour that covered England, Australia, America, back to England and then the Continent and finally back to Dallas. All this in a four month span, and only one or two of the amps failed. This reliability he credits to the fact that there is nothing in the amp to wear out, as well as the way that Showco packs their power amps in cabinets such that a rack could fall off the scaffolding and not damage an amp. 150 Crowns, including twenty used for the monitor system, are employed on the Zeppelin tour.

Showco does not believe in noise reduction, feeling that the crowd noise is above the normal electronic noise. They also don't use compressor/limiters. They used to use them regularly in the early going as a protection device but found that when used in that manner it severely degrades the sound. For the past year they have been working without an overall limiter, though they do use a limiter on bass guitar or somewhere where it can be used creatively, not just as a device to protect the system, feeling basically that the protection device for the system is the engineer. Showco is able to take that stance since most of the acts that hire the company also allow a Showco engineer to do the mixing. The final consideration in terms of system protection is to put enough speakers on each amp so that even at full clipping the speakers will take the load. While it won't sound very good, at the same time it won't fry the speakers.

Nor does Showco believe in acoustic

analyzers. "That's really the bullshit end of the business," Rusty states. "What you'd need is every mic going through a computer to get a read-out on the curve. With only one mic, it's worthless. Besides, it all changes when the kids get into the hall."

With the exception of the monitor system, the sound systems for both McCartney and Led Zeppelin are identical. With the number of musicians employed by McCartney as well as the fact that Paul played various instruments throughout the set, the monitors were stacked on the sides and augmented with floor monitors all over the stage. It is due to McCartney that Showco began hanging monitors, and he may well be responsible for an innovation in the industry. He was paying Showco extra money to hang the system in order to improve the sight lines, but with a wall of side monitors he wasn't gaining anything. So, he asked if the monitors could be hung as well. Showco experimented with it and found it quite workable. They are very happy with the results, for now a performer can't run across the stage and stick a mic in the monitor. The monitors are now hung twenty feet above the stage, making Showco's performance, and therefore that of the artist as well, much more consistent.

Zeppelin has never used floor monitors, preferring a clean stage so that Plant can move freely, which is a main part of the act. The monitor system for Zeppelin consists of six cabinets, each designed to handle 2,000 watts, or comprise a 12,000-watt system. Two cabinets are hung on each side of the stage for the front, with one directly behind drummer John Bonham and one extra large floor cabinet put on end for when John Paul Jones plays keyboards. There are three separate monitor mixes with one man running the front and keyboard, and another for drummer Bonham.

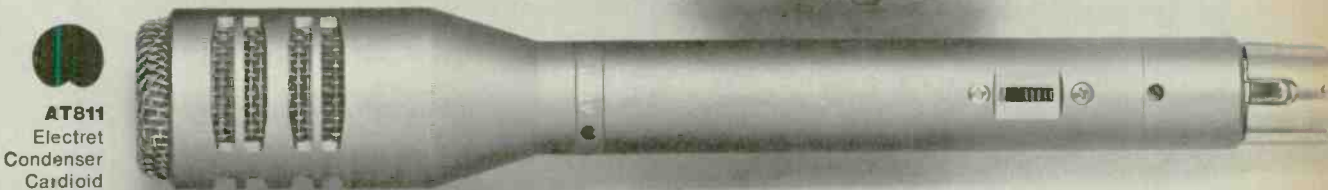
During the acoustic set three, 600-watt floor monitors are used for nothing but acoustic guitars. Here again Crown DC-300As are used, though not in stereo. Since the amp comes with two channels, Showco uses each side as they see fit. So, in the monitor system they will bridge the amp (use both channels) for the lows, bridge a second amp for the low-mids and the third amp is used as a two-channel amp, one side for mids and the other, highs. Stereo to Showco does not mean amp, but rather side of the stage. On the floor monitors, one amp



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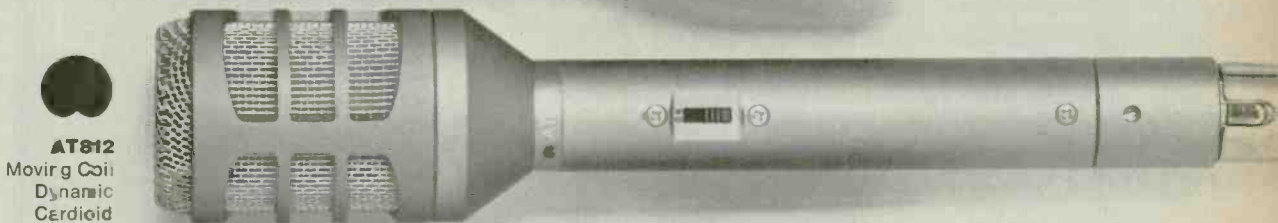
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will go to the same speakers, but one channel is for lows and the other highs. Therefore, Showco describes their four-way hung monitors as being powered in a discrete four-way, quad-amped fashion and driven by a four-way electronic crossover.

The two boards used in the monitor system are both made by Interface located in Houston. They are custom made in that Interface offers many variations in terms of options and components. Showco selected modules with the intent of the board being used in conjunction with much special equipment. The main monitor board is 24-in/8-out with the drum monitor board being 8-in/8-out. The special equipment used in conjunction with the boards is: the Showco Mixing Matrix, which will put any mix desired into any cabinet; the Showco Automatic Dip Filter, which was designed and is used to eliminate feedback; the Showco crossover, which is used on both the floor monitors and the full-range M-4 cabinet, with the right side being all EQ, utilizing seven graphic equalizers. Finally, an Aphex unit designed by Curt Knoppel of California (see *MR* October '77 for details) is used on Plant's vocals and the keyboards as well and is used to add brilliance and clarity. In asking the monitor engineer to describe its use further, he explained that it adds a certain brilliance that can't be achieved through any crossover. It is only used as a back-up, however, when the highs cannot be obtained by another method.

## Microphones

As Led Zeppelin's engineer, Rusty Brutsche has the final say as to what microphones will be used where. It is his belief that while some engineers in the sound business are fanatics when it comes to mic selection, he has found that with most hard rock groups you're dealing with such incredible volume levels that he defies anyone to hear the difference between mics. For him the most important quality that a mic can have is that it be rugged, and for that reason the Shure SM 548 is his mainstay. It is employed on Page's amp and on all of the drums except for the overheads which are a pair of unidirectional AKG C 451Es.

John Bonham wants a big, loud and powerful drum sound as opposed to a tight crisp studio sound. Every drum head is miked, including tympani and

gong, although the latter are only used during his solo, so there is no other sound with which those instruments must compete for the full attention of the mic. In order to get the sound Bonham likes, the snare, hi-hat and bass drum are miked front and back. All in all, fifteen mics are used on the drum kit alone. The bass and all keyboards are taken direct and do not go through a sub mix but rather are mixed by Brutsche so that he can EQ them separately. The keyboards are comprised of a Fender Rhodes, a Mellotron, acoustic piano and a Hohner clavinet.

Due to the inherent problems with the Rhodes, Showco uses a company out of Dallas called Sound Productions that only handles pianos. When pushed hard the piano will distort, since that's its natural sound, but will not overload the system, only project what's there naturally. A Helpinstill pick-up is used on the acoustic piano and is set up and tuned by Sound Productions. The lid is closed and no mics are used. The acoustic instruments are taken direct via Barcus-Berrys. All vocals are miked with SM58s.

## The Showco Superboard

Showco completed designing and building its own board, of which there are now eight, two years ago. Prior to that they used a vertical rack of six-channel mixers with bass, treble and monitor, which they built themselves. While the mixers admittedly were crude, they were quite standard and very reliable. With a large number of young, raw personnel to train, this was the logical mixer on which to build a company. These served their purpose until six months before Showco started building their board, at which time they simply gave out. Rusty is quite glad that they waited as long as they did, however, for the rack mixers bought them enough time to get all the bugs out of the design and therefore eliminated the need for modification from board to board.

Before designing and building the board Showco carefully analyzed what the market had to offer, finding every piece of equipment worth considering lacking in roadability. To eliminate any potential problem Showco designed their board with durability as a major factor. The main frame is a truss design made of welded aluminum. The wood shell is for aesthetics and not for

structural soundness. Each module is physically supported in all directions so that the board may be packed in any position. The carrying case is made of fiberglass-reinforced plywood. Showco also learned that most other boards incorporate printed circuit plugs that mate with hard mounted receptacles in the main frame. Any physical abuse will result in broken printed circuit cards, receptacles or both and bring on the need for drastic repairs. Showco solved the problem by using flexible pigtailed and locking receptacles.

The board itself has thirty full-capacity microphone inputs and four channel discrete quad outputs. There are also two additional independent mono outputs, as well as monitors A, B and Echo Send. Modular in design, it features plug-in modules and the use of operational amplifiers in all active circuits throughout the board. All input module equalizers are parametric, which combines the best features of the standard three knob switched-frequency equalizer, the graphic equalizer and the active program equalizer. The advantage offered by the parametric is its functional flexibility. The peak or dip being swept through the desired point of correction can be heard, and the engineer can accurately and quickly judge aurally the frequency and amount of correction needed. The board has a built-in patch bay and offers a special tape input module that will accept the output of a quad tape player without tying up any of the microphone input modules.

For panning, the Showco Superboard offers eight buses, enabling the engineer to virtually do all of the mixing on the eight submasters once the initial mix has been set up. Each input module has a rotary panner. Four buses of discrete stereo are available in the following manner: for a given module, an odd and an even number bus selector button are punched up (1 & 2). Buses 1 and 2 are now one stereo bus. The joystick on bus 1 is set LF and the joystick on bus 2 is set RF. The same applies for the next three pairs of buses. Any module punched up on buses 1 and 2 will now pan between left and right. As a safety precaution the stereo pan function is defeated if a given module is only punched up on one bus. Quad panning may be accomplished in one of two ways. Either by quad panning each of the eight buses, or four stereo buses can be quad panned using two joysticks at a time.



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## Superboard Accessory Rack

This unit houses the associated equipment required to interface the board with the speaker system. The standard Showco accessory rack contains four Showco 4-way Master Panel Crossover Units, which are a 4-way electronic crossover with balanced line outputs. The unit features a VU meter, LED overload, mute switch and trim pot on each line output to provide the engineer with the maximum control over the speaker system. This is one of the most important components in the Showco sound system. There are two UREI 1176LN Limiters which are used to limit the stereo outputs of the board, and two UREI 527A 1/3-octave graphic equalizers which are used to equalize the sound system to the room. A patch bay is included to patch the limiters, graphics and other signal processing equipment into the board. Also included is a Kenwood KC 6060 oscilloscope which is used for basic trouble shooting and monitoring the output wave form of the four Master Panel Crossovers. Lastly, a Nakamichi 550 cassette recorder is included to play music before the show and can be patched into the board to tape the performance should the artist so wish. At additional cost, Showco will provide a Roland Space Echo, which is a closed loop, multi-head tape echo with a spring reverb system; an Eventide DDL; and an Eventide flanger.

## Mixing Led Zeppelin "Live"

Mixing Led Zeppelin "live" requires a different approach to engineering than does mixing a group like Yes or Genesis. With the latter, the music comes from so many sources that the engineer is required to be very familiar with the music as well as being constantly on his toes in terms of the actual mixing, timing of cues, etc. While the frequency range of these acts is the same, it is harder to get Zeppelin to sound good because of the sheer volume needed to achieve the "correct" level of intensity and energy without, at the same time, compromising a clean mix. No other group taxes the Showco system as does Led Zeppelin, running it to its limits. All thirty channels are used, with fifteen going for drums, four to the keyboards, bass, guitar and Page's Sonic, three acoustic instruments, four vocal mics and three effects returns.

Preparation for a Zeppelin show is both logical and surprising. Showco personnel arrive days in advance of a show, not for the purpose of checking out the acoustics, but to see whether anything has changed in terms of power and rigging. Rigging at the Kingdome is a great problem since it all has to be done through the dome, requiring lots of cable. Except for dressing room facilities which are located at the opposite end from the stage, Showco found the Kingdome to be physically well laid out to handle rock shows. There is good truck access, it's level, has enough power and a very willing building staff. The immediate problem is its seven-second decay rate when empty, which decreases to a "tolerable" 1.5-2 seconds when full. Showco has been fortunate in that the two shows they have done here have both been 65,000 full. As the hall is boomy with low-end rumble, Showco's approach to solving the problem is to overpower the decay through volume and the use of horns to hit the back of the hall.

"I don't think the Kingdome's that bad," says Rusty Brutsche. Though Keny Whitright feels the hall has deteriorated soundwise since they were last here, attributing it to the paint curing on the dome ceiling. "You either have the equipment or you don't, but you can't blame it all on the arena."

Rusty set up the Showco superboard 150 feet in front of the right speaker bank. Unlike Clair Brothers who have a separate snake for indoor and outdoor shows, Showco employs a plug-together type used both for indoor/outdoor. Brutsche does not mix Led Zeppelin in stereo, feeling that to mix in pure stereo isn't fair to most of the people in the hall. During various parts of the show he will pan for effect, however.

While many groups of comparable or lesser stature will either consult with their concert engineer as to reproducing their recorded sound, or use the same engineer for both functions, Led Zeppelin does neither. Surprisingly, Rusty does not listen to much Zeppelin on record, either. "The sound they get 'live' is not what they get in the studio. It's similar, but 'live' it's so much louder, so much more powerful. They're such an incredibly loud band that I just try to get a nice blend with clarity on everything and distinction between various instruments. The voice is mixed such that it's on top

with the rest behind it." He also does not feel for the most part that studio engineers make good concert engineers. "I've seen a lot of studio engineers come in and spend the whole concert trying to get those exact separations you find in a studio. You can't. It's a whole different approach to engineering ('live' engineering) and most studio engineers can't do it."

While he handles the main mix and two Showco personnel the monitor mixes, Benjy, a Zeppelin roadie, manages all of the vocal effects. Zeppelin in particular uses a lot of echo, a Harmonizer and DDL in their "live" show.

Hours prior to the show it was discovered that all of the guitar and power cords had been left behind in Dallas, requiring Keny to slave over a hot soldering iron for four hours. Added to that was the discovery that the newly purchased JBL replacement equipment was defective, the problem being "open" drivers. Truck space limits the amount of spare equipment possible and when you're playing a hall this size, you need all the gear you can carry. When the doors opened at five, however, everything was ready to go.

There was much speculation among Showco staff as to when the show would begin. While scheduled for 8 P.M., those at Showco who have traveled over the years with Zeppelin know them to have a notorious reputation for tardiness. To pacify the growing crowd, Rusty was running tapes of different groups from the Nakamichi 550 into the system at low volume. When AWB's version of "Work To Do" came up, Rusty boosted the system slightly to test it out. The kick drum and bass that start the tune off came through the system so clear, sharp, loud and powerful that it not only brought a great cheer from the crowd, but brought out the separations in that song as I've never heard them. He wasn't kidding when he said 30,000 bass watts!

At 8:20 the house lights went out and the fireworks and matches went up. As Zeppelin took its time tuning up and Robert Plant complained about the audience not being exuberant enough (!) ("We are, after all, Led Zeppelin, and how often do we come to town?"), Keny's wife was busy passing out cotton to place in their ears to all at the board. To all, that is, except Rusty Brutsche. "I don't use it!" What'd he say?





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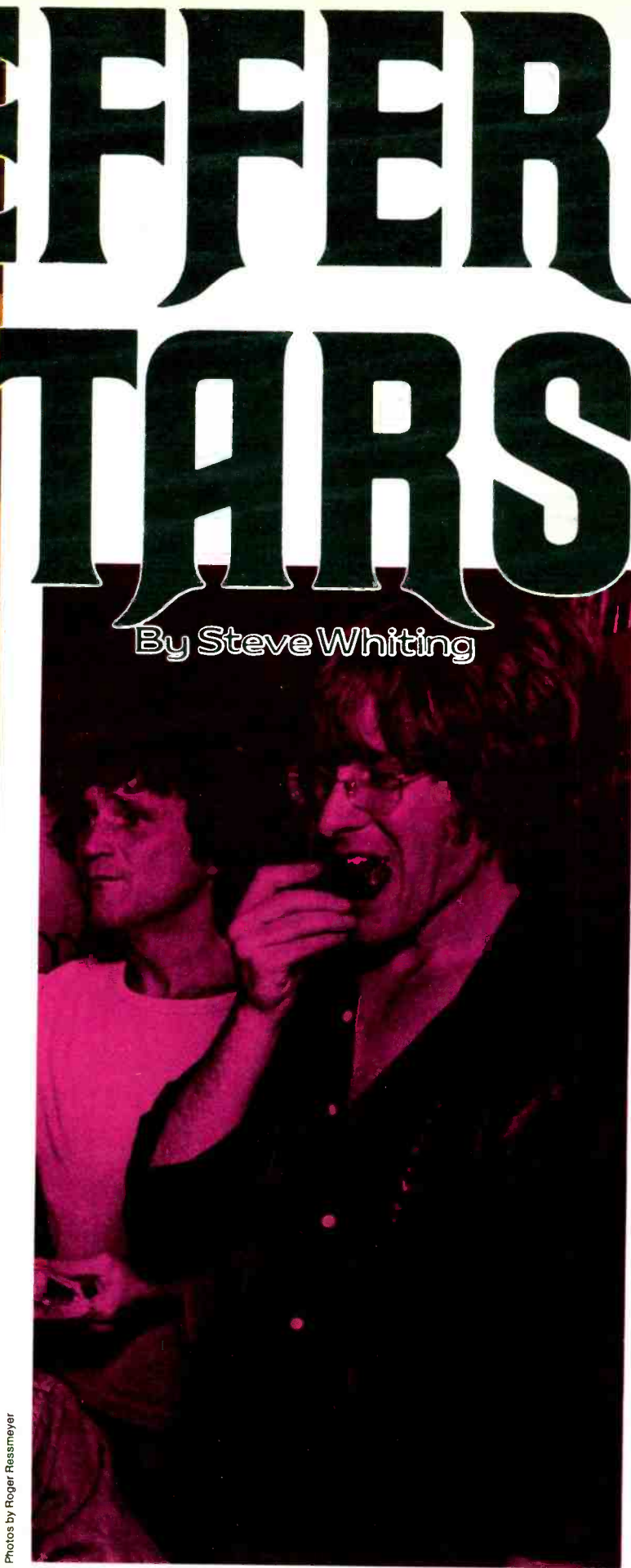
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# JEFFERSON STARSHIP

By Steve Whiting



Photos by Roger Reasmeyer





*Jefferson Starship Earth* is the fourth album to be released by the group whose name, along with its predecessor, The Jefferson Airplane, has always been synonymous with what is considered to be the "San Francisco" sound. The Starship is comprised of vocalists Grace Slick and Marty Balin; rhythm guitarist Paul Kantner; lead guitarist Craig Chaquico; drummer John Barbata; with keyboards and bass responsibilities shared by Peter Sears and David Freiberg. The question is: "How do they get their sound in the studio?"

Unsurprisingly enough, the sound is recorded in San Francisco at Filmways' Wally Heider Studios. Heider's has been home to the Airplane/Starship since the studio opened in 1969. The studio was still being built around them as they recorded *Volunteers*, and the group has had a great influence in its refinement and development ever since. According to Paul Kantner, "It's the best in town and this is the Starship's town so there's no reason to go elsewhere."

### Heider's "A"

Studio A is equipped with a Quad-Eight console, Ampex MM 1200 tape machines and API in-line equalization. Most other outboard equipment is satellite and interchangeable to the various rooms. Prior to the Starship's mixing sessions Heider's will be installing an API console in studio A.

The monitor system, and familiarity therewith, has been another prime consideration in the initial selection and subsequent utilization of Wally Heider's. Studio A is equipped with three monitor systems using Altec 604-E speakers, which is one reason producer/engineer Larry Cox likes it; he is familiar with their characteristics. The first system has no EQing. The second has the EQ that was present when Cox first recorded there and the third is a combination which he has developed over the four years that he's been recording there. Most engineers are familiar with the 604-E "right out of the box," which characteristically does not seem to have a great deal of very low bottom or very high top end and has a "hump" around 2000 to 3000 cycles. Many rooms are now equalized to compensate for this. Therefore, Cox precedes a project by listening to and analyzing final product tapes on which he knows the cor-

rect sound. When possible, he always includes the previous album by the group with which he is working. He then equalizes the system until it sounds right. In so doing he feels he can then reasonably trust his ears and the system not to deceive him in what he hears throughout the ensuing project—both in fact and in theory.

### The Starship Family

The Starship (along with Larry Cox who doubles as engineer) has produced all of its own albums. Pat Ieraci is the production coordinator, and in this capacity takes care of all the business involved in the production of their albums. His love for and working relationship with the Airplane/Starship go back to their first album, and he openly states that there is no other rock and roll band that he could have worked with so long either as personalities or artists. Dave Frazer is serving as second engineer.

With so many cooks in the kitchen one might expect very time consuming and often chaotic sessions to result. This, however, is not the case with the Jefferson Starship because each member is primarily involved with the recording of his/her own material. The others serve in an "advise and consent" capacity. Tight group cohesion and mutual respect are obviously vital to make this sort of arrangement possible.

As stated by lead guitarist Craig Chaquico, "Larry Cox is of the utmost importance to every tune and has the final say on any question." This was reiterated by each member of the group and is put by production-coordinator Ieraci thus, "Everyone is very closely involved but Larry Cox is the master of it all. As far as I'm concerned Larry is technically the best and easiest [engineer] to work with I've ever seen. He fits perfectly into the Starship family."

Conversely, Larry says that the composer and group have the final say. The result is a very cooperative effort with nothing having to come down to a "final-say" situation in any but a technical sense. Again, Cox prefers never to say, "You technically can't do that." This, he feels, stifles artist creativity, and since there's always some way to do just about anything in a modern studio, the word "can't" seems inappropriate. "An artist should never be the victim of the electronics or





### Sound & Energy

Ieraci describes the Starship's sound as, "having evolved from the psychedelic music of the early Airplane into that of an extremely tight rock and roll band with concentrated emphasis on vocals." Kantner describes it as "a swirling interplay between the music and the vocals which ideally drives and spirals above all the component parts into the realms of energy potential above the sum of its parts."

The basic tracks are being recorded quite "live." This is done for the sake of capturing the energy and magic of the Starship's interplay. Paul feels that because the overall is much greater than the sum of the individual parts, stacking the basic tracks would eliminate much of Starship's spontaneity. A minimum of baffling is used so that the band can feel and be close to one another. The band tries to bring its concert sound to the studio rather than try to reproduce a perfect yet perhaps somewhat sterile studio sound on the concert stage. Of course, it is virtually impossible to accomplish a concert sound in the studio because of the loss of audience energy which is so necessary to a high-performance band such as the Starship. The reason they don't record their albums on stage is their feeling that unless the listener at home was at the recorded concert, he can quite often feel left out. What

makes a performance special is the being there, something which cannot be captured or accurately recreated on plastic.

### Backward Drums

A solid drum sound is essential to any good rock and roll album. One thing that is readily identifiable in the way Cox records drums is that they sound "backwards." Because he was a drummer (Buddy Holly, Waylon Jennings and numerous jazz groups), he records them backwards from the norm. That is, the sound of the drums in the stereo spectrum is as if you were sitting *at* and not in front of the set. Therefore, the sock cymbal is on the left and the toms and fills going small to large travel left to right as you face the speakers.

John Barbata, with some seventy-three studio albums behind him has a very definite drum sound in mind for each group he has worked with. He keeps a journal of the miking set-ups employed every time he's especially satisfied. John has an unusual drum set-up because he has a closed high-hat on his bass drum. He puts a mic right between his two toms which also catches the high hat. Overheads are used for the cymbals, and the floor toms, bass and snare drums are all individually miked. As an experiment on this album, they are using a Kepex as a noise gate on the drums to eliminate low frequency rumble. In this way they are attempting to eliminate the necessity of putting tape or anything on the heads themselves which generally tend to deaden the attack.

John's kick drum is miked with a Shure 546, which Cox considers his pet. He feels that the directional characteristics of the 546 make it great for rock and roll. The 546 is similar to 604-E speakers as they have a hump in about the same place (around 2000 to 3000 cycles) and both have a lot of punch. However, in the instances when it hasn't felt right he has gone to a Sennheiser 421. On snare and hi-hat again the 546. The hi-tom, timbale and floor tom all are miked with the AKG 414 padded -10 dB at the source (in cardioid pattern) and another 20-30 dB on the console. Overhead L and R: Neumann KM 84s.

A snare drum often poses problems to an overall drum sound. As a rule of thumb Larry recommends that one might try using the 546 by putting its signal through a Lang active equalizer,

physics of the recording art."

Elimination of communication breakdowns is the key reason Larry Cox serves as his own engineer. He can work more quickly and efficiently with his own hands than he can by telling someone else what he hears, what he wants changed and how to change it. His twenty years of experience as a studio sideman, engineer and producer no doubt have a lot to do with his ability to effectively fill both roles simultaneously.

If a band member had to be singled out as having the most influence in the recording of the Starship sound, Cox feels it would most probably be Paul Kantner because, "Paul is always aware of what has been done and has to be done on anyone's song. He has a good grasp of the overall and can in the long run see to the target—which is the overall sound."



## Acoustical Set-ups

adding either 7500, 10 K or 12 K and taking off some 400 cycles. If one or the other doesn't get the sound, a combination probably will. Cox always dips out some 400 cycles on drums and frequently some 800. He often replaces that with a broad 100 cycle boost. This contours the sound and sweetens it considerably without deadening the attack or punch of the drummer.

Along with the drums, the bass guitar sound is critical in establishing the pulse and presence of the basic tracks in any recording. As a general rule David Freiberg plays bass on the big, round sustaining parts while Pete Sears plays the more crisp, punched out lines. Pete is recording his Fender Jazz bass direct through a "Fat Box" and with a Shure 546 on an Ampex B-15 amplifier. They'll probably end up using only the direct on this album.

(The Camaro Fat Box is a transformerless direct box. Cox likes it because it cuts out a stage of transformers and because the sound it produces requires less EQ as far as transients are concerned. It is very sensitive to gain and voltage levels and it leaves a roundness in the bottom that a direct box incorporating transformers normally takes out.)

Pete consistently has a unique sound to his bass. 'Tis indeed a pity that one cannot read the melodic British accent with which he explains how he gets the sound. He sets volumes on full (which Cox pads 10-30 dB at the board) and picks very near the bridge. Pete plays very aggressively with a sharp attack. He sets the tone controls about in the middle. They try to get one good setting for the bass sound and stick with that setting for the duration of a recording project.

Cox doesn't use any direct on electric guitars. Kantner's rhythm guitar amp is miked with an Electro-Voice RE20 and an AKG 414 which is padded -10 dB. This is more for Paul than for Larry. They used to use only a Sony C-37, but Paul would find that the sound on playback often didn't match what he heard when playing. On *Red Octopus* they went to using a C-37, U-87 and a RE 20 so that Paul could choose and/or combine them until he was satisfied that the tape could sound as "live" as the room. Larry now has gone to the 414 for fullness and the RE 20 for attack which seems to satisfy them both.

On *Chaquico's* lead guitar they use either a C-37 or an AKG 414 padded -10 dB.

Various set-ups have been employed on the acoustic guitars by Larry and the Starship over the years. They've used combinations of 414s, Neumann KM 84s and Frap Contact mics. According to Cox it has evolved in this way: "There was a time when Arnie Lazarus [president of Frap] came out and set us up using two Fraps very near the bridge; it was a good rock and roll acoustic sound, but it wasn't quite the sound I wanted. I put a KM 84 with it, combined the Fraps to one side of the mix and the 84 to the other and was happy with it. Paul got the punchy sound he wanted and we still got that nice top end on the 12-string guitar—which I really like to hear."

The acoustic piano is miked with Sony C-37s both on the bottom and across the mid-range strings and a 414 on top a little to the high end of middle C. The electric piano is direct with a Fat Box. The reason for not miking the electric piano is that since both guitars are miked, they consequently cover a lot of spectrum space with the guitar amps. Electric piano tends to get lost within that space. The Minimoog, Polymoog and clavinet are all through a Fat Box direct. Pete has the Polymoog set with a low gain.

The Leslie speaker for the Hammond B-3 organ has Neumann U-87s on both the high and low ends. Both are pad-

ded -10 dB and are in cardioid patterns. The U-87 has a very even response which makes it a versatile condenser microphone capable of dealing with the wide range of frequencies often encountered in recording the organ. Cox hears the U-87 as being a 1000 cycle mic which is not particularly top or bottom heavy.

"It's a good punchy mic and that's what is needed for miking an organ such as the Starship's. The mid-range is most essential in the organ sound particularly when Pete cranks it up, distorts the Leslie and gets his Rod Stewart type sound."

## Vital Vocals

Because the vocals play such a vital part in the Starship's sound, a great deal of time is spent in arranging and recording them. The harmonies often are worked out in the studio to enable them to fit with the musical tracks





more tightly. Everyone sings and plays an integral part in this stage of the production. Again, wherever possible all the parts are done all at once for the sake of the energy of the performance. Then, if necessary, individuals will go in and patch up any holes or weak spots.

Grace Slick has a wide dynamic range and sings with a tremendous amount of expression. For her vocals they use a Neumann U-47 tube type mic in the cardioid pattern. "Grace's voice is one of the easiest that I've ever recorded; it probably is attributable to her excellent mic technique," says Cox. On the song "Skateboard," for example, he has padded the mic -10 dB at source and -2 at 10 K on the board. The API is set at 0. The input setting on the United Audio 1176 low noise limiter is at 36 while the output is set at 18. The compression ratio is 12:1 with the attack and release both set at 1.5.

Larry feels that the best way to set up a limiter level is first to get the source up on the console independent of any limiting. Then check to see what seems to be the proper amount of padding. At this point one should set the limiter appropriately. "The reason for doing that is to decide the correct amount of padding so that you don't overwork or underwork the limiter. If you neither overwork nor underwork the limiter it will be operating at optimum efficiency at all times. For example, if you have no padding on the console on a vocal that normally would require 20 dB of padding, the limiter is going to be seeing a gain of 20 dB above what it should be looking at. So this is actually a way of getting the most efficiency out of each piece of equipment."

The 12:1 ratio is another generally used setting by Cox. He likes a relatively quick attack and release time. Hence the 1.5 setting (which is at approximately 3:00 o'clock on the potentiometer). With the United Audio limiter he never sets the output above 18 because he feels that that point is its highest efficient setting.

Paul uses the old RCA 44 mic which dates clear back to the early days of radio. It picks up the deep resonant quality of his voice and enhances its warmth. The 44 has a very round, mellow sound which is boosted +4 at 10 K and rolled off -2 at 40 cycles. The limiter settings are the same as on Grace's vocals except that the 1176 input is set at 38 instead of 36.

On this album two new microphones are being tried to record Marty Balin's vocals. They are using the RCA 44 on the tunes "Count on Me" and "Run-away." According to Cox, "Marty has some very mellow, resonant tones in his voice which have never really been adequately captured on any of his previous recordings. The 44 really brings these out." The Beyer M 160 is also being tried and will be heard on the more intense Balin parts. On Craig's tune, "Skateboard," which is being used here as an example of vocal mic settings, the M 160 was padded -10 dB at source and an additional -4 dB at 100 cycles on the board. It was boosted +2 at 10 K cycles and the 1176 input is at 33 with output again at 18.

On "Count on Me" where Marty sings lead there is no padding at the source on the RCA 44 mic. At the board the signal is boosted +4 at 10 K and padded -2 at 40 cycles. The API is boosted +2 at 40 cycles and attenuated -2 at 50 cycles. The limiter input is at 42 while all other limiter settings are as above stated.

David Freiberg's vocal parts are recorded with a Neumann KM 84. He often ends up doing the high harmony parts. "We like the 84 on David," Cox says, "because he has a very pointed upper-midrange voice and he has some very nice things happening in the extreme top end of his voice which the KM 84 handles very well. Also, it tends to give a very nice, round bottom quality to a vocal. His voice is in a frequency curve that humps in the middle and I'm using a reverse curve on it because the KM 84 to me is a loudness contour mic. It has lots of top, lots of bottom and not much punch in the midrange. It's the total opposite of a mic like a Shure SM 56." The KM 84 is padded -10 at source and -2 at 140 on the board. It is boosted +2 at 10 K.

Both Craig and John are contributing vocal harmonies for the first time on this album and both of them are being miked with Beyer M-160s. These seem to be working out well, and Larry feels that if things are going along smoothly it is often better not to interrupt the flow of the sessions to see how much better things can get. The essence of recording technique is to get the best performance that is to be given by the artist down on tape. It is better to deal with any problems of tonality or equalization further down the line and by any means necessary

rather than to ask a performer to repeat his/her part time and time again while the engineer searches out the best possible settings, microphones or equipment to enhance the performance. Perhaps it is this consideration for his artists that makes them so willing to listen to Cox and so comfortable with his demeanor as a producer.

## Tape Reviewing

On arrival at the studio for the 6:30 p.m. daily start one is likely to find Kantner behind the board reviewing the work from the night before or previewing the nights work to come with the assistance of Dave Frazer. Often one or more of the other group members will have come in early to go over the tapes as well. The attention to detail is remarkable and copious notes are taken. Dave Frazer keeps the notes for Cox which tell him every setting for EQ, etc., that has been used. Cox has a complete set for every album he's worked on and can go back, find and closely duplicate any technique that has worked for him in the past. This is also a great time saver in that Dave can put up any tune and have the mix just as it was left from the last time the tune was worked on within a few minutes.

## Sweetening

Upon completion of the vocal tracks the Starship will be traveling to Los Angeles to record the strings. They'll be using twelve violins, four violas and four cellos which will be recorded with one pass. That is, there will be no doubling or overdubbing of individual string parts. Which mics are used will depend upon which studio they end up in. Placement will probably be one mic for every two violins and violas, a mic on each of the cellos and two overheads for the whole section. The strings are being arranged by Gene Page.

After the strings are done it will be back to San Francisco for final sweeteners which may include Barbata's new synthesized drum set. Then, after a few weeks of mixing, the Jefferson Starship will have completed the project. Their first album, *Dragon Fly*, was gold, while both *Red Octopus* and *Spitfire* achieved platinum status. There is no reason to expect anything less from *Jefferson Starship Earth*.





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# INSIDE A SOUNDMAN'S TOOLKIT

by Brian Roth & Jim Ford

It is amazing how many bands are out on the road with nothing more in their toolbox than a pair of rusty pliers, a hammer (with a broken handle) and a six-pack of empties. This state of affairs can go on for a long time with no ill results until some horrible fate befalls the equipment Saturday night at a gig in East Mobeetie. Then, the advantages of a properly stocked toolbox become painfully obvious.

The purpose of this literary ramble is to discuss the selection, care and feeding of a useful set of tools. While intended to assist those poor souls out on the road—whose very livelihood depends on typically intermittent electronic equipment—much of what is to be discussed will apply to the recordists at home or in the studio.

To begin, the first thing required for a properly stocked toolbox is, a toolbox. A shoebox or pillow case doesn't cut it. Preferably, the toolbox should be made of fairly heavy gauge steel with an appropriate paint job so the bottom doesn't rust out. However, a strong wooden model will suffice. Probably the best arrangement is the style with a tray that sits in the top part of the toolbox. Little dividers in the tray are convenient as long as enough room is left for the tools to fit. There are many different models to choose from, so select one that is large enough to anticipate present and future needs, yet is not so big that a

forklift is necessary to move it.

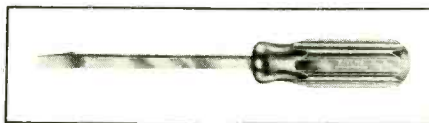
Now, there's nothing sadder than an empty toolbox, so it's easy to go tool crazy and fill the box with useless trinkets. Don't. Instead, think of the basics.

## Screwdrivers

Screwdrivers are very necessary items. A good variety will include slot heads with  $\frac{1}{8}$ -inch,  $\frac{3}{16}$ -inch and  $\frac{1}{4}$ -inch size blades as well as Phillips head in the #0, #1 and #2 sizes. Additionally, a small  $\frac{3}{32}$ -inch blade screwdriver for set screws is required. Four- to eight-inch lengths are optimum.

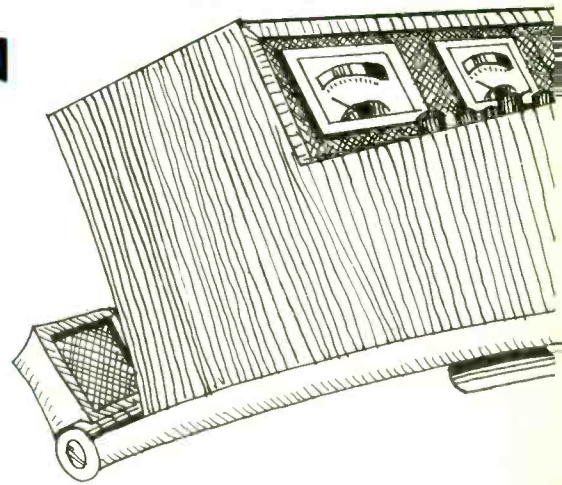
Screwdrivers should have comfortable, plastic insulated handles. Check the handle before you buy to be sure that some sadist in the factory didn't sharpen the ridges in the handle so that it will double as a steak knife.

The metal shaft should be of high quality steel or steel alloy, chrome plated if possible to inhibit rust.



The Xcelite S5166 slot head screwdriver.

The shaft must be securely fastened to the handle so that the shaft won't rotate in the handle (it's interesting how some screwdriver makers haven't



yet overcome that problem).

The "4 for 99¢" cheapies are usually a bad bargain because they won't hold up. Sears Craftsman screwdrivers are a good buy (watch for tool sales), as are Xcelite and Vaco.

Once you have your screwdrivers, try not to use the slot head types as a pry bar or the Phillips head types as a punch. This only serves to wreck the tips and make them useless for turning screws.

Some brands of equipment may use oddball type screws to discourage disassembly. However, Murphy's laws tell us that disassembly will be necessary sooner or later, so investigate the equipment to see if there are special screws in use. Some of these special types are the clutch head whose slot looks somewhat like the letter "S," the ScruLock with a square slot, the spline which resembles the hexagonal Allen head and the Pozidrive which looks like a Phillips head with four extra slots. All of these and others require the proper screwdriver, so be aware of the requirements of your equipment.

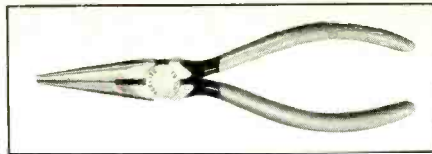


The Xcelite RP103 Phillips screwdriver.



## Pliers

Next on the list should be an assortment of pliers. The ubiquitous slip joint pliers are obvious (the 5 to 6 inch length is about right), but also required are diagonal cutting pliers ("dikes") preferably in two sizes: 6-inch length for heavy cutting and a smaller 4-inch length for those more delicate jobs like trimming moustaches. Add similar sizes of round nose



The Xcelite 51CG needle nose plier.

or chain nose (often called needle nose).

Try the pliers out before purchase and select ones that operate smoothly without being so loose that they flop around in the breeze. Insulated handles are nice if you happen to cut

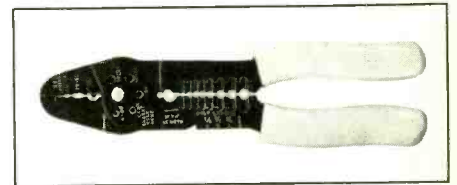
into "live" wiring (not recommended), so look for pliers with plastic coated handles that don't slip off. Good brands include Sears Craftsman (no, we're not on their payroll!), Utica, Klein and Diamond.



Wire strippers by GC Electronics

Even the best pliers will rust, so keep a thin film of light oil on them to avoid watching your investment turn brown. Special platings help prevent rusting.

In a similar category with pliers are



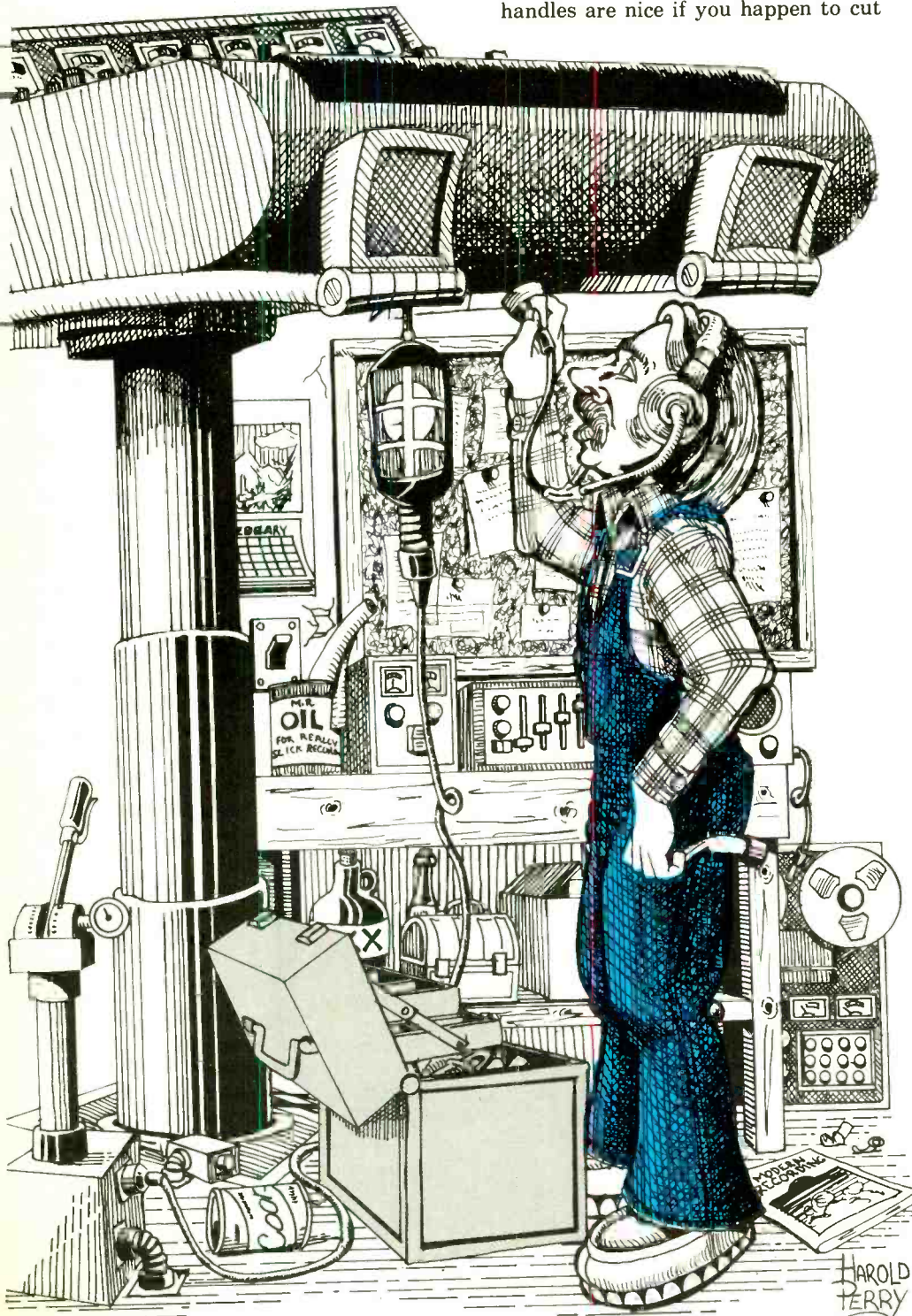
Wire strippers by Vaco.

wire strippers. No one has made a universal set of wire strippers that satisfy everyone. However, it appears that the type with a little wheel to set the strippers for different gauges of wire is widely favored. GC Electronics is one of the several manufacturers of this type.

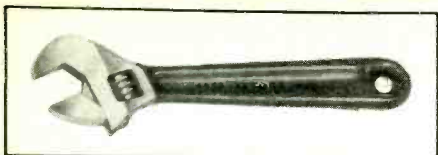
## Wrenches

A "crescent" or similar adjustable wrench may seem the way to go, but there is nothing like having the right size wrench to start with. A set of open-end wrenches from 1/4-inch to 3/8-inch should cover most needs except for replacing blown head gaskets and similar automotive malfunctions. Choose stoutly made wrenches with chrome plated finishes.

In tight places, nut drivers are often more convenient than wrenches. Buy nut drivers with hollow shafts so that they can slip over the ends of bolts.







Xcelite 46CG adjustable wrench.

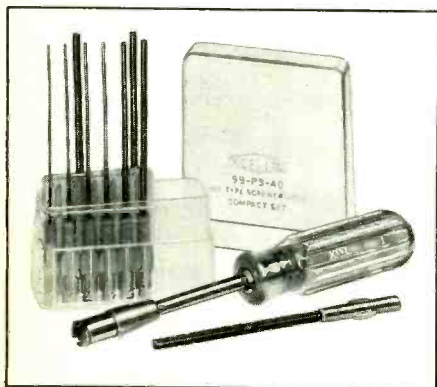
Xcelite makes a small set that has a plastic case to keep track of inventory. Sears Craftsman also has a full-size set with a plastic carrying case.

Included in the wrench category are the so called "Allen" wrenches or hex keys. This type of tool was invented by



Xcelite HSC-1 nut drivers.

a paranoid that didn't want anyone stealing the hardware. Seriously, there is nothing like an Allen wrench set when you need one. The best sets (and they don't cost that much more than the cheapies) are made to close tolerances and then hardened by heat treatment. This type generally has a black finish. For convenience, the hex keys should be in a pouch that provides a separate place for each one; this makes it much easier to keep track of how many of them were left sitting in the shag carpeting. Unfortunately, while Sears (who else?) makes a nice set, they are supplied in a single pocket pouch which is most inconvenient.



Xcelite 99PS40 Allen wrenches.

Several manufacturers make fold-out hex keys that are fastened together like a pocket knife. You won't have to worry about losing them, but often the handle and other wrenches get in the way when working in close quarters.

Xcelite makes a set with the hex keys installed into screwdriver handles. These are nice, but they are also expensive.

## Soldering Equipment

For some reason, when thinking of doing some soldering, many people grab for the biggest soldering gun they can find. The high degree of heat provided by guns is often unnecessary, and consequently everything in the vicinity (wire insulation, connector parts, etc.) is reduced to a charred puddle.

One of the most important rules of soldering is to use only enough heat to make a good connection. This leaves out the favorite soldering guns except for the heaviest jobs. A good iron in the 35- to 45-watt category is required for most applications. A fairly small, screwdriver shaped tip on the iron is probably best.

Ungar makes a wide variety of irons, but their Imperial models are probably the most popular. Weller makes a series of moderate cost irons (W-60 models) that feature temperature controlled heating elements. This last type of iron is a good idea since the heat is regulated for optimal soldering results.

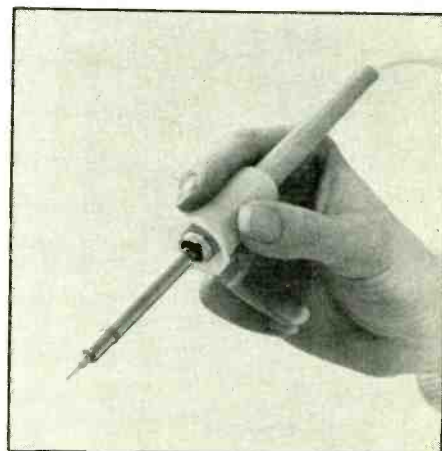
A proper soldering iron stand is a must unless you happen to like the smell of burning substances that come in contact with the iron. A moist sponge is definitely required so that all of the gunk caused by oxidation can be cleaned off. While soldering, wipe the tip on the sponge before each connection, thus ensuring as clean a tip as possible. This not only makes for pretty work, but also helps heat transfer to the work.

It cannot be emphasized enough that *only rosin core* solder can be used for electronic applications. Time and time again careless people have ruined electrical equipment by using acid core solder. While the connection will work for awhile, soon the acid eats everything up and you are left with a noisy, intermittent connection. Use only rosin core solder!

The solder metal itself is an alloy, most universally tin and lead. The ma-

jority of solder uses a ratio of 60% tin and 40% lead. Another alloy, 63% tin/37% lead is also becoming popular due to its slightly lower melting point and the fact that it is eutectic, which means that as it heats or cools it goes directly from solid to liquid (or vice versa) without going through a "plastic" stage. 63/37 solder makes it easier to create nice, shiny connections.

As you solder, be sure to heat the connections being attached; do not just put solder on the iron and wipe it onto the connection. Apply the solder to the heated connection. Use only the least amount of solder possible. Do not allow big blobs of excess solder to form on the connection. Also, while the solder cools, do not be tempted to wiggle the joint to see if the solder has solidified; this will lead to cold solder connections which are dull and crusty looking and unreliable.



One of Ungar's many soldering irons.

Sometimes, a soldering gun is required, so be aware of how to properly maintain the gun. Many times people using a soldering gun think that their unit is defective and no longer even able to melt butter. This can usually be traced to improper tip care. Use the sponge to wipe off the crud that forms on the tip. Also, periodically loosen the two nuts that secure the tip to the gun and move the tip around a bit. This helps loosen oxide deposits that build up at this point. Retighten the nuts and the gun should again work fine.

It is a very good idea to carry spare tips for your gun or iron. In fact, it is good planning to have two irons in case one of them croaks, which, at the worst possible moment, they have been known to do.

Sometimes it is necessary to remove solder from a connection. There are little solder sucker squeeze bulbs for this



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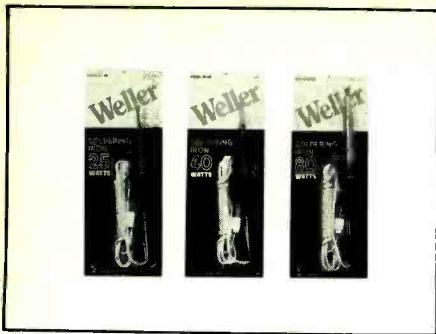


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The Weller Model SP-40 soldering iron.

purpose, but they only work moderately well. The spring loader solder suckers made by Edsol are better, but the user should be careful with these since they can spew little solder flakes all over the place if not kept scrupulously clean. Also, the Edsol models rely on oil to keep a vacuum seal in the suction mechanism. If kept clean and oiled the plunger units work nicely.

Another type of solder remover is the solder wick. This is nothing more than a length of copper braid on a plastic spool. The braid is set on the connection to be cleaned, the iron placed on the braid, and presto—the solder is wicked off. It is considered to be a pretty effective method for most applications, and a roll of solder wick is not terribly expensive.

## Volt-Ohm Meters

No toolkit is complete without a volt-ohm meter (VOM). It is invaluable for checking the AC power voltage to see if the local electrician wired 240 to the 120 volt outlet. Also a VOM is useful for checking out guitar cords and the like.

There is no need to buy an expensive unit. The digital readout models are nice, but the mechanical meter VOMs are much less costly.

The input characteristics of a VOM are given in terms of ohms per volt for the voltage scales. The least expensive VOMs have a 1000 ohms per volt input. Better models have input impedances up to 100,000 ohms per volt. The higher the rating, the less the meter will load a circuit. For general purpose, an input of 10,000 ohms per volt or more is fine.

The ohms or resistance measurement scale, which is used for checking continuity of cords, is a battery operated function. The batteries have a long life, but it is good to have a spare set. Be sure the meter has at least three different ohms ranges to handle

all resistance measurements. It is particularly important that the low ohms range be such that very low resistances (10 ohms and less) are easily readable. On some meters, these lowest values are crowded together on the scale making reading of the values almost impossible.

A number of manufacturers make VOMs—Eico, Simpson and Radio Shack are some of the more widely known.

Be careful when using a VOM. Make sure that it is switched to the proper scale for the desired measurement; checking a 120 volt power line on the ohms range generally will charcoal broil the internal workings. Also, most mechanical meters really dislike being dropped.

When checking power voltages, be sure to keep your fingers out of danger or else you will be in for a real shock.

## Miscellanea

The preceding tools are the basic requirements. Some other items to be considered follow here.

A variable speed reversible electric drill can be used to puncture things, and with the addition of a screwdriver bit it becomes very handy as an electric screwdriver. Since the back covers on most speaker enclosures are secured with a jillion screws (give or take a few wazillion or so), it is a lot easier on the wrists to use a drill. A reversible function is necessary for backing the screws out, so definitely buy one with this feature.

Naturally, you'll also need drill bits to go with the drill. The Morse cutting tools company has some nice, high-speed twist drill bit sets for a reasonable price. These should be available at a local industrial supply company.

Obviously, a flashlight is a very good thing to have in the toolkit. It beats burning your fingers on a match when trying to check out some dark corner on the stage.

A package of clip leads with small

alligator clips on each end is an inexpensive addition. Have plenty on hand since these for some reason have a tendency to be pilfered.

It is reasonable to expect cords and connectors to fail, so always have spare parts to anticipate this. A roll or two of insulated hook up wire is also worth having. *Plastic* electrician's tape should be on the tool list too; forget about using that cloth "friction" tape.

"Get a bigger hammer" is the oldest phrase in electronic servicing. The standard carpenter's hammer with a wooden handle can be found from a number of different sources.

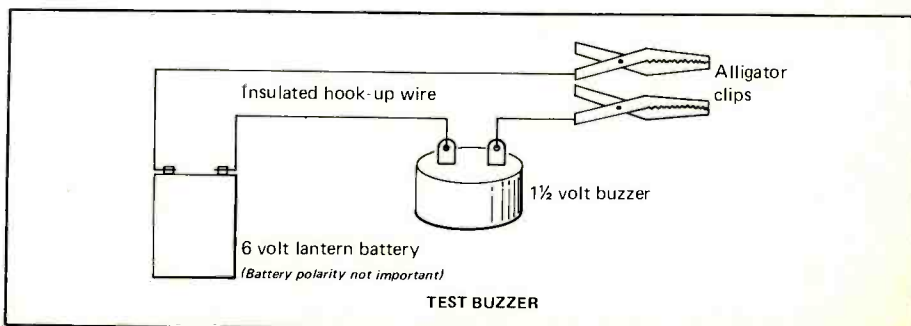
If you have the bucks, consider purchasing a hacksaw and a couple of different files. These will be required if you have to change a volume pot on a guitar or other piece of equipment since most replacement controls have a mile long shaft that must be chopped back to size. You don't really want input volume control #5 sticking up four inches from the top of the mixer.

Two other types of pliers that may be useful are a set of vice-grips and a pair of ignition pliers. The vice-grips look somewhat like regular pliers, but they will clamp down and lock onto whatever is placed in their jaws. An adjustment is provided to establish how tight the jaws clamp when the vice-grips are locked. These are useful for a multitude of purposes when it is important to hold the work in one place. There have even been cases when vice-grips were used to hold the stage together!

The ignition pliers are a miniature version of the so called "Channelock" style of pliers. Their small size makes it easy to get them into tight places where ordinary pliers won't fit.

## Cleaning & Lubing

Many times it is desirable to have a small variety of various cleaning and lubricating chemicals. An aerosol can of Freon solvent will clean just about





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anything without leaving residue. A silicone-based cleaner is required for noisy volume controls, although the noise can also be caused by other malfunctions.

For lubricating, a can of WD-40 is most convenient, as is a small can of general purpose household oil.

If a tape recorder or tape echo device is in use, cotton swabs and isopropyl alcohol are absolutely necessary to maintain these units in top operating condition.

## Fuses & Shorts

What would happen if the bass guitar amp decided to eat a fuse? Would you reach for a discarded chewing gum wrapper and create a Wrigley's 50 amp fuse with it? If you would, may your days be filled with smoldering power transformers.

The intelligent person would be prepared for blown fuse by having made a master list of all fuse sizes of the equipment in use and stocking one box of each size fuse in his tool box.

Please note that if the first replacement fuse blows, DON'T try a larger fuse. The equipment is trying to tell you that it has developed an internal tumor when it repeatedly pops fuses. Stop while you're ahead.

Two other handy items to have are a battery operated continuity buzzer and an audio signal tone generator.

The continuity tester (see figure) is a very simple device that is useful for checking microphone or speaker leads for open circuits or shorts. In operation, one of the test leads is touched to one end of the cable and the other test lead is attached to the other end. If the buzzer sounds, the electrical path through the cable is continuous. If, on a two-conductor cord like a speaker or mic cord, the buzzer sounds when the leads are attached to each separate conductor, the cord or connector has a short.

Note that the diagram shows a 6-volt battery with a 1½-volt buzzer. This is to ensure that there will be sufficient voltage to trigger the buzzer if a long cord is being tested. The buzzer can withstand the over voltage for short periods.

The continuity buzzer does the same job as the ohms (resistance) scale on a VOM, but in many instances it is easier to listen for the buzz rather than squinting at the meter scale.

The tone generator need not be elaborate or expensive. The Shure

## TOOL CHECK LIST (Refer to Text for Details)

### The Basics:

- 1/8" diameter blade screwdriver
- 3/16" diameter blade screwdriver
- 1/4" diameter blade screwdriver
- 3/32" diameter set-screwdriver
- #0 Phillips screwdriver
- #1 Phillips screwdriver
- #2 Phillips screwdriver
- 6" length slip joint pliers
- 6" diagonal cutting pliers
- 4" diagonal cutter pliers
- 6" round nose (needle nose) pliers
- 4" round nose (needle nose) pliers
- Wire strippers
- Open-end wrench set, 1/4" to 5/8" size
- Nut drive set
- Allen wrench set
- Soldering iron with proper stand and sponge
- Pound of solder, rosin core, 60% tin/40% lead or 63% tin/37% lead
- Solder wick
- Spare soldering iron tips
- Volt-ohm meter
- Flashlight
- Spare connectors and wire

- Roll of electrical tape
- Hammer
- Aerosol volume pot cleaner
- Lubricating oil and/or WD-40
- Spare fuses

### Optional:

- Special tip screwdriver (as required)
- Adjustable wrench
- Spare soldering iron
- Soldering gun
- Reversible variable speed electric drill
- Set of drill bits, 1/16" to 1/4" (minimum)
- Screwdriver bits for drill
- Package of clip leads
- Hacksaw
- Files
- Vice-Grips
- Ignition pliers
- Freon aerosol solvent
- Cotton swabs
- Isopropyl alcohol
- Battery and buzzer continuity tester
- Small Audio Tone Generator (battery operated)

A15TG is a small, battery-operated model that plugs directly into a low-impedance microphone line. Having this generator makes trouble shooting much easier than having someone shouting "Test-Test" into one of the stage microphones.

## Safety

The most basic rule of safety is: Use your head! Tools should be used for their proper function. For example, a pair of pliers being used as a hammer can chip and send pieces of metal flying into your eyes.

Power tools require some care in use. An electric drill can easily become entangled in long hair and inflict pain and injury. If drilling in metal, protective eye goggles are required.

Keep all power cords in good shape. Repair all damage to these or else electrical shocks and fire can result.

If a power tool uses a third prong on its plug for grounding, do not break it off or defeat it. It exists to protect the user from shock if by some chance the tool malfunctions.

When working inside of an amplifier or other electrically operated gear, ALWAYS DISCONNECT THE POWER FIRST! This will protect both the serviceman and the equipment from damage.

Use common sense when working with tools, and you'll live a long life (unless being on the road gets you first!).

## Summary

Hopefully, this article has given you some ideas on how to stock a toolbox. There are probably some items that have been left out, but the listing covers the majority of tools required for most applications.

If you have an experience to share concerning tools, or have an additional suggestion, the Editors of *Modern Recording* would be glad to hear from you.

In closing, the next time you're out in East Mobeetie and something blows up, have a good tool assortment and the show *will* go on.

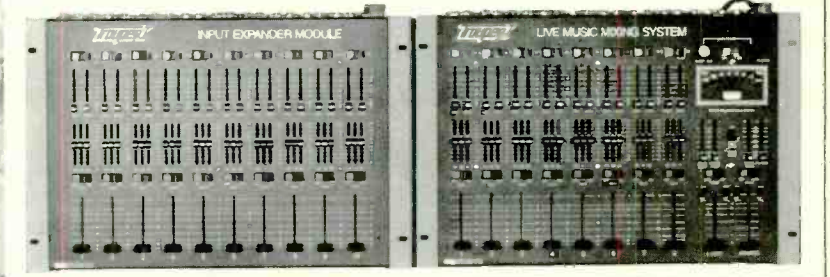




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# Ambient Sound

BY LEN FELDMAN

## Classy Amplifiers

A recent letter from one of our readers suggested that it might be a good idea, in view of the recent emphasis by manufacturers on the "Classes" of their amplifier products, if we reviewed the differences and defined the various classes of amplification. Such a review is particularly relevant now because in the last few years, after living contentedly with three basic classes of amplifiers for many decades (Class A, B and C) there have recently been a rash of "new class" amplifier introductions which are unfamiliar to audio professionals and hobbyists alike. So, let's begin at the beginning, with a description of Class A amplifiers.

A Class A amplifier, whether it be a tube or transistor type, is generally biased so that maximum current flows through the amplifying device regardless of whether or not an audio signal is applied to the amplifier. When an audio signal is applied (to the grid, in the case of a tube amplifier, or to the base circuit of a transistor), its amplitude must be kept small enough so that the amplifier device is neither "cut off" nor driven into saturation. Since the amplifying device conducts during the entire signal waveform (positive and negative halves of each cycle), Class A amplifiers can operate with only one active amplifying device (tube or transistor) in the circuit. A Class A amplifier, carefully designed for linear operation, exhibits very low orders of distortion and higher orders of distortion are reached only if and when the amplitude of the input signal is too great to be handled within the linear operating range of the tube or transistor used. The disadvantages of Class A operation have to do with the low efficiency of this amplifier class. Even with no signal applied, the Class A output stage draws maximum current. So, power dissipation or total power consumed by a Class A amp is constant (and relatively high) under all signal conditions. With no signal applied, the power consumed has to be dissipated within the amplifier itself, giving rise to large heat sink requirements even for relatively low power output amplifiers. In a Class A design, some of the power consumed is transferred to the load when signals are amplified, so that at maximum output, such amplifiers actually dissipate *less* power internally than at

no-signal conditions. Overall efficiency of Class A amplifiers (output power divided by input power, expressed as a percentage) runs around 20%.

## Class B Amplifiers

In a Class B amplifier, two output signal amplifying devices (or pairs of devices in parallel) are generally used in what is popularly called a "push-pull" circuit. Each device (or each half of the stage) handles only half of the signal waveform being amplified. With no signal applied, the amplifying devices are biased almost to cut-off. When a signal is applied, the positive half of the waveform causes conduction and amplification by one half of the circuit, while the negative-going waveform is handled by the other half. With no signal applied, therefore, power consumption of a Class B amplifier can be made very small or almost negligible. This arrangement reduces overall dissipation within the amplifier and thereby reduces heat sink requirements (in the case of transistorized equipment) and increases overall amplifier efficiency. Efficiency of Class B amplifiers can reach a figure of 60% or even a bit higher. Most solid-state amplifiers sold these days generally employ Class B, or Class AB design. In a Class AB design, the push-pull idea is still employed, but each amplifying device is biased somewhat more into its conductive region, so that there is some overlap of signal waveform handling, with both devices conducting in and around the "crossover" region, or the region where the signal waveform crosses the zero-amplitude axis in its positive and negative going swings. Class AB design is one method used to overcome the chief disadvantage of pure Class B design—crossover or notch distortion. This type of distortion occurs at the zero-crossover point if the amplifying devices exhibit non-linear characteristics at or near their cut-off points, creating a discontinuity "notch" or "glitch" as the amplified signal alternated through the zero-axis during each alternation. Notch distortion, unlike clipping or overload distortion, becomes even more bothersome at low power output or low listening levels, since the discontinuity of waveform is fixed and becomes a greater percentage of the total signal output as the volume control is turned *down* to lower percentages of the rated output of the given amplifier.



## Why No Class C Amplifiers In Audio?

Class C amplifiers are those in which conduction of the output stage takes place for only a small fraction of the duration of a single alternation or waveform. Since such an amplifier cannot possibly accurately reproduce an audio signal, this type of amplifier is only used in fixed-frequency RF amplifying circuits, where tuned circuits (consisting of inductances and capacitances, or their equivalents) provide the necessary "flywheel" effect to fill in the "missing" section of the waveform. On the positive side, a Class C amplifier may have an efficiency as great as 80%.

## "Class D" Amplifiers

So-called Class D amplifiers are more properly described as "switching" amplifiers, or even pulse-width modulation amplifiers. In such amplifiers, a very high, super-audible frequency is generated within the amplifier, creating a series of short-duration pulses. The frequency of these pulses may be of the order of 500 kHz or even higher. The incoming audio signal voltage is used to modulate these pulses, varying either their width (in the case of a pulse-width modulation amplifier) or their amplitude. The output stage is therefore called upon to amplify a series of short-duration pulses rather than a continuous signal waveform. Passive, integrating circuits following the power amplifier stage are then used to convert the varying amplitude or varying width pulses back into a filtered, smooth audio waveform which is an amplified replica of the input signal.

The advantage of the Class D idea, as you might have guessed, is very high efficiency, ranging above 90%. Because of other inherent problems associated with switching amplifiers, such as RF radiation and the difficulty in designing high-powered switching devices that can operate at the high frequencies required, only two manufacturers have offered consumer versions of the Class D or switching amplifier, to date. These manufacturers are Infinity Systems, Inc., and Sony Corporation. The latter company expects to market their version of a switching amplifier very shortly.

Classes E and F seem to have been used up in fields other than audio, which brings us to Hitachi's highly touted "Class G" amplifying system.

In the Class G amplifier, each half of the classical Class B circuit is replaced by *two* amplifying devices wired in a sort of series arrangement and powered by two different supply voltage sources. At low signal levels, the waveform is amplified by the lower-powered transistor (for each half cycle) while the upper, higher voltage transistor remains non-conducting. When the signal input voltage exceeds a predetermined amplitude, the lower-voltage transistor is turned off and the higher-voltage, higher-powered transistor takes over the job of amplifying the peaks or crests of the waveform during each alternation. The idea here is that

each pair of transistors is operating more often at its most efficient operating point and the efficiency of the Class G amplifier exceeds that of a Class B circuit not only when the amplifier is delivering its full rated power but at lower power levels as well.

## And Then Came Class H

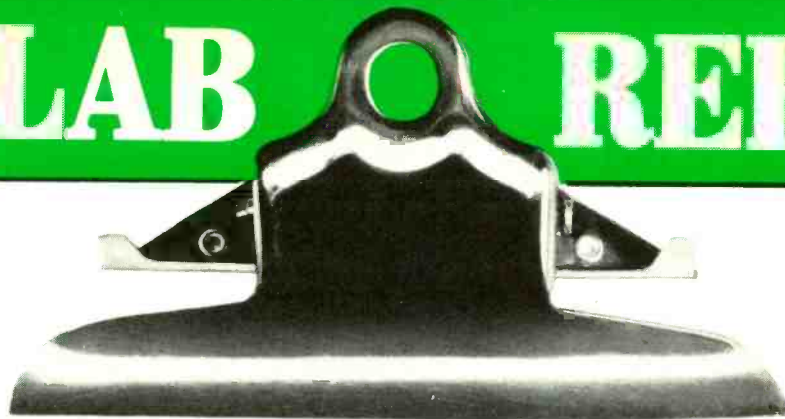
Not to be outdone, the folks at Soundcraftsmen, Inc. have come up with what they call a vari-portionial amplifier system that some audio people have dubbed the "Class H" circuit. In this scheme, only one pair of output amplifying devices is used, much as in the case of a Class B or a Class AB power stage. However, these output devices may be powered from either of two voltage supplies, one supply being higher than the other. A sophisticated logic or monitoring circuit measures the amplitude of the incoming signal. At low signal levels, the lower voltage supply powers the output transistors. When the logic circuits detect a rising waveform that is likely to exceed clipping levels of the amplifier, the higher-voltage power supply is "turned on," extending the operating range of the output devices so that they can now handle those higher voltage swings. The higher voltage supply is always turned "on" *before* it is actually needed so that there are no discontinuities in the amplified waveform or switching transients. Furthermore, the speed of turn-on is great enough so that even when a high-amplitude high-frequency transient is to be amplified, the higher voltage supply is available sooner than it is needed. Again, the advantage claimed for the Class H amplifier is its increased efficiency, lower internal dissipation over more of its operating range and therefore, decreased heat sink or heat dissipation requirements. The inventors of this idea also maintain that because only one set of transistors is used (as opposed to having to switch from one pair to another in the Class G approach) there is less of a problem with switching distortion or discontinuities in the reproduced waveform.

## More Classes?

Whether inspired by the energy crisis or for other reasons, more engineers and audio companies seem to be turning their attention to developing more and more classes of more efficiently operating audio amplifiers. Normally, we would conclude by saying that we have covered the operation of all existing classes of audio amplifiers, but since we generally prepare this column a few weeks before it is published, that might be a foolhardy statement to make. For, by the time you read this, perhaps some obscure lab here or abroad may have already announced another breakthrough in amplifier classes—perhaps "Class I" or "Class J" or who knows what. It's at least comforting to know that, with twenty-six letters in the alphabet available to us, innovators need not be concerned about running out of designations just yet.







NORMAN EISENBERG AND LEN FELDMAN

## Sansui SC-5100 Cassette Recorder



**General Description:** The Sansui SC-5100 is a top-of-the-line cassette recorder employing two motors and a solenoid-logic transport control system that boasts some new convenience features for this format. A front-loader, the SC-5100 features "Direct-O-Matic" loading whereby the cassette is simply placed in or removed from the cassette recess. It is initially held in place by the head cover which hinges out; in addition during any wind mode, two small "arms" emerge from the sides of the recess to secure the cassette in place. This design obviates the need for an eject mechanism and its button. At the same time, the swing-out head cover permits ready access to the heads and capstans.

The transport control permits fast-buttoning (going from any mode to any other directly) and includes the

option for "punch-in" recording. It also permits programming the machine for automatic play after re-wind, for automatic repeat and for operation via an external timer. A special button, which provides a fast wind of a few seconds, is designated as the "tape lead-in" control and may be used at the beginning of a cassette to advance past the leader section.

As is true generally of front-loaders, all operating controls and features are arranged on the front panel, permitting the recorder to be installed in the same manner as an amplifier or tuner, without regard for access to the top surface. The cassette recess, which may be covered with a transparent dust-cover (supplied), is at the left. To its left are the power off/on switch and a stereo headphone output jack. To its right are a tape-



index counter and reset button, and the feather-touch transport controls. To their right are the various "trick" buttons arranged vertically. From the top, they are: memory rewind, auto play, auto repeat, timer record, timer play and tape lead-in.

Two VU meters occupy the upper right portion of the panel. They function during both record and play. In addition, during record there is a peak LED indicator designed to come on if the recording level exceeds +6 dB. This LED, and another one showing Dolby-on, are between the meters. The meters are calibrated from -20 to +3. Below the meters are five switches. Two of these handle bias and equalization, each with three settings for "FeCr," "high (CrO<sub>2</sub>)," and "normal (LH)." The other switches include Dolby FM, Dolby off/on and limiter off/on.

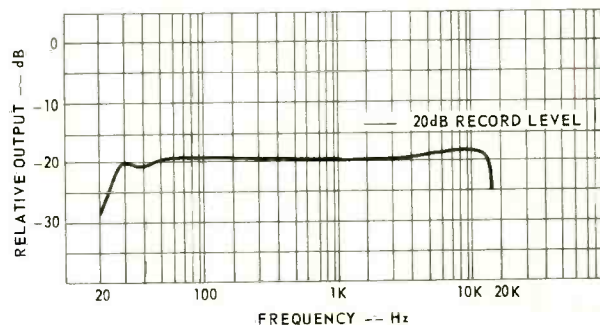
Below this group are three pairs of dual-concentric knobs for level adjustments, separately on each channel, of microphone input, line input and line output. The mic knobs also handle an optional DIN connection. Mic and line inputs may be mixed during recording. Each control-knob pair has a movable marker ring which may be set to a numbered legend around the control knobs for reference. Finally, at the lower right corner are left and right mic inputs, with the left jack also serving as a mono recording mic input.

The rear of the SC-5100 contains the line-in and line-out phono jacks, a DIN socket, an adjustment for varying operating line voltage, a grounding terminal and the power cord. The unit comes in a walnut vinyl-clad wooden case with small "feet." In addition to the cassette recess cover, it is supplied with two pairs of stereo signal cables and a head-cleaning "pen."

**Test Results:** Using a ferric-oxide tape and then an "equivalent chrome" tape, *MR* checked key performance areas of the SC-5100 and obtained results that generally exceeded the published specs for this deck. Response with either tape made it very nicely to the 15-kHz mark. Signal-to-noise ratios were excellent. Distortion, while not the lowest ever measured, was still low. Ample headroom signal was verified, with +7.5 dB and +5 dB (for 3% THD) obtained with "normal" and "chrome equivalent" tapes respectively. Wow and flutter were insignificant. Signal input and output levels all were satisfactory for good interfacing with normal audio components.

In addition to a generally superior electronic section, the SC-5100 impressed *MR* as a model of mechanical precision, thanks to its versatile transport-control system which, in repeated tests, worked flawlessly and effortlessly.

It may be of interest to mention that for the ferric-oxide tape in our tests we used TDK-AD; for the high-bias or "chrome equivalent" we used TDK SA. The newest AD formulation has a rising high-frequency response characteristic which we found was easily compensated for by setting the EQ switch to the CrO<sub>2</sub> position during *playback*. For recording, both the EQ and bias switches are set, of course, to "normal" or "LH" position. It may be argued that equalization should not affect playback response in a tape deck, but as far as we are concerned—with all the tape formulations now available—any method that can be used to produce a reasonably flat response curve (provided it does not degrade the S/N ratio) is justified these days



**Sansui SC-5100: Record/play response, using TDK-AD tape.**

as long as the maker specifies what to do with each tape. This Sansui does, and most thoroughly too, in a comprehensive table of tapes and settings which is included in the owner's instruction manual.

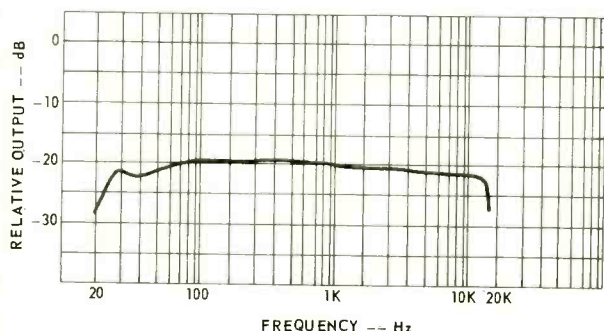
**General Info:** Dimensions are 19 7/8 inches wide; 8 1/2 inches high; 12 7/8 inches deep. Weight is 29.8 pounds. Suggested retail price is \$600.

**Individual Comment by L.F.:** What a difference an extra motor and solenoid-logic controls make in a cassette deck! The control system in the SC-5100



makes the machine a joy to use. By combined use of memory, auto repeat, auto play, timer record and timer play buttons, in various combinations, this cassette deck can be programmed to do just about anything—whether or not you are there to watch it. Of course, an external timer is required for absentee operation.

When I first saw the tape lead-in button I half-hoped that the forward motion of the cassette past the leader



**Sansui SC-5100: Record/play response, using TDK-SA tape.**

would be governed by some light-sensing mechanism that stopped the tape after the first few inches of leader had passed beyond the heads. Here I was somewhat disappointed since the tape lead-in button advances the tape by a predetermined amount which may or may not correspond to the number of inches of leader tape used by a particular tape-cassette manufacturer.

This minor "shortcoming" however is my only criti-

cism of this machine. In all other respects I think it is a winning combination of superior electronics and a superior mechanism. Our lab data pretty much tells the story. Not shown in that data, by the way, is the action of the peak LED indicator which, in our sample, flashed at a recording level of +6.5 dB. We also plotted the action of the limiter circuit which would be especially useful when making "live"-mic recordings. This circuit makes itself felt at a recording level of about +2 dB and it limits gradually, so that a +4 dB recording level shows up as a +3 dB with limiting, and a +10 dB level is held to +4.5 dB. Both, happily enough, are still below the 3% THD point for either of the two tapes used in our tests.

The SC-5100, in short, is a cassette deck that emphasizes useful features rather than showy gimmicks.

**Individual Comment by N.E.:** A sensible functionalism combined with excellent audio response make the SC-5100 a very likable kind of machine. Everything seems to have been carefully thought out, and then re-thought just to make sure, including the perhaps-unusual but sensible recommendation in the owner's manual to record certain tapes with one kind of EQ and play them back with another. The tape loading procedure used in this cassette deck is different—but it works admirably and it stands as a telling challenge to the "pop-up" toaster kind of eject system customarily found. One can perhaps wax more or less enthusiastic over the auto options but there is no arguing the utterly smooth, professional-like "feel" of the transport control system. You can even go, with two fingers and a second or so pause, from either fast-wind mode directly into recording.

#### SANSUI SC-5100 CASSETTE RECORDER: Vital Statistics

##### PERFORMANCE CHARACTERISTIC

Frequency response, ferric-oxide tape chrome or equiv.  
 Wow & flutter (WRMS)  
 S/N, ferric-oxide tape, w/o Dolby w/Dolby  
 S/N, chrome or equiv., w/o Dolby w/Dolby  
 THD at 0 VU, ferric  
 THD at 0 VU, chrome or equiv.  
 Record level for 3% THD, ferric  
 Record level for 3% THD, chrome or equiv.  
 Bias frequency  
 Fast-wind time, C-60  
 Input sensitivity for 0 dB, mic line  
 Output level, line phones

##### MANUFACTURER'S SPEC

± 3 dB, 30 Hz to 13 kHz  
 ± 3 dB, 30 Hz to 14 kHz  
 0.05%  
 NA  
 NA  
 57 dB (wtd)  
 67 dB (wtd)  
 NA  
 NA  
 NA  
 NA  
 85 kHz  
 60 seconds  
 0.2 mV  
 70 mV  
 400 mV  
 NA

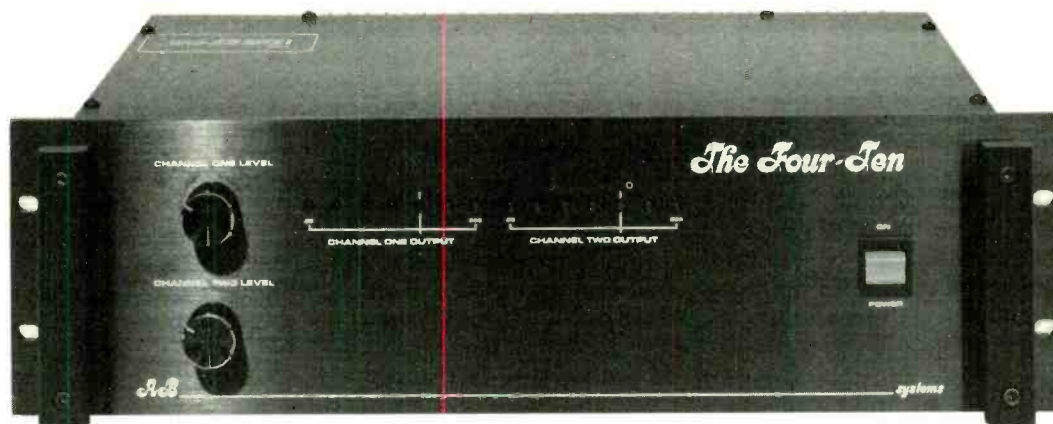
##### LAB MEASUREMENT

± 3 dB, 30 Hz to 15 kHz (TDK AD)  
 ± 3 dB, 28 Hz to 15 kHz (TDK SA)  
 0.04%  
 57 dB (re: 3% THD ref.)  
 67 dB  
 57 dB (unwtd)  
 65 dB (unwtd)  
 1.3%  
 1.7%  
 +7.5 dB  
 +5.0 dB  
 confirmed  
 58 seconds  
 0.23 mV  
 60 mV  
 375 mV  
 59 mV/8 ohms

CIRCLE 9 ON READER SERVICE CARD



# AB Systems Four-Ten Power Amplifier



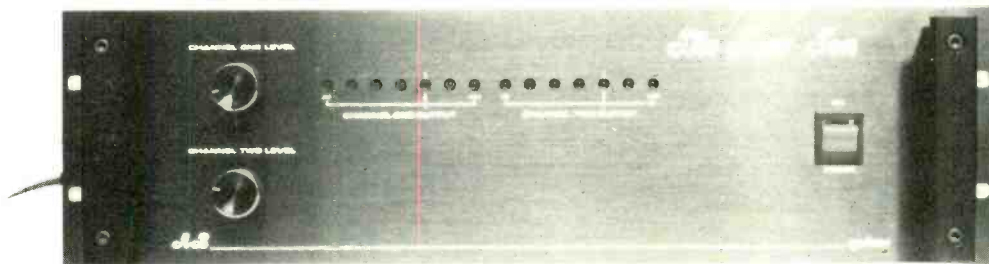
**General Description:** The Four-Ten from AB Systems is a two-channel power amplifier offered for commercial sound applications. The design emphasizes long-term reliability and maximum service accessibility as well as very high power, linearity of response and low distortion. Of rack-mount dimensions, the amplifier's front panel features dual channel LED output displays (seven indicators per channel). Each channel has its own level control. The unit's power off/on switch and two handles complete the picture "up front."

Most of the rear of the amplifier is given over to an enormous heat-sink structure, with the connector panel at one end. Each channel on our test sample has a standard (1/4-inch) phone jack input. Alternate inputs that are available include screw-type terminals, XLR and phono jack connectors. Below the input connectors are input accessory octal sockets that will accept standard bridging or matching plug-in transformers. If no plug-in accessory device is used, pins 6 and 7, and pins 1 and 8 in each socket must be jumpered (our test sample was supplied this way). For the outputs, professional grade binding posts are used which will ac-

provided, the front-panel controls duplicate the rear controls when the latter are set to maximum. Lesser settings of the rear controls then provide an upper limit on the range of the front-panel controls. The front-panel controls may be added to the amplifier after purchase. Another option that may be ordered or added is a dual/mono mode switch for converting the amplifier to single-channel bridged mono operation. Available on special order is a front-panel control for selecting two different output loads (either or both may be selected). When fitted with this option, the amplifier also is provided with dual output posts for each channel, and the octal sockets for input accessories are relocated inside the main chassis.

Yet another option is a fan pack which may be fitted to the amplifier when it is used for producing over 400 watts output per channel into 4-ohm loads. Finally, one or two 70-volt output transformers may be added to the unit.

**Test Results:** In MR's tests, the Four-Ten amplifier exceeded most specs by very comfortable margins and



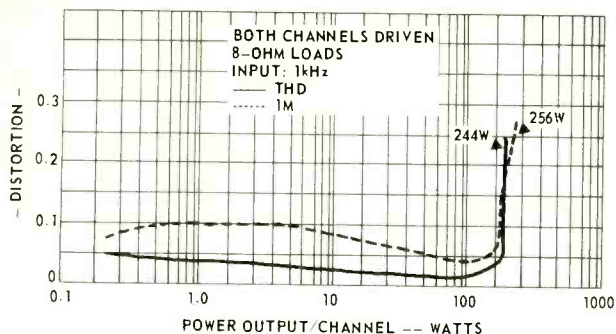
AB Systems Four-Ten: Front panel view.

cept dual banana plugs or to which stripped leads may be connected. Below the outputs are the line cord (fitted with a three-prong grounding plug) and an accessory AC outlet.

The amplifier may be ordered with or without the front-panel controls. If the latter, input gain controls are provided at the rear. If both sets of controls are

generally impressed us as a product of very high caliber, carefully designed, ruggedly built, and living up to its claim of "'work horse' reliability" as stated in the owner's manual. It should be noted that the output section of each channel uses six RCA multiple-emitter power transistors with a total dissipation capability of 900 watts. In an optional bridging mode

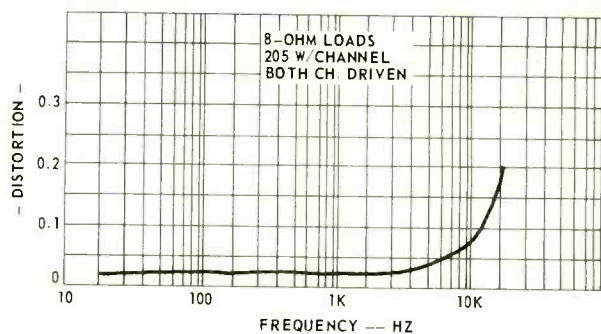




**AB Systems Four-Ten: Harmonic & IM distortion characteristics.**

(for 70-volt direct-transformerless operation) and using the optional fan pack, the power output is rated for 800 watts into 8 ohms. We did not have this fan pack so we stayed with normal stereo mode into 8-ohm loads. The results we obtained suggest that there would be just as much of a safety margin in the alternate modes of use of this amplifier.

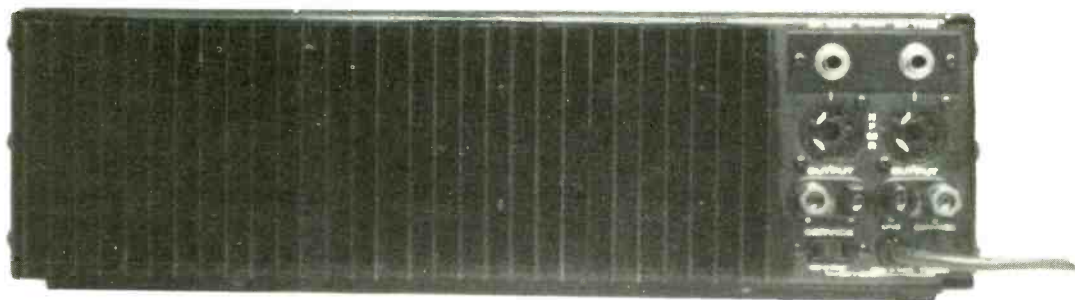
We tried every way we know to "upset" this rugged



**AB Systems Four-Ten: Harmonic distortion vs. frequency.**

fact that only 20 dB of loop negative feedback is used which, according to the recent amplifier literature, is supposed to be contributory to low TIM distortion.

**Individual Comment by L.F.:** Eminently qualified as a professional amp, the Four-Ten is superbly built, with many internal design features of



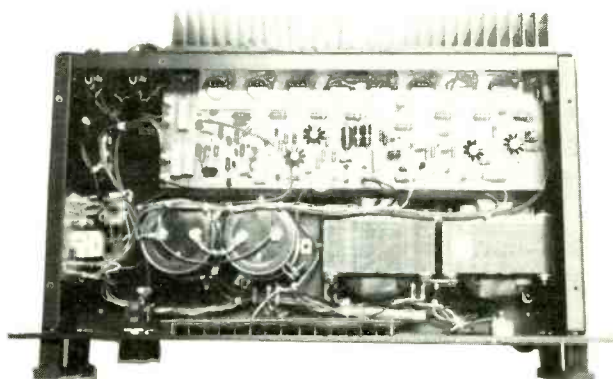
**AB Systems Four-Ten: Rear panel.**

amplifier, subjecting it to quick turn-ons and turn-offs while feeding nearly-rated input signals into it. We did the FTC preconditioning bit (for an hour) with no disastrous results—not even a thermal cutout. Finally "in frustration" we dumped in a high-frequency square-wave at around 20 kHz, and of an amplitude great enough to make any amplifier scream for help. All that happened is that we popped a fuse which, when replaced, restored everything back to normal. Quite an amplifier!

**General Info:** Dimensions are 19 by 5¼ by 10¾ inches. Weight is 26 pounds. Advertised price is \$758.

**Individual Comment by N.E.:** If high-fidelity consumer amplifiers often are promoted with professional implications, the AB Model Four-Ten may represent a reverse situation. While obviously intended for sound-reinforcement use, this amplifier has many of the characteristics we usually associate with hi-fi amplifiers, including the main one of good sound at all power output levels. A possible clue to this may be the

true merit. For instance, VI type energy limiters are used for short-circuit protection, and they will operate only if the load is well below 2.8 ohms at full power.



**AB Systems Four-Ten: Internal view.**

Additional solid-state circuitry protects the connected speaker systems and monitors the DC condition at the output. In the event of a positive or negative DC latch condition in excess of one second, a control circuit is



activated which defeats the entire system by turning off the primary AC circuit. In addition to the 20-dB negative feedback loop, another clue to this amp's

good sound is the use of high-speed, high-voltage silicon annular devices for the pre-driver and inverter stages.

**AB SYSTEMS MODEL FOUR-TEN AMPLIFIER: Vital Statistics**

**PERFORMANCE CHARACTERISTIC**

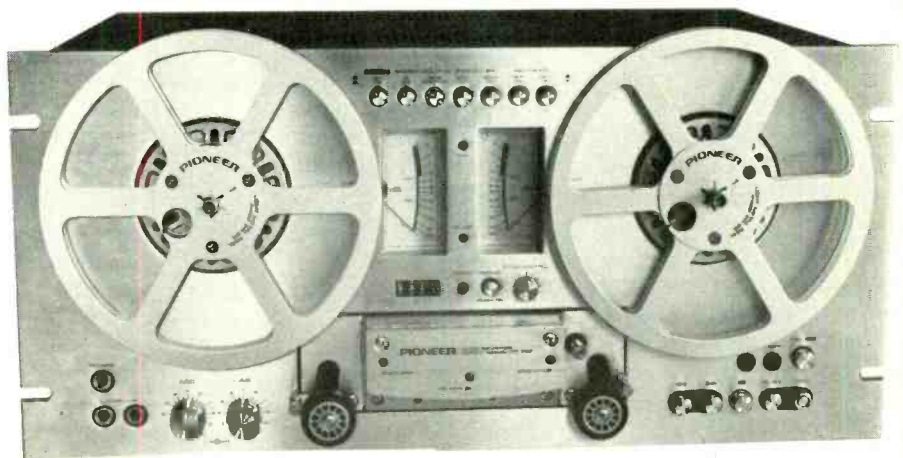
**MANUFACTURER'S SPEC**

**LAB MEASUREMENT**

Continuous power/channel, 1 kHz, 8 ohms	205 watts	244 watts
Continuous power channel, 20 Hz to 20 kHz, 8 ohms	205 watts	208 watts
Power bandwidth	20 Hz to 20 kHz	10 Hz to 22 kHz
Frequency response	± 0.25 dB, 20 Hz to 20 kHz	± 1 dB, 18 Hz to 44 kHz
Damping factor	NA	140
Rated THD	0.25%	0.02% (1 kHz, 205 watts)
Rated IM	0.25%	0.06% (205 watts equiv.)
Residual hum & noise	- 101 dB	- 101 dB
Input sensitivity	0.75 V	1.0 V

CIRCLE 20 ON READER SERVICE CARD

## Pioneer RT-707 Tape Recorder



**General Description:** The Pioneer RT-707 is a reel-to-reel, two-speed (7½ and 3¾ ips), quarter-track tape recorder with an automatic-reverse option for playback (recording is in the forward direction only). In the forward direction there are three heads, separate for erase, record and play. In addition, a fourth head handles playback in the reverse direction. Maximum reel size is 7 inches.

An unusually compact deck, the complete transport and associated electronics are contained in a format not much larger than a high-powered amplifier or receiver. Nevertheless, the unit offers all the basic operations, plus a few extras, of a normal open-reel deck. Performance too is of a high order.

The reel hubs are sturdy platforms fitted with hard rubber radial strips to cushion the reels. In addition, reel pads are supplied for optional use if a particular reel does not "seat" properly. Spring-loaded retainers keep the reels in place. The tape path goes through a

left-hand swinging guide and roller, through the head assembly which includes additional guides, and out past a right-hand swinging guide and the driving capstan and pinch-roller up to the take-up reel. On the head cover are access holes to adjustment screws that permit azimuth alignment of the forward record and play heads, and of the reverse play head.

Centered between the reels are the VU meters which are mounted vertically so that you read them from "down" to "up" instead of from left to right. Calibration is from -20 to +3 dB. Between the meters are two LED indicators, one showing the record mode and the other coming on when the pause control is used.

Above the meters are pushbuttons for power off/on; speed selection; monitor tape or source; bias for standard or LH tape; EQ for the same options; left- and right-channel record-mode off/on.

Below the meters, and just above the head-cover, is a four-digit tape counter and reset button; a pushbutton



for repeat option; and a pitch control, with a center detent position, for varying nominal tape speed over a  $\pm 6$  percent range.

Grouped at the left, near the bottom of the front panel, are standard  $\frac{1}{4}$ -inch jacks for stereo headphone out, and for left- and right-channel microphones in. Near these are the input level controls—a dual-concentric pair (separate per channel) for mic, and a similar pair for line.

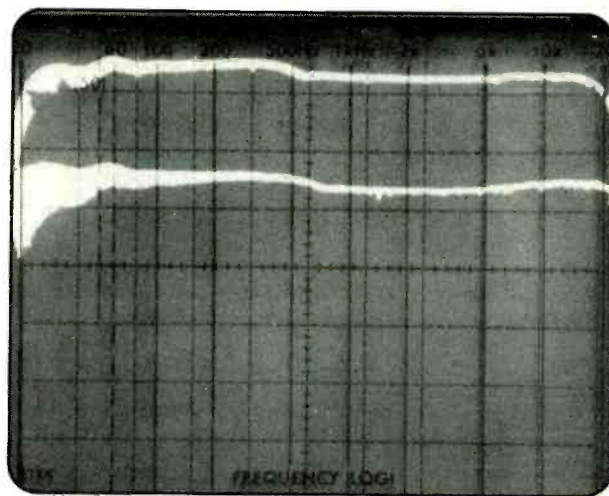
Grouped at the lower right are the transport controls, quick-acting pushbuttons that handle tape motion via a solenoid system. These include the direction selectors as well as the pause, fast rewind, fast forward, stop, play and record functions. The system permits fast-buttoning (going from one mode to another without the need to stop the machine), run-in recording and setting levels before recording. The transport is powered by three motors using a direct-drive system (no belts) throughout.

At the rear of the RT-707 are the line input and output jacks ("hi-fi" pin jacks), an optional DIN socket and line output level controls with detent stop positions for a standard output level (450 mV for 0 dB on the meter). Also at the rear are the AC power cord, an unswitched AC convenience outlet and a grounding terminal. The RT-707 comes in a metal case fronted with a heavy-gauge panel suited for standard rack-mounting. Or, it can be simply placed wherever convenient, resting on the small "feet" under the chassis. Supplied with the deck are an empty metal 7-inch reel, two pairs of stereo signal cables, a small spool of splicing tape, several head-cleaning cotton-swabs and cleaning fluid, a supply of metal foil tabs (to attach to a tape for activating the automatic-reverse feature) and an excellent owner's instruction manual.

In addition to the automatic-reverse option, the RT-707 may be programmed for automatic repeat. Mixing of mic and line inputs is possible via the built-in control system. In addition to stereo recording, the RT-707 can record in mono using the left or right channel only, which permits very long mono takes, as well as sound-on-sound recording, "follow-up" recording (taping a new program while playing a previously-recorded one), and recording with the aid of an external timer while the operator is away (or asleep).

**Test Results:** On all counts, the RT-707 shaped up in *MR's* tests as a better open-reel deck than its price might suggest. Specifications were in general either met or exceeded. Using TDK Audua tape, response at  $7\frac{1}{2}$  ips went well beyond the 20 kHz mark; at the  $3\frac{3}{4}$  ips speed it remained within  $\pm 3$  dB to 17.5 kHz. Distortion at the faster speed did not exceed 0.6 percent even at +3 on the VU meter. Signal-to-noise was excellent at 63 dB. It might be relevant to point out that measurements such as these, obtained without the use of Dolby-B circuitry and with a normally good grade of regular low-noise tape, rather reaffirm the inherent superiority of the open-reel format.

These excellent audio-performance marks were



**Pioneer RT-707: Record/play response at 0 dB (upper trace) and -20 dB record level.**

matched by equally impressive mechanical measurements which were just as good in the reverse-play mode as in the forward-mode.

A three-motor machine using direct-drive, the RT-707 boasts a logic switching system as fully sophisticated as those found on some of the costlier pro decks. Bidirectional "rocking" for accurate cueing is both practical and easy. Tape heads are accessible for cleaning and maintenance. The independent left and right record buttons add some measure of record versatility, and also enable the user to do "punch in" recording and "electronic editing."

In addition to its fine electrical and mechanical performance, and numerous features, the RT-707 seems extremely well built.

**General Info:** Dimensions are: 18  $\frac{29}{32}$  inches wide; 14 inches deep; 9  $\frac{1}{16}$  inches high. Weight is 44 lbs. Advertised price: \$575. (Available too without reverse-play as Model RT-701, \$525).

**Individual Comment by L.F.:** Our more professionally oriented readers may ask why we are reporting on a recorder that seems obviously to be more of a "hi fi" or "home-type" machine, albeit an open-reel model. There are several reasons. For one, it has been a long time since we (or anyone else) has been able to review an open-reel deck priced well below \$1,000 that offers the kind of performance a serious home recordist might expect of an open-reel deck. Then too, many of our readers—while not necessarily audio pros—are nonetheless knowledgeable enough to realize that if they want improved dynamic range, really good signal-to-noise ratio, and editing flexibility, they are still ahead with a good open-reel deck *provided* they do not have to spend about double what they would spend on a good cassette deck to realize those advantages.

In these respects, the Pioneer RT-707 qualifies as a machine eminently worthy of consideration. Of course



its top speed is only 7½ ips, and it handles only 7-inch reels—but at that speed its measured wow-and-flutter beats that of any cassette deck I know of, and its S/N ratio (relative to the 3% THD point) is much better than can be obtained with even the very best (and most expensive) cassette decks around. Remember too that all of our measurements were made without any noise-reduction system in the tape recorder.

To the semi-pro recordist, the reverse-play feature may seem like an unnecessary frill. In fact, when we realized that this feature was not augmented by dual-capstan drive we were at first skeptical about it. After all, it seemed as if the single capstan arrangement was literally “pushing” the tape in the reverse-play mode, with take-up tension of the reel determining the consistency of motion. Imagine our surprise, therefore, when we measured just as excellent wow-and-flutter in reverse as we had in forward.

Note the sweep photo taken of r/p response at 7½ ips, at levels of 0 dB and of -20 dB. Even at 0 dB, response is darn near flat all the way out to 20 kHz.

The RT-707 is small enough to be outfitted in a rack-type carrying case, and I wouldn't be surprised if even a few professionals end up using it as a field open-reel deck wherever a source of AC is available. After all, if you compare its price with that of the standard Nagra there is much to be said for the Pioneer.

**Individual Comment by N.E.:** The format of the RT-707 must be some kind of inspired design. It breaks with the traditional top-heavy format and packages a full-fledged open-reel tape recorder within dimensions not much over those of a high-powered receiver or even of some of the larger cassette models. To be sure, it is reminiscent, stylistically, of an older line of Magnecord recorders that were styled generally this

way, but the RT-707's performance and features are far in advance over those of the older models—not to mention that the older models were mono, not stereo. Comparing the present Pioneer deck with one of those is like comparing a 1978 Alfa-Romeo to a 1958 MG. All they have in common is compact size.

Whether the RT-707 is a “pro” deck or a “home hi-fi” deck can be argued either way, in my opinion. If you insist that a pro deck must run at 15 ips speed and accept 10½-inch reels, then—by that definition—the RT-707 is not a pro deck. But if by a pro deck you mean one that can make excellent tapes, and which also affords a liberal measure of those operational features important to serious recordists (such as fast-buttoning, run-in recording, sound-on-sound, bias and EQ options, reliable and smooth operation), plus the kind of audio performance we have measured on this deck, then certainly the RT-707 qualifies.

Whatever “product category” you choose to fit this machine into, it surely “fits in” very nicely in terms of an installation—not unlike the front-loading cassette deck, this open-reel deck may be installed just like any other audio component. Or, it may be rack-mounted. The price, in view of its performance and features, is a little hard to believe; it seems very attractive, enough so to possibly woo a buyer away from the cassette format—a buyer, that is, who is more than passingly serious about tape-recording, and tape playback too—since the RT-707 does a marvelous job of rendering prerecorded tapes. With the automatic-reverse-play feature it is just the thing for listening to those favorite operas and other long works recorded in both directions on open reel. In my view, the RT-707 could fill many needs in straight-out professional work; it also could be of high interest to the serious home hi-fi fan; and it would make a very apt first recorder for the budding serious recordist.

#### PIONEER RT-707 OPEN-REEL TAPE RECORDER: Vital Statistics

##### PERFORMANCE CHARACTERISTIC

Record/playback frequency response, -10 dB

7½ ips  
3¾ ips

Harmonic distortion, 7½ ips  
at 0 VU  
at +3 VU

Best S/N ratio, std tape

Input sensitivity, mic  
line

Output level, line  
headphone

Bias frequency

Speed accuracy, 7½ ips

Wow and flutter

7½ ips  
3¾ ips

Rewind time, 1200-ft. reel

Erase ratio

##### MANUFACTURER'S SPEC

± 3 dB, 30 Hz to 24 kHz  
± 3 dB, 30 Hz to 16 kHz

1.0%

NA

58 dB

0.25 mV

50 mV

450 mV

70 mV/8 ohms

125 kHz

± 0.5%

0.05% WRMS

0.08% WRMS

100 seconds

70 dB

##### LAB MEASUREMENT

± 3 dB, 22 Hz to 23 kHz  
± 3 dB, 26 Hz to 17.5 kHz

0.6%

0.6%

63 dB

0.20 mV

44 mV

500 mV

70 mV/8 ohms

125 kHz

± 0.3%

0.045% WRMS

0.060% WRMS

65 seconds

70 dB

CIRCLE 14 ON READER SERVICE CARD



# Sound Workshop 1280 Series Mixer

By Jim Ford and Brian Roth

**General Description:** The Sound Workshop 1280 series mixers are intended for the budget conscious user that requires full mixing and monitoring facilities for 8-channel multi-track recording.

Each of the 12 input channels provides:

- (A) A straight-line fader with 2- $\frac{3}{8}$ " travel.
- (B) Solo pushbutton.
- (C) Channel mute pushbutton.
- (D) Four track assignment pushbuttons that operate in conjunction with a pan pot for routing to the 8 outputs.
- (E) Echo send control.
- (F) 3 band equalizer (described in detail below).
- (G) Mic/line selector switch.
- (H) Microphone input attenuator (pad).
- (I) Level trim control; affects microphone or line input levels.

The standard equalizer on the console consists of bass and treble shelving controls as well as a midrange peaking type equalizer with center frequency of around 3500 Hz.

The optional equalizer (available for eight inputs as on the review unit or for all twelve inputs) adds a concentric knob for five frequency selections for each of the three equalizer bands. All of the equalization curves are of the peaking variety except for the last position on the treble frequency selection switch which activates a shelving type response.

Directly above the input channel controls are the eight channel monitor and headphone mix controls. For each of the eight tracks, a monitor level control, monitor pan pot and headphone cue level control are



included. A pushbutton selects either the console line output or multi-track tape machine for the monitor/cue mix. Thus, it is possible to generate a totally separate mix of a combination of tape playback tracks and console outputs for the engineer in the control room as



well as a separate mix for the musicians' headphones.

Above the monitor and cue mix controls are the master level pots for the eight mixing buses. Next to each master pot are three LEDs for level monitoring. Two of these are green and correspond to approximately  $-15$  VU and  $-6$  VU. The third is red and indicates "0 VU." This three light arrangement is used in lieu of mechanical VU meters (which are available as an extra cost option).

To the right of the monitor/cue controls are master gain pots for the cue and echo outputs. Another pair of controls allows the reverb return from an external reverberation unit to be sent to the musicians' headphone cue mix.

Additional controls included are a stereo mixdown master level pot with two sets of LED level indicators; this portion of the mixer is intended for the final mixdown operations as the 8-track master tape is remixed into stereo.

A control room volume control is included along with four interlocked pushbuttons that allow listening to the output of the 8-track monitor mix, the cue mix, the stereo mixdown output or playback from the stereo mixdown recorder.

Below this section are the solo master volume control with an LED tally light to indicate when a solo switch has been activated, the echo return level controls and bus assignment switches and the talkback controls. This last section can talk to either the headphone cue mix or to the 8 buses. A separate talkback output signal is provided by a rear panel jack.

The particular model reviewed has balanced, transformer isolated microphone inputs with connections via 3-pin "cannon" jacks. The majority of the other connectors are RCA phono jacks. Each input channel includes accessory send and receive jacks for patching outboard equalizers or limiters; the send jack is a  $\frac{1}{4}$ -inch phone type with the receive jack an RCA phono





connector. Direct outputs for all twelve input channels are provided by means of RCA jacks.

**Field Test:** We first connected the mixer to a phono preamplifier/turntable combination to get an idea of the fidelity of the circuitry. Overall, the 1280 was quiet and clean sounding. The control room circuitry didn't appear up to par with the rest of the mixer; this section exhibited low level radio pick-up when the control room volume control was near minimum. Also, electrical disturbances in the building from adding machines and similar equipment would cause a strong crackle in the control room output.

We experimented with the equalizers and were pleased with their sound. The equalization curves are fairly broad which means that their characteristics are musical sounding. The bass section of the standard 3-band equalizer appeared to have too high of a turn-over frequency which would create a somewhat boomy sound when moderate amounts of low frequency boost were applied.

The optional fifteen-frequency equalizer performed quite well. All of the curves sounded very good. A sixth position on the frequency selection switches would turn off that section of the equalizer to ensure flat response, a very nice feature.

Next, we tried the 1280 in conjunction with an Ampex AG-440C-8 recorder and a Tascam 80-8 (with dbx). The gain structure of the mixer is designed for recorders such as the Tascam 80-8 which use lower than the standard +4 dBm operating levels. However, the owner's manual gives some recommended internal resistor changes if the mixer is to be used with a pro machine that produces +4 dBm levels. This gain situation caused no real problems other than the fact that playback levels from the Ampex were stronger than the console line outputs when comparing bus and tape by means of the selector switches in the monitor/cue

mix section. The resistor change should eliminate this problem.

We were very happy to see the inclusion of several features not normally found on smaller mixers. The mute switches on each input helped us to keep the tracks clean since we could kill the microphone signal during periods when the musician wasn't playing and thus eliminate headphone or room leakage.

The solo circuitry worked as advertised (the manufacturer claims that the solo function will in no way introduce extraneous noises on to the tape) and we especially liked the fact that the solo signal is taken before the mute switch. This was useful during back-up vocal overdubs. We would cut the chorus, then mute the channel during the verse. Then, after pushing the appropriate solo switch, we could have a two-way conversation (via the talkback circuitry) between the control room and studio while still in the record mode and awaiting the next chorus.

We did continue to have electrical noise pick-up throughout the recording, and we noted that the crackling would record on the tape, although not nearly as strong as heard over the control room loudspeakers. We could not find any simple method of eliminating this noise (grounding, reversing line cords, etc.).

On our model, the frequency designations for the optional equalizer were printed on a clear plastic overlay that mounted underneath the equalizer mounting nuts. The markings were very small and light blue in color making reading of the designations very difficult unless the lighting was just right.

The owner's manual gives recommended procedures for setting the master gains, channel faders and input gain trims. We found that there was sufficient headroom to allow considerable "cheating" of the recommendations. This indicates a well thought out gain structure.

We cannot understand why the manufacturer chose 26 dB for the pad attenuation. This much padding meant that if an input signal required the inclusion of the pad it was necessary to advance the input trim considerably and thus increase the noise level. Fortunately, the 1280 was a quiet performer and this wasn't an extreme problem. However, a small amount (15 or 20 dB) would have handled just about any signal a microphone could generate, and helped maintain low noise levels.

We checked out the direct outputs and found these would produce the quietest feeds since there was not the noise from the mixing amplifier to contend with. The mix bus outputs were quiet, but those direct outputs were nearly dead silent! We did find that the mute switch wouldn't affect the direct feeds, a disadvantage of using those outputs. An examination of the circuit diagrams revealed that it shouldn't be too difficult to change the direct outputs so they are controlled by the mute switch.

The "Tri-lite" level indicators were clever, but not as useful in our opinion as real VU meters. Since mechanical meters are optionally available, we feel that the LED circuitry should have been designed to allow sufficient adjustment range so that the LEDs could indi-



### Noise Performance

All measurements unweighted 20 Hz–20 kHz dB figures are below 0 VU (1 volt, +2.25 dB)

Direct output, pad in, fader normal, microphone gain adjusted for 20 dB	-80 dB
Direct output, pad out, fader and microphone gain adjusted for 20 dB	-94.5 dB
Direct output, pad out, fader normal, microphone gain adjusted for 40 dB for 60 dB	-87 dB -70 dB
Equivalent input noise	-127.75 dBm
Track output, output trim normal, faders down, all inputs assigned to bus	-78 dB
Track output, output trim normal, fader normal, 1 input assigned to bus, mic gain adjusted for 40 dB for 60 dB	-78 dB -69 dB
Mixdown bus, master normal, all inputs assigned to mix bus	-79 dB

#### Maximum Input Levels, Microphone Input (0 dB = .775 volts RMS)

	1 kHz	20 Hz
With pad	+20 dB	+18 dB
Without pad	-5.5 dB	-8 dB

#### Maximum Output Levels, Track Output (0 dB = .775 volts RMS, voltages are RMS)

Frequency	High Impedance Load	600 Ohm Load
20 Hz	9 volts (+21.25 dB)	6.2 volts +18 dBm
1 kHz	9 volts (+21.25 dB)	6.2 volts +18 dBm
20 kHz	8.5 volts (+20.75 dB)	5.8 volts +17.5 dBm

Direct outputs approximately ½ dB lower.

#### Total Harmonic Distortion, Line In to Direct Out (0 dB = .775 volts output level)

Frequency	1 volt (0 VU)	7.75 volts (+20 dB)
20 Hz	.01% +	.02% #
1 kHz	.005% *	.02% #
20 kHz	.009% #	see text

\*Mainly noise

+ Mainly 2nd. and 3rd. harmonics

#Mainly 3rd. harmonic

Figures for track and mixdown approximately the same, residual consists of higher order harmonics.

#### Intermodulation Distortion 60 Hz and 7000 Hz mixed 4:1

	Output Level	
Output	1 volt (0 VU)	7.75 volts (+20 dB)
Direct	.006%	.04%
Track and Mixdown	.014%	.05%

cate clipping conditions. Although the indicator sensitivity is adjustable by trimmer pots accessible through holes punched in the mixer's bottom plate, it was not possible to raise the trigger point high enough to indicate clipping.

After satisfying ourselves that the 1280 was a good performer, we examined the interior of the unit. After removing six screws from the bottom plate and four screws from each of the wooden end plates, we finally gained access to the circuitry.

Component quality was adequate, and construction standards were very good. All of the integrated circuits were installed in sockets, making their replacement very easy. The printed circuit boards themselves could prove more difficult to service since they are attached to the front by the various controls. We could find no line fuse, a potentially hazardous situation.

Our basic opinion of the mixer after using it was that

it is a versatile and clean sounding unit. The performance was excellent, particularly considering the price.

**Lab Tests:** On the test bench, the 1280 held its own. Noise figures were low with only a small trace of hum ever noted. The lack of hum is due to careful internal layout.

The frequency response was astounding. Even through the microphone input, the high end -1 dB roll off was at 42 kHz. Through the line inputs, we noticed that the setting of the input trim controls would vary the frequency response, although at worst case, response was -1 dB at 85 kHz. At other trim settings, the response would extend to as high as 600 kHz! This is all well and good except for the fact that the I.C. op-amp chips used had a rather low slew rate. Thus, there is no way that ultrasonic frequencies could be safely handled since they would exceed the slew rate capabilities of the op-amps. We would have preferred to see a more limited high-frequency response (-1 dB at 75 kHz or so should make even the hard core "golden ears" happy).

Square-wave response was good, although there was some "ringing" through the microphone inputs. Ringing was also noted at certain gain settings through the line inputs.

Distortion figures were generally very low with the exception of the +20 dB (7.75 volt) output level at 20 kHz. The slew rate limiting characteristics of the op-amps reduced the maximum output level to about 5.5 volts RMS (+17 dB) for .5% THD. We would have been happier to see "faster" chips used to eliminate this situation.

The distortion residuals were mainly second and third harmonics although higher ordered products were observed from the mixing bus and control room outputs.

The microphone preamplifier could handle about -5 dBm levels at 1 kHz and about -8 dBm at 20 Hz without the pad. Distortion through the preamp was generally on par with the line inputs with the exception of higher distortion at low frequencies.

As received, the red "0" VU LEDs lit at about 1 volt (2.25 dB) rather than the -2 dB level mentioned in the literature. This was easily adjustable, however.

Finally, the owner's manual seemed complete, although perhaps a bit confusing for the novice. Nevertheless, the manual is much better than many we have seen.

The service data was very detailed and should give ample data to a competent technician.

**Conclusion:** With a very few exceptions, it seems that Sound Workshop has hit the nail on the head. The 1280 gives all of the basic necessities for 8-track work (or for an elaborate PA system) and it is a clean performer. A few areas need examination (power fuse, the equalizer designation overlay and line noise pick-up) but generally the mixer is first rate.

CIRCLE 3 ON READER SERVICE CARD







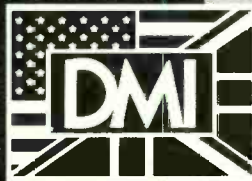
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### **SPECIFICATIONS:**

#### **INPUT**

**IMPEDANCES:** Hi Z = 50 K unbalanced; Low Z = 200 Ohm transformer balanced. **MAX. INPUT LEVELS:** Hi Z = +20dBm; Low Z = +8dBm. **GAIN:** Hi Z = 0-46dB, continuously variable; Low Z = 12-58dB, continuously variable. **EQ:** High  $\pm 15$ dB at 10K, shelving, Middle  $\pm 9$ dB at 2K, peaking; Low  $\pm 15$ dB at 100 Hz, shelving. **MONITOR:** Pre-EQ, unaffected by off switch. **ECHO:** Post-EQ, Post-fader. **LEDS:** Green lit from -10 to +21; Red lit from +15 to +21; 6dB headroom left when Red lit. **EQUIVALENT INPUT NOISE:** -110dBm from Hi Z input -122dBm from Low Z input. **T.H.D.:** @ 1kHz any level up to clipping typically less than 0.1 percent.

#### **OUTPUT**

**IMPEDANCE:** Nominal 600 Ohm unbalanced. **MAX. OUTPUT LEVEL:** 8.8V RMS @ 10K Ohm (+21dBV). **GAIN:** Mike in to line out +60dB. **EQ:** Hi  $\pm 15$ dB @ 3.5 kHz; Low  $\pm 15$ dB @ 35 Hz. **V.U. METERS:** "0 VU" = +4dBm at output of buss amp, switchable from stereo mix to monitor mix. **FREQUENCY RESPONSE:** Mike in to line out  $\pm 1$ dB, 30 Hz - 20kHz. **SIGNAL TO NOISE:** Mike in to any output - typically 70dB. **T.H.D.:** Any output 1kHz any level up to clipping typically less than 0.1 percent. **POWER REQUIREMENTS:**  $\pm 15$ V DC @  $\frac{1}{2}$  Amp.

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CIRCLE 47 ON READER SERVICE CARD



# GROOVE VIEWS

Reviewed by:  
SEDGWICK CLARK  
JOE KLEE  
GIL PODOLINSKY  
RUSSELL SHAW

POPULAR

**REX:** *Where Do We Go From Here?*  
[Eddie Leonetti, producer; Lee DeCarlo, engineer; recorded at Record Plant, New York City; 000 Studios, New York City;

and A&R Studios, New York City.]  
Columbia PC 34865.

Performance: **Totally derivative**  
Recording: **Muddled**

Some of the members of Rex got their start playing some of the clanging rock clubs of Atlanta, Georgia, which just happens to be this writer's residence. By

themselves, the two facts matter little, yet I should like to report that I've seen bassist Orville Davis about two dozen times with his old band, Hydra. Vocalist Rex Smith I recall with hazy brain. I've heard him, but no performances stand out.

So why is there no tinge of hometown loyalty? Well, simply because this is some of the most distinctly unoriginal



REX: Decidedly unoriginal



music I've heard in years. Bands like this are usually signed to labels as a result of returned favors and a lot of politics. They sound no better than your local copy group, the type who plays Aerosmith imitations till last call.

In this case, the model is Led Zeppelin's Robert Plant. Smith really has Robert's act down pat, from the wailing falsetto vocals to the quaver. Anyway, Smith fails to carry the ball over the goal line. "7 Come 11" encourages Smith to tackle the upper register, an assignment he barely passes. More tragically, the bluesy confessional "Chains On My Heart," which has all the makings of a good song, is not properly conveyed by Smith's weak, indecisive timbre.

Not helping matters is the vocal mix. It gives a weird echo effect which has the practical result of placing everyone in an apparent fishbowl. This tactic muddles the indecipherable lyrics even worse than they were to begin with. However, considering the notion that this quintet does not harbor any latent Randy Newmans, little is lost. R.S.

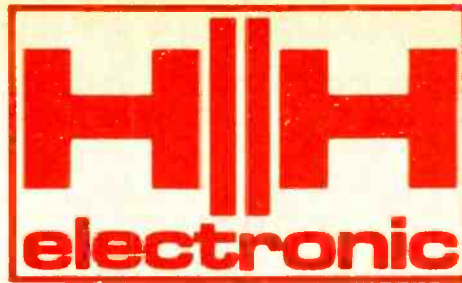
**DAVE MASON:** *Let It Flow.* [Dave Mason, Ron Nevison, producers; Michael Beiriger, Rick Smith, engineers; recorded at The Record Plant, L.A., Ca.] Columbia PC 34680.

Performance: **Consistent, though due for an overhaul**

Recording: **Okay**

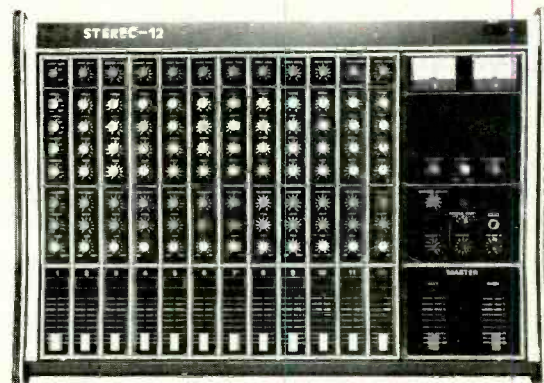
Dave Mason has been around one hell of a long time, which is neither good, bad or indifferent, merely a statement of fact. His songs are, however, all tending to sound the same. One of the problems of being around so long is that you run the risk of no longer being relevant. Personally, I'd like to see some sort of change in either his songwriting or production—preferably both.

This album is no different from any of his others. "Mystic Traveller" (the third cut on side one) opens with a dry acoustic guitar, quite similar both in sound and effect to Chicago's intro on "Wishing You Were Here." The second time through the intro, the strings make their appearance, along with a harp, letting you know that they're going to be there throughout the piece. Low cellos and oboes lead into the vocal. The combination of plodding voice and time signature immediately identify Mason. As he makes his way to the chorus, it's harp arpeggios and synthesized strings.



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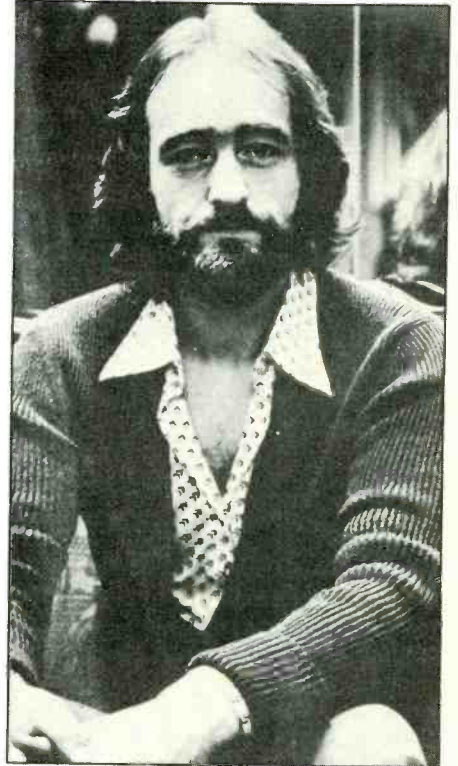
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Running through it is either a high female vocal line, or synthesizer line similar to that in the Star Trek theme, used to obtain the same effect. The acoustic guitar that Mason's been picking to this point is backed off such that only random notes filter through. Bass is well off the front, serving only as an underlay. Likewise, the snare, placed in the center of the mix, is in only for the downbeat. Make no doubt about it, this is a string tune with



DAVE MASON: Losing his relevance

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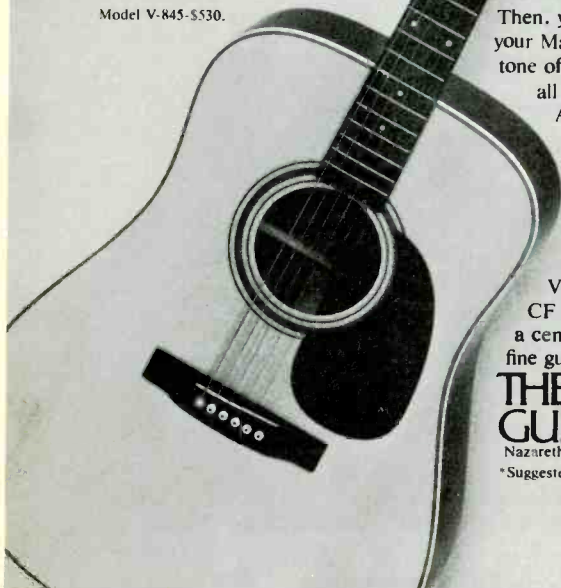
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themes, counterthemes, arpeggios and riffs emerging, running opposite and into each other—amuck, in general. At the break, horns join the fray, and are also centered in the mix. Mason's voice ends up fighting the strings to be heard, leaving you wondering if he's going to make it all the way through. He did, but I didn't. Dave, a change is indicated. G.P.

**METRO:** *Metro*. [Metro, Peter Sames, producers; Dave Grinstead, engineer; no studio credited] Sire SR 6041.

Performance: **Refreshingly new**  
Recording: **So enjoyable!**

This is my choice for debut album of the year. Instrumentally, musically and lyrically astute, this record is the salvation of punked-out, bored and batter-



ed music critics and listeners alike. It's so unexpectedly good for a debut album that it's difficult to get excited about anything else. For those of you who demand comparisons, take the strengths of Alan Parsons, 10CC, Steely Dan, Roxy Music and David Bowie and you have Metro. This English trio (along with backing musicians) approach each track differently, resulting in the feeling that each track was done by a different group. They produce so many varied moods of great intensity that to single out only one track cannot be done in terms of style, but only in terms of underlining their versatility. My favorite track is "Flame," which begins with "Overture to Flame." To say there's a lot going on here is quite an understatement. "Overture" begins with a heavy synthesized string intro, giving way eventually to an electric guitar left which has been rising in volume for several bars. On top of that, still left of the mix, is a second electric guitar playing chords in reverb. A third guitar right plays a repetitive riff and is joined by drums and what is either a wowed bass or clavinet, both in stereo.

As the piece moves into "Flame," cymbal crescendos are left, a picked electric guitar consumes the background right while its counterpart plays a competitive riff left. While that is going on there's another duel between a volume pedaled guitar right and synthesized string sweeps left, giving way to a guitar solo left. That movement is then climaxed by both the lead guitar and bass joining in a mounting scale which concludes with the introduction of a classical guitar left, signifying yet another movement. As that guitar begins to lay the foundation of the next passage, cymbal crescendos emerge left, followed by a second classical guitar placed opposite in the right of the mix. Finally, the slightly echoed vocal breaks center. For the first verse the voice is flanked by two classical guitars. Next bass and drums enter. The bass is very subdued while the drums are recorded with no bottom, just mids and highs to get that thin, ringing sound. All this is embellished by what appears to be echoed finger cymbals recorded at a distance to capture a natural ambience.

The solo emerges, being acoustic piano right, classical guitar left, and a Rhodes playing only selected single notes to achieve that vibrato effect. As the song goes into its last chorus, a male chorus emerges so that the song is now layered with bass and drums bottom, male chorus comprising the second layer,

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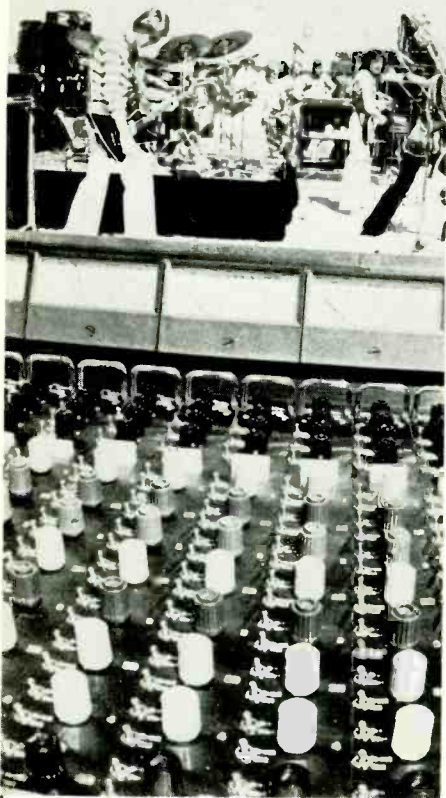
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## At the heart of the Swing Era

By Nat Hentoff

A quite wondrous dividend of the surging interest in jazz these past few years is a bonanza of reissues. A number of them have been produced by Frank Driggs, an impressively precise and thorough historian and discographer. One of his most resplendent achievements is *The Complete Lionel Hampton*, (Bluebird)—a boxed, six-LP set of all the titles the Hampton's select small combos recorded for Victor during the apex of the swing era. (In a number of cases, alternative takes are also included).

Admittedly, and inevitably, there are routine passages; but a sizeable percentage of these performances have become part of the classic jazz canon. Among the most incandescent are those dates including members of Duke Ellington's orchestra—Johnny Hodges's soaring "On The Sunny Side of the Street," "Don't Be That Way," a paradigm of the essence of relaxed swing, and a sharply witty yet lyrical Rex Stewart in "Twelfth Street Rag."

Threading in and out of these resolute informal Hampton dates—where arrangements were far less important than the spontaneous mix of the high-powered improvisers—is an array of jazz titans. Benny Carter, the elegantly incisive alto saxophonist; the intensely driving Chu Berry, a tenor saxophonist almost of the stature of Coleman Hawkins; and Hawkins himself, magisterial, bursting with ideas, and possessing a sound of enormous authority.

In terms of the transition between swing and modern jazz, the most renowned tracks here are four recorded in 1939 with Benny Carter, Coleman Hawkins, Ben Webster (a nonpareil reed section)—and Dizzy Gillespie. The latter revealing even then a freshness of conception that was, of course, to become one of the most influential

in jazz history. The key performance from that date was "When Lights Are Low," presented here both as originally released and also in an unissued master. Yet a further source of pleasure and vivid history in this set are solos by jazzmen who, if not forgotten, do remain underappreciated. Trumpeter Henry "Red" Allen, trombonist J.C. Higginbottom, and—somewhat of a revelation to me—trumpeter Ziggy Elman of the Benny Goodman band. Elman, rather constricted in a big band setting, clearly delighted in stretching out in this ambience. His big, vibrant tone and thrusting swing made for satisfying flights that were often marked by the cadences and "cry" of what can be called Yiddish soul music. Elman was one of the relatively few Jewish jazzmen to incorporate his own down home strengths in this kind of session work.

As is customary with Frank Driggs's historic productions, the accompanying booklet includes full discographical information and a valuable historical profile of the leader. (This one by Stanley Dance.) The leader, to be sure, was the vital, jumping center of these proceedings. A vibist of infectiously genuine enthusiasm and a sure structural sense of improvisation, Hampton provided a rhythmic exaltation and generosity of spirit that had much to do with the pervasive ease of these performances. He also sang on occasion, and while his voice was not exceptional, his phrasing was so resiliently instrumental that the vocals, too, added to the continuing celebrations.

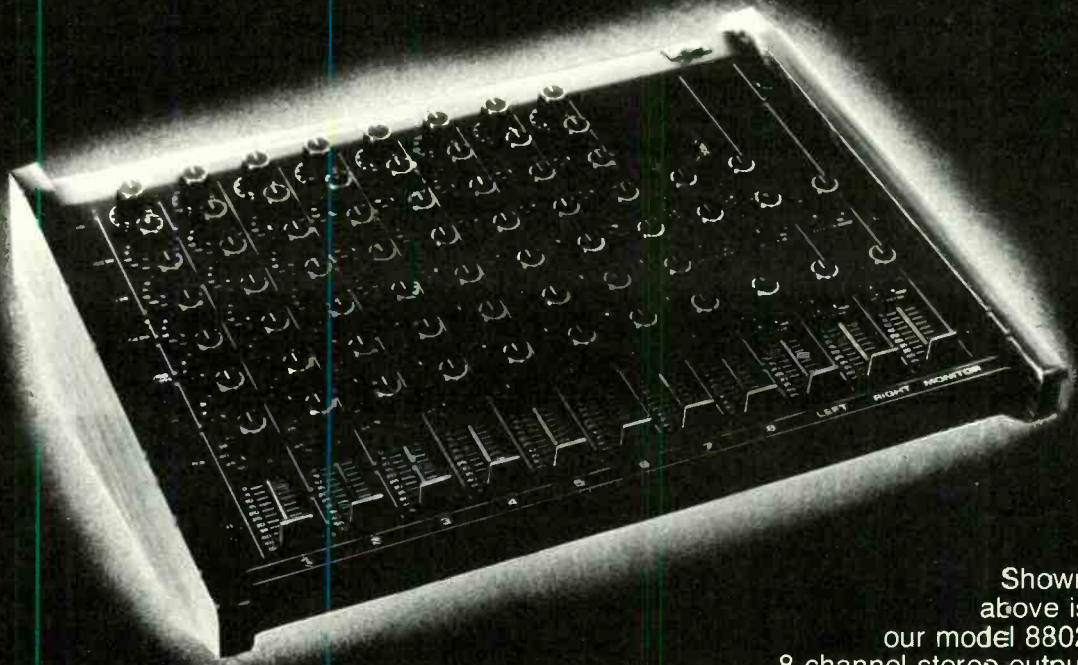
**LIONEL HAMPTON:** *The Complete Lionel Hampton. 1937-1941.* [Frank Driggs, reissues producer.] Bluebird AXM6-5536.





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**METRO:** Unexpectedly good

light synthesized strings on top of that, topped off by the lead vocal, still flanked by the two classical guitars. At the completion of the verse, the song then picks up tempo, changes octaves and builds to a fade out. Whew! This is truly the work of individuals who understand both the workings of the studio as well

as the use of instruments for effect. Not only is this recording no stranger to my turntable, but I anxiously await the arrival of its next of kin. G.P.

**PABLO CRUISE:** *A Place In The Sun.*  
[Bill Schnee, producer; Bill Schnee,

Eric Schilling, George Tutko, engineers; recorded at the Record Plant, Sausalito, Ca.] A&M SP 4625.

Performance: **Mechanical**  
Recording: **Functional**

Pablo Cruise has all the prerequisites for competency; adequate instrumental abilities, a theatrical sense of compositional and vocal attack which finds fruition in carefully timed solos, neat, measured lyrics, and ultimate high placement on the charts.

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We've heard songs like "Never Had A Love," "Atlanta June," and "Watcha Gonna Do" before. "June" is a lament about a former love who raked him over the emotive coals. Little guitar and keyboard fills, not amounting to anything more than a few measures on someone's

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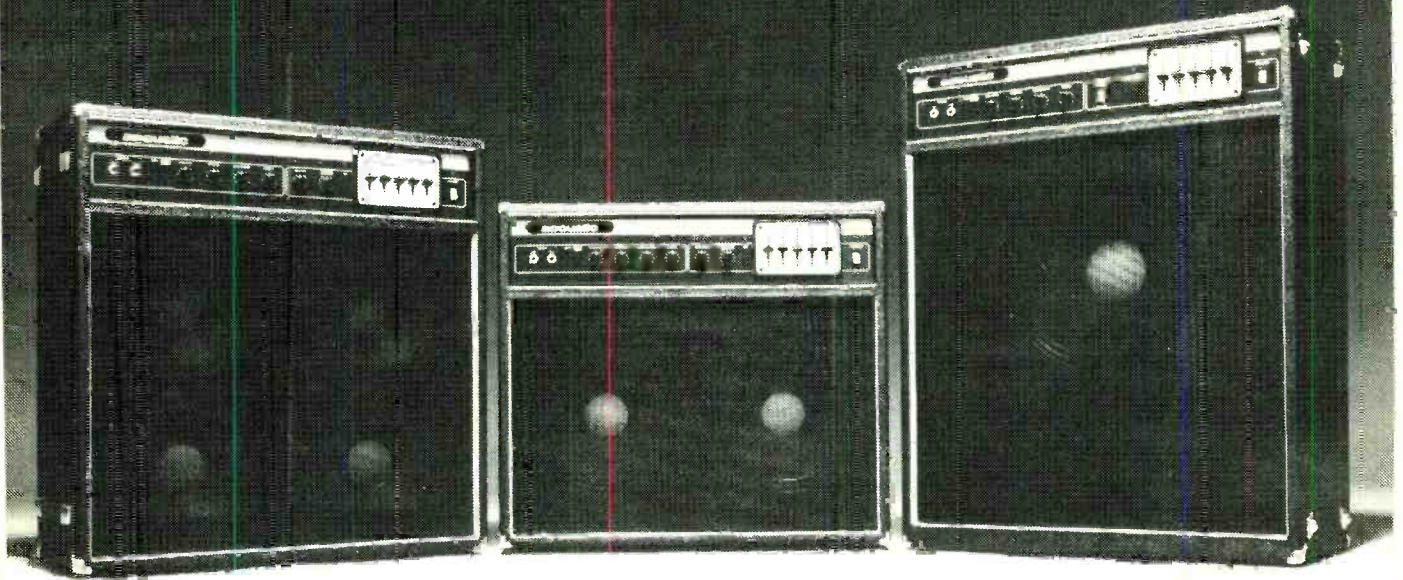
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**PABLO CRUISE:** Latent fire

lead sheet, are vagrantly tossed out. On "Watcha Gonna Do," a series of flattened fifth vocal blue notes are summarily dispatched.

With a group as dry as this, you could

turn the tapes and let them roll. Any latent fire, such as the promising instrumental "El Verano," is lopped off. A cooling melange, it is given less than five minutes to live. More propulsion—

and less formulaic equations—would produce a disc of more than passing interest. R.S.

**Dictators:** *Manifest Destiny*. [Murray Krugman and Sandy Pearlman, producers; John Jansen, engineer; recorded at the Record Plant, New York City, plus one "live" track, site unspecified.] Asylum 7E 1109.

Performance: **Damning power**  
Recording: **Brilliantly raw**

This is not music for the meek. If you are a gentle, reticent soul, stay away, please, for this stuff will harm you.

The monotonous, endlessly repeated series of banging guitar-based chords (with an occasional solo) work effectively to drive home the Dictators' messages of alienation, and frequent satirical lunacy. Throughout, we are introduced to several bizarre situations: a friend of a scientist cracks open the test tube, giving birth to a monster; a man captures a dread disease with literally disgusting anatomical changes; a revolutionary decides that he could make more waves if his love life

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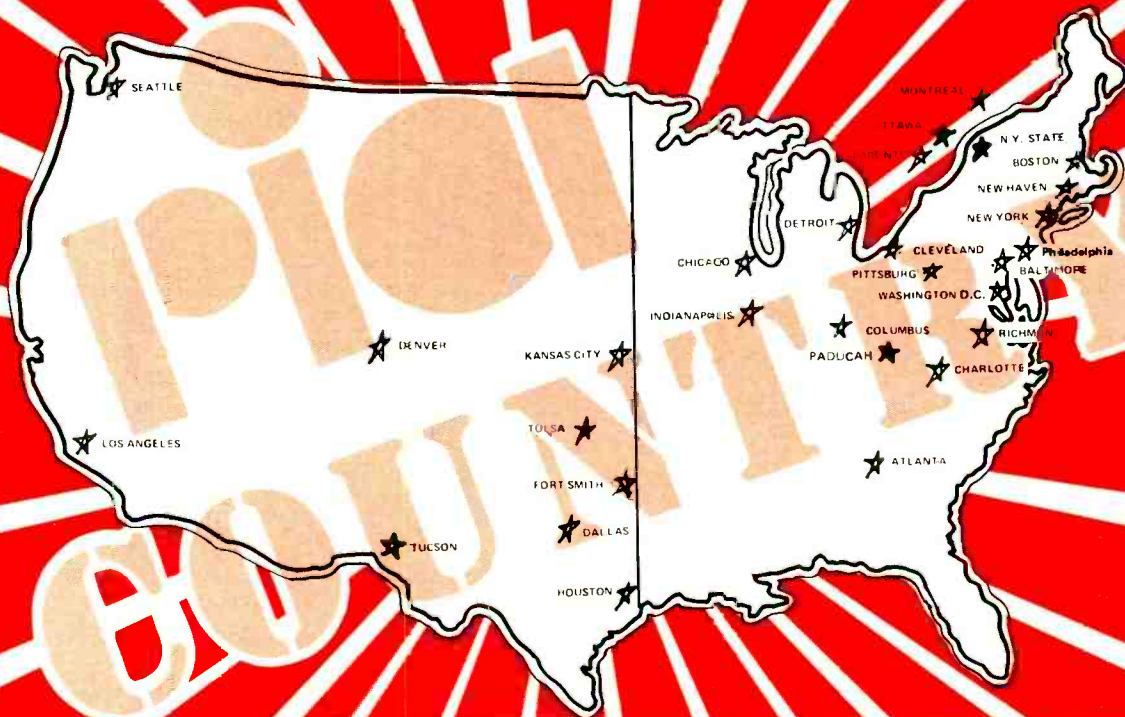
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**JESSE WINCHESTER:** *Live At The Bijou Cafe.* [Sonny Fox, producer; Joel Fein, Steve Tose, Al Williams, engineers; recorded at the Bijou Cafe, Philadelphia, Pa., and Media Collage, Montreal, Quebec, Canada.] Bearsville PRO 693.

Performance: **Eloquently tasteful**  
Recording: **A few mixing problems**

One can hardly bring up the name Jesse Winchester without drawing immediate comment about his experiences in expatriation. While his move to Canada to avoid the draft, his long exile, and recent return for touring purposes have, in certain quarters, placed him in celebrated martyr status, he was an eloquent songwriter long before his political views were widely known.

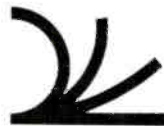
Not long after President Carter took office, he pardoned the draft resisters, permitting Jesse to enter, and play, the States legally. Two of these sides are a "live" tape of one of those performances—at the Bijou Cafe in Philadelphia.

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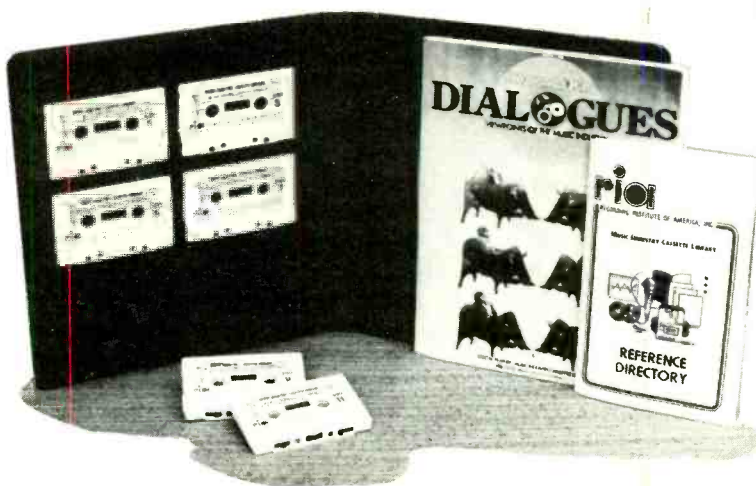
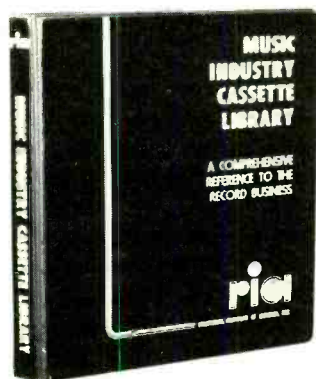
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JESSE WINCHESTER: Intensely human

casual of "Payday," the poetic imagery of "Defying Gravity;" the satirical drollness of "Twigs and Seeds;" the romanticism of "Yankee Lady." He's an intensely human performer and backed by a reasonably capable band, he gets the message across.

Unfortunately, the fluid emotive flow is hindered by some severe mixing problems. On the bluesy rocker "Payday," the drums of Dave Lewis, while brewed to overprominence, are excusable; yet on a love ballad like "Tender Heart," this same flaw is both detracting and distracting. Conversely, on the same track, Marty Harris' electric bass is discernible only with the home console gain turned almost all the way up.

The other platter is an interview designed for radio purposes. There are even silent segues where a station can stick in a commercial message. Taking almost fifty-three minutes, this discussion covers the questions you would expect Jesse to be asked. Actually though, there is not much talking, as the format seems to be an interweaving of Winchester's replies with lyrically compatible selections from his previous works. Example: "after the pardon came through, I had to weep;" suffixed by a rendition of "Bowling Green," the old Everly Brothers paean to that

charming Kentucky burg. Although Jesse is actually from Tennessee, it's close enough to make the point. R.S.



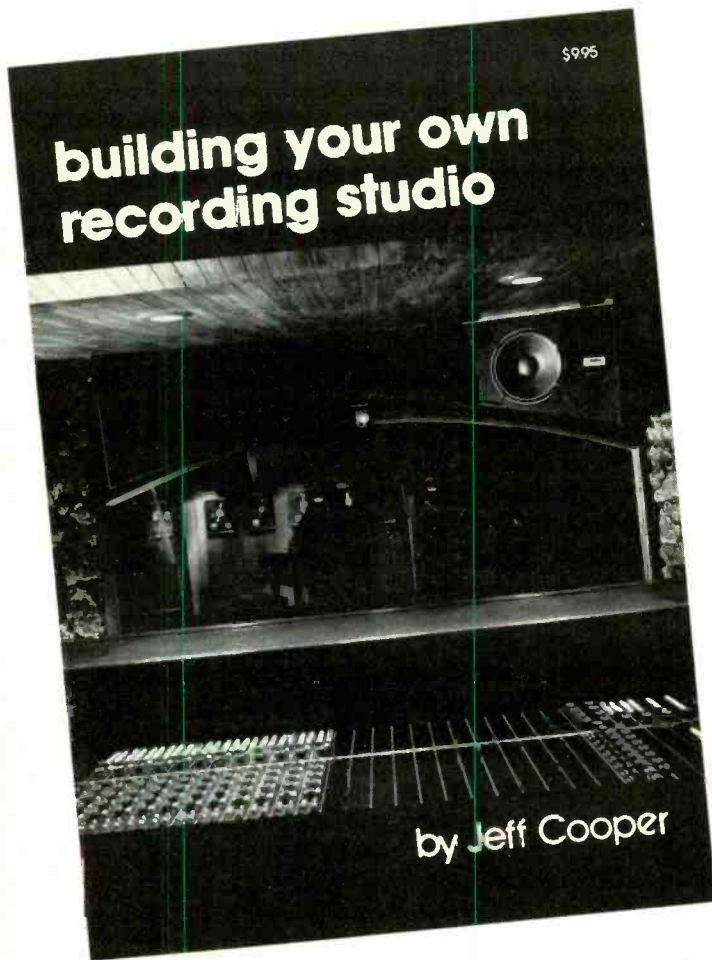
**DAVE JASEN:** *Rip-Roarin' Ragtime.* [Dave Jasen, producer; Dan Presgrave, engineer; recorded at the studios of Washington University, St. Louis, Mo. in June, 1977.] Folkways FG 3561.

Performance: **Rare nuggets revealed**  
Recording: **Mono...but that's all they really needed**

The thing that sets Dave Jasen apart from the other players on the ragtime scene is his repertoire. There are only two selections in this program "Fig Leaf Rag" and "Ophelia Rag" which have ever appeared on an LP prior to this recording. The other material is either composed by Jasen himself ("Somebody's Rag" and "Macadamian Scuffle") or neglected masterpieces by ragtime composers, some of which, such as Joseph Lamb's "Champagne Rag" and Roy Bary's "Sweet and Tender," have



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never been recorded before... ever! This is the sort of scholarship one can expect from a ragtime expert whose book *Recorded Ragtime* is soon to be joined by another book *Ragtime, An Original American Music* written in collaboration with Trebor Tichenor.

As a player Jasen makes the music live. The literalists who take too seriously Scott Joplin's admonition not to play this music fast overlook the fact that ragtime was a joyful music for dancing and enjoying. This is exactly what Jasen and his musical pals (Ed McKee on tuba and Mike Schwimmer on washboard) make of it. This spirit is captured in the

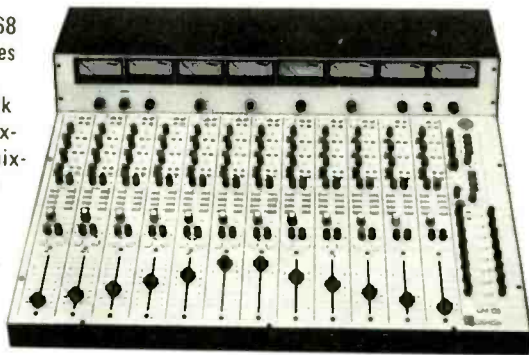


DAVE JASEN: Not heeding the warning

very tasteful monaural recording and put out by Folkways Records with authoritative liner notes by Alan Douglas. Actually this album was originally to be recorded in New York with a studio tuba player and drummer but when Dave Jasen arrived at the St. Louis Ragtime Festival and had the opportunity to play with McKee (tuba player with the St. Louis Symphony as well as alternate tuba player with the St. Louis Ragtimers) and Schwimmer (a Chicago-area based percussionist who has returned to the crispy virtues of a well-scrubbed washboard—the instrument used for percussion effects on pre-electrical recordings made with equipment that would not record a full drum set) there was a quick change of plans

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\*[S]=shelving, [P]=peaking

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and the album was recorded in St. Louis which, they tell us, is the cradle of ragtime. J.K.

**DAVID SANBORN BAND: *Promise Me The Moon.*** [Dale Oehler, producer; Alex Sadkin, Jack Nuber, engineers; recorded at Criteria Studios, Miami.] Warner Bros. BS 3051.

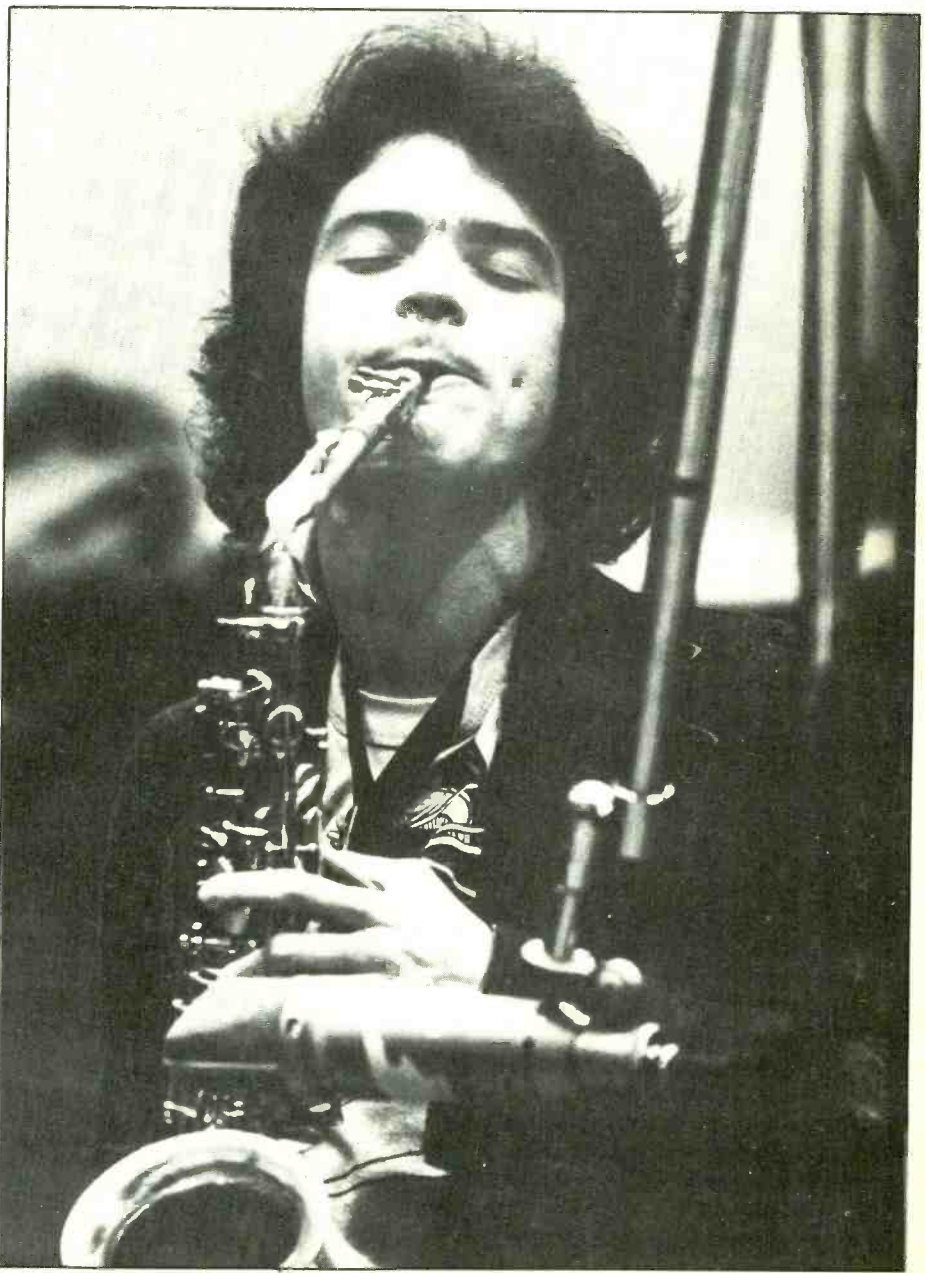
Performance: **Leader upstaged by female chorus**  
Recording: **Okay**

This album is very difficult to categorize, for it's too light musically to fall into any one specific style. It's also full of half-baked ideas which indicates con-

stant directional change in terms of production.

A saxophonist by trade, Sanborn makes the mistake of singing and accomplishes nothing by running over such fine female vocalists as Lani Hall, Kat McCord and Christine Faith. Just when we start getting the impression that this is a rock album, the music downshifts into an instrumental that uses a bland funk bass for a cornerstone and different percussives simply for the sake of having them. Overall I'm left with a great feeling of utter contrivance.

This is purposeless music and quite uneven at that. What would have been more effective would have been to reverse the roles and feature the female chorus with occasional sax interlude.



DAVID SANBORN: *Fragmented*

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Guitarist Hiram Bullock, who contributed two songs here is another man who should never be allowed near a mic with the intention of singing into it. As the featured guitarist, he only plays a few chords, so who knows if he can play? That's the story for the whole rhythm section as well, since no one solos but Sanborn, and so they tend to fall into repetitive, boring rhythms. There isn't one song really worth singling out to describe the mix, in fact, there's very little redeeming play here. This is a perfect example of an album that was recorded without the production goals completely thought through. The result is a fragmented recording. G.P.

**FREDDIE HUBBARD:** *Bundle of Joy*. [Bert DeCoteaux, producer; Bob Hughes, engineer; recorded at Total Experience Studios, Hollywood, Ca.] Columbia JC 34902.

Performance: **Joyous**  
Recording: **Slick and polished as a rock star's**

Freddie Hubbard's certainly come a long way since his days in Sonny Rollins' group. Today Freddie is winning polls right and left and recording under his own name for a major label and reaching a mass market he never dreamed of back in his days as a struggling sideman. Unlike some of his peers, he's been able to do that without losing his sense of taste and style which makes the truly creative jazz player a different breed from the third horn player with whatever jazz/rock band you'd care to mention. He *still* improvises. He *still* shows his firmly implanted roots in Dizzy Gillespie and Clifford Brown. So even if today he records with string backgrounds and rocky rhythm sections, he's still basically the same musician he was when he played with Rollins or with Art Blakey's Jazz Messengers.

Another facet to be admired in Hubbard's playing is his fondness for the old standards. He once admitted to me in an interview that, if he couldn't come up with an original tune that he enjoyed playing more than he enjoyed playing a standard, he'd rather play the standard—and he usually does include a standard, often a neglected one, on his albums. This album includes "A Portrait of Jenny," a 1948 ballad by one-time Original Dixieland Jazz Band pianist J. Russell Robinson, played by Hubbard as a trumpet solo accompanied only by

harpist Dorothy Ashby and David Garfield on celeste.

As for the sound, well, it's typical of the sound that Columbia's been giving their jazz stars turned pop stars lately. It's a good, glossy, finished sound but it's probably the result of a lot of overdubbing, echo and all the gimmicks that go to make up a record today. If a jazz performer feels he wants these advantages for his jazz performances, I won't deny him that. It's when the technology becomes so important that the music becomes secondary that I throw up my hands in disgust. Happily, that hasn't happened yet with Freddie Hubbard. J.K.

**LEE RITENOUR:** *Captain Fingers*. [Skip Drinkwater, producer; Don Murray, Tommy Vicari, John Mills, engineers; recorded at Kendun Studios, Burbank; Sound Labs and Western Recorders, Hollywood, Ca.] Zembu PE 34426.

Performance: **Good, with high expectations**  
Recording: **Contemporary**

This is the best solo album made by a session musician to come out for some time, for it demonstrates great potential. It's obvious that Lee can play—and equally as obvious that he's still developing his own style. There are other drawbacks, however. The overall intent of the production appears to have been to do a George Benson-type album (what, *another* one?), so Lee has to put up with strings and single note melodic playing rather than improvisation. I think they went too far in having Ritenour use the same tonal quality as Benson, and the complete vocal/scat singing/guitar interplay (a la Benson on Stevie Wonder's "Isn't She Lovely") is absolutely tasteless. When he goes for the more contemporary rock sound, like on "Captain Fingers," he sounds a bit like Jeff Beck. Still, Dave "3 Days of The Condor" Grusin composed two tunes and played on four of the seven, which is a definite bonus.

Ritenour himself contributed three numbers, as well as utilizing the 360 Systems Polyphonic Guitar Synthesizer on four others, opening the door slightly further as to the potentialities of the instrument. Given a free rein, who knows what Lee would have done. Mix wise, lead guitar, other soloed instruments, bass, drums and strings are centered. Depending on the tune, rhythm guitar and accompanying piano

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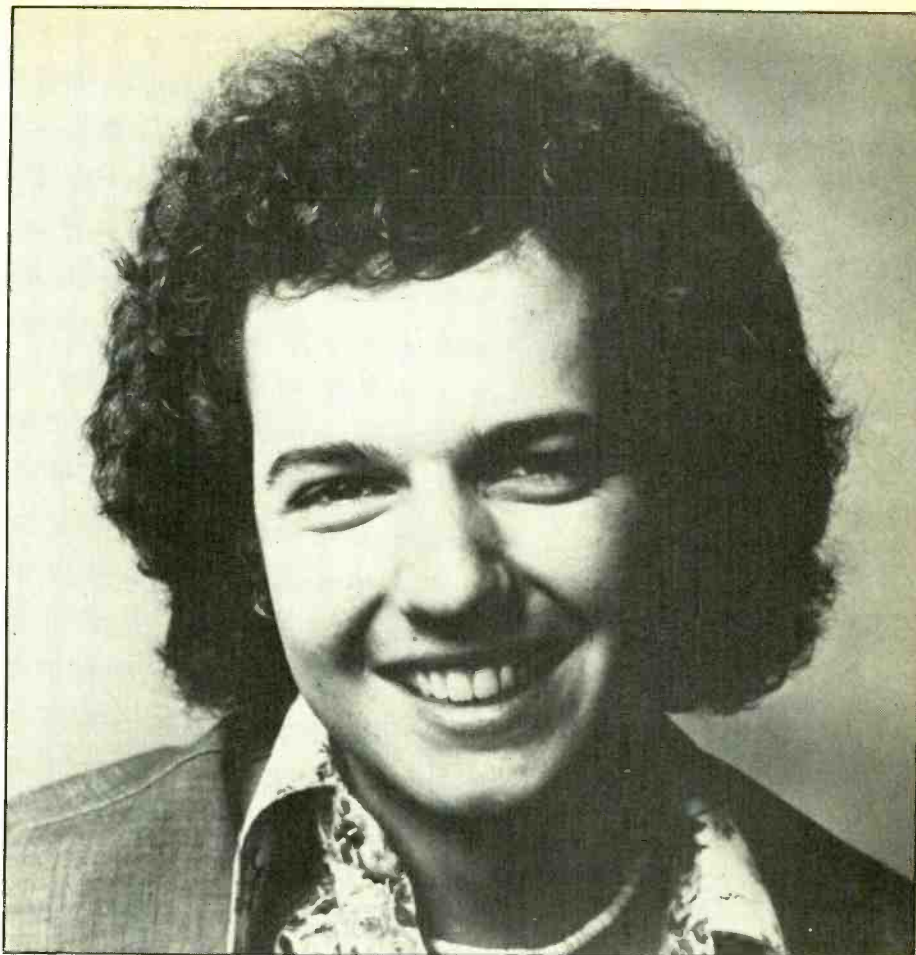
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LEE RITENOUR: Bad habits

tracks alternate being left and right of the mix. However, I find the use of rhythm guitar and keyboard on the same track redundant; for the most part they add little to the overall product. I have no complaint as to the overall presence of the mix, though I do think that the value given the use of strings burdensome. Whether Lee Ritenour emerges as a solo contender will depend totally upon how much further session work he does, for bad habits—and imitations—are hard to break. G.P.

Another fine Vox Box, beautifully recorded by Marc Aubort and Joanna Nickrenz of Elite Recordings, with Jerzy Semkow directing his Saint Louis musicians in vital, mostly straightforward performances of Schumann's four symphonies and the *Manfred Overture*. Even with sets by Bernstein, Karajan, Klemperer, Solti and Szell in the catalogue, and imminent cycles from Barenboim/Chicago (DG), Levine/Philadelphia (RCA) and Mehta/Vienna (London), Semkow is competitive—especially at Vox's low price.

Since the late 1800's, conductors have freely changed Schumann's orchestral textures in the name of clarity (Szell's early-'60s set on *Odyssey*, for example). Bernstein's set, also recorded in the early '60s, made a big fuss about using the original orchestration, but the sloppy New York Philharmonic playing and cavernous sound tended to negate the positive qualities, even though the conductor's irresistible ebullience in the First and Third carried the show. If Semkow has altered the scoring in his new Saint Louis set, the changes are too subtle to note. Textures have the necessary weight yet never seem heavy or

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**SCHUMANN: Symphonies 1-4; Manfred Overture.** Saint Louis Symphony Orchestra, Jerzy Semkow cond. [Marc Aubort and Joanna Nickrenz, producers; Elite Recordings, engineering; recorded in Powell Hall, Saint Louis, Mo.] Vox QSVBX 5146 (three records).

Performances: **Good**  
Recordings: **Warm and resonant**

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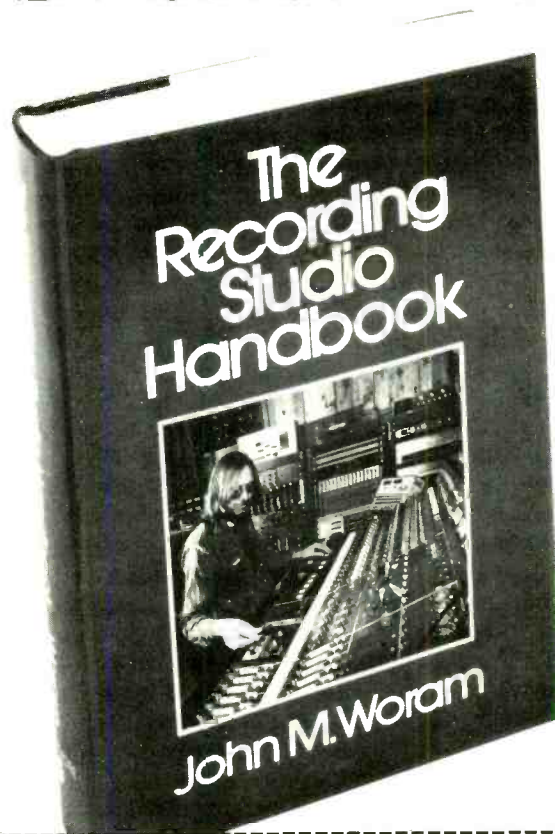
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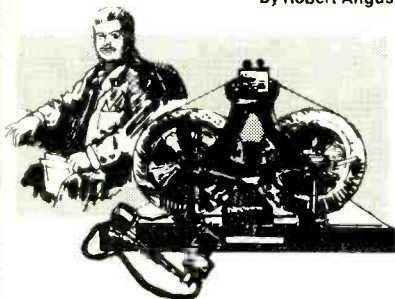


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muddy, and he maintains taut rhythms and careful balances. Although not particularly "singing" interpretations, neither are they cool or merely efficient and musicianly.

Every once in a while, an unnecessary *luftpausen*, heavy ritard or counter-productive rubato breaks the flow, but these are fortunately rare. Although I do not approve of Semkow's omission of exposition repeats (in all but the Fourth Symphony's first movement), my only major complaints come in the last moments of the Third and Fourth. In the former, Semkow's excessive broadening of the horn fanfare near the end and again just before the coda gets in the way of one of the most abandoned outpourings of exuberance in Romantic music. In the Fourth, Semkow (like every other conductor I have heard except Cantelli on his long-deleted 1954 recording) slows down for the coda, which Schumann marks *Schneller* ("faster"). Still, these reservations should not keep anyone from discovering this set's many fine qualities.

One of those qualities is the sound, typical of the Aubort/Nickrenz team's preference for a natural-sounding, concert-hall pick-up. Hanging only two mics about twenty feet above the fifth row of the auditorium and two mics in the back of the hall for quad, they consistently get a warm, resonant orchestral blend. Aubort, who does the engineering, admits that he will occasionally use a mic somewhere in the orchestra for more definition on an individual instrument (e.g., harp or timpani), but that no less than 80% of the signal on the final record is from the two front-curtain mics. I was therefore surprised that the dramatic timpani solo at the end of the Second Symphony seems uncharacteristically out of proportion to what has come before. Could it be that an extra presence mic, coupled with the timpanist's reticence earlier in the work, and his zeal at finally being able to shine combines to produce the exaggerated effect?

The appeal of this set is further heightened by Vox's quiet surfaces and Richard Freed's customarily thorough notes (although Vox deserves a pox for misspelling Semkow's name on the spine). S.C.

**SIBELIUS: Symphonies 3, 4 and 6; Tapiola.** Boston Symphony Orchestra, Colin Davis cond. [Vittorio Negri, producer; recorded in Symphony Hall, Boston, Mass.] Philips 9500.142 (Nos. 3 &

6) and 9500.143 (No. 4 & Tapiola).

Performances: **Excellent**

Recordings: **Excellent**

These two discs complete Colin Davis' Sibelius symphony cycle with the BSO on Philips. A box set (6709.011) has also been released—five records for the price of four—but buyers of the single discs should content themselves with the marvelous Edvard Munch cover art.

The praise given to the earlier releases in this series (*MR*, Dec/Jan 1976 and October 1977) must rise to an even greater pitch for these final records. The cutting level is somewhat low, but as the volume is increased, the BSO spreads out before you with dynamic tonal splendor and lifelike presence. Sonically distinguished as the earlier releases were, these records represent a culmination of Philips' work in Symphony Hall.

In the Third Symphony, Davis must compete with Bernstein's romantic sweep and Maazel's brisk and bracing drive. Davis' is the more individual view, however, with especially sensitive treatment of the *Tranquillo* sections and a very broad second movement tempo, and he enjoys further advantages in playing and sound. Anthony Collin's early-50s set, recorded by Decca/London and available here on Vox, is obviously not competitive sonically, but contains a very exciting, spritely rhythmic performance of the Third.

In the intimate Sixth Symphony, Davis' major competition is Maazel (also coupled with the Third). Bernstein is too sentimental, with variable playing from the New York Philharmonic and a coarse recording. Collins is casual and slackly played. Maazel, on the other hand, is very tightly controlled, with brisk tempos, virtuoso playing from the Vienna Philharmonic, and one of Decca/London's finest recordings. Timpani sound—my only complaint about Philips' engineering—is superb and the harp is always clear—ludicrously so in the miked-up swoop toward the end of the exciting third movement (but I love it, nevertheless!). Davis chooses moderate tempos and always secures beautiful, cleanly articulated playing from the BSO. Philips' gorgeous sound is more naturally balanced—that harp swoop is inaudible here—than London's, but choice between the two is a toss-up.

Davis' performance of the Fourth Symphony is, simply, magnificent. Sibelius thought he was dying of throat cancer when he composed this austere, unrelentingly severe work. The orches-



tral palette is gray, the atmosphere brooding and the temperature ice-cold—quite in contrast to the puckish warmth of the Third and the brassy grandeur of the Fifth. Most critics and musicians (including Colin Davis) consider the Fourth to be the ultimate test of the true Sibelian.

Interpretations on disc range from the

The final movement is the revelation. The symphony ends with the terrifying indecision of fourteen *mezzo-forte* string chords. Every other conductor in my experience has slowed down in some fashion or another and played the chords too quietly, imparting a false sense of finality and consolation to the music. But Davis takes the composer lit-



COLIN DAVIS AND THE BOSTON SYMPHONY ORCHESTRA: Dynamic tonal splendor and lifelike presence

uncompromisingly bleak Davis to the grossly sentimentalized Bernstein. Between these extremes are notable performances by Barbirolli (dark, richly recorded, never released here by Angel), Karajan (beautifully played and spaciously recorded, but too consoling and softly etched), Beecham (the pioneering 1936, available on a World Records import or on Vox, obviously not a contender sonically) and Maazel (many fine attributes, but hampered by a business-like third movement).

However, Davis is *the* performance to own—the one we've been waiting for, in my opinion. The first movement is very tautly controlled, with vicious brass attacks and an extraordinarily icy string climax halfway through. The tempo of the second movement is relaxed but never slack, and those nasty muted horn *sforzandos* in section M have unparalleled bite and snap. Davis' very slow third movement *largo* has an eerie spaciousness and desolation approached by no other conductor.

erally, holding to a single tempo throughout and absolutely refusing to relax his grip at the end. His decision (contrary to Jack Diether's otherwise excellent liner note) to use tubular chimes and glockenspiel in this movement is also a good one. We may never really know what Sibelius intended by "Glocken" or by whose authority someone has written in an "sp" following that word in the Breitkopf & Hartel score, but Davis' choice makes musical sense.

The record is completed by a vital performance of Sibelius' tone poem *Tapiola*, his final work. Beecham (a 1955 early stereo recording) and Maazel (same coupling as Davis) each have good points, but the sonics and superior playing on the new Philips disc tip the scales in Davis' behalf.

No connoisseur of Sibelius or recorded sound can afford to miss these records.

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79	Peavey	11
93	Quantum Audio	96
68	Recording Institute of America	91
70	Russound	21
69	SAE	14,15
81	Sansui Electronics	33
58	Sennheiser	22
71	Soundcraft Electric	10
92	Sony Corporation of America	5
No #	Sound Workshop	88
No #	Sound Workshop	19
31	Studer/Revox	31
65	Studio Master	1
64	Sunn	63
99	Superscope	Cvr. 3
56	Tangent Systems	94
66	TDK	45
No #	Teac	2
89	Technics	13
54	Unicord	99
59	Unisync	67
77	Wasatch Musical	16
55	Whirlwind Music	32
96	White	8



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