TALKBACK: Pros Answer Your Questions

# MODERN RECORDING

#05691 (F)
$1.50

SERVING TODAY'S MUSIC/RECORDING-CONSCIOUS SOCIETY

VOL. 3 NO. 12
SEPT. 1978

## A Session with Leo Sayer

## The Studio Glossary

## How To Fool Your Ears and Make Bad Recordings

**LAB REPORTS:**

JVC KD-85 Stereo Cassette Recorder
Unitsync Model 100 Stereo Power Amplifier
Yamaha TC-1000 Cassette Recorder

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**RECORD REVIEWS**

# SEE WHAT'S NEW, THEN SEE WHAT'S BETTER


You've seen what's new . . . what's louder, slicker, bigger, shinier . . . but have you seen what's better? The MXR Phase 90 makes a small claim on new with its new lower price and new graphics, but even better is that we've added a touch of regeneration for more intensity without sacrificing that classic Phase 90 sound. What this amounts to is that the phaser that set the industry standard is now even more versatile in its performance while maintaining the MXR standard of quality and reliability.


The Phase 90 is one member of our family of phase shifters, which includes the Phase 100, our top-of-the-line phase shifter, and our Phase 45, which offers the same MXR quality at an even lower price.

So, go out and see what's new. Then see what's slightly new . . . and better . . . from MXR.

For more information see your MXR dealer. MXR Innovations, Inc., 247 N. Goodman Street, Rochester, New York 14607, (716) 442-5320. Distributed in Canada by Yorkville Sound Ltd., 80 Midwest Road, Scarborough, Ontario.

MXR Professional Products Group

CIRCLE 91 ON READER SERVICE CARD


# High perform
# no longer has to

From input to output, live performance to recording session, Studiomaster offers the ultimate in performance. In doing so we surprised ourselves. We have actually put more logic, convenience and quality into our incredible new 16/4 mixing console than competitors who range thousands of dollars above our price.

**The input channels:** Five equalization controls. Input gain control. Peak overload indicators. 0/−30db padding. 2 echo sends and a foldback (monitor) send. L/R panning and 1/3-2/4 routing. Prefade monitoring and smooth input level faders. Sound like high performance?

**The output is as good as the input:** 1 kHz lineup oscillator. Individual line output level faders. Individual channel master panning, foldback, and monitoring controls. Both echo returns have 3-position routing capabilities.

Now for the real payoff... a remix switch that converts the first four input channels to *stereo* mixdown channels automatically, thus allowing a program just recorded on a four channel deck to be mixed dow
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**The next pe**
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audio specia st
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Select your closes
what high perform
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Rowlett, Texas 75088;
In Canada contact RM
borough, Ontario MIN 340.

## STUDIOMASTER MIXING CONSOLES 16/4 & 12/2B

Pictured is the Studiomaster 16/4 mixer. Also available is a 12/2B model with the same great features though in a considerably lesser priced stereo version.

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# The deck that separates the pros from the amateurs.

There is a difference between so-called consumer decks and professional decks. Several, in fact.

That's why TASCAM SERIES created its Model 40-4 Recorder/Reproducer. While consumer decks are designed for play, our Model 40-4 is meant for work. Hard work.

It's a tough, heavy-duty deck with the professional specs, features and functions it takes to qualify for professional, in-studio use. But our Model 40-4 costs a lot less than its in-studio peers.

Our Tascam 40-4 has a suggested retail price of $1600* That's more than most consumer decks, but it's designed to do a lot more.

The 40-4 transport is the same as our 80-8 half-inch eight-track deck. Designed to move heavier half-inch tape, the 40-4 handles lighter quarter-inch tape smoothly without strain.

It's rugged enough to take the constant wind and rewinding to build your tracks to where you want them. The 40-4's tape transport system is a good example of the mechanical overkill that separates our 40-4 from lesser decks.

Okay. If you're just beginning, you can buy any consumer deck; TEAC makes the best around.

But if your commitment is serious enough to require a four-track recorder/reproducer you can rely on for a long time and produce studio-quality results, it's our Tascam 40-4.

Check out the details below, then check in at your authorized TASCAM SERIES Dealer.


The impedence roller is strictly professional caliber. Along with the heavy dynamically-balanced flywheel, it guarantees better tape-head interface. Therefore, reducing the possibility of dropouts during a critical recording session.

Our exclusive Function Select initiates TAPE/SOURCE, PLAY-BACK/RECORD and dbx ENCODE/DECODE modes with just one button. Additionally, FET circuits (not mechanical relays) enable you to punch in and punch out without pops.

Heavy-duty motors, bearings and brakes assure you of smooth tape handling throughout the long hours of the multitrack recording process.

Individual, removable PC cards carry the electronics for record, reproduce and bias amps. So calibration or replacement comes quick and easy. Just swing down the meter panel for quick access.

Full IC logic and motion-sensing circuit lets you enter play mode quickly without risking tape spill or stretch.

The optional dbx module (DX-4) gives you a dynamic range of over 90dB. Because it's integrated, its electronics are perfectly calibrated to match the recording/reproduce circuits of the 40-4.

Thanks to our single record/playback head, you'll hear existing tracks in sync with full frequency response while over-dubbing at 15 ips.

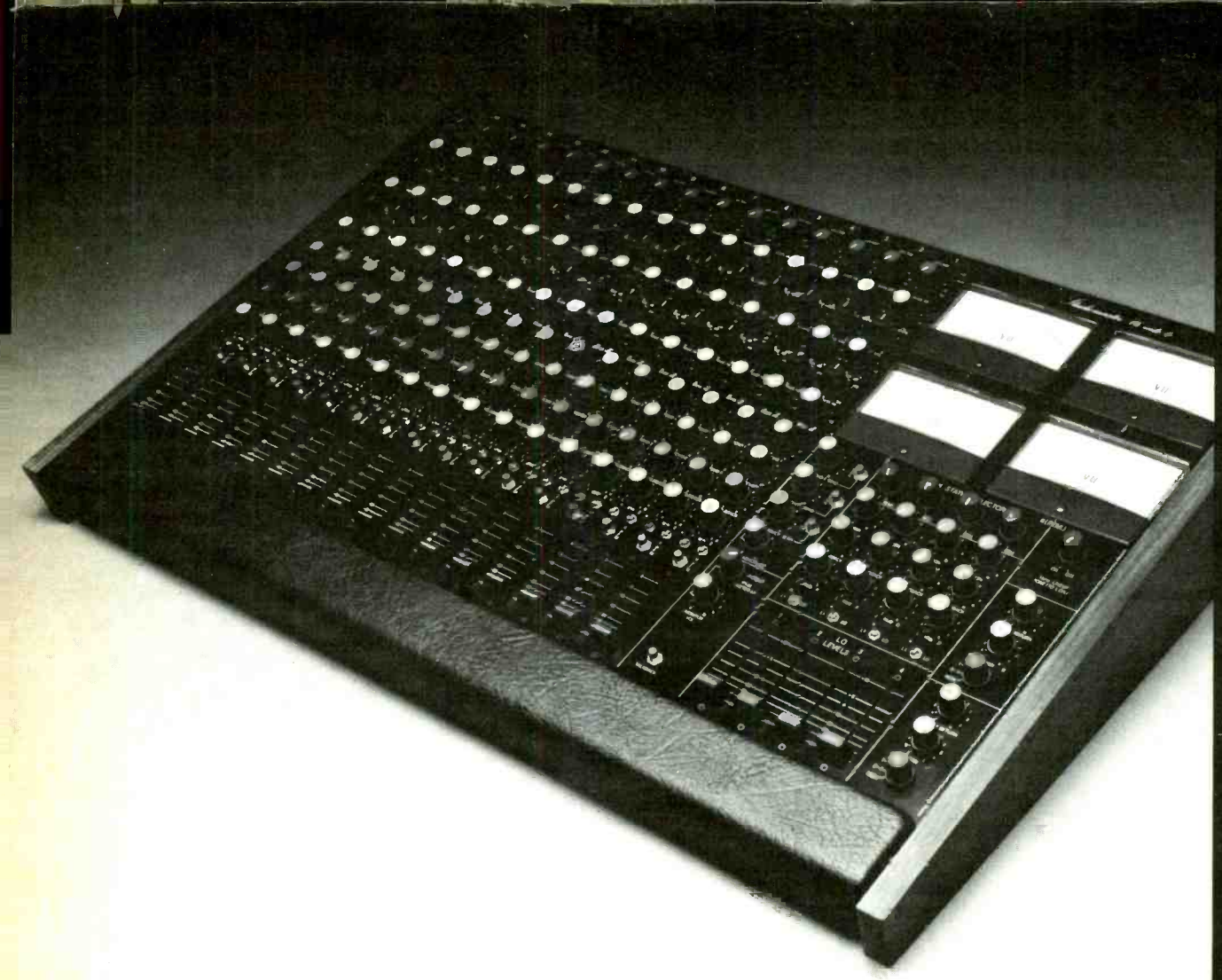
The heavy-duty power supply features a pro-quality *toroidal* transformer. This assures that each deck function will receive its correct voltages without any fluctuations. Even if your 40-4 runs constantly for 24 hours a day.

*Price subject to dealer preparation charges where applicable.

## TASCAM SERIES BY TEAC®

A new generation of recording instruments for a new generation of recording artists.

TEAC Corporation of America · 7733 Telegraph Road, Montebello, California 90640 · In Canada TEAC is distributed by White Electronic Development Corporation (1966) Ltd.

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Now for the real payoff...a remix switch that converts the first four input channels to *stereo* mixdown channels automatically, thus allowing a program just recorded on a four channel deck to be mixed down onto 2-track *from the same board!* Imagine the patch cord and second mixer confusion that can be overcome. Did we mention high performance?

**The next performance could be yours:** It should be. Studiomaster has trained qualified pro audio specialists in your area to really show you our mixer's fine points. Take a look at the list on page 17. Select your closest dealer and see him now to learn what high performance is all about. You'll be as surprised as we were to see that it doesn't have to cost like it.

For a free brochure on Studiomaster products please write to STUDIOMASTER, P.O. Box 211, Rowlett, Texas 75088; or call toll free 800-854-0348. In Canada contact RMS, 2271 Kingston Road, Scarborough, Ontario MIN-1T8; or call 416-264-2340.

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# MODERN RECORDING

SERVING TODAY'S MUSIC/RECORDING-CONSCIOUS SOCIETY

## THE FEATURES



**COMING NEXT ISSUE!**
*A Session with War*
*Building a Power Supply*
*A Discussion on Monitor Speakers*

## THE STAPLES



Cover photo by Robert Ellis

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SERVING TODAY'S MUSIC / RECORDING-CONSCIOUS SOCIETY

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# Letters to the Editor

## Filling the Gap

We've been with you from the early issues and can see a healthy improvement as time goes by. One thing we've noticed is that your readers seem to range from rookies just learning the tools up to techs with endless qualifications and acoustic engineers with "State-of-the-Art" printed circuit brains.

We'd like to know if you would consider introducing a "back to basics" column with how-to-do-it articles. Many publications—even the heavy tech magazines—include a corner for education. Us guitar pickers who evolved from raunchy Honky Tonk music had to search out and seize any information available, from any source that happened by, in the pre-everything era. But it seems the average American recordist these days can hardly give a clear explanation of the difference between balanced and unbalanced lines. Many of us could use articles dealing with electronics and recording from the bottom up.

Of the large amount of printed material we consume in a month's time, 85% is worthless to a musician/recordist, but *MR* comes close to filling the gap between sales pitches and overstuffed tech articles.

—Mike Dollins
Victor Marquez
Bostonia Sound
El Cajon, Ca.

*Upcoming issues are slated to have articles that might be what you're looking for. Contributing Editor Peter Weiss hasn't yet revealed his topics in finite detail, but we're expecting that those readers who have been clamoring for pieces of an educational nature shall soon be appeased.*

## Jazz Sans Reinforcement

Bravo! I wish to congratulate you on an excellent publication. As a musician and budding audiophile, I've found *Modern Recording* a tremendous asset to my overall understanding of sound reinforcement and recording.

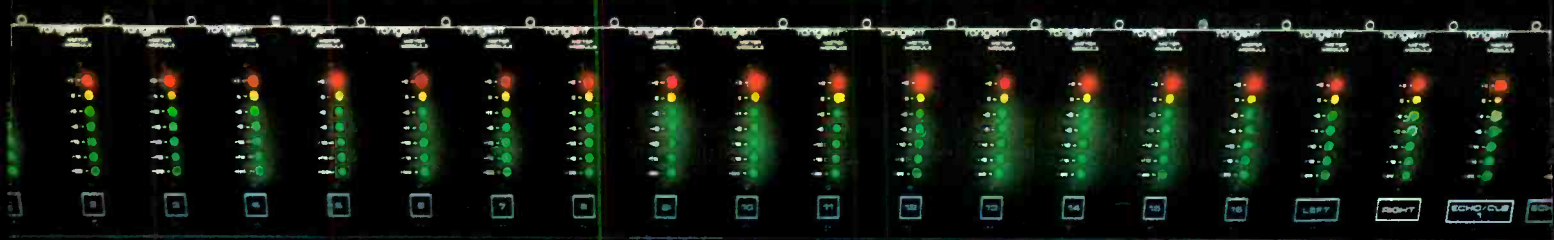
However, I was talking to the sound engineer for a jazz club in Washington D.C. the other night about *MR*, and he seemed to feel a bit uncomfortable with the fact that you "serve today's music/recording-conscious society" and (to the best of our knowledge) have somewhat neglected the recording of minimally reinforced jazz (trios, quartets, etc.). As a "purist," he is interested in catching the "as it is" sound in any particular room.

Being the eternal antagonist, I questioned the engineer concerning the role of the sound engineer as a creative participant in music. He did agree with me that the engineer, if working closely with the producer or the power figure of the band, could be a part of the sound of the group. I believe, now more than ever, that the sound man is an integral part of the band and that the degree to which that relationship is continued will directly affect the potential of that group's total sound.

To wrap it up, I was wondering if *Modern Recording* would

# Specs and Price.

## It's about time someone offered both.




*The Tangent Model 3216 Professional Recording Console. Take a look at the specifications and the price . . . you won't find any other consoles in the world that compare with Tangent.*

SPECIFICATIONS

| | |
|---|---|
| Total Harmonic Distortion (1 kHz, -20dB output) | .004% |
| Intermodulation Distortion (+20 dB output) | .004% |
| Signal-to-Noise (Equivalent Input Noise) | -128 dB |
| Frequency Response (± 1 dB) | 10 Hz-65 kHz |

These are typical specifications measured by MODERN RECORDING in the "Hands-On Report", October 19**. The unit reviewed was a Model 1202, which the Model 3216 surpasses with even cleaner and quieter performance.

PRICES

| | |
|---|---|
| Eight channels in a sixteen-channel mainframe | 5,580 |
| Sixteen-channel mainframe, filled | 8,940 |
| Sixteen channels in a twenty-four channel mainframe | 9,540 |
| Twenty-four-channel mainframe, filled | 12,900 |
| Twenty-four channels in a thirty-two-channel mainframe | 13,500 |
| Thirty-two-channel mainframe, filled | 16,860 |

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CIRCLE 106 ON READER SERVICE CARD

consider doing a piece on the recording and reinforcement of jazz with the emphasis on keeping the jazz sound as close to what's happening in the room as possible.

—Joe Mori
Brandywine, Md.

*We agree the topic is an interesting and largely neglected one. Presently, an article of this nature is in the works and will be appearing in a future issue. Thanks for your input.*

## Some Facts About 'Growing' Your Own

Having read the question of Mr. Scott Herschler, and the reply by Mr. Michael Tapes of Sound Workshop ("A Mixer for Developing Drums," Talkback, April 1978, page 30), I'm spurred to make a few comments regarding, not only the specific question on construction of a mic mixer, but general construction projects as well.

While I can appreciate Mr. Tapes' position on commercial vs. "home brew," respect his opinion and agree with him in some cases, I feel his comment, "It is my experience that it is not cost effective to build *one of anything* if it is commercially available" is a gross generalization and a highly opinionated remark!

Now, whether or not it is "cost effective" to build a specific piece of gear for a specific function depends on many other factors besides the piece of equipment and its intended use(s), not the least of which are the builder's own desires, knowledge and experience. The latter will help the builder in such respects as knowing where to buy components and where to get the best price for a particular one-of-a-kind project.

I make these comments since I feel strongly that any aspiring audio engineer or technician who feels inclined to "grow his/her own" gear should not be discouraged by generalizations. Furthermore, having read every issue of *Modern Recording* since you began publishing, I've noted that many *MR* readers *are* interested in home construction projects.

Now, I don't want to make the same kind of generalization of which I have been critical. Therefore, let me point out that in many cases it would not be "cost effective," or technically practical, for a piece of gear to be home built. Yet it has been *my experience* that in many cases it would be desirable to design and build

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one's own audio equipment! Furthermore, it does not take sophisticated technical knowledge or skill to learn to seek out adaptable plans or schematics for one's own application! In this age of "op amps" and linear integrated circuits things are certainly a lot easier for the home builder.

In regard to Mr. Herschler's specific question regarding a mic mixer, Mr. Tape is correct in his advice to scrap the idea of a *passive* mixer for microphones. However, this doesn't mean he should scrap the idea of *building* a mixer! I especially question Mr. Tapes' comment, "The cost of the parts, the time of building and the degradation of performance preclude any advantages in building the device yourself." I feel that this comment, especially the part about "degradation of performance," is quite a powerful *assumption* on the part of Mr. Tapes!

Now, as for commercial mixers, there are many available that would handle the required tasks and, I agree with Mr. Tapes that the Shure M68 would do the job as well as any. In fact, I started my recording career with a rack of M67s and M68s. However, I feel that we must point out that it is possible to now build a mixer of comparable quality and function for under $40.00. At the same time, I concede that this specific cost figure does not leave room for mistakes or trial and error.

I'd like to recommend a small publication to *Modern Recording* readers for no other reason than the valuable information it contains within its pages. The Audio Amateur, P.O. Box 176, Peterborough, N.H. 03458, is published four times per year. Back issues are also available. This publication is most helpful, not only with excellent construction articles, but also with sources of supply for hard to find components at low cost.

A particular back issue, which should be of special interest to Mr. Herschler and other readers interested in a professional quality, low cost mic/line mixer, is the February '71 issue containing detailed plans for an eight channel, stereo mixer with beautiful specifications. Furthermore, this mixer is available in kit form, with all components (including ten slide pots) and printed circuit board, for just $62.75! Other issues contain similar articles including a professional, multifunction recording console and, most recently, an article by Mr. Edward Gately, Jr. on home construction of the famed Gately Micromixer.

Ziff-Davis Publications also publishes an interesting annual magazine called, *101 Electronics Projects*, which is available on newsstands, or directly from the publisher. Of course, the listings of useful literature for aspiring technicians goes on and on. Just like the knowledge which is contained within the literature, the more literature you discover, the more you find out is available for discovery!

So, I say to anyone with the inclination, by all means, *build it!* You'll certainly learn from your experience. Remember, in the long run, acquired knowledge and experience can be quite "cost effective."

—Hayne Davis
Producer/Director
Mother Cleo Productions
Recording Studios
Newberry, S.C.

*(Mr. Davis' letter was forwarded to Michael Tapes. The following is his reponse.)*

My answer to Mr. Herschler was merely meant to point out that building the mixer he needed would not be "cost effective." Cost effective relates to many factors including not only the cost of parts, but also the time required for research, building and testing; whether or not the "home built" mixer will stand up on the road both mechanically and electrically; the lack of warranty; and others. How do we figure the cost of the test equipment to verify the final performance of the device, or do we just build it, and if it works assume that it meets spec? If Mr. Herschler was not working with a band, and merely wanted to experiment with electronics I would have only encouragement to offer him, but his band depends on their equipment for income. How does one predict the reliability of a one-of-a-kind device built by a novice?

Yes, in this age of opamps things *are* a lot easier for the home builder, but let's not forget that in a lot of cases a little knowledge is worse than no knowledge at all. The majority of hobbiests that I speak with are not knowledgeable enough to consider *all* of the design parameters necessary in the building of their projects. This is not meant to discourage experimentation, but to encourage maximum education from projects, rather than defending them as the state-of-the-art.

So, I, too, say *build it,* but don't plan

# THE NEW TAD* DRIVER, IT GIVES YOU MORE BY GIVING YOU LESS.


The new one-inch TAD driver is truly unique. There is nothing else like it. Use it with your favorite horn and you'll get a frequency response from 800 to 22,000 Hz. So one speaker does the same job it used to take both a tweeter and super-tweeter to do. Saves weight. And money.

The secret is the TAD driver's beryllium diaphragm.

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The quality of both parts and workmanship, plus the same care in assembly given a fine watch, makes the TAD driver a new standard for the entire industry. It allows the driver to reproduce frequencies up to 22,000 Hz without any major drop-off in response and permits it to withstand high input power.

If your job involves professional sound reproduction — on stage, in concert halls, in clubs or studios — you have an obligation to yourself to hear this remarkable driver.

With the arrival of the TAD driver the state of the art just took a quantum leap.

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*TAD is an abbreviation for Technical Audio Devices, the professional products division of U.S. Pioneer Electronics Corp.

on getting off cheap; don't think it'll be easy; don't get mad if a high frequency oscillation burns out all your tweeters (and you thought it was working perfectly); but *do* enjoy and learn as much as you can from your experimentation.

—Michael Tapes
President
Sound Workshop
Professional Audio Products, Inc.
Hauppauge, N.Y.

### Still Available

I need a service manual for an old Roberts 778X tape recorder that I have. I cannot find an address for Roberts; indeed, I don't think they're in business any longer. I believe these recorders were distributed in America by Akai before they began manufacturing their own pieces. I'm interested in converting this machine from a ¼-track to a ½-track and I'd like to learn if it is possible.

—B. E. Herring, Jr.
Goldsboro, N.C.

*A call to the marketing department of Akai informed us that they did indeed distribute these machines and that, yes, a service manual is still available. You can get the information you need by writing to East Coast Transistors, 2 Marlborough Road, N. Hempstead, New York 11552 or by calling 516-483-5742. They might not have the manual in stock, but they will be happy to order it for you.*

### Rock Eater Finds Error

What a surprise to be glancing through the July issue of *MR* and to read my letter so truthfully labelled "Dedicated and Determined," (p. 16). I hope that James F. Rupert (Confessions of an Audio Addict, *MR*, April 1978, p. 22) is pleased to know that there are other dedicated "Audio Addicts" who hibernate to their basements (coal bins, in some cases) with hammer and saw—or in my case, with hydraulic jack.

In case some people, though, after reading my letter, are pondering over the idea that 60 tons of rock could have occupied a space of only 100 square feet, I'd like to restate that my finished project will have a 9 foot ceiling with over one thousand (1000) square feet of studio space. I believe that somewhere in the editorial process, a "0" got left off my original statement of 1000 square feet—just for the record. (My control room alone will occupy over 160 square feet.)

All in all, it was super of you guys to let half the world know of my long-awaited project. Sixty tons of rock standing in my way is nothing if I can get my studio off—or should I say "out of"—the ground! And if anyone wants more detail concerning the "Rock Eater" up there in Canada, I'll be happy to chat with them. Or sell them rocks for their rock gardens.

Once again, many thinks. Keep up the good work (and my subscription till 1984).

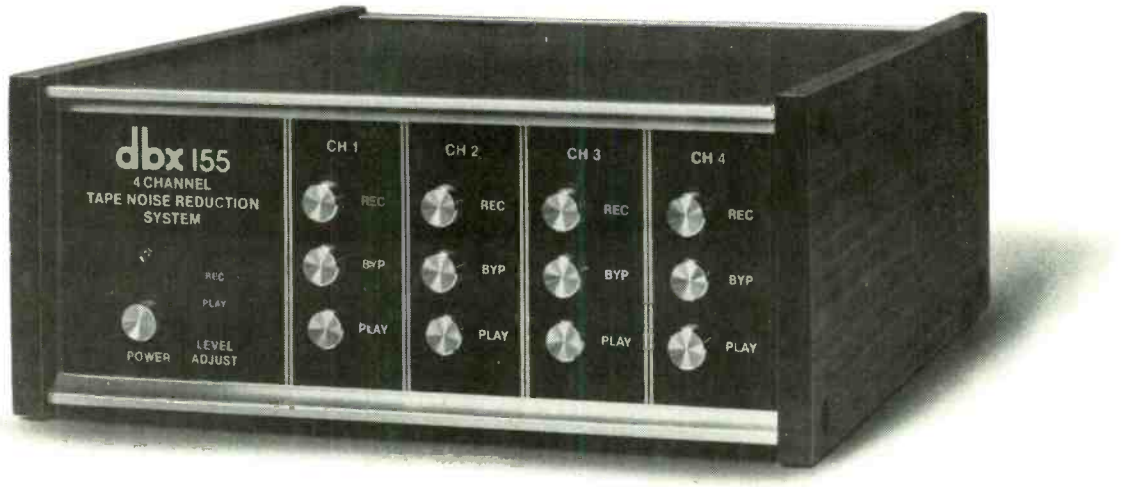
—Ron Brault
Hawkesbury, Ontario, Canada

*Thanks for drawing our attention to the disappearance of that "0." As it happened, a staff member swiped and affixed it to a most lucrative position on his paycheck. He is very sorry, and has asked us to convey his apologies.*

### Confessions Strike Chord

I particularly enjoyed James F. Rupert's article, "Confessions of an Audio Addict," which appeared in your April 1978 issue. As a recent subscriber, and novice to the field of audio engineering,

# HUSH UP YOUR 4-TRACK.




## Introducing dbx professional four-track tape noise reduction for under $500.

You've just settled on a TEAC, Tascam, Otari or Dokorder four-track tape deck for that studio you always wanted to have. You've chosen the mikes, the carpenter is almost finished (or maybe you even built it yourself). Your console's ready to be wired into place.

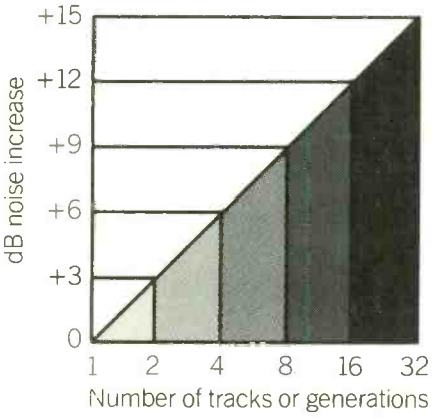
But...haven't you forgotten just one important item?

Noise reduction.

Because every time you (or your group) want to bounce a track, you're adding at least three dB of tape noise (see chart). So the great artistic result you plan to end up with, might end up sounding like a rainstorm.

Fear not. Help is at hand. It's the new dbx 155 four-channel tape noise reduction system. You can add it for far less money than you ever imagined possible. Here, on one compact chassis, is a complete dbx noise reduction system. But the best part is, it will give your tape deck an extra 10 dB of headroom, and reduce tape noise by 30 dB. That means no audible noise whatsoever will be added to your tracks. And, because dbx tape noise reduction operates by linear compression/expansion, you won't have to get involved with tedious level calibration, either.

### Additive Noise Chart




All you need do is press the playback buttons to hear noise-free, full dynamic range reproduction of your music.

The new dbx 155 also has user-changeable modular circuit boards, so in the unlikely event that one processor fails, the other channels remain operational. You can even keep a spare on hand.

Visit your dbx professional dealer now, for a demonstration of our new 155 tape noise reduction system. Discover how you can put an end to tape hiss, without putting an end to your bankroll.

dbx

dbx Incorporated
71 Chapel Street
Newton, MA 02195
617/964-3210

CIRCLE 99 ON READER SERVICE CARD

I was relieved to see an article geared toward the layperson. I would like to see you continue publishing articles like Rupert's—ones that deal with some of the non-technical aspects of a career or hobby in audio engineeering. In an industry as competitive as the music and recording industry, the novice needs all the helpful guidance he or she can get to become a successful engineer.

—Jack Schutz
Buffalo, N.Y.

### Stickler Offers Congrats

Well, I'm new to the *MR* subscriber gang, and I read your book cover-to-cover. Sad to report, I haven't been able to spot an ad for the *1978 Buyer's Guide,* which is referred to every few minutes. I would gladly send you money in exchange for one if I knew how much and where to send. I'm also interested in obtaining back issues not listed in the ad currently published.

I also just wanted to tell you that I like what you're doing there. My background in sound involves 16 years of theatre tech: sound, lights, sets, and so on; also pro sound: reinforcement, recording, PA. Your magazine is the first I've seen that answers questions of "How . . ." and "Where can I get . . ." and the like, with *real* answers, instead of the usual "Buy this or that," and "Keep your fingers out of the inside of that." My congratulations.

A note on accuracy—I will admit that I am a detail freak, but for what it's worth—your technical accuracy is good, but occasionally you slip up. On the other hand, *results count,* and your people obviously all get them or they wouldn't still be around. Keep going for technical accuracy, and keep up the good work.

—Jim Chernoff
San Luis Obispo, Ca.

*Even sadder is the reason you've been unable to spot an ad for the* 1978 Buyer's Guide: *It is out of print and hence no longer available. The only alternative may be an impatient wait for the* 1979 Buyer's Guide, *which should be on the stands in December 1978.*

*A very limited supply of the following back issues exists: only June/July 1976; and from 1977, Dec/Jan, Feb/Mar, April, May, June, September, November, and December. Each is $2.00 plus 50¢ (postage and handling) per issue. The April 1978 (Vol. 3, No. 7) issue is now out of print and unavailable. (Admissions on our part as to back-issue*

# Custom specifications packaged to go.

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**CALIFORNIA**
California Musical Instrument Co.
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Anaheim, CA 92805
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Gospel Sound & Music
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Monterey, CA 93940
(408) 373-5272

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Hollywood, CA 90046
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The Guitar Center
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San Diego, CA 92101
(714) 234-8731

The Guitar Center
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San Francisco, CA 94100
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San Jose, CA 95128
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**LOUISIANA**
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**MISSISSIPPI**
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Jackson, Mississippi 39212
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**NEVADA**
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Las Vegas, Nevada 89101
(702) 382-9147

**NORTH CAROLINA**
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(704) 375-8662

**OKLAHOMA**
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**SOUTH CAROLINA**
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Billy's Band Aid
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Danny's Band Box
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Parker Music
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River City Music
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San Antonio, TX 78216
(512) 826-4101

**VIRGINIA**
Ambassador Sound
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Norfolk, VA 23505
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**STUDIOMASTER, P.O. 221, Rowlett, Texas 75088, or call 800-854-0348** (see our ad on the first page of this magazine)

CIRCLE 101 ON READER SERVICE CARD

*availability invariably disappoint members of our readership who get their checks in just as the last extant issue hits the postage meter, so we do avoid making them.)*

### A & M Console

The audacity of you guys to feature a photo of our superb console (July 1978, page 73) and identify the location as Sunset Sound!

Folks, that photo was taken in Mix Room #1 here at A&M Recording Studios in Hollywood.

That board is one of our best. It was designed by Karl Bischoff and built here at A&M. Everything is custom-designed except the excellent Quad Eight EQ modules.

Karl will soon begin an even better board for one of our other mix rooms. First he has to finish the new custom consoles for our disc-cutting rooms.

I'm sure you can imagine our dismay at seeing a photo of our superlative facilities accidentally credited to some other studio.

Glad to have the chance to set the record straight.

—Tim Hovey
Maintenance Technician
A&M Recording Studios
Hollywood, Ca.

*Tim, rest assured that your dismay was nothing compared to ours when we realized what a blooper had been made. We regret this mislocation of your fine board and hope that all the fine people at A&M and especially Karl will accept our apology.*

### The Cost of Experience

What a pleasant surprise to find *Modern Recording* at my favorite newsstand. Unlike other magazines in this field such as db and RE/P that are locked into a select group, your magazine is both pleasant and down to earth. My compliments. Needless to say, I have subscribed for two years.

I would like to take this opportunity to comment on David Moyssiadis's article "The Making of A Record, Part I" (June 1978, page 38). I found this piece both informative and accurate. Having worked my way up through the school of hard knocks, I recently opened my own company in the Rocky Mountains. As you can well imagine, there's little or no competition. It has been my experience that if a group (inexperienced in the studio) think they can record a song in five hours, I multiply that by three and presto—I hit the actual cost of the session very close. Little do groups realize the amount of time involved in over-dubs, mistakes, experimentation, etc. when calculated in the studio. Fortunately, I am blessed with a low-cost 24-track ($60. per hour) so the cost is nowhere what it might be in New York or Los Angeles.

I also agree that the first generation recording on a $800.00 machine may not meet pro specs and the fourth or fifth generation tape from an inexpensive machine sounds like mince meat. This fact is hard to get across to a bunch of inexperienced people that somehow "know it all."

Thanks for the opportunity to air my comments.

—Ronald Watts
President
Jenero Record Co.
Soda Springs, Id.

### Schooling for Audio Engineers

If possible, please send me a list of schools, colleges, etc. that I may write to who have an Audio Engineering program. Thank you.

—Marian C. Gildea
Dallas, Pa.

*Many readers write to us with this request—we can't repeat ourselves too often, though, so please check out p. 16 of* MR*'s July 1978 issue.*

### Likes Cassette Library

Just thought I'd drop you a note to let you know I received the Recording Institute of America's "Guide to the Record Business by the Pros," the *Music Industry Cassette Library,* which I recently ordered.

I find it to be an in-depth look into the recording business, very interesting and very informative.

—R.G. Sayre
CFBV Radio Ltd.
Smithers, B.C., Canada

### Where Are Reverb Vendors?

Part II of Peter Weiss' Echo, Reverb & Delay article (June 1978, p. 52) included references to the Orban/Parasound Dual Reverb and the Quad/Eight Electronics CPR-16 Digital Reverberation System. I would appreciate your help in getting dealer addresses, prices and

# Tandberg Presents the Next Generation

information on these pieces of nent.

—Martin Kulikov
Toronto, Ontario, Canada

*For the most accurate and up-to-date information, contact the manufacturers directly: Orban/Parasound is at 680 Beach St., Suite 411, San Francisco, Ca. 94109, and Quad/Eight Electronics is located at 11929 Vose St., No. Hollywood, Ca. 91605.*

## Parts, Please

In response to Neill C. Porter's letter in February 1978 issue (Letters To The Editor, "Plan On Buying It," page 8), I'd like to inform him that I know of a place where he can buy the various ingredients that he needs to complete this project. Precision Recording Instrument Labs (12001 Lanham Severn Road, Bowie, Maryland 20715) stocks recording console parts, circuit boards, etc. They even stock engraved faceplates! In addition, they carry record playback amps for multichannel recorders. They can be reached by telephone at 301-262-4147. I'm sure they can be of some help to Mr. Porter as well as many other do-it-yourselfers.

—John Shell
Technical Director
Global Output Devices
Falls Church, Va.

*Using the telephone number supplied by Mr. Shell, we called Precision Recording Instrument Labs and spoke with Bob Lloyd. Mr. Lloyd confirmed the information we had been given and went on to explain that Precision Recording Instrument Labs is a custom recording console manufacturer and that they are presently working on a console kit that will probably solve quite a few problems similar to Mr. Porter's.*

## Things To Consider

I want to thank you for the great work you do. With each and every issue, many new items come to light. Keep up the good work.

I have read with interest over the past months, the pieces regarding building your own mixer—the pros and cons. Since companies will not sell schematics (understandable), I would like to know if you feel it is ethical to purchase a board, such as a 16 in/4 out and have an electrician copy it? My main interest is in a 32 in/8 out board, so would it be practical to double a 16 in/4 out board?

—Rod Steinbrook
Pasadena, Tx.

*Answering your last question first, doubling a 16 in/4 out board will not result in a "ready to record" 32 in/8 out board as there are wiring specifics that need to be altered. This being the case, we wonder if you are interested in copying a pro board as you originally intended. If you still propose to do it, please be advised that if you should try to sell your reproduction, it becomes a legal matter. While it is not our place to judge any situation ethical or not, we do wonder that once you consider all the expenses you might incur, if you'll consider it a practical plan. Our advice would be for you to save yourself a lot of time and aggravation and buy a properly built 32 in/8 out board.*

# Here's a company who's out standing in its field.



UNI-SYNC
A BSR COMPANY

Designers & Manufacturers of Professional Audio Systems & Equipment
Featuring the Trouper Series & Professional Power Amplifiers
742 Hampshire Rd., Westlake Village, CA 91361, (805) 497-0706
A division of BSR (Canada) Ltd., 26 Clairville Rd., Rexdale, Ontario M9W 5Z9, (416) 675-2421

CIRCLE 93 ON READER SERVICE CARD

# 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.*

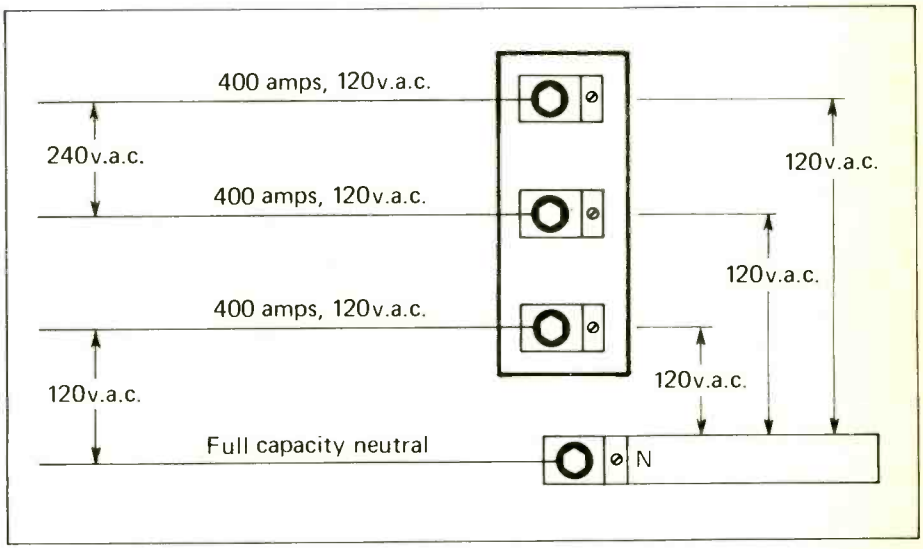


Fig. 2

## And Then There Was Light

**Basically, how is AC (alternating current) supplied for large-scale stage lighting systems? Are there step-up transformers or rectifiers that can be used or can all that current be drawn from house circuits?**

**—Linda Bialous**
**Hillsdale, N.J.**

Let's limit that question with the following "given:" Most American lighting control and sound equipment operates at 120 volts, 60 Hz AC. Large amounts of AC are available for the lighting systems and sound systems of big-name acts at the large theatres and arenas that cater to them. But what's a "large amount of AC"?

Typically, a new fifty- to seventy-thousand dollar home has a main service of 100 amps, single phase-three wire (useable 200 amps at 120 VAC). (See figure 1.)

Power requirements for a top act (like the Eagles) might be 400 amps, three phase, four wire (useable 1200 amps at 120 VAC). (See figure 2.)

To give you an idea just how much power that is, 10 amps at 120 VAC is 1200 watts. So the 400 amp, three phase system diagrammed here yields 144,000 watts of power.

Since there are cities with various kinds of available power, (Norwalk, Connecticut two phase, five wire; Boston's Music Hall is DC only), and since some newer buildings have only 440 VAC available, *sometimes* step-down transformers are used, but they are a heavy, large and expensive alternative. Most often, if insufficient or unsuitable power is all that is available in the building, large "portable" generators are rented and used. Rectifiers are rarely used, other than on individual pieces of equipment, because of cost and availability.

—John C. Gates
Customer Services
Capron Lighting and Sound
Needham Heights, Ma.

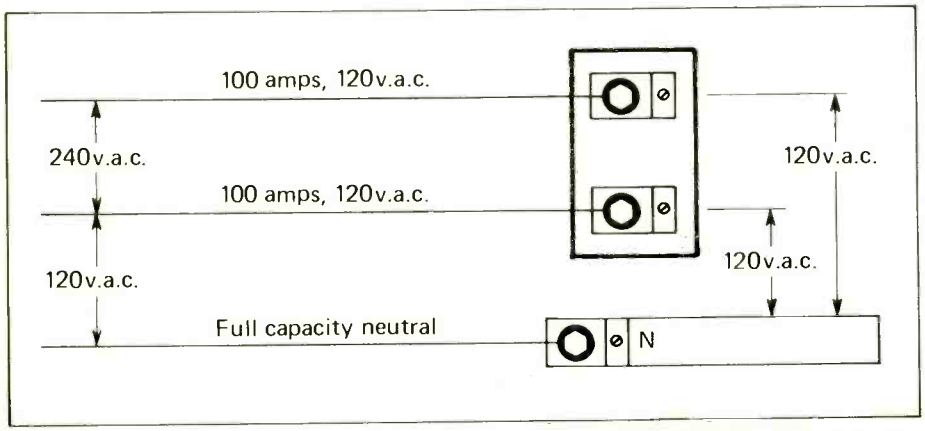


Fig. 1

## Tips For Touring Systems

**What are the advantages and disadvantages of open back midrange cabinets (i.e. Alembic's double twelve-inch) in a touring system?**

**—Barry Carmody**
**Rutherford, N.J.**

Cone speakers, either ten- or twelve-inch models, are often employed in the midrange (or mid-bass, as it is sometimes called) sections of large touring systems. Usually run from 200 or 300 Hz to 1500 Hz or so, the intent is to reduce the midrange distortion that develops from using compression drivers in that range. This distortion is primarily a function of high SPL at the diaphragm-phase system interface; SPL so high that the air starts to behave as a non-linear medium and produces the resultant distortion. The only solution to this problem is to use more diaphragm or cone area, thereby reducing the SPL and the distortion. Since the largest currently available compression drivers have a 4.125-inch diaphragm, many people elect to use cone speakers, even though their lower efficiency requires more amplifier power to achieve the same output levels as compression drivers.

Of all the enclosure types available, the open-backed cabinet would seem to be the worst choice, primarily because the SPL would be about as high behind the cabinet as in front of it, causing considerable feedback problems. (In a real budget system, you might use the back radiation as stage monitoring, if you could tolerate monitors that were all midrange and completely uncontrolled). (Editor please note, that was a joke.) For a cabinet system, the best solution would probably be a completely sealed column with low internal volume. This configuration would raise the resonance of the speakers and give them a bit more efficiency in the desired range, and also provide some amount of pattern control. For large systems, probably the best use of a cone midrange driver is in a good horn. A well designed horn will have good uniform coverage over its operating range, as well as providing considerably more efficiency and projection ability than either type of cabinet.

—Bruce Howze
President
Community Light and Sound, Inc.
Philadelphia, Pa.

## Settling The Trim Control Controversy

**Can you settle a question for me? My friend says that while recording, the trim control should be open full and you should work it down if the situation calls for it. I say you should keep it half open and work either side. What would an engineer with a great**

**deal of experience do or would it depend on the specific situation?**

**—Robert Hartford**
**San Francisco, Ca.**

The term "trim control" could refer to one of two things, a mic input variable pad or the line trim control.

If you are referring to the mic input pad, it is my practice to adjust these so that the input level allows me to use the attenuator, or fader, within a comfortable working range, usually around 15 dB below the maximum output level of the fader. As most faders are not linear, using it in the upper portion allows for more subtle level changes and more accurate preplanned changes within a song. This position still gives adequate flexibility to increase or decrease the level as desired.

Using the pad in the manner above also equally serves a couple of other very critical purposes. First, by lowering the signal of a loud instrument or high output mic at this point, it reduces the possibility of over-driving and distorting the preamp signal.

Inversely, by raising the level of a low putput mic or quieter instrument at the preamp, it allows sufficient working gain, without having to increase the level at the fader and increasing the input module noise significantly.

Now, regarding the line trim controls, most console manufacturers give recommended operational design points for optimum performance of the equipment. In many instances this may be about "half open." The main advantage of this is to have the ability to increase or decrease your line level after you have combined several mic signals. This allows you to make the necessary change with one control rather than having to alter your entire mix individually.

So, in both cases, the mic pad and the line trim, the standard operating position would not generally be "open full." You should have the capability with both to raise or lower your signal as the situation demands.

—Rick Horton
Director of Operations
Jack Clement Recording Studios
Nashville, Tn.

## Duplicating Guidelines

**Recently, I recorded a series of lectures at a workshop. Most of my recordings are on seven- and ten-inch reel masters. People who attended these lectures are interested in purchasing copies of these tapes, and many have specified that cassette tapes are preferred.**

**Can you offer me any guidelines on cassette duplicating?**

**—Steve Harris**
**Erie, Pa.**

*In answering your question, we assumed that you are interested in making your copies one at a time, in your home or studio and that you would not be involved with high-speed, mass production of these cassettes. This being the case, there are four basic things that you can do to insure a good reproduction.*

*Bruce Kennedy, Studio Manager of EMC Corporation of St. Paul, Minnesota (a company involved with professional high-speed cassette duplicating), told us that good quality equipment is the key to making successful copies. To a great extent, the condition of your master reel-to-reel foretells a good or bad reproduction. Therefore, Bruce advises you to make sure that there is no residual material on the heads of your tape machine. A thorough degaussing will take care of this. Be sure to clean the heads of the machine as well.*

*Head alignment on both the tape deck and the cassette recorder should also be measured. There are tapes available in high-end audio stores that will help you make the necessary measurements. These tapes are available in both open reel and cassette formats.*

*Invest in high quality cassettes. Cheaper tape has more inherent noise and its frequency response is not always the best it can be. With a better grade of tape, you will also decrease the chances of sticking or "hang ups" that often plague people working with cassettes. The better quality tape is also important since, in dubbing from tape to cassette, as Bruce pointed out to us, tape saturation is often something of a problem. You experience saturation when you record at too high a level. The resulting distortion can make all your efforts almost worthless to the recipient of the tape.*

*The VU meters on both your open reel and cassette recorders will prove most important during the dubbing. While recording on cassette, try to stay out of the red! Occasional peaks splashing into the red are allowable, but do try to keep the body of the program material out of the red.*

*Keep these points in mind and cassette copies of good quality will be quite easy to produce.*

# The best tape decks in the world are only as good as this tape.

While there's a lot of controversy over who makes the world's best tape deck, there's very little over who makes the world's best tape.

Maxell.

Because Maxell gives you the widest frequency response, the highest signal-to-noise ratio and the lowest distortion of any tape you can buy. In fact, people who own the finest high-performance tape equipment use our tape more than any other brand.

So why buy one of the world's finest tape decks and get less than the world's best sound.

When you can use Maxell and get everything you paid for.


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maxell

CIRCLE 87 ON READER SERVICE CARD

## Playing Havoc

**I own a TEAC A-3340S. It's located in the same room as my color TV—about fifteen feet away from it. When the machine is put into the record mode while the TV is on, it plays havoc with the picture—I get multi-colored diagonal dashes. (They move.)**

**My layman's knowledge tells me that this might be a tremendous magnetic field problem. This is of no small concern to me since the only convenient place to store my tapes is behind the TEAC and I'm afraid I may be ruining them.**

**The tapes are currently under my bed awaiting your reply.**

**—Mike Fornatale**
**Park Ridge, N.J.**

You need not worry about magnetic fields from your tape deck during the record mode. What you are seeing on your TV screen is "RFI," or radio frequency interference. It will not erase tapes in close proximity. It is caused by a slight bias leakage transmitted either through the air or power line in your house. It will only affect one TV channel because of its fixed frequency of around 100 kHz. As a remedy, you should obtain an RFI filter at your local electronics store. It is an inexpensive adaptor that plugs into the wall outlet. Then, you plug the TV into the filter. You might try one on the tape deck also. This device should filter out the interference and clear your picture. Should you need any further assistance, you may contact me directly.

—Roy Kamin
Sales Dept.
TEAC Corp. Of America
Montebello, Ca.

## Tapco Conversion

**I own a TEAC 3340S and a Tapco 6000R mixer. Since there are no line level inputs on the Tapco, it forces me to EQ and add reverb in the initial master.**

**Is there a way that I can make something that will accommodate line levels into the mic level inputs? How about a mic attenuator for those screaming guitar parts? Is there a formula (given the specs of the inputs and outputs) that I could use for any situation that does not match up?**

**—Steve Bittle**
**Highland Park, Il.**

Yes, there is a way to convert the mic

# Studio quality microphones that don't need a studio to survive.

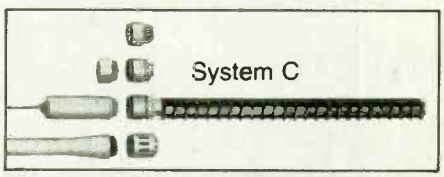
**The CS15P condenser cardioid** microphone is equally at home in a recording environment or broadcast studio. When hand-held it puts sex appeal in a voice with its bass-boosting proximity effect. With shaped high-frequency response and its ability to handle high sound pressure levels (140dB with 1% THD at 1kHz), the CS15P is ideal for close-up vocal or solo instrument miking applications.

When boom mounted, the CS15P has better gain-before-feedback and a better signal-to-noise ratio than most shotguns. It's phantom powered and it's rugged.

**The CO15P condenser omni** extends frequency response to the very limits of audibility, 20 to 20,000 Hz. Unlike other "omni's," the CO15P maintains its omnidirectional polar pattern at the very highest frequencies. Perfect for the distant miking of an entire orchestra as well as up close on individual instruments. And like the CS15P, it's phantom powered and it's rugged.

**The Electro-Voice warranty**
Electro-Voice backs up these two microphones with the only unconditional warranty in the business: for two years we will replace or repair your CS15P or CO15P microphone, when returned to Electro-Voice for service, at no charge – no matter what caused the damage!

We can do this because we build these microphones to meet our standards for performance, ruggedness and durability. We accept nothing less, and if you're a professional, buying a professional quality microphone, you shouldn't either.




Electro-Voice®
a gulton company
600 Cecil Street, Buchanan, Michigan 49107

CIRCLE 71 ON READER SERVICE CARD

inputs of a 6000R to line inputs. For use with your TEAC 3340S, install an open-circuit jack (an RCA phono jack will do) through the chassis and wire a 20K resistor from the center contact of the jack to pin 3 of the XLR connector. The wiring is shown in the schematic. The wattage rating of the resistor is not critical A ½- or ¼-watt resistor will do. Use sleeving on the resistor leads to prevent short circuits. All six channels may be wired this way.

When line levels are fed to a channel, the mic for that channel should be disconnected to prevent its sound output from interfering with the channel. By the way, the use of a 100K resistor instead of the 20K resistor will provide a useful line input level from those tape recorders that provide a 0 dBm to +4 dBm output level.

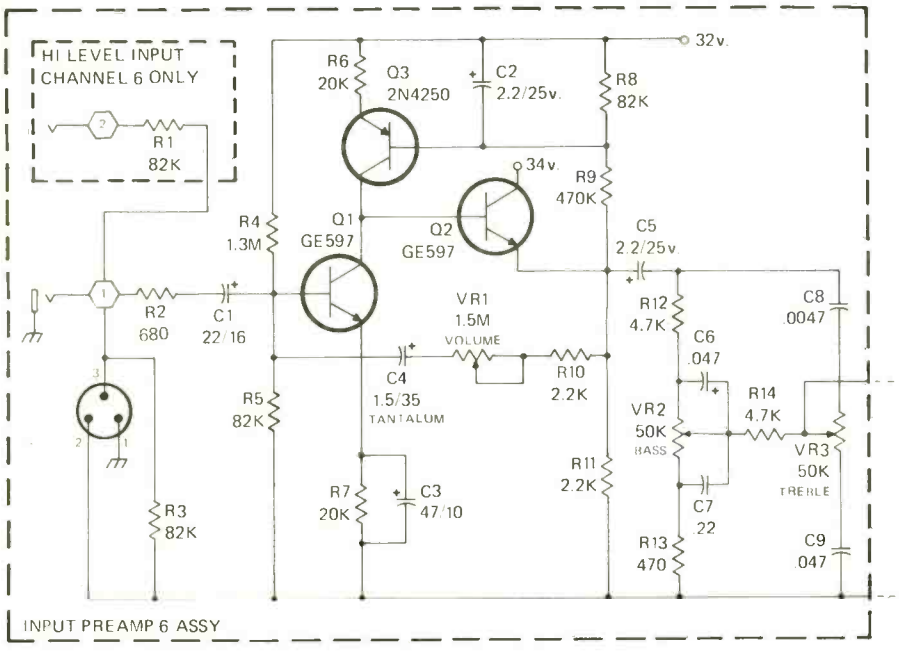



Fig. 1

If you want mic/line switching, simply add an SPDT switch. Use the subminiature type such as those made by ALCO, C & K, or JBT. There isn't much room under the top panel, so you may have to put the switch on the front or back of the mixer. Again, all six channels can be modified.

To attenuate those screaming guitar parts, a resistive pad must be placed in series with R2 (680 ohms). As before, the wattage rating is not critical, a ½ or ¼ watt resistor being adequate. The table shows the attenuation for various values of resistors.

| Attenuation | Resistor Value |
|---|---|
| 5 dB | 510 ohms |
| 10 dB | 1500 ohms |
| 15 dB | 3000 ohms |
| 20 db | 6200 ohms |
| 25 dB | 11K ohms |
| 30 dB | 22K ohms |
| 40 dB | 68K ohms |

The resistor should be installed inside the mixer in series with the wire that goes to pin 3 of the XLR connector (in series means cut the wire and insert the resistor). If you want to vary the attenuation, install several of the resistors called for in the table on a rotary switch (shorting wiper type) and mount the switch inside a metal utility enclosure (Bud, Hammond, LMB, etc.). Input and output can be through XLR connectors. The box can then be used when it is needed for a particular channel.

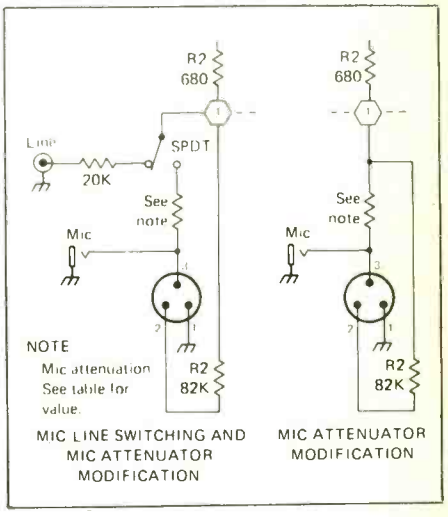



Fig. 2

# PROS GET BEHIND BGW AMPS


Over the past seven years BGW has turned a lot of professional heads around. We came out of nowhere to successfully challenge the stand-pat technology of the aging monarch of professional amplifiers. The most demanding buyers in the music business now rely on BGW: Studio owners. Recording engineers. Serious musicians. Everyone who makes his living from recorded or live sound. Performers and technicians alike have gotten behind BGW's legendary power, impeccable performance and workhorse reputation.

Here's what's made BGW the most imitated product in the pro sound business:

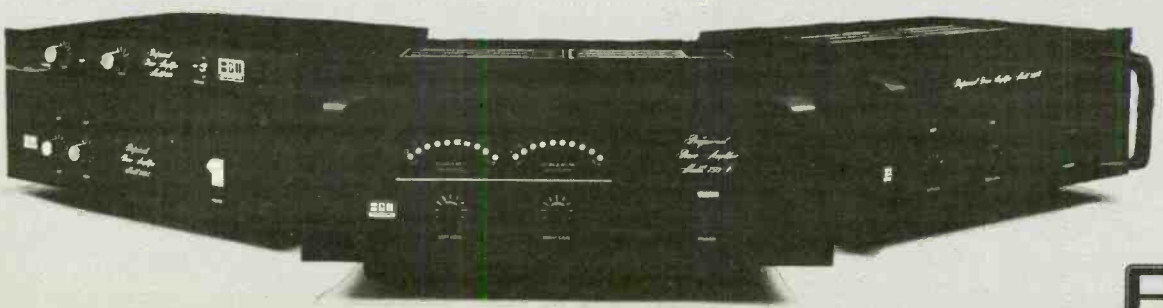
A full professional line starting with the MODEL 100: 30 watts per channel into 8 ohms, 20 Hz to 20 kHz, at less than 0.1% THD (80 watts mono);

The MODEL 250 C: 100 watts per channel into 8 ohms, 20 Hz to 20 kHz, at less than 0.1% THD (251 watts mono);

The new MODELS 750B and 750C: 225 watts per channel into 8 ohms, 20 Hz to 20 kHz, at less than 0.1% THD (720 watts mono).

For the true sound professional, quality isn't a luxury. It's a necessity and something we build into every BGW amp.

Contact our home office for complete technical specs. You'll understand why so many of your professional peers get behind BGW. And why the competition stays behind.



BGW Systems, Inc., 13130 S. Yukon Ave., Hawthorne, CA 90250. Telex: 66-4494
In Canada: Omnimedia Corp., 9653 Cote de Liesse, Dorval, Quebec H9P 1A3
International inquiries please contact the factory.

BGW SYSTEMS
Get Behind Us!

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The formula used to compute the values in the table is as follows:

$$R = (680[10^{\frac{dB}{20}} - 1]) - 680.$$

R equals the resistor value in series with the 680-ohm input resistor; dB equals the absolute value of the desired attenuation. Please bear in mind that this formula applies only to a Tapco 6000R, 6000RCF, and 100K. For other Tapco mixers, and mixers from other manufacturers, "U-shaped" and "H-shaped" resistor attenuation networks must be used. They should be built into a shielded enclosure, such as a Switchcraft S3FM, which has a male XLR plug at the output end and a female XLR socket at the input end. They look like the ones available from Electro-Voice and Shure, for example. The S3FM is also useful for building things like phase-reversal adapters. The networks will work with both balanced and unbalanced inputs. See the sketch for wiring ideas, and be sure to use sleeving where necessary to keep the components from shorting out.

Present-day microphones are designed to work into an impedance about ten times their characteristic impedance. Most mic inputs like to see an impedance of about 150 ohms. Ten years ago it was common practice to match impedances and properly terminate all audio signal lines. There were good reasons then, but nowadays the practice is to make outputs low impedance and bridge them with a higher impedance. Most microphone pads show a 150-ohm impedance both to the microphone and to the mic input. The circuit values given will make pads in

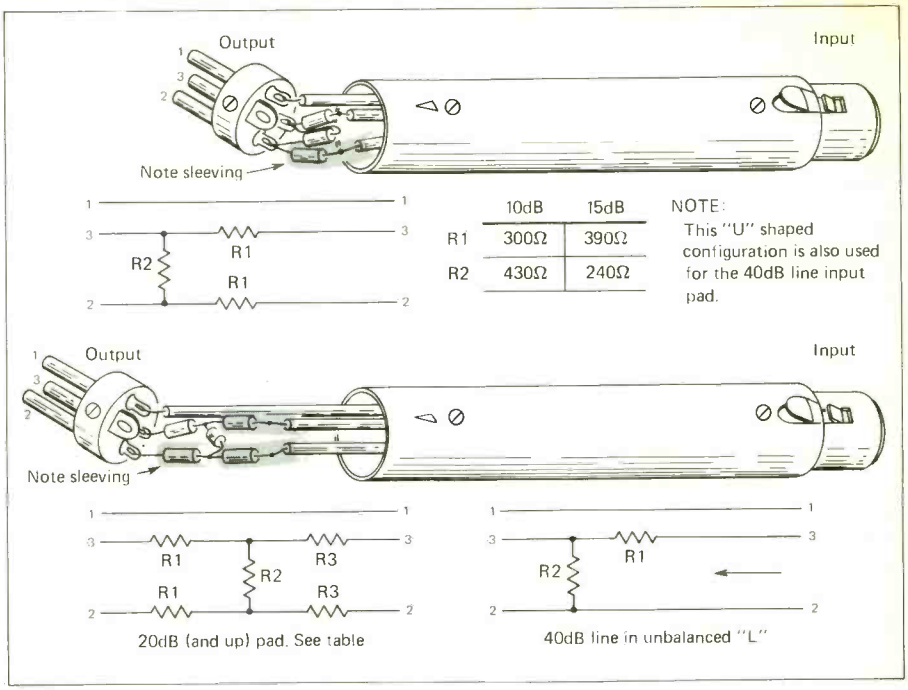


**Fig. 3**

# The most powerful argument for our new receiver is not just power.


True, it's tempting to be swept up by our power.

150 watts per channel minimum RMS at 8 ohms, from 20Hz to 20kHz, with no more than 0.07% Total Harmonic Distortion, is nothing to sneeze at.

But raw power means nothing. What's important is how that power is delivered. In the case of the STR-V7, it's brought to you by Sony in a very classy package.

You get a combination of features and controls that are impressive on their own—but almost unheard of in a single machine.

To start with, we've built in a Dolby system, for decoding Dolbyized FM broadcasts.

The advantages of our tuner, though, need no decoding. They include a normal and narrow FM IF bandwidth selector. It makes life simple for people in areas where their signals are crowded together elbow to elbow.

In our preamp section, the V7 comes equipped with a special phono EQ circuitry. Thanks to Sony's high IQ, it allows for direct connection of a low-output, moving-coil cartridge phono source. Without calling for an external step-up transformer or pre-preamp.

When you're gifted with as much power as the V7, you need a way to keep track of it. This receiver keeps tabs with two power-output meters, monitoring the power being fed to the speakers. So overload can't result from oversight.

And all that power comes from our direct coupled DC power amp. And our power is stable, thanks to a high-efficiency, high regulation toroidal-coil transformer.

There's a lot more to the STR-V7 than power. This receiver takes the best that contemporary technology has to offer, and offers it in a single machine.

Other manufacturers may have the power to bring you power. But only Sony has the power to bring you more than just power.

SONY®
AUDIO

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nput impedance is about
and the output impedance is about 150 ohms. Note as shown that the 10 dB and 15 dB pads are U-configured. The others are H-configured.

| dB Loss | R1 | R2 | R3 |
|---|---|---|---|
| 10 | 300 | 430 | — |
| 15 | 390 | 240 | — |
| 20 | 430 | 130 | 18 |
| 25 | 470 | 75 | 39 |
| 30 | 470 | 43 | 56 |
| 35 | 470 | 22 | 62 |
| 40 | 470 | 13 | 68 |
| 45 | 470 | 7.5 | 75 |
| 50 | 470 | 4.3 | 75 |
| 40 (line in) Unbal. "L" | 7500 | 150 | — |
| 40 (line in- 15K | | 150 | — |

You can also pad your line inputs. Both balanced and unbalanced inputs can be attenuated 40 dB. Use the resistor values shown in the table in an "L" or "U" shaped configuration as shown in the sketch.

Just a word of caution: Unless you are experienced in making these kinds of modifrcations to electronic equipment and have the proper tools, do not attempt the modifications yourself. Take this information to someone who is qualified to make the changes. These modifications are not made by Tapco, but merely offered as expert information for those people who want their equipment to operate differently from the way it was originally designed and intended from the factory.

—Rick Chinn
Product Specialist
Tapco
Redmond, Wa.
Schematic design: John Allen

## Successful Separation

**I would like some hints on improving the separation of tracks in multitrack recording mixdowns.**

**Experience and common sense tell me that some obvious methods would be panning each track to a different location, adding different amounts of reverb to each track, or differing the EQ on each track.**

**In spite of doing the above, I find that certain tracks still seem to be competing with each other for a particular place in ones' headphones or speakers, with the result being an unclear sound. What would the experts suggest I do to remedy this situation? I work with a Tascam 80-8 reel-to-reel.**

**—Ronnie Braverman**
**Bagel Studios**
**Montreal, Quebec, Canada**

Your problem seems to be one of acoustic masking. Two tracks containing the same spectral information can interact randomly causing a variety of frequency and time related anomalies, most of which add up to obscure the independent harmonic structure of each individual sound and hence cause them to each lose their independence and clarity in the overall mix.

Panning away each similar track will not help, as it only serves to minimize the electrical mixing together of the sound and maximize the acoustic (or, in the case of headphones, the psychoacoustic) mix, leaving you with the same culprit and the same problem all ready to pop up again when you mixdown to mono.

The answer to your dilemma lies in analysis of what you are going to record before you record it. Proper arrangement of instruments, vocals, etc. will ensure that fundamentals do not overlap and that the individual definition you are looking for is restored.

Don't overlook the fact that the masking phenomenon can be used to creative advantage. Two sounds played together in the same key instantly create a third new sound which you might find pleasant and unique.

Finally, loudspeaker or room resonances cause a masking problem independent of the one previously discussed. In these cases we have mechanical or acoustic resonances reinforcing certain frequencies and thereby masking their true structure, contributing in certain areas to your problems of separation and definition.

—Bob Snelgrove
Applications Engineering
Midas Audio Corporation
Niagara Falls, N.Y.

## Synthesizer Stumbling-block

**I am a guitar player with two problems: 1) I am a perfectionist and 2) I don't have much money. However, I want to build a guitar/keyboard synthesizer system. I presently own a Minimoog and electric guitar and the typical high-end sound modification devices. I also own my own recording gear which includes a TEAC**

# Whichever half-inch 8 track machine you choose, the Sound Workshop 1280 remains the most together recording console in its field.


The 1280B-8EQ with optional Meter Bridge

the Sound Workshop 1280 recording console

**Sound Workshop**
PROFESSIONAL AUDIO PRODUCTS

**It sounds better.**

1324 Motor Parkway, Hauppauge, New York 11787 516-582-6210

**3340S and a 3300S, a Tapco reverb 4400, a Soundcraftsmen RP2212 equalizer and a Furman PQ - 3 preamp/equalizer. I don't own a mixer because I record one channel at a time and I haven't yet felt the need for one.**

**I would like to build single-channel modules that could eventually be mounted to comprise a mixing system. These modules would have to have panning, EQ, pre- and post-fader busses, etc.**

**I would also like to construct synthesizing modules that would be compatible with the Minimoog Model D but which would also be able to be interfaced with guitar signals. Are the filtering circuits similar for guitar and keyboard synthesizers?**

**I have an expanding knowledge of electronics theory and good construction techniques but I need good reliable how-to materials. Are high-grade components and ICs available to people like me?**

**—Dave Howse**
**Lagrangeville, N.Y.**

To answer your question completely would involve a volume of information, so it seems best to explain the major differences between the two types of synthesizers.

In monophonic keyboard synthesizers, the audio signal created by the instrument does not flow through the keyboard circuitry. Actually the keyboard is set up as a network of individual electronic or mechanical switches which close to provide pitch information (applied to the VCO and VCF) and gate information (applied to the loudness and filter-contour generators).

With this system it is understandable why keyboards so readily adapt themselves to synthesizers. Interfacing problems are minimal as keyboard designs are relatively flexible.

In order to adapt an instrument such as a guitar, however, we are faced with a completely different problem. Each string induces an AC signal in the pickup to the instrument. This AC waveform is a representative of the pitch, loudness attack and decay, and may be monophonic or polyphonic in nature. To add to this, playing techniques such as hammering, bending, close picking, etc, complicate the waveform structure. Hence, we have before us a harmonically rich audio signal with a wide dynamic range. In


# At last, professional performance at less than a dollar per Watt!

The latest high speed, high voltage, discrete technology combines with unique packaging and exclusive features to create the Peavey CS-800, a new stereo power amplifier that is unrivaled by anything on the market at its price.

The CS-800 produces 400 Watts RMS per channel. Overall that's 800 Watts of solid, high fidelity amplification retailing for only $649.50*. At about 81 cents a Watt, that's an incredible price for a stereo power amp with the CS-800's performance and versatility.

We invite you to compare the features designed into the CS-800. You'll see why no other power amp offers the value built into a Peavey.

- 5 Hz to 60 kHz response
- Less than .05% THD 0.1% IMD
- LED overload indicators
- Loudspeaker protection system
- Balanced inputs and electronic crossover capabilities
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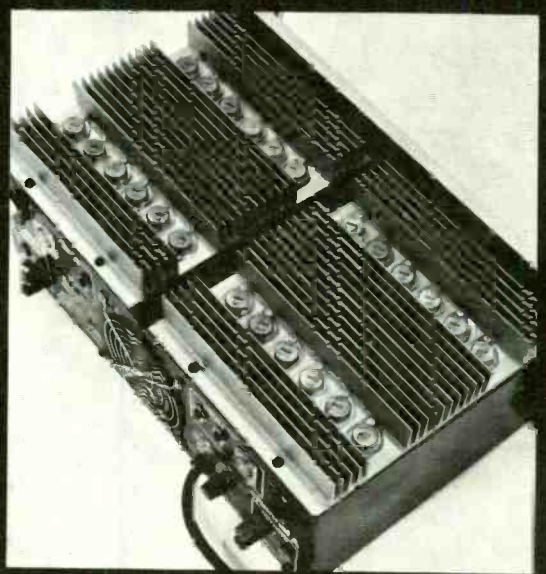
- Forced air cooling

*Suggested retail



The CS-800's twenty-four high voltage output transistors are mounted on massive, fan-cooled heatsinks for ultimate reliability even under the most demanding operating conditions.

**Peavey Electronics Corporation**
Meridian, Mississippi 39301

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this form, the signal is totally useless as far as synthesizer control is concerned. This waveform structure must be broken down by circuits to interpret each characteristic into some kind of useful control to allow the synthesizer to respond correctly.

Some IC manufacturers have made available intergrated circuits known as "frequency to voltage converter." One of these is manufactured by Raytheon (4151 voltage to frequency converter). It may be possible to secure some circuit applications and data from any relatively large electronic warehouse, or write directly to the manufacturer. A split pickup will be extremely helpful in isolating the output from each string to reduce the complications caused by string interaction.

Since guitar synthesizers are very new, we may expect to see a wide variety of techniques being applied to overcome interfacing problems. As these problems are solved, the guitar may prove itself to be a potentially powerful force in synthesizer control.

—Don Besecker
Field Service Specialist
Moog Music Inc.
Buffalo, N.Y.

## Percussive Phase Cancellation

**I have two questions regarding the engineering techniques involved when direct miking drums. How much of a problem is phase cancellation when combining direct and conventional mics? How often are kick drums miked direct?**

**—P. Barnes**
**Seattle, Wa.**

It's very difficult for me to answer your question restricting the subject to drums. I have polled several engineers and, although we have heard of drum pickups, I can find no one who has had the occasion to mic them "direct" in a studio situation.

In general, direct techniques are used to increase clarity and provide almost absolute separation. They more naturally apply to instruments having an electrical output as an integral part of the instrument (e.g. electric bass, guitar, Fender Rhodes piano, et. al.). There the signal originates electrically rather than acoustically.

With drums, the leakage problem is usually in their being picked up in other instrument mics, a problem solved by taking such other instruments direct rather than the drums. Without having tried the technique, I feel you would be faced with a large transient problem using any type of direct pickup on the drum.

To get to the basic question, which is phase cancellation (and this should apply to the drums as well), this will occur at certain frequencies varying with the distance of the conventional mic from the sound source. By definition, the direct mic is at the sound source. Any conventional microphone has to be further away and have a different phase relationship. We have found a combination of direct and "live" mics to be particularly effective on electric bass and guitar in particular. The string noise and speaker flap on the electric bass gives the notes some of the natural definition that they have "live." This technique was used quite effectively on many of the Beatles' LPs.

To determine phase problems, I would suggest that every so often you monitor in mono on a single speaker from a single tape track or mixing bus. Listening in this mode, the out-of-phase information will disappear. Another technique to find phase problems is to combine one channel of a stereo master with the other channel, phase reversed. This will allow you to hear the out-of-phase components. Should you hear any amount of bass you will almost certainly have trouble in disc mastering.

For background and additional information, allow me to suggest the following sources: Recording Engineer/Producer, Jan-Feb 1971, Vol. 2, No. 1, "An Interview With George Martin;" Recording Engineer/Producer, Feb. 1977, Vol. 8, No. 2, "Recording The Drums," by Paul Laurence; and *Microphones: Design and Application* by Lou Burroughs, Sagamore Publishing Company, Plainview, New York. I have found this last work to be the best of its kind.

In closing, let me say that I have not ignored your question regarding the kick drum, but I was unable to find anybody who uses direct mics.

—C. Nicholas Colleran, Jr.
President
Alpha Audio
Richmond, Va.

## A Puzzling Proposition

**Let me say first that I truly enjoy reading your magazine and that I think it's outstanding in its field. As a sound and recording enthusiast, I always find something new and stimulating in every issue. I espe-**

# PHASE LINEAR SETS THE STANDARD FOR HIGH POWER.

Current loudspeaker design theory takes for granted the availability of a high power reserve. An idea once considered frivolous by many. Today it is considered essential for the best possible reproduction of recorded material.

To reproduce a musical peak, a loudspeaker requires up to 10 times the average power being delivered. If the amplifier lacks a sufficient power reserve, it will clip, producing distortion and audibly destroying sonic quality.

The Phase Linear Dual 500-Series Two Power Amplifier is capable of delivering in excess of 505 watts per channel from 20Hz-20kHz into 8 ohms, with no more than 0.09% Total Harmonic Distortion. That's unsurpassed power for unsurpassed realism.

**CONVENTIONAL OUTPUT TRANSISTOR.**

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The Dual 500 utilizes an advanced design in output devices to overcome the problems associated with amplifier clipping at realistic listening levels. As a result, the power handling capability is greatly improved. In fact, the power semiconductor complement of the Dual 500 features the highest power handling capability in the audio industry.

A massive rear mounted extruded aluminum heat sink assembly protects the 36 output devices against overheating and includes a self-contained, thermally activated forced

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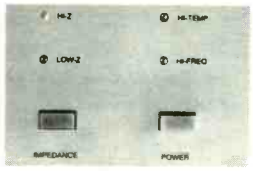
Instantaneous indication of output activity is easily maintained with an exclusive 32-segment LED display,


while a special 4-segment clipping indicator warns of hazardous overloads. High/Low Impedance Operation modes are automatically, or manually activated for increased amplifier efficiency when using low impedance speakers.

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**SPECIFICATIONS**

OUTPUT POWER: 505 WATTS MINIMUM RMS PER CHANNEL 20Hz-20,000Hz INTO 8 OHMS, WITH NO MORE THAN 0.09% TOTAL HARMONIC DISTORTION.

CONTINUOUS POWER: 1000Hz per channel, with less than 0.09% Total Harmonic Distortion:
8 ohms - 600 watts
4 ohms - 800 watts

INTERMODULATION DISTORTION: 0.09% Max (60Hz: 7kHz = 4:1)

DAMPING FACTOR: 1000:1 Min

RESIDUAL NOISE: 120uV (IHF "A")

SIGNAL TO NOISE RATIO: 110dB (IHF "A")

WEIGHT: 65 lbs. (32 kgs.)

DIMENSIONS: 19" × 7" × 15" (48.3cm × 17.8cm × 38.1cm)

Optionally available in E.I.A. standard rack mount configuration.

Optional accessories: Solid Oak or Walnut side panels.

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THE POWERFUL DIFFERENCE

MADE IN U.S.A. DISTRIBUTED IN CANADA BY H. ROY GRAY LTD. AND IN AUSTRALIA BY MEGASOUND PTY. LTD.

CIRCLE 97 ON READER SERVICE CARD

**cially enjoy the Talkback, Ambient Sound and Groove Views sections. Now, on to my question.**

**What is the basic difference in the resultant recorded sound when you mic a source through a Leslie-type rotating speaker and when you record the same source through an amp using a phaser and two mics (mixed, with slight separation)? Allowing for random noise, theoretically, I would think that they'd be quite similar.**

**Thanks for your time and keep cranking out those great issues!**

**—Cary S. Rogers**
**Nashville, Tn.**

The question you've asked puzzles me somewhat. I presume that you're suggesting using two microphones on the Leslie-type device as well as in the other method you describe, thus creating a widening and moving effect if panned across the mix. In the second example, you also do not state whether you'd be using a two-speaker amplifier, which would be necessary to create something similar to the Leslie sound.

The similarity of the effects is demonstrated by the number of manufacturers now distributing amplifier units with two speakers and an electronically adjustable circuit which either pans the signal between the two speakers of the amp, or with a vibrato circuit on one speaker and a simple on/off circuit on the other speaker which switches on or off in relation to the vibrato. Two examples of pieces which exhibit this property would be the Fender Rhodes stereo piano and the Roland Chorus Amp.

The Leslie speaker is an important part of the Hammond organ sound. The change from fast to slow speed and vice versa is a very effective transition. In the studio, guitars, vocals and numerous other sounds have been put through Leslie speakers for various effects—primarily I would say for widening and movement, but also in some cases for vibrato, etc. In recent years, the other method has been introduced. The choice of which to use depends on many factors and the program material. Personally, I lean towards the electronic method, but I certainly have not retired the good old Leslie.

Whichever system is used, there is some noise introduced. A Leslie speaker, no matter how well maintained, has a synthetic swishing. Depending on microphone placement, the Leslie system can seem to dissolve from side to side, but better separation can be achieved with the electronic method. If required, it can also be recorded by direct injection, thus eliminating the need for microphones, and getting almost perfect separation.

If, however, you are proposing one microphone on the Leslie but two on an amp with a phase shifter in the circuit, the effect would be quite different. The Leslie would still produce a feeling of movement, because of the time delay principles produced from the rotation of the sound source, even though it is in mono. Whereas when used with a mono amp, phased and recorded, the second microphone would introduce a roomier dimension.

—Roger Monk
Recording Engineer
The Little Mountain Sound Company Ltd.
Vancouver, British Columbia, Canada

# HEAR FROM US BEFORE YOU HEAR FROM THEM.

Today's broadcasting equipment and standards let you transmit things you never could before.

Like tape hiss, cue tone leakage and turntable rumble, to name a few.

And that's precisely why you need the JBL 4301 Broadcast Monitor.

It lets you hear everything you're transmitting. All the good stuff. And, all the bad. So you can detect the flaws before your listeners do.

The 4301 is super-compact, so it fits all EIA Standard racks. 19"h x 12 1/16"d x 11 1/2"w. It costs $168. And it's made by JBL. The recognized leader in professional sound equipment.

Just give us your name and address and we'll send you all the 4301's very impressive specs.

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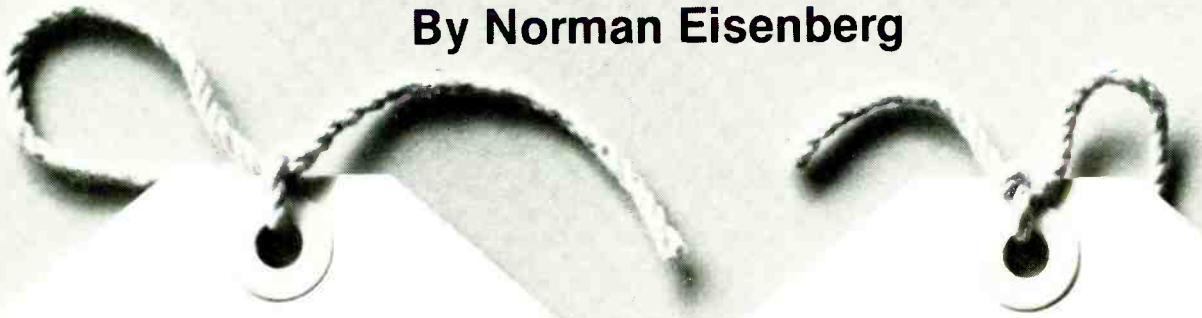
# THE PRODUCT SCENE

By Norman Eisenberg



## FENDER SOUND SYSTEM

The MA-6, a new sound system from Fender, consists of a console and two speaker systems, plus an included foot-operated reverb off/on switch. The MA-6 permits monitoring all six channels together or each channel separately. The 6-channel monitoring is ahead of channel volume controls; there also is 5-band monitor equalization. This enables the operator to hear a lead vocalist or key instrument as loud as desired via the monitor system, while the main speaker provides the mix intended for the audience. Re-patching and reverb facilities are included. Each channel has 15 dB of boost and cut for treble and bass. Reverb is built in (spring-type system). For increased power, it is possible to patch an instrument amplifier directly into the MA6 console. Amplifiers or voice also may be miked.

CIRCLE 4 ON READER SERVICE CARD

## SIGNAL-PROCESSING/PREAMP

Soundcraftsmen of Santa Ana, Calif. has introduced the model SP4002, a new preamp with front-panel pushbutton switching facilities for outboard processing loops, as well as for internal circuitry providing octave-wide EQ, subsonic filtering and three-way tape recorder dubbing and monitoring. Of rack-mount size, the new device features two phono preamps with variable cartridge loading (0 to 750 pF) and variable impedance (100/47 K) that will accept any type cartridge with an output from 0.28 to 300 millivolts. Each stereo phono preamp is completely separate and has a 97-dB signal-to-noise ratio; each may be driven by any type cartridge including moving-coil pickups. The signal path is routed via labeled pushbuttons from any of six input sources sequentially through a subsonic filter, two external processing loops, an equalizer, a mono A+B mixer, and to either the two tape outputs or the two line outputs. Tape dubbing and monitoring may be readily switched in and out; any source may be listened to normally during dubbing.

The equalizer itself is an octave-wide graphic type with 15-dB minimum boost or cut per octave, and up to 22 dB per octave boost or cut with all octaves full. Two headphones (8 ohms to 2000 ohms impedance) may be driven directly from the SP4002, with one headphone muting the speakers by interrupting the line-1 output. Price is $699.

CIRCLE 5 ON READER SERVICE CARD

## ACTIVE CROSSOVER

A new device for use in implementing a bi-amped or tri-amped playback system without external patching has been announced by Audio Perceptions of Diamond Bar, Calif. The Model 201 provides selectable frequencies in precise steps of 100 Hz from 100 to 1100 Hz. An "X 10" switch expands the range to 11 kHz in 1-kHz steps. Precise gain control of each output channel is provided in 1-dB steps from −5 to +5 dB.

According to the designer, high-pass and low-pass signals remain in constant phase to eliminate


crossover "null" and distortion. The device is capable of processing signals of up to +20 dBm before clipping. The balanced transformerless input stage switches to unbalanced mode when a standard 2-conductor plug is inserted. Balanced transformer outputs are available on request at extra charge. Self-powered, the Model 201 costs $350.

CIRCLE 6 ON READER SERVICE CARD

## AUDIO EFFECTS DEVICE

From MICMIX Audio Products, Inc. of Dallas, Texas comes news of a new audio effects unit called the Dynaflanger, which is said to provide the unique capability of dynamically controlling its effects in response to the program material. Featured among other functions is one called Freq-E-Flanging by means of which the resultant notch spacings are frequency enabled. In this mode, the device performs a frequency analysis of an incoming signal and continuously varies the control voltage on its delay line in accordance with control settings. The device also operates dynamically in the envelope follower mode, with its control voltages responding to peak amplitudes and the tracking switch selecting a following or inverse response to signal level changes. Dynaflanger also can be used for standard or nondynamic flanging. Packaged in a standard rack panel frame, the device is 1¾ inches high and 5¼ inches deep. Price is $895.

CIRCLE 7 ON READER SERVICE CARD

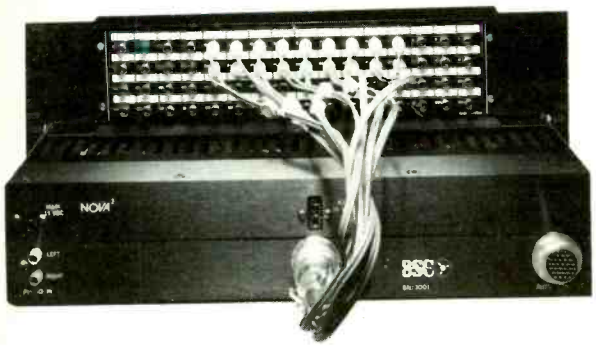
## OTARI SHOWS 1-INCH 8-TRACK RECORDER

Claimed to be the "first full-function" one-inch eight-track recorder is the new model MX-7800 from Otari. Among its features are: remote synchronous reproduce for overdubbing on all eight tracks; remote tape timer with LED readout; remote return to zero; record punch-in without clicks or pops; 30 and 15 ips speeds; varispeed DC capstan servo with coarse and fine controls on both transport and remote control; automatic monitor switching to match input or tape to record, reproduce or sync modes; built-in test oscillator; easy access to the innards; and more.

The MX-7800 handles NAB size reels and uses three one-inch 8-track heads. Overall frequency response in recording at 30 ips is listed as within ±2 dB from 50 Hz to 22 kHz; at 15 ips, from 30 Hz to 20 kHz. Sync response at either speed is listed as within ±2 dB from 50 Hz to 12 kHz. The 260-pound recorder is mounted in a console cabinet.

CIRCLE 8 ON READER SERVICE CARD

## BSC OFFERINGS



BSC, Inc. of River Grove, Illinois offers its System 700 Series III which consists of modular sections to assemble and update later for studio console arrangements.

BSC's Nova is described as "the ultimate preamp"—among the "rather amazing things" it can do, says BSC, is power 250 Marantz 510 amplifiers to full output because of its 60-ohm output impedance, and accept the output of a moving-coil cartridge direct.

CIRCLE 10 ON READER SERVICE CARD

## NEW PRO TRADE GROUP

CAMEO, standing for Creative Audio and Music Electronics Organization, is the name of a recently formed trade group consisting so far of nineteen companies whose primary function is the manufacture or distribution of finished electronic products under their own brand name that are used by musicians and production people vocationally to produce creative and original sound. Companies who joined at the first meeting, held in L.A. in May, are: AKG, Altec, ARP, BGW, dbx, Fender-Rogers-Rhodes division of CBS Musical Instruments, ITX-Aphex, JBL, KM Records, MXR, Oberheim, Phase Linear, Roland Corp US, SAE, Sirius Music, Soundcraftsmen, Tangent, Tapco and TEAC Tascam.

The board of directors will be made up of two members each from six product categories: musical instruments, signal processors/interface equipment; mics/speakers; amps/mixers; recorders; and instrument amplification. According to elected president Ken Sacks of TEAC Tascam, the new organization will assist in marketing and education efforts, and also would devote itself on a long-range basis to standardizing products, quantifying market demographics and interfacing with other trade associations. Such groups as NAMM, IHF and the American Music Conference all have expressed support for CAMEO, Sacks stated. Headquarters of the new group was given as Suite 3501 LaSalle Plaza, 180 N. La Salle St., Chicago, Illinois 60601. Telephone number is (312) 332-7400. Executive director is David Schulman.

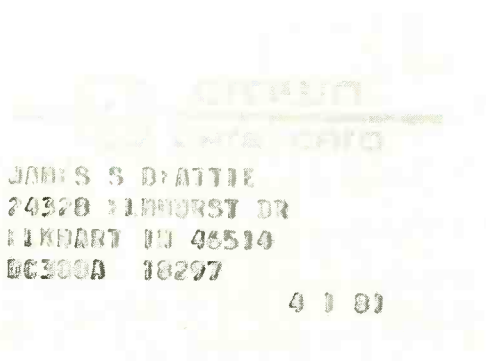
CIRCLE 9 ON READER SERVICE CARD

## DIGITAL MULTIMETER


Low cost and high accuracy are claimed for a new factory-assembled multimeter announced by EICO of Hicksville, N.Y. The model 272, priced at $69.95, has digital readout that eliminates, says the company, the "need to guess what the readings are, or to use complicated scale multipliers when measuring current, voltage, or resistance." The device reads out up to 1000 volts DC, up to 600 volts AC, up to 1000 milliamperes DC and AC, and up to 1 megohm resistance on three LED digits. Overrange is shown by a flashing display. The zero setting is automatic, and it is not necessary to operate a switch or reverse the leads for polarity since the polarity reading is also automatic. Battery supply consists of four penlite cells. The model 272 measures 6 by 3¾ by 1¾ inches.

CIRCLE 12 ON READER SERVICE CARD

## CROWN "CARE CARD"




By way of assuring its customers that with a purchase of Crown equipment, the firm's "commitment does not end, but rather, becomes deeper and more personal," Crown International of Elkart, Indiana has developed its "Care Card." The card identifies the owner and the equipment purchased and assures him or her of three years of "FTC full warranty." Each Crown component must meet or exceed all published specs for three years, or Crown will repair or replace it at no cost. Round-trip shipping charges are paid by Crown, and they even will send a free shipping carton if needed.

CIRCLE 13 ON READER SERVICE CARD

## TAPE SPLICERS

Nagy Research Products of McLean, Virginia, has announced a line of tape splicers for 1/4-inch, 1/2-inch and cassette tapes. The splicers feature self-sharpening shears that are said to cut Mylar accurately and easily. Several models are available, priced from $18.95 to $69.95, and all come with a 66-foot roll of splicing tape.

CIRCLE 14 ON READER SERVICE CARD

## A WATT IS STILL A WATT

The recently completed IHF amplifiers Standard is a job well done, in my view. It updates and codifies many areas of amplifier testing and performance, and thus it should prove of value to all users of amplifiers.

In it, however, is some kind of optional rider or, as Len Feldman puts it, a "parenthetical suggestion," concerning the possible use of a relatively new power expression known as the dBW. This expression attempts to translate normal amplifier wattage ratings into decibel values, with "1 watt" designated as "zero dBW" and then from there up the scale. For use with speaker outputs, another scale is needed which starts with a given dB output and converts amplifier watts into dB/SPL values for a "zero dBW" (i.e., 1 watt) input, based on speaker efficiency.

After going over this dBW thing carefully, I must conclude that it serves no useful purpose. It does not really clarify anything; it merely substitutes one numbering scale for another and thus it needlessly complicates an already complicated matter. You can, that is to say, go through the calculations of the dBW and still remain uncertain about how "powerful," relatively speaking, a given amplifier is vis-a-vis another, and further, how loud a given speaker may sound when driven by that amplifier.

The existing acoustic data we have, based on the work of Harry F. Olson some years ago, still is very serviceable as long as: a) it is understood that there is a significant difference between "electrical watts" and "acoustical watts," and b) we can get some idea of speaker "efficiency" or "sensitivity" (i.e., how much acoustical power over an appreciable portion of the response range will a given speaker produce for a given wattage input from the driving amplifier).

The trouble is, most speaker manufacturers are loath to publish efficiency ratings, probably because the percentages would look so small. But this is an important area of audio in which it is high time the industry "grew up" and told it like it is. It would remove a lot of the mystery and guesswork now involved in setting up sound systems in both homes and in professional applications.

This proposal, of course, puts the "burden of proof" on speaker manufacturers. The dBW puts the burden of numbers manipulation on the consumer and sound technician, and even then it really does not clarify anything.

You can call it something else, and you can disguise it behind elaborate arithmetic, but a watt remains a watt, and while it may be an awkward concept it still can serve its intended purpose when supplemented by real audio understanding. Making up new number scales is a poor substitute for helping to foster that understanding.

CIRCLE 15 ON READER SERVICE CARD

# MUSICAL NEWSICALS

## SOUND REINFORCEMENT

The Model 142S Monitormaster is a low-cost ($179), 40-watt RMS per channel stereo power amplifier from Earth Sound Research. Features include dual inputs to each channel,

bass and treble EQ, volume and balance controls and an illuminated stereo VU meter. Earth Sound also sells the amp as part of a complete monitor system.

CIRCLE 16 ON READER SERVICE CARD

In a literally unprecedented move, Electro-Voice, Inc. recently introduced a line of eight new microphones specifically designed to meet the full range of needs of the professional musician. Electro-Voice's new pro line is comprised of four cardioid microphones, two of them dynamic and two electret condenser designs, designed specifically for vocal use, and four dynamic mics specially suited for instrument use. Among the instrument microphones, two of the models are omnidirectional and two are cardioids using Electro-Voice's patented "Continuously Variable-D" design which eliminates proximity effect, the phenomenon that boosts bass frequencies when a directional microphone is used close to a sound source. Elimination of proximity effect in the PL6 and PL11 cardioid dynamic mics means that they do not appreciably change sound whether they are used at a distance of three inches or three feet. Both models have extra-tight directional patterns and carefully controlled off-axis frequency response to help eliminate feedback problems, and the PL11 has particularly extended frequency response making it suitable for almost any application including drum overhead use. The PL5 omnidirectional dynamic is a super-rugged, wide-range design which will not bottom out or distort


even in 160 dB sound fields making it an ideal choice for tight-miking of drums and amplifiers, while the PL9 is a super-flat omni whose frequency response stretches from 40 Hz to 18 kHz. On the vocal side, we find the PL91, an extra-rugged dynamic with a locking on-off switch, excellent anti-feedback performance, and a good, strong bass boost when used close-up. The PL95 is a slim dynamic—without an on-off switch—that features a special two-piece diaphragm for more extended low- and high-frequency response and remarkable anti-feedback characteristics. The PL76 and PL77 are both cardioid electret condenser models with virtually identical performance specs; the PL76 is battery powered, while the PL77 may be battery powered or used with remote phantom powering. Both models feature frequency response that is essentially ruler-flat from 50 Hz to 18 kHz when used at a distance; when used close, the bass response tilts up smoothly for full-sounding vocals. All eight pro-line mics are low impedance units with XLR type connectors, and feature rugged die-cast housings finished in non-reflecting gray and almost indestructable Memraflex grilles. In addition, each model except the PL6 and PL9 instrument mics have integral blast filters to prevent popping and wind noise.

CIRCLE 17 ON READER SERVICE CARD

## MUSICAL INSTRUMENTS

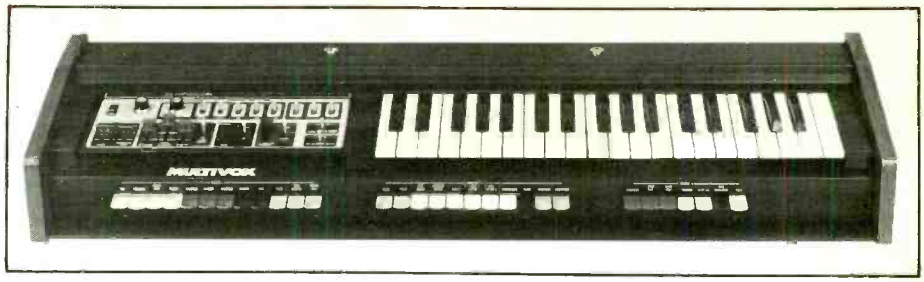
Music Man, Inc. has announced a new model electric guitar, the Sabre, to replace the company's Sting Ray models. Many of the Sting Ray's patented features have been retained in the Sabre, but the new model also incorporates several features intended to make the instrument extremely versatile and capable of adapting to a

wide variety of playing requirements. The Sabre uses newly developed slim-line humbucking pickups which are said to yield a high output level for good sustain and distortion while retaining the brighter, thinner sound of single-coil pickups. The pickups are widely spaced for greater tonal range and greater picking room, and are coupled to Music Man's micro-powered preamp. The preamp features separate bass and treble tone controls, toggle switches for treble accent and phase reversal, and a three-position lever switch for pickup selection. The guitar is a contoured design which is both smaller and lighter than more traditional designs. A new design cast bridge and a patented new truss style make the light weight possible without any sacrifice in sustain or strength. Two models are available with different fingerboard curvatures, and each model is available in a variety of finishes.

CIRCLE 18 ON READER SERVICE CARD

## SYNTHESIZERS

The Multivox MX-2000 is a versatile new preset synthesizer from Sorkin Music Co., which adds the extra dimension of a second oscillator voice to the versatility of its thirty preset sounds. Twenty-one of these presets are standard instrumental sounds, simulating a variety of wind, string, percussion and keyboard sounds, and the remaining nine are unusual effects sounds. In addition to the presets the unit has controls for filter modification, envelope hold, long sustain, repeat, portamento, unison, solo and variable modes for the second oscillator. A touch effect feature allows volume, wow, growl, vibrato, or pitch bend to be controlled by a slightly greater pressure on the keys.




CIRCLE 19 ON READER SERVICE CARD

## MUSICAL INSTRUMENT ACCESSORIES

Norlin Music, Inc. has announced a new addition to their Maestro line of sound modification devices. namely a parametric filter. The new unit combines a flexible parametric equalization capability with overdrive type distortion effects for a wide range of effects possibilities. Like all the latest Maestro efects devices, the Maestro Parametric embodies the "total foot control" concept which allows the musician to change his settings with his foot while still playing his instrument with both hands. The entire pedal acts as an effect on/off switch, and all controls are designed as extra large footwheels or foot discs. One of the two footwheels tunes the specific frequency of the filter while the other controls the amount of boost or cut at that frequency. The top-mounted foot disc controls the filter's bandwidth and also acts as an on/off switch for the overdrive effect. An additional feature of the Maestro Parametric is the auxiliary output jack which always carries a straight-through signal which can be combined at the amplifier with the effects signal.

CIRCLE 20 ON READER SERVICE CARD

New from Polyfusion, Inc. is the FF-1 Frequency Follower. This unit is basically a pitch-to-voltage converter similar to the units which form the heart of a guitar synthesizer system. When the output of any electrified monophonic instrument is fed to the input of the FF-1, the unit produces an accurate control voltage which is proportional to the frequency of the input according to the accepted 1 volt/octave standard. The unit also produces V and S type gate outputs to trigger external synthesizer functions, such as envelope generators; the gate circuits are variable threshold, of course. List price for the FF-1 Frequency Follower is $995; it is supplied in a 3½-inch rack-mount package. Also from Polyfusion is the SP-1 Sound-A-Round automatic stereo panner. The SP-1 pans a given input signal between its two outputs at any preset speed from 14 sweeps per second to 10 seconds per sweep. Controls are provided for speed and effect depth, and the speed may also be controlled from an external control voltage source, and the unit also boasts a bypass footswitch with indicator lights.

CIRCLE 21 ON READER SERVICE CARD

# MODERN STUDIO

This article is the last word in recording studio terminology. It is not just "another glossary," but it is *the* glossary for the professional which will supplant all previous works of its kind. Every important term in studio usage today is set forth in this paper and is clearly and concisely defined. It is designed for the experienced professional as well as the serious amateur.

All possible meanings of each of the herein contained terms were researched over many years to insure that the most precise definition of each entry would be obtained and set forth. There are absolutely no errors whatsoever in this list as the preparation, editing, and even the preliminary and final printings were carefully analyzed and proofread to eliminate any possible error. No other glossary can make that claim. It can be unqualifiedly said that there has never been a more extensive nor more accurate listing of terms specifically relating to the science and art of today's modern recording technology.

In an effort to show the relationship of terms to each other, one departure from the ordinary glossary has been observed. The terms are not listed in alphabetical order but are presented in a more interesting, sensible and logical order, where related terms are grouped together. The logic of this listing is so profoundly sound and the definitions given so accurate and comprehensible that were a Martian to drop from the sky and read this glossary it would know exactly what was going on in any recording studio it happened to visit.

**MICROPHONE**—An electro-mechanical device which converts the transverse waves of acoustical energy into analogous longitudinal waves of electrical energy. Such a mechanism usually is either ignored or swallowed by the singer.

**VELOCITY MIC**—Type of microphone thrown at mixer by irate producer whose 48-piece string section has just been erased.

**MIKE PAD**—The place where Mike lives.

**SINGER**—A musician rarely skilled in the use of the human voice as a musical instrument. Usually found lurking (with large semi-spherical objects where ears should be) in darkened vocal booths.

**ACOUSTICS**—Science of sound invented solely for the purpose of making fools out of soundmen. No other practical use has been found for it as of this day.

**ECHO**—An embellishment commonly thought to be capable of sharpening a flat note by the amount that the note is flat.

**REVERB**—Often confused with echo.

**DELAY**—What happens to a session after it is discovered that the horn charts won't work.

**OVERDUB**—Process of replacing the best lead guitar take with one that is inferior.

**SLAP-BACK**—What you get from the producer's chick when you start to mess around with her.

**PUNCH-IN**—What you get from the producer when he finds out you've been messing with his chick.

**PRODUCER**—Neurotic person who sits in a studio control room and periodically freaks out. Never sleeps or goes to the bathroom. Occasionally will eat your pizza.

**MONSTER**—Beast whose entire diet consists of over-rated producers.

**ENGINEER**—A technical-sounding name for a type of technician who has mastered the art of sleeping with his eyes open.

**MIC TECHNIQUE**—Mysterious modern method of utilizing recording microphones. It is strongly suspected that every professional engineer has a secret manual containing all the mic placements for all instruments. Novices and amateurs are constantly seeking this manual and seasoned mixers continually deny its existence.

**MAGNETIC TAPE**—Plastic ribbon coated with rust used primarily to store engineer's mistakes.

**MAGNETIC TAPE RECORDER**—Machine which can endlessly play back your recorded errors.

**DIGITAL TAPE RECORDER**—Complex machine which trades harmonic distortion and hiss for gravel and glitches.

**MIXING DESK/CONSOLE/CONTROL BOARD**—Large complicated-looking object containing thousands of switches without which we would be forced to record music exactly as it was intended to be played.

**PHONOGRAPH RECORD**—Somewhat disc-shaped object made from polyvinylchloride (which for some reason has escaped the surgeon general's attention) with wavy edges and often laced with kitty litter.

**DISC MASTERING**—Process by which a mixer's best efforts are ruthlessly mangled by a peculiar beady-eyed introvert.

**DISC MASTERING LATHE**—Machine used by peculiar beady-eyed introvert to ruthlessly mangle a mixer's best efforts.

**PHASER**—Black box capable of making the drum kit sound as if you

# RECORDING GLOSSARY

**Compiled by Phil E. Flash**

were being run over by a steam engine.

**FUZZ BOX**—Device over-used in White music.

**WAH WAH**—Device over-used in Black music.

**DIRECT BOX**—A $10 audio transformer which can be sold for $100 if this label is affixed.

**CLOSE-MIKING**—Technique where microphone diaphragm makes contact with singer's vocal cords. Similar to direct box.

**LEAKAGE**—What happens after three bottles of Ripple, twelve cups of cold, black coffee and one-hundred-and-fifty-two takes.

**RACK**—Six-foot-high by nineteen-inch-wide box used to store engineers overnight.

**VU METER**—Similar to a miniature pinball machine. Object is to make pointer stick to righthand pin. Game is lost if pointer falls into black portion of scale. Prior to its current entertainment value it was used to measure signal levels in dB.

**dB**—Unit of measurement of sound level which to date has been quintessentially undefinable. This is brought about by the fact that a 6 dB change is sometimes the same as a 3 dB change, and that a change of 1 watt can equal the same dB change as a change of a million watts.

**LED VU METER**—Private light show.

**EQUALIZER**—Device used to bend original sound from flat to bent. Use is mandatory in recording and broadcast studios.

**GRAPHIC EQUALIZER**—Device that lets you see just how much you are mangling the sound.

**PARAMETRIC EQUALIZER**—Device used to permanently warp a response curve so that it can not be restored to flat.

**MASTER FADER**—An attenuator which normally is inched downward as channel faders are inched upward.

**PAN POT**—Similar to pots and pans.

**POT**—Short for potentiometer; used to raise sound levels. Another type of pot is used to raise the level of studio personnel.

**BIAS**—Parameter of magnetic tape recorder which is usually adjusted to get the worst possible performance out of expensive equipment.

**BI-AMPLIFICATION**—Process of using two amps where one will do.

**TRI-AMPLIFICATION**—Process of using three amps where one will do.

**ANECHOIC CHAMBER**—Room specially designed to be totally devoid of echo, reverberation and external sound. Such a condition does not actually exist anywhere in nature; nevertheless, microphone and speaker manufacturers design their products to perform best in this environment instead of in the real world of recording studios and living rooms.

**LOUDSPEAKER**—A product originally designed to provide a means of monitoring what was being recorded in the studio and for playback in the home. Today it is used primarily as a device to inflict pain and suffering on recording engineers and to mass test resilience of audiences' eardrums.

**JUKEBOX**—Earlier models were primarily low-pass filter devices, until it was discovered that too much distortion was lost that way. Later models have restored the distortion.

**QUAD**—Currently in a coma resulting from too many doctors hawking their own brand of snake oil.

**SPL**—*Sound Pressure Level.* A means of defining and measuring sound levels. This method has been successfully used to determine that a producer's threshold of hearing is approximately equal to an engineer's threshold of pain.

**HYPERCARDIOID**—Producer with a heart condition.

**ELECTROSTATIC PICK UP**—Heavy weekend date.

**FIGURE-EIGHT PATTERN**—Similar to above.

**GROUND LOOP**—Exotic position used on electrostatic pickups.

**LOW IMPEDANCE**—Easy pickup.

**TRANSIENT RESPONSE**—What happens when you try to get the skid row bum off your front doorstep.

**POLAR PATTERN**—Remote recording session in the Arctic.

**BUS**—Large box-like vehicle covered with graffiti used to bring the recording studio to the musician.

**NOISE REDUCTION**—Peaceful condition existing only during a massive power failure.

**DOLBY SYSTEM**—Method of recording in which the engineer who plays back the tape must guess to within one dB what the original recording engineer's operating level was.

**PATCH**—Wire used to fix up a piece of equipment.

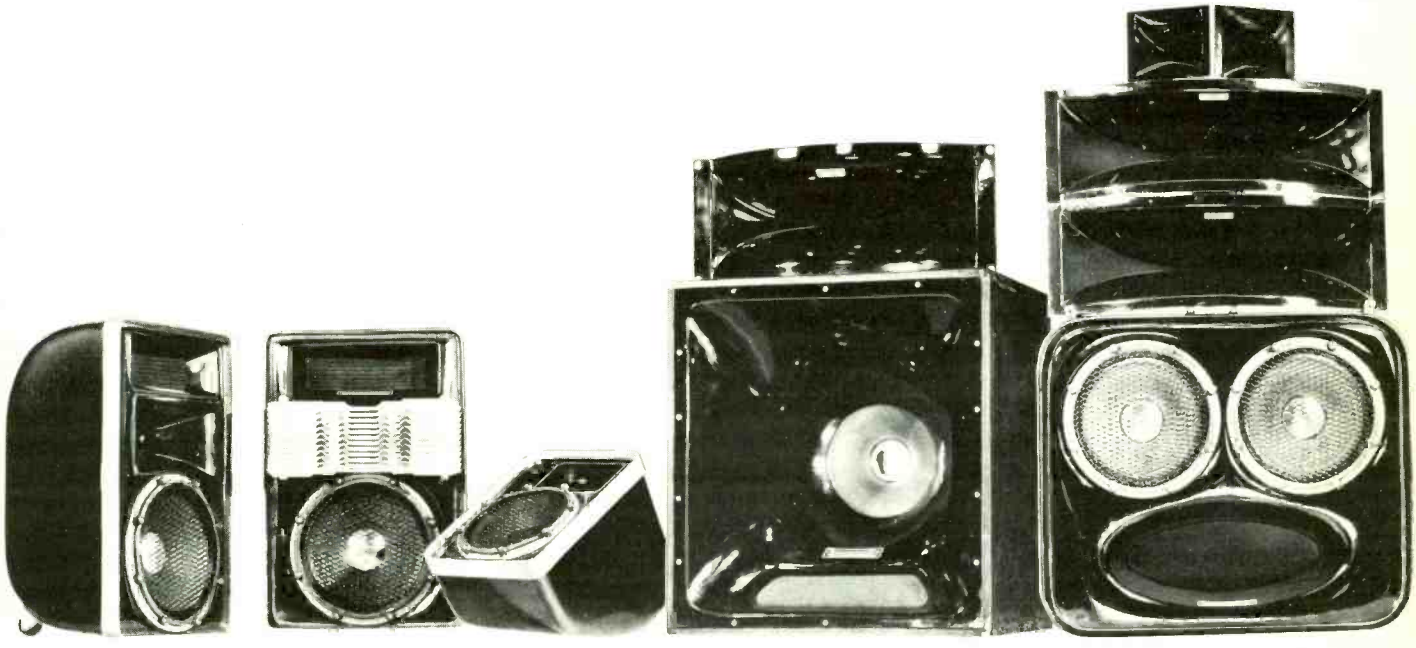
**SHELVING**—What happens to most records.

**ATTACK TIME**—Time it takes musicians to reach control room after being told that the engineer thought they were just running down the ten-minute tune instead of taking it.

**PINK NOISE**—Type of noise inherent in Russian tape recorders.

**RECORDING STUDIO**—Large box containing all the other terms in this glossary.

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



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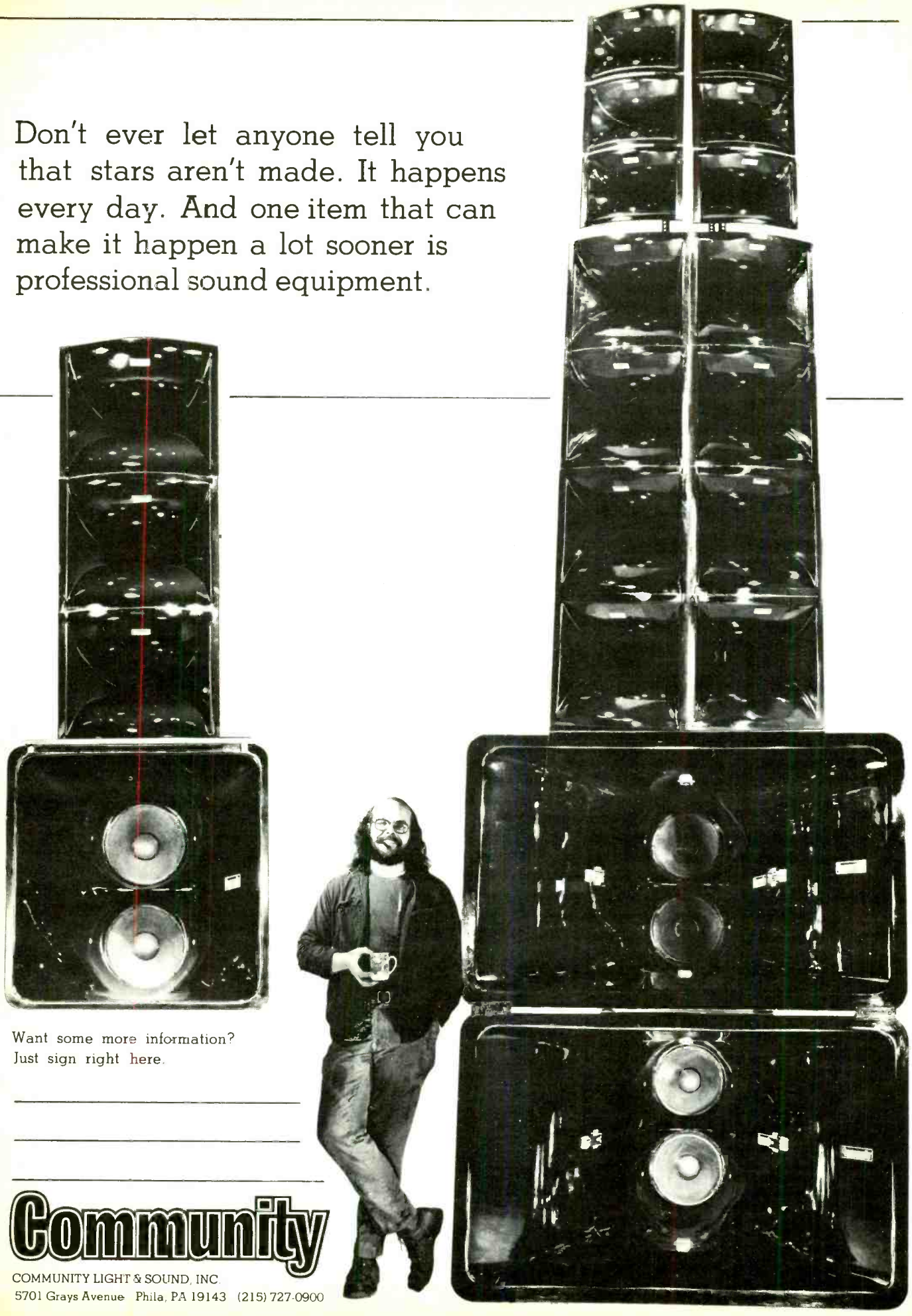

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# a session with LEO SAYER

by Michael Gershman

### The Room

Studio A, "the big room" at Studio 55 in Los Angeles has a lot going for it. The old Decca Records studio, it was built in the 1940s and never remodeled. Bing Crosby recorded "White Christmas" here, pedaling over on a bike from the nearby Paramount Pictures lot. More recently, it has been the scene for hit after hit from co-owner record producer Richard Perry. He's worked his magic here with Carly Simon, Ringo Starr, Diana Ross and Leo Sayer.

The other co-owner, engineer Howard Steele, bought the studio several years ago, when it was Abbey Sound and built his own recording console in A. (Through his company, Quantum Audio Labs, Steele has just built a board and studio for Randy Bachman in Washington.) When Steele bought the place, he was delighted to discover that all the walls and the ceiling were slate. Furthermore, 50% of the surfaces were reflective and 50% absorptive, giving the room a transparent and bright sound.

### The Approach

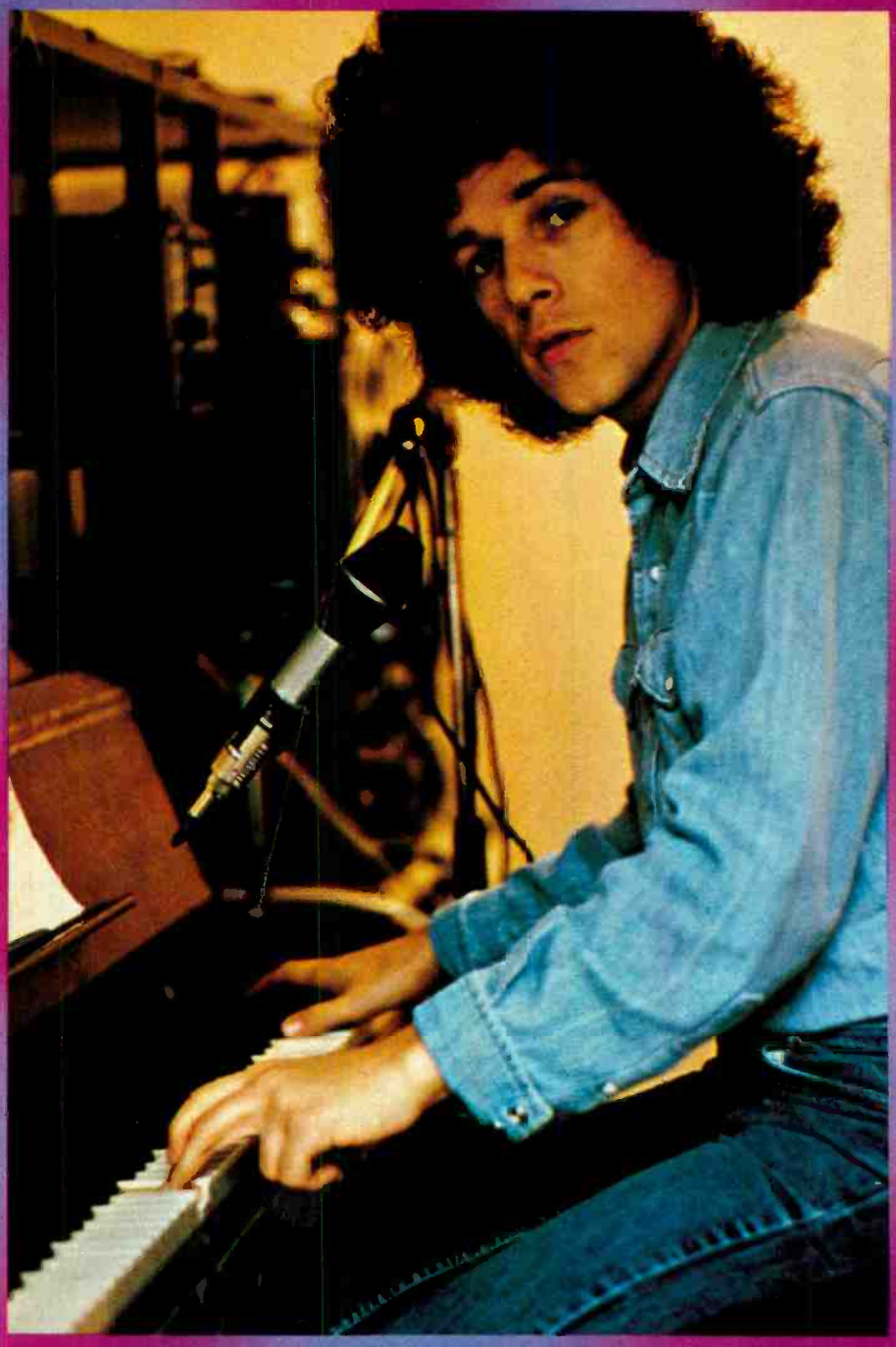
This is Leo Sayer's third album with Richard Perry. Their first, *Endless Flight*, produced back-to-back number one records in "You Make Me Feel Like Dancing" and "When I Need You," while their second collaboration, *Thunder In My Heart*, produced hits in the title cut and "Easy to Love." However, both Sayer and Perry want to take another tack this time.

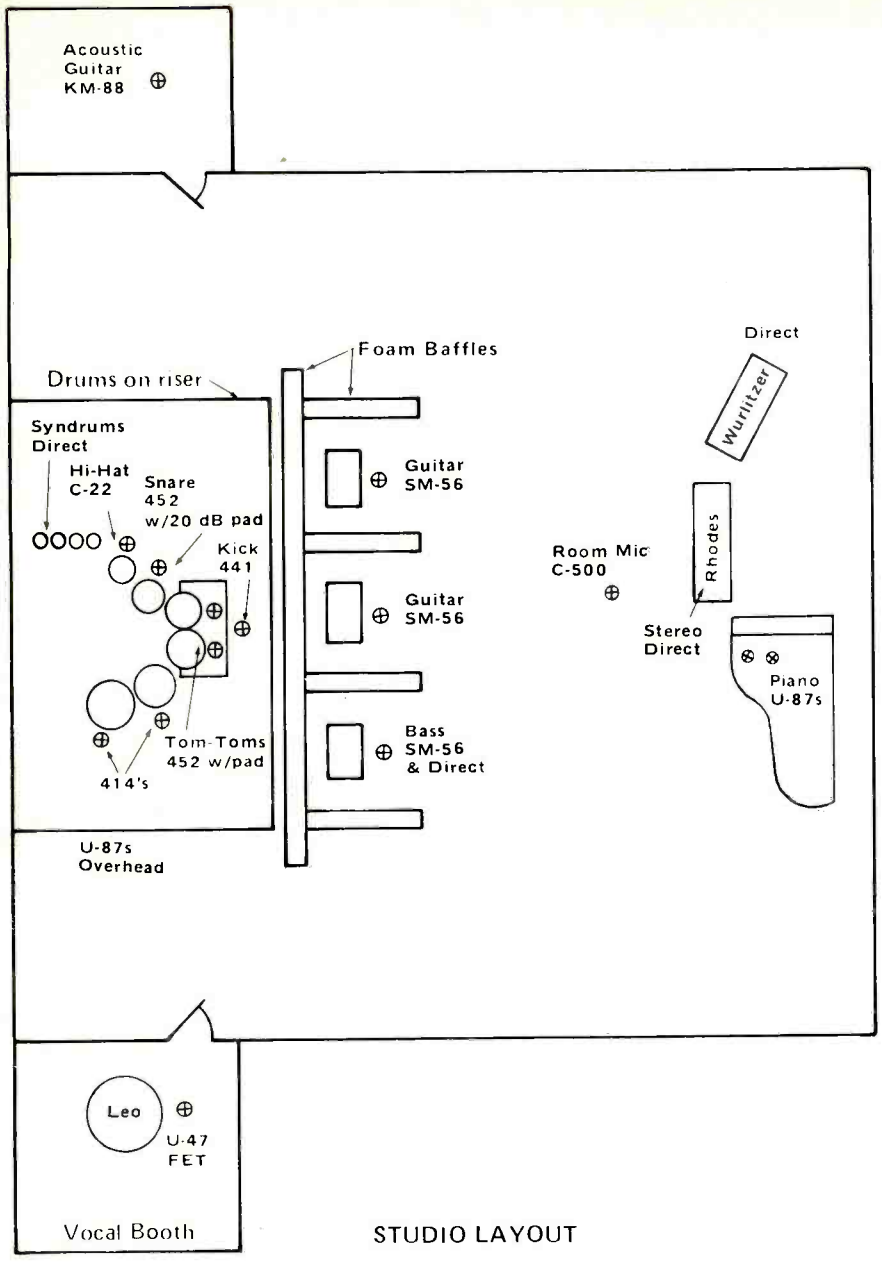
Says Perry, "The songs on 'Thunder' took on a little too much sophistication which proved ultimately to be not good . . . although, at the time, I thought it was the best album I'd ever made. This time, I wanted to get down to basics with more simplicity in the records and showcase Leo as a singer."

Sayer agrees. "This time, we wanted a raw approach, and that suits the material. A lot of the ideas for this album came out of my U.S. tour last year. When I went through the South particularly, I experienced acoustic American music in a new way. The things you hear on the radio in Memphis, Nashville and New Orleans are fabulous. I would sit there on the bus recording off the radio. When we got the black gospel stations, I was in heaven. I'm white and English, but I understand that music instinctively."

### The Set-Up

Given Sayer's and Perry's feelings about the kind of album they want to make, engineer Steele sets up the room accordingly. "When you're going to make a record with a lot of 'space' in it and not many overdubs, you have to be doubly careful about your mics because you want to capture the full sound of the instrument without any unnatural coloration. This fits my idea of recording anyway because I try not to record with a lot of overdubs. That stems from being a musician myself (Steele played bass in a number of Texas bands). I always do things critically, but, in this case, the weight is really on Leo and the musicians. When there's lots of natural sound blending as a result of having lots of musicians, you don't have to be as critical."






STUDIO LAYOUT

Steele hasn't used multi-track noise reduction in recording Sayer before but feels it's necessary for this project. He's using the fairly new Telcom noise reduction system on the two-track. "It's kind of a cross between Dolby and dbx. dbx does limiting and expanding to such an extent that you can hear it working. Dolby rolls off the supersonic top end purposely and it removes that feeling of presence. With Telcom, you can't tell it's being used.

"As for the set-up, I get the players arranged just as if they were playing a 'live' gig. The drum kit is on a riser with the bass and guitar in front so all three musicians have eye contact. Similarly, the acoustic guitar booth has a half-inch-thick glass door to keep up communication. Also, the wooden floor transmits sound nicely, and gives the players a greater feeling of unity. I separate the drummer from the bass and guitar with four-foot-high foam baffles that are a foot thick. The amps stand next to the baffles, but the bassist and guitarist sit in front of them so they're not confined.

"When we're running down a tune, I leave the room mic (a Sony C-500) open. I find that prevents communication problems. Every musician can talk to everyone else. I think a lot of engineering problems are really problems caused by restricting communication in the studio or between the studio and the control room."

## The Studio

Steele gears his microphones to the instruments rather than the musicians. He uses a Neumann KM-88 on the acoustic guitar. "It's got a really smooth frequency response and a nice airiness to it." He uses a Neumann U-87 overhead on the drums and in the piano. "I find it is *the* quality workhorse condenser mic. It's the most widely-used mic, and you *could* use them everywhere, but I use other mics for other qualities."

The rest of the drum kit takes a variety of mics. Steele uses the Sennheiser 441 on the kick drum and the AKG 452 on the mounted tom-toms and the snare. (On the snare mic, he inserts a 20 dB pad to cut down the level before it hits the mic preamp.) He prefers an AKG 414 on the floor tom but has reservations about it. "It might be a better mic than the U-87, but it's not [doesn't seem to be] as reliable. Besides, it takes six weeks to repair." A Sony C-22 on the high-hat completes the drum kit mics.

Steele varies the level of the overhead mics for different tunes. "In this album, I backed off the level of the overheads and relied on the floor mics for the majority of the tom-toms. That gives me a tighter sound. The drums sound bigger when you open the overheads as we did on a rock tune like 'Don't Look Away.' For an acoustic number like 'Raining In My Heart,' the overheads were hardly used."

He uses Shure SM-56s on the bass and guitar amplifiers. On tunes with stereo guitars, he mics with two SM-56s and has the guitars on two tracks. He takes the bass direct as well as through the mic on separate tracks and mixes it accordingly. He usually limits the direct bass with an out of production Teletronics tube-type LA-2A. The acoustic piano gets two U-87s close to the hammers in the Steele style. "It gets the stereo effect, plus, it gives you a brighter, more definitive piano sound. If I want a mellower sound, I'll move the mics back a bit."

As for the electric keyboards, Steele takes the Rhodes direct in stereo and the Wurlitzer direct with several options. "Sometimes I'll run the Wurlitzer through a Univibe [a phasing/flanging unit from Univox] if I'm looking for a little vibrato. If I'm looking for a little more exotic sound, I'll use a Boss Chorus [A RolandCorp product] which features phase shifting like you have on a Hammond organ." Steele also puts a little extra on the electric guitar—Sound Design's Vocal Stresser. He uses this combination EQ and complex limiter in the expander mode to cut down hum and noise.

Steele keeps the vocal tricks to a

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CIRCLE 72 ON READER SERVICE CARD

Engineer Steele and producer Perry flank Leo Sayer at Studio 55.

minimum with Sayer. "Leo's got a pure, clean voice and exceptional vocal control. He also has the happy faculty of adding different colors and textures himself. We used an LA-2A limiter on his voice and the U-47 FET (Field Effect Transistor) mic which is the solid-state version of the old tube mic. On 'Raining In My Heart,' we tried the RCA-77, that happens to be my favorite of the ribbon mics."

Recording Sayer can be tricky, says Steele, especially when he lets go. "When he starts belting, his voice thins out. If you then try to thicken the voice with EQ, you get a very muddy sound. The lower his volume, the rounder the sound and the warmer the tone." Steele uses the EMT 250, an electronic echo system for Sayer. "This allows the engineer to control the decay time of both high and low frequencies which is helpful [when] recording a transparent voice like Leo's."

## The Control Room

The control room in Studio B is dominated by Steele's customized version of Neve's computer automated console. He won't divulge any of his trade secrets except to say, "The less electronics in a console, the less degradation of the sound." (He will say that there are no voltage-controlled amplifiers.) He records on an Ampex MM-1200 using AGFA 2-inch tape. The multi-track is recorded at 30 ips and the mixdowns at 15 ips. "This is the best way we've found to get the good points of both speeds. Bass response is better at the slow speed and the high end sounds better at the higher speed." He uses Ampex's ATR-100 for a two-track machine.

Monitoring is done on the Mastering Lab Big Red System or JBLs, and Auratones are used for the small speakers. Steele has his choice of three equalizer systems—Trident's parametric, Pultec's switchable and UREI's new graphic system. Echo is handled through EMT 140s and two "live" chambers. Ampex's VSO and Eventide's digital delay unit and Harmonizer complete the picture. Steele particularly swears by the Harmonizer. "I've used it on every session I've done in the last two years."

## The Material

Kathleen Carey (Kathy to her friends) might be called Richard Perry's Richard Perry. In addition to running Perry's publishing companies, she finds songs for the artists he produces and often puts him together with artists to produce. In fact, Carey had been a friend of Sayer's while his records were being produced by Adam Faith and helped bring Leo and Richard together.

When she knew the two would be in the studio in the spring, she began compiling material in January. "I start early and really scout songs all over the place. It's not enough just to hit the publishing companies in Los Angeles. I look for material in London, New York and Nashville too. In fact, 'La Booga Rooga' and 'I Can't Stop Loving You' both came from London." (The latter tune is published by Claude Abroad, Roger Daltrey's company. Ironically, Sayer was first recognized for the songs he wrote on Daltrey's first solo album.)

She also picked "Runnin' To My Freedom," which is one of the highlights of the album. "When Tom Snow and John Vastano played me that song, I knew it was right for this album. We were looking for songs with real earthy lyrics, something meaty for Leo to work with. Generally, a song for Leo has to have an important lyric or convey emotions in an important way. That's why I knew 'When I Need You' would be right for him. This time we were looking for something relatable to both AM and FM radio. In the four years I've been working with Leo, this was the toughest project to pick tunes for because Richard and Leo wanted really specific material. I went through hundreds of songs for Leo and I think we've come up with a really good blend."

## The Producer

Richard Perry is probably the most well-known record producer in America. In addition to cranking out hits with regularity, he appeared as a producer in *American Hot Wax* and has a new record label and several TV and movie projects in the works. He first saw Sayer at the Troubadour [a club in Los Angeles] and remembers the night very well. "I immediately sensed a special and unique magic he had as an entertainer. He was one of the most exciting performers I'd ever seen. I knew then that I'd like to become involved with him."

As for working with Sayer in the studio, Perry says, "I let Leo go with what feels good for him, both with material and takes. As a singer, he has an incredible instinct and feeling for the essence of what he is singing about. He also has an amazing feel for pitch, which is a problem for most singers. We hardly ever talk about pitch."

## The Artist

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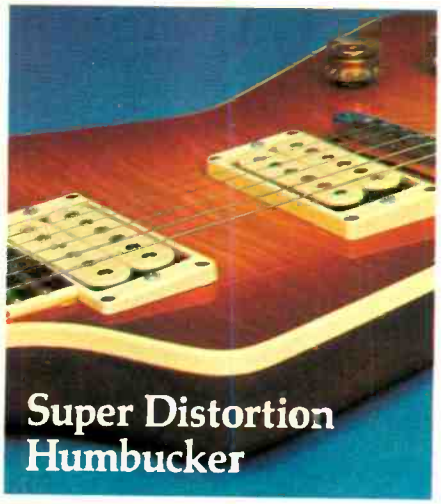


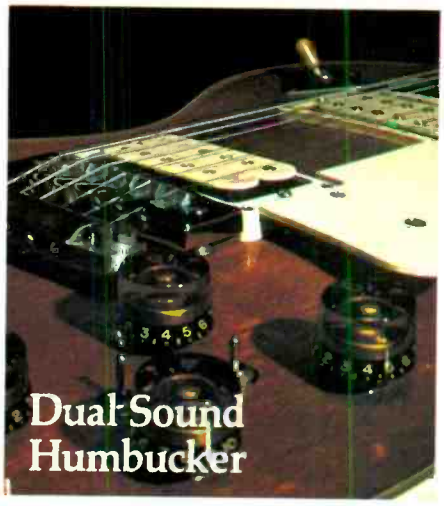


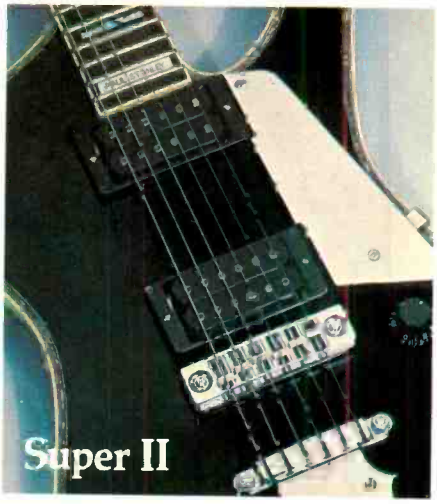


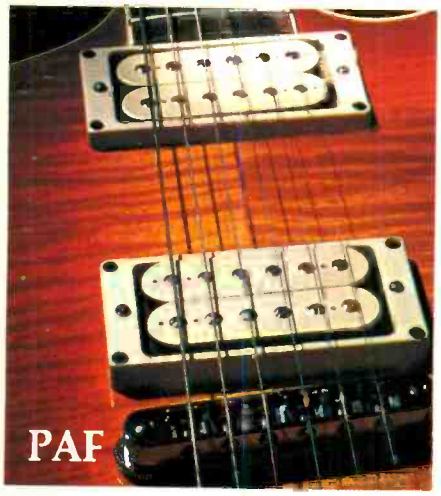



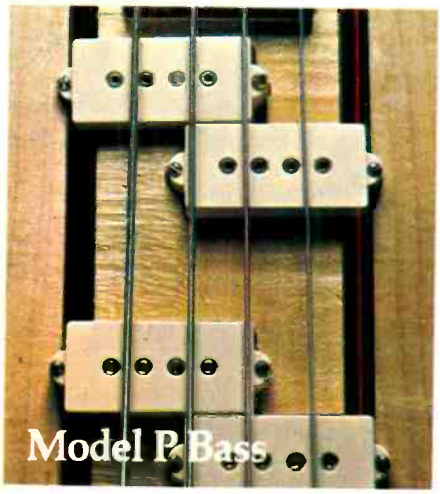




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tremely bright package, Leo's definitely your man.

We did slow him down long enough to get some insights into his view of Richard Perry.

"Richard likes to be in at the birth of a song. He wants to be part of the creation. And that to me is the magic of Richard Perry. He can make things hits. He's got a way of working with songwriters that influences them, not into something he wants personally but into something he can work with. He creates the vehicle along with the songwriter, which is quite unique."

## The Sessions

The first song recorded is "Stormy Weather" written by Sayer with Tom Snow. The two are old collaborators by now and were in a "Tim Hardin mood" one night when this tune came about. Drummer Jeff Porcaro, bassist Dean Parks, guitarist Fred Tackett, and Snow on electric piano go through a handful of takes before they hit one that causes Perry to say, "That's the one." An electric guitar overdub by young Steve Lukather (keep your eye on this guy) is flawless and David Lindley adds to the feeling with a beautiful steel guitar track.

Now comes the moment. Sayer hasn't played harmonica for three years although he got his start as a harp player in the blues bands that proliferated in England in the mid 60s. He's made up his mind to get back to it both on record and on tour.

Take one. Nothing. Takes two, three and four. Getting there. Take five. Yes. The noble experiment works and Sayer proceeds to lay down a lead and harmony vocal. The studio is still because everyone realizes that the vocal is the center of the track. Sayer gives it several different approaches until he hits what feels right. As Perry predicted, if it sounds right to Leo, it sounds right.

"Howja like that one, Rich?" Perry saves words by smiling his approval.

That's one down and nine to go. The nine turn out to be twelve. Several songs cut "don't make the finals" in Perry's phrase. Sayer is disappointed when his rendition of Arlo Guthrie's "The Last To Leave" doesn't pan out. "I've always loved that song, but it's just not right. Maybe I'll take another crack at it on another album."

His spirits rise after working on "Frankie Lee," a rocker he wrote with Ray Parker of Raydio. Porcaro, Parker, Lukather and bassist Scotty Edwards lay down a smoking track that gets applause in the control room, a rarity. When David Paich adds a piano track and James Newton Howard's clavinet lays right in, everyone in the big room knows they're onto something. Sayer sings the story of a classic Don Juan with verve, and the excitement is palpable.

Next comes a ballad from Sayer and Snow and the studio quiets down. "No Looking Back" is recorded "live"—a piano-vocal duet with Snow on piano. The magic is there and three minutes after it is started, "No Looking Back" is in the can, a one-take job that needs no improvement.

Several days later, the idea of doing a Jackson Browne song comes up. Sayer asks Perry, "What about 'Doctor My Eyes'?" Perry says, "I think perhaps it's a little too familiar, but I love the idea of your doing his stuff." As if by prior arrangement, the control room door swings open and in walks a friend of Perry with the *Jackson Browne* album under his arm. He suggests "Something Fine" and all heads nod signifying yes. Perry makes a phone call and the magic gets a little more intense as he announces, "Lindsey Buckingham is coming over to play guitar and sing harmony with Leo." It's done as if things like this happen every day for Perry. Sometimes they do.

Buckingham arrives all smiles and he and Leo exchange stories about mutual acquaintances to the delight of all. When they run down the tune, it becomes evident that this is a perfect marriage and they get a fabulous take in twenty minutes. The two musicians then decide to take a stab at a minor r&b hit called "I've Been Lonely For So Long." After the track is laid down, they go into the vocal booth and, just as they're getting started, Joan Armatrading and Bonnie Raitt walk in to lend some moral support. It turns out to be not enough and this track joins the might-have-been pile in Studio Heaven. Sayer is philosophical this time. "Different horses for different courses, right?" Right.

* * *

Through the triumphs and disasters of daily studio life, Perry remains detached, keeping the keel even. Sayer balances his down moments by playing to the control room as if to an audience. He does Chaplin walks, Groucho bits and outrageous musical parodies. Between vocal takes on "La Booga Rooga," he suddenly sings "Stayin' Alive" *a la* Bob Dylan (Stayin' *Aliiiiiieve*) and breaks everyone up. This is his way of dealing with the tension, and it works.

## Democracy in Action

Sessions at 55 often turn into democratic listening sessions. After "Frankie Lee" has been run down and Perry has gotten three takes he's more or less happy with, he polls the room as to which should be *the* take. Robin Rinehart, Perry's assistant, Kathy Carey, Steele and assistant engineer Gabe Veltri are polled. Says Perry, "We're in the semi-finals. Will it be take three, take five or take eight? Cast your votes."

Take three gets one vote; five gets two votes; eight gets two votes. "All right. It's the finals. Five or eight, which will it be?" After one more round of voting, a compromise is reached. Perry will go with the beginning of five and the end of eight. Everyone signifies their approval and that's that.

Sayer is satisfied with his vocals for the moment and gives an interview in the studio one night. His questioner wants to know who influenced his vocal style. "The first guy that I really listened to, no, there were two—Sam Cooke and Lloyd Price. I was gonna say Cooke, but Lloyd Price really knew how to get over the atmosphere of a song. Later on, it was the Stax people I listened to—Otis Redding, Sam and Dave, Joe Tex." Sayer then breaks into "I've Been Lovin' You Too Long" and everything stops in the control room. James Newton Howard picks up on it in the studio and plays gospelish piano that's perfect. This Sayer performance won't be recorded, but half a dozen people have heard something rare and wonderful and applaud madly. Sayer mock bows and the interviewer leaves. There is nothing left to say.

After the album is supposedly in the can, Sayer compares the vocal he does on "Raining In My Heart" with his "live" version of the song and is not totally pleased. While on tour in Canada, he calls Perry and they discuss the situation. Steele gets on a plane to Edmonton. Sayer gets on a plane to Edmonton. On a lazy Saturday morning, they redo the lead vocal and the background parts in two hours. Steele gets on a plane to Los Angeles. Sayer gets on a plane to Vancouver.

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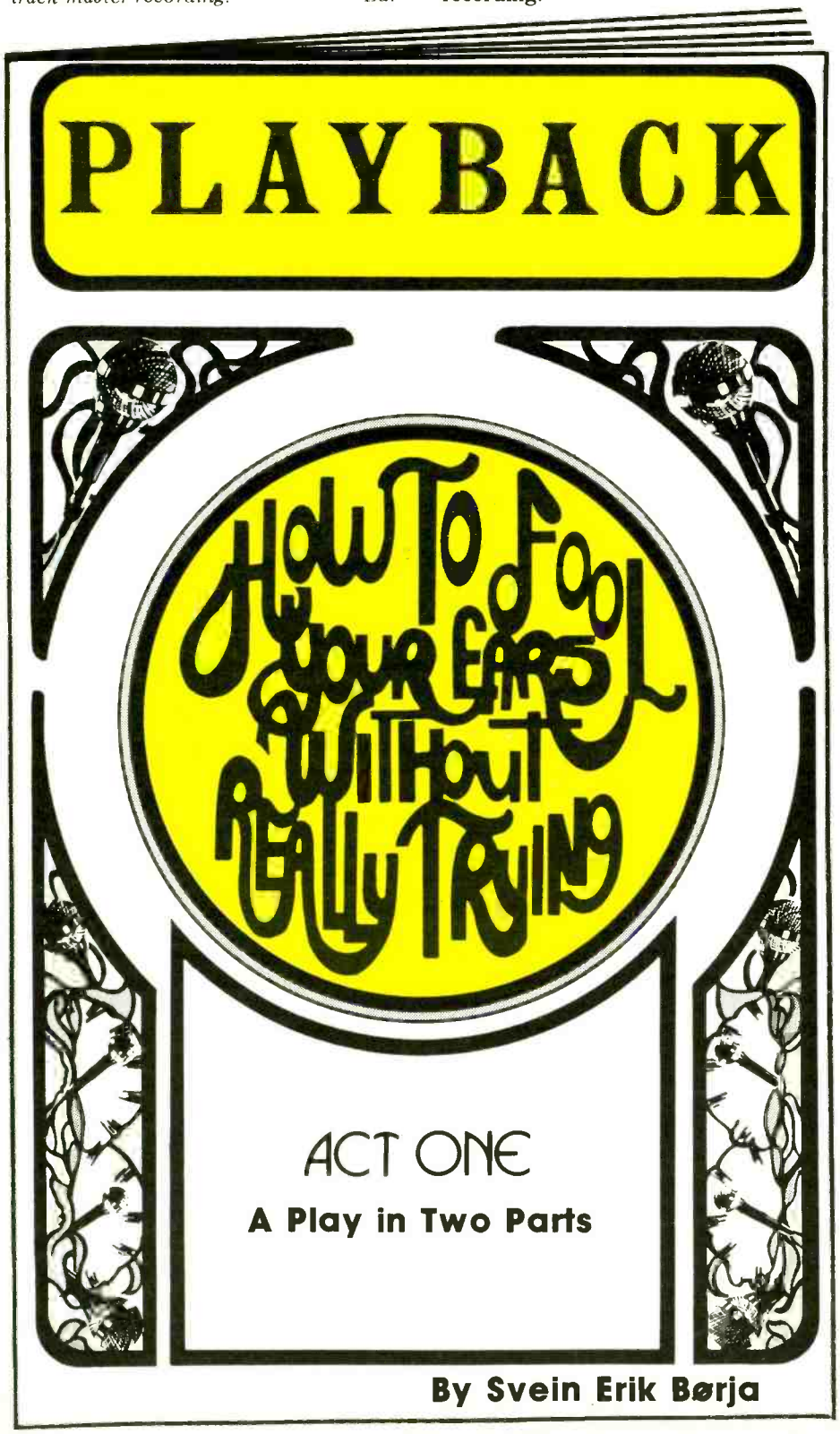
*This article appeared originally in a similar form—additions and revisions have been made—in the* Journal of the Audio Engineering Society *(AES), Vol. 25, No. 7/8, pages 482-490, July/August 1977. It was presented as a paper at the 55th AES Convention in New York. The discussion concerns itself with the influence of the listening response in studio control rooms on the mixdown of a multitrack master recording.* —*Ed.*




## Introduction

A 16-track master recording of a jazz/rock group has been mixed down in four different sound control rooms under the existing listening conditions. After the mixdown the listening response was measured and compared with equalizations done to the program material and with the spectrum energy response of the corresponding recording.

## A Constant Problem

The problem is not new or unknown. It has been causing irritation and worry to the concerned record producer for many years: After many hours of concentrated work in the sound control room you may feel pleased with what has been achieved. However, when you put the master tape on your own playback system, you often experience a shock, realizing that the recording sounds horrible. The tonal quality of the instruments may be bad; there may be too much or too little echo; overall balance may not be what you wanted; and the panorama may be too wide or too narrow.

You know there is nothing wrong with your playback-system; in fact, what you hear is what is on the tape. But it is not what you heard in the control room the night before. It all adds up to the problem of the listening conditions in control rooms, which too often are completely unknown to the record producer or even to the recording engineer. Many engineers do not know the specifications or behavior of their most important control instrument: the listening response.

Audible effects of these problems become more important and evident as quality of home playback systems improves. Also, the growing habit of recording and mixing down at different studios adds to the problem of getting the same sound on different tracks of an LP record. Although the subject has been widely discussed, little has been done to show the relationship between the listening response of the control room and the sound of a mixed tape.

The simple project described here will show some of the effects. However, it should not be regarded as a scientifically valid research. Firm and final conclusions cannot be drawn because too many subjective and uncontrollable factors are involved.

## How It Was Done

The project started as a normal job—a jazz/rock recording. It was only later, after a disappointing mixdown,

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*Svein Erik Børja was born in Norway and has worked as a freelance record producer for several recording companies. He is a television producer and director by profession, and has composed music for films and written articles on high fidelity and sound reproduction for various technical magazines in Scandinavia.*

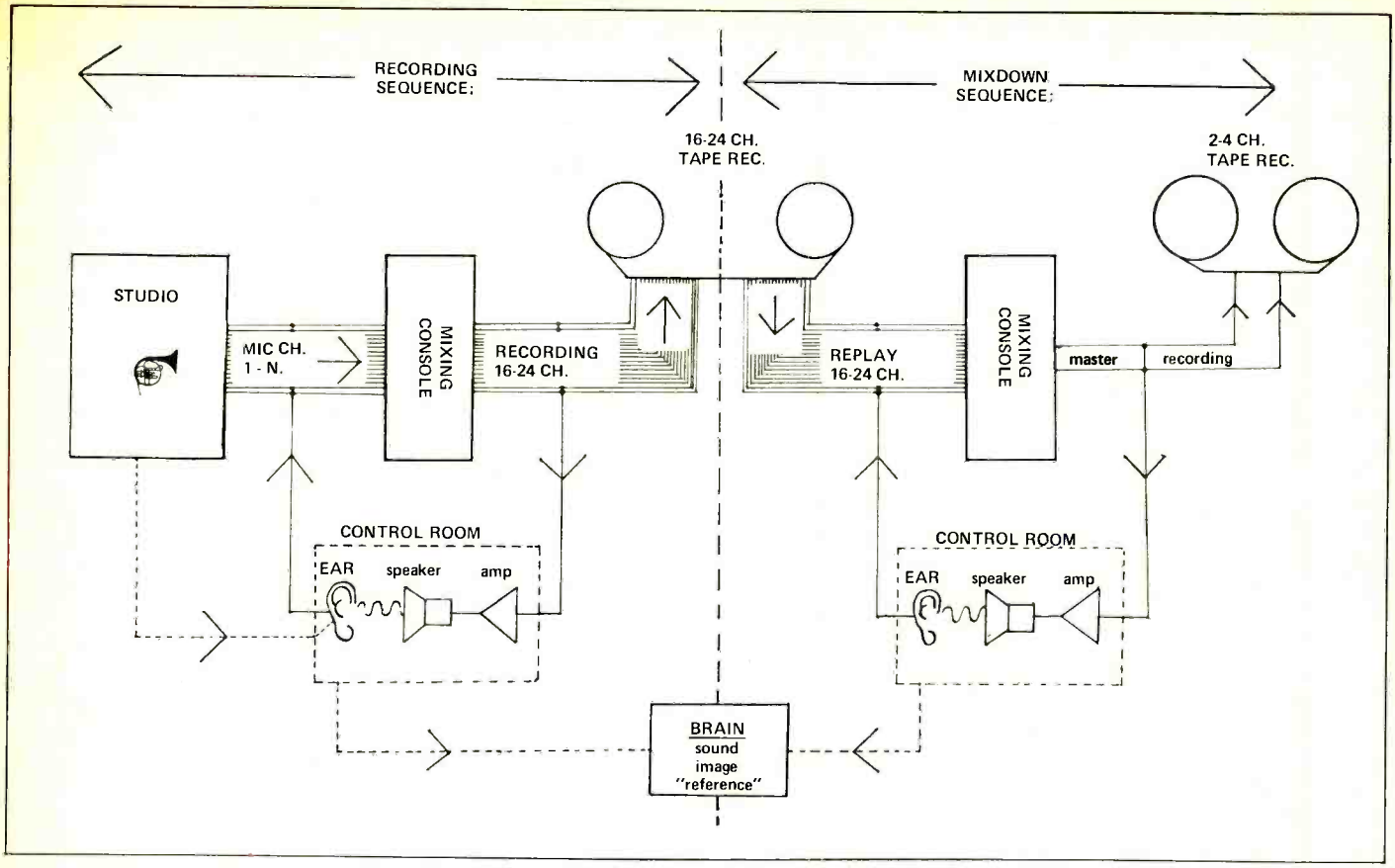


**Fig. 1: Block diagram of recording and mixdown sequence.**

that it turned into an experiment with the aim to establish some relationship between the listening impression in the control room and what actually went to the tape recorder.

In a very simple form Fig. 1 shows how a recording is done from the studio to the master tape. It also suggests the role of the ear in the process. (This report will only deal with the mixdown sequence.) The starting point was a 16-track master tape of a Norwegian jazz/rock group. The instrument list and tracksheet look like this:

| | |
|---|---|
| Track 1 | Electric bass |
| Track 2 | Bass drum |
| Track 3 | Drums (stereo) |
| Track 4 | Drums (stereo) |
| Track 5 | Snare drum |
| Track 6 | Electric guitar |
| Track 7 | Electric violin |
| Track 8 | Electric piano |
| Track 9 | Hammond organ/Leslie (top) |
| Track 10 | Hammond organ/Leslie (bottom) |
| Track 11 | Electric violin |
| Track 12 | Empty |
| Track 13 | Moog synthesizer |
| Track 14 | Moog synthesizer |
| Track 15 | Moog synthesizer |
| Track 16 | Empty |

The program material was a "typical" jazz/rock sound with instrumental energy from the deepest bass to the highest treble. It suited this experiment very well. When the 16-track master was recorded, it was monitored through the playback system in the control room of Studio 1. Some minor equalization was done to the sound of the drums and other instruments during the recording. Thus, the basic sound track was influenced by the listening response in this control room. This 16-track master tape is the stable factor during the experiment, as CCIR equalization and Dolby were standard for all the studios that participated.

## The "Reference"

The next factor to examine is the "reference," the record producer's "vision" of what the final result should sound like. This is by no means a stable, never-changing factor. It is influenced by many different factors—physical and psychological—like mood, spirit and atmosphere, as well as the relationship between the recording engineer and musicians, experience from past mixdowns and listening fatigue. One can discuss the relative importance of each of these factors; certainly, they are all important to some degree. Some problems were avoided, by mixing down early in the morning when the ears are still good. But, however unstable this "reference" is, I think the sound image of the inner ear remains stable enough for an experiment like this.

Normally the final sound of a recording is the result of the musical taste of the record producer, the recording engineer and the musicians who do the mixdown together and throw in ideas as well as likes and dislikes. However, in this experiment there had to be a "reference," since it would be done in four different studios, with four different recording engineers. Because the musicians were not participating in the experiment, the producer's "vision" had to be the "reference."

Assuming that the electronics of the various control rooms would add little coloration during the mixdowns, the dominant factor contributing to the final sound of the recording would be the listening conditions of the various control rooms. The essence of the experiment then would be for the producer through the technical possibilities of the mixing console, to force out of the monitoring system a sound that corresponds to his inner-ear "reference."

## Technical Measurements

After each mixdown the listening response of the monitoring system was measured at the recording engineer's position. Right and left response was measured in order to reveal differences. These measurements were done by means of a Bruel & Kjaer sound level meter and their one-third octave filtered pink-noise test record.

The validity of this method has been widely discussed. It certainly has shortcomings; for example, it does not discriminate between direct or reflected sound but measures the sum. Reflected sound normally increases at lower frequencies, and even if the loudspeaker itself could produce a flat response, the final listening response would be quite uneven with a tendency to lower output at high frequencies. This rolloff also is a function of dispersion characteristics normally found in loudspeakers. The various aspects of this measuring technique are beyond the scope of this paper. What is of interest here is the comparison of these results and other measurements.

The final measurement was to have the tapes, which had been mixed down in the various control rooms, analyzed through a Bruel & Kjaer Real-Time Spectrum Analyzer to plot the maximum energy levels for each one-third octave of the various recordings. In doing this, the recording was played back in mono to read the total energy of both channels. The maximum energy response for the last two minutes of the recording, where all instruments are playing and the balance between them is delicate, was used for the experiments in this report. This measurement compared to the listening response could then establish the relationship between what the ear hears through the monitoring system and what is actually being recorded.

## Individual Results: Studio 1

Studio 1 belongs to one of the biggest record companies in the world, who claim they have a world wide control room standard for all their studios.

The monitoring system is a British 2-way monitor speaker hanging from the ceiling and driven by a 2 X 100W commercial amplifier with conventional tone controls, normally switched out of the circuit. The control room is quite large, and has two highly reflecting brick walls, one entire wall of window and the fourth wall also has a window, in front of the mixing console. The speakers are hanging at an elevated level and tilted down to give axial response at the engineer's position.

The 16-track master recording was done here, as well as the first mixdown, both under the conditions of the listening response shown in Fig. 2a. The response would not be welcomed by anyone working in a sound control room, and the audible effects of the various peculiarities of this response are easily heard both in the control room itself and on the recording when it is played back on a flat system. It is important to note that this response was not known by the staff working in the control room, and although for a long time they had been suspicious that "something" might be wrong they never realized how bad it was. They had felt that recordings made in this studio often were lacking in fundamental bass, sounding too much on the "thin" side.

The low-end peak is caused by and reinforced by the liveness of the control room. The worst effect of this peak is not so much what it does to the overall balance of the final recording, but that it makes it almost impossible to determine the tonal-quality of instruments in the bass region during recording and mixdown. The remedy at many recording sessions has been to increase energy in the mid-bass to upper-bass region in order to work outside the resonant peak and create the feeling of a tight bass. But, in this way, one loses deep bass on the tape.

The two smaller peaks between 400 and 1000 Hz is a serious problem, since they certainly are caused by the loudspeaker itself. (The same peaks are found in the same type of loudspeakers in a neighboring room, which acoustically is very different from this control room.) What these peaks are doing to the sound of most instruments and voices is of such importance that they can not be overlooked. They are responsible for much of the unnecessary equalization done to instruments and voices during recording and mixing. They also make it very difficult to get a good balance. A voice often comes forth quite strongly during monitoring in the studio but when the tape is played on a flatter system, the voice often recedes into the musical backing, and sometimes sounds "squeezed" due to the fact that one tries to restore (to the ear) a natural voice quality by reducing (via active equalizers) energy in this region. Also, the piano will suffer seriously, as the 400-Hz peak often makes it sound woolly, "round" and badly defined. To compensate for this, one often tries to add energy in the 1,500 Hz to 3 kHz region, only later to find that the piano sounds hard and metallic.

The rolloff at the high end of the listening response is also responsible for the "thin" sound on recordings made at this studio. The ear is led to believe that there is little energy at the top. Instruments having their tonal spectrum in this region are usually either heavily equalized to increase their energy output in this region or mixed in at a higher level than normal balance would require. An uneven listening response like this will also cause tremendous masking problems and further bad lateralization and depth.

The average sound pressure level (SPL) during mixdown in this control room was about 95 dB, which was the highest used during the experiment. The reason for this can be discussed, but one possibility has been mentioned by Brian Cornfield and John Lyon of Everything Audio: "Audiology tells us that in the neighborhood of the threshold of hearing (approximately 40 dB SPL) the amount of change in level required for us to perceive a 'just noticeable difference' is about 4 dB. At very high listening levels, about 100 dB, the amount of change to perceive a 'just noticeable difference' is only ½ dB. In other words, we are more sensitive to small level differences when the program level is loud than we are when it is soft. This means, for example, that if the reverberant field in a control room is nearly as loud at the listener's position as the direct radiation from the monitors, turning up the level can subjectively increase the difference between the direct and reverberant levels (in other words, it can seem to pull the program out of the mud)."

It may be true that the brain makes use of the direct sound when determining sound quality when a recording or mixdown is done. This control room no doubt was the "livest," most reverberant, one used during the experiment. The possibility of coping with Haas effect may also be a reason for the high-level listening in this control room. Ex-

tensive equalization through active filters in the mixing consoles was used during the mixdown in order to restore the tonal balance of each instrument from a listening point of view.

One may ask what kind of thinking is behind such operations. It should seem clear to anyone knowing just a little about electronics and recording that such corrections would be unnecessary, since the response of the signal path from the microphone through the mixing console to the loudspeaker terminals normally is quite linear. Analytical suspicion or intuition should tell us that there is something else wrong if heavy equalization is needed to restore the tonal balance of a piano or a drum, at least when the problem is not related to well-known microphone behavior, such as proximity effects of cardioid microphones caused by necessary but unfavorable microphone positioning. After all, it is what we hear that decides how we are going to blend the instruments or voices. And how do we decide when mixing down how loud the drums should be to achieve good balance with other instruments when the overtone spectrum of the drums and cymbals is many dB down from the fundamentals of these instruments? The same is true for a piano or any other instrument. In order to bring forth the full body of a drum set in a mix, one would have to bring its level up to a point where it might totally dominate the sound picture, and certainly would when played back on a flat system. Many disagree, saying we work with meters which give us the level and intensity of an instrument. But what kind of meter: peak-responding, VU or something else . . . ? And if we depend on them completely, what do we need ears for?

## The Spectrum Energy Response of Recording 1

Besides listening, the final proof of what the listening response in a control room does to a recording can be seen from the spectrum energy response reading maximum levels for each one-third octave of that recording. The energy response given in this report is for a mono version of the recording, the sum of both channels. The response is read directly from the tape recorder and shows the last 2 minutes of the recording where all instruments are playing and balance is

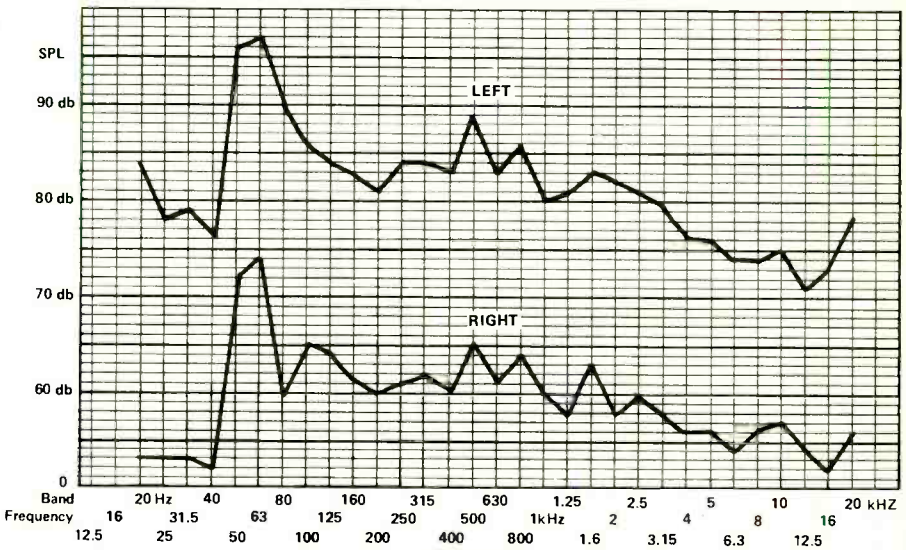


Figure 2A

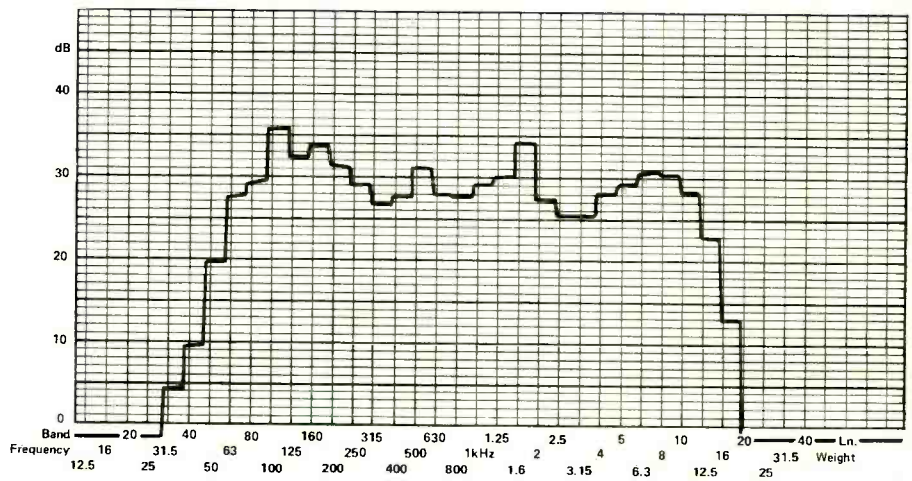


Figure 2B

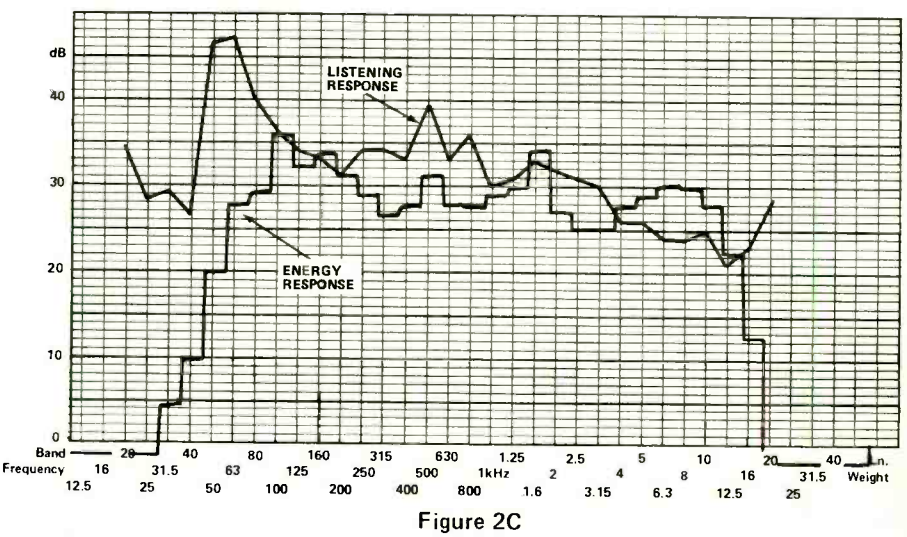


Figure 2C

**Fig. 2: Measurements taken in Studio 1. *a*) Listening response; *b*) Energy response; c) Comparison of a and b.**

extremely critical. Only 2 minutes was read to avoid going beyond the storage time of the analyzer.

As can be seen in Fig. 2b the energy response is almost a perfect mirror image of the listening response (Fig. 2a) of this control room in many respects. Fig. 2c is a combination of Fig. 2a and 2b and clearly shows the relationship between the listening response of the sound control room and the energy response of the recording made in that control room. The tendency to "mirror imaging" is quite obvious. Where the listening response has excessive energy, the energy response of the recording has less energy and vice versa. The peak at 1.6 kHz denotes a solo instrument. If we start from the low-frequency side of the graph, a comparison shows that below 100 Hz, where the listening response has a huge peak more than 2 octaves wide, the energy response drops off dramatically. This certainly is one reason why recordings from this studio sounded "thin" and not "full-bodied." After leveling off at about 200 Hz, the listening response follows a ragged curve with two rather defined peaks toward 1 kHz. This is a critical part of the response since much of the musical fundamentals are found here. Making corrections for such deviations in the listening response by equalizing the program material will result in clearly audible effects of most instruments and voices when played back on a more linear system.

In this case, one can easily see from the spectrum energy response that such equalization has been done. There is a definite loss of energy in the 200-1200 Hz region. This also accounts for the fact that some recordings often sounded a little distant and "cold" when produced in this studio.

From about 1.6 kHz the listening response rolls off rather rapidly, first by 3 dB per octave, then by 6 dB per octave. Again, the energy response is a mirror image; from 4-16 kHz we find very high energy levels—at least when compared to the register of the instrumental fundamentals. This obviously is why this recording sounded so aggressive, "thin," and without punch. It is unusual to find such high energy levels between 4-16 kHz in "live" or even recorded music.

END ACT ONE

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KENWOOD · MERITON · NAKAMICHI
OPTONICA · PIONEER · ROYAL SOUND
SANSUI · SHARP · TEAC · TOSHIBA
UHER · YAMAHA

---

**And are joined by these in recommending SA for use in their decks:**

BANG & OLUFSEN · DUAL · FISHER
HARMAN/KARDON · LAFAYETTE
SANKYO · TANDBERG
AND MANY OTHERS.


There's been a quiet revolution going on in the cassette world. □ Leading makers of quality cassette decks have adopted TDK SA as their reference standard tape for "High" ($CrO_2$) bias and equalization settings. Why TDK SA? Because TDK SA's advanced tape formulation and super precision cassette mechanism let them (and you) take full advantage of today's advanced cassette deck technology. □ In addition, a growing number of other companies are recommending SA for use with their machines. □ So for the ultimate in cassette sound and performance, load your deck with SA and switch to the "High" or "$CrO_2$" bias/EQ settings. You'll consistently get less noise, highest saturation and output levels, lowest distortion and the widest dynamic range to let you get the best performance from any quality machine. □ But you needn't believe all this just because we say so. All you have to do is check our references.

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CIRCLE 89 ON READER SERVICE CARD

# Ambient Sound

BY LEN FELDMAN

## Metal Particle Tape Arrives

Industry rumors have been around for a couple of years. The rumblings concerned a new kind of tape which was reputed to provide 7 dB, 10 dB, 15 dB or 20 dB (take your pick) of additional headroom and could be the "analog camp's" answer to digital recording. But there were also rumors that the new tape formulation had a "mission impossible" aspect to it. It was said that if the pure metal particles used as the magnetic medium in this new tape weren't handled properly and were exposed to air, the tape would "self destruct" in a violent explosion!

Well, to quote a relevant phrase (if not an accurate one), where there's smoke there's fire! By that I mean the rumor about the new metal particle tapes was true, but they neither self destruct nor need to be handled with any special care.

While several companies have been experimenting with metal particle tapes, the first to announce availability of this new kind of tape was the 3M Company, makers of the well-known and respected line of "Scotch" recording tape. Surprisingly, the first available product will *not* be in open-reel format, nor will it be for video or computer applications (though, certainly, the magnetic tape needs of these segments of the tape industry will certainly be met eventually), but rather will be made available for the lowly home cassette deck. The reasons for this are, apparently, economic. The consumer cassette tape market has grown by leaps and bounds in the last several years and so 3M probably figured that they could recoup their investment in production facilities more quickly by concentrating on the market that used the greatest volume of tape — the home cassette market.

## Advantages of Metal Particle Tape

The new tape, which 3M calls "Metafine" (their registered trademark) uses pure metal particles (as opposed to oxide compounds of ferric or chrome materials) as the magnetizable medium coated on the base material. As explained in a recent press conference held by 3M, tape performance improves at the low-frequency or mid-frequency end of the audio spectrum if the coercivity of the tape is increased. Coercivity is a measure of how hard it is to magnetize (or demagnetize) a given recording tape formulation and is measured in Oersteds.

On the other hand, the remanent magnetization of a tape, or its remanence (measured in lines/¼ inch) is a measure of how strong the magnetization of a given tape can be. Increasing the remanence of a tape improves its high-frequency performance capability.

When companies in the tape field developed Chromium Dioxide (and later, Cobalt-treated ferric oxide) cassette tapes, the primary improvement was in increased remanent magnetization which, in turn, served to improve high-frequency performance. In the case of the new Metafine tape, tremendous increases in both remanence and coercivity were realized, all of which means that improvements in maximum output level were attained over the entire audio frequency range. To give you some idea of just how great these improvements are, here are some specification comparisons between typical Chrome tape and the new Metafine tape now developed by 3M:

| | TYPICAL CHROME | "METAFINE" |
|---|---|---|
| REMANENCE | 0.43 | 0.8 |
| COERCIVITY | 550 | 1000 |

3M offered other interesting comparisons between Chrome (or high-energy Cobalt-treated tapes) and the new Metafine product in terms of actual performance characteristics on a two-headed cassette deck having a tape head gap of 1.25 microns and for a 3-headed cassette deck where the record head was better optimized with a record head gap of 2.5 microns. For the two headed machine, low/mid frequency sensitivity

was 2.5 dB greater than when Chrome is used, while for the high-frequency sensitivity it was 2.5 dB higher than for Chrome. Maximum modulation level (for the 3% harmonic distortion level) was 5.5 dB higher at low/mid frequencies and 11 dB higher for high frequencies while third harmonic distortion improved by 10 dB (one third as much THD).

In the case of the three-headed cassette deck, performance compared with Chrome tape showed even greater improvements. Low- and high-frequency sensitivity were up 3.0 dB (with bias adjusted for flat response), while maximum modulation levels were up 9 dB for low/mid frequencies and +7 dB for high frequencies. Distortion was found to be lower by between 21 and 23½ dB!

## Compatibility Problems

3M's "Metafine" tape requires a playback equalization of 70 microseconds. There is, therefore, no problem of playback compatibility, since Chrome and other high-energy tapes already require that equalization setting and it is now provided on most commercially available cassette decks intended for use in high fidelity component systems. So, if you can find a prerecorded "Metafine" cassette tape, you could probably play it back right now on your present-day stereo cassette deck and, assuming that the electronics of your tape deck could handle the higher tape outputs that the head would pick up without any overload, you could realize the improved performance without having to change anything.

Problems of compatibility do arise, however, when you want to make a recording on the new metal particle tape. As I mentioned a moment ago, these great performance numbers are achieved only if the new tape is biased correctly. As you probably know, bias current required for Chrome tapes is several dB greater than that required for ordinary ferric oxide tapes. Well, "Metafine" tape requires between 5.0 and 6 dB *more* bias current than Chrome! Most existing record heads used in present day cassette decks cannot handle that much bias current without saturating the magnetic structure of the head itself (not to mention possible burn-out of the tape-head coils themselves).

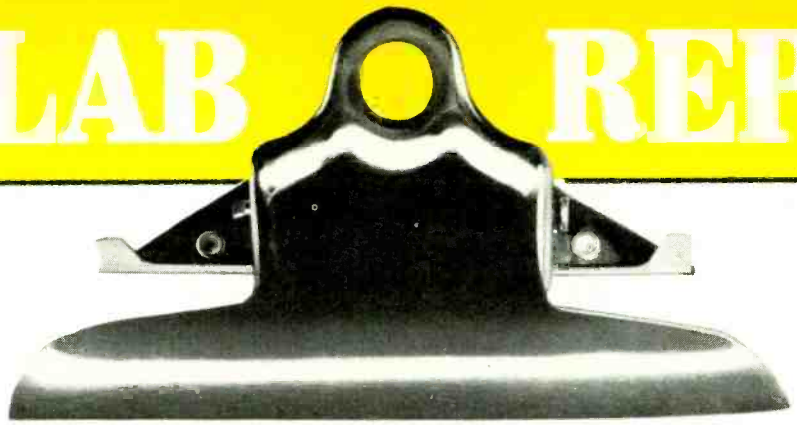
So, it will be necessary to build completely new machines to use the new Metafine tape for recording as well as playback. Not only must the heads be able to take the extra bias current, but the electronics must be designed to handle the higher signal levels which can be accommodated by the new tape without running into overload or high orders of distortion. The almost doubled coercivity of the new tape means that it is much harder to erase previously recorded material from the tape, so the erase heads used on machines designed to handle metal particle tape will have to be able to handle higher levels of current as well.

Not that there are no record heads presently available that can handle the job. JVC America, Inc. reports that their "Sen-dust" heads can handle the currents necessary and the Sen-Alloy heads used by Technics by Panasonic are said to be capable of handling those high currents as well. It's just a matter of time before leading cassette deck manufacturers will begin turning out machines designed to work with the new metal particle tape.

So far, the tape will be available in C-60 and C-90 cassette lengths. According to the people at 3M, the tape is no more abrasive than other tape formulations, so no new problems of increased head wear should arise through its use. No definite retail price was disclosed for the new tapes, though it was conceded that the Metafine variety will be priced considerably higher than 3M's present top-quality "Scotch" Brand Master II variety.

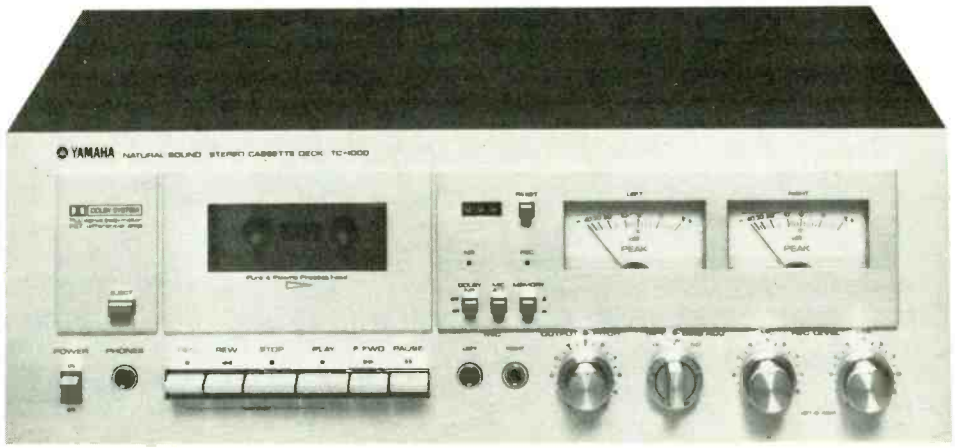
We asked about the residual noise level of the new tape and were told that it is about the same as that of other high-quality cassette tapes. The added output and headroom of the tape, however, means that one could expect overall S/N improvements on a properly designed machine of well over 10 dB compared with the best tapes available today. Add Dolby into the equation and it becomes conceivable that we may be looking at cassette tape systems in the near future which boast "A" weighted signal-to-noise ratios of well beyond 70 dB! All of which raises an interesting question or two. If you read my two previous AMBIENT SOUND columns you may remember that two months ago I pointed out that all was not so glorious with digital recording as it is presently envisioned. Then, last month, I talked about a new two-speed cassette deck line which, by virtue of the higher 3¾ ips speed improved signal-to-noise ratio, frequency response and distortion.

If you now add in the contribution of the new metal particle tapes (and you can be sure that 3M will not be alone in offering this type of tape for very long), the question really resolves itself into, "do we really need digital tape recording for anything but the most elaborate professional studio applications?" For that matter, since metal particle tape will probably hit the open-reel market before long, will digital or PCM tape recording offer any advantages even in the professional recording field?



NORMAN EISENBERG AND LEN FELDMAN

# Yamaha TC-1000 Cassette Recorder




**General Description:** The TC-1000 is a front-loading cassette recorder featuring peak-reading meters, input mixing, memory rewind, fine bias adjust, fast-buttoning in all transport modes and a speed pitch control—among other things. The two-head configuration (combined record/play and erase) is fairly familiar, but the head amp directly coupled to the sendust heads—described as using a first stage with both dual-FET differential amplification and bipolar transistor differential amplification, and twin (positive and negative) power supply sections—is unusual for a tape machine. The transport mechanism uses a phase-locked loop servo motor for capstan drive, and a two-speed electronically governed motor for reel drive. Four solenoids are employed, and it is possible to go from any transport to any other mode, including—if you hold down the record and play keys—directly into recording from play or from fast wind.

The cassette compartment is covered by a swing-out door. Part of this cover may be removed for access to the heads for cleaning or degaussing. Cassette area and transport functions are grouped to the left of the front panel. Included are the eject button, the power off/on switch, a headphone jack, the six transport keys (record, rewind, stop, play, fast forward and pause). Right of the cassette area is a three-digit tape counter and reset button. Below these items are pushbuttons for the Dolby-B system, a mic attenuator and the memory rewind option (which will stop the tape motion when the counter reaches 999). Below this group are the left and right channel mic input jacks.

The two meters dominate the upper right-hand portion of the panel. Each is calibrated from −40 to +5. Below the meters are four concentric knob groups. The outer knob of the first group handles output level (simultaneously on both channels), and the inner knob is a pitch control marked from −10 to +10. The next knob group is for tape selection, with the outer knob selecting LH ("normal"), chrome and ferrichrome, and the inner knob adjusting the bias (only during recording). The third knob pair handles left and right channel mic input levels; the fourth pair handles line input levels. The deck has three illuminated indicators—one comes on inside the cassette compartment when power is turned on, and there are two more for recording mode and Dolby on.

Signal jacks (other than for mic input) are at the rear. One stereo pair handles line input; two pair handle line output—of these, one pair provides a fixed output level of 340 mV and the other pair provides a variable output level. Also at the rear is a switch to activate a multiplex filter which may be used (with the Dolby feature) if it is needed for off-the-air FM dubbing. The unit's AC line cord completes the rear.

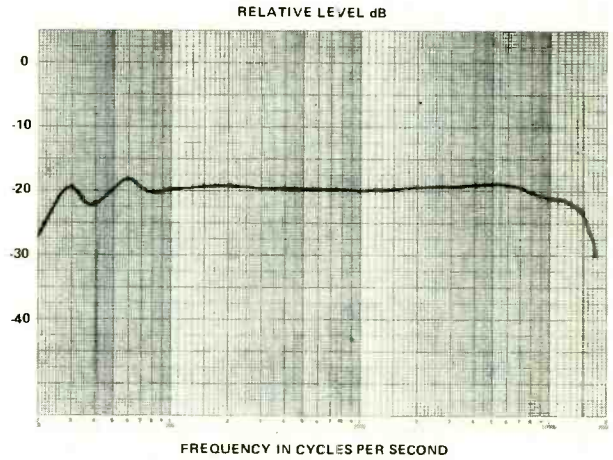
**Test Results:** For normal tape, the Yamaha TC-1000, in *MR's* tests, was 1 kHz shy of the 16-kHz top specified, but response still made it comfortably to the 15-kHz mark. With $CrO_2$ tape, the deck did far better in response, exceeding specifications at the high end by a notable margin and actually making it out to 20 kHz. S/N figures were somewhat better for standard tape; with the SA tape we used the deck did not quite make its $CrO_2$ S/N specs. Distortion was well within spec for both kinds of tape. Signal headroom was better for standard tape than for the SA tape. Input and output levels all were confirmed as within, or better than, specs. Transport action was positive, smooth, and with very little wow or flutter. The peak-reading meters were judged to be more preferable to work with (in the absence of any secondary level indicators such as peak-reading LEDs) than typical slow-acting VU meters, although the Yamaha's metering system took some getting used to when setting up for tests. Being peak-readers, the meters here are calibrated so that Dolby level corresponds to −5 dB; so-called "0 VU" level is at −8 dB on the meter scales. So, our "0 dB" measurements were made at a −8 dB reading on the Yamaha meters; all other levels (such as the −20 dB recording levels used for checking r/p response) were all relative to this −8 dB level.

In both instances of r/p response, by the way, we used the center setting of the vernier bias control. Obviously, we could have backed off a bit on the bias setting for the ferric-oxide sample (Maxell UD-XL-1), but this would have increased distortion somewhat, particularly in the high frequencies.

The relatively small differences in our test results vis-a-vis published specs for this machine should not be taken as serious discrepancies. The TC-1000 is a very good cassette recorder which impressed us as being capable of providing reliable and clean performance. That a two-headed cassette deck can span the frequency range up to 20 kHz is itself noteworthy.

**General Info:** Supplied in walnut-finished wooden case. Dimensions: 18 1/8 by 6 11/16 by 12 7/8 inches. Weight: 22 pounds, 1 ounce. Price: $595. Owner's manual is very complete and amply illustrated.

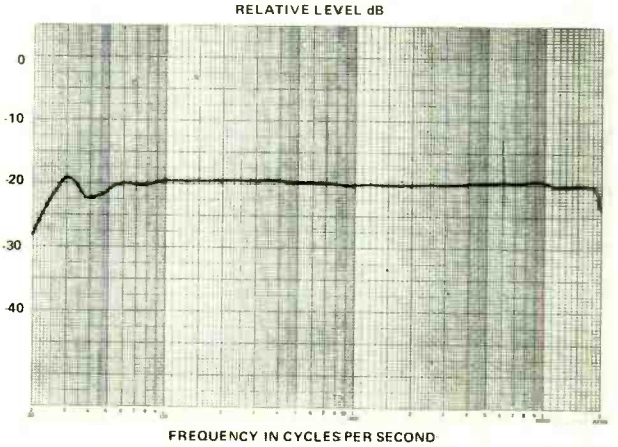
**Individual Comment by N.E.:** Alongside other recent cassette recorders, the Yamaha TC-1000 presents a relatively unsensational appearance—no array of colored lights, no microprocessing devices, no flashing LEDs, etc. What it does have, however, on its front panel is probably all that the average recordist really needs and this, combined with the undeniable "guts" inside the chassis does make for a very competent cassette recorder. For some reason, the Dolby system here seemed to work for me a jot better than most; it really wiped out the high-frequency garbage




**Yamaha TC-1000: Record/play response using Maxell UD-XL-1 C-90 tape.**

on several test recordings I made, but without audibly hurting the highs in the signal. The owner's manual does not make a point of it, but you really can "fast-button" this machine including "run in" recording from a flying start if you're so inclined. (Oddly, I observed this facility on several recent cassette decks; the logic-control of solenoids must really be catching on). The owner's manual calls for backing off on the front-panel bias control when using most LH tapes; as explained elsewhere in this report we opted not to do so since in our view the rolloff above 15 kHz is less important than getting the least distortion in this frequency region. Yamaha may disagree with this but that's our feeling.

I liked the straightforward general design of the deck, the uncomplicated cassette insertion and removal, the double output signal option (the fixed level outputs can be used for direct input to another deck for deck-to-deck dubbing; the variable output




**Yamaha TC-1000: Record/play response using TDK SA C-90 tape.**

would be suited of course for hookup to a playback amplifier). To get at the heads for cleaning or degaussing you have to slide off the metal-framed transparent section of the cover and then poke in at the heads—not the most convenient arrangement but certainly feasible once you try it.

**Individual Comment by L.F.:** As stated in the test results section, the first thing I had to get used to when working with the Yamaha TC-1000 was its metering system. I have no quarrel with the peak-reading meter system and the fact that here the meters show −8 dB for "0 VU"—but I wish that manufacturers of cassette recorders would finally get together on this and standardize just what is meant on their meters by "0 dB." According to Yamaha, their −8dB reading is equivalent to 160 nanowebers per meter.

Transport action was first rate. The vernier bias adjustment reflects a growing awareness by cassette deck manufacturers of the importance of precise bias for this format (in many ways, because of the limited dynamic range of the cassette format, precisely adjusted bias is perhaps more important in cassette recording than in open-reel recording where some headroom margin exists). The way this machine was set up, we actually got slightly better S/N figures (referred to the 3-percent distortion level) using ferric-oxide tape (Maxell UD-XL-1) than we did with using a $CrO_2$-equivalent tape (TDK-SA). As for r/p response, the situation was reversed, as explained elsewhere in this report.

Having facilities for individual record-level on each channel, plus mic/line input mixing is another of the benefits you get by spending a bit more on a cassette deck such as this one, and of course the "feather-touch" action of the transport controls conveys a feeling of reliability and confidence when using the machine. Another nice touch, I felt, was the mic attenuator switch which reduces mic input sensitivity by 20 dB—a feature that could insure against first-stage overload of the mic preamp electronics in view of the variety of microphones (and output variations among them) that might be employed. The sendust alloy head and the low-noise differential amps go a long way to achieving flat response out to 20 kHz, at least with the "chrome-equivalent" tape.

The pitch control varies speed by up to ±5 percent on playback. It has no effect on speed during recording. My feeling is that it is only marginally needed, since any cassette that I might play which is off speed by a significant amount would probably have been recorded on a "cheapie" machine to begin with, and would hardly be worth worrying about as far as accurate pitch is concerned. Still, this frill probably did not add much to the overall cost of the unit (speed control is fairly simple to accomplish with the precision phase-locked loop servo motor used for capstan drive in the TC-1000), so there's no harm done. The separate reel motor, by the way, results in a minimum of belts which in turn means fewer parts to wear out.

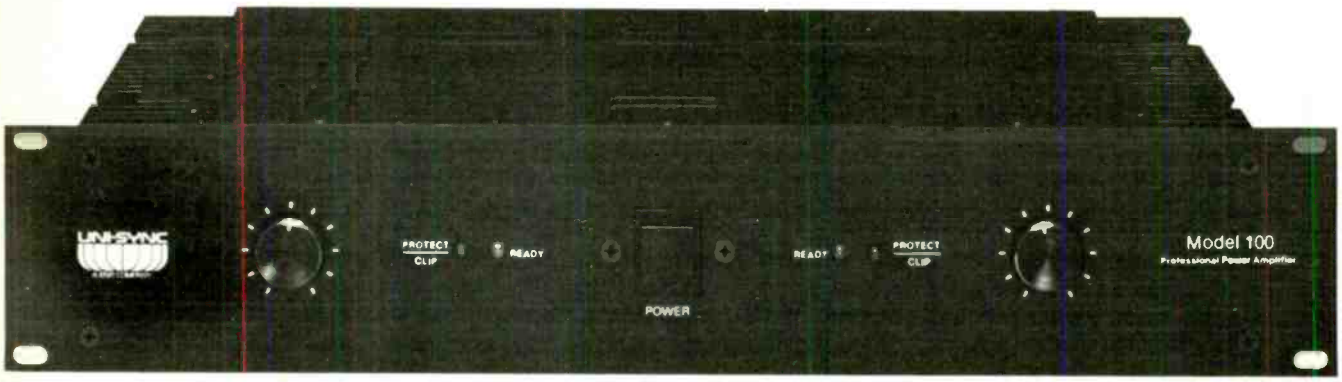
Judging by my experience with the TC-1000 it seems to be a reliable and high-quality cassette deck that would provide long, trouble-free performance in a home music system.

**YAMAHA TC-1000 CASSETTE RECORDER: Vital Statistics**

| PERFORMANCE CHARACTERISTIC | MANUFACTURER'S SPEC | LAB MEASUREMENT |
|---|---|---|
| Frequency response, normal tape | ±3 dB, 30 Hz to 16 kHz | ±3 dB, 25 Hz to 15 kHz |
| $CrO_2$ (or equiv) tape (SA) | ±3 dB, 30 Hz to 18 kHz | ±3 dB, 25 Hz to 20 kHz |
| Signal-to-noise, normal tape | | |
| w/o Dolby | NA | 59 dB |
| w/Dolby | NA | 66 dB |
| Signal-to-noise, chrome tape(SA) | | |
| w/o Dolby | 60 dB | 57 dB |
| w/Dolby | 69 dB | 63 dB |
| THD at 0 VU | | |
| normal/chrome (SA) | 1.0%/1.6% | 1.0%/1.5% |
| Record level for 3% THD | | |
| normal/chrome (SA) | NA/NA | +6/+3 |
| Wow and flutter (WRMS) | 0.05% | 0.05% |
| Mic input sensitivity | 0.25 mV | 0.28 mV |
| Line input sensitivity | 50 mV | 53 mV |
| Line output level | 340 mV | 360 mV |
| Headphone output level | 90 mV (8 ohms) | 120 mV (8 ohms) |
| Fast wind time, C-60 | 70 seconds | 80 seconds |
| Bias frequency | 105 kHz | 105 kHz |
| Power consumption | 37 watts | 31 watts |

Note: 0 dB VU (160 nW/M) = −8 on TC-1000 meters.)

# Uni-Sync Model 100 Stereo Power Amplifier




**General Description:** The Uni-Sync Model 100 is a high-quality, professional-grade power amplifier in the 100-watt-per-channel class. The 100-watt rating applies to 8-ohm loads. With 4-ohm loads power output is a bit higher than 150 watts per channel. Strapped for mono operation, the model 100 is rated to deliver at least 250 watts into an 8-ohm load.

Completely modular in construction, the model 100 is described by its manufacturer as "not just a stereo amplifier, but actually two amplifiers in one chassis. . . ." The claim is justified, in *MR's* view. As may be seen from the photo we took of the amplifier's innards, we are dealing here with two completely separate amplifiers, each having its own power transformer, power supply filters and power amplifier module attached to its own output heat-sink at each side of the chassis. Power supply parts are mounted on a third, common module. Each channel is equipped with a separate thermal shut-down circuit (which never shut down, for all the punishment we gave the unit), and relay isolated speaker protection. All this is neatly crammed into only 3½ inches of vertical panel space. Uni-Sync claims that its model 100 is the smallest dual 100-watt professional power amp on the market, and we have to agree with them (at least until someone shows us a smaller one).

Of rack-mount width, the front panel contains the power off/on switch, flanked symmetrically by two indicators per channel, and a gain control for each channel. One of the indicators shows "ready" state; the other comes on at clipping level.

The rear panel contains the amplifier's AC power cord, fuse holder, the stereo/mono switch and the input and output connectors. Input may be made via XLR connectors or quarter-inch phone plugs, and either connection may be balanced or unbalanced. Either way, input impedance is 15 K ohms. Output terminals are five-way banana binding posts.

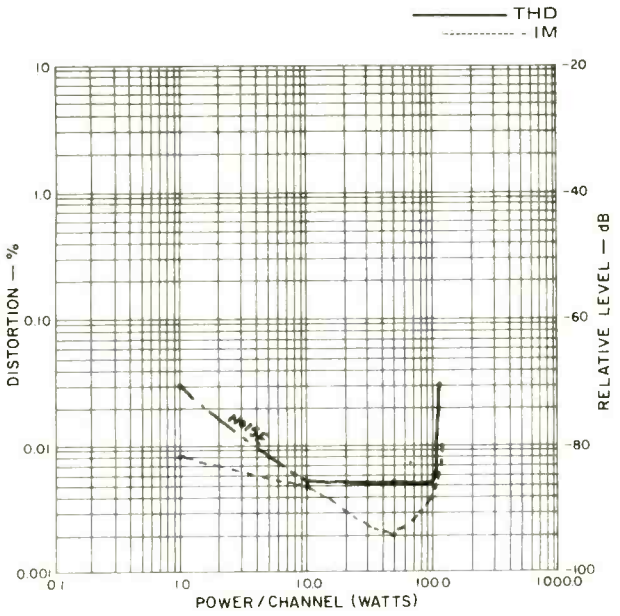
**Test Results:** In *MR's* tests, the model 100 ran generally within or better than spec'd performance, and impressed us as being a very capable amplifier—the more so for its relatively compact dimensions. In 8-ohm stereo operation, continuous power per channel across the 20 Hz to 20 kHz band reached 103 watts; in 4-ohm stereo mode, the available power per channel was 155 watts. Damping factor was very high; distortion was very low; signal-to-noise was exceptionally good at a −121 figure. We found it rather interesting that even though the model 100 is classified as a professional amplifier (and therefore its manufacturer need not have been bound by the FTC Power Disclosure Rule), Uni-Sync nevertheless does spell out the full FTC-type power output rating, including bandwidth, rated harmonic distortion and rated loads. All of these parameters were met in our tests. In addition, the amplifier has a transient response capability that is somewhat awesome (no wonder, considering its excellent claimed-and-measured rise time and slew rate).

The two front-panel indicators were checked out during tests and found to be both accurate and convenient to use. Observing the steady-state output waveform on a 'scope, we can attest to the fact that the "clipping" indicators do flash on precisely when the beginning of waveform clipping shows up on the 'scope as the input level is increased. And, thanks to the definite way they do light up (there is no "slightly illuminated" condition followed by brighter illumination), these indicators are very easy to notice and interpret.

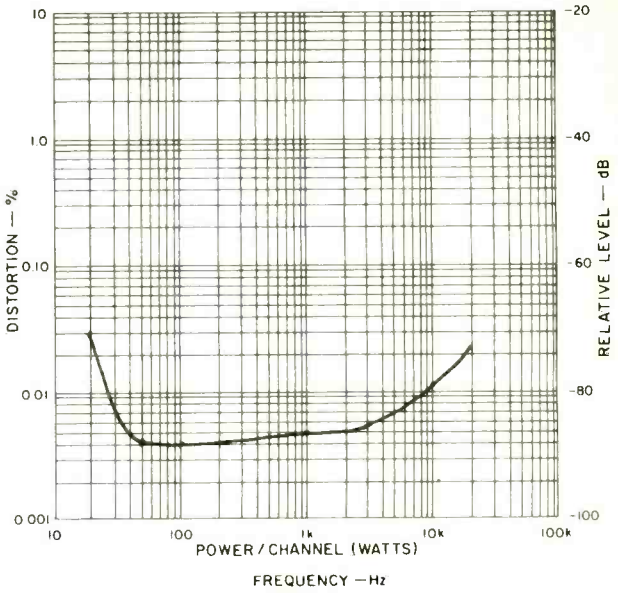
The chassis is made from 13-gauge steel, while front-panel thickness is a full $\frac{7}{16}$ inch. The level controls, switch and indicators are so arranged that nothing protrudes more than $\frac{7}{16}$ of an inch in front of the panel.

Our measurements were made for both 8-ohm and 4-ohm loads (see "Vital Statistics" table). It also is possible to operate the amplifier as a strapped mono unit, in which instance the 8-ohm rating becomes 250 watts across the band from 20 Hz to 20 kHz. Harmonic distortion, at output levels from 250 milliwatts to 250 watts, is rated at no more than 0.05 percent.

The amplifier has no fan, but it ran surprisingly cool, even when delivering full rated output power.




**Uni-Sync Model 100: Output power vs. THD (1 kHz) and IMD, 8-ohm loads.**

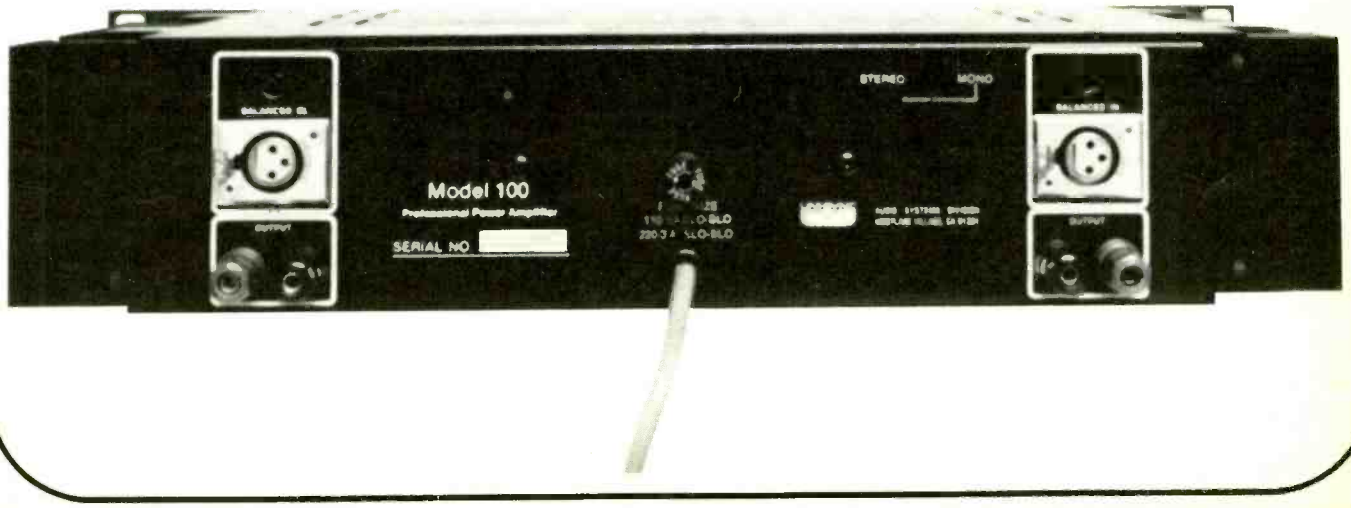



**Uni-Sync Model 100: Harmonic distortion vs. frequency, at rated output, 8-ohm loads.**

**Individual Comment by L.F.:** Without resorting to any trick circuits such as "Class D" or "switching" amplification, or "Class G" or "Class H" (all of which offer increased efficiency and therefore more compact design), Uni-Sync has managed to come up with a cool-running, dual amplifier that takes up only 3½ inches of panel height. I also liked the front panel LED indicators for "ready" and "clipping"—their action as described in this report is precise and definite.

Interestingly, despite the fact that the industry has not yet agreed on a method of measuring transient intermodulation distortion, this is the first pro amplifier I have seen whose specifications include TIM figures. We were not set up to verify the results of their TIM spec (they used a 3.18 kHz square wave with a superimposed 15 kHz sine wave in a 4:1 ratio, and came up with a rating of 0.05% TIM), but judging from what I heard when listening to the amplifier reproducing music, I am prepared to go along with this low, low figure.

**Individual Comment by N.E.:** From the extra-thoughtfully planned external features (especially those reliable LED indicators, and the choice of inputs and outputs) through its all modular internal construction, the Uni-Sync model 100 is a superior amplifier. Yes, it is of professional grade and yes too, it could serve admirably in a home music system. Our tests and listening experience simply add up to one conclusion: a good amplifier is a good amplifier, regardless of what you use it for. The "dual amplifier on one chassis" approach is credited by Uni-Sync with providing accurate bass reproduction, greater dynamics and the elimination of crosstalk distortion. Having listened "through" the model 100 to program material, I am prepared to go along with all that.



**UNI-SYNC MODEL 100 STEREO POWER AMPLIFIER: Vital Statistics**

| PERFORMANCE CHARACTERISTIC | MANUFACTURER'S SPEC | LAB MEASUREMENT |
|---|---|---|
| Continuous power/channel, | | |
| 1 kHz 4 ohms/8ohms | 165 watts/110 watts | 165 watts/105 watts |
| 20 Hz to 20 kHz 4 ohms/8 ohms | 150 watts/100 watts | 155 watts/103 watts |
| Power bandwidth | 20 Hz to 20 kHz | 20 Hz to 25 kHz |
| Frequency response | −3 dB, 1 Hz to 65 kHz | −3 dB, 1 Hz to 80 kHz<br>−1 dB, 3.5 Hz to 45 kHz |
| Damping factor | 250 | >200 |
| Rated THD 4 ohms/8 ohms | 0.05%/0.03% | 0.013%/0.005% |
| Rated IM 8 ohms | 0.01% | 0.005% |
| Residual hum & noise | −105 dB | −121 dB ("A" wtd) |
| Input sensitivity | 1.5 V | 1.5 V |
| Rise time | <5 μsec. | 2.5 μsec. |
| Slew rate | 20 V/μsec. | 25 V/μsec. |

CIRCLE 2 ON READER SERVICE CARD

# JVC KD-85

**General Description:** JVC's model KD-85 is a stereo cassette recorder of very competent performance and some advanced features. Of these the most novel is a front-panel display of "spectro-peak" level. This consists of a five-frequency-segment indicator, with five LEDs in each division. Center frequencies are nominally at 100 Hz, 300 Hz, 1 kHz, 3 kHz and 10 kHz. Vertical scale markings for each division run from −10 dB to +6 dB. This display provides instant visual indication of signal strength, by frequency groups, in both recording and playback. Its primary purpose is to enable the recordist to take full advantage of the dynamic range of any tape used while avoiding tape saturation and distortion. The display also can serve as a kind of frequency analysis—in a general way—of program content.

The KD-85 also has a full-logic, solenoid-operated transport control system with unrestricted "fast buttoning" that includes the ability to go directly into recording from any other transport mode.

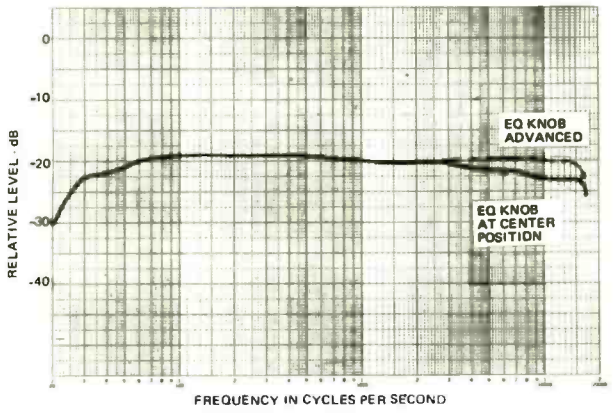
Also included is JVC's recently developed "super ANRS" which is useful in maintaining linear response when recording high-level high frequencies. The "ordinary" ANRS provided in the deck is, of course, compatible with the Dolby-B system and may be used interchangeably with it.

Another useful feature is a separate knob for "trimming" the recording EQ at 10 kHz in five steps of 1.5 dB each (from −3 to +3 dB). In addition, there are the more usual switches for bias and EQ, with markings that are somewhat more "numerically significant" than those usually found on cassette models. The EQ switch has settings for 70, 70 and 120 (microseconds) which correspond to SA/$CrO_2$, FeCr and SF or "normal" tapes respectively. The bias switch has markings for 150, 110 and 100 which correspond to the same order of tapes, respectively. The EQ switch is operative in both recording and playback; the bias switch, only during recording.

Other features include memory rewind, a timer option for automatic recording and playback, front-panel mic jacks and stereo headphone output jack, a rear-panel DIN socket in addition to standard pin-jack connectors, a pause control to stop tape motion while the electronics are still operative (good for setting recording levels before moving the tape). A two-head design (Sen-Alloy for the r/p head) the KD-85 is powered by two DC motors, of which the capstan-drive motor is servo controlled.

The front-loading cassette compartment is covered by a hinge-out door that opens at the press of a button; the button cannot be activated unless the deck is in the "stop" mode.

The unit's two VU meters are mounted vertically




**JVC KD-85: Fig. 1: Record/play response using Maxell UD-XL-I C90 tape.**

and are marked from −20 to +5 dB. Each meter has, in addition, a percentage calibration scale to assist in setting up recording levels in conjunction with using the spectro-peak level indicator system. All operating controls and adjustments are on the front panel, with logical arrangement of electronic features to one side, and transport operations to the other. Input level is controlled by dual-concentric knobs, one for each channel. Output level is handled by a single knob for both channels. This control governs headphone output level as well as line-output level. An input selector switch chooses either mic or line inputs; no input mixing is possible on the deck itself. The tape-index counter is a three-digit type with a reset button; with the memory switch set to "off," the tape counter functions normally; with the memory switch engaged, the tape automatically stops at "999" during rewind.

**Test Results:** Every important performance specification for the JVC KD-85 was met or exceeded in our lab tests. During the frequency response tests we took special note of the features provided for improving response and verified their effectiveness. For instance, if you study the graph (Fig. 1) of response for normal tape you will note a dotted line and a solid line for the response range above about 3 kHz. The first plot (solid line) was made with the vernier EQ knob in its center position, resulting in a slight "shelving" downward beyond 10 kHz. The result of advancing this control two notches is shown by the dotted line which is a clear improvement in high-end response. Being able to thus trim the response by using this control was very gratifying, akin to the kind of "tweaking" one is able to do with professional recorders.

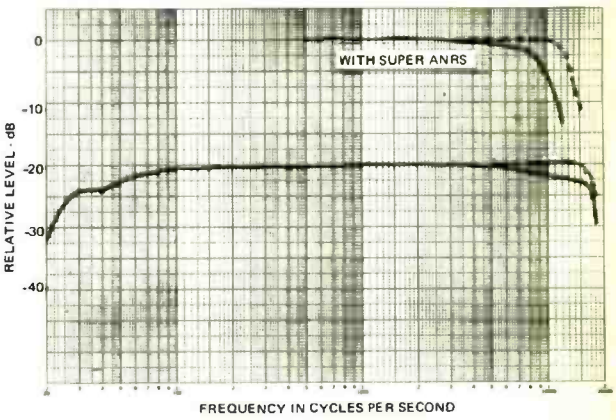
For response tests using the switch settings for $CrO_2$/SA tape (Fig. 2), we again found it necessary to use a higher setting of the vernier EQ control to achieve best results. Also, in this test, we verified the effectiveness of the Super ANRS which, when activated, produced a very obvious improvement in the high-end response when recorded at a zero dB level. The improvement at 10 kHz is a clear 5 dB gain.

On all other counts the KD-85 performed as claimed. Signal-to-noise figures were excellent; distortion was low. Ample recording headroom is available.

The transport operated very smoothly and in fact had the feel of a professional grade deck.

**General Info:** Dimensions in metal case are 17¾ by 6¼ by 12⅞ inches. Weight is 21.8 pounds. Price is $499.95. Unit is supplied with demo tape, two head-cleaning swab sticks, two pairs of signal cables and owner's manual.

**Individual Comment by N.E.:** In the highly competitive area of cassette recorders, we have seen a variety of efforts by manufacturers to come out with something new or different by way of appealing to buyers. With this particular model, I feel that the innovations not only are intriguing but genuinely helpful to the serious recordist. Beyond them however, is the simple fact of the high performance of this machine both electrically and mechanically. A cassette recorder priced at $500 that permits trimming the recording EQ to achieve documentably improved high-end response, and that displays relative amplitudes of signal energy in five frequency segments, and permits unlimited fast-buttoning (you can go into record from the rewind mode if you care to) must be something to "write home about." The KD-85's transport system, indeed, can be described as one sweet piece of machinery—the more so for a middle-priced cassette machine. I also liked the simple system for cassette insertion and removal. When you press the eject button, the door hinges out gently and you can remove the cassette with your finger-tips. The ANRS setup works as it should, and the differences in the various switch positions are definitely audible. I can find nothing to criticize adversely with this machine. I happen not to like multi-language instruction manuals (JVC is not the only company, of course, to use such a manual).

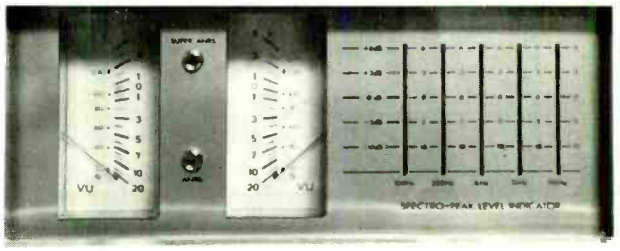



**JVC KD-85: Fig. 2: Record/play response using TDK SA-C90 tape. Upper dotted line curve shows improvement of high-frequency response at 0 dB record level when Super ANRS is used.**

They may help teach you some aspects of foreign languages, but they require that you turn more pages than otherwise would be necessary in order to read a complete instruction procedure.

**Individual Comment by L.F.:** Of the two important features built into the JVC KD-85 that differentiate it from other stereo cassette recorders in its price category, perhaps the more important one is the spectro-peak LED indicator. To really take advantage of the full dynamic range possibilities of any deck, one has to "fit" the program material perfectly between the lower "noise floor" and the upper "saturation threshold." Various metering systems have been used in the past to aid in doing this. Peak-reading meters are of course somewhat more useful than slow-acting VU meters since they respond more quickly to signal peaks. But even peak-reading meters (or peak-reading singled LEDs) cannot tell you whether a given peak being recorded occurs at 1 kHz, 100 Hz or 10 kHz. And, as you probably know, cassette tapes saturate much more readily when subjected to high-level high-frequency signals than they do with mid-frequency program material.

The five rows of LEDs on the KD-85 may be thought of as a "poor man's real-time spectrum analyzer." By observing the frequency content of the recorded material, in addition to its overall amplitude via the adjacent meters, the recordist can know at once when high-frequency content is getting dangerously close to the saturation point of a given tape, and can accordingly back off on recording levels. Of course, these indicators cannot serve as an accurate spectrum analyzer. The filters are too broad for that, and when single test tones are applied to the line input terminals, the row of LEDs closest to the applied frequency lights up,



**JVC KD-85: Close-up view of spectro-peak LED and meter section.**

but adjacent rows light up too (though not to the same amplitude). For all of that, however, when used with actual program material, it is possible—with a little practice—to use this feature to great advantage in guarding against tape saturation and distortion.

The second most important feature here has to be JVC's super ANRS, a circuit innovation that has not been given much publicity and may be misunderstood by many. Ordinary ANRS is very much like Dolby-B. Super ANRS is something else. Think of it as a "reverse Dolby" applied to *high* record levels. That is, when super ANRS is used and you attempt to record high-level high frequencies, the signals are progressively compressed during the record mode and re-expanded during playback. The result of this compander action is that you can record safely at much higher levels and still avoid tape saturation. (The effect is illustrated in our response curves, Fig. 2).

The super ANRS feature, combined with the Spectro-Peak LED arrangement, results here in a deck that permits you to safely and positively get everything onto a cassette tape, with as low distortion and as high a signal-to-noise ratio, as the cassette medium permits. At a list price of $500, that adds up to a unit worthy of serious consideration.

JVC KD-85 STEREO CASSETTE RECORDER: Vital Statistics

| PERFORMANCE CHARACTERISTIC | MANUFACTURER'S SPEC | LAB MEASUREMENT |
|---|---|---|
| Frequency response, normal tape | ±3 dB, 30 Hz to 16 kHz | ±3 dB, 30 Hz to 16 kHz |
| $CrO_2$ or equiv. tape | ±3 dB, 30 Hz to 16 kHz | ±3 dB, 40 Hz to 16 kHz |
| Wow and flutter (WRMS) | 0.05% | 0.04% |
| Signal-to-noise w/o ANRS std/$CrO_2$ | 56 dB/NA | 60 dB/61 dB |
| Signal-to-noise w/ANRS std/$CrO_2$ | 62 dB/NA | 67.5 dB/68 dB |
| Mic input sensitivity | 0.2 mV | 0.2 mV |
| Line input sensitivity | 80 mV | 77 mV |
| Line output level | 0.5 mV | 0.45 mV |
| Headphone output level | 0.5 mW | 0.528 mW |
| THD at 0 VU std/$CrO_2$ | NA/NA | 1.0%/0.9% |
| Record level for 3% THD std/$CrO_2$ | NA/NA | +9.5/+9 dB |
| Fast wind time, C-60 | 85 seconds | 64 seconds |
| Bias frequency | 95 kHz | 95 kHz |
| Power consumption | 30 watts | 37 watts |

CIRCLE 3 ON READER SERVICE CARD

# DeltaLab DL-1 Digital Delay Module

## By Brian Roth and Jim Ford

Back in the "Good Ol' Days" the method used to time delay an audio signal consisted of using a tape recorder and VFO (variable frequency oscillator). A signal was recorded onto a piece of tape and played back from the reproduce head. The delay time was established by the head spacing between the record and repro heads as well as the tape speed which was controlled by the VFO. Now, it is much more economical to use a digital delay unit (particularly for shorter delays up to about 200 milliseconds), thanks to the technology available from the space program. As with digital watches and calculators, modern science has caused quality to increase and prices to plummet. The audio industry has benefited from this tremendously since the "price per millisecond" of digital delay has decreased dramatically, without any apparent sacrifices in specifications.

**Description:** The new DeltaLab DL-1 provides one input and three outputs, each with separately variable delay time. Two of the output channels are controlled from the front panel of the 1¾" high by 19" wide package (designed for standard equipment racks). A toggle switch for each of the "A" and "B" outputs causes the time delay to change in 5 millisecond steps up to 50 ms and then in 10 millisecond steps from 60 to 100 ms. The selected delay time is displayed by a row of LEDs, one row per "A" and "B" output. An additional toggle switch expands the delay range and allows 8 millisecond steps up to 80 ms delay, and then 16 millisecond increments up to the maximum 160 ms delay.

The sharp-eyed reader may now be wondering how the third output is controlled. Well, the "C" output time delay is internally programmed by a series of small slide switches. Also, similar internal switches allow setting of the delay time for the "A" and "B" outputs as well. These controls allow the user to defeat the front panel adjustments for the "A" and "B" delays; this is quite useful for permanent installations when it is determined that the janitor may like to play with buttons and knobs.

Back on the front panel, the customary input and output level controls are located along with quarter-inch phone jacks for input and output terminations. The input is electrically balanced and the output jack provides either a balanced line for the "A" output or unbalanced outputs from the "A" and "B" delays. A toggle switch determines which output mode is in operation.

A cluster of LEDs labeled "headroom" give signal level indications in a rather interesting fashion. One set of four LEDs shows the peak level of the signal fed into the delay circuitry while four other LEDs labeled

"slew," monitor the slew rate of the audio program passing through the delay line. As we have mentioned in the past, slewing induced problems are prevalent in audio equipment, and yet are often ignored by manufacturers. Slew rate limiting is caused by high signal levels at high frequencies, and the distortion thus generated by the type of non-linearity is very audible when present in sufficient amounts. Therefore, we were very pleased to see the type of indicator as found on the DL-1 since it displays both level and frequency information on a small quantity of LEDs. In operation, the instructions specify that the input level should be adjusted so that the "−20 dB" lights are on through most of the program. The "0 dB" LEDs should flash only occasionally. Since a digital delay device typically has a smaller dynamic range (the ratio between noise floor and overload) than most other audio processing gear, these signal level indicators should prove to be invaluable when optimizing levels for minimum noise and distortion. Also, since the DL-1, like most digital delay units, pre-emphasizes (boosts) the high frequencies before digital conversion to optimize signal to noise (naturally, there is a corresponding de-emphasis after decoding the digital signal back to analog), these indicators are even more important.

On the rear panel are found screw-type terminals that allow balanced line interfacing for the input and the three outputs. A permanently attached power cord is also secured to the rear pan. The AC power fuse is mounted internally.

The interior of the unit appears to be very well laid out. Two printed circuit boards, mounted basically back-to-back, contain the majority of the analog and digital processing circuitry. Another circuit board assembly holds the power supply components, while a fourth, which is mounted to the front panel, secures the various controls and indicators. The final circuit board is mounted on the rear of the back panel input/output connector block. Independent level control trimmers for the three outputs are located on this board, and holes are punched in the lid to allow access to these pots. Interconnections between the various circuit boards are accomplished by means of ribbon type multi-conductor cable. Component quality was judged as being very good.

The DL-1 was supplied with a preliminary owners manual which appeared sufficiently detailed to give the user a useful description of the various controls. We also examined a pre-publication copy of the complete operations manual which presented very thorough applications information for the usage of the DL-1 in recording or sound systems.

**Field Test:** We originally auditioned the DL-1 at DeltaLab's demonstration room during the May 1978 AES show in Los Angeles. There, after extended listening and A-B comparisons with a straight wire, we found ourselves pleasantly impressed with the overall fidelity of the unit. There was no evidence of any digital "sound" as we have heard in many other makes. In fact, during that examination, all we could perceive was a slight bit of dullness on the top end. Considering that several DDUs (digital delay units) we have experimented with imparted a "R2-D2" sound to the audio program, the level of fidelity of the DL-1 was all the more impressive.

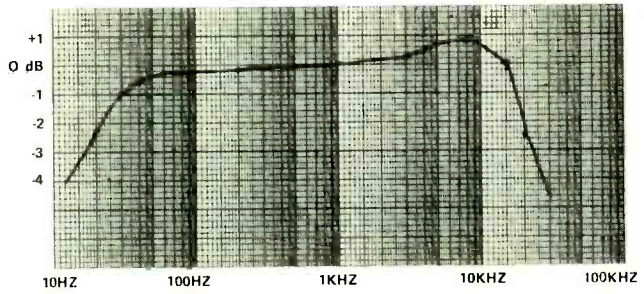
When we received the DL-1 at our shop for a complete evaluation, we connected it to our listening system for further listening. Using some new direct disc recordings and some favorite master tapes, we listened critically. Again, we were very impressed with the sonic qualities. The DDU did not increase the noise floor of the system, and the fidelity was excellent. There was only that slight dullness in the high-frequency region. We could not remember listening to another DDU with as clean a sound as the DL-1. It was all the more impressive when the number of outputs and maximum delay time were compared with the manufacturer's listed price.

When interfaced with a P.A. system as a special effects unit (utilizing the P.A. mixer's effects send and return circuits), we were impressed once again. The DL-1 performed flawlessly, generating some

interesting doubling effects for the vocals, and even flanging. Note that since the minimum increment between delay times is 5 milliseconds, it is not possible to create a sweeping type of flange. Nevertheless, we had some great fun making the lead guitar sound like it was coming through a steel pipe. We wished that we could have had smaller delay steps, but we accept the fact that the price probably dictated this situation.

Since there are so many limitations on sound quality at a "live" gig, it is impossible to be completely certain of the sound quality of any given device in the system. Nevertheless, at no time did the DL-1 introduce any audible distortion (except in one instance when we fed the input a dose of +10,000,000 dBm or so, but the indicators told us we boo-booed) or any noise. Compared to the tape loop echo device the DL-1 replaced during the test, the fidelity of the special effects was greatly improved by the DDU.

The level indication LEDs were most useful and seemed to give ample margin before any type of overload was audible. We liked the calibration method since it showed us how many dB we had left before we bumped the headroom. The little LEDs were also fun to watch!




**DeltaLab DL-1: Frequency response graph (see text).**

All switches and controls operated well and were totally silent in operation. We noted an occasional noise spike when changing the delay time during usage, but this was likely due to the fact that with musical program information there can be a large instantaneous level difference from instant to instant. Thus if the delay time is changed, so is the signal voltage at the time of the change since we are moving from one point in time to another. There were absolutely no audible pops or clicks when altering the delay time when no audio signals were present.

There is little left to say since the DL-1 performed as it should; the audio went in, circulated through the digital marvels within, and came back out later with virtually no coloration or noise added. That's *exactly* what a DDU is supposed to do. The packaging appeared well-made and robust. It can be rack mounted, but it has an attractive enough appearance to be left sitting on the table next to the mixer.

**Lab Test:** The DL-1 easily met its published frequency response of +1, −3 dB from 20 Hz to 15 kHz. As the graph shows, the response slightly droops below 1 kHz and has a rising characteristic to about +.75 dB at 8 kHz. The high-end roll-off is not *nearly* so extreme as with most other delay units (one can find high-frequency cut-off rates of 100 dB per octave or more on certain DDUs), which should account for a cleaner top-end sound.

We measured the output noise and found it be −74 dBv (20 Hz-20 kHz unweighted) in the short range mode and −70 dBv in the long range. The maximum output at 1 kHz was at slightly more than +17 dBv. Thus, the dynamic range was 91 dB in the short range and 87 dB in the long range; both figures were 6 to 7 dB better than spec. Total harmonic distortion at 0 dBv output level measured .3% at 1 kHz and around 3.5% at 10 kHz (the slew indicators showed that this was too high of an input level for this frequency since the "0 dB" slew LED was on during this test). Lowering the 10 kHz input signal level so that the "−10 dB" slew indicator was on dropped the distortion to a level near that of the 1 kHz measurement, or around .4%. Switching to the long range approximately doubled the THD figures for a given input level. The distortion residual consisted of mostly very high frequency (supersonic) digital noise due to the processing.

We checked the accuracy of the delay times as calibrated on the front of the unit and found them to be extremely close to the values as indicated. This is important for applications involving remote loudspeaker systems that must be delayed with respect to the main speaker to eliminate an echo effect. Since the DL-1 was within 1% or better, the user can calculate the time delay required to "synchronize" the multiple loudspeakers and set the delay on the unit without worrying about the accuracy of the DL-1.

All in all, the DL-1 handed in a remarkable level of performance on the bench, especially compared to other units we have examined.

**Conclusions:** The sound quality of the DeltaLabs DL-1 was probably the best we have encountered in any digital delay unit. The quality of construction and packaging was also excellent. When the price and features are considered, the DL-1 looks like it should be a real success story.

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*Note: Just as this issue went to print, we were informed by DeltaLab that the "original dual transformer power supply has been replaced with a toroidal power supply. Thus giving the DL-1 a 2-3 dB improvement in dynamic range and an extended frequency response out to 17 kHz."*

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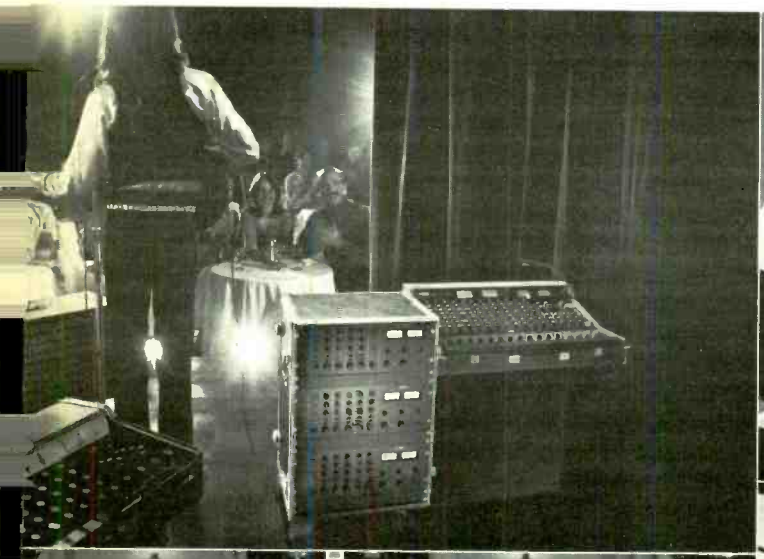

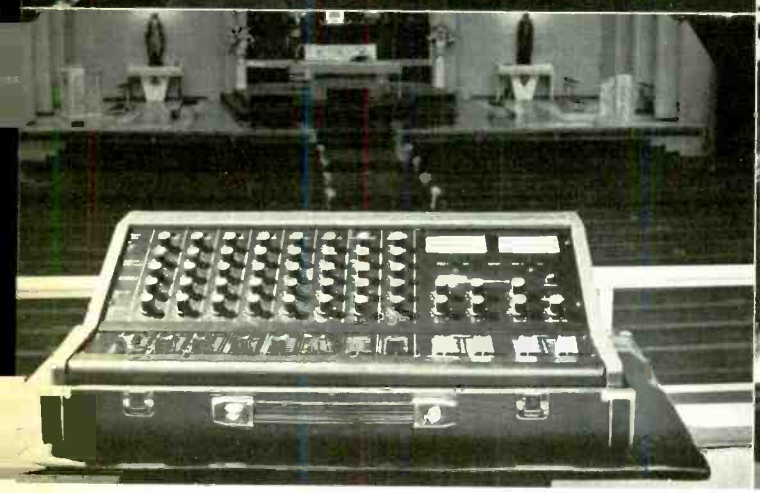


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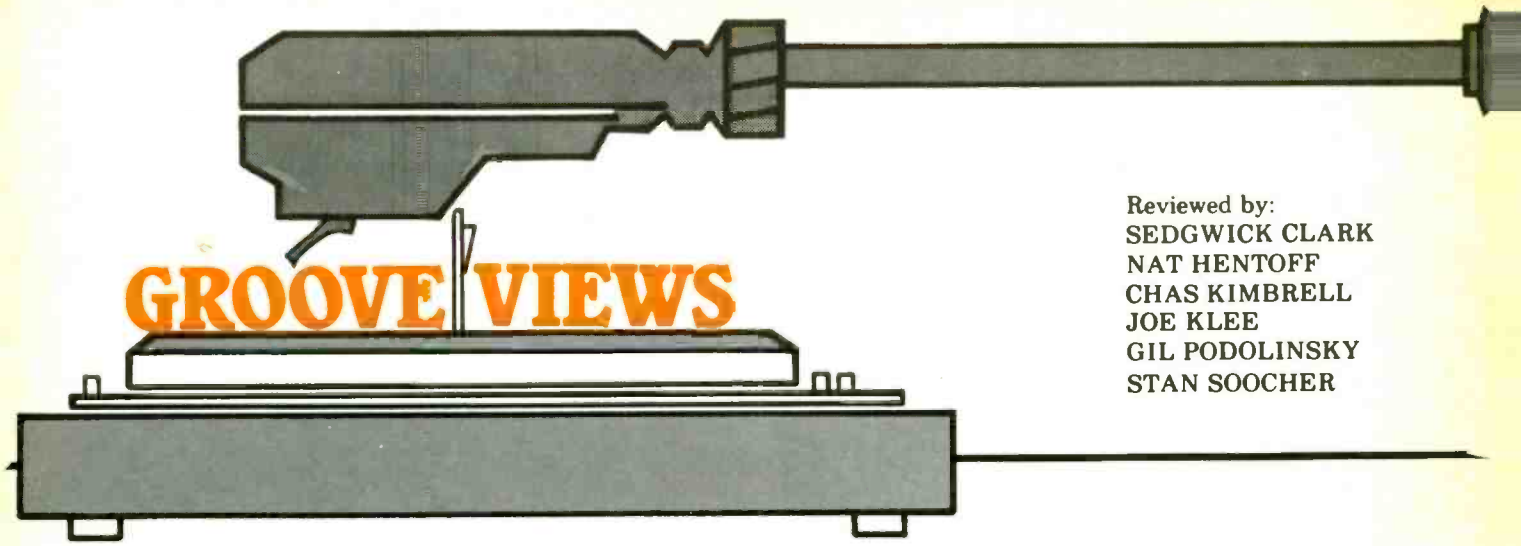
CIRCLE 85 ON READER SERVICE CARD

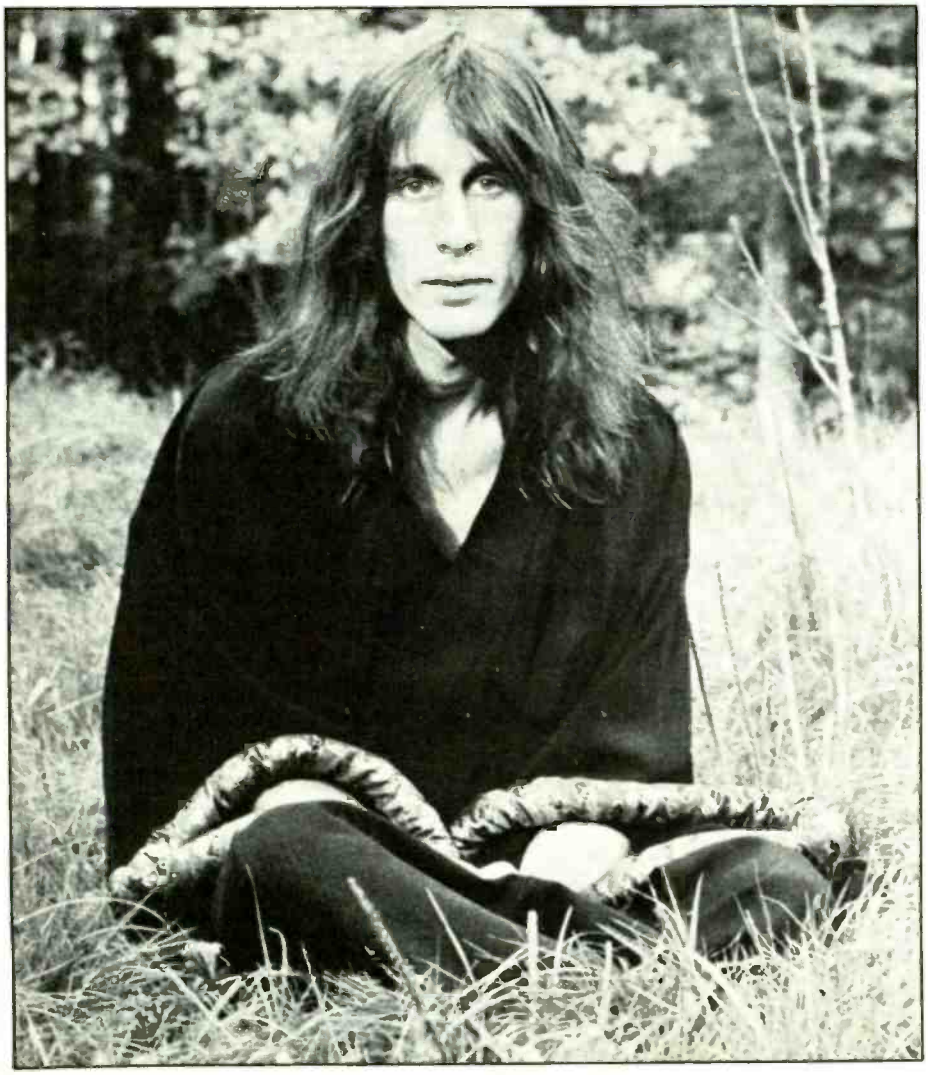



Reviewed by:
SEDGWICK CLARK
NAT HENTOFF
CHAS KIMBRELL
JOE KLEE
GIL PODOLINSKY
STAN SOOCHER

**TODD RUNDGREN: *Hermit of Mink Hollow.*** [Produced, engineered, arranged, written and performed by Todd Rundgren; additional engineering, Mike Young; recorded at Utopia Sound, Woodstock, N.Y.] Bearsville BRK 6981.

Performance: **A happy return to 1972**
Recording: **Just like ice—clear & solid**

Todd is back; the balladeer, the comedian, the cynic, the social conscience of the rock world. He's back all by himself and the result is one extremely enjoyable album.



TODD RUNDGREN: Better and better

In contrast to his last disc, *Oops, Wrong Planet*, recorded with Utopia, the music is brighter and, while not as busy instrumentally, still quite full. *Oops* tended to be a bit overproduced, a flaw not uncommon to some earlier Utopia albums. *Hermit*, on the other hand, is more solidly produced and the overall sound is more cohesive. This album could have been released right between *Something/Anything?* and *A Wizard, A True Star* and not seemed out of place. It has the feel of *Something/Anything?* but the synthesizers are used a bit more on this outing.

Included in the material are Todd's ballads with their haunting melodies and lyrics alive with honest feeling. One tune of special note is "Can We Still Be Friends" in which Todd gives us a good look at a place we've all been before. Then there's the comedic relief of "Onomatopoeia," a nonsense number with lyrics like "a sound in my head that I can't describe/ It's sort of zoom, zip, hiccup, drip, ding, dong, crunch, crack, bark" all accented with the appropriate sound effects. As side two rolls around there's "Bread" showing Todd's concern for his fellow man, "Save your regrets for the dead, but for the living/ give them love and give them bread." Rock & Roll hasn't been overlooked by any means as Todd pours out "Out of Control" and "You Cried Wolf" which bears a striking resemblance to "Wolfman Jack" from *Something/Anything?*. (Todd, have you been listening to your old stuff, too?) Also of special note is Todd's fine sax solo on "Bag Lady," a song which deplores the plight of New York City's shopping-bag ladies. The vocals are well up front and Todd's

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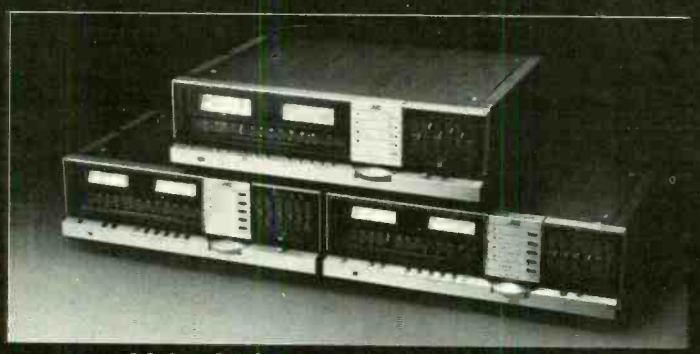

JR-S 401 (top), JR-S 201 (bottom left) & JR-S 301 (bottom right).

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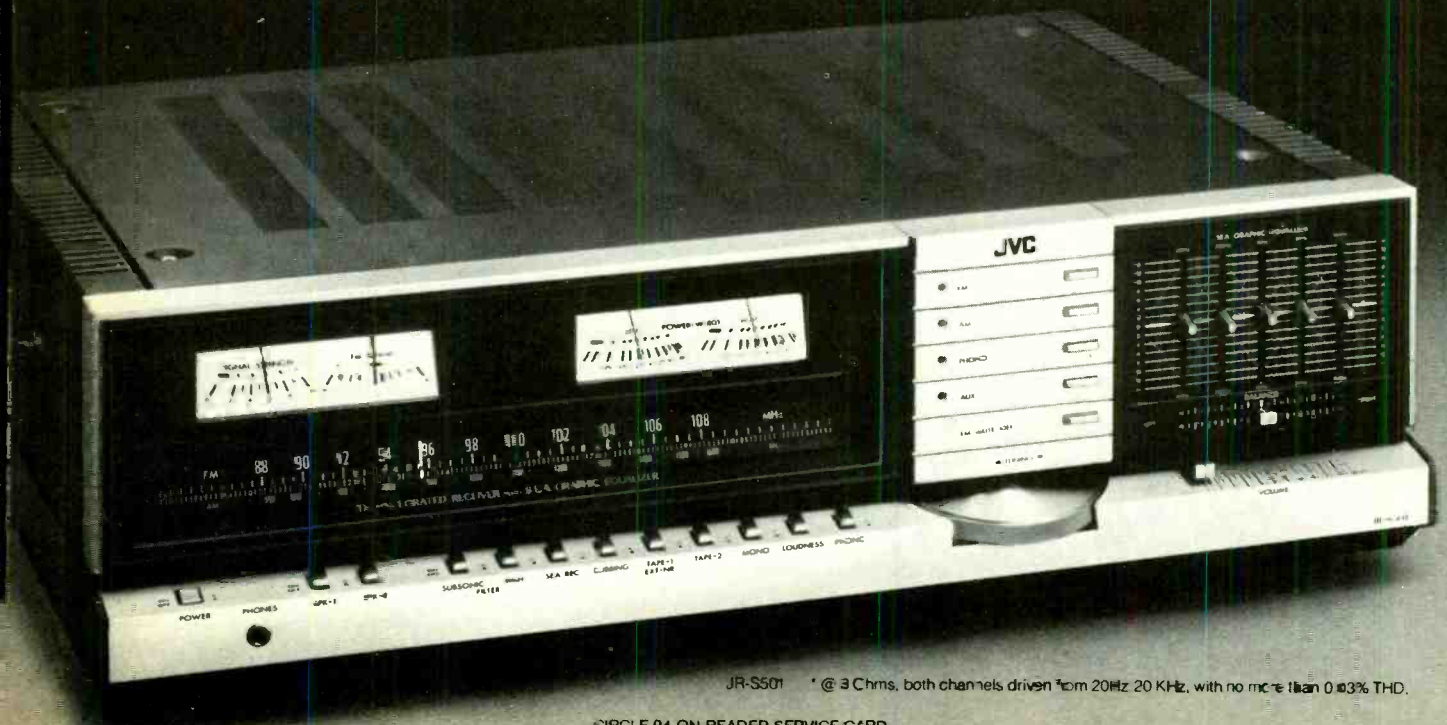
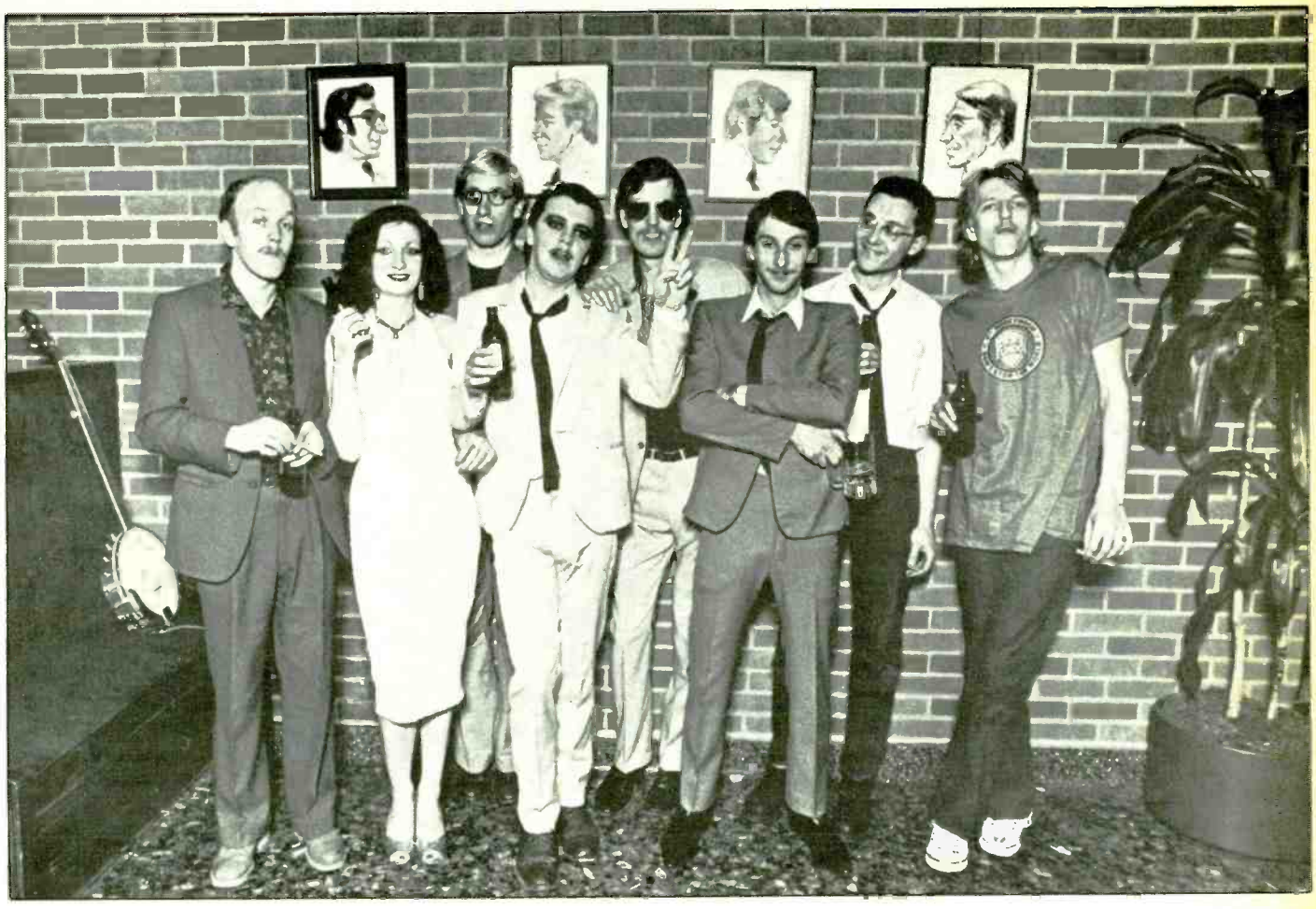



JR-S501 * @ 8 Ohms, both channels driven from 20Hz-20 KHz, with no more than 0.03% THD.

CIRCLE 94 ON READER SERVICE CARD



DEAF SCHOOL: A punk non-event

voice is getting progressively better. Everything is well placed in the mix with plenty of separation and little gimmickry. Panning is even kept to a minimum (as compared to 'normal' Rundgren recordings), and is used with good taste the few times it appears.

Fans of Todd who liked his pre-Utopia sound will find this album a worthwhile addition to their record collection. My only complaint with this album is that it isn't a double record set. C.K.

**DEAF SCHOOL:** ***English Boys/Working Girls.*** [Robert Lange, producer; Ted Sharpe, engineer; no studio credited.] Warner Bros. BSK 3169.

Performance: **Your basic punk**
Recording: **Your basic okay recording**

Meet the new establishment. With all the rich, and on the whole, talented English musicians leaving their homeland for tax purposes, the ill-trained, unprepared and talentless punkies have taken over the musical scene which has not put up a whimper in its own defense. All I can say is, musically speaking, England must be a very boring place now. This album, representative of those now abounding, is—yawn—dull.

I assume you've heard of the Deaf School, that eight piece, theater/musical/lacrosse team that features a vicar, or former vicar or son of a vicar who claims that by birthright he has the right to wear a clerical collar on stage? *That* is the highlight of this non-event.

The title track, "Working Girls," despite its synthesizer comps lifted right off the Supertramps' "Bloody Well Right," the echoed crash cymbal imitating a cracking whip and some rather tasty sax interludes never rises above the mundane. This dirge-like salute to the working day is typical of the cuts that plague this album.

I'm afraid Warner Bros. will have to give this one away.

G.P.

**MOBY GRAPE:** ***Live Grape.*** [John Chesleigh, producer; John Timms, engineer; recorded "live" at The Shady Grove, San Francisco, and The Inn of the Beginning, Cotati, Ca. by the Sonoma Recording Studios, Cotati, Ca.] Escape Custom Record Production. ESAIA.

Performance: **Tired**
Recording: **Up and down**

Had the accompanying discography not informed me, I would never have guessed that this was Moby Grape's tenth album. A group who's initial debut was marked with great promise, they never lived up to their potential. Members came and went, with original members like Don Stevenson now selling insurance. The performance here is largely lackluster, saved only by the guitar work of Jerry Miller. The packaging of this custom label is most impressive, what with purple marble vinyl, plastic record liner and a quality grade of cardboard cover. Mastered in London, the Grape apparently wanted to spare no expense for a quality recording. Unfortunately, the material let them down.

"Set Me Down Easy," a plagiarized version of "Don't Mess With Bill," opens with dull drums, a flat-sounding bass and a muddy Hammond. The rhythm guitar seems to have been added at a

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later date as it's very clean and distinctive, unlike the rest of the mix. The bass is indistinguishable, which may be the result of trying to compensate for a volume loss. The cymbals and drums sound as if they were recorded over the phone. The guitar solo sounds compressed. I wouldn't be a bit surprised if the vocals were recut in the studio. This particular track seems to have an element of hiss in it as well. True, it's a head boppin' tune, but only if you like the Allman Brothers meeting Mary Wells. And only if you're willing to settle for a lot less than this band is capable of really doing. G.P.

**PHIL MANZANERA/801: *Phil Manzanera/801.*** [Phil Manzanera, producer; Rhett Davies, engineer; recorded at Basing Street Studios and The Manor, Oxford, England.] E.G. Records Ltd. Polydor PD 1-6147.

Performance: **Best yet**
Recording: **Very impressive**

**801 LIVE: *801.*** [801, producers; Rhett Davies, engineer; recorded "live" on the Island Mobile.] E.G. Records Ltd. Polydor PD 1-6148

PHIL MANZANERA: Top notch

Performance: **Good**
Recording: **Good**

In the past, I have found the Phil Manzanera-Eno collaborations definitely out of the norm, requiring equal amounts of patience and an affinity for the bizarre in order to appreciate them. These two new releases, recorded between 1975 and 1977, show them in a different light. The material is more structured here, with no spacey experimentation. *801 Live* is an excellent recording with clean separations and an even mix. A few too many instrumentals in the repertoire for my taste, but an interesting recording nonetheless. The vocals presented here are so true you're faced with an is-it-"live"-or-overdubbed dilemma.

A problem I may have created in terms of comparison was listening to *Phil Manzanera/801* first. In comparison to this studio LP, *Live 801* suffers overall from the absence of all the keen personnel who adorned Manzanera/801: Kevin Godly, Lol Creme, Mel Collins, Ian McCormick, Simon Ainly, etc. *Phil Manzanera/801* is quite a surprisingly good album featuring top notch talent, material and an intelligent use of the studio. Both effervescent and imaginative, I'm stumped as to why it took so long for their release. My only guess is that apparently there has been a label change from Island to Polydor, but then logic would dictate that these tapes should have been released by Island and not Polydor. . . . Oh well, the important thing in this case is that Manzanera/801 was released at all.

G.P.

STEVEN T: Not much in his favor

**STEVEN T:** ***West Coast Confidential.*** [Kim Fowley, producer; Taavi Mote, engineer; recorded at Larabee Sound, Los Angeles, Ca.] Dream Records DA 3500.

Performance: **Bruce Springsteen goes west, meets Kim Fowley and wins a date with the Runaways**
Recording: **Clean**

It's lucky that Springsteen released another album recently for his imitators were beginning to run out of ideas for new material. Scanning the charts, it's clear that these Springsteen idolators attract little airplay and seldom enter the top 200, so I have to wonder why labels continue to release them.

"These Are My Life and Times," a tune apparently as un-Springsteenish as Steven T will get, is a rather well-made track with AM crossover appeal. I did, however, find the electric guitar a bit superfluous, and felt that it only cluttered up the track.

A sound-alike on a small label often doesn't stand much of a chance of making it. This one doesn't have much of anything else going for it either.

G.P.

**NANTUCKET:** ***Nantucket.*** [Win Kutz, producer; Win Kutz, Reed Rudy, engineers; recorded at Kaye-Smith Studios, Seattle, Wa.] Epic JE 35253.

Performance: **Slick**
Recording: **Nothing fancy**

Producers, especially rock ones, have one great and common fault—they outfox themselves when trying to make commercially successful records. This is the record industry's version of writing The Great American Novel. Everyone tries to cash in on a proven sound through duplication. Trying to predict tomorrow's line up with yesterday's box scores is a loosing effort. I'd rather have a producer go out on a limb and show both the label and the public the potential of a new group than, as in this instance, to allow them to sound like a cross between Player, early Todd Rundgren and Styx. Any garage group can do that. Nantucket comes out sounding like any other bar band—cliché guitar solos, novice lyrics and repetitious song structures. Here's another prime example of gearing music down to an adolescent level. Nantucket's ability to harmonize and come up with an occasionally interesting

NANTUCKET: In need of a polish

chord change indicates that there may be something there. What they need is someone who can bring it out. Judging by the end result, what Win Kutz sees is an average band. We won't know until they try another producer whether or not it's his perception that made them that way.

"Never Gonna Take Your Lies," is one of only two tracks that I found interesting thanks to an odd chord change which unfortunately is not very long. The use of extensive fade echo on the vocals during the second and third lines of the chorus, backed only by drums, is downright tacky. In addition, a synthesizer is used for sound's sake alone and contributes little or nothing to the proceedings.

Instrumentally, this band needs extensive polishing to lose its beer hall smudginess. I have a feeling that if they ever find the right producer we could see some very nice things from them in the future. G.P.

**WINGS: *London Town.*** [Paul McCartney, producer; Geoff Emerick, engineer; recorded at EMI's Abbey Road Studios, and AIR Studios, London, and aboard the "Fair Carol" by the Record Plant Mobile Studio in the Virgin Islands.] Capitol SW 11777.

Performance: **Paul's still cute**
Recording: **Bright**

Is Paul McCartney opening a candy store? After all, his music has more calories note for note than anything this side of Leif Garrett or Shaun Cassidy. *London Town,* his ninth album since the break up of the Beatles, selling like

WINGS: Overgenerous tidbits

penny candy, would make a fine display for the front counter. "Morse Moose" or "Cuff Links," anybody?

Actually, McCartney's music today suffers more from comparisons to his work with the Beatles than from his contemporaries in the seventies. His flair for melodic hooks is intact and he's singing as good as ever right down to his imitations of Little Richard and, on "Name and Address," of Elvis Presley. But instead of being a leader and prime mover on the scene, McCartney with Wings is satisfied offering up prime time musical entertainment. Confronting his own image in "London Town," Paul sings, "I was accosted by a barker singing a simple tune," and, indeed, McCartney is overgenerous with thirteen lukewarm tidbits. Paul could inject some muscle into his music if he spiced up his lyrics and tackled subjects aside from burnt-out groupies, marital bliss, or idyllic travels. Let Linda McCartney confirm: you can't take color photos with black and white film.

The production of *London Town* is its strongest point. McCartney isn't George Martin, but classics like *Band On The Run* have surfaced under his direction. Pools of keyboards in "With A Little Bit Of Luck" and acoustic guitar banks in "Deliver Your Children" accentuate McCartney's concern with the texture of his arrangements. Even so, "Morse Moose and The Grey Goose" suffers from garbled overproduction. Fancy keyboard effects left and right and flighty drums are unleashed unfocused among erratic guitar fills. Simpler attempts like "Girlfriend" are more effective with airy acoustic guitars, thick bass and drums, and soprano choruses.

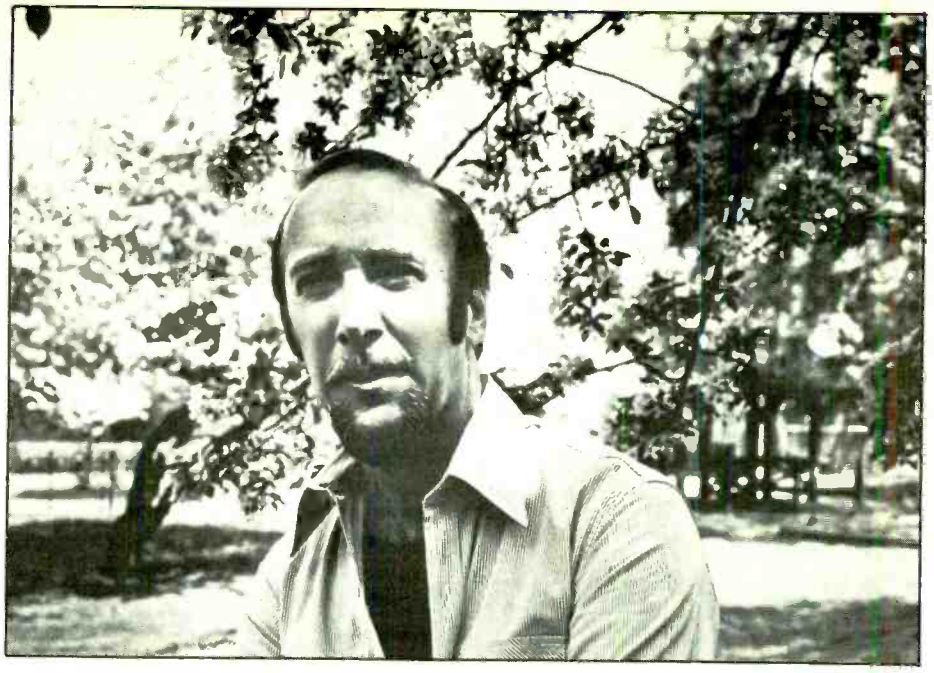
In summation, there is nothing really heavy about Paul McCartney and Wings, although you may get fat listening to the music. S. S.

## JAZZ

**HERBIE MANN: *Brazil Once Again.*** [Herbie Mann, producer; Jimmy Douglas and Lew Hahn, engineers; recorded at Atlantic Studios, New York City, N.Y.] Atlantic 19169.

Performance: **Mann-sized slice of Latin jazz**

Recording: **Overdubbed, but the result came out pleasant**



HERBIE MANN: Getting magnificent

Nobody has ever doubted Herbie Mann's ability as a virtuoso jazz flutist. Sometimes his taste comes in question, but never his ability. I think one of Herbie's problems is his desire to be all things to all people. This quality has led him into soul albums, disco albums, Latin albums, straight-ahead jazz albums, far-out jazz albums, African roots albums and just about everywhere else.

This album is the Latin Herbie Mann and it seems to be one of his most comfortable roles. It also helps that all the arrangements on this LP are by Pat

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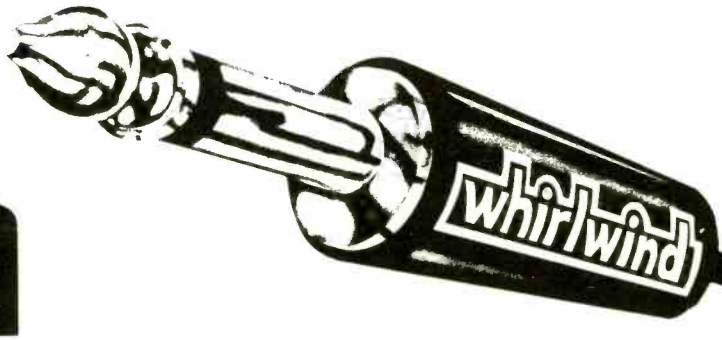


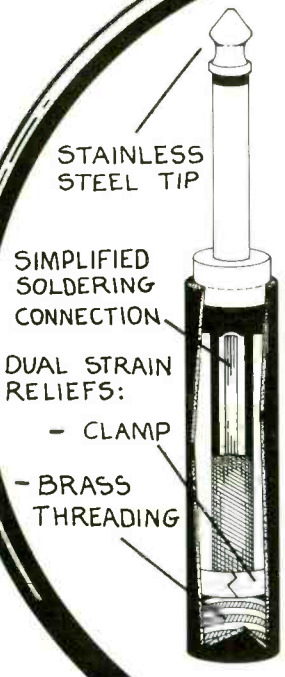


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Rebillot, a keyboard player and arranger whose genius far surpasses his limited reputation. Pat and/or Herbie came up with an idea that works. Overdubbing Herbie Mann's flute over itself is probably nothing new. I'm sure that Herbie's done this sort of thing before, although I can't cite chapter and verse, but I don't think he's ever done it this effectively. Also the album is programmed very intelligently. Side one consists of Herbie Mann's original tunes, "Pele" and "Oh, How I Want To Love You." Side two is music of Brazilian composers such as Joao Donato and Luis Marcal. Herbie's regular band is augmented by percussion and horns where needed. The gem of the album, however, is Herbie and his great playing when he gets something worth the effort. To hear Herbie Mann interacting with himself on the opening track, "Pele," is a thrill not soon to be forgotten by the listener.

The recording is very contemporary. There's a lot of gimmicky stuff used but it works even better for Herbie than it does for your average rock band because there's more there to begin with. While a straight-ahead version of J. D. San-McDony's "Dingue Li Bangue" might have been pleasant enough to get by without the added horns and the overdubbed flute work, they certainly add to the experience and for a change the large percussion section is held in proper balance rather than being allowed to override the tune.

I would, however, have been happier without the bird calls and rain forest noises that introduce Herbie's otherwise sensitive version of Joao Donato's "Lugar Comum." But once the sound effects are over and Herbie gets down to the tune, it's magnificent. J.K.

**DEODATO: *Love Island.*** [Eumir Deodato, Tommy LiPuma, producers; Al Schmitt, Charlie Conrad, Jeffrey Kawalek, engineers; recorded at Capitol Recording, Hollywood; Hollywood Sound, Hollywood; Warner Bros. Recording Studios, North Hollywood, Ca., House of Music, West Orange, N.J. and Media Sound, New York, N.Y.] Warner Bros WB BSR 3132.

Performance: **Enjoyable**
Recording: **Tight**

Deodato, long a percussionist of note, is fronting his keyboard work on his latest vinyl testament, *Love Island*. Having composed six of the eight pieces

DEODATO: Quality music in quantity

present on this outing, he only fails to create interest with one. Overall, this is a highly melodic album, with no flashy instrumental breaks taken outside of an occasional guitar solo by Larry Carlton. What this album offers in quantity is music with a strong rhythmic base, which is not at all surprising when one considers Deodato's South American heritage.

"Whistle Bump" is typical of the fine tunes that compose this record. Despite a working complement of drums, guitars, bass, synthesizers and Rhodes, the only solo is taken by the very capable Carlton and his Leslied electric guitar. For a brief moment before the fade-out ending, a flute comes into focus. Before you can figure out from where it comes or really appreciate it—it's gone much too quickly, but it leaves a shimmering memory that stays with you long after the record's off the turntable. I want more!

G.P.

**NINA SIMONE: *Baltimore.*** [Creed Taylor, producer; David Palmer, engineer; recorded January 1978 at studio Katy in Brussels, Belgium.] CTI 7084.

NINA SIMONE: Going for the prize

Performance: **Long overdue winner**
Recording: **Another transatlantic overdub?**

By definition, pop artists are judged by the success of their latest hit as opposed to a jazz, classical or folk artist where values are more in the realm of the abstract than the commercial. Nina Simone has had her share of hits. The biggest was Billy Taylor's song "I Wish I Knew How It Would Feel To Be Free" but that was way back then and she just hasn't seemed to have been able to catch the brass ring since.

This album should mark the end of that cycle. Halfway through side two there's a rendition of the old church hymn, "There Is A Balm In Gilead," which must be called, by standards either sacred or secular, extremely moving. That's only one facet of this album which moves from the soft rock of Randy Newman's "Baltimore" through Judy Collins' sensitive portrayal of "My Father" to the ultimate romance of "That's All I Want From You." Nina doesn't just sing, she communicates; but then the best singers always were the communicators, the ones who make the song live and make you live both with it and in it.

The album notes say that this album was recorded at studio Katy in Belgium. That's probably accurate as far as Nina and her basic accompanying group are concerned, but you can be sure that Creed Taylor didn't fly a fifteen-piece string section across the Atlantic for the date! This had to be overdubbed back here as the personnel lists the *crème de la crème* of New York City Studio string players. Not that it really matters to me, but it must have mattered to Creed Taylor who lists only the Belgian session and a mixing session at Electric Lady in New York. Somewhere between here and there strings got added and a lot of sweetening was done.

If this album gets Nina back on the track to hit city it's a good deal because she certainly belongs there—and she's been away too long. J.K.

**GIL GOLDSTEIN: *Pure As Rain.*** [Fred Miller, producer; Bruce Gerstein and Fred Miller, engineers; recorded November 14, 15 and 16, 1977 at Downtown Sound, New York City, N.Y.] Chiaroscuro CR 201.

Performance: **Untapped mine of golden music**
Recording: **As pure as rain—almost**

Considering the tendency toward overnight stardom in the pop field, I'm getting rather used to receiving albums from artists that are unknown to me. Usually, it turns out that there are very good reasons for their anonymity, but occasionally there is an exception. Gil Goldstein's first album as a leader (he's made several as a sideman with guitarist Pat Martino) is a gem—a mature statement from an accomplished professional musician/composer.

I had no trouble spotting the influences. There's a strong Bill Evans feeling to Goldstein's playing. His composing reminds me of the early Return To Forever sides with Chick Corea, Airto, Flora Purim and Joe Farrell. But still it's Gil Goldstein and if he's not quite an innovative original, he will become one in time.

My favorite cut is "The Boy Within A Drum." On this recording, it's structured like a suite. It begins with Mary Eiland singing the charming lyric with grace and style and then moves into a Gil Goldstein improvisation on electric

GIL GOLDSTEIN: Mature statement

piano followed by a harmonica solo by Toots Thielmans which I find, like much of Toots' playing, too busy for my taste—too many notes, too many frills. He makes up for these excesses on "Without An Anchor," taking a solo which I find more enjoyable than any I have heard from him previously.

Ray Barretto's playing on conga drum is in extremely good taste and is used only where it fits. He doesn't play on every tune just because he's there. I have more respect for Barretto each time I hear him, especially in jazz settings like this. Another plus is Jeff

Berlin's fretless bass guitar. Th fretless certainly has it all over the ore conventional instruments. Jeff achieves an amazing sustain on the instrument which is unusual for bass guitar. He also has a tendency to play in the upper register of the instrument, giving it an interesting and haunting cello-like sound.

The recording features some of the best piano sound I've heard from Chiaroscuro, in fact, some of the best piano sound I've heard on jazz records lately. How much of it Fred Miller did, having to double as producer, I can't say. I'm sure Bruce Gerstein was a large help, if only because his presence allowed Fred Miller the freedom to take a solo on English horn in "Downhill Racer." The recording seems honest and was done "live," with the exception of Toots Thielmans who had to overdub his parts since he was not available at the time of the original recording date. That's why it's almost as pure as rain—but then these days rain isn't all that pure either. J.K.

**PERRY ROBINSON:** ***The Traveler.*** | Hank O'Neal, producer; Bruce Gerstein, engineer; recorded at Downtown Sound, 1977. | Chiaroscuro CR 190

Performance: **Avant garde with roots and branches**

Recording: **"Live," a bit echo-y at times, but lively**

I've known Perry Robinson for quite a few years. I've been listening to him in dozens of different settings with musicians as far apart as avant garde trumpeter Don Cherry and veteran jazz trombonist J. C. Higgenbotham. I am more aware than most of his listeners of the many different musics that go to make up Perry Robinson. His studies with Jimmy Giuffre, his later listening experiences from Johnny Dodds through Ornette Coleman and beyond. The album is aptly titled because Perry Robinson is indeed a traveler (his credits include the Brubeck family and Archie Shepp and even a folk/rock album backing up a duo named Bunky and Jake). The interesting thing about Perry's playing is that each association, each experience, adds something new to what he plays until now he plays the entire history of jazz clarinet from Dodds and Noone through Teschmaker and Pee Wee to Giuffre and Tony Scott and it all comes out Perry Robinson.

His cohorts on this album are worthy

Photo by Hank O'Neal

PERRY ROBINSON: Deep roots

men, especially the exciting new bass demon, Frank Luther. His work on Perry's bossa nova, "You Are Too Good" is indeed just too good to describe in words. You've got to hear it.

Perry's throaty tone on clarinet is a temptation to a recording engineer. There are so many games you can play with a sound like that. Your imagination can just run crazy—sometimes too much so. It sounds to me as though the temptation to enhance the sound with echo was a bit too much for the engineer here and there (particularly on "The Call"). The general sound of the session is a lot more "live" than we've come to expect from Chiaroscuro yet it's a pleasant change from the flatness of some of their earlier records. It's not a hot rock sound but Perry's horn still fairly leaps at you out of the record, especially if you're listening through earphones.

There is a psuedo rock and roll track called "Atomic Twist" in which some of the rock and rollisms are trite enough to border on banality, so I don't think Perry meant it to be taken seriously. But then with Perry Robinson you never can be sure. Laughter can be heard at the end of the track so somebody got the joke anyway. Still the gem of the album has got to be Perry's sensitive interpretation of "How Can I Keep From Singing" which comes out of the banjo concerto written by his father, Earl Robinson, composer of "Ballad For Americans" and "Joe Hill" among others. Yes, Perry Robinson has roots that run deep and branch out every which way. J.K.

**BUCK CLAYTON: *The Golden Days Of Jazz.*** [John Hammond and/or George Avakian, producers; John Franks, reissue producer; engineers not listed; recorded in New York City, December 16, 1953; March 31, 1954; August 13, 1954 and March 15, 1955.] Columbia Special Products JC2L 614.

Performance: **Jam-packed with good jazz**
Recording: **50s mono**

It's never quite been established whether the Buck Clayton Columbia sessions (of which these tracks were part), or John Hammond's Vanguard Jazz Showcase series was the first utilization of the LP to preserve the extended performance of the jam session. But when both were so good, it's pointless to fight over who was responsible. The idea behind this work is that Buck Clayton could gather some of the top jazz stylists in New York on any given day into a studio and jam for more than twenty-five minutes on "Christopher Columbus" and that's pretty much what happened.

There's solo space aplenty for the cats and there's room to spare for improvised ensembles and chase choruses (you play four bars, I'll play four bars, then you play four and I'll play four). In the older days there would have been a cutting contest, but the mainstream men of the 50s were of a more polite breed which ultimately counts against this record, oddly enough. When Buck Clayton and Joe Newman lock trumpets there's so much mutual love and respect between these two ex-Basieites that it becomes "after-you-my-good-friend-no-you-go-first." Twenty years earlier Roy Eldridge and Lips Page might have locked horns for a real battle to see who was in better form on that particular evening.

Everyone plays well here, especially Buck Clayton, Coleman Hawkins and Trummy Young, plus that marvelous rhythm team of Freddie Green, Walter Page and Jo Jones. It is a shame, however, that nobody listed the solo order in the liner notes. In sessions like this, it's sometimes hard to identify even those stylistic giants who have a truly individual sound, much less players like Newman and Clayton who are not instantly identifiable. One way to tell might be the fact that Clayton often used a cup mute in those days, but he played open as well so there's no easy answer. Also, especially when Avakian and/or Hammond (whoever did these sessions) heard how well the extended twenty-five minute jam on "Christopher Columbus" came off, why did they go back to the format of two tunes to a side and keep them brief? The only other cut that goes over ten minutes is "Jumpin' At The Woodside," and even that would have gotten hotter had it been allowed to go the full limit. Also some of the other sides come up short. Side four, for example, lasts less than sixteen minutes.

BUCK CLAYTON: Of a more polite breed

I'd just like to remind you that Columbia Special Products is not responsible for the programming, the recording or the sound—they simply reissue the original LPs which were put out by Columbia in the 50s in new packages, sometimes with new liner notes, sometimes using the old ones. That's company policy. It also seems to be company policy to put some darn good records back into circulation and we have John Franks and his staff (especially Mike Brooks) to thank for that. J.K.

**WARREN CHIASSON: *Good Vibes For Kurt Weil.*** [Bill Borden, producer; Claire Olivier, assistant producer; Harvey Goldberg, engineer; recorded September 13 and 15, 1977 at Media Sound, New York, N.Y.] Monmouth Evergreen MES 7083.

Performance: **Solo work excellent, ensemble a bit too Shearingly polite**
Recording: **Good, clean and comfortable**

Warren Chiasson is one of the tastiest vibraphone players in New York today. He's shown that time and again. Actually there was every reason to hope for a truly great album from this set which teams two former members of George Shearing's Quintet (Chiasson and guitarist Chuck Wayne) with a New York based rhythm section of bassist Earl May and drummer Ronnie Bedford and latin percussion master Ray Mantilla. Maybe it was too much to expect. It looked so damn good on paper it just couldn't be true. Chiasson and Wayne spice this album with the same great sort of playing that we've come to expect from them. What went wrong is the ensembles ended up sounding like "I Remember The George Shearing Quintet," without the piano. I guess when you put together players who've worked on the same bands (though they didn't work on Shearing's group at the same time) it's bound to come out with that kind of sound. The addition of Mantilla does make the group a bit percussion heavy—a problem which could be remedied the next time around by the addition of a horn player. (I would recommend Ruby Braff or Zoot Simms as an ideal foil for the melodic Mr. Chiasson.)

The best thing about the record, outside of the expert playing of Warren Chiasson's little group is the repertoire of Kurt Weil tunes. Of these tunes only


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WARREN CHIASSON: Contemporocky?

"Mack The Knife" is in danger of being done too frequently. This, too, could have been eliminated in favor of such gems as the seldom heard "My Ship" from "Lady In The Dark." I'm also not too sure about Chiasson's "contemporocky" treatment of "September Song." At first I didn't like it but once you get behind the gimmick of the rock rhythms the listener will discover that Chiasson's musicianship wins out over the gimmick. . .Wayne only slightly less so.

Bill Borden's staff at Monmouth Evergreen and the gang at Media Sound have captured the sound of Warren's group with unusual warmth and clarity, especially the rich resonance of Warren's Concert Musser Vibraphone.

The best thing about this record, in fact the best thing about any Warren Chiasson performance, is his ability to think in chordal terms. Since the advent of players like Milt Jackson, vibraphonists have tended to rely on the single note line to extremes. With Chiasson we have a revival of the multi-mallet way of playing the instrument which puts him in a direct line with Red Norvo and Gary Burton as a player of harmonic chordal invention. And that's a plus in my book. J.K.

**RY COODER: *Jazz.*** [Ry Cooder and Joseph Byrd, producers; Lee Herschberg and Douglas Decker, engineers; no recording date or place listed.] Warner Bros. BSK 3197.

Performance: **Fine country jazz**
Recording: **Excellent, if at times a bit bigger than life**

There is an extraordinarily close relationship between some of the early forms of jazz and some of the early forms of country music. It comes from sharing such common roots as ragtime, work songs and church music. Therefore, it's not at all surprising that Ry Cooder, who was a country-rock-crossover session man before becoming a star in his own right, is into a lot of the music on this record which ranges from Jess Picket's rag "The Dream" through Jelly Roll Morton, Bix Beiderbecke and Louis Armstrong. That's a heavy chunk of repertoire but it works because the sidemen, like Cooder himself, are session men who can play anything the job demands. That's not a putdown, by the way. It's an art to be able to come into a session, glance down the chart once and play it right the first time. It's just as much an art as it is for a jazz improviser to walk into a jam session and fall in with whatever's happening. Very few musicians can do both. Of the musicians on this record, all do their jobs well but only Cooder gets in some good, improvised jazz solos as well. The others, particularly Tom Collier on marimba and vibes, sound like they've worked it all out in advance rather than improvising their licks.

RY COODER: Doing it better and better

There are several gems present here. My personal favorite is Ry Cooder's overdubbed version on lord knows how many different instruments of Jelly Roll Morton's "The Pearls" and "Tia Juana." I'm also very partial to Cooder's vocal on "Shine" which includes the verse to the song which I'd never heard before—not even from Louis Armstrong's version.

The only reason I've ever found to prefer an amplified guitar to an acoustic guitar is that in order to record the full-bodied sound of an acoustic guitar, it must be miked so closely that a lot of pick noise and string slide is also recorded. This occurs frequently on this recording, particularly in such solo efforts as "Pearls," "Tia Juana" and "Flashes." Some guitarists argue that it is part of the performance and that these extraneous noises should be preserved. But when you hear an acoustic guitar in a club, you're not sitting right on top of the instrument the way the mic was in at least some of these recordings. I think I'd be willing to sacrifice some of the bigness and closeness to eliminate these unwanted intrusions on the music.

I don't know who Joseph Byrd is, but I do recall that guitarist Charlie Byrd had a brother named Joe Byrd who either played bass or guitar in his group at one time. I doubt that this is the same Joseph Byrd or more would have been made of it in the liner notes. Whoever he is, Joseph Byrd has a nice chamber-arrangement concept of jazz similar to the jazz concept of the Alec Wilder Octet in the '30s. It's a concept that still works today and on this disk it works wonderfully. J.K.

**DAVID SPINOZZA: *Spinozza.*** [Mike Mainieri and David Spinozza, producers; Jeffrey Kawalek, engineer; Peter Roulinavage, assistant producer; recorded at House of Music, New Jersey, dates unlisted.] A&M SP 4677.

Performance: **A session man at his own session**

Recording: **Good MOR to rock sound, but not really honest**

Ordinarily this is the sort of album I'd toss aside with only a cursory listen. However, I was intrigued by the presence of the old Dreams horn section (the Brecker Brothers and Barry Rogers) plus Mike Mainieri and a lot of the members of his jazz rock fusion group, White Elephant. I certainly didn't expect it to be a jazz album—not when the opening cut is Leon Russell's "Superstar" but I should have known that anything that involves players like the Breckers, Mike Mainieri, Dave

# Big Ben and the Instant Swinger

**By Nat Hentoff**

He could swing the whole band, as if it were in his huge hand, on *Cottontail;* and then he could make you remember your first real love with his breathy, tender lyricism on *All Too Soon*. Ben Webster attained his initial international renown with Duke Ellington; but long after, his instantly identifiable tenor saxophone drew attentive musicians and lay listeners wherever he played. And the locations were many, for Ben was a wanderer.

Ben was so universally admired—and indeed loved by many—because of his overwhelming lyricism. He was a romantic, and the gentlest of his ballad performances also pulsed with the strength of his sense of wonder and of possibility. A large man, he felt largely, and the generosity of spirit that his friends knew also coursed through his music. And there was the sound of the man—big, firm, passionate. And his dynamics. Ben could make one song a microcosm of nuances. As for his time, it was deep and full, exultant on hard-riding numbers, reflective on ballads, and always afloat.

One of the most satisfying sets of Ben Webster's robust final years is *Did You Call?*, recorded in Europe in 1972 and now available here for the first time on Nessa (distributed by Flying Fish Records). Backed by a relaxed trio, Ben is in total command of one of the most expressive horns in jazz history. The songs range from a wholly transformed "Sweet Georgia Brown" to "Ben's Blues" and "How Long Has This Been Going On?" The recorded sound is spacious, clear, and Ben is miked to his natural advantage.

Unlike Webster, Sonny Stitt never worked for Duke Ellington, but his *Blues for Duke* (Muse) is nonetheless a knowledgeable, solid, hot tribute. Except for one track ("I Got It Bad And That Ain't Good"), Stitt plays tenor rather than alto. His conception on both horns is lean, incisive, and directly emotional. Not as continually fresh and inventive a melodist as Ben Webster was, Stitt, however, spins crisp, unerringly logical variations. And they generate intense momentum because he has one of the most enlivening beats in jazz. It is impossible for Stitt *not* to swing. And he, like Webster, can be soaringly lyrical, as in the aforenoted "I Got It Bad."

What makes this tribute particularly stimulating is the fusing of Sonny with exactly the right rhythm section for him. Pianist Barry Harris, a cornucopia of harmonic knowledge and imagination, may well be the best horn-accompanist in jazz; and his own solos are invariably paradigms of lucid, exceptionally intelligent improvising. Bassist Sam Jones is always resilient and time-dependable, while drummer Billy Higgins pays as much attention to sound as he does to rhythm. Being so secure in the latter, he is able to keep on perfecting the former.

The sound is exactly right—plenty of presence, depth, and clarity. And the session, it should be added, is no attempt to imitate Duke. Sonny and his colleagues are paying tribute as their own musical selves which Duke would have dug.

**BEN WEBSTER: *Did You Call?*** [No information on producer or engineer.] Nessa N-8.

**SONNY STITT: *Blues for Duke.*** [Elliott Meadow, producer; Ed Korvin, engineer.] Muse MR 5129.

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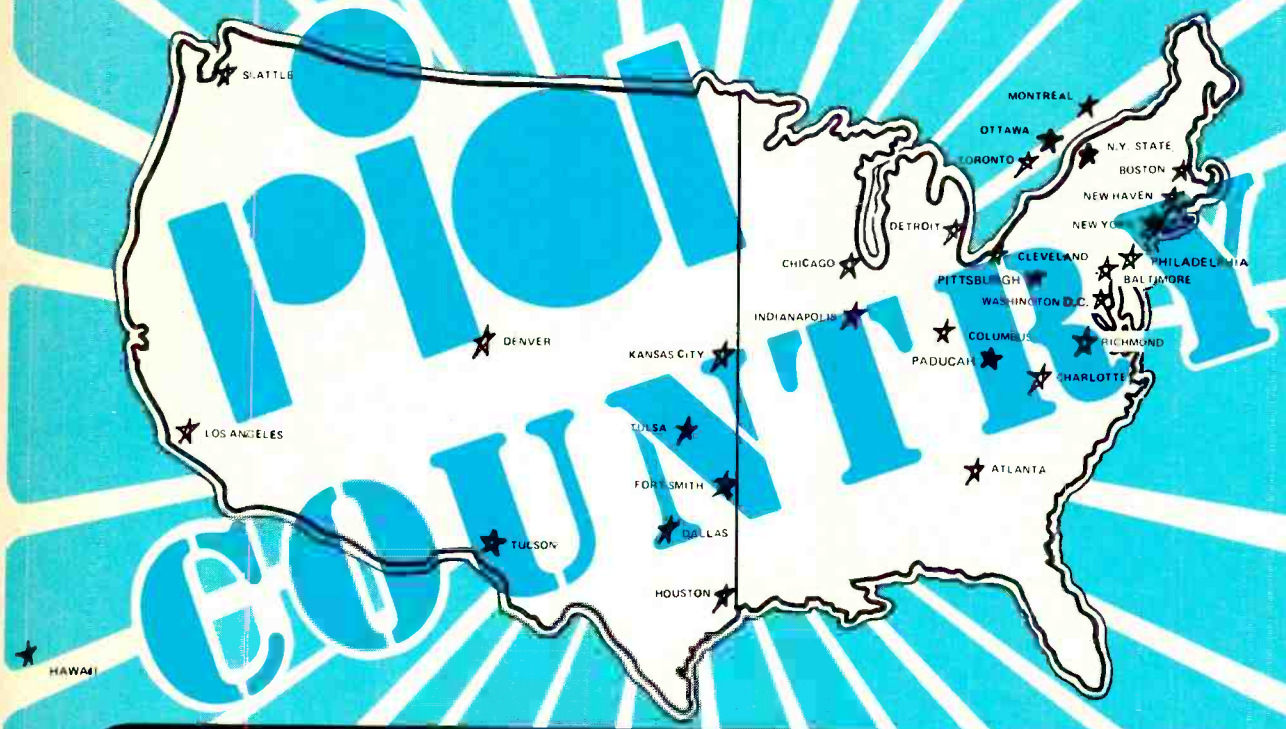


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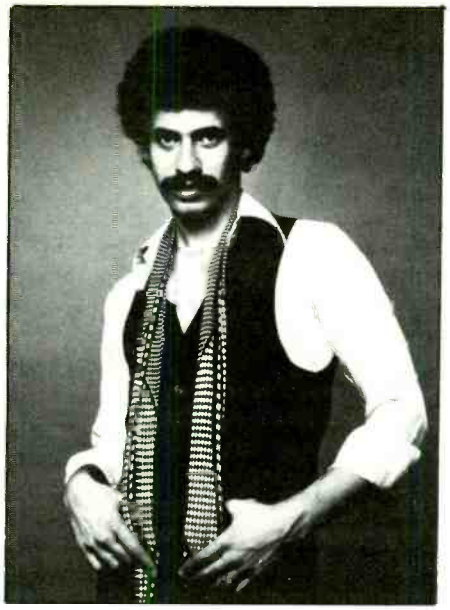
anborn and Warren Bernhardt has got o have some jazz going on somewhere. he real surprise is Spinozza, who has layed on sessions featuring some retty heavy talent but primarily in the ock and roll vein. So I wasn't expecting he kind of hip swinging guitar that pinozza plays on Leon Pendarvis' tune On My Way To The Liquor Store" or is own "Airborne." This latter tune eminds me of "Solo Flight" which was immy Mundy's chart featuring the uitar of Charlie Christian with the Benny Goodman band. Spinozza pays is respects with some very Christian-nspired playing. He may have gotten it rom Wes Montgomery but Wes got it rom Charlie Christian. Another plus or "Airborne" is a Mike Mainieri vib-aphone solo and it's been much too long ince I've heard one of those. I guess a ot of people are going to make a fuss ver Spinozza's singing of his own "The Ballerina." I'm not especially taken vith either the singer or the song but hen maybe I'm not the one to be mak-ng value judgements on rock material. get far more pleasure from Spinozza's lelightful acoustic guitar work on 'Doesn't She Know By Now."

As far as the recording goes it's tight and clean and letter perfect with over-



DAVID SPINOZZA: Superb results

dubs and all the latest technological gimmicks in place. It makes for a very slick finished product but just how honest is it—how much of it could be produced "live?" I guess that's not even a legitimate question to ask. The technological advances are here and the artist who doesn't use them, if they suit his music, is probably a fool. And, if it is true that the end justifies the means, whatever means it took to make this record are justified by the superb results.

J.K.

## CLASSICAL

**COLLECTION:** ***"The Budapest Quartet: The Historic Early EMI Recordings (1932-1936)."*** [Disc-to-tape transfers by Ward Marston.] Odyssey Y4 34643.

Performances: **Warm and romantic**
Recordings: **Excellent '30s sound, superbly transferred**

This is one of the most important historic releases in some time—handled with the care such great recordings *always* deserve. Anthony Griffith of British EMI is known for his excellent refurbishing of 78s, but these transfers to LP by Ward Marston are perhaps among the best I've encountered from an American company. Side-joins on this work are virtually undetectable.

Astonishingly, these Budapest Quartet recordings from the 1930s are only

now making their first appearance on 33⅓ rpm. Unlike some legendary recordings, these are every bit as great as their reputation. To begin with, even considering the 40-year-old sonics, the tone and resonance of the instruments is extraordinary, yielding a richness of sound rarely encountered in today's antiseptic chamber music recordings. And, incidentally, these recordings utilize that newfangled experimental technique called "direct-to-disc."

The quartets in this four-record set are by Brahms (No. 3), Mozart (No. 20), Wolf (Italian Serenade), Bartók (No. 2), Schubert (Quartettsatz), Mendelssohn (E-Flat), Beethoven (Nos. 8 and 13). This is a style of playing rarely heard these days, and to some listeners the expressive warmth and commitment will be positively revelatory. Another box of Budapest '30s material is promised in the future. It could hardly be more welcome. S.C.

**DVORAK: *Symphony No. 9*** ("From the New World"). Chicago Symphony Orchestra, Carlo Maria Giulini cond. [Cord Garben, Recording Supervision; Hans-Peter Schweigmann, engineer; recorded in Orchestra Hall, Chicago, Ill.] Deutsche Grammophon 2530 881.

Performance: **Superior**
Recording: **Excellent**

This recording is one of the first made in the Chicago Symphony's regular concert hall since 1966, when remodeling caused an acoustical change that producers found unsuitable for recordings. For over a decade, therefore, the CSO had been "moonlighting" in either Medinah Temple (London, RCA, Angel, DG) or in the Krannert Arts Center (London) at the University of Illinois, over 200 miles away from Chicago.

DG decided to have another go at Orchestra Hall, however, and the results are marvelous! Giulini is in an uncharacteristically taut mood and the Chicagoans give their best. The sonics are rich, warm and clear—bespeaking the work of a producer who attends concerts regularly and knows how to capture that sound with all the depth and spread that one hears from a good orchestra seat in the middle of the hall. A few EMI/Angel recordings (Christopher Bishop, producer) in Medinah have been as successful—recently, Giulini's fine Bruckner Ninth—but one must get British EMI pressings to savor the full quality.

Within the past year, DG has released two Mahler recordings done in Medinah, both of which have received (perplexingly, in my estimation) excellent reviews for performance and sound. Giulini's turgid Mahler Ninth (Günther Breest, producer) is almost totally without front-to-back depth, as if each instrument were lined up on the eave of the stage. Mic placement on Claudio Abbado's intermittently successful Mahler Second (Rainer Brock, producer) is so unfocused that presence and a clean bass line are almost nonexistent. Most of RCA's Chicago recordings with James Levine in Medinah suffer from artificial balances. London has been producing some very flat recordings in Chicago in recent years (e.g.,) Solti's *Le Sacre, Enigma Variations, Zarathustra*), with every instrument seemingly miked and mixed equally. Far more sonically satisfying, on this label, is Solti's recent London Philharmonic recording of Elgar's *Pomp and Circumstances* Marches.

Back to the initial record at hand, however, DG has successfully restored the CSO in Orchestra Hall to its former glory. Giulini takes the first-movement repeat, does not slow down as much as some other conductors in the second and third themes of the first movement, secures clean textures and adopts affectionate but never sentimental phrasing. This superior "New World" stands with DG's Kubelik/Berlin version for a stereo recommendation. In mono, two 1953 recordings—Kubelik/Chicago on Mercury (deleted) and Toscanini/NBC on a re-channeled Victrola disc—are particularly noteworthy. S.C.

## SHOWS and SOUNDTRACKS

**PRETTY BABY: *Sound Track Recording.*** [Jerry Wexler, producer; Skip Godwin and Roberta Grace, engineers; recorded at Sea Saint Studios, New Orleans, La.] ABC 1076.

Performance: **Authentic sounds of the Storyville era**
Recording: **Surprisingly natural—nothing added, nothing subtracted**

For a film score to succeed as a record it needs to do two things. It must underline the dramatic content of the film or it won't be a good film score. It must also be able to stand alone without the fil on its own musical content or it won't b a good record. A soundtrack like the on that Jerry Wexler put together fo Louis Malle's film *Pretty Baby* has built-in advantage. As a collection c pieces which existed independently c and prior to the film, the music doesn depend on the film for its impact. Th music of Jelly Roll Morton, Scott Joplir Kerry Mills and J. Boedewalt Lampe among others, can make for a goo enough LP on its own musical merit Anyone who enjoys music lik "Heliotrope Bouquet," "Creole Belles, "Swipsey Cake Walk" and "King Porte Stomp" will find this record enjoyable i so far as it goes. The one defect is that i an effort to include something of ever recognizable tune that's heard durin the film, "Tiger Rag" is reduced to a forty-six second snippet an "Shreveport Stomps" uses its fifty-nin seconds to negotiate only one brie strain of Jelly Roll Morton' magnificent multi-strained composi tion. Even the five-minute plus versio of "After The Ball" by Kid Thomas an the Jazz Combo sounds like it was just getting up steam when someon signalled for the fade out.

The music is provided by three basi units. One is the solo piano of Bo Greene whose Jelly Roll Morto inspired piano ghosts for the actor wh plays the professor (pianist) in the house (bordello). Another is Lars Edegran's New Orleans Ragtime Orchestra which is already well know from their various albums on Vanguard and other labels. The third and most magnificent, for my money, is the Jazz Combo which includes the punchy horn work of Kid Thomas Valentine and the incredible saxophone playing o Emanuel Paul and the gutsy trombone of Louis Nelson. Yet another configuration emerges for one tune, "Big Lip Blues," which combines pianist Greene and New Orleans Ragtime Orchestra bassist Walter Peyton with legendary clarinetist Louis Cottrell. This may be one of the last chances we get to hear Cottrell for he died shortly after the film was completed. That alone makes giving this album a listen worthwhile.

But the biggest surprise of both the album and the picture is that Hollywood actually left well enough alone. The music was recorded pretty much as it went down with little or no effort spent playing for the grandiose. J.K.

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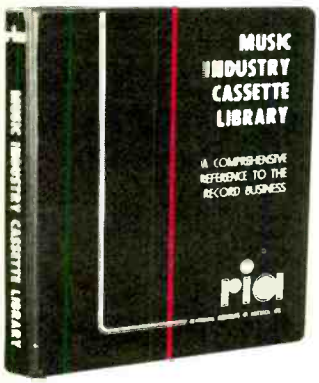



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## Now, professional 3-head monitoring in a cassette deck.

Up to now you had to choose between a cassette deck for convenience. Or, reel-to-reel for professional recording features. Now have it both ways in the Marantz 5030 cassette deck.

Here's how:

The Marantz 5030 has separate record and playback heads... the same as reel-to-reel. This gives you an instant check of the quality of your recording as you record. And, like some of the most expensive reel-to-reel decks, the record and playback heads on the Model 5030 are super-hard permalloy—a long-lasting metal alloy that gives better frequency response and signal to noise ratio than Ferrite material.

For precise azimuth alignment, both the playback/monitoring and record heads are set side-by-side within a single metal enclosure. They can't go out of tracking alignment.

Complementing this outstanding "head-technology" is Full-Process Dolby* Noise Reduction Circuitry. It not only functions during record and playback... but during monitoring as well.

What drives the tape past the heads is every bit as important as the heads themselves. For this reason the Model 5030 has a DC-Servo Motor System. The steadiest, most accurate tape-transport method. Speed accuracy is superb, with Wow and Flutter below 0.05% (WRMS).

To adapt the Model 5030 to any of the three most popular tape formulations, press one of the three buttons marked "Tape EQ and BIAS." There are settings for standard Ferric-Oxide, Chromium Dioxide ($CrO_2$) or Ferri-Chrome (FeCr) tape.

With Mic/Line Mixing, two sources can be recorded at the same time, combining line and microphone inputs. The Master Gain Control lets you increase or decrease the overall volume of the total mix.

What else could we pack into a front load cassette deck?

More features. Like a 3-digit tape counter with memory function. Viscous Damped Vertical-load Cassette Door. Switchable Peak Limiter. Fast-response LED Peak Indicators. 3" Extended-range Professional VU Meters. Locking Pause Control for momentary shut-off in record or play... and Total Shut-off in all modes when the tape ends.

And, of course, the unbeatable Marantz 5030 is front loading. Easy to stack or fit on a shelf. The styling is clean and bold. The sound is the truest recreation of what was put on tape. If you want the best—then do what you really want to do—go for it. Go for Marantz.

25th Anniversary marantz®

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CIRCLE 98 ON READER SERVICE CARD

# Technics introduces three ways to achieve the one ideal: Waveform fidelity.

To achieve waveform fidelity is an achievement in itself. But how Technics audio engineers accomplished it is an even greater achievement.

Like the unprecedented use of two automatically switchable IF bands in the ST-9030 FM tuner. A narrow band for extra-sharp selectivity. And a wide band for extra-high S/N and extra-low distortion. But just as incredible is a pilot-cancel circuit which Technics invented for optimum high-end response. Even the basic tuning function in the ST-9030 is unique. Like an 8-ganged tuning capacitor for outstanding reception.

The engineering in the SU-9070 DC pre-amp is similarly unique. There's a built-in moving coil pre-amp with −157 dBV noise voltage. A moving magnet pre-amp with an extremely high S/N of 100 dB (10 mV input). Direct-coupled circuitry to keep distortion at a minimum of 0.003% (rated THD). What's more, the SU-9070 has inputs for three tape decks.

Finally there's Technics SE-9060 amp. It's DC like our pre-amp. Has a frequency response of 0-100 kHz (+0, −1 dB). And a "strapped" circuit for more than double the power in a multi-amp system.

Compare specifications and prices. And you'll realize there's no comparison for Technics waveform fidelity.

ST-9030. THD (stereo, 1 kHz): Wide—0.03%. Narrow—0.3%. S/N (stereo): 73 dB. FREQUENCY RESPONSE: 20 Hz—18 kHz +0 dB, −0.5 dB. SELECTIVITY: Narrow—90 dB. CAPTURE RATIO: Wide—0.8 dB. IF, IMAGE and SPURIOUS RESPONSE REJECTIONS (98 MHz): 135 dB. STEREO SEPARATION (1 kHz): Wide—50 dB.

SU-9070. PHONO MAX INPUT VOLTAGE (1 kHz RMS): MM—380 mV. MC—9 mV. S/N (IHF A): MM—100 dB (10 mV input). MC—72 dB (50 μV). FREQUENCY RESPONSE: Phono 20 Hz—20 kHz (RIAA ± 0.2 dB).

SE-9060. POWER OUTPUT: 70 watts per channel (stereo), 180 watts (mono) min. RMS into 8 ohms from 20 Hz to 20 kHz with no more than 0.02% total harmonic distortion. S/N: 120 dB (IHF A).

Technics. A rare combination of audio technology. A new standard of audio excellence.

**Technics** *Professional Series*
**by Panasonic**

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