

Audio

The
Authoritative
Magazine
About
High Fidelity

NOVEMBER 1981 • \$1.50 • © 06030

BLANK TAPE
DIRECTORY

INTERVIEW:

TODD
RUNDGREN
ON VIDEO
ARTISTRY

NATIONAL'S
NEW NR CHIP

REVIEWS:

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PREAMP

SONY
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have won Pioneer acclaim throughout the high fidelity industry.

Pioneer's engineers have designed an exclusive ID MOS FET transistor for the front end of the SX-7's tuner. It allows you to tune in stations with weaker signals without worrying about stronger stations causing distortion due to front end overload. That's what keeps the SX-7 virtually free of RF intermodulation.

But no matter how free a receiver is from all forms of distortion, it must be able to keep the station you select perfectly tuned for hours. Pioneer's quartz-PLL digital synthesized tuning does this by making drift virtually impossible.

Pioneer's exclusive
Non-switching™ amp

also eliminates distortion caused by output transistors switching on and off thousands of times a second in response to music signals. This is one of the reasons that the total harmonic distortion of the SX-7 is no more than 0.009% (continuous average power output of 60 watts per channel minimum at 8 ohms, from 20Hz to 20,000Hz).

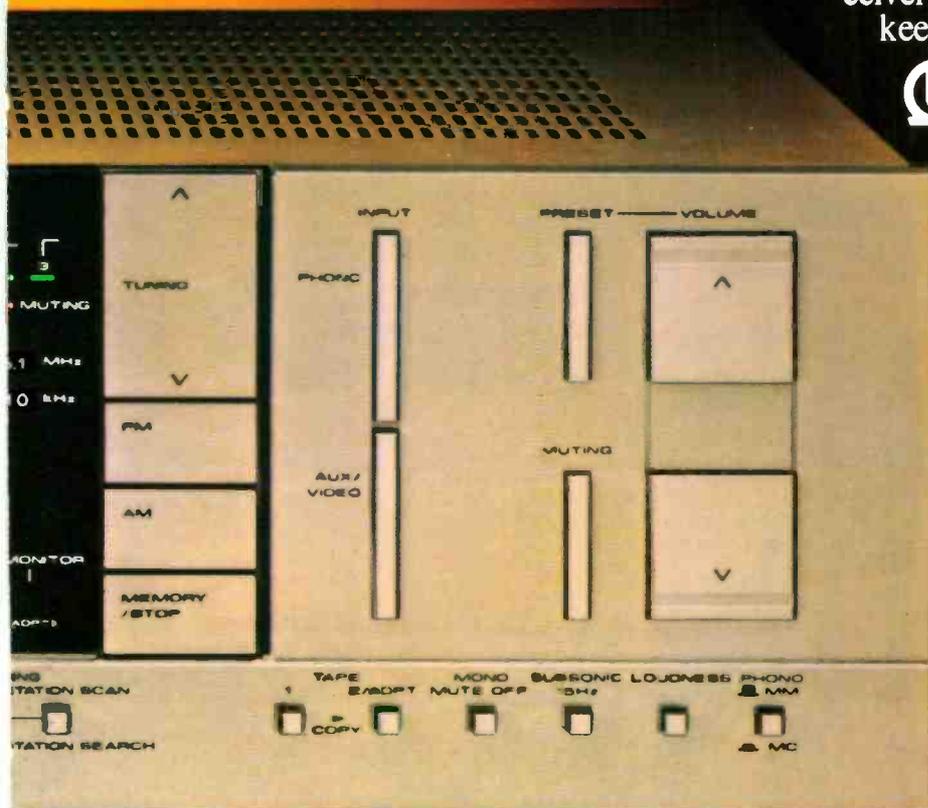
And Pioneer's high-gain phono preamp section allows the use of either MM or low-output MC cartridges selectable by a front panel switch. There's even a Subsonic filter you can use to do away with very low frequency interference caused by record warps.

Now if you think all these features sound great in print, listen to them in person at your nearby Pioneer dealer. He'll demonstrate the SX-7 and an entire new line of Pioneer receivers. And you'll quickly see that we've done everything humanly possible to give you more music for your money.

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AND ONLY PIONEER OFFERS A ENGINEERING CONCEPT ON T

You'd expect a new receiver from the leading manufacturer of stereo receivers to be packed with exciting features. As you can see, it is. But Pioneer didn't get to be No. 1 in receivers by doing the expected and stopping.

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What's more, with just the touch of a button you can search out the next station up (or down) the AM or FM tuning band. Stations are brought in perfectly tuned every time. And you can select any station by tuning it manually or scanning the entire band automatically sampling five seconds of each station.

But these human engineering features aren't all that make the SX-7 such an extraordinary receiver. It also offers features that

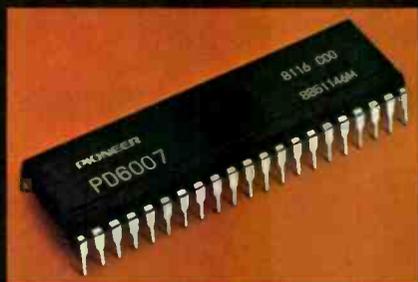
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five seconds of every station strong enough to meet the mute threshold.

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Subsonic Filter:

This control lets you do away with ultra low frequency distortion caused by record warps and such.

Volume Memory:

The SX-7 will also remember the volume you select for each preset station.

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High-Gain Phono Preamp:

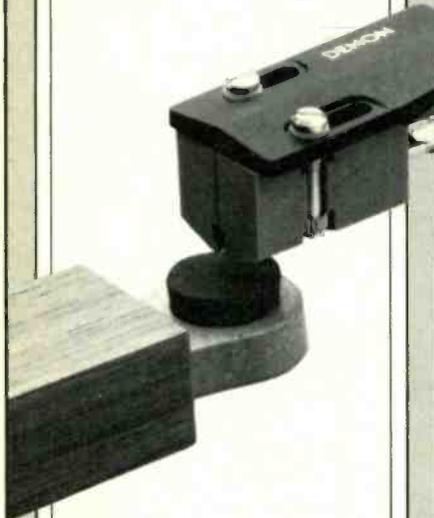
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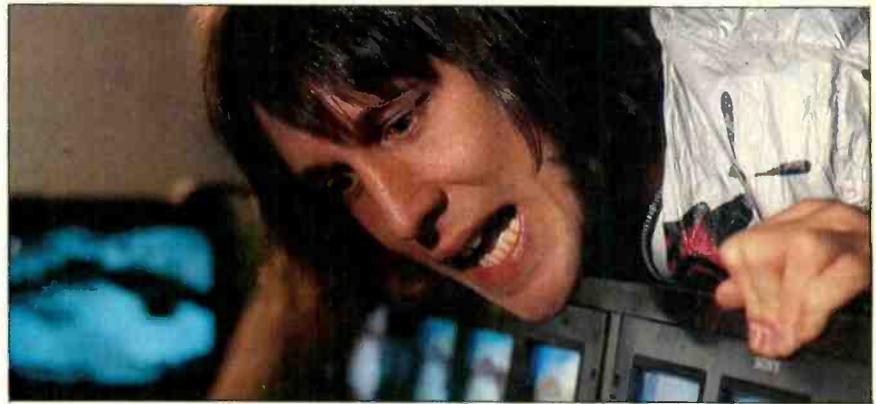
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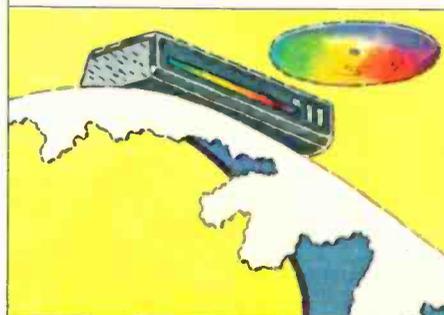
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ABOUT THE COVER: Rock star Todd Rundgren is one of the few artists developing new material specifically for the New Look video formats. Jon and Sally Tiven's interview begins on page 28. Photo by Chris Callis.

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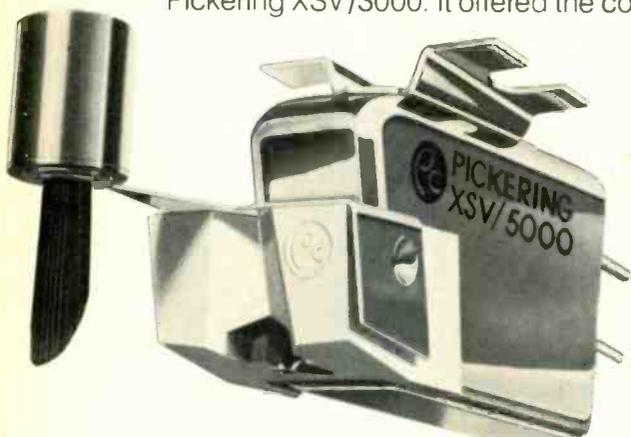
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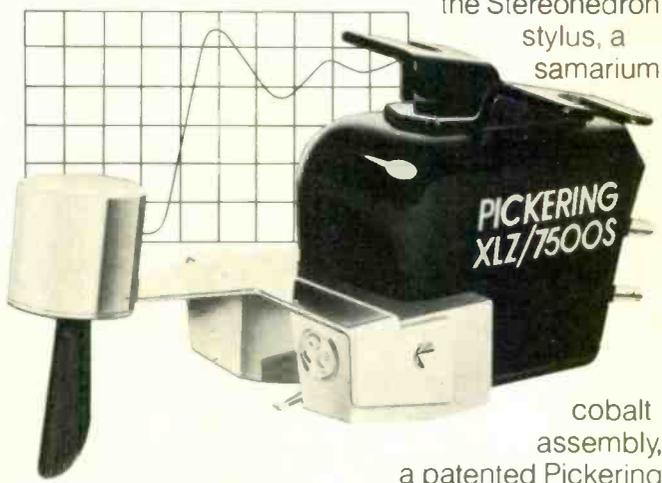
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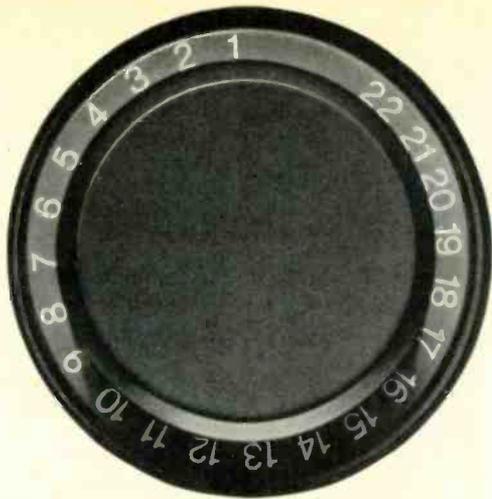


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Must we call them "PZM microphones"? It seems so; like a.c. current. Crown International, which makes PZMs, neatly avoids the redundancy by the following usage, "PZMicrophone" — but how do you pronounce that? By the same logic, we would have "ACurrent" and "DCurrent."

Anyhow, this is Part Two of a PZM discussion, prompted by my experience hearing and seeing these new mikes in use at the 1981 Oregon Bach Festival in Eugene, where I went to hear Bach "live" and stumbled upon PZMs as per my account last month. I came away convinced that this new type of signal picker-upper can indeed lead to basic changes in the entire art of miking, especially with classical music but also in all sorts of sound reinforcement and other speech uses and even in many areas of pop music.

There are some curious aspects of that strange "pressure zone" where the tiny PZM capsule responds to sound, the space within a few thousandths of an inch of a flat plane or barrier, the so-called primary reflecting surface, a space where acoustic sound waves are uncolored by the primary reflections which usually interact to produce interferences, comb-filter patterns of peaks and cancellations which we usual-

ly call coloration, especially in the off-axis response. Not gross distortion, of course. But enough to make vast amounts of trouble, as every engineer knows. Remove that coloration, especially at the sides, the off-axis pickup pattern, and you do indeed have a new mike phenomenon with accompanying pickup characteristics that are sometimes startling. That's PZM.

There's a kind of infinity involved here. The closer you get to the primary reflecting surface, the higher the frequency of the interferences between direct and reflected waves. At the PZM's tiny distance, these occur well above the range of human hearing. That's the idea, if I'm right. Push 'em upstairs where they're harmless. Some engineers will be wondering, I expect, whether, because electronic circuitry "hears" much higher than we do, there are residual problems with the supersonic. See technical lit, but I expect the PZM people have long since figured that one out for a workable arrangement.

More intriguing, what if you just keep moving your PZM pickup capsule closer and closer to its flat plane? The interferences get higher and higher in frequency, right? Good! So you move still closer until — whoops, you've bumped right into it. Dear me, can't do that. Even if your interferences have now zoomed to

infinity. To be sure, infinity is a nice place to relegate unwanted acoustic phenomena but now your mike won't work. It needs room to move, after all. Still, wouldn't it be nice if . . .

Now, this is not my idea, and Alan Yordy of KWAX in Eugene merely dropped an aside on the subject during our long rap about his use of PZMs at the Oregon Bach Festival, but . . . it seems that one of our big audio outfits has been experimenting with exactly this idea. Not so impractical! Just dig a little hole, a pit, and mount your mike capsule right in it, flush with the plane surface. Voila! The infinity-mounted super PZM. (My title, thanks.) Now, I don't know enough acoustical math to say, but I expect that the Achilles heel of such a fine idea might be that little pit, which could set up (relatively) vast reflections of its own, right where you do not want them. Beware of infinity. It's always tricky dealing with a limitless constant.

Yordy (Operations Director of KWAX) first commented to me, on his own use of two pairs of PZMs mounted in clear Plexiglas rectangles, that for stereo — real-time overall stereo, of course — these mikes should be placed considerably farther apart than normal mikes would be.

For his Bach Festival setup, in a moderately large university concert hall or on a big, open stage for a medium-sized orchestra and a chorus (maybe some 50 to 75 people in all), he found the optimum stereo separation was with some 25 feet between the mikes — which is a lot. This jibes precisely with what I'd heard about PZMs, in particular that they have extreme off-axis uniformity, absolutely uncolored sound within a large "half-omni" hemisphere of pickup. At wide angles off-axis, almost all standard mikes are subject to coloration, variably and annoyingly. In a stereo setup, a pair of standard mikes tends to confuse and muddy up the vital center area, since it is "off mike" for both microphones. (Good reason why so many purists use three stereo mikes spaced out overall, even with some loss of stereo separation.) In theory the PZM is absolutely flat all the way out to the sides of its half sphere, and without a doubt it is indeed just that for a very large part of its wide pickup. Hence — *mirabile dictu* — you can use a wide stereo separation with only two PZMs and still achieve a clear, un-



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PZMs can indeed lead to basic changes in the entire art of microphoning, especially in recording of classical music.

confused stereo center. As we used to say (before the Surgeon General), put that in your pipe and smoke it.

In addition, because the PZM cuts way down on the confusion of distant sound pickup, again thanks to that uncomplicated clarity of off-axis coverage, it has extraordinary "reach" — indeed this is probably the first thing most users will discover. Clear, sharp details, like whispers, show up at amazing distances (sometimes all too clearly!). Musical sounds are sharp and well defined even though they originate much farther away than normal. This allows a more distant pickup in all situations, from the overall to solo miking, and goes just fine with that wider stereo separation.

I should note that these PZM effects take us a long way towards approaching that binaural clarity of distance reception which our human ears provide via two discrete "audio" channels, an effect that has never been directly achieved by loudspeakers. Just how PZMs compare with actual human hearing is a subject that'll keep us busy for years.

The biggest factor in PZM use is that flat "baffle" and its size. The larger the area of the flat plane, the lower the bass pickup. Alan Yordy's ideal Plexiglas rectangle would be four feet square (and of quarter-inch stock for rigidity) though his actually are somewhat smaller, but the important point is that one can vary the area according to required use. Smaller areas are fine for voices, either chorus or solo, and even smaller for the speaking voice. People don't talk at 16 Hertz. And there are countless other ways to achieve the required baffle "acreage," including the lid of a piano, a flat conference desk or speaker's stand, a wall, floor or maybe even a ceiling mount, just so your half-omni flat response points in the general direction you need. No off-axis coloration, remember.

Well, hardly any. Yordy did remark that in his practical experience the PZM does color the sound a bit at the extreme edge of the pickup hemisphere — but, mind you, that is out sidewise at almost 90 degrees! Compare this with the usual polar patterns for standard mikes.

A few problems do arise with such unwieldy instruments as the Plexiglas-mounted PZMs, even if they are invisible. A big, thick piece of that stuff is not light in weight, and I shudder to think

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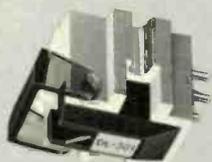
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(Shown with stylus guard removed.)



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In theory, the PZM's pickup is flat all the way out to the sides of its half-sphere, achieving a clear stereo center.

what might happen if one came loose from above and fell on an orchestra, like a French guillotine, perhaps slicing a cello in half along with its player. Yordy's hanging PZMs were, in fact, mounted over the orchestra at the Bach Festival, held in place by a thin guy wire between the two and, presumably, fall-proof.

I assume this placement was to pick up the chorus, in the rear, while the cardioid AKG 414 coincident stereo pair out front picked up the orchestra, and rejected audience noise. Chorus mikes are usually necessary, of course, because the distance ratio between singers in back and orchestra in front is false from close mike range — the live audience hears the music from much further away. But why the PZMs for the chorus, not the out-front overall?

Well, I can tell you. Choral sound is one of the "peakiest" of composite musical waveforms with vast quantities of relatively violent acoustic transient intermodulations, coming from all those different and only partially blending voices. Especially in loud music, this adds up to a mass of what the mike — with the entire circuitry — sees as high-level distortion; worse, the VU meters are treacherous in such situations, reading too low, as I personally discovered to my cost years ago. Serious overloads thus can occur anywhere from mike through to tape or transmitter. Chorus recording is tricky.

The PZM, as noted last month, isn't bothered by high levels; it can take 150 dB, and so can its accompanying circuitry. More importantly, there is once again that fabulous non-interference clarity, uncolored in every direction over a full half-sphere. Off-axis, most mikes add coloration, hence both real distortion and a higher level of "peakery" to choral sound, which means exaggerated brilliance, harshness and overload. It often happens. So Yordy was wise to use his PZMs specifically for voice, both for the strong chorus and the solo vocalists. The standard mikes will do fine for the orchestra.

For the Bach soloists, from one to three or four in a row at the very edge of the stage on one side, Yordy used his second pair of PZMs as described last month. These were mounted on mike stands, desk-like; the Plexiglas, angled upward, was at the singers' ankle level, the stands down on the hall floor a num-

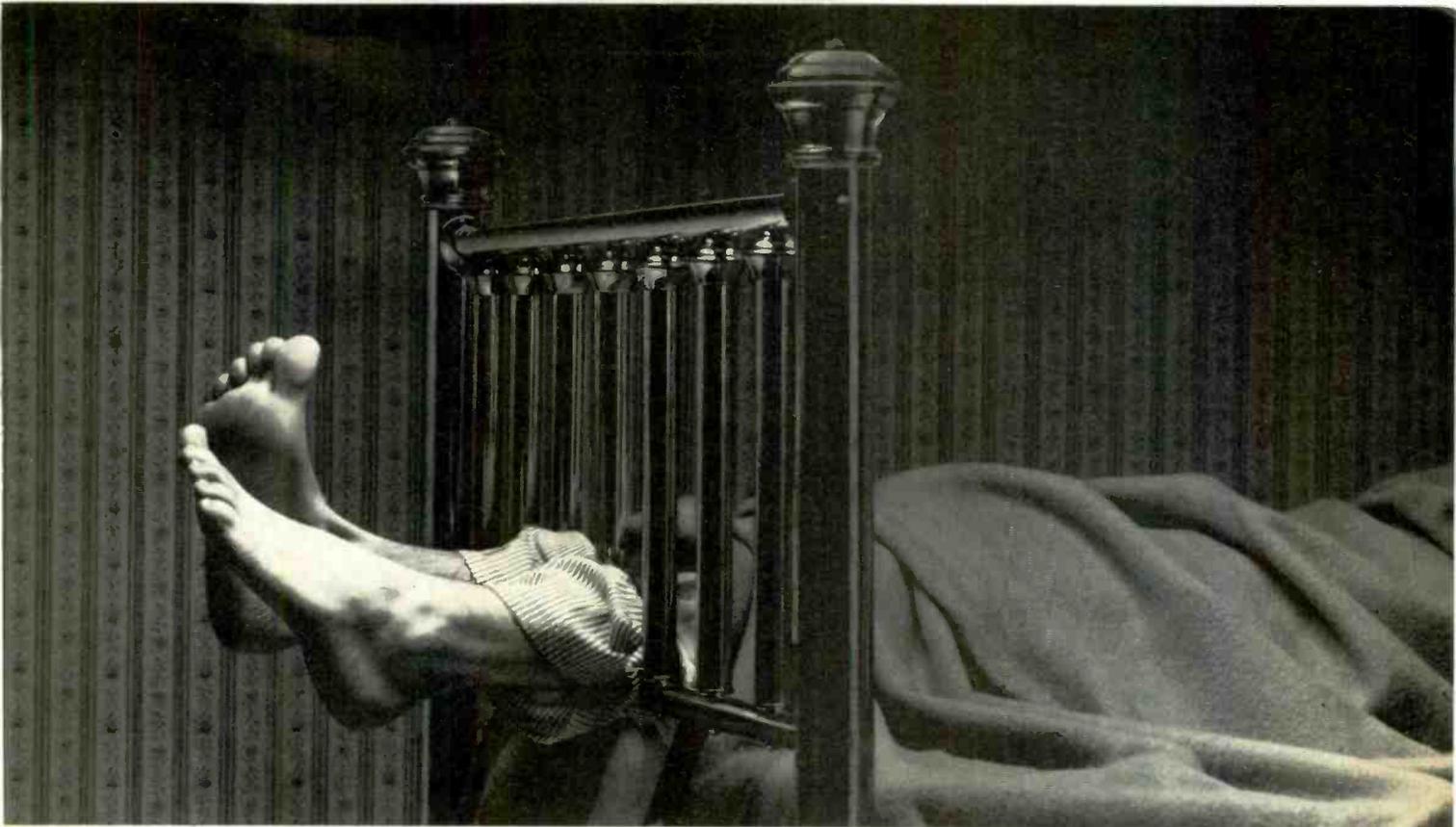
ber of feet below the stage. Due to acoustic mixing problems, the "3-to-1" ratio between overall and solo mikes on the same channel, these PZMs were not in stereo but were tied together in mono and fed into both channels, putting the solos in the broadcast center as I heard them. No change in quality of sound when off-axis, no change from one mike to the other three or four feet away as the sound was balanced according to the number or position of the soloists. Distance was, I'd say, six to eight feet — that's a lot. More flexibility, since it minimized the inevitable movements of the performers.

Result: Steady, ultra-clear solo sound, unvarying in position or in level when heard in broadcast, in spite of all the shifting around from one piece to another on the actual stage.

A final word on KWAX's biggest PZM effort, Mendelssohn's vast oratorio "Elijah" (a Bach-related work) which closed the Bach Festival. For this big show there was a larger orchestra, an augmented chorus behind it, and a battery of solo voices — was it six? — lined up in front of the two PZM floor mikes. The Beall Hall stage was jammed to the gills. But the mike setup remained basically the same. There were two performances on successive nights: I went to the first performance and then listened the next night to the broadcast, all 2½ hours of it.

The results on the air were generally the same as with the Bach, if on a larger scale. Clean, big choral sound from the hanging PZM pair, rock-steady clear solo voices — really remarkable sound — even though the other two PZMs now had to cover six singers in a line. But suddenly I noticed a curious effect. On the left stereo side of the orchestra, some of the second violins sounded extremely close and individually sharp, as though from a solo mike only a few feet away. Odd! Because *there was no solo mike anywhere near them*. As I knew from the previous evening.

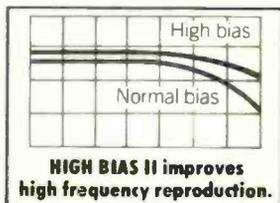
Here's what I think happened. Just my guess. Because of the extra crowding, some of the second violins were pushed back, just barely underneath the hemisphere pickup of those overhanging PZMs aimed towards the rear of the stage. Remember the PZM "reach"? And remember Yordy's comment on extreme-edge PZM coloration? That would do it! Am I right, Alan Yordy? A



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MEMOREX

DEAR EDITOR

One from Column dbx, One from Column CX

Dear Editor:

In his discussion of the CBS CX decoding system and the present dbx system in the August 1981 issue, Edward Tatnall Canby addresses the question of compatibility between dbx-encoded discs and non dbx-encoded equipment. However, he does not address the question of compatibility of dbx-encoded discs and the CBS CX system. In other words, will the CBS system decode dbx as well as CX discs?

What shall it profit the audiophile to have a wide array of encoded discs available from a range of manufacturers if he must buy a separate decoder for each company's records?

Steven J. Haller
Oak Park, Mich.

The Editor Replies — The CX decode system will not handle dbx discs, and this is the thought behind CBS trying to sign up other major record labels to use

the system. They presently include Warner and RCA. To a great extent, I agree with your logic. — E.P.

Words Across the Seas

Dear Editor:

I'm Polish, 25-year-old girl and, since last year, an engineer. I write to you with great request for a pen pal.

I'm a big enthusiast of music, as well as hi-fi and photography equipment. Because of the shortage of these things and information about them.

I apologize for all mistakes I made in this letter, but my English still leaves much to be desired.

Danuta Rajpold

97 300 Piotrkow Jnybunalslu
u1. Sienluewicza 28 m. 38
Poland

Addenda: THD Analyzer

I have found that improved calibration tolerances result if the following changes in resistor values are made in the THD

analyzer: R121: 910k to 1M; R124: 12k to 11k; R179: 2.7k to 3.0k. (See "Parts List" on page 61 of the September issue.)

The third sentence of the caption for Table 3 (page 58) should read, "R (E, F, G, H) should be 5%, ¼-watt carbon-film types where each group of four like values should be matched to within 1%."

Robert R. Cordell

Erratum:

Laser Speaker Testing

On page 43 of the September issue, the definitions for Equation 1 in "Measuring Speaker Motion with a Laser" were incorrect. The equation as given was correct, but the explanation should read as follows:

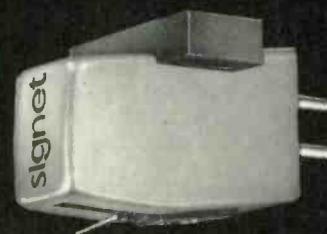
E is the Young's modulus of the cone material, ρ is its density, α is the semi-apex angle of the cone and R_b is its outer radius.

We apologize to the author, G. J. Adams, and the readers for this error.

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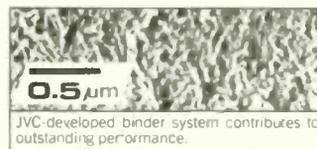
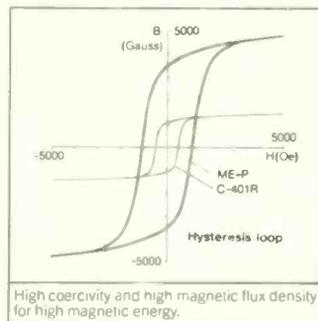


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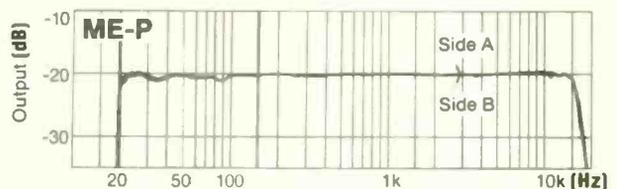
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TAPE GUIDE

HERMAN BURSTEIN

Metal Treble

Q. I use metal tapes with my cassette deck. The manual says that the equalization should be set to 70 μ S for metal tape playback. But the sound is much better if I use the 120- μ S setting. Why?—Thomas Muhlethaler, Kloten, Switzerland

A. The 70- μ S playback equalization denotes bass boost commencing at 2274 Hz; 120 μ S, at 1326 Hz. In relative terms, say relative to 1000 Hz, this signifies more treble cut at 70 μ S than at 120 μ S. Accordingly, there will be more pronounced treble response when using 120- μ S playback equalization. For metal tape, 70 μ S is appropriate.

If a cassette deck is properly adjusted in terms of bias, record equalization, and playback equalization, it should produce substantially flat response to at least 14,000 or 15,000 Hz, particularly with metal-particle tape. The fact that your deck sounds better with 120 μ S than with 70 μ S equalization when using metal tape indicates a fault in your deck. It

might be something as simple as a failure to clean the heads. It may be excessive bias, improper record equalization, improper playback equalization, or some other factor that causes the treble loss. It is probably advisable to have your deck checked by an authorized service station.

Which ips?

Q. Does having an open-reel tape deck with three speeds give more versatility? If so, in what way?—Mark Belloto, Struthers, Ohio

A. Three speeds (presumably 7½, 3¾ and 1½ ips) permit you to make a trade-off between performance (wide and flat frequency response, low distortion, low noise, and low wow and flutter) and playing time. At the two higher speeds you can get generally excellent performance. With a high-quality deck, chances are that you may not be audibly able to detect a significant difference between the two top speeds, although instruments can measure such a differ-

ence easily. At 1½ ips, you will probably detect a difference — more noise and less highs — but not so great as to prevent enjoyable use of this speed. For material such as background music, speech, etc., the 1½-ips speed can give you tremendously long recording time (3 hours and 12 minutes in each direction with a seven-inch reel containing 1800 feet of long-playing tape) along with satisfactory performance.

Former Fan

Q. I found that the left side of my open-reel deck gets hot after about 30 minutes of operation, so I opened it up and installed a small fan. When the fan is on, I detect a slight hum in my speakers. The fan is plugged directly into the wall socket.—Mark Jackson, Hinesville, Ga.

A. The signal produced by a tape playback head is very weak and very deficient in bass. Therefore, this signal must not only be amplified a great deal but also subjected to much bass boost. At the same time, any hum due to a

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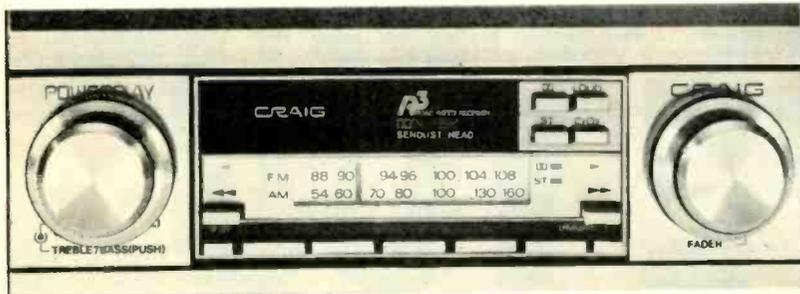


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magnetic field—such as is apparently being picked up from the fan's motor—is also greatly amplified. Relocating or turning the fan or interposing a magnetic shield between the fan and the circuitry *might* help. Probably the best course is to remove the fan. A number of tape decks do get quite hot but are designed to withstand this heat without damage. It would be advisable to get the opinion of an authorized technician on this.

EQ and Bias Basics

Q. I'm confused about tape types, bias, and equalization. Please give me the basic definitions or a basic explanation.—David Barr, Wyandotte, Mich.

A. Because recording on magnetic tape is not a linear process, a high-frequency bias signal is added to the audio signal to get the recording process into a more linear area and reduce distortion. All of the Type I tapes, which are made with ferric oxide, require roughly the same amount of bias current for recording in the linear area, while the Type II tapes, which use a chromium-dioxide or a cobalt-modified ferric particle, require more bias. Type III or ferrichrome tapes need still more bias, and Type IV or metal-particle tapes require yet more.

Even with the bias properly set to achieve the lowest distortion with a given tape, the recording process is not perfectly linear since there are magnetic and other losses which occur. What's done in this case is equalization, essentially a substantial treble boost. Record equalization may also consist of a small bass boost to compensate for the leveling off at 50 Hz, but the amounts of treble and bass boost will vary according to the maker's idea of what is required with a particular tape and his conception of flat response. The treble boost also varies with the amount of bias current, which, in turn, depends on the manufacturer's intent on distortion, noise, and frequency response. Altogether, record equalization on a single tape deck will probably vary with the tape type settings, and it may well vary from one make of deck to another.

Playback equalization, however, has been standardized by the industry. It consists mainly of a very large bass boost to compensate for magnetic characteristics of the tape head, that is, declining signal output with declining frequency. Playback equalization may also

include a relatively small amount of treble boost to compensate for treble losses of the playback head. The industry standards call for 120- μ S equalization for Type I tapes, which means that bass boost begins at 1326 Hz. For the remaining standardized tapes, Types II, III, and IV, 70- μ S equalization is called for by the standard, meaning that bass boost begins at 2274 Hz. Thus, 70 μ S provides more bass boost than 120 μ S. In all cases, bass boost begins to level off at 50 Hz.

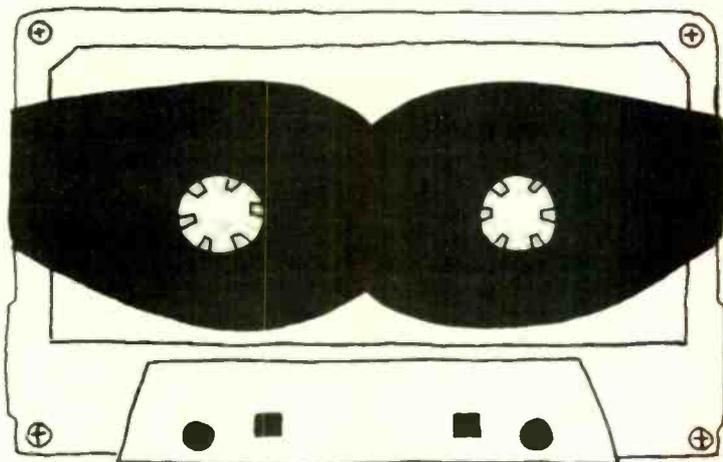
Lethal Levels

Q. How can you tell when amplified music is loud enough to be harmful? What specific type of ear protection is recommended?—Con Schieder, Delta, B.C., Canada

A. Sound levels above 90 dB must be regarded with caution, particularly if sustained for an appreciable time. Levels above approximately 100 dB tend to be dangerous, even for short periods. Rock and disco levels may reach 120 dB or more, and they can produce a good deal of hearing impairment, sometimes permanent. A person whose hearing is already impaired may not realize how loud the sound is, and therefore expose himself to further injury. A sound level meter can tell you what you need to know; such units come at varying prices, some of them quite affordable. Industrial-type ear plugs or ear muffs can help prevent injury.

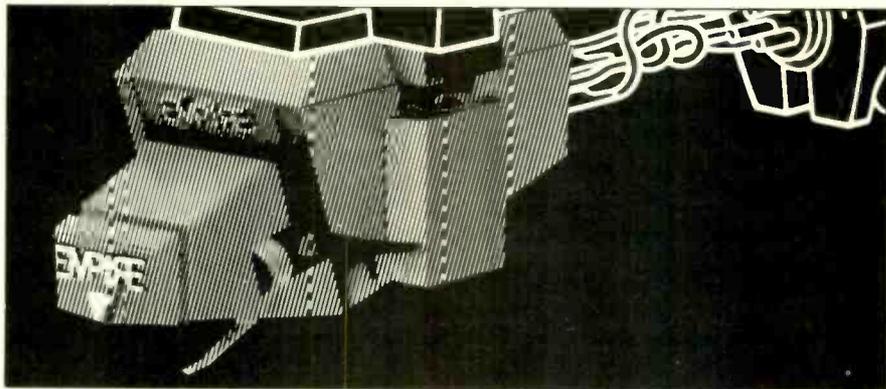
Editor's Note: The January 1981 issue of *Sound and Vibration* contains a buyer's guide to hearing conservation equipment and lists a dozen makers of either ear muffs or plugs for hearing protection. Of these, I can recommend three from personal experience: Muffs from David Clark Co., 360 Franklin St., Worcester, Mass. 01604, and plugs from E-A-R Corporation, 7911 Zionsville Rd., Indianapolis, Ind. 46268 and from Flents Products, 14 Orchard St., Norwalk, Conn. 06850. Such items are invaluable to Editors-in-Chief when Editorial Assistants are asking for raises, not to mention when receiving flack from irate advertisers. — E.P. 

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.



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Patch as Patch Can

Q. Is there any point in wiring an entire system with low-capacitance patch cords or am I wasting my money on a marginal improvement? — Sp-4 Darrel Babin, APO N.Y.

A. Unless audio cable runs are long, 50 feet or so, capacitance has little effect on performance. Of course, the exception to this is phonograph interconnections. Phonograph cartridges often must "see" some given amount of capacitance. Therefore, the kind of cable you use in this case is, in part, dictated by its capacitance and by the amount of capacitance your phonograph cartridge requires.

It is often true that low-capacitance cables do not have good shielding and thus are more subject to the pickup of r.f. interference than some of the high-capacitance cables.

Obviously, as patch cords are relatively short, there is no need to use low-capacitance cables for this purpose.

Correspondence Course In FM Stereo Reception

A reader on the West Coast wrote both to me and to the chief engineer of an FM station to which he listens. He complained that despite the installation of a directional antenna, complete with coaxial cable, his stereo FM reception was noisy.

This seemed hard for me to believe, inasmuch as he was located relatively close to this desired station. I suggested that my correspondent check his antenna installation once again, looking for defective balun transformers, poorly soldered connections, etc.

I thought that this was the end of the matter. My correspondent, however, kindly forwarded the reply from the broadcast engineer. Inasmuch as his diagnosis of the situation proved to be correct, I am including it here with the hope that it will be of help to others who may at some time be afflicted with this interesting and annoying situation. —J.G.

"Trying to diagnose reception problems at a distance is like trying to diagnose illness over the telephone. I believe your problem is caused by receiver front-end overload from the very high-power FM transmitters located on Wolfback Ridge, behind Sausalito.

"The cure for this problem is to continue to use your outdoor antenna with

an attenuator inserted in the line next to the receiver. You should use the balun at the receiver and at the antenna, with RG/59 coaxial cable between the baluns.

"The value of the attenuator must be determined experimentally. The idea is to reduce the strength of the unwanted signals to a value which will no longer overload the receiver without reducing the desired signal to a point where it becomes noisy because of lack of strength.

"Plug-in attenuators for use with 75-ohm cables are available from electronics dealers who supply cable television equipment. I suggest the use of a 20-dB attenuator to begin with. If you locate a dealer with a stock of attenuators, arrange exchange privileges until you locate a value which works." — Fred Krock, Orinda, Cal.

Punch and Tweeter Show

Q. My left channel has more "impact" or "punch" than my right channel. Conversely, my right channel sounds "thin" when compared to the left channel. What can I do to get better stereo imaging, with equal punch from both channels? — Lawrence A. Joe, Toronto, Ont., Canada

A. The difference in punch between the left and the right channel may be resulting from room acoustics problems. Without moving the speakers, interchange the cables between the two speakers so that the cable which was intended to serve the left channel now serves the right, and vice versa. If the difference in sound quality still remains — with the left channel still having more punch — you have ruled out all possibilities except differences in the speakers or anomalies in room acoustics.

To determine which of these conditions is the culprit, interchange the left and right speakers, being careful to place them in the exact positions their "partner" previously occupied. If the lack of punch still occurs in the left channel, the problem is caused by room acoustics. If the right channel now has the problem, you will know that the problem lies with the speakers — tweeter balance being the most likely problem. Hopefully your speakers will have means for making such an adjustment.

If the quality shifted to the right channel when you made the original cable interchange, both speaker problems and

room acoustics are ruled out. You must look elsewhere in your system for the answer.

If you interchange the two channels from the turntable and the problem shifts to the opposite channel, you will know that there are differences in the phono cartridge from one channel to the other.

If the problem does not shift with the interchange of phonograph channels, you are left with possible differences in the tone controls, phono stage or amplification. You will then need to measure the electrical performance of each channel for further evaluation.

Ground to Earth

Q. I have several questions concerning audio system grounding.

1. When using a number of separate components, is it better to (a) run a separate chassis ground wire from each component to a central grounding point, and from that point to ground or (b) run a single chassis ground wire from chassis to chassis, and from there to ground?

2. Should the main earth grounding wire be tied to the ground on a three-prong grounded outlet or would it be better to run the main earth ground wire to its own separate earth-grounding point, such as a cold water pipe? — David Yandle, Berkeley, Cal.

A. There are no hard and fast rules about grounding. I have seen cases where no grounding whatsoever is the way to keep hum at a minimum and therefore suggest starting out that way. If you find, for example, that the tape machine produces excessive hum, run a wire between the tape recorder chassis and the preamplifier or receiver chassis. One thing is virtually certain, however. The phonograph should be grounded to the preamplifier or receiver, preferably at a point near the phono inputs.

If the main unit in your sound system has a three-wire power line system, no earth grounding is likely to be required. Chances are good that you will not need to run wires between the rest of the components and the amplifier, or whatever serves as your main control center.

When it is necessary to run grounds between pieces of equipment, each one is to be run to the control center. My own rule is that if they are not required to reduce hum, do not use them.

It is only where you do not use a three-prong outlet that you may need to

DISCOVER THE REAL MUSIC IN YOUR COLLECTION.

consider some kind of earth ground. Using both an earth ground as well as that which automatically occurs when using a properly installed, three-prong outlet will likely add hum and, in some cases, produce rather severe voltage differences between the earth ground and that taken as ground by the three-prong outlet's own ground.

Switching to Drive

Q. I would like to know if there will be any problem involving impedance, performance degradation, chances of equipment damage, etc. when driving the power amplifier sections of three inexpensive receivers, equipped with preamplifier outputs and power amplifier inputs, from the preamplifier outputs of one of the receivers, feeding through an equalizer. In essence, I would be using the second and third receivers as power amplifiers only.

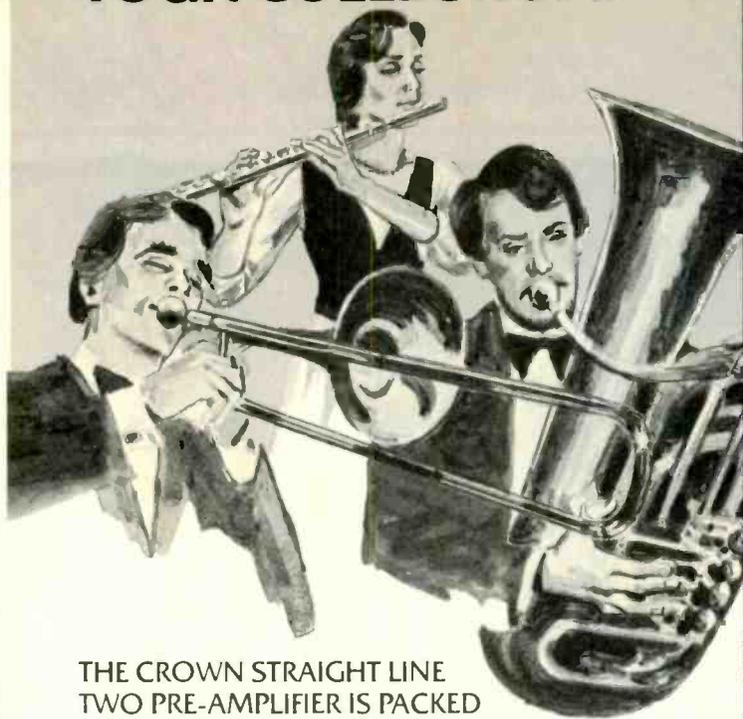
I know this could be accomplished via the tape monitor loops but I wish to control all six channels of amplification (only two channels of program source) with one volume control to avoid building or purchasing any special equipment. — H. Schulman, Detroit, Mich.

A. There is no problem feeding three power amplifier sections in three receivers from the outputs of one receiver's preamplifier. You will have to work out Y connectors or some similar means in order to accomplish your purpose of having all amplifiers controlled by the same volume control on the "master" receiver.

I suppose that, if you have long cable runs between the preamplifier and the inputs to the receiver, there could possibly be some loss of highs which you could make up by the use of the equalizer. I hope that the equalizer has a low-impedance output so that this will shunt out virtually all capacitive reactance of the interconnecting cables.

Your idea will work whether or not the equalizer is interposed between the preamplifier's outputs and the various power amplifier inputs. In any case, no damage will be produced by so arranging your gear. A

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1515 Broadway, New York, N.Y. 10036. All letters are answered. Please enclose a stamped, self-addressed envelope.



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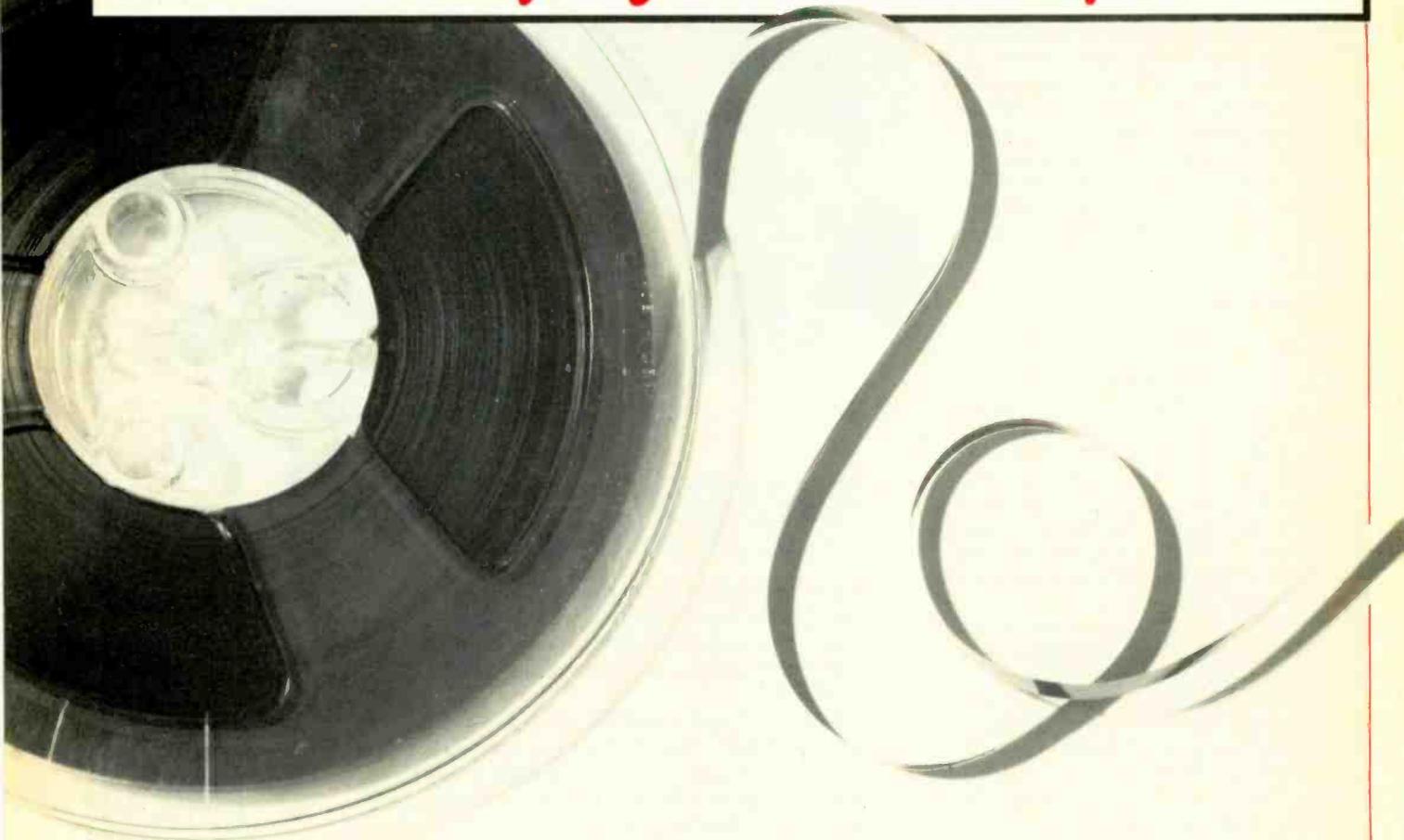
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BASF

Crosby Dr.
Bedford, Mass. 01730

Denon

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Fairfield, N.J. 07006

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Haddon Heights, N.J. 08035

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New York, N.Y. 10118

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JVC

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Carson, Cal. 90745

Loranger Entertainment

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ReVox

1425 Elm Hill Pike
Nashville, Tenn. 37210

RKO Tape

3 Fairfield Crescent
West Caldwell, N.J. 07006

Sony

9 West 57th St.
New York, N.Y. 10019

Swire InterMagnetics

234 West 146th St.
Gardena, Cal. 90248

TDK

755 Eastgate Blvd.
Garden City, N.Y. 11530

There's More to Noise Reduction Than Silence.

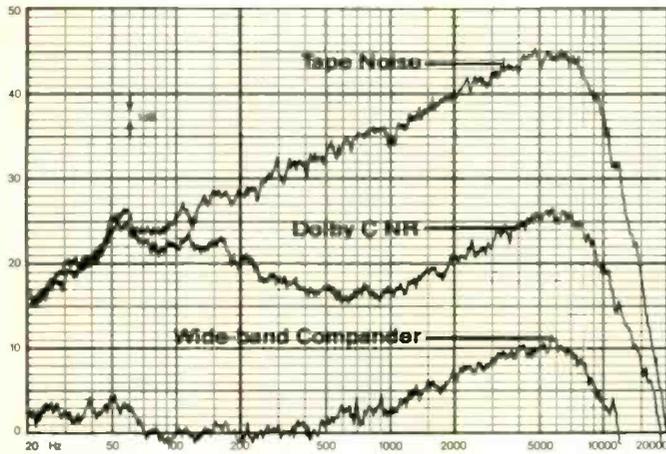


FIGURE 1: NOISE AND NOISE REDUCTION IN THE ABSENCE OF MUSIC.

Noise from biased cassette tape without noise reduction, the effects of Dolby C-type noise reduction, and the effects of a wide-band compander are shown in the absence of any signal.* Dolby C's noise reduction effect results in an overall perceived noise level below the ambient noise of many listening rooms, even at high playback levels. In the absence of signals, the conventional wide-band compander provides still more electrical noise reduction (but usually no more audible noise reduction).

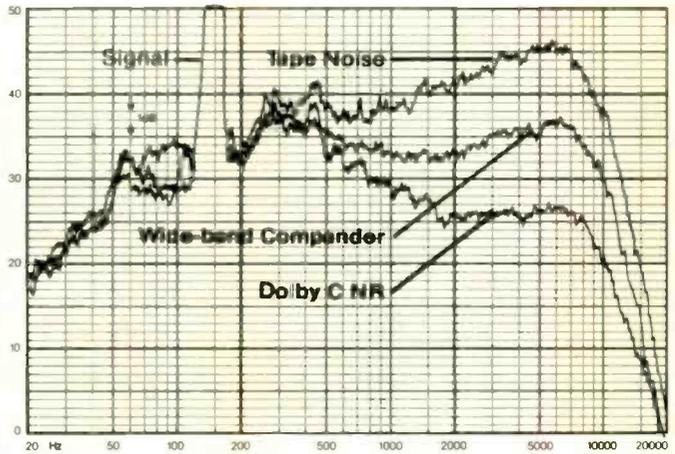


FIGURE 2: NOISE AND NOISE REDUCTION IN THE PRESENCE OF MUSIC.

In the presence of a signal (148 Hz, D below middle C on the piano, recorded at Dolby level), in all cases noise in the region of the signal will be masked by it. However, at higher frequencies, especially between 2 kHz and 10 kHz where tape hiss is clearly audible, Dolby noise reduction provides almost as much noise reduction as if the signal weren't there, while the compander allows the noise to increase to a considerably higher level than with Dolby C.

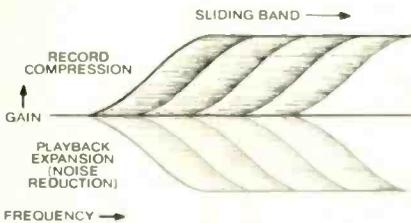


FIGURE 3: THE SLIDING BAND PRINCIPLE.

Dolby noise reduction operates over a band of frequencies which slides up out of the way of the music, resulting in noise reduction just where there is no musical signal to hide the noise. Thus the perceived noise level is consistently low at all times.

Providing noise reduction on silence is not all that difficult. For years, conventional wide-band companders have been available which dramatically reduce noise — between selections on a tape or record.

Yet it is just as important to have noise reduction when there is music playing. While music will mask noise part of the time, there are times when it won't. A bass drum note, for example, cannot hide tape hiss, no matter how loud the drum is: the ear can detect both simultaneously.

Conventional noise reduction systems effect noise reduction at the time of playback by turning down the volume when there is little or no music present. This turns down the noise as well. But they also turn the volume back up again on louder music, and so turn the noise back up at the same time. Thus the bass drum note is accompanied by a burst of tape hiss — hiss which is audible if there is no music at higher frequencies to hide it.

This problem is called noise modulation. It means that with a conventional NR system, the noise level is constantly shifting up and down with changes in the level of the music. But Dolby noise reduction, on the other hand, is free of noise modulation on virtually any type of music (Figures 1 and 2).

Unlike conventional companders, Dolby noise reduction operates over a constantly changing, or sliding band of frequencies (Figure 3). The band extends low enough to provide very effective noise reduction on silence. But in the presence of music, the band slides up just out of the way of the music, so that noise at frequencies above the music is almost as effectively reduced as if the music weren't there.

Both Dolby B-type and Dolby C-type noise reduction are sliding-band systems. With the standard B-type system, noise reduction begins at 500 Hz and increases to 10 dB at 4 kHz and above, while with the new C-type system, noise reduction begins at 100 Hz and increases to 20 dB at 1 kHz and above. With either system, the presence of music does not prevent noise reduction from occurring where it is still needed.

*70µs equalization, measured with a constant-bandwidth wave analyzer, and weighted (CCIR/ARM) to reflect the ear's sensitivity to noise and noise reduction effects.

DD Dolby®

Dolby Laboratories Licensing Corp.,
731 Sansome St., San Francisco, CA 94111.
Telephone (415) 392-0300. Telex 34409.

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Blank Tape

MANUFACTURER	Brand	Recommended Bias Level	Cassettes					Open-Reel				Notes	
			C-30	C-45	C-60	C-90	C-120	1200 Ft.	1800 Ft.	2400 Ft.	3600 Ft.		
ADAMS MAGNETIC	Studio-EC	Normal	2.19		2.39	3.19							
	Studio-FE203	Normal	2.49		2.89	3.49							
	Studio-Superchrome Spoken Word	High			4.49	5.89							
AIWA	MX	Normal			2.39	3.19							
	3MC-60LHY 3MC-46MXY	Ferric Metal		6.50†	8.70 3.50	11.90							†C-46.
AUDIO MAGNETICS	TRACS	Normal		1.49	1.59	2.19	2.69						
	High Performance I	Normal			3.49	4.49							
	High Performance II Cycles	High			3.99	4.65							
BASF	Pro I	Normal			3.99	5.49							
	Pro II	Normal			4.49	5.99							
	Pro III Ferro LH Perf.	FeCr		2.59	4.29	5.79	3.99	4.99		12.99	16.99		
DENON	DX1	Normal			2.75	3.85							
	DX3	Normal			3.99	5.60							
	DX5	Normal			5.00	7.00							
	DX7	FeCr			5.00	7.00							
	DXM	Chrome Metal			8.60	12.00							Dual coated. As above, cobalt-modified particle. As above.
DIRECT-TO-TAPE RECORDING	Direct II	Chrome			3.75†	4.50††							†C-68; ††C-96.
	ASF	Normal			2.95†	3.50††							†C-66; ††C-96.
	Agfa Professional I	Normal			2.10	2.50	3.70						
	Agfa PEM 368								8.25		8.75		
	Agfa PEM 468									4.50			
	Agfa PE 36										8.80		
	Ampex 407 Ampex 642 Ampex 456 (Grandmaster)								7.90†		5.30		
FUJI	FL	Normal		3.00	3.40	4.70	6.50						
	FX-I	Normal		4.25	4.89	6.70							
	FX-II	High		4.40	5.10	6.95							
	Metal	Metal		8.30	9.10	12.00							
IRISH MAGNETIC INDUSTRIES	Irish	Normal	1.50		1.75	2.15		8.95	11.25	17.40			
	Irish Emerald	Normal			2.10	2.70		12.25	15.25		6.75		
JVC	ME-P	Metal		11.50	13.50								
	ME	Metal		9.50	11.00								
KENWOOD	MD				12.00	15.00							
	CD				5.50	7.50							
	ND				4.50	6.50							
	N				3.50	4.50							
LORANGER	Loran	Chrome			5.75	7.95							
	Loran	Normal		4.55†	5.55	7.65							†C-46.
	Loran	FeCr			5.65	7.75							
	Loran	Metal			12.70	15.75							
LUXMAN	XN-IV	Metal				14.95						Skew adjustment.	
3M	Scotch Metafine	Metal		7.19†	7.99	10.29							†C-46.
	Scotch Master I	Normal		3.79†	4.09	5.39							
	Scotch Master II	Chrome		4.39†	4.79	5.99							
	Scotch Master III	Normal		4.39†	4.79	5.99							
	Scotch Dynarange	Normal		2.79†	3.29	4.59	6.39	6.29	8.39	12.59	16.59		600-ft. reel, \$4.09; 900-ft. reel, \$4.89.
	Scotch Highlander	Normal		1.69†	1.99	2.99	4.39	5.49	7.59		35.69		
	Scotch Master XS Scotch 206-207							7.99	9.99				
MAXELL (Continued)	MX XL I-S XL II-S	Metal Normal High		8.95†	9.95 5.10 5.10	11.95 6.95 6.95							†C-46.

Last year we gave our competition a lesson in geometry. This year it's physics.

For years, we've patiently explained why curved tonearms contribute nothing to record playback except higher mass and instability.

Finally, this simple lesson in tonearm geometry began to sink in. And as you've seen, more and more turntable manufacturers are now going straight.



Dual 508

While that's a step in the right direction, they still have a lot to learn before they can match the performance of a Dual.

Which brings us to Ultra Low Mass and the *physics* of tracking records.

Simply stated, the lower the mass of the tonearm, the better it will track. Especially on warped records.

So when we introduced ULM with total effective mass under 8 grams, it was quickly recognized as a major breakthrough in record playback technology. (Conventional tonearm and cartridge combinations typically have 18 grams total effective mass.)

All the independent test labs quickly appreciated the benefits of ULM. Julian Hirsch reported in *Stereo Review*: "... tracked the most severely warped records in our collection, usually so well that we heard nothing wrong."

And when you consider that most records manufactured today are warped, ULM is not just desirable—it's *essential*.

No surprise that our competitors are beginning to lower the mass of their tonearms.

But that doesn't make their turntables perform like a Dual any more than straightening their tonearms did.

Which brings us to the most important lesson of all: You can't equal a Dual by simply imitating one part of it. Or even two.

Because what makes a Dual a Dual is much more than its straight-line tubular design or Ultra Low Mass.

It's also the four-point gyroscopic gimbal. The new XM300

alloy (the most rigid and resonance-free material ever used for a tonearm.) The tunable anti-resonance filter that matches the tonearm to the mass and compliance of all available cartridges. And the unique tracking force and anti-skating systems that don't disturb the tonearm's perfect dynamic balance or increase its effective mass.

Beyond all this, there's the matchless craftsmanship long synonymous with Dual and West Germany.

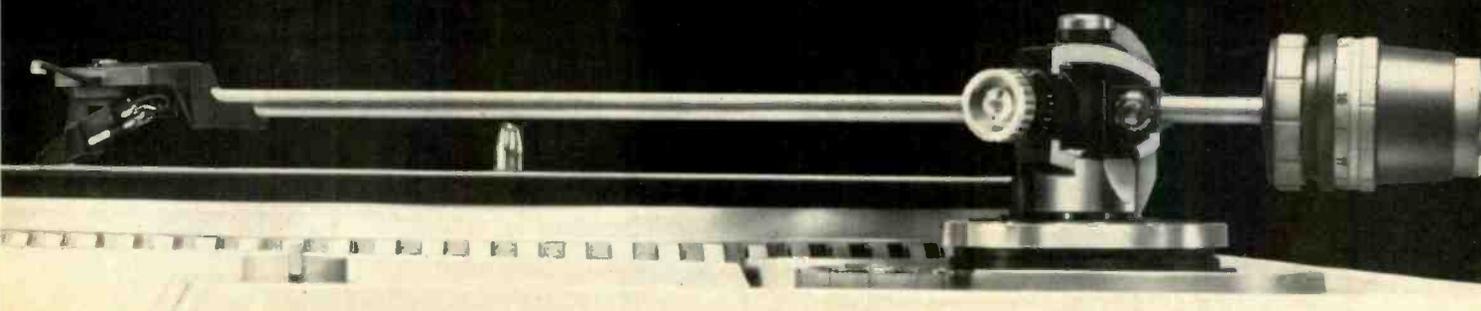
Fortunately, you don't have to wait until other manufacturers have learned all their lessons. Because we did our homework a long time ago.

Nor have we overlooked the subject of value. For example, the single-play, semi-automatic Dual 508 with Vario-belt drive is less than \$160.

For the complete curriculum covering all ten new ULM turntables, write to United Audio, 120 So. Columbus Ave., Dept. A, Mt. Vernon, NY 10553.

Dual[®]

Exclusive U.S. distribution agency for Dual.



Blank Tape

MANUFACTURER	Brand	Recommended Bias Level	Cassettes							Open-Reel				Notes
			C-30	C-45	C-60	C-90	C-120	1200 Ft.	1800 Ft.	2400 Ft.	3600 Ft.			
MAXELL (Continued)	UD-XL I	Normal			4.39	5.99								For EE-capable decks. As above. Professional back coated, 7-inch plastic reel. As above. †2500 feet; professional back coated, 10½-inch metal reel. As above. Seven-inch plastic reel. As above. †2500 feet; 10½-inch metal reel. As above.
	UD-XL II	High			4.39	5.99								
	UD	Normal	3.09†		3.35	4.95	6.65							
	LN	Normal	2.05†		2.25	3.45	4.45							
	XLII 35-90	Chrome							10.75			19.00		
	XLII 35-180	Chrome										52.00		
UD-XL50-60B	Normal													
UD-XL35-90B	Normal											29.15†		
UD-XL50-120B	Normal													
UD-XL35-180B	Normal												33.30	
UD50-60	Normal							8.60						
UD35-90	Normal									9.90				
UD50-120	Normal											24.45†		
UD35-180	Normal												27.55	
MEMOREX	Metal IV	Metal			7.49	9.99								
	High Bias II	High	2.99	3.19	4.39	5.99								
MR CASSETTE	MRX I	Normal			3.39	4.99	6.79							
MR CASSETTE	GST	Chrome			2.99	3.99								
	Correct	Normal			4.50	6.00	8.25							
	Replacement DE													
	Correct	Normal			3.00	4.50	6.75							
	Replacement HE	Normal			2.50	3.50	5.50							
Correct	Normal													
Replacement LN	Normal			3.00	4.50	6.00								
Toyota	Normal													
Grandmaster	Normal													
Grandmaster	Chrome										100.00			
NAKAMICHI	ZX	Metal			9.75	13.50								
	SX	Chrome			6.30	8.00								
	EXII	Normal			6.00	7.80								
OSAWA	MX	Metal		7.99	8.99									
	CR	Chrome			3.99	5.49								
	FC	Chrome			3.99	5.49								Dual coat, ferri-cobalt. Dual coat, ferri-chrome.
RADIO SHACK	Supertape	Metal			7.95	9.95								
	Supertape	Chrome			3.99	4.99								
	Supertape	Normal		2.69	2.99	3.99	4.99							
	Gold													
Realistic	Normal	1.59		1.99	2.79	3.49								
Low Noise														
Supertape								5.59	5.99			10.99		
Realistic								3.79	4.99			7.79		
Concertape	Normal	.66		.88	1.25	1.66				5.99				
REVOX	631												36.00	
RKO TAPE	Ultrachrome	Chrome			4.49	5.99								
Broadcast I	Normal				3.99	5.49								
Xtra-Dynamic	Normal		2.49		2.99	3.99								
SONY	FeCr7-550BL										14.00			
	FeCr11-1100BL												39.00	
	ULH72-370BL								9.00					
	ULH7-550BL										11.50			
	ULH11-1100BL												31.00	
	LNX	Normal		2.05†	2.25	3.20	4.15							†C-46.
	HFX	Normal		3.00†	3.20	4.55	6.20							
	SHF	Normal		3.40†	3.85	5.20								
	EHF	High		3.70†	4.15	5.75								
	FeCr	Normal		4.35†	4.75	6.10								
Metallic	Metal		8.00†	10.00	13.00									
SWIRE INTER-MAGNETICS	XL	Normal		.99	1.29	1.79	2.29							
	Laser	Normal		1.29	1.79	2.29	2.79							
TDK	MA	Metal			10.60	14.40								
	SA	High			5.50	7.75								
	AD	Normal	2.60	2.85†	4.10	6.00	5.00							
	D	Normal			3.10	4.25								
	LX50-120BM											35.00		†C-46; C-180. \$7.00. Back treated.
	LX50-60B												38.75	As above.
	LX-180BM													As above.
	LX-35-90B										13.75			As above.
	LX-35-180M													
	LX-35-90										12.50			
	SA35-90										20.00			
	SA35-180M	Chrome											52.50	For EE-capable decks. As above.
	MA-R	Chrome												
SA-X	Metal			14.30	19.20									
OD	High			6.00	8.40									
GX50-60B	Normal			4.70	6.60									
GX50-120BM											13.75		Back coated. As above.	
GX35-90B											16.25		As above.	
GX35-180BM												43.75	As above.	



SA-X. HIGH BIAS IS RICHER FOR IT.

The greatest honor a cassette can receive is to be held in higher esteem than the one now setting the high bias standard. SA-X has already gone beyond SA in frequency response, sensitivity, and resolution. It was intended to. With its ultra refined dual layer of Super Avilyn and the Laboratory Standard Mechanism, nothing less was possible. TDK believes sound reproduction should have no set barrier. No limit. For us, high bias was a limit to be surpassed. SA-X has won three international audio awards to date. It will no doubt win others. But we take awards philosophically. They represent our continuing effort to create the machine for your machine. In that, we could not be happier with SA-X.

 **TDK**
The Machine For Your Machine



Todd Rundgren

JON and SALLY TIVEN

Todd Rundgren was one of the first pop musicians to return from one side of the soundproof glass to the other to sit in the producer's chair, seeking to realize his sonic visions to the fullest. As a pop superstar in the Sixties and Seventies, he had written and performed hits



like "Hello, It's Me," "I Saw the Light," and "We Gotta Get You a Woman," and acted as producer for numerous albums by other performers. After building his own sound recording studio near his home in the Woodstock area of New York, he assembled a video complex that has come to be known as Utopia Video, a comprehensive multimedia production facility with a mind-boggling array of futuristic equipment.

Rundgren has made a life's work of mastering the technology of the arts and using it to fulfill his artistic fantasies — first in music, and now in multimedia productions which he intends to be as stunning as his sonic creations.

With the numerous new technological

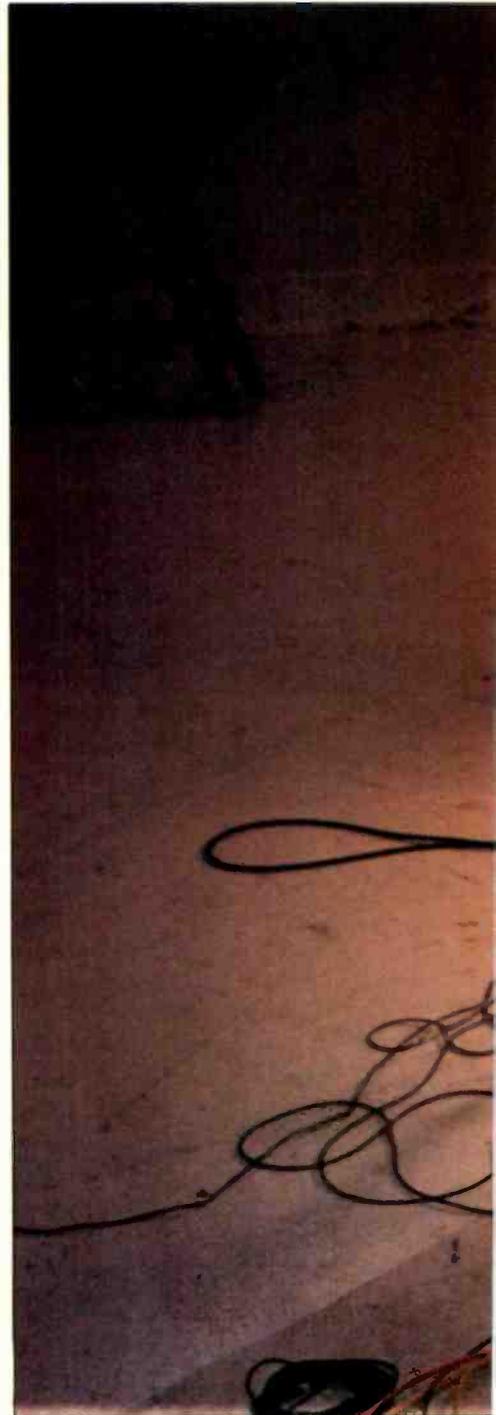
advances of the video era just now appearing, Rundgren has developed serious reservations about how the current methods of marketing the arts and entertainment may affect the way we receive

information and entertainment. He sees broad changes and serious problems in the direction the video era is headed — for the artist, the consumer, and the business community.

In this interview, conducted with Audio Contributing Editors Jon and Sally Tiven at the Utopia Video facility, he describes his view of the "video revolution" and its future in characteristically outspoken terms.

Audio: Any mention of the video revolution hinges on one of a handful of specific new technologies, and the videodisc is held out by many to be the most promising and potentially profitable among them. What do you think about the future of the videodisc? Can it overcome the problems of the various non-compatible formats and the attractiveness of recordable media like tape?

Rundgren: No, I think that the videodisc may have some appeal for those with a dilettante mentality. But for most people, those who are increasingly practical about the way they spend their money, I don't think videodisc will prove attractive. The failure of the videodisc will be caused by the same afflictions that have affected the American auto industry, shortsightedness, greed, and a smug



The failure of the videodisc will be caused by the same afflictions that have affected the American auto industry, shortsightedness, greed, and a smug view that you don't have to cooperate to make a product successful.



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view that you don't have to cooperate with anyone else in order to make a product or an idea successful.

Other forms of media distribution, meanwhile, are overtaking the videodisc. Computerized information storage and retrieval is far more sophisticated than either cassette or disc, and it's possible to store any kind of information — musical, numerical, graphic — that way. You can digitize the music and store it in a form that is readable by laser. Beyond that is temporary storage on magnetic tape or bubble memory. Eventually, you will be able to store a record on a tiny chip and have access to any part of it immediately — the so-called solid-state memory.

The videodisc people may manage to sell enough machines — if they're lucky — to amortize their long costly investment in hardware development, but that's only if they're lucky. Videodisc will probably end up being sold primarily to educational institutions rather than to the consumer.

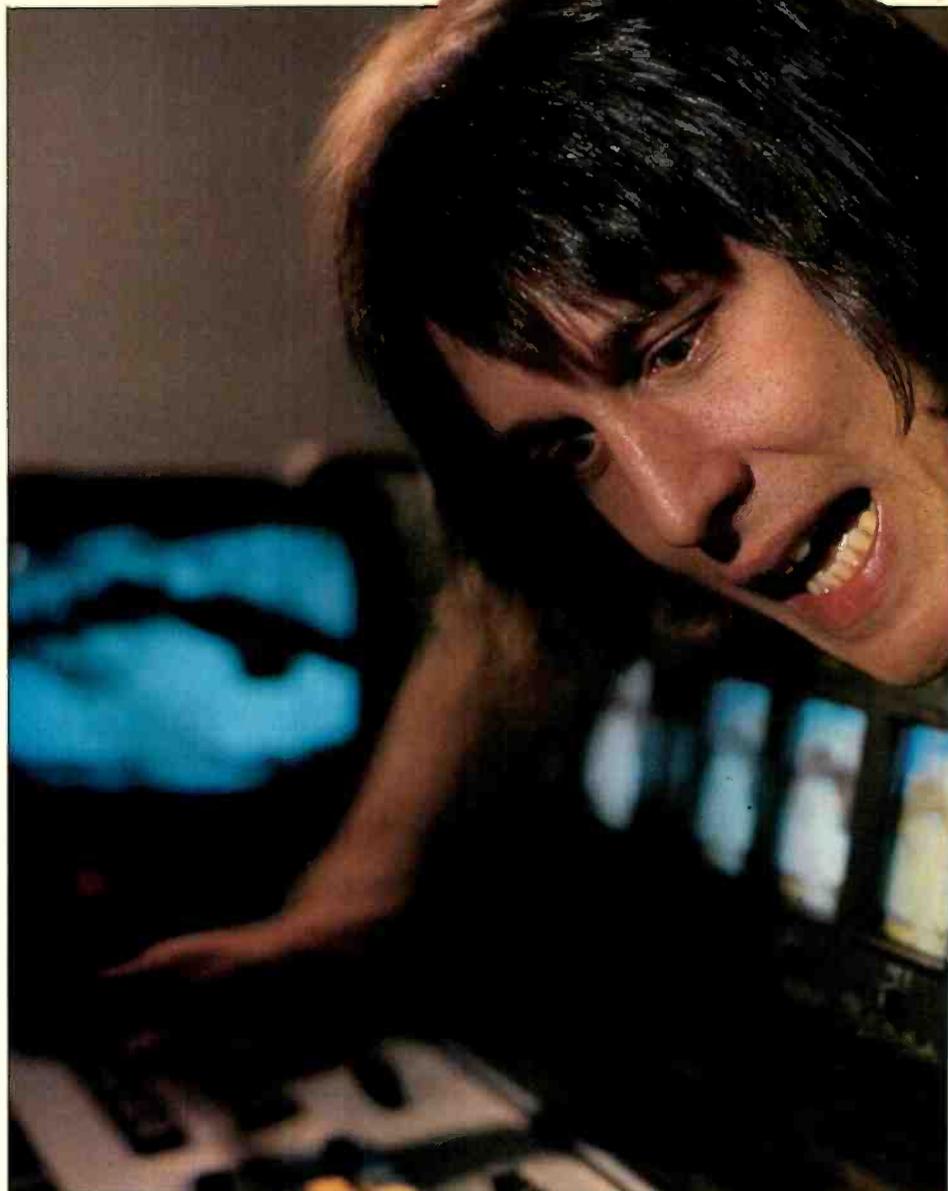
Audio: Still talking about videodisc, though, which of the three competing videodisc systems will . . .

Rundgren: . . . die first or die last?

Audio: That, and which is technically superior in your view?

Rundgren: Of the three primitive technologies out there, the laser (Philips optical) system is the most sophisticated. But the primitiveness of the *concept* is still there — the concept being that people will buy "hard" recordings that can't be disposed of or used over again.

One big problem with videodisc is that there is no intrinsic software; there is nothing available exclusively on videodisc. It may be that the big bosses in the videodisc field have realized that in the long term there will be more efficient ways of getting software out to the public, because these people are paying only minimal license fees for programs that have appeared in other media — on TV, in theaters, etc. They're paying only a \$1500 licensing fee, which in the video business just barely covers postage and handling for the tapes! Since the powers that be are not willing to establish a market for intrinsically videodisc-oriented software, I think they're going to be stamped out by software distribution systems that give people a greater selection and a more convenient way of acquiring the things they're interested in.



Two-way cable systems, computer-controlled cable systems, and satellite television: These are all media where the recording and playback mechanism can be "written over."

Audio: How sophisticated are such systems today?

Rundgren: I'm told that there is already a system in the Los Angeles area that can order up anything you want in the way of information. Computer technology is obviously still advancing by leaps and bounds. And the cable systems are becoming cheaper and easier to implement all the time. Once a cable system is in place in the user's home, there are enormous advantages for both the artist and the software distributor. If you want to sell a videodisc, you have to convince people to go out to a store and purchase your particular disc, if indeed they have

a videodisc machine in the first place. If you're dealing in cable, people are prone to using the things that are on the cable because they are *there*— immediately available. The advertising for such programs is also easily implemented, in that the cable networks are advertising their programs in the same way that the broadcast television networks always have — via in-house programming commercials.

Audio: What about the difficulties in distributing the royalties?

Rundgren: It can be done. There are two-way cable systems, sort of an extension of the Qube system under development. [Qube is a cable network in operation in Columbus, Ohio which permits viewer feedback and commentary via a console in each viewer's home; many observers view it as the prototype of an



Plain cable is not the answer; two-way interaction is needed.

The remainder of the music industry should survive, and even burgeon into a larger industry. A record that sells five million copies today is a huge hit; with cable, it might be possible to sell five million copies of that record in a week. Think about the fact that you don't have to go through either the physical manufacturing process or the physical distribution process — which together are as much as half of the final cost of a current record. You could charge less, and still be making more money, and with a potentially larger market. If the whole country was wired for musical programs the way it's wired into television, you could easily sell 20 million accesses, as you might call them, in a week.

Audio: How soon could this be implemented?

Rundgren: How soon is soon? I don't think it'll be an everyday occurrence in any less than 10 years.

Audio: Doesn't it follow that with these new methods of distribution that record companies will be reduced to production houses, handing over much of their creative and financial control to the cable and satellite networks?

Rundgren: That's what most record companies are now. They finance productions, but not much else. Most record companies are acutely aware of the expanding video market, but they aren't as aware of how it's going to affect them as they should be. They don't see that the future of home entertainment will require complete multimedia entertainment production complexes.

Audio: Returning to the videodisc for a moment, don't you think that if it fails on as large a scale as you predict, that the money for other entertainment dispersal systems will be harder to come by?

Rundgren: The beginnings of such dispersal systems are already here, and I base my prediction on the fact that they have *already*, at these early stages, made the videodisc obsolete. You can get the movies that you would be buying on videodisc on Showtime or some other feature-film cable system, and in the long run your subscription rate for something like HBO (Home Box Office) or Showtime is much lower than the cost of buying videodiscs and the machine to play them on. That's right now, in 1981.

Audio: Commercial television, of course, pays for itself through advertising. How do you see advertising fitting

into the new media distribution methods?

Rundgren: Cable derives its income directly from the viewer; the person who watches pays for what he watches directly. Broadcast television has that person paying rather indirectly by buying the products advertised — which, of course, incorporate the cost of broadcast advertising in their final prices. Broadcast television has already begun to be affected by cable and other systems in the reduction of viewership. They know that every time another person subscribes to cable, that person — a serious television watcher — is going to be spending fewer hours watching broadcast television. Hence all of the broadcast television networks are getting involved in cable ventures, and all of them would like to control cable.

One interesting side effect of this will be the effect of cable-broadcast competition on programming. If the broadcast networks cannot stamp out cable by buying it, they may attempt to eliminate FCC regulations on programming content — including obscenity regulations — in an effort to supply the lowest common denominator programs, unfettered by anyone outside. Ultimately, it may become a Supreme Court issue.

I'd like to emphasize, however, that just plain cable media distribution is not the answer; it's the two-way communication and the *interaction* that are essential. The end result of this capacity for interaction will be some combination of HBO, AT&T, and IBM — a system by which people can communicate in audio and video forms with one another, with the government, and with all forms of entertainment. There will be access to electronic libraries, electronic mail, etc.

Audio: A question about your role as a multimedia producer. In a sound recording facility you have the ability to "fix it in the mix" — if someone sings a note slightly out of tune, you can use the harmonizer to make it right. If someone's instrumental tone is off, you can equalize it. Do you have these resources when working in the audio-visual medium?

Rundgren: You can do it to some extent, but the special effects make themselves much more apparent in visual terms. If you have a dramatic presentation where an actor does a bad job of portrayal, you can't just cover it with psychedelic blobs falling across the screen.

interactive cable format that will be used in the future to sample public opinion, perform educational tasks, and permit at-home catalog shopping, among other things. — Ed.] It should be possible in the future to tell what any particular watcher is watching at any particular time, such that if the set is turned on, the charges — which incorporate the royalties — can be added to a monthly bill.

Audio: How will the sorts of changes you're talking about affect the music recording industry?

Rundgren: Well, there will always be a recording process; it may well grow and become more expansive. The only element of the recording industry that *must* change is the distribution chain. What will disappear will be record stores — outlets dedicated to a particular piece of plastic we call the phonograph record.

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In that case, editing is the only option you have, so it's much more critical in video work to get the right performance, to have a good script to start with, and to get a clear idea of the direction you want to go.

Audio: How do you think the availability of multimedia performances in recorded form will affect the "live" performance business?

Rundgren: Most musicians are not going to be extremely successful in video and they'll still have to maintain themselves as artists always have — in live performances and in sound recording. There will be some who become successful with video, but we'll have to wait and see how soon that market develops. A videodisc done as well as it can be would cost a million dollars, and there's only one place you can go today to get that kind of money, to the TV broadcast networks. So unless they decide there is some marketability in this kind of musical multimedia production, it probably won't develop as a format for awhile.

Audio: Do you know of any collaboration between record producers and film producers now going on?

Rundgren: There is very little. Most of the people involved in what little is being done in that field are seeking to exploit something, a promotional exercise of some kind. Of course, there isn't much of a market for multimedia musical material yet, either. We at Utopia Video are at this point doing all kinds of video productions just to keep the facility open, so that we'll be around when demand for those kinds of programs does develop.

Audio: You've been active in the audio field in breaking down the barrier between producer and musician. Do you think that there will be a similar movement in the visual medium?

Rundgren: Prior to the Sixties, when The Beatles became big hits, artists were foreigners in the recording studio, totally at the whim of the producer in terms of sound and so on. The priorities of the producer were always directed toward budget and commercial appeal.

It wasn't until Sgt. Pepper that artists discovered they had rights in the studio, and that it was their obligation to understand what was going on and to utilize studio capabilities to the fullest. Ever since then artists have more or less determined what situation they wanted in the studio. The whole *modus operandi* of recording studios has changed. They are more comfort oriented to put the artist in a productive frame of mind; the facility is oriented toward his consciousness. Video studios have been more or less like old-style recording studios, especially since they are more expensive than sound recording studios. The technicians are in command and trying to keep their thumb on everybody. We've tried at Utopia to design a facility and maintain it in the more enlightened style of contemporary sound recording studios, and to give artists a clearer idea of their capabilities and options. If somebody wants to come in and do something in particular, we're there to try and help it happen. A



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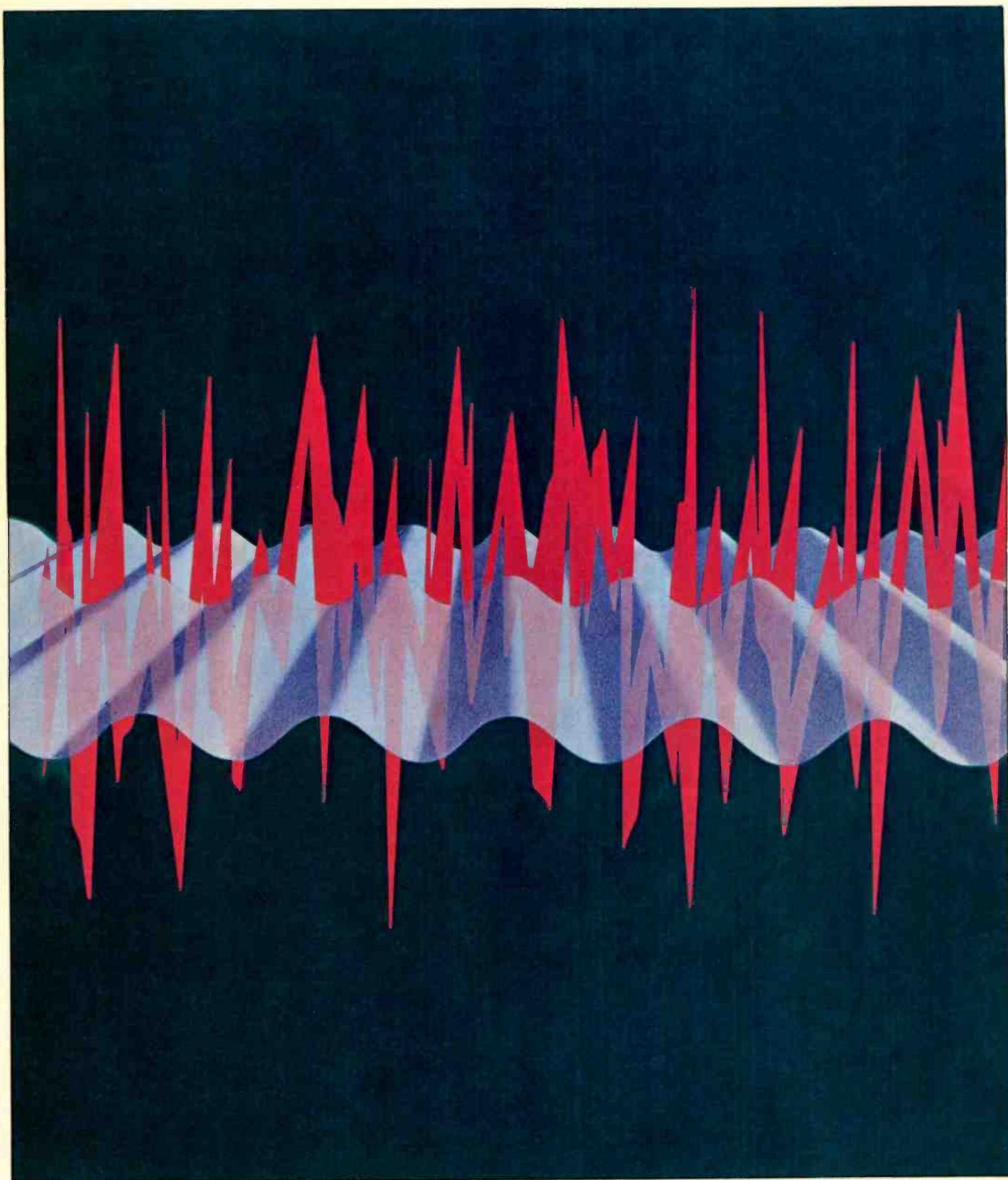
For the name of the nearest audio specialist who carries the AU-D 11 and AU-D 9 or other fine components in Sansui's extensive line of high fidelity products, write: Sansui Electronics Corp., 1250 Valley Brook Avenue, Lyndhurst, NJ 07071.



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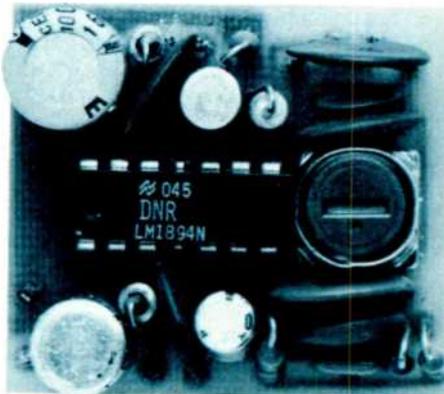


NATIONAL'S NEW NOISE REDUCTION CHIP

RALPH
HODGES

National Semiconductor, one of the nation's oldest and certainly one of the leading makers of integrated circuits, is by no means new to noise reduction. Selling Dolby B-type integrated circuits to cassette-deck manufacturers is one of the higher volume activities of its consumer linear division, and you can be sure that other products of its manufacture turn up as gain blocks in many alternative noise-reduction systems. What the company has not conspicuously participated in is the *design* of noise-reduction processors. Indeed, making component parts for everybody else's NR system — and everybody else's electronic anything, for that matter — would seem to be business enough, why should it get further involved? Or, rather, why *has* it, because National Semiconductor's DNR (Dynamic Noise Reduction) amounts to just that sort of involvement?

The reason, according to the company, is that noise reduction in its commonly encountered compander form is all well, all good, but all too rare. Efforts by Dolby Labs notwithstanding, FM broadcasts are still largely compander-unencoded. The cassette you play in your portable "tape player cum headphones" may be encoded, but it's unlikely that the player will be able to *decode* it, and the hiss from a diaphragm within an inch of your ear is hard to ignore. You can buy encoded discs from dbx, but per-



The DNR device is essentially a dynamically controlled LPF that is inexpensive, simple and compact in implementation, and reasonably free of audible side effects.

NR

haps not with the performers and performances you'd most prefer. Although tomorrow's videodiscs may be encoded with some form of noise-reduction processing, today's are not. The same goes for the majority of prerecorded videocassettes. The future (AM stereo, stereo TV) remains clouded, but the past is clear, and much of it is made up of recorded material that never had a chance to benefit from practical noise reduction.

The DNR scheme seems an appropriate solution to an inherently insoluble problem.

Of course, the situation is not new, but, ironically, new media and program sources are making it more prevalent. In response, National Semiconductor has seized on a solution that is also not strictly new, but which is probably timely. Now, the company believes, is the right moment for noise reduction that can cope with sources which already contain noise. This means a "single-ended" processor — one that steers its way between program and noise, lopping off the latter insofar as it is able to separate such noise out. The DNR device is essentially that of a dynamically controlled low-pass filter, but one that skirts negatives in previous designs of this sort, which as a rule were not (1) inexpensive; (2) simple and compact in implementation, and therefore adaptable to a broad spectrum of products, and (3) free as they could be of audible side effects. DNR is all of these according to National Semiconductor, who expect its appeal to grow rapidly as the word gets around.

Basics of Operation

In its latest form, DNR consists of a single IC (National Semiconductor LM1894) for two channels, plus a number of external components (see sidebar). As shown in Fig. 1, a single control circuit regulates the filter action of both audio channels, which can vary in bandwidth from 800 Hz to as much as



Advanced Audio Systems International's DNR 450 (\$225), an outboard processor with a threshold adjustment and an LED display for instantaneous bandwidth indication, bears the proprietary logo for the National

Semiconductor system.
Manufacturer: Advanced Audio Systems, San Jose, Cal.

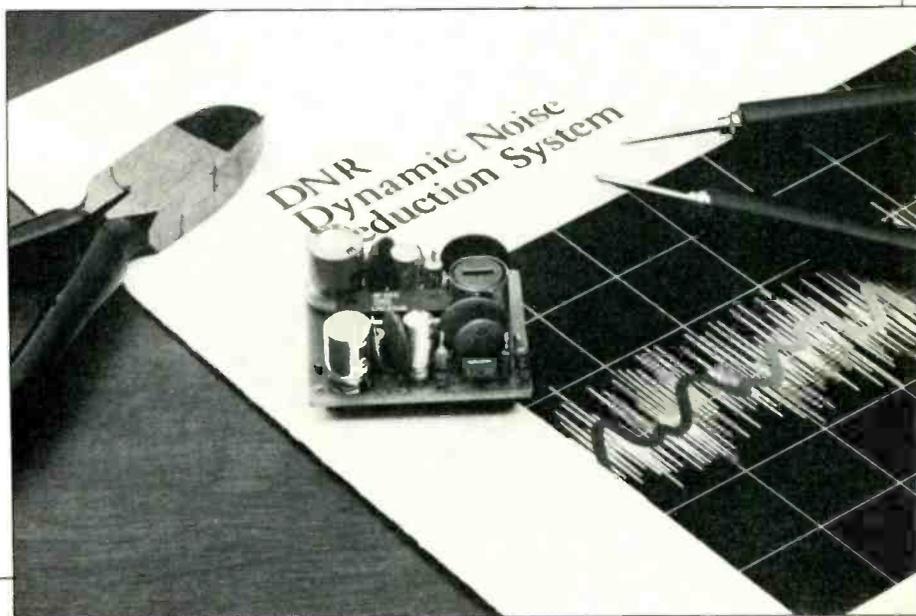
30 kHz (-3 dB points). Maximum noise reduction (CCIR/ARM weighted) is in the neighborhood of 10 to 14 dB. The filters are single-pole configurations, providing a uniform 6-dB per octave roll-off above whatever corner frequency the voltage from the control circuit dictates (see Fig. 2 for operating parameters).

The control circuit itself derives a control signal from the rectified sum of the two channels. The circuit's response is not uniform with frequency, but increases at a 12-dB per octave rate from about 1 to 6 kHz, flattening out above. A threshold, sometimes fixed but user-variable in the case of one available outboard processor, establishes the noise "floor" of the system, determining what levels of high-frequency energy will be construed as noise (for which the filters will remain closed) and what levels as program (for which the filters will progressively open up). The filters can open (attack time) in as little as 0.5 mil-

liseconds, which is consistent with the sharpest transients to be expected in program material. Release time is a more leisurely 50 milliseconds, to avoid the foreshortening of any lingering reverberation.

Considered within the constraints of cost, simplicity and playback-only processing, the DNR scheme seems an appropriate solution of an inherently insoluble problem. The time constants (attack and release) are well chosen in terms of present-day psychoacoustic understanding, and the operational frequency bands are the right ones for maximum suppression of audible steady-state noise (hiss, in other words). Governing the action of the control circuit by higher frequencies alone is a particularly logical idea. It both focuses appropriate attention on the critical area, and avoids control-signal ripples that low-frequency information can impose on a peak-detecting circuit such as DNR employs.

National's LM1894 IC with its external components on a p.c. board.



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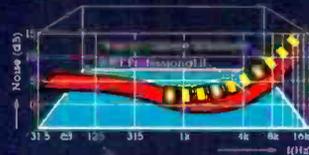
Professional II is like no other tape because it's made like no other tape. While ordinary high bias tapes are made from modi-

fied particles of ferric oxide, Professional II is made of pure chromium dioxide. These perfectly shaped and uniformly sized particles provide a magnetic medium that not only delivers an absolute minimum of background noise, but outstanding high frequencies as well.

Like all BASF tapes, Professional II comes encased in the new ultra-precision cassette shell for perfect alignment, smooth, even

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With Professional II, you'll hear all of the music and none of the tape. And isn't that what you want in a tape?



The difference in noise level between PRO II and ordinary high bias tape is greatest where the human ear is most sensitive (2-6 kHz).

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All BASF tape cassettes come with a lifetime guarantee. Should any BASF cassette ever fail—except for abuse or mishandling—simply return it to BASF for a free replacement.

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BASF Professional II is so superior it was chosen by Mobile Fidelity Sound Lab for their Original Master Recording™ High Fidelity Cassettes. These state-of-the-art prerecorded cassettes are duplicated in real time (1:1) from the original recording studio master tapes of some of the most prominent recording artists of our time.



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For the best recordings you'll ever make.

In common with any practical noise-reduction system, DNR depends on auditory masking of noise by program material occurring at or near the same frequency. If this masking does not take place when the filters open to pass high-frequency program, noise will be heard. Worse, noise will be heard going up and down in level with the filter action. Such noise modulation — and arranging for masking to conceal it — is the crux of noise-reduction system design. In less guarded moments, all responsible engineers admit that masking is bound to fail under some circumstances, and can be made to fail predictably if program mate-

Program sources that could not previously accommodate noise reduction are obvious candidates for the DNR system.



Technidyne's Hip Pocket Stereo incorporates DNR circuitry.

rial is chosen with that end in mind. A proper noise-reduction system considers typical listening fare first and foremost, and trusts the flaws won't loom too large when unusual spectral distributions of program overthrow the designers' expectations.

The claims made for DNR in this regard are certainly not so extravagant as to strain credulity. According to Martin Giles, National's Manager of Consumer Linear Applications, the system will be at its best with material that has signal-to-noise ratios (again CCIR/ARM weighted) exceeding 35 dB for musical ensembles. Certain critical solo instruments may have to start with a S/N of 45 to 50 dB to avoid all masking failures and audible side effects. (These differences have to do with the longer reverberation times of spaces regularly used to record ensembles and the nature of ensemble playing itself.) DNR is not effective with impulse noises such as record clicks and pops; it may alter them in character, but it will certainly not remove them.

Summing the system up, Giles remarks that it will help most of the time, hurt in some rare instances, and not do much of anything audible in those cases where the program material is good enough to stand on its own. But when it is deemed desirable to switch it out, the system is fully out; with compander systems that encode the material, the system can never be fully eliminated once the recording is in existence. For program that is borderline, the threshold control (when provided) will enable the user to set his own compromise between maximum fidelity, minimum noise, and the intrusion of audible side effects.

The Destiny of DNR

DNR has existed for several years now in a two-IC form, and as such has found its way into several portable and home music centers. With the advent of the LM1894, DNR has been adopted by General Motors for use in 1982 car stereo systems, by Technidyne for its Hip Pocket Stereo, by Benjamin in its RAC-10 MK-II DNR cassette changer, and by Advanced Audio Systems in its stand-alone Model DNR-450. Program sources that could not previously afford or physically accommodate noise reduction are obvious candidates, along with new media that have not yet established noise-reduction standards. The company is also hopeful about broader applications and about a supplementary role to existing noise reduction. For example, a tape encoded by a compander system like Dolby B, even though properly decoded during playback, will still not be perfectly quiet if listened to at louder levels. But it

will be much quieter if DNR processing is used as a further step in the reproduction chain.

To forestall misunderstanding, it should be emphasized that DNR does not decode Dolby noise reduction or the processing of any other compander system. It cannot return dynamically compressed program material to its original form. It acts only on steady-state noise but does so wherever it is found and whatever its origin. This means universality and compatibility with any source — factors National Semiconductor counts on to carry DNR into the mainstream of audio noise reduction. **A**

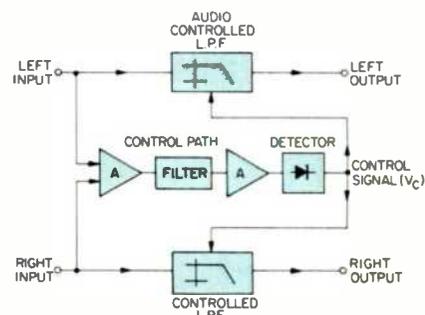


Fig. 1—A breakdown of the essential operators in the DNR system, all of which are contained within a single IC.

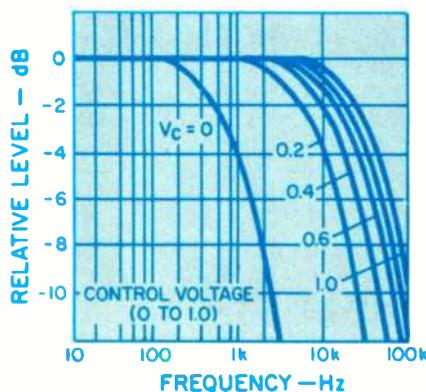


Fig. 2—Increasing control voltages, derived from a network that responds more to higher frequencies in the program, open the DNR passband until it extends well beyond the audio range.

In Search of The Perfect Magnetic Head

Nakamichi Spoken Here.

In magnetic head design, there is one objective—minimization of loss—every type of loss. "Gap loss" and "spacing loss" in a playback head severely curtail high frequency response so a very narrow gap and perfect tape contact are imperative. "Core loss"—composed of "eddy currents," "hysteresis," and low permeability—degrades signal and increases noise. In a recording head, core loss reduces efficiency, while core coercivity causes "self demagnetization" of the tape. While the ideal playback gap must be infinitesimal to resolve the extremely short wavelengths of a high frequency recording, the recording gap must be wide so that its field penetrates the tape to maximize operating level and decrease distortion. And, the record gap must have a sharp "critical recording zone" to minimize high frequency self erasure and the frequency-dependent phase shift that smears the stereo image. This inherent conflict between the ideal recording gap and the ideal playback gap requires separate heads for best performance.

In a Nakamichi *Discrete* 3-head recorder, playback gap length is 0.6 micron—shorter than a wavelength of light—and capable of resolving frequencies to 25 kHz! The record gap is 3.5 microns and is critically formed to penetrate the entire tape coating with an ultra-sharp recording zone. No single-gap erase head is fully effective because the recording being erased modulates the field within the head and is partially re-recorded as the tape leaves the gap. Thus, we use two gaps—the first eliminates most of the recording; the second removes the vestige re-recorded by the first.

While ferrite and sendust have virtues—we use a combination of the two in our erase head—their low permeability and high coercivity make them far from ideal for recording and playback. Thus, our record and play heads are fabricated from thin Crystalloy laminations—a material of extraordinarily high permeability and virtually zero coercivity—to minimize losses in these critical structures. Playback core geometry is designed to suppress "contour effect" and provide smooth bass response, and each head is individually contoured and polished to assure intimate tape contact and minimal spacing loss. Since a Nakamichi transport does not require a pressure pad to maintain tape contact, it is lifted out of the way to reduce wear and yield a head life in excess of 10,000 hours!

The quality of our magnetic heads is the secret of "Nakamichi Sound." Experience it today at your Nakamichi dealer.



To learn more about Nakamichi's unique technology, write directly to:
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THE CIRCUIT

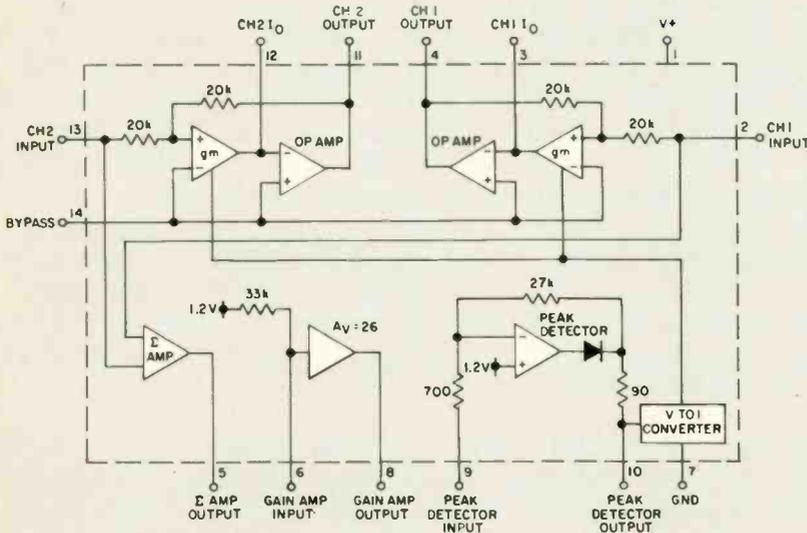


Fig. 3—Block diagram of the LM1894.

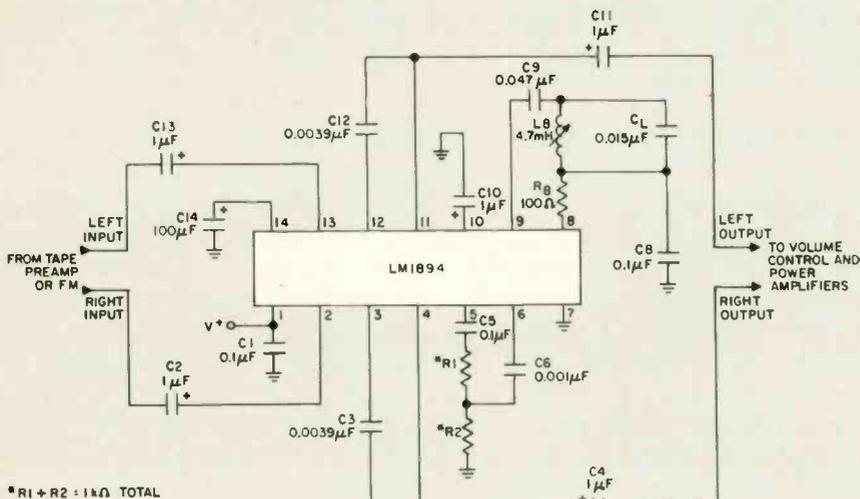


Fig. 4—Schematic of suggested external circuit for LM1894. IC pin designations correspond to those of Fig. 3.

The LM1894 is a 14-pin DIP intended to operate with supply voltages from 4.5 to about 18. Current drawn is 12 milliamperes for a typical supply voltage of 8. Input impedance is approximately 20 kilohms; input overload occurs at 1 volt rms.

Figure 3 is a block diagram of the IC itself; Fig. 4 is a suggested external circuit for the IC. The primary external operators for the audio channels are C3 and C12, which determine the bandwidths passed by the filters. Since bandwidth is inversely proportional to capacitance, the frequency range of the noise-reduction effect can be adjusted by changing the capacitive values. Capacitors C5 and C6 determine the band of program frequencies to which the control circuit responds — in this case roughly 6 kHz and above. The voltage divider formed by R1 and R2 sets the threshold of the control path, which is normally adjusted so that steady-state noise from the program source just begins to open the filters. Resistors R1 and R2 are altered together so that their sum always equals 1 kilohm. Wiring a suitable potentiometer in their place creates a threshold-varying control.

Coil L8 and the components surrounding it comprise a 19-kHz notch filter which prevents the stereo FM pilot signal from affecting the operation of the control circuit. If the DNR module will not be used for FM, or if the tuner has an adequate multiplex filter of its own, these components can be replaced by a simple 0.047-μF capacitor bridging pins 8 and 9.

National Semiconductor foresees and has demonstrated the use of LM1894s in cascaded arrays of two or three, in which case the slopes of Fig. 2 become 12 or 18 dB per octave, and the noise-reduction effect becomes 20 dB or greater.

The LM1894 is available in quantity to manufacturers of licensed products for about \$2 apiece. The price is expected to decline as production increases. It is not presently available in small quantities or to unlicensed manufacturers.

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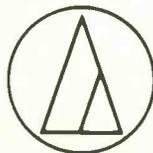


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1

BRYSTON MODEL 1B PREAMP

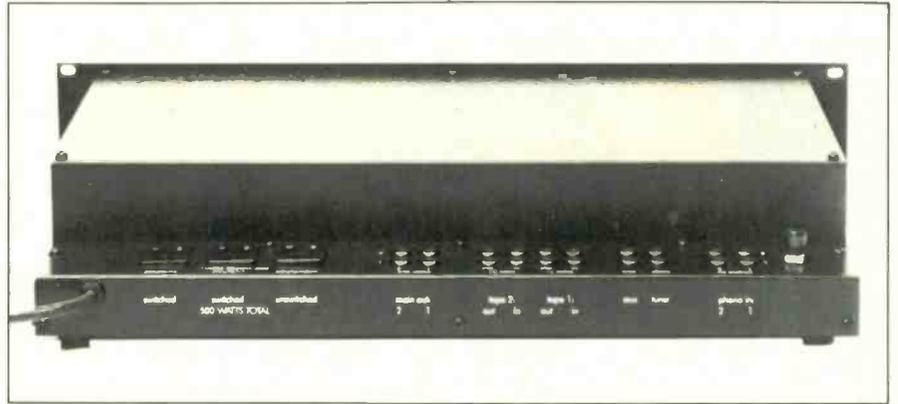
Manufacturer's Specifications

Frequency Response: Phono RIAA and high level, 20 Hz to 20 kHz, ± 0.1 dB.

Rated Noise: Phono, -80 dB, A weighted, ref. 5 mV rms at 1 kHz; high level, -95 dB, A weighted, ref. 500 mV at 1 kHz.

Maximum Output: 10 V rms from Tape or main output (typically 20 V rms available).

IM or THD Distortion: 0.005 percent.
Price: \$700.00.



I must confess that ever since I auditioned and measured Bryston's Model 4B power amplifier a couple of years ago, I have regarded the company with a great deal of respect and admiration. Their 4B amplifier remains a sort of reference product whenever I test or listen to power amps. Having now had an opportunity to examine the Model 1B preamp, it is clear that Christopher Russell (Bryston's chief engineer) and his crew have not lost their touch. This preamp is a fitting companion to any of Bryston's high-quality power amplifiers or to any other high-end state-of-the-art power amplifier with which it might be used.

Front-panel controls on the 1B are kept down to a minimum. There are, of course, the usual master volume and balance controls, a power on/off switch, and an accompanying power-on indicator light. Two small push buttons serve to activate a low-frequency filter (active below 31.7 Hz with a slope of 6 dB per octave) and to select mono or stereo operation. In addition, separate rotary selector switches are provided for source and tape selection. In other words, you can listen to one program source while you feed another to the tape outputs on the preamp's rear panel. The front panel of the Bryston 1B is designed to fit into standard professional 19-inch rack mounts and is equipped with the necessary mounting holes for such installations.

While it would appear from the above panel description that taping and monitoring facilities are limited, that does not turn out

to be the case. Any input except tape 1 or tape 2, when selected, appears at both rear panel tape outputs. The *Tape 1* position connects the tape 1 input to the tape 2 output. The *Tape 2* position connects the tape 2 input to the tape 1 output, for full two-way dubbing capabilities. Furthermore, when the source selector switch is in the *Phono 1* position and the tape selector is in the *Phono* position, phono 1 inputs are connected to the tape outputs. With the source selector set to any other position, setting the *Tape Select* switch to *Phono* connects the phono 2 inputs to the tape outputs. So, if the user wanted to record from a turntable, the phono 2 inputs would be used. The tape monitor function is activated by moving the source selector switch to any input being taped.

Connections to the Bryston 1B preamp are made along a horizontally oriented projecting platform at the rear of the unit. This arrangement means that no plugs have to project beyond the maximum depth dimension of the component. In addition to the twin pairs of phono inputs, high-level inputs, tape in/out pairs, and two pairs of main output jacks, this connecting "platform" is also equipped with three convenience a.c. receptacles (one unswitched and two switched), each of which is a three-prong, grounded type for minimum hum and maximum electrical safety. A chassis grounding terminal is located near the twin pairs of phono input jacks.

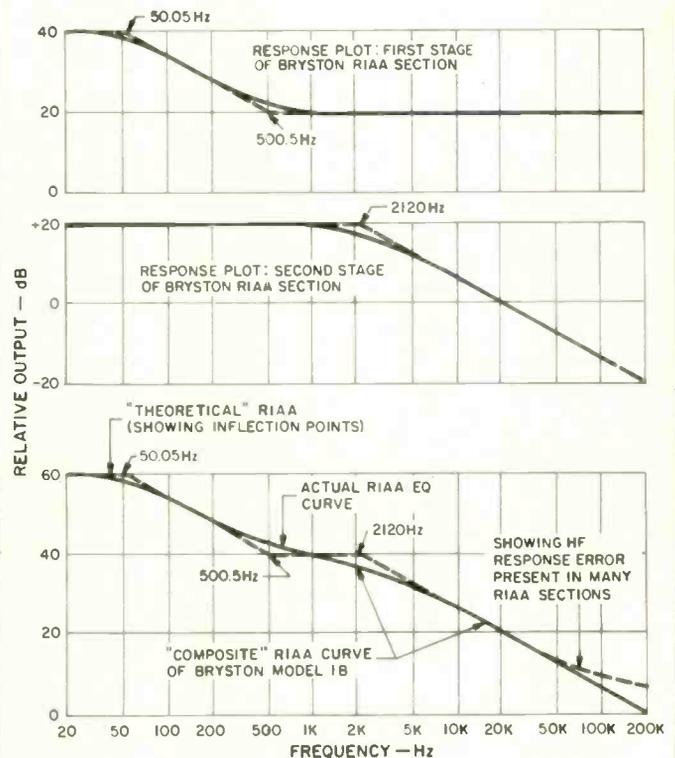
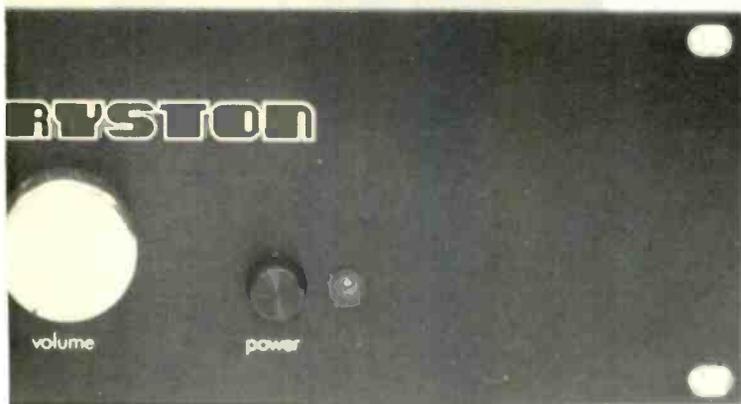


Fig. 1—RIAA equalization in the Bryston 1B preamp is accomplished in two separate stages (upper two graphs) to create composite response shown in lower graph.

The Bryston 1B preamp is a fitting companion to any state-of-the-art power amplifier.

Circuit Highlights

One of the outstanding circuit accomplishments in the Bryston 1B preamp is its phono preamplification and equalization circuitry. As pointed out in their well-written brochure accompanying this unit, the basic problem with most methods of deriving an RIAA equalization response lies in the extreme difference in gain requirements from the lowest to the highest audio frequencies to be reproduced. This calls for the use of reactive components whose a.c. impedance follows the required ratio (about 40 dB of change, or a ratio of 100 to 1), either in a feedback loop or as a direct passive load. If a noninverting feedback network is used in the feedback network, gain cannot be brought below unity. Accordingly, at some high (super-audible) frequency above 20 kHz, the curve would level off instead of continuing to roll off at a rate of 6 dB per octave as specified in the RIAA curve. This brings into play another problem: Due to the combination of severe high-frequency reactive loading and large low-frequency gain, many phono stages have a tendency to oscillate or "motor boat" at some low frequency. Some designers have countered these problems by resorting to completely passive equalization. This in turn can raise new problems, depending upon how the passive equalization is accomplished. Either a sacrifice of signal-to-noise ratio must be made, or the preamplifier must be able to sustain very high gain and excessively high signal levels at high frequencies, increasing the chances of high-frequency overload and distortion.

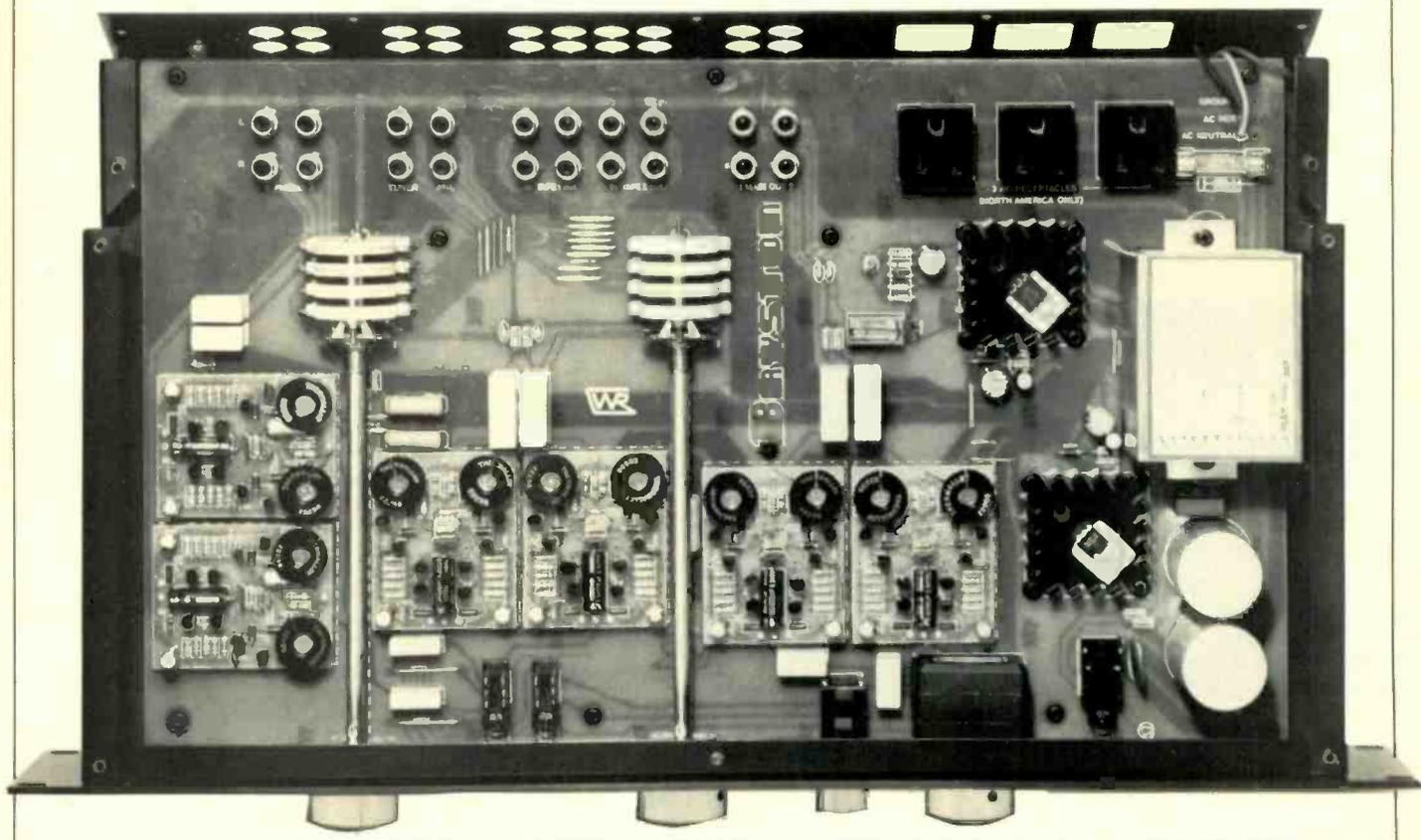
Bryston chose a third approach in the 1B. They divided the

phono equalization curve into two sections (see Fig. 1). One section accomplishes the low-frequency tailoring, while the other takes care of the high-frequency gain characteristics. The high-frequency section operates in the inverting mode so that the equalization curve remains accurate all the way out to the megahertz region. This inverting configuration also eliminates common-mode distortion, a problem common to amplifiers handling high-frequency signals in a low-gain, noninverting configuration.

Bryston lists as additional advantages of this circuit approach better signal-to-noise ratios, the elimination of phono cartridge interaction without buffer stages, low distortion without the need for extreme amounts of overall feedback, and extremely close accuracy of phono equalization (which they specify at no worse than ± 0.1 dB).

Measurements

The true test of a preamplifier such as the Bryston 1B is in the listening, but for the record, I made the usual bench measurements of this superb unit, suspecting all the while that the results would hardly offer any surprises. They didn't. Input sensitivity for both sets of phono inputs (referred to 0.5-volt output at the main output jacks) measured 0.8 millivolt (at 1 kHz). The phono inputs were able to handle signal levels of 175 millivolts before noticeable distortion occurred (again, at a frequency of 1 kHz). Hum and noise in phono was impressively low, measuring 83 dB (A weighted) below an input reference level of 5 mV with respect to an output reference level of 0.5 V rms.



Whether measuring IM or THD, I always came up with readings which were at the known residual of the signal sources.

Input sensitivity for the high level inputs was 66 millivolts referred to a 0.5-V output. Signal-to-noise ratio for the high level inputs measured 90 dB, improving still further to 94 dB for the minimum volume setting.

Figure 2 is a plot of RIAA phono response (an inverted RIAA test signal is applied to the preamp so that the output curve of response comes out flat if the preamp's EQ is perfect). If you find it difficult to see the response plot, that is because it almost always falls right on the reference grid line (0-dB reference) established for each of the two channels. In Fig. 2A the movable display cursor has been shifted over to 20 Hz (it is obscured by the left-most vertical line of the display) to show a deviation of only 0.1 dB from perfect RIAA in the left channel and 0.0 dB deviation in the right channel. In Fig. 2B the cursor was moved to the right, to 20 kHz (again, it is obscured by the right-most double-vertical line which corresponds to this frequency), and the readout below the graph shows a deviation of only 0.1 dB for the left channel and no deviation at all for the right-channel output.

A repeat plot of phono response for the phono section of the 1B appears in Fig. 3, this time for one channel only and with the low-frequency filter activated. The cursor has been shifted to 25 Hz, where an attenuation of 2.8 dB is recorded by the test equipment. Note that the scale used in this figure is compressed, compared with the scale used in Figs. 2 and 4 (10 dB per vertical division as opposed to 2 dB per division).

Figure 4 is a response plot for the high-level inputs of the Bryston 1B and, with the cursor set to its highest possible frequency (40 kHz), an attenuation was recorded of 0.3 dB for the left channel and 0.4 dB for the right channel. In addition to these automatically obtained response plots, I attempted to measure harmonic and intermodulation distortion for the phono and high-level inputs of this preamp. No matter where I measured, the answer always came out 0.002 percent for THD (the known residual THD of the signal generator) and 0.0015 percent for IM (the known residual IM distortion of the SMPTE IM signal source). Duly frustrated by this attempt, I finally made the only meaningful measurement that I could on the bench. Power consumption was 13 watts!

Use and Listening Tests

The Bryston 1B is an audio purist's preamplifier. It adds or subtracts nothing from the program sources fed to it. In almost all of the listening tests, I preferred to leave the low-cut filter on; this was highly effective in reducing too-wide excursions of woofers caused by warpage on some records and by turntable rumble, however minimal it may have been. Phono reproduction was as perfect as I have ever experienced. In a series of A-B tests involving playback of favorite master tapes directly through my current reference power amplifier and through the series combination of the Bryston 1B and that same amplifier (with gain levels carefully adjusted identically), I could detect no difference in sound quality whatever. That's about all anyone can ask of a well-designed preamplifier such as this one. My only regret is that I no longer had the Bryston 4B power amp on hand to team up with this superb preamplifier. Expensive, yes! But for the truly discerning audiophile, that's not likely to make much difference.

Leonard Feldman

Fig. 2—Phono frequency response error was never more than 0.1 dB for either channel; deviation shown from RIAA in (A) at 20 Hz and in (B) at 20 kHz.

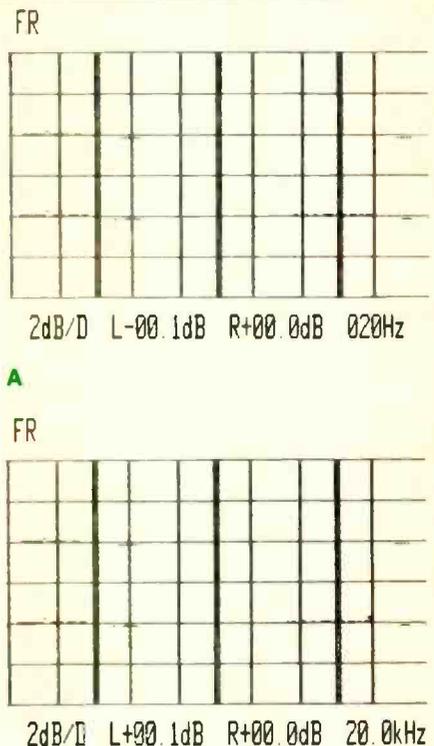


Fig. 3—Low-cut filter attenuates phono response by 2.8 dB at 25 Hz.

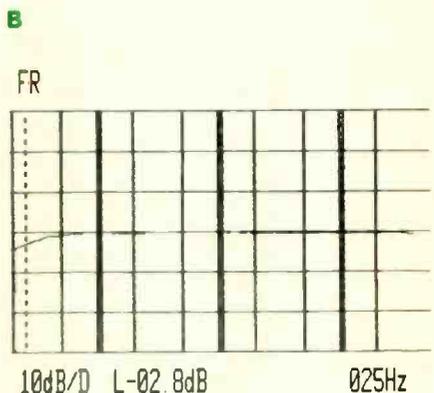
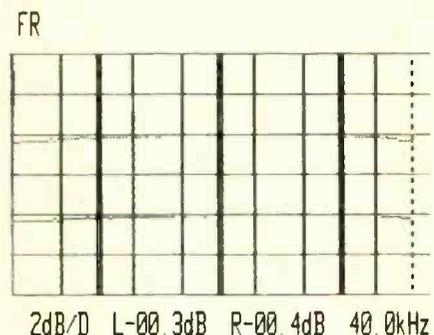


Fig. 4—High-level input frequency response was down 0.3 dB in left channel and 0.4 dB in right channel at 40 kHz.



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2

SAE A-501 POWER AMPLIFIER

Manufacturer's Specifications

Power Output: 250 watts per channel into 8-ohm loads, 20 Hz to 20 kHz; 375 watts per channel into 4-ohm loads.

Rated THD: 0.025 percent.

Rated SMPTE IMD: 0.025 percent.

Clipping Headroom: 0.5 dB.

Damping Factor: 60.

Frequency Response: 20 Hz to 20 kHz, ± 0.25 dB.

S/N: 100 dB, A weighted, re: 1-watt output.

Input Sensitivity: 2.24 V re: rated output, 0.14 V re: 1-watt output.

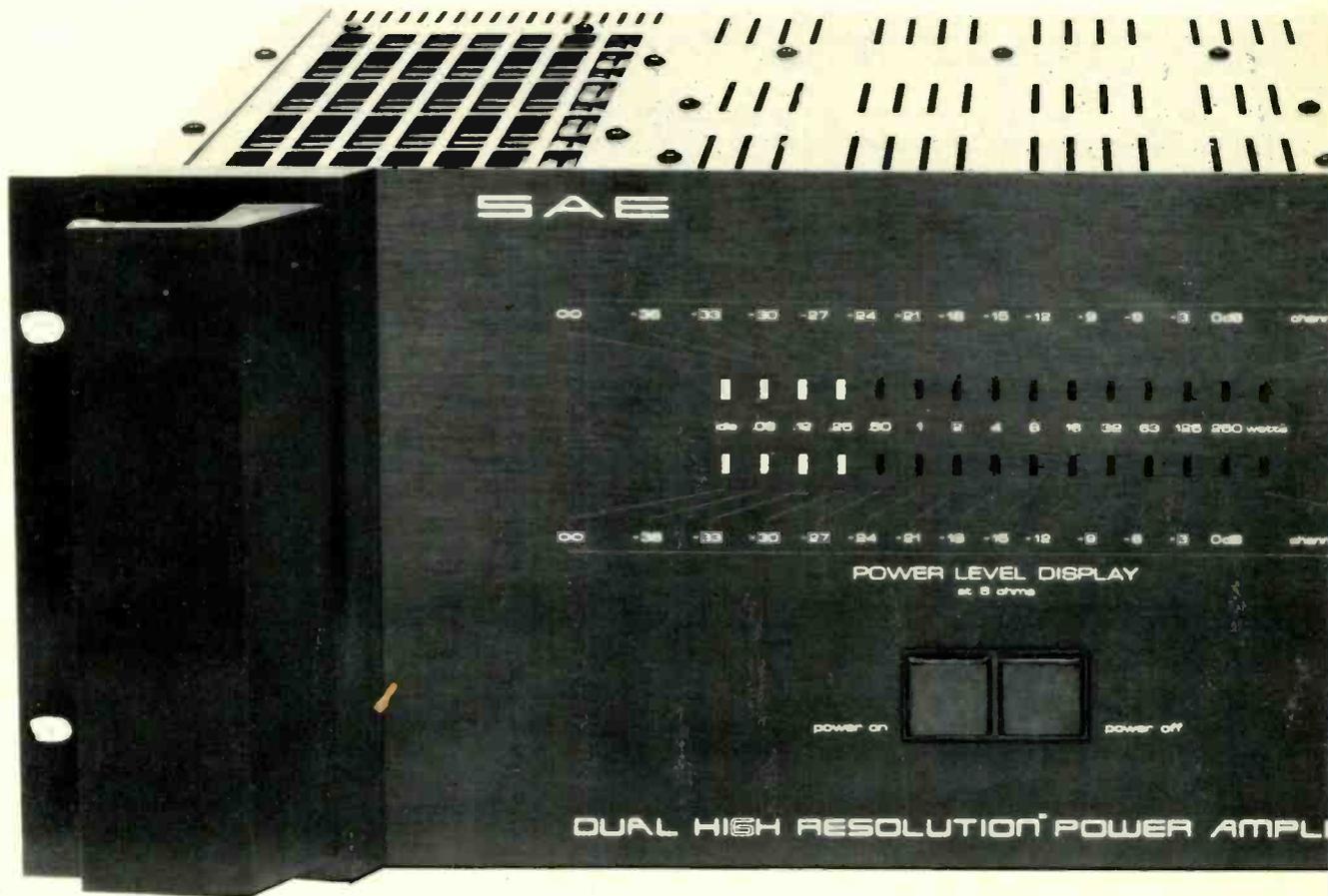
Slew Factor: 3.

Current Slew: 20 amps/ μ S.

Dimensions: 19 in. (48.3 cm) W x 7 in. (17.8 cm) H x 12 1/2 in. (31.7 cm) D.

Weight: 52 lbs. (23.4 kg).

Price: \$1050.00.



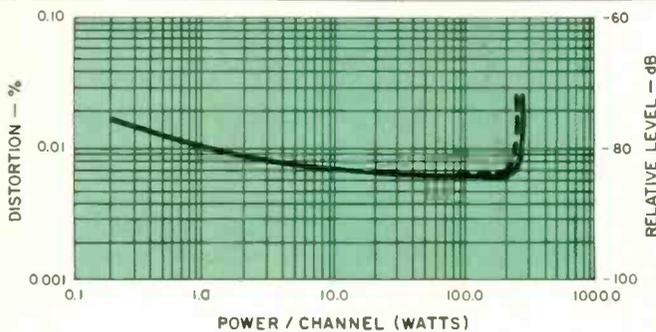


Fig. 1—Power output vs. THD at 1 kHz, solid line, and at 20 Hz and 20 kHz, dashed line, into 8-ohm loads.

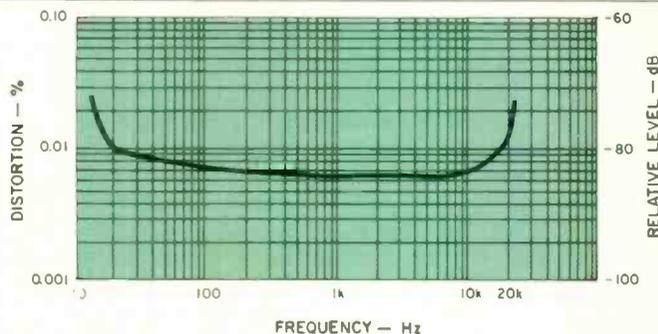
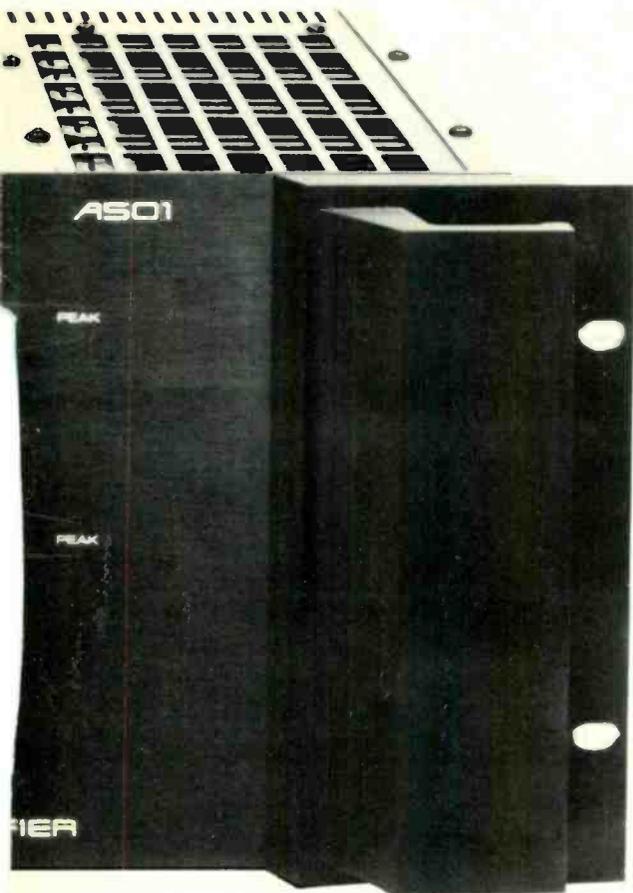


Fig. 2—Distortion vs. frequency at the rated output of 250 watts per channel, both channels driven into 8-ohm loads.



In introducing their "01" series of amplifiers (of which this one is the second highest powered), SAE published a widely distributed "white paper" which restated several basics some of us have realized only too well for a long time. Amplifiers, says SAE, do not operate into resistive static loads under normal use, and therefore the static measurements that most of us make (including this reviewer) do not tell us how an amplifier will sound. Further on in the white paper they go on to say that, "These conventional tests do provide insight as to the quality of the engineering of the product under test but not an absolute measurement of the sonic quality." And, further on again, "The point is that the current concept of distortion is not wrong, it is just not relevant to the whole system process unless it is set up to deal with this process. Unfortunately, THD, IM, TIM and the like are basically a one-dimensional view of a multi-dimensional event."

The SAE paper then goes on to describe how the company designed a series of amplifiers which dealt with the problems of reactive loads that constantly vary. They offer arguments why these amplifiers were a.c.-configured (rather than following the current vogue of all-d.c. design) and speak of their high current slew rate (which they feel is more relevant than the popularly quoted voltage slew rate of so many volts per microsecond), as well as the steps taken to insure a high natural damping factor (as opposed to the "artificial" damping factor, which is a function of the amount of negative feedback in the amplifier and tends to fall off above bass frequencies).

I have no particular quarrel with any of the statements in the SAE paper, but I had hoped that as I read further I would be confronted with some new and magical method of measurement which I might apply to the A-501 in order to verify the claims made for its sonic superiority. Aside from an experiment in which we are asked to compare the amplifier output when an asymmetric pulse is fed to it, first when the amp is hooked up to a static (resistive) load and next when hooked up to a loudspeaker, the only other suggestion is that we listen to the amplifier, in addition to measuring its static performance characteristics (which, as you see from the specs listed at the outset of this report, SAE continues to do as well).

In their "01" amps, SAE has emphasized high current capability, which they feel is more important to good sound than high voltage capability.

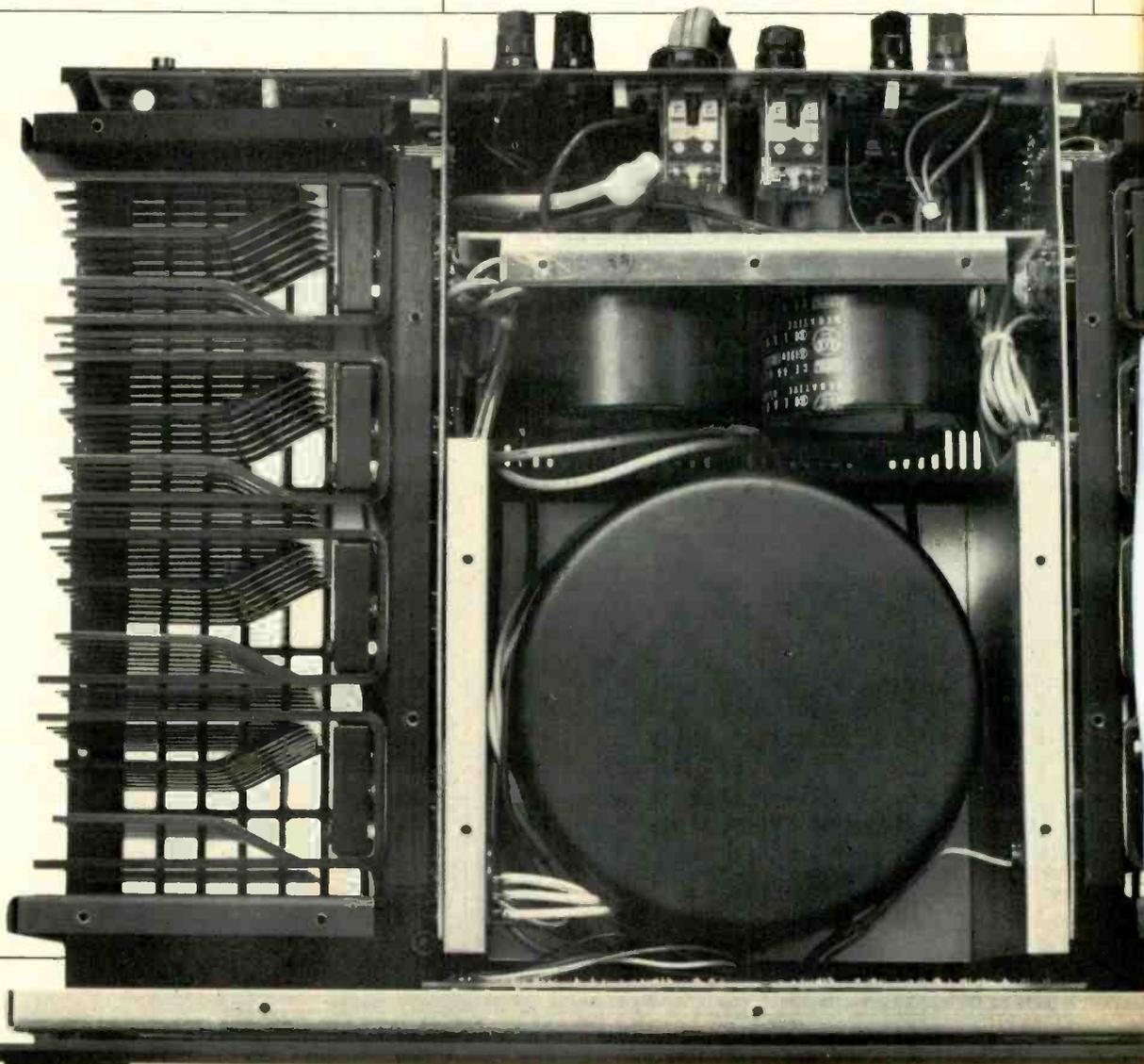
Somewhat disappointed at the lack of a new amplifier measurement technique in the SAE white paper, I therefore proceeded to measure the A-501, examine it, and listen to it, not necessarily in that order. The massive looking all-black front panel is configured for 19-inch standard rack mounting and is fitted with a pair of handles that are, considering its weight, more than ornamental. Separate power-on and power-off square push buttons are at the lower center of the panel. Above these are a rather elaborately calibrated series of LEDs (one row per channel) which serve as peak power output indicators. Calibration is in watts (referred to 8-ohm loads) and in dB below rated output of 250 watts per channel.

The rear panel of the A-501 power amplifier is equipped with color-coded, five-way binding posts for speaker cable connections, and, at either end of the rear panel, there are pairs of input jacks. The two jacks associated with each channel's input are not wired in parallel. One of them gives direct access to the amplifier's first stage and provides ultra-wide band operation. The other input, identified by the words "high pass," provides 6 dB per octave roll-off below 20 Hz and is intended for use in a bi- or tri-amplified system or where extended low-frequency response has proven to be hazardous to speaker performance or

has caused acoustic feedback between speakers and turntable. The rear panel also contains a line fuseholder.

Circuit and Construction Highlights

The A-501 uses multiple output transistors and a very large power supply, including a high-current toroidally wound power transformer and large high-current power storage capacitors. All power handling circuits are hand-wired using #14 gauge multi-stranded cable for minimal internal impedance, instead of being part of circuit board paths. As can be seen from the photo of its internal construction, the A-501 has extensive heat-sinking, which is one of the reasons why it is as heavy as it is. The amplifier is equipped with a relay protection circuit. If, under any circumstances (internal or external), d.c. or subsonic frequencies appear at the output, the amplifier will disconnect from the load and remain disconnected until the problem has been corrected. The sensitivity of the protection circuit is adjusted so that commonly encountered transient signals, such as the thump of a tuner's muting circuit or the act of dropping a stylus on a record surface, will disconnect the loudspeakers momentarily. In such cases, the amp will not shut down completely but will allow a low-level signal to be heard. Part of the relay design is a contact-



4

TECHNICS SL-QL1 TURNTABLE and P22S MOVING- MAGNET PHONO CARTRIDGE

Manufacturer's Specifications

SL-QL1 Turntable

Type: Quartz phase-locked direct drive, fully automatic.

Motor: Brushless d.c.

Speeds: 33 1/3 and 45 rpm.

Platter: Aluminum diecast.

Speed Accuracy: ±0.002 percent.

Wow & Flutter: 0.025 percent W rms (JIS C5521), 0.035 percent peak (IEC 98A weighted).

Rumble: -78 dB DIN B (IEC 98A weighted), -56 dB DIN A (IEC 98A unweighted).

Tonearm

Type: Linear tracking.

Tracking Error Angle: ±0.1 degree.

Resonance Frequency: 12 Hz with P22S cartridge.

P22S Phono Cartridge

Type: Moving magnet.

Frequency Response: 20 Hz to 35 kHz, ±3 dB.

Output Voltage: Greater than 2.5 mV at 1 kHz, 5 cm/S lateral velocity.

Channel Separation: 22 dB at 1 kHz.

Channel Balance: Within 1.8 dB at 1 kHz.

Recommended Load Impedance: 47 to 100 kilohms.

Stylus Tip: 0.3 x 0.7 mil, elliptical diamond.

Recommended Tracking Force: 1.25, ±0.25 g.

General Specifications

Dimensions: 17 in. (43.1 cm) W x 3 1/2 in. (8.8 cm) H x 13 3/4 in. (34.9 cm) D.

Weight: 16.3 lb. (7.4 kg).

Price: \$470.00.



When Technics introduced their remarkable SL-10 turntable last year, it was stated that this model would be the first of a complete line of tangential-tracking turntables — so that it was no real surprise when the SL-QL1 came along. Like the SL-10, it includes a phono cartridge but instead of it being a moving-coil type, the SL-QL1 has a high-quality moving-magnet type, the

P22S. Although, naturally, there is no built-in head amplifier, this turntable is four inches longer than the SL-10. There is no record clamp but, other than these relatively minor items, the basic design of these two turntable models appears identical.

The phono cartridge is mounted on a 4 1/2-inch arm which slides along a bar mounted in the dust cover, while an illu-

minated arrow, visible from the top, indicates the arm's position. The cover, of course, has to be shut before the unit can operate, but the control buttons are located outside the cover for ease of access. The on-off switch and speed selectors are on the left, while four buttons on the right are for *Start*, *Stop*, *Repeat*, and *Cueing*. Lifting the cover reveals a slide switch marked *Auto* with additional posi-

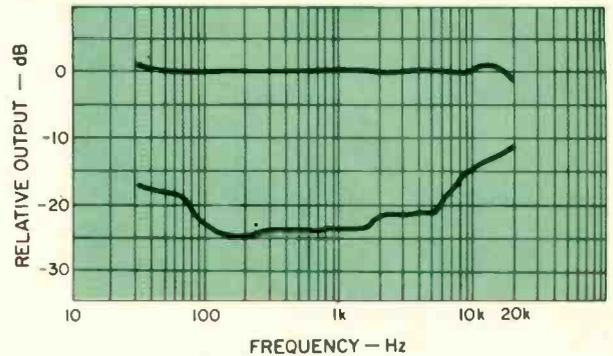
All the measurements, wow and flutter, rumble, and tracking, showed that the SL-QL1 can stand comparison with the best.

tions for three record sizes. Normally, this would be left in the *Auto* position as an optical sensor under the platter automatically sets the correct arm drop point over the lead-in grooves; the manual selector only needs to be used when playing transparent records.

A strobe-type speed indicator is located at the left of the platter, near the front, though a variable speed control is not provided on this unit. The motor is a direct-drive brushless d.c. type with the rotor attached to the platter. It uses the Technics planar-opposed slotless construction in conjunction with special flat, overlapping coils. A built-in frequency generator supplies error-correction pulses to a quartz-controlled PLL circuit.

The tonearm drive motor is a precision d.c. type controlled by optical sensors which detect minute groove deflec-

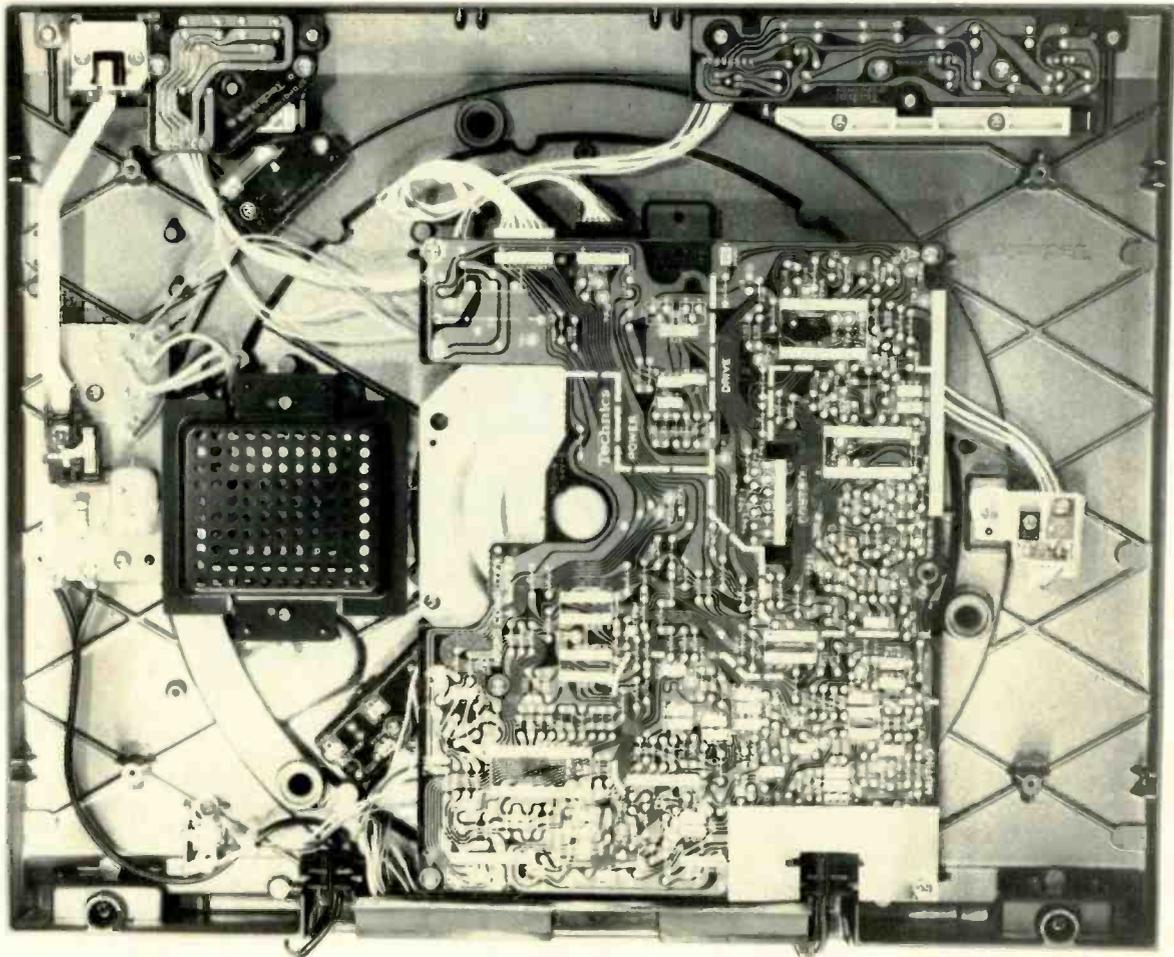
Fig. 1—Frequency response, Technics P22S moving-magnet phono cartridge.



tion angles. The arm bearing is a four-point gimbal suspension design, and a two-position switch, near the pivot, offers a choice of tracking forces — 1.25 or 1.5 grams. The cabinet base and the

mechanism are made from diecast aluminum, and the unit stands on four isolating feet.

When the *Start* switch is depressed, the arm automatically moves to the lead-in groove and the cartridge is gently lowered. If the switch is depressed during



This turntable is resistant to acoustic feedback problems and can take a hard blow to the base without the cartridge mistracking.

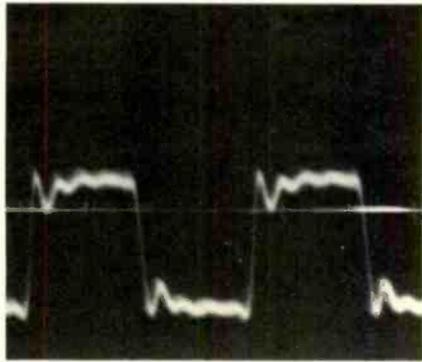


Fig. 2—Square wave response, P22S cartridge.

play, the arm will return to the start position and begin the cycle again. However, if the *Start* button is kept depressed, the arm lifts the cartridge and then begins to move towards the center of the record until the button is released. If the *Stop* button is then pressed, the arm will move in the other direction. When it reaches your desired spot, the cartridge can be lowered by pressing the *Cueing* button. Thus, there is complete control in either direction, and the arm will not move if there is no record on the platter. Furthermore, if the dust cover is raised during play, the tonearm will return to its start position.

As mentioned earlier, the cartridge fitted is a moving-magnet type, the P22S, and it has an elliptical stylus with 0.3 by 0.7 mil radii. The cantilever is made of pure boron tube, and the magnet is one of Technics' new disc types. The compliance is stated as being 12×10^{-6} cm/dyne at 100 Hz.

Measurements

For the initial tests, the tracking force was put in the 1.25-gram setting, although I must confess I could not check it as the phono cartridge is directly above the lead-in groove in the off position and the tonearm cannot be lowered without the motor running and the platter turning! So the first test was for wow and flutter, which clocked in at a low 0.035 percent using the DIN 45-507 standard. Rumble was better than -63 dB, ARRL, while speed was less than 0.1 percent fast. Figure 1, a plot of the frequency response, shows a slight rise in the 12 to 14 kHz range, while separation was 24 dB in the midband, falling to a respect-

able 11 dB at 20 kHz. The square wave response, taken with a CBS STR-110 record, shows a single overshoot followed by well-damped ripples.

Arm resonance was at 11 Hz with a rise of 4 dB. Trackability was very good indeed. All bands of the Shure ERA-III test disc were negotiated without any difficulties, and the DIN 300-Hz disc was tracked to 100 microns, although the tracking force had to be increased to 1.5 grams. With the Shure ERA-IV "Obstacle Course" record, slight mistracking occurred on band 5 of the orchestral bells and flute section. High frequencies (10.8 kHz pulsed) on the Shure TTR-103 test disc were tracked to 24 cm/S and the mid-frequencies (1 kHz and 1.5 kHz) to 30 cm/S.

Use and Listening Tests

A wide variety of records was used to evaluate sound quality, some direct-disc, some digitally mastered, and several dbx-encoded types. The overall sound quality can be characterized as crisp

treble and a tight but well-defined bass. Brass and percussion instruments were well reproduced, offering a little more "zing" than my standard reference cartridge. The stereo image was spacious, with a good sense of depth, and large-scale orchestral works came over with an easy clarity.

The player itself was a pleasure to use, and, as you might imagine, cueing is positive and accurate. After all, the stylus only has a short distance to travel, and there is no anti-skating bias to contend with. I was happy to find that the arm-control buttons have two steps; in the first position, the arm moves slowly, but press a little harder and the arm will move quite fast. The unit is surprisingly free from acoustical feedback problems, and the base could be knocked quite hard before any mistracking occurred. One other point: Special replacement cartridges are now being offered by Shure, Audio-Technica, and Ortofon.

George W. Tillett

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5

MXR MODEL 139 LINEAR PREAMPLIFIER

Manufacturer's Specifications

Rated Output Voltage: 1.0 V rms.

Maximum Output Voltage: 7.0 V rms.

Gain: Phono, 40 dB at 1 kHz; high level, 0 or 20 dB, selectable.

Frequency Response: Phono, RIAA ± 0.25 dB; high level, 20 Hz to 20 kHz ± 0.25 dB, 10 Hz to 100 kHz -3 dB.

S/N Ratio: Phono, 88 dBV; AUX or line, 90 dBV; minimum volume, 95 dBV.

THD or IM: 0.005 percent, rated to maximum output, line or phono.

Phono Input Impedance: 47 kilohms and 200 pF.

Phono Input Sensitivity: 5 mV rms.

Phono Input Overload: 120 mV, 1 kHz, peak.

High Level Input Sensitivity: 50 mV rms.

Low Filter Response: -3 dB at 19 Hz, -29 dB at 5 Hz; phono only.

Crosstalk: High level to phono, 80 dBV.

Headphone Power: 150 mW.

Slew Rate: 7 V/ μ S.

Output Impedance: 600 ohms.

Dimensions: 19 in. (48.3 cm) W x 6 1/2 in. (16.5 cm) D x 1 3/4 in. (4.4 cm) H.

Weight: 5 lbs. (2.3 kg).

Price: \$350.00, rack mount optional.



The Model 139 Linear Preamp from MXR is one of two relatively recent preamp additions to that company's line. Unlike MXR's System Preamp, which was designed for mixing and complex signal routing, the Linear Preamp was designed for basic, simple control of audio signals within a high-quality stereo system. The low-profile front panel of this component is equipped with only a few needed controls. Three push buttons select tuner, AUX or phono inputs. Three more buttons handle the two tape-monitor loops, including dubbing from one deck to the other in either direction. Two additional buttons select combina-

tions of mono or stereo reproduction, while a final button alters high-level gain from 0 dB (unity gain) to 20 dB, depending upon program source and power amplifier requirements. The manufacturer recommends that the gain switch be left in the 0-dB position for best signal-to-noise results unless special program sources or listening conditions necessitate additional gain.

Balance and volume controls utilize rotary knobs. To the right of these are a power on/off switch, a power indicator light, and a stereo headphone jack. Solid walnut end pieces enhance the appearance of the all-black component, and all nomenclature on the front and rear panels is in highly legible white screening.

The rear panel is equipped with a convenience a.c. outlet (North American

version only), a pair of output jacks, the required input jacks plus tape out and in jacks for the two tape monitor loops, and a chassis grounding terminal adjacent to the phono inputs.

Circuit Construction and Highlights

Virtually all of the audio signal circuitry of the Model 139 Linear Preamp is constructed on a double-sided military grade, glass epoxy p.c. board. The block diagram of Fig. 1 shows how each stage of the preamp is interconnected. The phono section provides 40 dB of gain (at 1 kHz) with extremely low noise level. Resistive loading of the phono cartridge is factory set to 47 kilohms, while capacitive loading is set at 200 pF. Phono loading capacitors may be changed by the user if specific cartridge requirements dictate such a change, and access to these capacitors is relatively easy.

The subsonic filter is incorporated in the phono preamp stage to remove unwanted low-frequency information near its source. The filter is a three-pole Butterworth alignment type, with flat re-

sponse in the pass band and a very sharp roll-off below 20 Hz (18 dB per octave). The power supply, a potential source of hum in any low-level preamplifier, is extremely well filtered and decoupled from the phono preamp section in this design layout.

Muting circuitry in the Linear Preamp eliminates turn-on and turn-off transients. FETs, controlled by a time-delay circuit, shunt the signal outputs to ground until all on/off transients have occurred. The headphone output is buffered from the main preamp outputs by its own amplifier, thereby eliminating loading of the main outputs by low-impedance headphones. The Model 139 Linear Preamp has an output impedance of approximately 600 ohms, which allows it to drive any power amplifier having an input impedance of 600 ohms or more.

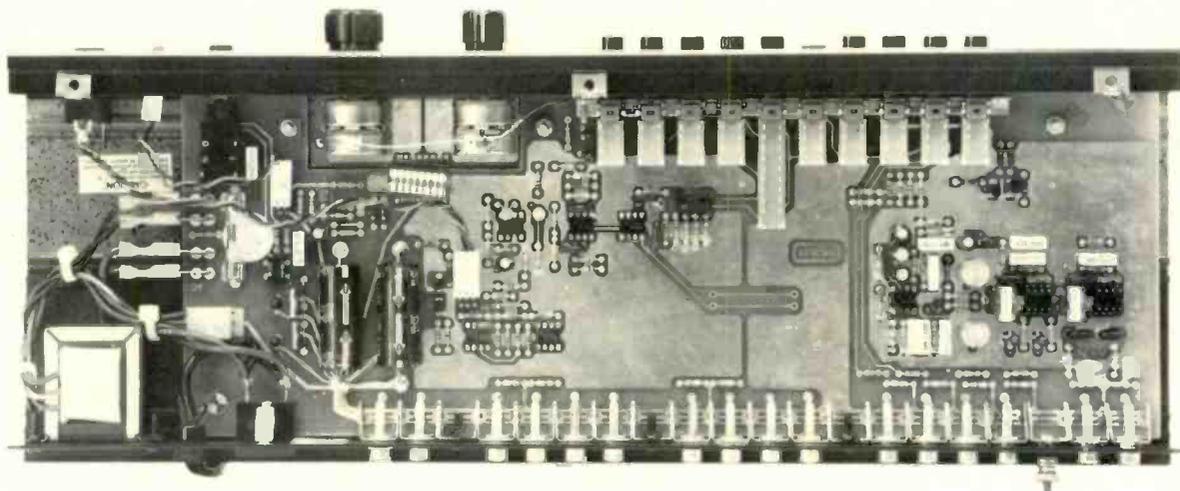
Measurements

Most of the published specs supplied by MXR are referenced to 1.0-V rms output. My measurements are made in accordance with latest IHF/EIA amplifier measurement standards, which call for a preamplifier output reference of 0.5 V, and input reference levels of 5 mV for the phono inputs and 0.5 V for the high-level (line) inputs. These factors should be considered by those readers who attempt to compare results reported here with claims made by MXR.

I measured a phono input sensitivity of 3.13 mV for the unity gain setting of the gain switch, while for the 20-dB gain setting, input sensitivity measured 0.31 mV for 0.5-V output. RIAA frequency response is plotted for both channels in the graphs of Fig. 2. Note that these plots are made with a vertical sensitivity of 2 dB per division. Maximum error oc-

curred at approximately 33 Hz (position of dotted line cursor), where deviation from RIAA was +0.2 dB for the left channel and 0 dB for the right channel. Phono overload measured 90 mV at 1 kHz. At first glance, this appears to be far short of the 120 mV claimed by MXR — until you look at the published spec more carefully and discover that MXR claims a phono overload figure of 120 mV peak and not rms. Not altogether candid, we thought, especially since the 90-mV rms figure is nothing to rave about these days, when some phono inputs can handle 200 and more millivolts at mid-frequencies (and then some loud passages of modern recordings can cause high-output phono cartridges to deliver in excess of 100 mV rms).

Phono signal-to-noise ratio, on the other hand, was superb, measuring 84.5 dB (A weighted) with respect to a



The MXR Linear Preamp deserves accolades for its incredibly low phono noise and hum.

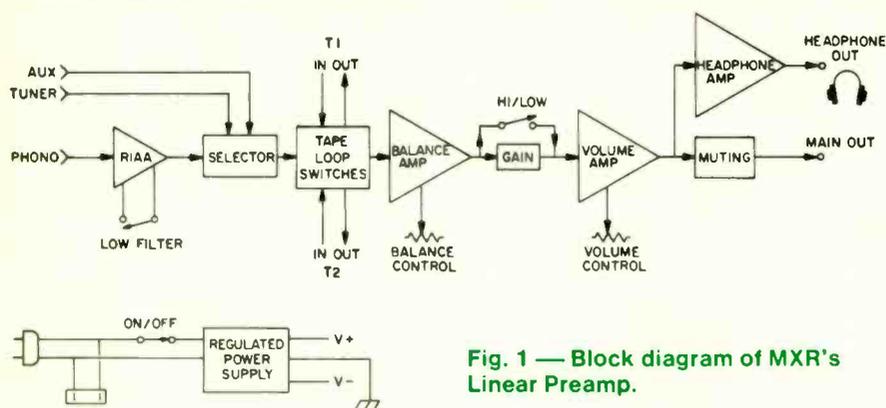


Fig. 1 — Block diagram of MXR's Linear Preamp.

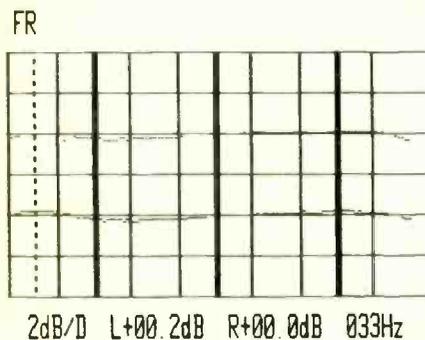


Fig. 2 — Frequency response of the phono section.

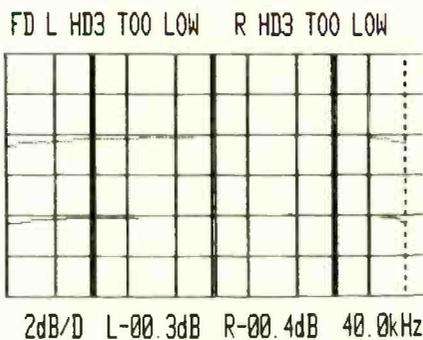


Fig. 3 — Frequency response of the line-level section.

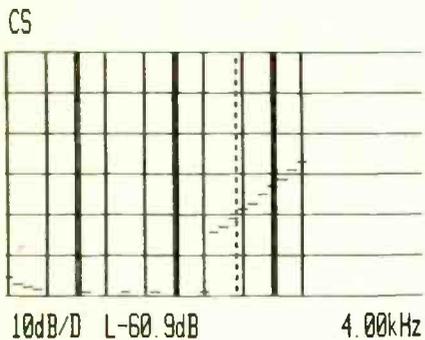


Fig. 4 — Separation of the line-level section.

5-mV signal input and a 0.5-V output. Signal-to-noise for the line level section measured 92 dB in the unity gain setting (95 dB at minimum volume) and 85 dB in the 20-dB gain setting (91 dB at minimum volume), referred to 0.5-V in and out.

Figure 3 is a plot of line-level frequency response extending from 20 Hz to 40

kHz. Deviation from flat response is less than 0.5 dB at the frequency extremes and less than 0.2 dB over most of the audio band. Note that at the top of the display are the notations "HD3 TOO LOW" for both the left and right channels; these notations mean that third-order harmonic distortion was too low for the Sound Technology instrument to measure accurately. (Its lowest reliable reading is about 0.02 percent.) To accurately read THD and IM for this preamp, I had to resort to a manually operated distortion analyzer (Sound Technology 1700B), where I obtained THD readings for the line level section of 0.005 percent at 1 kHz, 0.0055 percent at 20 Hz and 0.007 percent at 20 kHz. SMPTE IM measured 0.0025 percent. The sub-sonic filter had a -3 dB roll-off point at 19 Hz, and at 10 Hz it attenuated the input signal by 17 dB.

Figure 4 is a plot of channel separation versus frequency for the line level section of the Linear Preamp. The cursor

was arbitrarily set to 4.0 kHz to obtain a channel separation reading of 60.9 dB. Note that at mid-frequencies, channel separation could not be read accurately, being in excess of 80 dB (the maximum dynamic range of the display of Fig. 4). The graph reappears below 100 Hz on the display, but even at 20 Hz (left-most point on the display) separation was still in excess of 75 dB.

Use and Listening Tests

The simple layout of this preamplifier should appeal to audio purists who have no desire for fancy signal processing circuits, tone controls, loudness controls, and the like. The faithfulness of the sound reproduced by this deceptively simple unit will appeal to anyone who craves accurate music reproduction. I especially liked the way in which the balance control is calibrated; its tapers are arranged so that constant volume levels are maintained even if the control has to be positioned away from its center point.

The front-panel headphone jack, when connected to low-impedance headphones, supplied ample sound for monitoring purposes but was no substitute for a headphone jack found on a power amplifier and intended for serious, full-volume listening. Feeding an 8-ohm load, this headphone jack was able to deliver only 30 mV. Greater power levels were attainable from this jack when higher impedance phones were used.

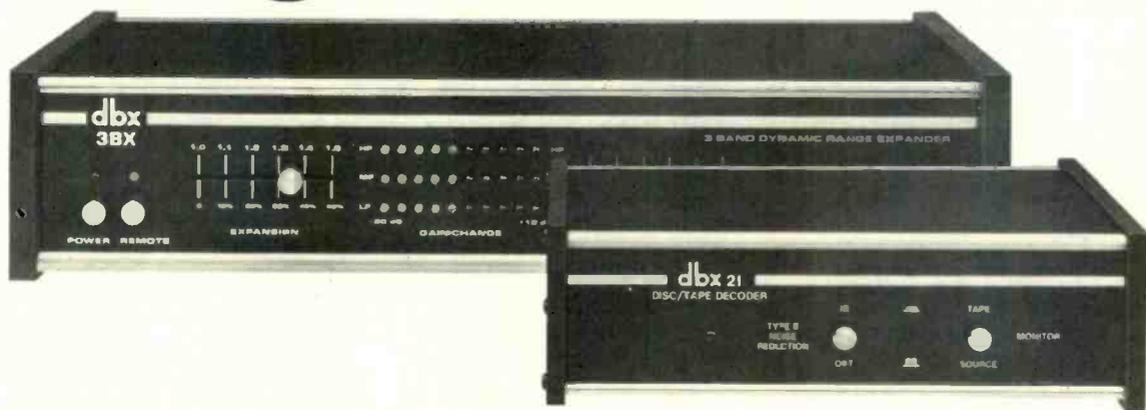
The two-position gain switch was a welcome feature and one which more preamp makers ought to adopt. What with all the program sources now available for home high-fidelity use, there is a wide range of voltage outputs that a preamp is called upon to handle. To be sure, the master volume control can usually take care of these variations, but it is sometimes inconvenient (and often penalizing to S/N ratios) to have to operate the master volume control at "barely cracked open" or at its full clockwise position.

Besides its totally uncolored reproduction of sound, the MXR 139 Linear Preamp deserves accolades for its incredibly low phono noise and hum. This is all the more impressive since its power supply is not outboard of the chassis, as is true of some other high-end preamps that attempt to achieve this level of performance.

Leonard Feldman

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A live performance has 90 or more decibels of dynamic range.

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MAROVSKIS AUDIO SYSTEMS MIT-1 PHONO CARTRIDGE

Manufacturer's Specifications

Type: Moving coil with van den Hul stylus.

Output Voltage: 0.25 mV rms at 5 cm per second.

Frequency Response: 20 Hz to 10 kHz ± 1 dB, +3 dB at 20 kHz.

Channel Separation: 25 dB at 1 kHz.

Dynamic Compliance: 16×10^{-8} cm per dyne, 100 Hz.

Channel Balance: Within ± 1 dB at 1 kHz.

Recommended Tracking Force: 2.00 to 2.50 grams.

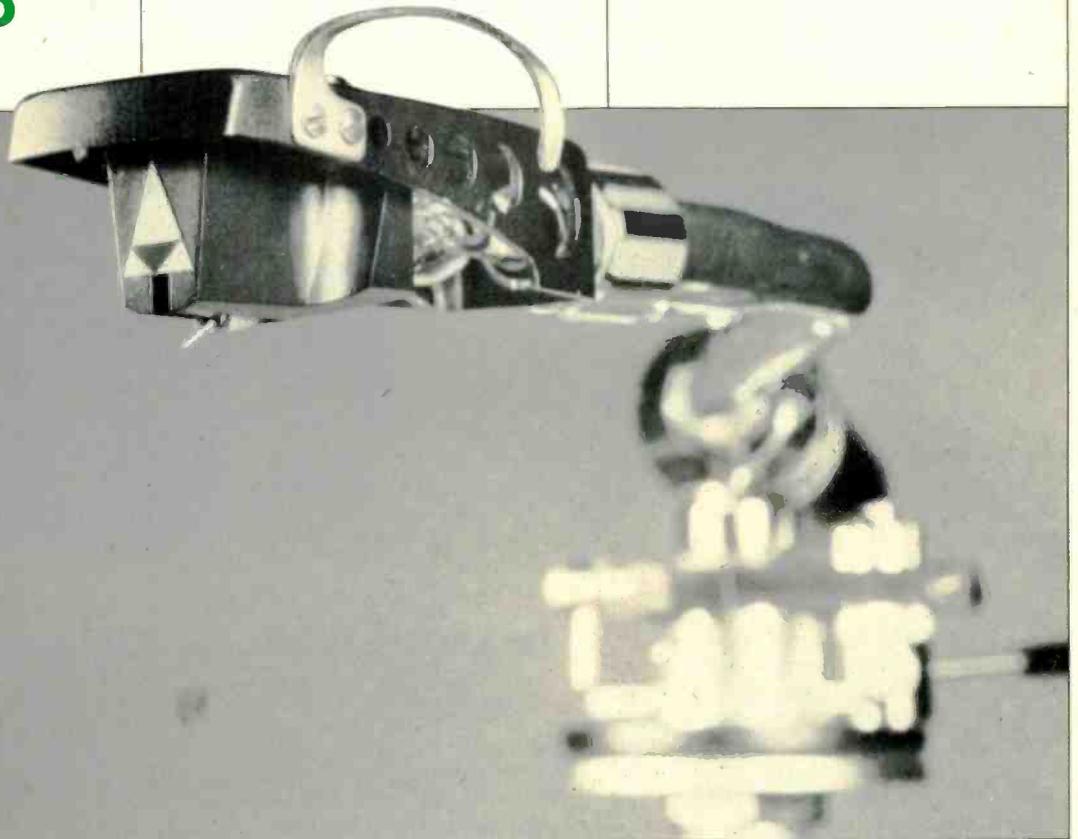
Vertical Tracking Angle: 18 degrees.

Input impedance: 3 to 5 ohms.

Weight: 5.5 grams.

Recommended Tonearm Type: Light to medium mass.

Price: \$550.00.



Contrary to widespread belief, the moving-coil phono cartridge is not a recent invention, only its use has become popular within the past decade. Actually, the moving-coil cartridge was invented by Arthur C. Keller of Bell Laboratories in 1929, utilizing either a diamond or sapphire stylus. The invention was announced substantially later at the 67th Audio Engineering Society Convention in New York on October 21, 1980,

where Keller presented his paper, "Early Hi-Fi and Stereo Recording at Bell Laboratories (1931-1932)." The first commercial version of Bell's moving-coil cartridge was called the 7A Reproducer, and it was followed shortly thereafter by an improved version, the 9A Reproducer. An interesting related fact is that Keller and his associate Ira Rafuse had already completed their work on the single-groove 45/45 stereo system in

1932, one year before Alan Blumlein of England. Why Bell Laboratories did not choose to announce these inventions in 1932, but waited until 1980, may never be known.

In the interim, the moving-coil phono cartridge has undergone many refinements, and one of the latest is embodied in the Mirror Image Transducer (MIT-1) distributed by John Marovskis Audio Systems, Inc. Perhaps the most interest-

ing feature of this cartridge is its use of the van den Hul stylus, named after its inventor, A.J. van den Hul, of Delft, The Netherlands. This stylus has a profile as close as possible to that of a cutting stylus so as not to degrade records in playback. The area of groove contact with this stylus is a thin line, the same as with a cutter stylus. The fit to the groove is, then, quite exact even though the area of the footprint of the van den Hul stylus is actually about the same as that of an elliptical stylus, though of course very different in shape. The van den Hul contact area, as measured using a Scanning Electron Microscope (SEM) picture (see Fig. 1), is 143 μ long with a constant contact diameter of 10 μ over its entire length.

By contrast, the contact area of other styli more often resemble broad ellipses. This occurs because a normal elliptical stylus has a quite narrow frontal angle which results in a small area of contact with the groove walls near the bottom of the groove. Vertical tracking force (VTF) then deforms this area of contact in the groove to a degree sufficient to generate a force required to counteract the VTF needed to track the modulations. This groove deformation, with conventional styli, is quite extensive and is close to the elastic limits of the vinyl at the maximum VTFs commonly specified.

The van den Hul stylus has a frontal angle of about 88 degrees with nearly straight groove-contact lines. These contact lines, in fact, extend well above the groove walls even for the most highly modulated grooves. The fit to the groove is thus very precise, about 80 percent. More significantly, this fit is maintained with the MIT-1 cartridge even at high modulation levels. Since the contact radius on the van den Hul stylus does not vary along the length of this line contact, unlike other line contact profiles, extraordinary resolution of complex information is possible, even at high modulation levels. The deformation of the groove by the VTF is much less extensive with the van den Hul stylus because of the good fit to the groove allowed by the stylus geometry. Thus, much greater safe-tracking forces are possible than with standard stylus profiles. The MIT-1 requires a minimum vertical tracking force of 2 grams and a maximum of 2.5 grams — a range providing optimum tracking of high-velocity modulations.

SEM studies have shown that increasing the VTF by 1 gram above the maximum recommended when using certain standard stylus profiles can result in permanent groove deformation after only a single play. On the other hand, the MIT-1 cartridge can be used with tracking forces sufficient to nearly collapse the suspension without introducing visible permanent deformation of the groove. The van den Hul stylus then appears to be more gentle on the groove than other stylus profiles, provided the stylus is positioned precisely in the groove. This paradox is very welcome in view of the very narrow contact line of this profile (10 μ). However, this paradox is true provided the azimuth angle is adjusted so that the stylus is placed in the groove in the same orientation as the cutter stylus cut the groove. With the van den Hul stylus there is less than 1.5-degree allowance, while for other styli this adjustment is relatively non-critical and only introduces a degradation in crosstalk. Unless this azimuth adjustment is correct, it is possible for the van den Hul stylus to deform the misaligned groove beyond the elastic limits and thus introduce record damage which, in extreme cases, actually takes the form of shaving material off the groove walls. To use the van den Hul stylus properly, the user must be assured that the stylus is in correct alignment with some visible reference mark that can be used to place the stylus in proper orientation to the groove. In assembly of the MIT-1, the logo on the front of the cartridge is carefully aligned by optical means with the front axis of symmetry of the stylus. When installing the cartridge, the user must carefully align the logo with respect to the record surface. A simple reflection of the bottom of this logo in the record or in a mirror must be visible as parallel with itself. When this is achieved, the stylus is properly aligned in the groove.

The choice of materials in the moving mechanism have been made to take advantage of some unusual benefits and possibilities that the van den Hul stylus allows in record playback, as well as to satisfy certain requirements for its use. In general, the suspension and cantilever must be more robust and have a high degree of stiffness. Torsional effects under dynamic conditions must be held to a minimum. Because of the good fit to the groove, there is a much more tight

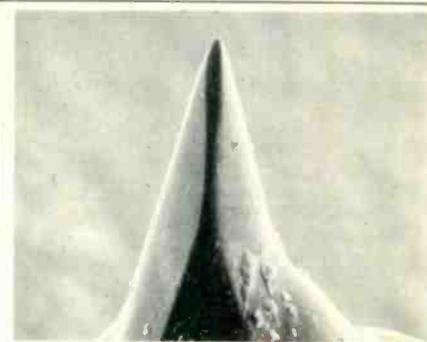


Fig. 1—Lateral SEM view of the van den Hul stylus in the MIT-1. The dark area in the center of the stylus, from the tip to where it begins to widen, is the actual groove contact area, which is 143 μ long by 10 μ wide. (x300 magnification.)

groove coupling with the van den Hul stylus than with conventional profiles, and this, in turn, results in differences in the forces that the groove modulations can exert on the moving mechanism. Particularly interesting is the need for more moving mass with the van den Hul than for conventional styli. Reasons for this arise from the nature of the groove geometry as a function of modulation levels. In the MIT-1 the ultra-low mass or minimum mass allowed by existing materials is replaced by the concept of optimum mass.

A reason for this difference in design approach is because it is desirable to minimize all deformation of the vinyl groove in playback with conventional styli, but not with the van den Hul stylus. Conventional styli do not look like the record cutter styli, and consequently a groove deformation in playback results in an additional source of distortion. Moreover, SEM studies also show that the record groove geometry can differ greatly from the record cutter geometry when the modulation is large. One important effect is due to the deformation of the groove by the spring-back of the lacquer master into which the modulations are cut. Measurement of groove cross sections revealed that grooves with small modulations have walls that are close to the 90-degree angle of the cutting stylus. But, for large modulations the groove walls can make an angle of

After listening to the MIT-1 cartridge over an extended period, I feel it is one of the finest I have ever tested.

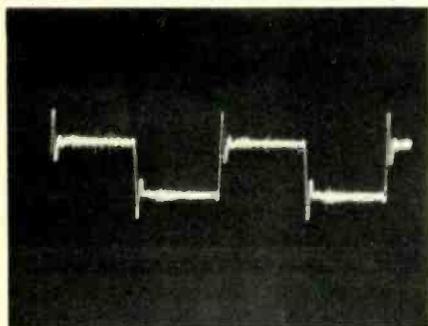


Fig. 2—Response to 1-kHz square wave.

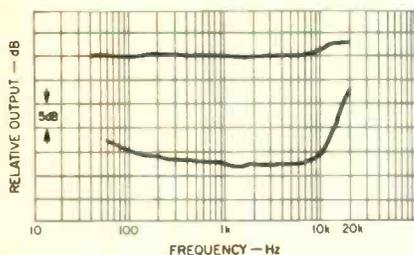


Fig. 3—Response of left channel and separation.

less than 80 degrees. This is a very large deformation and gives rise to a dynamic modulation of the crosstalk in playback because the entire playback system expects an orthogonal relationship for the groove walls. It should be noted that a conventional stylus, which fits near the bottom of the groove, increases this type of distortion in playback unless the dynamic deformation of the vinyl in playback can be minimized. The minimum-moving-mass concept can help to bring this about.

A different circumstance is found when a van den Hul stylus is used. The 88-degree angle required for good groove contact at small modulation levels can result in a spurious vertical modulation that is related to the program dynamics. The van den Hul stylus can be literally pinched out of the groove in those instances where the groove angle becomes less than the 88-degree angle of the van den Hul stylus. The very nature of the van den Hul profile requires that lacquer spring-back and vinyl deformation be taken into consideration. This can be achieved by introducing the notion of an optimum mass for which one obtains, under dynamic conditions, a de-

gree of deformation in vinyl that complements the spring-back deformation introduced in the cutting process and transferred to the record by duplication. Because the amount of spring-back is substantial, a significant improvement in sonic performance can be realized. It should be noted that this correction is only possible because the spring-back deformation and dynamic deformation under playback are both related to the geometry of the cutting and playback styli. When these are similar in appearance, the two can be made to at least partially cancel one another. The van den Hul stylus of the MIT-1 phono cartridge represents an attempt to correct for effects derived from the elasticity of the two media, i.e., the spring-back distortion depends on the material composition of the lacquer master and upon the cutting temperature, just as the degree of dynamic deformation upon playback also depends upon the vinyl composition and temperature.

The JMAS MIT-1 phono cartridge comes mounted on a metal plate which is encased in a black velvet box. The cartridge is supplied with a small screwdriver, mounting screws and nuts, a stylus brush, and four color-coded wires with gold-plated contacts for connecting the cartridge to the shell. The cartridge has a removable stylus guard rather than the hinged guard usually supplied nowadays. The stylus assembly is not user replaceable. Except for the van den Hul stylus, the cartridge is manufactured by the Coral Audio Corp. of Japan to JMAS specifications. The cantilever is made of a beryllium alloy and the van den Hul stylus is obtained from Fritz Gyger Co., Switzerland. All optical alignments and final adjustments of the mechanism are performed by JMAS.

Because of the minute size of the moving coils, the signal output is very low and a step-up device is needed to raise the output voltage to a level that can be used with the usual preamplifier phono input stages. I tested the MIT-1 cartridge with the a.c.-line powered Audio Standards MX-10A pre-preamplifier, which proved to be excellent, and the battery-powered Marcof PPA-2 pre-preamplifier, which was also very good. However, all the reported measurements and listening tests were made with an Audio-Technica AT-650 Moving-Coil Matching Transformer set for an input

impedance of 3 ohms. The AT-650 proved to be an excellent passive matching device for the MIT-1.

Measurements

The MIT-1 phono cartridge was mounted in an Audio-Technica headshell and used with the Audio-Technica Model AT-1010 tonearm mounted on a Luxman PD-555 vacuum turntable. The cartridge was oriented in the headshell and tonearm with the Dennesen Geometric Soundtracktor. Laboratory tests were conducted at an ambient temperature of $74^{\circ}\text{F} \pm 1^{\circ}$ (23.33°C) and a relative humidity of 68 percent ± 3 percent. The tracking force for all reported tests was at 2.4 grams, with an anti-skating force of 2.5 grams. The cartridge, when lightly tapped, was found to be slightly microphonic. As is my practice, measurements were made on both channels, but only the left channel is reported unless there is a significant difference between the two channels, in which case both channels are reported for a given measurement.

Frequency response, using the Columbia STR-170 test record, was +0.5 dB from 40 Hz to 6 kHz, +1 dB at 8 kHz, +1.9 dB at 10 kHz, and +3.7 dB from 15 to 20 kHz. Separation was 23 dB at 1 kHz, 23.5 dB at 7 kHz, 23 dB at 10 kHz, 19 dB at 15 kHz, and 12 dB at 20 kHz. From these data, it is evident that the MIT-1 has an excellent frequency response and a most satisfactory high-frequency separation.

The 1-kHz square-wave response shows a large overshoot followed by ringing which decayed rapidly. The overshoot is probably due to the underdamped high-frequency resonance of the cartridge, which is in the ultrasonic range. The cartridge-arm low-frequency lateral resonance is at 8 Hz at +6.5 dB amplitude. The vertical resonance is about 8 Hz.

The following test records were used in making the reported measurements: Columbia STR-170, STR-100, STR-112; Shure TTR-103, TTR-109, TTR-110, TTR-115, Deutsches Hi-Fi No. 2; Nippon Columbia Audio Technical Record (PCM) XL-7004, and the Ortofon Direct-Cut Pickup Test Record 0001.

Wt., 4.8 g; d.c. res., 6.8 ohms; opt. tracking force, 2.4 g; opt. anti-skating force, 2.5 g; output (using AT-650 transformer), 2.77 mV/cm/S; IM distor-

Especially noted in the listening tests were the excellent sonic clarity, transient response, and transparency of sound.

tion: (4:1) +9 dB lateral, 200/4000 Hz, 3.2 percent; +6 dB vertical, 200/4000 Hz, 4.6 percent; crosstalk (using Shure TTR-109), 23 dB; channel balance, within 0.5 dB; trackability: high freq. (10.8-kHz pulsed), 30 cm/S; mid-freq. (1000 and 1500 Hz, lat. cut), 31.5 cm/S, low freq. (400 and 4000 Hz, lat. cut), 24 cm/S; Deutsches Hi-Fi No. 2 300-Hz test band was tracked cleanly to 86 microns (0.0086 cm), lateral at 16.20 cm/S at +9.66 dB and 55.4 microns (0.00554 cm), vertical at 10.32 cm/S at +5.86 dB. The latter measurements are excellent, especially the vertical measurement, because not many cartridges can track the higher level 300-Hz bands on this test record.

The JMAS MIT-1 phono cartridge played all the test bands except for level 5 of the violin, where there was a hint of stridency, on the Shure Obstacle Course — Era III. On the Shure Obstacle Course — Era IV, the cartridge had difficulty with the harp and flute test band, level 4, where the flute started to break up, and the flute and bells test band, level 5, where stridency was heard. Overall, the MIT-1 performed superbly inasmuch as it's a very rare commercially available phonograph record that has recorded musical signals with a velocity greater than 20 cm/S, the average being around 15 cm/S. Level 4 of the harp and flute and level 5 of the flute and bells are recorded at velocities over 45 cm/S and over 50 cm/S, respectively.

Use and Listening Tests

As usual, I performed many hours of listening tests both before and after measurement. While listening to a wide variety of records, I especially noted the excellent sonic clarity, transient response, and transparency of sound, as well as the lack of detectable coloration, particularly when reproducing the high recorded levels present on most direct-to-disc recordings. I did not find the MIT-1 to be bright despite the 1-dB rise at 8 kHz, and the bass was sonically well defined and tight. Voice was reproduced rather well, and applause definition was excellent. After listening to the MIT-1 phono cartridge over an extended period of time, I am of the opinion that it is one of the finest phono cartridges I have ever listened to in many years of testing cartridges.

B.V. Pisha

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One of the most prestigious names in audio offers a remarkably affordable way to improve your stereo system. Bang & Olufsen MMC Cartridges.

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Audible Images Test Tape AI-106, cassette, \$17.00. (822 Stendhal Lane, Cupertino, Calif. 95014.)

This cassette is intended to provide "a convenient way to confirm playback-deck compatibility with Audible Images' tapes." Unhappily, in the hands of most laymen, this tape may cause undue worry when played on just about any cassette deck. This is because meters on cassette decks are merely recording indicators and *not* accurate voltmeters, and because the meters used on cassette machines are *not* VU meters or flat-response devices. In addition, specialized equalization is often applied to the meters as an aid in recording and to help prevent high-frequency tape saturation. So, without a good voltmeter, at the very least, this test tape is really only a curiosity. One word of caution: Do not try to make adjustments based on this tape since it is not a standard alignment tape. Such work is best left to a technician trained at the factory.

Be that as it may, this appeared quite a worthwhile effort on the part of its manufacturer, so I decided to use two separate tape decks for verification of the tape's material as well as for the review of the other seven Audible Images tapes. The cassette decks chosen were a Technics RS-M95 and a Pioneer CT-F1250. A great deal of effort was spent to match up the decks to the tape, including the use of two calibrated Hewlett-Packard voltmeters to verify readings on the meters, to make small adjustments to the playback equalization, and to check internal voltages in the cassette machines.

The first offering on the tape is a Dolby level tone which was 1 1/4 dB below the 200 nWb/m level test tape I have from Dolby Laboratories. This was the case on both machines but is well within the tolerances of the heads and tape itself (Fuji Metal Tape, the only tape formulation used for Audible Images' cassettes).

Following is a 15-kHz tone at -10 dBV for head azimuth alignment. My copy had ticks superimposed on the tone, and the phase of the two channels drifted sufficiently to make perfect azimuth adjustment impossible (a Tektronix 503 scope was used for this).

The next offering is a frequency response test encompassing 19 different

frequencies from 20 Hz to 15 kHz at -10 dBV. This run turned out to be fairly flat, considering the cassette medium, except for the extreme top end which was down in magnetic level on the tape. Both machines showed flat response (after EQ adjustment) to ± 2 dB from 20 Hz to 12 kHz, although the Pioneer was down about 8 dB at 20 Hz.

There follows a pink noise run of about one minute which is of questionable value. Although instructions are given on its use, I'm doubtful that it will be of much value to someone not experienced in its use. Pink noise at high playback levels can damage speakers and should be used with great care and at reduced volume levels.

The reverse side of AI-106 contains a demo recording of "Ionization" by Varese and "Music for Orchestra" by Kirchner, both performed by members of the San Francisco Conservatory Orchestra under Barry Jekowsky in the former and John Adams in the latter. These selections are rather stunning in their sonic impact, if you have the power to reproduce the levels without clipping. The performances are not super-polished, but serve their purpose. The original source, unfortunately, has some very annoying on-off recording clicks which were not edited out. There's also some modulation noise in the original tape, as well as audible tape hiss (obviously the production did not use Dolby A). However, these are not such that the sonic pleasure is substantially diminished. There is, however, one cymbal crash in the "Ionization" that is seriously overloaded, and there is some distortion in the brass. It is not possible to tell whether the original or the cassette is the culprit here.

All Audible Images cassettes are duplicated in real time (1:1), much like the In Sync Labs cassettes, on "highly modified" Nakamichi machines. They may be obtained in Standard or "Nakamichi" equalization. C. Victor Campos

Solid Gold: Tibor Szasz, piano.
Audible Images AI-105, cassette, \$17.00.

Performance: B Processing: A
Recording: C

This is a potpourri of piano pieces which is intended to dazzle the listener.

However, Mr. Szasz is musically "young," despite being a good pianist, and this makes me wonder quite why he chose material which has been played and recorded often by masters of the instrument, thereby inviting comparison. The sonorous majesty of the Bosendorfer Concert Grand piano is totally missing here, and this instrument even sounds clanky at times. The pickup is very close, which makes the midrange prominent at the expense of the ends of the frequency range. Also, there is a slight, but obtrusive, recording-hall hum on some of the selections.

C. Victor Campos

Nights in the Garden Court: San Francisco String Quartet
Audible Images AI-104, cassette, \$17.00.

Performance: B- Processing: A
Recording: A

These are a series of short selections for string quartet including the now-ubiquitous "Kanon" of Pachelbel. The original recording superbly captures the sound of the quartet, though the pickup is a little too close for me. The room in which the recording was made does not enhance the sound of the instruments and may be the reason for the close pickup. The extreme top end appears to be rolled off. The performances are so-so with little interpretive depth, but it's a good effort, worthwhile in the listening.

C. Victor Campos

Professor Plum's Jazz
Audible Images AI-101, cassette, \$17.00.

Performance: B- Processing: A
Recording: B+

Here's a pickup done just as music sounds in a club, with real-life perspective, no gimmicks — the finest I've heard in some time. You can close your eyes and, on a good system, you can swear you're in the club. The vocalists are also picked up naturally, not with the "mike down the throat" and Jolly Green Giant effects that result in the vocalist being 10 dB louder than the group or orchestra. Sometimes it's so accurate you can hear the cornet (on the right channel) bounce off the left wall ("Jazz-



Bob Carver explains (briefly) how the Magnetic Field Amplifier works. (Others tell how it sounds.)

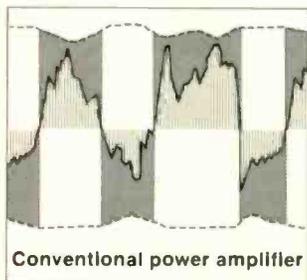
Q. How is it possible for an amplifier as small and as light as the M-400 to deliver so much power and to cost so little?

A. The M-400's size (less than 7 inches) and weight (less than 10 pounds) reflect the advanced technology and the new patented designs used in both its power supply and amplifying stages—and the innovative relationship between them. (Not to mention the incredibly low price that resulted: \$399.)

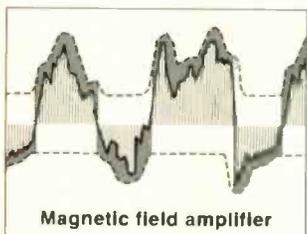
Q. What is different about the M-400's power supply and amplifying stages?

A. In any amplifier, the power supply produces and stores energy for use by the amplifying circuits.

Conventional amplifier power supplies are very inefficient because they produce a constant high voltage level at all times—irrespective of the demands of the ever-changing audio signal—and even when there's no audio in the circuit at all!



Solid line: audio output signal
Broken line: power supply voltage
Shaded area: wasted power
Vertical lines: power to speakers



Magnetic field amplifier

This inefficient approach demands large and expensive power transformers and electrolytic capacitors. Large heat sinks are also needed to get rid of the heat associated with the constant high voltage of conventional power supplies.

In sharp contrast, the M-400's "smart" power supply produces only the power that the amplifier section needs from moment to moment to handle the signal accurately. In effect, the M-400's power supply is *signal-responsive*. As a result, overall efficiency is extraordinarily high.

Q. Do I really need 200 watts per channel?

A. Yes! If you want to hear music reproduced with full realistic impact and dynamic range, the musical peaks must be handled without compression, clipping or overload.

You'll be amazed at the improvement in openness and clarity when your system is able to deliver the power that music really requires.

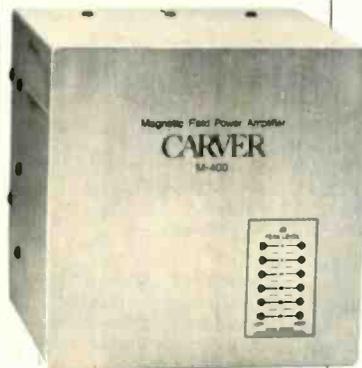
When full digital audio arrives, dynamic-range capability will be even more significant. And the M-400's power will be even more necessary—with its ability to deliver 500 watts in mono, 900 watts for brief time periods, and more than 1200 watts on peaks!

Q. Now I understand why the M-400's power capability will improve my system, but can my speakers take it?

A. Speakers with a power rating of 50 watts or so will have no problem with the M-400. That's because speakers are not generally blown out by high, clean power, but rather by low-powered amplifiers pushed beyond their overload points. These low-powered amplifiers

"clip", generating speaker-damaging transients.

In addition to providing better sound and sufficient protective circuits that guard both itself *and* your loudspeakers from almost any conceivable damaging circumstance. These include long and short-term overload, sudden overdrive signals (such as from dropped styli), shorted speaker leads, etc.



M-400 Magnetic Field Amplifier
201 watts minimum continuous power per channel (500 watts mono) into 8 ohms, 20 Hz to 20 kHz, with no more than 0.05% total harmonic distortion.

All this protection operates via the signal-controlled power supply circuits, not the amplifier stages, so there's absolutely no chance of the typical distortions caused by conventional protection circuits.

Q. Aside from the technical innovations in its design, how does the M-400 sound when it comes to music?

A. My design goal was to make it sound musically accurate, and I'm proud to

say that it does. More convincing perhaps, others confirm this. Leonard Feldman in *Audio* reported: "Music reproduction was superb and completely free of any false bass coloration or muddiness. The amplifier handled the toughest transients we were able to feed to it with ease... there was none of the brittle quality that one often detects from amplifiers that are beginning to strain."

Julian Hirsch reported in *Stereo Review* that "...Its distortion and noise levels are entirely negligible... hardly conceivable that a small, inexpensive, lightweight cube such as this could deliver as much clean power as any but a few of the largest conventional amplifiers on the market—but it does."

Q. Is the M-400 limited to systems with separate amplifiers?

A. No. The M-400 can be used in many different types of systems, including those with receivers and integrated amplifiers. With our new Z-coupler device, you can upgrade your existing low-power system into a superb 200 watts-per-channel system. What's more, the M-400 is easily connected without accessories to put out 500 watts mono!

Q. How can I get more information?

A. Easily. For literature, test reports and the address of your nearest Carver dealer, circle the number below. For faster response, write to us directly.

CARVER

C O R P O R A T I O N

P.O. Box 664, 14304 N.E. 193rd Place Woodinville, Washington 98072

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Despite problems with some of their sources, the Audible Images cassettes generally have excellent processing of their tapes.

in 'Babies Blues'), as in real life.

The performers are highly competent but there's a certain flavor and enthusiasm missing from their playing that one can hear in just about any club in New Orleans. But, nevertheless, this cassette is highly recommended. Unfortunately, my copy had serious IM distortion in

some medium-level cornet passages on the right channel of "Snag It." Also, the right channel near the end of "Jazzin' Babies Blues" had two thumps (digital drop-outs?) after which the selection was quickly and audibly terminated. The selections contained here probably originate from different sessions since the

musicians' positions change from some selections to others. Superb cassette processing with almost inaudible hiss.

C. Victor Campos

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Guitar Music from South America:
George Sakellariou, guitar.
Audible Images AI-102, cassette, \$17.00.

Performance: B- Processing: A
Recording: B+

Guitarist Sakellariou doesn't have the feel for the syncopations and flavor of Latin music, but he is nevertheless an excellent performer. Since this is really a sonic showpiece, one must consider the performance secondarily.

The recording venue has a strange ambience with short reverb but strong reflections that mar the otherwise great sonic perspective. There is also a great deal of distracting fingering noise due to close pickup, but at the right volume level with good speakers, it could become a representation of the guitar in your room.

There's some tape hiss from the original from which this was sourced, but there are no artificial resonances to the guitar and the cassette copying is superb.

C. Victor Campos

Mendelssohn: Octet for Strings, Op. 20 (string orch. version). Strings of the Israel Philharmonic, Zubin Mehta.
London LDR 1009, stereo, digital, \$10.98.

Sound: ? Recording: ? Surface: A-

Mendelssohn was 17 when he composed this masterpiece for strings, comparable to his "Midsummer Night's Dream" music of the same period. It was scored for four violins, two violas, and two cellos, an exact double quartet, and it is frequently played today by a coalition of two "name brand" quartets.

That it should be acoustically "amplified" to symphony proportions was inevitable in the days before electronics. It was louder, more people could hear it, symphony orchestras could play it and conductors conduct it (there is never a conductor for the original). And most of all, symphonic string sections could show how easily they could play as one, a single violin!

When I put the disc on my table I hadn't noticed that it was the "amplified" version. (Not very clear on the cover.) The Israelis played so well that for a time I was entirely thrown off — I thought the recording was somehow remarkably vague and fuzzy, for only eight instruments. A poor mike pickup?

This fuzziness points up the difference between live music and recorded. No matter how brilliant, on disc the full string orchestra is not one bit louder than the eight soloists of the original. It is simply, noticeably, muddier.

Why this record, then? No doubt for "live music" tie-in reasons. The appeal of the Israel Philharmonic and of that much-traveled conductor Zubin Mehta from New York. And for the virtuoso playing (even if muddied). But if you are truly objective, you will instead go out and buy an LP of the original work done by a mere eight players.

Why digital? Simply because digital recording is clean, and strings do tend to show up any faint trace of residual distortion. Also, London is surely converting to routine digital mastering equipment like everybody else, probably with an eye to the future when these tapes can be put out on home-type digital discs or tape. I must note that there is no particular audiophile appeal here, unless that of Mendelssohnian cleanliness. It is surely possible to produce a state-of-the-art analog recording that would equal this one in sound. A dollar cheaper, too. E.T.C.

Rachmaninoff: Sonata in G minor for Cello and Piano, Op. 19. Stephen Kates, cello; Carolyn P. Kobler, piano.

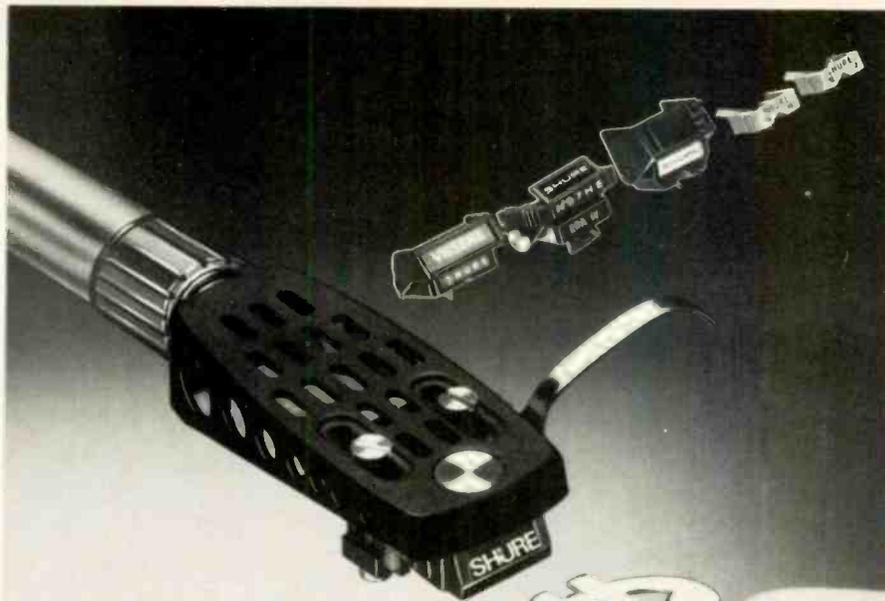
Audible Images AI-107, cassette, \$17.00.

Performance: B Processing: A+
Recording: B+

Here's a very clean cassette of cello and piano. It is perhaps recorded too close as the solidity of the cello is a little greater than life and the slight and corrected bowing errors are clearly audible. It's a very quiet recording with no noise, and the subtle nuances of both the piano and cello are convincingly conveyed with no masking. A very, very nice recording with great undistorted dynamic range, very solid bottom on the Bosendorfer Concert Grand, and clear lower octaves on the cello. The close pickup, though, gives the cello an edgy sound in its top ranges.

Mr. Kates is an excellent performer who elicits a nice tone from his cello, and both musicians deliver a fine performance of this little known and seldom recorded sonata. Superb cassette production from Leo de Gar Kulka.

C. Victor Campos



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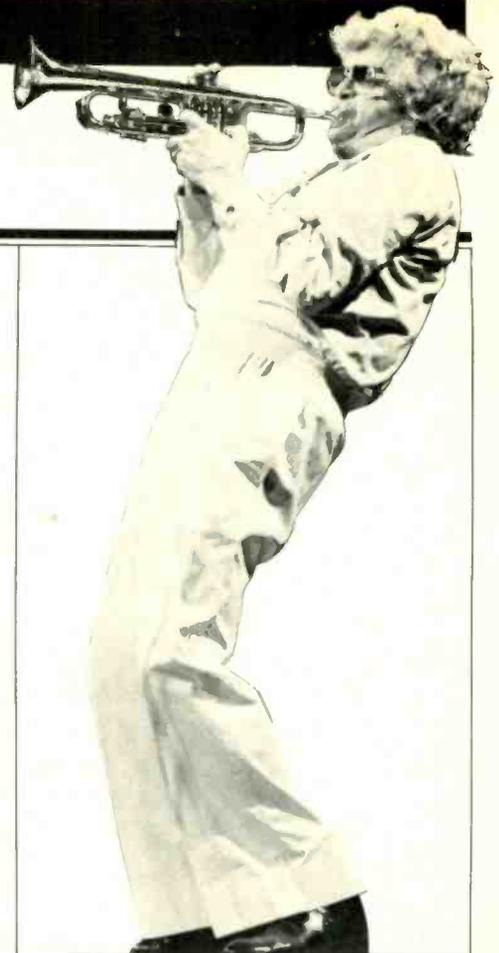
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JAZZ & BLUES

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The Best of . . .: Maynard Ferguson
Columbia JC 36361, stereo, \$8.98.
It's My Time: Maynard Ferguson
Columbia JC 36766, stereo, \$9.98.

Sound: A- Performance: C

Though trumpeter Maynard Ferguson's reputation was gained in the popular tradition of the Big Bands in jazz, the past 10 years have seen him veering steadily away from these roots. His music has never been related to the innovative and exploratory traditions established by Parker, Coltrane, and Miles. Instead, he has always homogenized the spontaneity of jazz into calculated orchestrations centered around the high-note pyrotechnics of his trumpet.

In the last decade Ferguson showed an ability to tap the mainstream sounds of R & B and disco and graft them to the jugular of his adrenalin-rush approach to music. His increased involvement with this form is chronicled on *The Best of Maynard Ferguson*. Like all of Colum-

bia's records in their recent *Best of . . .* series, it is shoddily packaged, poorly programmed, and lacking in any discographical information such as original album sources and personnel. But even without these aids, the delineation of Ferguson's music is clear to see.

The album features a live rendition of his first crossover hit, "MacArthur Park," along with Ferguson standards like "Pagliacci," Sonny Rollins' "Airegin," and "Stella by Starlight." The latter is the most mainstream cut on the album and, along with "MacArthur Park," the most exciting, with a fast-paced rhythm section and some energetic soloing from Ferguson's uncredited hornmen. Also included are Ferguson's more recent pop overtures such as the themes from "Star Trek," "Battlestar Galactica," "Star Wars," and "Rocky," all performed with stylized solos, incessant disco beat and insipid choruses.

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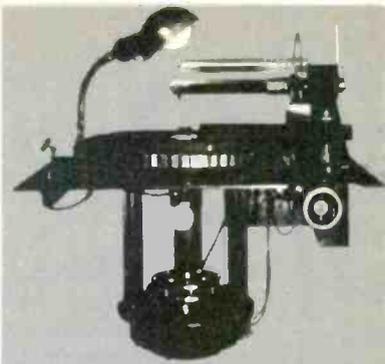
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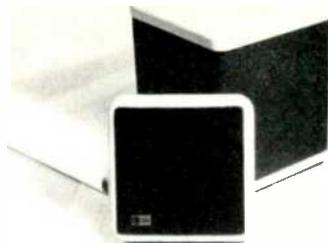
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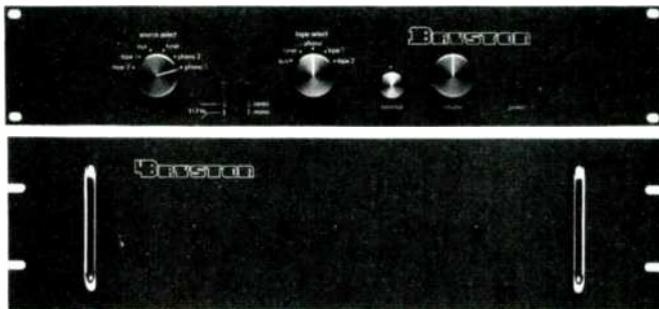
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lowed by more of Ferguson's piercing trumpet in which every solo cimaxes in a high sustain. An obligatory Latin piece is thrown in with "Red Creek," though it features a pleasant flute solo by Ed Marina. "Everybody Loves the Blues" is a nod to his mainstream jazz past and has a nice double-faceted arrangement beginning with some lonesome guitar picking by Tom Rizzo who is then joined by the roaring big band. Fortunately, Ferguson seems to let his soloists take more chances than he is willing to take himself. Nick Lane and Mike Migliore take it to the edge on trombone and alto, respectively, while Ferguson sounds like he wrote his down first.

Ferguson's music has become that of craft rather than inspiration or vision. He has his concept and a target audience, and everything is geared in that direction. As part of that craft the recording quality of his music is crackling and sharp. His arrangements pit masses of horns against each other with finely drawn lines. If you want to impress someone with your sound system, these are albums to do it with. *John Diliberto*

Sparkling Ragtime & Hardbitten Blues: Katzman, Green & Goldstein
Kicking Mule KM 167, stereo, \$8.98.

Sound: B

Performance: B+

Just when it seemed that interpretive guitarists had hit upon every possible permutation of the country blues, along comes Nick Katzman with his latest album to show that thoughtful musicians can indeed do something fresh in the idiom. Many contemporary guitarists who use the blues as a basis for fancy instrumental work often make the mistake of elevating form over substance, resulting in technically sensational but emotionally soulless recordings.

Katzman gives no quarter to his peers as a dazzling technician, but his original compositions retain all the grittiness of the Delta and Southeastern bluesmen he emulates. Through the use of intricate fingerpicking techniques pioneered by his guitar idols, Katzman's acoustic instrument produces a sound so rich that it would do credit to two musicians.

Most of Katzman's songs are styled along the guitar rags of such late blues instrumentalists as Blind Blake and Rev. Gary Davis.

Ruby Green, who sang on Katzman's earlier Kicking Mule release, again contributes several vocals. She displays a pleasantly understated manner of delivering a lyric, but her singing seems to inhibit Katzman. Consequently their collaborations are among the album's weakest tracks.

Sparkling Ragtime & Hardbitten Blues fully lives up to its title. *Roy Greenberg*

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TOM BINGHAM

Meeting in the Air: Jim Watson, Mike Craver & Tommy Thompson
Flying Fish FF 219, stereo, \$7.98.

Sound: A- Performance: A

There have been many tributes to the original Carter Family over the years, including a few by second-generation members of the family. But I have yet to hear a more absorbing or affecting collection of Carter Family material than these 14 songs, performed by three of The Red Clay Ramblers.

Whereas The Ramblers' group recordings have become increasingly progressive and often quite bizarre, *Meeting in the Air* is simplicity itself. The songs are done straight, the arrangements pure, with no attempts to modernize or adapt them to The Red Clay Ramblers' eclectic approach. While it's true that Craver's tenor is rather slight and Watson's nasal voice can be a bit strident, their singing throughout this album is thoroughly expressive, eminently tasteful, and totally satisfying. Thompson's deep voice has the most "authentic" sound for this context — both anchoring and jostling the trio harmonies a la A.P. Carter. Instrumental backing is limited primarily to the normal Carter Family instruments (i.e., guitar and autoharp).

The repertoire steers clear of the more familiar Carter Family standards. You won't find "Will the Circle Be Unbroken," "Wildwood Flower," or "Keep on the Sunny Side" on this album. Among the better-known songs here are "Anchored in Love," "I Ain't Gonna Work Tomorrow," "One Little Word," "Dixie Darling," and "Are You Tired of Me My Darling," none of which could be said to be overexposed. Hard-core Bob Dylan fans will recognize "The Wayworn Traveler" as the source for "Paths of Victory," an obscure Dylan song most widely disseminated on a Hamilton Camp LP. Most of the songs on this set are of the sentimental variety and could very well strike a contemporary listener as hopelessly corny were it not for the sincerity, conviction and genuine love Jim Watson, Mike Craver, and Tommy Thompson bring to them.

In an era when so-called "folk" records are increasingly taking on the trappings of the commercial music world in terms of production, arrangement and instrumentation, it's refreshing to know



that a record so simple, so warm, so basic, so rooted in the mores and verities of an age and lifestyle now virtually vanished can still be recorded by three major folk stars for a major folk label. This one gets my vote as the finest folk record of the year. *Tom Bingham*

The Ghost of His Former Self: Devilish Merry

Wildebeest WB 002, stereo, \$7.98; \$6.00 direct from record company. (Wildebeest Records, P.O. Box 311, Wexford, Pa. 15090.)

Sound: B+ Performance: A

Devilish Merry (the name is a take-off on the old string band song, "Devilish Mary") plays both Appalachian and Anglo-Irish music. That in itself is hardy unheard of. But what makes this Pittsburgh-based quintet so extraordinary is the totally unprecedented way they combine the two forms.

Although the hammered dulcimer (or its Irish equivalent, the tiompan) is on rare occasion employed by an Irish band for coloration or an infrequent solo (witness Derek Bell of The Chieftains), Devilish Merry's Burr Beard uses the dulcimer as a lead or at least featured instrument on all but one of the album's Irish/Scots medleys. Even more revolutionary is Sue

Powers' finely integrated use of the five-string banjo in her slightly modified clawhammer style, in direct opposition to the tight, triplet-ornamented four-string tenor banjo commonly encountered in Irish music. Oddly enough, the five-string seems especially suited to jigs, as "Banish Misfortune" and "The Exile's Jig" illustrate.

What's more, the interaction works both ways. Just as Beard and Powers graft American instrumental concepts onto an Irish context, Larry McCullough introduces the tinwhistle, bodhran, and Irish flute to Southern U.S. string band music. McCullough's quietly thumping, gently impulsive bodhran adds a marvelous quickstepping rhythm to "Hobart Smith's Rag" (a sort of mountain boogie) and "Kitchen Gal." He slips the whistle into Appalachian tunes so neatly, it's as if it always belonged there. It should be noted that McCullough is the author of "The Complete Irish Tinwhistle Tutor," the standard textbook on the subject. His playing is cleanly blown, nimbly fingered, intricately ornamented, and highly spirited. The sets opening with "The Humours of Allegheny" and "The Breach of Killecrankie" demonstrate how well the tutor has absorbed his own lessons.

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and bouzouki may not break any new ground, but his accompaniments show a fine ear for patterns and textures, and his melodic lines are clear and precise. Fiddler Jan Hamilton is somewhat elusive, if only because her contributions are so unobtrusively melded into the overall group sound, she's all too easily overlooked. In that sense, she typifies what may be the band's most uncommon attribute — for all their individual excellence and personal innovation, everything they do is for the sake of the group sound.

In an era in which string bands seem to be lurking in every alleyway, Devilish Merry is exceptional for its musical vi-

sion. Moreover, every one of the members has the talent necessary to turn that vision into an exciting reality. An outstanding debut album. *Tom Bingham*

Voice of the Trees: Dan Peterson
Radex SDP-7906, stereo, \$5.95 (Mail orders, contact Radex Recording Studios, 802 South Chicago Ave., Freeport, Ill. 61032.)

Sound: B- to B+ Performance: A-

Voice of the Trees is a marvelous display of contemporary acoustic guitar composition at its most varied and intricately arranged.

Dan Peterson is equally comfortable with jazz and folk, though he also ranges through ragtime, pop, and a few less readily classifiable styles of his own. As if this stylistic diversity weren't impressive enough, he arranges his pieces for multiple guitars (dubbing all the parts himself), attempting all sorts of daring, yet cohesive (and, gratifyingly enough, immediately accessible) complexities. He has a fondness for dense, high-pitched textures in dancing, syncopated rhythm patterns, executed with often awesome precision timing (the most obvious example is "You Are The Flame," the lone non-original, in which the parts are staggered so that some enter and exit slightly before or after other parts in other channels), ear-catching unison passages (note the fast runs on "Waterfall"), and a highly developed ear for pitch and harmony.

The variety of moods and emotions Peterson conveys, which become increasingly introspective as the album progresses, is as fascinating as his eclecticism and his technique. What's more, he can play simple material just as effectively as he can whip out more intricate passages, which isn't always the case with virtuoso guitarist-composers. "Movements," an extended work consisting of a prelude plus three movements performed on electric guitars, is played slowly, quietly, deliberately, yet Peterson's musical personality shines through just as recognizably as on his flashier, acoustic-jazz pieces. The same holds true for the acoustic "Song For Ann," in which his upper-register guitars combine for an almost harpsichord-like timbre. Peterson also sings two songs in a soft, laid-back, not in the least unpleasant baritone.

One of the cuts, "The Sea," is unidentified on both cover and label; it's the guitar piece which follows the vocal "Kansas, My Friend." There is also a short piano solo, in which Peterson unsuccessfully attempts to translate his guitar concepts to keyboard (an attempt at least partially done in by constricted recording), which was not for release.

These errors, as well as an audible buzz between some of the selections, evince the album's hasty assembling, accounted for by the fact that the recording studio was about to be demolished as part of an urban renewal project, its equipment to be placed in storage for an indefinite period. Thus, completion of the album had to be rushed to make way for the wrecking ball. Less easily excusable is a whirring which sounds like the tape machine in motion on "Contemplation." Nonetheless, the multi-guitar tracks are finely recorded, lushly mixed, and carefully coordinated.

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Chuck Mangione's album "Tarantella" is available on A&M records and tapes.

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YAMAHA

Peterson's next album, *New Life Suite*, in which he applies his multiple-guitar arranging tactics to electric jazz and jazz-rock. *Tom Bingham*

Days Beyond Recall: Trebor Tichenor
Folkways FS 3164, stereo, \$7.98.
(Mail orders, contact Folkways Records,
43 West 61st St., New York, N.Y.
10023.)

Sound: C+ Performance: B+

Pianist-historian Trebor Tichenor is today's leading exponent of what is known as "folk ragtime." That term, at least as applied to this album, does not refer to

ragtime played on acoustic stringed instruments, although that certainly isn't an unrelated phenomenon. Folk ragtime was the style of syncopated piano music played in Midwestern bars, honky-tonks, brothels, and the like in the years immediately surrounding 1900. It was this folk style from which Scott Joplin drew the basis of his harmonically sophisticated "classic ragtime." Ironically, it was also the source for Tin Pan Alley's diluted commercial-ragtime songs, which were quick to drive both folk and classic ragtime into decades of obscurity.

On *Days Beyond Recall*, Tichenor revives nine forgotten folk rags (including one by the highly successful pop

songwriter Percy Wenrich, who came from a "folk" background) and also contributes seven of his own compositions. The latter are especially enticing in that Tichenor does not keep to strict turn-of-the-century melodic/harmonic formulas, but has allowed a number of more modern influences to seep into his writing. "Hickory Smoked Rag" is instantly recognizable as bluegrass translated to solo piano. "Cottonwood Rag" takes a number of unexpected turns which catch the unsuspecting listener off guard. The first two strains of the title rag echo country and blues, though the rest is reminiscent of minstrel tunes. By contrast, the opening strain of "Pierce City Rag" is at least a partial steal from Scott Joplin.

None of the older works can be dismissed as mere period pieces. But four stand out above the others. "Cotton Bolls," by the highly regarded but rarely heard Charles Hunter, is irresistibly joyous, Brun Campbell's "Essay in Ragtime" is a devil-may-care romp, while Les Copeland's "French Pastry Rag" contains some intriguing syncopations. Harry Jentes' 1916 gem, "Bantam Step," which boasts one of the most descriptive and ear-catching themes in all of ragtime, is deservedly the best-known piece here, having been recorded earlier by Tichenor's cohort, Dave Jasen.

Tichenor plays with a vigorous two-fisted attack which, coupled with the buoyancy of his syncopation, is a sure indication that he's enjoying the music as much as the listener. When compared to the precise formality of a classical ragtime pianist, Tichenor's playing may reveal a few technical flaws, but if he burns a note here and there he does so out of sheer enthusiasm. Rest assured he's much closer to the true essence of ragtime as played in a turn-of-the-century sporting house than, say, Joshua Rifkin.

The recording is respectable enough except for three brief spots which are plagued by an ugly and disturbing distortion. One can only wonder how this went unnoticed at the time the album was being okayed for release. *Tom Bingham*

Dixie Highway Sign: Robin and Linda Williams with Peter Ostroushko
June Appal JA 031, stereo, \$7.98.
(Mail orders contact June Appal Recordings, Box 743, Whitesburg, Ky. 41858.)

Sound: A- Performance: A

I confess this is my first exposure to singer-guitarists Robin and Linda Williams, though they've gained considerable popularity and acclaim as live performers and have had other albums with minimal distribution. If their earlier re-

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Enter No. 35 on Reader Service Card

Performing a sort of country-folk, Robin and Linda Williams can handle both traditional and contemporary compositions.

cordings are anywhere near as fine as their June Appal debut, I regret not having made the Williams' acquaintance earlier.

The Williamses and mandolinist-fiddler Peter Ostroushko perform what can best be described as country-folk. It is the sort of music that many folk fans insist on calling "good old country music" (the implication being that it's somehow superior to the Nashville or Texas varieties), but which country fans consider folk, if they consider it at all. Actually, the trio draws from both traditions about equally, not to overlook the heavy Cajun influences on Ostroushko's impeccable, sweet-toned, multi-stopped fiddling.

Moreover, the trio crosses between tradition-oriented and up-to-date country-folk with consummate ease. Their repertoire encompasses both adaptations of public-domain tunes, such as "Johnson Girls" (featuring Linda's clawhammer banjo) and the Irish "Step It Out Nancy" (which Robin Williams and Jerry Clark have transplanted to a cowboy setting), and contemporary gems by Butch Hancock (the lovely "If You Were a Bluebird"), Greg Brown ("Early," with beautiful double-tracked fiddling), and The Amazing Rhythm Aces ("I Pity the Mothers and the Fathers"). Their own compositions are likewise excellent, especially Ostroushko's "Red Dancing Shoes" and Robin and Linda's modal Appalachian ballad "Murderers on the Cumberland Plateau."

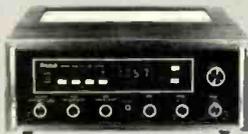
Robin Williams has a comfortable folkie voice which, if perhaps not what you'd praise as great pipes, can slip congenially into any sort of acoustic context. He's also a very adept and melodic flatpicker with a very secure and flexible touch. Linda is a supple rhythm guitarist, but more importantly she's a supremely soulful singer, with an exuberant voice rendered simply unique by a peculiarly tremulous-yet-stable vibrato. Ostroushko's harmony vocals blend in well with Robin's and Linda's leads, while his fiddle and bluegrass-tinged mandolin are so deftly integrated into the overall pattern that his playing virtually serves as a fourth voice.

I may be late in discovering Robin, Linda, and Peter, but it hasn't taken very long to become a confirmed fan. Now let's hope some enterprising label with decent distribution picks up those earlier albums as well.

Tom Bingham

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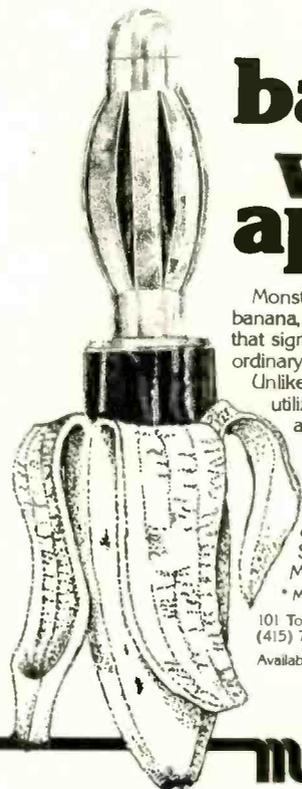
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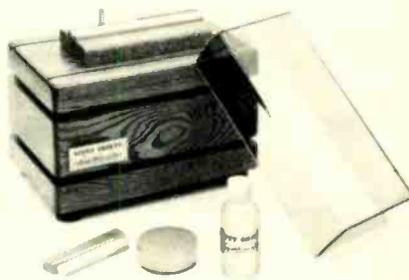
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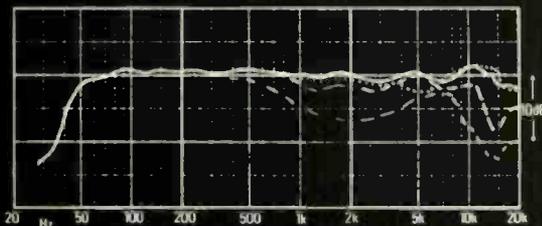
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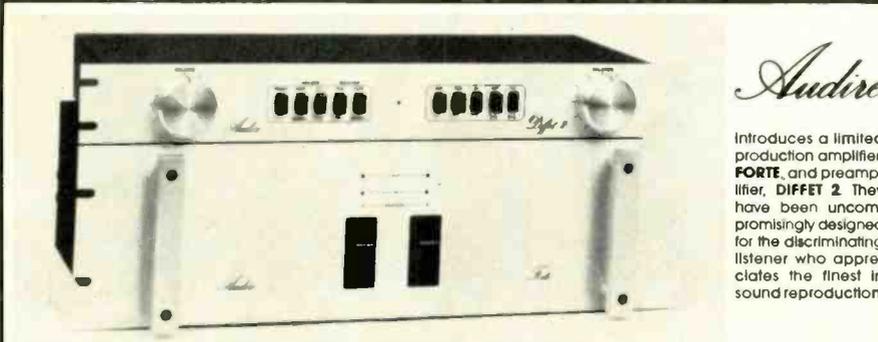
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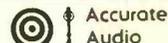
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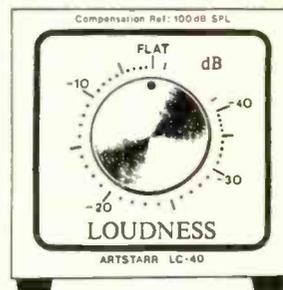
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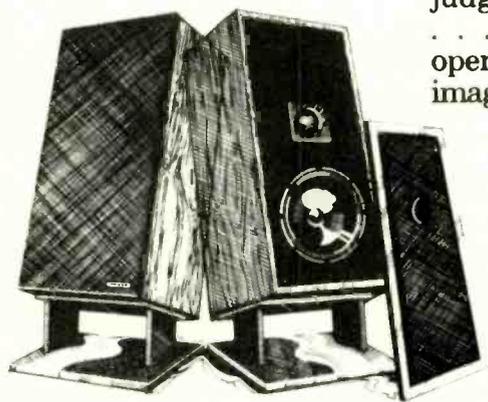
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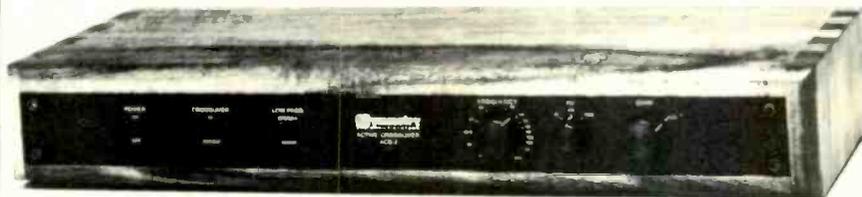
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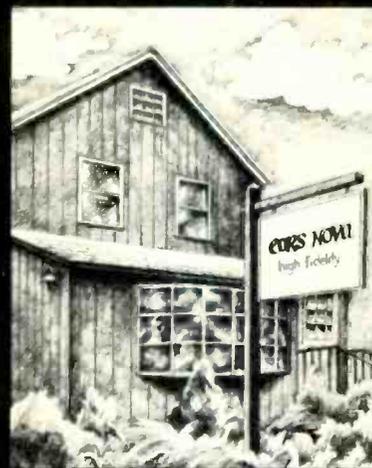
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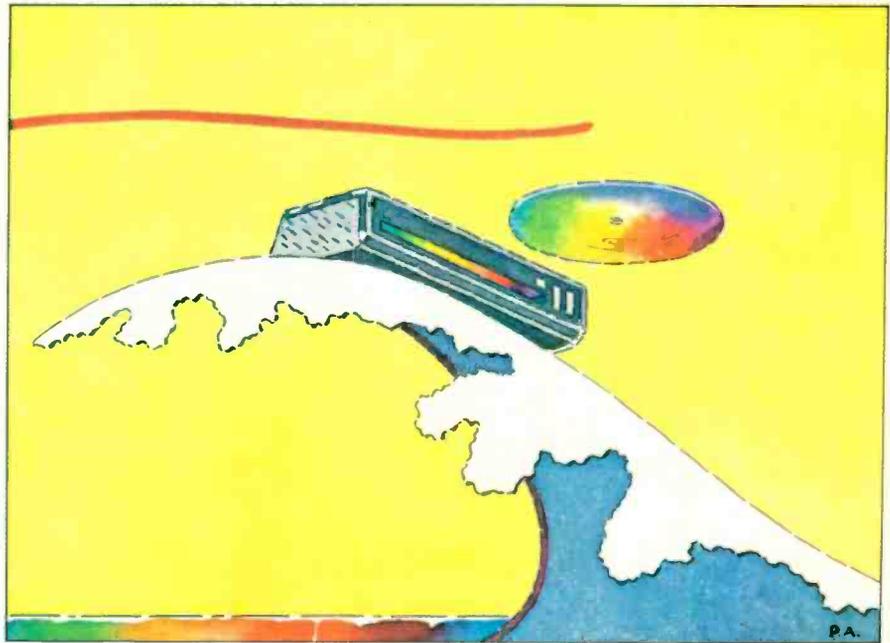
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RCA has had the goal of producing a consumer-usable videodisc for many years. Initially, they spent a lot of time and money on a videodisc concept which used a very thin plastic film, somewhat similar to Saran Wrap, as the signal storage medium. I remember being fascinated by reports that if the film was accidentally punctured, this would not impair its signal playback capabilities! However, too many difficulties were encountered with this system and it was abandoned. After still more years of development, RCA launched its CED (capacitive electronic disc) SelectaVision videodisc in March of this year.

Coming into the videodisc market after Magnavox and Pioneer had introduced their Philips-licensed laser videodiscs, RCA pinned its hopes for a quick penetration of this market on SelectaVision's lower price (\$499 versus \$749), a huge software catalog of films (from the MGM, Columbia and Paramount libraries), and a massive advertising program. Up to this point results seem mixed, with SelectaVision selling well in some sections of the country but poorly in others, yet it must be noted that the laser videodisc systems are not faring too well in similar areas. Quality-control problems with the discs themselves seem to be the culprit in the case of the laser systems, while it is said that part of RCA's problem is that they are not producing the software in sufficient quantities. Indeed, a personal investigation of a major department store in one of Long Island's largest shopping malls revealed the store had only six SelectaVision videodiscs in stock!

Unlike the laserdiscs and JVC's upcoming VHD grooveless capacitance disc, there is a specific stylus/groove interface with RCA's discs. They are mastered on discs with electro-deposited copper surfaces because of the very smooth cut that can be achieved using a diamond cutting stylus with a V-shaped cutting face. The following description of the cutting process, and other aspects of the RCA videodisc, is excerpted from the publication *RCA Engineer*: "... the diamond cutting stylus is driven perpendicularly to the copper surface by a piezo-electric transducer to cut the modulated groove in response to signals derived from a taped program via a video tape machine. The recorded



wavelengths vary from 0.5 to 1.5 micrometers. As the copper surface rotates in a clockwise direction past the stylus, the stylus advances radially from outside to inside with about a 2.5 micrometer advance per revolution so as to provide about 10,000 grooves to the inch."

Talk about tiny — 40 of these videodisc grooves can fit into one groove of a typical analog LP record! Signal information appears on the videodisc master as frequency-modulated vertical undulations in a V-shaped spiral groove. After cutting, the copper videodisc master goes through typical nickel electroplating operations, and, when separated, the negative becomes the stamper. The RCA videodiscs are replicated from polyvinyl chloride which is heavily loaded with carbon in order to make them conductive and enhance the capacitance variations. The 12-inch discs are 70 mm in thickness and are designed to play at a speed of 450 rpm. At this speed, the signals from the disc vary from 4.3 to 6.3 MHz for "peak white balance."

The videodiscs are housed in protective plastic "caddies." When the caddies are used in the prescribed fashion, the discs are never handled by the user, thus remaining free of fingerprints, dust, etc. When a loaded caddy is inserted into the player, the disc is deposited on the player turntable, ready to play.

Conversely, when an empty caddy is inserted into a loaded player, the disc is retrieved and can then be stored. The RCA videodiscs can provide up to an hour playing time per side.

The playback stylus and the playback process are most interesting: "A diamond stylus tracks the V-shaped grooves of the disc. Because the end of the stylus extends over several of the longest recorded waves, the stylus rides on the crests like a sled runner riding over small hillocks. As the groove undulations pass under the stylus, a metal electrode on the trailing edge of the stylus experiences capacity variations. The end of the metal electrode acts as one plate of a capacitor, the disc is the other plate. As the surface of the disc rises and falls under the stylus electrode, the varying capacity this produces provides the read-out of the recorded signal information. The 'keel' shape of the stylus tip reduces the tendency for it to become wider and read signals from adjacent grooves as the tip wears. The discs are coated with about 300 Angstroms of oil to lubricate the disc/stylus interface in order to extend playing life." The diamond stylus is mounted on the end of a three-inch-long arm made of thin-wall aluminum tubing. A flexible rubber mounting supports the arm with enough compliance at the stylus end so

that the stylus will follow irregularities in the disc in both the vertical and lateral directions. The electrode on the diamond stylus is connected to the circuit by a flexible flylead, which also serves as a spring to hold the stylus against the disc with about 65 milligrams of force. The stylus, arm, flylead, and compliant support are mounted in a stylus cartridge, a plastic case that provides for easy replacement of the stylus in a player. The encoding of the NTSC color signal and the audio signals and their conversion to frequency modulated signals which are cut onto the disc are much too complex to detail here.

The RCA SelectaVision videodisc

player weighs 20 pounds and is mounted in a wood-grain plastic case measuring 17 inches wide by 15½ inches deep with a height of 5¾ inches. The back panel has jacks for antenna input, r.f. output, and channel selection (3 or 4). A function lever switch is on the right side of the front panel and has positions for "Load/Unload," "Play" and "Off." In the "Load/Unload" position the caddy entry door is opened to permit insertion or retrieval of the videodisc via the caddy. In the "Play" position the caddy entry door is closed, the turntable is energized, and playback commences. During playback of the disc, five push buttons control operations. The "Pause"

button interrupts both video and audio and can be left engaged for extended periods without harming the disc. Two "Visual Search" push buttons cause the stylus to be kicked two grooves either forward or back during each vertical blanking interval so that the program action proceeds at 16 times normal rate without picture break-up. The "Rapid Access" push buttons lift the stylus and move the stylus carriage at about 150 times the normal speed in either forward or reverse direction. During this operation, both the video and audio signals are muted. There are LED indicators which provide information on minutes of playing time and the various mode functions. Quite unexpected was the provision for user replacement of the stylus cartridge via an access door on the top panel.

How well did the RCA SelectaVision videodisc system perform? I must preface this by stating that I had seen numerous demonstrations of the system, and quite candidly, I felt that it was okay, but certainly not outstanding. I wasn't too pleased about picture "hash" which I attributed to poor signal-to-noise ratio. In my home playback testing, however, I was pleasantly surprised by the excellent quality I obtained from the SelectaVision system, both from discs which had been played a number of times as well as a new disc. None of the discs displayed any of the annoying picture "hash" and in fact were quite clean. Color was accurate, with fine brightness and contrast ratios. Black-and-whites also remained clean. Picture resolution was about on a par with the best quality prerecorded videocassettes, and only slightly inferior to the best cable TV reception. However, it could not compete with the crisp images of the best laserdiscs. As for picture "glitches," several minor ones were encountered in the "used" videodiscs, mostly on the order of jumping a few frames, but continuity was maintained. The new disc was singularly free of any "glitches." Audio quality was quite good, far better than that from videocassettes.

The system is extremely simple to use — even that proverbial "six-year-old child" could easily handle it. All the functions worked well, especially the "Visual Search" mode. RCA claims the discs can be played hundreds of times without picture degradation. I cannot verify this here, but I will make a fair number of plays on one of the discs and see if picture quality holds up. If wear didn't cause that picture hash in the demonstrations seen at shows, what did? All in all, the RCA SelectaVision system performed quite well, much better than I thought it would. I intend to run quite a few discs through the player and see if it continues to "fly right." A

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The Proc Amp is another example. It gives you the ability -electronically- to regulate chroma level and phase, and overall luminance level. This means you can correct color saturation and hue for greater color accuracy. And adjust overall video signal level for optimum contrast and brightness. Not simply upon playback - where it may be too late - but in making the recording itself.

That's not to mention some of the small things you can do with our Proc Amp. Like eliminate color all together - to rid a black and white program of color fringing, for example. Or create fade outs and fade ins - to make nice, smooth, professional looking transitions.

Features include center-detent controls, a luminance level meter, and a four-output distribution amplifier.

A bypass feature is also provided - both on the Proc Amp and Detailer II - to give you instant picture-before and picture-after comparisons. So you can accurately judge the results.

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For a close look at what we mean, visit your Vidicraft dealer. Where you can see our complete line of video components. For the location nearest you, dial toll free: 1-800-547-1491.



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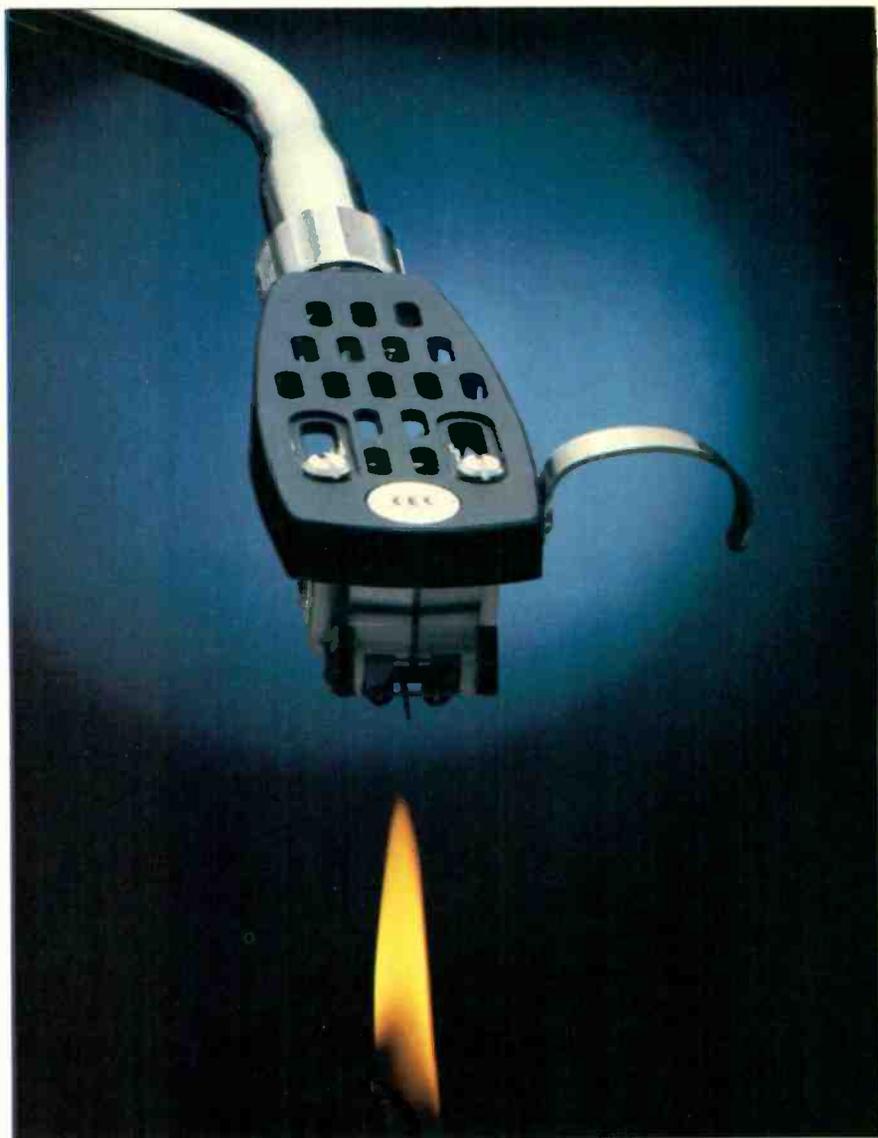
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BEHIND THE SCENES

BERT WHYTE

Despite the encroachments of the once-lowly prerecorded audio cassette, the venerable phonograph record remains the major source of high-quality recorded music. The LP record has proven to be a wonderfully resilient and adaptive medium for the reproduction of music. It has withstood the challenge of prerecorded tape and the difficulty of stereophonic sound, and even managed to accommodate the four channels of quadraphonic sound. The record currently has less noise due to cutting masters using Dolby noise reduction, and improved vinyl formulations have given discs quieter surfaces. Modern cutterheads and better electronics have meant significant increases in the fidelity of the reproduced sound. Yet for all of its strengths, the modern LP record is still a fragile thing. It is subject to various forms of warpage, the soft vinyl is easily scratched, and it electrostatically attracts all kinds of dirt. In addition, it deforms from excessive heat, is subject to "cold flow," the vinyl can be attacked by fungi and bacteria, and well-intentioned cleaning with some fluids can leach out vital components in the vinyl formulation, thereby increasing noise. If one is to enjoy optimum quality of music reproduction, the LP record demands tender loving care. Having said all this, consider that we take the hardest substance known to man, diamond, and then grind it to a specific contour for a minute stylus which will be interfaced with the microgrooves of a soft vinyl phonograph record.

No matter how good the preamp, amplifier and loudspeakers may be in an audio component system, it can truly be said that high-fidelity reproduction must begin at the stylus/groove interface. Although it may not be readily apparent, there are immense forces involved in the tracking of a record groove. Some ongoing and recent research has indicated the nature and magnitude of these forces. A spherical or elliptical stylus simply placed on a record groove can exhibit static pressures on the order of 30 tons per square inch. As the record revolves at $33\frac{1}{3}$ rpm, dynamic pressures come into play, the stylus rises in the grooves, somewhat akin to a boat coming up "on plane," and the instantaneous pressure is still many tons per square inch. The undulations of the music signal cut into the groove walls are



causing violent vertical and lateral (45/45 stereo groove) motion of the stylus. Near the inner grooves of the record, accelerations as much as 2000 G are encountered. The stylus traversing the grooves at $33\frac{1}{3}$ rpm produces friction, and thereby heat. Although we are talking about microseconds, instantaneous stylus tip temperatures are thought to be as much as 2000 degrees F. It is felt that through the combination of pressure and heat, certain components of the vinyl formula are physically deposited on the stylus, and some vaporization takes place which instantaneously condenses on the stylus. Vinyl formulas contain

such things as plasticizers and lubricants. Lead stearate is often used as a lubricant, and it is thought likely that this is what accumulates on the stylus. Of course, much grosser materials, such as dirt, lint, various fibers, and the residues of some types of record cleaners, are also picked up by the stylus — and the result is noise and mistracking.

All of this preamble is by way of pointing out the vital importance of cleaning records and, most especially, the playback stylus. You might think that such an admonition is hardly necessary. Common sense would lead one to believe that most people do clean their records



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The phono cartridge stylus is often overlooked as something to be cleaned, even when one cleans records regularly.

and styli. But the key point is how well do they clean, and how often? I could say there is more than meets the eye. In other words, don't depend on the naked eye to determine the status of your stylus. Use at least a magnifying glass, or better still, use a small hand-held inspection microscope. Osawa makes a handy little one, Model OS-50M, which is only 1 1/4 inches long and 9/16 inch in diameter. At a magnification of 13.6X, it gives a bit better view than the usual 10-power units. It is not really intended to detect wear facets but serves well to check the general condition of styli, especially their cleanliness. With styli which are cleaned in the usual fashion — with small brushes with or without an alcohol mixture — what this little scope can reveal still encrusted on the stylus may shock you. The worst part is that much of the dirt normal cleaning does not dislodge builds up cumulatively on the stylus. Left in this condition, the stylus will simply grind this material into the record grooves and produce noise. The

better the sound system, the more apparent this noise becomes. Up to this point, the prudent audiophile would try to rectify such dirt problems by periodically removing the cartridge from the tonearm and laboriously try to remove the encrusted gunk. Not too easy a task since some contaminants, like the lead stearate, literally weld themselves to the stylus.

Fortunately, there is a dandy new device which most efficaciously solves the problems of dirty styli: Signet's SK-305 Electronic Stylus Cleaner. Shaped something like a Churchill cigar tapered at both ends, the device has a small circular pad of densely packed nylon bristles and a small inspection lamp on one end. On top of the housing is a slide switch, and inside the unit is an oscillator circuit powered by a penlite battery. A small bottle of an alcohol mixture is also furnished. In use, two or three drops of the alcohol mixture are placed on the nylon bristle pad, and the stylus is lowered onto the center of the pad. Turning

on the switch activates the oscillator which sets up very energetic vibrations in the pad. I am presuming that the vibrations in combination with bristles and the alcohol mixture set up a sort of scrubbing action over the surface of the stylus. The device is used for about 20 or 30 seconds and then switched off. Since it will undoubtedly be resting on your turntable platter during the cleaning operation, it is a wise precaution to leave the turntable switched off.

Microscopic inspection of a stylus that has been treated with this device will reveal that the stylus is absolutely pristine clean. In fact, in most cases the stylus will appear to be in brand new condition. The alcohol mixture used in this operation appears to be of the methyl variety, and I certainly can't fault its cleaning power in conjunction with the vibrator circuit. However, remembering something I heard years ago from Paul Weathers, who you may remember pioneered low tracking pressures with his one-gram capacitance phono pickup, I checked some old notes. Sure enough, there was Paul's observation that the most efficient agent for cleaning styli is caprylic alcohol and that it is of particular use in removing lead stearate from styli. Caprylic alcohol is one of the so-called higher alcohols, somewhat more volatile than methyl or ethyl alcohol, and should be obtainable from chemical supply houses. I assure you this Signet electronic stylus cleaner works really well and is one of the best improvements you can make in an audio component system for \$29.95.

I would be remiss if I did not mention here one of the older stylus cleaners available presently, the SC-2 from Discwasher. It includes a small bottle of fluid, which does a very effective cleaning job, and a dual purpose brush and magnifying mirror in a wood handle. While the tonearm is securely locked into its rest, the stylus can be inspected with the mirror; should any contaminants be observed, the brush, moistened with the SC-2 fluid, is used to clean them away. This little system can be most handy.

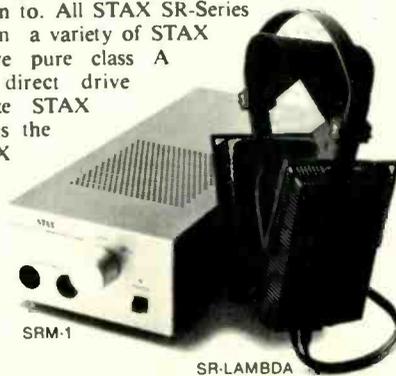
It goes without saying that a clean stylus mates best with a clean record. As you are well aware, there are a zillion record cleaning devices using some form of a proprietary liquid and various kinds of brushes and pads. A myriad of claims are made and now, like the auto-

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Whatever cleaning item one uses, the important thing is to do this job regularly, preferably with every playing of a disc.

mobile industry, rival companies dispute the merits of their competitors' products. There are good record cleaning products on the market, and there are others which do little more than rearrange the dirt on the record. While most of us have successfully used a number of these products, there are many audiophiles who feel that any kind of cleaning fluid will leave a residue detrimental to their records. These poor souls endure the "Rice Krispies" effect, which is something beyond my understanding. Some months ago, a well-known cartridge manufacturer put me on to a record cleaning idea that I have found works quite well. You have probably seen the TV ads in which a product called StaticGuard is sprayed on a woman's dress to eliminate the static charge that made the garment cling ungracefully to her body. My manufacturer friend said to get two large, new powder puffs, direct a short burst of the StaticGuard on one powder puff, and then rub the sprayed puff on the second powder puff. While the record to be cleaned is revolving on your turntable, preferably at 45 rpm, apply one of the puffs to the record surface with moderately firm pressure. Turn the record over, and repeat this operation with the second puff. I have found that not only does the StaticGuard clean the record very effectively, but it destatisizes the disc as well. It also reduces stick-slip friction to a considerable degree. I have been assured by my friend that he has run extensive tests on the fluid, and there are no problems with any residue. Although cost should not be a reason for buying a product, it is nice to know that a large can of StaticGuard costs \$1.98.

Having addressed ourselves to obtaining clean styli and clean records, another old friend of mine in the industry called my attention to a product called Gruv Glide. This is supposed to be a sort of "spin-off" from the space program. In any case it is a very volatile liquid said to be a "dry" treatment for cleaning and destatisizing, and most importantly, it is a highly effective agent for combatting stick-slip. My friend says there are neither silicone nor Teflon-type ingredients in its formula, and the stick-slip chemical is entirely different from anything previously used for this purpose. And the stuff works like a charm. It is also applied with powder puffs supplied with the liquid. Once on the record, you can feel the

smooth slickness of the surface, and a brief buffing will remove your fingerprints.

But whether one uses these products or ones from the better known companies, such as Discwasher, 3M Co., Audio-Technica, Stanton, et al., the most important thing is to be diligent in clean-

ing the stylus and the record every time a disc is played. If methods such as I have described are used with good regularity, disc playback can be very significantly quieter and that, my friend, is the way to obtain maximum fidelity from a recording. It's these little things that count. A

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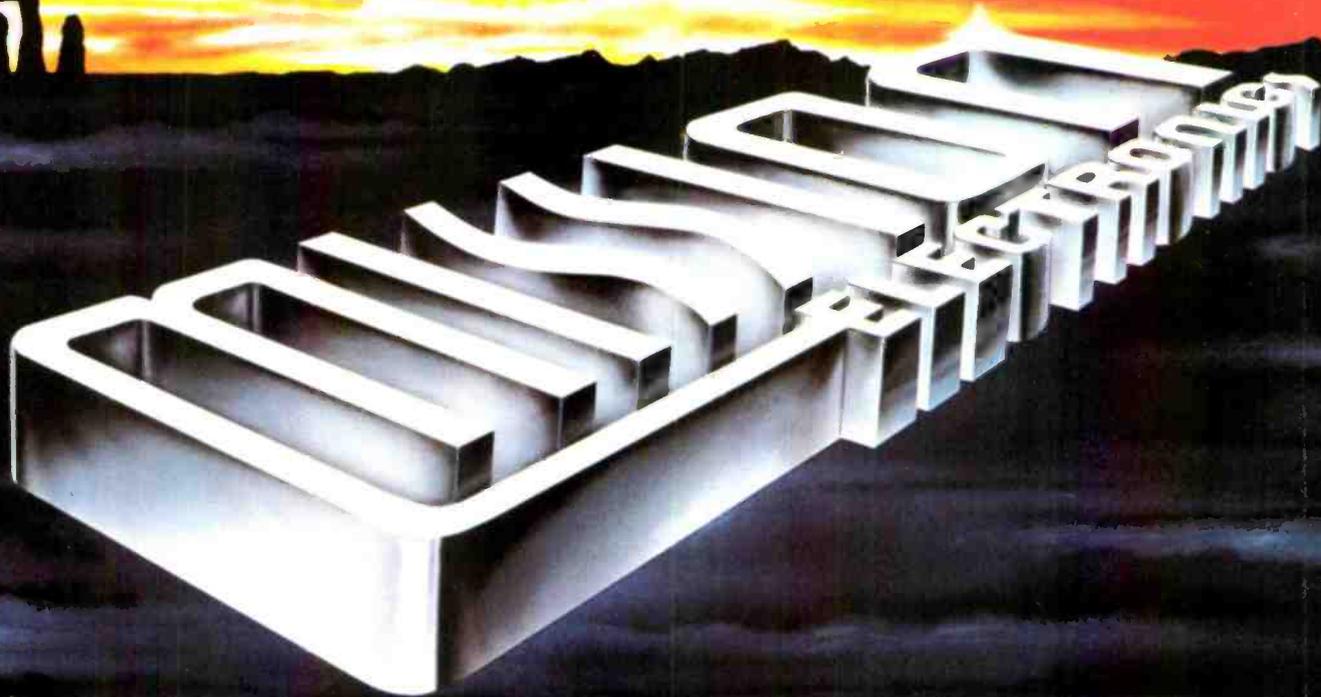
THAT'S THE WAY IT WAS

WALTER I. SEIGAL

Sophie Tucker and Irving Berlin got together in July of 1938 prior to a special broadcast which paid tribute to Berlin's 25 years of songwriting beginning with "Alexander's Rag Time Band." The program aired over WABC-CBS radio on August 3, 1938, and joining Tucker and Berlin in New York were Paul Whiteman, Guy Lombardo, and their respective orchestras, while Rudy Vallee took part in Chicago and Tommy Dorsey was heard from Hollywood. Mr. Berlin will be 94 on his next birthday.

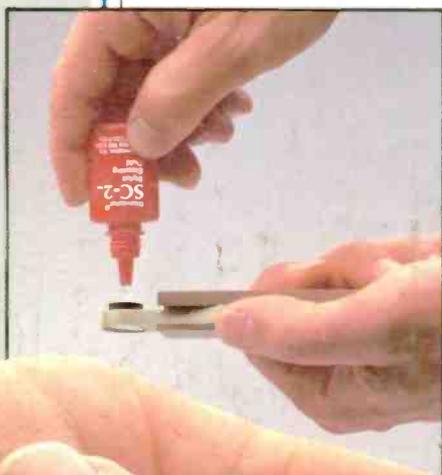


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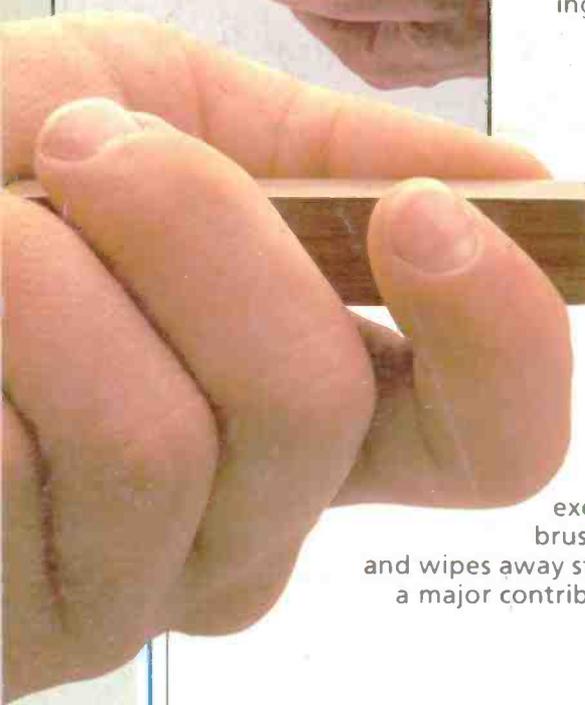
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