

Audio

The
Authoritative
Magazine
About
High Fidelity

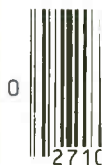
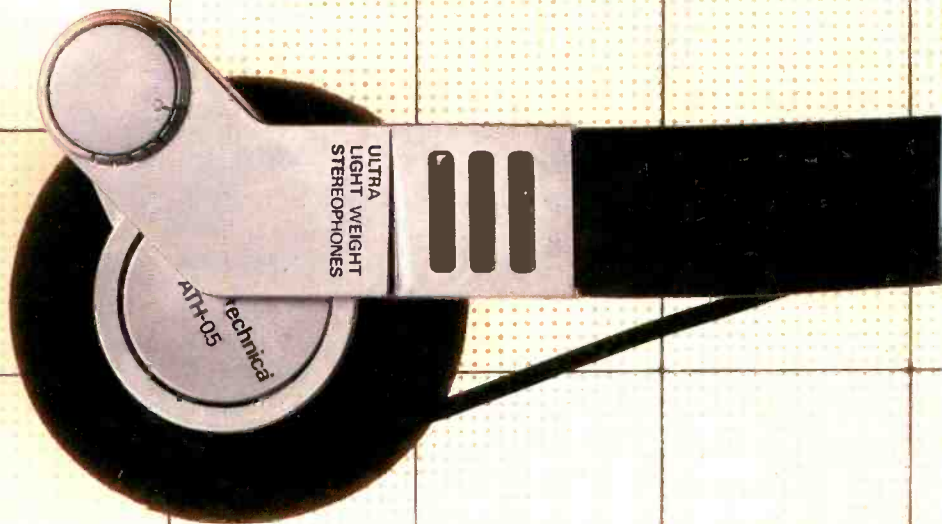
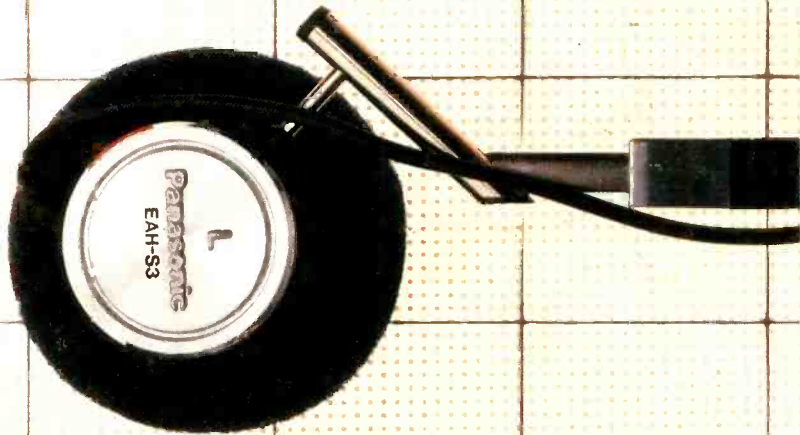
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on first Classified Ad page.

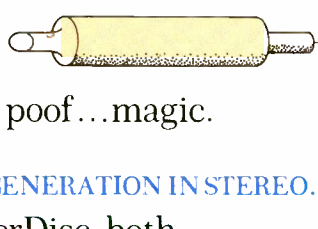
In hi-fi, up until now, sound was the whole picture.

Since the very beginning, hi-fi has appealed to one sense: your hearing. The rest was up to your imagination.

Now Pioneer brings you closer to the reality of performance than you've ever experienced at home: LaserDisc™

Now you can hear and *see* a concert or a movie as easily as you can play a record. With sound that's pure hi-fi.

The Pioneer LaserDisc player is easy to hook up and easy to operate. One wire to your TV; two to your hi-fi. Then just place a disc on the player, and poof...magic.



THE SOUND: A NEW GENERATION IN STEREO.

With Pioneer LaserDisc, both channels are completely discrete from each other. It's stereo in its truest sense. And since the disc is read by a light beam rather than a video head or needle, with normal use, it doesn't wear out from play. In addition, unlike conventional records,



Concerts like Paul Simon.



New movies and classics like Dracula.



Sports like NFL Football.

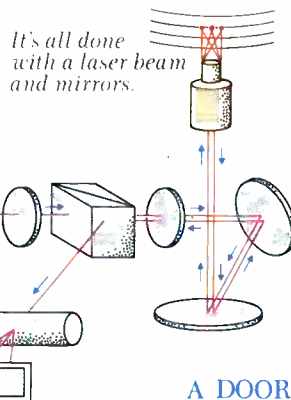
you can handle the LaserDisc as much as you wish. Even minor surface scratches won't effect the superb audio and video fidelity. You can enjoy the disc forever.

THE PICTURE: BETTER THAN HOME VIDEO TAPE.

The Pioneer LaserDisc player offers a picture with actually 40% better resolution than the picture delivered by a home video tape player. A picture of the highest broadcast quality. For the first time on your television set, video fidelity is matched by audio fidelity.

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Try to imagine what it would be like to sit down in front of your television and see whatever program you wished whenever you wished to see it. With a sense of performance, a feeling of "being there" never before experienced at home: Movies, concerts, sports. Pioneer Artists and MCA/Discovision discs like Paul Simon, Liza Minelli, Loretta Lynn, Jaws, Animal House, The Blues Brothers, the NFL.



A DOOR TO EDUCATION.

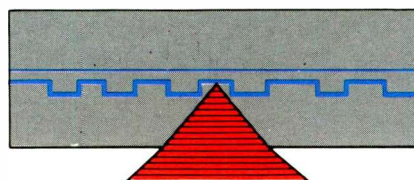
With standard-play discs, you can create your own instant sports replays at home, you can go in fast motion, slow motion, one frame at a time, even stop motion indefinitely. But LaserDisc offers something far more revolutionary. Everyone of the up to 108,000 frames on the disc is coded. And a built in micro-computer lets you access any individual frame at will. This means you can go to your favorite scene in a movie or song in a concert in seconds.

But that's merely the beginning. On one disc you can stroll through the National Gallery and study art masterpieces one masterpiece at a time.

And since play can't wear out the disc, they can be studied forever.

THE FUTURE IS IN REACH.

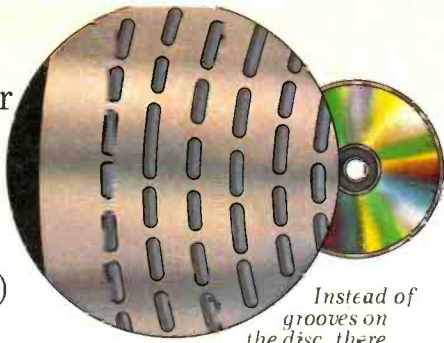
One of the most surprising parts of this new technology is that it's affordable.



A beam of light instead of a needle.

The Pioneer LaserDisc player has a suggested retail price of \$749* (Optional remote control just \$50* more.)

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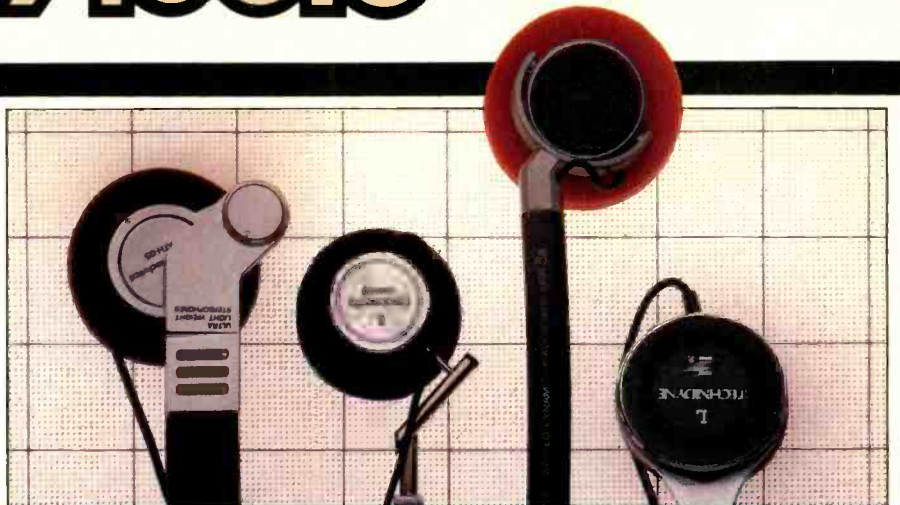
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Audio

MAY 1981

VOL. 65, No. 5



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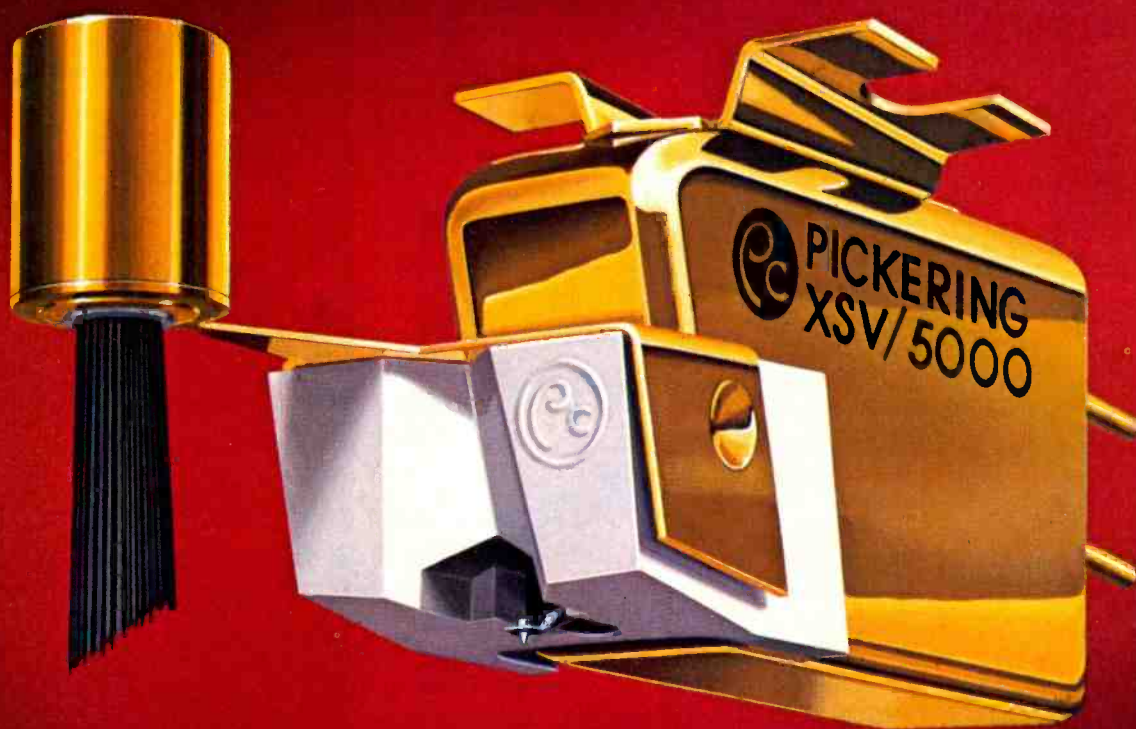


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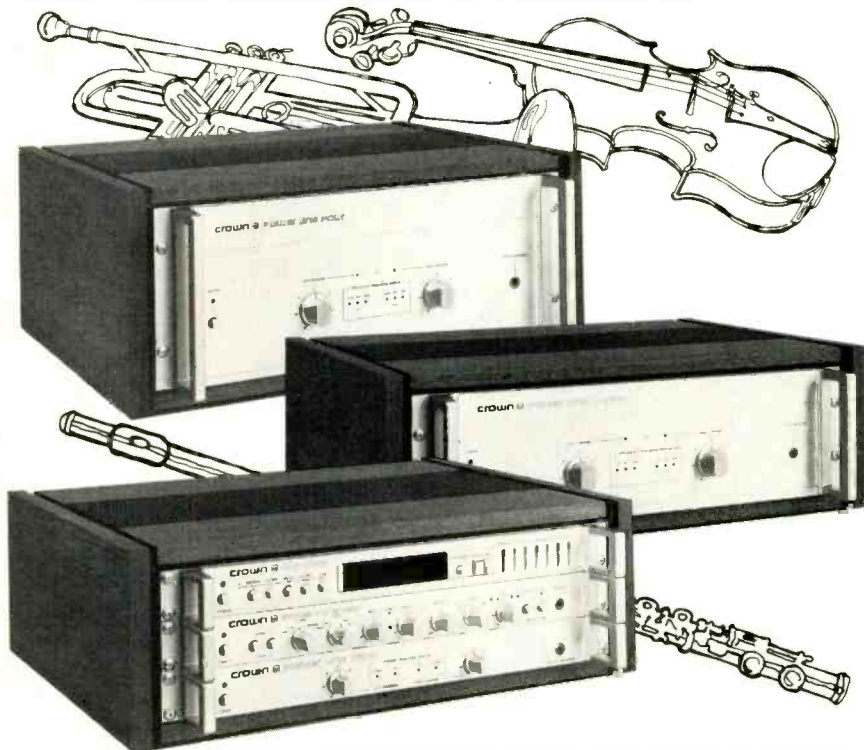
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WHY SPEND \$200 MORE ON A BETTER TAPE DECK WHEN ALL YOU NEED IS \$2 MORE FOR A BETTER TAPE.



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Now this might not sound exactly earth-shattering, but it can help your tape deck live up to its specifications by improving output, signal-to-noise ratio and frequency response.

Our new XL-S cassettes also have an improved binder system, which helps keep the oxide particles exactly where they're supposed to be. On the tape's surface, not on your recording heads. As a result, you'll hear a lot more music and a lot less distortion.

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EDWARD TATNALL CANBY



why. It's the greatest blessing we can have, though not widespread among us. If we intuit well, we go straight to the point and say *that's it*. And can't explain. I know hi-fi people who can do this with their home equipment. When one channel suddenly goes dead, they close their eyes and point, saying "THERE." And the channel is made to work again.

I have discovered recently that there is a split in the computer world. On one side are those near-relatives of ours, the people who invent or design computer hardware, the memory cores, the doughnuts and magnetic bubbles, and the ever-more-potent microchips. Most audio people are at least moderately at home with this sort of technology since it is encroaching so very rapidly into our own territory.

But on the other side we find the legions of new computer programmers. Another breed! I remain much in awe of them, with their new and easy ways of thinking, but — shocking! I am now aware that many of these young geniuses do not know even the simplest basic proto-facts about the insides of their own computers. And, very often, they do not want to know. Same old story. These people are Thinkers. They are operators, not technicians. They live in their own high-level stratosphere, far from plebeian things like electronics and microcircuits, though they use them every day. Their special work is cut out for them and it does not usually include servicing machines, let alone understanding their working principles.

A young friend of mine in the neighborhood had a big floppy-disc computer in his summer shack last year and I was eager to look at it, anything to do with discs being my special interest. But he was politely diffident. And I suspect that he did not really want to answer my questions, which might have been a bit uncomfortable for him. I very much doubt if he knows how his floppy discs actually store their info, though he is expert at retrieving it. So I never set eyes on the machine.

That man is the modern man, all right! His eye right on the ball, as we used to say, going straight for the main chance, and no distractions. (Like proto-fundamentals.) And as you can see, the holes in his Swiss cheese are deliberate. He does not want to know. This is as it should be, I guess, in a competitive

In your audio thinking, amateur or pro, do you keep track of what I call the proto-fundamentals? A lot of us don't and couldn't care less. That is, until something goes wrong. Then it turns out we really need them.

I do not mean basic principles like Ohm's Law or Negative Feedback or the Hysteresis Loop. I mean much more elementary basics, the kind that one would really think ought to be taken for granted, such as the wheel.

I find that many people of considerable intelligence don't know about the basics at all and often are not even aware they do not know. Do you think that audio is any different from the rest of our life? People's knowledge of the audio proto-basics is like so much Swiss cheese, full of holes. You can't see them but, I assure you, they are there, even so. And, dare I say it, from top to bottom of the audio spectrum.

It's typical of our civilization that we acquire extraordinary skills in the operation of our millions of gadgets and yet

mostly haven't the slightest idea how they work. We are practical, or so we think. We learn to work the levers and pedals, push the buttons, tweak the toggles and knobs and juggle the readouts, remote controls, programmings, to get what we want, all the way from the Sony to the Cuisinart, from GM X to Chrysler K. ABC to . . . I was about to say XYZ. Let's be tactful and say CBS.

We buy our audio and we play it, play with it, just as we compute and calculate, play TV games, program the microwave, set up the VCR, turn on the cassette, check out the deep freeze, and activate the burglar alarm.

You do not really need any proto-fundamentals to listen to your hi-fi. Designed that way, on purpose. Not until you have an accident or a breakdown. Yet, curiously, some people don't have accidents and they cope beautifully with breakdowns, apparently without knowing anything. Shall we call it a sixth sense? Others would call it intuition, which is knowing how without knowing

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The DM22 achieves a new level of value and is truly the least expensive loudspeaker worthy of the B&W name.

It's typical of our civilization that we acquire extraordinary operational skills without the slightest idea of how things work.

world. Efficiency. Why clutter the brain with useless side information? Stick to what you must know, and shun the rest. Gets in the way. True, some day you might get shown up, or your equipment might let you down. But (you tell yourself) it won't happen. It's not supposed to happen.

Question: How many of our audio

readers fit right into this admirably practical category of mind, whether in professional audio or the home type? I'd guess plenty. And glad of it. No point in being defensive! It's good pragmatism and most of us think like this, even though our audio may be classed as entertainment.

And yet there are others of us, those

who find basic principles, even the sillier proto-fundamentals, absolutely fascinating. We have to know how, and why, however uselessly. Alas, I am one of these! We do tend to be a bit slow, I'll admit. Too many interesting distractions. But we enjoy life and, in a way, we are more practical than you may think. When disaster strikes (when the heater busts, the car stalls, the blizzard hits, when the hi-fi goes dead or up in smoke), we know what to do. We have resources. We understand. Whereas the practical-minded majority is stymied.

Crown, Inc., the audio maker, recently fired off some material concerning its own service reliability, which, I can say from experience, is indeed excellent. The company speaks of the low rate of returns for repair, but then mentions one factor that has to be discounted, returns for *no good reason*. Equipment in perfect condition sent back for "repairs" not needed. Now this is a sizable factor in every company's operations and a terrible nuisance. And it stems straight from those gaping holes in our knowledge that we seem to cultivate so assiduously.

When things do go wrong, it's the panic button. Ask Crown. My amplifier is dead! (Somebody pushed in a Tape Monitor button.) The left speaker blew out! (Simple loose connection.) My tuner doesn't work! (Antenna busted.) The phono cartridge is defective; it plays mono! (Accidental short in the tiny rear connections.) What a mess. And all for the lack of a few silly fundamental proto-bits. Here are hundreds of intelligent people who put two and two together to make five — and out goes the equipment, back to the factory. Crazy. It's the kindergarten stuff we don't know.

I'll give you three choice little examples of kindergarten fundamentals, which are missing and shouldn't be. Each was a minor disaster. Two are in our area and one, for balance, is outside.

My brother, an editor of numerous "picture books" on scientific, cultural and historical subjects, sometimes asks me to "proofread" the stuff his professional writers send in, when I happen to be around. Two minds are better than one. Back a dozen years ago, he set up a book on a hot new subject, rocketry and space travel, and for this he hired a top journalist out of the London *Times* who specialized in this very area. When

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the manuscript came in, I was there. After a bit, my brother handed me the typescript. "Does this say what I think it says?" And a few minutes later there was another passage, also very strange and just as incorrect! Though neither of us is a rocket man, it soon became obvious to us that this writer, with impeccable credentials and all the facts of rocketry at hand, *actually did not understand how a rocket works!* As compared with a plane in the atmosphere. Action and reaction, in space as well as air. Talk about fundamentals! That book had to be rewritten by another author.

Then lately, I was slightly stunned to read in our "Tape Guide" (January) an innocent little question concerning reel-to-reel tape editing. "I am confused about tape splicing. On which side of the tape should I apply the splicing tape?"

Which side? Heavens above, why, of course, on the backside, not on the magnetic coating or you will "play" your splices over the head with a dropout in the sound. Mr. Burstein's answer was courtly and gracious, but I was dumbfounded. You mean that an owner of a reel-to-reel recorder, presumably well able to operate the same, still does not know the basics of tape movement past the machine's heads? Apparently so. I could understand this in a cassette owner. But reel-to-reel? No offense! We should respect this reader for taking the trouble to record reel to reel, and more, for desiring to improve his product through his own editing.

Here's another. Gal-friend, a singer, called me, said her cassette was acting up and could I help? She sings into it and listens to the playback as part of her practicing. She has hi-fi too, a lot of records, and is very knowledgeable in music. But in audio, NO! Blissfully unaware of the most proto of fundamentals.


The machine played back fine, she said, except that when she sang a *low note followed by a high note*, the high note played flat, too low. And, she added matter of factly, would a new microphone fix it?

Take a breath and figure that out. For one thing, since when, I ask you, have microphones, even faulty ones, produced variable-pitch playback? You record an A and it comes out G, so you buy a new mike and try again? Some logic!

Then do tell me, how could her first

note play right and the very next one too low? I wondered desperately, could there be a sudden drag on the machine's motor? (Obviously she has no idea that pitch and tape speed are related.) True, a phono stylus produces some small drag when the groove modulation gets heavy. But a tape? And why on

playback only? (A similar drag in record mode would cancel out.) At that point I gave up. She always tosses me problems like this! Fertile imagination.

Frankly, between you and me, I think she sings the high note flat. And the recorder is all too faithful. But don't tell her I said so. 



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HERMAN BURSTEIN

Playback Without Lag

Q. I have an inexpensive open-reel deck with separate record and playback heads. Is there any way I can add Sel-Sync when making sound-with-sound recordings so that both channels can be played back without a time lag between them?—David Wasilewski, Elysburg, Pa.

A. The answer depends on your ability to read circuit diagrams and find your way around your tape machine. What Sel-Sync does is to convert one section of the recording head into a playback head. For example, suppose that you made a recording on track 1 through the left channel. Now you want to make a recording on track 3 through the right channel, in sync with track 1. By switching the left channel of the recording head to the playback mode, you can hear what is on track 1 in sync with what you are recording on track 3. Thus your task is to work out a switching system which connects one channel of your recording head to the playback electronics instead of to the recording electronics. Inasmuch as oscillator current will then no longer be going to one channel of the recording head and to one channel of the erase head (which must be partially disabled to prevent erasing the recorded track), you require a substitute load; otherwise the amount of oscillator current going to the active sections of the recording and erase heads will change, adversely affecting your recording.

Intemperate Tape Deck

Q. On a top shelf with more than ample air circulation, my tape deck displays a temperature rise which I feel may be harmful to the tapes and equipment. From an ambient temperature of 86 degrees F, the machine's temperature rises to 110 degrees in less than an hour's operation. I understand that transistors start to lose power at about 90 degrees and that high temperatures adversely affect tapes. Are the temperatures I mentioned excessive with respect to either equipment or tape? — Edwin Small, Honolulu, Hawaii

A. A number of tape machines run quite hot, sometimes over 110 degrees after an hour or two of operation. To my knowledge, transistors do not significantly change characteristics at a temperature as low as 90 degrees F; they would be unsuited to many purposes if

they did. Tapes can stand appreciably elevated temperatures, probably well over 110 degrees. When you see a warning about leaving tapes in a closed car on a warm day, bear in mind that the temperature can easily mount to 150 degrees. I doubt that any of your equipment is in danger as long as the temperature mounts to no more than 110 degrees or so. Nonetheless, if you are worried, why not bring the equipment down to a lower shelf where the ambient temperature is lower.

Inimi-Treble Range

Q. I plan to buy a cassette deck and am curious about the limited treble response of most medium-priced decks. If I am correct, the audible range is up to 17.5 kHz, while most cassette decks record only up to 14 to 16 kHz. Will I be losing audible sound? — Howard Ross, Columbus, Ohio

A. The human hearing range is said to extend from approximately 20 to 20,000 Hz. Ability to hear frequencies as high as 20 kHz at normal levels probably exists chiefly or entirely among children, and only among relatively few of them. For most adults the upper limit is something like 14 kHz or less, unless the signal is of quite high level. In most music and other program material, little if anything is found at high level much above 14 kHz or so. If a cassette system can maintain flat response to about 14 kHz, it sounds like a reasonably faithful reproducer to most of us. Accordingly, in looking at frequency response specifications, what is important is flat response up to about 14 kHz; what happens above that tends to be of relatively minor importance.

The above, I think, is a consensus; there is no complete unanimity. However, there are a few, the so-called "golden ears," who can distinguish between a system faithful to, say, 14 kHz, and one faithful to 20 kHz or better. There is a small probability that you are one of these few.

Bass Non Profundo

Q. When I play back 8-track recordings I have made, they have a lack of bass. Please tell me the cause of this problem.—J. Marquez, Gurabo, P.R.

A. One possibility is the tape you are using. Some tapes, particularly those with extended treble, tend to be deficient

in bass. Another possibility is defective playback equalization, owing to a faulty capacitor or resistor. Recording equalization may be defective, and still another possibility is insufficient bias, which would favor high frequencies over low ones.


Trade-In Value

Q. As I understand it, the higher the recording level, the narrower the frequency response. If this is true, doesn't a Dolby noise-reduction system trade some frequency response for quieter performance? — Bruce Rubin, APO Seattle, Wash.

A. When properly adjusted, the Dolby system does not trade a reduction in noise for a reduction in treble response. Dolby NR applies treble boost in recording only at low signal levels, and therefore it does not increase the danger of tape saturation and consequent loss of treble. In playback, treble cut is applied at low levels, thus restoring flat response and at the same time reducing noise. The lower the signal level, the greater is the Dolby system's action (record treble boost and playback treble cut). At high levels, Dolby NR is inoperative, and program material tends to mask noise.

Switched-On Bias

Q. I am interested in buying low-noise high-output tape. Will this kind of tape damage my heads? My tape deck does not have a bias switch. Will I still get the low noise and high output that the tape is designed to provide? — Ronald Harrmann, Columbia, S.C.

A. Such tape will not wear your heads any more than other tapes of high quality. There is a good chance that you will get reasonably satisfactory frequency response with your present bias when using low-noise high-output tape, although ideally the bias should be increased somewhat. If you do get a moderate departure from flat response, there is nothing wrong with using the bass and treble controls of your audio system to touch up the response. If the departure is more than moderate, that is, an appreciable increase in treble, it will be necessary to increase the bias. 

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.

How to master tape.

Eventually, you reach a point with your tape recording system where you realize you just can't make the kind of quality recordings you want.

Even though your equipment may be the very finest.

Because despite Dolby,^{®*} the tape still has too much noise. It doesn't give you enough headroom. And its dynamic range – the range of volume that makes music sound alive and real – is just too restricted.

If you've reached that point, you're ready for the dbx Recording Technology Series. Noise reduction systems that eliminate tape hiss and allow you to record with a quality equal to studio master tapes.

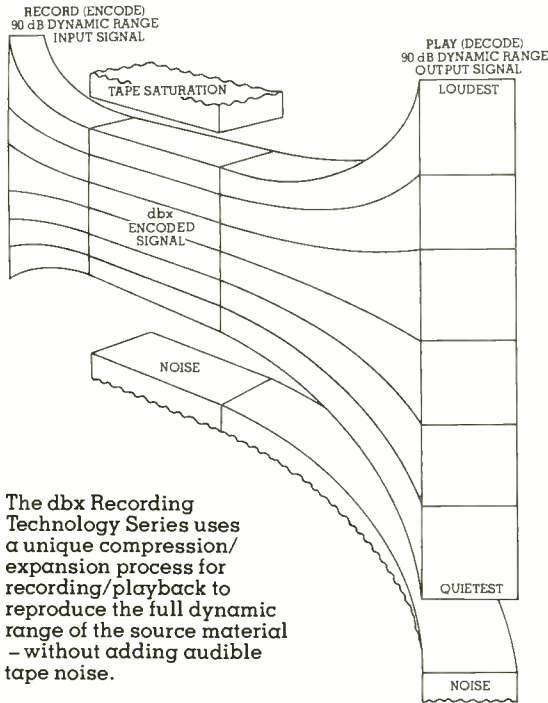
With a dbx Recording Technology Series Model 224 or 222, noise is reduced by 30 dB across the *entire* frequency range. You get 10 dB more headroom. You can even make live recordings with 80 dB or more of dynamic range. Remarkably close to a live performance.

And there's one final touch. The dbx Recording Technology Series includes a built-in dbx Disc Decoder that lets you play the revolutionary dbx Discs and Digital dbx Discs, the world's first Full Dynamic Range Recordings.

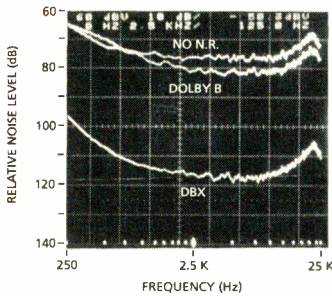
See your authorized dbx retailer for a demonstration of the dbx Model 224 and 222 and learn which is best suited for your system.

Short of buying your own recording studio, it's the only way to master tape.

dbx, Inc., 71 Chapel St., Newton, Mass. 02195 U.S.A. Tel. (617) 964-3210. Telex 92-2522. Distributed throughout Canada by BSR (Canada) Ltd., Rexdale, Ontario.



The dbx Recording Technology Series uses a unique compression/expansion process for recording/playback to reproduce the full dynamic range of the source material – without adding audible tape noise.



Dolby B reduces noise by only 10 dB in the high frequency range. dbx reduces noise by more than 30 dB across the entire frequency range. (Unretouched laboratory photograph. Data for cassette recorder from "The Importance of Dynamic Range," Audio Magazine, January, 1980. For a copy of the article, write dbx.)

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

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Making good sound better

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Phonograph Facts

Q. How many pressings is a master disc capable of producing before its original quality becomes degraded? Do record manufacturers make it a point to completely curtail use of masters which have reached the end of their quality-producing life? Is there a difference in the quality of a record when it is purchased from different sources (discount stores, record clubs, etc.) and at different prices? I have heard that records purchased from sources selling them at less than the full retail price are of lesser quality due to the fact that they are being supplied from masters near or past the end of their quality lifespan. — Arthur Darrow, Troy, N.Y.

A. The master disc is not directly involved in the pressing of phonograph records. Rather, it is an intermediate step. The master disc is vacuum sprayed with a thin layer of silver only a few molecules in thickness. This coating makes the surface of the disc conductive and the conductivity, in turn, allows for the electroplating of nickel. This nickel negative is then stripped away from the lacquer master disc. Under some conditions the negative itself can be put into a record press, with the discs produced much like waffles are produced in a home waffle iron. This negative, however, is most often used to generate another plated metal part which becomes a positive. With appropriate equipment this metal component can be played. In fact, it sometimes is played to check quality so that the pressing plant is sure that parts produced from this positive can be used for record production. The positive, or mother as it is more often called, is once again plated, and the resulting negative is a metal stamper which is actually placed into the record press. When the stamper wears out, a new stamper is prepared from the mother. Thus, the number of discs produced from a master disc can number into the many thousands.

The number of discs, however, which can be produced from any one stamper is limited. At one time it was not possible to produce more than 1,000 pressings of high quality from any one set of stampers. This is partially because of the nature of the processing of the raw vinyl material which is placed in the press. Today, with modern vinyl extrusion techniques and chrome-plated stampers it is

often possible to produce 2,500 discs from a single set of stampers.

The use of chrome plating does have some drawbacks. Because it adds a small amount of noise, some producers opt for stampers which are not chrome-plated. If chrome plating is not used, it is likely that no more than 1,000 to 1,500 discs can be produced before noise begins to build up.

It is hard for consumers to tell whether or not a set of stampers has been run past its prime. When this is the case, I do not know how much of an attempt is made to separate the less-than-optimal discs from the rest. The cost of a stamper is relatively low, so there would be little benefit in servicing discount stores with discs which have been pressed with worn stampers.

Some record clubs have discs made especially for them — often collections of the albums and singles recorded by a given artist. These discs, however, are often recorded from original tape masters. The pressings are generally produced by reliable houses.

There is one other source of phonograph records which is the bootlegger. Those engaged in this practice do not have permission from either the record companies or the artists. Generally speaking, the quality of such offerings is inferior to the authorized releases of these same titles.

Though the prices of these illegally produced discs may be attractive, they should not be purchased. In part it is a matter of uncertain quality but there is another consideration: When one buys these pirated records rather than the authorized version, it deprives the artist, the song writer, and the publisher of the royalties which they receive when the authorized version of a disc is sold. In other words, these people are cheated out of a portion of their livelihood.

How Impedant of You!

Q. Very little seems to be written on the subject of extension speakers, except that equipment reviews will often say, "You cannot use more than two pairs of speakers at one time."

Is there any way for an amplifier to be set up so that three or possibly four sets of speakers can be played simultaneously from one amplifier without running into amplifier overload problems or losing a significant amount of sound quality?

Also, if two 8-ohm speakers are connected in parallel, is the resulting impedance four ohms or something else? If three 8-ohm speakers are in parallel, what is the resulting impedance? If there is a formula for working all of this out, I would appreciate your giving it to me. — James Smith, West Palm Beach, Fla.

A. If two 8-ohm speakers are connected in parallel, their combined impedance is four ohms. If they are connected in series, this same pair of speakers will have an impedance of 16 ohms. If two pairs each of 16 ohms are in parallel, their combined impedance is 8 ohms.

If three 8-ohm speakers are connected in parallel, this will produce a combined impedance of about 3.66 ohms. The formula for obtaining impedances of speakers in parallel is the same as for finding resistances in parallel: The reciprocal of the resistance of speaker number one plus that of speaker number two, etc. The final answer is obtained by taking the reciprocal of the sum of all of the reciprocals. Thus, in the case of two 8-ohm speakers, we take each of them and call them $1/8$ (which is the reciprocal of 8); $1/8$ plus $1/8$ is $2/8$. Taking the reciprocal of this, we now have $8/2$, which is four, or four ohms.

If you wish to have four speakers connected to one channel of your amplifier, you must put two of them in series, put the remaining two in series, and finally, connect the groups in parallel. Use heavy-gauge wire to keep damping as high as possible. The damping will not be high in any case, but with many speakers this loss of damping will not matter. This series or parallel arrangement is the only way to have four speakers per channel operating from a single power amplifier, all at the same time.

Connecting three speakers to one channel of an amplifier is a real problem unless one wishes to waste power in the form of heat in a resistor. Where your amplifier has been designed to work into loads lower than four ohms, three speakers can be connected in parallel with no difficulties.

There is always the alternative of hav-

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.

ing two separate power amplifiers, each of which is fed to two speakers. This arrangement provides the best damping — in those instances where this is important.

Naturally, the greater the number of speakers per channel, the more that the available amplifier power must be distributed into each of them. If really loud listening is contemplated with all speakers operating, and if the speakers are relatively inefficient, it may be that a low-power amplifier may not have sufficient reserve power for this application.

Que Sera, Ceramic

Q. I recently decided to build the Leach moving-coil pre-preamplifier (Audio, February, 1978), and I would like to use the highest quality components.

Mr. Leach specifies the use of ceramic capacitors in the circuit for r.f. interference suppression, and he specifically discourages substituting parts.

Would the use of film-type capacitors — polystyrene or polypropylene — instead of ceramic capacitors improve performance of this circuit? —William E. Bobrick, Richmond, Va.

A. Ceramic capacitors were recommended because many other capacitors are inductive at radio frequencies, thereby reducing their efficiency as r.f. bypass capacitors. Dielectric materials have been improved and ceramic capacitors have been made smaller for a given amount of capacitance. This has

cartridge having deteriorated. There is probably no phonograph stage in equipment which employs ceramic cartridges.

If your console employs a magnetic cartridge, check the stylus to see if it is properly centered or if it is bent, touching the cartridge body. This would restrict the motion of the stylus, leading to

lower volume and considerable distortion.

If the magnetic cartridge proves to be all right, perhaps the phonograph preamplifier stage or stages are not operating as they should. Sometimes dirty switches are the cause of low volume from a phonograph system. **A**

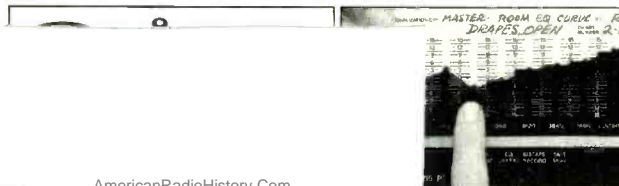
Soundcraftsmen THE EQUALIZATION LEADER...

WHY? Because WE CARE about HOW an equalizer does its job BEST!
That's the reason for Our 10-POINT "TOTAL-SYSTEM EQUALIZATION"

YOU NEED MORE THAN JUST AN EQUALIZER... FOR OPTIMUM EQUALIZATION BENEFITS, HERE ARE THE TEN ESSENTIAL ELEMENTS YOU NEED:

- 1 YOU NEED VISUAL ZERO-GAIN LEVEL INDICATION.** SOUND-CRAFTSMEN combination zero-gain controls with LIGHT EMITTING DIODE indicators to show when exact zero-gain is accomplished. Adjusting the zero-gain controls for equal L.E.D. intensity assures you of input vs. output level matching.
- 2 YOU NEED FULL-SPECTRUM BOOST OR CUT CONTROLLABILITY.** SOUND-CRAFTSMEN'S "zero-gain" circuit provides an additional 18 dB control-range over the full spectrum 20 to 20,480 Hz on each channel for instantaneous input-output zero-distortion signal matching.

- 3 YOU NEED AUTOMATIC/CONTINUOUS OUTPUT-OVERLOAD WARNING SIGNAL.** SOUND-CRAFTSMEN'S 2 top L.E.D.'s glow brightly, (bottom L.E.D.'s off), if output voltages is boosted excessively, thus eliminating the danger of distortion and/or damage to related equipment resulting from the high voltages that can be generated by any line equalizer.
- 4 YOU NEED A POSITIVE METHOD OF READING dB SETTINGS.**
- 5 YOU NEED AT LEAST 30 dB TOTAL CONTROL OF EACH OCTAVE.**
- 6 YOU NEED A UNIT THAT WILL ADD ZERO NOISE AND DISTORTION.** SOUND-CRAFTSMEN'S signal-to-noise and distortion performance figures are far superior to most high fidelity components. SOUND-CRAFTSMEN products are used in professional broadcast and recording systems, assuring you of completely noise-free and distortion-free integration into your system.
- 7 YOU NEED TO BE ABLE TO LOOK AT YOUR ACTUAL "EQ" CURVES.**
- 8 YOU NEED THE ABILITY TO EQUALIZE TAPE RECORDINGS...**



10
YOU NEED A MEMORY SYSTEM FOR "EQ SET-RESET REFERENCING". SOUND-CRAFTSMEN provides you with a quantity of "COMPUTE CHARTS" for recording the exact setting of each octave control for future reference and resetting. Automatic "Instant Memory Programming" is readily available by cutting off the "Compute Chart," holding against front panel, and moving up knobs into position.



Digitally mastered and audiophile recordings have added an exciting new dimension to the state of the audio art. Sonus cartridges are exceptionally well-suited to realize the full sonic potential of these new recording techniques.

This is especially true of the new Sonus Dimension 5. Its unique phase-coherent, integrated, stylus construction enhances still further the exceptional purity and integrity of reproduction found throughout the Sonus range of high compliance cartridges.

DEAR EDITOR

Speaking Up

Dear Editor:

In your interview with Daniel von Recklinghausen (February 1981) it is stated that DvR "developed the first widely used planar-dynamic driver with reasonable power handling...." In the interest of historical accuracy, your readers should know that James Winey (the president and founder of Magnepan) developed a planar-magnetic (i.e. planar dynamic) driver in the late '60s. In 1971, Magnepan began producing and selling the first high-power handling, full-range planar magnetic loudspeaker — the Tympani I — under the trademark Magneplanar. The fact that over 30,000 pairs of various models (of the same principle) have been sold in the U.S. and abroad qualifies them as "widely used."

Our Magneplanars are still the only full-range planar magnetic loudspeakers on the market.

David E. Carambula
Magnepan Incorporated
White Bear Lake, Minn.

Mr. von Recklinghausen Replies:

Mr. Carambula may be unaware that the history of the flat, large-area loudspeaker with a planar-magnetic driver goes back to the 1920s. In particular, the German "Blatthaler" (literally "sheet hailer") loudspeakers of this era enjoyed some popularity as wide-range loudspeakers in Europe in public-address systems. What Mr. Winey and I accomplished was the tailoring of such units to specific needs, and these were improvements over the older designs.

Addenda: The New Level Meters

Dear Editor:

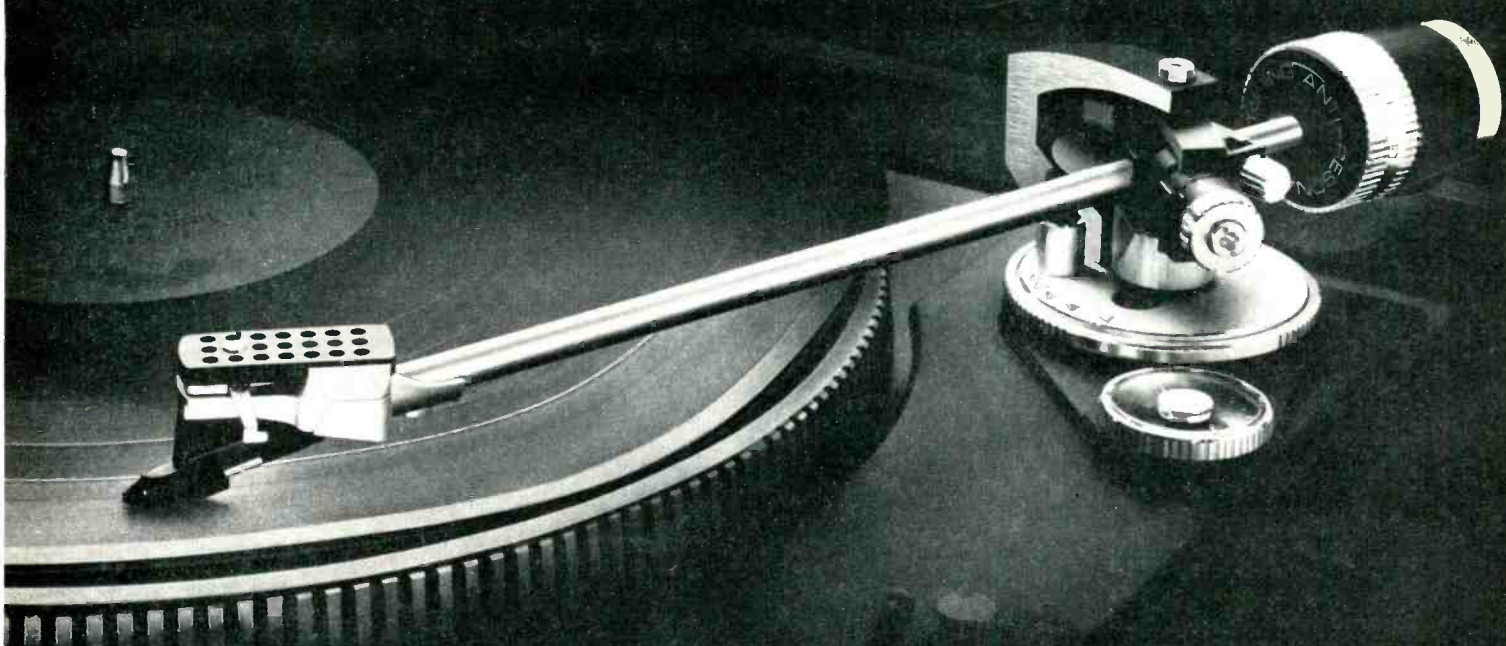
I have a few comments to make about my article, "The New Level Meters," which appeared in the December 1980 issue. This article was solely informative and by no means intended to be used for accurate design or as a complete construction article for audio level meters. There are so many methods of designing such meters using these ICs, more than can practically be included in one article, that I left it to the reader to devise by using the source list provided.

I know that the diagram in Fig. 2 is not

the best design, and I appreciate the comments I have received to make it work better. The use of Fig. 2 was for experimental purposes, and it should not be followed for best construction technique. The following is a better version of Fig. 2 suggested by Michael Maida of National Semiconductor Corp. This firm offers excellent data sheets (LM3914, LM3915, and LM3916) showing applications and design procedures for audio level meters.

Ronald G. Ajemian
Institute of Audio Research
New York, N.Y.

Test labs now use
an extraordinary new instrument to
evaluate record playback performance.
A warped record.



Magazine test reports are usually based on measurements made with professional equipment and under ideal laboratory conditions. None of which matches the real-life situation you face at home.

Virtually all records manufactured today are warped. And even records that are slightly warped can make conventional tonearm and cartridge combinations (typically 18 grams effective mass) distort badly and even leave the record groove.

The test labs know this, of course, which is why they tried something different with Dual's 8-gram Ultra Low Mass tonearm and cartridge system. They added an innovative test instrument to their scopes and meters.

A badly warped record.

The results of this new test are not reported as percentages, decibels or other technical jargon, but in clear and unmistakable language:

"Navigating the worst warps we could find, the Dual/Ortofon combination proved very agile indeed, with nary a mistrack."
High Fidelity

"... tracked the most severely warped records in our collection, usually so well that we heard nothing wrong."
Stereo Review

"Even a severe warp that would normally throw the pickup into the

air will usually give no more than a slight 'thump'... and most warps are undetectable by ear."

Popular Electronics

"The Dual takes dead aim at the fiend of disc reproduction—the warped record—and response to record warps practically is eliminated at the source."
Stereo

One test lab, after making the usual measurements, chose to just listen to music as reproduced by ULM.

"There is no way measurements, or mere words, can describe the acoustic presence of this record player... highs are crystalline, with a purity we haven't heard before. The bass is so clean that one can hear new sounds from records, such as the harmonic vibration of unplayed strings on the double bass... overall definition and transient response were outstanding."
HiFi/Stereo Buyers' Guide

You too can hear the difference ULM makes. Visit your local Dual dealer and be sure to bring your own "test instrument." Especially one that seems unplayably warped.

ULM.

A major breakthrough in record playback technology.

Write for our brochure describing all nine Dual ULM turntables. Prices start at less than \$190. United Audio, 120 So. Columbus Ave., Mt. Vernon, NY 10553.

Dual



SOTA Industries Pre-Preamplifier

The SOTA pre-preamplifier is a step-up device designed by John Curl and intended for use with moving-coil cartridges. This unit is designed to completely eliminate hum and r.f. interference which subtly mask music signals. This pre-preamp features complimentary Class-A push-pull solid-state circuitry in two separate gain modules, and it has a rated THD of less than 0.02 percent, IM of less than 0.05 percent, and crosstalk better than 70 dB over the frequency range of 6 Hz to 160 kHz, +0, -3 dB. Price: \$275.00.

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CAMEO Dictionary

The *Dictionary of Creative Audio Terms* contains over 1,000 definitions—from A-B test through zenith adjustment—and is intended to provide a fundamental working knowledge of the jargon of professional audio. Drawn from a variety of disciplines, including acoustics, sound reinforcement, recording, music, and electronics, these definitions were written for those who are not technically inclined. Illustrations are included for easy understanding, and the text was written in as few words as possible while still covering all relevant facts. Price: \$5.95.

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MIS Alignment Cassettes

Ten-minute prerecorded test cassettes from Magnetic Information Systems provide a precise 0-dB signal at the Dolby reference level to check level setting, azimuth adjustment, EQ and bias setting, and flutter testing. "Ultra Quality" tapes are housed in aluminum, and "High Quality" cassettes in a precision-molded enclosure. Both are available at test frequencies of 333 Hz, 1 kHz, 3 kHz, 6.3 kHz, and 10 kHz. Prices: Ultra Quality, \$24.95 each; High Quality, \$18.95 each.

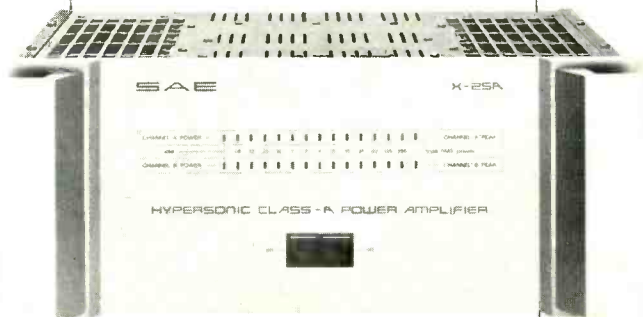
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SAE Amplifier

SAE's Model X25A hypersonic Class-A power amplifier uses a patented design technique to produce the low distortion inherent in Class-A designs, yet exhibits high efficiency so that it loses only a very low percentage of its power to heat. The unit is rated at 250 watts per channel into 8 ohms with less than 0.02 percent THD. In addition to separate 15-LED power level indicators, each channel employs two independent amplifiers to handle both the positive and negative slopes of the waveform. Price: \$1,500.00.

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MXR Preamplifier

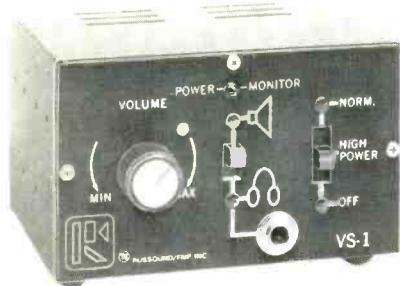
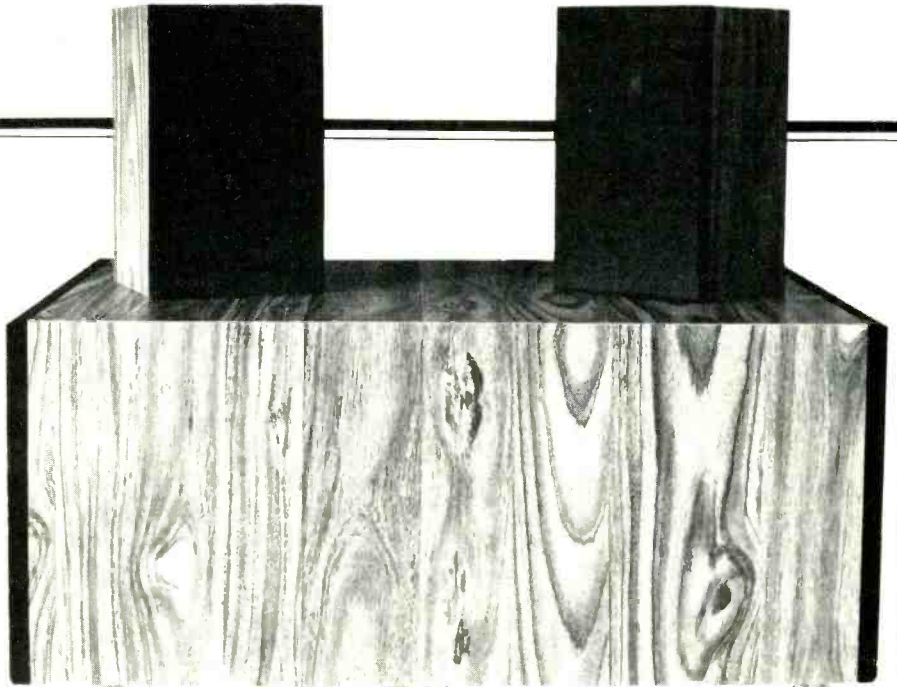
MXR Innovations' Linear Preamp serves as the control center of any stereo system, and its two-position gain switch allows 20 dB of additional gain — only when needed — to help insure optimum signal-to-noise ratio. Standard function controls, a subsonic filter, two tape or processor loops, and left-right mono/reverse capability are features of this 19 x 6 x 1 3/4 inch unit. Price: \$330.00.

Enter No. 103 on Reader Service Card

Trilogy Speaker System

Trilogy's Premiere Subwoofer-Satellite System uses mylar capacitors, air-core inductors, and plastic and mylar drivers in its design. The subwoofer features two separate enclosures in a common housing; each driver faces opposite the other (left facing left, right facing right) to provide maximum dispersion while reducing standing waves. The satellites contain a 4½-inch cone mid-range and a ¾-inch dome tweeter. Frequency response is stated to be 25 Hz to 22.5 kHz, ±2.5 dB, and impedance at 8 ohms, with amplifier power recommendations from 25 to 300 watts. Maximum output is 115 dB SPL at 1 meter on axis. Price: \$680.00 for three pieces.

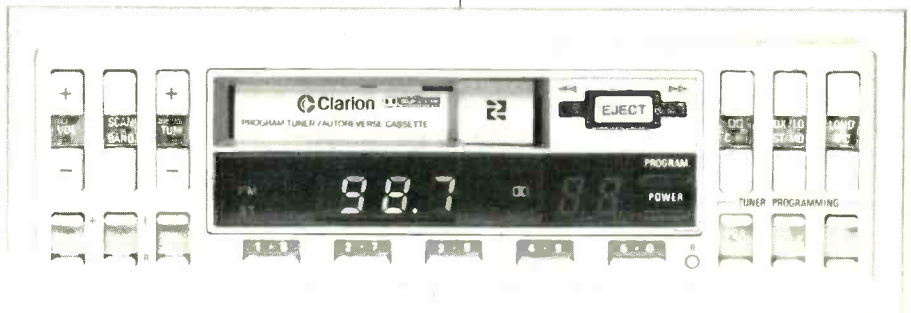
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Russound Remote Listening Controller

The VS-1 remote volume control from Russound permits the user to select either speakers or headphones and to control volume levels at the listening location rather than at the amplifier. Power outputs of up to 150 watts/channel can be accommodated because of a constant-impedance L-pad control. A self-contained power attenuator can be switched in, and a red LED signals when power levels make this necessary. The unit measures 3 x 4¾ x 4½ inches. Price: \$79.95

Enter No. 105 on Reader Service Card



Clarion Programmable Car Radio

The microprocessor-equipped Model PE-959A car radio from Clarion Corp. can be programmed to make up to 10 AM and/or FM automatic station changes at predetermined times. Specifications include an FM usable sensitivity of 14 dBf, a capture ratio of 2 dB, stereo

separation at 1 kHz of 35 dB, and wow and flutter of 0.13 percent wtd. rms. Dolby NR, equalization for CrO₂ and metal tapes, a local/distant station switch, an automatic reverse mechanism with locking fast forward and rewind, and a digital display are among the PE-959A's other features. Price: \$899.95.

Enter No. 106 on Reader Service Card

Superex Parametric EQ

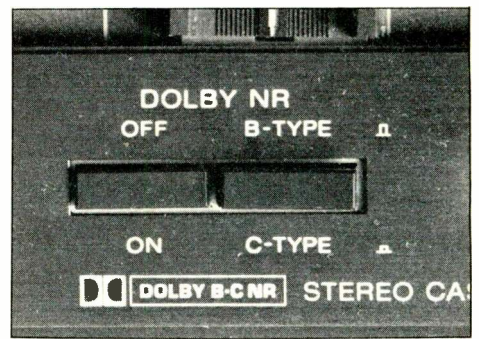
The GEM-7, from Superex Electronics, is an eight-section full parametric equalizer with four response-shaping frequency banks per channel. Bi-FET circuitry has been employed in a design which has a boost/cut range of ±18 dB per band and S/N of -89 dBm, THD of less than 0.01 percent, and IM distortion of less than 0.005 percent. Frequency selection is continuously variable from 30 Hz to 16 kHz, and the unit is supplied with handles ready for rack mounting. Price: \$449.95.

Enter No. 107 on Reader Service Card



JOSEPH HULL*

DOLBY C-TYPE NOISE REDUCTION



The Dolby B-type noise-reduction system was introduced to the consumer in 1968; the first cassette decks incorporating it were introduced in 1970. Today, tens of millions of consumer audio products with Dolby noise reduction have been manufactured, and cassette recordings made with the system probably number in the hundreds of millions.

The adoption by the consumer electronics industry of a single noise-reduction system, with characteristics maintained throughout the world by means of a comprehensive licensing program, has ensured compatibility among recordings and recorders. Thus, any recording made with Dolby B-type noise reduction can be played on any machine equipped with Dolby B circuitry, regardless of manufacturer or country of origin. The effectiveness of the system is such that today's high-performance cassette recorders, using good tape formulations, can record the vast majority of available program material without significant degradation.

However, over the past two years or so, there has been a growing desire for a system giving even more noise reduction than is provided by Dolby B. Audiophile disc releases with wide dynamic range, a continuing reduction in the cost of amplifier power, loudspeaker systems with increased accuracy and robustness, the use of equalizers in elaborate systems, and in some markets a serious interest in high-quality live recording on cassettes are all indications of a need for more noise reduction, at least at the higher end of the marketplace. While it remains to be seen just how deeply that need goes, it seemed appropriate in late 1980 for Dolby Laboratories to offer its licensee the option to use a new system, Dolby C-type noise reduction, to supplement the standard B-type system. Dolby C provides 20 dB of noise reduction

above about 1 kHz compared with the Dolby B-type system's 10 dB of noise reduction above about 4 kHz. Dolby C-type noise reduction has been designed specifically to deal with the noise spectrum and other parameters particular to slow-speed consumer tape recording formats such as the standard compact cassette and the microcassette.

Objectives for Dolby C-Type Noise Reduction

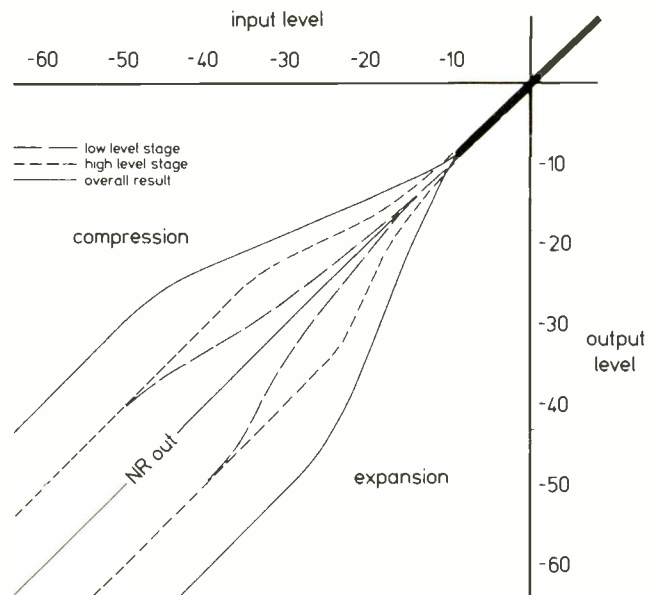
The goal for a new Dolby system was not simply and arbitrarily "more noise reduction." A number of devices, such as wide-band compressors, have long been available which provide more noise reduction than Dolby B under some signal conditions, most notably in the absence of signals altogether. However, these devices also introduce such side effects as noise modulation and overshoot distortion under other signal conditions. Thus, an important objective for Dolby noise reduction was minimizing the side effects, and there were a number of other, related goals:

1. Quantity and quality of noise re-

duction. With a companding noise-reduction system, the greater the noise reduction desired, the more the signal must be manipulated by the encode/decode process, and thus the more likely that side effects will be audible. It was decided that Dolby C would not trade more noise reduction for more audible side effects than had Dolby B. This decision is not only reflected in the design of the system, but also in the choice of the amount of noise reduction the new system provides. To minimize the signal processing required, it was necessary to establish the minimum amount of noise reduction required to meet the likely demands of the market. It was concluded that for cassette recording, 20 dB of noise reduction would provide a noise level below that of any current or likely future program source, and would indeed result in tape noise below the ambient noise level of most home listening environments.

2. Tolerance of normal recorder errors. For a noise-reduction system to be practical, it must be reasonably tolerant of errors introduced by the recorder at

Fig. 1 — Dolby C transfer characteristics, showing how the effects of the two stages combine to produce 20 dB of compansion.



*Director of Communications, Dolby Laboratories, San Francisco, California.

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both high and low frequencies between encoding and decoding. Dolby B-type noise reduction has proved sufficiently tolerant of such errors to be practical, so a similar tolerance was an objective for Dolby C. (As it turned out, Dolby C is more tolerant than Dolby B, as the result of developments which will be described later.)

3. *Provision of the Dolby B characteristic.* With so many Dolby B encoded recordings in use, it was thought essential to design the new system so that the Dolby B characteristic could be incorporated easily and economically. Licensees who decide to manufacture products with Dolby C-type noise reduction can provide Dolby B at the same time without the cost and complexity of redundant circuitry.

4. *Cost.* It was obvious that a system providing 20 dB of noise reduction would be more costly than Dolby B-type noise reduction. However, a considerable effort was made to keep its cost appropriate to at least the higher end of the current market. This meant the use of regularly available parts, and also a system which would not put a greater burden on the manufacturer in the way of unusually elaborate production-line testing and adjustments.

5. *The sound of Dolby C recordings played with Dolby B decoding.* A vital factor in the adoption of Dolby B-type noise reduction has been that cassettes encoded with Dolby B sound acceptable on players not equipped with Dolby B circuitry. Thus, assuming there would be interest from duplicators in issuing C-type recordings, consideration was given in the design of the new system to what those recordings would sound like when played on machines equipped only with Dolby B-type or with no noise-reduction circuitry.

The Problem of Noise Modulation

With a companding noise-reduction system, noise reduction occurs at the moment of playback by means of an expander circuit which acts as a gain control constantly adjusting the playback volume. The general idea is to turn the volume down on quiet passages, thus turning down the noise as well, and to turn it back up again on loud passages, which will hopefully mask the noise. If this expanding process is preceded at the time the recording is made by a complementary compression process (i.e., turning the record level up on soft passages and down on loud ones), then the net result on playback should be a restoration of the dynamics of the original music along with noise reduction.

In designing a system which minimiz-

Fig. 2 — Low-level encode characteristic of Dolby B and Dolby C (decoding is precisely reciprocal).

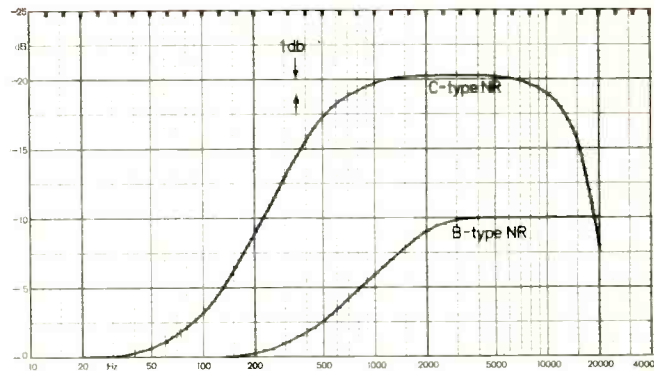
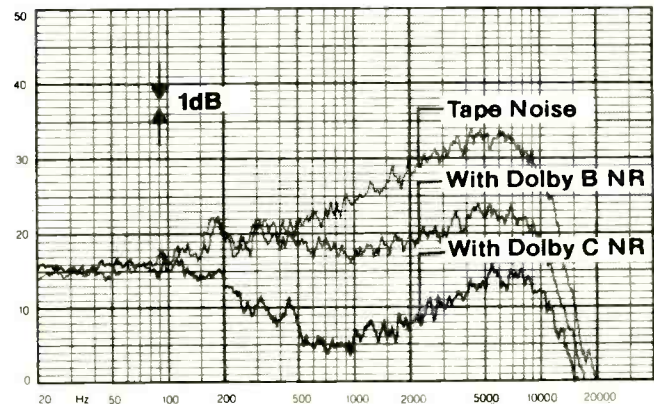


Fig. 3 — Noise from biased cassette tape (70 μ S), measured with a constant-bandwidth wave analyzer and weighted (CCIR/ARM) to reflect the ear's sensitivity to noise and noise-reduction effects.



es audible side effects, the trick is to provide a subjectively consistent amount of noise reduction, that is, to design a system which does not allow the noise to audibly (and annoyingly) go up and down with level and/or spectral changes in the music. This problem is called noise modulation. As the expander turns up the volume on a loud bass drum rap, for example, it will also turn up the volume of the tape hiss at higher frequencies at the same time so that the bass drum note is accompanied by an audible burst of hiss.

In more than 15 years of research into noise reduction, Dolby Laboratories has discovered only two effective and practical ways to render noise modulation inaudible. The first of these techniques is called band-splitting, and it is used in professional Dolby A-type noise reduction, where the spectrum is divided into four bands, each of which has its own independent compander. Thus, when the hypothetical recording of the bass drum is played back, the expander which acts in the frequency range of the drum lets it through at full volume, while noise in the drum's vicinity is masked by its sound. But in the other bands, where no musical signals mask the noise, the other expanders simultaneously keep the volume turned down, thereby providing full noise reduction in regions such as that of tape hiss.

The band-splitting technique is most

appropriate to professional applications because it deals with noise at all audible frequencies; among other things, this characteristic complements the relatively equal distribution of noise in media such as higher-speed professional tape recording. But it is a comparatively costly technique, which fortunately is not required for consumer tape recording where the predominant noise is higher frequency hiss. The second approach, called the sliding-band technique and developed for the Dolby B-type system, uses a single band of compansion which reaches low enough to provide effective noise reduction in the absence of signals, but which also changes its width in response to musical signals. In the case of the solo bass drum note, the companding band will slide up in frequency so that on playback the bass drum is let through at full volume, while the expander lowers the volume, and thus the tape hiss, at the frequencies above the bass drum where there is no musical signal. If the bass drum is accompanied by a violin, the companding band slides further up in frequency to let both the drum and violin through, while still maintaining noise reduction at frequencies above the violin. The result is an effective noise-reduction system with many of the same benefits as the band-splitting technique, but one which is more cost-effective and particularly appropriate to the needs of consumer tape recording. Thus, the slid-

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ing band technique has been used for the new C-type noise-reduction system.

Dual-Level Processing

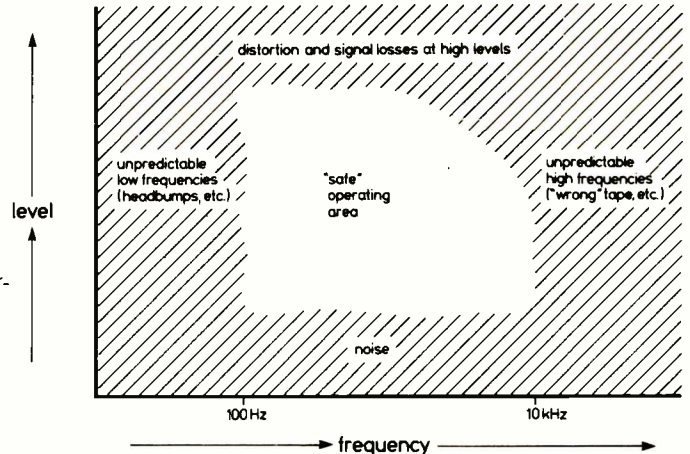
Simply modifying Dolby B to provide 20 dB of compansion at higher frequencies instead of 10 dB is inadequate, as a single processing stage suffers from problems such as overshoots and level uncertainties in manufacturing. Those problems were overcome by the use of two compander circuits in a special way, by which both cover the same frequency band but are sensitive to signals at different levels. One processor is sensitive to signals at essentially the same level as the Dolby B-type processor, while the other is sensitive to signals at a somewhat lower level. Each processor provides 10 dB of compansion; as they are connected in series, their effects add together to provide 20 dB of compansion and so 20 dB of noise reduction.

Figure 1 illustrates by means of transfer characteristic curves how the dual-level processors work together. Note that the total companding action is restricted to middle-level signals. At high signal levels, unlike conventional companders, there is no dynamic action and the system acts as a unity-gain amplifier, while at low signal levels, again unlike many conventional companders, the system acts only as a fixed-gain amplifier. By restricting the system's companding action, such side effects on the signal as overshoot distortion can be minimized; this is characteristic of all Dolby noise-reduction systems.

Noise-Reduction Bandwidth

Yet a further departure from Dolby B was required. The B-type system begins to take effect in the 300-Hz region and increases its action until a maximum of 10 dB of noise reduction is provided in the 4-kHz region and above. The subjective result, due to the ear's sensitivity to the particular spectrum of low-speed tape noise, is an overall reduction of noise, and the remaining noise is subjectively evenly distributed. However, reducing noise in the B-type system's operating range by a further 10 dB, while resulting in very noticeable additional hiss reduction, has the further subjective effect of revealing mid-frequency noise. Thus, a further difference between Dolby B and Dolby C is that the latter reaches two octaves lower, begins to take effect in the 100-Hz region, and provides on the order of 15 dB of noise reduction around 400 Hz and 20 dB in the critical 2 to 10 kHz hiss area. This means that Dolby C, like Dolby B, produces a subjectively even spectrum in what little noise remains (Figs. 2 and 3).

Fig. 4 — To prevent mistracking between the compressor and the expander, a noise-reduction system should operate only on signals which are reproduced reliably by the medium. (The vagaries typical of cassette tape are illustrated.)



As can be seen in Fig. 2, the C-type system's action is sharply and deliberately curtailed below 100 Hz because of the ear's relative insensitivity to low-level, low-frequency noise. The only potential low-frequency noise of any real concern is 50-Hz or 60-Hz hum, which can be kept inaudible (at all but totally impractical listening levels) by proper cassette recorder engineering. This is fortunate, because very low-frequency noise reduction brings up several new problems. For example, it might be tempting for a recorder designer to use the noise-reduction system as a crutch to reduce hum which could (and should) be eliminated by other means. Were there to be considerable hum and were a single-band (now virtually a wide-band) noise-reduction system to reach low enough to affect it, hum modulation would result, whereby higher frequency signals cause the hum level to go up and down audibly. The noise-reduction system could get around this problem if it included a separate low-frequency band, but then the cost and complexity of the system would go up substantially. In addition, a system providing noise reduction at very low frequencies would result in encoded recordings with substantially boosted low frequencies. Such recordings heard without reciprocal decoding would most likely be considered unacceptable due to gross exaggeration of such low-frequency noises in program sources as the room rumble inevitable at most recording sites and turntable rumble components from disc sources.

Dealing with Recorder/Tape Errors

It is important in noise-reduction systems that the expander precisely track the compressor so that the original signal is accurately reconstructed. In tape recording, however, the expander derives the information it needs to reconstruct the original signal after the com-

pressed signal has been recorded on the tape. Therefore, if the tape and recorder combination significantly alter the compressed signal, mistracking and potentially audible side effects can occur. To make things even more difficult, the degree to which recorder/tape errors are troublesome is related to the amount of noise reduction desired.

In cassette recording, the likelihood of the recorder and tape introducing unpredictable alterations of the signal is very real. For example, different recorders introduce different characteristic head "bumps" at low frequencies so that the signal level coming off any particular recorded tape at those frequencies cannot be predicted accurately. While flat, extended response is theoretically achievable at high frequencies, above 10 kHz it is in reality also unpredictable because the consumer may use a type of tape for which his recorder is not adjusted, and/or the heads may be worn or dirty. Furthermore, he may use a record level too high for the tape, causing distortion and again unpredictable signal losses, particularly at higher frequencies. Ideally a noise-reduction system should operate only on signals in what might be termed a "safe" area, as shown in Fig. 4, where response from the tape can be predicted with some degree of certainty.

Dolby B-type and C-type noise reduction have been designed with these cassette limitations in mind. (For example, as shown earlier, neither system processes signals at unpredictable low frequencies.) But with C-type noise reduction, because more compression and expansion is being squeezed into the same safe operating area, two further developments were necessary to prevent such problems as mistracking, particularly at high frequencies. These are the blocks in Fig. 5 labelled "spectral skewing" and "anti-saturation."

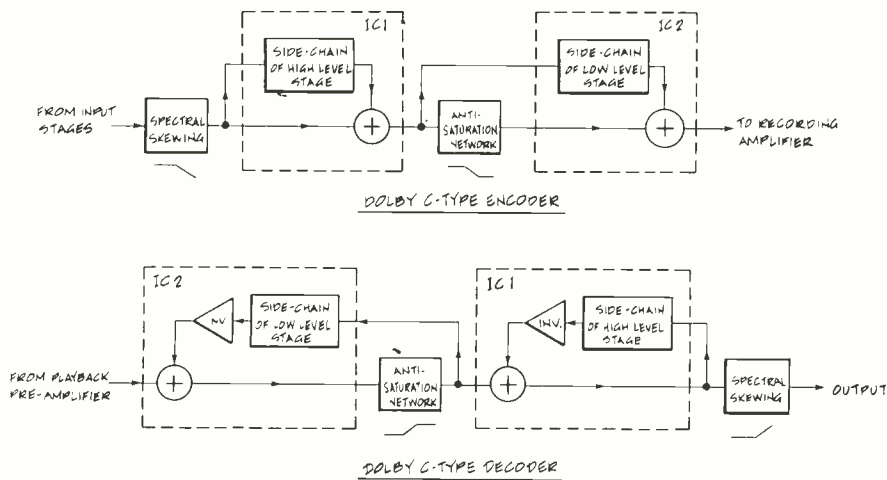


Fig. 5 — Dolby C-type noise reduction block diagram.

1. *Spectral skewing.* To prevent expander errors as a result of unpredictable cassette response above 10 kHz (such as those caused by using the wrong tape type), a controlled high-frequency roll-off called spectral skewing is introduced ahead of the compressor when the system is in the encode mode. This roll-off desensitizes the noise-reduction system so that it tends to ignore what's happening above about 10 kHz and so is less likely to mistrack as a re-

sult of changes in response introduced by the recording process. A complementary boost of frequencies above 10 kHz is introduced after the expander in the decode mode to maintain flat frequency response. While the noise-reduction effect is thus reduced above 10 kHz, the ear's sensitivity to noise above 10 kHz drops off at an even faster rate than does the noise-reduction effect.

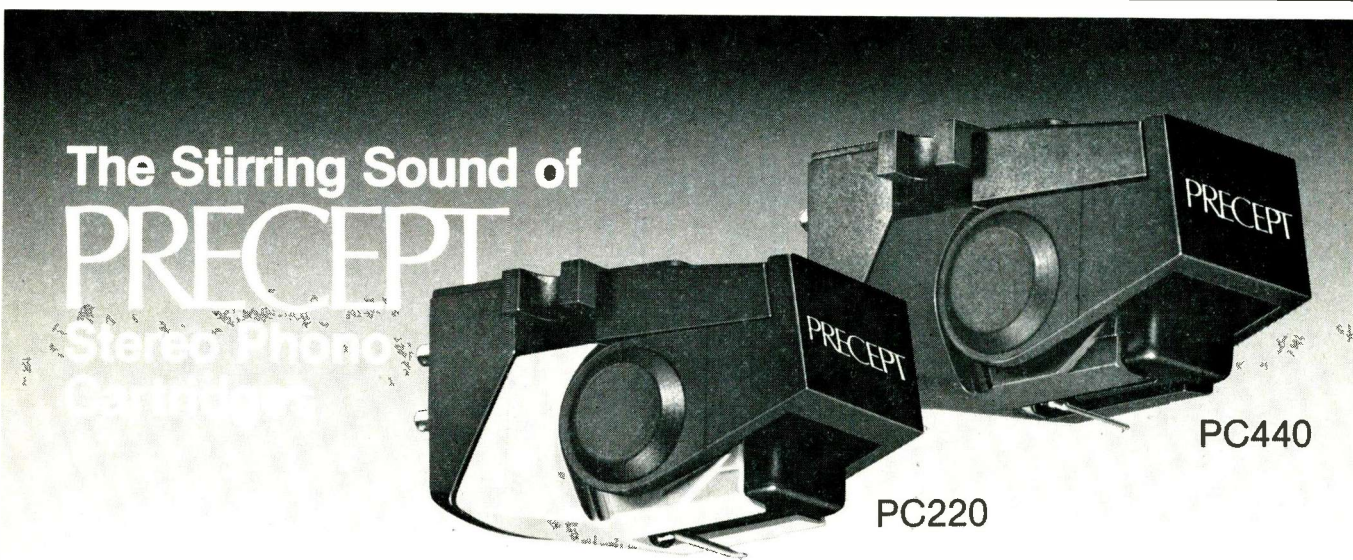
2. *Anti-saturation* helps prevent overloading the tape at higher frequencies,

not only to prevent signal losses which might cause expander mistracking, but also to provide higher quality recording overall by reducing the IM distortion resulting from saturation. A shelving network is placed in the circuit in such a way that it affects only the high-level signals which would cause saturation; at low levels, most of the signal passes through the low-level side chain, thus bypassing the network (and thereby maintaining the full noise-reduction effect at low levels). As with spectral skewing, there is a complementary network in the decode (expansion) mode to maintain flat response.

The encode curves shown in Fig. 6 not only illustrate the overall characteristic of Dolby C-type noise reduction, but also show the specific effects of spectral skewing and anti-saturation. The roll-off above 10 kHz at all levels is the result of spectral skewing; the gentler downward slope beginning at about 1.5 kHz on the higher-level curves is the result of anti-saturation.

Implementation of the New System

Ultimately, the most efficient way for the cassette deck manufacturer to provide Dolby C-type noise reduction will be by means of dedicated C-type integrated



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circuits which are now being developed by several IC manufacturers. As this development will take some time, the first C-type circuits will be based on pairs of standard ICs now being manufactured for Dolby B-type noise reduction in large quantities and at moderate cost by seven different suppliers. Additional circuitry around the IC pairs provides the necessary changes in time constants, the anti-saturation and skewing networks, switching between the B-type and C-type characteristics, and so on. The complexity of the two-IC design is approximately 2.5 times that of Dolby B alone (however, the C-type circuit includes the B-type function as well). That figure should not be taken as a guide to what the premium will be at retail, because greater noise reduction puts greater demands on the recorder performance itself. (Input and output stage noise, for example, must be on the order of 10 dB lower than was necessary before.)

Dolby Laboratories provides its licensees with the C-type system's technology under terms of the current B-type licensing agreement. This means that the royalty paid Dolby Laboratories on a single Dolby noise-reduction processor will remain the same, whether it provides B-type noise reduction only, C-type noise

reduction only, or is switchable between both types. (The royalty per processor, which averaged 22¢ at the end of 1980, is not dependent on the number of ICs used.)

So far more than 25 manufacturers and marketers of consumer tape recorder products have plans to introduce models incorporating Dolby C-type noise reduction. Virtually all are likely to incorporate the switchable B-type feature so that existing libraries of Dolby B encoded cassettes will play back properly, and some will incorporate Dolby HX (headroom extension) circuitry in addition. Also, several cassette duplicators have expressed interest in releasing Dolby C encoded recordings, and prototype professional Dolby C encoders have been developed and are being tested for this purpose.

The first products incorporating Dolby C-type noise reduction have just begun to reach the market. It is not yet known how many consumers will elect to pay how much more for a cassette deck with a 10-dB lower noise floor than before. But those who choose these products are likely to find that, with Dolby C-type noise reduction, cassette tape noise, even at the highest playback levels, will no longer be a matter of practical concern. A

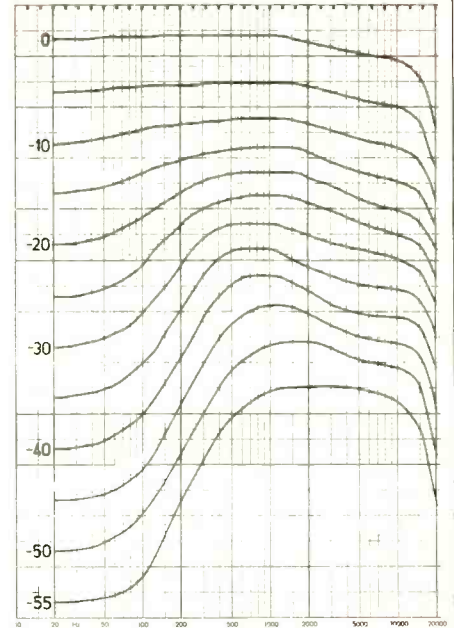


Fig. 6 — Dolby C encode characteristics, showing the effects of spectral skewing and anti-saturation (see text).

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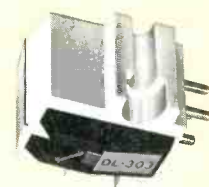
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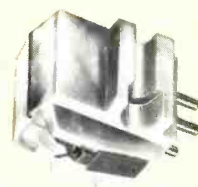


DL-301 To control resonances, the cantilever fulcrum of all Denon MC cartridges is independent of the damping rings. The DL-301 uses two damping rings, each optimized for its portion of the frequency range.

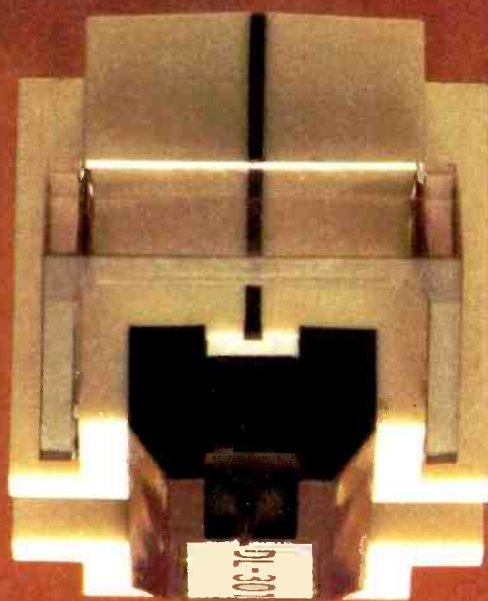
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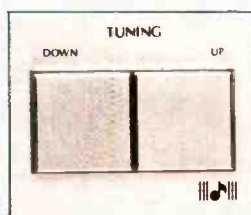
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And there's more. Instead of up/down tuning buttons, both the 9900Z and the 8900ZDB have tun-



ing knobs linked to a rotary "encoder" disc. As you turn the knob, the encoded disc works with an LED and a photo transistor to generate electronic pulses to raise or lower the tuned frequency. In addition, the 9900Z, 8900ZDB, and 7900Z have ceramic buzzers which signal unobtrusively while you tune in a station. There are three speaker select switches on the 9900Z for driving any two of three connected speaker pairs and two switches on all the other "Z" receivers. Included are LED's for every important function. Two Muting Modes. Two tape deck connections with dubbing. And much more.

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100 watts/chan., min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.02% THD.

5900Z

75 watts/chan., min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

4900Z

55 watts/chan., min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

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40 watts/chan., min. RMS, both channels into 8 ohms, from 20-20kHz, with no more than 0.03% THD.

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THE NEW FEATHERWEIGHT HEADPHONES

GARY STOCK

The Featherweights are this year's big news in the stereophone field. Typically, they weigh in at two ounces or less, sit directly upon the central portion of the pinna (the ear's fleshy outer structure), are supported by a minimal headband assembly, and operate off very modest amplifier powers due to their high-sensitivity and impedance (generally in the range of 50 ohms or so). In conjunction with portable stereo cassette players, they just might be the technical development that expands the popularity of headphone listening beyond the audio enthusiast and into the workaday world, simply by combining portability, credible performance, and comfort for the first time in a reasonably priced product.

The idea of a low-mass high-performance headphone is not entirely new, of course. Sennheiser's classic HD 414, introduced in 1968, weighed an unprecedentedly low 4½ ounces



Many people are realizing that the best examples of the Featherweights can hold their own with almost any conventional model.

might well be called the Comb Filter Controversy, and the roots of the question go down to the most basic points about how human beings hear sounds.

There is universal agreement that no one actually hears a flat frequency response. In large group tests where participants were asked to make different frequencies sound equally loud to them by adjusting levels, and in other tests where miniature microphone capsules were placed at the entrance of the ear canal, the resultant curves demonstrated that the structure of the pinna and the presence of the head radically alter the frequency balance of what we hear. This introduces both a general curve shape like that shown in the accompanying figure and groups of sharp narrow dips — "suck-outs" — caused by the cavity resonances and mechanical bending of the pinna. These patterns of dips collectively comprise a "comb filter" (so called because of its characteristic comb-like pattern on a frequency response chart) which varies enormously from one person to the next. The notably large ears of actor Clark Gable may well have heard a response curve that would vary by as much as 10 dB at certain frequencies from that heard by the petite ears of, say, actress Mia Farrow. All of us carry around an elaborate comb filter attached to the sides of our heads, and we hear every sound throughout our lifetimes processed through that filter. Yet because we learn to hear both "live" and recorded sounds through this filter, we come to view its effects upon what we hear as normal; removing or changing its effects will perform sound unrealistic to us.

Recorded music heard through loudspeakers will sound natural if the loudspeaker response is fairly linear, since the ear processes the sound of the speaker just as it would any naturally occurring noise. With headphones, however,



and employed an innovative open capsule approach in order to eliminate large ear cushions. Among the first of the lightweights, it enjoyed sales of 2½ million units and went on to become one of the world's best selling headphones. Other open designs from Beyer, AKG, and Koss also became popular during the '60s and '70s. Most of these stereophones fell into the four to seven ounce weight range, and all were intended primarily for home and studio use.

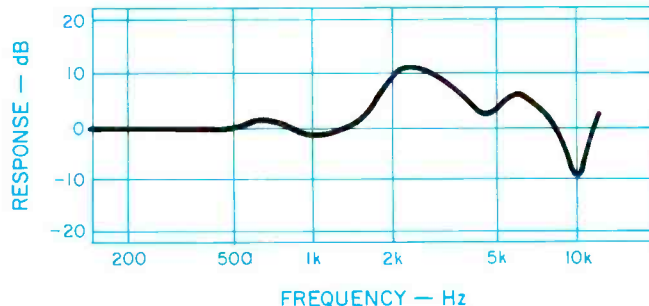
Then at last year's January Consumer Electronics Show, a handful of companies introduced portable stereo cassette

and a lot of people are coming around to the notion that the best examples of the type can hold their own with almost any full-sized stereophone.

There are a number of technical reasons for the astonishing sound of the Featherweights. To some extent, new materials technology is involved: Recently developed high-energy magnetic materials such as samarium cobalt — the same material that has increased the output efficiency of a number of phono cartridges and speaker system drivers — are used in most of the Featherweights. These materials provide enough sensitivity so that the designers can then exchange some of that efficiency for more linear frequency response and/or reduced distortion. Koss Corp.'s Dave Thomas comments that "You try for maximum element efficiency so that you can throw some of it away using me-

Because of diffraction effects by the head and resonances in the cavities of the outer ear, a loudspeaker which measures flat in a free field will have this curve when it is measured in the ear canal.

(Data courtesy AKG after Blauert, 1974; Shaw, 1966; Jahn, 1960, and Wiener, 1974.)

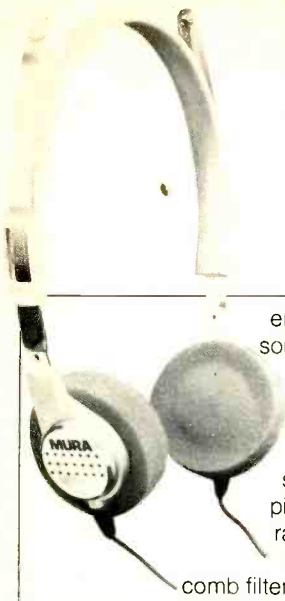


systems that used extremely lightweight headphones. Sony called theirs the Soundabout, then changed their mind and began using the term Walkman, while Technidyne called their system the Hip Pocket Stereo. The entire category became the splashiest high-fidelity success story of 1980, prompting more than 15 companies to show Featherweights at this January's show, by the way, including several that use matchbox-sized microcassettes. It also dramatically demonstrated the performance potential of low-mass headphones to both casual listeners and audiophiles, and spurred many of the large, well-established manufacturers of conventional-sized headsets to reexamine the technical tenets of the low-mass approach. Suddenly, there is a flock of featherweight headphones to choose from,

mechanical damping in order to get smoother response." More sophisticated plastics have also contributed to better performance by reducing the level of mechanical resonances within the element diaphragm. Even the cabling to the amplifier is said to have been improved; Sony makes a big point of the oxygen-free copper lead-in cable used in their MDR-series featherweight phones, noting that the reduction in series resistance and stray inductive effects noticeably improve the system's response.

The most significant reason for the remarkable sound quality of the Featherweights, though, may simply have more to do with the way they interact with the outer ear and the ear canal — and therein lies an intriguing controversy long debated by headphone designers but rarely discussed in the audio press. It

The most significant reason for the Featherweights' remarkable sound quality may lie in the way they interact with the outer ear and the ear canal.



er, deriving a real-sounding response becomes considerably more difficult, since the mere presence of the ear-piece *near the ear* radically changes the nature of the comb filtering. Headphone

designers have three basic choices in the development of a stereophone, as far as controlling ear/headphone interaction is concerned. As shown in the adjacent figure, the earcup can surround

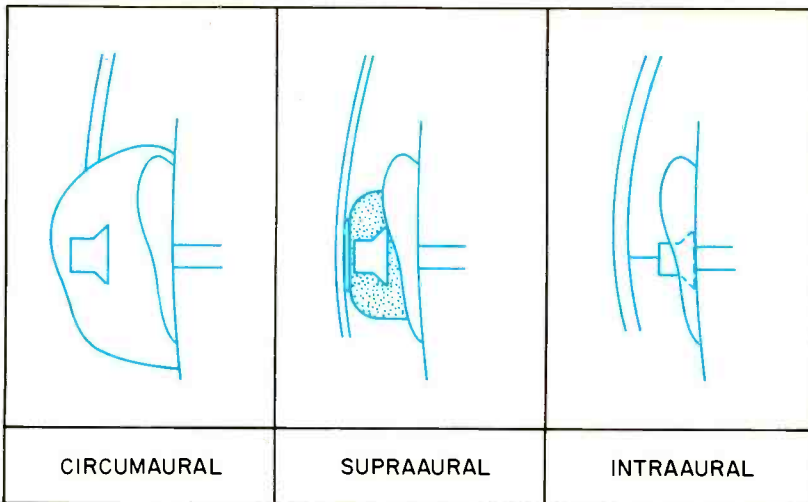
ment and the eardrum, and therefore bass response down very close to d.c.; Koss' Thomas notes that it is not difficult to reproduce 8 Hz in a well-sealed circumaural headphone. More important to headphone design theorists, however, is the notion that a circumaural headphone surrounds the entire pinna and thereby should leave the comb-filtering effects of the outer ear pretty much unchanged, and thus sound is fairly realistic.

Supporters of the supraaural approach concede the advantages in bass performance of sealed designs, but hold that the presence of a closed cavity adjacent to the pinna alters the severity and

ance, may be in its ability to sidestep — at reasonable cost and with reasonable compactness — the verified disadvantages of both circumaural and supraaural design types. The exceptionally small capsules used in most of the Featherweights fit even closer to the ear canal than most conventional supraaural elements, thereby augmenting bass performance, and they may also exert far less of an effect on the pinna's various resonances than either the conventional closed-chamber circumaural phone or the resonance-damping large cushions of a typical supraaural unit. In this sense, most featherweight units have taken what might be called a "quasi-intraaural" approach that preserves some of the major comb-filtering influences of the outer ear along with very good bass performance and comfort.

The featherweight headphone is not the only direction headphone engineers are exploring, of course. AKG has made elaborate studies of comb-filtering effects in the development of their "free-air" K-240 and K-340 headphones, which use passive diaphragms and several chambers to *simulate* a series of comb filter resonances. Both the piezoceramic diaphragm approach developed by Pioneer and the electret approach used by Audio-Technica and others represent new directions for the future. Substantial work on developing artificial heads (so-called "couplers") that will permit accurate testing of perceived headphone frequency response is underway through a number

of sources [including Audio's own Equipment Profile program — Ed.], and headphones that sound better on a wider variety of real heads should be the result. The subjective listenability of the better Featherweights, despite their modest size and cost, however, will give stereophone designers a good deal more to think about in their efforts to derive more realism from speakers that sit on your head. **A**



the entire pinna, an arrangement called the *circumaural* approach; sit directly on the pinna's outer surface, the *supraaural* approach, or fit within the entrance to the ear canal stethoscope-style, an arrangement rarely used in hi-fi designs which might be called *intraaural*, though no specific term is used for this approach. Each of these approaches has its own virtues and drawbacks; it is these fairly arcane acoustical concepts, rather than the simplistic "comfort versus performance" questions usually raised, that are responsible for the numerous different headphone designs available today.

Circumaural headphones have the indisputable advantage of sealing against the side of the head, usually with a soft, heat-sensitive plastic cushion that molds itself to the head with the help of body heat. This, in turn, permits a more or less direct coupling between the driver ele-

ment and the eardrum, and therefore bass response down very close to d.c.; Koss' Thomas notes that it is not difficult to reproduce 8 Hz in a well-sealed circumaural headphone. More important to headphone design theorists, however, is the notion that a circumaural headphone surrounds the entire pinna and thereby should leave the comb-filtering effects of the outer ear pretty much unchanged, and thus sound is fairly realistic. Supporters of the supraaural approach concede the advantages in bass performance of sealed designs, but hold that the presence of a closed cavity adjacent to the pinna alters the severity and

frequency of the dips that collectively make up the outer-ear comb filter. By moving the headphone capsule into the nearfield (a fraction of a wavelength) of the ear, these engineers argue, reasonable bass performance can be maintained, pressure on the tender outer ear reduced, and the comb-filtering effects of the pinna preserved, though in somewhat attenuated form due to the damping effect of the foam ear cushions on the pinna's many cavity resonances. Sennheiser's Vice President of Engineering Horst Ankermann comments that "It is better in many cases to simply damp out some of the less predictable resonances than to allow them to be changed in frequency and then magnified by a sealed ear cup."

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THE VIDEO SCREEN IN YOUR FUTURE

LEONARD FELDMAN



The Sony Profeel monitors now available in Japan.

If you now own a color television receiver, it may come as a surprise when I tell you that this may be the last color TV set you will ever buy. I am not for a moment suggesting that TV broadcasting is on the way out or that your present receiver is going to last forever. What I am suggesting is that in the very near future your video screen is going to become such an important element in your household that it will no longer make much sense to tie it in to a TV-r.f. tuner in the traditional way.

I did not come up with this idea on my own. During a recent visit to several of Sony Corp.'s modern Japanese plants as well as to last fall's Japan Electronics Exhibition in Tokyo, I was introduced to Profeel, a new video concept which Sony began marketing last summer in their own domestic market. The name given to the new product concept, like so many other catch-phrase titles invented by the Japanese, tells you very little about what the product is. Even after I was told that the new word Profeel is a combination of two recognizable words, "professional feeling," my Western mind was not able to correlate the new term with the product itself.

In case you haven't guessed, Profeel is a super-high-quality video monitor; the largest version has a screen of 27 inches measured diagonally. The other two are less expensive and have screen sizes of 20 or 16 inches measured diagonally. All of the Profeel monitors are

equipped with audio and video input jacks but lack a TV tuner; there are several reasons for this.

Sony has come to the conclusion that the home entertainment system of the future will be based upon the family video screen. That is to say, a single, conveniently located video screen will be "fed" by the family videocassette recorder, by a video color camera, by black and white security video cameras mounted at entrances to the home, by an assortment of video-game electronic units, by a home computer terminal, possibly by a teletext receiver, by a satellite TV tuner — you name it! Now, consider this fact: If you own a videocassette recorder and a color TV set at the present time, you have one TV tuner too many! The TV tuner section within your videocassette recorder performs the same function as the one in your color TV receiver. More often than not, having to include an r.f. modulator in the videocassette recorder just so that the recovered video composite signal within the recorder can be retranslated to an r.f. signal at the frequency of TV Channel 3 or 4 is not only a needless addition to the cost of a VCR but has also been known to degrade ultimate picture quality because of the additional r.f. signal-processing performed by that r.f. module. How much simpler and better it would be if the video output of the VCR could be fed directly to a video input jack on a true monitor-type TV component. That's where products

like the Sony Profeel monitor come in, and apparently the idea is already being met with a great deal of success in Japan.

The first thing that struck me about the Profeel TV monitors was the quality and resolution of the reproduced picture. Any degradation in picture quality would have been particularly obvious on the large 27-inch unit, but in fact, even when looking at that oversized screen, the color picture seemed clearer and had better detail than any other I had seen on typical home sets. It should be pointed out that Japan, like the U.S., is saddled with the NTSC transmission standards which do not lend themselves to as good picture quality as other world systems such as PAL or SECAM. Yet, for all of that, the pictures were excellent.

Managers of the Sony factory in Ichinomiya, where these Trinitron monitors are manufactured, explained why the Profeel units deliver such an excellent picture. The key circuitry involved is an advanced type of comb filter. In conventional TV sets, a 3.58-MHz resonant "trap" is used to extract color burst signals and information from the composite video signal, which includes luminance (brightness) signals to beyond 4.0 MHz. Using such a conventional trap circuit, some of the luminance signal which carries the fine detail of the picture is also extracted by this 3.58-MHz color trap. It is these very high-frequency luminance signal components which are responsible for high resolution in a typical TV picture. Unfortunately, if some of these high-frequency components are inadvertently eliminated because of the color trap, good resolution or high definition is lost as well.

In the Profeel monitor, selective comb filters are used instead of a conventional resonant trap. In this way, the 3.58-MHz signal and associated sidebands can be extracted from the composite video signal without impairing the luminance signal in any way. This technology is certainly more costly, but when you think about it, the elimination of an entire TV r.f. front end or tuner section probably more than compensates for the additional circuitry. The Profeel units end up costing not much more than a conventional color set of the same picture tube size.

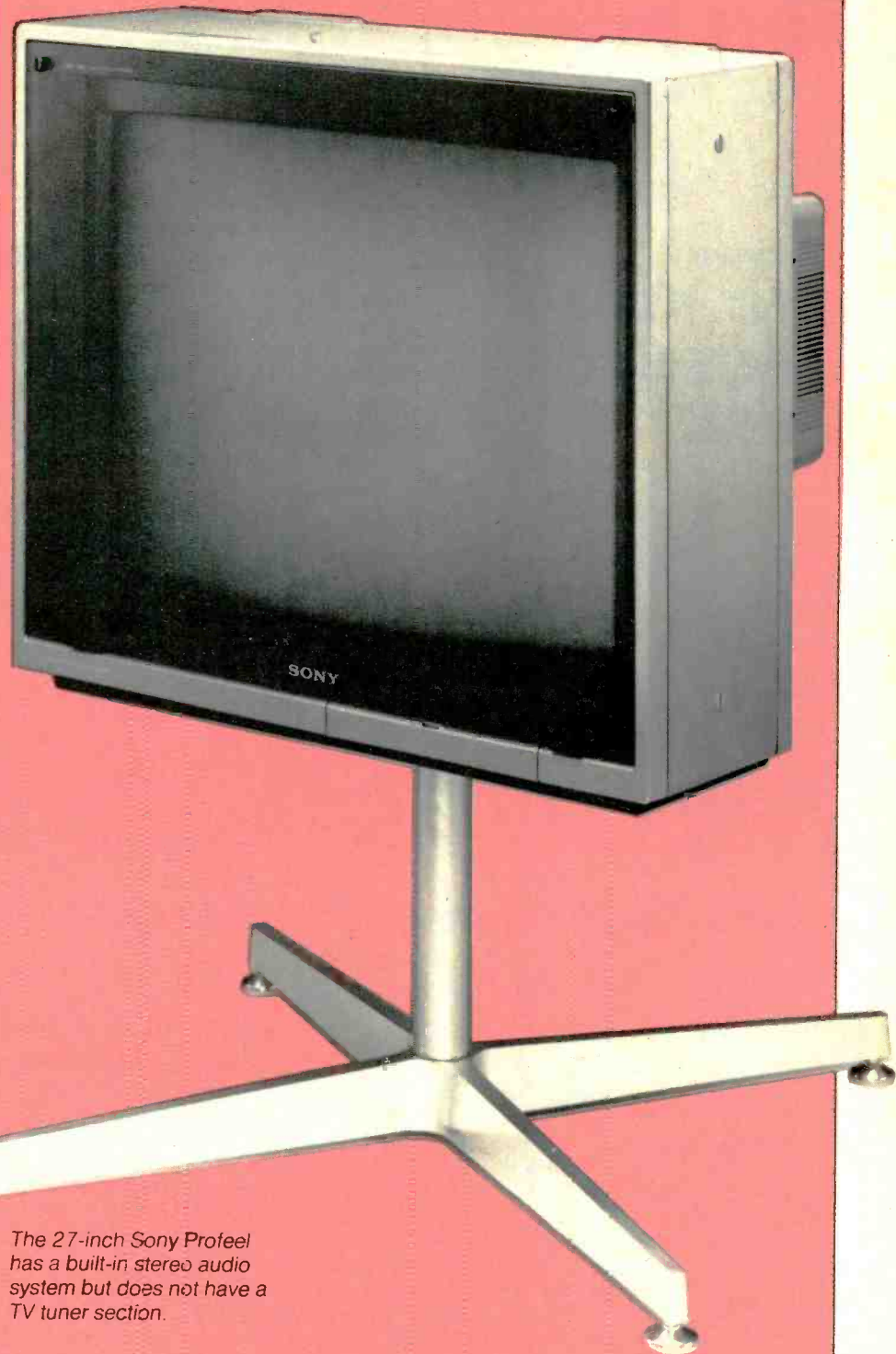
As a general rule, new products ex-

Even when looking at the 27-in. Profeel screen, the color picture seemed clearer and had better detail than any other I had seen on typical home sets.

hibited in Japanese electronics or audio shows often make their appearance in the United States between six months to a year later. Whether or not the Profeel concept of a TV monitor of high quality will be marketed in the U.S. by Sony (or, for that matter, by any of their competitors) will depend upon several factors. For one thing, the proliferation of other video-related products in this country is presently not nearly as great as it is in the Japanese domestic market. To be sure, we are seeing our fair share of TV game sales and VCR sales, but we are a long way from having an approved TV stereo sound system in this country, where such a system will have to be tested and approved by the FCC. One of the compelling reasons for owning a TV monitor in Japan is the fact that Japan's NHK-TV network and other private TV broadcasters currently transmit a fair amount of stereo programming as well as bilingual programming. While the Profeel units have a pair of built-in 10-watt audio amplifiers and a pair of reasonably good-sounding loudspeakers, most purchasers of these monitors are connecting the audio outputs of their separately purchased TV stereo audio tuners to the audio inputs of the Profeel or directly to their stereo component systems.

It may well be two to three years before we in the United States have an approved stereo audio TV system on the air, and this could delay the acceptance of the TV monitor concept. Then, too, just as audio components took a long time to gain acceptance with the general public in this country (and we still lag far behind Japan's estimated 67 percent of all households with a stereo component system), the "component" concept in video may not gain immediate acceptance even after it is finally introduced.

One final point is worth noting. From what I have seen thus far of videodiscs, they are capable of yielding better, sharper pictures than can usually be obtained either from videotapes or from TV broadcasts received over the air. That being the case, it would seem like a good idea for manufacturers to put more effort into designing and producing TV sets that are up to reproducing videodisc pictures at their very best. The new Sony Profeel TV monitors seem designed to do just that. **A**



The 27-inch Sony Profeel has a built-in stereo audio system but does not have a TV tuner section.

1

JVC KD-A7 CASSETTE DECK

Manufacturer's Specifications

Frequency Response: 25 Hz to 17 kHz, ± 3 dB, with metal tape; 25 Hz to 17 kHz, ± 3 dB, with CrO₂ tape, and 25 Hz to 16 kHz, ± 3 dB, with normal tape.

S/N: 60 dB.

Improvement with Super ANRS: +5 dB at 10 kHz, 0 VU.

Distortion: 1 percent at 0 VU.

Wow and Flutter: 0.04 percent W rms.

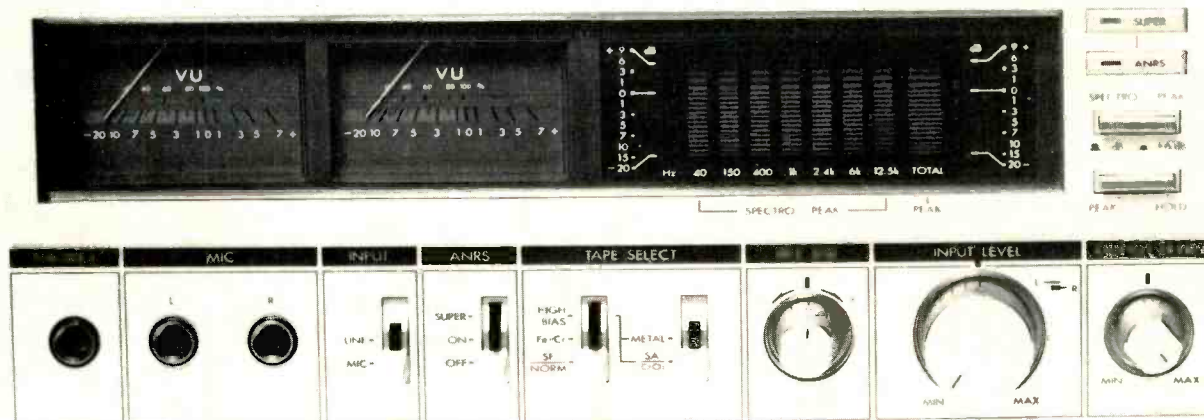
Dimensions: 17 3/4 in. (45.08 cm) W x 12 1/4 in. (31.11 cm) D x 4 3/4 in. (12.06 cm) H.

Price: \$449.95.



JVC

KD-A7 STEREO CASSETTE DECK ANRS



Cassette decks have come a long way since the original Philips design which boasted a response all the way up to 8 kHz! Many present-day models not only extend the response another octave but offer such features as full logic controls, eye-catching displays, and facilities that were once reserved for very expensive open-reel machines. A good example of modern design practice is the JVC KD-A7, a two-head machine with metal-tape capability. In addition to a pair of VU meters, the KD-A7 has a fluorescent graphic display that JVC calls their "Spectro-Peak" indicator. This has seven vertical bars which respond to frequencies centered on 40, 150, 400, 1,000, 2,400, 6,000, and 12,500 Hz. An eighth bar indicates the total, so it corresponds

to a normal VU meter but of course is fast acting.

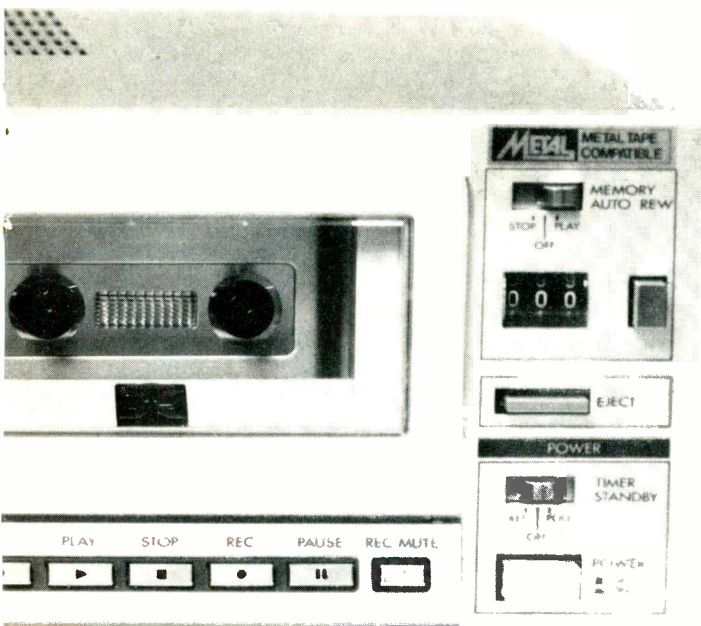
The aforementioned VU meters are on the extreme left of the front panel, and to their right is the graphic display followed by two push buttons. One increases the range of the display by 6 dB, and the other gives a choice of "hold," when the peaks are displayed for about 4 seconds, or peak. Above these switches are indicators for ANRS and Super ANRS. JVC's noise-reduction system, and next to them is the cassette compartment. Over on the right are the memory, timer, and on-off switches and the eject button and the digital counter. Also located on this side is a push button which controls the cassette door-opening mechanism. Under the cassette compartment are seven push buttons

for the tape transport logic controls, record button, and the record-mute switch. Sockets for microphones and headphones are below the VU meters on the extreme left, and they are followed by switches for line-mike input, ANRS and tape selection with equalizing. Then come three rotary controls: The first is for adjusting the equalization, the second controls the output, while the third is a dual-concentric type for input levels. The ANRS switch has three positions: Off, ANRS and Super ANRS, about which more later.

There are two d.c. motors. The motor which drives the capstan is servo-controlled, using a frequency generator (FG) system. The record/play head is one of the new X-cut types; this designation refers to the shape of the head surface which is angled back on each side of the gap. It is claimed that this method of construction restricts the stray magnetic flux, thus reducing low-frequency "fringing."

Measurements

Using a standard test tape, playback response was within ± 1



dB from 40 Hz to 12 kHz, as shown in Fig. 1. The first tape selected for record-replay measurement was a TDK MA-R metal formulation, and the results are shown in Fig. 2. The upper -3 dB point was at about 21 kHz, which is excellent! But even more important, the high-frequency saturation was very low indeed. This brings us to a consideration of the Super ANRS system incorporated in this deck. JVC's standard ANRS system is similar to the Dolby system, and, in fact, the two are quite compatible. What the Super ANRS version does is to reduce high-level high-frequency signals when recording and put them back in again during playback. In this way, tape saturation is considerably reduced. The effect is shown by the broken line in Fig. 2.

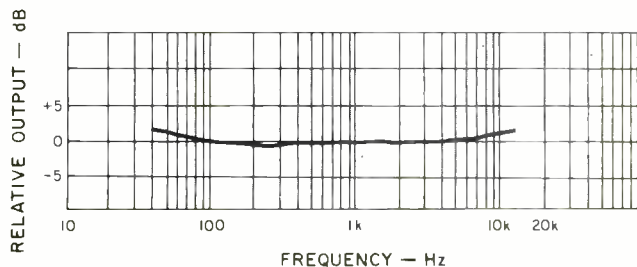


Fig. 1—Playback response using a standard test tape, JVC KD-A7 cassette deck.

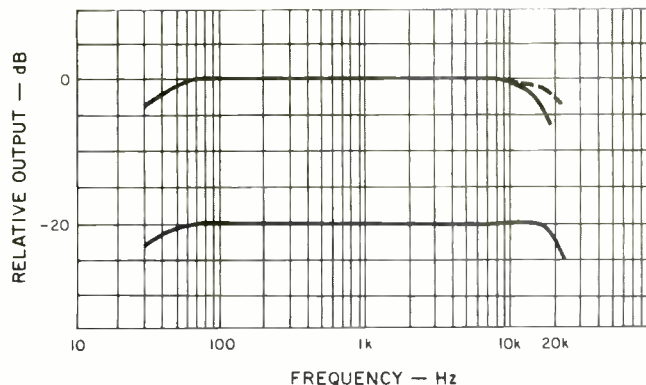


Fig. 2—Record-replay response with (---) and without Super ANRS system using TDK MA-R metal tape.

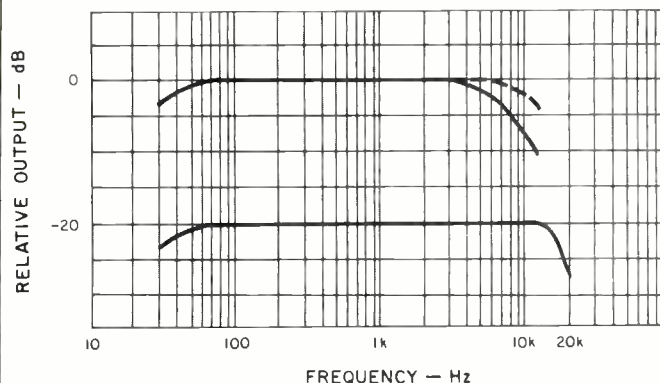


Fig. 3—Record-replay response with (---) and without Super ANRS system using Fuji FX-I tape.

Two impressions stand out:
The clear superiority of metal
tapes and the dramatic
improvement in headroom
with the Super ANRS system.

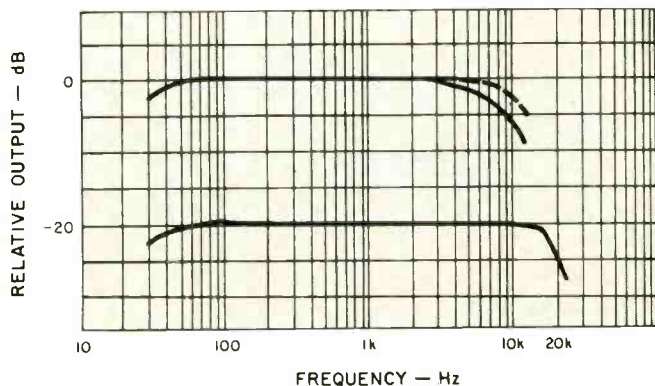
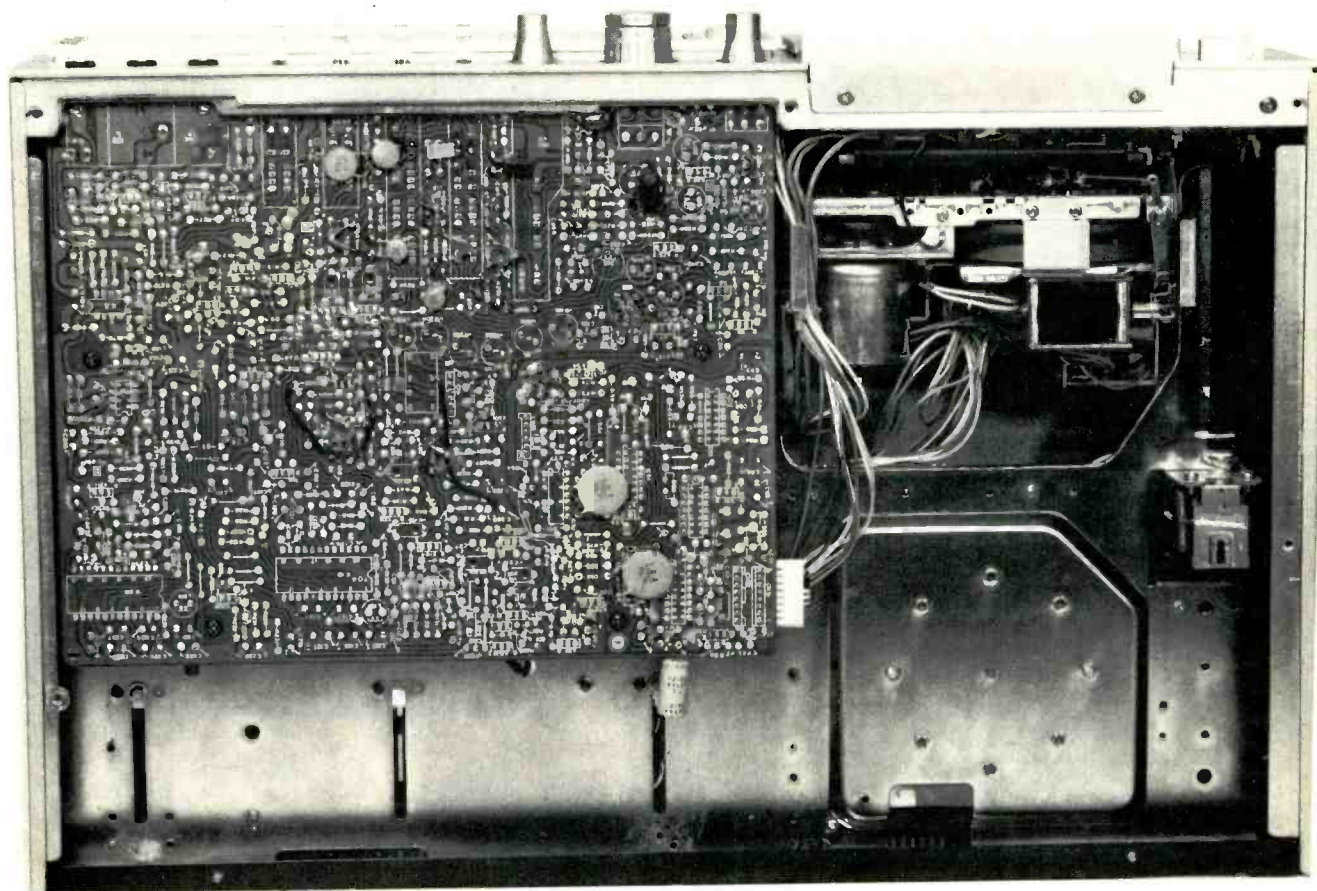


Fig. 4—Record-replay response with (- - -) and without Super ANRS system using Maxell UD-XL II tape.

note that the response at 0 VU is nearly the same as the one at -20 dB.

Next, a standard 120- μ S ferric tape was tested — a Fuji FX-I. Because the first measurement showed a droop at the high end, the chart in the instruction manual was checked out and the variable equalizing control turned to its correct +1 position. (Note that unlike most bias controls, this variable equalizing control is turned to a plus position to increase the highs and to a minus position to reduce them.) The upper -3 dB point for the FX-I came out at 16.5 kHz (see Fig. 3), and switching in the Super ANRS system improved the headroom at 10 kHz by nearly 6 dB. The third tape tested was a Maxell UD-XL II, a chrome-substitute formulation requiring 70- μ S equalization. As shown in Fig. 4, the upper -3 dB frequency was slightly higher at 17.5 kHz and the extra headroom produced by the Super ANRS system was 4 dB.

Distortion and headroom at 1 kHz can be seen in Fig. 5 for the three tapes, while distortion versus frequency is shown in Fig. 6. The signal-to-noise ratio (ref. 3 percent THD, "A" weighting) measured 58 dB for the TDK MA-R and Fuji FX-I with 57 dB for the Maxell UD-XL II. Switching to the ANRS mode increased these figures by approximately 10 dB.



With TDK MA-R metal tape, the upper -3 dB point was about 21 kHz, which is excellent! Saturation was very low indeed.

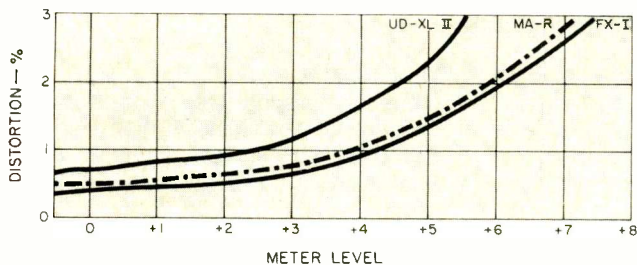


Fig. 5—Distortion and headroom at 1 kHz.

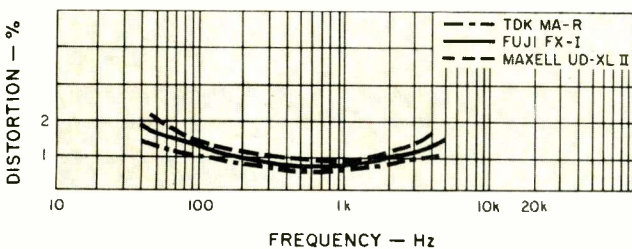


Fig. 6—Distortion vs. frequency, 0 VU.

Input required for 0 VU was 71.5 mV line and 0.17 mV for microphone, the output then being about 240 mV depending on the kind of tape used. Maximum signal handling capacity at the microphone input was 44 mV. Wow and flutter was a low 0.35 percent (DIN 45-507), and speed was right on the nose. Rewind time for a C-90 cassette was 98 seconds. Crosstalk measured 41 dB at 1 kHz, and erasure with metal tapes was better than 65 dB.

Conclusion

Two impressions stand out from the foregoing tests: The clear superiority of metal tapes and the dramatic improvement in headroom with the Super ANRS system. For most purposes, "ordinary" tapes with Super ANRS will give very satisfactory results indeed, but when taping direct discs or the new digitals the extra cost of metal tapes will almost certainly be justified. How about that spectral graphic display? (I like JVC's German description better: *Spektral-Pegelspitzenzeigers!*) Well, it does enable the user to analyze the signal in terms of frequency and it might well help to prevent overloading with electronic music, for instance, but I must say I found the single bar indicator plus the meters quite adequate. I am also certain that most users will appreciate the Super ANRS, auto rewind facility, feather touch logic controls and variable equalization. All in all, above-average performance for JVC's KD-A7 cassette deck. *George W. Tillett*

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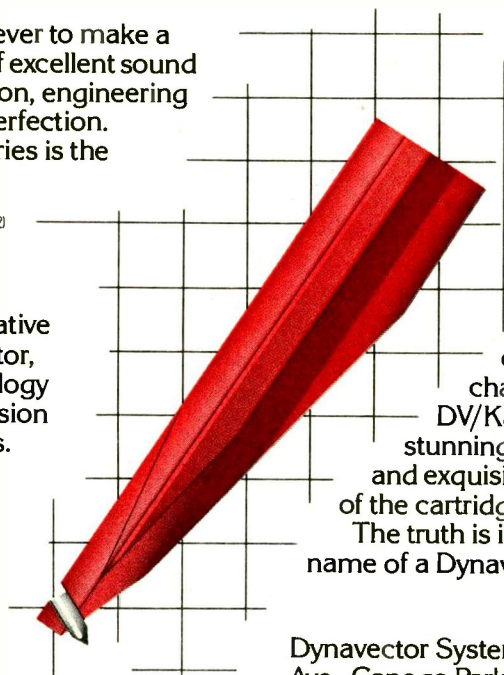
$$C_B = \alpha \sqrt{2\pi f} \left[1 - \frac{1}{4} \beta \frac{2\pi f}{\alpha^2} + \frac{1}{4} \delta (2\pi f)^2 + \dots \right] \dots \text{②}$$

$$\alpha^4 = \frac{EI}{m}, \quad \beta = \rho \alpha^4 \left(\frac{1}{E} + \frac{\gamma}{G} \right), \quad \delta = \frac{\rho^2 \gamma \alpha^4}{EG}$$

Dr. Noboru Tominari, the creative genius and founder of Dynavector, developed a radical new technology taking into account wave dispersion and cantilever vibration theories.

Dr. Tominari reasons that the "soft" sound of most cartridges was due to the various delays of frequencies along the length of the cantilever.

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Another benefit of the short/hard ruby cantilever is the high resonance frequency above 50 kHz. Therefore, the elimination of rubber damping. Without the "creeping time effects of rubber" (temperature changes and age deterioration), the DV/Karat's ability to produce sound with stunning realism, brilliant tonal balance and exquisite detail is maintained over the life of the cartridge.

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2

MTI MODEL 500 PREAMP

Manufacturer's Specifications

Phono Section

Frequency Response: 100 Hz to 20 kHz, ± 0.2 dB; 20 Hz to 100 Hz, +2, -0 dB.

Time Displacement: Approx. 2 μ S.

Hum and Noise: Silent at normal listening levels; noise is dominated by thermal noise of cartridge.

Maximum Output Voltage: 9 V rms.

Rated Output Voltage: 2 V rms.

Distortion (All Types) at Rated Output: Below 0.01 percent.

Input Impedance: MM input fully adjustable; MC type current driven and matches any cartridge impedance.

Line Amplifier Section

Frequency Response: 15 Hz to 150

kHz, +0, -3 dB.

Time Displacement: Approx. 8 μ S.

Maximum Output: Main, ± 12 V peak; speakers, ± 24 V peak.

Rated Output Voltage: 3 V rms.

Distortion (All Types) at Rated Output: Below 0.01 percent.

Output Noise: -80 dBm, unweighted.

Main Output Impedance: 50 ohms.

Input Impedance: 20 kilohms.

Gain: Main, 20 dB; speakers, 26 dB.

General Specifications

Dimensions: 16½ in. (41.91 cm) W x 2¼ in. (5.71 cm) H x 9 in. (22.86 cm) D.

Weight: 11 lbs. (4.95 kg).

Price: \$895.00.

MTI is the acronym for Micro-Tech Inc., and when I first began to examine their Model 500 "preamplifier" (in a moment you'll see why I put this in quotes), I thought that there was something familiarly clean and elegant about its front panel design. Only later did I learn that the front panel design had been executed by none other than Saul Marantz, who apparently loves the hi-fi business so much that he just can't stay away. Sherwood Scribner, who is more concerned with circuitry than cosmetics, is responsible for the innards of this unit, and, indeed, he can come up with some novel ideas about what a preamp should and should not do.

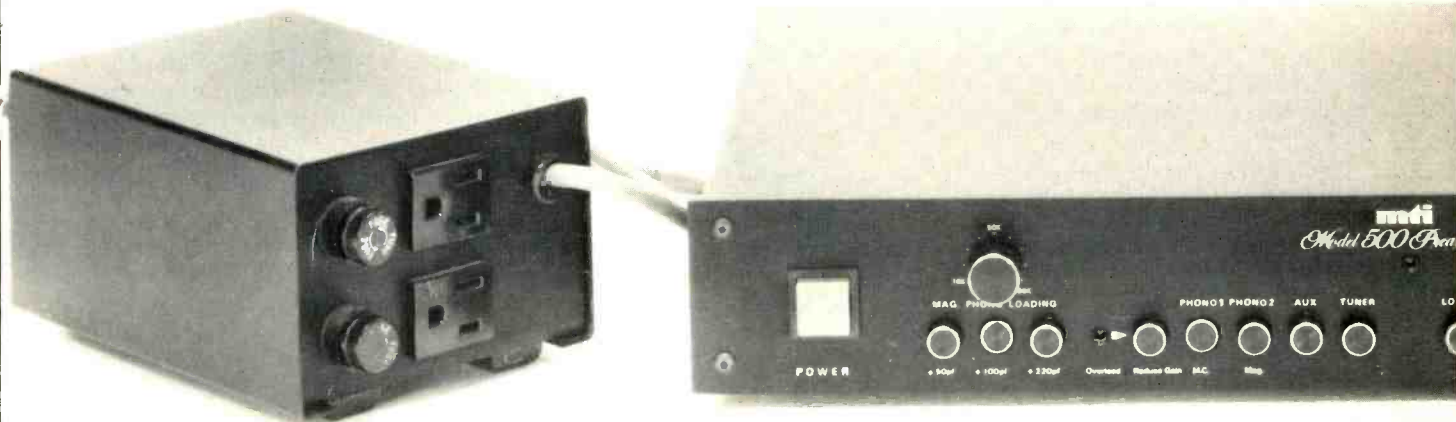
Clearly, Scribner subscribes to the school of design that wants to minimize signal processing in a control chassis while at the same time maximizing switching flexibility. So, while there are no tone controls to be found on this preamp, it is equipped with a subsonic filter, a pair of tape monitor circuits, tape copy switches, mono/stereo switching, dual concentric level controls, and an illuminated separately mounted power on/off switch.

Program selection is done by means of push buttons for tuner, AUX, phono 2 (MM), and phono 1 (MC). A button identi-

fied as "Reduce Gain" does just that and is to be pushed when an adjacent overload light illuminates. A rotary control and three push buttons are used to adjust the resistance load across moving-magnet cartridges and to adjust the loading capacitance from a low of 50 pF to a maximum of 370 pF in seven steps. A helpful table of recommended capacitance values for some popular makes and models of cartridges is included in the owner's manual.

The power supply for this preamplifier is a separate module connected to the main control unit by means of a long multi-pin cable and connector. The power supply contains a pair of a.c. convenience outlets (one switched from the main chassis, the other unswitched) and a pair of fuses: A 10-ampere fuse that protects the electronic power switch and the lower 9-ampere convenience outlet, and a ½-ampere fuse that protects the line amplifier in the Model 500 itself.

Although the Model 500 is called a preamplifier, it incorporates a line amplifier capable of driving loudspeakers of reasonably high efficiency to fairly loud listening levels. Interestingly, the designers tell us little about the IHF Standard ratings of this



built-in amp when it is used as a power amplifier, saying instead that it "sounds like a 50-watt amplifier." I am not quite certain as to why MTI chose to call the 500 a preamplifier instead of an integrated amplifier, which, from my point of view, it certainly is, but I suspect they want the user to regard the amp as a temporarily available feature, suitable for use with speakers until a more powerful basic amp is purchased.

Circuit Highlights

MTI suggests that "time alignment" of the entire audio spectrum, the ability of this preamplifier to process or pass all frequencies through it in correct relative time relationship, is as important in an electronic component as it is in the design of a multi-driver transducer system. The company further suggests that such time alignment circuitry has been employed in the design of this system — a claim that we would find difficult to affirm, since we were not provided a schematic as the circuit is proprietary.

The Model 500's built-in moving-coil pre-preamplifier has a current-driven self-matching moving-coil cartridge loading system which does adjust automatically to provide an ideal match for any MC cartridge. The flat amplifier section, which MTI calls the "line amplifier" of this unit, is a Class-A design having high headroom capability and, as mentioned earlier, a speaker output stage which can drive loudspeaker systems having impedances as low as 4 ohms. Low-level signals can be driven over extremely long distances because of the low output-impedance characteristics of the line-level outputs of the amplifier. The MTI 500 has a "Separate Amp" switch on the rear panel which, when pushed in, bypasses the line amp, routing signals directly from the level control to the main-out jacks with no gain. The reasoning here is that most high-level sources (tuners, tape recorders), as well as the phono preamp section of the MTI 500 itself, have enough gain to drive a power amplifier directly. When the "Separate Amp" switch is depressed, the line amplifier's inputs are routed to "Separate In" jacks on the rear panel, allowing the amplifier to function independently of the control functions. In this mode, the line amplifier might be used to drive a subwoofer or it might also be used as a high-pass amplifier in bi-amplified systems.

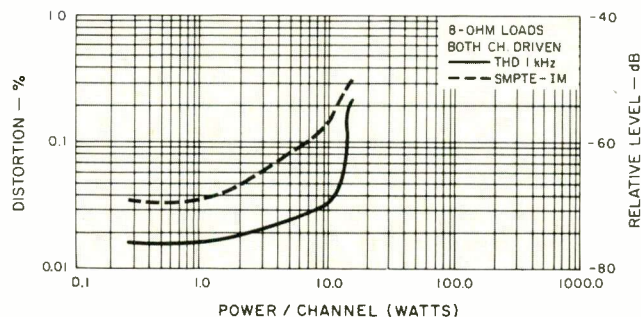


Fig. 1—Power output vs. THD and IMD, MTI Model 500 preamplifier.

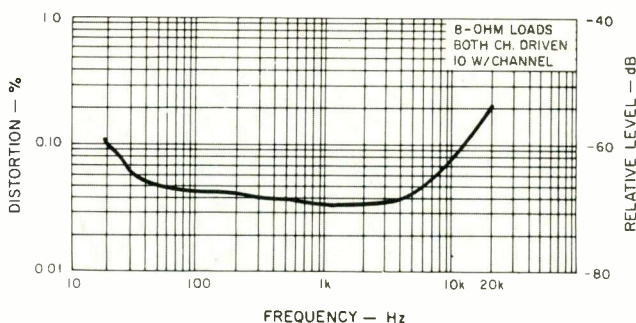


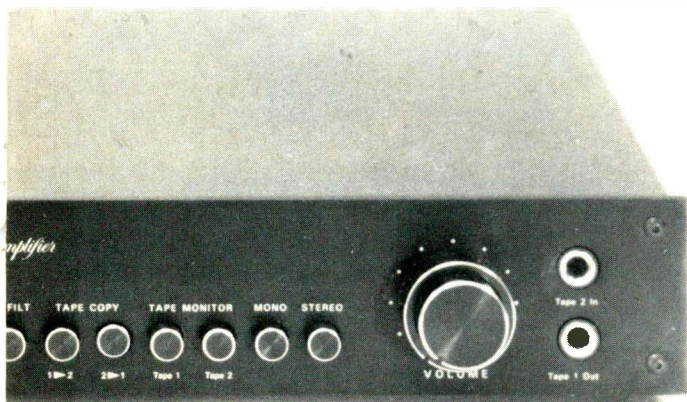
Fig. 2—Distortion vs. frequency.

Measurements

No information is offered regarding the small power amplifier section of this unit, and we were unable to elicit definitive IHF specifications from the manufacturer on this point. Because we did not have a reference distortion level to check against, we decided to arbitrarily assign our own, 0.2 percent THD. For this level of THD, the amplifier was able to deliver 16 watts per channel. A plot of power output versus harmonic and IM distortion for mid-frequency signals is shown in Fig. 1, while in Fig. 2 we have plotted distortion versus frequency for a constant 10 watt per channel output. Maximum output for 0.2 percent THD at 20 Hz measured 13 watts per channel, while at 20 kHz it was 16 watts per channel.

Figures 3A and 3B show plots of the RIAA playback equalization curve. In Fig. 3A the "cursor" has been moved to read the roll-off at 10 kHz (-13.9 dB for the left channel, -13.8 dB for the right channel), which is within 0.05 to 0.15 dB of the precise required value; in Fig. 3B we show the boost at 100 Hz of +13.5 dB for the left channel and +13.5 dB for the right channel, which is within 0.39 dB of the precise required value. In both plots, 0-dB reference was set at 1 kHz.

Aside from quoting frequency response of the preamplifier and line amplifier sections of the Model 500, the makers of this unit supply little IHF Standard specification data against which to compare our own measurements. Using the latest IHF reference levels, we measured a phono input sensitivity, for moving-magnet cartridges, of 0.87 millivolt for 0.5-volt output. In the case of the moving-coil inputs for the same output level, input required



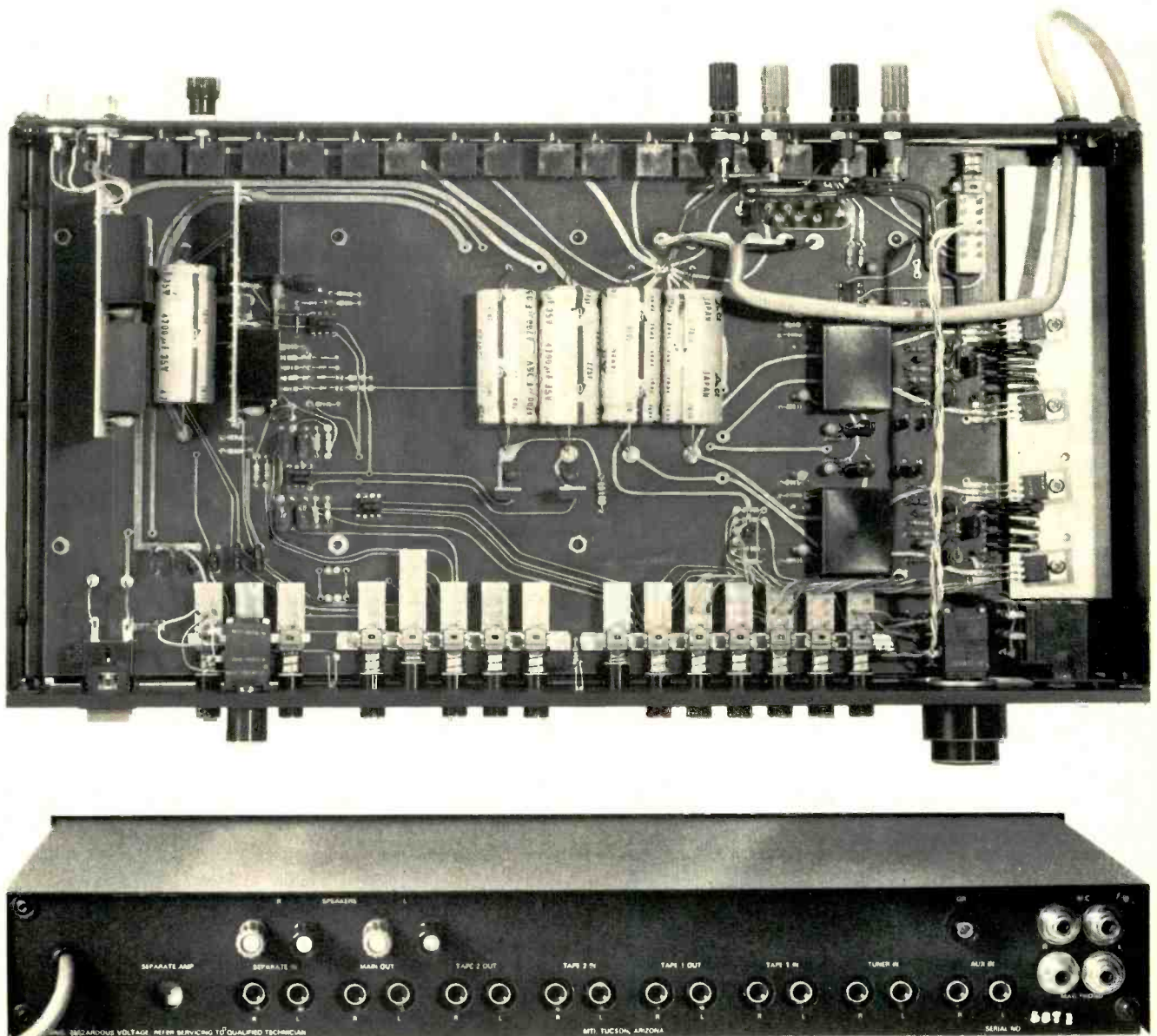
MTI suggests that time alignment is as important in a preamp as it is in a speaker system.

was 0.05 millivolt. High-level input sensitivity measured 63 millivolts for 0.5-volt output. Phono overload was 110 millivolts at 1 kHz with the moving-magnet inputs — acceptable but not outstanding compared with some of the figures we have obtained of late from the preamp sections of both preamplifier-control units and receivers. The signal-to-noise ratio for the moving-coil phono inputs, "A" weighted, was a very acceptable 72.0 dB for the left channel and 72.1 dB for the right channel. For the high-level inputs, still referred to 0.5-volt output, the S/N measured 77.0 dB for the left channel and 76.7 dB for the right channel.

The subsonic filter has a -3 dB cutoff point at 30 Hz and a slope of 6 dB per octave. The rated output of the phono section of the MTI-500 is listed at 2.0 volts rms while that of the line-

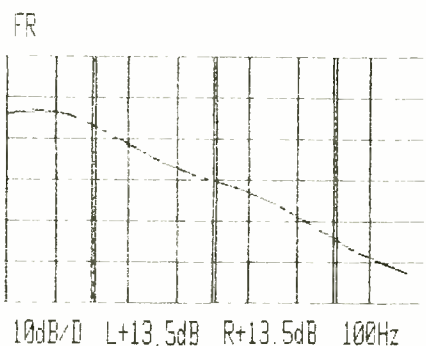
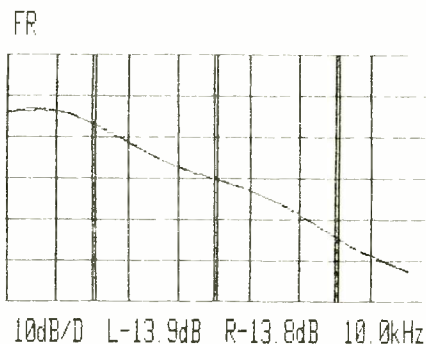
level amplifier is quoted at 3.0 volts. We are not certain what this latter figure means, since the amplifier can deliver far more than that amount of drive through the speaker terminals. This may mean the reference output level when measured via the main-out line terminals of this amplifier, ahead of the speaker stage.

Returning for the moment to the power amplifier section of this "preamplifier," we measured a damping factor of 40 at 50 Hz, referred to 8-ohm loads. IM distortion at the equivalent of 16 watts measured 0.3 percent. The Model 500's amplifier section does have a surprisingly high dynamic headroom. We measured this at around 2.2 dB (referred to 16 watts of continuous power output capability), which means that under short-term musical signal conditions the amplifier could deliver unclipped signals



The Model 500 offers maximum switching flexibility with a minimum of signal processing.

Fig. 3—RIAA playback equalization curves, phono section. Note almost perfect match between left and right channels.



peaking at around 26 watts per channel, considerably in excess of the continuous power capability of the unit. Voltage gain via the main and speaker outputs measured 20 and 26 dB respectively, as claimed by the manufacturer.

Use and Listening Tests

We did not judge the MTI 500 as an integrated amplifier, but rather as a phono preamplifier/control unit which is, we believe, its prime purpose. The unit exhibited a high degree of audio quality when used with a top-grade power amp and high-quality, time-aligned speakers. The reproduction that we heard from records was excellent. The unit is obviously not intended for those who crave a bunch of knobs and lots of signal processing beyond phono preamplification and equalization. If you are of the school that believes tone controls have no place in an electronic component that attempts to minimize time and phase errors and you can afford a preamplifier control chassis that costs nearly \$900.00, the MTI 500 does offer an unusual means of entry into the world of audio esoterica. We must be critical of the owner's manual, which, though elegantly bound and certainly longer in its text than most, unfortunately leaves us without the Standard data we really need and with information a bit irrelevant to the potential user. Still, that's a relatively minor flaw and one which we are told will soon be corrected by MTI.

Leonard Feldman

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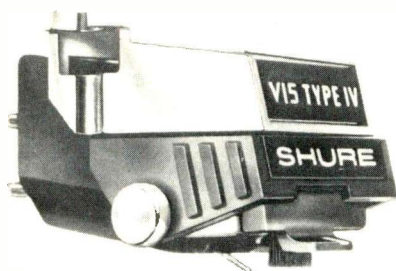
SHURE V15 TYPE IV PHONO CARTRIDGE and SME 3009 III TONEARM

Manufacturer's Specifications V15 Type IV Phono Cartridge

Generating System: Moving magnet.
Output Voltage: 4 mV (1 kHz, 5 cm/S, horizontal).
Channel Separation: 25 dB at 1 kHz.
Recommended Load Resistance: 47 kilohms.
Recommended Load Capacitance: 250 pF.
Recommended Tracking Force: $\frac{3}{4}$ to $1\frac{1}{4}$ grams.
Playback Frequency Response: 10 Hz to 25 kHz.
Weight: 6.4 grams.
Price: \$191.00; replacement stylus, \$66.00.

3009 III Tonearm

Type: Static balance with multiple counterweights.
Effective Length: 9 in. (22.86 cm).
Overhang: Adjustable.
Height Adjustment Range: 0.875 in. (2.22 cm).
Acceptable Cartridge Weight: 0.1 to 13 grams.
Tracking Force Range: 0 to $2\frac{1}{2}$ grams.
Maximum Tracking Error: $1\frac{1}{2}$ degrees/inch.
Price: \$294.00.



SME are the initials of Scale Model Engineering, a British company which has dedicated its efforts to producing what it says is "the best pick-up arm in the world." The 3009 III is their latest effort. SME has been making precision tonearms, to the exclusion of any other audio products, for more than 20 years. Their desire for perfection can be seen in the firm's listening room which was designed and built under the guidance of SME's Managing Director, Alastair Robertson-Aikman. This room, which is shown in Figs. 1 and 2, is 36 feet by 21 feet, 6 inches and has a 10-foot high ceiling. The walls are of brick, while the roof is a single span of reinforced concrete, weighing about 30 tons! Over two tons of wool are used in the rugs and drapes. The music system is very elaborate and includes the usual two front channels plus two rear channels which are fed by a 55-millisecond delay. The loudspeakers include two 18-inch servo-controlled woofers and electrostatic elements for mid-ranges and tweeters. Two turntables are mounted on sand-filled platforms, and their platters are filled with clay to damp out any internal resonances. Other details of the system similarly indi-

cate that SME tonearm designs are auditioned with great care during their development.

The rationale behind the development of the SME 3009 III tonearm is described succinctly by SME in their brochure and other informational sheets. One goal was to achieve a low effective mass at the stylus tip. Since effective mass is different than tracking force, a tonearm/cartridge combination can be set for zero tracking force and still have a high effective mass. At equilibrium, the effective mass means nothing, but as soon as the stylus of the phono cartridge sees any change, as it surely does when it is tracing a record groove, then effective mass becomes important. In the case of record surface variations, due to warp or even high modulation levels, a high effective mass can cause changes in the tracking force and even the vertical tracking angle of the stylus. The SME 3009 III has achieved a very low effective mass, and so problems of this kind should be reduced considerably.

The "S" shaped, nitrogen-hardened titanium carrying arm has a wall thickness about the same as two human hairs. The



Fig. 1—Listening room at SME, built under the guidance of the firm's Managing Director, Alastair Robertson-Aikman.

Fig. 2—The open drapes reveal the elaborate music system in SME's listening room, called the Stokes Music Room.



MEASURED DATA

SME 3009 III Tonearm

Pivot-to-Turntable Center Distance: 8.5 in. (216 mm).
Pivot-to-Stylus Distance: 9.313 in. (236.5 mm).
Pivot-to-Rear of Arm Clearance Distance: 2.5 in. (64 mm).
Arm-Rear Clearance from Turntable Center: 11 in. (280 mm).
Overall Height Adjustment: 0.875 in. (22.2 mm).
Maximum Tracking Force Adjustment: 2.5 grams.
Tracking Force Calibration: 0 to 1.5 grams.
Tracking Force Accuracy: Within 0.05 gram.
Cartridge Weight Range: 0.1 to 13 grams.
Counterweights: Six, coined lead; one, 55.9 grams, five, 11.1 grams.
Counterweight Mounting: Plastic carrier.
Sidethrust Correction: String and weight, adjustable knob; uniformity increases toward center of record.
Pivot Damping: None (external damping system).
Lifting Device: Damped lever.
Carrying Arm, Total Weight: 9.9 grams.
Headshell Offset: 24.5 degrees.
Fingerlift: Integral with headshell.
Mounting Screws Weight: 0.1 gram.
Overhang Adjustment: Rack and pinion movement of pillar, template excellent.
Bearing Alignment: Excellent in both planes.
Bearing Friction: Less than 50 milligrams in both planes.
Bearing Types: Horizontal, ball; vertical, knife edge.
Bearing Play: Horizontally, none; vertically, some.
Lead Torque: Insignificant.
Dynamic Mass: Approximately 5 grams.
Static Mass: Too low to measure.
Lead Capacity: Total, 125 pF; arm leads, 25 pF; external leads, 100 pF.
Lead Resistance: Total, 1.14 ohms; arm leads, 0.83 ohm; external leads, 0.31 ohm.
Lead Length: 48 in. (1.22 m).
Structural Resonance: Possible at 250 Hz in arm tube.
Base Mounting: Horizontal slot to allow main pillar adjustment for minimum tracking error.

Shure V15 Type IV Phono Cartridge

Serial No.: None

	Left	Right
Inductance, mH	480	470
Resistance, ohms	1320	1280
Output, mV/cm/S at 45° (B&K 2009, band 3)	1.2	1.2

Dynamic Tracking Force

Grams required to track B&K 2010
 (Grams x 980 = dynes; 0 dB = 10 cm/S lateral or 7.07 cm/S 45°)

	Vertical Force	Sidethrust
Band 3, +8 dB	1.1	1.2
Band 4, +6 dB	0.7	0.5
Band 5, +4 dB	0.6	0.4
Band 6, +2 dB	0.5	0.3
Band 7, 0 dB	0.4	0.2

Add 0.5 gram with Dynamic Stabilizer

Cartridge Mass: 6.35 grams.
Microphonic Pickup: Excellent rejection.
Hum Rejection: Excellent.
High-Frequency Resonance: 23 kHz.
Low-Frequency Resonance: 11 Hz, with Q of 2.75. See text.
Rise Time: 25 μs.
Recommended Load Resistance: 100 kilohms
Recommended Load Capacitance: 250 pF.
Polarity: Negative for inward groove modulation.
Recommended Tracking Force: 1.1 grams.

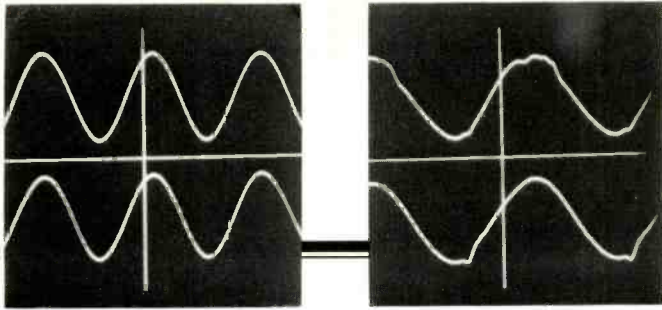


Fig. 3A — Response of Shure V15 Type IV cartridge to 300-Hz signal in band 9 of CBS STR-112, +18 dB re: 11.2 μ M; 0.9 g vertical tracking force and 0.7 g sidethrust force. Upper trace represents left channel and lower trace the right channel (as in all photos).

Fig. 3B — Response to a 1-kHz signal in band 3 of B&K 2010, +8 dB (17.76 cm/S at 45 degrees); 1.1 g vertical tracking force and 1.2 g sidethrust force.

low-mass carbon-fiber headshell is fixed securely to the carrying arm. Instead of changing headshells, as with most other designs, the arm tube itself, which SME calls the carrying arm, is slipped in and out of a socket close to the main pivot. The mass of the connector plug and socket, which carry the signal from the cartridge to the arm leads, is kept close to the main pivot which reduces its contribution to the effective mass considerably. Since the effective mass is a function of the square of the distance from the fulcrum or pivot, a mass of 81 grams one inch

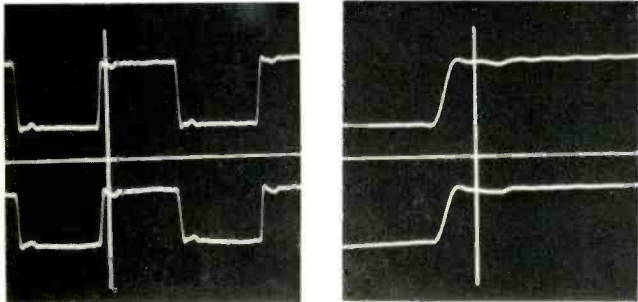


Fig. 4A—Response to a 1-kHz square wave in band 1 of CBS STR-112; 3.54 cm/S modulation in each channel. Combination of SME 3009 III tonearm and Shure V15 Type IV with loadings of R = 27 kilohms and C = 500 pF.

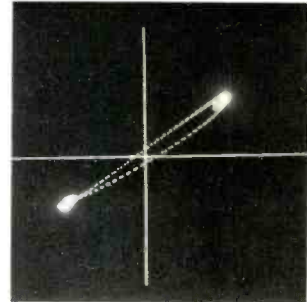


Fig. 4B—Expanded view of Fig. 4A. Note the excellent damping.

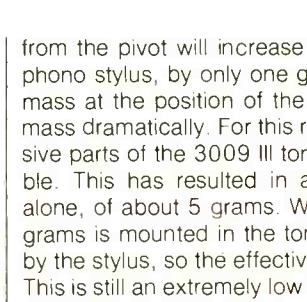


Fig. 4C—Same as Fig. 4A except left vs. right channel showing inter-channel phase relationship.

from the pivot will increase the effective mass, as seen by the phono stylus, by only one gram. Conversely, small increases in mass at the position of the cartridge will increase the effective mass dramatically. For this reason, SME has kept the more massive parts of the 3009 III tonearm as close to the pivot as possible. This has resulted in an effective mass, for the tonearm alone, of about 5 grams. When a cartridge weighing about 6.5 grams is mounted in the tonearm, nearly all of its mass is seen by the stylus, so the effective mass would be about 11.5 grams. This is still an extremely low total effective mass.

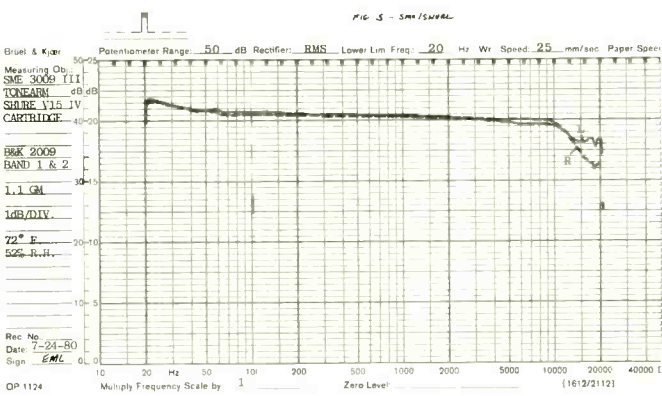


Fig. 5—Amplitude vs. frequency response with input loading as shown in Fig. 4.

Another contribution to maintaining a low effective mass is the use of multiple counterweights, made of lead, which can be loaded into a molded plastic container close to the main pivots. The manual shows the proper combination of weights needed to balance cartridges of different weights. This scheme allows the tracking force to be adjusted from 0 to 1.5 grams, while keeping the mass close to the pivots.

When the stylus is modulated by the signal in the record groove, some of the energy is transmitted through the body of the cartridge into the tonearm. If not sufficiently attenuated, this delayed reflected energy can remodulate the stylus and, in turn, be seen in the output. Such delayed energy can sometimes

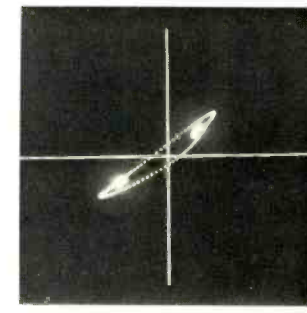
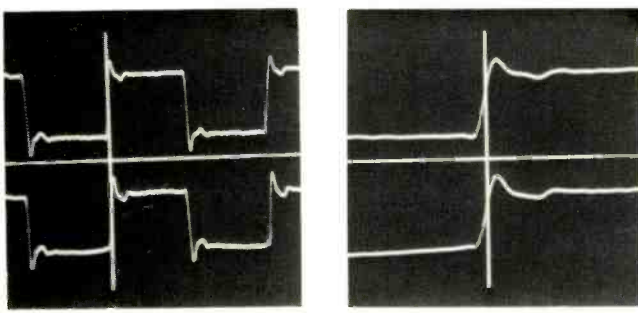


Fig. 6A — Same as Fig. 4A except input loading set to R = 47 kilohms and C = 250 pF.

Fig. 6B—Expanded view of Fig. 6A.

Fig. 6C—Same as Fig. 6A except left vs. right channel showing interchannel phase relationship.

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High Fidelity put it this way: "... seems to open a curtain and reveal a deployment of musical forces extending behind, between and beyond the speakers... terrific."

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The achievements of Carver technology can be appreciated best when some aspects of Bob Carver and Carver Corporation are understood.

Bob Carver designed his first amplifier when he was twelve, took his master's degree in physics—not electronics—and has pursued life and his profession in electronic engineering in a highly personal way.

He has always found innovative solutions to conventional problems, and his solutions in high fidelity engineering have also established new price/performance standards.

One such problem was the two-dimensional aspect of the stereo presentation—the speakers being the all-too-apparent source of the sonic image. Other limitations were the weight, size, heat—and cost—associated with high-power amplification.

Carver solved these problems in ways that are so astounding that listeners at early demonstrations were somewhat suspicious. But the products were soon acclaimed as marking totally new directions that others must inevitably follow—as they have already begun to do.

"It is 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!"

Julian Hirsch,
Hirsch-Houck Labs



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As for its sound, Leonard Feldman reported in Audio: "Music reproduction was superb and completely free of any false bass coloration or muddiness... none of that brittle quality that one often detects from amplifiers that are beginning to strain."

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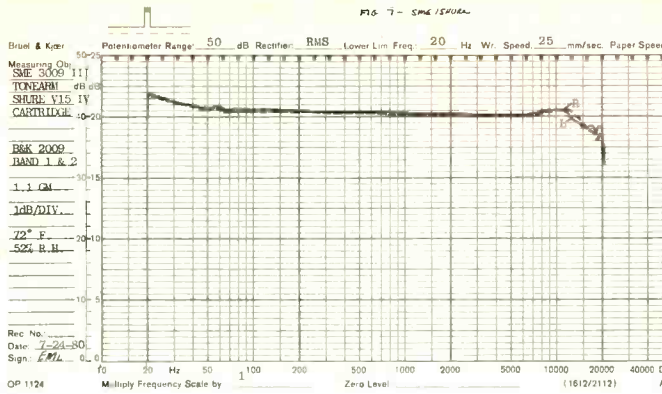


Fig. 7—Amplitude vs. frequency response with input loading as in Fig. 6.

"enhance" the sound by adding "warmth" and "body" in the middle register. It can also add "brightness" and "smear" in the top register. SME has chosen to attenuate these effects and by so doing eliminate such "enhancement."

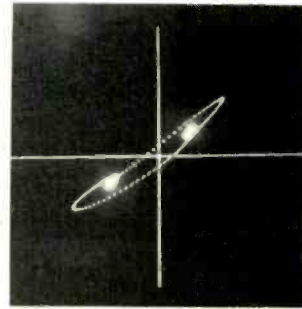
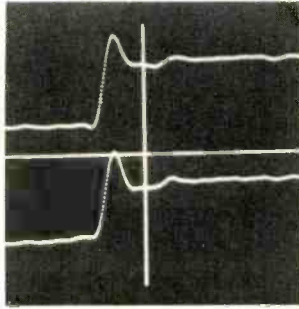
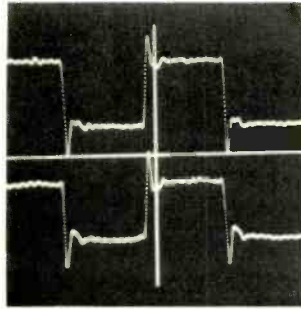


Fig. 8A—Same as Fig. 4A except input loading is $R = 100$ kilohms and $C = 250$ pF.

Fig. 8B — Expanded view of Fig. 8A.

Fig. 8C — Same as Fig. 8A except left vs. right channel showing interchannel phase relationship.

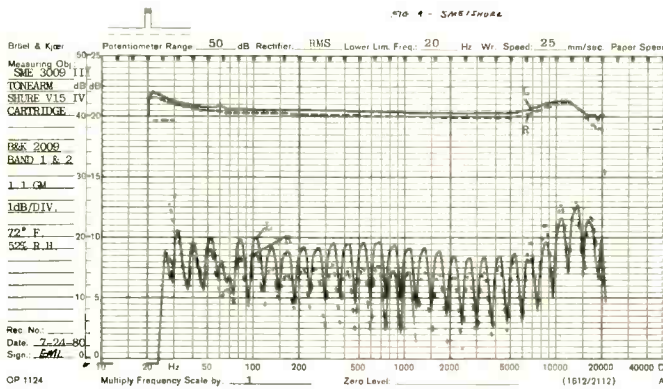


Fig. 9 — Amplitude vs. frequency response with input loading as in Fig. 8. This R-C combination was used during the listening panel evaluations. Interchannel crosstalk is also shown.

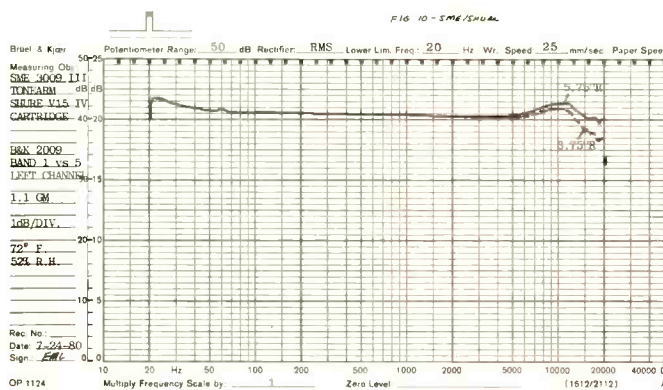


Fig. 10 — Scanning loss vs. record diameter (5.75-inch and 3.75-inch radius); $R = 100$ kilohms and $C = 250$ pF.

The vertical pivots, which allow the lateral tonearm movement, are twin stainless-steel ball races, while the horizontal pivots, which allow the vertical movement, are knife-edge bearings. There is a small amount of play in the knife-edge bearings, unavoidable in this type of design, but the large amount of force, which is between 500 to 600 lbs. per square inch, keeps them from causing any problems. The axes of both bearings are located in line with the plane of the stylus when it is playing a record, which means that the ill effects of record warp are greatly reduced. The bearing friction is claimed to be about 20 milligrams. Measuring such tiny forces is extremely difficult, and anything less than 50 milligrams, which is what we measured, is considered excellent.

The location of the pivots, with respect to the turntable platter, is adjustable by a rack and pinion system which moves the main arm post along a track. The total adjustment is one inch, more than sufficient to allow the exact positioning of any phono cartridge for minimum distortion due to tracking angle error. The arm height may also be moved up and down by releasing a locking screw. Besides these two arm-positioning adjustments, there are seven other adjustments, including four that are made by simply turning a knob. These include the vertical balance, the lateral balance, the vertical tracking force, and the lateral sidethrust force, all knob adjustable, and the 1.5- to 2.5-gram additional weight, the viscous damping system with its three different paddles, and the patented counterweight system with its six lead weights.

The four-foot phono cable supplied with the SME 3009 III tonearm has gold-plated phono plugs at each end. These cables include internal 220-pF capacitors, which may be removed easily since the phono plugs have threaded covers. There are two gold-plated phono sockets at the bottom of the arm pillar.

The SME 3009 III tonearm is distributed in the U.S.A. by Shure Brothers, an American company with a worldwide reputation for manufacturing phono cartridges and microphones which are the result of dedicated research and engineering. It therefore seemed natural to perform the technical measurements and listening panel evaluations using the top-of-the-line Shure V15 Type IV phono cartridge mounted in the SME 3009 III tonearm.

The Shure V15 Type IV cartridge, reported on previously in

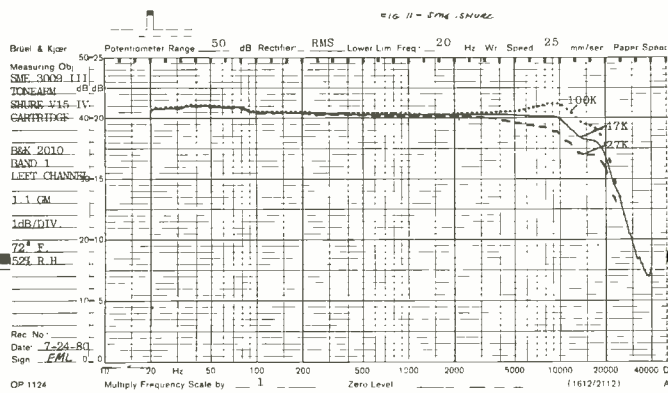


Fig. 11 — Effect of various resistive loadings on output; R = 100, 47 and 27 kilohms and C = 250 pF. Note roll-off above 20 kHz.

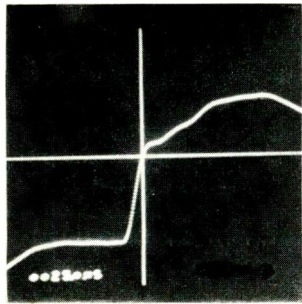


Fig. 12A — Rise time is 25 μ S with load of R = 100 kilohms and C = 250 pF.

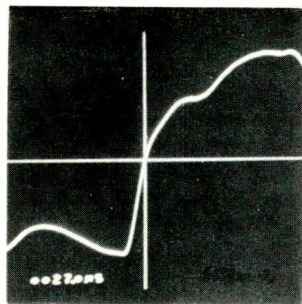


Fig. 12B — Rise time is 27 μ S with load of R = 27 kilohms and C = 500 pF.

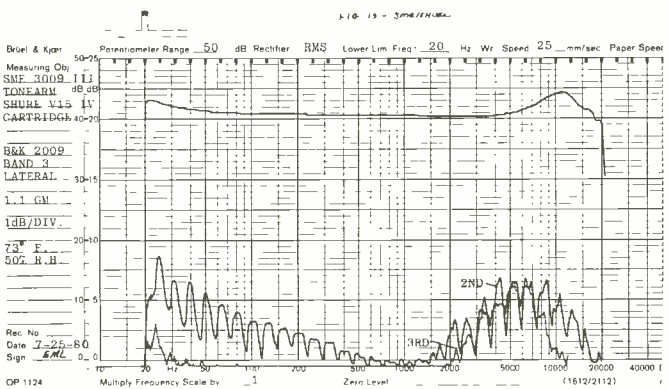


Fig. 13 — Response and harmonic distortion (2nd and 3rd), lateral modulation; R = 100 kilohms and C = 250 pF.

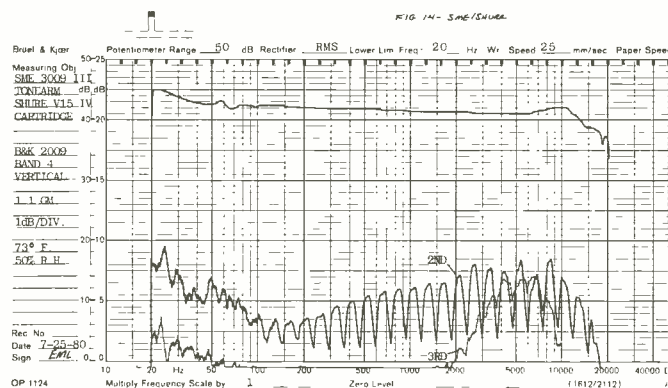


Fig. 14 — Same as Fig. 13 except vertical modulation. Note the increase in 2nd harmonic distortion in the middle register.

the February 1979 issue of *Audio* by B.V. Pisha, incorporates some technical features about which the Shure engineering team has written a number of interesting papers. The dynamic stabilizer system is one such feature. After the initial set-up procedures were completed, the dynamic stabilizer was used throughout the technical measurements and listening tests. Consisting of a tiny, viscous damped brush composed of electrically conductive fibers, this multipurpose device removes dust particles from the grooves of the record, neutralizes the electrostatic attraction between the record and the cartridge, and reduces the amplitude and the Q of the low-frequency resonance due to the compliance of the stylus assembly and the effective mass of the tonearm/cartridge. The dynamic stabilizer is very effective in reducing mistracking due to record warps, since it acts in much the same way as an advance ball system of a disc cutter head by reducing variations in vertical force caused by lack of uniformity in the disc surface.

As in the past, subjective evaluations regarding the performance were made by a listening panel. The panel auditioned two systems for comparison purposes. The reference cartridge/tonearm/turntable system and the SME/Shure combination mounted upon the Pioneer PLC-590 turntable we have used in the past. The two systems were designated "A" and "B" during each selection played. Between the selections, the designations were changed randomly, and the panel was told that this would be done. No comments or discussions were allowed during the playing of each selection; comments about the relative qualities were made and discussed after each selection was finished. Some selections were evaluated using a rapid "A" vs. "B" comparison by synchronizing the two turntables and playing copies of the same record, with a 4- to 6-second delay. The order of the delayed turntable arrangement was also varied during the tests. In other tests, the same record was used on each turntable, and selections ranging from about 1 to 5 minutes in duration were auditioned.

After carefully mounting and adjusting a tonearm, we usually proceed to a brief listening test, without the listening panel present, before making initial measurements to determine the optimum resistance and capacitance loading and tracking force. During this preliminary listening test, the manufacturer's recommendations are followed to set the values of electrical loading and tracking force. The first order of business was then to check the force required by the SME/Shure combination to track the high-level bands of CBS STR-112 and B&K 2010 test records.

Figure 3A shows the left (upper trace) and right (lower trace) channel outputs to the 300-Hz tone on band 5 of CBS test record STR-112. For all photos in this report, as in past reports, the left channel is the upper trace unless otherwise noted. Band 5 is the highest level band of STR-112 and represents +18 dB referenced to a modulation level of 11.2 μ M. As can be seen, the SME/Shure combination tracks this band beautifully at 1.1 grams with no sign of distress, which is amazing. In tests of other tonearm/cartridge combinations, we have shown both band 4 (+15 dB) and band 5 (+18 dB) of the STR-112, with the band 5 output usually showing the results of mistracking. Not so with the SME/Shure combination. Instead, Fig. 3B shows the output of band 3 of the B&K 2010 test record, containing a 1-kHz tone cut at +8 dB relative to a 0-dB level of 7.07 cm/S at 45 degrees which is 17.76 cm/S. No jittering was observed while tracking these high-level bands, which is

The SME/Shure combination tracked band 5 of the STR-112 test record beautifully at 1.1 g with no sign of distress, which is amazing.

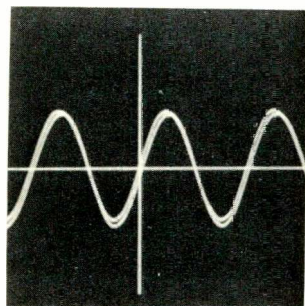


Fig. 15A — 3-kHz left and right channels. Note the slight time offset.

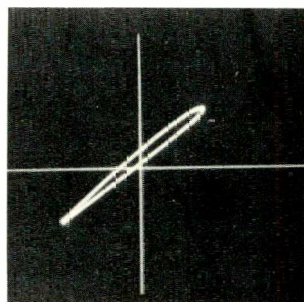


Fig. 15B—3-kHz left vs. right channels. The small amount of "bowing" indicates some nonlinear distortion.

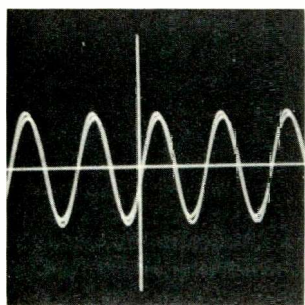


Fig. 16A — Same as Fig. 15A except 5 kHz.

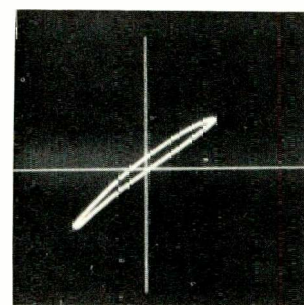


Fig. 16B — Same as Fig. 15B except 5 kHz.

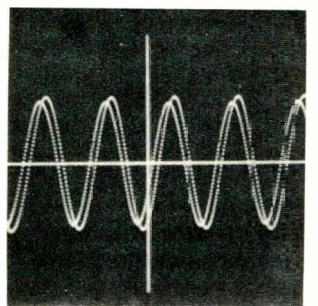


Fig. 17A — Same as Fig. 15A except 10 kHz.

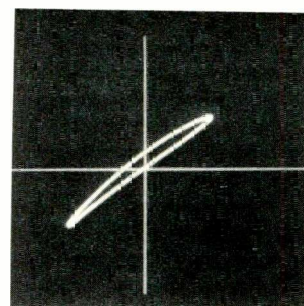


Fig. 17B — Same as Fig. 15B except 10 kHz.

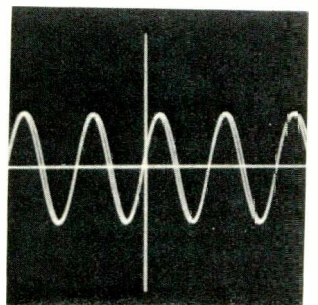


Fig. 18A — Same as Fig. 15A except 20 kHz.

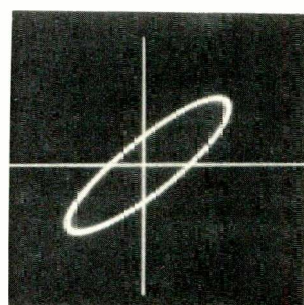


Fig. 18B — Same as Fig. 15B except 20 kHz.

quite remarkable when compared to other tonearm/cartridge combinations. We did find, however, that the sidethrust compensation force had to be set at 1.2 for a tracking force of 1.1 grams. At lower tracking forces, the sidethrust had to be set at a lower value than indicated for the tracking force employed. During the listening evaluations, panel members made no comments which could be attributed to mistracking. It would appear that the quest for "trackability" by Shure and the quest for low dynamic mass by SME have succeeded in this respect.

After finishing the series of measurements which detail the tracking capabilities of the SME/Shure combination, the rest of the measurements were made at 1.1 grams vertical tracking force and a setting of 1.2 for the lateral sidethrust compensation. The calibration for the sidethrust compensation is meant only as a guide to allow it to be set at a value predetermined by SME, which corresponds with the vertical tracking force chosen. The actual lateral sidethrust force is much less than the vertical tracking force. It was also determined that there was no high-frequency scanning error introduced when the tracking force was varied from 0.8 to 1.3 grams when using the B&K 2010 record, so the usual graph which would show scanning error due to changes in tracking force is not shown in this report.

A certain lack of brightness had been perceived during the preliminary listening test and it was thought that a change in the resistive (R) and capacitive (C) values of the electrical loading might bring an improvement in the sound of the upper register. As it turned out, the effects upon the output of the Shure V15 Type IV cartridge due to changes in the values of R and C were quite interesting. The results of three different combinations of R and C are shown in Figs. 4 through 9 and Fig. 11.

Figure 4A shows an almost perfect square wave, though the frequency response of Fig. 5, with the same loading, shows a relatively steep roll-off above 10 kHz. Figures 6 and 7 show the results with R = 47 kilohms and C = 250 pF, values found in many phono systems, while in Figs. 8 and 9, the R has been changed to 100 kilohms. This last R-C combination produced the best subjective reaction and was used during the listening panel evaluations. The interchannel crosstalk, also shown in Fig. 9, was adequate if not exceptional but did not correlate well with listening panel comments about a lack of perceived spaciousness when compared with the reference system.

Figure 10 shows the scanning loss of the SME/Shure combination when tracing band 1 (5.75-inch radius) and band 5 (3.75-inch radius) of the B&K 2009 test record. It should be pointed out that commercial discs are recorded with compensation for scanning loss by a diameter equalizer which attempts to correct for normal diameter-related scanning loss.

Over the years, various people have written, discussed and debated whether there exists a correlation between the perceived spaciousness of sound reproduction and the bandwidth of the total sound reproduction chain involved. Those who contend that wide bandwidth, extending beyond 20 kHz, improves the spatial quality would find it easy to correlate the listening panel comments about the lack of spaciousness in the sound of the SME/Shure combination with the data presented in Fig. 11. Even with the 100-kilohm loading, the response above 20 kHz is shown to fall steeply when the B&K 2010 record, which has response to 45 kHz, is used as a source. The roll-off is at a rate of about 30 dB/octave.

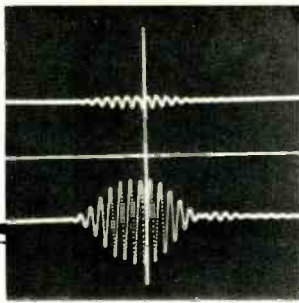


Fig. 19 — Response to 10.8-kHz tone burst from Shure TTR-103 test record, band 4, 30 cm/S peak at 45 degrees. The echo appears to be an artifact of the record.

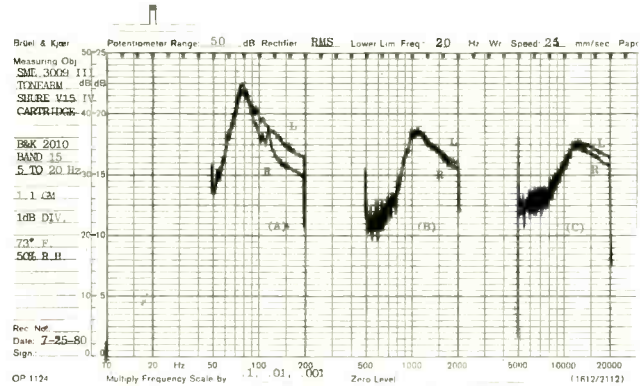


Fig. 20 — Low-frequency resonance. A, undamped resonance occurs at 7.8 Hz and has a Q of 6; in B, damped by the Shure V15 Type IV stabilizer, the resonance shifts to 11 Hz with a Q of 2.75, and in C, damped by both the Shure V15 Type IV stabilizer and the SME 3009 III small paddle damper, the resonance shifts to 12 Hz with a Q of 1.2.

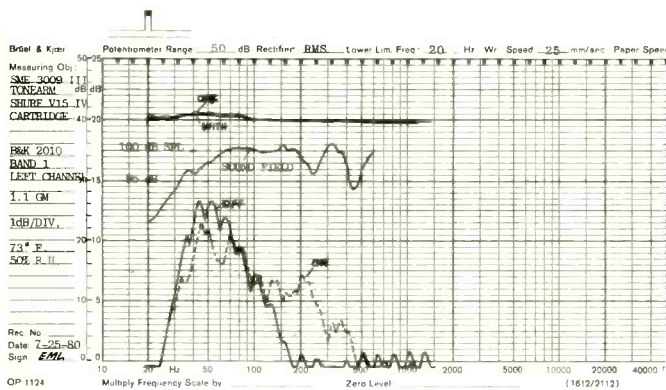


Fig. 21 — Effect of a sound field at the cartridge position. The curve of the sound field spectrum is shown for reference and was synchronized with frequency sweep from test record. SPL reference is for sound field only. Solid line is with sound field off; dashed line is with sound field on. Note the difference in crosstalk.

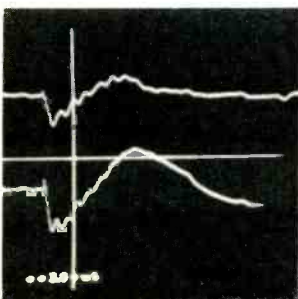


Fig. 22 — Polarity test, both channels. Output is negative going with modulation of groove toward center of record. Tonearm/cartridge resonance is 10.9 Hz. Note the second resonance, which is of lower amplitude and occurs at 256 Hz.

The rise-time information of Figs. 12A and 12B indicate that changing the R-C loading didn't greatly affect the results. The rise time of 25 μ S is respectable for a magnetic cartridge with an inductance of 500 mH. Later tests showed the Shure V15 Type IV to be capable of 15- μ S rise time into a high-impedance, low-capacitance load. Changes in capacitance had less effect than changes in resistance values of loading.

The inability to completely resolve some comments by the listening panel about the perceived dullness and lack of spaciousness, even with the 100-kilohm load, and some comments about apparent distortion which didn't seem to correlate well with the original distortion measurement data, caused us to rerun the tests for frequency response and distortion. Originally, the second and third harmonic distortion in each channel had appeared reasonably low. Figure 13 shows the distortion for the left channel when the lateral modulation of band 3 of the B&K 2009 record is used as the source. It looks about the same as the results of previously run tests using the 45-degree left- and right-channel bands, 1 and 2, of the same record. But then we used band 4 of this record which provided vertical modulation. Figure 14 shows an increase in the second harmonic distortion, especially in the middle register. Also of interest is the difference in high-frequency response due to the lateral (Fig. 13) and vertical (Fig. 14) components of modulation in the left channel. The lateral modulation produces more high-frequency output than the vertical output. This would tend to give the direct instrumental sounds, which are produced to a great extent by the lateral modulation component, a bright, forward character. It would also cause the stereo information, contained primarily in the vertical modulation component, to be reduced. The presence of a greater amount of second harmonic distortion in the vertical mode, which tends to cause a mellowness, plus the reduced high-frequency energy could very well be the technical answer to the subjective comments. When listening to small ensembles, playing non-complex material, or a large ensemble, playing complex music, there seemed to be little change in the perceived dullness and lack of spaciousness. The ability of the SME/Shure combination to produce a relatively good square wave from CBS STR-112, as shown in Fig. 8, indicates that the ability to reproduce either simple or complex program material should be about the same. This is born out by the results of the listening panel tests, and there were no adverse comments made about wandering or smearing of images.

Part of the perceived lack of brightness is also most probably due to a very positive aspect of the SME 3009 III tonearm. The stiffness of the arm tube, its "S" shape, and the internal damping of the arm tube tend to inhibit the higher frequency mechanical energy inevitably present in all tonearms due to mechanical coupling of energy from the record grooves. This high-frequency energy tends to reflect back to the stylus and be added to the desired signal as a slightly delayed signal which can add an artificial brightness to the perceived sound.

Figures 15 through 18 show the "stop action" digital storage displays for 3, 5, 10, and 20 kHz tones contained in the 20 Hz to 20 kHz sweep of the B&K 2009 record used to obtain the data shown in Fig. 13. The bending in the display of left vs. right channel signals shown in the B part of each figure is due to nonlinear distortion.

Figure 19 shows the response of the SME/Shure combina-

If a truly comprehensive competition were held to determine "the best pick-up arm in the world," the SME 3009 III would be a major contender.

tion to the 10.8-kHz tone burst of band 4 of Shure test record TTR-103. The modulation level is 30 cm/S peak for each of the left and right channels. There is some compression in the highest part of the positive excursion which would account for the second harmonic distortion, but this is an extremely high level of modulation. The echo in the display seems to be an artifact of the record itself.

Comments from the listening panel about the quality of the bass reproduction of the SME/Shure combination were generally favorable. The deep bass was perceived as being tighter and better defined than that from the reference system. The reference system had a slight edge in the upper bass such as is produced by guitar, for instance, but the SME/Shure combination was still considered quite good.

Figure 20 shows the results of the tests for the low-frequency resonance due to the effective mass of the tonearm/cartridge in combination with the compliance of the cartridge stylus assembly. The listening panel tests were conducted with both the SME damping system and the Shure dynamic stabilizer operative, as shown in Fig. 20C. The damping of the low-frequency resonance by this combination is excellent and certainly contributes greatly to the perceived tightness in the bass reproduction.

Figure 21 shows the results of measuring the amplitude vs. frequency response of the left channel with and without the presence of an airborne sound field at the cartridge position.

The main left-channel output is about the same with or without the presence of the sound field. The effect upon the crosstalk is a different matter and shows an interesting effect. Without the sound field, the crosstalk appears as it did previously. With the sound field present, the crosstalk output from the right channel is reduced below about 70 Hz, while above about 100 Hz it is greater, being up in level principally at 200 Hz. This might be a clue to the perceived tightness in the lower bass and a slightly forward sound in the upper bass from the guitar. The sound level at the turntable during the listening panel evaluations was considerably lower than that shown in Fig. 21. The actual frequency spectrum and level are also shown in Fig. 21 as a reference. The frequency of the sound field and the frequency of the test record were synchronized during the test.

As mentioned in previous reports, the absolute polarity of the acoustical signal presented to the listening panel is scrupulously maintained for both the reference system and the system under test. A polarity switch is used to determine the correct polarity for each recorded selection used during the evaluation. Figure 22 shows the results of a polarity test which we have devised to check the polarity of phono cartridges; the results of such tests will be included in future reports. To our knowledge, there are two proposed standards, but unfortunately they call for opposite results from phono cartridges. The first is by David S. Stodolsky who proposed standards for phono, tape, radio, etc. in his

AKG

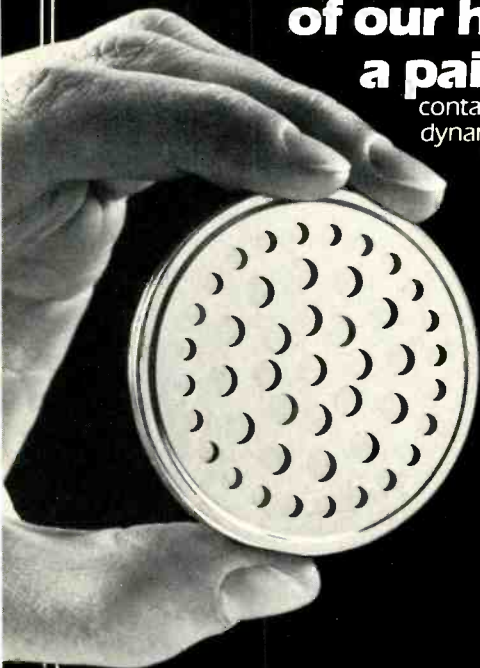
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paper, "The Standardization of Monaural Phases," which appeared in *I.E.E.E. Transactions on Audio and Electroacoustics*, Vol. AU-18, No. 3, pp. 288-299 (Sept. 1970). Using this standard, the Shure V15 Type IV would have a reverse polarity, since it gives a negative electrical output for a modulation of the left channel in the direction toward the center of the record or in the ultimate direction of the stylus as it plays a record. The second proposal is "Standards for Quadraphonic Disc Records" published by the R.I.A.A. as Bulletin E-7 (Sept. 12, 1973). This applies to discrete four-channel records made for a while by RCA. By this proposed standard, the Shure V15 Type IV would have the correct polarity since it would produce a negative output.

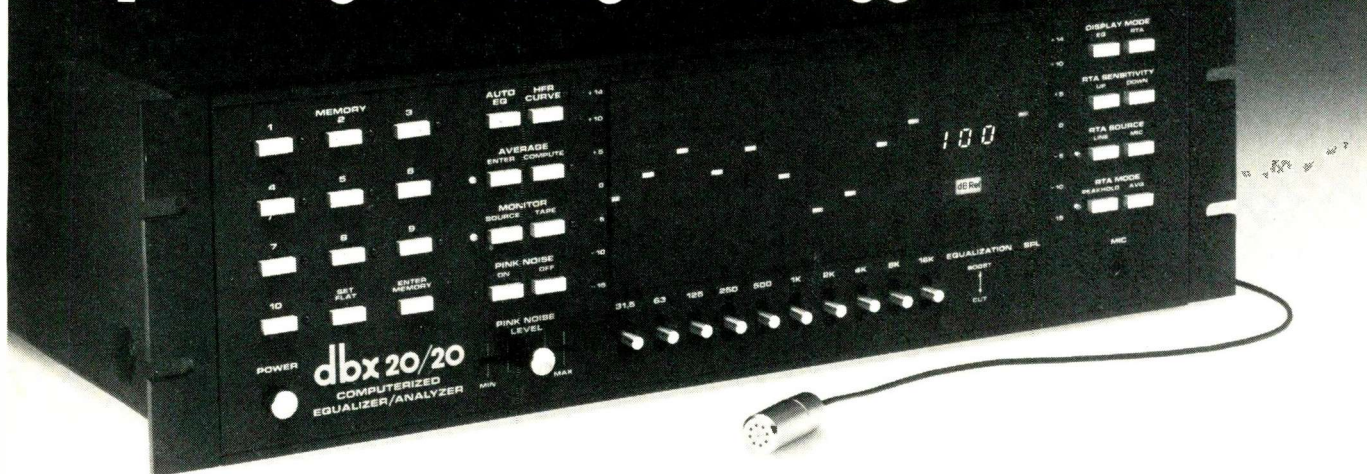
Another artifact which shows up in the polarity signal test is the ringing at about 250 Hz which can be seen easily on the oscilloscope. This correlates well with the slightly forward guitar quality and with the tiny glitch in the response seen at that frequency in Figs. 13 and 14. It may be due to a small standing wave phenomenon in the SME 3009 III tonearm.

The mounting and adjusting of the SME 3009 III tonearm is time consuming but not difficult. Many turntables are supplied with mounting boards which provide the elongated hole necessary to mount the tonearm; this cuts the time needed considerably. The manual supplied by SME is very detailed, with 61 clearly written steps and 63 photos and diagrams.

There are very many more good points than bad in the design of the 3009 III tonearm, but a few minor points should be mentioned. One is the relative lack of space in the headshell. The connector pins must be bent at right angles and carefully dressed to mount some cartridges. There is no mention of how the armlift is adjusted. This can be done by moving the curved lift itself to whatever height is necessary. Although there is a set screw in the main collar of the lift assembly, it cannot be moved up or down, although you might be misled into thinking that it can. No mention is made of the fact that the little plastic arm-locking device can be used as a means of allowing the tonearm to drop gently to the lead-in groove of a record if the tonearm is positioned correctly. Lastly, it seems a shame that with all the refinements and adjustments on the 3009 III tonearm, there is no sophisticated method of adjusting the vertical tracking angle as there is for adjusting the lateral tracking angle. The lateral tracking angle error adjustment need only be set once for a given cartridge, but the optimum vertical angle can vary from record to record. Of course, no other tonearm, to our knowledge, provides this feature so this is a quibbling matter when considering the overall quality of the SME 3009 III tonearm. It must be said that if a truly comprehensive and fair competition were held to determine "the best pick-up arm in the world," the SME 3009 III would be a major contender. *Edward M. Long*

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bizarre synthesizers tend to dominate the record. *Healing* is Todd at his most esoteric. He preaches, he incants, and his vocals tend toward the ponderous; certainly he isn't looking to embrace any of his harshest critics. It's a very demanding record when listened to as a foreground piece, and as with many of Todd's most recent works it seems like it was created more for his own catharsis than to meet any demand or critical standards. Personally, we find it much more enjoyable to treat it (dare we say it) as background Muzak than to sit and listen to Todd intone these very personal lyrics.

Jon & Sally Tiven

Laughter: Ian Dury & The Blockheads
Stiff/Epic JE 36998, stereo, \$8.98.

Sound: B- Performance: B

Ian Dury's humorous approach hasn't exactly taken America by storm, although the rest of the world seems to hang on every word he throws up, and by the sound of *Laughter*, his status in the U.S.A. will be changing none too soon. His enunciation demands a translator for non-British speaking citizens and seems designed for strictly his cults in this country. However, with the addition of Wilko Johnson on guitar (formerly with Dr. Feelgood), The Blockheads are somewhat more hard-hitting in their approach and should be able to consolidate their stronghold with American New Wave fanatics. A case could be made



Contractual Obligation Album: Monty Python

Arista AL 9536, stereo, \$8.98.

Sound: A- Performance: A-

Yes, crass as it seems, the only reason for this new Monty Python album is to complete their recording contract. What is even crazier is that it's their funniest record in years. I suspect the reason for this peculiarity is that it is also the first Monty Python album in five years that is not a film soundtrack or a live recording of a stage show. In other words, it is a record actually conceived and created as an album.

Rest assured that the Monty troupe has lost none of the keen, abrasive and tasteless edge that has been the hallmark of their comedic endeavors. With song titles like "I Like Chinese," "I Bet They Won't Play This Song on the Radio" and "Sit on My Face" (which incidentally is a rousing march), it is clear that their silliness is intact. Bits include an Anglican bishop voicing a beer commercial and another about designing a deceptive ad campaign for string. And there's one about a man being eaten in a crocodile competition. Plus a love song to Finland.

Poor chaps. Clearly there can be no hope for them. So it's just as well that now they are not legally bound to anybody for anything. It has got to be hard on the innards to be this funny on purpose.

M.T.

The Best of Pearls Before Swine:

Pearls Before Swine

Adelphi AD 4119, stereo, \$7.98.

Sound: B+ Presentation: A

Combining the two long out-of-print albums the legendary Pearls Before Swine recorded for the even more legendary ESP label in the late '60s, this reissue is a delight. If you remember the albums as fondly as I do, I need say no more than they are out, freshly mastered, and have never sounded better.

If you don't know the work of Tom Rapp and Pearls Before Swine, it is muse music on the order of Leonard Cohen and predates Joni Mitchell completely. This group was one of the important bands at the start of what we then seriously called Progressive Rock. The album might be dated in spots, but its charm is timeless and its tranquility is needed more than ever. The cover reproductions are marvelous, too. Fine essay also included.

M.T.

Healing: Todd Rundgren

Bearsville BHS 3522, stereo, \$8.98.

Sound: B+ Performance: B-

Todd's latest solo album recalls *Initiation* more than any of his recent works — it sounds more like Barry Manilow on acid or a Bar Mitzvah section than a rock artist. There's very little guitar and the

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for *Laughter* being Dury's best album, but we'd be more inclined to say that his best album is still a few records away.

Jon & Sally Tiven

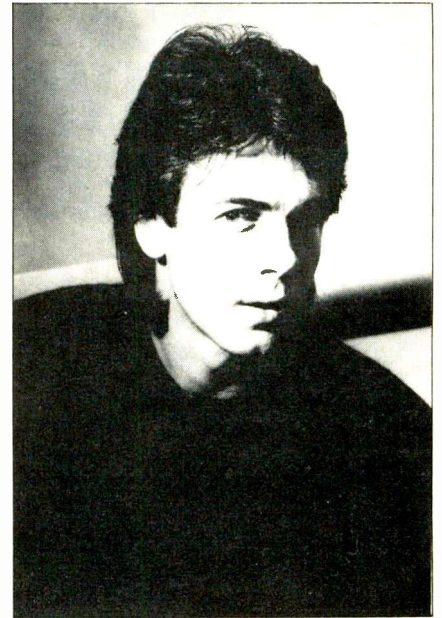
Working Class Dog: Rick Springfield
RCA AFL1-3697, stereo, \$8.98.

Sound: A- Performance: A-

This is the story of a poor Australian rock star who sold his soul to an American manager to get out from Down Under. This manager took him from his native land, plonked him down in California and turned him into a Saturday morning TV teen idol, where his only duty was to

look cute and woo the hearts of the under-12 set. His albums during this time period were crass pop, sort of a David Cassidy-does-Elton John, and although he placed prominently on the singles charts he never had a music career. Springfield finally got out of his manager's clutches circa 1975 and released an album a year later that more fully demonstrated his talents, but the crassness hadn't completely worn off. *Working Class Dog* is still a bit slick for some tastes, but when you come right down to it the record's a kicking rock 'n' roll album, full of good songs that has more than a mild chance of success.

There are a few things on this record



that might put you off — the back cover shows off Rick's good looks a little too much, and he's got the Springsteen T-shirt and shadows pose. There's no question that he's overproduced himself in the background vocal department, reflecting a little too much of Queen. But the songs are killers, from the Jackson Browne-ish "Hole in My Heart" (which could be a hit single) to the Bob Segeresque "I've Done Everything for You." Rick's boss guitar licks and gruff voice could have been played up a little more, but these are minor complaints; this is, for all intents and purposes, a *debut* album by one of the most promising rock artists to come along in awhile.

Jon & Sally Tiven

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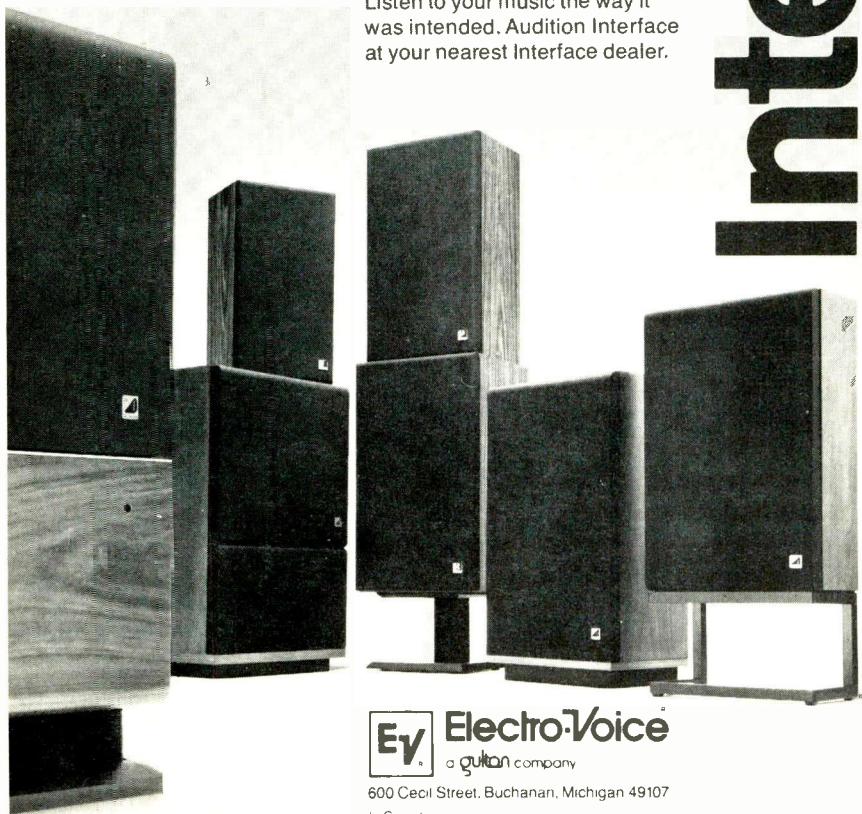
The "power war" is over. High-powered receivers and amplifiers are going the way of the "gas guzzler" in this era of energy consciousness and inflation. Yet technological advancements in source material, such as direct-to-disc and digitally-mastered records, demand far more from your loudspeaker system than ever before.

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I'm Not Strange, I'm Just Like You:

Keith Sykes

Backstreet MCA 3265, stereo, \$7.98.

Sound: B Performance: B

Keith Sykes is no newcomer despite the fact that you've probably never heard of him. At the other end of the '70s he had a pair of good Vanguard albums that went nowhere. Since then a lot of good musicians have been recording his songs.

On *I'm Not Strange* Sykes returns as a rocker, a fitting labelmate for Tom Petty. He's got a tight, hungry little band whose licks are sharp, and so are a lot of his tunes. The bell that kicks off the lead track "B.I.G.T.I.M.E." grabs your ear, and the music holds it tight. Then there's some lovely and smart bayou guitar licks in "Love to Ride." Keith and the boys proceed to a dandy version of "Smack Dab in the Middle," real sly and greasy. "Ain't That Some Lovin'" showcases his flair with a slow number. "928" is one of the best love songs to a car in

years. And all that is just the first side. The second side is not anywhere nearly so compelling; the really punchy and rocking stuff is bunched on the first.

Getting Greg Ladanyi to mix the album was another smart move. His style on the last few Jackson Browne and Warren Zevon records especially shows up in the way he handles male vocals.

This album serves notice for Keith Sykes. He's got songs plus smarts, nerve, and guts to go with them. M.T.

Going Deaf for a Living: Fischer-Z
Liberty UAG 30295, stereo, \$7.98.

Sound: A Performance: A-

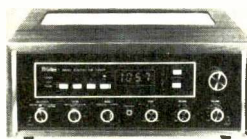
Fischer-Z (pronounced "Zed") is a relatively new group that shows phenomenal promise in a style which they're still refining. Like many recent U.K. exports, this is rock with a twist of reggae, but on about half the album the reggae influence is almost subliminal, making the approach of Fischer-Z wholly unique and all the more interesting. Lead singer/guitarist/songwriter John Watts seems to have followed not only his Jamaican roots but Mr. Johnny Rotten Lydon as well — many of the tracks carry a Sex Pistols-like thrust, and the lyrics are laden with anger. Yet Watts' voice is totally unlike his influences, resembling what The Who's Roger Daltrey might sound like if he had a little more soul.

It's always a thrill to hear a band with a tremendous amount of talent going through their growth stages, and although some people might be put off by the lack of consistency, there are three cuts on this, their second album, that are undeniable in their attraction: "So Long," "Limbo," and the title track "Going Deaf for a Living." They may not have arrived with the first two tides of the New Wave, but Fischer-Z (wish they'd change that name) are true musical pioneers with a load of promise. We only hope that the record company will stand by them for as long as it takes this band to attract the audience they deserve. We also hope that the band has the courage to stand its ground and keep exploring uncharted territory. Jon & Sally Tiven



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The In Sync Cassettes: An Explanatory Preface

All commercially available tape products (cassettes, 8-track cartridges and open-reel tape) marketed by record companies are usually produced using what is termed the high-speed duplication process. In this process, a "mother" tape is made in the exact format of the final tape product (i.e., two tracks, four tracks or eight tracks are recorded onto the mother tape exactly as they will appear on the product). For example, the mother tape for a cassette will contain two tracks recorded in one direction and two tracks recorded in the opposite direction of tape travel. Mothers are usually recorded at 7½ ips on ½-inch tape. While duplicating, all the channels recorded on the mother, both forward and reverse, are transferred onto the final tape during a single pass of the mother tape. The term "high speed" refers to the fact that copying from the mother tape generally occurs at a speed up to 64 or more times the normal playing speed of the tape (e.g. 480 ips for a 7½ ips mother and 120 ips for the cassette tape). The deleterious effects of high-speed duplication on a prerecorded tape are not only audible but rather well known. This plus the fact that the final tape product sold in stores is usually sixth generation conspire to make prerecorded cassettes inferior sonically to their disc counterparts.

In Sync Laboratories pioneered the use of the one-to-one method of commercial cassette duplication. In this procedure, a very careful Dolby A copy at 15 ips is made from the *original* tape. This mother tape is run in "real time," that is, at the normal playback speed of 15 ips, through the Dolby A noise-reduction system to feed a bank of Nakamichi cassette recorders operating at normal 1⅞ ips speed. However, the quality of In Sync cassettes is only in part due to this procedure. The complete system frequency response and distortion are checked every morning. The cassette recorders are cleaned after every run and then checked for magnetization of the heads. The azimuth, bias, and frequency response of each cassette machine are verified and adjusted before each run using the actual cassette to be used in that run. During recording, each cassette is A-B tested against the mother on

a regular basis to insure that an identical copy is being made. Any cassettes skewing or showing any anomalies, defects, etc. are immediately discarded. (In Sync claims a 10 percent reject rate during the recording process alone.) The switching system is manned by an experienced auditor, and the A-B testing is continued throughout the entire run. After side one is completed, the cassettes are flipped and the second side is recorded in the same manner. At the point of packaging, each cassette is again auditioned at critical points.

In Sync cassettes, loaded on the premises with Dupont chromium dioxide tape, contain the exact length of tape necessary for the specific recording. The cassette shell is also assembled at In Sync after thorough inspection of individual parts for all important parameters so that the cassette shell will not compromise the recording in any way.

The point of this preface is to try to explain that in order to make any quality recorded product — be it disc or tape — unflinching and uncompromising attention to every step and detail of the process is necessary, along with a total commitment to a quality production with no excuses or license for error, sloppiness or an inferior original source.

The following equipment will be used in my reviews for this column: Phono cartridges, Denon 103C with Verion transformer, Adcom XC-LT and XC-VDH; cassette decks, Pioneer CTF-1250 and Hitachi C5500M; preamplifiers, DB Systems, Infinity FET, Adcom GFP-1, Hegeman HAPI-2; amplifiers, Lux M-6000, Adcom GFA-1a, Hitachi HA-7700, Phase Linear D-500 II; loudspeakers, Infinity 4.5, Acoustic Research AR-93, Advent 4002, and Braun SM-1003.

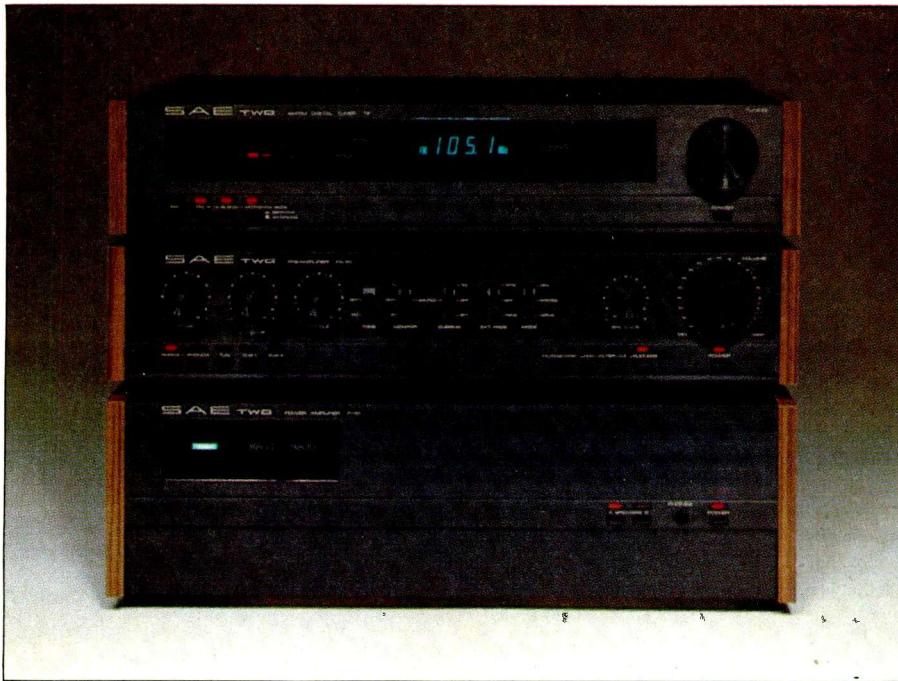
C. Victor Campos

Szymanowski: Notturmo e tarantella, Dance from "Harnasie," Romance, Berceuse, Sonata Op. 9. Wanda Wilkomirska, violin; Tadeusz Chmielewski, piano. Producer, E. Alan Silver; engineering, Marc J. Aubort.

In Sync Labs C-4059 (2211 Broadway, New York, N.Y. 10024), cassette, \$14.98.

Recording: A+ Performance: B+
Processing: A+

No one having a stereophonic system with any pretension of high playback



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The PA10 is a careful mating of SAE's most sophisticated tape and external processor control systems with our latest advances in phono circuit technology. The PA10 means superior sonics with control flexibility.

Phono Power Amplifier. The PA10's phono circuit is literally a complete power amplifier. Our studies have shown that the phono stage must face a highly reactive load (just like the loudspeaker) in its own RIAA network, *and* drive the output at the same time. Because of the power reserve of its phono power amplifier, the PA10 can easily drive this complex load without strain or distortion. The result is unmatched musical clarity and definition.

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Moving Coil Preamp. The PA10 also offers a superior moving coil pre-preamp, utilizing SAE's fully complementary circuitry with special low noise transistors.

THE P10 POWER AMPLIFIER

The P10 power amplifier is the end product of SAE's extensive research into the real world of driving loudspeakers. For you, the P10 means greater dynamic realism and more sonic clarity than ever before.

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Although rated at 100 watts per channel*, the P10 is capable of providing much more instantaneous power when complex musical signals or difficult speaker loads require it. With twice the number of output transistors of a conventional amplifier, the P10 can effortlessly drive loads as low as 2 ohms.

Natural Damping. Unlike "synthetic" damping produced by negative feedback which most power amplifiers rely upon, natural damping is neither frequency nor load dependent, and gives the P10 the ability to apply the needed electronic "brake" to the speaker cone motion regardless of the music's complexity.

External Amplifier Protection.

Conventional amplifiers have current limiters, which can cause uneven clipping and loss of critical transient peaks. These are not used in the P10. Instead, a relay circuit outside of the amplification stage reads both voltage and current levels and, upon sensing an extremely high current of a long duration, simply disconnects the speaker. This external amplifier protection is feasible because of the large number of output devices in the P10. As a result, transient peaks are fully reproduced.

THE T6 AM/FM TUNER

The T6 Tuner completes the system. Its sophisticated four-gang front end provides greater selectivity and less cross-modulation distortion than other tuners in its class. Special IF filters are designed for phase linearity to ensure that left and right channels are fully and accurately reproduced.

The excellent selectivity of the T6 allows the use of a wide-band ratio detector for converting the FM information to an audio signal. All of this, coupled with the SAE-pioneered digital read-out, results in a tuner which provides a truly notable sonic performance.

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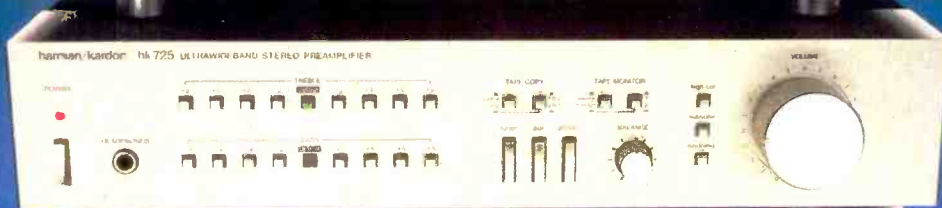
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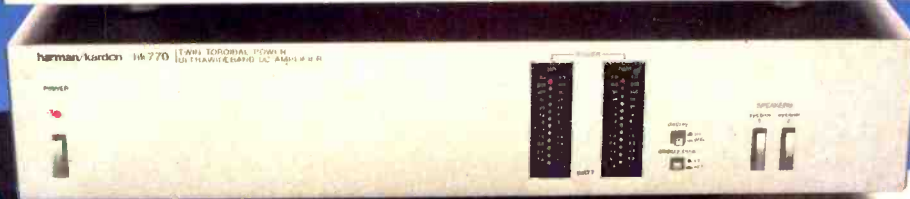
Our first low negative feedback components were designed for the audiophile.



The hk715 High Technology quartz locked digital tuner.



The hk725 High Technology preamplifier.



The hk770 High Technology 65 watt per channel power amplifier.



The hk710 High Technology phase locked analog tuner.



The new hk750 High Technology 45 watt per channel integrated amplifier.

Last January, we introduced our 700 series High Technology Separates. The first moderately priced separates designed with low negative feedback.

Negative feedback?

It's a form of electronic compensation used in virtually every preamplifier, amplifier and receiver. Used judiciously, negative feedback can improve frequency response and THD

distortion characteristics. Unfortunately, most manufacturers try to reduce THD to lower and lower levels by adding more and more negative feedback – typically 60-80 dB. This excess negative feedback results in a new form of distortion called Transient Intermodulation Distortion (TIM), which does far more to degrade music than THD. In fact, according to a listening survey, TIM in music is detectable at

levels just 1/10 the detectable levels of THD.

By keeping negative feedback to 30 dB or less in all Harman Kardon electronics, we've eliminated the harsh, metallic, grating effects of TIM produced by conventional equipment with high negative feedback. You'll hear startlingly clean, clear, open sound.

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*20-20,000 Hz into 8 ohms @ 0.09% (or less) THD.

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In Canada, E.S. Gould Marketing, Montreal.

This recording is simply incredible, with no equal in the current violin-piano repertoire.

quality should be without this recording. The violin pyrotechnics here are without equal, or at least there are none available with this level of reproduction quality. The violin has been recorded with a natural sonority in conjunction with realistic piano presentation, and the combination is a challenge to the performance quality of the very best loudspeaker systems.

In short, it is simply an incredible recording with no equal in the current violin-piano repertoire.

The recording sessions took place during March 1979 in a small church on West 73rd Street in New York. The microphones used were Schoeps, while the tape recorder was a wide-track and highly modified vacuum-tube device with

Dolby A, a combination which, along with Marc Aubert, has made many classic and stupendous recordings in the past. A quick listen to the "Notturmo e tarantella" will vindicate easily the choice of equipment and prove the completely natural properties of this production.

Karol Szymanowski was a contemporary (he died in 1937) of the great pianist Artur Schnabel, who has often commented on the almost sinful way Szymanowski's music has been ignored. Here in this recording are two compatriots of Szymanowski who do more than justice to this exciting, liting and fun music.

Wilkomirska, a widely performing and well-known artist in Eastern Europe, is an accomplished and brilliant musician who, perhaps because of her background and homeland, has the perfect temperament for this music. She performs these selections impeccably and with great excitement. This cassette would have earned an A+ for performance were it not for the fact that her piano accompanist, Chmielewski, is just not in her league. But her excitement seems to suffuse his playing as well, because here the violin and piano don't sound like just two instruments — in some excitingly rapid sections the subjective effect is almost as if one were listening to a small chamber ensemble. Great, fun music not only for listening but for demonstrating how good your rig is to your friends and neighbors.

C. Victor Campos

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Stravinsky-Raphling: The Rite of Spring. Dickran Atamian, solo piano.
RCA digital ARC1 3636, stereo,
\$11.98.

Sound: A Recording: A- Surfaces: A-

I had been hearing about this one — "Hey, have you tried that Armenian pianist, playing the 'Sacre du printemps' on ONE piano?" I hadn't but, curiously, it reached me only a day after I had heard "Le Sacre" (to use the French title) in Telarc's New York demo of their digital recording of the orchestral original. That demo was held in RCA's monster art deco Studio A, which is where this piano version was recorded.

One look at the label and I dived into my record card catalogue for a more important comparison — yes, there it was: Stravinsky's own transcription for four piano hands, as played on Angel by a

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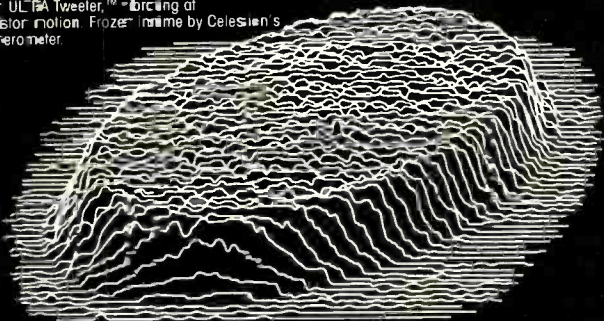
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younger Michael Tilson Thomas and Ralph Grierson on two pianos (Angel 36024), released back in 1969.

As you understand, one piano has the same potential volume range on disc as two pianos, the same range, in fact, as with full orchestra. On records, music loses its "absolute" volume completely; recorded volume and balance are matters of production. "Rite of Spring" on a single piano can have all the sonic impact, in dB terms, as the same music by the enormous orchestra of the 1913 original, the differences being in sound color and texture. So, too, with the difference between 10 fingers on one piano and 20 on two.

Almost a dozen years fall between these two performances, marking great engineering advances including digital recording, but also a revolution in piano playing styles. The two-piano version with Thomas and Grierson still reflects the late neoclassic manner, Stravinsky's own, if with hard-as-nails precision and a pounding, dry, trip-hammer rhythm. I remember finding this recording an astonishing feat for two youngsters (Thomas was 24), but chilly — more so, in all truth, than Stravinsky warrants. But with Thomas-Grierson, the steady "beat" that is a Stravinsky hallmark is never questioned, and the two-piano music exhibits a reasonably accurate reflection of the orchestral version.

Atamian, on the other hand (he is from Chicago and Texas), is one of the new ones, the neo-Romantics. He plays "The Rite of Spring," notably in the softer passages, like so much Chopin, with *rubato*, uneven, hesitatingly expressive rhythm. There is indeed very little of the Stravinsky "beat" anywhere, and the changing tempos seem to be strictly of the pianist's choosing with little relation to the conventions of the usual orchestral playing. In spite of fantastic finger power and technique, this man turns out a basically "Romantic" interpretation. Who'd have believed it! I enjoyed the whole thing, if I couldn't recognize a lot of it, perhaps because this is such an original and startling new approach. After all, we don't have to dance to this version.

There is no question that the digital technique has big benefits for the difficult art of piano recording. This one has a huge sound, yet mellow and clear, never a sense of strain (unless it's your equipment). Angel's two-piano job, circa 1968, is excellent if somewhat dry, but RCA's digital comes through maybe twice as loud and as big in the hearing. A heavier cut, reflecting other improvements in technology as well as the digital master, and the surfaces are much better than Angel's older ones. No ticks.

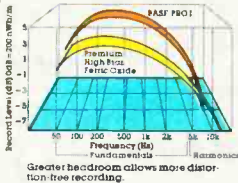
E.T.C.

The Tape Guide

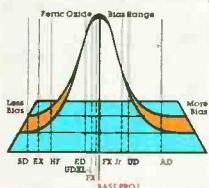
Professional-I.
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Premium ferric oxide tapes have more headroom which allows higher maximum recording levels (MRL). Among all premium ferric oxides PRO I has the best MRL for loud recordings. Uniform maghemite particles provide increased headroom for very accurate and loud recordings with virtually no distortion. In the fundamental music range (20Hz-5kHz) PRO I can be



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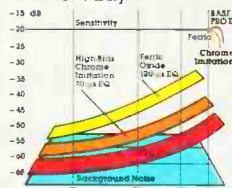


High bias tapes consistently provide wider frequency response and less tape noise (hiss or background noise) than any other tape type. Among premium high bias tapes PRO II is in a class by itself. It is the second generation chromium dioxide tape with superb frequency response and outstanding sensitivity in the critical (10kHz-20kHz) high frequency range. It also has the lowest background noise of any other competitive tape available today.



The pure chromium dioxide particles in the PRO II, unlike ferric oxide particles, are homogeneously shaped and universally sized to give this tape superior performance.

PRO II will capture the many subtle harmonics of the most demanding recordings and play them back with the reality and presence of a live performance. PRO II is the tape for the Type II/chrome/high bias position that comes closest to Metal tape performance for half the price.

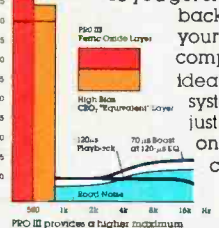
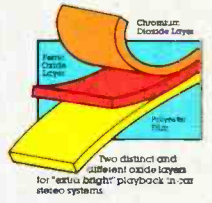


PRO II has the best high frequency sensitivity and the least background noise of any high bias tape.

Professional-III.
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Ferrichrome tapes combine the benefits of chromium dioxide and ferric oxide tapes for superior performance in car stereos. The top layer is pure chromium dioxide for unsurpassed highs and low background noise. The bottom layer is ferric oxide for superior lows and great middle frequencies. And it also gives you higher recording levels, so you get clearer, louder playback without cranking up your volume control to compensate. PRO III is the ideal tape for car stereo systems and performs just as well in the home on the Type III/ferrichrome position.



PRO III provides a higher maximum recording level (MRL) than high bias tapes, and effectively blocks the highs to overcome road and car noise.

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DEADLINE- 1st of month two months preceding the cover date. If the first of the month falls on a week-end or holiday, the closing date is then the last business day before the holiday or weekend. **ADS RECEIVED AFTER THE CLOSING DATE WILL BE HELD FOR NEXT ISSUE UNLESS OTHERWISE STATED.**

BLIND ADS- Box numbers may be used at \$5.00 extra for handling and postage.

GENERAL INFORMATION Ad copy must be type-written or printed legibly and received on or before the 1st of the month, two months preceding the cover date. Display advertisers must make a space reservation on or before the closing date, material (Camera Ready Only) may follow by the 10th. The Publisher, in his sole discretion, reserves the right to reject any ad copy he deems inappropriate. All advertisers must supply: Complete name, Company name, Street address (P.O. Box is insufficient), and telephone number before ads can be published. Classified ads are not acknowledged and do not carry Reader Service Card Numbers. Frequency contracts not fulfilled will be short-rated accordingly. Ads submitted for a 3 time frequency or less are unchangeable. Classified ads are payable in advance (Sorry, we can not accept credit cards.). Additional information available upon request. Contact: Catherine Paduano, Advertising Coordinator, 1515 Broadway, NYC 10036 . . . Direct Dial (212) 975-7530.

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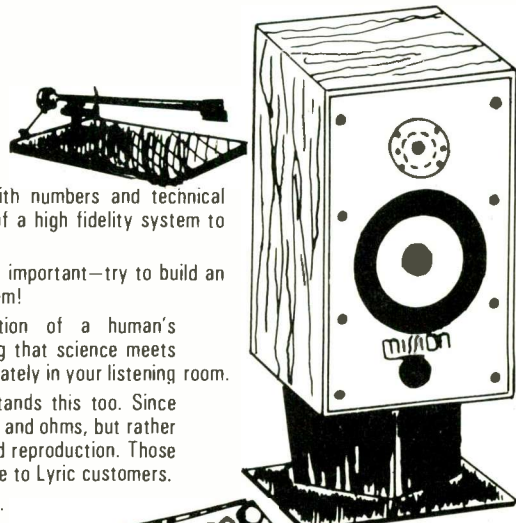
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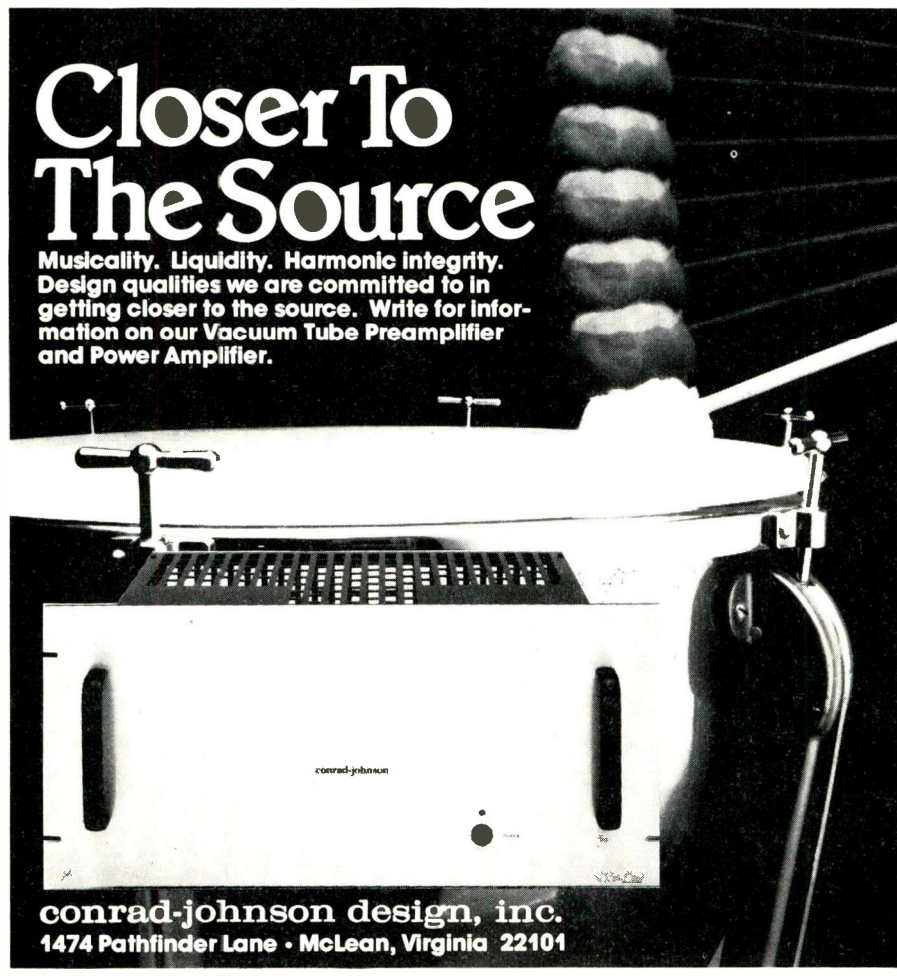
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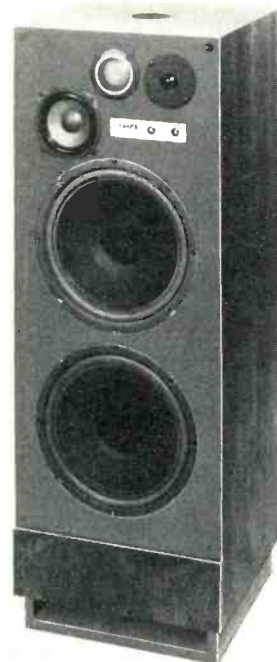
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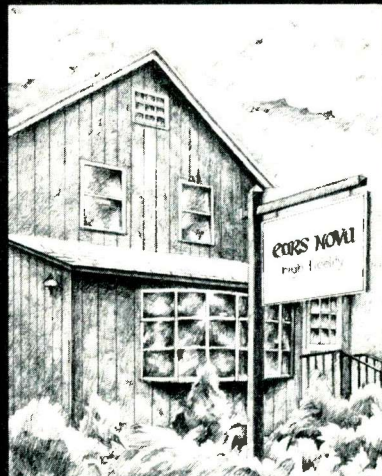
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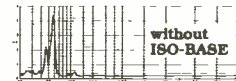
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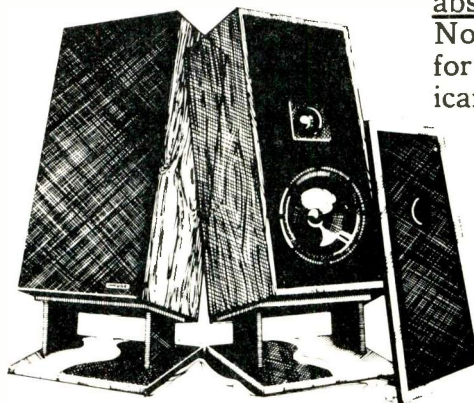
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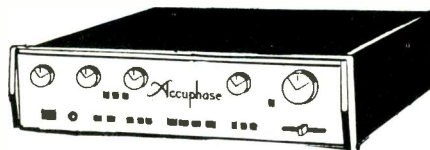
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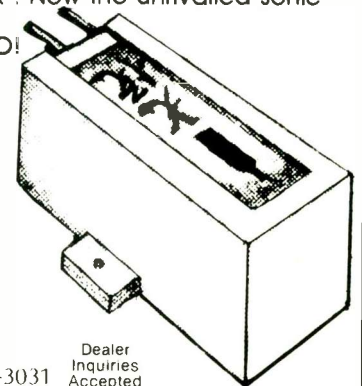
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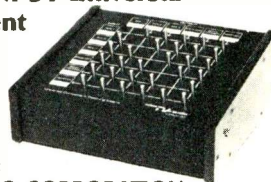
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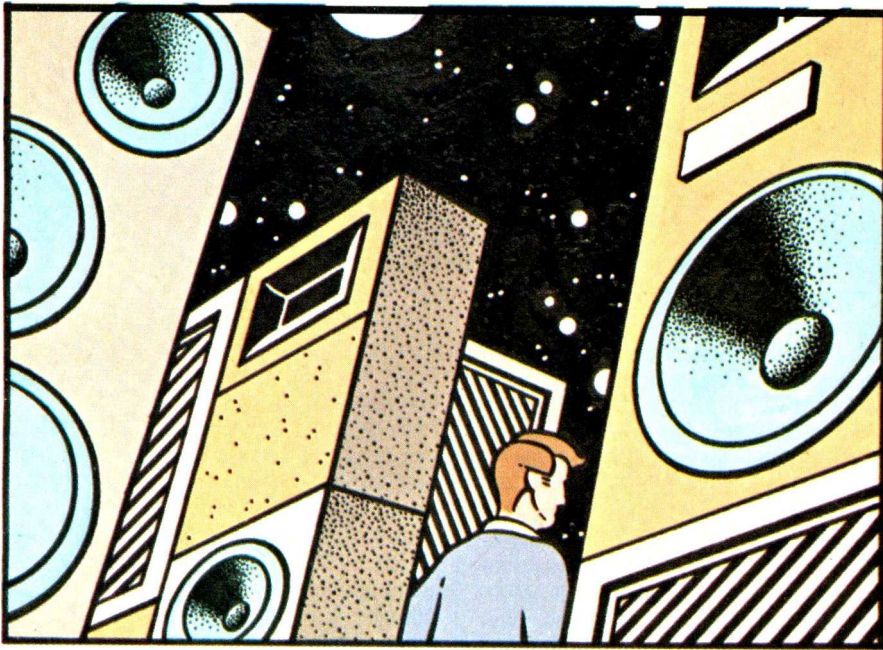
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There is never a dearth of new loudspeaker designs at any Consumer Electronics Show. But while many loudspeakers are demonstrated, few are worth listening to for more than a minute or two. To me, it is rather incredible to walk into audio demo rooms at the Convention Center and into room after room at the Jockey Club and be subjected to so much really poor sound. In many cases, there are basic design flaws in the loudspeakers that are the root of the trouble. Other loudspeakers have some merits, yet the demonstrations are so badly handled it is impossible to reach any conclusion. When the speakers and the demonstrations are both poor, you get a sort of "sonic symbiosis" that produces a cacophonous assault on one's hearing. Boomy bass, peaky midrange, screeching high frequencies, poor or nonexistent imaging, no perception of depth, and out-of-phase conditions are commonly encountered in these demonstrations. The majority of the personnel conducting these demonstrations have no musical sensibility and obviously have no experience with live music in the concert hall. How else to explain their poor choice of recordings and general disregard of musical values? It is apparent that far too many companies have forgotten the basic purpose of hi-fi components, to af-

ford a psychoacoustic approximation of a live musical event. High fidelity components are not an end unto themselves, but a medium for the enjoyment of music.

After having encountered so much terrible sound, it was such a pleasure to walk into the Shahinian Acoustics room and refresh my ears with some really superb music. Dick Shahinian really loves great music, and his knowledge of high-quality classical recordings is encyclopedic. He manages to obtain many original EMI recordings and many other hard-to-get foreign pressings. He chooses the best of these for his demonstrations of his excellent Obelisk speakers, which themselves are models of fine musical balance, accurate imaging, good depth, and wide dynamic range.

Dick's Obelisk speaker has been brought to a high state of refinement with such things as a new polypropylene cone woofer, a 1 3/4-inch cambric dome midrange and two 3/4-inch polyamide dome super-tweeter units, and a complex new crossover network. This middle-sized (27 inches high by 14 inches wide by 12 inches deep) speaker has claimed frequency response of 32 Hz to 21 kHz, plus 2 dB, minus 3dB. Although the bass response is remarkably good for such a small speaker, Dick had crossed over the unit at 80 Hz and com-

bined it with his latest product, the Contra-Bombarde subwoofer.

The Contra-Bombarde design is more than 20 years old and is the brainchild of none other than Stewart Hegeman. Yes, the same Stu Hegeman who designed the Citation power amplifiers and other forward-looking audio products. This subwoofer is a twin conical slot-loaded stereo horn, with a horn path length of more than 20 feet from throat to mouth. It was originally the bass portion of the Hegeman Pro loudspeaker, which among other things was noted for its unique upward-firing tweeter which looked like a paper tulip cup! The horn construction is incredibly complex and must be very accurately built if it is to function properly. Ultra high density Finnish birch is used for making the horn and is an aid in resonance suppression. Twin 8-in. drivers with quite stiff, but not massive, cones are used, with 2-in., high-temperature voice-coils and extra-heavy magnets. In other words, the Contra-Bombarde is Stu Hegeman's classic horn subwoofer, brought up to date with modern materials and drivers. Response extends to 16 Hz and power handling is 150 watts/channel, with short peak ability to 750 watts/channel. Dick Shahinian was using various recordings with extended bass response, including my own Virgil Fox organ recordings, to really shake the rafters with a very clean bass of tremendous power and impact. At \$1,250, the Contra-Bombarde isn't cheap, but one should remember this is a stereo subwoofer. Availability is slated for May 1981.

Many people favor the transparency and transient attack of electrostatic loudspeakers. The Acoustat full-range electrostatic speaker with built-in, direct-drive tube amplifier has enjoyed good sales for some years now, but a new embodiment of the design may generate even greater sales. The Acoustat Model Two uses the same full-range electrostatic driver elements as the earlier Acoustat speakers. The big difference is that it does not have the built-in, direct-drive tube amplifier, but instead uses what Acoustat calls the MK-121 Magneto-Kinetic Drive System. Essentially, this is an impedance-matching transformer as used in other electrostatic loudspeakers but with some significant differences. Most objections to transformers in the past had to do with their generation of

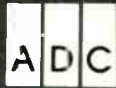
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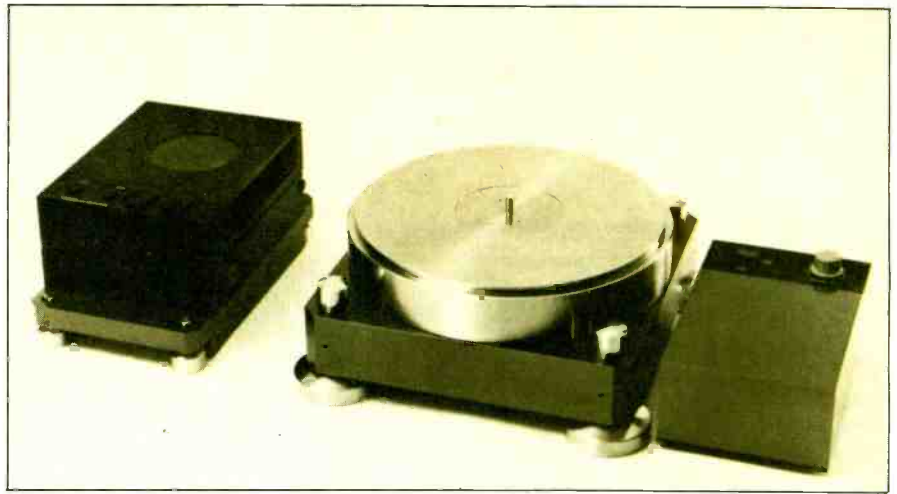
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spurious resonance or "ringing" and difficult impedance and voltage matching. The MK-121 uses two physically and electrically different "push-pull" transformers with some passive components, and the design allows the circuit to operate in a quasi-parallel band-overlap manner. In other words, there is a low-frequency transformer which operates from the low end of the spectrum and a high-frequency transformer optimized to operate from the top of the spectrum downwards. The transformers overlap at a median frequency of about 1,500 Hz. The result is much higher efficiency than possible with any single transformer, far less distortion, and an impedance which never drops below 3 ohms. Most importantly, the MK-121 permits the use of standard solid-state and tube amplifiers.

Most audiophiles generally shy away from equipment with built-in amplifiers, preferring to use their own favorite amplifier. The Model Two Acoustat is said to reach SPL of 108 dB with amplifiers of 50 to 100 watts per channel, so this should appeal to many who have always wanted to try electrostatic loudspeakers. I believe the Model Two in the Acoustat room was being driven by a Bedini 100 W/channel Class A amplifier. Listening to a Philips recording of some Rossini Overtures, I was impressed by the ultra smoothness of the first violins, the clarity of the woodwinds, and the sharp attack of the percussion, along with fine imaging and an exceptional perception of depth.

After weary hours of speaker auditioning at the Jockey Club, with one's ears protesting against further abuse, blessed respite can always be found at the B&W suite. Here is an oasis of good taste and good music, where genial John Bowers presents his new products in his inimitable low-key fashion with no hype, no fanfare, no outrageous claims. Superb

classical music and carefully selected pop music played through the various B&W loudspeakers are his eloquent spokesmen.

B&W's range of loudspeakers continues to grow. The 802 is now well into production and has found good acceptance from music lovers who like the sound of the 801, but do not have the space for this system. Speaking of the 801, like EMI and Decca, I now have adopted the 801 as my "official" monitoring speaker, and it goes along with me on all my remote and location recordings. I also take along 120 pounds of Levinson ML-3 amplifier, which can be burdensome, but the combination is superb and has elicited much favorable comment. At the WCES, B&W introduced their new DM-16 loudspeaker. This is the successor to the DM6, the first linear phase speaker made in Europe. Because of the "stepped" design, used to place all the driver units in the same acoustic plane, it was known familiarly as the "pregnant whale." The DM-16 is much more graceful and elegant while maintaining the concept of linear phase response.

The DM-16 features a new 220-mm woofer with a thermoplastic cone whose profile was derived from laser interferometry studies. The 2-in. voice-coil is high-temperature Nomex. The midrange driver is the identical unit used in the 801, and the tweeter a derivative of the 801 unit, but employing a flat plate driver. The crossover network is a 4th-order Butterworth type, similar to the unit in the 801. The -3 dB point is 60 Hz, and there is an audio-activated protection circuit. The sound of this new DM-16 has a close family resemblance to the 801, very smooth and clean, with highly detailed midrange and exceptional imaging and depth. Bass is clean and solid but does not have the extension of the larger systems.

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Combine exceptional low-frequency response, with clear, well-dispersed highs and a mid-range of unparalleled articulation and precision, and you have the SIARE 400 Series.

Through the use of a woven fiberglass mid-range driver, SIARE has created an immaculate sonic mirror of the original performance. **Revolutionary? You bet!!**

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The Audio Critic is now published every other week!

Starting with Bulletin 1, dated January 15, 1981, The Audio Critic has become a biweekly newsletter. Everything is still the same—the hard-nosed equipment reviews, the sophisticated laboratory measurements to back up the listening tests, the eschewal of paid advertising—only the format has changed. Now it's just a few reviews at a time, but every other week!

Later in 1981, *The Audio Critic Handbook* will be published, covering all the theoretical and philosophical material that's too lengthy for the Bulletins. Here's the new offer:

Our \$30 package. This includes the 24 biweekly Bulletins to be published in 1981, plus the Handbook when it is ready. A handsome loose-leaf binder for your Bulletins will be made available at nominal extra cost.

Our \$50 package. This includes the entire \$30 package, exactly as described above, plus the four old-style, magazine-size issues of The Audio Critic that are still in print: Vol. 1, No. 6 (cumulative reference issue with over 150 reviews) and Vol. 2, Nos. 1, 2 and 3, the last being the much-awaited recent issue reporting on the remarkable Fourier I speaker system. We strongly recommend that you get these issues in order to have a fuller understanding of what The Audio Critic is all about and a better foundation for reading the Bulletins. If you already own one or more of these, you may subtract \$5 from the package price for each one you do not wish to receive.

Send your check or money order in the correct amount (no Canadian dollars, \$6 extra for overseas delivery) to **The Audio Critic, Box 392, Bronxville, New York 10708.**

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- Only a limited quantity is available. A few sets also remain from 1975, 1977, 1978, and 1979. It's first come, first served, so place your order now.
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Of other loudspeaker systems noted, Brian Cheney was on hand with his VMPS Super Tower, sporting new polypropylene midrange drivers. Poor Brian had gone to the trouble of acoustically treating his demo room with Sonex (about which I'll soon be bringing you a detailed report), and visitors found his sound very impressive, until some overzealous CES official told him the Sonex did not conform to regulations (Bah! The Bureau of Standards uses it in their laboratories) and made him remove it.

KEF is another dependable oasis of tranquillity and good music. Raymond Cooke's lads always have a selection of high-quality recordings (of which Sir Malcolm Arnold's "Symphony No. 1" on EMI ASD 3823 was quite outstanding for its dynamic impact). As heard on their new Model 303 Series 2 and Model 304 Series 2, the sound was impressive for its smoothness combined with excellent definition. Both speakers employ a new 1-in. tweeter developed through KEF's by-now-famous computer-aided design techniques. The Model 303 has a single 8-in. mid/bass unit; the somewhat larger Model 304 has two of the 8-in. drivers and is capable of 107 dB SPL. A unique cosmetic feature of both speakers is a "wrap-around" grille cloth covering all sides of the enclosures, which can quickly be interchanged among six different colors.

Not to be outdone, JBL has a new floor-standing speaker, the L 150A, which also employs laser holography in its design. The system has a new very lightweight phenolic-dome tweeter coated with aluminum. It features a 1-in. copper voice-coil and a 2-lb. magnet. The columnar-shaped system has a 5-in. mid-range, and its 12-in. woofer has a 3-in. copper voice-coil and 10-lb. magnet. A passive radiator is used to extend low frequencies, and a computer-designed network provides crossovers at 1.1 kHz and 3.7 kHz. This system is in the JBL tradition, with plenty of punch, but it also has a very clean and extended bass response as well as smooth and well-detailed high-frequency response.

The winner in the audio exotica sweepstakes has to be the new Micro Seiki air suspension turntable SX-8000. The 48-lb. stainless-steel turntable platter is mounted on a solid zinc base, and a remote air pump supports the oil-immersed central shaft on a thin layer of air. It is claimed the tremendously compressed air damps all platter resonances. This is a belt-drive model with the drive motor and electronics in a remote unit. Up to four arms can be mounted on the turntable base. This can guarantee you one-upmanship for a mere \$10,000!

Wish I had room for more, but . . .

1939...FIRST DIRECT-DRIVE TURNTABLE SYSTEM.
 1951...FIRST MOVING-COIL CARTRIDGE
 1972...FIRST DIGITAL (PCM) RECORDING.



Denon was founded 71 years ago, making it among the oldest extant companies in the audio industry. Thirty years ago, Denon first entered the professional recording field, and today it is the prime supplier to organizations like the NHK, Japan's equivalent to the British BBC.

Denon's professional products range from blank tape to 24-track recording consoles to fully automated radio stations; their accomplishments include the development of PCM (digital recording), one of the most significant advancements in the history of recorded sound.

In the U.S., Denon is known primarily by those in the know. In Japan, the land where electronics is king, Denon is king of the land.



1981...THE DENON DR-330 AND DR-320 SERVO-TENSIONER THREE-HEAD CASSETTE DECKS.

Many manufacturers would lead you to believe that three heads alone can transform a cassette deck. Denon's experience with professional studio tape recorders proved that lack of uniform tape-to-head contact and proper transport stability can create serious phase problems — especially in the high frequencies — whether the recorder has three heads or two.

To solve this problem, Denon developed a unique Tape Tension Servo Sensor, a system that maintains uniform tape-to-head contact during record and playback. In addition, Denon originated the Non-Slip Reel Drive mechanism (without clutches) which provides the extremely stable tape movement and prolongs the deck's life.

Before the development of the DR-330 (Speed Control and fine Bias Adjustment), Denon built two-head decks, which many audiophiles prefer even to the most expensive conventional three-head units.

With the development of the Tape Tension Servo Sensor and Non-Slip Reel Drive, Denon has realized the full potential of the three-head configuration.

The Denon DR-320 and DR-330: two important contributions to better sound reproduction, from the company where innovation is a tradition.

DENON
*Imagine
 what we'll
 do next.*

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BERT WHYTE

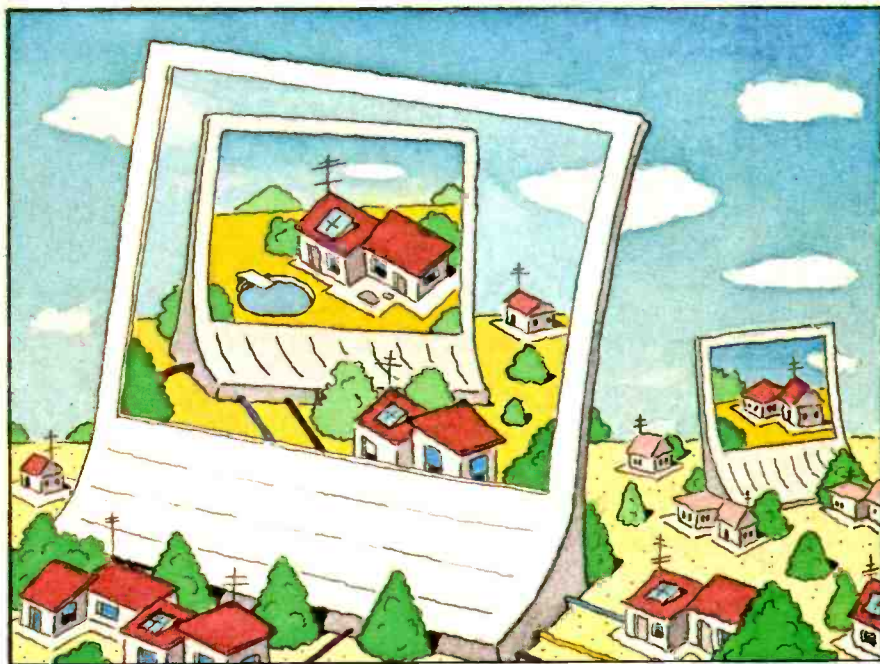
As I noted in last month's "Video Scenes," the Winter Consumer Electronics Show in Las Vegas clearly showed that the much prophesied video boom has begun. What is surprising is the scope of the boom, encompassing virtually all aspects of video, and the rather astonishing speed with which all this activity is occurring.

I mentioned a broad range of new video products last month, concentrating on the major items of interest to that strange new creature — the videophile. Make no mistake — the videophile is flourishing in the land, and, if you take a peek inside his wallet, you'll often find a card-carrying audiophile. It would appear that video has a strong fascination for audiophiles, especially the more technical aspects of the subject. There are several interesting areas where audio and video can interface, and audiophiles are eager to participate.

The newly minted videophile is heavily into portable videocassette recorders and associated color cameras. Having acquired this kind of video equipment, videophiles usually want to view their productions on big-screen projection televisions. However, projection TV has been a sort of stepchild in mainstream TV sales. Desirable, yes, but not quite technically refined enough — and too expensive.

RCA entered this market with their Model PFR100R, a one-piece system with a 50-inch screen. RCA did not say how they will accomplish their claim of a screen 50 percent brighter than any projection TV system currently available. The company evidently believes that the FCC will be approving stereo TV sound transmission, since their unit features a 10-watt stereo amplifier feeding four speakers. With an eye to the future, RCA's projection TV has audio and video inputs so that a VCR and videodisc player can be connected simultaneously. The system will also feature an infrared remote control. RCA is very bullish on the projection TV market, predicting sales will reach \$175 million in 1981.

Advent, a pioneer in the projection TV business, had dynamic Bernie Mitchell on hand at the WCES to startle the troops with its latest system. The Model VBT100 has a special 50-inch screen that is hinged and folds down to make an attractive functional table. It measures 44 inches square and is 27 inches in



height. Advent claims this Videobeam projection system is their "brightest ever," with a screen brightness of 75 foot-Lamberts, and that satisfactory viewing is possible from fairly wide angles. The system has inputs for VCR and videodisc players, and its price is pegged at \$2,495. Mitchell also announced Advent will be selling a laser/optical videodisc player (probably made by Pioneer) and what he terms a "high-fidelity" videocassette recorder. According to Mitchell, Advent extensively studied available VCR systems and chose the Beta format because of the level of resolution it provides. He reported the VCR will be furnished by Sony but extensively modified by Advent to include such things as stereo sound and Dolby C noise reduction.

Mitsubishi introduced two new high-technology projection TV systems, the \$4,200 VS520U and the \$4,500 VS520UD (which differs from the former in having doors to cover the screen when not in use). These are one-piece projection TV systems with ultra-fast f-1.2 four-element lenses. Coupled with an in-line three-tube projection configuration, this affords a screen brightness of a rather startling 120 foot-Lamberts. The 50-inch screens are made of a special washable aluminum-coated vinyl. There is full-function remote control with 105-

channel accessibility, and time and channel are flashed on the screen when a new station is selected. These projection systems are "stereo ready" with two sets of speakers, each with its own amp.

Years ago, some high end hi-fi stores carried what could best be termed "component" TV sets made by Radio Craftsmen and the Conrac Company. The latter's 27-inch (black and white) unit was sold without a cabinet. It featured special TV circuitry and outputs for connection to an external high-quality amplifier and loudspeaker. Back in those days there was a lot of live music on TV, and I well remember the absolutely superb live sound which resulted from the high-fidelity circuits of the Conrac. Folks with today's high-quality FM tuners would flip over such program material. It would appear that videophiles will soon be able to purchase modern versions of the Conrac custom-TV chassis, as Sony will be introducing what they call their Profeel color TV. No cabinet, same provision for using your own amplifiers and loudspeakers. Super-quality Trinitron circuits will provide the utmost in picture resolution and color fidelity from its 27-inch tube. Already available in Japan, it is expected to cost between \$1,200-\$1,400 here. With a good videodisc, this should be quite a thrilling viewing experience. **A**

IF YOU'RE NOT USING THE SCOTCH® RECORD CARE SYSTEM, YOU'RE USING THE SECOND BEST.

**THE SCOTCH® RECORD CARE SYSTEM. IT CLEANS,
ANTI-STATS AND REDUCES FRICTION—ALL IN ONE STEP.**

Finally there's a way to give your records the kind of care and protection that hasn't been possible until now... a way to insure a long life of true sound.

The System.

The Scotch Record Care System combines Sound Life™ record care fluid with a unique dispensing applicator. To use, simply depress the supply container and Sound Life fluid is fed automatically to the pad. That's all there is to it. It's quick, easy and simple. No guesswork about how much fluid you need or how to apply it correctly. Just place the applicator on your turntable spindle, revolve it and the record is cleaned.

Super-wetting action deep-cleans grooves.



Artist's representation. Water-based record-cleaning solutions bead up on the grooves (left). Sound Life with super-wetting action deep-cleans grooves (right).

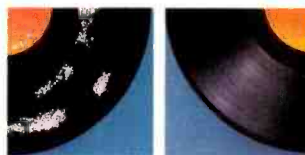
If your present cleaning solution beads up on the record surface, it may not be getting the job done.

Scotch Sound Life spreads onto the disc surface evenly—safely penetrating grooves to remove micro-dust and fingerprints. Sound Life leaves the record with a brilliant look, as brilliant as the sound is clean and true.

As it cleans, it wipes out static.

Even though your record surface is clean, it's generally the electrostatic charge that gets it dirty again. An anti-static gun is just a temporary treatment.

One application of Sound Life reduces the residual charge to near zero. And it prevents static from returning no matter how often the record is played.



(Left) Foam beads are attracted to static charge left on record after cleaning with a leading record cleaner. Same record (right) after one treatment with Sound Life fluid with anti-static action.

Friction reduction's a plus.

The same application of Sound Life that super-cleans and removes static can reduce stylus drag up to 15%.

And with your sensitive stylus that can mean less wear and improved record life.

Better stereo performance.

To get all the true, pure sound you expect from your stereo, you need records that are truly clean, and protected from static and friction. Only the Scotch Record Care System gives you all three in one application. Ask to see a demonstration at your record or stereo store right now.

All of the tech data we've used to back up these statements is available free. Write to Home Entertainment Products Department, 3M Company, 3M Center, St. Paul, MN 55144. Ask for report C-242.



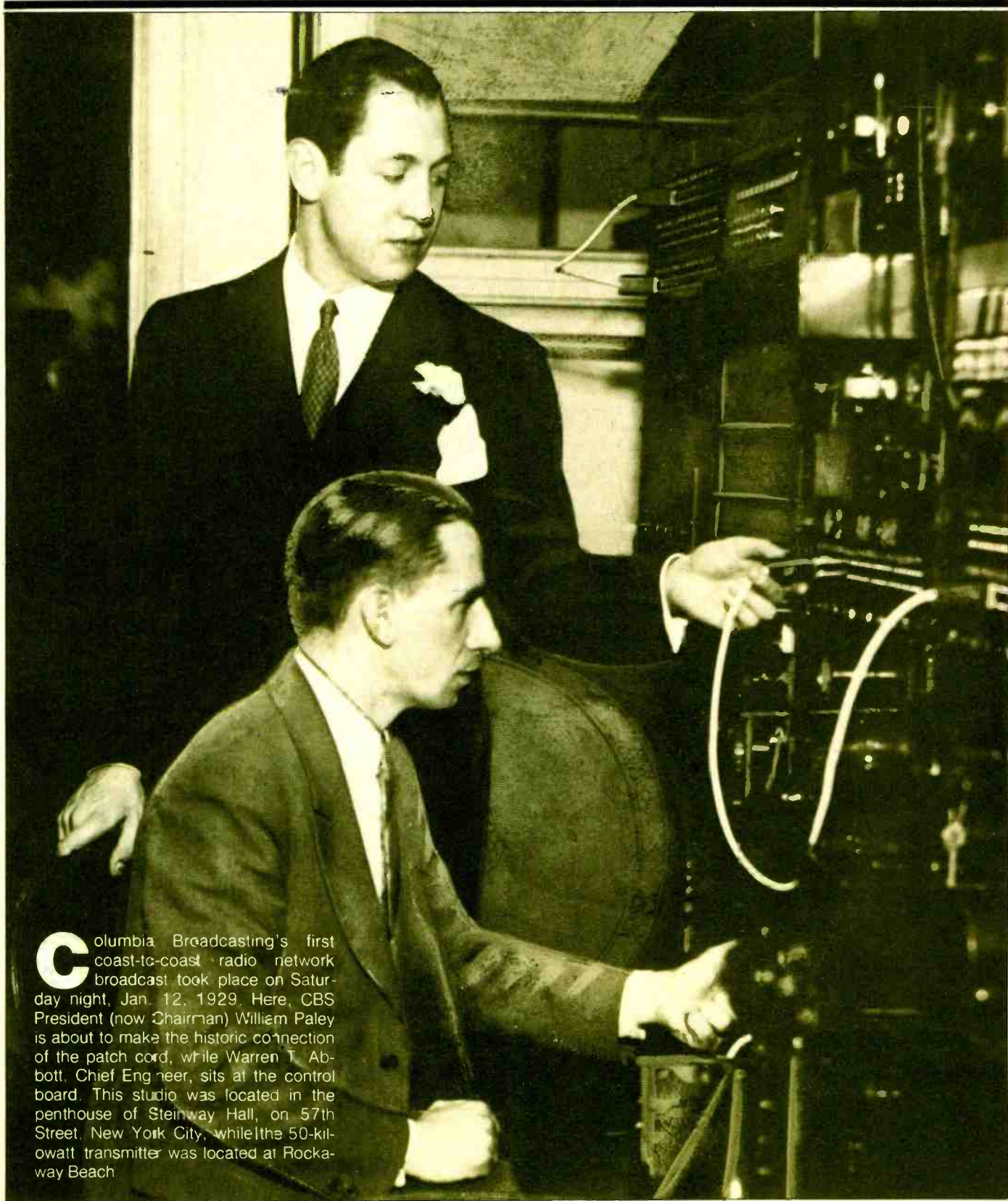
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THAT'S THE WAY IT WAS

WALTER I. SEIGAL



Columbia Broadcasting's first coast-to-coast radio network broadcast took place on Saturday night, Jan. 12, 1929. Here, CBS President (now Chairman) William Paley is about to make the historic connection of the patch cord, while Warren T. Abbott, Chief Engineer, sits at the control board. This studio was located in the penthouse of Steinway Hall, on 57th Street, New York City, while the 50-kilowatt transmitter was located at Rockaway Beach.

Five Reasons Why You Should Buy The New Optimus T-70 Speaker by Realistic®



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*See our catalog 326, page 26. Retail price may vary at individual stores and dealers.

DISCWASHER® AUDIO SCIENCE™ SERIES

Record Care, Part 2: A Record Life Study

How long will your phonograph records last?

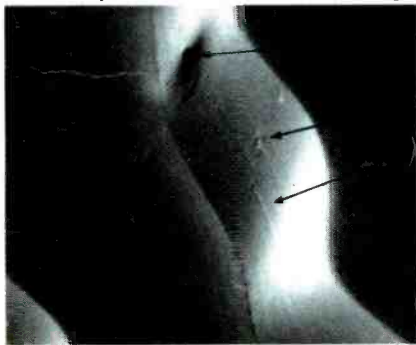
How many times can you safely play records without degrading sound quality?

Using quality playback equipment, the factors of Record Longevity are twofold and closely interrelated: the record must be kept free of contamination, and the stylus must be kept clean during playback.

Scanning electron microscopy clearly shows the need and contribution of both record cleaning and stylus care.

Exhaustive research shows that with proper record/stylus care, an entire "life span" of 200 play events will not damage record surface quality or fidelity. (Most albums are played a total of 50 times or less.)

200 Plays Without Record Cleaning

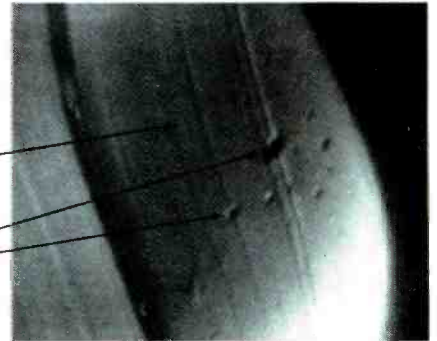


Pit from dust abrasion.
Ground-in microdust.
Prominent dust abrasion.

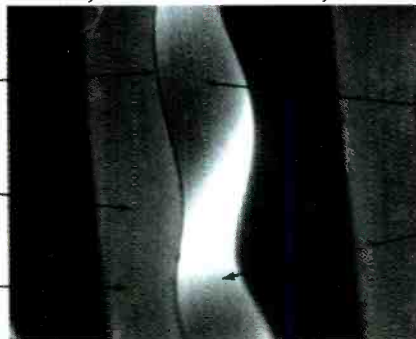
Prominent stylus path from abrasive-coated diamond face.

Vinyl particles welded by contaminated upper area of stylus.

200 Plays Without Stylus Care



200 Plays With Record and Stylus Care



Results of D4 Record Care:

Clean central radius due to capillary attraction of D4 Fluid into D4 pad fabric.

Microdust-free stylus path due to exclusive D4 "spiral fiber" particle holding.

No wall-slurry of "lubricant" products.

Results of SC-2 Stylus Care:

Reduced wall abrasion due to uncontaminated diamond face.

Cleaned stylus leaves no welded-in particles.



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