

Audio

MASS TEST
49 CASSETTES

JUNE 1986 • \$2.00

EXCLUSIVE REVIEW:
SME'S SERIES V—IS THIS
THE ULTIMATE TONEARM?

COMPARISON TEST:
FOUR CD CHANGERS

TESTED:
SOTA STAR SAPPHIRE
TURNTABLE

DENON DCD-1500
CD PLAYER



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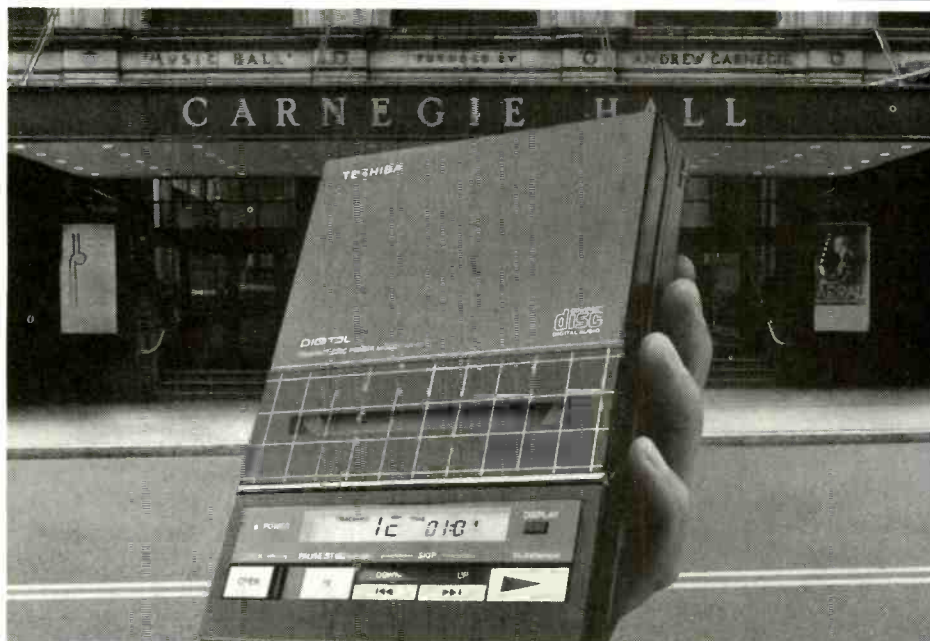
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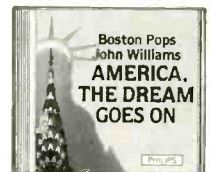
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AT

Proof of the Pudding

Dear Editor:

I want to compliment you on your "Equipment Profile" of the Fried Studio IV Speaker which appeared in the February 1986 issue. That company never seems to advertise, so the fact that you reviewed one of their products is sure proof that you are not letting your technical opinions be swayed by advertising dollars. I like your willingness to present graphs and, in general, to give detailed, factual reviews of equipment. One of your competitors presents equipment reviews that annoy me greatly by their wishy-washy character and lack of quantitative data. I'm letting my subscription to that magazine lapse.

Francis B. Shaffer
Newport, R.I.

Repair Needed

Dear Editor:

I am looking for someone to repair an old Grundig Majestic table radio from the 1950s, Model 3035. Is there anyone in the New York/New Jersey area who can help me out?

R. E. Olsen
Madison, N.J.

Editor's Note: We will be glad to forward any responses to our correspondent.—A.P.

Enough Already

Dear Editor:

Come on guys! The first Lirpa items were clever and amusing. The constant follow-ons ruined last year's Annual Equipment Directory (not just one entry but one in each category), and now you continue to waste editorial space with this tiresome routine.

For this type of humor I buy *Mad* and *National Lampoon*. I buy *Audio* for information of a different kind.

Hector O. Myerston
Milpitas, Cal.

Brewed or Instant?

Dear Editor:

With regards to the article about the Lirpa Turbo Steamtable (April 1986), I don't think I'm willing to trade hum for whistle. I'll bet it makes a great cup of tea, though.

William R. Hitchens
Mountain View, Cal.

No More April Fools

Dear Editor,

I am writing in regards to the April issue of *Audio*. Up until now, I have always considered your magazine a happy medium between the mags for the masses and the high-end publications. You have provided me with reviews of good equipment in my price range as well as a look at esoteric gear. I feel that the April issue was a sad and wasteful departure from this practice. An entire issue devoted to auto sound equipment is a definite step into the realm of low fidelity. Furthermore, I found the inclusion of products from Prof. I. Lirpa a gross misuse of page space as well as a waste of my money. If I want stupid journalism, I'll buy the *National Enquirer*. In future issues, please try to bring the quality of your magazine up to the level that it should be.

Robert T. Shaw
Bremerton, Wash.

Subjective Impressions

Dear Editor:

Bravo! I applaud your steps to find a middle ground between the slick audio periodicals and the underground high-end journals. The "Auricle" column is a welcome departure from traditional product reviews; three cheers for Anthony Cordesman!

In the November 1985 issue, I was pleased that reviewers Laurence L. Greenhill and David L. Clark described the associated equipment used in their tests of the Bryston 4B amplifier, but unfortunately Mr. Heyser made no mention of what amp was driving the Thiel CS3 speakers during his listening sessions. I encourage you to include the listening setup for all product reviews, and perhaps even give a description of the listening room.

Again, my compliments to all of you. You are breaking new ground, and I suspect the going may be tough at times. Press on with a clear conscience—a little subjectivity never hurt.

Robert E. Suminsby, Jr.
Clovis, N.M.

Editor's Note: Subjectivity? Is that where "One man's meat is another man's poison"? Or is it where "What's sauce for the goose is sauce for the gander"?—E.P.

To Err Is Human

Dear Editor:

This communication will take some kind of record for insignificance.

In the first paragraph of my interview with John Charles Cox (*Audio*, January 1985), I date the Joseph Henry experiment as 1854. The date should be 1849. I wish all my mistakes were this small.

F. Alton Everest
Whittier, Cal.

Pickup on South Street

Dear Editor:

I have recently been hearing about inquiries from owners of B-I-C turntables, and other B-I-C audio equipment going back as far as the Garrard days, who have been having a difficult time locating parts and service, and have heard that B-I-C is out of business.

B-I-C's policy was always to support its products with a strong service organization. A company called South Street Service has taken over all of the service and parts for B-I-C equipment. The owner, Adam Ruthkowski (former national service manager at B-I-C), confirms that virtually all parts are still available through his company. In fact, they have remanufactured many parts that previously were not available, such as speaker grilles, turntable motors, headshells, etc. The company's address is 202 South St., Oyster Bay, N.Y. 11771, and their telephone number is (516) 922-0358.

Arthur Gasman
Port Washington, N.Y.

FM A-OK

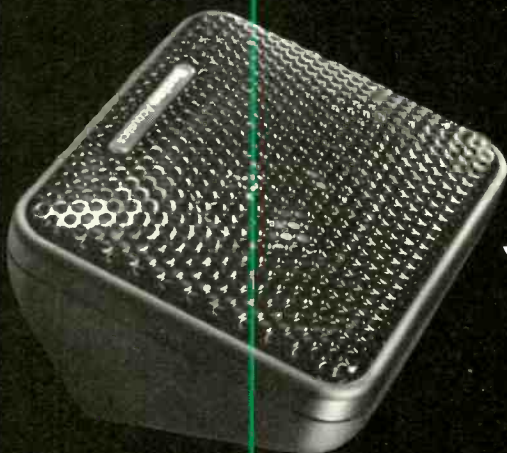
Dear Editor:

You have used much ink bad-mouthing FM lately; I thought you might be amused to hear from someone who likes things as they are.

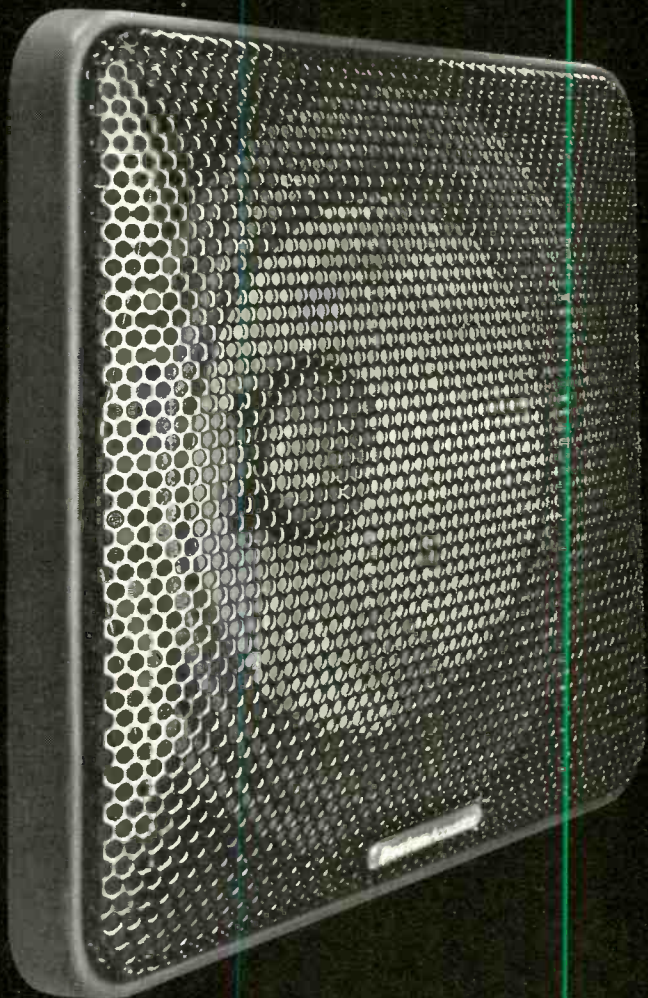
First, the facts of life: Commercial broadcasting is designed to serve the needs of the advertiser. "Processing" is a good thing. Take so much garbage and run it through a processor—nothing is lost. The signal is louder. The advertisers are happy. Nothing else matters. The consumer does not care about quality, but wants mindless noise to fill the background as he goes about his daily routine.

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You just may get into the habit of picking up your car keys when you want to do some really serious listening.

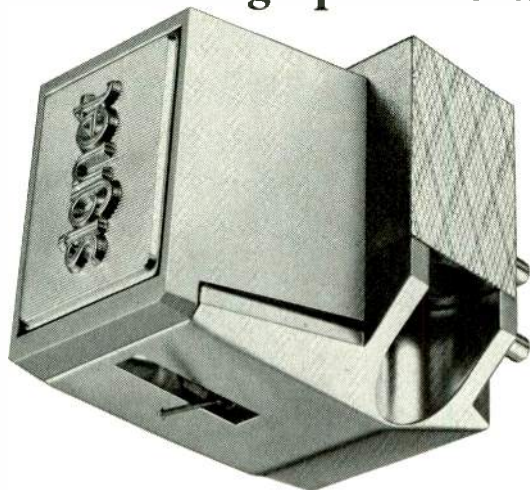
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like a wide-band TV-signal
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As to reception, how many audiophiles do you know of who spend \$1,000 for a tuner and use a ribbon-wire dipole or some active indoor antenna? The same people, I'll wager, who are so upset about processing. Signal-to-noise ratio is the name of the game; you can't move your antenna closer to the station, but you can move it farther from the noise, by moving it outdoors. The most rudimentary outdoor antenna will be more successful than any antenna in your living room, where the walls shield it from the desired signal, and your home's power lines and electrical equipment bathe it in wide-band electronic noise.

Since the FM band is located just above TV channel 6, most low-band TV antennas will do a good job on FM. (An FM-only antenna is preferred, though, as it will reject out-of-band signals and noise.) Omnidirectional antennas are the cheapest and easiest to install, but directional antennas have gain; because signals and noise from undesired directions are rejected, the desired signal seems stronger. Often, best results are obtained by nulling an undesired signal, rather than pointing the antenna directly at the desired signal's transmitter.

But nothing will destroy a good tuner's performance like a wide-band TV-signal preamp in the antenna line. You do not want to cram every signal in the VHF spectrum down your tuner's throat. Furthermore, a noisy preamp will mask weak signals, and a preamp that overloads will cross-modulate, and cause each station to appear at several points on the dial. An antenna preamp should have only enough gain to cover the loss in the down-lead, usually a few dB. But most preamps have much more gain, enough to reduce the tuner's overall dynamic range, upset its AGC and muting circuits, and possibly cause it to overload. Try a preamp only after you have put up the best possible antenna—and don't be surprised if the preamp makes your reception worse.

For more information about FM and VHF in general, get a copy of the *VHF Handbook*, available for \$17.50 from the American Radio Relay League, 225 Main St., Newington, Conn. 06111.

Kerry Stiff
Otis, Kans.

"Great and important"

—Julian Hirsch,
Stereo Review

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Stereo Review

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Equalization with LPs and CDs

Q. When I bought my CD player, I was a bit disappointed with the sound on some of my discs. The frequency response was not what I could obtain with LP versions of the same records. To my ears, the CD versions had a peaky midrange (3 kHz) with loss of warmth. I then remembered an article in Audio that suggested a boost of 3 dB in the 120-Hz range along with a cut of 3 dB in the 2- to 4-kHz range for CDs with this problem.

The other day I was searching through my record collection, and found a record with the label "Digital." This LP never sounded right because of too much warmth and lack of midrange. It was then that I thought of using the mirror image of the CD-correction curve. That did the trick!—Marc Ferland, Montreal, Que., Canada

A. As with any other program source, you will like the sound of some CDs and dislike that of others. As you have found, you can, with a slight adjustment of some equalizer controls, make a given program source sound better. Using an equalizer in this way is more important, to me, than using it merely as a tool for producing an overall flat frequency response for a given listening position.

Static Solutions

Q. In your December '85 column, reader Andrew Hinds raised the issue of static. Your answer merely scratched the surface with regard to solutions. Having spent the last 20 years in the computer industry fighting this stuff, I would like to offer the following suggestions:

1. Check if your wall outlet is grounded. If you are not the technical type, get a qualified person to do this for you. Should the outlet not have a ground, get one installed. It may be expensive, but it's worth it.

2. Ground all your equipment. Because most audio equipment has only a two-wire wall plug, you will need to run extra wires from your components to the wall outlet/receptacle.

3. Install a grounded anti-static mat in front of your equipment. This means wiring the ground to the mat. Most computer stores carry these or will direct you to a source.

4. Use anti-static spray on your car-

pet. Commercial sprays, although good, smell horrible, do not last long, and are expensive. I prefer a 50/50 mixture of fabric softener and water. Apply in a fine spray. Not only is this cheap and long-lasting, but it will also make your carpet smell nice.

The presence of static has wounded many computer systems, causing untold damage. In audio components, static, at its worst, can lead to premature equipment failure. At best, it can reduce one's listening pleasure.—Lutz E. Moeckel, Costa Mesa, Cal.

Groove Skipping and Compliance

Q. I recently switched from a cartridge of relatively high tracking force to one requiring somewhat less force; the compliance of the new cartridge is higher than that of the old one. For some reason, my new cartridge often skips over the opening grooves, whereas the first one did not. Why aren't cartridges uniform as far as compliance and tracking force are concerned?—Henry C. Moski, Branford, Conn.

A. The most likely cause of your groove-skipping problem is a mismatch between your new cartridge and your old arm. Every arm/cartridge combination has a resonant frequency, which is a factor of the cartridge's compliance and the total effective mass of the cartridge and arm. By raising the compliance without lowering the mass, you have moved the system's resonance down, probably below the desirable 8- to 12-Hz range. As a result, record warps (which are most pronounced at the record's outer edge) and, perhaps, vibration caused by footfalls in your room can now excite this resonance. Possible solutions include switching to an arm with lower mass (difficult and expensive), and switching to a cartridge with lower compliance. Your cartridge's manufacturer might possibly offer a stylus for your cartridge with lower compliance than the one you have now, but it may not have as desirable a tip design.

As to why tracking force and compliance are not standardized: All else being equal, a cartridge with high compliance and requiring a minimum tracking force will tend to have better transient response than cartridges of lower compliance which require a greater

tracking force. Obviously, given the same stylus tip configuration, cartridges which require less tracking force will also produce less record wear than those requiring higher tracking force. Cartridges with high compliance are more expensive to produce and are sometimes unsuited for some discs. Further, these cartridges are more readily damaged.

In order for a cartridge to have high compliance and to track at as low a force as practical, some trade-offs must be made, often in terms of reduced output voltage. Thus, high-compliance cartridges may prove unsatisfactory when used with preamplifiers or receivers having insufficient voltage gain and/or signal-to-noise ratio to accommodate them.

Signal Loss at Low Volume

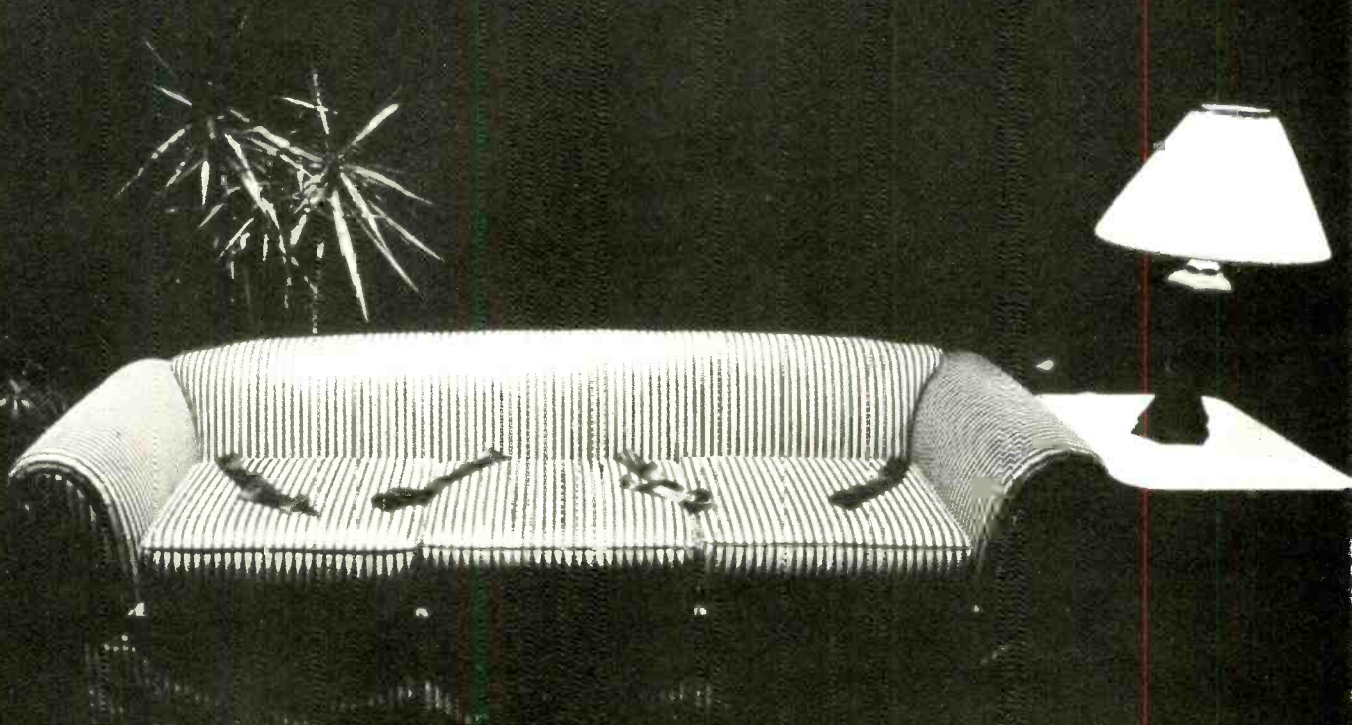
Q. At low volume, regardless of program source, both channels of my receiver cut in and out—with lots of static. The receiver will operate normally for about 5 to 10 minutes before the onset of this condition. I can temporarily restore the receiver to normal operation by quickly turning the volume control way up and then turning it down to its original setting. I then can listen for another 5 to 10 minutes before the cycle starts again. The receiver works properly at volumes above background-music level.

I have had this receiver in the shop several times. Each time, the technician believed that the receiver was merely dirty. All the controls were cleaned, but these "repairs" had no effect.—Jon T. Satterwhite, Rossville, Ill.

A. The condition you have described could be the result of so many different factors that I cannot pinpoint any one as the likely cause. The interesting thing is that the condition occurs on both channels. This tends to support the idea that there is a defect in the power supply, which is certainly common to both channels. But I cannot explain how the quick rotation of the volume control could shock-excite the power supply into proper operation.

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

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Bridging a stereo amp for mono use can increase total power or damage the amp. Better check with the amp's manufacturer before you try it.

Can it possibly be that there is an IC (other than a voltage regulator in the power supply) common to both channels? You will need a schematic of your equipment to determine this.

In any event, you need to trace the signal through your receiver. Hopefully, you will locate the earliest stage which exhibits volume loss. Even here, the effects of feedback could obscure the true nature of the problem. Use a second amplifier to trace the signal. You will likely need a service manual so you can follow the path of the signal through the receiver. Obviously, you must monitor your receiver as well as the "test" amplifier so you can hear the reduction in volume—maybe in both amplifiers and maybe not, depending on whether you have connected the test amplifier to a stage of the receiver which exhibits this volume drop.

Of course, you can also watch for changes in any of the various power-supply voltages.

Another possibility is that the system becomes unstable and breaks into oscillation. The frequency of such oscillation may be too high to hear, but it should be detectable on a 'scope or by noting an unexpected a.c. voltage. A defective filter capacitor may lead to unwanted coupling among various audio stages. This, in turn, can produce oscillation.

If you are unable to perform these tests, find a competent service shop. Perhaps a factory service center has found your problem to be a common one, with your make and model of receiver, and it may well have a cure.

Bridging a Power Amplifier

Q. I am confused about how to bridge a stereo power amplifier for monophonic use. Can you enlighten me on the subject?—Edgar A. Gorspe, San Diego, Cal.

A. To bridge an amplifier in this fashion, a monophonic signal must be fed to each of the amplifier's input channels, with one channel receiving the signal out of phase with respect to the other. This out-of-phase condition causes one channel's "hot" output terminal to go positive while that of the other channel goes negative, producing a greater voltage swing than either channel could manage on its own. To do this, essentially places the two out-

put circuits in series, just as you would place two batteries in series in order to increase their output voltage. The speaker is connected between the two hot terminals rather than between one hot terminal and ground (as is done for normal stereo use). Some amplifiers incorporate the necessary bridging (phase-reversing) circuit, thus requiring only one input cable. Others require external bridging circuits, while still others cannot be bridged without damage.

Results vary. Most commonly, bridging the amplifier will cause it to deliver exactly twice the rated power of either channel when used normally. But some amplifiers can deliver more than twice their single-channel rated power when bridged, while others may deliver a bit less.

Consult your amplifier's manufacturer about the advisability of bridging, and to find out what output power may result and what impedance restrictions, if any, may be imposed for bridged operation.

About CDs and Players

Q. Before I buy a CD player, I need to know more about the product. If CDs are better than conventional records and tapes, why? Would a reasonably discriminating listener really be able to notice this improvement? Why is the term "digital" used? How is a disc made? Is there more than one size? What features should I look for in a CD player? Is there a version which can both record and play? Finally, are CDs recorded directly from the music source or are they copied from records and tapes?—P. Y. Williams, Marble Falls, Tex.

A. No matter what I tell you about CDs and the machines used to play them, the only way you will know if you like the music they produce is to listen to them. As with anything related to music listening, our perception of CDs is subjective. However, I can say that most listeners do hear a distinct improvement, while some critical audiophiles feel that LP records, despite the measurable advantages of CD, sound better in some respects.


There are some objective facts I can mention. It is possible to record more low frequencies on CD than is possible either on tape or on phonograph rec-

ords. The signal-to-noise ratio on CDs is better than on phonograph records or cassettes. Wow and flutter are virtually unmeasurable. Given all of this, you can see that the dynamic range of music on CD can be extremely wide.

The term "digital" refers to the fact that music is encoded on the disc as a series of binary numbers (ones and zeros) representing its amplitude measured every 0.0000226 second. These binary digits (1.4 million per second) are represented by tiny pits, too small to be seen by the naked eye, which are read by the finely focused beam of a small laser. The original recording from which the CD is made may have been either digital or analog; if the latter, it is converted to digital form for the CD.

The discs come in only one size, 4.7 inches (12 cm) in diameter. The manufacturing process is complex, involving the creation of a master from which the tiny pits are molded, the molding of the disc, and the coating of the disc with a reflective aluminum layer and then a protective lacquer on which the label information is stamped. Only the lower side of the disc is read by the laser, but the disc can still hold up to 74 minutes of music. The present Standard specifies that these discs be recorded only on one side.

Most CD-player features relate to convenience rather than sound, helping you locate and access specific points on the disc and set up programs of tracks you wish to play. Have a dealer demonstrate these to you so you can determine for yourself which ones you want. Machines which can record other types of optical discs are still comparatively rare and quite expensive. It is anticipated that CD player/recorders for the home will be available in a few years.

Compact Discs are made from the record companies' master tapes, and therefore have higher fidelity than if they were copied from the records and tapes released for sale. (There are exceptions: CDs of historic performances made before studios began using tape recorders. Even these are probably made from tape dubs of the original master discs, with ticks and pops edited out and possibly other enhancements made.) Since CDs cannot be edited (among other reasons), they are not used for studio recording. 

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A Tape for All Players

Q. My primary tape deck has both Dolby B and C noise-reduction systems, while the tape players in my cars have DNR (Dynamic Noise Reduction) but not Dolby B or C NR. I also have a personal stereo player with Dolby B NR. Using my primary deck, I want to make a single tape that can play back satisfactorily on all my decks. How can I best do this?—Robert A. Nuernberg, Mequon, Wisc.

A. I suggest that you make your recordings with Dolby B NR. When played back without Dolby decoding, they will sound a bit bright but not unreasonably so; this added brightness may even be desirable in the environment of a moving car. If the brightness is undesirable, a mild downward turn of the treble control will help. Another strategy is to use Type I (ferric oxide) record EQ and play back with Type II EQ; this will provide a moderate treble cut.

Checking Dolby Alignment

Q. I own a home cassette deck with Dolby C NR, which I use to make recordings that I play on my Sony Walkman, which also has Dolby C NR. The first time I made recordings and played them back on the Sony or several other cassette decks, they sounded muffled and lacking in highs. There was also audible pumping of the sound as the Dolby C NR switched the playback levels at obviously incorrect points. Recordings made and played back on the home deck sounded fine. On the other hand, professionally recorded tapes with Dolby C NR sounded fine on other equipment, but not on the deck in question.

I have made test recordings on the deck, using Dolby B NR and no NR, and these recordings are compatible with other equipment. This eliminated azimuth misalignment as the cause of my problem. I believe that the fault lies with the deck's Dolby NR calibration, so I sent the unit back to the manufacturer. The deck was returned to me—improved, but still not totally compatible with other equipment. Is there any way that I can determine if my cassette deck is adjusted correctly, once and for all?—Robert A. Ward, Cleveland Heights, Ohio

A. To check your deck's Dolby NR

alignment, you need a test tape containing a 400-Hz tone at Dolby level (200 nWb/m) and a signal generator that produces a 400-Hz tone. First, play the test tape; the meter of your deck should indicate Dolby level. Next, record a 400-Hz tone on your own tape at a level that drives the indicator to the Dolby mark; when playing this tape, the indicator should again come to the Dolby mark. If playback of the test tape does not produce a Dolby-level reading, or if recording at the Dolby mark does not produce a Dolby-level reading in playback, your deck is misaligned.

High-quality Dolby-level test tapes are expensive. If you have access to a cassette deck that you trust to be properly calibrated, you can make your own Dolby test tape with probably sufficient accuracy to be useful. Record a tape at Dolby level as indicated by this deck's meter, using a 400-Hz tone from a signal generator or perhaps from a test phono disc. When this tape is played on your own deck, your deck's meter should read Dolby level.

Deck Incompatibility

Q. I own two cassette decks, a JVC KD-V200J and a Technics RS-B14. When I record on the JVC with high-quality tape, using Dolby C NR, the playback on the JVC sounds superb. But when I play this cassette on the Technics, the high end sounds muffled. Also when I record on the JVC and play the tape on the Technics, the right meter is about 2 or 3 dB down relative to the left meter, and the right channel seems to have more bass than treble.—Eric Gagne, South Hadley, Mass.

A. Apparently you have an azimuth alignment problem. That is, either the JVC or the Technics record/playback head, or both, are not correctly aligned. You may also have a Dolby NR tracking problem, which often results in treble loss. Again, one or other of the two decks, or both, may be at fault. The difference in response between the left and right channels may relate to the azimuth problem or the Dolby tracking problem, or both.

If the JVC plays its own tapes well enough, the fault is more likely to lie with the Technics. But you do not say what happens when you record and

play tapes on the Technics, or when you record tapes on the Technics and play them on the JVC. Analysis of those results might point more surely at the source of the problem.

Going Into Reverse

Q. In my auto-reverse tape deck, when the tape changes direction only the drive motor reverses; the head stays stationary. Why isn't this design used in all auto-reverse decks? Wouldn't this overcome the problem of azimuth alignment in decks that use a swivel-head design? Surely it must be cheaper, as it doesn't require an extra motor to turn the head.—Daniel Cohen, Verona, N.J.

A. One of the problems in designing and constructing a high-quality tape head is to keep the gaps co-linear, that is, in exactly the same vertical line so that azimuth is the same for both gaps. The problem is compounded by the fact that physical co-linearity does not assure magnetic co-linearity. In the case of a reversible cassette deck which does not use a swivel head, the head must have four gaps, two for each direction of tape travel. To keep all gaps co-linear is a good deal more difficult for a head with four gaps than for a head with two. Hence a number of manufacturers have elected to go the route of swivel heads. Swivel-head decks usually have separate azimuth adjustments for each direction of tape travel.

VCR Dropouts

Q. I am considering the purchase of a hi-fi VCR solely for audio recording, because five or six hours of audio can be recorded on a single tape with sound quality superior to that of most open-reel or cassette decks. If I record only at the slower LP and EP speeds, will audible dropouts be more prevalent than at normal speed, as some audio experts contend?—Frederick Goldsby, Pitman, N.H.

A. In theory, these experts are correct. That is, the slower the VCR speed, the more noticeable the drop-

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.

outs will be. However, much depends on the quality of the tape employed. A good tape will have fewer and briefer dead spots. Hence you have a good chance of obtaining satisfactory results at the slower VCR speeds.

Dubbing: Three to Two Or Two to Three?

Q. My stereo system includes a three-head cassette deck with a rated frequency response of 20 Hz to 24 kHz and a 75-dB signal-to-noise ratio. I am planning to buy a two-head deck for dubbing; its specs are 20 Hz to 20 kHz frequency response and 74-dB signal-to-noise ratio. My problem is that I have been told by an audio salesman that it is much better to dub from one three-head deck to another three-head deck. Please advise.—John DeRosa, Mattapan, Mass.

A. The two-head deck you plan to buy should serve quite adequately for dubbing. Apart from not being able to monitor the tape as you record, the chief drawback of a two-head deck as compared with a three-head deck is less extended treble response in playback. This drawback can be inconsequential, particularly with a two-head deck that maintains playback response substantially to 20 kHz. After all, does your program material go out to 20 kHz or beyond? Does your hearing extend that far?

It is usually best to play a tape on the same deck that was used to record it. Therefore, in dubbing, you would play the original tape on the three-head deck (assuming that's the deck it was made on) and record the copy on the two-head deck.

(Editor's Note: Playing a tape on the same deck that recorded it has two advantages. First, if the recording deck's tape speed was too fast or slow, playing it back at the same speed would cancel the effects of this error, since pitch and tempo change only when a tape is recorded at one speed and played back at another. Second, if the playback and record head were aligned at the same factory, as is the case with three-head decks, the odds of azimuth mismatches would be reduced. If the same head is used for both functions, as is the case with two-head decks, it entirely eliminates the possibility of such mismatches.

However, this presumes that the recording deck's speed and playback azimuth have not changed since the recording was made, and that you're not dubbing tapes made on some other recorder altogether. If these presumptions are not true, you'd do best to experiment to see which dubbing arrangement—three-head to two-head or vice versa—gives you the best results.—I.B.)

Tape Type and Print-Through

Q. Are Type II cassettes less susceptible to print-through than Type I tapes?—Victor G. Alter, Amherst, N.Y.

A. High-coercivity tapes—that is, tapes with high resistance to demagnetization—are less subject to print-through than low-coercivity tapes. Inasmuch as Type II has higher coercivity than Type I, Type II is less subject to this phenomenon.

Protecting Magnetic Recordings

In the January 1986 issue, reader K. P. Moylan told of his problem with tapes going through U.S. Customs; they were being damaged by inspection devices. Mr. John Carr, of John Carr & Associates, Flossmoor, Ill., writes of his experience:

"I frequently use the U.S. mails and various carriers, namely U.P.S., Federal Express, and Express Mail, to ship magnetic computer disks. We have experienced almost 100% failure rates (unreadable data) after shipment through Customs. In the past two years, we have experienced an increasing error rate in disks shipped via U.S. mail, even when the shipping cartons are clearly marked with colored warning stickers. We've had no problems yet with U.P.S. or Federal Express. We avoid problems by: (1) Shipping in stiff cardboard cartons secured with plastic tape and marked with colored warning stickers; (2) wrapping the disk in a single layer of aluminum foil (lead-lined photographic film pouches offer greater protection, but at higher cost); (3) cushioning the disk with air-cell material—there are special plastic packing materials for cushioning and radiation protection, available from electronics-supply houses; and (4) avoiding those carriers which have a record of damaged disks."

Steven Pecsek of Riverbank, Cal.,

writes: "Regarding the effects of Postal Service X-ray machines on recorded tapes I recall reading that although X-rays have no effect on magnetic tape, the large electromagnets in the machines can erase some of the signal [with the high frequencies being most vulnerable—H.B.]. I have operated an open-reel mail-order tape service for the past 10 years and shipped perhaps 100 tapes overseas, but have never had any complaints of damage due to X-ray machines or any other causes. However, I do write on the boxes, "Do Not X-ray—Magnetic Tape."

Mr. Pecsek has brought to my attention a *3M Sound Talk* bulletin on the subject, dated Volume III, No. 1, 1970. Following are some excerpts: "Laboratory-conducted tests have determined what would constitute adequate protection from stray magnetic fields of a magnitude which may possibly be encountered in transit. It was found that field strengths within the tape of 50 oersteds or less caused no discernible erasure . . . Sources of magnetic energy to which tape being shipped might be subjected would be motors, generators, transformers, etc. These devices are designed to contain their magnetic fields to accomplish some kind of work. With this in mind, it is safe to assume that field strengths of more than 1,500 oersteds would not be encountered in ordinary shipping situations.

"Because field intensity decreases rapidly with distance from the source, the 50-oersted point . . . is reached at a distance of 2.7 inches from a 1,500-oersted source. From this it can be seen that the easiest and least costly method of obtaining erasure protection is by insuring a degree of physical spacing from the magnetic source. It is suggested that tape being prepared for shipment be packed with bulk spacing material such as wood or cardboard between the tape boxes and the outer shipping container.

"Three inches of bulk spacing should give adequate protection and virtually eliminate any potential for erasure. This magnetically protective spacing can also be justified because of the excellent protection gained against physical damage to the contents"

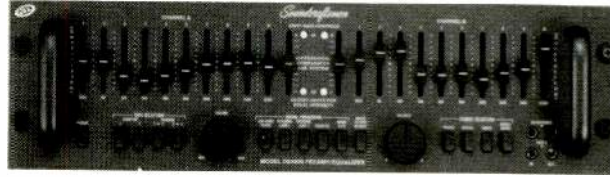


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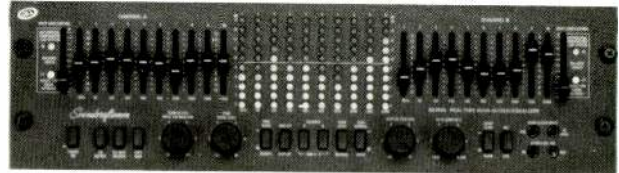
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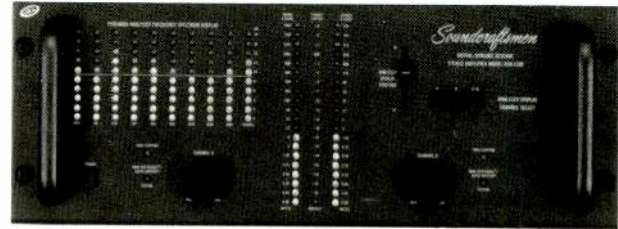
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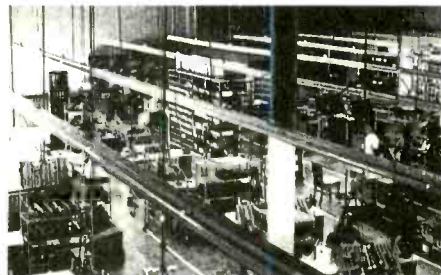


the Soundcraftsmen STORY

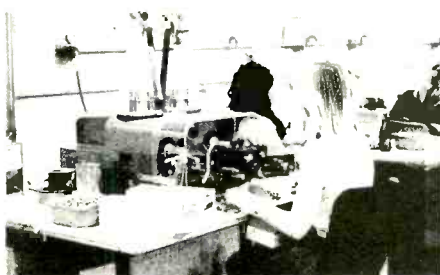
Soundcraftsmen Celebrates it's 17th Year of Manufacturing Audio Components for the Discriminating Audiophile... Right Here in Santa Ana, California

From the introduction of our first Equalizer in 1969, through to our present-day product line of 26 models of U.S. Made Amplifiers, Pre-amps, Equalizers, and Analyzers, all made right here in Santa Ana, our goal has been to Design and Manufacture very affordable State-of-the Art "SEPARATES," with all of the unique and necessary features that audiophiles demand...and to assure the highest level of performance, 35% of Soundcraftsmen's Production Staff is involved in Quality Control procedures...100% Quality Control is seen on EVERY unit manufactured, and EVERY transistor and EVERY circuit board is put through an individual test.

More Importantly, EVERY completed unit is final Q-C Tested 3 TIMES!...First, EVERY unit is electronically tested for specification accuracy...and Second, EVERY unit is connected to a High Fidelity system and listened to—just like you would at home...and Third, if your unit meets or exceeds the critical standards set forth on these tests, it is then hooked up and tested again on the final packing line, before it is packaged for shipment. EVERY unit, absolutely no exceptions, is FINAL-TESTED 3 SEPARATE TIMES, in 3 SEPARATE DEPARTMENTS, to assure you unsurpassed Reliability as well as superb Performance.



PRODUCTION AREA, MAIN PLANT



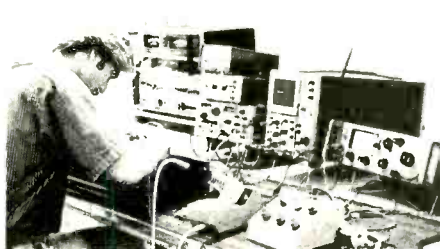
PRECISION COIL-WINDING



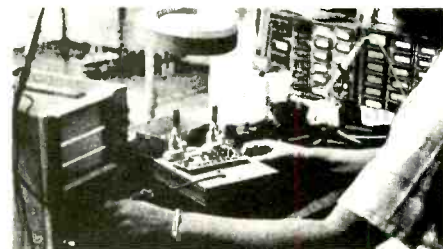
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QUALITY CONTROL #1



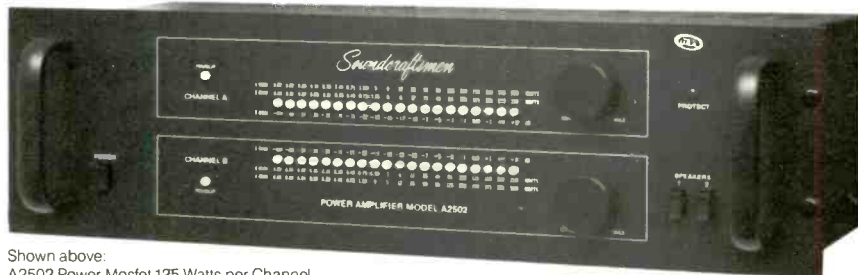
Meet Paul Rolfes, Chief Engineer, V.P., and inventor of Soundcraftsmen's many "FIRSTS" in amplifier technology...

His inventions in electronic power circuitry have resulted in more than a dozen original patents, plus all of the following Audio industry "FIRSTS":

- FIRST—with signal-tracking multiple-rail power supplies.
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The Audio Industry's Most Complete line of Power Amplifiers— 16 Models of Power Mosfet and Class H Amplifiers, from 125 Watts p/c to 375 Watts p/c @ 8 ohms, 20-20kHz, < 0.05% THD.

Our newest Power Mosfet Amplifier is the PM840, a phenomenal value in High-Current and High-Power... 205 watts per channel output at 8 ohms, 20Hz to 20kHz with less than 0.05% THD, and with a Performance/Value ratio that is unmatched... a total of 410 watts RMS at 8 ohms, over 600 watts RMS at 4 ohms, and over 900 watts RMS at 2 ohms... \$499.



Shown above: A2502 Power Mosfet 125 Watts per Channel



Yes, rush me the name of my nearest dealer, 1986 Buyer's Guide, and info on FREE 16-page color Brochure and 12" LP Test Record System Evaluation Kit. Mail to Soundcraftsmen, 2200 S. Ritchey, Santa Ana, CA 92705.

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BERT WHYTE

MARKING TIME



If the 104,163 industry people who attended the 1986 Winter CES in Las Vegas were expecting any major advances in technology or the introduction of exciting new product categories, they were sorely disappointed. The general consensus seemed to be that most manufacturers were marking time, merely showing updated and face-lifted versions of existing products. It was apparent that they had decided to make their major new product introductions at the Chicago Summer CES.

At both the summer and winter shows, I spend most of my time where the high-end components are demonstrated. At this WCES, high-end audio components were shown at the Sahara Hotel, and I must say I felt very sorry for the manufacturers who had to exhibit there. These companies spent a lot of time and money trying to present worthwhile demonstrations of their products, but even the most conscientious of them could not cope with the Sahara's abominable exhibit rooms. Not only were they relatively small, converted guest rooms, but their raised platforms upon which beds are normally placed could not be removed. The sounds from loudspeakers made many of these large, undamped platforms vibrate and resonate, superimposing a most degrading coloration on the reproduced sound. This made any accurate assessment of quality well nigh impossible. Surely, audio components deserve better than this sort of treatment.

As is usual these days at Consumer Electronics Shows, CD players held the spotlight. Though virtually every major component manufacturer offers CD players for home use (most made by several OEM suppliers), new configurations continue to proliferate.

There is a trend towards changer-type CD players. For the car, Sony has their unique "DiscJockey," with a 10-disc changer remotely mounted in the car trunk. CD changers for the home are represented by such units as the original six-disc Pioneer PD-M6 and a five-disc Mitsubishi model. One of the problems with the various CD changers, for home or car, is that they all use different magazines or disc caddies for holding discs such that none of them are compatible with each other. (See the feature article on CD changers in this issue.—Ed.)

Many of the mid-priced and high-end CD players are much improved. Some incorporate third-generation technology which affords remarkably high-quality reproduction. More CD players are being designed with extra refinements and convenience features in an effort to make them seem different and more desirable.

Onkyo was showing what was billed as the first CD player to use fiber-optics technology. Six fiber-optic cables interconnect various stages carrying only digital information such as L/R, word and bit clock signals, audio data, de-emphasis actuate, etc. All this is supposed to help achieve lower noise and distortion. A U.S. version, the DX-320, should be available this spring.

Tandberg introduced the TCP-3015A Compact Disc player. This \$1,295 unit apparently will be one of the first to employ the new Philips 16-bit, four-times oversampling, 176.4-kHz system. Dual D/A converters are used, along with digital and analog filtering. The analog circuitry is direct coupled, is totally discrete (no ICs), and has zero negative feedback. Wireless remote control is provided, along with a full complement of time-display and programming features.

Yamaha introduced no less than 10 new CD players, ranging in price from \$249 to just under \$1,000. The CD-2000 and CD-2000M are the flagship models, with the latter featuring XLR balanced-line inputs and special r.f. shielding for broadcast and studio use. Both units use Yamaha's third-generation digital filter (which has a 90-dB cutoff slope); new fifth-order active analog filters are also used. An important feature is a new vibration-damping assembly for the analog audio circuit board. Newly designed VLSI chips are used, 88.2-kHz oversampling is employed, and an S/N ratio of 105 dB is claimed.

The Magnavox CDB 650 uses Philips' new 16-bit/176.4-kHz oversampling system, has a new laser pickup, and features access time of less than 1 S. Uniquely, 785 tracks from different CDs can be programmed into the unit! The price is \$410.

Much to the horror and chagrin of the anti-digital brigade, there are people (many of whom are newly minted audio enthusiasts) who don't care one whit about vinyl phonograph records and don't even own a turntable! For these people, and for those who want a really high-quality preamplifier for CD playback, the clever folks at Mod Squad have introduced their Active Line Drive. This neat, compact unit has an outboard power-supply transformer and has high-level inputs for CD, tuner and video equipment, plus two auxiliary inputs. A tape-monitor loop is provided. Front-panel rotary controls include an input selector, balance control, 31-step volume control, and a source/mute/tape switch. According to Mod Squad specs, the Active Line Drive provides 18 dB of gain, with an S/N ratio of 90 dB and very low harmonic and IM distortion. The output

Illustration: Rita Pocock

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Barbra Streisand The Broadway Album

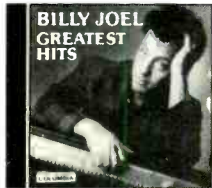
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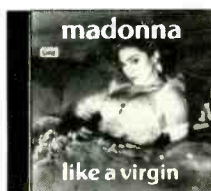
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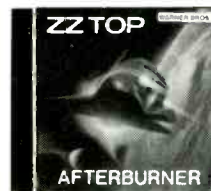
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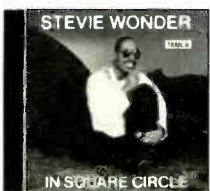
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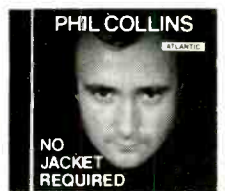
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339200



321570



333286

338616. Miami Vice—Music From The Television Series. G. Frey. #1 You Belong To The City; many more. (MCA)
339903. The Cars—Greatest Hits. Tonight She Comes, Drive, more. (Elektra)
341263. Enach Light & The Light Brigade—Big Bands Of The Thirties. Begin The Beguine; more. (Project 3)
322008. Linda Ronstadt & The Nelson Riddle Orch.—What's New. (Asylum)

323261. Lionel Richie—Can't Slow Down. All Night Long; Sluck On You; Hello, etc. (Motown)
340182. Philip Glass—Mishima. Original music from the film. (Nonesuch)
335547. Berlioz: Symphonie Fantastique. Barenboim, Berlin Phil. (Digital—CBS Masterworks)
331264. Bryan Adams—Reckless. #1 hit: Heaven; Run To You; etc. (A&M)

343160. Beethoven: Symphony No. 9 (Choral). Bruno Walter, Columbia Sym. (CBS Masterworks)
318089. Michael Jackson—Thriller. Billy Jean; The Girl Is Mine, etc. (Epic)
273409. Beethoven: Piano Sonatas. Vladimir Horowitz plays. Appassionata; Moonlight; Pathetique. (Columbia)
320499. The Police—Synchronicity. Winner of three Grammy Awards! (A&M)

341073. Steely Dan—A Decade of Steely Dan. Reeling In The Years; Hey Nineteen; more. (MCA)
337279. Placido Domingo—Save Your Nights For Me. Love songs. (CBS)
288670-398677 Barry Manilow—Greatest Hits. It's A Miracle; Mandy; etc. (Counts as 2—Arista)
322024. Huey Lewis & The News—Sports. Bad Is Good; Heart & Soul; etc. (Chrysalis)

336578-396572. Bach: Flute Sonatas—Rampal, flute; Pinnock, harpsichord, etc. (Counts as 2—Digital—CBS Masterworks)
314443. Neil Diamond's 12 Greatest Hits, Vol. 2. You Don't Bring Me Flowers (with Barbra Streisand); etc. (Columbia)
340760. Stevie Nicks—Rock A Little. Top 10 Talk To Me; I Can't Wait; title cut; etc. (Modern)

328740. Mozart: Piano Concerto No. 26 (Caranation); Rondos. Murray Perahia and English Chamber Orchestra. (Digital—CBS Masterworks)
219477. Siman & Garfunkel's Greatest Hits. El Condor Pasa; Bridge Over Troubled Waters; etc. (Columbia)

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Do you have a VCR? (Check one.) Yes No 708/F86

Do you have a credit card? (Check one.) Yes No

This offer is not available in APO, FPO, Alaska, Hawaii, Puerto Rico. Please write for details of alternative offer.

Note: All applications are subject to review. The CBS Compact

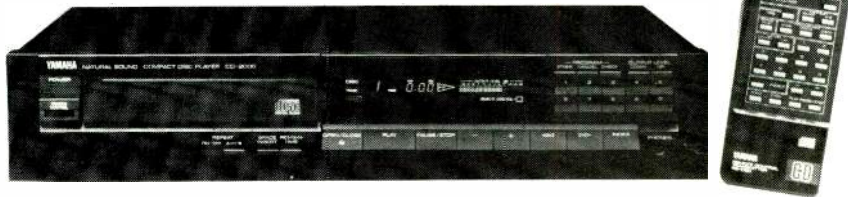
Disc Club reserves the right to reject any application.

1TF/NZ

Most Japanese firms have been keeping prototypes of DAT recorders under wraps, apparently to avoid any negative effect on the booming CD market.



Tandberg 3015A CD player



Yamaha CD-2000 CD player

impedance is 100 ohms, maximum output is 13.5 V rms, and the unit will safely drive virtually any power amp.

At \$500, the Active Line Drive is a good companion for upscale CD players. I have used this unit with a number of high-quality amplifiers, and it has proven to be an excellent performer. Its sound is very neutral and clean, with an open, transparent quality, a nice preservation of depth, and good, stable imaging. The unit is extremely quiet and does not degrade the S/N ratio of even the most expensive CD player. Eliminating the cost of high-quality phono circuitry enabled the Mod Squad to provide the Active Line Drive with high-quality parts and to achieve a level of performance as good as many higher priced preamps.

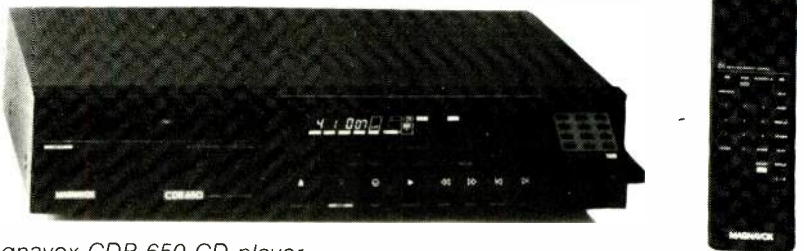
Although a number of Japanese manufacturers are known to have fully developed models of digital audio tape recorders, they have been keeping them under wraps, apparently by mutual agreement. However, Onkyo evidently believed the CD market was so strong that there was really no compelling reason for further delay. Thus, they showed a prototype of their DT-1000 DAT recorder, although price and delivery schedule were not announced. The DT-1000 is equipped with a real-time music counter and music program system, allowing access to any part of a program by index or time.

As you may know, the Japanese have developed both stationary-head and rotary-head DAT system versions. To make matters more complicated, the EIAJ (Electronic Industries Association of Japan) has adopted *both* formats as standards.

However, there seems to be a general favoring of the rotary-head (R-DAT) format, and this is what Onkyo has employed in the DT-1000. The R-DAT cassette is approximately two-

thirds the size of a standard audio cassette. It moves at a snail's pace of 8.15 or 12.225 mm per second, which respectively affords 120 and 80 minutes of recording. There are two channels, and with a 30-mm recording drum operating at 2,000 rpm, the writing speed of 3.13 meters per second is equivalent to a linear speed of over 10 feet per second! Quantization is 16-bit linear, and the sampling rates are 48, 44.1 and 32 kHz. You may note that the 48-kHz rate is the same as used in the professional digital formats; theoretically, this means that a DAT cassette might exhibit higher resolution than a CD! Error correction is similar to CD, with double-encoded Reed-Solomon code employed.

A remarkable system, this DAT. One can only speculate on its uses. Of course, to be competitive with CD there will have to be prerecorded DAT music cassettes. Even when duplication becomes fast and cost-effective, however, a comparison of wear characteristics would still favor the CD. Though many playbacks could be made with little degradation, eventually there would be wear on the magnetic coating of the tape (even with evaporated metal), and edge-frilling of the tape could also be, ultimately, a degrading and limiting factor. Nonetheless, the DAT provides fascinating new recording technology. **A**



Magnavox CDB 650 CD player

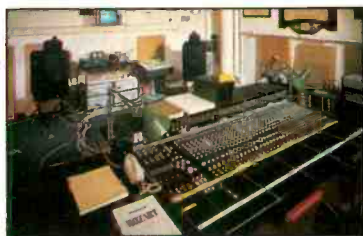


Prototype of the Onkyo DT-1000 digital audio tape recorder

THE 800 SERIES MASTER MONITORS



LISTEN AND YOU'LL SEE



801's at a Deutsche Grammophon digital recording session in the Kingsway Hall, London.



801's pictured here in the Decca digital suite, London.



801's in the celebrated EMI Abbey Road studios, London.

Top-of-the-line models 801F, 802F, 808 and the new MPA810 power amplifier: at the fore-front of sound reproduction technology. Used by digital recording studios worldwide and soon, we hope, by you.

1966  1986

B&W CELEBRATES 20 YEARS OF THE QUEST FOR PERFECTION

The inspiration behind B&W was, and still is, that of John Bowers — creator, engineer, music-lover and perfectionist. B&W is a personal dream that became an internationally respected company.

Twice the winner of the Queen's Award to industry and designer of numerous award-winning and trend-setting loudspeaker models, B&W still remains committed to the goal which was the impetus for its founding: the most faithful re-creation of music possible. For while John Bowers and his B&W team enjoy the great respect of the audio industry, they have as many admirers and friends among the world's top professional musicians, conductors and recording engineers. That, perhaps better than any other accolade, attests to the quality of every B&W design.

Today the B&W sound quality is legendary, and extends from the professional monitor models 801F and 808 to a range of products to suit virtually every application. The affordable 100-series of Digital Monitors, the Video Acoustical Monitors, Professional Amplifiers, Active loudspeakers and a complete range of Automobile loudspeakers, all reflecting the "Quest for Perfection" which motivated B&W's beginnings 20 years ago.



"My own critical standards when listening to music have always been exacting. I have never expected those of B&W customers to be less so." John Bowers
 Founder and Managing Director, B&W Loudspeakers

The world's audio press tells the story:

Model P2 (1966) "... for this loudspeaker with its broad and balanced polar response, its linear and extended frequency response is approaching the ideal everyone is seeking — perfection."

John Gilbert, Gramophone (U.K.)

Model 801 (1979) "In simplest possible terms, the 801 is among the handful of great loudspeakers available."

High Fidelity (U.S.A.)

Model DM6 (1975) "... the overall impression left after many weeks of listening is predominantly one of satisfying, untiring natural sound, without any distracting feature which could be termed a flaw."

Trevor Atwell, Hi-Fi News (U.K.)

Model 808 (1984) "It is difficult to describe how one gets caught up in the music, how the climaxes of a Mahler symphony, for instance, afford an emotional impact that can truly be described as uplifting... There is no doubt that the B&W 808 is a major achievement in advanced speaker design."

Bert Whyte, Audio (U.S.A.)

Active 1 (1985) "The John Bowers Active 1 certainly measured like a fine speaker, and we are happy to report that it sounds as good as its measurements imply—beautifully balanced and uncolored... The bass output from the two 6-inch drivers... compares very well with the output from good 12-inch woofers in cabinets at least twice the size of the Active 1."

Julian Hirsch, Stereo Review (U.S.A.)



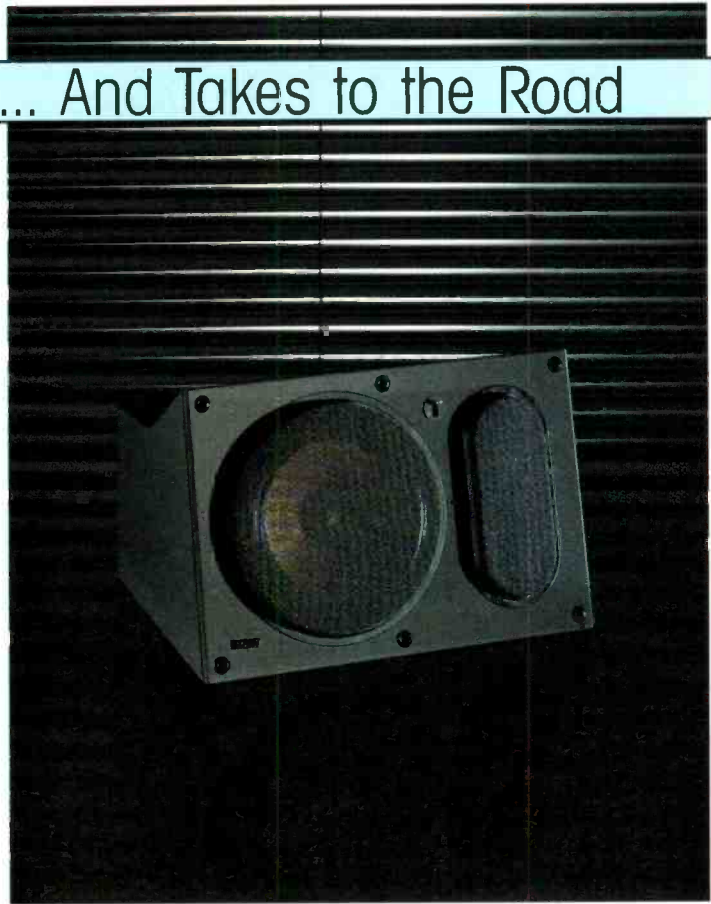
B&W Hi-Fi Leaves Home... And Takes to the Road

The beginning of this decade saw the logical extension of home hi-fi into the automobile, with sophisticated audiophiles seeking performance standards on a par with those of their high-end domestic systems.

B&W responded to the challenge in 1982 by introducing their LM1 series of Leisure Monitors. For many LM1 provided for the first time an opportunity to have quality hi-fi in the automobile.

The enthusiasm with which LM1 was received led to the introduction of MASS — B&W's Modular Automobile Sound System — in 1985. Comprising 8 interlinking modules, MASS combines B&W's world-famous sound quality with system flexibility, high sensitivity and a wide range of installation options.

MASS provides a refined solution to the problems of critical in-car listening, maintaining the highest performance standards while overcoming installation limitations, off-axis listening positions and adverse climatic conditions. Such refinements as B&W's APOC (Audio Powered Overload Circuit) to protect the drive units and the unique dual-action swivel mount of the LT40 tweeter (based on the famous TXS26 high-frequency driver used in studio monitor 801F) are just some of the technological advances made with MASS.



Leisure Monitor LM1



Eight associated modules form MASS

The Kevlar Cone

Kevlar — DuPont's aromatic polyamide fibre — is vastly superior to conventional loudspeaker materials and particularly suited to automobile loudspeaker applications. Kevlar's combination of high stiffness and low mass had proved its sonic superiority through use in the all-important midrange driver of the 801F. Its extremely low mass is particularly critical for automobile applications where high sensitivity is an important criterion given the lower power output of most car audio amplifiers.

Easily capable of withstanding temperature extremes and high humidity, Kevlar will not be affected by the adverse conditions inherent in the automobile environment. Initially developed for bullet-proof vests Kevlar is used today for racing cars, yachts, and many other high-performance products where the weight-to-strength ratio is critical, such as the Porsche 959 which must be a prime example of today's technology ahead of its time.



Kevlar cone & Porsche 959

Two Decades of Creative Innovation

In his heart John Bowers is an engineer and designer, and his engineering creativity has directed B&W's policy from the very beginnings of the Company. This dedication has made B&W one of the most research-oriented companies in the audio industry, and their Steyning Research Establishment is among the most advanced acoustical laboratories in Europe.



Steyning Research Establishment

Although equipped with some of the most modern and sophisticated tools available, it is the Steyning Research Establishment's engineering team which is B&W's greatest asset. Their creativity over the last twenty years has pioneered a number of industry milestones:

- a calibration certificate included with every production loudspeaker
- digital testing for quality control in production
- incorporation of electronic overload protection circuits
- first to use Kevlar for loudspeaker cone construction
- first in Europe with a linear-phase loudspeaker — DM6
- first with computer optimisation for crossover design
- first to use composite enclosure techniques employing Fibrecrete bonded to structural foam
- first to employ laser interferometry to study the vibrational behaviour of loudspeaker drivers.

... and in 1986...

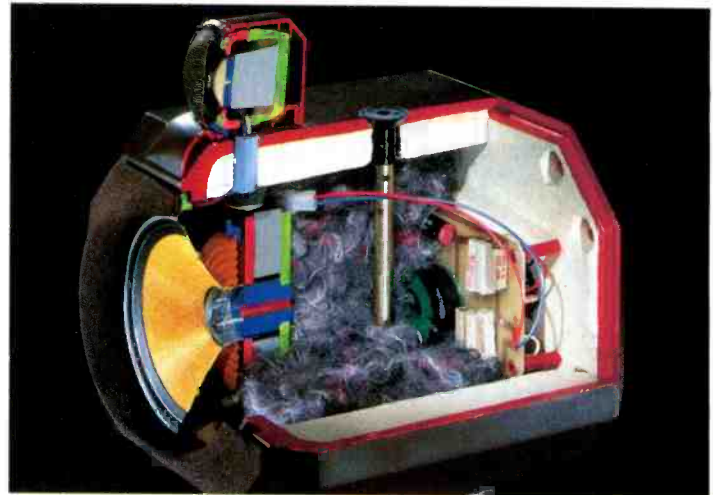
MATRIX — a significant advance in loudspeaker enclosure technology.

It is a source of considerable pride to everyone at B&W that every model in the range employs only components of B&W's own design and manufacture. All drivers and crossover networks are manufactured at B&W's facilities in Worthing, Sussex, under the most stringent quality control systems.

Styling has always been recognised as an important feature of B&W loudspeakers and Kenneth Grange of Pentagram Design has consistently created enclosure designs which complement the technical excellence of the loudspeakers.



Dr. Glyn Adams, head of B&W's research department, pioneered a technique for monitoring the vibrational behaviour of loudspeakers using lasers.



The Fibrecrete lining of its midrange head assembly is one of the important reasons for B&W 801F's superior performance.



B&W's automated tweeter assembly. Technology in the service of music.

MATRIX — The Modern Art of Sound

In loudspeaker design, as in other technologies, the frontiers of what can be accomplished are pushed back gradually in an evolutionary process of development. Occasionally, however, a breakthrough of major proportions is made. B&W MATRIX* is just such a breakthrough.

Whilst steady progress has been made in the development of new and better drive units, until recent years little attention has been paid to the actual enclosure housing these drive units. Because of its importance to loudspeaker performance, B&W instigated a research programme on enclosure design three years ago, embracing a wide range of materials including the so-called Aerospace materials, "Sandwich" construction and even concrete. Despite the extravagant claims made for these materials, B&W's research showed that in some respects they were inferior to a conventional enclosure. B&W therefore invented MATRIX.

The MATRIX enclosure comprises an inner honeycomb structure bonded to the outer skin of the cabinet and filled with sound absorbing foam. The enormous stiffening provided by this structure virtually eliminates enclosure radiation at low and mid frequencies, with the additional damping providing a similar effect at high frequencies. The cellular foam configuration almost completely absorbs rear radiation by the driver.

Of equal importance is the "Time History" — the time required for the sound to decay. MATRIX scores equally well on this count, minimizing "hang-over" inherent in less sophisticated loudspeaker enclosures.

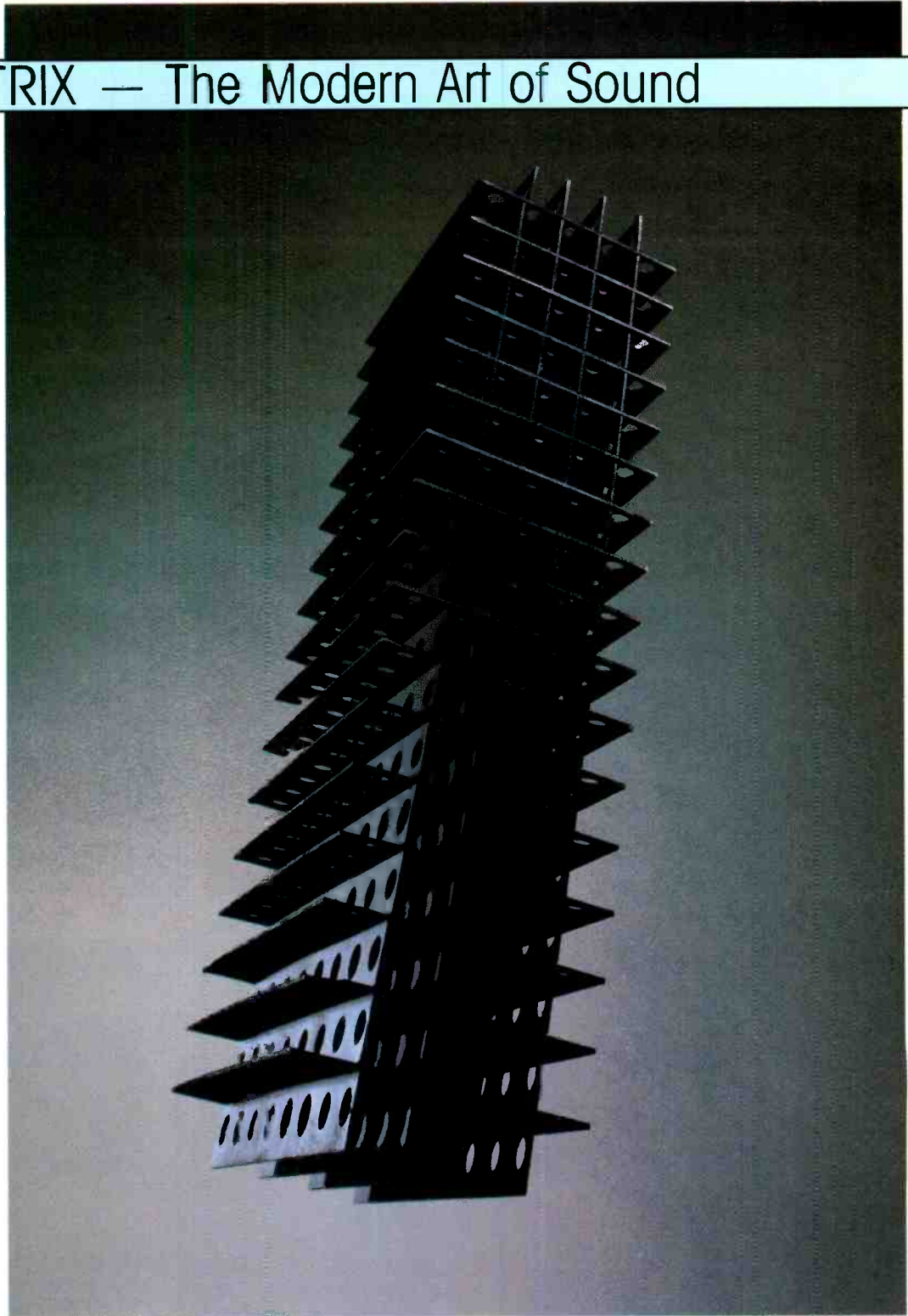
The B&W MATRIX series of Digital Monitors has been designed for the age of the compact disc, with all the additional requirements this source material places on the loudspeaker system: increased dynamic range, increased transient information and a lower noise floor.

Having designed a near-perfect enclosure B&W developed totally new and improved components to complement their invention. Homopolymer Polypropylene cones (almost twice as stiff as Copolymer Polypropylene

used by other manufacturers), a totally new Ferrofluid cooled tweeter giving 8dB increased dynamic headroom at high frequencies and a crossover network providing a new standard for low distortion and resistive amplifier loading.

B&W have published a complete "Design Story" on the MATRIX series of Digital Monitors, including research results from the three-year design programme. Write to us for your copy, or visit your local authorized B&W dealer.

*B&W MATRIX is a trademark of B&W Loudspeakers Ltd.

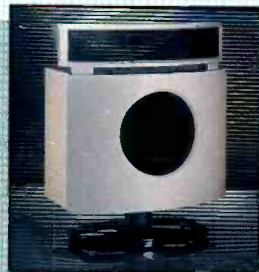


1966 **B&W** 1986

MILESTONES



1967 P2H "Approaching the ideal everyone is seeking - perfection."
JOHN GILBERT, GRAMOPHONE

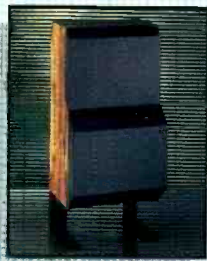


1970 DM70 When launched Funk-Technik (Germany) said: "... a milestone of development for the next decade." Time proved them correct.



1972 DM4 Increased B&W's export tenfold in five years winning a second Queen's Award.

1975 DM6 Europe's first linear phase system and the first to use Kevlar in cone construction.



1983 DM10 Pop, jazz, rock, classical - total spectrum capability from this popular and 'affordable' Digital Monitor.



1979 801 B&W's first professional monitor loudspeaker. Now selected worldwide as classical music monitor by all major recording labels.

1984 ACTIVE 1 B&W's first electronic loudspeaker system. Originated, designed and produced completely in-house.



1984 808 Reproduction to full reference standards - perfection to 120dB.



1986 MATRIX This unique system concept incorporates a revolutionary enclosure design. Find out more from your B&W stockist.



Two decades of creative innovation, of setting the standards in advanced loudspeaker design. Constantly pushing at the frontiers of sound technology. The B&W quest for perfection continues.

20 Years Of Sound Technology

ANGLO AMERICAN AUDIO, P.O. BOX 653, BUFFALO, NY 14240 416-297-0595



UNSPRINTABLE OPTIONS

The ink had barely dried on my critical examination of DAT (in the February and March issues) when the letters started arriving. Of course, every in-house journalist knows that crank mail typically far outweighs fan mail, but I was still surprised at the growing imbalance of opinion. Letters of encouragement from analog fans, desperate to put the hex on the next digital technology? No.irate letters from digital supporters, displeased at criticism of their conquering hero? Nope. The reactionary correspondence came in business envelopes, on letterhead, from Japanese audio companies.

When big companies take issue with an individual, some very tangential things can be said, especially when the companies involved are bona fide, aboveboard, maximum-integrity outfits which fully understand the power of the audio press. An exceedingly polite message is conveyed; no mention of a disagreement is made. Rather, points are argued with copious amounts of information. The tacit message is: "As you can see, at great cost we have figured out the technology; it's great, the public will agree, and we shall recoup our investment."

Backed by the weight of technical evidence, that's a hard argument to counter. All the numbers and diagrams certainly inspire confidence, as well as some expectation. And it is clearly high technology, hence it *must* be desirable. As I sifted through the pages of documentation, I wondered whether I had been foolish in shooting off my mouth against DAT. Were my objections to the soon-to-be format founded on defensible hypotheses, or was it only a case of intolerance based on lack of information and awareness?

I decided to take a closer look at the technology of the DAT system. Coincidentally, a recent Electronic Industries Association of Japan (EIAJ) committee meeting has resulted in new guidelines for the design of the system, affording us a greater understanding of things to come. This EIAJ committee was formed in 1983 to guide development of DAT, and now consists of 81 manufacturers (60 of them Japanese). Within the committee, there are R-DAT and S-DAT subcommittees. It firmly controls the destiny of DAT.

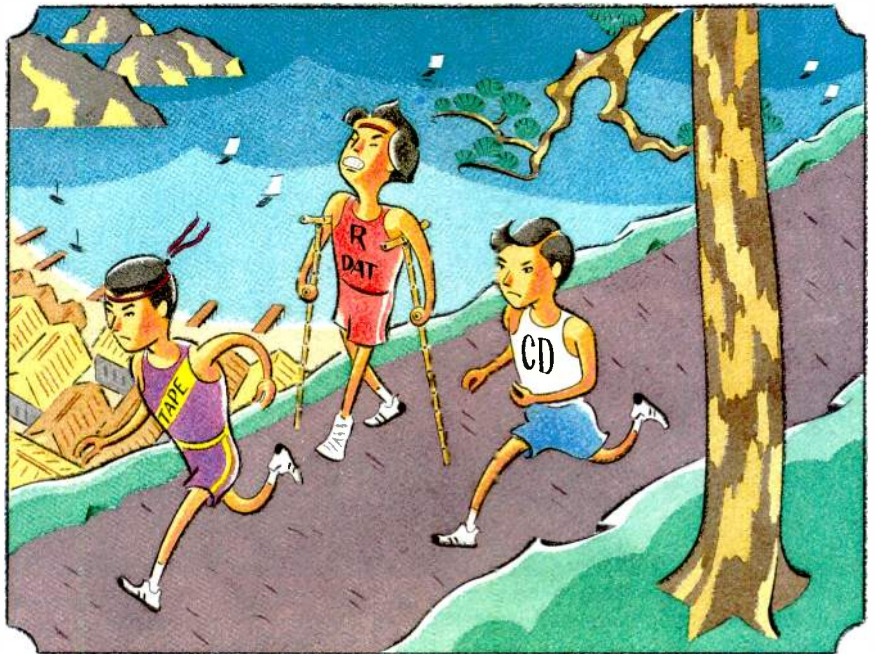


Illustration: Philip Anderson

At this time, S-DAT appears to be on the back burner, due to technical obstacles such as head technology and tape formulation. On the other hand, R-DAT is forging ahead, borrowing from video head and videotape technologies which already offer wide recording bandwidths. Because R-DAT can adapt existing technology, it appears to have the shortest road to commercial realization and thus the best prospects for near-term success.

One of the benefits of digital technology is the flexibility of design parameters; the EIAJ committee has used this flexibility to expand DAT's capabilities—or abused it to the point of confusion, depending on your point of view. Table I shows the format specifications for R-DAT. There are no fewer than four record/playback modes and two playback-only modes. Every R-DAT machine will have at least the Standard record/playback mode and both playback-only modes (called Normal and Wide). The other three modes are options for specific applications.

The Standard record/playback mode offers 16-bit quantization and a 48-kHz sampling rate. Full digital inputs and outputs will permit digital recording and playback of data; however, that capability is crippled by the committee's choice of sampling rate.

By design, 48 kHz is incompatible with the Compact Disc's 44.1-kHz sampling rate. Thus, you will not be able to digitally transfer CD material to tape even with a CD player that has digital outputs; intermediate conversion to analog will be required.

Though you won't be able to record digitally at the 44.1-kHz sampling rate, you will be able to play back tapes made at that rate—pre-recorded tapes made by the record companies from the same masters they use for CDs. In addition, every recorder will have a feature which prevents operation if any digital source has been copy-guarded. While all of this puts the whammy on piracy, it also has the effect of creating a digital recorder with little or nothing digital to record. I suggest that the R-DAT logo depict a sprinter who has just shot himself in the foot.

The only record/playback modes with potential digital source material to record are the optional modes, which all use 32-kHz sampling rates. Option 1 provides two hours of recording time and Option 2 provides four hours. Option 3 allows two hours of four-channel recording and playback. What kind of digital source material is available for full digital recordings? There is direct-broadcast satellite material, beamed at 32 kHz, in Japan and parts of Eu-

Full digital inputs and outputs would permit digital recording and playback, but that ability is crippled by R-DAT's 48-kHz sampling rate.

Table 1—Specifications for R-DAT operating systems.

	RECORDING AND PLAYBACK MODES				PLAYBACK MODES	
	Std.	Opt. 1	Opt. 2	Opt. 3	Normal	Wide
Number of Channels	2	2	2	4	2	2
Sampling Frequency (kHz)	48	32	32	32	44.1	44.1
Quantization Bit	16L*	16L*	12NL*	12NL*	16L*	16L*
Rec. Line Density (kB/in.)	61.0	61.0	61.0	61.0	61.0	61.1
Rec. Sq. Density (MB/sq. in.)	114	114	114	114	114	76
Subcode Capacity (kB/S)	273.1	273.1	136.5	273.1	273.1	273.1
Cassette Size	← 73 x 54 x 10.5 mm →					
Rec. Time (minutes)	120	120	240	120	120	80
Tape Width	← 3.81 mm →					
Tape Material	← Metal Particle → Ferric					
Tape Thickness	← 13 microns, ± 1 →					
Tape Speed (mm/S)	8.15	8.15	4.075	8.15	8.15	12.225
Tape Pitch (microns)	13.591	13.591	13.591	13.591	13.591	20.41
Drum Size	← 30 mm; 90° Wrap Angle →					
Drum Rotating Speed (rpm)	2,000	2,000	1,000	2,000	2,000	2,000
Writing Speed (meter/S)	3.133	3.133	1.567	3.133	3.133	3.129
Head Azimuth, Alt. Tracks	← ± 20° →					

*L = Linear; NL = Nonlinear

rope—but it's not available in the U.S. I think the sprinter actually shot himself in both feet.

Okay, okay, you've just sunk \$2,000 into an R-DAT recorder. You'll never use it for digital recording because you don't live in Japan or Europe. You can't make digital-to-digital copies of your Compact Discs (unless someone markets a black-box sampling-frequency converter, but on the other hand, why record a CD to tape anyway?) and you can't make digital-to-digital copies of prerecorded R-DAT tapes. And how often will you use it for live microphone recordings of, for example, your mother-in-law singing opera arias?

Well, what will you use your R-DAT for? You can do what all analog cassette recorders already do—record from analog sources or from digital sources converted to analog. Or you can play back prerecorded digital tapes. Tapes for the Normal playback mode will be mass-recorded in real time; as with the record/playback modes, metal-particle tape will be used. Tapes made for the Wide playback mode can be prerecorded at a higher speed using the same sort of "contact print" techniques that are used to duplicate videotapes: A blank tape is fast forwarded (200 times normal speed) in contact with a master tape; a focused magnetic field at the point of contact causes the blank tape to assume the magnetic characteristics of the master.

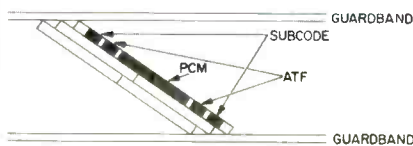


Fig. 1—R-DAT data fields, showing tracking correction blocks.

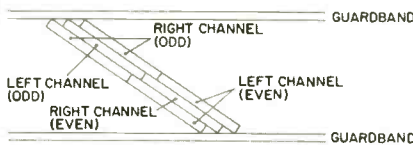


Fig. 2—Distribution of the R-DAT data for error correction.

Because the signal level resulting from contact duplication is significantly lower than that of normal-speed dubbing, the Wide mode requires a wider track than the other formats to compensate for the decrease in output level. This is accomplished by running the tape 50% faster. Playing time is reduced to 80 minutes; however, since the recording square density is lower, regular ferric oxide tape may be used instead of metal tape.

All R-DAT modes use a common head and tracking system. The rotating drum has two heads 180° apart, with a tape wrap of only 90°. Because of the low wrap, tracking stability is said to be better than M-wrap and U-wrap video systems. This should facilitate design

of portable and car players. To help ensure accurate tracking, a dedicated tracking correction system is employed. As shown in Fig. 1, part of each data track contains correction data (labelled ATF). As each track is read, the head overscans the track width to read a small part of the adjacent tracks. Then, the intensity of the ATF data is compared to that on adjacent tracks; a difference causes the tracking correction system to adjust the head accordingly.

Other data blocks are used for subcode. As on the Compact Disc, this data is used for tape time, indexing, music selection, etc. The audio is contained in 196 blocks of PCM data. As with any video-based system, time compression must be used to divide the continuous signal into fields, with enough time left between the fields to accommodate the recorder's head-switches. The fields are rejoined in playback.

Each track is split into halves, for left and right channels, as shown in Fig. 2. To facilitate error correction, data for each channel is additionally split into even and odd data blocks, one for each head. If one head reads bad data (because of dirt on the tape or a tape defect), the other head's received data can be used to interpolate the missing information. All of the data is encoded with the Reed-Solomon error-correction code, as on CDs.

Technically, the R-DAT has apparently arrived. Pending critical first-hand listening tests, I can only speculate that it will sound better than analog cassette recorders. In the same way that the Compact Disc conquered the analog disc, digital audio tape might conquer the analog cassette. Like the CD, it should provide higher fidelity, longer playing time, and conveniences such as programmability and indexing. It will also further open the door to future-generation audio systems in which digital outputs from sources such as the CD and DAT are digitally processed and amplified.

But I'm still not a believer. The purposely incompatible sampling rates largely negate the supreme advantage of DAT—direct digital recording of digital sources such as CD and DAT. Why design lameness into a product? That's a technological tragedy. **A**



ONKYO
Grand Integra M-510
Power Amplifier

Artistry in Sound

ONKYO®



The ONKYO Grand Integra M-510 Power Amplifier combines transparency, musicality, and accurate spatial imaging together with sufficient power to drive any high quality loudspeaker system, regardless of efficiency or load impedance.

Conservatively rated at 300 watts per channel, the M-510 features Onkyo's unique Real Phase power

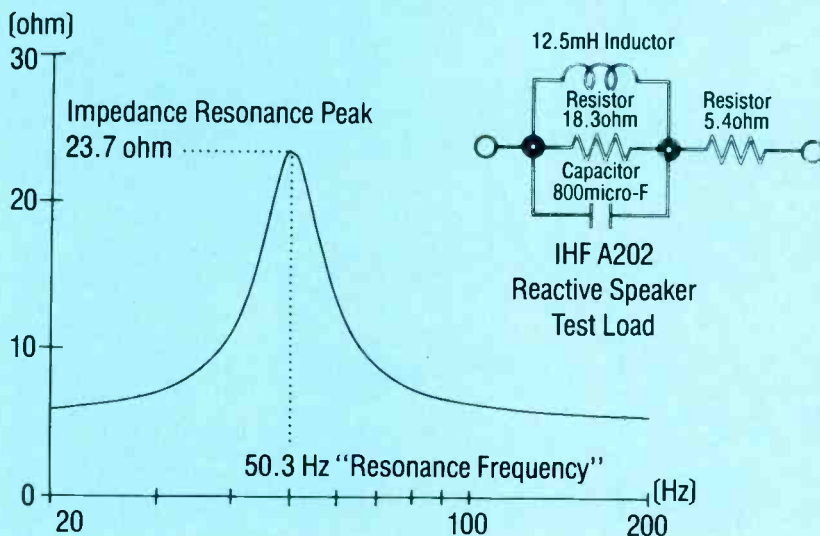
supply design, which prevents sonic degradation due to amplifier/speaker interaction.

Loudspeakers represent complex electrical loads, compared to the rather simple resistive loads used by engineers who design power amplifiers. Recently, many designers have examined the loudspeaker's impedance characteristics, and quality

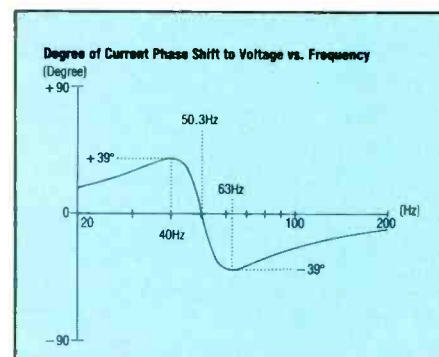
amplifiers now feature the ability to provide increased power output into lower impedance loads. This low impedance drive capability is necessary due to the changing impedance of a real loudspeaker, as well as to properly drive the growing number of low impedance rated speaker systems.

However, these designs still fail to take into account the reactive nature of the speaker load. The ONKYO Grand Integra M-510 Power Amplifier combines for the first time the Real Phase power supply design, with Onkyo's True Low Impedance Drive Capability.

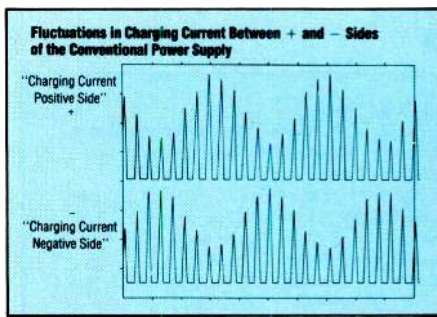
Impedance Characteristics for IHF Reactive Speaker Test Load



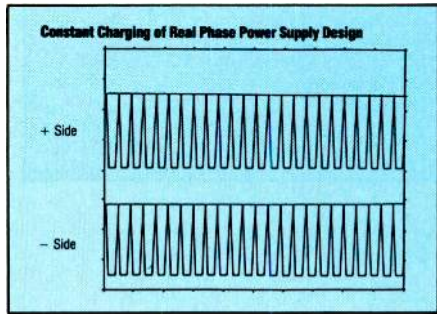
Loudspeakers present complex, reactive loads to the amplifier. This is the impedance curve from a loudspeaker load test model, showing a peak of 23.7 ohms at the 50.3 Hz resonance peak.



The graph shows the amount of phase shift between current and voltage relative to frequency, with a phase shift of +39 degrees below the resonance point and -39 degrees above the resonance point.



Fluctuations in the power supply charging current between the '+' and '-' sides of a conventional supply; these fluctuations cause a loss of image specificity, "smearing" the stereo image.



The ONKYO Real Phase power supply design eliminates these fluctuations, providing stable power on demand, resulting in precise stereo imaging, with no loss of detail even during the most dynamic passages.

Power Supply:

The M-510 features three separate power supply systems. Essentially, the amplifier is a Dual Mono type; that is, the left and right channels are separate all the way back to the power switch and AC cord. Each of the two main power supplies features two power transformers; one, a large toroidal unit, features tremendous power handling capacity; the second, a Real Phase transformer about half the size of the main unit, smooths out fluctuations in charging current due to amplifier/speaker interaction. AC from the transformers is converted to DC by high current rectifiers, and each channel features two massive 33,000 microFarad 100 Volt filter/storage capacitors.

Input Controls:

Two sets of inputs are provided on the rear panel. The set labeled "Direct" bypasses the front panel attenuators. The other set of inputs allow attenuation via the two precision potentiometers hidden behind the flip down front panel door. Both sets of inputs are direct coupled.

ONKYO's exclusive Super Servo circuit cancels DC and extremely low frequency AC (below 3 Hz) without the use of coupling capacitors.

Meters and Relays:

The third power supply system provides separate DC energy for the front panel lights, the protection circuitry, and the speaker relays. This ensures that large peak outputs can not affect these important stages in any way. Two sets of speakers can be hooked up to the M-510, and the switchable relays allow System A, System B, or System A + B operation. The four output relays wired in parallel per channel provide extremely high current handling capability, with very low contact resistance so that damping remains high.

The front panel meters are peak reading, with fast attack and slow decay for maximum effectiveness. Each meter draws from a separate power supply, so the activities of one channel cannot affect the meter indication of the other. The meters are calibrated using 8 ohm loads, and are very accurate. Meter sensitivity can be changed from normal to -10db by a pushbutton; in the -10db mode full scale (0db) deflection indicates 30 watts into 8 ohms load. Approximate power output into 4 ohm loads can be calculated by doubling the meter readings. Approximate power output into 2 ohm loads can be calculated by quadrupling the meter readings.

Protection Systems:

The amplifier must protect both itself and the loudspeaker systems from damage in the event of component failure and/or severe overdrive conditions, but these systems must not interfere with musical integrity under normal conditions. Short term power available from the M-510, depending upon load impedance, can be over 2.5 kilowatts per channel, which can cause severe thermal damage to even the most rugged loudspeaker system.

The M-510 protection circuits will disrupt operation in the presence of the following conditions:

1. Overheated output stage(s)
2. Excessive DC at the input terminals
3. Amplifier output stage component failure producing DC
4. Excessive current flow

at the speaker terminals in the presence of extremely low impedance loads at full power, including short circuit.

The protection circuits monitor the various conditions, but are totally isolated from the audio circuits by photoelectric opto-couplers. The protection systems are powered by the third main power supply and are thereby unaffected by high power consumption during peak audio signal conditions.

Start-up Sequence:

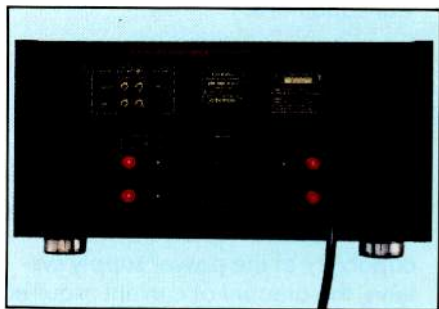
The start up sequence of the amplifier's various stages is carefully controlled, in order to prevent excessive inrush current from the house AC line. Due to the massive storage capability of the power supply systems, the amount of current required during turn on of all three supplies at the same time would trip the house AC circuit breaker(s) or blow the fuse. Also, excessive turn on currents can damage circuit components, so the M-510 switches on in a gradual, controlled manner.

Start up of the M-510 energizes the three power supplies in sequence, and after the DC storage is stabilized, the four audio stages are energized in sequence. Meter lighting is gradually increased to normal or low intensity, depending on the lighting switch selector, and after all stages are settled, the output relays close. The process takes about ten seconds. The front panel "Waiting Monitor" indicates the sequential turn-on of the four stages.

Pre-conditioning:

The input and driver stages of the M-510 amplifier are biased in true Class A constant current fashion. The output stage consists of fourteen high current transistors per channel, with a dissipation capability of 2800 watts continuous. The output transistors are biased partially on all the time (Class AB) using Onkyo's exclusive Linear Switching system to eliminate switching distortion. When the amplifier is first turned on, a special pre-heat system increases the output stage bias, until the correct output stage temperatures are reached. The front panel "Waiting Monitor" indicates correct output stage temperatures when all the LED's are lit. The amplifier will operate from approximately

ten seconds after initial turn-on; however, distortion is higher when the output stage is cool, so we recommend the unit remain idle until the Waiting Monitor indicates correct output stage temperature. Idle current from the AC line is approximately 250 watts when cold, settling down to about 160 watts when correct output stage temperatures are reached.



PERFORMANCE SPECIFICATIONS

Power Output:

300 watts per channel, RMS into 8 ohms
500 watts per channel, RMS into 4 ohms
800 watts per channel, RMS into 2 ohms

IHF Dynamic Power Output:

>400 watts per channel, 8 ohms
>750 watts per channel, 4 ohms
>1.3 kilowatts per channel, 2 ohms
>2.1 kilowatts per channel, 1 ohm

Harmonic Distortion:

<.005%

Intermodulation Distortion:

<.003%

Power Bandwidth (IHF):

5 Hz to 100 kHz, -3 db, THD .2%

Gain:

33.8 db

Frequency Response:

1 Hz - 100 kHz, +0, -1.5 db

Input Sensitivity:

1 Volt for full output

Input Impedance:

20 kOhm (direct inputs)

S/N, A weighted:

120 db

Load Impedance:

1 ohm to 16 ohms, nominal speaker impedance
4 ohms to 16 ohms, EIAJ specification

Damping Factor:

>300; 8 ohms at 50 Hz

Meter Range:

44 db

Meter Accuracy:

0 db indicated: + or - 1 db
- 10 db indicated: + or - 2 db
- 20 db indicated: + or - 3 db

Meter Rise Time:

Minimum to 0 db - 100 microseconds

Decay Time:

0 db to -20 db - 1 second

Power Requirement:

120 Volts, 60 Hz (USA model)

Power Consumption:

720 watts EIAJ specification
160 watts idle, no signal

Dimensions:

507mm wide x 264mm high x 512mm deep

Weight (Shipping):

72 Kg 160 lbs.

As reviewed in

stereophile

“The lab concluded that “so far, this appears to be the best amp evaluated on our test bench.””

“Here we have a very powerful amplifier with outstanding sonics across the board—power with delicacy. Low-impedance panel systems like the Apogee Scintillas will do their best with this amplifier.”

“Most important, the Grand Integra costs over \$4000, putting it up against the Krells, the Levinsons, and the best of Audio Research. Although this is very strong competition, today I find the M-510 unmatched in its soundstage width and transient fidelity; in other respects it is at least very good. I would advise Onkyo to continue pushing back the frontiers of audio engineering; their American competition certainly will be.”

Laurence Greenhill

stereophile

Vol. 8 No. 8

Artistry in Sound

ONKYO®

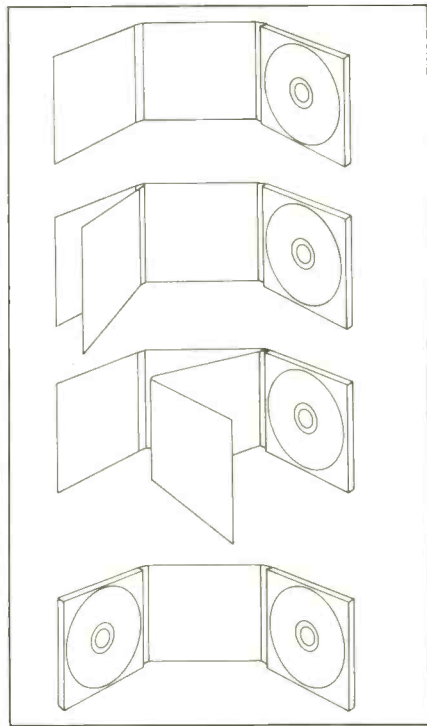
200 Williams Drive, Ramsey, N.J. 07446 201-825-7950

DRESSED-UP DISCS

Fumble-Proof Packaging

I rather like a new Compact Disc packaging format—the Digi-Pak from AGI—that appears to me to offer a reasonable alternative to the Jewel Box. Now, while the Jewel Box is part of the CD Standard, there are Standards and there are standards. For example, the original Standard for the Compact Cassette, also a Philips development, specified the cassette box, and of course there are now a variety of other styles of boxes available, both in the aftermarket and as original packaging. This new Digi-Pak is to be used by the record companies on an OEM basis, and it appears to offer certain advantages.

I don't know how many times you've dropped a Jewel Box and broken a hinge, but I've got about 15% of my collection of CDs suffering from this seemingly congenital malady—*fumblitis Editorius*. I think, however, that the ear on the lid or front of the box just isn't strongly enough made to stand up to the wear and tear it will take in the normal course of its life. I've asked several of my CD-maker contacts about replacement lids, and a couple of them have promised me a handful.



I'm still waiting. I'd even *buy* a few dozen at, say, 50¢ each, but I can't find anyone who sells them—mail order or otherwise. If anyone decides to go into this business, I'll take a bunch of lids as my fee for use of the idea.

Anyway, the Digi-Pak does away with this problem. Basically, it's made up of a revised center insert, of plastic, shaped much like the one inside the Jewel Box, with a wraparound of cardboard to carry the graphics. The insert is not *exactly* like the Jewel Box's. For one thing, it's easier to get the CD off the center spindle of the Digi-Pak because its four corners have ramps arranged so that it is easy to get a finger under the CD. Pressure at two points—up at the ramp, and down at the spindle—pops the CD out of the Digi-Pak.

It's also easier to get to the CD. I need two hands to open the Jewel Box; I can open the Digi-Pak with one. Who cares? Someone trying to get at a CD to play it while driving a car, for instance.

You can see in the drawings that there are several configurations AGI can supply; we've seen only the

simpler, single-disc styles so far, a few from Island Records and one from A&M. The half-dozen I've had my hands on look better to me than the Jewel Box. Which is to say, in university terms, that their graphical achievement quotient is relatively superior. ("What?") Also, to look at the album-cover graphics, you don't have to peer through the plastic lid of the Jewel Box.

My contact at AGI is chary about answering my "How much?" question directly, and I think he's right to point out that the two forms of packaging aren't directly comparable. And he needs an answer to "For how many?" before he can answer my question on price. The different formats cost different prices too. The upshot of this is that using a Digi-Pak won't cause a CD manufacturer to suddenly have to raise prices by \$5—or enable him to lower prices by that much.

My guess is that you'll be seeing more of these in the record stores, from several more labels than Island, A&M, Capitol, and American Gramophone, the only firms said to be testing the packaging at this time. *E.P.*

We use CDs instead of LPs for listening checks because the last pass is as clean as the first, provided our ears are still reacting cleanly.

Demos de Mode

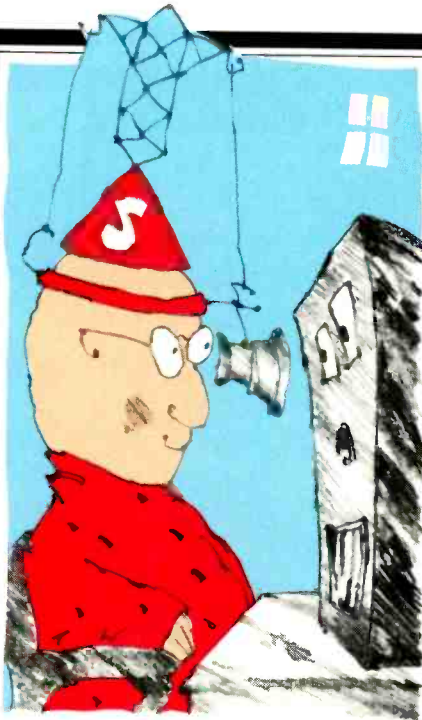
We editors use specific recordings, other than the ones we normally listen to for pleasure, to wring out loudspeaker systems during our travails at shows and press functions. At *Audio*, we also use these discs to separate the sleepers from the goats amongst the speakers herded in for review. This latter hurdle is a go/no go or pass/fail test where units submitted for potential review get two chances to sound acceptably good. We presently use CDs, rather than LPs, because of their ease of handling and repeatedly clean signal—the last pass is as good as the first, providing our ears are up to it. I might add that we are still searching for a truly good piano run, preferably at high level, but with enough notes to have fundamentals in the ranges of all three drivers in a three-way system. If anyone knows of such, please write to us in care of the magazine.

Though we would not pretend that the following are the only discs which might be employed for these purposes, here are some we do use:

Opus 3 Test Record 1, *Depth of Image* (CD 7900). "Labyrinth" has a very nice male vocal, "Zamponas" switches from large panpipes to conversation and produces a startling sense of space, and Bach's "Invention No. 14" has four guitars arranged in a semicircle (at least on the better speakers). We're still getting to know Test Record 3, *Dynamics*, but it promises to be useful.

RCA's *Transformer* by Lou Reed (PCD14807) is a good example of how the transcription of old masters to CD can be worthwhile. The cut we use is "Walk on the Wild Side," specifically, the part where the girls come across the studio toward the open mikes. With some speakers, it sounds as if the distance they travel is upwards of 20 feet; with others, it sounds like only about five. On one system, they seem to jump at listeners from about 10 feet out, right up to the mikes. Thanks are due Randy Patton, now of Sumo; he played me this cut on the Ti series speakers from JBL, for whom he worked at the time.

Verve's *We Get Requests* by the



Oscar Peterson Trio (810 047-2) is another example of how some of the older recordings do well in the transfer. We use the bowed and plucked bass on "You Look Good to Me" to check the low-end reproduction. It's recorded at a higher level than the piano, but it's naturally high, even though many speakers reproduce it at a lower level. One speaker seemed to fall off a cliff when bassist Ray Brown got halfway down his fingerboard.

GRP's *Mountain Dance* by Dave Grusin (GRP-D-9507) is something I first ran into on a JVC prerecorded metal tape. The master used for the CD has, I believe, had its balances altered from the running master used for the tape, but the title cut has a cymbal imaged so well I can almost count the rivets. There are some extreme transients here too, from the piano, which is very closely miked. Indeed, some say it is *too* closely miked; I can only reply that I've heard some few speakers not go CrUnCh with this input. Also, "Thanksong" has my nomination for Sweetest Piano Ever Recorded and is rivaled, in my estimation, only by the "Three Cowboy Songs" cut on Sheffield's *Discovered Again*, also by Grusin.

Female vocals are tough for speakers to reproduce without

coloration, and it amazes me how two different speakers—both good—can be so different in how they handle the ladies. The CD we use most often is Sheffield Lab's *West of Oz* by Amanda McBroom (CD-15), and then usually the "Dorothy" track. (Why *did* Dorothy leave Oz?) Two other discs of this same genre are *Silver Linings: Songs by Jerome Kern* sung by Joan Morris (Arabesque Z6515) and *Blue Skies*, with Kiri Te Kanawa and Nelson Riddle and his orchestra (London 414 666-2). These are relatively new additions to our library, but at present I think they will be permanent.

Male vocals, for some reason, are usually less difficult for speakers to reproduce, at least in my experience. We use two CDs: *Trouble in Paradise* by Randy Newman (Warner Bros. 9 23755-2), with "The Blues" being the most played track, and "Der Doppelgänger" sung by Shura Gehrman, with Nina Walker playing piano, on a Nimbus sampler (NIM 5001 1). There is a very wide dynamic range to Mr. Gehrman's voice on this recording, and some speakers go buzzy as a result.

One recording which received much attention in its LP version also deserves mention in CD: *Cantate Domino* on Proprius/AudioSource (CDP 7762), which we use less often than the others, mostly because of my musical tastes, but which is sweet and clean nonetheless.

The last disc, which fits into the The CD to Take When You Can Only Take One to the Show category, is the Denon Audio Technical CD (38C39-7147). The 99 tracks on this disc may be divided into two basic categories, music and test signals, with the latter further divided into general audio signals and special ones for CD players. There is a good variety of music, from jazz and rock to classical, with the emphasis on instrumental classical. The test signals in the basic section include tracks for channel identification, balance, and phase checks; there are white and pink noise tracks for measurement and setup. The signals in the CD test section are pretty specialized and are generally intended for measurements.

E.P.

Audible Elegance

Audio Components of Uncompromising Quality

Exclusively from Revox of Switzerland



From Switzerland, A Harmonious Blend of Elegant Styling



Only Revox can offer complete systems designed and engineered to please both the demanding audiophile and the discriminating, convenience-conscious homeowner. The front faceplates on Revox components do not trumpet unnecessary "high tech" ostentation. Such gimmickry is not needed. A few moments of listening to a Revox system will let you know that, indeed, advanced technology is at work.

Pioneering Revox technology goes beyond impeccable sonic performance. For example, advanced digital control systems developed by Revox extend remote control convenience to rooms throughout the home. The luxury of superior music reproduction with fingertip control need no longer be confined to the living room.

This leaflet gives a brief description of the Revox component line. Should you desire more information, please visit your Revox dealer and request a free copy of our 48-page full color catalog.

Revox B285 AM/FM Receiver

A symphony of sophistication and simplicity, the full-featured B285 is surprisingly easy to operate. The secret lies in the B285's two on-board microprocessors. You program the B285 to respond to your listening habits and your room environment. Set it once and, from then on, the B285 remembers all the adjustments for you.

Features include:

- Programmable input sensitivity for all input signals
- 29 AM/FM station presets
- Programmable output levels for A & B speaker terminals
- Multimode LC display
- Advanced digital synthesizer tuner section
- Infrared remote control of 9 functions
- Bi-directional data port for multi-room remote capability
- Power amplifier section with class AB output stage
- Rise time of 3 μ s and slew rate of 100 V/ μ s for superb transient response
- Exceptionally low noise for optimum CD reproduction. *B286 Tuner/Preamplifier*. No power amplifier stage; otherwise identical to the B285.

Agora B Speaker Systems

Digital sound recording challenges the limits of conventional loudspeaker design, and Revox meets this challenge with the new Agora B active speaker systems. Each Agora B enclosure contains three separate power amplifiers—one each for the bass, mid-range, and high-frequency drivers. This triamplified design delivers deep, tight bass and breathtaking high frequency transparency. • *Agora B speakers also feature:* • Active filter network instead of passive crossovers • Two bass drivers, one mounted on top of the enclosure and facing inward to eliminate even-order harmonic distortion • Feedback sensing circuit to compensate for back EMF from bass driver • High rigidity titanium dome tweeter • Bass, treble and bass blend adjustment controls.

B215 Cassette Deck

Revox has designed a cassette deck to please the most performance-conscious audio enthusiast. Yet this same cassette deck also allows a non-technical music lover to make professional-quality recordings consistently and effortlessly.

A unique microprocessor controlled system, developed by Revox engineers, automatically calibrates the B215's internal bias and equalization for the best possible performance on any tape selected.

Other B215 features include:

- Automatic or manual input level setting
- 3 heads • 4 direct drive motors • Dual capstans driven by quartz-locked Hall-effect motors
- Microprocessor spooling motor control for constant speed winding and jerk-free stops
- Azimuth stable pivoting headblock
- Dolby** B and C NR • Dolby** HX Pro headroom extension
- Elapsed time counter
- Address locate • Automatic start-of-record locate • Loop function • Automatic fade-in/fade-out
- Bi-directional serial data bus.



and Advanced Technology

B225 Compact Disc Player

Overwhelmingly acclaimed by audio critics as the reference standard CD player, the B225 makes no compromises in sonic performance or user convenience.

B225 features include:

- Oversampling (176.4 kHz) and digital filtering for superior sound resolution and optimum phase response
- Cueing time of less than 3 seconds to any point on the disc
- Pre-programming of nearly every conceivable combination of repeat, skip, pause, loop, and autostop functions
- Programming steps may use track

(selection) or time as boundaries • Dual mode LCD shows total tracks on disc, disc index, track playing, time of track, program step, as well as status of pause, loop, and autostop functions • May be operated using same infrared remote transmitter as other Revox system components.

B791 Tangential Tracking Turntable

With its patented Linatrack tonearm, the B791 provides exceptional sonic performance while rendering record damage of any kind virtually impossible.

B791 features include:

- Servo controlled linear tracking system
- Tonearm less than 1 3/4" long from pivot to stylus tip
- Hall commutated direct drive motor with quartz-locked speed control
- Variable speed control • LED display shows nominal speed and percentage of deviation in variable speed mode.

Revox Infrared Remote Control with Multi-Room Capability

Your entire Revox audio system may be controlled by a single, lightweight, palm-sized infrared remote transmitter.

With over 30 different commands at your fingertips, you can orchestrate the operation of your AM/FM receiver (or integrated amplifier and tuner), turntable, compact disc player, cassette deck, and open reel recorder.

What's more, thanks to advanced digital technology, you may now extend the convenience of remote control beyond your main listening room to the other rooms of your home. Simply place a pair of extension speakers and a B206 Remote Receiver wherever you wish to enjoy full-fidelity music. All transmitter functions are relayed instantaneously



Revox B205 Remote Transmitter

through the B206 to your Revox system. Revox multi-room remote lets you match the music to your mood, in bed or bath, by patio or pool.

Revox multi-room remote control is available in a variety of different configurations for easy installation in any home. Inquire at your Revox dealer for more information.

**Remote transmitter and receiver units optional. Some Revox components may require optional individual receiver modules.*

***Dolby and Dolby HX Pro are trademarks of Dolby Licensing Corporation.*

Our commitment to music begins here.



Producer/engineer Bob Clearmountain at the Power Station studios, New York. Clearmountain uses these 24-track Studer recorders in his work with Bruce Springsteen, Bryan Adams, Hall & Oates, and Huey Lewis and the News, among others.

When you purchase Revox audio components, you are investing in more than buttons and lights in a box. Your Revox system is the culmination of a 30 year commitment to quality music reproduction that stretches across the entire spectrum of professional and consumer audio.

Our Studer professional recorders dominate the world-class recording studio market. And Studer engineers have been prime movers in development of digital audio systems.

Our recorders and mixing consoles carry this commitment into television and radio studios. From NBC in Washington to CBS in Hollywood to KUFM in Missoula, Montana, broadcasters count on Studer Revox for reliability and superior performance.

It continues here.



On-air studio at WFMT, Chicago's classical music "superstation."

We apply the same strict standards of engineering excellence to every Revox home audio component. Because we know what it takes for quality music reproduction. After all, we were there every step of the way.

And finishes here.



Revox system with B285 Receiver, B225 Compact Disc Player, B215 Cassette Deck, Agora B Powered Speakers, B791 Turntable, and multi-room remote capability.

STUDER REVOX

Studer Revox America

1425 Elm Hill Pike/Nashville, TN 37212/(615) 254-5651

FORDING AHEAD



The Ford/JBL system



The Ford Premium system

Motown Sound

When I provided a technical description of the Ford/JBL sound system back in November of last year, I didn't say too much about the sound because I hadn't yet had a chance to hear it on the road. Now I've had that chance, and a chance to compare it to another Ford sound system, called the Premium.

First, the human-engineering aspects: On the Ford/JBL system, which I tested in a Lincoln Continental, the tuning controls cover all the bases, but the number of presets (Detroit's standard four AM plus four FM) struck me as skimpy, especially for a luxury car. The bass, treble, balance, and fader controls have pointers so you can read their positions by touch, but they and the volume control are too close together and too similar in size. It would have been better if the volume knob were a bit larger and spaced off slightly from the others, and if the bass and treble knobs were somewhat farther from the fader and balance controls. The control legends are offset to the right of each knob—except for one legend, "Speakers," which bridges the gap between the fader and balance knobs.

An LED shows when the AMS (Automatic Music Sensor) is on, and an indicator on the dial display lights up when you switch on the Dolby B NR circuit. However, there's no indication of when DNR is on or off—and DNR does audibly affect the treble of wide-range material. Tape equalization is selected automatically, which I like in car systems. The night illumination is basically good.

The Ford Premium system I used was in a new Ford Taurus. The

Premium has more speakers than Ford's standard sound systems (not just in the doors and rear deck, but also in the dash), and it has a separate amplifier. It lacks two features I liked on the Ford/JBL system (DNR and scan tuning) but adds a local/distant switch and has more presets (six AM, 12 FM), a better placed tuning knob, and even better night illumination.

Neither head units have automatic tape ejection when the ignition or their power switches are turned off, turns on automatically when a tape is inserted, nor has separate memory switches. To memorize a station, you push the button down for a few seconds, until the sound cuts out, and then back in again. On the Ford Premium system, I had to hold the station preset buttons nearly as long to recall a memorized station as to memorize a new one.

The Continental has a power antenna, controlled by a separate switch some distance from the radio. On a car bristling with automatic circuits, the omission of an automatic antenna switch keyed to the radio struck me as absurd. The Ford Taurus has a fixed antenna.

Both systems performed well. The Ford/JBL in the Continental had only so-so multipath resistance but exhibited no wow and flutter on rough roads. There was some picket fencing; the transition between mono and stereo was too abrupt and perhaps was set at too high a signal level.

The Ford/JBL's upper bass can get loud enough to make most rock fans happy, and the lower bass goes down low enough to induce some mild (and pleasant) gut flutter on

organ pedal tones, but that low bass becomes less audible on the road, where low-frequency road noise competes with it. The very lowest string-bass tones on my test tape could not be heard at all—it would take a subwoofer to make them audible. Our Editor, Eugene Pitts, thought he heard a dip somewhere in the region of 80 to 150 Hz.

At the high end, the Ford/JBL system made triangles ring with a pleasant metallic character, though I've heard them sound a hair more silvery. Voices, especially familiar ones, were noticeably but not objectionably altered, making the words clearer but the sound a bit less musical.

Because of the overall bass boost, I had to turn the bass down slightly and the treble up a bit for most program material, to about the 11 o'clock and one o'clock positions, respectively. But on other material, I had to set the controls back to flat. Both Gene Pitts and I felt that the tone-control hinge points might have been set at the wrong frequencies.

Imaging was reasonably good for a car-stereo system, though some cuts (such as the "Bach Invention" dubbed from Opus 3's Test Record No. 1, *Depth of Image*) were noticeably flattened, with instruments pushed into the speaker locations. To get a good stereo blend, I had to fade in a bit of the rear speakers (I set the controls at 75% front, 25% rear); this very occasionally caused some high-frequency sounds to originate from behind the listener.

The Ford Premium system had less bass and a different overall balance—I sometimes found myself moving the bass setting up to one o'clock and the treble down to 11 o'clock, instead of the other way 'round, but I mostly left the controls flat. Stereo imaging was not as good as the Ford/JBL's, but still far better than I usually hear in cars; I heard stereo which seemed to originate from dead ahead of me rather than from the middle of the car, but I had to dial in a bit more rear speaker to get it.

On AM, the Ford/JBL system had an over-plummy sound, like a telephone with bass boost. The Ford Premium may have had more treble,

The reverse charge from misconnected booster cables brought violent death to one of my car's amplifiers and damaged the voltage regulator.

and certainly it had less bass, for a more natural balance.

My wife, who is rapidly becoming an audiophile, volunteered that the Ford/JBL had a "very pleasant, full sound, but not a really authentic one. It always seems like you're listening to a sound system." Of the Ford Premium, she said, "It sounds even more like a sound system—not as rich, not as spacious. But still good."

The Ford Premium system in the Taurus costs \$295 more than the radio that normally comes with the car; if you order a Taurus without any radio, you save \$196, making \$491 the real price of the Premium system in the Taurus. You can't buy a Continental without stereo; it normally comes with a Premium system somewhat like the Taurus', and the Ford/JBL system costs an additional \$506. If the Premium systems in the two cars have the same real cost, then the actual price of the Ford/JBL system is about \$1,000. All these prices include installation, which makes them pretty competitive with custom systems of equal quality.

You can do better than even the Ford/JBL system, of course, but you'd have to spend more money to do it. I hope to have an example for you in a month or two.

Reverse Samaritan

My car stalled in traffic recently—dead battery (since replaced). Most drivers honked impatiently as if I'd done it on purpose, then swerved around me with no particular interest in helping a fellow motorist in distress. But once the next red light had clotted up the traffic again, the owner of a battered van (note how new-car owners never stop and help?) responded to my wildly waving booster cables by pulling up next to me, opening his hood, and clipping my cables to his battery.

I popped back into my car for a quick re-start. Then I noticed sparks from under his hood—he'd hooked up his end backwards. I flew out of the car, grabbed and reversed the cables, and got my car started again.

Since my battery was low, I didn't play my stereo that day, and didn't use the car for a few weeks. So it was quite a while before I noticed that only one end of my car was making music. One amplifier had died—and it was a violent death, which surprised Tony Igel, who's now working on my sound system. "I've seen cracked resistors before, but the ones in that amp *popped*, until nothing was left but the lead-in wires," he said. At first, he couldn't account for it. Then I

remembered the reverse charge; it came to mind when I found my voltage regulator damaged too.

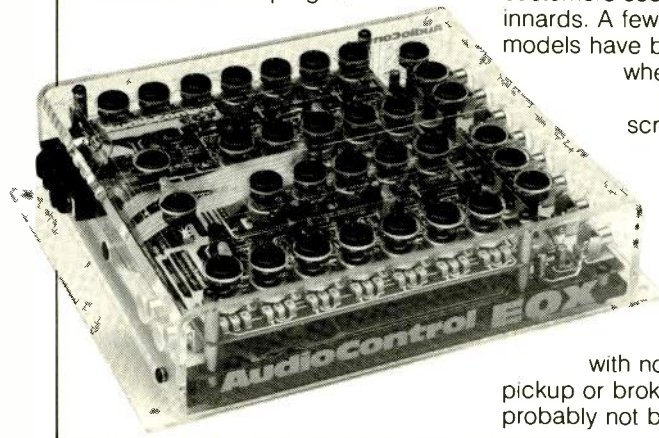
When I'm not flustered by a sea of honking horns, I always handle—or at least oversee—my booster cables for myself. Had I done that, I'd probably have avoided the mistake my Samaritan made, and would certainly have taken the cables off quicker if I *had* made it. (In all fairness, some yoyo had wired the van so both its cables were red!)

I'd also have hooked up the cables in the proper order. Safety experts say you should first hook up the hot (+) lead to the car being charged, then connect both leads to the car doing the charging, then hook the negative (-) lead to the car being charged—and not to the battery but to some grounded point a slight distance away. This lowers the chance of the connection spark setting off hydrogen fumes.

In the present case, I'd run a small risk of a fire or explosion, and blown my regulator and an amp (not to mention losing my cable), all because I was spooked by embarrassment and by concern for the maddened motorists behind me. Their horn blasts showed how much concern they had for me.

Perfectly Clear

The metal case that normally surrounds Audio Control's EQX car equalizer is deliberately bland and uninteresting to discourage tinkering by those without the instruments and facilities to set it up right.



This, alas, makes it rather dull to look at on the sales floor. To give the product visual sex appeal, the company made up a few samples with transparent plastic covers for showroom use, thus letting customers see and admire the EQX's innards. A few of the plexi-cased models have been used in show cars, where looks count for more than plastic's inability to screen out electrical noise.

You guessed it:

Now some car stereophiles are trying to get transparent EQXs for their cars too.

They can—but for about \$100 extra, with no warranty against noise pickup or broken cases. Showoffs will probably not be deterred.

Double Threat

Dual cassette drives have found their way into double-well decks, rack systems, portable systems, and even pocket-sized tape players. So why not into the car as well? The Nippon CAR6060 has an analog AM/FM tuner plus a dual-cassette system, one side of which can record as well as play tapes. Using a hand-held microphone (included), you can dictate into the latter as you roll along, or use both drives together to dub as you drive. This little wonder was apparently made to sell for \$299, but for some reason failed to sell at that price. So it's now available from COMB, a liquidation house, for \$99. Ordinarily, I don't include dealer information in a "Roadsigns" item, but since you're not likely to find this in your neighborhood, COMB's number is (800) 328-0609.

DESIGNED BETTER TO SOUND BETTER



THE CR TICS AGREE:

HI FI CHOICE "Best Buys"
RA820, RA820BX, RA870,
RE870

WHAT HI FI? Awards winner
1985, RA840BX

WHAT HI FI? (RA820BX)
"Rotel have provided hi-fi
enthusiasts and the casual
buyer alike with an amplifier
to take your breath away. A
very deserving award winner
(best amplifier, 1986)."

HI FI FOR PLEASURE calls
RA820BX "a remarkable
little amplifier which shows
the competition a clean pair
of heels. It's a gem that can
only further enhance Rotel's
reputation." Their verdict on
the RP850 turntable? "Rotel
has pulled the rug from
under the competition with a
good sounding turntable-
arm combination offering
splendid value for the
money."

STEREO REVIEW sums up
their test of RA870/FB870
(branded): "We cannot recall
seeing any other integrated
amplifier that can match its
distinctly above-average
power-output capacity."

AUDIO MAGAZINE:
"Anyone, even the most
judgemental of golden-ears,
should find the sound
reproduction quality of the
RC870 (Pre-amp) to be
beyond reproach."

GFAND PRIX AWARD 1986
Hi-Fi Product Of The Year:
RA820BX Amplifier
WHAT HI-FI? Magazine

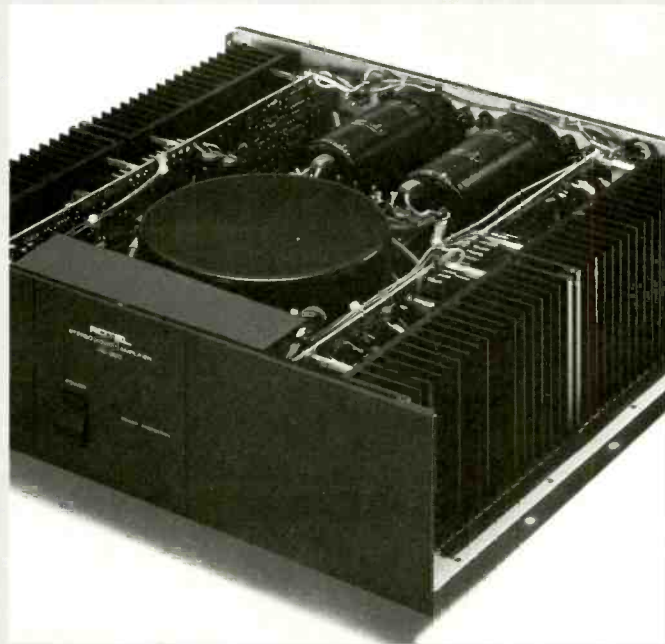
Find out what the
excitement is about. It's as
easy as visiting your local
Rotel dealer for a
demonstration.

ROTEL *hi-fi*

ROTEL *hi-fi*

The Smart Choice in High-Performance High Fidelity

Rotel hi-fi is an overnight success which was twenty five years in the making. Founded in 1961 as an OEM manufacturer building hi-fi equipment for many of the big names of the day, Rotel has today taken its rightful place among those respected brand names with a top-quality line of high-performance audio components designed for the serious audio enthusiast.



"After our experience with the RB880, we can better appreciate why Rotel products enjoy favour among demanding high-end audiophiles. If the RB880 is a typical example of the company's products, the reputation is well deserved."

Stereo Review April, 1986

Twenty-five years' experience manufacturing audio components shows: since its introduction, the Rotel hi-fi line has won an overwhelming number of awards and accolades from the international audio press, culminating in the selection of the RA820BX amplifier as Hi-Fi Product of the Year (1986) in the prestigious **What Hi-Fi** Awards.

Such immediate acclaim and impact on the marketplace is virtually unheard-of. It is an indication that Rotel's performance-oriented design philosophy is precisely right for today's discerning audio enthusiast.

The Rotel line is designed in Britain to suit that very demanding, purist market. The United Kingdom has spawned some of the audio industry's most famous names — product lines which have led the way in advancing the state of the audio engineering art and science. Today Rotel hi-fi is one of the most successful, sought-after and valued names in the British audio market, and has earned the respect of knowledgeable audio enthusiasts in Europe and America as well.

Critically-Acclaimed Amplifiers

The first components designed to Rotel's very high performance standards were the superb amplifiers. Rotel amplifiers are available in a variety of configurations: power amplifiers (bridgeable for triple the power in monaural mode), pre-amps of the highest quality and refined performance, and integrated amplifiers combining the technology of the separates onto a single chassis for great cost-efficiency.

Each model has since come to be regarded as a performance leader in its price range, easily out-performing even amplifiers costing considerably more.

Technically Speaking

At the heart of each Rotel amplifier is the high-voltage, high-current design. In simplest possible terms, this means Rotel amplifiers will sound much more powerful when driving real loudspeakers than conventional amplifiers of comparable rated power.

Amplifier power ratings are measured under strictly-controlled laboratory conditions, with the amplifier driving a steady-state 8-ohm resistor at a continuous power level. Once connected to loudspeakers and reproducing music, however, the amplifier faces a completely different set of performance conditions:

All loudspeakers are reactive, presenting the amplifier with an impedance which fluctuates as frequency changes, requiring up to twice the power for the same volume level. Similarly, musical transients (short-term "peaks" such as a kick-drum note) may double or triple the power demand for a short period of time. High-voltage and high-current capability are required to cope with these conditions.

Rotel amplifiers are designed to easily handle these real-world demands. Such technical refinements as large power supplies and doubled or tripled output devices give Rotel amplifiers huge power reserves, great control on complex musical passages, and the ability to drive even difficult loudspeaker loads. The difference in performance quality will be truly appreciated with today's advanced digital recordings whose extended dynamic range puts tremendous demand on the amplifier.

MODEL	POWER OUTPUT			PEAK CURRENT
	8 Ohms	4 Ohms	2 Ohms	
RA820BX Integrated Amp (rated 25 W/channel)	52 watts	92 watts	156 watts	20 amps
RA840BX Integrated Amp (rated 40 W/channel)	95 watts	171 watts	256 watts	29 amps
RA870 Integrated Amp RB870 Power Amp (rated 60 W/channel)	100 watts	180 watts	292 watts	30 amps
RB880 Power Amp (rated 100 W/channel)	144 watts	262 watts	362 watts	60 amps
Conventional Amp (rated 60 W/channel)	84 watts	49 watts	25 watts	3.6 amps

Specially-Selected Components

Early in the design process it was determined that design and manufacturing dollars would be spent on those components which directly affect sound quality. For that reason, all electrical components such as resistors, capacitors and transistors are sourced from Europe's finest suppliers and hand-selected to a 1% tolerance for critical circuits (20% tolerances — that is, deviations from stated electrical values — are not uncommon in audio components manufacture). Such attention to close tolerances ensures that all circuits will perform precisely as intended by the design engineer. In addition, components are selected for the lowest possible noise levels, ensuring extremely quiet operation.

Straight-Line Design

Even the world's finest components are necessarily imperfect conductors. As a result, all Rotel amplifiers, tuners and receivers typify a straight-line design approach, eliminating all components from the signal path which are not strictly necessary for performance. This straight-line design is seen most graphically in the removal of "features" and controls which make no contribution to sound quality. It is also evident in direct loudspeaker connections and the absence of conventional protection circuits.

In strictly technical terms, this straight-line design eliminates the potential for phase shift, distortion and signal-loss. In terms of your listening enjoyment, it means a very low noise threshold, improved resolution of low-level details and the most natural, accurate sound reproduction.

System-Building with Rotel hi-fi



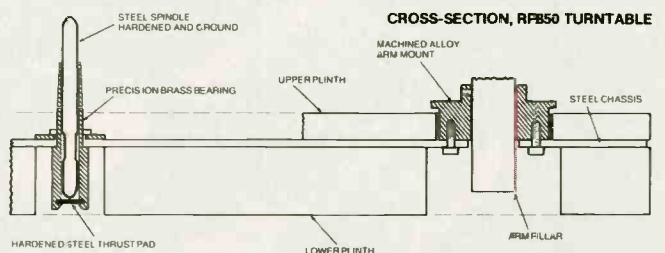
"Put simply, the Rotel sounded full, clear, detailed and very dynamic. More than any of the others, the RPE30 sounds like an expensive deck."

What Hi-Fi? Turntable Super-test.

Rotel hi-fi is a complete line, including tuners, receivers, compact disc players, cassette decks and turntables, all designed and manufactured to the very

high standards set by the Rotel amplifiers. The emphasis on pure, performance-oriented engineering has been the guiding principle in the design of every component in the line. Whether you choose to build a complete Rotel system or upgrade your current system with one or two Rotel components, you are assured of truly outstanding sound reproduction quality.

Rotel's quiet, accurate and supremely musical turntables, for example, illustrate the exhaustive attention to detail which is an integral part of every Rotel design: details like an arm-mount pillar precision machined from a solid piece of aluminum refined specifically to Rotel's high standards; details like a platter mat made of energy-absorbing Norselex, and details like silicone-filled feet to isolate the turntable from external vibrations.



The Balanced Design Concept

In the design of a high fidelity sound system, as in the selection of a high fidelity sound system, it is ultimately the weakest link in the chain, not the strongest, which sets the limit to the performance achieved.

In recognition of this fact, no single aspect of a Rotel component's design is considered paramount. Instead, each model is engineered for performance quality which is consistently high in all its aspects.

Similarly, all Rotel components are designed to complement each other in terms of sound quality and performance. This consistency has been repeatedly recognised in the selection of complete Rotel systems as top performers in their field by the British audio press. With Rotel hi-fi, the weak links simply do not exist.

Bringing You Back to What It's All About: MUSIC

In the final analysis, of course, the only criterion which truly matters in the design and selection of any audio component is its ability to reproduce music naturally, accurately and convincingly. While some "hi-fi" companies appear to have lost sight of this fact, we remember that you purchase audio components to enjoy your music to the fullest, not to read specifications. This is why the listening room remains our most important laboratory.

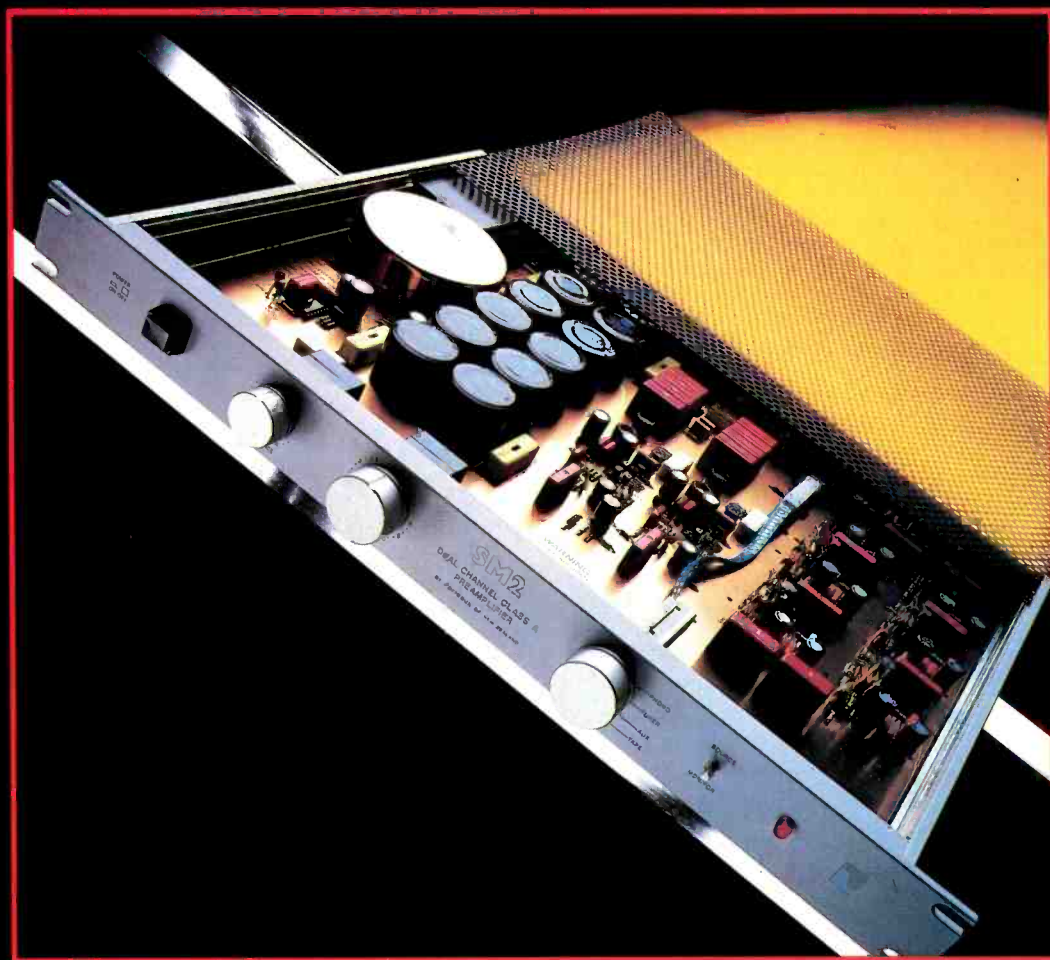
We invite you to put Rotel high fidelity components to the test. Visit your local Rotel authorized retailer with your favourite records or compact discs and listen to the music. A simple listening test is the best way to find out why Rotel hi-fi is the smart choice in high-performance high fidelity.

Designed in Britain, Enjoyed World-Wide

Perreaux: The art of reproducing art.

Perreaux audio components are handcrafted to serve the art of music. Their reproduction of music is the finest available. The meticulous attention to detail—from the hand selection and matching of transistors to the corrosion proof and high

conductivity 24 karat gold plated circuit board—preserves every detail of the original musical event. The creation of each limited production Perreaux audio component is an art in itself. A tribute to the senses of sight and feel.



In a vote of audio critics and retailers, Perreaux was awarded the Hi Fi Grand Prix for "its Mercedes-like construction."

Audio/Video Magazine, USA

"The Perreaux has the talent for making music become a physical entity within the room."

Hi Fi For Pleasure Magazine, England

"... the synthesis of all you could demand, perfectly accomplished."

Stereo Magazine, Germany

"Peter Perreaux's masterpiece is as smooth and velvety in sound as its graceful front panel is in finish."

Hi Fi & Elektronik Magazine, Denmark

"Perreaux electronics have all the appearance and finish of the finest Swiss machinery."

Revue du Son Magazine, France

"... due to Perreaux's verifiable quality, it is likely to be the best value purchase in audio."

Son Hi Fi Magazine, Canada

The best audio investment in the world... Perreaux amplifiers have a built in 80% trade-in value.*

An interview with Anthony Federici,
Director of Perreaux International

Q. Why do Perreaux components have such a high trade-in value?

The trade-in value of Perreaux components have always been far higher than average. This is probably due to several factors: Engineering that is at the leading edge of technology... hand crafted, limited production... simple, elegant, non-trendy styling...

and exceptional value when new. To further increase trade-in value, Perreaux is now giving a one-year limited parts and labor warranty on pre-owned Series 2 that is traded toward Series 3.

Q. How long do you anticipate that Perreaux will retain this exceptional trade-in value?

Probably indefinitely, because the resale value is intrinsic to the product. Given Perreaux's reliability and longevity, a 1-year warranty on pre-owned equipment is not an expensive commitment for the

factory. In other words, the trade-in "deal" simply reflects the real world value of Perreaux. I would expect both new and used Perreaux's to continue to retain the world's highest trade-in value.

Q. Why do you believe people will pay as much or more for a used Perreaux as for a new product from another manufacturer?

Because they are already doing so with Perreaux. A used Porsche or Mercedes costs more than many

new cars. However, because essentially there are no mechanical parts, it won't deteriorate like a car.

Q. Will this lead the way for audio components other than Perreaux to increase their trade-in value?

I hope so. Because it will allow more people to enjoy quality audio. As an example: The new Perreaux Series 1 system, consisting of a tuner, preamp and power amp, retails for about \$2000. I would expect it to retain about a \$1500 trade-in

value toward a new Perreaux. This means that the consumer will have been enjoying Perreaux quality and performance for about \$500. That's only the cost of a moderate receiver.

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PARENTS OF THE LOST ARK



After only three months, I must hastily return to my whiskered friend who bought a camcorder to make home videos and invited me to his party the day after he acquired it (see "Audio ETC," March '86).

This man is not young, but he has the energy of a man of 20. Since I last wrote, that big camcorder has already been hauled all over New York City and, believe it or no, to Mexico. I have seen—and heard—some of the results. I am glad to report that the video aspect of these new home movies continues to blossom and my friend to exploit it with ever more ingenuity. He is canny. I think he has a sense, at least in the video area, as to what is good, just as some of us do with our still cameras. He is learning, as predicted. But it is sad to note that, with one big exception, the audio as I hear it (or do not hear it) is getting nowhere fast. I saw lots of pretty Mexico; I heard nothing but faint, distant, unintelligible voices off somewhere. And so it goes—with that one exception. So much superb audio equipment at hand here, in the newer cameras, in the new VCRs, and *what* are we doing with it? Not much. We just let the sound roll, as it will, and take pretty pictures.

The one enormous exception to an audio that mostly does nothing at all came in a classic, ever-expanding area that is as inexhaustible as the human species—babies! And parents. Millions and millions of baby pictures in full color, fuzzy in print form, better (but less popular) in slides, are taken every day. Minus sound. And quite a few home audio tapes are made too, on every sort and size of cassette recorder. Minus picture. The *combination* of these two in video format is, shall I say, potentially explosive. That's what I think, after having seen it, again via my busy friend, who did all the work.

He is not, really, an amateur-at-large, though he was surely a beginner in the use of a camcorder as described in March. How could he be otherwise? But he knows what he wants. Days after he bought that equipment, he put out an ad offering his studio (that is, his apartment) for video pictures at \$50 an hour, videocassette included. It's my guess that what he *really* wanted was something to take pictures of, to experiment on—some subject matter. And I think he had a good idea of what might show up. Presto, a young couple with baby, plus a couple of ancillary hangers-on,

came right downstairs from higher up in his building and signed for a video hour, sound *and* sight. Young, and photogenic too. How could he do better? I have to admire the guy.

Gently mix a bland liquid, glycerine, with nitric acid and sulphuric acid, and you have another liquid, looking just as innocent, which will blow up if you so much as tickle it. Nitroglycerine, the basis of dynamite. That's what we have here in audio/video terms. Just combine the ingredients.

On the one hand, you have baby's first visibly toothless grin and drool, or maybe those epochal first steps, with visibly delighted adults beaming all around. Just lovely for those who are near and dear, but sometimes too much of a muchness if you are not quite *that* close. I speak, of course, firsthand. I am subject not merely to vast quantities of family photos but those of most of my older friends, whose grandchildren populate the world. I've seen 'em all. (I am not totally hard-boiled: Two lovely pictures of my Irish niece with baby, and her English husband with their second baby, are thumbtacked to my wall. Very nice.)

On the other hand, babies (and parents) in audio, minus pictures, are of very limited value, hi-fi or not. I should know. In palmier days I once made a long, super hi-fi audio tape of my first nephew. It went on and on—the great new feature at the time—via an Ampex or such, in impeccably first-class sound. Pioneer baby recording! I was proud of it. Babies are cute to look at, but, really, their audio is not of the best. Years later I played that tape to the same nephew, now grown up. What an anticlimax. He was merely embarrassed and disgusted. One does not play baby tapes to the same baby until he or she is at least 65 years of age. Baby's first argh-gargle-gargle is the way I put it. That's what you hear. Plus the ecstatic cooings and coochy-coochy sounds of the fond parents. Good sound only makes things worse. When my brother walked into the room, on the above playing, he merely said, "What's *that*?" and walked out again. He didn't notice that the grown-up voice doing all the cooing was his own. (He can't recognize his own mother in a recording I made, either, nor his father.) Isn't audio wonderful? So there's

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Two groups, one a live audience and the other recorded but very real, can happily merge in a useful if limited way.

the fate of baby's first audio, minus the picture. Throw it out, and the sooner the better.

When I saw my friend's baby videotape, or, say, around half of it (I think they went on into a second hour), things went *bang*. Nitroglycerine. I was astonished, entertained, pleased—even though these were total strangers. It was quite charming, even if it went on and on, and definitely something I had never imagined before in recording and reproduction of sound or sight.

Unrehearsed? Of course. Amateurs? Of course, though the mother might have been a model and all the other young folks were good looking too. As the minutes wore on—and on—I found that for the first time the endless expanse of recording was a positive thing and wholly new. These people just sat, or stood. No special arrangement, no script, no nothing. For a few moments, things were self-conscious and a bit uncomfortable, and the baby tended to hide behind Mama with a finger in her mouth. But time does march on, and after a while everybody began to relax; how long can you be uncomfortable? Not *that* long. Desultory conversation sprang up, not of any importance, not always intelligible, but natural enough. There were long silences, not at all uncomfortable. Baby began to come forward. The mother was on one side, father on the other; that calls for action among babies. Papa played games with baby on his shoulder, swinging her around casually, the familiar way of good papas. Then baby reached toward Mama, and crawled across. Delighted chirps and gurgles, much better than on any old "blind" tape. And finally, after about a dozen crossings back and forth (do babies ever get tired of such things?), the miracle happened. Right on camera, that baby took its first unaided steps. Wow! You don't get that in old-time short movies. Not the first, of course, but about 15 minutes worth of further first steps. Baby caught on, fast. By that time, honestly, I was one of that family, whose names I did not even know.

If the recording parameters are *right*—right for the picture, right for the audio—this kind of a long, long scene is practically self-generating. Just let it

go. And go some more. Not that a large audience would want to view at such length! This is still the old, traditional baby scene, for parents and others they can bulldoze into paying attention, not to mention aunts and uncles and neighbors. But for a while, maybe 10 or 15 minutes, almost anybody could find it pleasing. And if the audience starts its own desultory conversations while the video plays (they will, they will), then—again, if the thing is rightly done—the two groups, "live" and on videotape, will shortly seem to merge, and the celebrated baby is not in the least disturbed. Quite a fine thought; my imagination soars. How to combine two family gatherings at a distance, like the remotes that allow conversation between TV newscasters far apart? No, you can't do a give-and-take of that sort. But two groups, one a live audience, the other recorded but very real, can indeed happily merge in a useful if limited way.

So you see why I think the baby boom, plus all other and similar family affairs, babies or no, is about to come upon us in home-video terms. I do regret the (temporary) disappearance of the outdoor scenic picture, in favor of all this indoor stuff, but I bow to the inevitable. Me, I'll be out there taking stereo color slides again, of landscapes, mind you, and cats and dogs and horses as often as babies. (I got one marvelous, accidental 3-D shot of a baleful, yellow-eyed cat glaring at me from underneath a parked car in France. I never even noticed it as I took the picture.) The rest of you will be safely indoors wielding your video, and more audio/video power to you. Especially audio.

But how did this videotape get taken, in that same big apartment as described in March? The differences between this and my friend's first efforts are instructive. First, instead of a large, noisy crowd of party people, shouting over their eats and drinks, plus loud background music from the hi-fi speakers, there was this time only a handful of people, including baby, and no background noise in the apartment nor from outside (maybe it was Sunday morning). And the camera was now moved way forward, there being no impeding bodies, carrying its built-in

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What improved this video over the cameraman's first effort? There wasn't any background noise, and the camera with built-in mike was close up.

mike (which I have found is *not* removable, a terrible mistake) right up front, relatively close. The sound was still a bit off-mike, but the pictures made up for it as in professional TV (where the voices, minus picture, often sound surprisingly tinny). Thus the sound was good and natural as one watched—

including the baby. Indeed, it was a fine 50/50 proposition, a balance between audio and video such as we *must* have for good results.

If you want good sound, any sound at all, *do not* use the camera zoom to bring things up close! Not, at least, until someone takes up my idea of a

built-in and synchronized sound-zoom microphone which can change the sound pickup as the zoom changes the picture, automatically. Then you can zoom close and your sound will also be close. (Not only the mike pick-up pattern but the volume level would have to be synchronized, come to think of it, before feeding the overall automatic gain ride. Unless, of course, the gain ride could cope with the differences on its own. More R&D—we would have to find out.)

A few words, in contrast, about my friend's videos of Mexico. On a raw winter evening in New York, the big monitor suddenly spread out the blue, blue Mexican sea, all gentle wavelets (with, alas, color fringes) and piled-up white clouds above (the same). Such an idyllic scene! We gasped with pleasure—for about four minutes. We heard extremely faint occasional sounds of distant voices in the background, otherwise no audio. Just wavelets and a moderately distant shoreline, with white buildings discernible. We were anchored in a hired motor launch, a ways off shore. Ten minutes later, the same. Fifteen minutes, still the same. Ugh. Blue waves ad infinitum? Not very good video.

Then suddenly the cameraman (same old Mr. Whiskers) bethought himself and jumped into action. We had been sitting, motionless, in a hired boat, the bored local launchman ensconced in the rear at the tiller. Now we were seen to move in towards shore, at speed. The buildings loomed up closer, and the camera roved back and forth for some interesting views—houses, hotels, beach establishments, tropical foliage in green. We dashed sidewise along the shore at full speed, then turned and dashed back again. A fine picture! Lots to look at, even people along the beach and docks. But the sound? Nothing changed. What about the launch motor, which must have been pretty loud? It was silent. Yet the traces of audio were still there, distant voices and such.

You see, audibly we had never moved an inch. The motor did not stir. All that traveling was done with the zoom lens from a motionless deck. Clever, but the whole thing might as well have been a silent film. Give me babies, *audible* babies, any day. **A**



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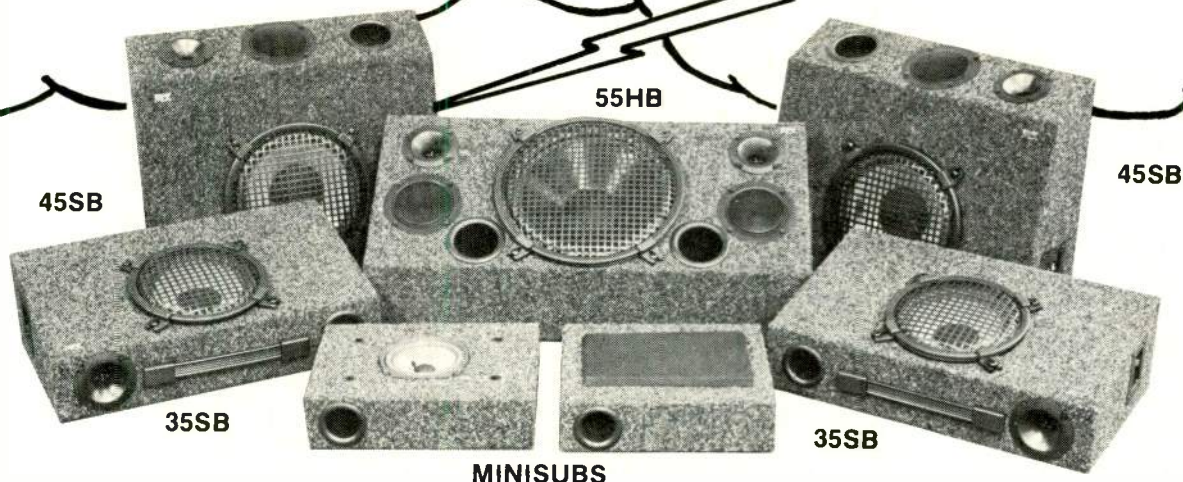
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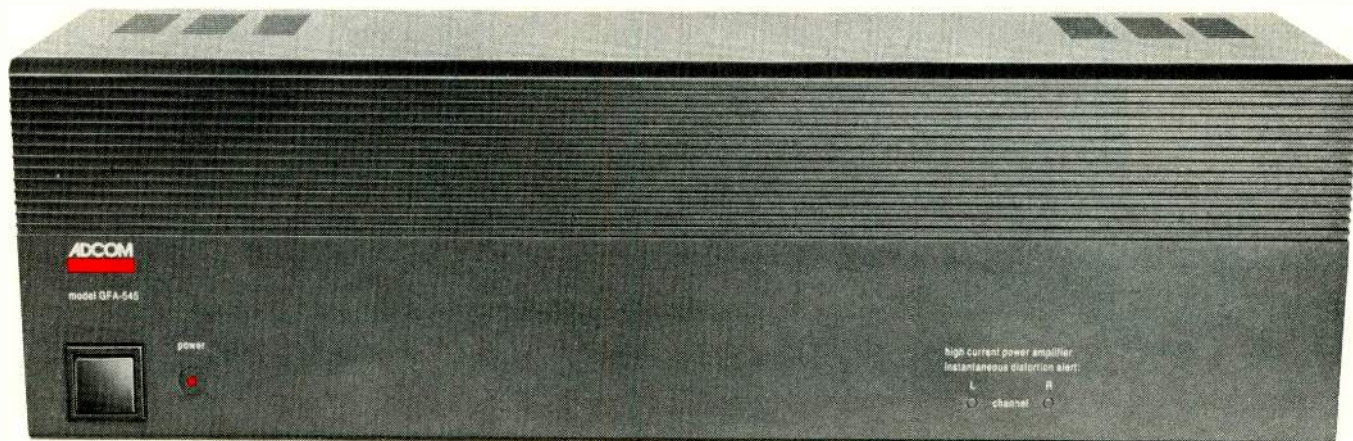
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A NOVICE APPROACH



The New Sound of Stereo by Ivan Berger and Hans Fantel. New American Library, paperback, 265 pp., \$12.95.

In *The New Sound of Stereo*, Ivan Berger and Hans Fantel have gathered together all of the knowledge that first-time hi-fi buyers need. Armed with such wisdom, beginners should be able to go bravely forth into the shops, avoid most of the pitfalls, take home a good-sounding system and perhaps even save some money. But the book goes farther than that, covering topics such as how to place speakers in a listening room, how to plan for future upgrades, and how to shop later for additional components that will extend the basic system. Berger and Fantel also discuss how to integrate video sound into an audio system.

No, you won't find detailed explanations of Thiele/Small parameters, nor probing surveys of exotic speaker cables. What's here is just the basics, straight from the shoulder. Still, even experienced audiophiles might find some of the information useful. Have you forgotten what a dBW or a femtowatt is, or how to trouble-shoot a system to find the component that needs repair?

This book truly delivers on its promise to be jargon-free. To explain the technical concepts behind audio in clear, easy-to-understand English is

not always easy to do, but Berger and Fantel succeed wonderfully. A glossary would be a nice addition to the second edition. However, terms are well defined in the text, and the well-organized index points to them clearly.

Another strong point is the book's emphasis on listening. Understanding technology is one thing, but knowing what it means in actual sound is quite another. Berger and Fantel encourage readers to trust what their ears are telling them, and offer guidelines about listening to hi-fi gear. Frequently, they raise the beginner's objection: "My ears are untrained, so my perceptions are not worthwhile," and beat it back by saying that you'll learn to recognize your new system's virtues *and* its vices after you buy it, so why not acquire some listening skills first, to minimize those vices?

Always, their advice is tempered with common sense. In discussing how to listen to speakers, the authors urge you to listen to the bass, but also point out that too much bass reveals a defect in the design. A powerful amplifier is desirable, but too much power can be a waste of money; of course, too little power leads to other kinds of problems. They quickly debunk the beginner's notion that a speaker with more drivers in the cabinet is always better than one with fewer drivers—even to the point of extolling the virtues of the theoretically ideal one-way system. Unfortunately, despite giving much attention to left-right speaker imaging, they neglect depth of image, which is one of the really interesting ways speakers differ from each other.

In the chapter on cartridges, Berger and Fantel cover all the principal topics, including stylus geometries, tracking, and groove structure. With dry humor, while discussing compliance, they appear to explain the units of measurement, but actually do not: "Compliance is usually expressed by a measurement such as 10^{-6} dynes/centimeter" (or pascals per millinewton, which amounts to the same thing)." In other words, don't worry about the strange units of measurement; what a beginner needs to know is whether a low or a high number is better, and why. Berger and Fantel don't explain why cartridges affect the sound of a system as much as speak-

ers do. Early in the book they allude to the idea that transducers have the greatest effect on the sound of a system. But they don't nail it down and advise the consumer to shop for a cartridge as carefully as for a speaker.

The authors observe that open-reel tape recorders are better than cassette recorders. Clearly, this is more or less true, but I've seen too many consumers who were misled by this oversimplification. A low-end open-reel machine is not necessarily capable of making better sounding tapes than a sophisticated cassette deck at the same price. They talk extensively about transports, but don't describe how they affect the sound quality. However, I like their orderly discussion of tape types and noise-reduction systems.

Probably, not many readers of *Audio* will think they need this book. After all, it's "just" basic hi-fi information. But we all have friends who pester us with questions. For them, we should keep a copy of *The New Sound of Stereo* handy. Then we can peek at it in the middle of the night to answer our own questions. Don't let its simple, straightforward language fool you; the book is a handy reference that belongs on every audiophile's shelf. *Steve Birchall*

San Francisco Nights by Gene Sculatti and Davin Seay. St. Martin's Press, paperback, 192 pp., \$12.95.

In the mid-'60s, as a few brave souls began trading in their acoustic guitars for electrics, something strange was happening in the already progressive San Francisco Bay area. A new sound, an amalgam of folk, bluegrass, raga, Bach and jug band music, was incubating in garages, back rooms and basements of Victorian houses. It would soon rush headlong into a realm ruled at the time by spike-heeled girl groups, squeaky-clean folk duos and trios, bleached-blond surf stylists and a handful of toned-down black singers.

The authors of *San Francisco Nights* set the stage for the psychedelic explosion by briefly reviewing the city's early days as a gold-rush boomtown and beatnik haven. They then plunge into the swirling musical waters. While raising the idea that the psychedelic era was ushered in when the pent-up energy of the '50s was dosed with

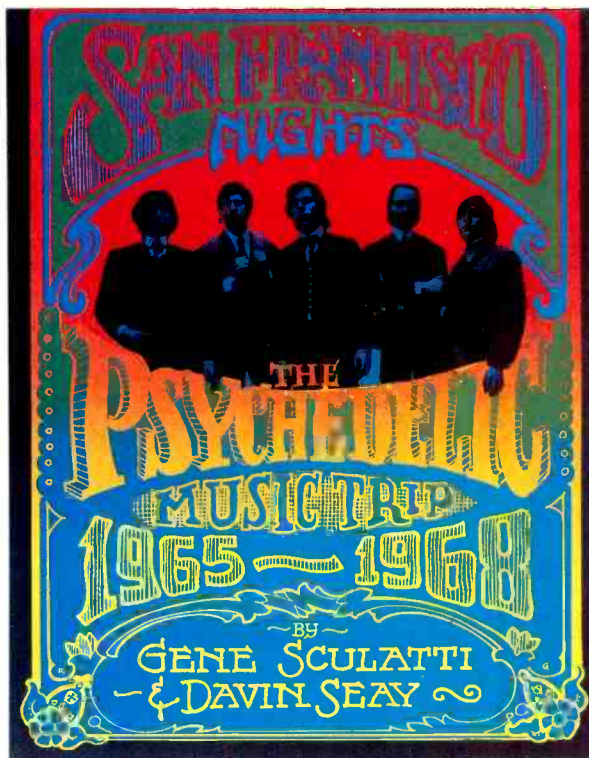
San Francisco Nights traces the commercial, personal, and spiritual aspects of the city's psychedelic era with a charming exuberance.

mind-altering drugs, the authors maintain that the scene was created by people who had nothing better to do. Boardwalks, rather than board rooms, sheltered the creative energy which blossomed in the four years covered by the book.

In a style of reportage that lacks chronological cohesiveness, but compensates with a charming exuberance of tone, the authors trace the histories of prototypical groups such as The Beau Brummels and The Charlatans, survivors like The Grateful Dead and Jefferson Airplane, and transplants such as Janis Joplin and Steve Miller. There are also various flashes in the pan, and groups who—like Only Alternative and His Other Possibilities—were too unstable even to record a whole album. Profusely illustrated with publicity photos and snapshots of the era's movers and shakers, *SF Nights* also provides a scenic side trip into the advertising world of the time. Many concert posters are reproduced, as well as laughable attempts by record companies to promote their psychedelic artists with band-member look-alike contests and ads lamed by stereotypical jargon.

Concert promotion, however, in the early days of the Fillmore and Avalon ballrooms, was more like throwing a big party. Hardheaded opportunism was blotted out by sheer romance—promoters such as the Family Dog organization exhausted their budgets on framable posters, light shows, party favors, fruit, and prizes such as talking mynah birds. To ensure good attendance at their shows in the spring of 1966, the Fillmore promoters would phone every one of hundreds of people in their personal phone books to get the word out.

The authors report that most artists and organizers shied away from the machinery of capitalism. With lines firmly drawn at that time between the establishment and the counterculture, record companies, by making money from art, seemed particularly evil. But eventually, the practicalities of big



business swept through the scene like a green tidal wave. The idealistic either sank or rode its crest. The original Family Dog members gravitated to Mexico in a yellow school bus, one of them with the entire working capital for a show that was already booked. The intimate ballroom "happenings," with their intricate trappings, quickly gave way to civic theater concerts and extravaganzas in sports stadiums. Attention to unromantic details such as contracts, insurance, upscale advertising and security police replaced concern over party favors. Jefferson Airplane had risked their counterculture status by "collaborating with known commercial interests" and signing with RCA for an unprecedented \$25,000 advance. Other San Francisco groups, encouraged by the Airplane's success and the control they maintained over their product, became less hesitant to cross the line. The Grateful Dead, who thought they were doing fine as a dance band with steady ballroom gigs, eventually signed up with Warner Bros., late in the game, for an experimental lark. During 1967's Summer of Love, Joe Smith of Warner Bros. was commuting to the Dead's house in the

Haight to conduct a flurry of scouting and signing.

By 1968, the San Francisco image was being imitated worldwide. *SF Nights* tours the complementary music scenes in New York, Los Angeles, Boston, Detroit, Chicago and Texas. Even England's psychedelic scene, the authors maintain, was essentially a graft of San Francisco, which took root in a London basement dancehall where patrons grooved to the house band, Pink Floyd, from dusk until dawn.

Up until 1967, record sales to the youth market were mostly of 45s; in assembling an LP, artists might pad out a few three-minute hits with filler and sound-alikes. With longer songs (in part developed to accommodate ballroom audiences) and expanded musical concepts, psychedelic music brought about the rise of albums. Almost overnight,

there was an onslaught of LPs packed with extended musical messages and bearing a \$5.98 price tag. And the new album market gave credibility to the wide-open formats of underground radio, which would slip, by the mid-'70s, into a predictably formulaic AOR programming format.

Although it covers the commercial angles of the psychedelic era with insight, *San Francisco Nights* doesn't fail to portray the personal dramas, spiritual underpinnings and naive good will which were its cornerstones. It's an armchair tour that will induce nostalgia in those who were engulfed by it. Held up against the less-than-best elements of today's music scene, it may evoke regret that the psychedelic era dissolved to leave us among a host of pretentious, vapid and soulless contenders.

Susan Borey

Principles of Digital Audio by Ken Pohlmann. Howard W. Sams & Co., paperback, 285 pp., \$19.95.

Every knowledgeable audiophile will want to have a copy of Ken Pohlmann's *Principles of Digital Audio*. This book, written in an easy, conversation-



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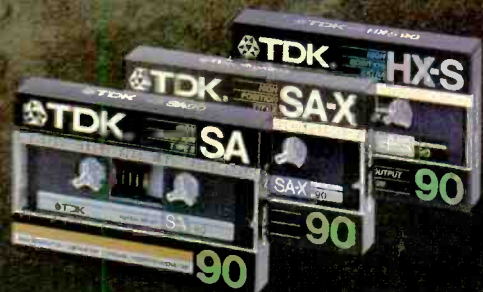
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Pete Best's narrative is superficial, and the only time you get a feel for his personality is when he recounts being sacked from The Beatles.

al style, explains nearly every facet of the subject. Pohlmann covers the familiar territory of digital encoding, but he goes much farther than most writers on the subject, exploring such topics as the decoding process, error protection, magnetic and optical storage media, and digital transmission methods. The chapter on the Compact Disc alone is worth the price of the entire book, particularly because of the section on the inner workings of a CD player. There are also hundreds of diagrams to illustrate and clarify the points under discussion.

This is not the sort of book you would read straight through while curled up in front of the fireplace, but rather the kind you keep handy to answer your questions. To make topics easy to find, Pohlmann has arranged them in a logical progression; the table of contents is a good general outline, and the index is genuinely helpful. The bibliography includes most of the standard works on digital audio and will be valuable to readers seeking more detailed information.

Despite the straightforward, conversational style of Pohlmann's writing, some readers will find that he has assumed a level of technical knowledge that they don't have. Occasionally, unusual terms such as "birefringence" (a measurement to check the flatness of a CD) or "syndrome" (not a disease contracted by bad data) go past without definition or explanation, so you might need to consult a technical dictionary from time to time. For the second edition, a glossary would be a nice addition. However, you can infer enough meaning from the context to get through it if you are persistent. I suspect that Pohlmann, being a college professor, is accustomed to the live interaction of a classroom, where students can ask about terms they don't understand. In a book, specialized language needs to be explained, especially in a relatively new field.

Sams' editors evidently need some courses in basic English grammar. They repeatedly fail to make subject and verb agree in number, and seem defenseless against the run-on sentence. Readers should keep a bucket of periods and upper-case letters handy. These are not matters of style and preference, but are shocking ex-

amples of incompetence. All I can say is, grit your teeth and plow through it, because what Pohlmann has to say is worth reading.

The design of the book is crisp and clean, and the boldface subheadings help you find topics quickly and easily. But the failure to coordinate the illustrations with the text is annoying. Why are the drawings *always* one page ahead of the text? With just a little more thought and care, the production team could have placed most of the diagrams on the same page as the text.

Books on technical subjects can be extremely dry, but this author's subtle sense of humor helps relieve any oppressively technical feeling. For instance, he warns readers not to experiment with ultra-fast sampling rates, because the energy required might create a black hole. In another place, he uses a budget for a motorcycle trip as a metaphor. The budget contains only three items: Beer, gas, and motels.

The section on rotary-head and stationary-head digital recorders is filled with good information. In the chapter on the Compact Disc, the description of how a CD is mastered and pressed should be fascinating reading to anyone who owns a CD player. A section on recordable optical discs will become more valuable in the future, as the various types of discs (DRAW, WORM, OROM, and who knows what else) start to enter the marketplace.

Principles of Digital Audio is packed with information, and it's worth reading. Don't hesitate to buy it and keep it handy for reference, but let the publisher know how you feel about the text editing. *Steve Birchall*

Beatle! The Pete Best Story by Pete Best and Patrick Doncastle. Dell Publishing, paperback, 192 pp., \$7.95.

In the years since John Lennon was assassinated, every childhood friend of Lennon's and every "fifth Beatle" has put pen to paper to let the world know the real story. Pete Best was The Beatles' drummer before Ringo was shuttled in, and one can sympathize with the fellow who sweated out the early days in the German clubs, before audiences were screaming for the Fab Four. (In fact, much of the time Best was with the group, they were the Fab

Five, with Stu Sutcliffe on bass. Sutcliffe had a row with McCartney on one of the German gigs and left the group, dying shortly thereafter of a brain hemorrhage.) Many of the facts included here have been documented in one book or another, as well as in Dick Clark's television special, *Birth of The Beatles*, for which Best served as a research consultant.

Beatlemaniacs keenly devoted to every aspect of the group's career might find this volume of interest, but it provides only a few insights into the group's history. Best's narrative isn't exactly inspired, and most of the time he deals with superficial incidentals—how George refused to clean up the evidence of his post-drunken sickness and managed to live with it in his room for quite some time, how the German girls were ever so eager to comfort the Fab Four, etc. The only time you get a feeling for the Best personality is when he recounts being sacked from the group. In a mire of pitiful anecdotes, he belabors the question, "If I wasn't a good enough drummer, why did they put up with me for the years of paying dues and then give me the elbow right after receiving a record contract?"

True, Pete Best got the shaft, but how many times should one try to make milk from sour grapes?

Jon & Sally Tiven

Bookcassettes

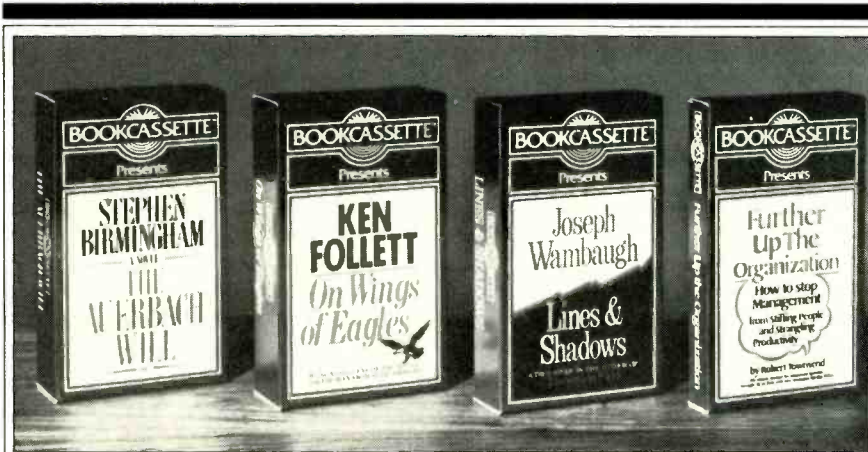
The success of radio drama was due to skilled writing, skilled acting, and skillful use of sound. Radio drama "worked" not just because of what was said, but because of what was left out and, hence, left to the imagination.

Similarly, a good novel relies solely on skillful writing, leaving the reader to fill in the blanks.

Now, the Brilliance Corp. of Grand Haven, Mich. has produced a combination of the novel and the spoken drama. On its *Bookcassettes*, complete books are recorded on cassette, read by excellent actors. The narrative passages are read as one might expect. What is unusual is that dialog is read by actors who can be considered as taking the parts of the characters whose lines they speak.

The dialog is in no way changed, nor are the narrative portions. Nothing is

Bookcassettes use digital speech compression for rapid narration, and are recorded monophonically using all four tracks of a stereo cassette.



omitted. Likewise, nothing is added, not even sound effects. If the book describes a high-speed car chase, you must supply the sound of the motor, the sound of shots, the smell of gasoline, etc. The only liberties which are sometimes taken involve such touches as adding a bit of reverberation if the action takes place inside a church, applying some filtering if we are eavesdropping on a telephone conversation, etc.

The reading is often done at high speed, and this can be a bit disconcerting at first. I found, however, that after listening a while, I became used to it. Further, this brisk pace adds to the tension in adventure novels.

A book can take several hours to read aloud, and if suitable steps were not taken, *Bookcassettes* would have to be recorded on many cassettes. To solve this problem, *Bookcassettes* are recorded monophonically, using all four tracks on the cassette. In order to play them, you need a stereophonic player. Begin by setting the balance control so that the left channel is heard. Play the first side of the cassette; turn it over and play the second side. Next, turn the cassette over once more, but now adjust the balance control so that output is obtained from the right channel only, and proceed as before, listening to the third and fourth tracks of the cassette.

Program material of this kind would likely be enjoyed by users of personal portable equipment. Even where such players are equipped with a balance control, it is often disconcerting to have the sound produced in just one channel of a headphone. To solve this, the Brilliance Corp. can supply an adaptor

to be placed between the player and the headphones. This device has switching which can send a signal from either the left or right channel into both sides of a headphone.

Another interesting technical note is that the folks at Brilliance use digital speech compression to achieve the reading speed, rather than having the actors wear themselves out attempting to maintain such a pace. This writer has considerable experience with speech compression and can usually detect it; I was not able to do so when listening to *Bookcassettes*.

The *Bookcassette* packaging is designed to look like a book, and the price is the same as that of the hardcover printed version. The headphone adaptor costs approximately \$2.

These products are available at fine bookstores. For a catalog and additional information, write to: Brilliance Corp., Box 114, Grand Haven, Mich. 49417. The phone number is (616) 846-5256 in Michigan, (800) 222-3225 elsewhere. *Joseph Giovannelli*

In One Lifetime: The Life of William Grant Still by Verna Arvey. The University of Arkansas Press; cloth, \$16; paperback, \$9.95.

William Grant Still was born in 1895 in the deepest South, descended from a slave woman and a Scots plantation supervisor named Still. He was, without a doubt, the first Negro (the term preferred in this book, and common through most of Still's life) to rise in the music world into the "classical" area by virtue of thorough training, and to compose on a professional symphonic scale and conduct major orchestras.

This in itself makes him an important figure in American musical life. Though he long outlived Gershwin, three years his junior, the two lives make an interesting parallel, running virtually side by side in the heady New York of the 1920s—though in Arvey's biography Gershwin's name is never mentioned, among hundreds of well-known musical personalities.

William Grant Still, like Gershwin, immersed himself in the show-biz excitement of post-WWI New York, both as a brilliant arranger/composer/conductor and as a performer on almost any instrument that came along. But oddly, Still's commitment to the classical took him technically far beyond Gershwin, who never really mastered either the required expertise in orchestration or, more important, the structural organization of larger classical forms. Still was a tune-writer of genius, with a marvelous sense of piquant harmonies and rhythms. His larger works are essentially strings of these tunes glued together with ingenious breaks.

As a teenager Still was already studying the basic classical disciplines—counterpoint, harmony and reading—through the scores of Beethoven and even Richard Wagner. Astonishing, one might think, in a Negro youth brought up at the beginning of this century in deepest Louisiana and in Little Rock (of more recent fame in black liberation). But from the very start, Still pursued a classical education, thorough and conservative, even including a stretch at that Midwestern bastion of "serious" music, Oberlin College.

Where Gershwin's genius kept him in the living theater, right on through *Porgy and Bess*, William Grant Still (who also wrote operas) was thus able to diversify into a surprising variety of musical entertainment, from Eubie Blake's traveling *Shuffle Along*, full of future black stars, to much success in radio, arranging for big-time network shows, and on to major symphony orchestras and worldwide recognition. This last did not imply a rejection of black values—far from it. Still went the opposite way, to bring classical dignity and craftsmanship to music with Negro themes. It was a notable aim, and often shocking to those who expected the "primitive" sort of black art.

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- Comparisons of different recording technologies.
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Though this account is far from totally objective, events in the life of William Grant Still make for a powerful biography.

All of which makes for a powerful range in the subject matter of this biography, in spite of many predictable weaknesses: The author, Verna Arvey, was Still's second wife, a brilliant and well-educated white pianist, writer and interviewer who began working with him when he came to the West Coast around 1934. They were not married until 1939, but their increasing interdependence is clear enough. She could put vast energy into an increasingly complex interracial social life and a growing involvement in music worldwide; she also became Still's literary partner, devising texts, fitting words to the shape of melodic lines, concocting entire plots of his operas directly with him. In this book, it is "we" and "our" throughout the second part, and no slightest disrespect or criticism of "Billy" can be tolerated by this strong-minded helpmate. A far from totally objective account, understandably.

The theme of racial tolerance, rather than belligerence, runs through the

book and can only be praised; it was an ideal for both Still and Arvey. Their case for the dignity of Negro accomplishments is even more persuasive. But the impetuous Verna is not a good judge; those many great names, and small ones too, who were sympathetic and helpful tend to be made into plaster saints; on the other side, she relates scurrilous plots, real enough, yet tending to blame the ominous "they" and, alas, leaning toward an intolerance that is not too pleasant.

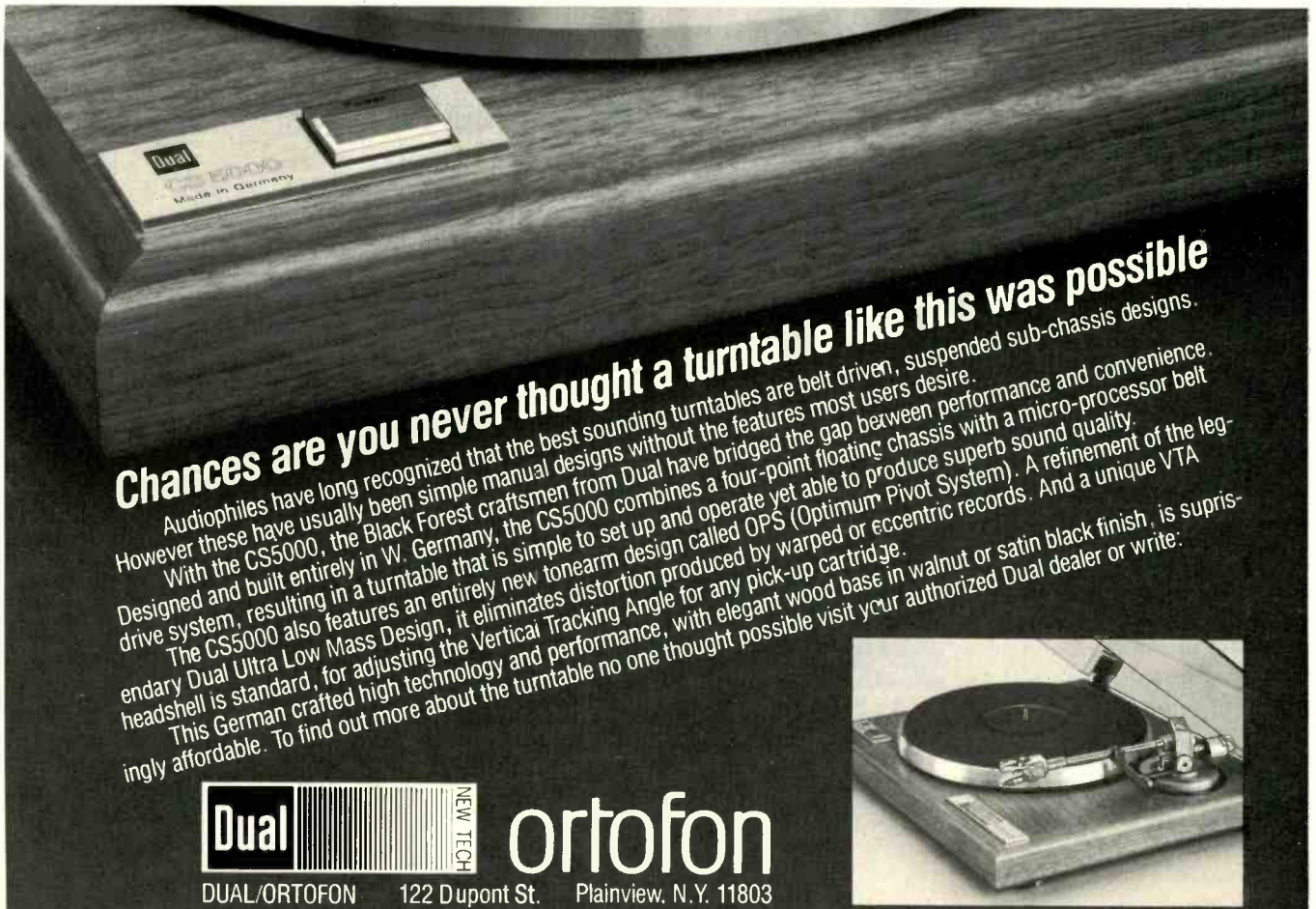
The famous Still benefactors are invariably "foremost composers" and the like, but though they surely were kindly, most of them are anything but foremost in many minds. They all belong to a very conservative, old-fashioned type, which seems to have been where the Stills moved. Atonal music, in contrast, is made by "tin pan clangers," and "modernists" in general are given very short shrift. "Modern music"—a term long outmoded—is senseless jangle and nothing more.

Some will agree, others definitely not.

The first half of the story, before the name-dropping (legitimate but, in the end, boring), is the salvation of this work and explains the rest. The picture of a group of highly intelligent 19th-century black families, well educated and well mannered, most of them quite literate and often schoolteachers, is quite fascinating, a side of the old Deep South life that seldom reaches us these days. It does, in truth, explain the later William Grant Still in rather moving terms, in spite of the tendency towards plaster sainthood, and is thus a contribution towards both musical and black history.

Incidentally, the entire world of audio electronics and recording of music is virtually ignored here. This is strictly a live-music world, straight through to the 1970s! Not atypical of the professional musician's viewpoint. Broadcasting, yes—but only as though it were another show, or a concert.

Edward Tatnall Canby




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S/N	100 dB	100dB

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Leonard Feldman

The world is full of CD players, thanks to the standardization of the Compact Disc format. A recent innovation is that you no longer have to load and play discs one at a time: If you want to play several discs sequentially (or play random selections from several discs), you'll find that suddenly there are several CD changers around. If you go shopping for one, you'll also discover, as I did in the course of testing four of them, that while the CD format has been standardized, the way CD changers handle multiple discs is, in fact, anything but standard.

THE BETTER:

Four Multi-Disc CD Players



In fact, of the four units tested for this report, no two even handle the same *number* of discs. Pioneer, the first company to surprise the world with a CD changer, uses a disc "magazine" that can house six discs. Nikko's mammoth NCD-600 comes close to being a CD jukebox, as it can store 60 discs in a huge disc tray. Sony's innovative DiscJockey car CD player puts most of the mechanism (including the CD magazine) in a sealed container that hides in the trunk of your car; it can hold and handle up to 10 discs. Finally, the very recently introduced Mitsubishi home CD player, similar in many ways to the Pioneer unit, uses a magazine that holds

five discs. So much for CD changer standardization! Features and programmability of these four CD players vary widely too, so let's take a look at them, one by one.

Pioneer PD-M6: Features and Controls

The Pioneer CD changer plays as many as six discs, loaded in a special magazine. Random-access programming of up to 32 tracks is possible on any of the discs, and direct access to any track on any disc is also easily accomplished. Repeat functions are available for repeat-play of all six discs,



Pioneer PD-M6

one track of one disc, or all programmed tracks of all six discs. Audible scan of program material is possible at two speeds. The PD-M6 has a headphone output with an independent level control. A wireless remote control allows you to operate the player's functions at a distance and even permits full programming of the player. Since "black boxes" to interface TV sets with CD players (for digitally generated still-frame pictures encoded on CDs) are expected to be available soon, the Pioneer PD-M6 is also equipped with a subcode output connector for such adaptors.

Because the PD-M6 accepts a six-disc magazine in its loading slot, it is necessary to use the supplied single-disc magazine when you want to play a single disc. The loading slot, about as wide as a VCR's cassette slot, is positioned below a multi-function display area on the front panel. To the left of the slot and display are the usual "Power" on/off button, the headphone level control, and the stereo headphone output jack. The fluorescent display has indications for "Repeat" play, "Program" memorization, program step (or time in minutes), disc number (or time in seconds), track number, and, finally, a series of one to six symbols showing which disc is being played. Six numbered buttons to the right of the display select the disc, while 10 numbered buttons just below are used to select tracks to be played or programmed. Below these are larger, light-touch pushbuttons to "Eject" the disc magazine and to actuate "Repeat" play, program memorization, and track advance or reverse.

A small "Display" key below this bank of buttons changes the information shown in a portion of the display. Depending on how many times you

push the button, this display section will show either the current track number and elapsed time within the track, or total playback time and the number of tracks on the disc, or the disc and track numbers of the selection being played. If the "Display" button is pressed a fourth time, the display changes back to its original mode. A "Check" key lets you review the contents of a previously entered program, item by item, while a nearby "Clear" key allows you to erase previously entered program commands.

The "Random Play" pushbutton is another nice touch. Push this button when you've loaded six discs into the player, and the unit will continuously

play tracks on all the discs, in random order, until you stop the machine. "Play" and "Pause" buttons are located at the right end of the front panel, and below them are the two-speed forward and backward audible search buttons. These, if pressed for more than 2 S, increase the speed of the audible search. A "Stop" pushbutton is at the lower right of the front panel.

The rear panel of the Pioneer PD-M6 is equipped with the usual left- and right-channel output jacks, an unswitched a.c. convenience outlet, and the subcode output terminal.

**Nikko NCD-600:
Features and Controls**

Nikko says that this 60-disc changer was essentially designed as a professional or commercial-grade unit; nonetheless, it is finding its way into all sorts of places, including radio stations, discos, and even the homes of some audiophiles. The NCD-600 can play any number of discs in sequence, furnishing at least 45 hours of continuous music if it's ordered to play all 60 discs in its tray. However—and this is an unexpected drawback—the number of randomly selected tracks you can pro-



Nikko NCD-600

All four CD changers showed the familiar, ultrasonic beat tones, but only two had even weak beats within the audible frequency range.

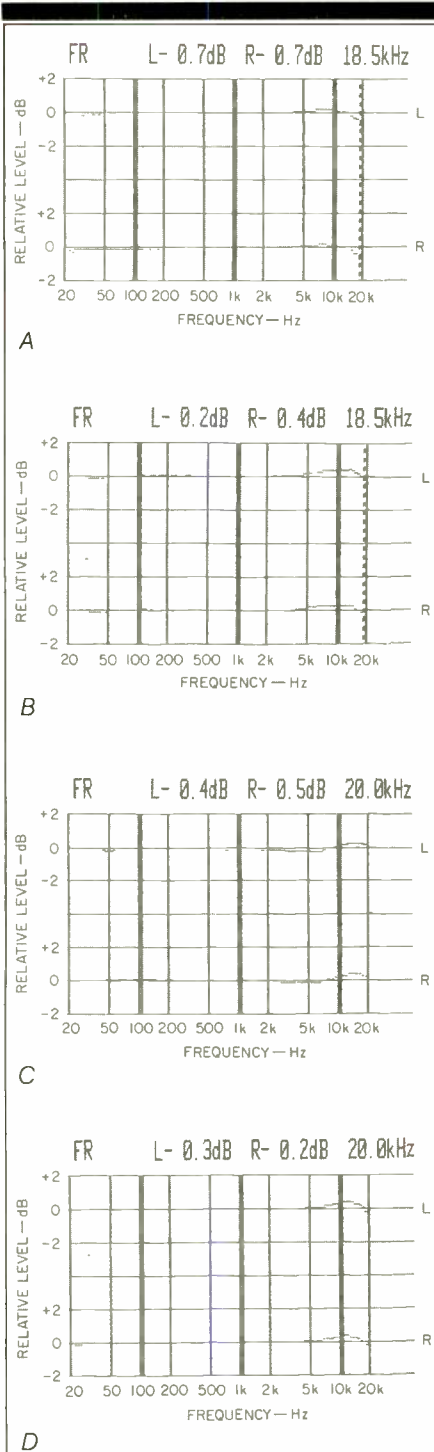


Fig. 1—Frequency response, left (top) and right channels, of Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D).

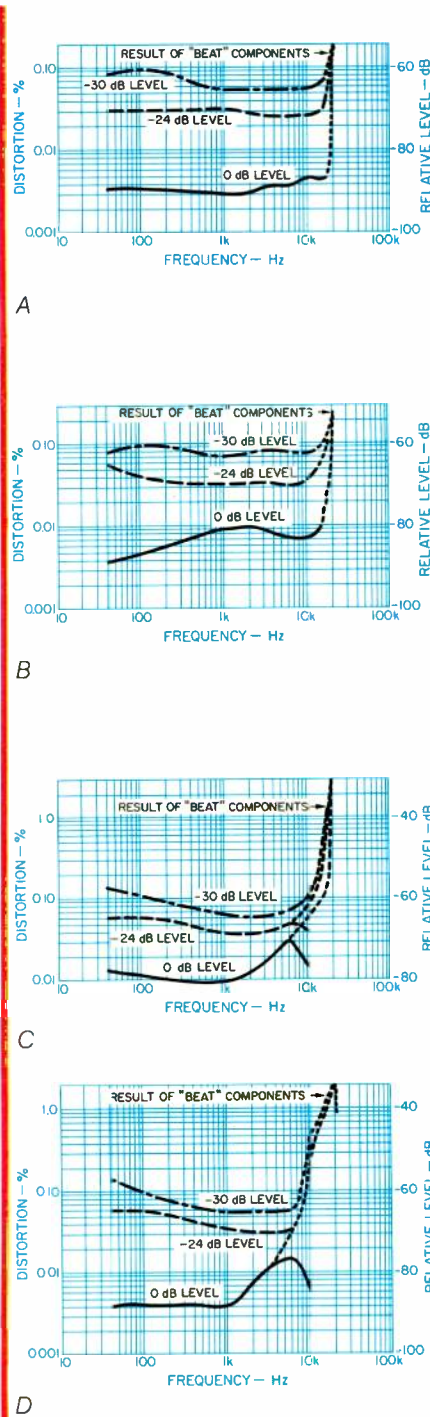


Fig. 2—THD vs. frequency, at three signal levels, for Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D). Note change in scales for (C).

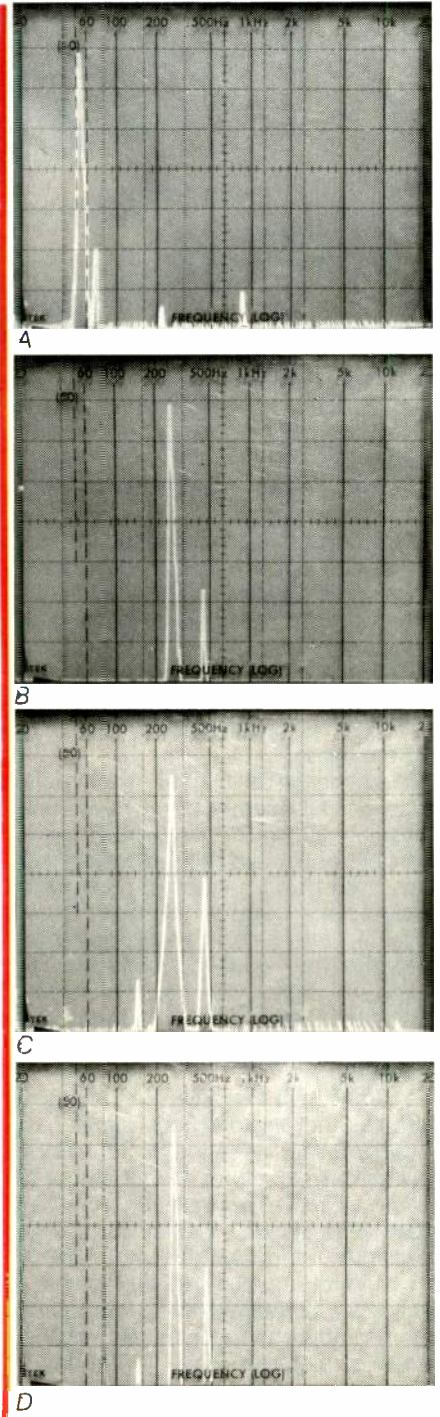


Fig. 3—Out-of-band components reproduced when playing a 20-kHz test tone for Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D).



Sony CDX-A10

gram is limited to five (though those tracks can come from any of the discs). You can, on the other hand, have the programmed selections repeated over and over.

Two unusual innovations found only in the NCD-600 are independent pitch and rhythm (or tempo) adjustments. In other words, you can adjust pitch up or down and, if you choose, readjust tempo so that it doesn't increase or decrease when you change pitch. Try doing that with a turntable, all you analog die-hards.

Mounting discs into this machine is not a casual operation. It involves unscrewing four hex-head screws from the front panel and then releasing the wide disc tray for loading. I wouldn't want to have to repeat this tricky operation too often, so, if you're going to load this tray to its full capacity, I'd suggest you carefully choose the discs you want to load and keep an accurate list of which disc is loaded into which numbered slot!

In addition to the usual control push-buttons, the Nikko's front panel has rocker bars for adjusting pitch (up to a half-octave in either direction) and tempo ($\pm 5\%$). Two multi-function displays plus an LED display for stereo output level are near the upper left of the control panel. The first display shows the currently playing disc number and track number as well as the player's status ("Play," "Standby," "Search," or "Error"). The second display shows the numbers of the preselected or programmed discs as well as the numbers of the preset tracks on those discs; it also indicates whether or not these discs and tracks have been correctly entered into the system's memory.

An output-level control on the rear panel controls both the headphone output jack on the front panel and the line-level output on the rear. There's also provision for connecting an alternate program source (such as a tuner or tape deck) to the NCD-600. A rear-panel slide switch selects either the player's output or the signal from the alternate source for output through the player's rear-panel jacks. If you can reach the rear-panel selector switch and output-level control, and feel no need for a preamp's tone controls, you could use the NCD-600 as the control center for a two-source audio system, feeding the output directly to a power amplifier.

If 60 CDs aren't enough for you, this unit can be linked by fiber optics to additional NCD-600s (at \$4,395.95 a pop), expanding program access to as many as 240 discs. An optional modification to later production runs (which will be made available for installation in existing NCD-600s) will also add unlimited programmability, nonvolatile memory to store programs for reuse, programmable pitch and rhythm control, and RS-232 serial interfaces for control by computer systems, which would expand the programming possibilities even further.

Sony CDX-A10: Features and Controls

Billed as the world's first Compact Disc changer specifically designed for the requirements of a car, the Sony DiscJockey is offered either as a changer only or with a fully integrated AM/FM synthesized tuner module (the Model XT-10, \$129.95). It can be used with power amplifiers alone or can be linked (via the optional XA-39 switch-

ing unit, \$29.95) to a previously installed head unit.

The only part of the CDX-A10 you need to have up front, where the driver can access it, is a tiny control unit which Sony has dubbed the DiscJockey Remote Commander. This unit has the same height and width as DIN-sized head units, so it can be mounted in standard radio slots. However, since it's only an inch thick, many more mounting choices are possible: The Commander can be mounted in an optional, gooseneck control pod (handy if the radio slot is already filled), can be attached with Velcro strips to the dash or any other convenient surface, or can be hung from a small hanger. The latter two options let you remove the Commander and pass it to other passengers. The unit can even be stored under the front seat when it's not being used, so passersby will have no clue that there's a stereo present.

The heart of the DiscJockey is its 10-disc magazine changer, which is installed in a vehicle's trunk. The mechanism floats freely on a sub-suspension to resist shock and road vibration. The changer's outer casing is built of dust-resistant, high-impact material. The changer provides rapid access to any selection on any disc, and can send up to six different operating-status messages directly to the control Commander's displays.

When you activate play mode on the Commander, the CDX-A10 checks to see which of the magazine's slots are filled; playback begins from the first filled slot, regardless of its position in the magazine. If all 10 discs are present, you can have more than 10 hours of continuous music without having to replace the magazine in the changer.

The unit has two modes of programmed operation. One, called the Random Music Sensor, lets you program up to five selections from any of the discs, but this memory clears whenever the system is turned off. In addition, the Program Play feature allows programming 10 selections, with memory status maintained even if you change listening sources (such as switching to the tuner) or if you turn the unit off. You can also begin play from anywhere within the program, not just from the first programmed selection. In effect, you can program a total of 15

In most of the players, stereo separation declined at high frequencies, but at worst it was still twice as good as a phono cartridge's.

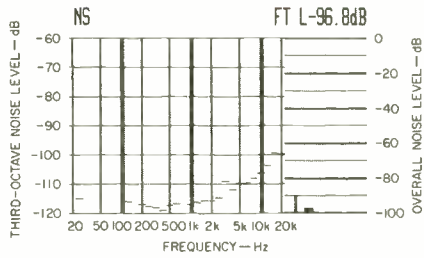


Fig. 4A—Unweighted SIN analysis, Pioneer PD-M6.

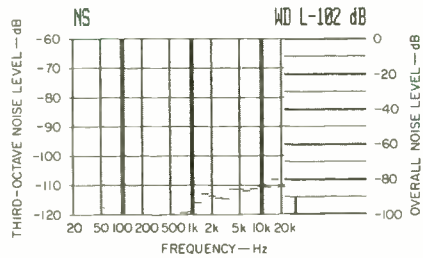


Fig. 4B—A-weighted SIN analysis, Pioneer PD-M6.

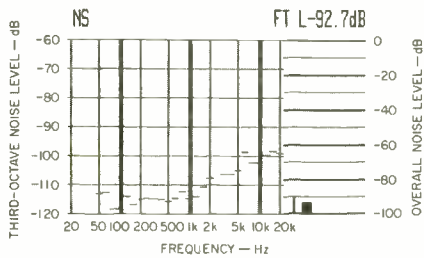


Fig. 4C—Unweighted SIN analysis, Nikko NCD-600.

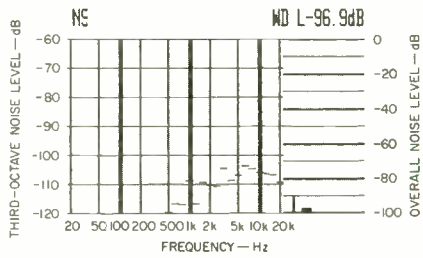


Fig. 4D—A-weighted SIN analysis, Nikko NCD-600.

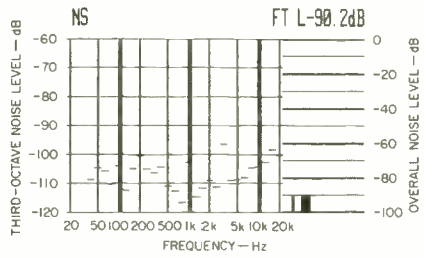


Fig. 4E—Unweighted SIN analysis, Sony CDX-A10.

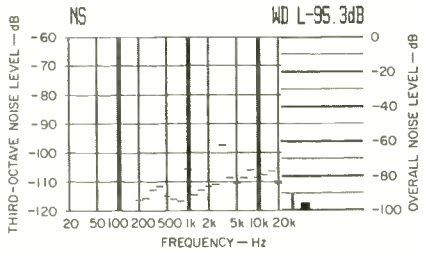


Fig. 4F—A-weighted SIN analysis, Sony CDX-A10.

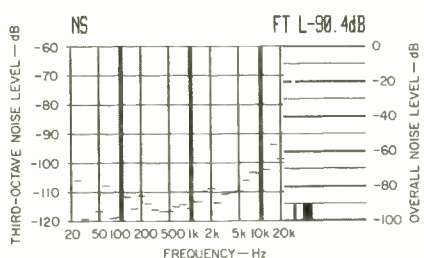


Fig. 4G—Unweighted SIN analysis, Mitsubishi DP-409R.

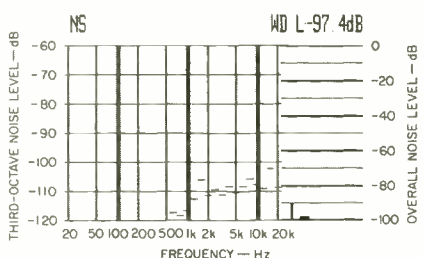
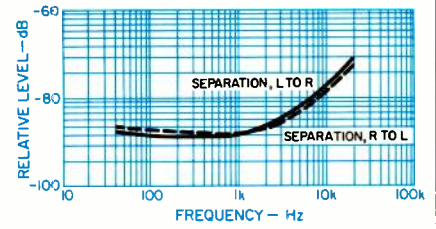
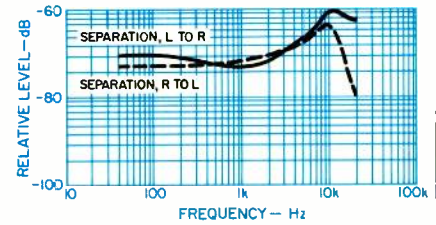


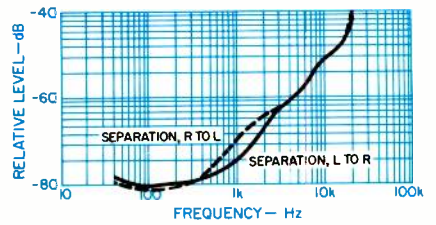
Fig. 4H—A-weighted SIN analysis, Mitsubishi DP-409R.



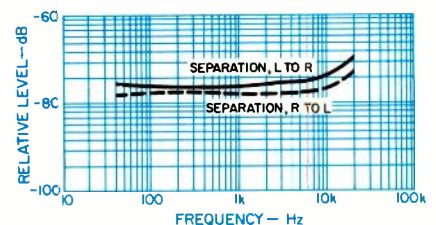
A



B



C



D

Fig. 5—Separation vs. frequency for Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D). Note change in scale for (C).

selections using the two memory systems, though you must press separate buttons to begin each of the two sequences. Other playback options include direct selection by disc and track number, skipping from one selection to another in either direction, and audible music search for sampling the music at 10 times normal speed in either forward or reverse.

The optional XT-10 tuner module (see sidebar) has no controls whatever. It simply plugs into a receptacle on the back of the changer module, and connections are provided for the antenna input and a power-antenna control. With the tuner module installed, when you switch to radio mode, the Commander's button functions change appropriately. The XT-10 offers 20 station presets (10 AM and 10 FM), automatic scan tuning, manual tuning, and a local/distant/mono switch.

Back in early 1983, when I was introduced to the intricacies of Compact Disc hardware and software manufacture during a visit to Philips and Polygram in Europe, one of the engineers at Philips predicted that it wouldn't be long before we'd all be listening to CDs in our cars. At the same time, he suggested it would be a good idea if car CD players were equipped with optional compressor circuits so that the wide dynamic range recorded on many CDs could be fully appreciated under actual driving conditions. The first car CD players, introduced almost two years ago, ignored this suggestion, but now Sony has practiced what the Philips engineer first preached. The CDX-A10 is equipped with a two-position compressor (or Dynamic Range Suppressor, as they call it). Sony has also tossed in a defeatable surround-sound circuit for arbitrary-matrix decoding to feed ambience to the rear speakers while regular stereo emanates from the front; since this is on the same button as DRS, you can't use surround and compression at the same time.

To keep the size of the Commander module as small as it is (just over 7 inches wide by 2 inches high by 1 inch thick), Sony wisely assigned multiple functions to its controls. The volume button, for example, also serves to alter tone-control settings, channel balance and even front-rear fader settings; its function is determined by a

small associated "Select" key. As this key is depressed successively, indicator lights tell you what function the up/down button is performing; a few seconds after any adjustment is completed, the control and display revert to volume-adjust mode. The usual controls found on any CD player's front panel are also found on this tiny Commander module, including numbered keys for programming desired track selections.

If you have connected the optional XT-10 tuner pack, pressing a key at the lower right of the CDX-A10's Commander switches you over to radio mode. As if by magic, the displays and buttons which previously governed the CD player suddenly assume new roles. The controls for CD fast search and track advance become manual and automatic radio tuning keys. Numbered buttons are now used to call up preset AM and FM stations, and the large display window tells you the frequency to which you are tuned, whether reception is mono or stereo, what preset number you have selected and whether you are in the local or distant reception mode.

Mind you, all that's connecting the Commander module back to the main unit in the trunk (and the tuner pack, if you've installed it) is a thin multi-conductor cable. This cable is easily hidden beneath the carpeting of your car, and requires only a small hole through the rear wall of the car's interior to the trunk space.

Extra magazines which hold 10 discs can be purchased at a suggested price of \$19.95 each. Because a multi-disc magazine generally takes up less space than the corresponding number of CD jewel-box cases, the 10-disc Sony, six-disc Pioneer and five-disc Mitsubishi magazines can all be used as handy CD storage devices in

the home. If you're wondering what to do with the booklets that normally accompany each CD, Sony has an answer to that too: With each of their 10-disc magazines, the company supplies a transparent folder (similar to a billfold credit-card holder) whose 10 pockets are just the right size for these booklets.

Mitsubishi DP-409R: Features and Controls

The Mitsubishi Compact Disc changer allows more selections to be programmed than any of the other changers tested here: A total of 30 selections from any of up to five discs can be loaded into its disc magazine. If you own a VHS VCR and have a cabinet with compartments for storing videocassettes, you'll find that you can store the Mitsubishi CD magazines in those same compartments. In fact, the slot on the front of this player looked so much like that of a front-loading VCR, for a moment I thought they had sent me the wrong component to test!

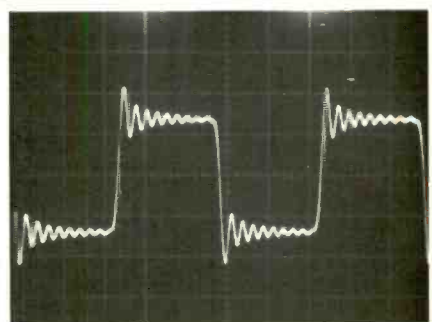
In addition to manual playback of an entire disc in sequence, the DP-409R allows you to program disc and track selections very easily. The player also has two repeat-play modes, for playback of programmed selections or of its entire five-disc magazine. Other features include the usual track-skip, fast-forward and -reverse (audible) scan, and scanning of the next disc. The unit does not have a headphone jack or an output-level control, but it does include a wireless remote control which duplicates most of the front panel's functions. This player is also offered without the remote control, as the Model DP-309, for a lower price.

The moment you insert the disc magazine into the loading slot, a series of bars lights up in the display to the slot's right; these bars tell you which

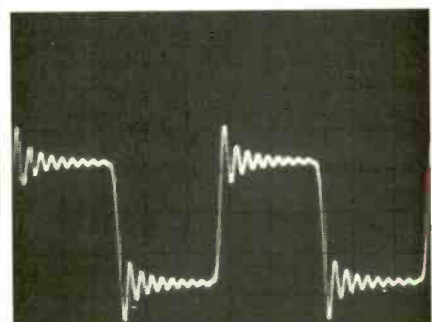


Mitsubishi DP-409R

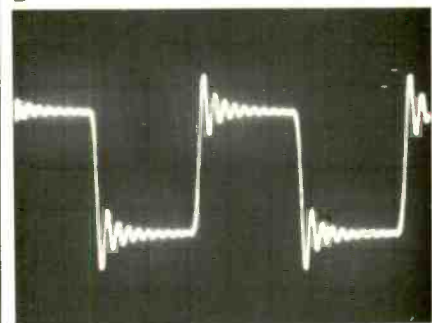
You can tell from the 'scope photos that all these units use analog filtration and single, multiplexed digital-to-analog converters.



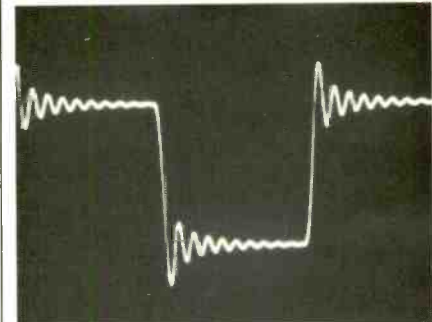
A



B

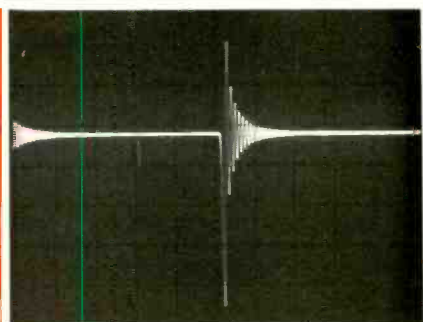


C

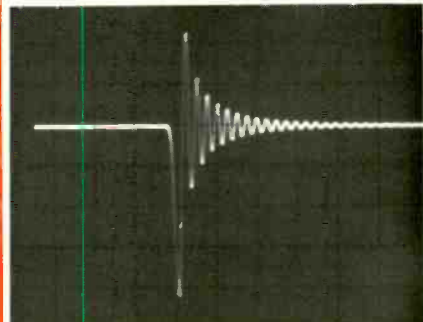


D

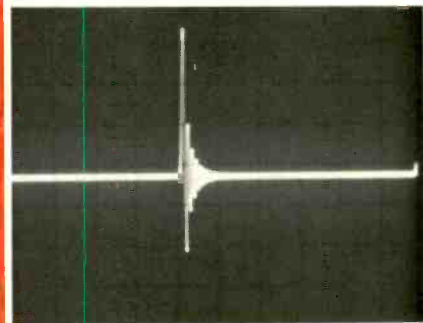
Fig. 6—Reproduction of a 1-kHz square wave by Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D).



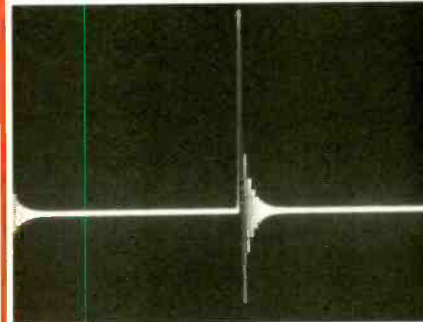
A



B

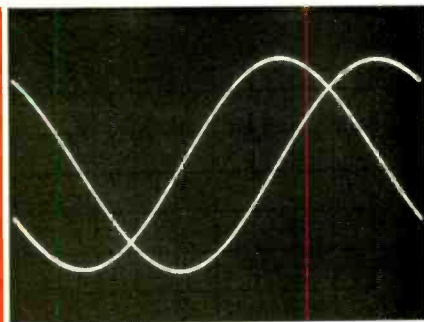


C

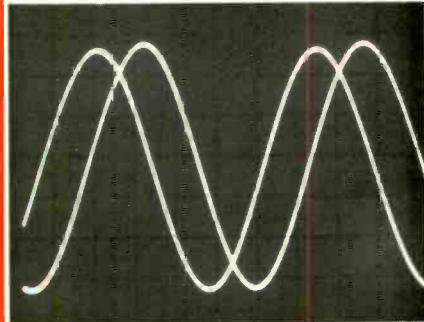


D

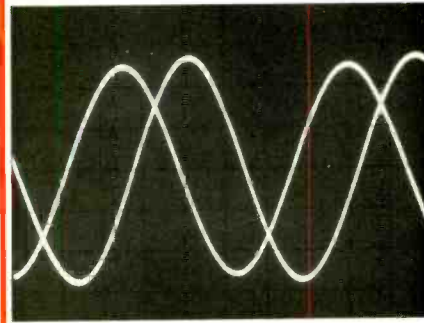
Fig. 7—Unit-pulse reproduction by Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D).



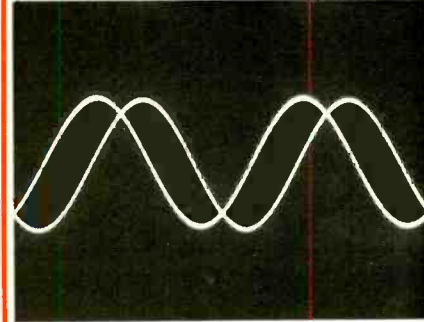
A



B



C



D

Fig. 8—Interchannel phase difference when reproducing a 20-kHz test tone for Pioneer PD-M6 (A), Nikko NCD-600 (B), Sony CDX-A10 (C), and Mitsubishi DP-409R (D). Horizontal scale: 5 μ S/div. for Pioneer only, 10 μ S/div. for all others.

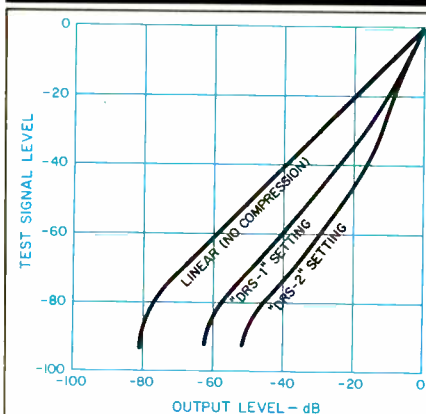


Fig. 9—Input vs. output characteristics for Sony CDX-A10, without compression and with each "DRS" compression setting.

disc trays have been filled. (Both the trays and the illuminated display bars are numbered 1 through 5.) The rest of the display area provides the kind of information we've all gotten used to on CD players, such as track number, disc number and elapsed time. During programming operations, the program number (1 through 30) is displayed instead of the elapsed time. Illuminated words also tell you if you are in the program mode or in a repeat-play mode.

Separate sets of forward and reverse keys are used for audible music search and for track advance or reverse. A button labelled "Next" advances play from one disc to the next, and the usual array of numbered keys and program buttons is used to memorize up to 30 desired selections from any of the five discs in any random order. When entering selections either for immediate play or for programming, the first button pressed will register as the disc number desired; the subsequent numbers pressed will automatically be entered as the desired track numbers of that disc. These steps make using the DP-409R very simple and straightforward.

Measurements: The Quartet of Changers

As you can well imagine, I did not measure these four CD changers at the same time—or even in the same month. I saved up my data, one model at a time, until I could do a side-by-

side analysis of measured results. I also kept an accurate set of notes concerning the musical listening tests that I conducted for the three home players. I had an opportunity to listen to the Sony car CD changer at this past Winter Consumer Electronics Show in Las Vegas. Since it's pretty hard to do a serious listening test at such an event, I had hoped that Technical Editor Ivan Berger would get a chance to road-test the unit. Unfortunately, that was not possible.

Rather than spell out the test results for each player, I've summarized the results in Table II and have presented most of my usual plots and spectrum-analysis photos. My comments will be limited to how the players' measurements compared with each other.

I found it interesting that all four of these CD changers exhibited the familiar out-of-band spurious components that I've been seeing from other players. These "beat" components have occurred when I've reproduced a 20-kHz test tone and examined the output spectrum from 0 Hz to 50 kHz, as I did for Figs. 3A, 3B, 3C, and 3D. Notice, though, that while all four players produced an output above 20 kHz (caused by an IM beat between the 44.1-kHz sampling rate and the 20-kHz test tone itself), only two of the players produced low-level, "in-band" beat signals (at around 16 kHz). To be sure, the level of these in-band beats is so low, and normal high-frequency program content is so far below the maximum 0-dB level at which this test was made, that this form of spurious signal will certainly not be audible under real-world listening conditions. Still, the difference in results between the Sony and Mitsubishi units versus the Nikko and Pioneer units suggests that each pair of companies is using a different type of chip for their D/A conversion.

I have the feeling, too, that the manufacturers' spec sheets do not reflect the new EIAJ-approved method of measuring dynamic range. As you can see from Tables I and II, my results are much better than the published specs of dynamic range for all four units. I doubt if it's a case of conservative specification writing; rather, the specs were likely written before the new EIAJ Standard was issued. In any case, dynamic range is no problem with any of

these CD changers, and here Sony's car unit is the winner, with a possible dynamic range of 114 dB. That's ironic, because you don't really need (and can't possibly appreciate) this amount of dynamic range in an automobile environment—unless, of course, the car is standing still.

All of the units had more than adequate stereo separation at mid-frequencies, but all but the Mitsubishi unit exhibited rather rapid reductions in separation as higher and higher test frequencies were reproduced from a single channel. Check this out for yourself by looking at Figs. 5A, 5B, 5C, and 5D. Still, even the worst case of decreased separation at 10 kHz (about 50 dB) is more than twice as much as I ever measured for a phono cartridge at that high frequency.

From looking at Figs. 6A, 6B, 6C and 6D, it was evident to me that all of these units have steep, multi-pole analog output filters rather than digital filtration. I'm told that the most commonly available (and least expensive) multi-function chips that are used in small portable CD players and in lower cost units are designed to be used with analog filters. To keep costs reasonable, what with the complexity of changer mechanisms and all of the added memorization circuitry involved in programming multiple discs, these manufacturers have probably elected to use such chips instead of those that provide digital filtration prior to D/A conversion.

It's also evident to me, from Figs. 8A, 8B, 8C and 8D, that each player employs only a single D/A converter. Left- and right-channel digital-to-analog processing is done by time multiplexing, which results in a time delay of just under 12 μ S between signals. However, if the time delay in Fig. 8A seems as though it's greater for the Pioneer unit than it is for the other three, this is my fault: I used a different horizontal sweep rate (5 μ S instead of 10 μ S per division) when testing the Pioneer. In fact, all four units exhibited the same time-delay error for the 20-kHz signals on opposite channels.

All of the units were able to track all of the built-in "defects" on a special test disc. This is especially important for the Sony car unit, which is going to have to track perfectly, even under

The dynamic range specifications claimed for these players are conservative and apparently were written before the EIAJ Standard for this spec.

TABLE I—MANUFACTURERS' SPECIFICATIONS

Parameter	Pioneer PD-M6	Nikko NCD-600	Sony CDX-A10	Mitsubishi DP-409R
Frequency Response	4 Hz to 20 kHz, +0.5, -1 dB	10 Hz to 20 kHz, ±0.5 dB	5 Hz to 20 kHz, ±1.0 dB	5 Hz to 20 kHz, ±0.5 dB
THD	Less than 0.005%	0.007%	0.015%	0.003%
Dynamic Range	Greater than 94 dB	85 dB	85 dB	94 dB
S/N	Greater than 98 dB	Unmeasurable	85 dB	98 dB
No. of Discs Handled	6	60	10	5
Programmability	32 Selections	5 Selections	15 Selections	30 Selections
Channel Separation	Greater than 92 dB	N/A	75 dB	98 dB
Line Output Level	1.5 to 2.5 V rms	0 to 5.0 V rms	N/A	2.0 V rms
Power Requirements	23 watts	37 watts	800 mA (at 12 V d.c.)	17 watts
Dimensions (W x H x D), Inches	16 ³ / ₁₆ x 3 ³ / ₁₆ x 12 ⁷ / ₁₆	18.4 x 13.9 x 14.7	12 ³ / ₄ x 5 ¹ / ₄ x 8 ³ / ₄ (Trunk-mounted)	16 ³ / ₄ x 4 ¹ / ₈ x 13 ³ / ₈
Weight	13 lbs. (5.9 kg)	59.4 lbs. (27 kg)	12 lbs., 6 oz. (5.6 kg)	16 lbs., 9 oz. (7.5 kg)
Price	\$499.95	\$4,395.95	\$999.95	\$500
Company Address	P.O. Box 1720, Long Beach, Cal. 90801 For literature, circle No. 10C	5830 S. Triangle Dr., Commerce, Cal. 90040 For literature, circle No. 10I	Sony Corp., Park Ridge, N.J. 07656 For literature, circle No. 10J	P.O. Box 6007, Cypress, Cal. 90630 For literature, circle No. 10K

TABLE II—MEASURED DATA

Parameter	Pioneer PD-M6	Nikko NCD-600	Sony CDX-A10	Mitsubishi DP-409R
Frequency Response	20 Hz to 20 kHz, ±0.7 dB (See Fig. 1A)	20 Hz to 20 kHz, ±0.4 dB (See Fig. 1B)	20 Hz to 20 kHz, ±0.5 dB (See Fig. 1C)	20 Hz to 20 kHz, ±0.3 dB (See Fig. 1D)
THD at 1 kHz (0-dB Level)	0.003% (See Figs. 2A & 3A)	0.009% (See Figs. 2B & 3B)	0.009% (See Figs. 2C & 3C)	0.004% (See Figs. 2D & 3D)
S/N (Unwtd./A-wtd.)	96.8/102.0 dB (See Figs. 4A & 4B)	92.7/96.9 dB (See Figs. 4C & 4D)	90.2/95.3 dB (See Figs. 4E & 4F)	90.4/97.4 dB (See Figs. 4G & 4H)
SMPT E IM (At 0 dB)	0.0047%	0.005%	0.01%	0.003%
SMPT E IM (At -20 dB)	0.03%	0.015%	0.03%	0.025%
CCIF IM (At 0 dB)	0.98%	0.0039%	0.018%	0.002%
CCIF IM (At -10 dB)	0.09%	0.0049%	0.02%	0.0023%
Separation at 1 kHz	88 dB (See Fig. 5A)	72 dB (See Fig. 5B)	73 dB (See Fig. 5C)	76 dB (See Fig. 5D)
Dynamic Range	100 dB	103 dB	114 dB	106 dB
Square-Wave Response	(See Fig. 6A)	(See Fig. 6B)	(See Fig. 6C)	(See Fig. 6D)
Unit-Pulse Response	(See Fig. 7A)	(See Fig. 7B)	(See Fig. 7C)	(See Fig. 7D)
Intrachnnl. Phase Delay	(See Fig. 8A)	(See Fig. 8B)	(See Fig. 8C)	(See Fig. 8D)
Maximum Output Level	2.0 V rms	4.7 V rms (See text)	3.68 V rms	2.3 V rms
Short Access	2.0 S	1.0 S	0.75 S	1.5 S
Long Access (Disc to Disc)	6.0 S	15.0 S (Varies)	12 S	13 S
Wow and Flutter	Unmeasurable	Unmeasurable	Unmeasurable	Unmeasurable
Tracks 900-μ "Scratch"	Okay	Okay	Okay	Okay
Tracks 800-μ "Dust"	Okay	Okay	Okay	Okay
Tracks "Fingerprint"	Okay	Okay	Okay	Okay

conditions of extreme vibration and external shock. When you add the problem of imperfect discs with opaque or scratched areas to the problem of external shock and vibration, it is almost miraculous that units such as the Sony car CD changer perform as well as they do.

The Nikko unit delivered a whopping 4.7 V of output for 0-dB recorded level

when its rear-panel level control was turned fully up. I don't believe the designers should have allowed for such a high level, especially since, if you allow the unit to operate at that level, the Nikko's own analog output stages are overloaded and distort audibly.

While all of the units exhibited extremely fast short-term access time (the time it takes for the laser pickup to

get from one track to an adjacent track), the Pioneer PD-M6 was the clear winner when it came to long-term access time (getting from one disc to another), performing this feat in 6 S. The slowest, in this regard, was the Nikko, at 15 S, but it's certainly understandable when you consider the number of discs and the size of the disc tray that has to be traversed.

Each of these changers offers a different combination of features, but all offer sound quality which could not be faulted.

SONY'S XT-10 TUNER MODULE:

An evaluation

Adding an AM/FM tuner module to Sony's 10-disc CD changer doesn't take up any more interior space inside a car or other vehicle: The tuner module itself is just another "black box" (actually silver colored) that can be hidden in the trunk and plugged into a receptacle on the main CD changer unit also located there. Once the connection is made, the Remote Commander in the car's passenger compartment becomes the control panel for tuner functions as well as for CD playing tasks.

Since anyone purchasing the CDX-A10 CD changer may want to add the XT-10 tuner module initially, or at some time in the future, I thought it would be only fair to evaluate the tuner module's performance in terms of the total system. The accompanying Table compares Sony's pub-

lished specifications with those I measured in my lab. Figure B1 shows how signal-to-noise ratios and 1-kHz distortion levels vary with increasing signal strength in both mono and stereo modes. As is true of most car FM tuners, the left and right channels are deliberately blended at low signal strengths, reducing background noise considerably to make the signal usable, but at the expense of some stereo separation. This action is the cause of the by-now-familiar dip in the stereo S/N curve shown in

Parameter	Published Value	Measured Value
Usable Sensitivity	9.3 dBf	12.0 dBf
50-dB Quieting,		
Mono	15.3 dBf	18.0 dBf
Selectivity	75 dB	75 dB
S/N Ratio		
Mono	70 dB	73 dB
Stereo	67 dB	71 dB
THD, 1 kHz		
Mono	0.15%	0.2%
Stereo	0.3%	0.55%
Separation, 1 kHz	42 dB	43 dB
FM Frequency Response	30 Hz to 15 kHz, ± 3 dB	30 Hz to 15 kHz, +1.4, -3.0 dB

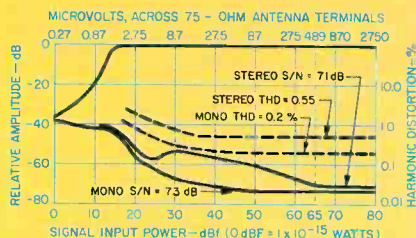


Fig. B1—Mono and stereo quieting and distortion characteristics, Sony XT-10 FM tuner module used with Sony CDX-A10 car CD changer.

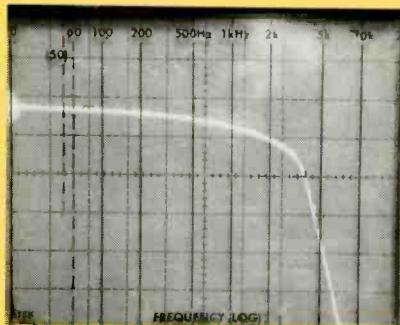


Fig. B2—AM frequency response, Sony XT-10 tuner module used with Sony CDX-A10 car CD changer.

Fig. B1, where S/N actually improves a bit as signal strength falls from 30 to 25 dBf. The tuner also has an impulse-noise suppression circuit, which may be contributing to the S/N performance. Frequency response for AM reception is shown in Fig. B2.

I found the station presets easy to program, and station seeking and scanning worked well on the test bench. My overall assessment of the Sony XT-10's performance is that, when used in conjunction with the CDX-A10 changer, it compared very favorably with some of the better separate car-stereo tuners I have measured over the past few months. L.F.

The action of the Sony CDX-A10's compressor circuits was checked both in listening tests and on the bench. Figure 9 shows how output level varied with input level for the three settings of the compressor: No compression (linear response), the moderate "DRS-1" setting, and the more extreme "DRS-2" setting.

Use and Listening Tests

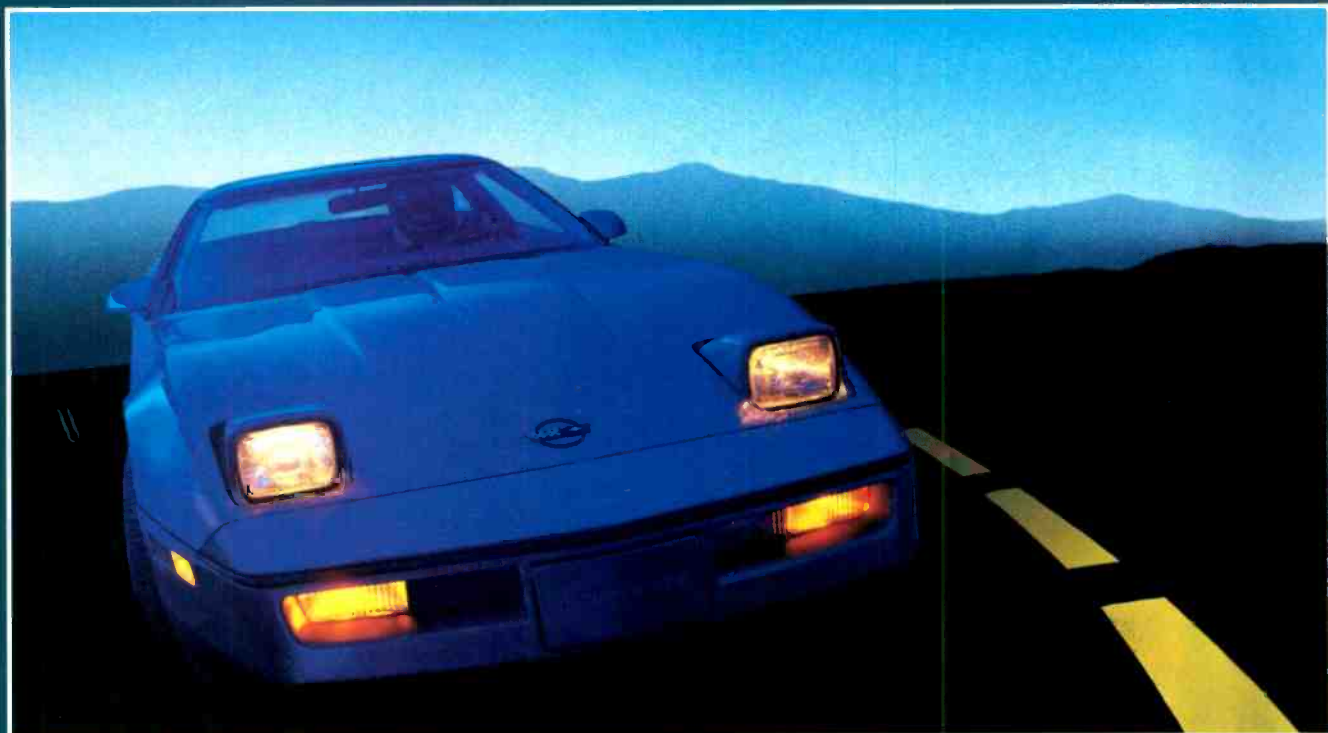
As indicated earlier, I wasn't able to test all of these CD changers at the same lab session, nor was I able to listen to them in side-by-side comparisons. As a result, I should not offer a definitive answer as to which model sounds best.

I found the Pioneer, Sony, and Mitsubishi units easy to load and use. I would reserve the Nikko unit for applications in which you really want to load up to 60 discs and, because of the difficulties of installing the tray, don't expect to change the complement of discs too often.

According to the notes I kept of my listening sessions, none of these units delivered sound quality that I can fault in any major way. In fact, since all of the players employ pretty much the same kind of digital circuitry, any differences that I would be likely to hear would arise from the analog output stages used in these four machines and from any minor deviations from perfectly flat response.

If I had to vote for the combination of best sound quality and best human engineering of the three home units, I'd pick the Mitsubishi DP-409R. The Pioneer PD-M6 would be a close runner-up, and the Nikko unit would place third. The Sony unit's ease of use was impressive on the test bench; its sound quality was also impressive in the listening room. I suspect that the two compression settings will be a most welcome feature for those car-audio buffs who have been hoping for a way to listen to CDs without either rupturing the cones of their car speakers or turning down levels so low as to miss the quieter passages of music. I found the "DRS-1" compression setting to be extremely effective and ideally set for my taste, but it would take a road test to fully qualify this feature, and the unit as a whole, in this "sweepstakes" of CD changers.

BECAUSE TOO MUCH PERFORMANCE IS NEVER ENOUGH

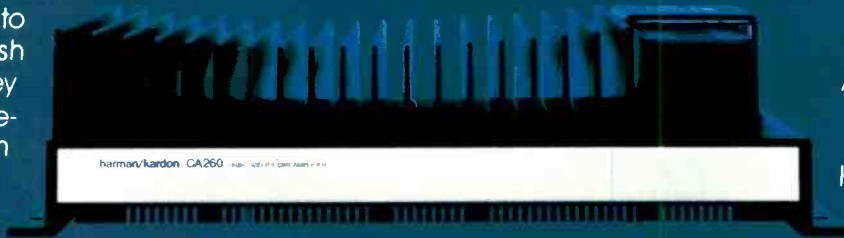


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90

Metaxial
60

POSITION-METAL

STEREO
NOISE RED
BASF CR-M
IEC II

Photo: David Hamsley

Sheet music score with various instrument parts including Tuba (Tb), Timpani (Timp.), Viola (Vla.), and Violin (Vcl.).

Cassette Test Update: 49 FORMULATIONS

Howard A. Roberson

In September 1984, we published a "Cassette Test Update" covering 12 formulations; this, in turn, was an update of the September 1983 review of 77 cassettes. The fact that this present article covers 49 new and updated products illustrates the continuing improvement made by all manufacturers. Included here are 20 Type I tapes, 23 Type IIs, and six Type IVs. There are three formulations from BASF, six from

Denon, three from Fuji, eight from Maxell, four from Memtek Products (Memorex), five from PDMagnetics, three from RAKS, four from Scotch, five from Sony, five from TDK, and three from Triad. I may have missed some improved tapes, at least since our previous coverage, but I have relied on the manufacturers' announcements and responses to queries. (Editor's Note: As we were fact-checking this article prior

to sending it for typesetting, we were told by a PDMagnetics technical services representative that the firm had ceased operations in the United States. Since goodly stocks will remain on dealer shelves and the firm will continue to do business in Canada, we felt the most reasonable course was to include the data Mr. Roberson had taken.—E.P.)

BASF emphasizes that their LH Maxima I and Chromdioxid Extra II are the IEC Standard Reference Tapes for Types I and II, respectively. The company's new Type II tape is Chromdioxid Maxima II. The names sound impressive, albeit a little complicated. The boxes and tapes show abbreviations: LH-MI, CR-EII, and CR-MII—much easier to handle. All formulations have new shells and packaging.

Denon's tape line is new, with the exception of DX-1, which remains to the line. The "HD" in each of the new formulations stands for "high density." In their literature, Denon emphasizes the "over-sized window, the higher-grade pressure-pad spring, the transparent H-shaped slip sheets and the DB (dynamic balance) hubs." Denon's best tape for high (Type II) bias is HD8, which uses New High Technoroom—a mixture of cobalt-coated ferrite and metal.



Cassette manufacturers have worked hard to improve formulas, so that competition for the title of "Best Tape" is tough.

Fuji has improved their FR-II with new, fine-grain Beridox magnetic particles, applied with advanced coating technology for greater density and uniformity. The FR tapes' cassette mechanism has been improved with honeycomb slip sheets, a loop-prevention guide, a tension stabilizer guide, and other features. Fuji's GT-I and GT-II cassette tapes are close, magnetically, to their FR-I and FR-II counterparts. The GT shells and mechanisms, however, are made to operate at higher temperatures and under conditions of vibration such as exist in car tape-player service.

Maxell made general improvements across the line and made changes to the line, as well. LN is gone, replaced by UR. UDS-I and UDS-II are new products specifically targeted for distribution through chain stores and other mass merchandisers. UD drops out of the line, with UDS-I in a sense its replacement. UDXL-I and UDXL-II, in case you haven't noticed, are simplified to XLI and XLII, respectively. XLI-S and XLII-S remain in the line. Experience with the particles used in these cassettes supported the technology used for the coating on UDS-II. A new ferric crystal magnetic particle was developed for UDS-I.

Memtek Products has updated the Memorex MRX I and HBII formulations, but two new additions to the line are of greater interest. HBXII is a high-remnance formula designed to provide higher MOLs (maximum output levels), greater sensitivity, and increased frequency response compared to standard high-bias tape. The new CDXII is a late addition to the still-limited category of metal-particle cassettes for Type II bias. Memtek wants the "CD" in the name to emphasize the tape's ability to record wide dynamic ranges, such as on Compact Discs and digitally mastered LPs.

PDMagnetics has updated most of the formulations in both its standard and HG (high-grade) lines. The improvements include new shell designs for better tape visibility and better mechanical performance. As a fair percentage of our readers may know, PDMagnetics is a joint venture between Philips (whence cometh the "P") in the Netherlands and DuPont (providing the "D") in the United States.

RAKS has not been represented in any of our previous surveys, and it appeared worthwhile to include their three formulations. The RAKS tapes are products of Turkey, and the supplied literature did not provide much information.

Scotch has made improvements across the entire line, including new packaging. I had never tested Scotch's CX formulation before, so a report was considered to be in order at this time.

Sony calls its line of newly designed audio cassettes "high tech," and they're not just using buzzwords. Bias noise levels are reduced with the use of new Super Crystal Gamma ultrafine magnetic particles, which are said to be distributed more evenly and densely, with an improved binding system for stronger adhesion. The improved Super Protection (SP) II mechanism, parallel-ribbed liners, and stepped hubs all help to ensure more even tape winding. The shells now have a wide-window design for greatly improved viewing. The line consists of HF and HF-S Type Is, UCX and UCX-S Type IIs, and the Type IV Metal-ES.

TDK has improved the D and AD Type Is, as well as the SA, SA-X and HX-S Type IIs. The D formulation has been updated to bring a new level of premium performance to "value-conscious consumers." The improved AD combines ultrafine Linear Ferric Oxide particles with a better binding process, improving both the distribution and orientation of the particles. TDK has resisted the name-changing strategy used by some others. They have, however, made further improvements in their SA formulation and have changed their Laboratory Standard cassette mechanism to reduce mechanical resonance during recording and playback. SA-X offers high sensitivity with low noise, claimed to be "lowest in its category." Because my first report on HX-S (September 1984) used early, limited-production samples, I decided to do a complete re-check to verify the conclusions made at that time.

Test Methods

Each manufacturer supplied three samples of each formulation evaluated. I examined the packaging and unwrapped the samples, noting any tab

instructions. Every sample was fast-wound once in each direction before any other tests.

I used a Nakamichi 582 deck for the great majority of these record/playback tests. I also used a Nakamichi CR-7A and Aiwa and Akai recorders for some follow-up tests.

Bias and sensitivity figures for all tapes tested were measured with reference to the standard IEC Type I, Type II, and Type IV reference tapes. Bias was measured at an internal point in the deck, using a Heath SM-5238 audio voltmeter in its dB mode and recording the meter's dB output on a calibrated stripchart recorder for easy reading to 0.1 dB. Sensitivity was calibrated using the 582's built-in 400-Hz tone and setting a Fluke 8050A true-rms meter, in dB mode, to read "0.00" during playback of the IEC reference tape. Relative sensitivities for all other tapes were then read directly from the meter.

Bias was set using pink noise, band-limited to 20 Hz to 20 kHz, as the source, with adjustment made for the best response at 20 dB below Dolby level. The record-head alignment was always trimmed before the bias adjustment to ensure the absence of skew effects. Because the bias could be set to make all of the -20 dB responses nearly alike, no plots were made at this level nor was there any effort to measure the minor differences in the -3 dB points. Swept-sinusoid plots and -3 dB checks were made at Dolby level, however, as this data was indicative of high-frequency saturation limits.

In a change from previous tests, the maximum 3% distortion points are *output* levels, referred to Dolby level (200 nWb/m at 400 Hz). The Fluke 8050A was set to read "0.00" dB for playback of a Dolby-level calibration tape, and all maximum output level figures were then read from the 8050A's display. The MOL figures for 100, 400, and 1,000 Hz show the signal levels at which third-harmonic distortion reached the standard 3% level. The MOL figures for higher frequencies show the signal levels at which twin-tone IM (TTIM) distortion reached 3%. For this test, I used tone pairs of 2.0 and 2.5 kHz for the 2-kHz MOL data, 5 and 6 kHz for the 5-kHz data, 7 and 8 kHz for the 7-kHz data (not shown in

TABLE I—MEASURED DATA

	Maximum Output Level (dB, re: 400-Hz Dolby Level)						Response At -3 dB For 0-dB Mod.					
	HDL ₃ = 3%			TTIM = 3%			S/N Ratio (dBA)	Level (kHz)	Mod. Noise (dB)	Bias (dB)	Sens. (dB)	
	100	400	1k	2k	5k	10k						
TYPE I	Tape											
	BASF LH-MI	+4.0	+4.8	+5.6	+0.8	-2.4	-8.8	58.3	10.6	-45.7	+0.4	-0.3
	Denon DX3	+5.4	+5.6	+5.5	+0.5	-2.4	-9.4	57.9	10.5	-43.2	+0.5	-0.5
	Denon DX4	+4.7	+5.5	+5.6	+0.7	-2.5	-8.9	57.7	10.2	-44.4	+0.4	+1.3
	Fuji GT-I	+4.0	+4.6	+4.7	+0.3	-2.7	-9.5	57.5	9.6	-43.7	0.0	-0.4
	Maxell UR	+3.9	+4.3	+4.4	+0.5	-2.5	-9.0	57.0	9.8	-43.8	-0.5	0.0
	Maxell UDS-I	+5.4	+5.9	+5.7	+1.0	-2.0	-8.2	59.2	10.2	-45.6	-0.4	+0.9
	Maxell XLI	+6.5	+6.8	+6.8	+0.8	-2.0	-8.5	58.8	10.0	-46.3	+0.1	+0.9
	Maxell XLI-S	+6.2	+6.8	+5.3	0.0	-3.0	-9.0	60.3	9.7	-45.7	+0.2	+1.4
	Memorex MRX I	+4.9	+5.3	+5.1	-0.3	-3.4	-10.3	59.1	9.3	-46.4	-0.7	+0.1
	PDMagnetics FERRO	+3.5	+3.9	+4.0	-0.5	-3.5	-10.0	55.5	9.3	-41.3	-0.5	+0.5
	PDMagnetics FERRO HG	+3.0	+3.6	+4.3	+0.5	-2.4	-9.0	57.9	9.9	-46.2	0.0	-0.3
	RAKS High Dynamic	-0.2	0.0	+0.8	-1.9	-5.0	-11.5	55.3	8.0	-37.6	-1.4	-1.8
	RAKS High Dynamic I	+0.8	+0.9	+0.8	-1.2	-4.3	-9.7	54.8	8.5	-35.8	-0.8	-1.2
	Scotch CX	+3.8	+4.2	+4.3	-0.6	-3.7	-10.7	55.1	9.4	-45.7	-0.9	0.0
	Scotch XSI	+3.2	+3.8	+4.2	-0.3	-3.4	-9.7	56.6	9.0	-45.3	-0.4	0.0
	Sony HF	+2.0	+2.4	+2.5	-0.9	-4.1	-10.3	54.3	8.9	-36.1	-0.9	-1.0
	Sony HF-S	+5.3	+5.7	+5.6	+1.0	-1.0	-8.4	59.5	10.0	-45.2	0.0	+0.3
	TDK D	+2.6	+3.5	+4.5	0.0	-3.1	-9.6	55.5	9.3	-45.4	-0.1	-1.0
	TDK AD	+3.8	+6.2	+6.2	+1.3	-1.7	-8.2	60.3	9.9	-44.3	+0.5	-0.3
Triad F-X	+5.2	+6.0	+6.1	+1.5	-2.1	-8.8	59.7	10.0	-43.7	+0.9	+0.2	
TYPE II	BASF CR-EII	+2.1	+2.7	+3.4	-4.3	-8.0	-12.0	60.0	7.7	-51.2	+0.4	-0.9
	BASF CR-MII	+4.8	+5.4	+4.0	-4.0	-8.3	-12.8	63.0	7.3	-51.0	+1.0	+1.0
	Denon HD6	+2.5	+3.3	+3.1	-3.6	-7.3	-12.7	59.6	8.3	-47.3	+0.5	-0.2
	Denon HD7	+3.5	+4.6	+4.6	-3.0	-7.0	-12.4	60.4	8.5	-46.7	+0.2	+1.6
	Denon HD8	+4.1	+5.2	+5.8	-1.2	-4.1	-7.9	59.0	11.3	-44.9	+0.6	+2.4
	Fuji FR-II	+4.5	+5.4	+5.4	-1.0	-5.1	-10.7	60.6	9.2	-49.4	+0.2	+1.4
	Fuji GT-II	+4.6	+5.6	+5.8	-1.0	-4.9	-10.4	62.1	9.3	-50.2	+0.4	+1.1
	Maxell UDS-II	+2.8	+3.5	+3.4	-2.6	-6.5	-11.4	59.4	8.7	-48.3	0.0	+0.7
	Maxell XLII	+4.4	+5.2	+5.1	-2.1	-5.6	-10.6	60.4	9.2	-48.0	-0.1	+1.7
	Maxell XLII-S	+5.5	+6.1	+4.1	-3.3	-7.3	-11.6	62.1	7.6	-43.8	+0.6	+2.8
	Memorex HBII	+3.0	+4.0	+4.8	-2.8	-6.2	-11.5	59.8	10.2	-48.0	+0.2	+1.0
	Memorex HBXII	+5.4	+6.1	+5.8	-1.0	-4.6	-9.9	61.4	10.1	-52.8	+0.1	+1.8
	Memorex CDXII	+5.7	+6.3	+6.1	-0.4	-3.1	-6.9	61.2	11.9	-47.4	+1.3	+2.9
	PDMagnetics 500 Crolyn	+3.5	+3.8	+2.7	-5.7	-8.7	-13.1	60.2	7.4	-50.5	+0.2	0.0
	PDMagnetics 500 Crolyn HG	+2.9	+3.5	+2.6	-5.1	-8.5	-12.8	61.5	7.1	-38.7	0.0	-0.1
	RAKS High Dynamic II	+0.4	+1.2	+1.5	-4.5	-8.3	-12.8	57.2	7.3	-41.2	-0.2	-0.1
	Scotch XSI	+4.0	+4.6	+3.6	-3.8	-7.4	-12.1	59.4	7.7	-46.2	+0.3	+0.7
	Sony UCX	+4.8	+5.7	+5.8	-1.5	-5.4	-10.9	60.6	9.2	-47.8	-0.2	+2.5
	Sony UCX-S	+4.1	+5.0	+5.2	-2.1	-5.4	-10.8	60.0	9.3	-48.6	+0.4	+1.7
	TDK SA	+3.4	+4.4	+4.9	-1.9	-5.7	-11.2	60.9	8.9	-47.2	+0.1	+1.1
TDK SA-X	+3.7	+4.4	+3.6	-2.8	-7.3	-11.5	63.2	7.8	-47.8	+1.0	+1.6	
TDK HX-S	+6.9	+7.5	+7.0	+0.3	-2.5	-6.6	60.6	12.2	-47.8	+1.2	+3.3	
Triad EM-X	+3.6	+4.2	+3.9	-1.0	-3.8	-7.0	60.2	11.7	-48.0	+0.5	+2.6	
TYPE IV	Denon HDM	+5.9	+7.2	+7.2	0.0	-3.4	-7.7	62.0	11.7	-48.0	+1.4	-0.8
	Maxell MX	+8.0	+9.1	+9.5	+2.3	-1.9	-6.8	62.7	12.5	-50.4	+0.1	+0.8
	PDMagnetics 1100 Metal HG	+7.7	+8.5	+7.9	+1.2	-2.4	-6.8	62.3	11.7	-45.7	-0.2	+0.5
	Scotch XSMIV	+5.8	+6.5	+6.2	-0.3	-3.4	-7.6	59.7	11.4	-47.2	-0.5	-0.1
	Sony Metal-ES	+8.8	+10.2	+10.3	+2.1	-2.4	-7.1	66.0	12.5	-50.8	+0.6	+2.0
Triad MG-X	+6.3	+7.3	+7.2	+0.9	-2.9	-7.5	61.9	11.7	-47.7	+1.0	-0.1	

Table I but used in plotting the figures for all formulations), and 10 and 11 kHz for the 10-kHz MOL data.

The signal-to-noise ratio was referenced to the signal level that produced 3% distortion at 400 Hz, measured with IEC A weighting. (For those who wish to compare these results with figures obtained with CCIR/ARM weighting, subtracting 2.6 from the dBA figure will provide a fairly accurate conversion.)

A 3-kHz tone was recorded and played back to assess flutter. I should point out that these results are just general indications: The deck which one uses has a considerable effect on the measured figure for any tape. Even relative rankings may shift when the same tapes are measured on a different cassette deck, especially if those rankings are close to begin with. The same 3-kHz tone was also used to test

for dropouts and to determine the degree of level stability at this moderately high frequency.

I measured modulation noise differently this time than I have in the past. Formerly, I used a simple 1-kHz notch filter to remove the recorded high-level tone, measuring the distortion products (and noise) remaining. However, the "notch" of such a filter is not perfectly square-sided, but tapers enough

This year we also checked the external plastic wraps, which may seem trivial, but they can be a source of great frustration.

to filter out some of the distortion products, too. This time, to minimize the notching needed, I recorded the high-level tone on both channels, reversed the polarity on one channel in playback, and trimmed levels and head alignment until the test signals from the two channels (when mixed together) nulled each other out as far as possible. I then used a filter to notch out only the residual tone left after nulling. This method works because the 1-kHz test tone is coherent and correlated channel-to-channel, but the modulation noise is not. Therefore, summing the two channels, with one out of phase, cancels the tone, while the noise power from the two signals adds; with a little level compensation, the method works out just fine.

Use Tests

The first tests involved removing the external plastic wrapping and then fast-winding the samples in each direction. I had been frustrated in the past when trying to get a cassette's wrapper off. Even after using the pull tab, it is often a struggle. I have found that by purposely pulling the tab toward the other end of the box and then, perhaps, toward the "short" end at the last moment, I can remove most wraps very easily. So, how well did this work on these samples?

BASF: Removal of the wrap was easy with the across-the-box pull. A couple of the boxes hung up a little when opening. All samples wound smoothly.

Denon: These tapes have a little curved arrow on the wrap, giving the essential clue for easy removal. I liked the high-quality boxes. All winds were smooth.

Fuji: Wrap removal was easy with the across-the-box pull. I liked the GT-I and GT-II shells with their tactile clues on A and B sides. Not only are these good for users of car players, but blind people will also find them helpful. All winds were smooth.

Maxell: There is a diagonal arrow at the tab, but I found it was better to pull straight for a short distance before going diagonally. All of the samples wound smoothly.

Memorex: The pull tab was not very obvious, but it worked very well with the swooping pull. The new Memorex boxes are not as well sealed against

dust as the previous ones, but the cassettes can still be inserted either way for storage. All samples wound smoothly.

PDMagnetics: The packages opened easily with an across-the-box pull (which I prefer). Some boxes hung up very slightly when opened or closed, but general quality was high. All samples were smooth and quiet in winding.

RAKS: Most samples opened easily with the tab. Several of the boxes were rather grabby on opening. Most of the cassettes made little squeals or burbles during fast winding.

Scotch: All samples opened easily—even CX, where the pull tab is closer to the center of the box. All cassettes wound smoothly.

Sony: The wrapper for each of this company's formulations has an obvious pull tab; right next to the tab is the instruction to "Pull Diagonally." This was the best combination for wrap removal I found in the collection. Some of the samples were notably quieter in winding than the average.

TDK: In general, removing the wrap was very easy. As a group, the TDK samples were the quietest during fast winding.

Triad: All samples opened easily with the tab, and all were quiet during the fast winding. The triangular window is different, but it limited the visibility of the tape packs between the hubs.

Measurements

Table I lists the results of the evaluation of the 49 formulations, using the Nakamichi 582 deck. The arrangement is different from most of our surveys in the past, although it is quite similar to the Table in our September 1984 report. I remind all readers that the present tests are based upon tests of maximum output level for 3% distortion rather than maximum recording level for that distortion point. Please also note that the 2-kHz data is now obtained from TTIM rather than HDL₃ tests. I have also provided plots showing frequency response at 0-dB output level (solid line) and MOL for 3% distortion (dashed line) for each tape formulation. Note that distortion at the 0-dB level is less than 3% wherever the solid curve is below the dashed one, and more than 3% wherever the dashed curve falls below the solid one.

Therefore, the MOL curve will probably be of more help in understanding the limits on record/playback levels for each tape.

The brief comments on each of the tapes are arranged alphabetically by brand within tape type. Most of these tapes showed little or no skew, had consistent bias requirements and sensitivity, had quite good 3-kHz output-level stability, and showed average flutter. I have therefore not mentioned these areas unless something was poor—or especially good.

TYPE I TAPES

For all tape types, high MOLs are a fundamental requirement for high performance. Since most of the Type I tapes have about the same absolute noise level, the higher a tape's 400-Hz MOL, the higher its signal-to-noise ratio. Type I tapes show neither high MOLs at 10 kHz nor really extended response at 0 dB, but they are generally better than Type II tapes in these regards. The basic reason for this is not an innate superiority of Type I tape but a difference in equalization: The smaller high-frequency boost used in recording Type I tapes causes less saturation. At the same time, however, the difference between Type I and Type II playback equalization is the main reason why Type I tapes have generally lower S/N ratios than Type IIs. Nevertheless, the best-performing Type I tapes, with 400-Hz MOLs of +6 dB or more, have S/N ratios that are a match for many Type II tapes.

BASF LH Maxima I (LH-MI): An above-average tape, with good MOLs, low noise and extended response at 0 dB. In fact, it had the widest response of any Type I tape tested here.

Denon DX3: This is an above-average tape, with good MOLs, fairly low noise and extended response at 0 dB. Bias requirements and sensitivity were very consistent.

Denon DX4: Because this formulation's measurements were so very close to those for DX3, I rechecked some tests. I got the same results—but no matter, this is an above-average tape for the same reasons as given for DX3.

Fuji GT-I: This is a slightly above-average tape. The MOLs were fairly good, but the response at 0 dB was not par-

TYPE I

ticularly impressive. Bias requirements were very consistent. As stated earlier, the shell design is excellent for easy use when the user isn't able to see the cassette.

Maxell UR: This LN replacement gets a somewhat above-average rating for its combination of fairly good MOLs and high-end response close to 10 kHz. Flutter was lower than average.

Maxell UDS-I: This is a good addition to the tapes available—one of the better Type I formulations. MOLs were high across the entire band, noise was low, and 0-dB response was quite well extended. Bias requirements and sensitivity were very consistent, and flutter was slightly lower than average.

Maxell XLI: This is one of the best Type Is, offering high MOLs, low noise, and fairly well-extended response. Bias requirements and sensitivity were both very consistent. Flutter was lower than average.

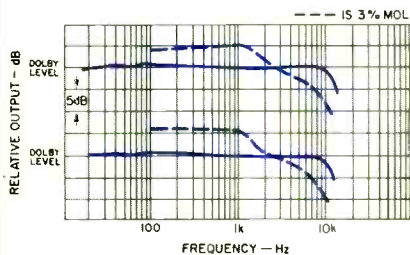
Maxell XLI-S: Overall, this is one of the best Type I tapes. It had high MOLs and low noise, but some areas were not a match for XLI. Bias requirements were very consistent, but sensitivity had a 0.6-dB spread among the two sides of the three samples. The 3-kHz output stability was very good, and flutter was lower than average.

Memorex MRX I: This formulation had good MOLs for the lower frequencies, but less so for the higher ones. The 0-dB response was about average, which corresponds to the results obtained for high-frequency MOLs. The bias requirements were very consistent, and the flutter was lower than average. Overall, this is an above-average tape.

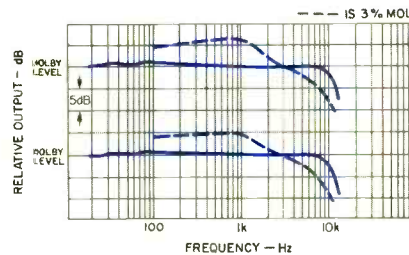
PDMagnetics FERRO: This is an average Type I tape in all respects.

PDMagnetics Tri-Oxide FERRO HG: Compared to FERRO, the higher MOLs overall, the lower noise and the more-extended response get this tape a slightly above-average rating, aided by consistent bias requirements and lower-than-average flutter.

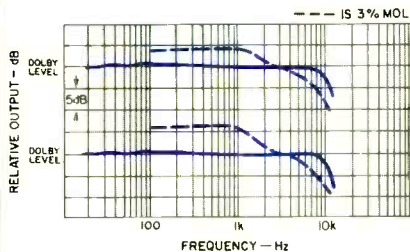
RAKS High Dynamic: This is a lower-than-average tape; in fact, it measured the poorest of the lot. MOLs were very low, the modulation noise was high, and the response was the least extended of the Type Is. Bias requirements and sensitivity were not consistent, and dirt deposits from two of the



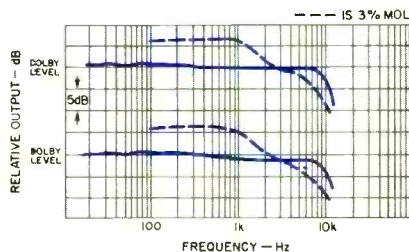
BASF LH-MI (top) and Denon DX3



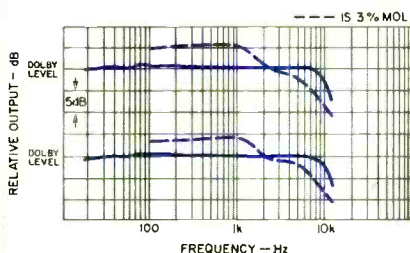
Denon DX4 (top) and Fuji GT-1



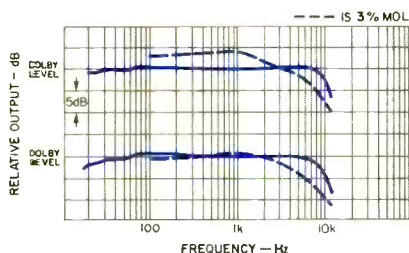
Maxell UR (top) and UDS-I



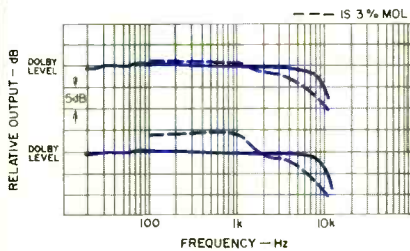
Maxell XLI (top) and XLI-S



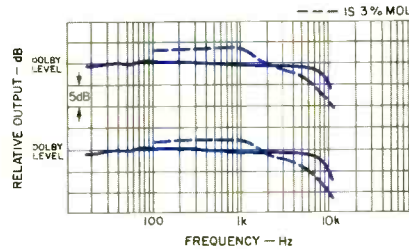
Memorex MRX I (top) and PDMagnetics FERRO



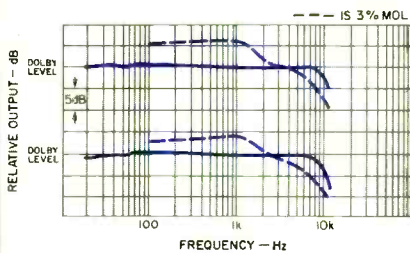
PDMagnetics Tri-Oxide FERRO HG (top) and RAKS High Dynamic



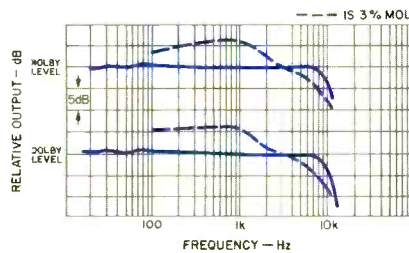
RAKS High Dynamic I (top) and Scotch CX



Scotch XSI (top) and Sony HF



Sony HF-S (top) and TDK D



TDK AD (top) and Triad F-X

New to the marketplace, since our last test, is the metal-particle Type II cassette, which exhibits superior performance.

three samples confused the taking of data. In addition, flutter was poorer than average.

RAKS High Dynamic I: Overall, this was a slightly better performer than the other RAKS Type I, but it showed other problems. Dropout performance was poor enough to be audible, and one sample jammed in record mode.

Scotch CX: Overall, this is a formulation of average performance in most respects. Bias requirements were very consistent, and dropout performance was better than average. Flutter was noticeably better than the average—one of the best in this regard.

Scotch XSI: In most areas, XSI seemed a lot like CX during the testing, and the general results were also average. Dropout performance was better than average, as was the flutter.

Sony HF: This is a below-average Type I tape, with rather low MOLs, high noise, and restricted response at 0 dB. Flutter was lower than average.

Sony HF-S: This is definitely one of the better Type I tapes. MOLs were good across the band, noise was low, and response was good at 0 dB. Bias requirements and sensitivity were very consistent. The flutter was slightly better than average.

TDK D: Overall, this formulation fits into the group of average-performing tapes. Bias requirements and sensitivity were very consistent.

TDK AD: A good combination of high MOLs, low noise, and a fairly well-extended response. Bias requirements were completely consistent, and flutter was slightly better than average. Add it all up: This is one of the better/best Type I tapes.

Triad FX: This is definitely one of the better Type I tapes, with good MOLs across the band, low noise, good response and high consistency in all respects. The flutter was lower than average.

TYPE II TAPES

Different criteria must be applied when evaluating Type II tapes. The basic need for a high-quality recording medium remains, of course, but a few differences from Type I tapes appear. For example, most Type II tapes have low MOLs at the higher frequencies, but they usually have higher signal-to-

noise ratios than Type I formulations. A good part of this is the result of record and playback with Type II (70- μ S) equalization. The record-EQ difference also affects 0-dB response at the higher frequencies, where Type I tapes beat most of the Type IIs. (If the same EQ were used for both Type I and Type II tapes, the performance of the two groups would be more similar, and some Type II tapes would then show better high-frequency MOL than Type I tapes.)

Take particular note of the results for Denon HD8, Memorex HBXII and CDXII, TDK HX-S, and Triad EM-X. These tapes stand as worthy competitors to the Type IV metal-particle tapes, at least in some areas of measurement, and generally demonstrate superior performance. Excepting HBXII, incidentally, all these tapes are metal-particle formulations, and they could be the best choice for tape decks that don't perform particularly well with Type IV tapes.

BASF Chromdioxid Extra II (CR-EII): The MOLs were lower than most of the other tapes in this report, and the signal/noise ratio and 0-dB response were average. Bias requirements were completely consistent from sample to sample. The 3-kHz output-level stability was better than the average Type II. Overall, about average.

BASF Chromdioxid Maxima II (CR-MII): The low-frequency MOLs were quite good, but the high-frequency ones were on the low side. The signal-to-noise ratio of 63.0 dBA was one of the very best for all Type IIs and Type IVs. The 0-dB response rolled off at 7.3 kHz, quite obvious in the plot. Bias requirements and sensitivity were very consistent. The 3-kHz output-level stability was excellent, and the dropout check showed good smoothness even at the fast scan rate. The flutter was lower than average. Overall, this is one of the better Type II tapes; for recording material which does not have considerable high-frequency content, it is one of the best.

Denon HD6: The MOLs were mostly on the low side, and other results were average. Bias requirements were completely consistent, and flutter was slightly better than average. In toto, somewhat below average.

Denon HD7: The increase in MOLs

over HD6, and other improvements, were desirable differences. Bias requirements and sensitivity were completely consistent. The fast scan for dropouts was quite smooth—one of the better performances. Flutter was better than average. Overall, a good, average Type II tape.

Denon HD8: This is one of the metal-particle Type II tapes, and it evidenced quite high MOLs across the band and a 0-dB response that was much more extended than most Type IIs. Do note that the signal/noise ratio was actually lower than average. If noise reduction is used, however, this may have little significance. Bias requirements were completely consistent, and the 3-kHz output-level stability was better than average. Adding it all up, this is one of the better-to-best Type II tapes.

Fuji FR-II: This formulation showed good MOLs and reasonable 0-dB response. Bias needs were very consistent. The 3-kHz output was smooth and stable, one of the best for all tape types. Flutter was low, also one of the best. Definitely one of the better Type II tapes.

Fuji GT-II: Although the manufacturer targets this tape for the car market, its high MOLs, low noise and good 0-dB response make it good for any use. Bias requirements were very consistent. The 3-kHz output was stable and smooth—the best overall for all tapes tested. Flutter was better than average. One of the best Type IIs.

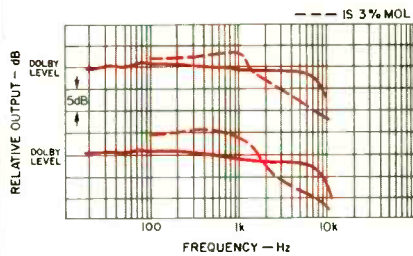
Maxell UDS-II: With so-so MOLs along with a mediocre signal-to-noise ratio, this is a below-average tape. Consistent bias needs were a plus.

Maxell XLII: The MOLs were quite good, the very consistent bias and sensitivity were nice, the 3-kHz output-level stability was excellent, and flutter was better than average. This is a better-than-average Type II.

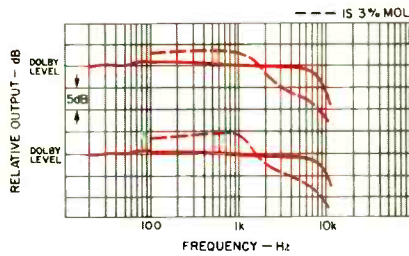
Maxell XLII-S: I expected this tape to outperform XLII but was puzzled to see that, overall, it did not. Its S/N and its MOLs (at frequencies below 5 kHz) were the only areas in which it outperformed XLII. Overall, this is one of the better Type II formulations, but it would perform best when recording material that didn't have very much high-frequency energy.

Memorex HBII: The MOLs were just average overall, but the 0-dB response

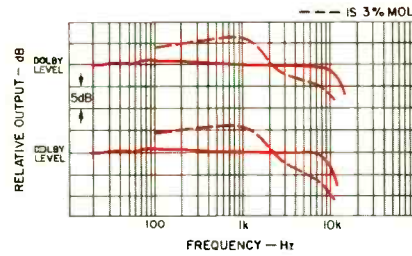
TYPE II



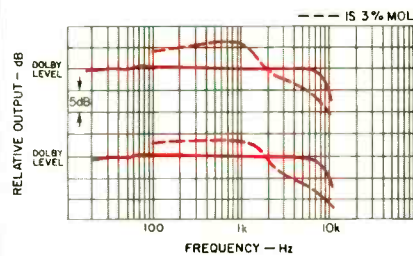
BASF CR-EII (top) and CR-MII



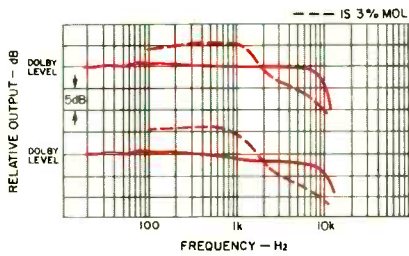
Denon HD6 (top) and HD7



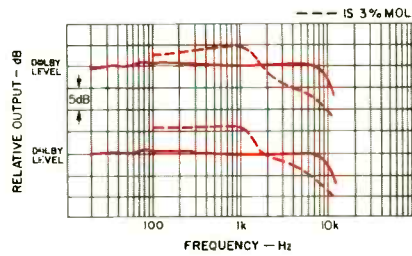
Denon HD8 (top) and Fuji FR-II



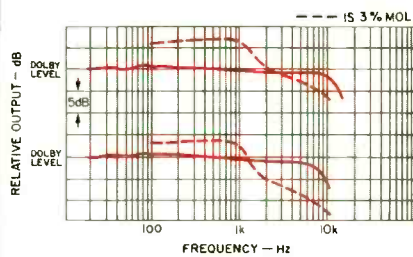
Fuji GT-II (top) and Maxell UDS-II



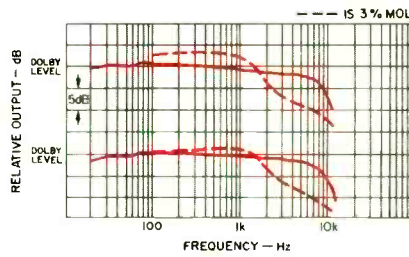
Maxell XLII (top) and XLII-S



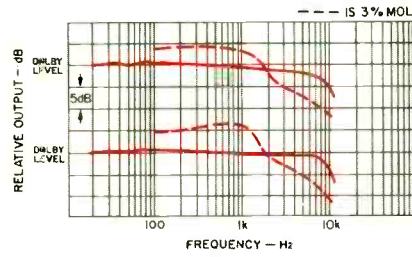
Memorex HBII (top) and HBXII



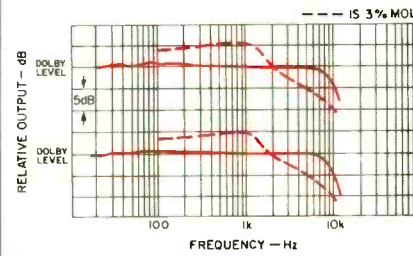
Memorex CDXII (top) and PDMagnetics 500 Crolyn



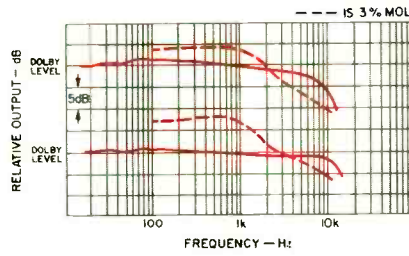
PDMagnetics 500 Crolyn HG (top) and RAKS High Dynamic II



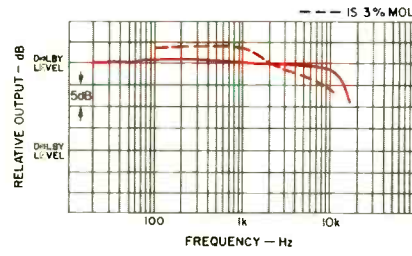
Scotch XSII (top) and Sony UCX



Sony UCX-S (top) and TDK SA



TDK SA-X (top) and HX-S



Triad EM-X

was impressive: In fact, it was the best for the nonmetal-particle Type IIs. Bias needs were very consistent. Flutter was slightly lower than average. The sum total makes for a better-than-average Type II tape.

Memorex HBXII: The high MOLs, the good 0-dB response, and the low noise make an impressive combina-

tion. Bias requirements were very consistent. The 3-kHz output-level stability was better than most, and the flutter was one of the lowest. HBXII is one of the better-to-best Type II tapes.

Memorex CDXII: This is Memtek Products' entry into the Type II metal-particle derby. (They have dropped their Type IV formulation.) The MOLs were

very high for a Type II, the noise was fairly low, and the 0-dB response was well extended. The flutter was noticeably better than average. This is one of the best Type II tapes, and it is a match for some of the Type IVs.

PDMagnetics 500 Crolyn: The MOLs were on the low side across the band, and the 0-dB response was quite re-

stricted. Bias needs were completely consistent, but this is a below-average Type II formulation.

PDMagnetics 500 Crolyn HG: This tape's designation indicates better performance than its stablemate, but alas, the tests don't show it. The S/N ratio was slightly better than that for 500 Crolyn, but the modulation noise was considerably poorer. With MOLs and 0-dB response on the poor side, this is a below-average tape.

RAKS High Dynamic II: With the lowest MOLs, the lowest S/N ratio and one of the poorer 0-dB responses, this is the poorest Type II in this report.

Scotch XSII: This tape had average MOLs overall, and the 0-dB response was rather limited. Bias needs and sensitivity were very consistent. The 3-kHz output-level stability was one of the better ones, considering all tape types, and the flutter was lower than average. This is an average Type II formulation.

Sony UCX: The MOLs were generally high, and the 0-dB response was better than average. Bias and sensitivity were very consistent. Flutter was much lower than average—one of the best. UCX is one of the better Type IIs.

Sony UCX-S: I had expected to get somewhat higher MOLs with this formulation than with UCX; instead, I got slightly lower figures. Nonetheless, UCX-S is also one of the better Type IIs. Bias needs were very consistent, the 3-kHz output level was very stable, and there was nothing to see in the dropout check—one of the best tapes in this respect.

TDK SA: Fairly good MOLs, a reasonable 0-dB response, and excellent output-level stability make SA one of the better Type II tapes.

TDK SA-X: This is nominally one of the "hot" tapes, recommended by its maker for challenging applications. Formerly, such tapes had very high MOLs at higher frequencies, but most manufacturers have changed their formulations to yield lower noise instead. Typical of such tapes, SA-X actually had average high-frequency MOLs. It did have the best signal-to-noise ratio of all Type IIs tested (albeit just barely), a figure exceeded by just one Type IV formulation. It is one of the better tapes for recording material with limited high-frequency energy.

TDK HX-S: The fact that this tape had the highest MOLs across the band, and the most extended 0-dB response, makes this the best-performing tape of all Type IIs. It is even a match for some Type IVs. The formulation evidenced very consistent bias needs and sensitivity. The 3-kHz output-level stability was one of the best for all tapes, and the scan for dropouts was one of the smoothest.

Triad EM-X: This recent addition to the metal-particle Type IIs had average low-frequency MOLs, but the high-frequency MOLs were impressive. The 0-dB response was well extended, matching the other similar-formulation Type IIs. Overall, one of the better Type IIs.

TYPE IV TAPES

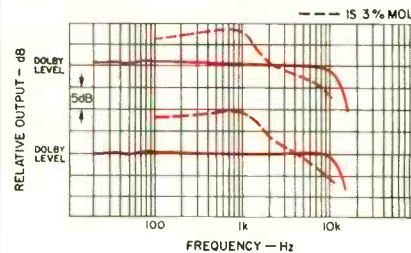
The better metal-particle Type IV tapes still stand as the best performers, primarily because of their very high MOLs and reduced high-frequency saturation, gaining greater response extension at 0 dB. It has also been generally true that the metal-particle tapes are relatively noisy, and the net result of this is that the signal/noise ratios for Type IV tapes have been little or no better than some of the Type IIs. However, I found a refreshing exception to this tendency, as the comments below reveal.

Denon HDM: This is an average metal-particle tape which offers high MOLs, low noise, and very good 0-dB response. Bias and sensitivity were very consistent, and the output level was very stable. Flutter was lower than average.

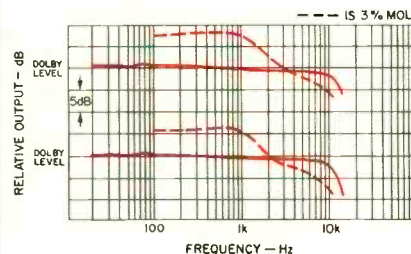
Maxell MX: The MOLs were very high, the S/N ratio was high, and the 0-dB response was very good—what else does one need? Well, MX does have very consistent bias needs and sensitivity, smooth 3-kHz output with high-speed scan, and lower flutter than average. One of the best Type IVs.

PDMagnetics 1100 Metal HG: This is a typical metal-particle tape with very good MOLs, a very good S/N ratio, and a well-extended 0-dB response. Bias needs were very consistent, and the 3-kHz output-level stability was one of the best for all tapes. Flutter was better than average.

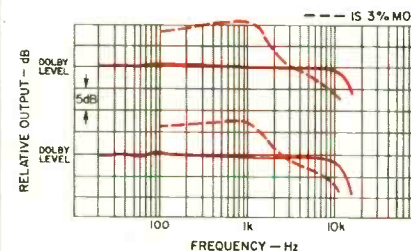
TYPE IV



Denon HDM (top) and Maxell MX



PDMagnetics 1100 Metal HG (top) and Scotch XSMIV



Sony Metal-ES (top) and Triad MG-X

Scotch XSMIV: The MOLs were the lowest for this group of Type IV tapes, and the formulation was matched or surpassed by two of the Type II metal-particle tapes in a number of respects. Bias requirements and sensitivity were very consistent. This is a very good tape, but the Type IV competition is tough.

Sony Metal-ES: This tape had the highest MOLs of the group, produced the highest S/N ratio by over 3 dB, and matched the widest 0-dB response. Bias needs were very consistent. Sony Metal-ES had the highest performance of all 49 tapes tested.

Triad MG-X: This is a typical metal-particle tape, showing high MOLs across the band and an extended 0-dB response. The samples were very consistent in most respects, but there was a regular ± 0.2 dB sensitivity change every 0.5 S. Flutter was higher than average.

Most people would improve the sound of their tapes if they paid more attention to getting a better tape-to-deck match.

Further Checks

While checking the 3-kHz output-level stability during playback, several formulations showed noticeable level variations that came and went for no apparent reason. The variations were almost always greater in the right channel than they were in the left, and a short rewind was associated with higher variations. These conditions were noted with the Nakamichi 582 test deck, but when the same tapes were given the same basic test on an Aiwa AD-M700 and an Akai GX-R99, the level variations were very much smaller—even nonexistent, in some cases. My tentative conclusion is that there was some sort of interaction between the particular tapes and their shells and the tape handling of the Nakamichi 582.

I don't know the exact mechanism involved here, but I do suggest to recordists that there may be subtle sonic effects that relate to particular deck/tape combinations. The variations were usually less than 1.0 dB total and occurred over a period of 2.5 to 3.0 S, so noticing any effects while playing music would be difficult.

Although I run all my tests on C-90 cassettes, I wondered how well other lengths match C-90s for bias and sensitivity. If other lengths are used, what will happen? Another facet of the same question is this: If the deck is set up with C-60s, then how well does it perform with C-90s? This is particularly pertinent when seeking the best Dolby NR tracking.

To test this, I used a variety of old and new formulations of Type I, Type II, and Type IV tape from Fuji, Maxell, PDMagnetics, RAKS, Scotch, and TDK—in as many lengths as I had available. For Types I and II, there was very close agreement among C-90s, C-60s and C-46s in each formulation. (I did not have C-46s for half of the brands tested.) The Maxell LN and UD C-120s, however, required noticeably more bias, particularly the LN tapes. Most of the Type I and II formulations showed agreement in sensitivity among all lengths. The exceptions were that the C-60 version of UDXLI was 1.7 dB less sensitive than the C-90, and the RAKS High Dynamic C-60 was 1.4 dB more sensitive than its C-90 version.

Each Type IV had its own story. The

Fuji FR Metal C-60 required 0.7 dB less bias than the C-90 and had 0.5 dB more sensitivity than its longer counterpart. The average figures for the Maxell MX C-60 matched the C-90 results, but there was some spread in both bias and sensitivity of the samples checked. With some older samples of TDK MA, the C-60s required less bias and were less sensitive, but with newer tapes, the C-60s required *more* bias and were somewhat *more* sensitive. With MA-R tapes, the C-60s and C-90s matched closely enough in both bias and sensitivity, but they produced different figures than those obtained for the MA formulation.

With recent Type I and II tapes, the bias requirements and sensitivity for most lengths agree pretty well. You would have only minimal problems in interchanging C-90, C-60, and C-46 versions of a given tape. The use of a C-120, however, could introduce some noise-reduction tracking problems, to say nothing about tape saturation and transport problems.

The discrepancies are larger for the relatively few Type IV tapes. The consistency from batch to batch, let alone from length to length, that is so common in Type I and Type II tapes is not yet shared by metal-particle Type IV cassettes. (I haven't seen enough Type II metal-particle tapes to comment on them.) However, the differences in bias needs that show up in my tests with a Nakamichi 582 might not show up on the many cassette decks, especially inexpensive ones, which lack the headroom or bias capacity to take full advantage of Type IV tapes capabilities.

To give an idea of how wide a range of bias and sensitivity variations one might encounter, I combined the bias and sensitivity data for the 49 formulations reported here with earlier data or 36 other tapes. The results are presented in Figs. 1 and 2; these show the number of formulations with which particular bias and sensitivity values occur. For these figures, I divided bias requirements and sensitivities into ranges ± 0.2 dB wide and 0.5 dB apart (center-to-center). Hence the "0.0" bar includes all tapes falling within a range of ± 0.2 dB, the "+1.0" bar includes tapes that have values of 0.8 to 1.2 dB, and so on.

Note that the most common bias-requirement values, for all three tape types, was just about 0.0 dB, the IEC Standard, but that tapes meeting the IEC Standard for bias were least common among the Type IV formulations. There was less agreement with the IEC Standards for sensitivity—especially among Type II tapes (where the most common value was +1.0 dB) and Type IVs (where it was -0.5 dB). The high-sensitivity Type II tapes are the "hot" ones referred to earlier, such as TDK SA-X and the new metal-particle Type IIs.

If you switch tape formulations without readjusting bias or record sensitivity, you can minimize possible Dolby-tracking problems by choosing a tape whose requirements are close to those of your original tape. Your new tape should therefore be one whose sensitivity is within 1.0 dB, and whose bias requirement is within 0.5 dB, of your original tape. (Bias affects tracking because a tape that requires more bias, but doesn't get it, will have a boosted high-frequency response.) The following list shows some combinations whose bias requirements and sensitivity meet the above criteria; note that the bias groupings do not correspond exactly to those of Fig. 1.

Type I: Among lower bias tapes, Konica ML, Memorex dB, and Realistic Supertape Gold have reasonably well-matched requirements. Medium-low bias: Maxell UR, Memorex MRX-I, PDMagnetics FERRO, and Scotch CX and XSI. Slightly low bias: Denon DX1 and Maxell UDS-I. Tapes requiring nominal IEC-zero bias fall into three sensitivity groups: Fuji GT-I, Loran Normal, PDMagnetics Tri-Oxide FERRO HG, and TDK D; Fuji ER, JVC DA3, Magnex Studio 1, Nakamichi EXII, and Sony HF-S; and Maxell XLI and TDK AD-X. For somewhat high bias, there are also three groups: BASF LH-MI, Fuji DR, and Konica GM-I; BASF LH-MI, Konica GM-I, and Yamaha NR; and Denon DX-4 and Maxell XLI-S. Finally, for high bias: BASF LH-MI, Denon DX-3, TDK AD, Triad F-X, and Yamaha NR-X. As this listing shows, BASF LH-MI fits in well with a number of other tapes; it's a possible choice in three combinations. On the other hand, some Type I tapes are not listed at all, because their combinations of bias

Cassette mechanisms have received a good deal of attention, as makers realize how much shells can influence play.

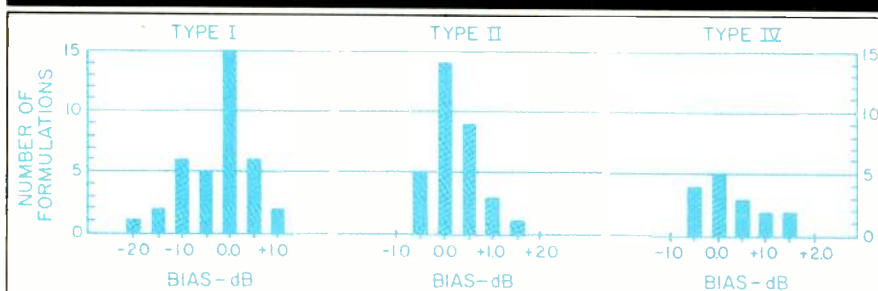


Fig. 1—Bias requirements for 85 tape formulations.

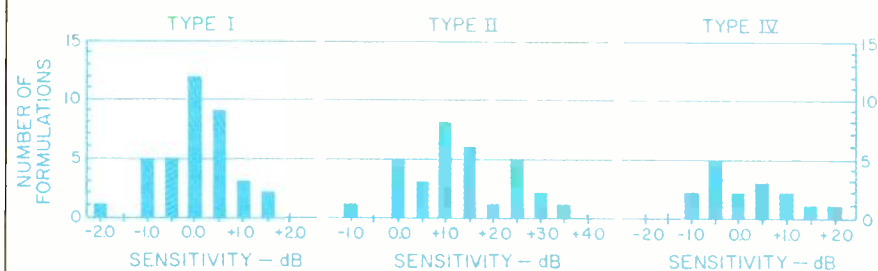


Fig. 2—Sensitivity of 85 tape formulations.

and sensitivity match no other Type I formulations.

Type II: Low bias: Konica GM-II, Nakamichi SX, and Yamaha CR. For nominal zero bias, again three groups: JVC DA7, Maxell XLII and UDS-II, Memorex HBXII, and TDK SA; Denon HD7, Fuji FR-II, Memorex HBII, and Realistic Supertape Hi-Bias (which match especially well among themselves); and the group of Nakamichi SX-II, Sony UCX, and Yamaha CR-X. I picked out two groups for somewhat high bias: Fuji GT-II, Maxell UDS-II, Scotch XSII, and TDK SA; and Denon HD8, Maxell XLII-S, Sony UCX-S, TDK SA-X, Triad EM-X, and Yamaha CR-X. The high-bias combinations are: BASF CR-MII and Loran High Bias, and Memorex CDXII and TDK HX-S. Denon HD8 and Maxell XLII-S are possible additions to the last pair of tapes.

Type IV: For low bias: BASF Metal IV, Konica Metal, Magnex Studio 4, Scotch XSMIV, and TDK MA-R. I picked two groups close to IEC-zero bias: JVC ME, Magnex Studio 4, and Nakamichi ZX are in one group; Maxell MX, PDMagnetics 1100 Metal, and Realistic Supertape Metal are in the other. For somewhat high bias there are also two groups: Fuji FR Metal, Triad MG-X, and Yamaha MR; and Sony Metal-ES

and TDK MA. For high Type IV bias, there are just two tapes: Denon HDM and Triad MG-X. Note that the bias and sensitivity combinations of the Magnex and Triad formulations allow them to be used with either of two adjacent groups.

All of these groupings should be considered as general guidelines for use when interchanging tapes without making bias or sensitivity adjustments. Users who do make such adjustments can interchange tapes more freely, without consulting these guides. In any case, the user should always listen carefully to assess the sonic effects when changing tape formulations.

Measuring Modulation Noise

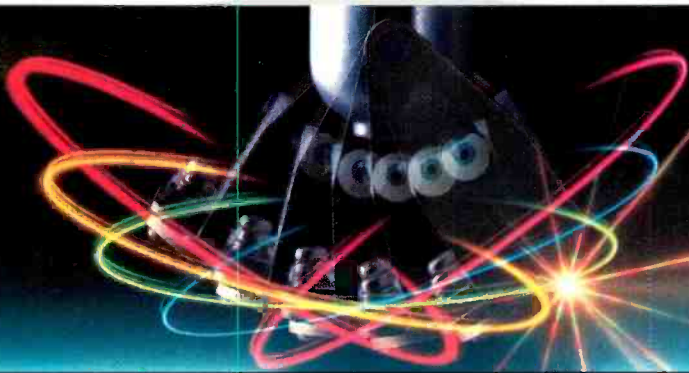
Although the test for measuring modulation noise was described and the results were listed, additional comment is in order. There is no common measuring practice, and no standards for the band-limiting or notch filters, so there is no way to ensure that different testers will get comparable results. Quite a few people believe that modulation noise should be measured at something like 10 kHz, but others say this should be called "scrape flutter." I'm hoping to find alternative ways of configuring my cancellation/filtering

setup for more assurance of stable, reliable data. With the increasing availability of source material having very wide dynamic ranges, such as Compact Discs, cassette recordings with Dolby C or dbx NR will be more revealing of modulation noise if it occurs. In general, with normal use, dbx NR helps to prevent modulation noise, which is directly related to the recorded level on the tape. Perhaps the improved and improving cassette formulations will ensure that modulation noise will not be a problem, but I will be keeping my eyes and ears open.

Present and Future Formats

Formulations of all types have improved continuously. Even in the last few years, there have been significant changes, such as metal-particle Type IV tapes and, more recently, their Type II counterparts. Shells have also improved, providing better visibility, greater resistance to heat, greater reliability, and lower skew. But we are constrained by the analog format, are we not? Actually, relatively few people are as restricted as they think they are: Many of them would greatly improve the sound of their tapes if they paid more attention to getting the best tape/deck match, followed better recording practices, and used higher quality sources. (Retiring their old decks for improved units might help, too.) There is much that can be done with the tools at hand, and the convenience and low cost of the many varieties of cassette recorders/players will continue to have great appeal for many years to come.

We will see digital audio tape (DAT) in one or two formats, and it is likely that we'll be seeing prototype recordable Compact Discs in the next year. Because the technology of the DAT medium is very sophisticated, it is logical to expect that initial prices will be high for both the tape and the recorder(s). The portable Compact Disc players indicate the possibilities as far as sophistication in a small package is concerned. The actual selling price of deck-type DAT recorder/players, and the cost of DATs, will determine how much of the large analog cassette-format market shifts to digital. In the meantime, enjoy all of the marvelous things there are to record, play and listen to. **A**



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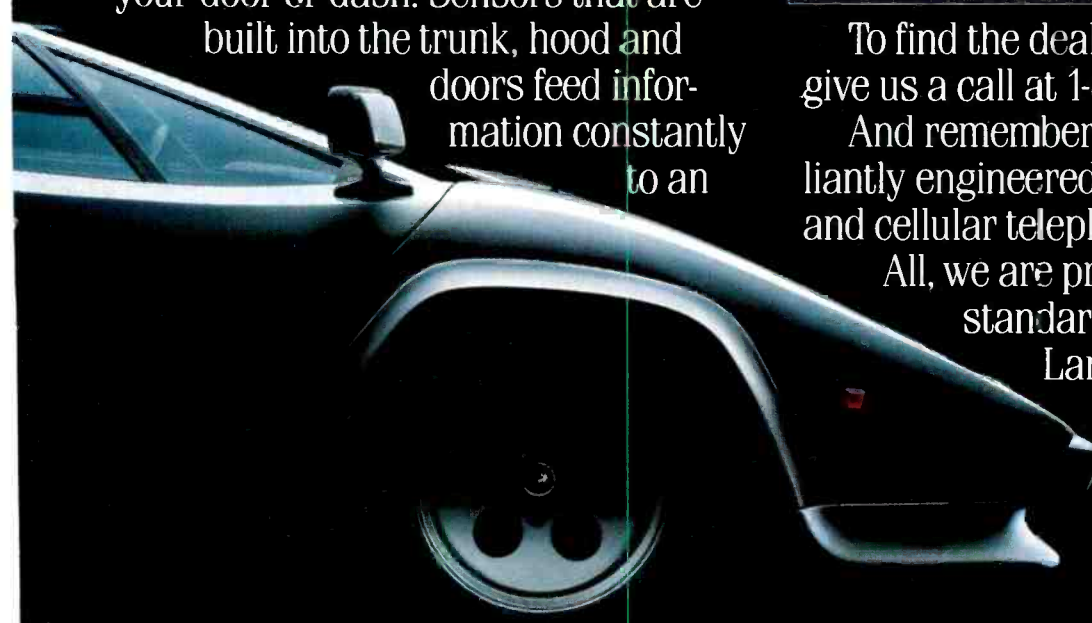
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1

SME V TONEARM AND TALISMAN VIRTUOSO DTi CARTRIDGE

Manufacturer's Specifications Tonearm

Type: Tapered magnesium tube with fixed headshell and dynamic balance.

Pivot-to-Spindle Distance: 215.35 mm (8½ in.).

Offset Angle: 23°, 38'.

Overhang: 17.8 mm, adjustable ±9 mm by rack-and-pinion shift.

Tracking Error: 0.012°/mm max.; 0° at 66.04 mm and 120.9 mm from record center.

Vertical Tracking Force: 0 to 3 grams, adjustable by 0.1-gram calibrated knob.

Wiring: Headshell, silver litz, user-replaceable; internal, silver litz; external, monocrystal silver with standard five-pin plug.

Effective Mass: 10 to 11 grams, without cartridge.

Weight: 720 grams (1 lb., 9 oz.).

Price: \$1,750.

For literature, circle No. 90

Cartridge

Type: High-output moving-coil.

Stylus: Miniature-shaft van den Hul Type I.

Cantilever: Titanium, diamond-coated.

Output: 1.8 mV into 47 kilohms for 5 cm/S at 1 kHz.

Internal Coil Resistance: 105 ohms.

Recommended Tracking Force: 2 grams.

Frequency Response: 10 Hz to 60 kHz.

Separation: 30 dB at 1 kHz.

Compliance: 15×10^{-6} cm/dyne.

Weight: 7.2 grams.

Price: \$1,200.

For literature, circle No. 91

Company Address: c/o Sumiko, P.O. Box 5046, Berkeley, Cal. 94705.



If you are at all interested in, or even curious about, the trend toward perfection of analog record playback equipment, you will be as interested in reading this report as I was in preparing it. I must admit that I consider the SME V tonearm to be a tour de force in design and manufacture. "Well!" you are saying, "Now I don't need to skip to the end of the report and see what Ed Long really thinks about the SME V tonearm." That's true enough, but if you care to know why the SME V works as well as it does and, paradoxically, why you initially might not like the sound which it helps to produce, read on. Besides, the Talisman Virtuoso cartridge is also a part of this report and is interesting enough on its own to be worth reading about.

It was May 1981 when I reported on the SME 3009 III tonearm in conjunction with the Shure V15 Type IV cartridge. A month later, in June 1981, I reported on the Shure MV30HE cartridge wand, which was designed specifically as a plug-in for the SME III. (The SME III was the model previous to the SME V tonearm; there was no SME IV.) If you are interested in comparing the versions III and V to see the change in direction of design exhibited by the SME V, you might want to look at these 1981 reports. A partial comparison between the two is presented here as a "Measured Data" Table.

One thing that has always impressed me, over the years, is the very personal approach exhibited toward the public by SME, a small British company. I think it is due, to a great extent, to SME's Managing Director, Alastair Robertson-Aikman, who is a very personable fellow. He and Reg Eidy, SME's Chief Engineer, have been working on the SME V tonearm for the past five years. At this time, SME is represented in the U.S. by Sumiko of Berkeley, Cal. The Technical Director of Sumiko, David Fletcher, also very personable though something of an iconoclast (Indeed!—Ed.), seems to have had some input into the design considerations of the SME V. David was the designer of Sumiko's MDC-800 tonearm and is the person most responsible for the technical aspects of the Talisman moving-coil phono cartridges. Since the latest model of the Talisman line, the Virtuoso (or V, for short), seemed like an excellent match for the SME V tonearm, I used it for the technical and listening tests.

The Talisman V is a new moving-coil design, and while it shares the Direct Field Focus configuration of the Models A, B and S, it is quite different from them in major respects. The Talisman S cartridge was reported on in the September 1983 issue of *Audio*, and you might want to refer to it to see the direction in which the Talisman line of cartridges is heading.

First Impressions

As can be seen from its photograph, the SME V tonearm is very impressive. It reminds me of one of the scale-model starships which have appeared in recent space-epic movies. The fact that the initials SME stand for Scale Model Engineering is purely coincidental, I'm sure. The construction and finish are of the highest quality and make it obvious that one should expect the highest level of performance. The fit of the bearings is excellent, and no play was evident when I tried my push-pull test by gripping the armtube in one hand and the arm pillar in the other. Tapping the arm-

tube produced a very dull sound, indicating that what resonances might be present were well damped and should not color the sound significantly. The SME V tonearm is a dynamic-balance design. This means that after a counterweight is adjusted to balance the tonearm for the cartridge being used, the vertical tracking force and sidethrust compensation force are set by coiled springs, rather than shifting weights, thus keeping the arm in balance even when it is not perfectly level. Two knobs with 0.1-gram calibrations set the tracking force and sidethrust compensation.

There is no finger lift on the headshell. The tonearm is raised or lowered by a viscous-damped mechanism mounted near the main pillar and operated by a control lever.

The Talisman cartridge has one very distinctive feature which I wish were available on all phono cartridges, threaded mounting holes in the cartridge body. That means no

MEASURED DATA

Parameter	Measurements/Comments	
	SME III	SME V
Year of Report	1981	1986
Shape of Armtube	S	Straight
Armtube Material	Titanium	Magnesium
Armtube Damping	Fibrous lining	Constrained-mode
Effective Mass	5.05 grams	10 to 11 grams
Pivot to Stylus	236 mm (9.3 in.)	233 mm (9.2 in.)
Pivot to Rear of Arm	64 mm (2.5 in.)	73 mm (2.9 in.)
Height Adjustment Range	22.2 mm (0.9 in.)	31.8 mm (1.3 in.)
Tracking-Force Adjustment	0 to 2.5 grams	0 to 3.0 grams
Tracking-Force Calibration	Within 0.05 gram	Within 0.15 gram
Cartridge Weight Range	0 to 12 grams	0 to 14 grams
Counterweights	Six	One
Counterweight Mounting	Locked to armtube	Plastic carrier
Sidethrust Correction	String and weight	Spring
Viscous Pivot Damping	Yes	Yes
Damped Arm-Lift Lever	Yes	Yes
Finger-Lift on Headshell	Yes	No
Headshell Offset	24.5°	23.5°
Arm Mounting Slot Required	Standard SME	Standard SME
Overhang Adjustment	Sliding base	Sliding base
Bearing Alignment	Excellent	Excellent
Bearing Friction	Less than 50 mg	Less than 40 mg
Vertical Bearing Type	Knife edge	Ball race
Horizontal Bearing Type	Ball race	Ball race
Lead Torque	Insignificant	Insignificant
External Lead Length	48 in. (1.2 m)	48 in. (1.2 m)
Arm-Lead Capacity	73 pF	85 pF
Arm-Lead Resistance	1.14 ohms	1.20 ohms
Structural Resonances	250 Hz	1.6 kHz
Price	\$294	\$1,750

Talisman Virtuoso DTi Cartridge

Coil Inductance: 350 μ H
 Coil Resistance: Left, *06 ohms; right, 103 ohms
 Output Voltage (47-Kilohm Load): Left, 0.38 mV/cm/S; right, 0.39 mV/cm/S
 Cartridge Mass: 7.7 grams
 Microphony: Very low
 Hum Rejection: Excellent
 High-Frequency Resonance: 25 kHz
 Rise-Time: 13 μ S
 Low-Frequency Resonance: 7.5 Hz (in SME V tonearm)
 Low-Frequency Q: 2.5
 Recommended Load Resistance: Greater than 5 kilohms
 Recommended Load Capacitance: Less than 1,000 pF
 Recommended Tracking Force: 2.0 grams
 Polarity: Plus, for CD-4 standard.

The SME V tonearm is very impressive. It reminds me of a scale-model starship from a recent space-epic movie.

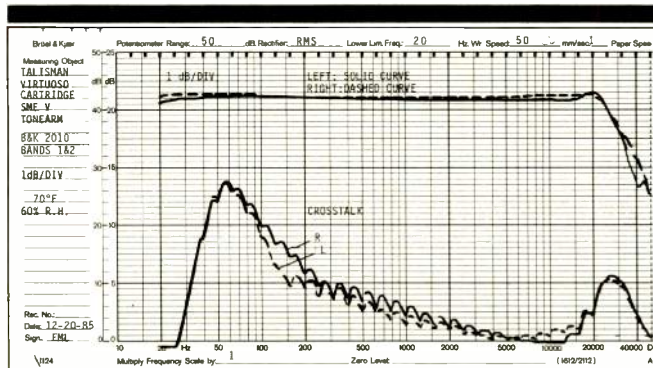


Fig. 1—Frequency response and interchannel crosstalk

of the SME arm and Talisman cartridge using B & K 2010 test record.

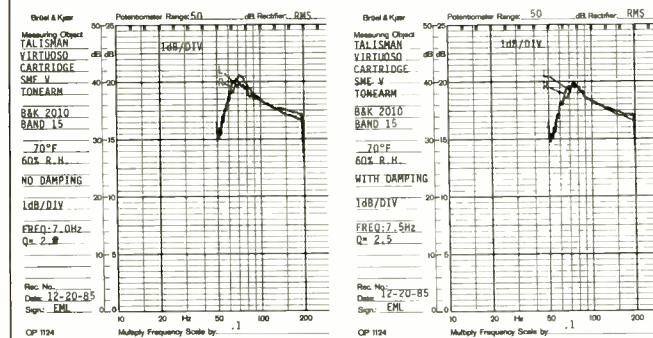


Fig. 2—Low-frequency arm/cartridge resonance is at 7.0 Hz and Q is 2.8 without damping (left);

resonance is at 7.5 Hz and Q is 2.5 with damping (right).

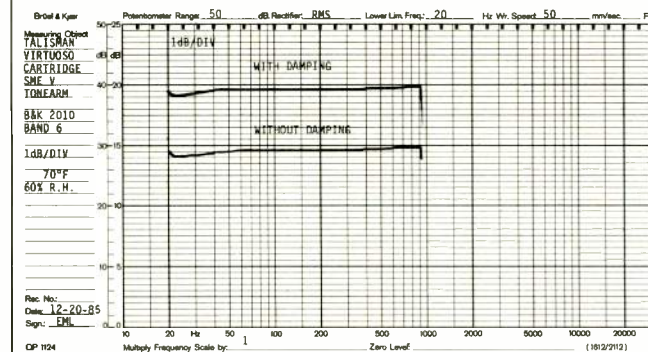


Fig. 3—Slow-sweep check (20 to 900 Hz) for tonearm resonances, with damping (upper curve) and without (lower curve).

separate nuts or washers must be held in place while the screws are lined up, started, and tightened, all while holding the cartridge in place. I would like to publicly thank St. Anthony for the many small hardware pieces which he has found for me, over the years, after they had seemingly fallen into some black hole during the intricate cartridge-mounting process.

Features

The armtube of the SME V tonearm is pressure die-cast of magnesium, which has a very good stiffness-to-weight ratio and good inherent damping. The hollow arm tube tapers in both thickness and cross-section along its length, and it extends from the headshell to the counterweight, passing through the pivot bearings without any joints or breaks. The internal damping of the armtube is accomplished by using a technique called constrained-mode damping (more on that later), which has proven very effective in reducing the type of mechanical-energy buildup most prevalent in thin-walled structures.

There are two holes with steel inserts in the headshell for mounting the phono cartridge. Since there are no slots in the headshell, the necessary stylus overhang must be adjusted by moving the whole tonearm in relationship to the turntable's center spindle. This stylus overhang is required for all pivoted tonearms to correct for tracking error across the record surface. The lack of slots does not allow the angle of the cartridge to be adjusted to correct for any misalignment of the stylus on the cantilever. With a "Line Contact" type of stylus, this can be a problem, because it means that the left and right groove walls will not be traced at precisely the same instant. This effect shows up in the phase-versus-frequency plot which I have been showing for a number of years. I am not certain how the interchannel time offset affects the total sound quality, but in the limited experimenting I have done, it seems to have an effect upon the precision of the sound image in the upper frequency range. In any case, the quest to eliminate any odd effects from the reproduced sound should make it a matter of some concern.

The counterweight system has a die-cast casing with weights inside. It is shaped so that it can be placed very close to the pivots, allowing the tonearm to maintain a very low effective mass. Cartridges weighing between 4 and 14 grams can be balanced by rotating a thumbwheel, which adjusts the position of the counterweight. After the cartridge is balanced, the counterweight can be locked in place by turning a lever. The tracking force can be set to as much as 3 grams by turning the calibrated knob.

The vertical tracking angle can be adjusted in one direction while playing a record, by turning the VTA screw, which raises the tonearm pivots. To lower the pivots, the main pillar must be pushed down again. Adjustment of the VTA is also helped by the two white lines which run the length of the armtube and by a special template. The 10-mm diameter horizontal and 17-mm diameter vertical bearings are captive in precision races, and located in the same plane as the record surface, to negate the effects of warp wow. The tonearm can be moved with respect to the center spindle by a rack-and-pinion system which uses a special horizontal

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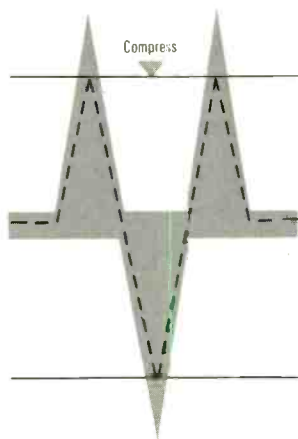
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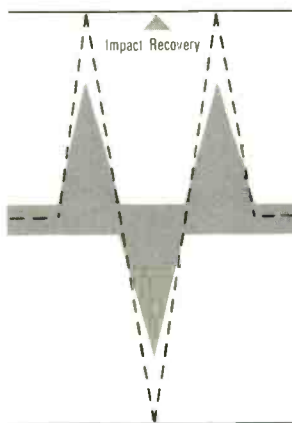
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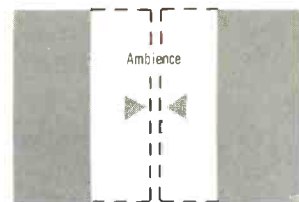
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I wish all cartridges had the Talisman's threaded mounting holes, which eliminate the need for tiny nuts and washers.

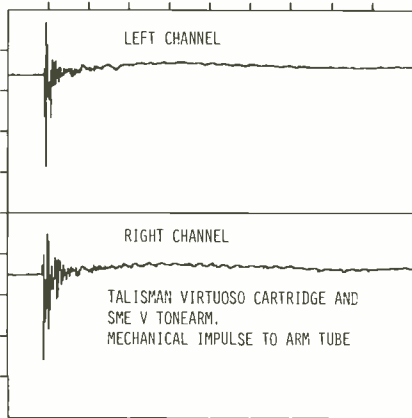


Fig. 4—Output of arm/cartridge when mechanical impulse was applied to armtube. Total period of measurement was 20.47 mS.

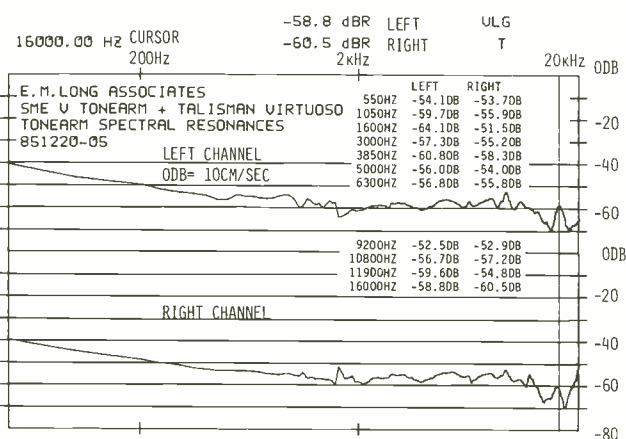


Fig. 5—Output (averaged) of arm/cartridge due to 16 mechanical impulses applied to armtube. This

is an excellent result, indicating good energy damping by the tonearm.

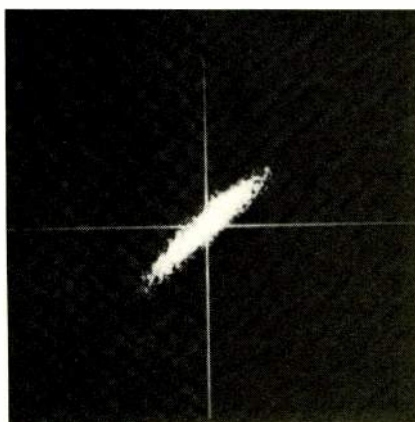


Fig. 6—Interchannel phase difference of arm/cartridge using pink noise from B & K 2011, band 7.

tracking angle key. The HTA key allows the tonearm to be adjusted so that the stylus will overhang the center spindle by the correct amount. SME has used this technique before but never with such an elaborate and precise mechanism.

The tonearm damping system, which consists of a trough of viscous fluid and a paddle, is also a refinement of the previous system used on the SME III tonearm. The amount of damping in the horizontal plane is increased or decreased by lowering or raising the paddle with an adjustment screw. The four color-coded cartridge attachment leads can be changed; the ones supplied were by van den Hul. The internal armtube wiring and the external phono cables are also specially made for SME by van den Hul. The bottom of the arm pillar is fitted with a viscous-damped, right-angle plug which can be rotated almost a full 360°. This allows the phono cables to exit the turntable base wherever it is most convenient and solves the problem of how to anchor them properly.

As a last note about this tonearm's features, I must compliment SME for the quality and comprehensiveness of the instruction manual. It is a gem.

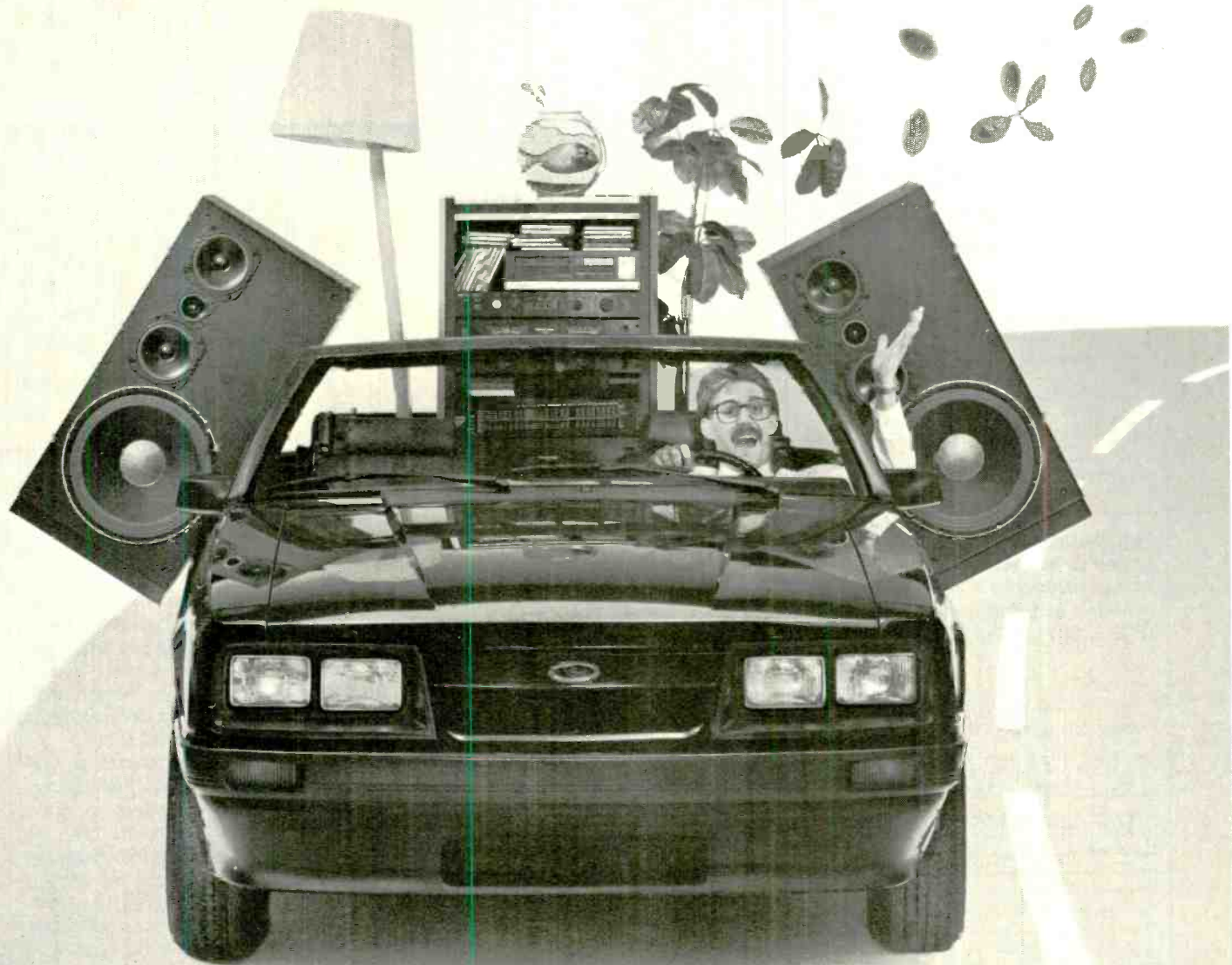
The body of the Talisman V cartridge is machined from a solid piece of aluminum. As mentioned previously, the mounting holes are drilled and tapped right into the body. A high-coercivity neodymium-iron magnet is used in the Talisman's Direct Field Focus system to achieve a very high output voltage. In fact, the output of the Talisman V is about eight times that of the Talisman S, so it needs no step-up device. This means not only lower system cost but that the signal degradation inevitable with a step-up is eliminated. The Talisman V can be operated directly into a 47-kilohm, magnetic phono-cartridge input. In fact, any load impedance above 5 kilohms is acceptable, and input capacitance also has negligible effect. The cantilever of the Talisman Virtuoso which I tested is titanium, with a diamond overlay (as denoted by its DTi designation), which gives it added stiffness. (A Talisman Virtuoso B, with boron cantilever, is also available, for \$800.) The stylus is a van den Hul Type I design, precision-cut from a small cross-section diamond shaft. A damper having very low hysteresis is used in order to maintain good time and amplitude response for better spatial-information recovery.

Measurements and Listening Tests

Figure 1 shows the amplitude versus frequency response and also the crosstalk versus frequency for the SME/Talisman combination; the results are very good. The response at 20 kHz is particularly interesting since it verifies comments by some members of the listening panel that the sound was very open and clear in the upper range. The high-frequency resonance at 25 kHz, due to the interaction of the compliance of the record groove with the effective mass of the stylus tip, is verified by the rise in the crosstalk. The rise in the crosstalk at 60 Hz is an artifact of the B & K 2010 test record; the actual crosstalk for the SME/Talisman combination is much lower.

The low-frequency resonance, caused by the interaction of the tonearm's effective mass and the cartridge's compliance, is shown in Fig. 2, with and without the low-frequency damping system activated. The Q is very low for either

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The panel had to learn to appreciate this pair's tightly controlled bass, which was lower but more realistic than with the reference system.

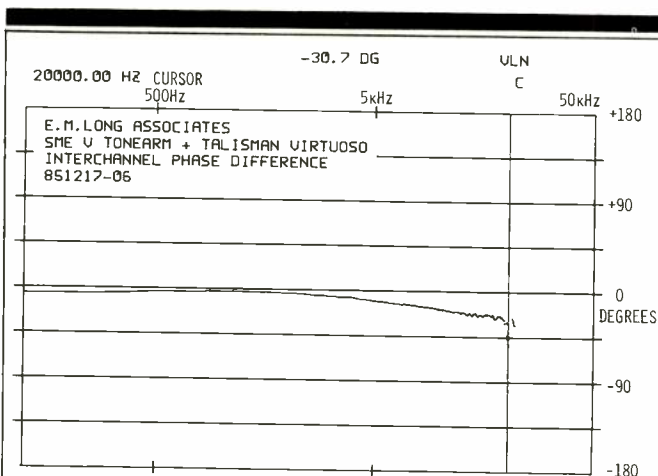


Fig. 7—Interchannel phase difference of arm/cartridge as a function of frequency (B & K 2011, band 7, pink noise). Phase difference at 20 kHz (cursor position) is 30.7°, equivalent to only 4.3 μ S of interchannel delay.

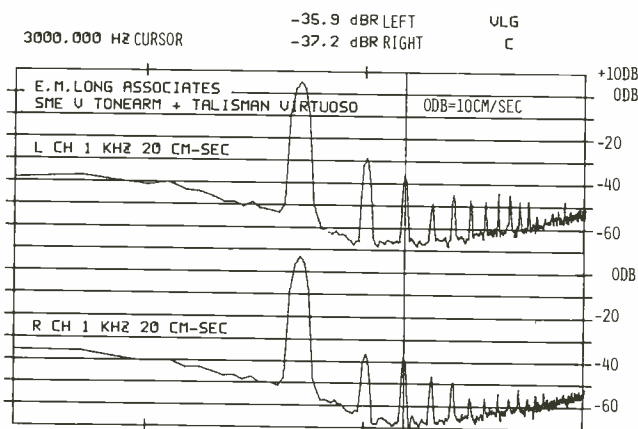
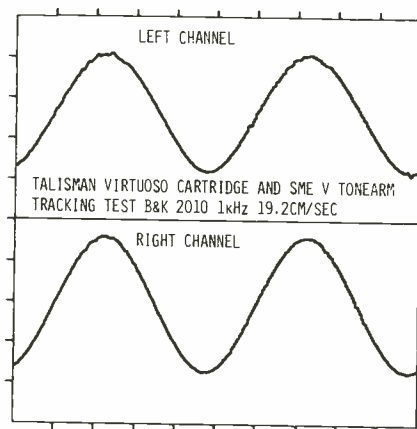


Fig. 9—Spectral analysis of the cartridge output when reproducing the test signal of Fig. 8. The third harmonic (at the cursor position) is 1.6% in the left channel, 1.4% in the right.

condition, but it must be remembered that I have taken much care in centering the test record, which reduces the side-to-side swaying of the tonearm. The viscous damping system is most effective for this horizontal motion, so it would be even more useful under normal conditions, with the record less carefully centered, than would appear from Fig. 2. The panel's comments about the very tightly controlled character and extension of the bass register were a bit difficult to sort out. Due to better damping of its low-frequency resonance, the SME/Talisman combo had less bass output than the reference system's, though perhaps a bit more extended. This confused some panel members a

Fig. 8—Tracking of arm/cartridge with a 1-kHz test tone from the B & K 2010 at 19.2 cm/S.



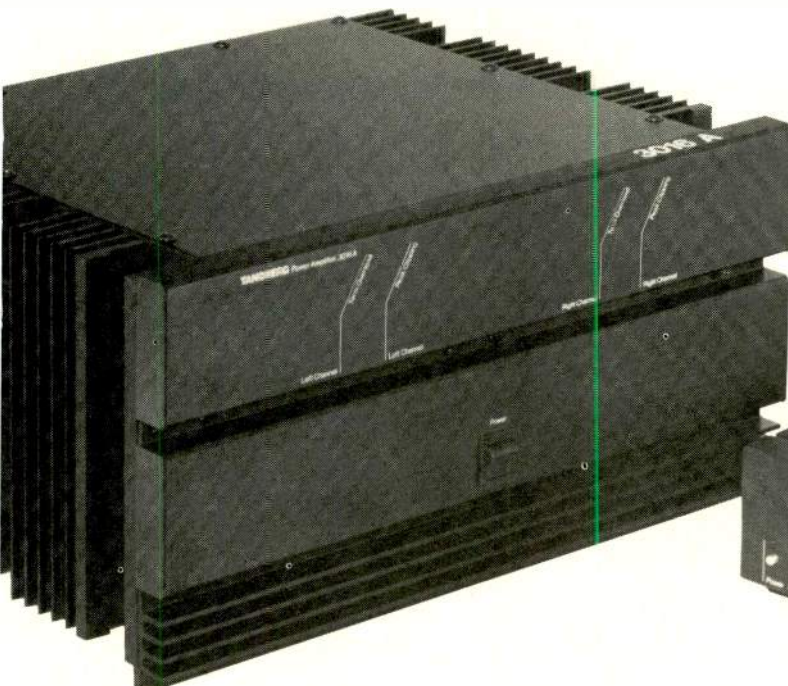
bit. The reference system was preferred by some panel members when reproducing drums and double bass because, as they commented, "the bass sounds fuller." This is another paradox of the SME/Talisman performance, since careful listening to the sound of bass drum on orchestral recordings convinced me that it was more realistic.

The smooth curves of Fig. 3 indicate the control of mechanical resonances in the SME V tonearm. The viscous damping system does not have any visible effect upon the response, but there aren't any major uncontrolled vibrations which would show its effect anyway. This lack of substantial resonances, which might color the sound, can be verified easily by tapping the armtube with a pen or a small screwdriver. I am convinced that it was this very lack of coloration which caused some members of the listening panel to comment that the SME/Talisman combination was more reticent in its quality than the reference system. This is what I meant earlier, when I said that you might not like the sound which the SME V tonearm helps to produce. The lack of coloration in the SME can cause other tonearms to be preferred, at least in short-term listening. I have seen this before, especially in the case of a tonearm which caused a very euphonic coloration due to its very loose pivots!

The results of applying a series of mechanical impulses to the armtube are presented in Figs. 4 and 5, which show the amplitude versus time and the frequency spectrum of the energy of the SME V/Talisman Virtuoso combination. These results indicate the excellent damping of energy by the SME's tapered magnesium armtube and the internal damping system. As I mentioned before, the technique used is called constrained-mode damping. This method places the actual damping material in direct contact with the surface from which the energy is to be removed. The damping material is then covered with, and its movement constrained by, a thin layer of stiff material. The energy is dissipated in the form of heat as it tries to move between the surface to be damped and the constraining layer.

Figure 6 shows the interchannel phase difference, displayed on the screen of a Nicolet Explorer III digital storage oscilloscope. Figure 7 shows the phase versus frequency


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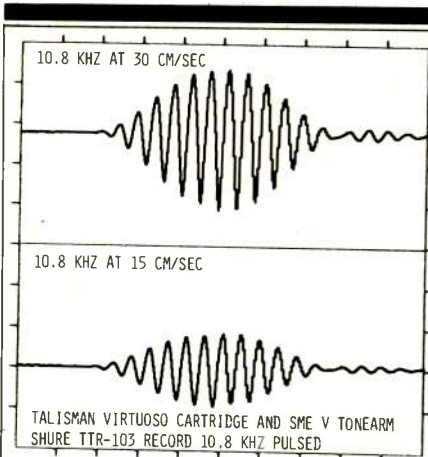


Fig. 10— Output with 30- and 15-cm/S, 10.8-kHz pulse test, Shure TTR-103 test record.

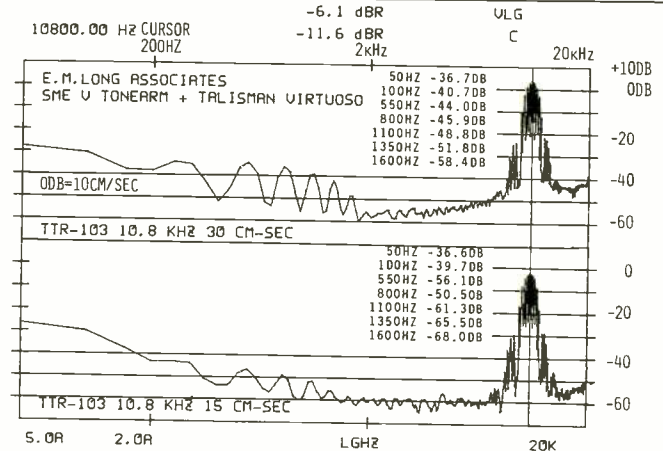


Fig. 11—Spectral analysis of distortion products from signals shown in

Fig. 10. Distortion at 50 Hz is 1.5% for 30-cm/S modulation.

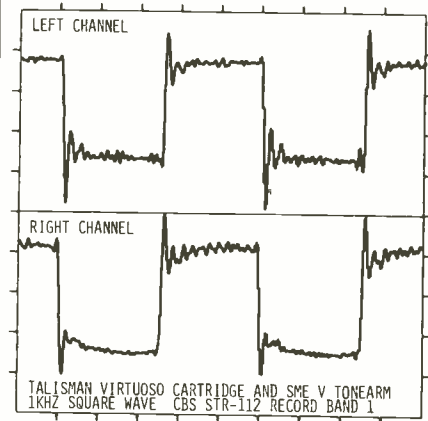


Fig. 12— Cartridge output from 1-kHz square wave, CBS STR-112 test record.

The ability of the SME/Talisman combination to reproduce high frequencies with a seeming effortlessness is verified by the information shown in Figs. 10 and 11. The output of the left channel, while reproducing a 10.8-kHz tone burst at 30 and 15 cm/S, is shown in Fig. 10; its symmetry and lack of compression, even at the higher level, is very good. The aspect of performance most often cited as an area of superiority over the reference system was the way that the SME/Talisman combination reproduced the midrange and high frequencies. The words "transparency" and "clarity" were often used by members of the listening panel to describe the sound.

The responses to 1-kHz square waves, Fig. 12, are excellent and indicate that, while time delay of the high frequencies with respect to low frequencies is present, it is very slight. The relationship of fundamentals and overtones will therefore be correct over a wide range of frequencies.

Conclusions

Both the SME V tonearm and the Talisman Virtuoso cartridge incorporate some very useful and innovative features. Most notable about the SME are its tapered, one-piece magnesium armtube and integral headshell; special van den Hul internal wiring, and the constrained-mode internal damping in the armtube. The Talisman's most remarkable features are, I feel, its solid aluminum body, with integral drilled and tapped mounting holes, and the diamond-coated titanium cantilever. Together, the SME V tonearm and the Talisman Virtuoso cartridge make an excellent combination; anyone who is looking for the finest reproduction of analog discs should try to audition it. Even if you can't afford to buy these components right now, you should listen to them to hear just how good records can sound. *Edward M. Long*

for 64 samples of the same pink noise signal used for Fig. 6. This is a phase transfer function, obtained using a Nicolet 660A-2D Fast Fourier Transform analyzer, and represents the difference in phase between the left and right channels. The very slight phase difference between the channels indicates that the ability to present a very stable stereo image is excellent. The comments of the listening panel confirmed this by indicating that both the SME/Talisman and the reference system presented superb stereo images.

The SME/Talisman combination has excellent tracking ability, as shown by Figs. 8 and 9. Figure 8 shows amplitude versus time of the left- and right-channel outputs while reproducing the second-highest-level 1-kHz band on the B & K 2010 test record. The waveform has only a tiny amount of jitter. The frequency spectrum of this waveform is shown in Fig. 9, and the distortion is very low for this high a level. The eighth and ninth harmonics show an increase; this may account for some of the brightness which was heard when reproducing a trumpet.

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2

SOTA STAR SAPPHIRE TURNTABLE

Manufacturer's Specifications

Drive System: Belt.

Wow & Flutter: Less than 0.1%, DIN weighted.

Rumble: Unweighted, -60 dB; weighted, -75 dB.

Speed Stability: $\pm 0.1\%$.

Suspension Resonance: 2.5 Hz.

Dimensions: 20¼ in. W x 7½ in. H x 16½ in. D (51.4 cm x 19 cm x 41.9 cm).

Price: \$1,600 (oak finish), \$1,800 (black lacquer); Electronic Flywheel power-line conditioner, \$300.

Company Address: P.O. Box 7075, Berkeley, Cal. 94707.

For literature, circle No. 92



Photograph: Carl Zapp

SOTA, which stands for State Of The Art, is also the name of a small, dedicated company, located in Oakland, California, which manufactures a very high-quality turntable that they claim is "the turntable that Newton would have built." In addition, they make some interesting electronic and accessory products meant to increase the performance of record-playing equipment.

The Star Sapphire is the latest version of a basic turntable which SOTA began manufacturing a few years ago, all designed according to the theory that the supporting mass must exceed the moving platter mass. The major current improvement is the addition of a vacuum record-clamping system; it is also available as a retrofit for the original SOTA Sapphire for about \$600, plus dealer installation. (You might want to look up the report on the SOTA Sapphire turntable in the June 1983 issue of *Audio*, because the new Star Sapphire is very similar but has some important improvements.) The Star Sapphire that I tested was also isolated from the a.c. power line by a new unit which SOTA calls the Electronic Flywheel and describes as a power-line conditioner. This acts as a power reservoir which regulates the voltage and removes noise from the a.c. power line. The Electronic Flywheel is also available separately, for \$300, and may be used not only with the Sapphires, but also with some other d.c. servo turntables. The vacuum clamping system and the Electronic Flywheel are each capable of improving the performance of the turntable, and taken together, they represent a real advance.

This particular Star Sapphire was finished in satin black, even including the wood base. The hinged dust cover is vacuum molded from a soft smoked-brown acrylic plastic. I was able to set the hinges so that the lid would lock in place in a partly opened position. This is handy when the shelf above the turntable doesn't allow the lid to be opened fully.

One thing that you may find strange is that there are no markings on any of the controls! Of course, after you have figured out which knob does what, by reading the instructions, you really won't need the markings anymore. (Besides, think of the power you will have by being the only person who knows where the on/off switch is!) The cover of the control area is different than that of the original Sapphire turntable. It is made of wood, has bevelled edges and a

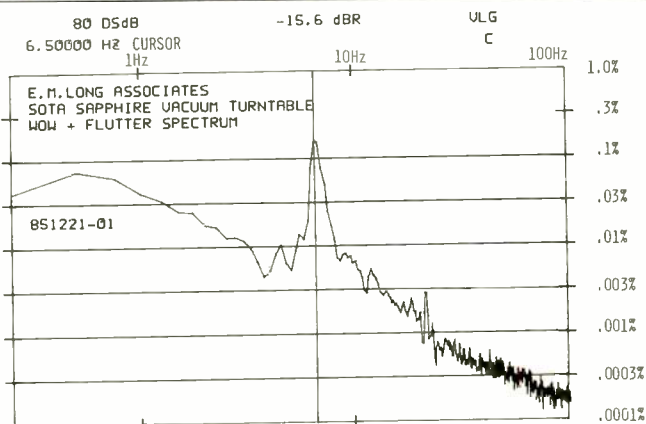


Fig. 1—Computer plot of wow and flutter spectrum, from 0 to 100 Hz. The peak at 6.5 Hz is due to the tonearm/cartridge resonance.

satin black finish, and is held in place by Velcro fasteners. (The original Sapphire has a metal control cover, which is held by screws.) The new cover can be popped on and off easily, although there is really no reason or need to do this; still, I like it and think that it is a clever touch.

I usually have no trouble locating a spot for any turntable I am testing, but this time I also had to find a spot for the vacuum system and the Electronic Flywheel chassis. I put these control units on a separate shelf for some of the tests and on the floor for some others. The noise level of the vacuum system is not very high, but in extremely quiet situations, it would be best to keep it away from your listening position. The vacuum hose is 9½ feet long, so there is some flexibility in where you can locate the vacuum control chassis.

High mass means high inertia and immunity from outside forces, and it is one of the main features of the SOTA turntable design. SOTA engineers believe that the best way to suspend a mass that is spread over a surface, is by not allowing any part of that surface to be outside the area bounded by the suspension. This means that no part of the surface can rotate around an axis formed by two adjacent supports. It follows, then, that the best way to suspend a rectangular surface is by placing four springs at the corners. (This is different from supporting a rigidly suspended mass, such as a turntable base with noncompliant feet, because a four-point rigid support system could allow the mass to rock around an axis formed by opposite corners.) Extra mass, of about 2½ pounds, is added at each of the suspension points. The resonance of the turntable suspension is controlled by using calibrated springs, and by adjusting the amount of this added mass. Since the linear on-axis motion of a coiled spring is accompanied by rotary motion, the Star Sapphire's springs are counterwound pairs

MEASURED DATA

Parameter	Claimed	Measured	Comment
Speed Stability	±0.1%	±0.20%	Very Good
Wow, Unwtd.		0.21%	Very Good
Wow, DIN Wtd.		0.18%	Excellent
Flutter, Unwtd.		0.11%	Excellent
Flutter, DIN Wtd.		0.07%	Excellent
W & F, Unwtd.		0.025%	Very Good
W & F, DIN Wtd.	0.1%	0.18%	Excellent
Long-Term Drift		0.10%	Excellent
Rumble, Unwtd.	-60 dB	-68.3 dB	Excellent
Rumble, Wtd.	-75 dB	-88.2 dB	Excellent
Suspension Resonance	2.5 Hz	3.7 Hz	Very Damped

High mass, for high inertia and immunity from outside forces, is a hallmark of SOTA turntable design.

positioned at opposite corners of the suspended mass. Each spring supports 8 pounds, so the total suspended weight is 32 pounds. A very important difference between the two SOTA Sapphire models and other turntables is that the mass is slung below the springs rather than being perched on top of them. The force of gravity thereby causes the springs to find a stable equilibrium. If the turntable is perched on top of springs, as is often the case with other designs, the force of gravity draws the suspended mass toward an unstable condition.

The mass of the tonearm must be accounted for in balancing the total suspended mass. Since tonearms of various mass must be accounted for, SOTA supplies lead shot in a plastic bag and a spirit level. With the tonearm mounted on the board, the turntable is balanced by pouring the lead

shot into a styrene cup, placed on the tonearm board, while watching the bubble in the spirit level. When the mounting board is level, it can be lifted up, and the lead shot poured into the well under the board. The original SOTA turntables had a hole and plug in the tonearm mounting board into which the lead shot was poured; this proved to be a disadvantage when the turntable had to be transported, because the lead shot could spill out.

The turntable platter is a low-pressure casting, tapered so most of its mass is at its periphery. It is lead lined for high mass and high internal damping, and machined on a CNC (computer numerical controlled) lathe to 0.0002-inch accuracy. Each turntable shaft is matched to a precision, sintered-bronze bearing sleeve and mounted in a surface support block. The shaft and bearing are mounted into a test fixture, and the perpendicularity is checked. If it is within the tolerance allowed, the sapphire thrust bearing is put into position and the combination is rechecked.

The SOTA Star Sapphire turntable has two speeds, 33.3 and 45 rpm, which are selected by a pushbutton. Separate knobs are used to control the exact pitch of each speed. There is no built-in speed indicator, so a strobe disc is supplied. It can be used with ordinary fluorescent lighting to set the exact speeds of 33.3 and 45 rpm by adjusting the appropriate pitch knob until the lines on the strobe disc appear stationary.

The vacuum record hold-down system is the Star Sapphire's single most important improvement over the previous Sapphire turntable. The vacuum pump and the associated control electronics and power supply are mounted in a chassis which is completely separate from the turntable. The vacuum, which is created between the underside of the record and the top of the turntable platter, causes the record to be pressed against the turntable platter surface by the force exerted by the surrounding air pressure. The record isn't actually pressed directly against the platter, because there is an interface, which consists of an acrylic plastic disc and a mat of highly damped rubber. The acrylic disc's internal characteristics are similar to those of a vinyl phonograph record. This allows most of the record's internal kinetic energy to be transferred from the vinyl record to the acrylic plastic disc with very little difficulty, because their impedances are similar. This energy is then dissipated in the highly damped rubber barrier, which is between the acrylic disc and the aluminum turntable platter. The rubber mat also damps out the energy caused by the natural resonance of the turntable platter. Two main attributes of the vacuum system enhance the Star Sapphire's performance: First, since the force pressing the record against the acrylic disc is applied in a very uniform and evenly distributed manner, the mechanical standing-wave energy inside the record can be dissipated in a similarly uniform manner. It also means that more internal energy, which would otherwise color the sound, can be removed from the record.

The other attribute is due directly to the flatness of the record, caused by the vacuum pulling the record flat against the surface of the acrylic disc; a flat record is not warped! (In a previous report, on the Nakamichi Dragon turntable, which had a record-centering system that prevented wow due to eccentricity, I commented that all we

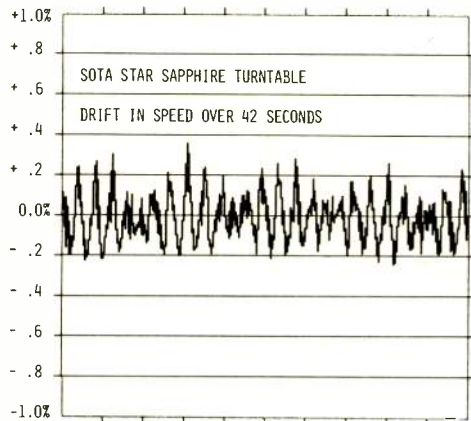


Fig. 2—Speed drift over a 42-S period. The variations are at 1.8 S per cycle (0.56 Hz), related to the 33.3-rpm speed.

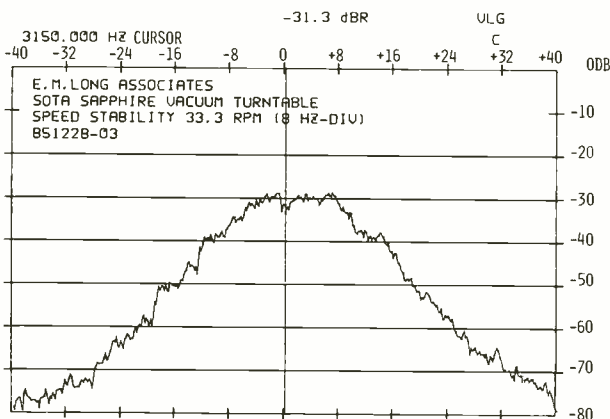


Fig. 3—Speed stability, referenced to 3,150-Hz tone on band 8 of B & K 2010 test record.

BEYOND CONVENTIONAL AUDIO

The DX-320 is divided into two sections, with coupling between the digital and analog stages of the player via Opto-Coupling Modules. In addition, power supply interference is prevented by using separate power supplies for the analog and digital sections, as well as for the transport mechanism.

Three high speed ONKYO Opto-Coupling Modules allow transfer of ultra high frequency digital audio data, word clock and bit clock signals which range in frequency from 17.64 kilohertz up to 4.32 megahertz. The module incorporates an optical fiber, between a precision LED light source and focusing lens, and a receiving photo-diode and lens assembly. Three additional opto-isolators are utilized for transfer of left/right clock, de-emphasis and muting signals. Together, these special components eliminate DSI.

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In addition to the digital audio data signals that must be converted into analog, CD players must also process non-audio digital data. During this conversion, Digital Signal Interference (DSI) occurs due to noise transfer between the various digital and analog stages, through printed circuit board wiring and common ground lines. These non-audio data signals can actually interfere with the digital to analog conversion, resulting in Digital Signal Interference. This noise contributes to the harsh sound characteristics often attributed to digital reproduction.

In order to prevent DSI from appearing at the player's outputs along with the music signal, we found that it was necessary to completely isolate the digital and analog blocks of circuitry from each other electrically. This was made possible by the development of ONKYO's exclusive Opto-Coupling Module.

This new technology prevents DSI by utilizing specially designed high speed fiber optics that convert the digital data signals into beams of light. This eliminates the transfer of noise between the digital and analog stages. The result is honest, accurate musical reproduction with none of the harsh characteristics often attributed to conventional CD players.

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The Star Sapphire's vacuum record hold-down system is the single most important improvement over the previous Sapphire.

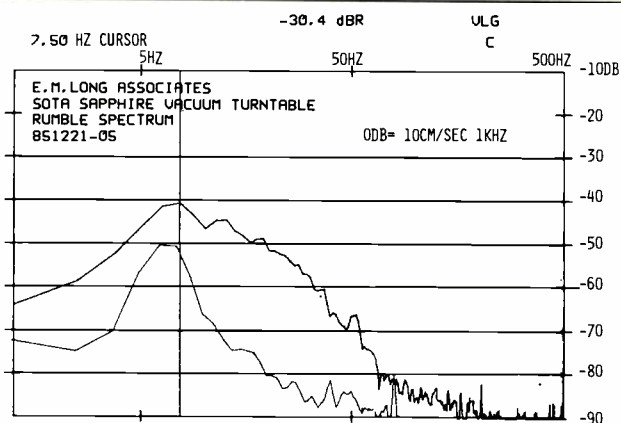


Fig. 4—Rumble spectrum, measured with B & K 2010 test record (upper curve) and with Thorens Rumpelmesskoppler (lower curve). The main factor in the rumble is the tonearm/cartridge resonance.

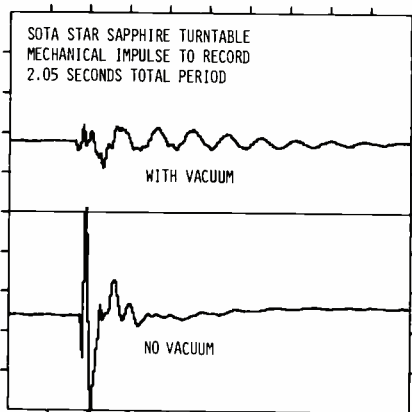


Fig. 5—Output vs. time for mechanical shock applied to edge of record, with stylus resting in groove. Results show effect of vacuum applied (upper trace) and not applied (lower trace). Measurement period is 2.05 S.

needed now was a turntable that would move up and down to remove the effects of warp! I was being facetious, of course, because the obvious solution is to make flat records [there I go again!] or to pull the records flat against the turntable platter by using a vacuum system.) The Star Sapphire's vacuum system reduces the effects of warp wow by removing the vertical component due to warped records. If you are willing to spend a little time centering a record on the Star Sapphire before you sit down to listen, you will be amazed at the difference in the clarity of the sound.

Measurements and Listening Tests

The SME V tonearm and the Talisman Virtuoso moving-coil cartridge were used for the technical measurements and listening tests.

The low-frequency spectrum of the wow and flutter present while reproducing the 3,150-Hz tone on the B & K 2010 test record is shown in Fig. 1. It represents 16 samples of the filtered output of a wow and flutter analyzer (which I also used for drift tests). The increased output at 6.5 Hz is due to the resonance caused by the interaction of the tonearm's effective mass and the compliance of the cartridge stylus suspension. The test record was not perfectly centered during this test because I wanted to show the large effect that the tonearm/cartridge resonance can have on the total energy output of the wow and flutter spectrum. If the wow and flutter were determined by merely observing the fluctuating pointer of a wow and flutter meter, the resulting figure would be higher for a poorly damped tonearm/cartridge combination reproducing a warped and off-center record than for a well-damped tonearm/cartridge combination reproducing a flat, well-centered record. In other words, a turntable could be blamed for having a much worse wow and flutter when it actually could be due, mainly, to the poorly damped low-frequency tonearm/cartridge resonance. The listening panel's comments on the reproduction of piano recordings by the Star Sapphire were very favorable with regard to the stability of sustained tones. I was able to hear an effect, however, while reproducing test tones, which I could associate with the data shown in Fig. 2. This is a cyclical variation which repeats every six rotations of the record. The zero line represents exactly 3,150 Hz, and the graduated lines, plus and minus, represent the percentage of speed increase or decrease from 3,150 Hz. However, like the members of the listening panel, I couldn't hear this effect when the Star Sapphire turntable was reproducing musical recordings. No listening-panel member made any comment which I could definitely correlate with this cyclical phenomenon.

Figure 3 is the spectrum of the frequency variation caused by the wow and flutter and indicates that the variation in speed varies in a rather uniform manner around the 3,150-Hz tone. The data represents the summation of 24 spectrum samples.

The rumble spectrum data which appears in Fig. 4 is a little different from what I've shown in past reports. Usually I have shown only the spectrum of the rumble caused by reproducing the B & K 2010 test record; this is represented here by the upper curve in Fig. 4. The lower curve was made using the Thorens *Rumpelmesskoppler* (German for

BEYOND CONVENTIONAL AUDIO



THE ONKYO INTEGRA DX-32C WITH OPTO-COUPLING THE SOUND IS NO ILLUSION

The Integra DX-320 Compact Disc player is the first of ONKYO's new generation of CD players to incorporate our unique Opto-Coupling digital signal processing system. Conventional CD players transmit digital data internally via printed circuit board wiring, which interacts with analog audio signals to produce Digital Signal Interference (DSI), resulting in an audible "harshness" in the music.

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200 Williams Drive, Ramsey, N.J. 07446

The uniform force of the vacuum flattens out warps and allows uniform dissipation of energy within the record.

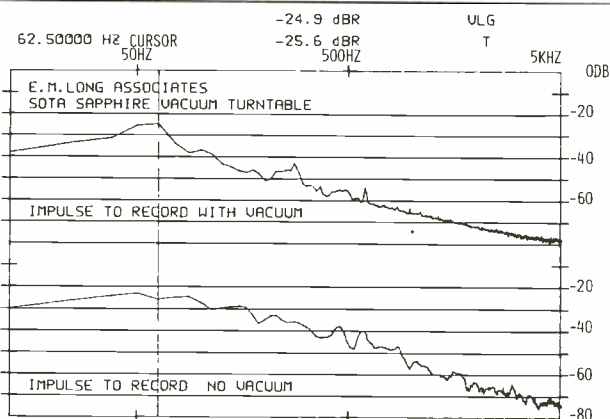


Fig. 6—Spectrum (to 5 kHz) of impulse shown in Fig. 5, with vacuum applied (upper curve) and without (lower curve). The tight contact between the record and the platter's interface disc when vacuum is applied reduces spurious energy. Except at the cursor position (62.5 Hz), energy is reduced by 10 dB or more, the best measured by the reviewer for any record-clamping system.

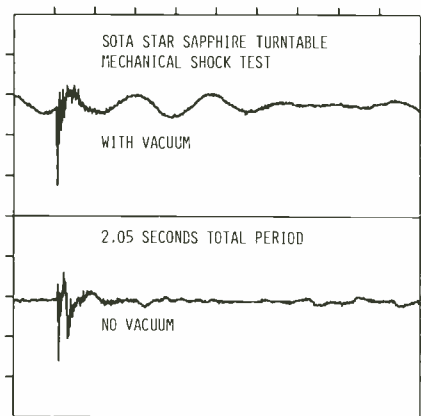


Fig. 7—Output vs. time for mechanical shock to platform upon which the turntable base rested, with vacuum applied (upper curve) and without vacuum (lower curve). Measurement period is 2.05 S.

rumble-measurement coupler), a special device which allows turntable rumble to be measured indirectly, thereby avoiding the artifacts inherent in the test record. Although I am not convinced that using this device is the best way to measure turntable rumble, I did so here because I wanted to show the effect of the tonearm/cartridge resonance on the rumble spectrum. As you can see, both the spectrum produced by the test record and the spectrum produced by the *Rumpelmesskoppler* show that tonearm/cartridge resonance is the major factor in the total rumble output. This is true of almost every modern, high-quality turntable and is certainly true of the turntables I have tested in the recent past. Once again, as in the case of wow and flutter, you can see the large effect that the tonearm/cartridge resonance has upon the measured performance. A poorly damped tonearm/cartridge resonance will cause a turntable to produce worse rumble figures than it justly deserves. In any case, the SOTA Star Sapphire turntable has extremely low rumble, and none of the members of the listening panel made any negative comments in this regard.

The ability of the vacuum record-clamping system to damp the energy in a phonograph record is shown in Figs. 5 and 6. For this test, a mechanical impulse is applied to the edge of a stationary phonograph record while the stylus of the phono cartridge is resting in a groove. The dramatic difference in the output versus time is shown in Fig. 5: The top curve indicates how the energy in the record, due to the first instance of the mechanical shock, is extremely well damped by the vacuum clamping. The lower curve shows the output versus time when the vacuum system is not activated; the initial energy impulse is many times greater than that shown for the vacuum system. Most of the comments of the listening panel about the difference in the quality of reproduction between the SOTA Star Sapphire and the reference system could be correlated to the vacuum system's effect upon the sound. In fact, during one comparison test, the vacuum between the Star Sapphire turntable platter and the phonograph record was released, allowing the tight coupling to be relaxed. This caused listening-panel members to become confused as to which turntable was "A" and which was "B" because these turntables seemed to have reversed their characteristics completely! The effect of the vacuum system on the quality of sound reproduction was clearly evident in comments made by the listening-panel members. Comments about violin and brass indicated that the reference system was "brighter," "sharper," "more forward." The vacuum clamping system made the sound quality of cymbals "duller"—an apparent paradox, which I will explain shortly.

The two spectra of Fig. 6 show how the vacuum clamping system is very effective in reducing the mid- and high-frequency energy from the record caused by a mechanical impulse to the record's edge. Except at low frequencies, such as 62.5 Hz where I set the cursor, the level is somewhere between 10 and 15 dB lower for the vacuum clamping system. When this much energy is removed from the record in the middle and upper frequencies, the quality of the sound is bound to be affected. Because the sound was different from what we were used to hearing, it seemed to be wrong at first. However, upon extended listening, it

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The SOTA Star Sapphire's isolation from high-level sound is remarkable, proving its suspension is very effective.

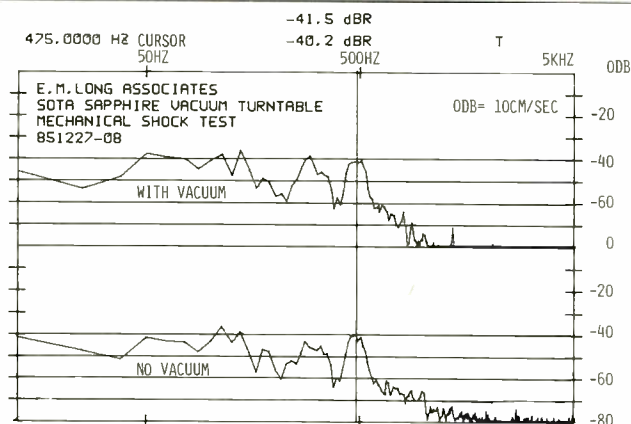


Fig. 8—Spectrum (to 5 kHz) of impulse shown in Fig. 7, with vacuum applied (upper curve) and without (lower curve). Isolation from external vibrations is excellent.

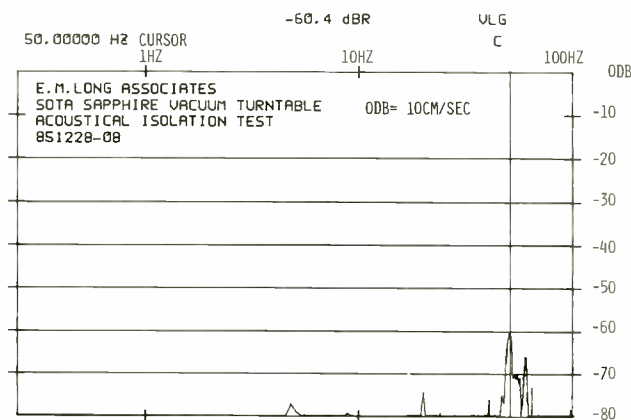


Fig. 9—Spectrum (to 100 Hz) of vibrations from a 100 dB SPL acoustic field at the surface of the record. Stylus was resting in a groove near the middle of the record. Isolation from the acoustic field is extraordinary.

became apparent that the sound from the SOTA with its vacuum was more real than that from the reference system, and in a very convincing way. The reference system has a good record-clamping system which gives good standing-wave energy removal, but it is no match for the SOTA Star Sapphire's vacuum clamping system.

Figure 7 shows output versus time for a mechanical shock applied to the platform upon which the turntable and base rested. The upper curve is with the vacuum system operating, and the bottom curve is with the vacuum turned off. The difference is due to the fact that when the vacuum is released, the record tends to be held away from the turntable platter by the rubber sealing ring which circles the edge of the acrylic damping disc. The spectrum data shown in Fig. 8 is for the same conditions as the time data in Fig. 7. Both with and without vacuum, the energy below 500 Hz is very low in level (shown in Fig. 8) and is quickly dissipated (Fig. 7). The interesting information brought out by these measurements is that the rubber sealing ring must be seated very carefully around the periphery of the record. This will prevent the ring from causing audibly bad effects in the reproduced sound.

Figure 9 is interesting because it shows almost nothing! It is the spectrum of the energy picked up by the stylus, resting in a stationary groove near the middle of a record, while a slow 20 to 100-Hz sweep from an oscillator produced an acoustic level of 100 dB SPL at the surface of the record. The data shown was measured with the turntable's lid open. I also ran the test with the lid closed, to check for any possible cavity resonance effects; the data was essentially identical to that shown. The isolation of the SOTA Star Sapphire from nearby high-level sound is remarkable and indicates that its suspension system and high mass are very effective.

Conclusions

I found that sorting through the listening panel's comments and checking the final scores that were given to the SOTA Star Sapphire and the reference turntables while they reproduced various types of program material were more interesting than usual. This seemed to be due mainly to the difference in sound quality produced by the vacuum clamping system. At first, there were contradictions in some of the comments and in the choice of which system was more satisfactory, but this changed as the tests progressed.

The Electronic Flywheel power-line conditioner was used with the SOTA Star Sapphire, but since the a.c. power line in my lab is generally very stable and free of radio frequency interference, I cannot find any specific correlation with its use. I have no doubt, however, that if you have problems with the purity of the a.c. line, the Electronic Flywheel would be a very good solution.

If you like a bright, forward quality to reproduced sound, you may not take to the SOTA Star Sapphire right away. I am convinced, however, that if you are seeking the most realistic reproduction of sound from analog records, you will like the extra clarity afforded by the vacuum clamping system. Also, the retrofitting of the new vacuum clamping system to already excellent, older SOTA Sapphire turntables is certainly very worth the cost.

Edward M. Long

NEC's digital
experience here...



brings you a better
digital experience here.



When you put a satellite in orbit, you want every possible assurance that it will perform. That's why corporations and governments all over the world ask NEC to build their satellites.

Even if you don't launch objects into outer space, it's comforting to know that NEC puts much of our satellite PCM digital technology into our Compact Disc players for the home.

While most high fidelity companies have only two or three years of experience with PCM digital audio, NEC has been at it since 1965. So it comes as no surprise that other manufacturers are now imitating the digital filtration and high-speed switching our CD players have had from the beginning. And it's no surprise that independent critics in America, Europe and Japan have awarded NEC's players top ratings.

You see, building satellites is not enough for NEC. We feel obligated to take the world's most advanced technology one step further. Into your home.

NEC

3

MAGNUM DYNALAB FT-101 TUNER

Manufacturer's Specifications

Usable Sensitivity: Mono, 10.3 dBf; stereo, 11.2 dBf.

50-dB Quieting: Mono, 13.2 dBf; stereo, 34.0 dBf.

Frequency Response: 20 Hz to 16 kHz, -3.0 dB.

S/N: Mono, 80 dB.

Alternate-Channel Selectivity: Wide-band, 55 dB; narrow-band, 75 dB.

Adjacent-Channel Selectivity: Wide-band, 6 dB; narrow-band, 20 dB.

Image Rejection: 75 dB.

Capture Ratio: 1.5 dB.

AM Suppression: 70 dB.

Wide-Band THD: Mono, 0.1%; stereo, 0.18%.

Wide-Band Separation: 60 dB at 1 kHz.

Antenna Input: 75 ohms.

Power Requirements: 120 V a.c., 75 watts.

Dimensions: 19 in. W x 3 $\frac{3}{4}$ in. H x 13 in. D (48.3 cm x 9.5 cm x 33 cm).

Weight: 12 lbs. (5.4 kg).

Price: \$549.

Company Address: c/o Castle Marketing, P.O. Box 219, Alexandria Bay, N.Y. 13607.

For literature, circle No. 93



As a long-time devotee of FM, I must say right up front that the Magnum Dynalab FT-101 tuner gave me a delightful couple of days of experimenting, measuring, and listening. After all the gadgets—the countless models with more and more presets, frequency synthesis, remote control, and anything else that imaginative marketers have dreamed up—it was nice to encounter a tuner whose main function is to receive FM stations reliably and with good sound quality.

Finding such features as a center-tune meter, a multipath meter, and a well-calibrated signal-strength meter (one that doesn't hit the peg at the top of the scale when a signal of

50 μ V or more is received) was, as one of my associates put it, like a breath of fresh air. Add to this the almost unheard-of gift accessory of a legitimate indoor antenna that comes with each FT-101 (instead of the usual limp piece of 300-ohm transmission line shaped into a T-bar), and I began to feel that here was a little company that really cares about their customers—and about high-quality FM. All of this is so commendable that I am ready to forgive the fact that this fine tuner did not meet some of its published specifications.

Analog tuning is not so common these days, but there are several good reasons for using it. Magnum Dynalab points

“Light my Lucky.”



SURGEON GENERAL'S WARNING: Cigarette
Smoke Contains Carbon Monoxide.

Lights: 8 mg. "tar", 0.7 mg.
nicotine av. per cigarette by FTC method.

Analog tuning is not all that common these days, but there are some good reasons why Magnum has used it in the FT-101.

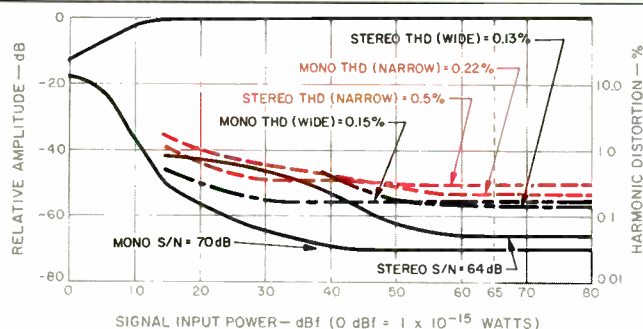


Fig. 1—Mono and stereo quieting and distortion characteristics.

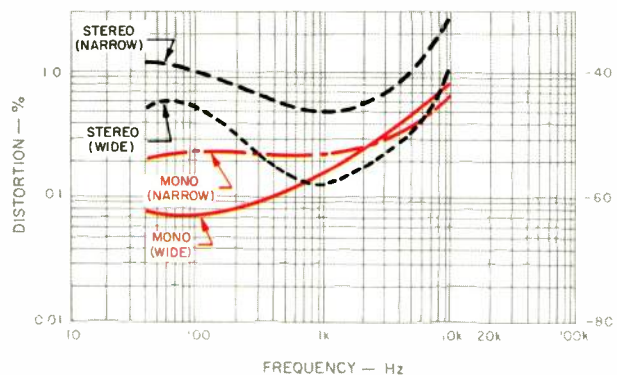


Fig. 2—THD vs. modulating frequency.

ing able to tune continuously, instead of in 200- or even 100-kHz increments, is a definite advantage in such instances.

Some minor errors in the six-page owner's manual are easily counterbalanced by the obviously sincere motives and dedication of the people at Magnum. I got the feeling that these people care more about delivering an honest product than about their quarterly or annual financial report. Long may they survive!

Control Layout

The 19-inch front panel of the FT-101 tuner is notably devoid of needless pushbuttons, lights, knobs, and fluorescent displays. At the left of the panel are five small toggle switches: A power switch, all by itself, and four others arranged in a vertical row. These handle mono/stereo selection, wide and narrow i.f. modes, a.f.c., and muting. A center-tune meter is fittingly positioned dead-center on the panel; it is flanked by a multipath meter at the left and a signal-strength meter at the right. The one concession to the "digital" age is a four-digit frequency display located below the center-tune meter. Just to the right of the display, below the signal-strength meter, is a "Stereo" indicator which lights up when a stereo signal is received. The only remaining control is a rotary (yes, I said rotary) tuning knob coupled to a nice flywheel for that old-fashioned, smooth tuning feel, albeit without the old traveling dial pointer. There is, incidentally, an FT-101R version that is rack-mountable.

The FT-101's digital frequency display is simply derived from the continuously variable local-oscillator frequency. A three-stage r.f. MOS-FET front-end is employed, and separate i.f. configurations are used for the narrow and wide i.f. modes. With their regular owner's manual, Magnum sent along an interesting bulletin which recommends that users keep the a.f.c. switch off if they live in an area with signal "congestion." As Magnum sees it, a.f.c. does not "lock onto" signals but rather indirectly broadens the pass-band of the tuner. I agree with them up to that point, but then they go on to say that keeping the a.f.c. off "will allow a distant station that is drifting slightly due to atmospheric to be received without unnecessarily bothering the FM-stereo 'blend' or the 'mute' circuitry." Well, that's the first time I've ever heard of "atmospherics" causing a station to drift! What they're apparently referring to is fading or fluctuation in signal strength when the signal is received by ground wave.

A word about the indoor FM antenna packed with each FT-101: In a way, it's almost as interesting as the tuner that it augments. Cleverly constructed of a flexible metal band similar to the metal strip used in those familiar pocket tape measures, the antenna is so assembled that you can pull up on the center of the metal band and thereby reduce the lengths of its two "dipole" rods. The business ends of the metal band remain rigid and extended, and the entire assembly can be rotated for best reception of a desired station signal. The "DX Silver Ribbon" antenna is not manufactured by Magnum but is imported by them for distribution in Canada and the U.S. (They sell it separately as well as supplying it with the tuner.) Since the FT-101 is equipped only with a 75-ohm input, Magnum provides a 300/75-ohm transformer for use with their indoor antenna or with any other 300-ohm antenna system.

out that a slight off-station adjustment can sometimes reduce interference (from adjacent-channel signals) and still leave the listener reasonably clean reception. An early spec sheet (since revised) discussed the problem of stations transmitting off their assigned broadcast frequency, a problem which, I gather from the company, may be more common in Canada than in the U.S. Here, where FM broadcast stations are required to be right on frequency (within a few Hz), many cable TV companies use FM-band carriers for stereo soundtracks to accompany their video programs. These carriers are often on nonstandard frequencies, which frequency-synthesized tuners cannot receive properly. Be-

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The measured performance of Magnum's FT-101 tuner is respectable, even though it did not meet all its published specs.

Fig. 3—Frequency response (top traces), separation with weak-signal input (middle traces), and separation with strong-signal input (bottom traces), for wide-band (A) and narrow-band (B) i.f. settings.

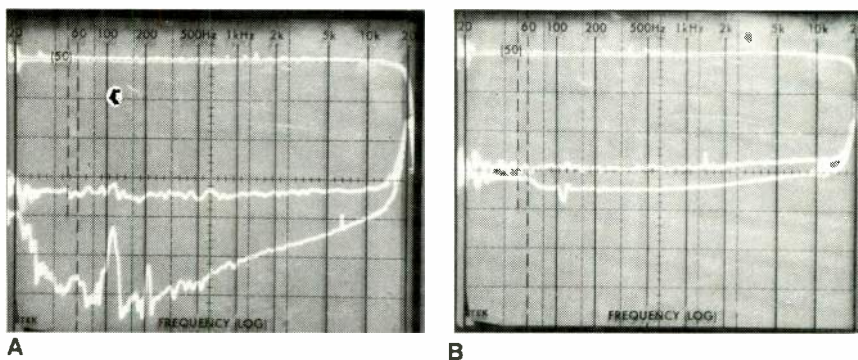
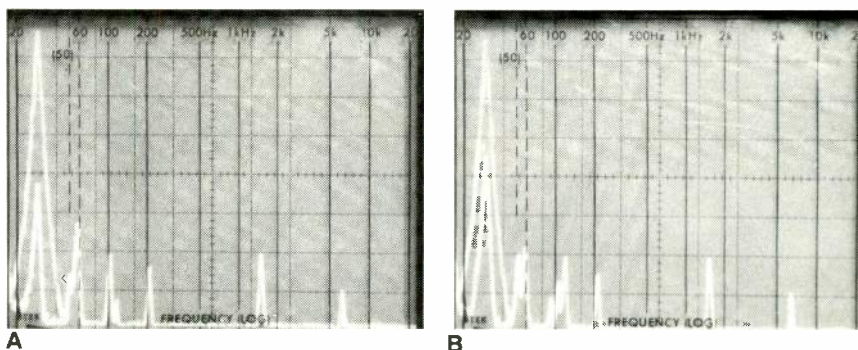


Fig. 4—FM stereo crosstalk and distortion components for a 5-kHz modulating signal in wide-band (A) and narrow-band (B) modes. Sweep is linear, 5 kHz/div.; ignore frequency notations on 'scope face.



Measurements

Though the tuner's performance was respectable, it fell short of meeting some of the manufacturer's published specs. Frankly, I have yet to test *any* tuner whose sensitivity actually measures 8.8 dBf, the figure on the FT-101's earlier spec sheet. The fact is that 8.8 dBf is approximately equivalent to 1.5 μ V across 300 ohms. If Magnum Dynalab had measured 1.5 μ V across the tuner's 75-ohm input, it would translate to 14.7 dBf, in which case the 12 dBf I measured on each of two samples tested would have been better than specified. (Incidentally, most measured data given here is for the second unit; the first seemed to be acting up and, we think, not representative of the breed.)

In any case, the revised specifications list only dBf figures, and I base my comparisons on these. Usable sensitivity in mono, rated at 10.3 dBf, measured 12.0 dBf. The stereo figure, specified at 11.2 dBf, measured 12 dBf. Sensitivity for 50-dB quieting in mono, specified as 13.2 dBf, measured 15 dBf. In stereo, it was rated at 34.0 dBf and was measured as 38 dBf.

Figure 1 shows mono and stereo quieting and distortion characteristics as a function of signal strength for both the narrow and wide i.f. modes. Note that the FT-101 deals with weak-signal stereo transmissions much as many car-stereo tuners do, blending the stereo channels together as the signals grow weaker to reduce background noise levels. This accounts for both the rather odd shape of the stereo noise curve in Fig. 1 and the surprisingly good figure I

obtained in stereo for usable sensitivity; at the very low signal levels involved in measuring this parameter, the stereo has been blended almost back to mono. The FT-101 is the first home tuner I have encountered which uses this design approach.

With strong signals, mono and stereo S/N were pretty much as expected and did not vary that much when I switched from wide to narrow i.f. modes. Distortion in wide-band, mono mode was 0.15%, close to the specified value (and better than the old specification). In stereo, also wide-band, distortion measured 0.13%. The fact that the stereo THD figure was a bit lower than the mono reading is not that unusual, but the first FT-101 I tested had lower distortion (0.2% mono, 0.18% stereo) in the narrow i.f. mode than in the wide mode (0.3% mono, 0.25% stereo). This is the opposite of what I would have expected, and I suspect that the first sample's alignment might have been slightly off. This may well have been the case, as the second unit's distortion did increase as expected in narrow-band mode (to 0.22% mono and 0.5% stereo), and its THD measurements were closer to Magnum's specifications. Figure 2 shows how harmonic distortion varies with frequency for both wide and narrow i.f. settings in mono and in stereo.

Figures 3A and 3B show frequency response and stereo separation. The plots in Fig. 3A were made with the tuner in the wide-band mode; in Fig. 3B, the narrow-band setting was used. In both cases, separation was measured with strong-signal inputs (bottom traces) and then at weaker

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This home tuner is the first I've tested which uses the car-stereo technique of blending channels when the signal grows weak.

signal levels of around 40 dBf (middle traces) to demonstrate the "blending" effect used by Magnum. The blending is much more pronounced in the wide-band mode, simply because separation in this mode, with strong-signal inputs, is much greater to begin with. Stereo separation was one characteristic that did exhibit the expected pattern when switching from narrow-band to wide-band i.f. modes. Frequency response (top traces) was exceptionally good, varying by no more than ± 0.2 dB from 30 Hz to 15 kHz.

Figures 4A and 4B show distortion and crosstalk products that appear at the unmodulated channel's output when a 5-kHz signal modulates an r.f. carrier to 100%. These photos confirm my earlier findings—that distortion was actually worse in the wide-band mode than it was in the narrow, and that separation was somewhat better in the wide-band mode, as one would expect.

Muting threshold measured 11 dBf, and, although there was no clear stereo threshold because of the blending system, the stereo indicator light turned on for signal inputs as low as 5 dBf.

Alternate-channel selectivity in the narrow- and wide-band modes was almost precisely as claimed, and I was particularly impressed by Magnum's ability to achieve 30-dB adjacent-channel selectivity while maintaining adequate bandwidth for relatively low-distortion reception in the narrow i.f. mode. AM suppression measured 58 dB, as against

the 70 dB claimed, and image rejection was close to 80 dB, as opposed to 75 dB claimed. Capture ratio measured 1.5 dB, as claimed, and was substantially the same in both narrow and wide i.f. modes.

Use and Listening Tests

Despite its failure to meet certain published specifications, the Magnum Dynalab FT-101 sounds good and is easy to use. The center-tune meter moved to dead center when signals were tuned precisely to lowest distortion reception. The multipath meter, unlike many such indicators, did move to a minimum reading when my outdoor antenna was oriented for minimum audible multipath effects. As I indicated earlier, the FT-101's signal-strength meter is calibrated so that a listener can get a meaningful idea of actual signal strengths.

The FT-101 will not appeal to everyone. To some, the very simplicity of its front panel might imply a lack of sophistication on the inside. Indeed, if you were to open the top cover of the tuner (as I did), you might be put off by the fact that much of the space inside is empty. Nevertheless, on the basis of its sound and engineering, I do not feel that the price of the FT-101 is particularly out of line. All of which proves that purist audio products don't have to be priced so high that the very people who appreciate them most can't afford them.

Leonard Feldman

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The only right way to clean a compact disc.

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"Knew you'd be a vision in white
How'd you get those pants so tight?
Don't know what you're doin'
But you must be livin' right
We got some places to see
I brought all the maps with me
So jump right in...Ain't no sin
Take a ride in my machine
City traffic movin' way too slow
Drop the pedal and go...go...go
Goin' ridin' on the freeway of love
Wind's ag'in' your back
Goin' ridin' on the freeway of love
In my pink Cadillac"

FREEWAY OF LOVE
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She's traveled the highway from gospel singing sister to the reigning Queen of Soul. Fueled by a big powerful voice and a big joyous heart. Maxell audio tapes are created so that you can have a permanent record of that long journey, now and in the years to come. At Maxell every tape is manufactured to standards 60% higher than the industry calls for. So even after 500 plays the genius that is Aretha will thrill you just like it did when you first heard it, tooling down your very own freeway of love. **maxell**



4

DENON DCD-1500 COMPACT DISC PLAYER

Manufacturer's Specifications

Frequency Response: 5 Hz to 20 kHz, ± 0.3 dB.

Dynamic Range: 96 dB.

S/N Ratio: 96 dB, A-weighted.

THD: 0.0025% at 1 kHz.

Channel Separation: 95 dB.

Number of Programmable Selections: 20.

Output Level: Fixed, 2.0 V rms; variable, 0 to 2.0 V rms.

Dimensions: 17½ in. W x 3½ in. H x 14 in. D (44.5 cm x 8.9 cm x 35.6 cm).

Weight: 13.2 lbs. (6 kg).

Price: \$629.95; wood side panels, \$30 per pair.

Company Address: 27 Law Dr., Fairfield, N.J. 07006.

For literature, circle No. 94



With so many low-cost CD players now available, I think a lot of us tend to forget that there are several companies which still offer a wide variety of CD players in *many* price categories. The higher priced units often deliver more than just increased programmability, remote control, and other convenience features; some actually provide better sound when compared with their lower priced counterparts. Denon's DCD-1500 is such a CD player. It does indeed offer a wireless remote control (which operates virtually all of the front-panel functions, plus volume) as well as full random programming of up to 20 selections. Certainly it provides several repeat-play modes and a display area that tells you just about everything you need to know about the player's operation. Still, my own enthusiasm for the DCD-1500 stems more from its circuitry and sonic performance than from its admittedly advanced and easy-to-use operating features. More about the sound quality of this excellent machine shortly; first, let's take a look at its superb ergonomics.

Control Layout

A slide-out drawer with its "Open/Close" pushbutton is at the upper left of the front panel; below the drawer is a "Power" on/off button. A large, well-illuminated, and easy-to-read display area to the right of the disc drawer indicates track and index numbers, time elapsed (or remaining time), presence or absence of a disc, and programmed track numbers (from 1 through 20). Below the display are separate pairs of pushbuttons for track skipping (forward and reverse) and for audible search in either direction.

A pushbutton labelled "Index" and another called "Program & Direct" are used, together with 10 numbered keys, to call up specific tracks or indexed passages for immediate play, or to enter up to 20 tracks for programmed play. A pushbutton labelled "+10" facilitates accessing track numbers above 10; if you wanted to play track 28, for instance, you would touch the "+10" button twice, then the "8" button, and then either the "Play" button or (if you were storing the command in the program memory) the programming button. A large "Play" button, along with "Pause" and "Stop," are to the right of the number keys. Still further to the right are buttons which activate the various repeat-play modes (track, entire program, or entire disc), clear a program from memory, recall previously programmed information, and switch from an elapsed-time to a remaining-time display. A timer-start switch, also at the right of the panel, allows the DCD-1500 to be turned on or off by an external timer.

At the lower right corner of the panel are a stereo phone jack and a level control for the phone output signal. The rear panel is equipped with the usual left and right output jacks as well as a subcode output jack for use with video-graphics adaptors when they become available to consumers, sometime in the near future.

Measurements

Frequency response for the Denon DCD-1500 (Fig. 1) was extremely flat, deviating from perfect flatness by no more than +0.2 and -0.4 dB from 20 Hz to 20 kHz. Total harmonic distortion at 1 kHz for a 0-dB (maximum recorded level) test signal was 0.004%. What's remarkable about the

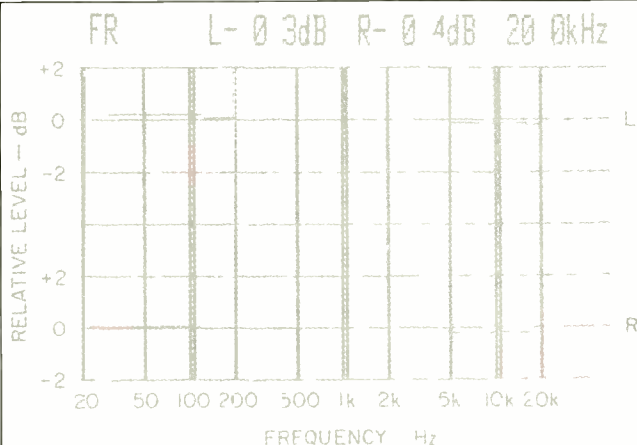


Fig. 1—Frequency response, left (top) and right channels.

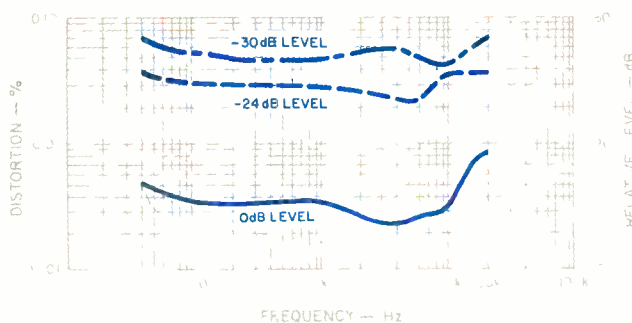


Fig. 2—Distortion vs. frequency at three recorded levels.

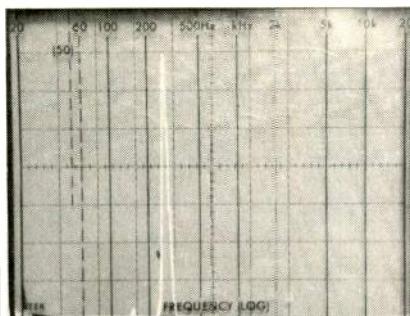


Fig. 3—Spectrum analysis of 20-kHz test signal shows no out-of-band components other than a minute "beat" at 16 kHz.

The outstanding separation indicates careful layout of analog output stages and complete independence of left- and right-channel D/A conversion systems.

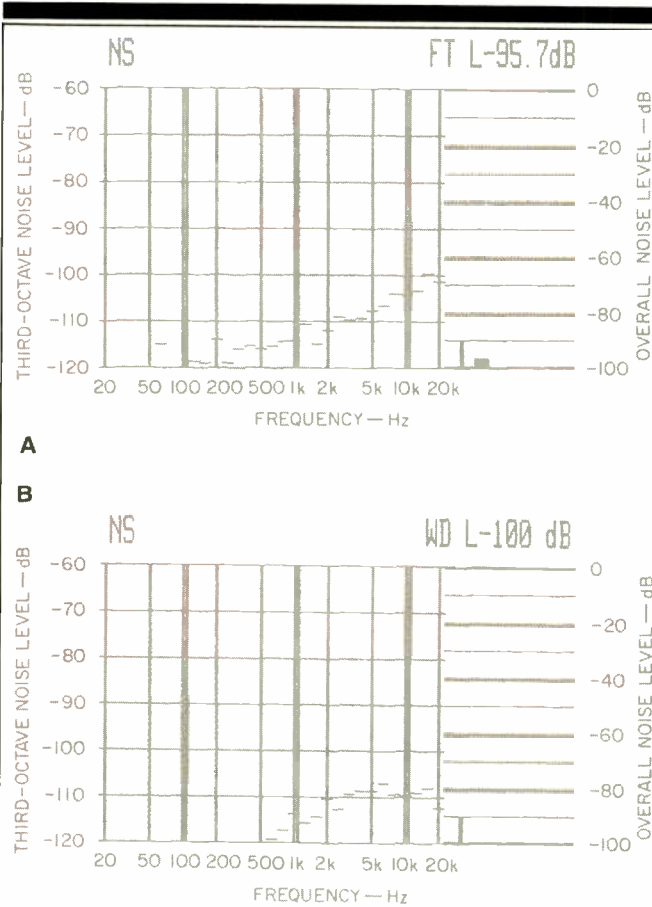


Fig. 4—S/N analysis, unweighted (A) and A-weighted (B).

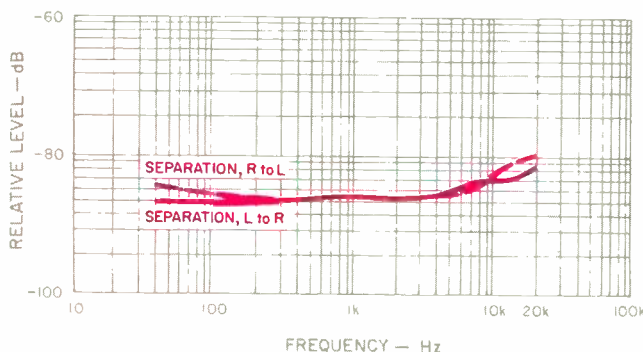


Fig. 5—Separation vs. frequency.

distortion characteristics of this player is that even at the high-frequency extreme, where I normally have to introduce a low-pass filter to obtain meaningful THD measurements, the readings on my distortion analyzer remained unusually low (see Fig. 2). The significance of this can best be appreciated if you refer to Fig. 3. In this 'scope photo of a spectrum-analyzer sweep (which is linear, from 0 Hz to 50 kHz), you can see a reproduced 20-kHz signal, but that's all you see, aside from a very minute "beat" at around 16 kHz. There were absolutely no out-of-band components visible outside the audio spectrum. It's been a long time since I obtained such a clean sweep (pardon the pun) when making this test on CD players; the last two players I tested that exhibited this kind of clean, spurious-noise-free out-of-band output were the Pioneer PD-9010X and the Sony CDP-620ES. Most other players usually produce an out-of-band beat at around 24 kHz when reproducing the high-level 20-kHz signal. I'm not saying that the absence of such out-of-band beats results in improved sound quality, but I'm beginning to wonder whether there isn't some sort of subtle correlation. The fact is that the Denon DCD-1500 did sound remarkably smooth and clean during my listening tests, but I'll get to that presently.

Figure 4A shows an analysis of unweighted signal-to-noise ratio; it measured 95.7 dB, almost as good as the weighted S/N claimed by Denon. When an A-weighting network was added to the measurement, as shown in Fig. 4B, S/N improved to an even 100 dB, several dB better than claimed by the manufacturer.

Stereo separation was outstanding too. Notice, in Fig. 5, how it remains almost as good at the high-frequency extreme as it is at mid- and low frequencies. Most CD players I've tested recently tend to offer much-reduced separation at high frequencies. In the case of the DCD-1500, separation remained above 80 dB even at 20 kHz. Maintaining this kind of separation involves careful layout of the player's analog output stages as well as complete independence of the digital-to-analog conversion system for left and right audio channels.

Output linearity was excellent, remaining accurate to within 0.5 dB all the way from maximum recorded level down to 80 dB below that level. SMPTE-IM distortion measured a mere 0.002% at maximum recorded level, increasing to 0.01% at -20 dB recorded level. CCIF-IM distortion was an insignificant 0.003% at maximum recorded level and an even lower 0.0017% at -10 dB. That's as low as I've ever measured, and provides further proof of the nearly complete absence of any intermodulation distortion products generated by the combination of sampling frequency and program content.

As I might have guessed, wow and flutter was too low to be measured by my test instruments, and any pitch error that might be present was also too low to be measured by my frequency counter. De-emphasis networks, automatically switched in when pre-emphasized CDs are played, were accurate to within 0.3 dB. The only parameter that fell short of published specs was dynamic range, which, when measured in accordance with the recently approved EIAJ Standards, was 91 dB as against 96 dB claimed by Denon. It's entirely possible that Denon is measuring this specification

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Pictured above, left to right are: The T95, T55, T65, and, the TL900, TL500, TL600.



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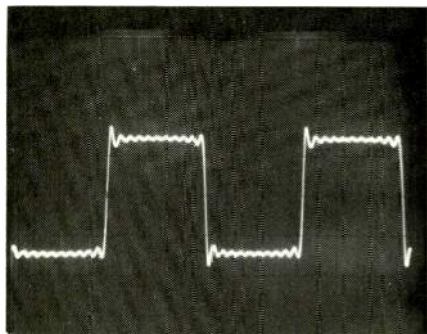


Fig. 6—Reproduction of a 1-kHz square wave.

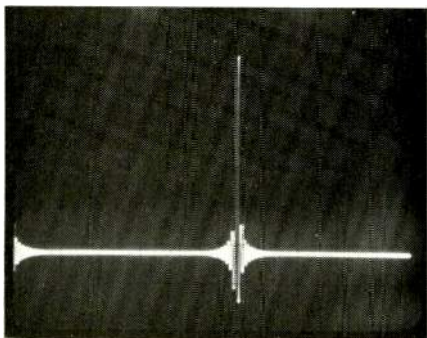


Fig. 7—Unit-pulse test.

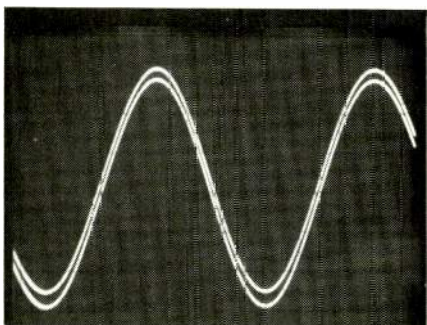


Fig. 8—Interchannel phase match when playing 20-kHz test tone shows that separate D/A converters are used in each channel.

in some other way. In any case, a dynamic-range capability of 91 dB is certainly nothing to be ashamed of, by anyone's standards.

Output level for the DCD-1500 measured 2.06 V on one channel and 2.08 V on the other, for a difference of 0.02 V. Denon employs 88.2-kHz oversampling and digital filtering prior to D/A conversion. This technique results in the extraordinarily clean and accurate 1-kHz square-wave reproduction shown in Fig. 6. What appears to be a minor amount of "ringing" along the top and bottom of the reproduced square wave is not ringing at all, but simply the absence of higher order harmonic components (above 20 kHz) that would be needed in order to yield a perfectly straight horizontal line here.

Figure 7 shows a reproduced unit pulse; its symmetry is consistent with what I have come to expect from CD players employing the type of filtration and oversampling used by the DCD-1500. As for the sine waves shown in Fig. 8, they are perfectly in phase with each other, indicating that Denon is using two separate D/A converters (one for each channel). This technique avoids the usual 11.3- μ S delay which occurs between channels when a single D/A converter is "multiplexed" to recover separate left and right signals.

I would have been very surprised if this superb player had not been able to play through my defects disc without any skipping or muting. In fact, it did play through the maximum width of the opaque wedge, the maximum-diameter dust simulation, and the simulated fingerprint smudge without so much as a hint that there was anything wrong with the test disc. It also successfully tracked a damaged disc that I keep around in the laboratory for just such rigorous testing—a disc that has been rejected by more than one CD player in the past.

Use and Listening Tests

I suspect that I am sometimes influenced by what I measure on the test bench when it comes time to judge a product's sound-reproduction qualities. I'm convinced that we can "psych" ourselves into hearing subtle qualities that we want to hear, or that we expect to hear. To me, the sound of the DCD-1500 seemed a shade better than what I have been hearing of late from several CD players whose measurements haven't been quite as good as this one's. I wanted to be sure that the measurements weren't prejudicing me, so I called in two friends who own CD players and asked them to bring their players along to my listening room. Without knowing when they were listening to their own players and when they were listening to the Denon, both of these friends preferred the sound of the DCD-1500 over that of their own.

I've always wanted to believe that, ultimately, there is a correlation between measured results and audible results—providing the right measurements are made. Happily, that contention held true in the case of the DCD-1500. It not only performed well on the bench and was easy to use via its remote control or via its front-panel controls, but it sounded as good as any CD player I have tested so far. What's more, its price is a good deal lower than that of some of my other favorite CD players. It is a winner in my book on every count.

Leonard Feldman

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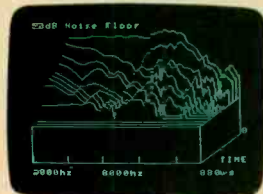
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5

SHURE SM91 MICROPHONE

Manufacturer's Specifications

Type: Unidirectional, surface-mounted electret condenser.

Frequency Response: 20 Hz to 20 kHz, at 30° incidence to infinite surface.

Polar Pattern: Half-cardioid (cardioid in hemisphere above mounting surface).

Output Impedance: Nominal, 150 ohms; actual, 90 ohms.

Output Level: -69.0 dB (0.35 mV) at 1 kHz (0 dB = 1 V/μbar, measured with sound source at 30° incidence to infinite surface).

Maximum SPL: 144 dB at 1 kHz, sound source at 30° incidence, 800-ohm load.

Hum Pickup: 16 dB equivalent SPL in 1-mOe field (60 Hz).

Output Noise: 23 dB SPL, A-weighted.

Phasing: Positive voltage at pin 2 with positive pressure on diaphragm.

Power: Two 9-V alkaline batteries (NEMA 1604A) for 300 hours continuous use, or 11 to 52 V d.c. simplex voltage (operational to 9 V d.c.); current drain, 1.8 mA.

Filter Response: In low-cut position, -12 dB/octave below 80 Hz; in flat position, -6 dB/octave below 30 Hz.

Cable: 7.6 meters (25 ft.), two-conductor, shielded, small diameter, between microphone and preamp; extendable to 75 feet with accessory cables.

Cases: Microphone, matte black enamelled die-cast base and perforated steel grille with replaceable or cleanable fine-mesh screen and foam-pad wind/dirt barrier; preamplifier, matte black enamelled die-cast aluminum.

Dimensions: Microphone, 3 $\frac{3}{8}$ in. W × 5 $\frac{1}{8}$ in. D × $\frac{5}{8}$ in. H (9.5 cm × 13 cm × 1.6 cm); preamplifier, 2 $\frac{3}{8}$ in.

W × 4 $\frac{3}{8}$ in. D × 1-1/16 in. H (6 cm × 11.1 cm × 2.7 cm).

Weight: Microphone, 9.3 oz. (263 grams), not including cable; preamplifier, 11.3 oz. (320 grams), including batteries.

Price: \$300.

Company Address: 222 Hartrey Ave., Evanston, Ill. 60204.

For literature, circle No. 95



This is my third review of a surface-mounted boundary microphone. The previous reviews (March 1983 and March 1985) described the Crown Pressure Zone Microphones (PZMs), which consist of a tiny, omnidirectional electret condenser capsule placed upside down, 1 mm from a metal plate. This assembly must be used on a large baffle surface for optimum results—at least 24 inches in diameter to obtain reasonably flat low-frequency response.

Since "PZM" is a trade name, competitors have used the terms "boundary" or "surface-mounted" to describe their own versions. It is not necessary for the transducer element of a boundary mike to be positioned upside down, as long as the input port or diaphragm is located within a few millimeters of the surface. The element should be small, about 10 mm in diameter. These dimensions pertain to music applications where uniform frequency response and polar pattern is required up to 15 kHz. For speech applications, the upper limit need be only 6 kHz, so these dimensions may be larger. Shure designed a boundary microphone for speech reinforcement applications long before the introduction of the PZM. It consisted of a cardioid element enclosed in a foam block, which was placed on a desk or table near the talker.

The boundary microphone is most convenient to use in applications where it can be placed on a natural boundary, such as a wall, floor, ceiling, or piano lid. If you need a stand-mounted mike, it makes more sense to use a conventional unit than to mount a large baffle on a stand with a boundary mike. An exception, in my opinion, is a "bipolar pair" stereo array (described in the March 1985 Crown review), which is a low-cost alternative to an expensive stereo microphone.

The omnidirectional boundary microphone has uniform pickup over a hemisphere, and therefore does not discriminate against ambient noise, particularly noises originating behind the microphone, i.e., in the direction opposite to the sound source. To provide discrimination, Shure has developed a directional boundary microphone, the SM91. The sound pickup pattern is a half-cardioid. To achieve uniform characteristics to 15 kHz, the SM91 uses a new electret condenser capsule only 10 mm in diameter. This capsule is mounted on its side rather than upside down. It is positioned close to the backing plate and protected by a foam and stainless-steel screen. Since floor-mounted mikes may get dirty, Shure has thoughtfully provided for easy disassembly and cleaning of the screens.

The microphone capsule includes an FET impedance converter. Up to 75 feet of cable may be used between microphone and preamplifier, including the 25 feet furnished plus a 50-foot extension. These cables are terminated with Switchcraft TA3F miniature three-pin connectors, which are readily available from electronic parts suppliers. The preamp input circuitry appears to be balanced and designed to reject stray r.f. picked up in the cable. This is a desirable feature for use in urban locations.

The SM91 is powered by the batteries in the preamp box or remotely from equipment having phantom power available. Battery power will satisfy most audiophiles, but response to earlier reviews indicates that some readers will want to use remote powering. As previously explained, two

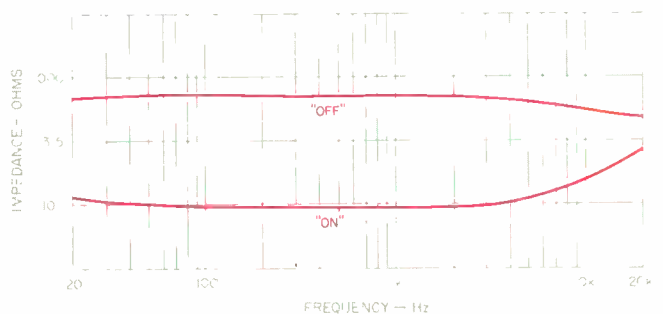


Fig. 1—Impedance vs. frequency, with battery power supply on (lower curve) and off (upper curve). Mid-frequency impedance with power on is 94 ohms; with power off, it is 680 ohms, still low enough to properly load preamp or mixer inputs. Note that the impedance scale is logarithmic.

kinds of remote power schemes, phantom and A-B, are in use today. The SM91 uses phantom power, though Shure's Technical Data Sheet refers to it throughout as "simplex" power ("phantom" is used parenthetically in one place). Shure says this is a telephone-company term, but in communications usage (and in my dictionaries of electronic terms), "simplex" refers to radio transmission and reception on a single frequency. One term should not have two usages within the field of electronics, I believe.

I have described electret condenser and boundary microphones in the *Journal of the Audio Engineering Society* (July-August 1985) and have previously reviewed two Shure electret microphones in *Audio* (the SM81 in August 1980 and the SM85 in May 1982).

Measurements

Figure 1 shows the measured impedance characteristics. The impedance with power on, 94 ohms at 1 kHz, agrees with specifications. (The mike's 680-ohm impedance with power off is still a suitable termination for microphone input circuits.) The inductive rise at 20 kHz with power on raises some questions as to optimum load impedance for best transient response, lowest noise, and minimum sensitivity to stray r.f. pickup. For my simple tests, I used an "unloaded" 150-ohm input of a professional-grade preamp. Shure specifies a minimum load of 800 ohms, so some experimentation with loads might be in order for critical applications.

The acoustical testing geometry for boundary microphones is not standardized, and as explained in previous reviews, I have devised my own methods which I think come close to conforming with EIA Standards for testing conven-



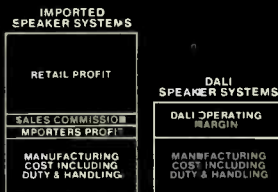
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The SM91 is a directional boundary mike, which discriminates against ambient noise better than omnidirectional PZMs.

tional mikes. The geometry I used for testing the frequency response of the SM91 with various directions of sound incidence is shown in Fig. 2. You must visualize the polar pattern of any microphone as a three-dimensional "figure of revolution." In the case of the SM91, imagine that the two-dimensional cardioid shown in Fig. 2A is revolved 360° about its axis. Then, the plane surface of the wood baffle cuts the 3-D cardioid in half. I measure the responses of a conventional, cylindrical mike with a circular diaphragm in only one plane, the horizontal. Because of symmetry, the mike can presumably be rotated in its mounting without changing these responses. My acoustic tests consist of measuring frequency response at various angles of incidence. If these stripcharts were recorded at many angles, one could plot polar diagrams at selected frequencies. A boundary mike requires response tests in one or more half-planes orthogonal (perpendicular) to the boundary plane.

The omnidirectional mikes previously reviewed were tested in only one half-plane for angles from 0° to 90°. The 0° axis was perpendicular to the baffle. Because of symmetry, three curves (0°, 45°, and 90°) were adequate to describe the performance.

Figure 2 shows that the SM91 requires tests in two orthogonal vertical planes. For clarity, I refer to one plane as "longitudinal" because it is aligned with the principal axis of pickup (Fig. 2A). The other (Fig. 2B) is called "transverse" because it is at right angles to the principal axis. Shure defines the angle or direction at which frequency response is measured as being theta and being 30°. If the SM91 is visualized as being on a stage apron, then an included theta angle of 0° to 90° would include all of the upstage-downstage sound sources. The audience noise and reverberant sound sources would lie at an included angle of 90° to 180°, and presumably would be attenuated. If the mike is connected to a sound-reinforcement system, these angles would include reflected amplified sound, which should be attenuated to minimize feedback.

The transverse plane includes sources to stage left and right. Note that this plane intersects the longitudinal plane where theta equals 90°. An inclined transverse plane intersecting where theta equalled 30° or 45° might have been a better choice for my tests, but this would have been too difficult to set up because the heavy-duty pipe stand required to support the massive baffle had no means to rotate the baffle about a horizontal axis, but only allowed rotation about a vertical axis. In all tests, the sound source remained in a fixed position while the baffle and mike were rotated.

I used angular increments of 45° for theta and alpha. Values of theta were: 0°, 45°, 90°, 135°, and 180°. Values of alpha were: 0° (same as theta being equal to 90°), 45°, and 90°, in one quadrant only because of symmetry. Shure defines theta being equal to 30° as the principal axis for response testing. It is of little concern that I omitted 30°, because the 0° and 45° response curves which I measured are smooth, parallel, and not too different from Shure's 30° curve.

The previous reviews of boundary mikes showed that my sensitivity data were 6 dB higher than the manufacturer's because of a difference in calibration procedure. They calibrated the SPL at the baffle surface, but I calibrated free-

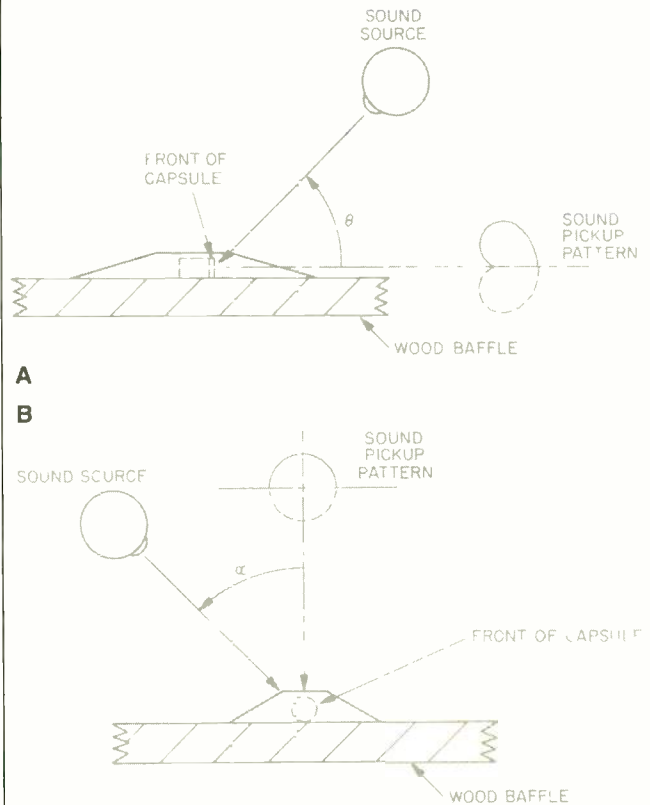


Fig. 2—Geometry of sound tests for a directional boundary microphone in longitudinal (A) and transverse (B) vertical planes.

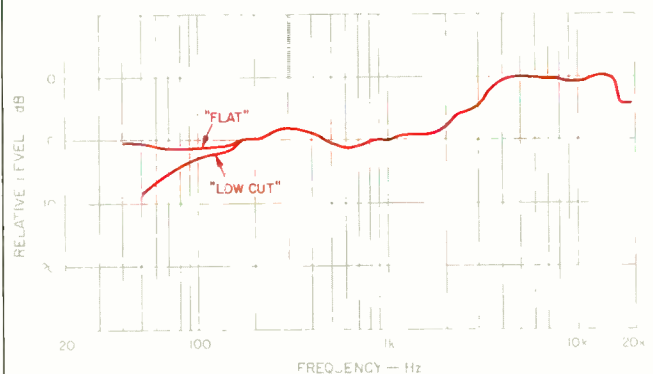


Fig. 3—Frequency response on pseudo-infinite baffle (0 dB equals -61 dBV/Pa).

There is no bass boost due to proximity effect; the response at 6 inches is much like the curves I obtained at 6 feet.

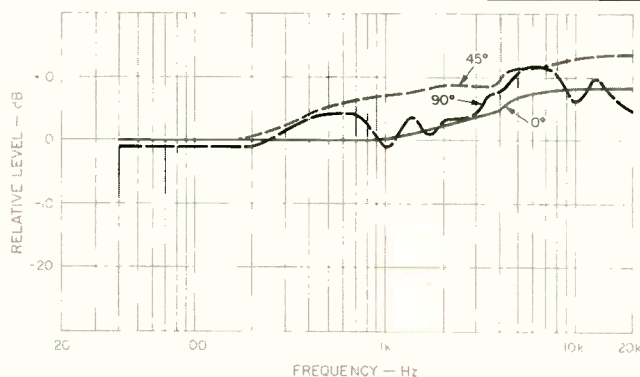


Fig. 4—Front-hemisphere frequency response for three longitudinal vertical angles, with microphone outdoors on 24-inch baffle at 6-foot distance (0 dB equals -61 dBV/Pa).

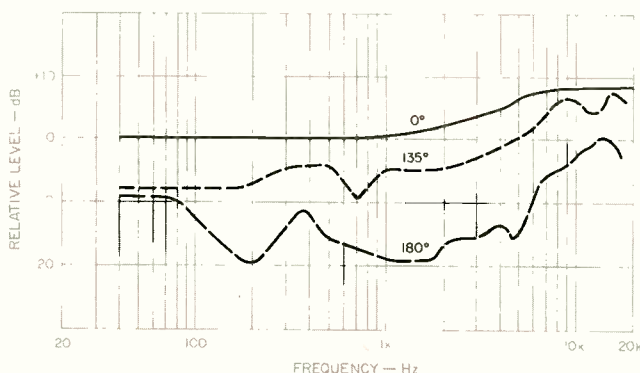


Fig. 5—Rear-hemisphere frequency response for three longitudinal vertical angles, under same conditions as Fig. 4.

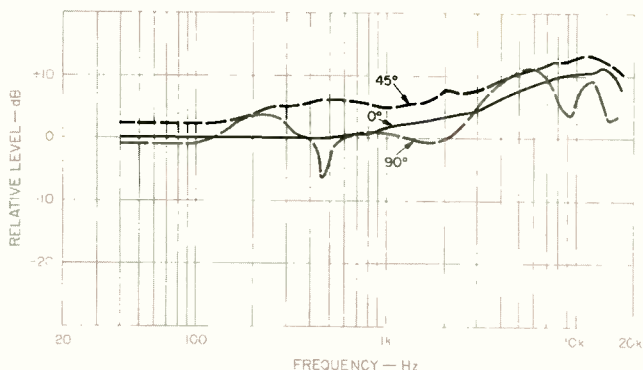


Fig. 6—Same as Fig. 4, but with microphone on 48-inch baffle.

space SPL prior to the introduction of the baffle. In addition to being easier to do, my procedure, I believe, follows EIA Standards.

The first response tests were conducted indoors, using a 2-inch-diameter precision sound source, with the mike and 24-inch square baffle only 6 inches away and oriented so theta was 90°. In previous reviews, I found that this produces the smoothest response curve for boundary mikes because it minimizes the wiggles due to reflections at the baffle edges. The reason is that, in the case of a 24-inch baffle, the reflected sound path is greater than 2 feet, compared to the 6-inch direct sound path. The results are similar to what one would expect from a large surface such as a floor or wall; hence the term "pseudo-infinite baffle response." The PZM microphone manufacturer conducted a similar test by using Time-Delay Spectrometry (TDS) to minimize reflections. The TDS method, unfortunately, had a lower limit frequency of 200 Hz in that test. My conventional test method, made possible by the very small sound source, works down to 30 to 40 Hz. In all tests, the microphone was mounted about 1 inch from the center of the baffle.

Figure 3 shows my pseudo-infinite baffle curve for the SM91. Sound is incident where theta equals 90°. If the mike were an ideal cardioid in free space, the 90° response would be 6 dB below the 0° response. However, this is not true for a boundary mike, as shall be seen. The SM91 shows an essentially flat curve to 2 kHz, then rises to +9.5 dB at 5 kHz. The manufacturer's curve for theta equalling 30° shows a rising response which, from 50 Hz to 5 kHz, increases 6 or 7 dB. Previous reviews showed that a rising response is desirable for boundary microphones. The astute reader will wonder why there is no bass boost due to proximity effect. The response at 6 inches is much like the curves (to be discussed) at 6 feet. I can think of two reasons for this. First, Fig. 3 shows the response where theta equals 90°, and a cardioid has no proximity effect at 90°. Second, the particle velocity is zero at a boundary, which should cause proximity effect to vanish. In most applications, the microphone will be too far from the source for proximity effect to be a factor.

I tried to measure directional responses indoors, at 12 and 24 inches, with the small source and 24-inch baffle, but results were poor. Then I resorted to outdoor testing with my large, spherical source (an 8-inch cone speaker in an 18-inch sphere, as compared to my small source's 2-inch aluminum piston in an 8-inch sphere). This was calibrated with a laboratory ribbon velocity mike prior to introducing the baffle. (See *Audio*, September 1978 and March 1983). The baffle/mike system was mounted 6 feet from the source so that a semblance of accuracy could be maintained with a 48-inch baffle rotated to the various angles of theta or alpha. To change from longitudinal to transverse planes, I simply turned the mike 90°.

First, I mounted the SM91 on a 24-inch baffle. Figure 4 shows the front-hemisphere responses for theta angles of 0°, 45°, and 90°. The lumps in the 90° response probably are due to edge reflection, because otherwise the curve should resemble Fig. 3. The 0° and 45° curves do not show these wiggles. The 45° curve is several dB above the 90° curve, as with a cardioid in free space. The 0° curve is 6 dB down, similar to the 90° curve, but for a different reason: At 0°

Frequency response, on a large surface, is uniform at all angles and smooth from 40 Hz to 20 kHz.

incidence, the pressure doubling vanishes. I set the 0-dB reference at -61 dBV/Pa because it looked best for the 0° and 90° curves. A better measure of axial sensitivity is the 1-kHz level of the 45° response, which averages about -55 dBV/Pa. Rated output at 30° and 1 Pa (94 dB SPL) is -49 dBV. Thus, these measurements are 6 dB low compared to Shure's value, just opposite to the outcome of the PZM tests. I trust that this disparity is likewise attributable to calibration techniques. Alternatively, it may just be a worst-case sum of production tolerances, lab differences, and the difference between sensitivity at theta angles of 30° and 45° . This caused a problem with noise-level calculation, which will be discussed later. The output level, -55 dBV/Pa, is acceptable for a 94-ohm mike; my *JAES* paper establishes -60 dBV/Pa as a minimum for a 250-ohm (passive) mike.

The frequency response curve for 45° rises about 12 dB, compared to 8 dB for the 0° measurement. Shure's value of 6 to 7 dB at 30° is significantly less than my 45° rise. The response curves are very smooth from 40 Hz to 20 kHz, so that if extra "brightness" is perceived, it may be equalized to suit the application.

Figure 5 shows responses for the rear hemisphere. If I had plotted the 45° curve as a reference, the discrimination at 135° at 1 kHz would be 10 dB, and at 180° would be 24 dB. This is excellent performance indeed.

Figures 6 and 7 show front- and rear-hemisphere responses with a 48-inch baffle. The rise of the 45° curve is the same as 0° : 10 dB, more in line with Shure's curve for 30° . Again, these curves are smooth, but the 90° curve is lumpy at frequencies about one octave lower than the curve in Fig. 4. This corresponds to the difference in baffle sizes. It may be concluded that only the 90° response of the SM91 is sensitive to baffle-edge reflections. Discrimination at 135° and 180° compares favorably to Fig. 5.

It was mentioned in the PZM reviews that the pressure-doubling effect (+6 dB) vanishes at a frequency related to baffle size, thus causing a step-down in bass response. (Frequencies are listed in the March 1983 review.) This effect is only very slightly seen in Fig. 6, as a 3-dB rise in the 45° bass response as compared to Fig. 4.

Figure 8 shows the transverse-plane response with the 48-inch baffle. The 0° curve is similar to the theta equals 90° curve. The 45° response picks up some edge reflections, but the 90° curve is smooth.

I conclude that the frequency response of the SM91, when the unit is placed on a large surface, is uniform for frontal angles of both theta and alpha equalling 0° and 90° and probably all angles in between. It is smooth from 40 Hz to 20 kHz, rising about 8 to 10 dB, which is appropriate for a boundary mike. Response where theta equals 180° is essentially a perfect null.

Measured noise level versus frequency is shown in Fig. 9. Battery power was used in this test. The measured levels in dBV are shown because the conversion to equivalent SPL is subject to interpretation. If I use my measured 45° value of acoustic sensitivity, -55 dBV/Pa at 1 kHz, the A-weighted overall noise level is 30 dB equivalent SPL. Rated noise level is 24 dB, but to obtain this value I would have to use the rated sensitivity figure. The noise level of the PZM I used for comparison measured -118 dBV A-weighted, which

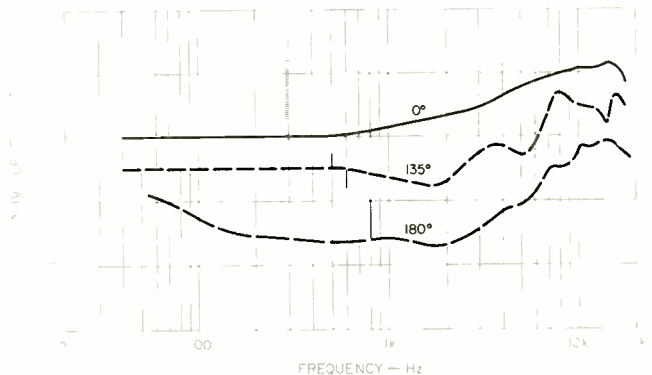


Fig. 7—Same as Fig. 5, but with microphone on 48-inch baffle.

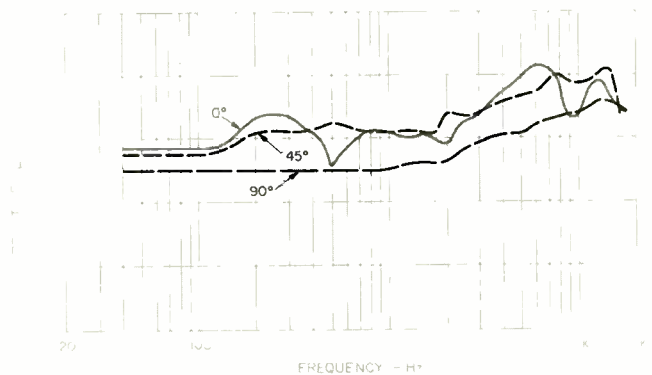


Fig. 8—Frequency response for three transverse vertical angles, with microphone outdoors on 48-inch baffle at 6-foot distance (0 dB equals -61 dBV/Pa).

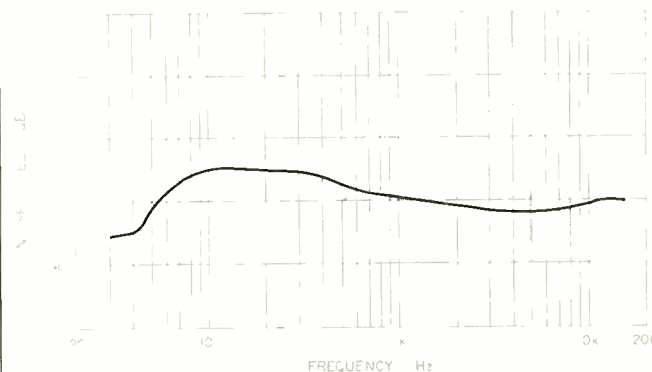


Fig. 9—Noise spectrum ($1/3$ -octave bands). Overall noise levels are -114 dBV, unweighted, and -119 dBV, A-weighted.

The SM91 makes clean tapes in noisy rooms and sounds lively. If I could have only one pair of boundary mikes, I'd choose Shure SM91s.

equalled 24 dB SPL, based on its -48 dBV/Pa measured sensitivity. (The PZM's 680-ohm impedance accounted for the higher output voltage level.)

Phasing was as specified, and agrees with EIA Standards. Clipping level exceeded 0.4 V peak output on speech (-11 dBV rms). Conversion to SPL depends on the acoustic sensitivity figure: Using -55 dBV, I obtain 138 dB, and -49 dBV results in 132 dB. Remembering that clipping exceeds these figures, the results compare favorably to the 144 dB specified.

Use and Listening Tests

The PZM or boundary has now been established as a legitimate high-quality microphone for both audiophile and professional applications, so it is a suitable reference for comparison to the SM91. I did not have any Crown units on hand, but I did have a Realistic, which was purchased from Radio Shack for \$39.95. I found that the frequency response and noise level of this mike compare very favorably to the Crown units, so I elected to use it as a reference.

The outdoor tests of the SM91 were frequently disrupted by wind gusts, which produced large excursions of the chart recorder pen. The gusts did not exceed 10 knots, which is an acceptable value for outdoor sound testing. I could not use the integral low-frequency filter while I was making my tests.

Indoors, I found that I could "pop" the SM91 with "Peter Piper picked . . ." spoken at 12 inches, and the mike was silent for a second following each pop. The Realistic would pop at 6 inches (with windscreen) and would not go silent after the pop impulse. The low-frequency filter in the SM91's preamp reduces but does not eliminate this effect. Popping should not be a problem, however, because the SM91 would rarely be used for close speech pickup.

Vibration noise caused by tapping my desk produced slightly more noise from the SM91 than from the Realistic.

The SM91 mike and preamp have negligible magnetic hum pickup compared to the Realistic. When testing with speech at 12 inches from the mikes on my desk, I found that the SM91 had more high and low frequencies than the Realistic and less room-noise pickup. The SM91 made a superior speech tape in a room with a noisy air conditioner.

The SM91 and the Realistic were placed side by side on the carpeted center aisle of a church (which seats 900 and has a ceiling 40 feet high). They were used to record a concert by a chorus of 25 young persons about 15 feet distant, with a piano between them and the mikes, plus a set of drums to the right of the piano. A two-track cassette tape using the two boundary mikes was made on an inexpensive Sanyo recorder, while an Aiwa AD-F990B recorder (with Dolby HX Pro) was recording the concert simultaneously using a permanently flown AKG C422 stereo mike 20 feet above the boundary mikes. Comparisons of the boundary-mike tracks on a monaural A/B basis showed that the SM91 had more vocal presence than the Realistic and more cymbal sound. Bass drum and piano sounded similar on both tracks. Overall, the SM91 sounded clearer and more pleasing. The audience was quiet, so no difference in ambient noise level could be detected. Reverberation was not heard in either mike, because the sources were relatively close and the room acoustics were not very live. Comparison to the Aiwa tape on a stereo basis is, of course, unfair. The HX Pro feature of the Aiwa, plus the very flat response of the AKG C422, means that high frequencies were very accurately recorded. I thought that the SM91's highs, by comparison, were a little excessive in relation to its low-frequency response. Surprisingly, the stereo perspective from the pair of dissimilar boundary microphones was not grossly different from that of the C422, and rather pleasing, I thought. I suspect that a pair of SM91s placed side by side and perhaps angled outwards might be excellent for stereo recordings.

I did not hear any noise (hiss) from either the Realistic or the SM91, but the sound level was consistently high at the mikes. No trouble was encountered with wind noise, of course, in this indoor application.

The cable of the SM91 is too stiff and kinky. It would not lie flat on the floor, which is essential for a surface-mounted microphone.

The recorder gain settings for the Realistic and SM91 were much different. The gain setting for the Realistic was normal, but the SM91 required a much higher setting because of its low impedance and output voltage. I think that a 150-to-600 ohm transformer should be used if the SM91 is connected to the mike input of a cassette recorder. (Jensen makes excellent transformers for this purpose.)

The minor problems evidenced in the measurements did not show up in the listening tests. These tests were limited in scope, due to lack of another concert to record and the fact that the single mike supplied for review precluded stereo recording. I conclude from these tests that the SM91 can make a cleaner speech tape in a noisy room, and a livelier sounding choral recording, than an omnidirectional boundary mike. If I were permitted only one pair of boundary mikes in my recording suitcase, I would choose the SM91.

Jon R. Sank

Top view of the Shure SM91. Note the steel grille, useful protection for a mike that will often be used on floors.





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The first version of the Oracle Delphi turntable appeared on the market in 1979, establishing a level of styling that made it a candidate for the Museum of Modern Art's design collection. Few high-fidelity products have been as visually attractive or provided so many new features. The new Delphi II retains all of these physical attributes and features, and, adding a number of important sonic ones, now definitely has high-end sound quality. At \$1,250 it may be expensive, but it is a serious contender for the title of the best sounding turntable currently.

The original Delphi had a good suspension and a very good ability to reject acoustic vibration and problems from movement of the floor and furniture. It was also one of the first turntables to provide a precise adjustment for tuning the suspension to different tonearm weights, as well as having a mechanism for securing the record to the turntable mat, thereby minimizing any resonance or coloration caused by the lack of a firm record/turntable interface. Setup procedures, however, were complex and poorly explained, and improvement was needed in some other areas too. For example, the original a.c. motor, noisy and a source of quality-control problems, was replaced in 1980 with a new, quieter d.c. motor. This didn't produce the smooth sound or stability of some of the top competition, and the unit had audible wow. Further, the spring suspension did not reject low bass and midrange energy from external sources well enough.

The Delphi II provides all the necessary improvements to correct these problems, and more. The d.c. motor now is a Pabst unit, first used on the \$2,500 Oracle Premiere. Its drive is smoothed electrically by a large capacitor bank, and mechanically by a built-in, 1-pound flywheel. The flywheel is dynamically balanced at the factory



at three times the normal operating speed. Potentiometers at the back of the turntable allow precise speed adjustment. A new molybdenum-disulphide oil, said to provide extended wear capabilities, is used in the main bearing assembly.

The base of the Delphi II is $\frac{5}{8}$ inch thick, rather than the $\frac{1}{2}$ inch of the previous Delphi, and its new spring suspension system does a far better job of rejecting external vibrations. Aluminum tonearm plates are optional, priced at \$66 if pre-cut to match your arm and \$38 if blank. Extra springs are supplied to tune the turntable suspension to match different arm weights; audiophiles who do their own setup or want to change tonearms will find this (and the now very well-written setup instructions) to be of major help. They will be equally pleased by the com-

bined stroboscope (for setting turntable speed) and cartridge-alignment protractor which Oracle has included with the Delphi II.

Most important, these improvements have clear sonic results. My extensive listening comparisons with other top-ranking turntables showed that the Delphi II provides an exceptionally neutral and musical sound. The speed-regulation and stability problems common to many belt-driven turntables were minimal to nonexistent, and the Delphi II consistently provided more musical data and low-level transient information, from the midrange up, than most competing designs.

The sound stage and imaging were stable and musically very convincing. The sound had excellent dynamics and musical life without a trace of hardness or the extra record noise

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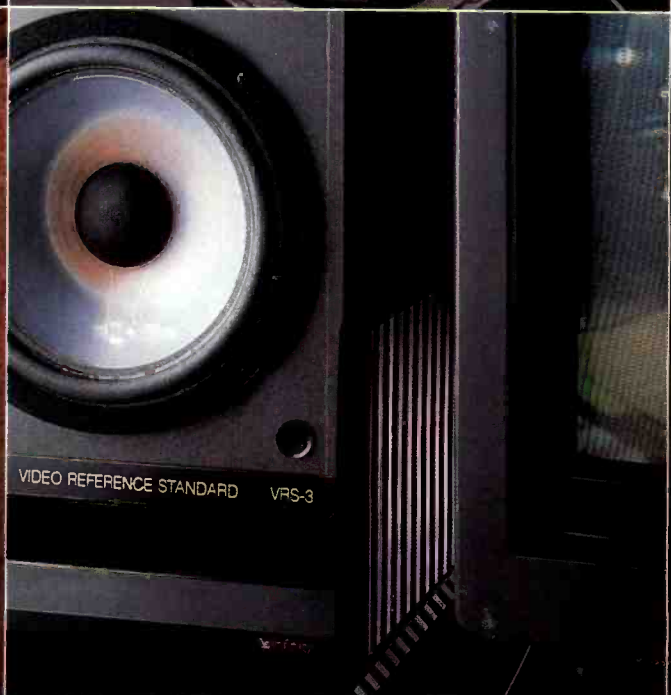
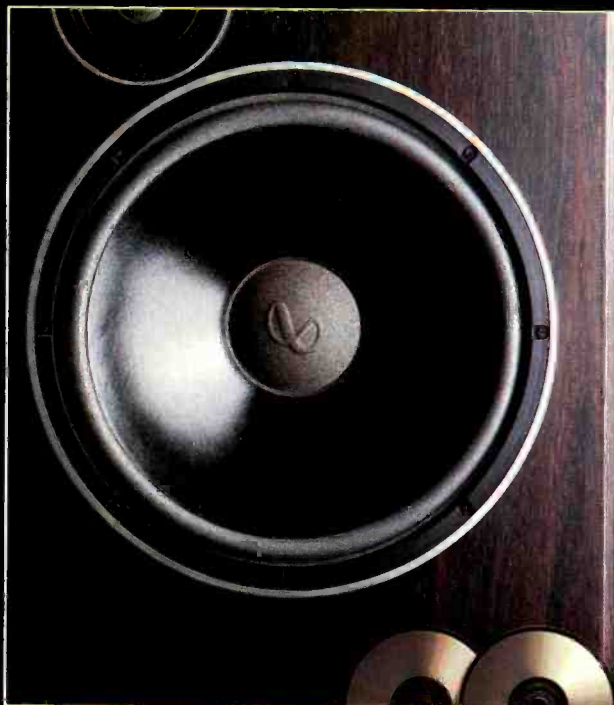
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The Delphi II provides an exceptionally neutral and musical sound that has excellent dynamics and life without any hardness.

common on many compromise designs. "Sweet" is overworked as an adjective for audio systems that communicate the character of the music, rather than imposing their own coloration on the sound, but it is appropriate for the Delphi II. Midrange coherence—the ability to provide a consistently musical and convincing sound over very long periods of time—rivals that of any turntable at any price.

If the new Oracle Delphi II does have a special sound character or coloration, it lies in the deep bass. Like most free-floating or suspension turntables, the Oracle tends to reduce bass energy in comparison with other designs. This can be minimized by using the manufacturer's optional metal tonearm mounting plate rather than the standard acrylic plate, and clamping it as tightly as possible to the turntable frame. A 1/8- to 1/4-inch rope of Mortite placed between the mounting plate and the turntable frame will help damp it. Without such damping, the metal plate tends to rob the sound of some of the sweetness found with the acrylic tonearm mounting plate, which cannot be rigidly clamped to the turntable frame.

A further improvement in the bass is possible by replacing the standard feet with spiked or metal-cone feet to "fix" the turntable firmly to the mounting cabinet or shelf. This seems to consistently improve the clarity and life of the bass and lower midrange. The Delphi II also works synergistically with the new air-bearing arms. The Eminent Technology Two, for example, provided outstanding performance and has a special mounting kit for the Oracle. The Alphason, Syrinx, and other top-quality pivoting arms also provided excellent overall performance, but with a little less bass data.

In summary, the Oracle Delphi II is the kind of turntable that makes many audiophiles feel that the analog disc is still the most pleasurable source of music in the home. The unit apparently does trade off some lower bass energy for exceptional sweetness in the upper midrange and higher octaves, but no competing product is free of such trade-offs. It is a superb audio product and one that can contribute years of musical pleasure and excitement.

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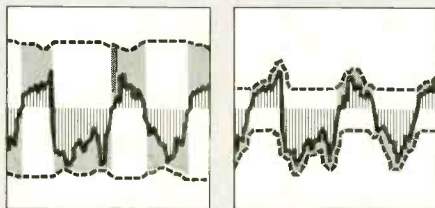
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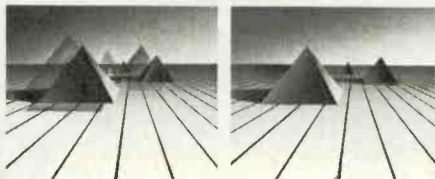
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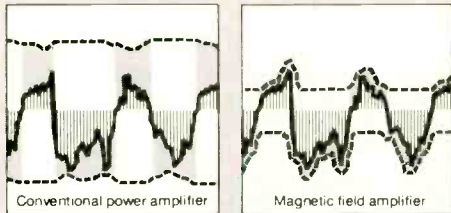
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GERRY MULLIGAN



Mosaic Records is bringing back to life a great deal of wonderful jazz that has not been available for quite a long time. Founders Charles Lourie and Michael Cuscuna—two seasoned marketing and production men with lots of experience in big and small record companies—have long-term leases on the old Blue Note and World Pacific catalogs; they also plan to lease significant contemporary material from a variety of sources.

The Connecticut-based company, founded in California in 1983, is packaging this music the way it should be: Reissued material is arranged in chronological sequence, along with alternate takes and previously unissued tunes used in toto, wherever and whenever possible. The packaging, liner notes, discographies, mastering, and pressing represent the state of the art for this kind of material. The only flaw I can find in their superb presentations is one I had to overcome more than 20 years ago, when I produced a somewhat similar series of packages at Columbia Records: There is no listing of contents on the backs of the boxes; this may prove to be a serious drawback for those who may not know the material well.

Still, the series is a remarkable accomplishment and an extremely valuable one. Mosaic has set a standard for the industry to follow, and we can look forward to more marvelous music in the months and years to come.

(Editor's Note: The following reviews are of Mosaic's first seven releases; several additional packages are available. All may be ordered from Mosaic Records, 197 Strawberry Hill Ave., Stamford, Conn. 06902; 203-327-7111. Prices quoted do not include shipping and handling.)



The Complete Blue Note Thelonious Monk (MR4-101, four-record set, \$34), a limited edition of 7,500 pressings, contains all the known recordings—as well as a considerable number of previously unissued alternate takes—which Monk made as a leader for Blue Note from 1947 through 1952. One of the great originals of jazz, Thelonious Sphere Monk had a sound so unique that he carved out his own niche while being wrongly regarded as a be-bopper. Generally, the sessions with just Monk and rhythm come off best, because horn players seem to have inordinate difficulty getting his rhythms in place. Not that there is any really bad

Photographs: Frank Driggs Collection

FITTING REVIVALS

THE MOSAIC REISSUES

FRANK DRIGGS

the very best Lee Konitz alto saxophone work to be found on record. "Bernie's Tune," "Walkin' Shoes," "Freeway," and so many other completely realized improvisations are all here, and sound to this listener's ears completely fresh and just as exciting as they were when originally released. Fourteen previously unissued performances also help make this Mosaic package absolutely essential.



The Complete Blue Note Albert Ammons and Meade Lux Lewis (MR3-103, three-record set, \$25.50) may well have less appeal than most of Mosaic's other releases. This would be a great shame, because solo boogie-woogie piano as played by Ammons

MEADE "LUX" LEWIS (LEFT) AND ALBERT AMMONS

playing, but Monk is such a whole, in and of himself, that horns are almost (to me, anyway) an intrusion upon his creations. There is some fine playing by Sahib Shihab on alto, Billy Smith on tenor, Milt Jackson on vibes, Lou Donaldson on alto saxophone, Lucky Thompson on tenor sax, Kenny Dorham on trumpet, and finally, by Sonny Rollins on his own date in 1957, with Monk as a sideman. There is wonderful accompaniment throughout, particularly by Art Blakey and a little-known bassist named Bob Paige.



The Original Gerry Mulligan Quartet with Chet Baker (MR5-102, five-record set, \$42.50) contains all the justifiably famous recordings which Mulligan's pianoless group made with Baker in 1952 and 1953. These records, as Pete Welding's extremely thorough and fascinating notes tell us, made Mulligan a media celebrity, made Chet Baker a major trumpet star at a time when Miles Davis was in eclipse, and pretty much launched Pacific Jazz as a record label. Their music was, for better or worse, also dubbed West Coast jazz. The hard-swinging and gifted Mulligan took great exception to this description, having performed superbly in a wide variety of contexts on both coasts before and after these history-making sessions, some of which were originally recorded for Capitol, others for Pacific Jazz. The last three sessions (including one live from The Haig, a Los Angeles club where the group made its initial impact) include some of





CLIFFORD BROWN

and Lewis, two of the genre's very best practitioners, is really no longer being performed. Yes, Sammy Price is still around, and quite capable in this style, but this was a specialty of both these players, in a time when boogie-woogie, believe it or not, achieved a national reputation of a sort. Although Ammons and Lewis recorded for many other companies in the 1940s, it was for Alfred Lion at Blue Note that they did their best work. Lion had them make extended recordings on 12-inch 78s—very expensive, in a time when few collectors knew or understood anything about boogie-woogie or Ammons and Lewis.

Ammons specialized in hard-driving, medium and up-tempo pieces. Lewis was adept at songs of all tempos, but none more so than the slow, introspective "Blues Parts I Through V," the last part of which was not released until this Mosaic package was produced. The complexity of Lewis' playing and the sheer joy and drive of Ammons' work really come across. It's the real thing, not the imitation done by every big band and then every R&B and rock group of the past 30 years. This set is essential to anyone wanting to know the beauty and joy of this very special branch of jazz and blues.



The Complete Blue Note and Pacific Jazz Recordings of Clifford Brown (MR5-104, five-record set, \$42.50) lets the listener know right from the start that a particularly gifted player had arrived on the scene. Clifford Brown was, at 23, the most promising of all modern jazz men to come up since the advent of the LP. He had it all—speed, articulation, ideas, a fine glowing tone, and tremendous punch to his playing. His



CHET BAKER

death at age 25 in an auto accident was a tragic loss to music. He is heard here at length in the company of proven talents like Lou Donaldson, Elmo Hope, J. J. Johnson, Horace Silver and Jimmy Heath, with stellar rhythm sections headed by Kenny Clarke, Art Blakey and Philly Joe Jones. There is no question of the value of this music and of Clifford Brown's unique talent.

ART PEPPER



The Complete Pacific Jazz Small Group Recordings of Art Pepper (MR3-105, three-record set, \$25.50). Much of Art Pepper's life was lived in the shadows, as he tried to deal with drug addiction, long incarceration and a general inability to come to grips with the world away from jazz. Luckily for us, he left a large legacy of beautiful music behind. Mosaic's beautifully packaged, mastered, and annotated set will very definitely stand as *the* tribute to Art Pepper's highly individualistic alto-saxophone solos. Recorded in 1956, with one date in 1957, the set starts off deceptively low-key, with Chet Baker and Richie Kamuca and some of the antsiest piano I've ever heard from Pete Jolly. Later things improve considerably, with Baker playing some of his very strongest solos and Phil Urso contributing some good tenor. Pepper shares the last dates with Bill Perkins and Bill Holman on tenor (both of whom play very well), with some good trumpet by Don Fagerquist, tuba by Red Callender and baritone by Bud Shank. And there is some excellent drumming throughout the set by Stan Levey, Lawrence Marable, Mel Lewis, and Shelly Manne.



The Complete Blue Note Forties Recordings of Ike Quebec and John Hardee (MR4-107, four-record set, \$34). Quebec and Hardee were two of swing's noncommissioned officers, jazz *soldati* of a high order. Their talents were put to the test time and time again during and after World War II, and the two enjoyed a measure of success in the '40s, only to be shot down in the overwhelming tide of public indifference to their consummate skills toward the end of the decade. It was an exciting time for modern jazz, but a very bad time for those in other genres, including many artists who had been major stars.

Both saxophonists were born in 1918. Quebec, from Newark, N.J., scored first because of his proximity to New York, where all the action was; he worked with a dozen big and small bands before settling in with Cab Calloway's band in 1944. He signed

with Blue Note that year and immediately had a major Harlem jukebox hit with "Blue Harlem," both takes of which were originally released. As long as Quebec remained with Calloway, he had a steady paycheck, but he most certainly deserved personal stardom, although he never achieved it on his own. John Hardee, from Corsicana, Tex., served his apprenticeship in local and territory bands before going into the service in World War II. He surfaced in Tiny Grimes' group on 52nd Street in New York and was added to Blue Note's roster in 1946. His first record, "Tired" backed with "Blue Skies," sold very well throughout the New York area, and in 1948 Hardee formed his own quartet. After a year, there was just not enough work to keep going, and late in 1949, at his wife's urging, he went back to Dallas and became a music teacher.



J. C. HIGGINBOTHAM



FRANKIE NEWTON

Both men have left a fine legacy of big-toned, warm, and swinging saxophone solos that Blue Note captured in the 1944-46 period. All are very much recommended as outstanding examples of the kind of playing that, for inexplicable reasons, fell into disfavor in the late '40s. Besides the two saxists, Jonah Jones, Tyree Glenn, Buck Clayton, Tiny Grimes, Ram Ramirez, Sid Catlett and J. C. Heard all have prominent roles to play here, in some of swing's last and finest moments on record.

which may well be taken for granted now; in 1939 it was highly unusual and quite daring, and was Blue Note's first major hit.

Because these were the first combo records made by Blue Note, they have a slightly tentative quality to them. Newton, Higgy, and Bechet are clearly the stars and the principal reason one would want to own this record. **A**

IKE QUEBEC



JOHN HARDEE



The Complete Recordings of the Port of Harlem Jazzmen (MR1-108, \$8.50) gathers Blue Note's first two 1939 sessions built around Frankie Newton and J. C. Higginbotham, with Sidney Bechet added on the second session. Piano is by Albert Ammons on the first and Meade Lux Lewis on the second and a rhythm team of Teddy Bunn, Johnny Williams and Sid Catlett round out the picture. There is fine playing, particularly by Frankie Newton, a trumpeter of real ability whose lengthy illnesses prevented him from realizing himself on records the way he might have. J. C. Higginbotham had been a major force on trombone since his days with Luis Russell in 1929, and he is still near the top of his form on "Basin Street Blues" and "Wearyland Blues," included here. Newton is at his peak on "Blues for Tommy," dedicated to the great New Orleans trumpeter Tommy Ladnier, who had passed away four days before the session, and who, according to Stanley Dance's lucid notes, may well have been producer Alfred Lion's first choice to make this date. Sidney Bechet stars on "Summertime" in a classic performance



SUBLIME FROM THE RIDICULOUS



At one point, the fictionalized Salieri is describing the third movement of the "Serenade for Winds." "On the page, just a pulse, like a rusty old squeeze box, and then, suddenly, high above it, an oboe—a single note hanging there unwavering, until a clarinet took it over, sweetening it into a phrase of such delight, filled with such unfulfillable longing. It seemed that I was hearing the voice of God." That describes Mozart's essential musical gift: His ability to mold the simplest gesture into a sophisticated musical expression of incredible beauty. *Steve Birchall*

Richard Strauss: A Hero's Life. The Dresden State Orchestra, Herbert Blomstedt.
Denon 33C37-7561.

Strauss' autobiographical tone poem, "A Hero's Life (Ein Heldenleben)," romps hilariously through his musical world. He pokes fun at his critics and music in general with subtle good humor. But many listeners, distracted by the late 19th-century, larger-than-life style of the piece, may overlook the humor.

Strauss' gigantic sonata/allegro form is so large a forest that it disappears; all we see are the trees. He compounds that joke in many ways. At the end of the first theme's exposition, he throws the gauntlet down to his critics with a loud, pompously pyramided dominant seventh chord. But he leaves it hanging, unresolved, until after a brief silence, when the critics answer with the chattering chaos of the second theme.

In the expanded coda, a poke at the "Eroica" symphony, Strauss quotes from his own works, including, with sly humor, "Don Juan." Later, in track 6, the critics' voices once again rise, and Strauss quotes the "Jousting with Windmills" passage from "Don Quixote." Wryly, he tosses in some "bleating sheep" (muted trumpets) and an imitation of the wind machine (cymbal roll) as well.

In 1944, Strauss recorded "A Hero's Life" with the Vienna Philharmonic (now available on the Vanguard LP set SRV 325/29). His tempos were a bit brisker than what we are used to hearing now, and he tended to separate phrases rather than to connect them

Amadeus, Original Soundtrack Recording. The Academy of St. Martin-in-the-Fields, Neville Marriner.
Fantasy FCD 900-1791-2.

A genius can be just as imaginative in his social life as in his artistic expression. Thus, although in Mozart's music we hear a world of exquisite good taste, polish, and perfection, the Mozart we see in the film *Amadeus*—based on known facts about the composer's personality—is superficial, shallow, and lewd.

In some ways, the musical selections found here reflect the side of Mozart that the movie depicts. For instance, the Rondo theme of the "Piano Concerto" is an absurdly air-headed tune—what a composer might whistle while walking to the post office. But Mozart molded that trivial tune into a masterpiece. He plays games with your expectations, especially at phrase endings, teasing you into believing the music will go in one direction when actually he's about to merrily go off in another. That precarious balance between the silly and the sublime is a basic aspect of his personality.

This recording sounds clean and spacious. However, wispy clouds of analog distortion are evident, and the choral selections suffer the most. Quiet and medium-level passages sound fine, but when the sopranos start to

soar, that familiar hollow, pinched, analog distortion appears. A digital recording by the same performers of the "Symphonie Concertante" (Philips 411 134-2) is especially revealing. When you come back to *Amadeus*, its fuzzy edges are obvious.

But this is still an especially good analog recording, and the production complements the music. In the "Symphonie Concertante" producer John Strauss keeps the solo violin and viola slightly separated spatially. Their similar but distinctive timbres are so accurate that we can follow them independently, just as if we were watching a live performance or reading the score.

Ambience changes from track to track because the acoustics of various rooms are integral parts of the way the film tells its story. A good example is the rehearsal of "The Marriage of Figaro" attended by the Emperor. This is the sound of an empty theater, not a full house.

Neville Marriner and the Academy of St. Martin-in-the-Fields made new recordings especially for the film, and they are among the best Mozart performances available. For those who don't know Mozart's music, the album is an excellent introduction. For those who do, listening to these superbly performed selections is a joyous experience. A second album already has been issued, both on LP and CD.

Illustration: Philip Anderson

smoothly. Perhaps the most interesting difference is the way he treated his melodies. Instead of long lines with convoluted contours, his melodies often turned out to be rather simple, with added ornamentation—more like Mozart, in a certain sense. Clearly Strauss wanted that quasi-Classical approach to the piece. Blomstedt and the Dresden State Orchestra come fairly close to realizing Strauss' point of view.

Although I like Denon's use of track designations to mark the various sections, the booklet notes are confusing, and wrong on what takes place in tracks 4 and 5. The location of the recapitulation is unmistakable; Strauss wrote it in large, bold brush strokes. The booklet says it starts at the beginning of track 5, but on the disc it actually occurs at 6:04 in track 4, and track 5 starts at an irrelevant point later on.

This disc's most immediately attractive characteristic is the resplendently reverberant hall sound. Not only is it a properly big, spacious sound, but the quality and character of that sound are excellent. At times, in the loudest passages, I would like to hear more of the inner voices. The offstage trumpets in track 4 sound distant but not muffled.

The Dresden brass play with awesome strength and power, especially in the "Battle Scene." In quiet passages, the horns have a wonderfully dark tone and a flowing legato. You'll hear some unusual colors in the woodwinds, particularly the double reeds. Peter Mirring's solo violin tone is extremely bright, enabling him to stand out from the darker massed strings while still playing softly.

Blomstedt leads the Dresden Orchestra in an exciting, well-controlled performance. From the fury of the "Battle Scene" to the tenderness of the "Hero's Helpmate" to the quiet contentment of the closing passages, this is an outstanding recording.

Steve Birchall

Lush Life: Linda Ronstadt with Nelson Riddle and His Orchestra
Asylum 9 60387-2.

Lush Life is a rich, extravagant aural delight, a Compact Disc of the very first rank technically. Artistically, the real star is arranger/conductor Nelson Riddle, not vocalist Linda Ronstadt.

The late Riddle exhibited sheer genius in his arrangements for the singing voice. No one knew better how to cradle, support, and highlight a singer, how to weave a totally appropriate orchestral framework that lived and breathed in tandem with each vocal shading. His work with Frank Sinatra is legendary.

All 12 classic pop songs on this generous Compact Disc are touched by Riddle's magic wand. Working with concertmaster David Frisina's four-piece combo, Riddle eases his orchestra, glistening with strings, mellow with horns and bass, through the slow torchers "It Never Entered My Mind," "When Your Lover Has Gone," and "I'm a Fool to Want You." He kicks it into high gear, with brasses blaring and feisty, for the uptempo "You Took Advantage of Me" and "Can't We Be Friends." The magic of Riddle's touch is apparent in the brilliant instrumental accents and underpinnings for Ronstadt's voice throughout—the exquisite solo acoustic guitar drifting behind her in the intro to "When I Fall in Love," the melancholy muted trumpet woven into "Mean to Me," the honey-gold harmonica flowing through "Skylark," the classic blast of massed horns in "You Took Advantage of Me." And the strings, those magical strings! Under Riddle's guidance they soar sweetly above orchestral clouds, twinkle in CD-silent space, or form calm, sonorous rivers of supportive sound.

Linda Ronstadt makes an admirable attempt to handle this splendid material. Her voice is sweet and clear with remarkable range and savvy. Unfortunately, the savvy is based on rock technique, and these selections are of another musical dimension. Despite Ronstadt's lengthy career and serious vocal training, the sweetness of her voice evokes an aura of innocence, but this material requires a worldly-wise voice, a voice with a psychologically ragged edge. Ronstadt may one day achieve the stature of the female greats of the genre like Billie Holiday, Julie Wilson, Carmen McRae, or Ella Fitzgerald, but right now she too often goes for the big belt instead of the smoky understatement. She does best on uptempo cuts, but simply lacks the resources for the rest. "Sophisticated Lady" and "Lush Life," two of the finest



DIGITAL DISCOVERIES 91

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This is the kind of disc that justifies the CD revolution. What clarity from the orchestra, and what art from Eva Marton!



and most difficult songs in the popular catalog, are utterly beyond her grasp.

Technically, this disc is CD dream stuff. Ronstadt's voice, lightly dusted with reverb and placed front and center, floats up from the disc with sparkling clarity and real intimacy. Solo instrumentals are cleanly placed one step back, and another step beyond lies Riddle's fabulous orchestra. Aural space is brilliantly defined by producer Peter Asher, and the dynamic range is astounding. The silence between cuts and passages is the *raison d'être* of digital recording.

Don't wait for Ronstadt to grow into this material. Give her an A+ for effort, and consider this CD a triumph in the pop domain. *Paulette Weiss*

Richard Strauss: Excerpts from Salome and from Die Liebe der Danae; Four Last Songs; Malven. The Toronto Symphony, Andrew Davis; Eva Marton, soprano.
CBS MK 42019.

This is the kind of Compact Disc recording (digital in every phase of production and, although recorded at a live concert, painstakingly thought out as to placement, separation and so forth) that justifies the CD revolution. What a glorious concert! What orchestral clarity! And what art from Eva Marton, whose American reputation has risen so swiftly!

The selections begin with the "Dance of the Seven Veils," that 9½-minute orchestral accompaniment to

Salome's legendary writhing. The castanets and xylophone, which Strauss did not include for mere grace notes, shimmer here as they never did on LP or cassette. The flutes' lethal playfulness and the high pizzicato on the violins are stunning—in fact, the ineluctable movement of this piece, from apparently friendly waltz tempo to the final frenzy, is almost overwhelming. This is powerful music whose effect has to be respected. You wouldn't want to live too long within it.

Then comes Miss Marton, to sing the quarter-hour final scene. Her Salome is no puppet: Caught between Herod's politics and lust and her mother's jealousy, she shares both the psychosexual obsession of one and the single-mindedness of the other. "*Ich lebe noch, aber du bist tot, und dein Kopf gehört mir*" has never sounded so frighteningly Pyrrhic a victory.

Davis and his orchestra, and the CBS production crew, have come up with a masterwork of a disc. "Your voice was a censor," Salome sings to the severed head of the Baptist, "and when I looked at you, I heard a strange music." On those last words, Strauss reverts to the notes of John's first prophetic announcement, from prison, at the opera's beginning. Marton conveys the whole terrifying arc of the story. I shuddered at the blasting finale.

An orchestral interlude follows: The restful, lush, symphonic fragment of the seldom heard "Love of Danae." Then Marton returns for the "Four Last Songs," in the third of which ("Time to



**THIS MONTH'S
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JUNE

5

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STREET DREAMS**

7

8

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LA GRANDE ÉCARTÉE / LA CHAMBRE DU ROY
JEAN-CLAUDE MALGOIRE

15

BERNSTEIN

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BONNIE TYLER

**SECRET DREAMS
AND FORBIDDEN FIRE**

22

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Edo De Waart achieves a wide range of dynamic expression and a fine balance between organ and orchestra in this peerless Saint-Saëns recording.

Sleep") her voice caresses us like a welcome dream. Davis plays piano for her 90-second delivery of the "Zueignung," as he does for the final cut—the "Malven," which was discovered just over a year ago, after the death of soprano Maria Jeritza. The short song was written and sent by Strauss to Jeritza just before his death in 1949, and when she left us in late 1984, we had to revise our Strauss list. At 84, Papa Strauss was still in control of his genius. I think Madame Jeritza would be pleased—delighted, even—with Marton's canny artistry. You will be.

Donald Spoto

Saint-Saëns: Symphony No. 3. The San Francisco Symphony, Edo De Waart; Jean Guillou, organ. **Philips 412 619-2.**

The Saint-Saëns Third Symphony, a big, bravura display piece for organ and orchestra, has long been a favorite of audiophiles. The organ is a very important part of this score, and in my opinion a truly successful recording of this symphony demands the use of a real pipe organ. Unfortunately, many recording halls do not have pipe organ installations. In those cases, the producer may elect to substitute an electronic organ or may decide to record the organ parts on a pipe organ in another location, be it a hall or a church, and then dub in those parts with a recording of the rest of the orchestra to make a composite.

This latter procedure is fraught with peril, because the acoustic character of the pipe organ's location is usually quite different from the acoustics of the orchestral hall. While a few composite recordings have skillfully integrated organ and orchestra, most of them are quite unsatisfactory and some verge on being ludicrous.

The music on this Philips CD was recorded in the new Davies Hall in San

Francisco, which appears to be an ideal venue for this Saint-Saëns symphony. The magnificent new Ruffatti organ installed in Davies Hall is said to be the largest concert organ in North America. It certainly has the immense power, tonal resources, and huge, 32-foot pedals necessary to give grandeur and majesty to the symphony's organ parts. Moreover, the approximately two-second reverberation period of Davies Hall gives the organ great clarity and articulation, allowing the organ sound to be completely integrated with that of the orchestra.

Edo De Waart's performance mirrors the sound, being a model of clarity. He achieves a fine balance between organ and orchestra, a very lyrical exposition of the second movement, and a wide range of dynamic expression. Throughout the third movement, De Waart maintains a brisk momentum. The finale is appropriately grandiose, with De Waart providing an exciting and propulsive thrust to the music which culminates in tumultuous and triumphant outbursts from organ, brass, and percussion.

Sonically, this recording has no peer. If you have a really good subwoofer, you will find the thunder of the bass pedals truly awesome. At the beginning of the second movement, the pulsating throbs of the mighty 32-foot pedals reach the most subterranean level of musical sonority. Of the five recordings of the Saint-Saëns Third Symphony currently on CD, this clearly is the one of choice. *Bert Whyte*

Tchaikovsky: Romeo and Juliet, Francesca da Rimini. The Cleveland Orchestra, Riccardo Chailly. **London 414 159-2.**

Here is a blockbuster CD that will challenge the capabilities of even the biggest, most elaborate and expensive of audio component systems. Engineer Colin Moorfoot has provided a recording of enormous dynamic expression, without sacrificing clarity or upsetting orchestral balances.

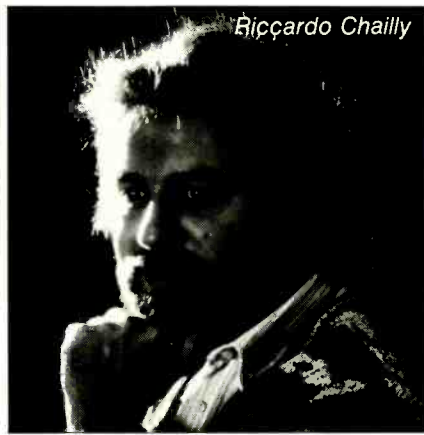
The "Romeo and Juliet" on this CD is of more than usual interest, because the same music, with the same Cleveland Orchestra in the same Masonic Auditorium, was also recorded by Telarc. Both are fine recordings with sur-

prisingly small differences. Here, the engineers opted for a slightly more distant acoustic perspective, so there is a bit more air around the instruments in this recording. In the opening passages of the work, the contrabassi in this version are somewhat darker and have more weight, and the bass drum is of lower pitch and has even more impact than the famous Telarc drum! The performances, though, are fairly similar, with Maazel on Telarc taking the piece at slightly faster tempi than Chailly.

However, the gem is Tchaikovsky's infrequently performed "Francesca da Rimini." If you like the music of Tchaikovsky but are not familiar with this particular work, you'll probably find it overwhelming!

For "Francesca da Rimini," Tchaikovsky wrote some of his most flamboyant music. In its unabashedly heart-on-sleeve romanticism, it becomes a searing emotional experience. Tchaikovsky's depiction of hell is a marvel of orchestration, with heavy use of brass and percussion. The love theme that follows is one of the most exquisite melodies Tchaikovsky ever composed. The finale is simply shattering, with huge brass fanfares and a barrage of bass drums, accented by explosive tympani strokes and the crash of cymbals and tam-tam. The final moments are cataclysmic, with the entire orchestra playing furioso and triple fortissimo.

The Cleveland Orchestra plays all these fireworks with their usual precision and élan. Musically and sonically, this is one of the best and most exciting CDs currently available. *Bert Whyte*



Riccardo Chailly

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Columbia 40173.

Sound: C Performance: B+

The problem with Elvis Costello has always been the same—credibility. How do you believe a guy who seems more to be playing with words than to be saying something he really feels? How do you believe a guy whose chords and chord progressions have gotten so runny, vague, and noncommittal that you suspect they'd be just as effective played backwards? How do you believe a guy whose singing style is distinguished by its ironic mock sincerity?

In that it reveals the artist's own struggle with these questions, *King of America* marks an important departure for Costello, whose real name, Declan MacManus, is used in the album credits. Based closely on a small variety of traditional genres such as folk, blues, and country & western, the music is harmonically clearer and cleaner than that of Costello's last few albums. Thankfully, the glitzy, ambiguous chords are fewer. The best thing about the music is the production by T-Bone Burnett, which is spare, simple, and

direct, in stark contrast to the busy, murky, funhouse hurly-burly into which The Attractions, Costello's backup band, had degenerated. Solid, understated playing by former Elvis Presley sidemen serves to clarify, rather than to obscure, the impulse behind each song.

Costello's struggle to come clean, and the partial extent of his success, is most apparent in his singing, which had gradually turned into a monstrous parody of the oozing, smarmy lounge crooners of yesteryear. Now, through his new resolve to be himself, he has managed at least to keep this parody at bay long enough to turn in two or three of the most genuinely moving performances of his career.

Susan Borey

Red to Blue: Leon Redbone
August AS 8888, \$8.98.

Sound: D+ Performance: B+

It's difficult for me to think of Leon Redbone as a serious musician or musical ethnographer when he insists on treating himself as a novelty. Musicians, though, seem to have little trouble with the eclectic white bluesman's

posing; on *Red to Blue*, Redbone's first non-bootleg album since 1981's *From Branch to Branch*, he gigs with David Bromberg (playing dobro), folk trio The Roches, Hank Williams Jr., and, on several cuts, blues pianist Mac "Dr. John" Rebennack. Redbone himself is a talented, imagistic guitar player—his intro to "Somebody Stole My Gal" might have made Pine Top Smith or Cow Cow Davenport honk and shout about how fine the man plays. Still, I wish somebody would tell me what Leon Redbone means.

Whether I ever find out or not, he and one hell of a pickup ensemble give a kiss to such old standards and obscurities as "Someday Sweetheart" and "Whose Honey Are You?" that brings them back to life—contemporary without being campy. And on the newer stuff especially, such as Bob Dylan's "Living the Blues" and Redbone's own "Steal Away Blues," his delivery is carefree but never throwaway.

Yet, as much of a delight as it is, *Red to Blue*—on Redbone's home-town label—is a little too faithful to the spirits of 78: Scratchy static and frequent small pops provided an unwelcome, almost-continuous accompaniment on my copy of the album. Redbone may be too quirky for mass tastes, but I'm astonished he can't or won't find some space on a blues specialty label that might show an aficionado's care in the pressing.

Frank Lovece

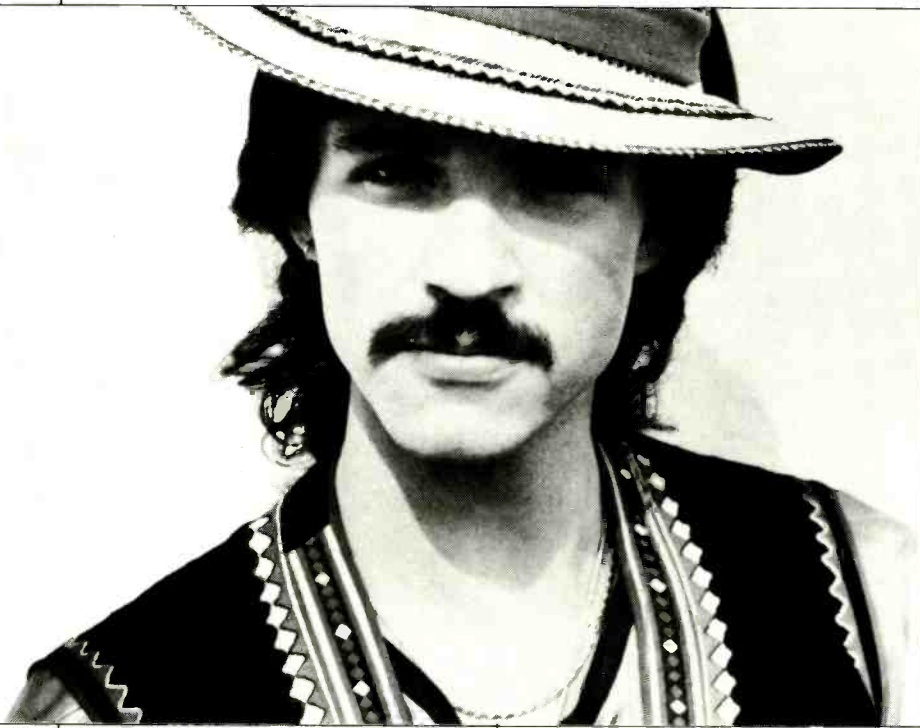




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Though Mark O'Connor plays everything except drums here, the lovely, clear and warm sound of his new album belies its overdubbed nature.



and excellent stereo deployment. Engineer Buford Jones has achieved a really warm sound, with a genuine ensemble feel to O'Connor's playing that belies the overdubbed nature of the recording.

Artistically, *Meanings Of* is a breakthrough album for Mark O'Connor. No longer may he be fairly called a country artist or even country oriented. He is one whale of a total musician as both composer and player, and his music defies all labels except wonderful.

Michael Tearson

Lives in the Balance:

Jackson Browne

Asylum 60457-1-E, \$8.98.

Sound: C

Performance: C

Three years in the making, *Lives in the Balance* offers proof that Jackson Browne hasn't been asleep at the wheel—he's just been taking time to turn a corner. Headmaster of the "sensitive" school of songwriting, Browne had a loyal following hanging on every poignant, cynical, or visionary observation up until 1983's widely misunderstood *Lawyers in Love*, whose title track failed to convey his intended irony and left fans bewildered.

There's nothing confusing about *Lives in the Balance*. Haunted by the spectre of war, Browne has clearly shifted his attention to politics, which he evaluates with the same intensity he formerly used to expose the dark side of romance. The more serious he gets, the less poetic he waxes; his willingness to trade in his trademark strengthens his new image as a concerned patriot. He's left room for just one love song; it's the only place you'll find lines about "the shallows and reefs . . . in the shape of a heart."

With synthesizers, hard-edged guitar, and horn, Browne has beefed up his accompaniments to fit his agitated mood, and to escape association with this decade's lightweight rock contingent. It doesn't always work; the title tune, for example, loses balance from its excess of drama. When it does work, however (as on "Soldier of Plenty," whose urgent tone and stinging chorus are about as mellow as whip-lash), this fresh approach yields some of Browne's best bits of music to date.

Susan Borey

Meanings Of: Mark O'Connor
Warner Bros. 25353, \$8.98.

Sound: B+

Performance: A

Barely into his 20s, Mark O'Connor is already making undeniably excellent music that absolutely defies pigeonholing. His pedigree is most impressive: He won national awards for both fiddling and flat-picking guitar before he was in his teens (he has won the fiddle title eight times). He has recorded half a dozen solo albums for Rounder and played on countless Nashville sessions. He's been a recording and touring member of David Grisman's superlative bluegrass/jazz fusion group as well as that seminal jazz/rock fusion group The Dixie Dregs.

Meanings Of is O'Connor's major league debut album, his first for Warner Bros. Its nine selections cover a wide variety of sounds and styles far removed from country music. Most amazing is that Mark has played everything except drums. This includes violin, viola, guitars, mandolins, electric bass, dulcimer, piano, percussion, and assorted synthesizers. His command is invigorating, but technical prowess alone is not what the album is about.

What it is about is O'Connor's compositions. Eight are totally original, and their bright attitudes, exuberance and diversity are the album's strongest assets. The ninth is a guitar medley dedicated to Mark's friend, the late Merle Watson. This medley includes "Amazing Grace," "Will the Circle Be Unbroken," "OMAC Blues," and "Taps," creating a lovely and heartfelt eulogy.

The recorded sound of *Meanings Of* is absolutely lovely, with great clarity

Jackson Browne



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Album: Public Image Ltd.
Elektra 9 60438-1, \$8.98.

Sound: B+ Performance: B

John Lydon, a.k.a. Johnny Rotten, a.k.a. PiL, a.k.a. Public Image Ltd., is not a singer or a musician per se but a personality who makes records. The discs he issues are not so much songs as rants put to music, and given that his melodies are never particularly gripping, the strength of his records is dependent upon the talents of whoever is laying down the music tracks.

In the beginning, Johnny's music was provided by The Sex Pistols, who laid a solid foundation for his banter. PiL, the group Lydon formed after the demise of The Pistols, was far more grating, as its initial incarnation featured musicians only slightly more musically inclined than Lydon himself. Personnel changes have since mutated the group to the point where PiL is now a creation of the producer (in this case Bill Laswell) more than any kind of rock group.

Ironically enough, with this album PiL sounds more like a coherent group than ever before. Although there is a tip of the hat to the studio experimentation that has dominated the previous

The Fabulous Thunderbirds



John Lydon's ensemble sounds more coherent than ever. They experiment, but also try to play backing tracks that might get on the radio.

PiL records, there is a conscious effort to come up with backing tracks that sound like they might almost get on the radio.

No credits are given on the album for players or songwriters. But our spies inform us that the personnel includes drummers Ginger Baker and Tony Williams, cellist Shankar (currently playing on the new Pretenders/Chrissie Kerr record), Laswell himself on bass, and guitarist Steve Vai (formerly with Frank Zappa).

One doubts that this turn of the worm will produce veritable hits for PiL, but at least Lydon has a chance of connecting with a larger share of the young music-buying marketplace, which could make all our lives more interesting. Amen. *Jon & Sally Tiven*

Tuff Enuff: The Fabulous Thunderbirds
Epic BFZ 40304.

Sound: B- Performance: B

The Fabulous Thunderbirds have been kicking around Texas for ages, playing terrific rhythm and blues with a heavy accent on the latter. Along the way they've made several albums too. However, *Tuff Enuff*, produced by Dave Edmunds, is their finest—no doubt about it.

The four-piece band is fronted by harmonica-playing, smoky-voiced Kim Wilson. Jimmie Vaughan, Stevie Ray's big brother, is the guitarist, and Preston Hubbard and Fran Christina make up the rhythm section. This is a great-chops kind of band.

Wilson writes most of the original material The Thunderbirds do, and he has come up with a couple of real winners this time, including the title cut, which has enough sizzle to make ZZ Top jealous, and the deadly clever "Amnesia." Another highlight is a hot cover of "Wrap It Up."

Edmunds' production does not fool around. It focuses on the band unit and their solid performance. For fill, Edmunds brings in keyboards alternately played by Al Copley, Geraint Watkins, and Chuck Leavell. On the light shuffle "Two Time My Lovin," Cesar Rojas and David Hidalgo of Los Lobos add voices.

Looking for something in the way of a house-rocking party album? *Tuff En-*

uff has all the ingredients—hot tunes, hot chops, lively sound. Put it on, turn it up, and check out how good it'll make you feel.
Michael Tearson



Different Light: The Bangles
Columbia BFC 40039.

Sound: C+ Performance: B

The four women who make up The Bangles have delivered a sweet album here, their second full-length. While there is nothing too blazingly original, it's a snappy set of sharp songs delivered with a brightness and simplicity reminiscent of late-'60s recordings.

In the best of The Bangles' songs is a feeling of vulnerability that is really quite appealing. The band does write some choice material, but the best songs here are a pair of covers. "Manic Monday," written pseudonymously by self-professed Bangles fan Prince, is a sweet/sad groan about facing the start of yet another week. Jules Shear's "If She Knew What She Wants" comes off as a charming slice of girl talk about a friend both pitied and envied.

Vocals are a focal point, and lots of soaring harmony is used. Each Bangle gets her shots at lead voice, but Susanna Hoffs emerges as the band's strongest singer. David Kahne's pleasantly uncluttered production is very right, as he doesn't let frills get in the way of the good material.

If *Different Light* isn't a world shaker, it is still quite a nice album. I expect it is making The Bangles a lot of new friends.
Michael Tearson

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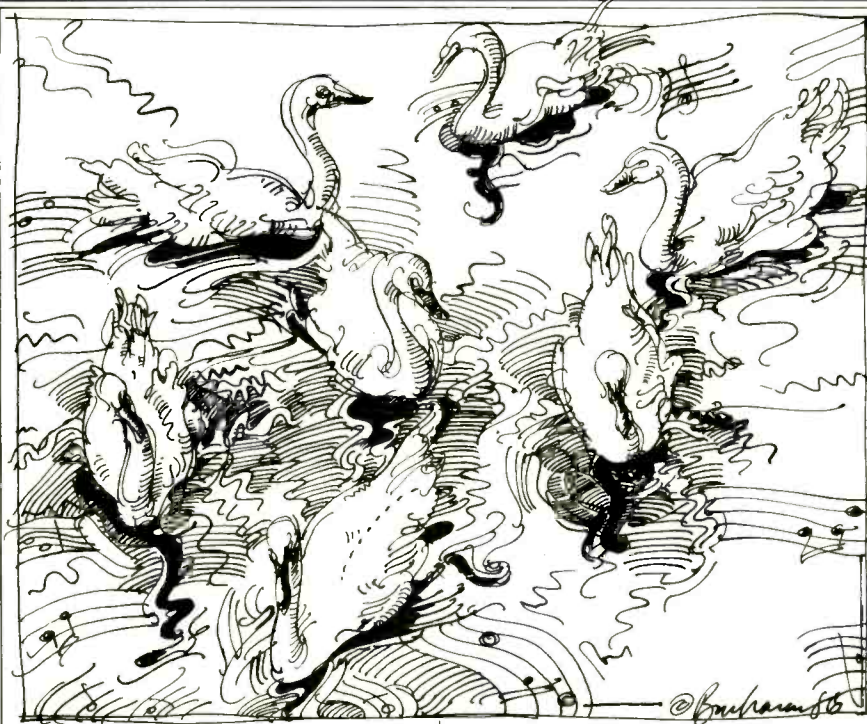
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EDWARD TATNALL CANBY

NO UGLY DUCKLING



Heinrich Schütz: Der Schwanengesang (Opus Ultimum). The Hilliard Ensemble, The London Baroque, The Knabenchor Hannover; Heinz Hennig, conductor.

EMI 27 0275, digital, two-record set (import).

Even among the most dedicated Schütz lovers, of which there are plenty in the U.S., there are probably quite a few who have not heard of this work, "The Swans' Song." It was composed around 1670, 11 sizable pieces plus two extras, but probably was not much performed and soon faded away. Only one segment, the final "German Magnificat," has been around and is familiar. Schütz, in his 80s when this music was composed, was the greatest pioneer of German church music for the Protestant faith—but what can you do when your boss and king, the Elector of Saxony, converts to Catholicism? Start all over again in Latin?

What we have here, now that the actual music has at last been assembled completely enough to work out a performance (appearing in unexpected finds from 1900 to as recently as 1970), is a "scholarly edition" according to newer ideas as to how Schütz must be brought into sound: Very

much amplified from the original notes. Schütz was conservative for that late time. He didn't say much of anything, but expected a lot—an organ and a very considerable collection of instruments, plus solo voices to contrast with the double chorus, all added ad lib. Today, we have to realize all this as best we can, a tough and controversial job for anyone who tries. There can be no definitive version.

All the more remarkable to hear what grand, big music this can be. For German music it is strikingly like Monteverdi, who wrote a generation earlier, and quite unlike the more familiar late Baroque of Vivaldi, Bach, Handel, and (er) Pachelbel. The older manner prevails, many short segments at different speeds, joined together in quick contrasts. None of the long stretches based on one or a few ideas that we hear especially in Bach. Instead of Bach chorales we hear their antecedents, Gregorian chants and the similar (and related) early Lutheran hymns.

Two choirs of voices, and choirs of contrasting instruments (added), bring plenty of drama and complex sound to the words of Psalm 119, a very long one, taken verse by verse in the exuberant German text. Solos and combinations of a few voices—boy sopra-

nos, countertenor, and bass—alternate with the mostly joyful chorus. It is a wide stereo expanse, big and live, and, when your ear adjusts, it can grow impressive.

I would rate these 13 motets (the technical designation for each of the separate movements) as still somewhat transitional in the performance, not entirely jelled into one style and manner. The diction is superb and un-failingly clear, the accuracy and verve are terrific, the speed—thank the Lord—is "up to time," at a *speaking* tempo in respect to the words themselves. The instruments are of an authentic type from recorders to trombones (no strings—the high voices and recorder take care of that). But the various voices are too dissimilar; some sing minus vibrato, some with quite a lot, some are throaty, some reedy and edgy. Not too good a blend and often a bit distracting. A more integrated sound would have been better, but this is not easy to achieve, today, when singing styles are changing so fast.

Schütz in digital! This British-made LP is not part of EMI America's catalog, but imports are often around, or can be ordered. Try.

Lost in the Stars—The Music of Kurt Weill: Various Artists
A&M SP-9-5104, \$9.98.

Sound: B— Performance: A+

Lost in the Stars is a celebration of the dramatic music of Kurt Weill, who is best known for *The Threepenny Opera* and his other collaborations with Bertolt Brecht. A wildly diverse collection of artists performs on this album, the third in a series that Hal Willner, coordinator of live music for *Saturday Night Live*, has assembled. The previous two honored Nino Rota and Thelonious Monk. All three are albums of startling performances by artists doing things you'd never expect them to, and there is brilliance throughout. *Lost in the Stars* is the best yet.

Sting offers a stark reading of "The Ballad of Mack the Knife" in a different translation from the German—more brutal and violent than the ones made famous by Bobby Darin and Louis Armstrong. Marianne Faithfull is appropriately jaunty, rough-hewn and melodramatic, by turns, doing the chilling

Illustration: Yvonne Buchanan

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Lost in the Stars is uncommonly intense, a challenging thrill-ride through some very dark and dangerous places evoked by Kurt Weill.

"Ballad of the Soldier's Wife." The presentation of "Alabama Song" alternates vocals by Richard Butler of The Psychedelic Furs, pop singer Ellen Shipley, and jazz singer Bob Dorough over Ralph Schuckett's wonderfully clanging chart. Tom Waits is brilliantly cast to sing the cynical and violent "What Keeps Mankind Alive?" as is former Wall of Voodoo vocalist Stanard Ridgway (remember "Mexican Radio"?) for the black wit of "The Cannon Song."

Dagmar Krause conjures up images of smoky, late-night movie scenes in the famous "Surabaya Johnny," with a spectacular rendition that segues to the dirge-like "Oh Heavenly Salvation" featuring the great New Orleans voices of Johnny Adams and Aaron Neville. Todd Rundgren's contribution is a surprisingly effective modern treatment of "Call from the Grave." The album's only real clinker is Lou Reed's "September Song," on which his coy monotone conveys neither sarcasm nor romance—whichever of the two he was trying to express.

Carla Bley and Phil Woods offer a dreamy instrumental version of the title song. (It would have been nice to have Maxwell Anderson's lyrics printed with the album notes, since we don't hear them, but you can't have everything.) Charlie Haden and Sharon Freeman do equally well with "Speak Low." Other contributors include the inimitable Van Dyke Parks, Steve Weisberg, John Zorn, and the Armadillo String Quartet.

This is an uncommonly intense album to listen to. Selections are ordered intelligently and often provocatively to

heighten irony. It becomes a challenging thrill-ride through some very dark and dangerous places.

The album was recorded in nearly as many locales as there are contributors, but it is still consistently wrought. For atmosphere, many selections have tricky little dramatic effects involving voices heard through filters (such as the radio voice echoing the lyrics late in "Alabama Song"). Throughout the album, horns are given warm and loving treatment. *Lost in the Stars* is a very classy recording. The only problem is that the generous length of the sides, 30 and 30½ minutes, leads to difficulty in maintaining levels—a problem that doesn't crop up on cassette. (Of course, with the cassette package you don't get the detailed annotation that comes with the album; all you get is two biographical paragraphs about Kurt Weill.) The Compact Disc release of *Lost in the Stars* is even longer than the LP, with the addition of "Meatball Song" by Elliot Sharp and "The Great Hall" by Henry Threadgill. It also sports extended versions of "Oh Heavenly Salvation" and "Johnny Johnson" by Van Dyke Parks.

Lost in the Stars is truly extraordinary. It throws a lot of light on a composer whose music grows more vivid with time, and reveals unsuspected facets of several very well-known artists. Best of all, it is a riveting listening experience, both on musical and dramatic levels. It is a milestone of an album.

Michael Tearson

Janáček: Lachian Dances, Idyll. The Rotterdam Philharmonic, James Conlon.

RCA Erato 75191, digital, \$10.98.

Leos Janáček—from the name, he is obviously out of the land of Dvořák and Smetana, once collectively called Bohemia as a part of the Austrian Empire. Janáček is a good 19th-century composer who lived on well into the 20th, incongruously continuing to compose in the "modern music" era. His late operas are really getting around now, and for good reason; he is, we might say, more modern than old Richard Strauss—roughly a contemporary—but old-fashioned enough to appeal to a lot of ears.

However, this music is something else again. The "Lachian Dances" date from 1890 and purport to be folk music. But in those days "folk" meant crude and, of course, subject to cleaning up as "art" music, which is what you will hear. Indeed, this thickly scored work goes along with everything from Brahms and Dvořák and Smetana to Grieg, as a pleasing and juicy dance suite. But both Grieg and Dvořák sound more modern than this bland yet tuneful Janáček.

The "Idyll" is even earlier, one of those lovely, strings-only suites that were so popular, again from the same familiar composers. This one was composed when Janáček was 24, in 1878—it is early "late-Romantic" and far, far from the 20th century. Though



James Conlon



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This album of foamy little dance pieces, led by Erich Kunzel, features some sound effects that are sure to exercise your hi-fi system.

harmonically more conventional than the "Dances," the "Idyll" is a strong and youthful work which seems perhaps more timeless than the composer's later music.

A resonant and rather distant recording here, not good for the somewhat thick "Lachian Dances," which are blurred and smeared in a golden acoustic haze. Nor did I much enjoy the peripatetic James Conlon's direction of the Dutch orchestra. It is technically correct but smoothly dull, and too often sloppy around the edges. Maybe he was just off the plane, and perhaps the orchestra had only a few run-throughs before facing the digital recorder. It happens. On the other hand,

the all-strings "Idyll" takes fire, is much more expressive and is more accurately played too. Moreover, the string orchestra is more at home in its acoustics than the full orchestra of the first LP side. Aha! One notes that the first side was recorded in June, the second side in October, and the sound engineers were different! That could explain a great deal. Curious art, this jet-style recording we do today.

Ein Strausfest. The Cincinnati Pops Orchestra, Erich Kunzel.

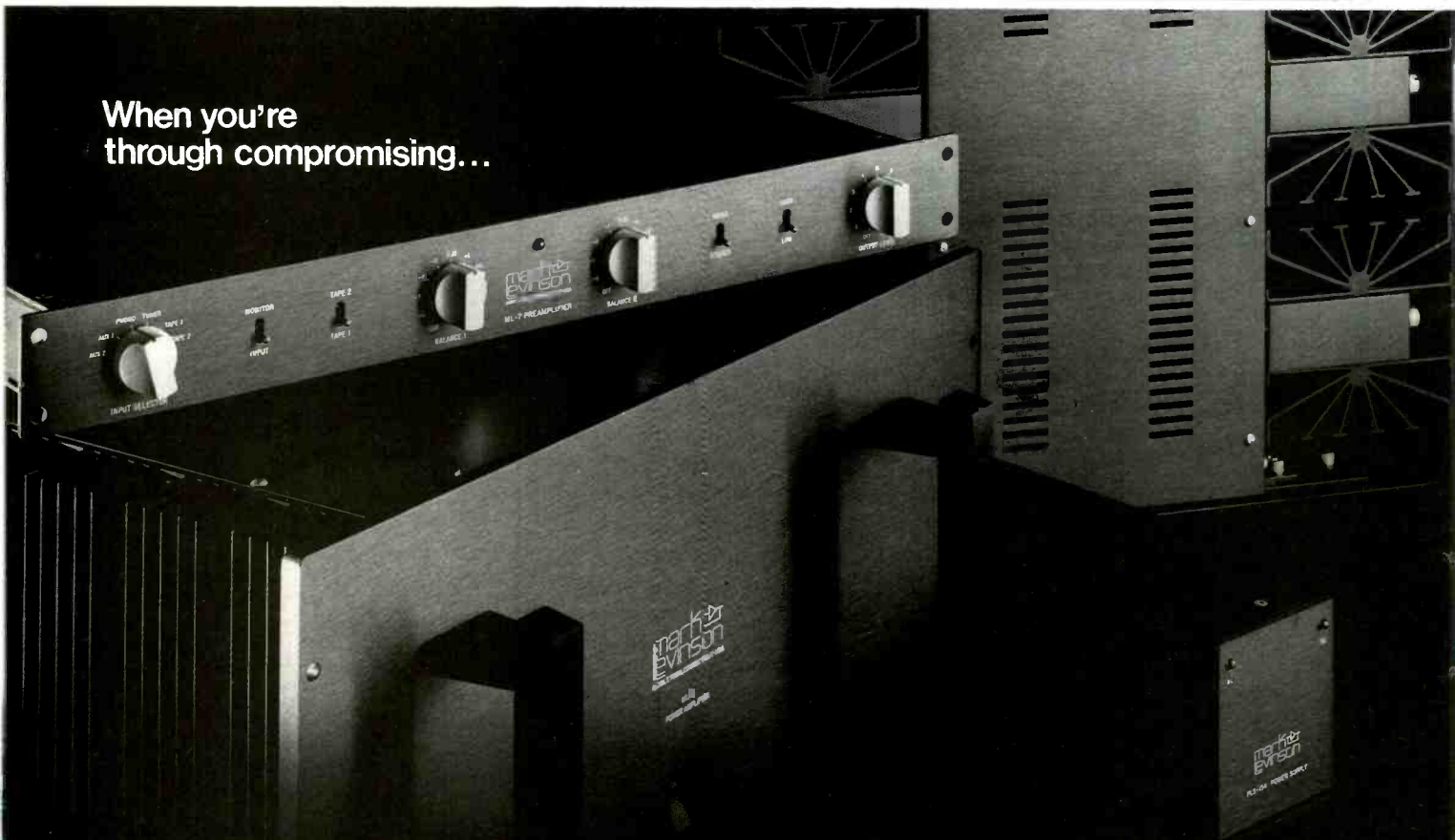
Telarc DG 10098, digital, \$12.98.

Telarc is busy on its "pops" series, using its home-town (well, almost home-town) orchestral forces. *Ein Strausfest* features music of the Waltz Strausses, led by big brother Johann Jr. Oddly enough, there is only one waltz on the first side and one on the second—the rest are the less familiar but more energetic polkas, galops and so on.

There's more. Telarc interestingly goes into a zany "sound effects" tradition that dates back acoustically to the days of Mozart and Haydn—echoes of which you will know in such items as the Haydn "Military" symphony, the many "Turkish" cymbal-like effects in works of the time (and through Beethoven), and, of course, the preposterous "Toy" symphony, apparently by Leopold Mozart, Wolfgang's papa. The fad for all sorts of incongruous noises reached right into the 19th century, but by the time of the waltzes and polkas from the Strauss family, it was more of a conscious reminiscence, just for the fun of it.

I won't go into a studious list of Telarc sound effects in these foamy little dance pieces, but needless to say, they are very well designed to exercise your home fi. As on the CD version, there is a warning about very loud (and very soft) sounds and potential danger to equipment! Rightly so. Have fun—and be careful.

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 Ave., El Cerrito, Cal. 94530.)

In a Chicago bar named Big John's, north of North Avenue, when it still was Old Town and not a sinecure for old geeks; before they pulled down Big John's, and Lee Schmidt's Second Chance next door, and the fluorescent Irish pub beyond, and while Vieux Carré was still a neighborhood bar, I lost a pool game, badly, on a tiny bumper-table just four feet in length. I'd gotten on the table by putting my paper match, split like a miniature dousing stick, at the end of the row, and waiting five games. When my turn came, the King of the Table broke the rack hard, put down nothing, and scratched, the cue bouncing off the table. I ran six solids, missed, he missed, and I knocked the last two off the slate.

The next guy up was a skinny little wimp with half a moustache spread over the two sides of his face. He couldn't shoot no pool, 'less the ball was shorter than six inches, straight in, out of the pocket. But he didn't need to, 'cause that's the kind of leaves he

got, both off his shots and the two I left him. I wasn't totally wiped—got one ball—but there wasn't no way but that I got run off that table.

Now, sittin' up on one of the shoe-shine chairs they had along the side for watching pool, like a king on a throne, with his hair up on the front of his head in a big do, was Mr. McKinley Morganfield. I knew who he was; I'd been listening to him earlier that night. Now, boys get to feeling bad when they get whupped worse than they ought to be. I looked up at Muddy and shrugged; he gave me one of his patented partial smiles where only the right lower quarter of his face moved. It didn't make me feel *no* better.

The story goes, Muddy was driving his uncle's coal truck when he heard from a friend that Leonard Chess wanted him at the studios. Leonard has said that Morganfield just walked in off the street; Arnold Shaw writes in his classic book, *Honkers and Shouters*, that Muddy was sponsored by another Delta bluesman, Sunnyland Slim, and that a Chess talent scout spotted him in a local club.

This 11-disc boxed set, which bills itself as a "P-Vine Special" on the bellyband, has a 20-page, 12 x 12-inch booklet mostly in Japanese, with a lot

of pictures this blues freak has never seen before. On page 3 are the enticing credit lines, "Originally produced by Leonard and Phil Chess. Manufactured and distributed by Blues Interactions, Inc., under license from Chess Records."

The recordings cover 20 years, beginning with "Gypsy Woman," from 1947, when Muddy was 32. This cut is one of 25 from Aristocrat in the box; the balance comes from Chess 45s and LPs. Included are "Rollin' Stone," "Hoochie Coochie Man," "Mannish Boy," "Crawling Kingsnake," "Messin' with the Man," and about 150 others. Now, I consider myself a blues record collector, which means that I have a few hundred blues LPs. P-Vine or Blues Interactions, whichever, has a much stronger idea of what it means to be a blues record freak than I do; I freely admit it. I just wish I could read the Japanese, because there's a wad of information in the booklet. Aside from the period photos, which had to be hard enough to dig up, it shows early record labels and jackets, clippings, a *Cashbox* regional Hot 10 chart from 1954, an interview with Mr. Morganfield together with a pic of him on some TV screen, and a 20-album Chess/Checker/Cadet-Concept discography. Taking up a page is a drawing of roots and influences showing Muddy's musical associations with literally dozens of important musicians from Son House and Robert Johnson, through the original Sonny Boy, Little Walter, Junior Wells, Otis Spann, Willie Dixon, Wolf, James Cotton, Chuck Berry, Buddy Guy, Otis Rush, and Carey Bell, to Paul Butterfield, Mike Bloomfield, Johnny Winter, and The Band.

All of which is to ignore the music—ah me, yes, the music—the present inside all this fancy wrapping. It's Big Muddy, up front, in the center, that's the attraction, and he's man enough to carry the show for all 11 discs. For a blues fan like me, it was enough to keep me listening straight through four or six discs, with a detour back through three or four of the stronger cuts. The subject's loving, always, and always Muddy's the man—present, strong, virile; intent, and not to be messed with. His voice is full of power, raw and hurting, and never uncontrolled. There are times when he's gen-

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tle, fully using an intricate technique; other tunes are heavy celebrations of what it means to be a man in Muddy's world.

On the early cuts there's melodic guitar work, with simpler groups; on several, Muddy was in country mode, soaring like Lonnie Johnson. The later pieces are more settled, in the Chicago style Muddy did so much to define, with a more solid, professional backing of piano, sax and slide guitar. The sound quality, regrettably, is at best only fair and generally poor—even though some caring soul has done a lot of cleaning up and quieting down to try to make this a quality reissue. It probably isn't possible to do anything better.

Now, I don't carry around \$95 in my pocket most days, but I have to say this collection represents a bargain at that price to this blues freak. *E.P.*

Soul Man—Live in Japan: Otis Clay **Rooster Blues R7609**, two-disc set, \$10 plus postage. (Available from Rooster Blues, 2615 North Wilton Ave., Chicago, Ill. 60614.)

Sound: B+ Performance: A-

The concert stage is the ultimate proving ground for a bluesman. Rock acts may hide behind elaborate theatrics, but blues and soul performers,

once away from the technical wonders of the modern recording studio, are forced to rely on that rarest of commodities, raw talent. And as his fans have long claimed, raw talent is precisely what soul man extraordinaire Otis Clay has in abundance.

Time and again during this two-disc live set, I was tempted to play parts of a track over and over again, much the way that you might repeatedly watch a perfectly executed sports play on videotape. Clay's vocals are a luxurious blend of technique, talent, and soul. Vocal mannerisms and nuances that lesser figures would nurse into trademarks, Clay casually tosses off without a second thought. He can do it all, but this veteran refrains from overpowering his material with his ability.

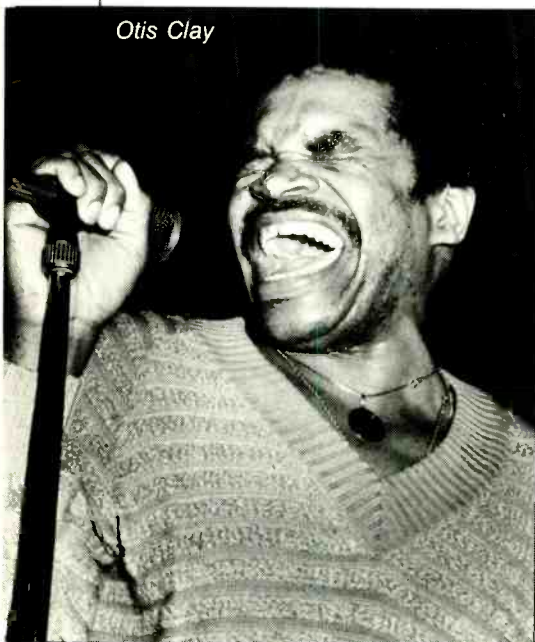
"Ellie" is the highlight of an album without a bad track. The Southern-born Clay started his career as a gospel singer, and his voice still drips with emotion in a spectacular performance that blurs the line between gospel and secular traditions. Clay's eight-piece band sensitively follows his vocals, sometimes almost disappearing into silence while Clay alternately pleads with and confesses to his enthralled audience.

Archivists take note: This set was cut in 1983 in Japan, but has been remixed for its domestic debut. Clay's stirring vocals are always in the forefront, his wonderful band is crisply recorded, and the set's live ambience augments the performances. Highly recommended, and here's hoping that Clay's now-deleted albums for American labels find their way back into record stores. *Roy Greenberg*

Out of the Blue: Didier Lockwood **Gramavision 18-8504-1**, digital.

Sound: B Performance: B-

Didier Lockwood is a French violinist who has been the designated heir to Jean-Luc Ponty—who was the designated heir to Stephane Grappelli—for several years now. Unlike Ponty, who's abandoned his jazz heritage for electrified music, Lockwood dips his bow into fusion as well as modern forms of acoustic jazz. His electric albums, including the recent *Didier Lockwood Group*, have been uneven, while his acoustic discs have been too even.



Otis Clay

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Didier Lockwood is an exceptional violinist, and his instrument has a nice cutting edge on this digital recording.

Here, Lockwood has selected one of the best contemporary jazz rhythm sections in bassist Cecil McBee and drummer Billy Hart. Their churning, inventive rhythms power *Out of the Blue* even through its most tepid moments. Much of this album is simple jamming, with great musicians playing unin-

spired tunes with little depth. "Cello Britten," "November Song" and "Train Blues" have moments, particularly some enlivened McBee solo spots, but they are not entirely memorable.

On the other hand, "Legs," the opener, promises an album of spirited duels and reckless charges as the en-



semble locks into a shifting rhythm under Lockwood's pyrotechnics. Pianist Gordon Beck turns in his best work, recalling pianist Don Pullen with a combination of speed and nuance. The title cut is a storm of tumbling rhythms, as Lockwood deftly leaps, twists, turns and slides through the maelstrom created by Hart and McBee. Thelonious Monk's "'Round Midnight" is introduced with a fiery obbligato and a more impassioned reading than is normally given this dark, cool classic.

Lockwood's violin has a nice cutting edge on this digital recording, and the rhythm section has more depth than any of his previous acoustic discs did. The ensemble has presence without the false equalization and reverberation that mar many contemporary jazz recordings.

Didier Lockwood is an exceptional violinist who has yet to make the definitive statement of his mastery. *Out of the Blue* shows all the markings of a musical genius who hasn't reached his first destination. *John Diliberto*

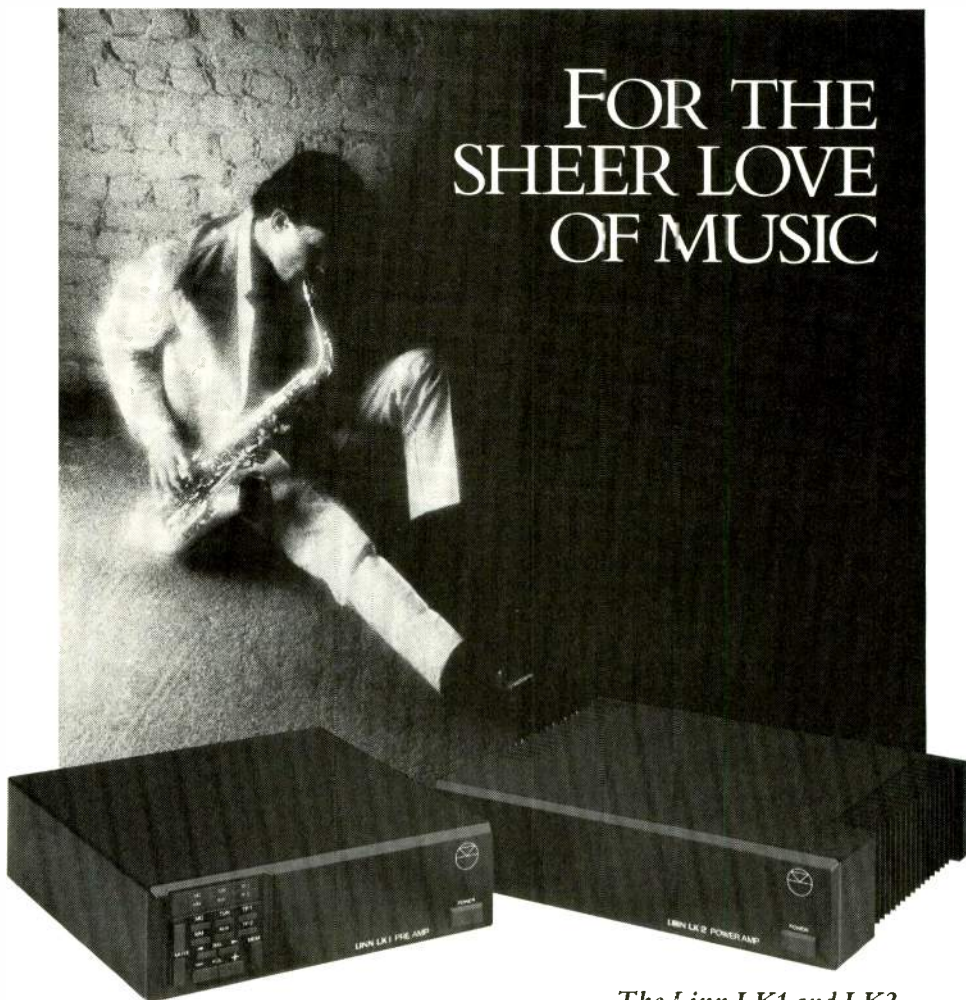
Le Parc: Tangerine Dream
Relativity EMC 8043, \$8.98.

Sound: C Performance: D+

Because they cleared the brush 20 years ago for our bumper crop of synth bands, any criticism of Tangerine Dream should be tempered with respect. Helping to haul the synthesizer from the lab to the pop arena is not enough, however, to excuse the band's creative stagnation, so embarrassingly evident on *Le Parc*.

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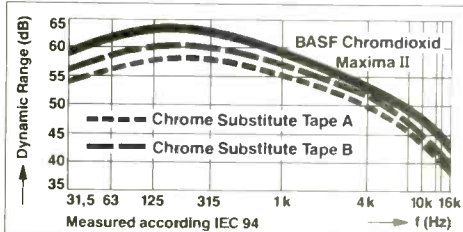
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Tangerine Dream

Creative stagnation is evident on *Le Parc*, an album with little warmth and a lot of unnervingly plastic sound.

In the right context, the pings and drones could be evocative, or at least amusing. Here, weak arrangements and insipid, poppish melodies make the album sound like video-game sound effects on a very grand scale.

A certain amount of blame can be laid on the percussion. On many songs, it's relentlessly constant, with rare variations, and usually pushed forward in the mix. In these cases a more subtle placement and a few fills and breaks might have given the music a much needed edge.

The songs on *Le Parc* are dubbed as "aural portraits" of various parks around the world, but not much distinguishes the different parks surveyed. With its evasive impressionism and narrow vision of the synthesizer's potential, *Le Parc* is, unfortunately, like a primer of what to avoid in electronic music. It's sad that trailblazers such as Tangerine Dream should be stranded on such an artistic plateau.

Susan Borey

synthesizer. It became a tool of convenience when used for simulation, an enhancing accessory when used for atmospheric sheen, a source of rhythmic focus when used to accentuate the beat. Tangerine Dream, however, has chosen to continue working with the most ineffectual, limp, and downright annoying attributes of synthesizers on *Le Parc*. Many of the sounds are so purely plastic that they're unnerving—

there's very little warmth against which the electronic sounds can serve as synthetic highlights. There are several remarkable tones on the album, bobbing like buoys on the sea of muck; these include the delicate, feathery tones that tickle the ear on "Hyde Park" and the expansively breathy tones on "Zen Garden" which sound like they've come from a giant chrome voicebox.

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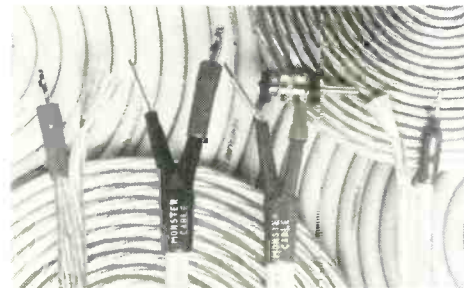
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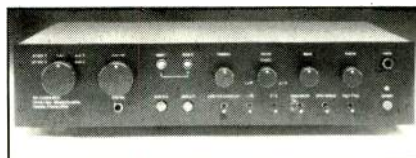
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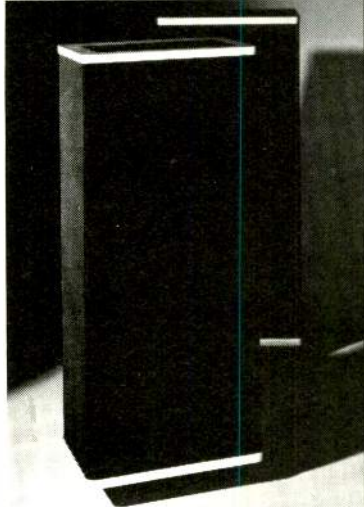
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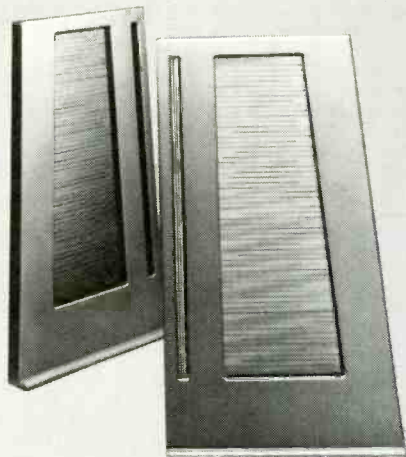
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Dimensions	160mm/6 1/4" Dia., 67mm/2 3/4" Depth
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Front Grill	Integral metal grill

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Tweeter Type	Soft dome, Aluminum voice coil
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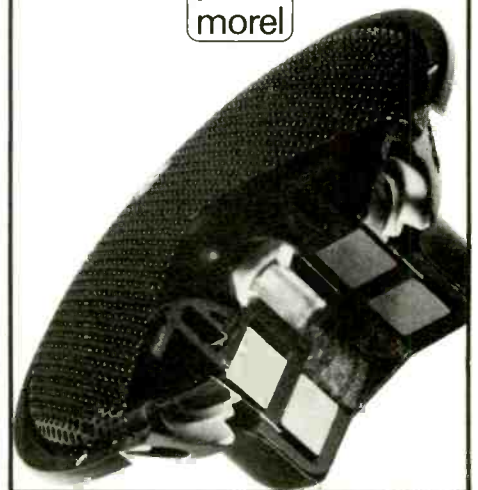
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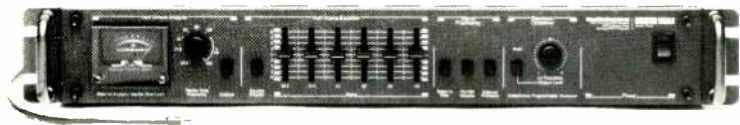
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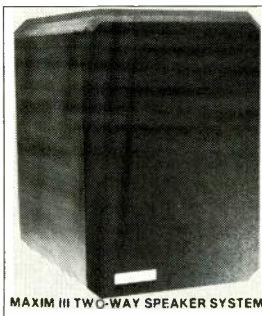
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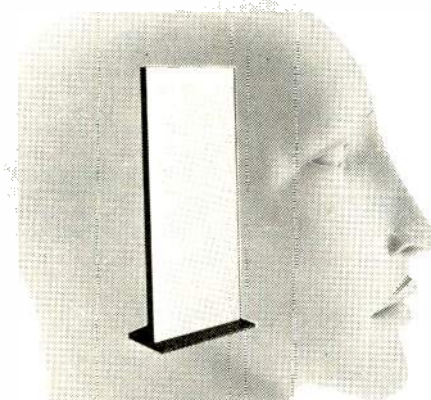
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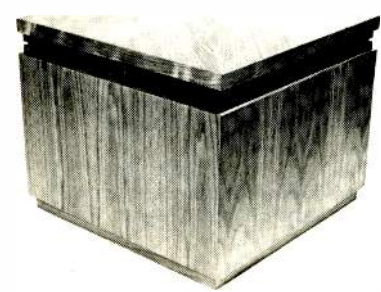
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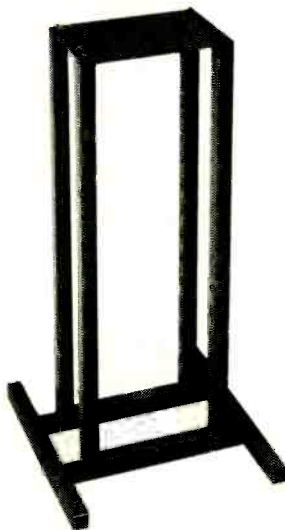
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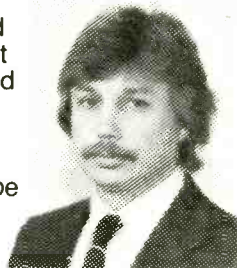
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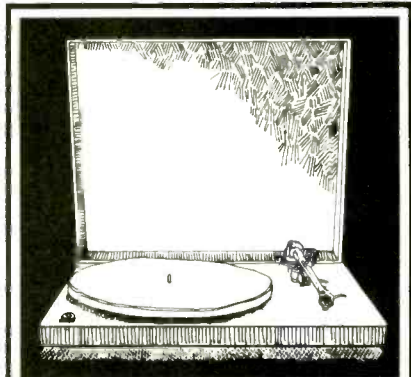
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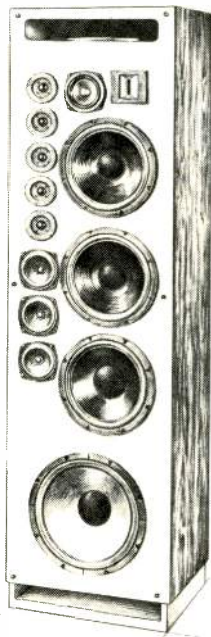
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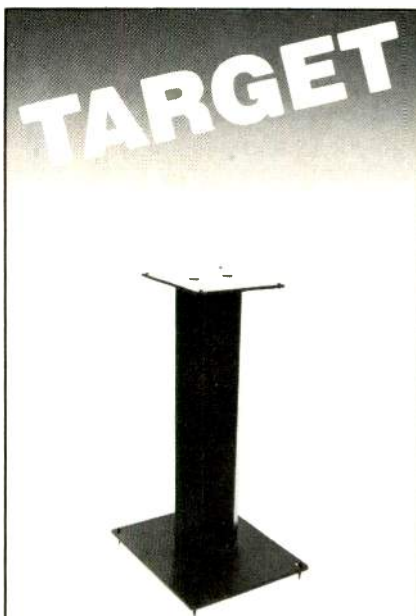
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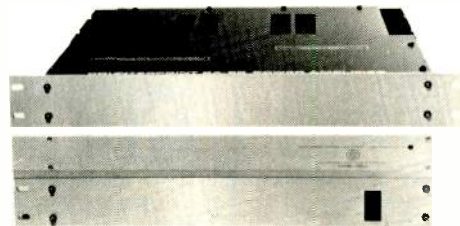
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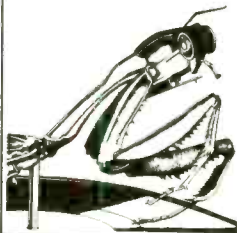
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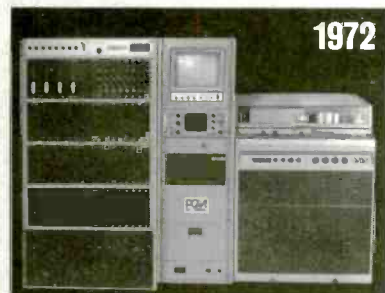
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