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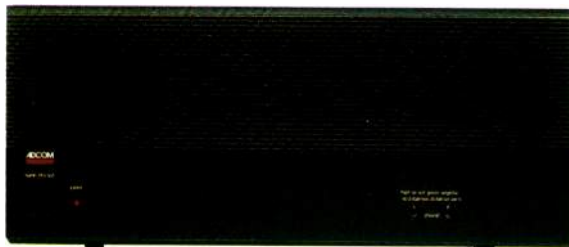
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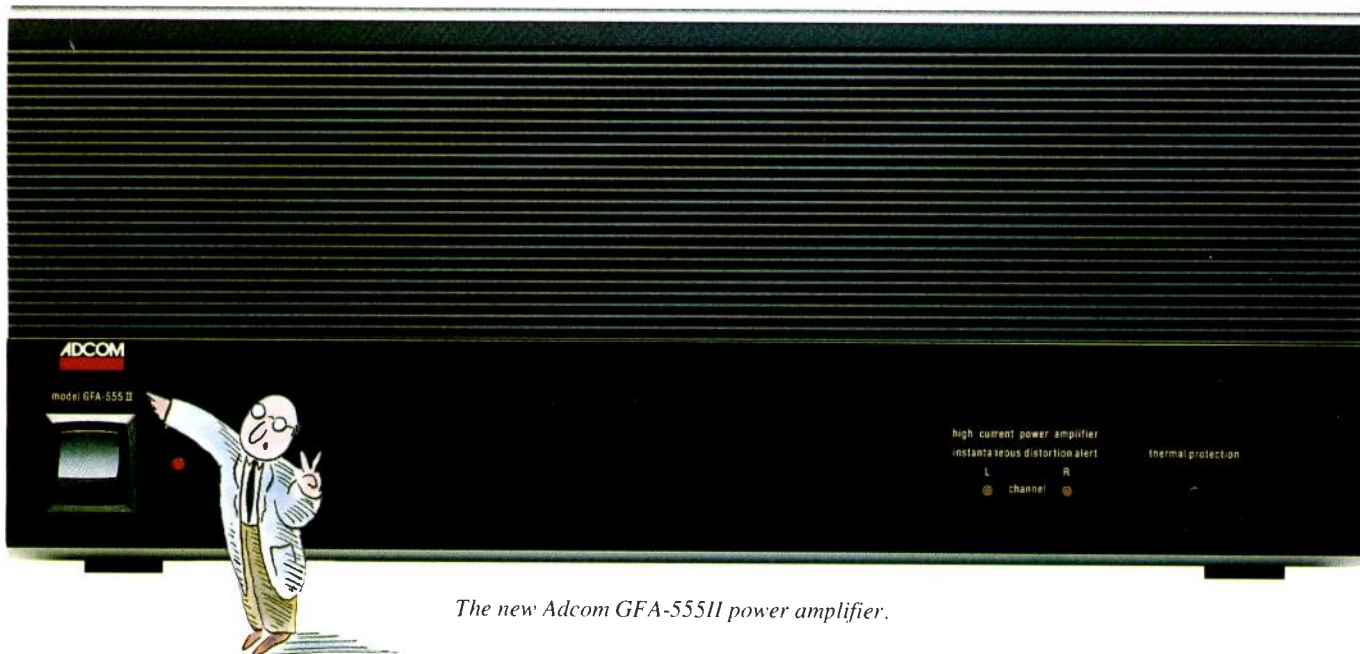


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(Nov. 1991)



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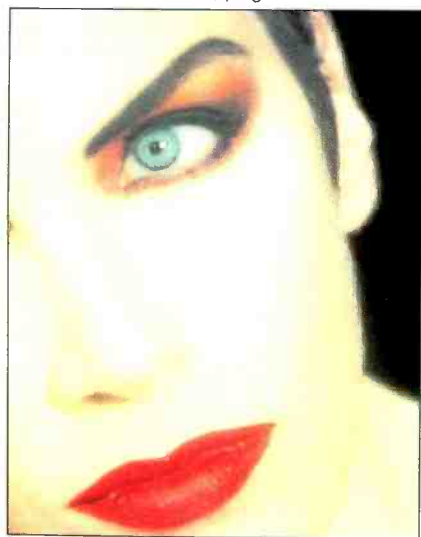
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A RETROSPECTIVE VIEW

FROM WINDHAM HILL



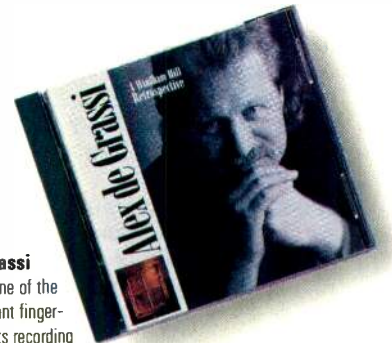
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Masur Looks Good in Profile

Dear Editor:

Robert Angus' article about Kurt Masur (December 1991) was a terrific look at the man and his musical priorities. His projected series of over 30 recordings with the New York Philharmonic on Teldec has already begun, so I'm sure your readers found the profile timely as well as informative.

I thought it was curious that John Eargle's sidebar on Masur's recording of the Tchaikovsky Fourth referred to its Eterna release. That CD, issued by the former East German state-owned record label, received virtually no distribution in the United States, but it is identical to the widely distributed Teldec release (it was a joint venture). That selection (Teldec 43339) is still very much available and is part of a complete Masur Tchaikovsky Symphony cycle on Teldec.

Keep up the good work!

Robert S. Goldfarb
Director of U.S. Operations
Teldec
New York, N.Y.

New Accustoms

Dear Editor:

I read my friend John Eargle's "Currents" in the March issue ("Data to the Masses") with interest. I have been following the progress of compression algorithms closely for several years on behalf of a client and, perhaps, am privy to some information otherwise not widely available.

Although I agree with many of Eargle's comments, I do not agree that systems with reduction factors greater than four-to-one "are generally relegated to speech applications." I have experienced perceptual encoders—I prefer that term to "data reduction"—operating at data rates as low as 64 kilobits/S (12-to-1 "compression" compared with 16-bit PCM with a 48-kHz sampling rate, approximately 11 to 1 referenced to CD sampling) that are capable of very fine music reproduction and certainly better than the typical commercial broadcast. At slightly higher data rates—say, 88 kilobits/S—certain algorithms approach CD quality now and should achieve it in the relatively near future. These statements are based on double-blind testing with a wide variety of sti-

mul, using technical people and musicians.

Unlike linear PCM encoding, on which sampling rate and quantization error impose unalterable theoretical limits on quality, perceptual encoders can be improved *after a standard is established*. As psychoacoustic knowledge increases, improved encoding algorithms can be created *that are fully compatible with the decoders already existing in the field*. Eargle's concern about "How much work can be done later to 'clean up' a marginal system after it has been accepted?" may be unfounded in reality.

I wish to point out that perceptual encoding requires a new way of thinking. We must free ourselves of the comfortable assumption that preservation of "waveform" or other easily measured technical parameters is the route to the Holy Grail. Like the perception of the sound of a tree falling in the forest, the perception of music exists only when it is heard—and the ultimate criterion of sound quality has always been the human ear. In the case of perceptual encoding, the ear is, at present, the *only* criterion. We engineering types are just going to have to get accustomed to that.

Edward J. Foster
Diversified Science Laboratories
West Redding, Conn.

Author's Reply: I appreciate Ed Foster's added insights into the subject of audio data reduction. "Perceptual encoding" is an appropriate term in that it positions this new technology in a special light. Instead of merely reducing data requirements for audio transmission, the aim is to optimize that transmission through application of what psychological acoustics tells us about the perception of sound. I certainly agree that traditional numerical notions of what constitutes "channel capacity" must be retired in favor of phenomenological ones.

Regarding bit-rate reduction well in excess of four to one, the examples I have thus far heard fall short of reasonable expectations for music. But we are in a rapid development phase of this new art and science, and I would expect many of the remarkable strides that Ed states are already here.

John Eargle

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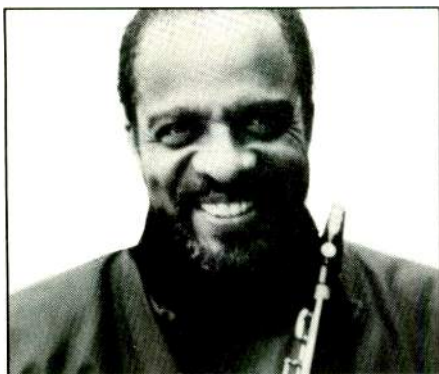
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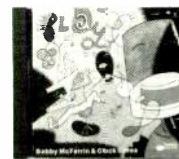
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TAPE GUIDE

HERMAN BURSTEIN

Shortening a Tape

Q. Where can I get a kit for splicing audio cassettes? What kind of adhesive should I use? What procedure can be used to shorten the tape in a cassette?—Ricardo Cueva, Monterrey, Mexico

A. Many audio stores sell splicing kits to repair breaks in cassette tapes and the special splicing tape required to do so. Use of conventional transparent tape is a no-no.

To shorten the tape, wind some of the tape onto the right-hand reel so that you are past the leader, which is usually transparent or white. With a toothpick or such, pull some tape out from the center opening of the cassette. Cut the tape. Pull out as much tape as desired from the left reel, which holds the bulk of the tape. Cut off the undesired tape. Splice the ends sticking out from the left and right reels, using your splicing kit and splicing tape. Finally, rotate the right reel, using your little finger or the rubber end of a pencil, so as to remove slack.

Dangers of Alcohol?

Q. Does the use of 91% isopropyl alcohol cause a tape deck's rubber pressure rollers to dry out and crack? Does it accelerate the drying/aging process of the pressure roller? I have noticed in my old tape player that my use of alcohol has caused the rollers to become dry and cracked, and the cotton swab even becomes black after all the brownish tape oxide has been removed. I'm afraid that the alcohol is even removing the rubber in addition to the oxide. Is there an alternative to alcohol? I just got a new tape player and don't want to make the same mistake again.—Name withheld

A. A solution of 91% isopropyl alcohol has been widely recommended as a cleaning agent for a tape deck's heads, guides, capstans, pressure rollers, etc., although some deck manufacturers specifically advise using another solvent. It may be that some makers' pinch rollers are adversely affected by this cleaner.

To date, I have received from "Tape Guide" readers only one other adverse comment on 91% isopropyl. The reader recommended S-711 by Intraclean, available at some audio stores. Most stores sell special tape deck cleaners,

often containing trichlorofluorethane, a substance recommended by some.

Inasmuch as your tape deck is an older one, perhaps the condition of your pressure rollers essentially reflects the normal results of wear and aging. In my own experience, I have used 91% isopropyl for many years on several decks and never encountered adverse effects on the pressure rollers. This may reflect that my decks have been of high quality, employing high-quality parts, and that my use of alcohol has been sparing.

When you do purchase a new deck, find out what cleaning agent(s) the manufacturer recommends.

Headphones vs. Speakers

Q. Every time I tape an LP, the tape sounds very nice through my headphones but sounds a little bit flat when I switch to my speakers. Please help me solve my problem so that I hear the whole sound through the speakers. If the sound is good through the headphones, then the speakers should be even better.—Eric Bailey, Chicago, Ill.

A. It is difficult to help you because I don't know what speakers you are using or what you mean by "flat." Dull?

Quite a number of people feel that high-quality headphones outperform high-quality speakers in many cases, and outperform virtually any speakers of middle or lesser quality. The \$400 speakers in my secondary music system don't sound as good as my \$240 headphones, but the \$3,000 speakers in my primary system do.

Inasmuch as you are getting satisfactory sound via headphones, it appears your deck is working satisfactorily—unless by rare coincidence a frequency aberration of your deck is offset by an opposite aberration of your headphones. However, there could be a problem in your receiver (or separate preamplifier and power amplifier) or speaker or your room's acoustics.

Perhaps you can improve the sound by judicious use of the tone controls or equalizer in your audio system or by engaging the loudness control. *A*

If you have a problem or question on tape recording, write to Mr. Herman Burstein at AUDIO, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

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OH, MI and CA residents only may receive complete official rules and a facsimile of the winning game numbers by sending a self-addressed, stamped envelope to be received by 9/25/92 to: JVC Jazz Festival Entry Information/Rules, PMI Station, P.O. Box 3571, Southbury, CT 06488-3571. Odds of winning a Grand Prize or a Match & Win prize will depend on the number of telephone entries received. Odds of winning in the Second Chance Sweepstakes will depend upon the number of unclaimed Match & Win prizes and the number of entries received. Prize winners may request a statement showing how the odds of winning were determined and how winners were selected. Sponsored by JVC Company of America, 41 Slater Drive, Elmwood Park, NJ 07407, manufacturers of Audio/Visual hardware and software.

Nº 30

REFERENCE DIGITAL PROCESSOR

PRIDE IN THE DETAILS . . .

Mark Levinson® components have earned a reputation for their rugged reliability, uncompromising fit and finish and, above all, superior sonics. We at Madrigal Audio Laboratories are understandably proud of this reputation.

The presence of "high technology" in our society has, for some, come to mean the absence of craftsmanship. Mass-produced look-alikes are everywhere, even in the realm of so-called high-end audio. The quality that you see and hear in a Mark Levinson component is not the result of automated mass production—rather, it is the result of painstaking attention to the details of design, and of pride in the art of craftsmanship.



Mark Levinson components are handcrafted in limited quantities and to exacting specifications. All who participate in their production share the feeling of pride that comes from knowing that they contribute to a product that defines quality.

It is with great pride, then, that we introduce the Mark Levinson Nº 30 Reference Digital Processor. Five years of exhaustive research into digital audio yielded a processor worth waiting for, deserving of the Levinson marque.

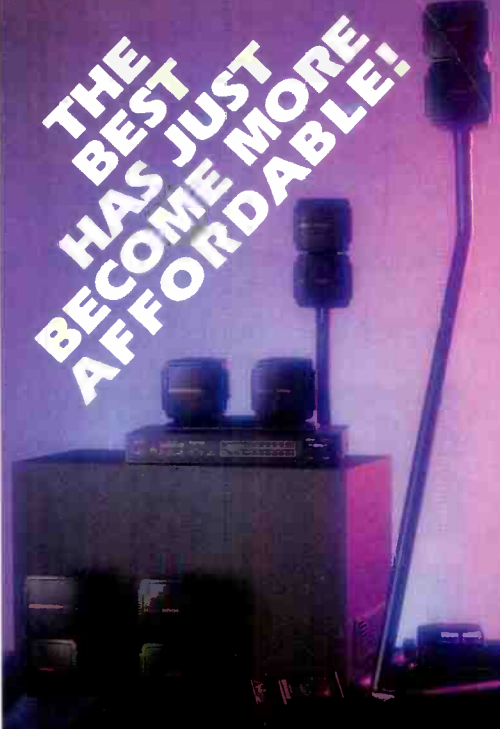
The Nº 30 is a true reference: it neither adds to nor subtracts from the music. It brings to your home the accuracy as well as the essence of the performance. Finally, the promise of digital audio is fulfilled.

The Nº 30 is proof that state-of-the-art digital *and* analog technology can coexist with craftsmanship. The subject here, however, ultimately is music, and the heart of music is in the listening. To fully appreciate the quality of the Nº 30, we recommend that you visit your Mark Levinson dealer for a full audition.



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Power Dissipation and Output

Q. My amplifier is rated to deliver 330 watts per channel continuously into an 8-ohm load. This seems strange to me. There are eight output transistors in my amplifier—four per channel. I checked their ratings in a semiconductor guide. Each transistor is rated at a maximum dissipation of 150 watts, and four times 150 is 600 watts. As I see it, that should be the output per channel, not the 330 watts shown in the instruction manual for my amplifier.—Name withheld

A. I can see how you arrived at your conclusions. You will notice that your transistors are shown as having a power dissipation of 150 watts each. Power dissipation refers to the maximum amount of power that can be wasted within each transistor in the form of heat. Notice that I said "within" a transistor. When rating power amplifiers, we are interested in the amount of power delivered from the transistors to the load, not the amount wasted within them as heat. And even when your amplifier is delivering its 330 watts per channel, the transistors are probably not dissipating 150 watts apiece—not if the designer left any safety margin to protect those transistors against burning out. In fact, dissipation probably remains under 150 watts per transistor even when the amp is feeding 4-ohm loads, which draw more current and therefore heat the transistors more.

Connecting Video and Stereo Systems

Q. I have a television set and a VCR and I would like to know how to connect these devices to my stereo system.—Jim Haberlin, Nutley, N.J.

A. Not knowing details about your equipment, I can only provide a general answer—which should serve in most cases.

Most VCRs and many TVs have audio line outputs, which can be fed to any high-level input (such as AUX, tuner, or tape) on your stereo system. Some TVs have two sets of outputs, one designed to feed a home entertainment system and the other designed to feed a VCR. The difference is that the audio output to the VCR is usually at a constant level, while the level from the other audio output can be controlled by the TV's remote. If

your stereo system has a remote control, you might prefer the "VCR" connections; otherwise, you'd probably prefer the controlled outlets. The audio output from your television should automatically match the video on the screen, whether you're watching an incoming program or playing a tape or videodisc.

If your TV does not have stereo line outputs, you can use the outputs from your VCR. When you watch a tape, these outputs will automatically feed the audio from that tape, but when you're watching an incoming program, you'll have to be sure the VCR is on and tuned to the same channel to feed appropriate sound to your stereo system. When you're watching one show while taping another, you'll just have to listen through the speakers on the TV. A VCR can be hooked into your stereo system's tape loop, just like an audio cassette deck. You will then be able to use it to record the FM stereo audio from TV/FM simulcasts along with the picture, if such simulcasts are still being done in your area. If the VCR is a Hi-Fi model, this type of hookup will also let you use it as an audio recorder.

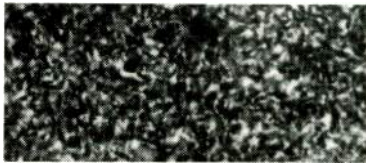
If you're feeding audio from your TV, check your TV set's instruction manual for further details. You may have to select some option from an on-screen menu, and you'll probably have to switch the TV's own speakers off or turn them down when listening to TV sound through your stereo.

More About Noisy Volume Controls

This is just a quick note about your reply to a question in the January 1992 issue about a noisy volume control. I have found that problem is, as often as not, caused by an electrolytic capacitor (used to block d.c.) becoming leaky. The symptoms can be very similar, with the small d.c. component being modulated by the control rotation, causing noise. I recommend checking for d.c. around the control pot before replacing it.—William Kindel, San Clemente, Cal.

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1633 Broadway, New York, N.Y. 10019. All letters are answered. Please enclose a stamped, self-addressed envelope.

A warning to those with toupees, small vulnerable house pets, and a fear of flying: Maxell has taken high bias tapes to an even higher level of performance.



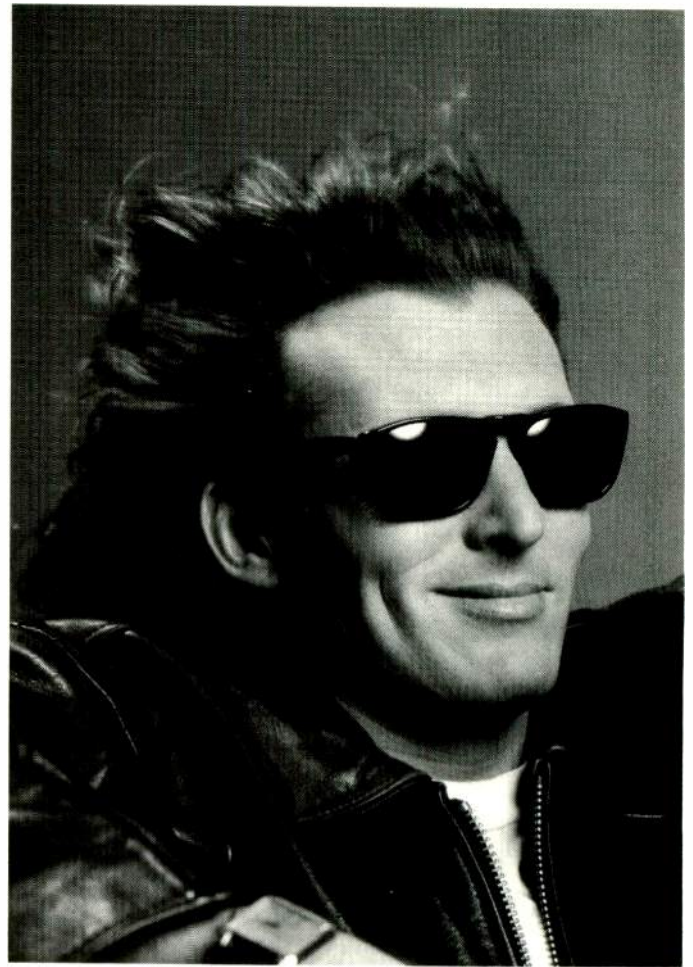
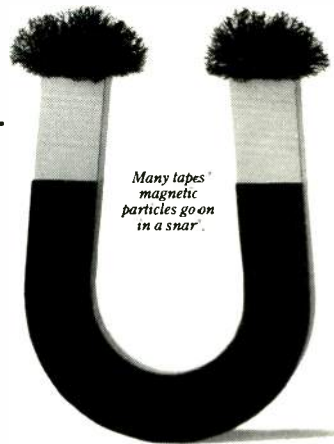
Compared to other tapes, XLII-S has a higher density of magnetic particles.

The tape is XLII-S. The power behind it is Black Magnetite—a unique magnetic material recently

harnessed by Maxell engineers.

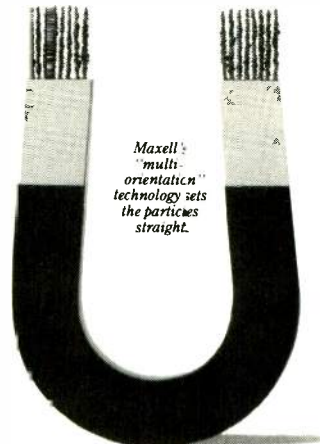
With 13% greater power than the magnetic coating on all other high bias tapes, Black Magnetite helps XLII-S deliver higher maximum output levels and wider dynamic range.

Black Magnetite's tiny magnetic particles are not only more powerful than conventional gamma ferric oxide particles, they're smaller and more uniform in shape. This enables us to pack more particles more densely onto the surface of the tape.

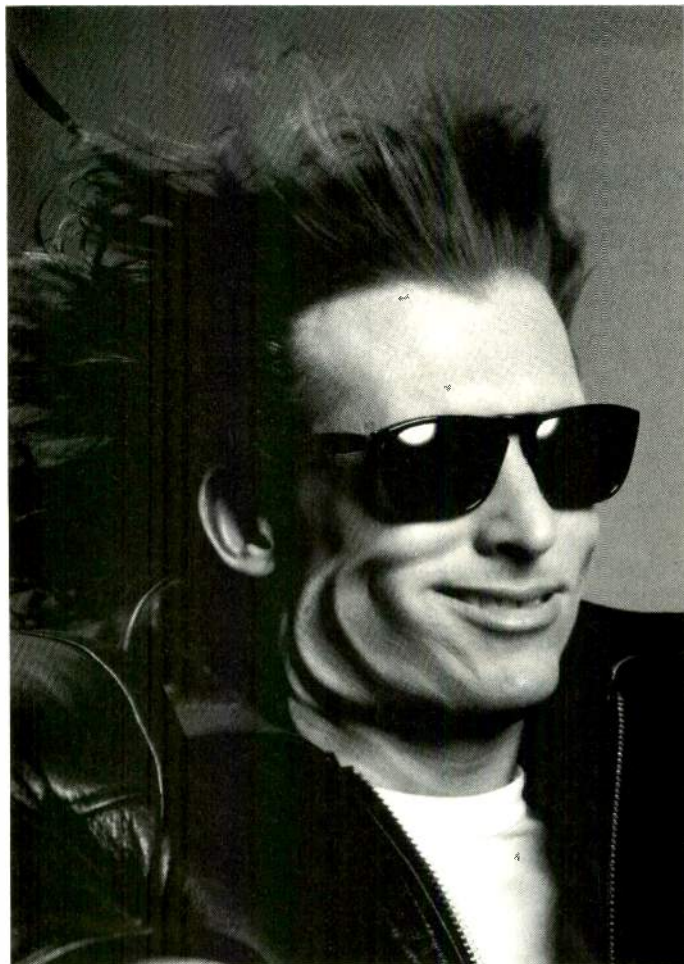


HIGH BIAS

During manufacture, conventional tapes run through a magnetic field where many of the magnetic particles adhere any-old-which-way. Like flies on flypaper.



But at Maxell, we employ a complex process called "multi-orientation" to set the particles straight. The result is a



BLACK MAGNETITE

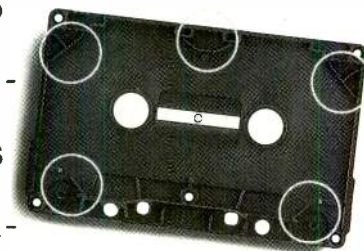
smoother magnetic coating, which produces less AC bias noise.

Unwanted noise is further reduced by our patented *dual-surface base film*. One side of the film is super-smooth for closer tape-to-head contact. The other is rough, deliberately so, for a stable ride through your transport mechanism with the least possible friction and tape jitter.

These innovations, however, are no

more remarkable than the cassette shell that houses them.

More rigid and weightier than standard cassettes, the XLII-S *high resonance-damping cassette* has been precision engineered to reduce



XLII-S vibration-damping cassette shell has five support points for increased rigidity and durability.

modulation noise. By making the window smaller, for instance, we were able to build in more anti-resonant material and five support points instead of three.

All of which helps XLII-S maintain phase accuracy as well as an extremely low noise threshold.

You can feel a difference in XLII-S just by picking up the cassette. Of course, it's nothing compared to what you'll feel the moment you press 'play'.



TAKE YOUR MUSIC TO THE MAX.



Stillwater Woofers

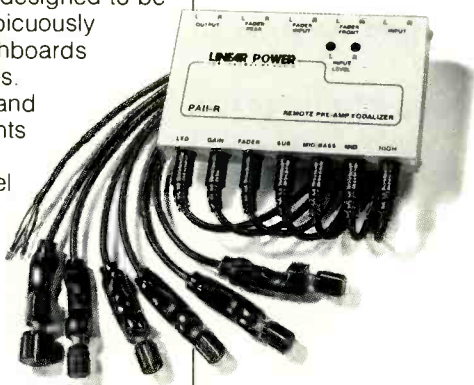
The Kicker Solo-Baric woofers are designed to perform as well in small but simple boxes as conventional woofers do in compact but complex isobaric enclosures. To do this, they have double the moving mass and beefed-up magnets and suspension compared to equivalent drivers. According to the makers, the resulting woofers work well in enclosures that are only half the volume of conventional sealed-box systems and can be 30%

smaller than isobaric systems of equivalent performance. Prices: S8, 8-inch, \$169; S10, 10-inch, \$249; S12, 12-inch, \$299. For literature, circle No. 100

Linear Power Preamp/Equalizer

The PA-IIR preamp/equalizer is designed to be built inconspicuously into car dashboards and consoles. Its controls and indicator lights (including a clipping-level indicator) can be mounted individually, in any desired arrangement.

The separate electronics module incorporates a preamp stage with up to 32 dB of gain, a patchback fader, and a four-band equalizer with bands at

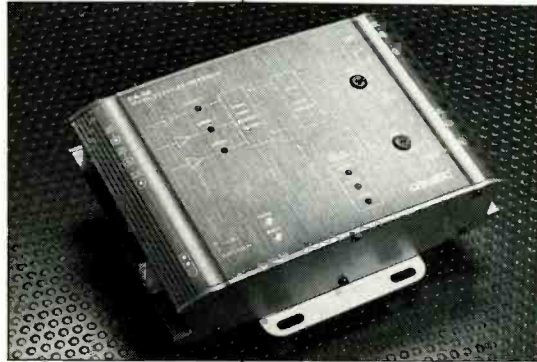


45 Hz, 180 Hz, 5 kHz, and 16 kHz. Impedances are 100 kilohms in and 150 ohms out, and S/N is 105 dB. Price: \$500.

For literature, circle No. 101

Coustic Car D/A Converter

A small but growing number of car CD and DAT players have digital outputs, and the Acoustic DA-55 outboard D/A converter can accommodate three. It automatically selects whichever of its inputs (two coaxial and one optical) is receiving a signal; a preset priority scheme comes into play if two or more signal lines are active. The D/A circuit, designed in



conjunction with Kinergetics Research, uses separate one-bit decoders for each channel. The converted signal is then fed through Class-A analog circuits to a balanced output. Price: \$499.

For literature, circle No. 102

NAD Power Amplifier

The 2400THX is the first amplifier in production to achieve certification for home THX theater systems. To accomplish this, NAD had to meet Lucasfilm's stringent specifications for low electrical and acoustical noise, low distortion and phase shift, and stability under all load conditions. Rated power output is 100 watts rms per channel into 8 ohms, with no more than 0.03% THD, from 20 Hz to 20 kHz, and peak current output of 50 amperes. A rear-panel switch can be used to optimize performance for 2- or 4-ohm loads. Bridged to mono, the amplifier is said to deliver 300 watts into 8 ohms. Dynamic headroom is 5.7 dB, and the 2400THX can produce up to 370 watts on transients lasting 0.25 s or longer. The Adaptive Soft Clipping circuit prevents clipping from becoming audible during any anticipated use. Signals through the "Normal" inputs are filtered to eliminate low-frequency noises such as LP warp, but signals through the "THX" inputs



are unfiltered, allowing a bandwidth of 3 Hz to 100 kHz. Price: \$599.

For literature, circle No. 103

Hint: The answer is
on everyone's lips.



THE PLEASURE OF SEAGRAM'S GIN.
IS IT HIDDEN OR REFRESHINGLY OBVIOUS?



ON THE OTHER HANDS



We are about to plunge into another era of "multi-media" audio for the consumer, a multiplicity of new products or systems that reminds me strongly of the early "hi-fi" era, the war of the three speeds—33, 45, 78—the battle between LP and 45 (it resolved itself—everybody made both kinds, for as long as the demand continued) and—can you remember?—the great war of the tape cartridges. You think the little Compact Cassette was the only contender? Far from it. We had a choice between 4-track cartridges, 8-track cartridges, cassettes and more, all aiming at the same and quite legitimate goal, to "automate" the clumsy reel-to-reel audio tape for consumer use.

Not only was there a bewildering choice of equipment for these systems, mostly incompatible type for type, but there were other issues for us to face—the ability to record on the tape as well as play, for instance. Each version had its own answer to that one, which in the end was a lot more important than some manufacturers realized. And then there was the simple matter of size and playing speed. In that unmemorable welter of "availabilities," the big 8-track, with its single roll of quarter-inch tape, looped so that as

tape wound on the outside it was pulled out of the inside, was the most extraordinary. It was a perpetual wonder to find that this worked at all. Have you ever tried to unravel a ball of string by pulling out the inside end?

Nobody is very good at guessing the winners in these big contests, least of all the manufacturers and designers. The public, as usual, swims in a sea of publicity almost impossible to penetrate. And yet, the public, in the end, still speaks and is heard.

I've always thought that the Philips people grossly underestimated the potential of their little Compact Cassette in its earliest mono format. The system was indeed strictly on the low-fi side to begin with, and quite honestly so. But there were built-in values in that system that began to impress the public as soon as the first cassettes were on the market. The biggest value, of course, was unparalleled small size, flexibility, convenience, a 50-50 ability either to play prerecorded material or to make recordings, a two-direction fast wind, and the turnover two-way recording system of reel-to-reel tape. In comparison, the other cartridge tapes were clumsy monstrosities.

What sustained the cassette victory was the engineering—the advanced

tape technology—recording at the unheard-of speed of 1 7/8 ips on an incredibly tiny and thin ribbon, the ingenious reel-less hubs that allowed the two rolls inside to graze each other throughout and thus save space with no compromise in the winding, the neatly designed windows that allowed a quick middle view of the two rolls as they turned, and, of course, the mechanical ingenuity that somehow kept the tiny tapes from mistracking, snarling, breaking—all the old and unpleasant attributes of home reel-to-reel recorder operation.

But most of all, I think the cassette survived because the specifications Philips set up ahead of time were ultra-careful and were rigidly enforced. Thanks to them, the system survives to this day, with only minor modifications to the original conception, and has allowed enormous advances in performance over the many intervening years.

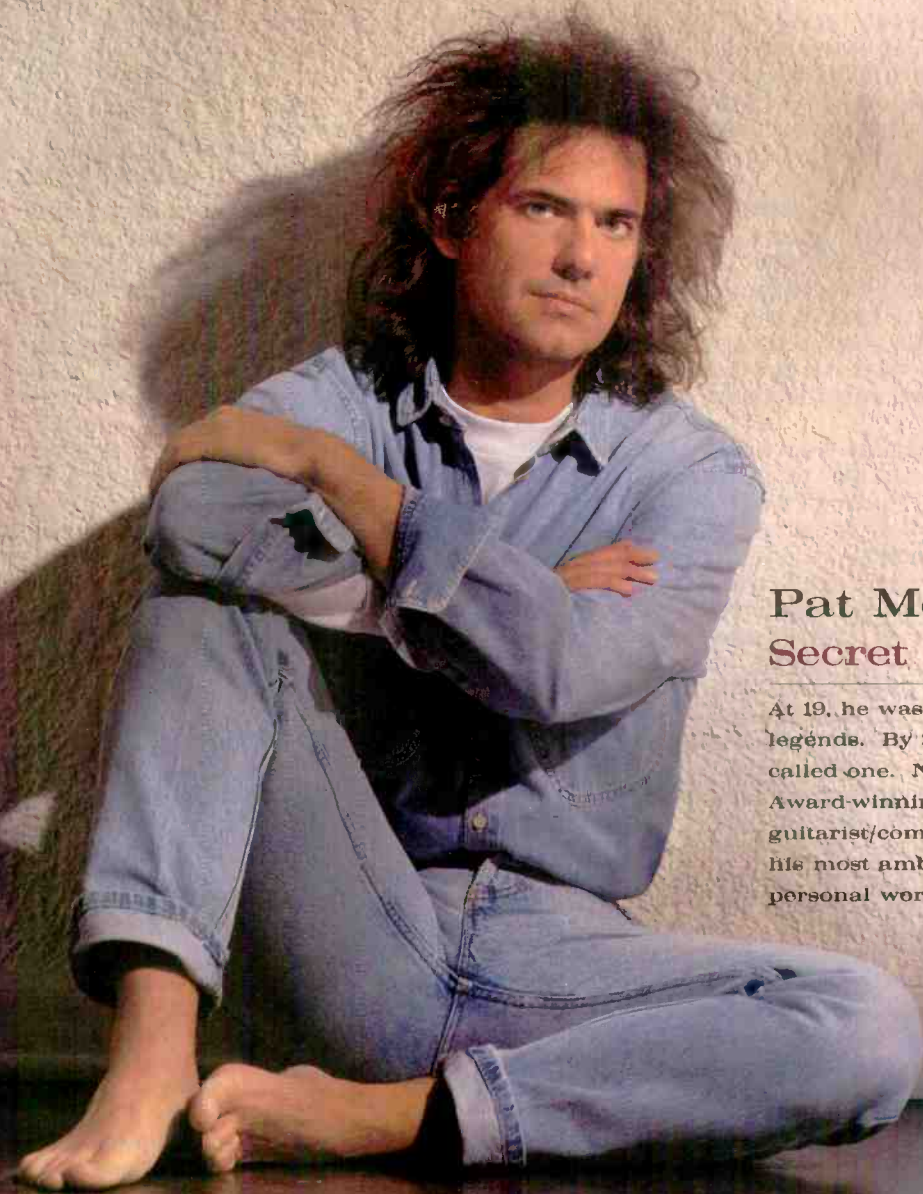
Even stereo was no block for the cassette. Two tracks became four—on that tiny tape—but cleverly rearranged from the interleaved tracks of the reel-to-reel four-track system so that each stereo signal occupied one-half of the tape; thus a mono tape was played by both stereo heads, compatibly. At the beginning, that was vital, though it's no longer important.

Most of us still can be astonished at the recording of four separate tracks on the little cassette tape, with a remarkably low level of crosstalk between them, and that almost entirely between the pairs of mixable stereo channels. How often do you hear any echoes of "side B" as you play "side A"? Rarely.

Out of the confusion of that long first period of multiple systems, the cassette and the LP emerged as standard. Further improvements, for years, went into these already established areas, and one might say that peace and harmony reigned. Competition in playing/recording settled down within familiar parameters, and progress progressed very nicely.

You can see where I'm aiming. Today, again—a wild and bewildering flood of new systems for consumer use, to record sound, to bring recorded sound to the home, car, and maybe the bathtub and the flower garden. It's the digital age, and putting a mere four

What good is the convertible, leather interior,
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The 8-track, with its one roll of quarter-inch tape, was extraordinary, like unravelling a ball of string by pulling the inside end.

tracks on a little ribbon of tape is nothing. Now, in digital, you can lay down literally dozens of discrete recordings *between* and around the existing four tracks, leaving them intact and still playable. (Similarly for Dolby digital movie sound, placed somehow around the film sprocket holes—see Bert Whyte's account in "Behind the Scenes" in the February issue.)

So once again we have a whole group of new systems for home-type or consumer audio recording, as usual not compatible with each other though variably compatible with existing equipment. The presence of video, around the edges of these systems, of visual information as well as audio, is a serious complication—if and when put into actual practice. The interactive movement adds still another area of immense possibility—and immense confusion as well. How do we go about getting a grasp on all these fascinating new media?

I can tell you one thing. We will have to move away from that good old American tradition, bipolar thinking. Either-or. Yes or no. This or that. A two-dimensional confrontation, and winner takes all even when the score is almost 50-50. It is an admirably decisive way of thinking, whether in politics, sports, or Oscar winning, and in a way it is unique to us in the United States. Other parts of the world think differently—they are multi-polar. Most of the other democracies have multiple political parties, and progress is by coalition and compromise. We prefer a much quicker resolution and so almost always still stick to the two-party system, as well as we can. So it is in most areas of our life, including audio.

Yet as anyone can see, the multi-polar approach is eating its way into our thinking everywhere, perforce. True, we haven't yet gotten to fielding

three football teams on one field to fight it out, but in plenty of other respects we are shifting to a multi-polar stance as the only possible way to think in a world of utter complexity. So look at the new audio, and act like the multi-pole a.c. motor or alternator! I can suggest a pole or two to get things started.

Count 'em, three radical new recording systems, digital, to add to the already ancient CD. One, DAT, is on the market and defining its place; the others, DCC and MD, lavishly described, are about to be available. There are also assorted peripheral systems semi-attached to those we already know, such as the extended CD family of discs.

One pair of poles to consider is the little matter of read and write, as the computer people put it. Record and playback. Either a system is able to record or it isn't. A bit of Hamlet in that. To be or not to be? Simple and utterly bipolar. But also quite wrong. In another past epic battle of systems, the video cartridge, a third pole was involved that determined the billion-buck outcome of that particular war—the *ability to copy*. Sony's original videocassette system beat many others simply because it so obviously offered home copying of video as a primary feature, even if this was carefully clothed in fancy language. I remember the press demos. Unwisely, I thought that Sony's was the least enterprising among a variety of systems from an engineering viewpoint. Maybe Sony blundered into a bigger success than it had counted on—no matter. The public got the message: Video at home, by choice, pre-recorded, but also *home copied*. The third pole. Too many audio designers overlooked it, to their enormous cost, including the CBS EVR system (Electronic Video Recording), which was strictly play-only. (As I see it, the subsequent Beta versus VHS rivalry was largely a bipolar fight between relatively similar systems.)

It was then that the first big flap over copyright material, taped or filmed, erupted with violence, effecting huge lawsuits and protracted argument—all thanks to this third pole. As anybody knows it was victory for Sony and for video copying. The principle also applied to the audio cassette, but this



area came to a boil only when the DAT cassette appeared, offering *literal clones* of copyrighted material indistinguishable from master tapes. Dynamite! This problem is now ingeniously compromised via the one-copy-only DAT system, and peace is restored. If you want the ultimate in cassette, you buy DAT, at a price.

On the other hand, a new consideration. The other new systems, soon to appear, make high-quality home-based copies like the older cassette, but these are not commercially (or illegally) usable clones. Instead, via remarkable compression or simplification they reduce the digital content of the signal by an astonishing amount and offer a great saving in space. To put it crudely, if a sound isn't there or is unlikely to be heard, it isn't recorded. This unlikely compression of audio sense, taking advantage both of the ear's characteristics and that of the signal, particularly music, seems to work. Most accounts so far say listeners can't tell the difference. If so, for many of us this is an important factor. An improvement, definitely, over the regular analog cassette, and yet not a clone. Good, safe ground, unlikely to stir up any new tempests.

Ah, but some of us, as is well known, will have only the best. That means, among the new systems, DAT. It is already widely used by professionals. But the demanding audiophile isn't going to leave it to *them*, no matter the cost! Maybe one perfect clone is enough? I'd say so.

So gather up the poles, by the dozen, be careful about bipolar opposites that may not tell a fraction of the whole story, and have fun. A



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BHDEX **AS**

EVERY LITTLE BIT HELPS

In the June issue, I described some of the testing and evaluation of Digital Compact Cassette (DCC) tapes, particularly in respect to the Precision Adaptive Sub-band Coding (PASC) system for data compression. At issue was whether the action of PASC is audible. Exhaustive tests at Decca Records in London seemed to indicate that PASC encoding had reached such a high degree of refinement and technical sophistication that it could not reliably be detected in A/B comparisons of master tape versus PASC-encoded/decoded DCC tapes.

As a result of these tests, there was quite a bit of speculation that DCC (a recording format) is better than CD (a playback-only format), based on the wider dynamic range of 18-bit DCC tapes. Some of this speculation probably arose because the parameters for CD technology and replication are all cast in concrete and invariable, as dictated by the Sony/Philips Red Book. This may foster the impression that CD sound quality cannot be improved beyond the optimum levels achieved by adherence to the Red Book standards. Although we are certainly not going to see 24-bit digital recordings with a sampling rate of 125 kHz, as fantasized by some audiophiles, there have been improvements in CD sound quality. The earliest CD players had brick-wall, 90-dB anti-aliasing filters which certainly degraded sound quality, causing high-frequency spurious that grated on perceptive ears. The continually evolving D/A converter technology—multi-bit, MASH, one-bit, bit-stream, and other variants—has expunged most of the offensive sounds. In fact, D/A converter technology has outpaced that of the typical A/D converters used in professional digital recorders. Studies have revealed that these recorders' A/D converters help create digital distortions and artifacts.

Recognizing this, manufacturers have been working to develop a new breed of A/D converter to address digital signal distortions. Most of these A/D converters are stereo units, accepting two signals from the mike preamps, and their circuitry provides 128-times oversampling and dither applications at various levels. Several new A/D converters, such as one from Sony and the Wadia 4000, afford 20-bit resolution.



Some converters will be offered as an eight-input module on a single chassis and then be used in multiples according to the number of tracks employed in the digital recorder.

In addition to new A/D converters, recording engineers are placing increased emphasis on high-quality microphone preamps and improved on-location and in-house monitoring facilities. With all these new devices in their armamentarium, I asked three highly respected recording engineers to describe their current digital mastering techniques.

Tom Jung is justly famous for the superb, ultra-clean pop/jazz digital recordings he engineers for his dmp label. Tom has been making digital recordings since 1978 and is known as a tireless experimenter and innovator in his quest for sonic realism. Currently, he feeds various mikes (types and patterns are chosen for particular recording applications) into high-quality mike preamps. He often feeds his main stereo mikes into FM Acoustics' Class-Amp M-1 mike preamp. The output of the ClassAmp M-1 and the outputs of the "sweetener" mike preamps are fed into four Wadia 4000 A/D converters. The digital output of the converters is fed into the eight input channels of a

Yamaha DMR-8 mixer/digital recorder. This 20-bit linear digital recorder has stationary thin-film heads and allows 40-channel redundancy recording on metal tape. It provides 22 minutes of recording, but slave-unit serial recorders switch on at 21½ minutes, taking over from the main unit. When the slave unit reaches 21½ minutes, it automatically switches back to the main recorder, so Tom can continue to record as long as he wants! The Yamaha DMR-8 allows him to mix in the digital domain. Since the Yamaha metal-tape cassette is not configured for CD mastering, the recorder's digital AES/EBU and SPDIF outputs are fed into a professional R-DAT recorder, and this tape is used for CD mastering. Tom also makes extensive use of Peter D'Antonio's RPG Diffusor and Abffusor acoustical panel treatments in his session monitoring and, whenever possible, in recording venues. This cutting-edge-of-the-art digital recording technique is expensive, but Tom's pristine-clean recordings speak eloquently for his dedication to high-fidelity sound.

Tony Faulkner is one of Britain's pre-eminent recording engineers for classical music, and the countless recordings he has made for many labels are distinguished by the sheer musicality

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of his soundscapes. Tony is always interested in new recording technology as long as it appears to advance the art, but basically he takes a purist approach, which is to say that he firmly believes in minimal miking for most classical recordings. Over the years he has employed Blumlein and other stereo pair techniques. He generally likes the warmth and musicality of tube microphones and favors near-coincident pairs of Neumann M49c and M50c mikes as well as the AKG C24 stereo mike, all modified for low noise. Tony does much of his recording on an open-reel, 20-bit Mitsubishi PDX-8620 digital recorder. Also aware of the problems with conventional A/D converters, he has upgraded to Meridian's 607 and has already mastered five albums with the Wadia 4000.

Tony is quite enthusiastic about his newest digital recording technique, which utilizes CD-R. He feeds his mike preamp into his A/D converter, then outputs the digital signal into a Meridian CD-R, which uses pre-grooved dye-polymer discs. The disc is edited on a Sonic Solutions digital workstation, then rerecorded on CD-R to create the digital master. Tony has found two CD mastering plants in England that accept the CD-R discs and use them directly to the CD glass master. He asserts that CD-R is presently the most transparent digital recording format, with the lowest error rate, and that it provides digital masters of exceptional clarity and cleanliness. Not the least of CD-R's attractions for classical recordings (which are usually done on location in various halls) are its very light weight and easy portability. These are major pluses, compared to the big Mitsubishi PDX-8620 open-reel recorder or the Sony 1630 U-matic. Tony reckons he has now mastered more than 20 albums using CD-R.

John Eargle, colleague and *Audio* contributor, is responsible for most of the remarkable digital recordings on Delos and is well known for his books on recording engineering and microphones. Over the years he has developed a recording philosophy based on his technical expertise and his insights as a trained musician. John's recordings are a distillation of his understanding and application of microphones, acoustics, and the characteristics of

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Engineers say that using 20-bit A/D converters gives extra headroom and ensures that all 16 bits of the CD are exercised to the LSB.

the instruments in the symphony orchestra. The musical balances he achieves between the various orchestral choirs, and his placement of the orchestra in accordance with the acoustical characteristics of the recording hall, are major contributors to the stunning sonic realism of his recordings.

John favors a modified near-coincident ORTF pair of cardioid mikes as his main pickup, flanked by omni mikes, with minimal use of stereo-pair sweetener mikes. He has been experimenting with A/D converters and currently is using the Wadia 4000. John feeds the output from his mike preamps to a specially modified Soundcraft 200B mixer. The mixer's two output channels feed into a Wadia 4000, and its digital output is recorded on a professional Fostex R-DAT recorder. This tape is later transferred to a Sony 1630, and subsequent editing is done on a Sony 3000 to make a CD mastering tape.

Other recording engineers have recognized the A/D converter problems and have been experimenting with new units. Jack Renner of Telarc has been using a proprietary A/D converter as well as the Wadia 4000. John Newton, who has made many recordings for Philips, EMI, and other labels, has been using Apogee Electronics A/D converters and the Wadia 4000. Of course, Sony Classical uses Sony's own 20-bit A/D converter, and Decca Records and other companies are using various new A/D converters, including 20-bit models. In all of this, you will note the trend to 20-bit A/D converters. A logical question is: Why use 20-bit converters, since the CD standard is a 16-bit system? The engineers say it gives them extra headroom and ensures that all 16 bits are "exercised" down to the least significant bit (LSB).

At my deadline for this column, Sony announced a new technique, called Super Bit Mapping (SBM), for transferring 20-bit masters to a 16-bit CD to yield sound quality beyond 16-bit resolution. SBM uses noise-shaping to shift quantization noise away from the frequencies the ear is most aware of. Sony's white paper states:

In order to shape the noise in this manner, the actual error at each point

must be tracked. This requires that the signal be quantized with more bits than will actually be used. For example, while CD-quality audio is quantized at 16 bits, SBM requires a higher number, such as 20 bits. Each sample then consists of the most-significant 16 bits, with the quantization error consisting of the least-significant 4 bits. Once the quantization error (noise) is identified, it can be shaped by a noise-shaping filter and fed back into the original signal, thus producing the desired noise spectrum. Note that the total noise power remains unchanged; only the spectrum is different.

An added benefit of SBM is a significant reduction in transient harmonic distortion, and there is much more to this Sony technology that will be revealed in due course. In the meantime, 16-bit transfers from the new 20-bit A/D converters will likely be improved by SBM and give us further enhanced CD sound.

(Editor's Note: At a press conference at the recent Consumer Electronics Show in Chicago, I heard A/B demonstrations of CDs made the standard way and a second set of discs made with SBM. Two recordings were used, ones with which I fortunately was familiar: Dave Brubeck's "Take Five" and Bob Dylan's "Just Like a Woman." It took me a little while to tune into the difference, which at first sounded like it was merely some sort of equalization. Some, but not all, of the intrusive old, analog tape noise was reduced, but more importantly the size of the musical illusion behind that "gray wall" of tape noise increased and became more three-dimensional. Further, the size of each instrument in Brubeck's group was reduced, and its place in that newly enlarged space was clarified. With the Dylan, his voice was much less harsh and sibilant, but yet more "voice-like" and realistic. This is a premium-quality sound from the CD medium, and I must confess I had thought CD's sonics were not to be improved upon. These SMB CDs are to be initially released on Sony Music's Legacy Series, and the best thing I can say about them is that I will search them out and pay the extra dollars to have them, for they are that much better. —E.P.)



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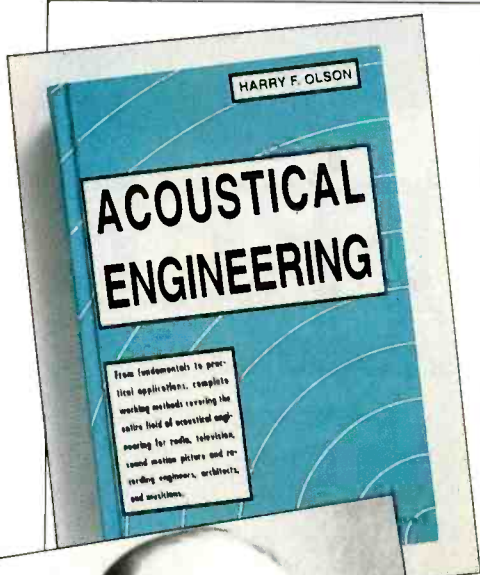
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TURNING BACK THE PAGES



HARRY F. OLSON

When I was learning the professional recording business at RCA Records during the '60s, Harry F. Olson was still a commanding presence at the RCA Sarnoff Research Center in Princeton, N.J. Most of us referred to that organization simply as RCA Labs, but in a more familiar way we considered it first and foremost to be "Harry's lab."

Olson's career was unlike any other in audio. It was all spent with RCA, and much of his landmark work was done so many years ago that later references often overlook it. It is said that the original Acoustic Research patent on the acoustic suspension loudspeaker was invalidated by a refer-

ence from one of his books. I know firsthand of an Olson-devised play-back-only noise-reduction system that is conceptually the father of some of today's digital techniques for cleaning up old recordings.

Most of the applied research work of Olson and his group was product-oriented and provided the basis for what the various manufacturing divisions of RCA produced. Other studies of his are in internal company reports, and these may never see the light of day. Fortunately for us, Olson the teacher and explicator maintained a busy writing schedule. He produced a number of books that are as sought after today as when they were first published.

His major work, *Acoustical Engineering*, was originally published in 1957 by the D. Van Nostrand Company. I am not sure when (or why) the book went out of print, but for the last couple of decades it has been virtually impossible to find. (I'm an avid collector of books on audio, but it has only been in the last two years that I received a copy of *Acoustical Engineering*, courtesy of two good friends in the industry.) Happily, the book is now available through Professional Audio Journals, Inc. (P.O. Box 31718, Philadelphia, Pa. 19147; \$53.95 including shipping and handling) in a hardbound format with a rugged binding worthy of its 718 pages. Jesse Klapholz is the man responsible for this, and he deserves our compliments for a job well done.

Before I get into a description of *Acoustical Engineering*, I would like to explain why I think it may be important for many readers of *Audio* to have a copy. Principally, Olson covers his subject matter on several levels at the same time, emphasizing the underlying physics along with clear, functional diagrams that are models of their kind.

As an example, consider Olson's description of a capacitor microphone. First, there is a description of the device, complete with pertinent physical equations governing its performance. For many readers, this description can stand alone, conveying as it does the basic operation. The figures accompanying the description include a detailed sectional view of the microphone, an equivalent mechanical circuit keyed to the elements shown in the sectional view, the pertinent electri-

cal circuit, and a graph of frequency response that shows the mike's typical behavior. Olson certainly knew the value of concise but detailed graphics.

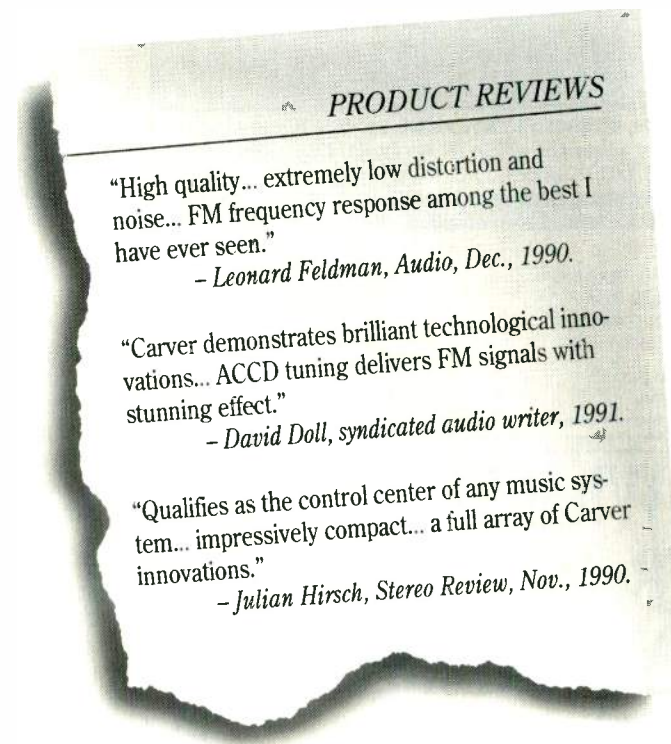
Thus, in a single to-the-point exposition, Olson satisfies all readers. The engineer walks away with a view of how the microphone is designed (complete with differential equations), and the non-mathematical novice gains an intuitive view of how the microphone works. The same approach is used in Olson's description of complete systems, such as loudspeakers, recorders, reproducing systems, and measurement setups.

The book begins with a short mathematical discussion of how sound is propagated, which leads directly to a detailed discussion of basic radiating systems. Included are point sources, line and circular sources, acoustic lenses, tapered arrays, and the like. The fundamentals are thus set down for how loudspeakers and microphones should be "shaped" if they are to do their respective jobs well. If you have ever wondered how and why the B & W 801 loudspeaker took on its bevelled midrange enclosure shape, you'll find the answer in Olson (page 23). This particular geometry ensures very smooth on-axis frequency response. If you read this section, you will find out why certain other shapes are generally avoided. It is safe to say that most of today's loudspeaker baffle geometry is a direct outgrowth of Olson's pioneering work in this area.

Mechanical vibrating systems are then discussed in their role as foundations of all acoustical devices. Following this is an explanation of dynamic analogies. This is the discipline Olson uses to set up the equivalent acoustical and mechanical circuits which he uses throughout his writing. Next is a lengthy chapter devoted to acoustical elements—horns, various slits, tubes, and juxtaposed media—and how they influence sound travelling through them. By this point, Olson has provided the foundation for the understanding of practical real-world devices.

We then move on to a favorite subject, the direct radiator (cone) loudspeaker. Here we immediately get into discussions of particular designs in which we can see the effects of changes in parameters on output, dis-

In case you missed our preamp/tuner reviews, here's a few highlites.



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— Leonard Feldman, *Audio*, Dec., 1990.

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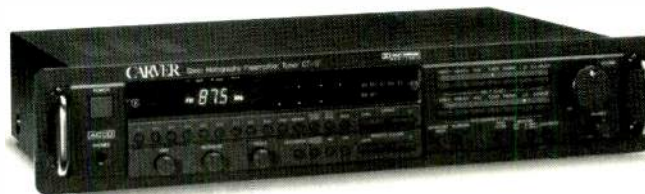
— David Doll, *syndicated audio writer*, 1991.

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Olson covered his subject on many levels, stressing the underlying physics and providing diagrams that are models of their kind.

tortion, and directivity. Even the most casual *Audio* reader will find items of interest here.

The next major section is devoted to horn loudspeakers, which are given the same depth and detail as cone devices. Though only a few of you may have horn loudspeakers in your homes, they are a mainstay in movie theaters and in speech and music reinforcement.

Perhaps Olson's crowning achievement in acoustical engineering was his work in microphones. Although not commonly encountered today, his basic ribbon microphone provided the broadcast and recording industries with their fundamental tool during the 1930s and 1940s. The subsequent popularity of capacitor and low-cost dynamic microphones put the ribbon designs in the background, but this in no way diminishes Olson's overall contribution. His work in higher order directional microphones is fundamental. The chapter on microphones covers all designs, including a few exotic items such as the electronic and "hot wire" mikes.

A chapter discussing various other transducers, including phonograph cutter heads and pickups, telephones, magnetic recorders, and basic noise-cancelling systems is next. Following chapters deal with such diverse subjects as measurements, architectural acoustics, psychoacoustics, and complete sound reproducing systems. Of special importance here is Olson's fundamental work in relating psychoacoustics to the parameters of playback systems. The author's listening tests regarding noise, distortion, and bandwidth in home music systems were probably the first of their kind and established consumer expectations in his day.

Acoustical Engineering's final chapters cover general information systems, underwater sound, and ultrasonics; as such, they may be of relatively little interest to the typical *Audio* reader. For engineers and physicists, I must state that the book expresses units basically in the cgs (centimeter-gram-second) system and not in the SI, or metric, system we use today. Conversions are simple enough to make, so this should not be a problem. Happy reading!



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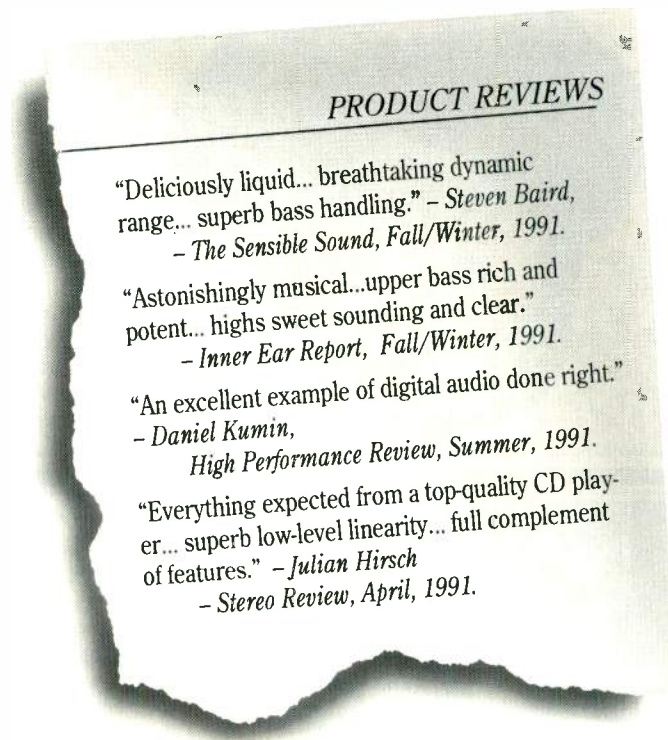
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IVAN BERGER

SWEETER TWEETER

Look, Ma! No Crossover

Jensen's new Advent car speaker line features that rarity, a new driver design, Inductive Coupling Technology (ICT). Invented by Goodmans of England, the ICT is a true coaxial design requiring no crossover network and having no wired connections to the tweeter. The tweeter element, a light aluminum dome whose voice-coil is one shorted turn of wire, picks up high-frequency energy by induction from the woofer's voice-coil. This induced current reacts with the field of the woofer magnet to drive the dome. A bullet-shaped phase plug, in front of the dome, balances the radiation impedance of the dome with that of the woofer's voice-coil former surrounding it to smooth frequency response; a horn-like wave guide surrounding the assembly smooths acoustical coupling to the air and helps control directivity.

With the tweeter at the base of the woofer, sharing the same acoustic



plane and central axis, the ICT system should have about the same stable, coherent imaging as a true point-source speaker, slightly better than a coax in this regard. An ICT speaker can also be physically shallower than a coax, allowing easier installation in many tight spots, such as behind a car's original speaker grilles. Advent says that the design is likely to be more reliable and easier to build consistently than conventional designs, and that ICTs weigh less than coaxial speakers of equivalent performance.

An ICT's efficiency will be less than that of an equivalent coax, due to the wider voice-coil gap and to increased woofer Q. But Advent says its ICT speakers are more efficient than most of the speakers supplied as part of factory-installed sound systems. That may not be as true in Europe, however; Goodmans now supplies ICT speakers to some car makers over there.



Free Thought

Good performance costs money, but good ergonomics need not raise a product's price. Take, for example, Sparkomatic's \$110 Model SR339 car stereo, which appears to have excellent human engineering. Some panel designations could be a bit clearer, but the layout is a gem. The six station buttons, instead of being laid out in one long string (which makes middle buttons very hard to identify by touch), are grouped in two rows of three, where your finger can instantly find any of them. The other buttons are also laid out in a 2 x 3 matrix. The volume and manual tuning controls are big knobs—old-fashioned but ergonomic as all get-out. The one tape control (fast forward/eject) is right by the tape slot, and the display is reasonably big.

There are limits, of course, to what \$110 will buy. The tape section has fewer features than the tuner (no Dolby NR, for instance), and performance specs are, as you'd expect for this price, modest rather than spectacular. But at least those specs are fully disclosed; for example, while low-end car stereos often carry nominal power ratings based on an unstated THD level of 10%, Sparkomatic not only specifies that distortion level for its nominal 10-watt power output but also gives a power rating at a more tolerable 1% THD (8 watts, total).

Improving a low-end unit's performance usually costs money. But, as the SR339 demonstrates, improving its ergonomics usually takes just a bit more thought at the design stage.

Woofer Wonders

Car woofer systems with bandpass and isobaric enclosures are both gaining fast in popularity. Bandpass systems cut off woofer upper frequency output acoustically, effectively sharpening the low-pass crossover slope and making woofer distortion products less audible. And because you hear fewer mid-frequencies from a bandpass woofer, you're less likely to notice that the bass is coming from a separate place. The virtue of isobaric systems is their compactness, a major asset in a car. Polk's C4 subwoofer uses both techniques—and it impressed me with its low, clean bass.

Blaupunkt, meanwhile, has come out with a new use for dual voice-coils, which they call Electronic Bass Injection (EBI). One of the woofer's two voice-coils is wired to the speaker's crossover. The other voice-coil can be driven separately by a second amp and active crossover, adding additional energy in the deep bass. If the second amp is hooked in before your front/rear fader or to both fader outputs, you'll also get constant bass regardless of the fader's setting.

Paradigm

AMS-200 • AMS-300



A R C H I T E C T U R A L M O N I T O R S E R I E S

THE FINEST IN-WALL SPEAKERS

Deriving music from in-wall speakers has been a virtually impossibility. They certainly are convenient. But no matter how much you spend, you always seem to end up with mediocre sound... *until now!*

Architectural Monitor Series (AMS) in-wall speakers redefine the state-of-the-art. Advanced design concepts that specifically address the wall's acoustic shortcomings results in performance that is nothing short of amazing... *at last, in-wall speakers that sound like music!*

PARADIGM speakers offer a level of performance that is unmatched at the price. In national dealer surveys, conducted by a leading trade publication, PARADIGM ranks #1 in price/value!

PARADIGM's product excellence is widely recognized with numerous rave reviews, Sound&Vision's Critic's Choice Awards and Audio/Video International's HiFi Grand Prix Award.

Specifically, AMS products have received multiple Sound&Vision Critic's Choice Awards and a Best Buy Award from Consumer's Digest!

AMS speaker development included a complete study of the wall's unique acoustic properties along with the sonic contribution of each individual component in the speaker. The interaction of all of these elements is very complex - there is never a single magic solution to good speaker design. However, when the best possible combination is determined the whole can exceed the sum of the parts and provide truly "magical" results. Although this method of R&D is very time consuming, it pays off in speakers capable of extraordinary musical performance.

BETTER BY DESIGN

- One-piece diecast aluminum chassis - a vast improvement over plastic - minimizes mechanical vibration, ringing and flexing. They also provide a heat sink for the drive units for increased power handling.
- Full-perimeter diecast aluminum mounting brackets ensure strong, rigid installation in the wall to minimize wall vibration and flexing.
- PARADIGM designed and built bass/mid-frequency drive units have smooth colouration-free response and low distortion. Mineral-filled polypropylene cones have very high stiffness-to-mass ratio and excellent internal damping. Synthetic butyl suspensions are specifically designed to eliminate "edge-hole" distortion - a type of distortion that occurs when the suspension begins to resonate in an uncontrolled manner. Voice-coils are longer than the magnetic field in which they operate, resulting in linear response regardless of cone excursion. Advanced adhesive technology ensures long-term reliability under conditions of extreme stress.
- The AMS-200 high-frequency drive unit uses a treated-textile dome radiating element which has extremely low mass and very high internal damping. The dome shape and size promotes maximum dispersion for balanced musical performance throughout the listening room. An oversized magnet assembly, along with a precision wound voice-coil and ferro-fluid cooling, ensures superb dynamic response and long service life.
- The AMS-300 utilizes the spectacular Q25™ pure-aluminum-dome high-frequency drive unit from the PARADIGM Monitor Series. This highly praised design has all of the benefits of treated-textile plus even lower levels of dome break-up distortion and higher power handling. The result is outstanding clarity throughout the entire listening room.
- Precision quasi-Butterworth dividing networks are time- and frequency-aligned to provide seamless coherent performance.

The AMS-200 is a supremely musical in-wall speaker that simply outperforms all others, except, of course, the AMS-300... here is an in-wall speaker that must be heard to be believed. The AMS-300 is a revelation in music... it sets an entirely new performance standard for in-wall speakers!

BEST BUY!

PARADIGM's design principles are based on the vast body of speaker research conducted by the world-renowned National Research Council of Canada. Extensive in-house R&D facilities allow PARADIGM engineers to evaluate many generations of prototypes before a design is put into production. The goal of this enormous commitment to R&D is to offer a performance/price ratio second to none. AMS speakers offer incredible performance and yet actually cost less than many other designs - they are clearly the Best Buy!

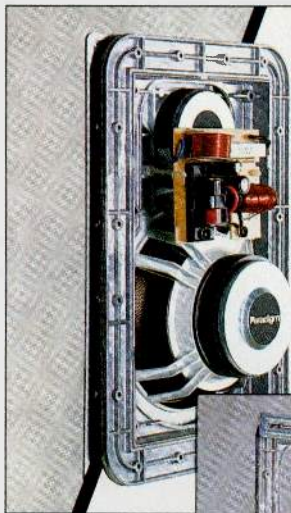
USE THEM ALMOST ANYWHERE

AMS speakers can be used in a wide variety of applications. The main chassis is made from non-magnetic aluminum that will not warp or crack. Polypropylene cones and textile or metal domes are unaffected by age or changes in temperature or humidity. They can be used inside virtually anywhere, and because they are water-resistant (not waterproof) AMS speakers can be used outside in weather-protected areas. Outside operation does, however, require a temperature of at least 10°C/50°F (no harm occurs below this, but the speaker will not sound correct - see owners manual).

AMS speakers take no floor space and are very easy to install. They are attractively finished in ceiling white to compliment most rooms. They can also be painted to match specific decors.

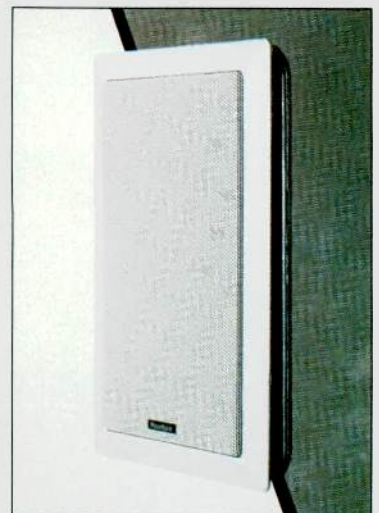
GUARANTEED PERFORMANCE

PARADIGM guarantees the performance of AMS speakers for a full 5 years from the original date of purchase. Within this period PARADIGM will correct any defect in materials or workmanship that causes deviation from original performance (see owners manual).

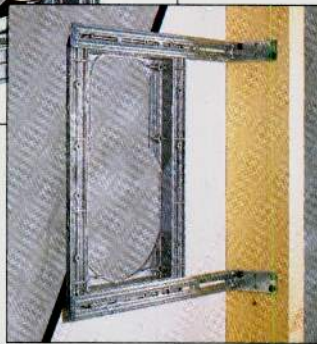


The precision one-piece diecast chassis and full-perimeter diecast mounting bracket provide a vastly superior in-wall installation.

This highly engineered mounting system dramatically improves musical performance.



AMS speakers are precision engineered for the unique acoustic environment of the wall.



Installation is easy. For existing walls simply use the full-perimeter diecast bracket. For new construction adjustable "L" brackets are included to allow for pre-installation of the diecast bracket.

SPECIFICATIONS

	AMS-200	AMS-300
• DESIGN	2-driver, 2-way acoustic suspension	2-driver, 2-way acoustic suspension
• CROSSOVER	2nd order electro/acoustic at 2.0kHz	2nd order electro/acoustic at 1.5kHz
• DRIVER COMPLEMENT	One 25mm (1") treated-textile-dome high-frequency driver One 165mm (6-1/2") mineral-filled polypropylene bass/midrange driver	One 25mm (1") Q25/300 pure-aluminum-dome high-frequency driver One 210mm (8") mineral-filled polypropylene bass/midrange driver
• PERFORMANCE	Low Frequency Extension* Frequency Response On Axis (0°) Off Axis (30°) Sensitivity-Room/Anechoic Suitable Amplifier Power Range Maximum Input Power† Nominal/Minimum Impedance	45Hz (DIN)* ±2dB from 60Hz-20kHz ±2dB from 60Hz-20kHz 89dB/86dB 15-150 watts 80 watts† 8ohms/4ohms
• PHYSICAL	Minimum Mounting Depth Minimum Internal Volume Required Height Width Depth Weight Finish	8.3cm/3.25in 20litres / .67cuf 33cm / 12in 20cm / 8in 9cm / 3-3/8in 6.4kg / 14lbs per pair Ceiling White Epoxy Powder Coat. Paintable.
	7.4cm/2.9in 12litres / .4cuf 31cm / 12in 20cm / 8in 9cm / 3-3/8in 5.5kg / 12lbs per pair Ceiling White Epoxy Powder Coat. Paintable.	
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Dashboard designers are beginning to acknowledge how often drivers reach for their volume, memory, and seek tuning controls.



1992 Mercury Sable



1992 Ford Taurus

Re: Search (et al.)

From 1992 on, the factory-installed stereo systems on the Ford Taurus and Mercury Sable have extra volume, seek, and memory buttons, placed where the driver can reach them without taking a hand off the wheel. That wasn't done just from logic, whim, or personal experience, but from market research. Surveying 1,200 owners of competitive cars (of whom about half responded), Ford found that these three controls and on/off (which is less necessary to use on the road) are the ones most often used in highway listening. Specifically, volume controls are used 86% of the time, memory buttons 80% of the time, and seek tuning 32% of the time. Scan tuning is used in only 21% of all listening sessions, the bass control is used 30% more than the treble control (13% versus 10% of the time), the balance control another 10%, and the fader tied with manual tuning at a dead-last 8%.

Other consumer preferences also emerged from Ford's study. Confirming the importance of memory buttons, 78% of those surveyed said they wanted the ability to

automatically load station frequencies into preset memories (and 68% said they wanted six memory buttons versus only 18% for five—almost no one wanted any fewer). But despite its low rank in usage studies, 74% of respondents wanted scan—more people would use it if they had it, I guess. Memory (or preset) scan was ranked only about half as highly, (40%); I wonder why it's far more common than regular scan, these days. Scan's cassette equivalent, music search, was wanted by 69% of those polled.

Half of all respondents wanted anti-theft coding, even though it doesn't do much good. (As long as coded radios aren't clearly and unequivocally marked, thieves can still sell them.) Half of those surveyed also wanted automatic volume control, to compensate for road noise.

Half of all listeners want Dolby B noise reduction, as opposed to 39% who want Dolby C NR and an equal number who want DNR. (Dolby S NR was too new to have been worth including in the survey.) Only 32% showed any interest in Type II tape equalization. Only 22% wanted multiple FM bands, while 37% wanted AM stereo. Nonetheless, more manufacturers seem to include the former than the latter, probably due to costs.

Nearly a third of those surveyed disliked the sound quality of their systems, while only 10% complained about their radio reception. Ergonomics accounted for more than half the grievances, with complaints about small graphics (2%), small

displays (4%), small controls (16%), and the location of the radio (25%). Modern dashboards leave little room to change radio location (though Ford has moved it above the heater in some of their vehicles), but car designers can at least put basic controls where the driver can reach them easily—as on the current Sable and Taurus.

Courtesy Call

Car stereo's popularity in Britain may be catching up with its popularity in the U.S. One sign of this comes from the Polite Society, of Newcastle-Under-Lyme, which ranks loud car stereo systems Number 3 on its Top 10 list of bad-mannered nuisances. (Littering is Number 1.)

Updated Drive-Ins

Drive-in movies in America may have been disappearing for decades, but Britain just got its first. Located in Hackney, the theater broadcasts the movie soundtracks in FM stereo, so viewers (and perhaps close neighbors) can pick them up on car radios or portables.

To hear the hum of the Lexus SC400's Four Cam, 32-valve engine is definitely a pleasure. But you have to admit, there will probably be times when you'll want to hum along with something a bit more musical.

Enter the optional Lexus/Nakamichi Premium Sound System with twelve-CD auto-changer, perhaps one of the finest audio units ever to be installed inside an automobile.

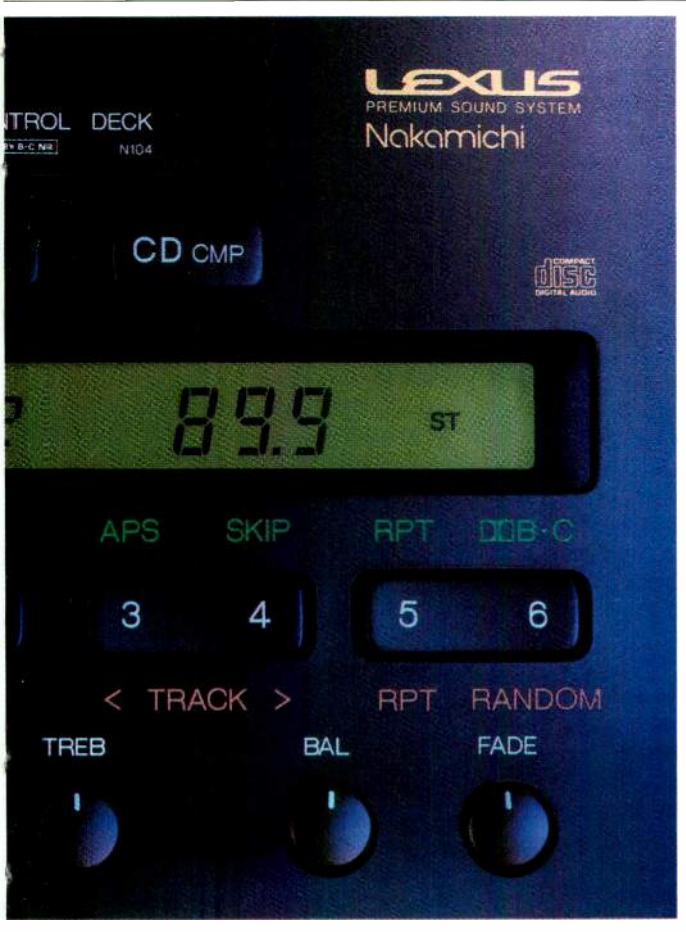
Dare we say, even a living room.

A total of seven speakers occupy the cabin: two tweeters, four extended-range speakers, and a ten-inch subwoofer. Each one placed in a distinct location to enhance sound imaging.

Turn up the volume and the first image that comes to mind is front row seats, thanks to 280 watts* that, at your discretion, can send a musical note to a place about four inches beneath the sternum. But power is nothing without finesse. That's why active high- and low-pass crossovers feed



As If The Etthe Eight Pounding Cylin



specific frequencies that match the optimized operating range of every speaker. Equalization circuits (we'll spare you the details) are also used to tailor sound reproduction to the interior design of the car.

In English,



this means phenomenal sound quality. "The finest system you can buy in a new car" is how *Car Stereo Review* translated it (*Motor Trend* magazine, on the other hand, took a more direct approach by simply naming the entire car 1992 Import Car of the Year).

Of course, if you ever decide to turn off the stereo, you can always listen to how well the engine carries a tune.



real Sound Of ders Werent' Enough.

Enter No. 10 on Reader Service Card

Early in the 1970s, long before I joined my present employer, Hughes Aircraft Corp., I ran a consulting and production firm concerned primarily with acoustics and speaker design. While I was designing speakers as best I could, I recognized certain shortcomings in them and, for that matter, in all stereo systems that I had heard over the years. Stereo systems, no matter how well designed or expensive, presented a two-dimensional image without any real depth. Even worse, sounds were almost always confined to the space *between* the speakers. If speakers were placed, say, 8 feet apart, then the apparent stage was 8 feet wide and no

for my first patent for the system on November 12, 1986, and it (Patent Number 4,748,669) was granted on May 31, 1988. As issued, the patent, assigned to Hughes Aircraft Co., contained no fewer than 159 granted claims. Additional patents, involving further improvements to the system, have also been granted. *Audio* readers may gain a better insight into the system that was subsequently called SRS (Sound Retrieval System) if I quote a few paragraphs from the section of the patent headed "Background of the Invention."

ARNOLD I. KLAYMAN



SURROUND SOUND WITH ONLY TWO SPEAKERS

wider. Another shortcoming of stereo systems at that time, I felt, was related to a well-known characteristic of human hearing—the so-called precedence effect. So long as I positioned my chair exactly midway between the speaker and at a sufficient distance in front of them, the monophonic portion of any stereo program—that portion involving a vocalist or a featured soloist—remained fixed or centered between the two speakers. However, if I moved closer to one speaker or the other, those sounds that *should* have remained centered drifted along with me. I began to wonder whether there was some way to correct these flaws.

When I went to work for Hughes in 1986, I was asked to work on a project involving stereo systems for commercial aircraft, the kind you listen to with headphones when flying in an airliner. As anyone who has had that listening experience (or, for that matter, anyone who listens to portable radios or cassette players through headphones) can confirm, no matter how good the quality of the headphones, sounds still seem to be coming from inside your

head instead of from up front, where the aircraft's motion picture or TV screen is located. My colleagues and I were assigned to come up with a system that would get the sound out of the listener's head and, if possible, expand the stereo image to a more realistic dimension. So, I began reading a variety of scientific papers spanning more than 50 years of acoustic and psychoacoustic research. (A bibliography of the papers and books that I used is found at the end of this article.)

After a great deal of experimentation, I came up with a system that seemed to solve these problems. I filed

The disclosed invention generally relates to an enhancement system for stereo sound reproduction systems, and is particularly directed to a stereo enhancement system which broadens the stereo sound image, provides for an increased stereo listening area, and provides for perspective correction for the use of speakers or headphones

. . . . Another consideration in stereo reproduction is the fact that sound transducers (typically speakers or headphones) are located at predetermined locations, and therefore provide sounds emanating from such predetermined locations. However, in a live performance the perceived sound may emanate from many directions as a result of the acoustics of the structure where the performance takes place. The human ears and brain cooperate to determine direction on the basis of different phenomena, including relative phase shift for low-frequency sounds, relative intensity for sounds in the voice range, and relative time arrival for sounds having fast rise times and high-frequency components.

As a result of the predetermined locations of speakers or headphones, a listener receives erroneous cues as to the directions from which the reproduced sounds are emanating. For example, for speakers located in front of the listener, sounds that should be heard from the side are heard from the front and therefore are not readily perceived as being sounds emanating from the sides. For headphones or side-mounted speakers, sounds that should emanate from the front emanate from the sides. Thus, as a result of the placement of speakers or headphones, the sound perspective of a recorded performance is incorrect.

There have been numerous attempts to spread and widen the stereo image with mixed results. For example, it is known that the left and right stereo signals may be mixed to provide a difference signal (such as left minus right) and a sum signal (left plus right) which can be selectively processed and then

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ILLUSTRATION: DOUG BOWLES

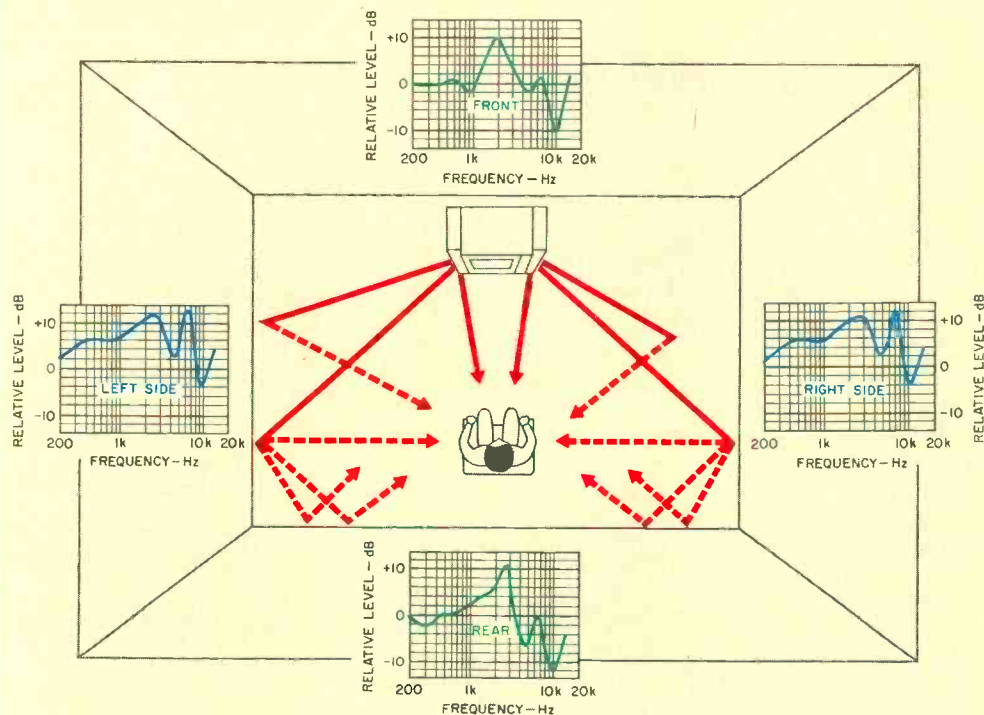


Fig. 1—One way we recognize the direction of a sound source is through the ear's differing response to sound arrivals from different directions. The SRS circuit uses frequency shaping to simulate these directional cues.

mixed to provide processed left and right signals. Particularly, it is well known that increasing or boosting the difference signal produces a wider stereo image.

However, indiscriminately increasing the difference signal creates problems since the stronger frequency components of the difference signal tend to be concentrated in the midrange. One problem is that the reproduced sound is very harsh and annoying, since the ear has greater sensitivity to the range of about 1 kHz to 4 kHz within the midrange Another problem is that the listener is limited to a position that is equidistant between speakers, since the midrange includes frequencies having wavelengths comparable to the distance between the listener's ears (which have frequencies in the range between about 1 kHz and 2 kHz). As to such frequencies . . . , a slight shift in the position of the listener's head provides an annoying shift in the stereo image. Moreover, the perceived widening of the stereo image resulting from the indiscriminate boosting of the difference signal is small, and is clearly not worth the attendant problems.

Some known stereo imaging systems require additional amplifiers and speakers. However, with such systems the stereo image is limited by the placement of the speakers. Moreover, placing speakers at different locations does not necessarily provide the correct sound perspective.

With other systems, fixed or variable delays are provided. However, such delays interfere with the accuracy of the reproduced sound since whatever delays existed in the performance that was recorded are already present in the recording. Moreover, delays introduce further complexity and limit the listener's position.

Much of what happens when SRS is working involves psychoacoustics. Many of the studies and research performed by those whose papers I read revealed that we perceive the direction from which sounds come by at least three different means. We detect the relative phase of sounds in the case of low frequencies (between about 20 and 200 Hz.) For midrange sounds (300 to 4,000 Hz) we detect relative intensity: Sounds coming from the side sound louder to the nearer ear and sound softer to the ear on the other side of our head. For higher frequency sounds—those having fast rise-times—we judge direction by the relative time of arrival. Those sounds reach the closer ear sooner than they reach the ear that is further away from the source of sound.

There is, however, a fourth factor that governs the way we judge the direction from which sounds originate. It is this factor that, until the development of SRS, had been ignored in stereo reproducing systems. It has to do with the way our hearing system's frequen-

cy response varies, depending on the angle from which sounds reach our ears. The outer ear, known as the pinna, has an effect on the spectrum of sound reaching the eardrum, while the concha (the section of the ear leading to the ear canal) has an effect on the frequency at which the ear canal resonates. Together, these two parts of our ears control the spectral shape (fre-



With just two speakers

SRS makes surround material seem as if it is coming from all around the room.

quency response) of the sounds reaching the eardrum. In other words, the system functions as a sort of multiple filter, emphasizing some frequencies and attenuating others, while letting some get through without any change at all. Response changes with both azimuth and elevation and, together with our binaural (two-ear) capability, helps us determine whether a

sound is coming from above, below, left, right, ahead, or behind. Examples of the response of our hearing system to frontal sounds, and to sounds coming at us from behind, are shown in Fig. 1. Our ears would exhibit still another frequency response for sounds coming at us from either the left or right side.

Much of what I read in connection with my development of SRS was clear about these phenomena. Let me quote from the introduction of the 1977 paper by Robert A. Butler and Krystyna Belediuk, "Spectral Cues Utilized in Localization of Sound in the Median Sagittal Plane."

Spectral cues provided by the pinnae are essential for localization of sound in the median sagittal plane (MSP). Distort the pinnae or occlude their cavities, and the listener is unable to locate at a level of accuracy exceeding that expected by chance (Roffler and Butler, 1968; Gardner and Gardner, 1973). Localization performance in the MSP for sounds recorded via an acoustic manikin and played back through headphones has been shown to be distinctly inferior to that associated with free-field listening (Damaske and Wagener, 1969). Searle and his associates (1975), however, placed insert microphones into the ear canals of five subjects and recorded the output when noise bursts emanated from the MSP. Four of the five participants were able to identify, with reasonable accuracy, the loudspeakers which had originally generated the sound currently being played back via headphone.

The importance of the outer ear structure and the ear canal in the ability to judge the vertical location of a sound had also been researched over the years, as is evident from the following introduction to a 1974 paper by Jack Henbrank and D. Wright, "Spectral Cues Used in Localization of Sound Sources on the Median Plane."

Auditory perception of elevation involves a complex interaction of several localization subsystems. For sound located off the median plane (position having nonzero azimuth angles), auditory localization cues comprise interaural time differences (ITD), interaural amplitude differences (IAD) and *directional filtering of the external ears* [emphasis mine], as well as changes in all these cues during head motion. Though the IAD and ITD mechanisms have been

investigated and explained through azimuthal localization experiments, the generation and processing of external ear filtering cues are poorly understood.

Finally, in one of the most significant papers on the subject of spatial perception, E. A. G. Shaw, in his 1974 paper "Transformation of Sound Pressure Level from Free Field to the Eardrum in the Horizontal Plane," states in his introduction:

The transformation of progressive waves by the head and external ear is of recurring interest in psychoacoustics and audio engineering. It is intimately connected with the spatial perception of sound, provides the essential link between auditory measurements in the free field and with earphones, is relevant to noise control, and is an underlying factor in architectural acoustics.

From the abstract of the same paper, "Sheets of data are presented showing transformation to the eardrum, azimuthal dependence, and interaural difference as a function of frequency from 200 Hz to 12 kHz at 45-degree intervals in azimuth. Other sheets show azimuthal dependence and interaural difference as functions of azimuth at 24 discrete frequencies."

During my studies of these and many other scholarly papers, I began to realize why the usual signal chain from microphones to reproducing loudspeakers could never hope to accurately reproduce sound fields as we hear them in real-life situations. Microphones used in making recordings don't behave like human ears. As can be seen in Fig. 2, omnidirectional microphones have relatively flat frequency response for sounds coming from all directions. Cardioid, or directional, microphones have flat response for sounds coming from the sides and from the front, but are "dead" to rear sounds. So, during playback, if sounds that originally came from one side or the other are reproduced by speakers located up front, those sounds are heard with incorrect spectral response, since they are no longer coming from the sides but from in front. The result is a spatial distortion of the sound field. We are prevented from hearing the proper spatial cues of what was originally performed.

The SRS technique helps to correct these problems by processing the electrical signals so that spatial cues are restored. A block diagram of the system, Fig. 3, is derived from the granted patent itself and shows much of what takes place in the SRS circuit-

Fig. 2A—Microphones also change response for off-axis sound, but not in the same ways as the ear does. Response stays relatively constant but exhibits noticeable treble roll-off, midrange dips, or irregularities at the points of minimum sensitivity.

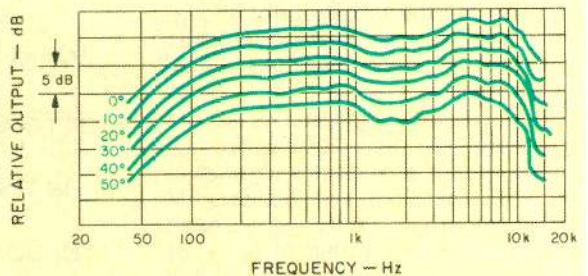
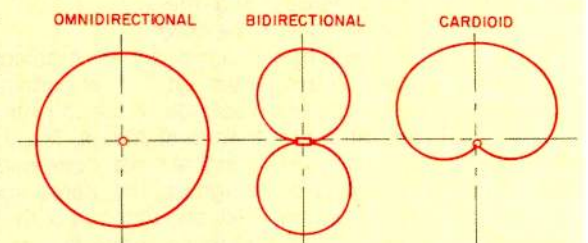


Fig. 2B—Microphones' polar pickup patterns affect their frequency response as well as their overall sensitivity. Omnidirectional microphones have the most constant response to sounds from all directions. Bidirectional mikes have identical response (but opposite polarities) for front and rear sounds. Minimum sensitivity, and greatest change in frequency response, occur at the sides of a bidirectional mike or to the rear of a cardioid.



provide the on/off option so that owners could easily compare stereo performance with and without SRS activated. From what I have been able to determine, most owners leave SRS on all the time, preferring the more spacious imaging that the system provides. It offers the kind of stereo enhancement that's very easy to get used to. Not only is there a fantastic spread of stereo sound, but when videotapes or videodiscs intended for surround sound reproduction are played, much of the illusion of sound coming at you from all around the room is maintained without having to add any loudspeakers besides the pair in the TV!

Hughes markets a stand-alone SRS signal processor, which has been assigned the model number AK-100. It has several front-panel controls that are necessary because of the variety of program material available from CDs, tapes, videodiscs, and radio and TV broadcast and cable sources. If the given signal source has good-quality stereophonic sound with good separation between left and right channels, a user need only press the SRS and power switches on the front panel of the unit. The AK-100 also includes a stereo synthesizer circuit that I consider unique, a control for subtly reducing reverberation on vocalists and decreasing ambient information in quiet passages, plus a filter to reduce the rumble that can be heard in some programs. (For a full description of the AK-100, see the "Equipment Profile" in last April's issue.)

In addition to the SRS, several other companies have introduced stereo-enhancement systems. Most of these are intended for use by recording studios when they create their software in the final mastering or mixdown process. What I feel is unique and different about SRS is that it requires no encoding or processing during software creation. Virtually any conventional stereo program source will benefit when played back on a system in which SRS has been incorporated. I would emphasize, finally, that contrary to many other stereo-enhancement systems, SRS neither employs any sort of time delay nor manipulates the phase relationships of the signals being processed. In effect, it recognizes and identifies what portion of the program being passed through it requires modification to restore proper spatial cues, and it performs such selective modification on a dynamic and continuing basis. A

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Listening and Experience

*I*n our pursuit of higher fidelity, objective tests have so far been unable to replace subjective testing as the ultimate judge of reproduced sound quality. As the purpose of recording and reproducing sound is for it to be heard by human ears, the need for subjective testing may seem so obvious as to be trivial.

What is less obvious is that the human ear is not always a true and consistent evaluator. This fact was brought home to researchers at Bang & Olufsen some years ago, in 1978 specifically, while we were doing a comprehensive set of listening tests that we were conducting in as scientifically rigorous a way as possible. The listeners in the tests were generally regarded as qualified, being the engineers and

technicians who design our audio products. The purpose of the testing was to determine whether moving-coil phono cartridges are inherently better, as is sometimes claimed, than other types of cartridges. We used several samples of different types of cartridges.



One of the simple but comprehensive tests spanned three whole days. We played a short excerpt from a mu-



Villy Hansen is Manager of Bang & Olufsen's Acoustics Department, which started the listening panel discussed in this article and S. K. Pramanik is Manager of Product Technology. Both are based in Struer, Denmark.



VILLY HANSEN and S. K. PRAMANIK


THE ULTIMATE JUDGE
OF FIDELITY IS THE TRAINED
LISTENER, BECAUSE HE FORMS
MORE ACCURATE JUDGMENTS.


sical selection three times, randomly selecting one cartridge for one play and using another cartridge for the other two plays. The listeners were asked to identify the two excerpts that had been played with the same cartridge, and to give their preference regarding overall sound quality. The tests were repeated for all listeners with all possible cartridge pairs and with different types of music. All the cartridge pairs and music types were repeated as a double check.

While one can always draw a conclusion based on an average in such tests, results are only meaningful when listeners are able to negotiate the checks and controls that should be built into any properly designed test procedure. In the test just described, for example, it would be pointless to draw any conclusions about overall quality if the user was unable to identify the excerpt played by the cartridge used only once. Similarly, there must be a clear display of consistency—from one test to the next and from one type of music to another. Otherwise, it must be assumed that the responses depend more on chance, whim, or—at best—some *imagined* difference in sound quality rather than an actual *perceived* difference. Statistically, the differences in responses are measured as standard deviation, which is a test of the “goodness” of the results (but a little too mathematically complicated to go into here).

Unhappily, in the tests using some of our engineers as judges, the deviation between individual tests was so large that the result was judged to be meaningless. After thinking about this for a while, we repeated the same tests but this time used professional listeners, a group of reviewers for British audio magazines. The results were not perfect but showed substantially better consistency, that is, a significantly smaller deviation between repeated tests. This was the trigger we needed to start a professional listening panel at Bang & Olufsen, and the group started functioning in 1982.

For practical reasons, such as finding time to listen during working hours, the panel was chosen from among the

*L*istening tests
are conclusive
only with listeners



*who can consistently
perceive differences
between sounds.*

staff of Bang & Olufsen who responded to an advertisement in our company magazine. From that group, we selected from those who had an interest in listening to music or playing an instrument and who were willing to spend some time listening outside of work in addition to the time spent during work. Finally, we chose so as to have a reasonable distribution of age and sex.

Seven regular members and one reserve were selected for the panel.

They then started a program of training to achieve the level of professionalism we required for our purposes. It was not our intention that the panel members become qualified to make comparative judgments between the different technical qualities of two or more products. Similarly, we did not intend that they make judgments regarding the value of products, that is, the perceived quality versus price. The primary aim was to give the panel the ability to make judgments and to point out reproduction errors, both on an absolute scale.

Absolute judgments are, of course, also relative judgments but where the reference is a sound in nature rather than some reproduced sound, however highly regarded. To be able to make absolute judgments, it is necessary to have a firmly established reference to the sounds of various kinds of music and speech as they are heard in real life. Therefore, one of the requirements for being a member of our listening panel is attending live concerts regularly, and the cost of attendance is considered a company expense. The panel members are also urged to play an instrument, and Bang & Olufsen sponsors a brass band, though

this is a free-time activity.

Selection of the material used for the tests is a primary factor in any procedure that requires absolute judgments, and this is no less true for the music for listening tests. To make judgments on the fidelity of recordings is not easy, but it is part of the responsibility of the panel members. Recorded music is chosen as a group decision, following debate and criticism of potential material. This is one of the facets of compulsory general training. Occurring once a week, training sessions are intended to increase the level of knowledge and awareness of detail in the chain of reproduced sound. For example, one session might focus on a specific instrument in an ensemble, on accessing microphones, or on evaluating room acoustics.

Members of the listening panel are not asked to do A/B testing, that is, they do not attempt to decide which of two or more products is the best. On

the contrary, each member attempts to point out specific faults or deficiencies in the sound of each product they audition. The goal or focus of the test is generally not known by the listener, be it a loudspeaker, a cassette recorder, or a pair of signal cables. This is immaterial to the test procedure. What is of importance is that the listeners are able to convey a precise impression of what they hear to the engineers in the research and development departments. Training in the ability to find these faults or deficiencies, and to convey them precisely to the engineers, is comprised of the listening and discussion sessions. We aim for the development of an exact descriptive jargon for communication between listener and technician.

It is then the job of the engineers to translate these impressions to improvements in the product. Provided engineers know the exact cause, any error can be removed, though not always without giving rise to side effects. In addition, not all subjective impressions can be translated into engineering models, but successive trials can lead to a better understanding of cause, error, and remedy. Continued trials thus help to establish relationships between subjective impressions and objective measurements. If at any time this correlation becomes perfect, the listening panel will have made itself redundant.

One of the pitfalls of a permanent listening panel is that it can become a vehicle for a particular kind of sound. This situation could very well be one of the contributors to "regional" preferences or ideal models in sound quality. It can be partially avoided by constantly refreshing the members' memory by exposure to live sound. In addition, each panel member is provided with a full set of Bang & Olufsen equipment, which is updated with the latest products. Any equipment that is purchased for review is circulated to the members, to make them aware of strong or weak points of competing equipment. Joint listening exercises and panel discussions by members also help.

Listening tests are done blind or double blind, with only an individual

AUDIO/AUGUST 1992

The panelists convey impressions to our engineers, who



then must translate these impressions into product improvements.

listener in the listening room in any one session, so as to avoid results by consensus. In all cases, the operator and the person conducting the test are outside the listening room. Considerable care is taken to ensure that no inadvertent clues are available to the listeners about the purpose of the test.

Finally, the listeners in such carefully conducted tests need the support of an equally carefully thought-out listening room. Such a room was specially constructed for our listening tests, following the principles laid down in the

I.E.C.'s 1985 publication, No. 268-13, "Sound System Equipment, Part 13: Listening Tests on Loudspeakers." Built on a flexibly mounted concrete floor, the room is completely isolated from the rest of the building in order to avoid transmitted sound. A double wall is used. The outer wall is of plasterboard, while the inner is of brick, and they are separated by 250 mm (9.8 inches) of insulating material. With the double doors closed, the room is soundproof. A glass window and a microphone in the room allow the listener and the operator to communicate with each other.

The room itself has a floor area of slightly more than 6 x 5 meters and a height of 2.85 meters (19.7 x 16.4 x 9.4 feet). Note that these dimensions were chosen so as to avoid identical resonances in any two dimensions. A carpeted floor, a wood-paneled ceiling, and living room furniture help to simulate the environment of a home listening room. Thin, acoustically transparent curtains can be drawn at about a third of the distance from the end wall. When lit from the listener's side by small ceiling spots, the curtains are optically opaque.

All source equipment is placed in the operating room, rather than inside the listening room, with signals transmitted at line level from a low-impedance source to sockets in the end wall. From here the signals are amplified as required and fed to the loudspeakers via short cables.

The reverberation time of the room is about 0.4 s at mid-frequencies, falling slightly at high frequencies. However, care has been taken to ensure that there are no peaks or abrupt changes in reverberation at any frequency. Small absorbent panels are placed specifically to damp flutter echo, which is often a problem in rooms with parallel hard surfaces. Rigid walls are necessary to avoid selective absorption due to surface vibration at specific frequencies.

The combination of a well-defined, consistent listening environment and a permanent, well-trained listening panel allows the facility to be used as a true measuring instrument for product evaluation and development.



1

BRYSTON 4B NRB AMPLIFIER

Manufacturer's Specifications

Power Output: 250 watts/channel into 8 ohms, 400 watts/channel into 4 ohms, or 800 watts bridged mode into 8 ohms.

Rated THD or IM: Less than 0.01% at 250 watts, from 20 Hz to 20 kHz.

S/N: 100 dB below full output.

Crosstalk: Below noise level, 20 Hz to 20 kHz at 250 watts.

Slewing Rate: More than 60 V/ μ S; more than 120 V/ μ S in bridged mode.

Power Bandwidth: From below 1 Hz to over 100 kHz.

Damping Factor: Greater than 500 at 20 Hz, re: 8 ohms.

Input Sensitivity and Impedance: 1.25 V for rated output, 50 kilohms.

Dimensions: 19 in. W \times 5 $\frac{1}{4}$ in. H \times 15 $\frac{1}{2}$ in. D (48.3 cm \times 13.3 cm \times 39.4 cm).

Weight: 42 lbs. (19 kg).

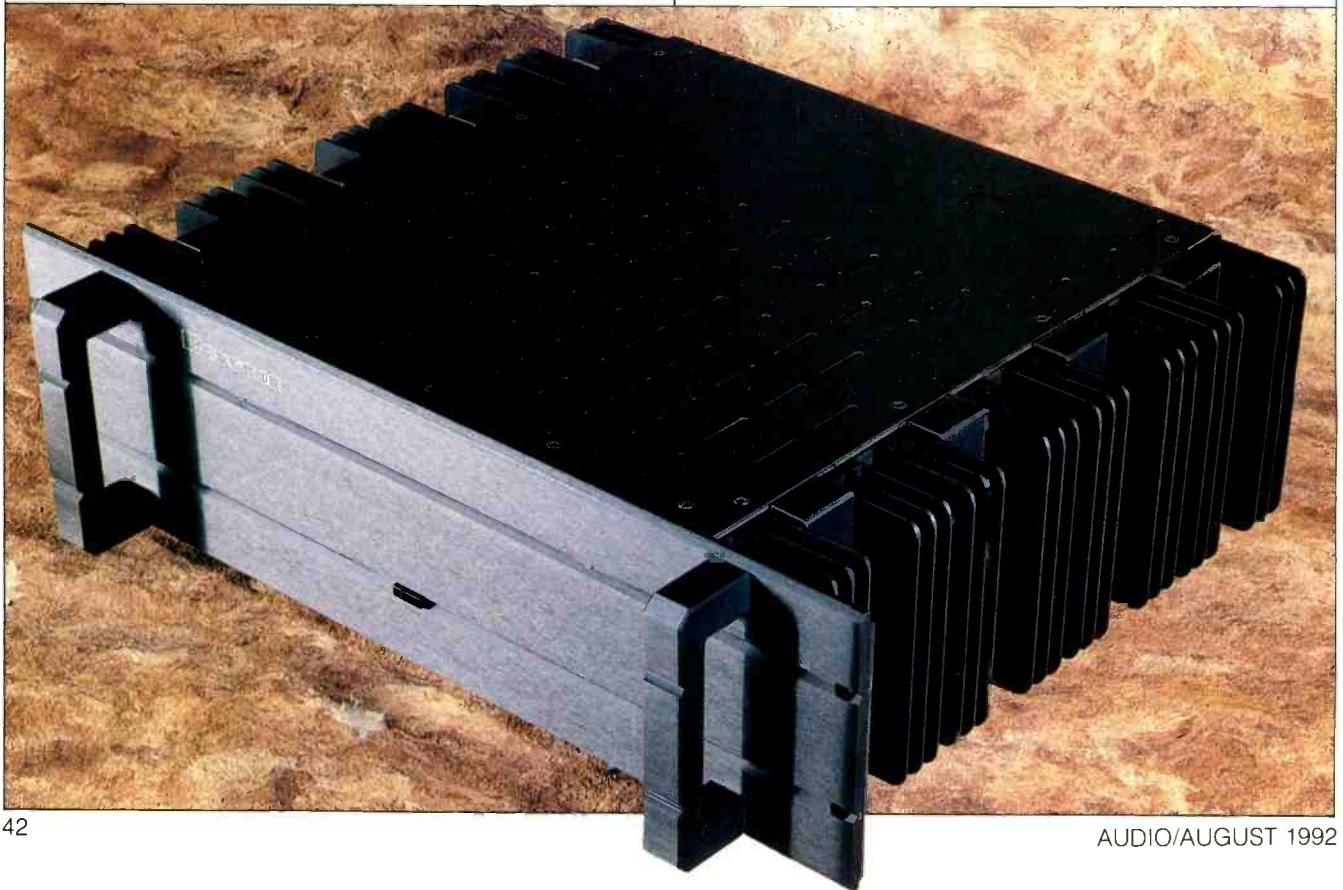
Price: \$2,095.

Company Address: 57 Westmore Dr., Rexdale, Ont. M9V 3V6, Canada.

For literature, circle No. 90

Longtime readers of *Audio* may be puzzled by the model number of this Bryston power amplifier. After all, the widely acclaimed Model 4B has been a Bryston staple since the late 1970s, and I tested one for the November 1985 issue. According to Christopher Russell, Bryston's vice president of engineering, the current Model 4B (with its added NRB designation) represents the fifth generation of this power amp. Much of the design has changed.

To begin with, the power supply now employs multiple small filter capacitors rather than a single pair of large filter capacitors per channel, as in previous versions. This makes for better high-frequency response and a reduction of power loss in the supply. Bryston has added a proprietary soft-start circuit, using Triacs, that is in series with the power transformers (which, incidentally, are now toroids). The company feels that this circuit is needed for starting up such



a high-power, high-current amplifier without blowing circuit breakers or fuses. The NRB does not have the previous 4B's wiring harness, so its channels plug directly into the power supply's circuit board, reducing resistance for improved current flow and filtering.

An input buffering circuit has been added, which linearizes the signal when driven from moderately high source impedances, according to Bryston. The buffer is also used for the balanced inputs (another feature new since the original 4B) and as the inverting input for bridged operation.

Even such simple functions as the front-panel clipping indicators have been improved. These LEDs now indicate any deviation from linearity, including shorted outputs or strong out-of-band information such as r.f. or d.c. The LEDs turn red in the presence of any distorted or inappropriate signal, however brief that signal may be, right down to the millisecond level. After transient overloads or other problems that go by too fast to be seen, the LEDs glow amber for a quarter of a second. For persistent conditions, the LEDs glow red.

The front panel of the 4B NRB has only the power switch and clipping indicators. The rear panel has a socket for the detachable grounded line cord at the left, output terminals and related switches in the center, and inputs at the right. For two-channel operation, speaker connections are made to each channel's red and black binding posts; in bridged mode, one speaker load is connected between the two red binding posts.

Further to the right are sets of unbalanced phono and balanced XLR input connectors. A tiny toggle switch is used to choose the type of input desired. Another small toggle switch selects dual-channel or bridged operation. A third toggle switch, "Ground Lift," can be used to break the connection between the signal and chassis grounds in installations where external ground loops cause hum problems. The switch is normally left in its shorted position. For safety's sake, the switch does not disconnect the chassis from the ground prong on the power cord.

Measurements

Figure 1 shows overall frequency response of the 4B NRB amplifier when driven to a nominal 1 watt per channel. Obviously, Bryston's engineers believe in ultra-wideband design. Response is flat down to 10 Hz (the lowest frequency available from my test equipment) and down a mere 1.3 dB at 100 kHz.

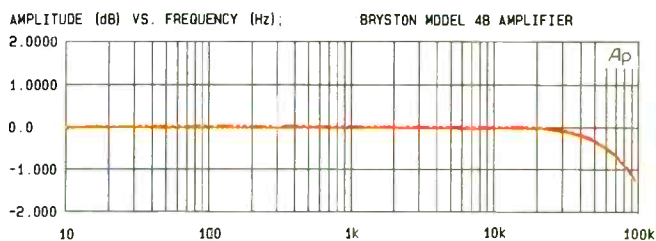
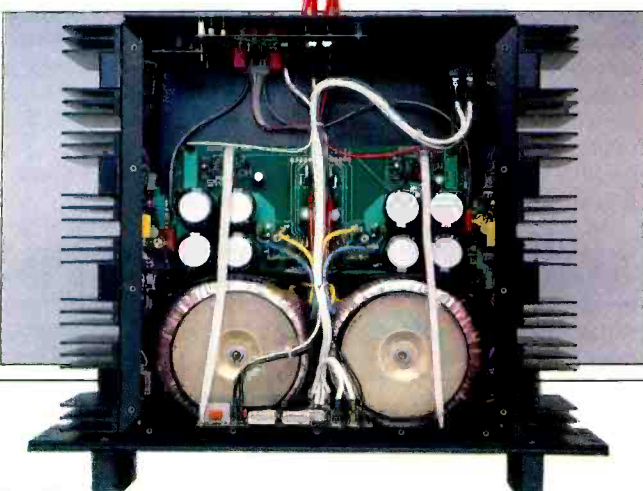


Fig. 1—Frequency response, at 1 watt output.

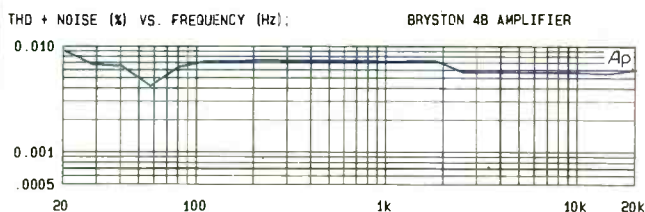


Fig. 2—THD + N vs. frequency at rated output.

For Fig. 2, generator input was varied dynamically to maintain a constant power output of 250 watts per channel into 8-ohm loads. Total harmonic distortion plus noise remains below the rated 0.01% level at all audio frequencies, measuring approximately 0.007% at mid-frequencies and an even lower 0.0058% at the high end of the spectrum.

When testing amps for THD + N as a function of power output, I nearly always find that distortion rises more rapidly at either 20 Hz or 20 kHz than at 1 kHz. However, this was not the case with the Bryston (Fig. 3), whose THD + N characteristics are virtually the same at the frequency extremes as they are at 1 kHz. Clipping occurs at about 280 watts per channel for all three test frequencies!

Figure 4 shows how SMPTE-IM distortion varied as a function of power output. In this case, the SMPTE-IM test signal consisted of a 60-Hz and a 7-kHz tone in a 4-to-1 amplitude ratio. The SMPTE IM remains under 0.01% for output levels below 100 watts per channel and rises to a still insignificant 0.025% before actual clipping occurs at an equivalent output level of about 300 watts per channel.

I made some additional tests using 4-ohm loads, and the Bryston 4B NRB delivered 423 watts per channel, with both channels driven, for the rated THD level of 0.01%. Limitations of my lab prevented me from operating the amp at rated output into 4-ohm loads for extended periods. After all, 400 watts per channel into 4-ohm loads represents a current flow of 10 amperes per channel (20 amps for both channels), a bit more than the Variac that I use to maintain a constant 120-V line voltage can take for long periods.

I made another quick check of power output for rated distortion with the amplifier operating in bridged mode. Before my noninductive 8-ohm load began to overheat, I was able to observe a power output level of 828 watts at mid-frequencies for the rated distortion level of 0.01%.

From the dynamic opening bars, the 4B pumped power into my speakers without any perceptible distortion or overload.

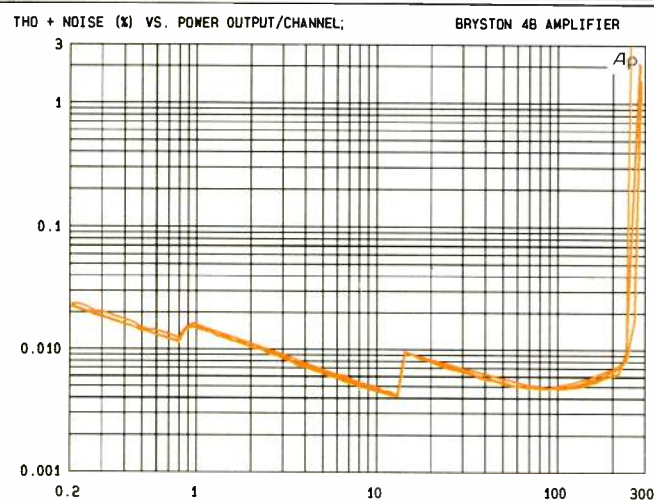


Fig. 3—THD + N vs. power output per channel into 8 ohms at 20 Hz, 1 kHz, and 20 kHz.

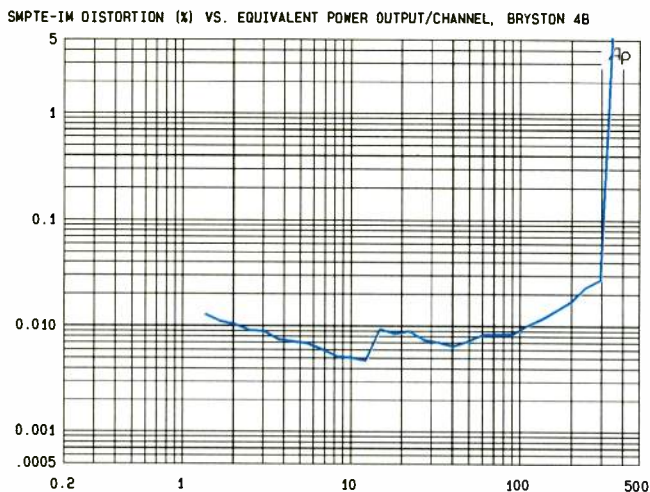


Fig. 4—SMPTE IM vs. power output per channel at 8 ohms.

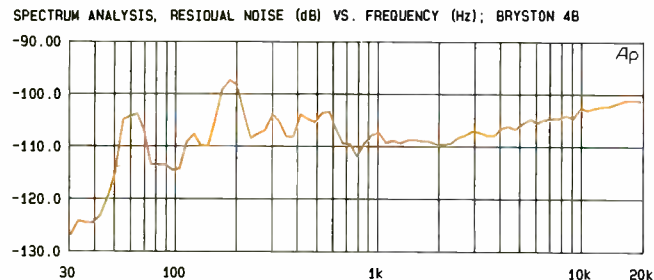


Fig. 5—Spectrum analysis of residual noise, referred to an output of 1 watt.

Returning to the dual-channel mode, and with 8-ohm loads connected, I measured the damping factor of the amplifier as 520 at a reference frequency of 50 Hz. Overall A-weighted S/N ratio measured 93.9 dBA for the left channel and 94.2 dBA for the right when referred to 1 watt output, which corresponds to 117.9 and 118.2 dBA, respectively, when referred to the full rated output of 250 watts. Bryston claims an S/N ratio of only 100 dB, which I suspect is an unweighted figure rather than the A-weighted one specified in the EIA Standards I use. Figure 5 is a spectrum analysis of residual noise as a function of frequency, plotted with a third-octave bandpass filter, again referred to 1 watt out. Notice that even the worst power-supply hum, at 180 Hz, is attenuated by nearly 100 dB.

Use and Listening Tests

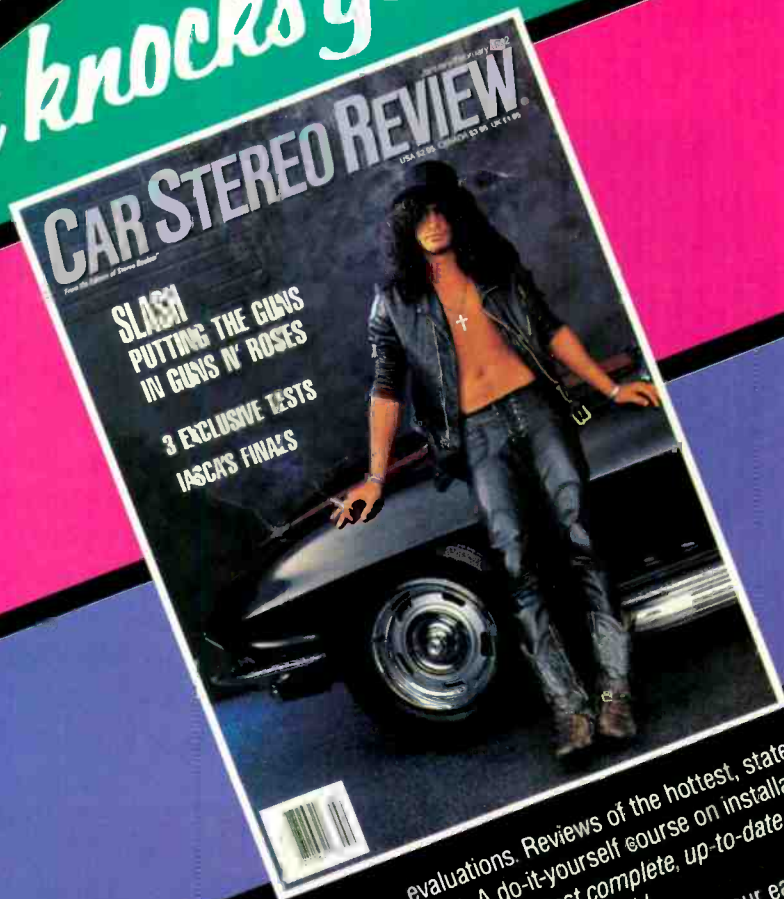
My recollection of the earlier Bryston 4B is that it sounded superb, and I would have liked to have had it on hand for comparison. One can hardly be expected to remember the sound of a component evaluated almost a decade ago! To eliminate as many variables as possible, I connected my reference CD player directly to the amp and used the player's variable outputs to control loudness levels.

I chose a couple of new discs for use in evaluating the sound of this latest incarnation of the Bryston 4B. The first was a Delos release (DE 3109) featuring a suite from Richard Strauss' *Der Rosenkavalier*, the same composer's *Burleske* for piano and orchestra, and a suite from his opera *Die Frau Ohne Schatten*. The dynamic opening bars of this last selection, following on the heels of the hushed final bars of the *Burleske*, were an ideal test of the amplifier's ability to pump power into my less-than-high-efficiency KEF speakers without any perceptible distortion or overload. As for Carol Rosenberger's piano playing in the *Burleske*, her Yamaha CFIII concert grand never sounded better. Of course, credit here must go to John Eargle, who serves as recording engineer for all Deios projects, but I have no doubt that the transparency of sound and the remarkable musical realism I enjoyed was also attributable to the excellent design of the Bryston 4B NRB.

The second disc I used in my evaluation was *Classics for All Seasons: Spring* (Telarc CD-80321), which has 16 brief excerpts from previously released Telarc discs. I was especially impressed by the Schubert excerpt *Scherzo: Presto*, from the Piano Quintet in A Major, the "Trout" (track 9), where the chamber ensemble and John O'Connor's piano came through with an intimacy that seemed to bring the players right into my listening room. Another excellent selection on this disc (and one that I think would be useful in evaluating any piece of audio equipment) was the Allegro from Vivaldi's *Mandolin Concerto in A Major* (track 14). The overtones produced by a mandolin are quite complex and need to be reproduced in perfect amplitude relationships—a task not easily achieved by lesser amplifiers.

All in all, I could not fault this latest version of the 4B in any way. Of course, not everyone is prepared to spend in excess of \$2,000 for a power amplifier, but I have come across some esoteric amps that cost considerably more without offering any significantly better area of performance than this latest contribution from Bryston. *Leonard Feldman*

The magazine that knocks you on your ear



It used to be simple. You had a car. It came with a radio. You listened. Period. Now you've got options. So many options, it's easy to get blown away just trying to find components that fit together—and fit your budget too. So what do you do when it's time to upgrade your car stereo?

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Listening in the 90's

Today people have become more and more space conscious. Many apartment dwellers don't want to give up valuable floor space for large speaker systems. Others who are planning a surround sound or home theatre system simply don't have the room for more speakers in their listening rooms or hesitate to commit the floor or wall space to a good sounding pair of speakers.

Until now, serious music lovers have had little, if anything, to choose from that would produce a large, bigger-than-life sound in a small, compact size. Systems that fit one's space requirements have been woefully disappointing in sound quality.

The RM 3000 Three Piece System

Polk's engineers had determined long ago that there were indeed certain technical advantages in

sonic performance.

The small satellites can be located on shelves, mounted on a wall or placed on their own floor stands. They are very attractive and yet small enough to be hidden from view if desired.

The RM 3000 subwoofer is also small enough to sit behind your furniture and can be used on its side to fit into tight spaces. And since it is beautifully finished, it can be used as a piece of furniture.



The RM 3000's satellites measure 7"H x 4 1/4"W x 5 3/8"D and are available in black matrix, gloss black piano or paintable white. The subwoofer is 12 1/2"H x 20"W x 12 1/2"D and is available with black wood grain sides and a black, mar-resistant top.

The Legendary Sound of Polk

In the tradition of Polk Audio, Matthew Polk and his team of engineers were determined to make the RM 3000 sound better than any other speaker of its type.

Initial reactions have been filled with superlatives including Julian Hirsch of *Stereo Review* magazine who says, "...they sound excellent...spectral balance was excellent—smooth and seamless."

Sound as big as life from speakers

small speaker systems. Both high and mid frequencies could be faithfully reproduced with superior transient response and dispersion characteristics, and the convenient, more flexible placement of small enclosures within the listening area could create an ideal sound stage. Unfortunately, reproducing the life-like, full body of the lower frequencies could not be achieved in a truly compact enclosure.

Polk's RM 3000 replaces the traditional pair of speakers with three elements, two compact midrange/tweeter satellites and one low frequency subwoofer system. This configuration makes it easy to properly and inconspicuously place the system within your listening room while offering superior

Behind these accolades is an impressive technical story.

The Technical Side

The big sound of the RM 3000 is due, in part, to the unique arrangement of the tweeter and midrange elements. This "time aligned system" delivers the high and mid frequencies at precisely the same instant. The result is a clear, lifelike and expansive presentation.

The cabinet materials selected for the satellites are over four times as dense as typical enclosures. The black matrix finish is a non-resonant polymer aggregate (FOUNTAINHEAD®). The gloss black piano and paintable white finishes are rigid ABS



Polk's RM 3000 Ultra Pure Speaker System easily fits into today's home decor.

small enough to live with.

surrounding a mineral filled polypropylene inner cabinet. Polk engineers have all but eliminated any "singing" or resonating of the satellite enclosure. You hear the effortless, free sound of a much larger system.

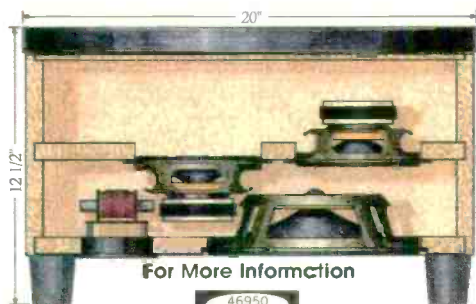
Most subwoofer systems look alike on the outside, but the Polk is worlds apart on the inside. Utilizing twin 6 1/2" drivers coupled to a 10 inch sub-bass

radiator, the bass is tight and well defined. There is no tuned port to create "whistling" or "boominess" of the bass frequencies.

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You really won't believe how good the RM 3000 sounds until you hear it. We invite you to your nearest authorized Polk dealer for a demonstration. You'll hear sound as big as life...from a speaker you can live with.

You'll hear the next generation of loudspeakers.



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For deep, well defined bass, Polk uses twin drivers coupled to a sub-bass radiator. Normally, one subwoofer system is used for both channels. For those desiring even greater low frequency performance, a second subwoofer can be added, one fed by the left channel, the other by the right channel.

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2

FORD JBL
CAR AUDIO
SYSTEM**Manufacturer's Specifications
Amplifier Section**

Main Output: Four channels, 15 watts per channel at 2.0% THD + N, 13 watts/channel at 0.08%, both from 200 Hz to 20 kHz into 4-ohm loads with all channels driven.

Subwoofer Output: 85 watts at 2.0% THD + N, 80 watts at 0.08%, from 20 to 200 Hz into 4-ohm loads.

General Specifications

Prices: Ford JBL Audio System, \$526 for non-luxury vehicles and \$577 for all Lincolns (see text); dealer-installed digital signal processor, \$449; trunk-mounted CD changer, \$833 factory-installed (1992 Lincoln Town Car only) or dealer-installed.

Company Address: Ford Audio Systems, 16800 Executive Plaza Dr., Suite 209, Dearborn, Mich. 48126. For literature, circle No. 91

Not too long ago, the only way to get high-fidelity stereo sound in your car was to install your own system, with components made by companies that specialized in car stereo equipment. Now auto makers such as Ford not only offer high-quality audio systems of their own but also team up with well-known audio manufacturers to create customized sound systems that rival "aftermarket" car audio. These systems are often equalized to suit particular cars' listening environments—which, of course, the car makers have the advantage of knowing in advance. For the system reviewed here, JBL designed the speakers and served as consultants to Ford during development.

As usual with factory-installed stereo systems, the real price is hard to state succinctly. The Ford JBL Audio Sys-

tem, which includes special speakers and separate pre-equalized amplifiers matched to each car model, costs \$526 more in non-luxury vehicles than a simpler stereo system (and \$577 more in Lincolns). However, counting the price of the simpler system—whose price, in turn, depends on what comes standard with the car model you buy—the total cost will run approximately \$1,028.

In the 1992 Lincoln Town Car, the system is available with an optional digital signal processor, and trunk-mounted CD changers are available in most models. Since bench tests of a DSP will yield nothing much beyond wild-looking curves, I left this evaluation to Technical Editor Ivan Berger for his "Behind the Wheel" report and tested only the head unit and four-channel amplifier in my lab.



Control Layout

All controls are pushbuttons or rockers and are grouped by function—tape controls at the upper right, tuner controls at bottom center and lower right, and the remaining controls just below the display at the left. Pressing the "Audio" button changes the function of the "Volume" rocker to adjust bass, treble, balance, and front/rear fading. During these adjustments, the display spells out what function is in use, and the illuminated bar below the readout of station frequency changes to show that function's setting.

The volume control lowers the level quickly but raises it slowly, so as to double as a muting control when you need some instant quiet while you ask directions. After loud listening, if the system is turned off by the ignition switch (but not if it's turned off by its own switch), volume is automatically lowered to a preset moderate level when the system is turned back on again. This feature should appeal to parents of teenagers, as they won't be blasted by sound if their kids used the car last. Incidentally, the volume control might also be considered a loudness control, as lowering its level automatically boosts the bass.

Several tuning options are available. Pressing the "Seek" rocker finds the next station up or down the dial. If you press "Scan Tune" before you use the rocker, the tuner will run through all listenable stations in the direction you select, stopping for 5 S to sample each; scanning stops when the same side of the rocker or "Scan Tune" is pressed again. For manual tuning, you press the "Scan Tune" button twice, then press the "Seek" rocker to move in the desired direction; if the rocker is held down, the radio zips through the station frequencies until the rocker is released again. If you leave the rocker alone for 5 S, normal seek tuning will resume.

There are 18 station memories, for six AM and two sets of six FM stations. To set a single memory, you tune a station in and hold down the desired memory button for 2 S. Pressing "Auto Preset" loads all six memories on the currently selected band; if you use this feature while travelling, you can restore your home settings by pressing the button again. Holding the button down for 3 S will load all 18 memories, a feature largely used by dealers to preload the radio before it's sold.

At night, when AM signals carry farther and can interfere with one another, the seek circuit's sensitivity automatically switches to local mode on AM. (How does it know it's nighttime? It senses when you've turned the headlights on.) If no stations are found, however, it will switch back to distant mode and try again.

Two noise-reduction systems are included. In AM or FM, DNR noise reduction will turn on when the signal is weak and turn off when the signal becomes strong again. And for tape, of course, there's Dolby B noise reduction.

In addition to the dedicated tape controls at the upper right, some radio buttons also have tape functions. The "Seek" rocker moves the tape forward or back to the start of a selection, while pressing both "Scan Tune" and the "Seek" rocker plays through the first 8 S of each track in the indicated direction.

The tape can be loaded whenever the ignition is on but only plays if the "Power" switch is on. Pressing the "AM/FM"

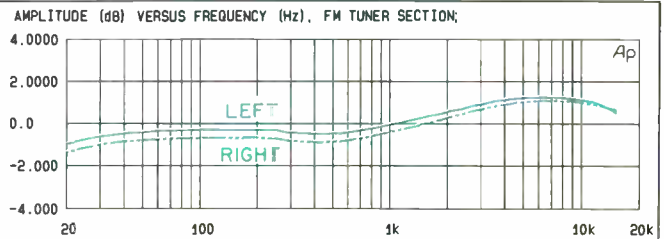


Fig. 1—FM frequency response.

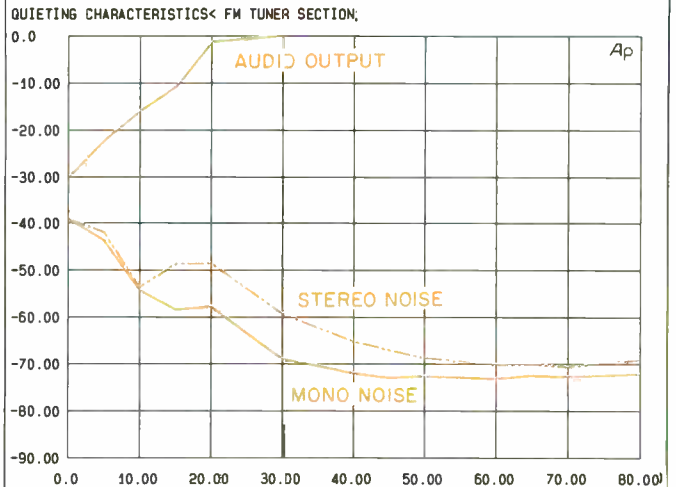


Fig. 2—FM quieting characteristics.

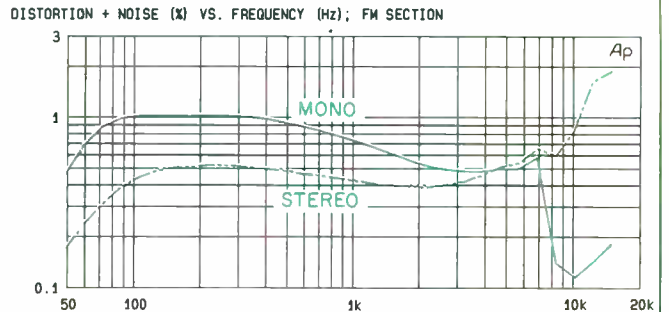


Fig. 3—THD + N vs. frequency, FM section.

The tuner is quite sensitive on both frequency bands, and AM reception was especially impressive.

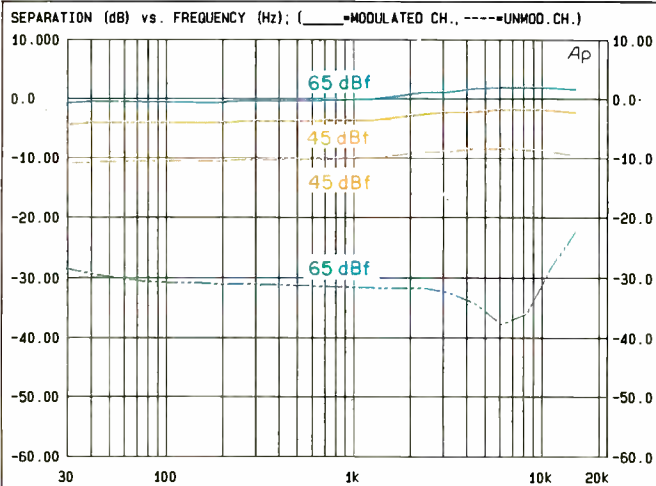


Fig. 4—FM frequency response and channel separation.

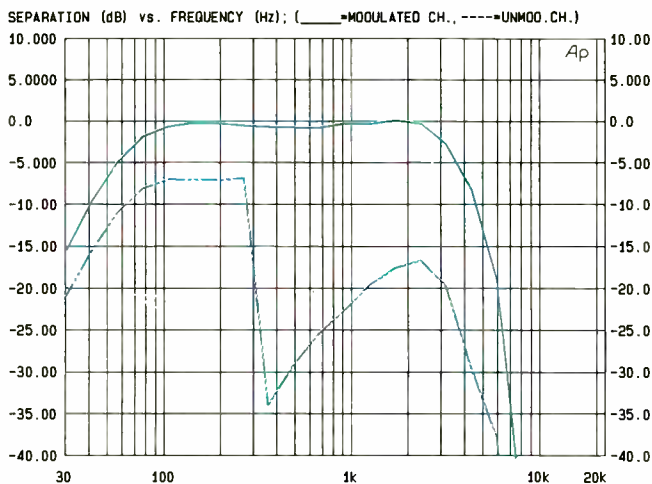


Fig. 5—AM frequency response and channel separation.

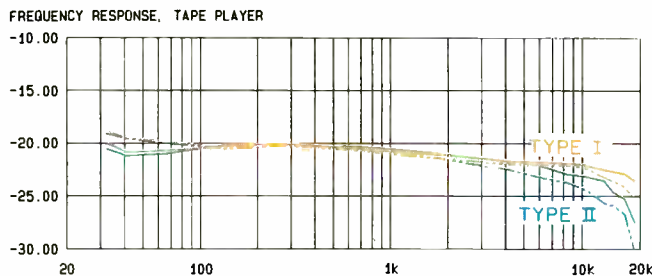


Fig. 6—Tape frequency response.

button during tape play stops the tape without ejecting it and turns on the radio. Fast forward and rewind can be operated during radio play. The tape is automatically tightened when a new cassette is inserted.

The tape controls also can be used to operate a CD changer if that changer is factory-installed. For 1992, this option is only available on the Lincoln Town Car, though it will be available on the Lincoln Mark VIII and Ford Crown Victoria for '93.

Tuner Measurements

Figure 1 shows the frequency response of the FM tuner section of the head unit. Response is down about 1.0 dB at 20 Hz and exhibits a slight rise of no more than a dB or so at the high end. Figure 2 is a plot of the FM section's quieting characteristics. Unlike many car stereo tuners, this one attains full audio output with only 20 dBf of signal applied. In mono, 50-dB quieting requires a signal level of about 17 dBf, while in stereo, 50-dB quieting is attained with signal inputs as low as 22 dBf. It should be noted that at such low signal levels, a good deal of "blending" takes place, resulting in substantially reduced channel separation (as will be seen shortly). Usable sensitivity, the signal level at which THD + N reaches 3%, was about 15 dBf in mono and 22 dBf in stereo. (The 22-dBf figure for stereo 50-dB quieting just cited includes noise alone, not distortion.)

Figure 3 is a plot of THD + N versus frequency for mono and stereo FM reception. Over much of the frequency range, THD + N is actually lower in stereo than in mono. At 1 kHz, THD + N measures 0.41% in stereo and 0.72% in mono.

Figure 4, channel separation for input signal levels of 65 and 45 dBf, shows the effect of stereo blending. At the stronger signal level, separation is slightly more than 30 dB at 1 kHz, 100 Hz, and 10 kHz. At the weaker signal level, separation decreases to around 7 dB—still enough to offer some semblance of stereo imaging but reduced significantly to cancel some of the background noise that would otherwise be heard.

A spectrum analysis (not shown) disclosed high levels of 19-kHz pilot tone, 38-kHz subcarrier, and sidebands of 38 kHz. This is typical for car audio, but these components are inaudible (even 19 kHz is inaudible under most car listening conditions) and car stereo outputs are not fed into tape recorders. (Home receivers must filter out these frequencies so as not to interfere with the proper operation of Dolby noise-reduction encoding circuits in tape decks connected to them.)

I next measured the frequency response of the AM tuner section, and results are shown in the top curve of Fig. 5. Clearly, Ford Audio did not build this AM section in accordance with recently adopted NRSC-1 voluntary standards (which calls for response out to 7.5 kHz), but the attenuation at high frequencies seems no worse than what I've found in most home "hi-fi" tuners and receivers that do not have improved bandwidths. Response between the -6 dB roll-off points extends from 50 Hz to 3.3 kHz.

Since this tuner can receive Motorola C-QUAM AM stereo, I went a bit further than usual and measured THD + N over the AM tuner's useful frequency range, with modulation

Cassette playback response was better with Type I than Type II tape, but even with the latter, response was only down 5 dB at 15 kHz.

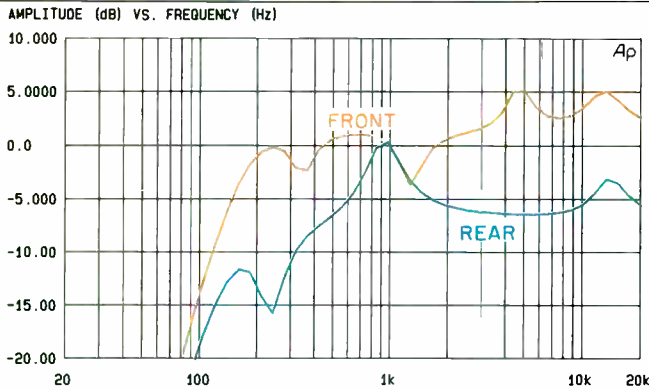


Fig. 7—Frequency response of front and rear amplifiers, showing custom equalization; see text.

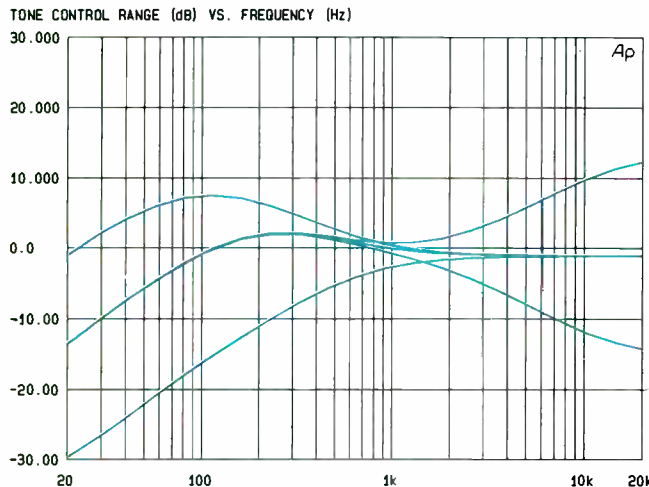


Fig. 8—Bass and treble control range.

levels of 30%. From 200 Hz to about 1.7 kHz, it was 2% or less in mono and about 1.5% or less in stereo. Above 1.7 kHz, THD + N rose, until at 3 kHz it was nearly 6% in mono and 5% in stereo. Typically, at mid-frequencies THD + N was just under 3% for mono and about 2.5% for stereo. I also measured channel separation and included that in Fig. 5. This is a strange curve indeed! Although separation at the lower frequencies is minimal (less than 10 dB), it suddenly increases at mid-frequencies to around 34 dB and then decreases once again to around 16 dB at 3 kHz. Perhaps Ford has found that this type of characteristic works best in the AM band, taking into account the fact that localization of sounds is minimal at low bass frequencies.

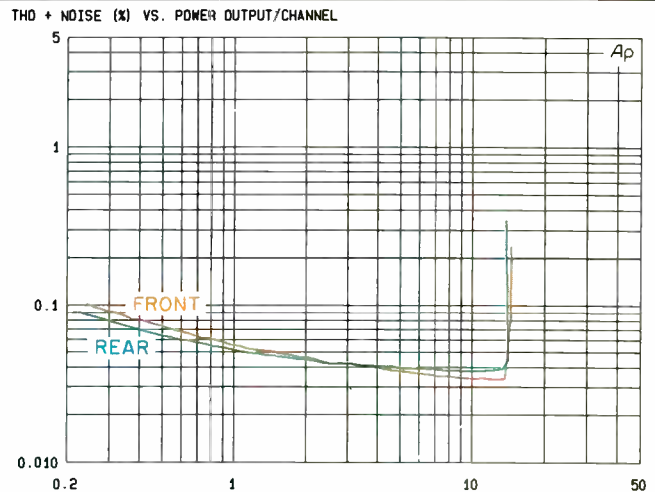


Fig. 9—Amp THD + N vs. output; see text. Measurements were made only at 1 kHz due to amps' built-in equalization.

Tape Player Measurements

I measured the performance of the tape player section using calibrated Type I (normal-bias) and Type II (high-bias) test tapes supplied by TDK. These tapes contain frequencies only up to 18 kHz and were recorded at a -20 dB level referred to 250 nWb/m. Figure 6 shows the excellent frequency response obtained with the Type I tape and the somewhat poorer response obtained with the Type II sample. Even with the Type II cassette, however, response is down approximately 5 dB at 15 kHz—not at all bad for a car player!

A-weighted signal-to-noise ratio was 56.4 dB without Dolby noise reduction (referred to a record level of 250 nWb/m) and 65.6 dB with Dolby NR turned on. The IEC peak weighted wow and flutter measured around 0.2% on average, while weighted rms wow and flutter (the specification most often listed by tape deck makers) was 0.12%, a very respectable figure for a car tape player.

Amplifier Measurements

It really doesn't matter much whether the amplifiers of a complete car audio system deliver 10 or 500 watts per channel. What's important is how much clean sound power you can achieve within the vehicle, given the chosen combination of amplifiers and speakers. Furthermore, in a system such as the Ford JBL, amplifier response is generally equalized to compensate for the unusual (and generally hostile) listening environment. Despite this, I was still interested in checking out the main four-channel amplifier, as it represents a major component of the overall system.

Figure 7 shows the frequency response of the front and rear channels. Note the roll-off at the bass end, allowing the separately powered bass driver mounted in the trunk of the

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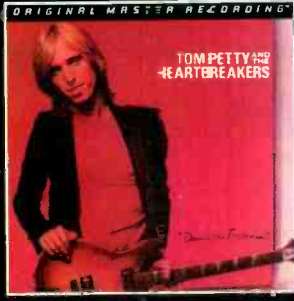
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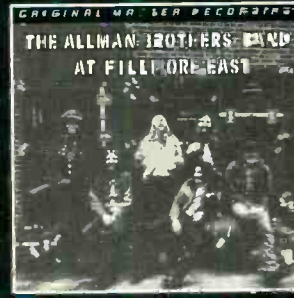
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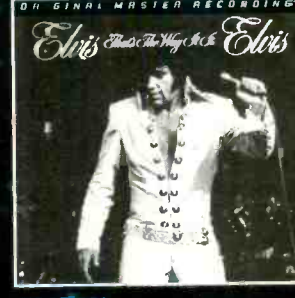
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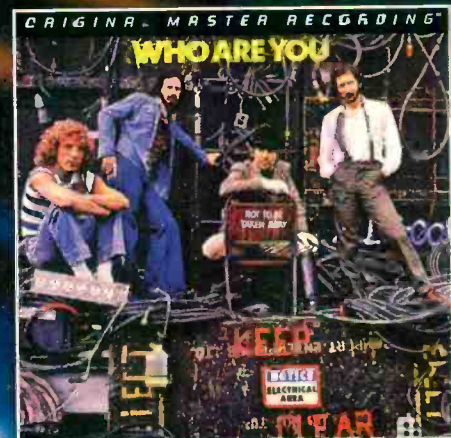
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vehicle to take over the job of amplifying any signals below 200 Hz.

At this point, I returned to the head unit of the system and applied a signal directly to the inputs, where auxiliary equipment such as Ford's optional CD changer signals would be applied. This enabled me to plot the range of the bass and treble tone controls, shown in Fig. 8. If you ignore the bass roll-off when the bass control is set to its mid-point, the range of the bass and treble controls is about what you would expect from a well-designed tone-control circuit.

Ford has wisely added a limiting circuit to both the front and rear channels of the main amplifier. As a result, once inputs reach levels that attempt to produce more than the rated 15 watts per channel, no further increase in power output is obtained. More importantly, distortion barely rises, even with double or triple the input level required to produce a nominal 14 or 15 watts. This feature is not apparent from Fig. 9, the usual plot of distortion as a function of output power, but was quite obvious when I attempted to push the amplifier into clipping. It would not be pushed! Output waveforms remained nicely sinusoidal rather than assuming the appearance of clipped or square waves. At the lowest signal level required to produce 14 watts per channel at 1 kHz, THD + N is 0.07%; doubling that input results in a distortion level of just 0.23% and only a minute power increase, to around 15 watts per channel. Much the same holds true for the rear channels. Again, THD + N for an output of 14 watts is around 0.07%, while doubling the input signal level results in only a slight increase in power output and a rise in THD to just above 0.3%.

To determine whether the readings taken from Fig. 9 were actual distortion and not dominated by residual noise, I analyzed the spectrum of a 1-kHz signal adjusted to produce an output of just over 14 watts per channel. The dominant distortion components were a second harmonic at -64 dB, a third harmonic at -67 dB, and a fifth harmonic at -68 dB, all referenced to the 14-watt output. These levels correspond to an overall THD figure of 0.087%.

At this point, I turn the reporting over to Ivan Berger. I'll be interested to learn if the fine user-friendly features and the better-than-average lab measurements of the Ford JBL head unit translate to equally good sound on the road.

Leonard Feldman

Behind the Wheel

I'd expected to miss the outstanding ergonomics of Ford's previous head unit (reviewed in the May 1988 issue), sacrificed to the added crash safety and visual appeal of this flat-faced design. But I didn't. While the tuning buttons are now far off to the right, the resulting control grouping is very logical. All is easy to see from either front seat, the buttons are angled slightly upwards toward the user, and Ford mixes button shapes, concave and convex button surfaces, and raised identification dots to allow easy operation by touch alone. Station buttons are grouped in a 3 x 2 matrix rather than lined up in an endless row. As in Ford's last unit, the volume-down control works much faster than the volume-up, for quick muting. Night illumination is good, with the tape slot outlined brightly.



Controller for Ford JBL digital signal processor.

The digital signal processor, a dealer-installed option, is operated by a small wired remote control. You can tell its controls apart by touch, but you can't figure out their settings without looking at the remote's tiny display or remembering the current setting and counting button pushes until you reach the one you want. On the other hand, most people pick settings primarily by ear anyway. The remote is easily concealed for security and can be placed anywhere you find it handy.

If you have the optional trunk-mounted CD changer installed by your dealer, it will be operated by a similar small remote. If factory-installed, it is controlled by the head unit. For the most part, all CD functions use the analogous tape-control buttons (e.g., "Rew" and "FF" to change discs, "Seek" for track selection). Pressing the Dolby NR button during CD play activates the compression circuit—hardly as obvious as the other CD controls but logical nonetheless.

My one problem with the head unit was that, after pressing the "Audio" button to select such functions as balance, bass, and treble, I tended to try varying those functions by pressing the adjoining "Power" and "AM/FM" buttons rather than the rocker down below. But this might be just my idiosyncrasy rather than a glitch in Ford's ergonomics.

The radio's performance matched the level of the ergonomics. The tuner is quite sensitive, on both AM and FM, but blending on weak stereo signals seemed slow. For instance, turning one rocky corner that I use as a reception test, I got both more noise and greater separation than I'm used to in that place—but once I'd gotten around the corner, reception remained pretty good for a mile or two more than usual. However, I did suffer from some unexpected station breakthrough at one point, a deficiency in either adjacent-channel selectivity or capture ratio.

I was especially impressed by the AM section. In my old Connecticut stamping grounds, I heard New York AM stations as clearly as I had when I grew up there, despite the decades of growing interference since then. When bridges

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How good the DSP sounds depends on how well you match its ambience and "Seat" settings to the music and the recording.

and tunnels made the AM fade, it did so cleanly, without crackles. The AM stereo image seemed to wander a bit in late-night distant listening.

My test car, a Lincoln Town Car, was very quiet, which made the sound easy to evaluate. Even so, the compression circuit was a must to preserve low-level details in any music that had wide dynamic range.

Bass extension was good, and the bass sound was rich without being clunky. Using the Autosound 2000 test disc, I could detect frequencies as low as 18 Hz but could not clearly hear them until 51 Hz. Bass output became increasingly loud and smooth between about 60 and 80 Hz, and there were no audible peaks.

Overall, there seemed to be excessive warmth (common in car stereo) that rounded off the corners of the sound, and instruments generally seemed to lack dimensionality. The sound was eminently listenable but didn't quite sing.

Ford's digital signal processor offers six ambience simulation modes that are fairly self-explanatory ("Hall," "Orch," "Opera," "Church," "Club," and "Stadium") plus a "Talk" setting. Ford says "Talk" eliminates spatial enhancement and rolls off the bass and nonvocal harmonics, for greater vocal clarity; it also seemed to lower level a bit, maybe 3 to 6 dB. "Talk" has its own pushbutton, and the "Mode" rocker is used to cycle through all the rest. The "Seat" rocker does not relate to listener positions within the car but to listening

position within the simulated ambience—in effect, it varies the ratio of direct to reverberant sound.

How well the DSP works depends on how well you match the setting to the music. The most welcome setting for me was "Talk," as it kept announcers from sounding like they were in a felt-lined cavern. As with other car DSP units, the most extreme setting, "Stadium," was too muddy for anything I listened to (Users of car DSP systems should have the chance to program out undesired settings, the way you can program out TV channels you never watch.) Opera sounded best on either "Church" or "Orch," depending on the recording. A Judy Collins recording sounded muffled on the "Club" setting, most natural on "Hall" and "Opera." Old mono recordings sounded pretty good on "Opera" or "Hall," again depending on the material. With the fader centered, I found all DSP positions too muddy when listening to a duo-piano recording of music by Percy Grainger, but when I changed the fader setting to full front, all DSP settings (except "Stadium") improved the sound, with "Orch" giving the best-centered image. "Hall" worked well with a guitar quartet on an Opus 3 test disc.

Overall, I have unstinting praise for the head unit's ergonomics and FM performance. The DSP system was a definite enhancement, though neither this nor any other car stereo DSP I've heard has convinced me that ambience processing has totally fulfilled its promise. *Ivan Berger*

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Frequency Response: 41 Hz to 30 kHz, ± 3 dB.

Sensitivity: 92 dB at 1 meter with 2.83 V applied.

Crossover Frequencies: 400-Hz low-pass on separate woofer, 2.5-kHz low-pass and high-pass between dual-concentric tweeter and woofer.

Crossover Slopes: First-order, 6 dB/octave.

Impedance: 6 ohms nominal, 4 ohms minimum.

Recommended Amplifier Power: 10 to 175 watts per channel; maximum, 300 watts/channel peak.

Dimensions: 38 $\frac{3}{8}$ in. H x 12 $\frac{1}{2}$ in. W x 9 $\frac{1}{4}$ in. D (97.5 cm x 31.8 cm x 24.8 cm).

Weight: 46.2 lbs. (21 kg) each.

Price: \$1,599 per pair in black ash or walnut; Model 6s1 base, \$99 per pair.

Company Address: c/o TGI North America, 300 Gage Ave., Unit 1, Kitchener, Ont. N2M 2C8, Canada.

For literature, circle No. 92



Tannoy, one of Britain's oldest loudspeaker manufacturers, pioneered the use of dual-concentric drivers back in the 1930s. Most of the models in their current "Sixes" line have dual-concentric drivers whose woofer magnets serve as horns for compression tweeter drivers, while their woofer cones serve as horn extensions. The Model 615 is the top speaker in this line.

Tannoy's latest 8-inch, dual-concentric driver, used in the 615, has both an

improved horn design and a structure the company calls a "Tulip" waveguide, said to produce truly spherical wavefronts, just in front of the tweeter. The horn is driven by a compression driver with an aluminum-alloy diaphragm and a Ferrofluid-cooled voice-coil. Coaxial or dual-concentric drivers have excellent coverage of the listening area because of their inherently coincident acoustic sources. The high and low frequencies emanate from the

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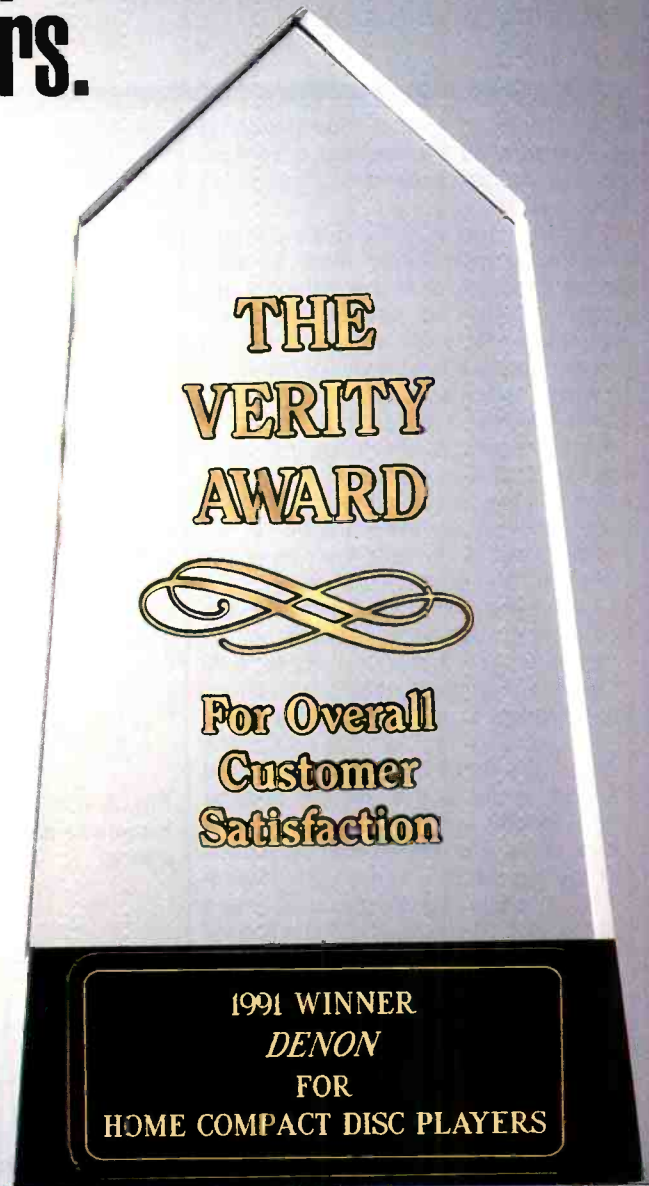
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The tonal balance of coaxial or dual-concentric drivers changes minimally with different listening locations and distances.

same point in space, thus providing well-controlled symmetrical coverage, that is, identical both vertically and horizontally.

Coaxial drivers come quite close to the acoustical-radiator ideal of constant directivity over a substantial frequency range. (I am intimately acquainted with such radiators, having designed constant-directivity horns for several manufacturers, and I hold three patents in this area.) A constant-directivity source, which has the same on- and off-axis frequency response, also has the unique advantage of having a power, or reverberant-field, response that is identical to its axial frequency response. This makes the source behave much more uniformly in different environments or locations in a room, resulting in a sound whose tonal balance changes minimally with different listening locations and distances.

In addition to the dual-concentric driver, the 615 includes an additional 8-inch woofer and a passive radiator that Tannoy calls a mass-tuned passive cone. The low-frequency portion of the system is a vented-box design with a passive radiator taking the place of the port. The passive radiator actually uses the same cone and suspension as the 8-inch woofers, but without a magnet or voice-coil, and thus has the same air-moving capabilities as either woofer does. At low frequencies, the two woofers operate in parallel, but above 400 Hz, the separate woofer is rolled off by the crossover. The cabinet forms a single cavity in which both drivers and the passive radiator operate. The cones of all three units are injection-molded of a mineral-loaded olefin copolymer plastic and are thicker near the neck section for increased rigidity at the driven point.

The enclosures are six-sided, which increases the cabinet's strength and minimizes wall vibration. This design also improves lateral dispersion by reducing edge diffraction. Identical grilles cover each of the three sound radiators on the front, and are attached with projections that fit holes on the cabinet front and hold the grille slightly off the cabinet's surface. The systems were supplied to me with optional molded-plastic bases that increase the footprint of the 615 to improve stability and also serve as attachment points

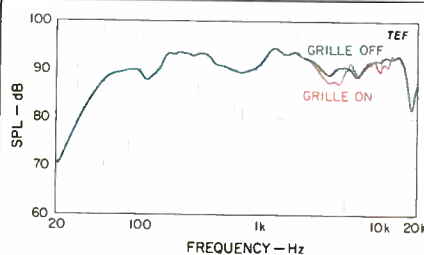


Fig. 1—One-meter, on-axis frequency response.

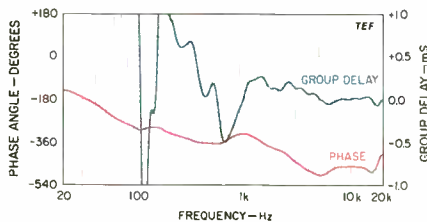


Fig. 2—On-axis phase response and group delay.

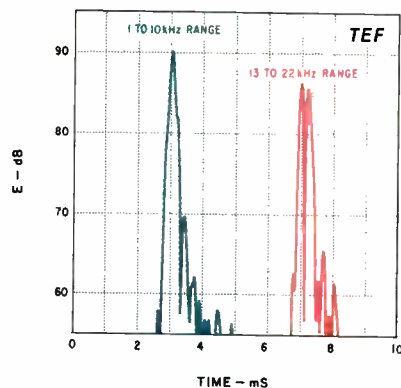


Fig. 3—One-meter, on-axis energy/time curves.

for either the mounting spikes or pads provided. These pads and spikes can also be screwed directly into the speaker cabinets.

The inside of the low-frequency enclosure is partially filled with a white polyester absorptive material. Most of the enclosure is constructed from 3/4-

inch-thick medium-density fiberboard. The top and bottom panels (Tannoy calls them end caps), and the portion of the enclosure separating the dual concentric's enclosure from the bottom portion of the cabinet, are made from injection-molded, mineral-filled polypropylene. The enclosure is reinforced very well with an internal top-to-bottom brace, which provides even greater stiffness beyond the multi-panelled construction. The drivers actually butt up against this brace for support, with a small amount of putty added between to eliminate vibrational contact.

The crossover of the 615 is of minimalist design and has only five parts: Two inductors, two capacitors, and one resistor. Parts quality is high, and iron-dust core inductors and polypropylene capacitors are employed. All connections use heavy-gauge wire and connect to the drivers with clips. The crossover is wired on a p.c. board attached to the rear-mounted input connection panel.

The connection terminal panel at the back of the system allows bi-wiring but also includes a unique captive assembly that slides out to connect the two sets of input terminals when the system is not bi-wired. The terminal wire holes are even large enough to handle a heavy cable in addition to the sliding connection straps.

Measurements

Figure 1 shows the 615's anechoic on-axis frequency response, along with the effect of the dual-concentric driver's grille. Measurements were taken on the center axis of the dual-concentric driver, at 2 meters with 5.66 V rms applied, and then referenced back to 1 meter. The response below 300 Hz was derived from 2-meter ground-plane measurements with the input reduced to 2.83 V rms to compensate for the ground plane's 6-dB boost.

The on-axis curve, although somewhat rough, is well extended and reveals a high sensitivity of 91.6 dB (close to the 92 dB specified) averaged over the four-octave range from 250 Hz to 4 kHz. A sharp, high-Q dip of 20 dB at 17.3 kHz is exhibited in the on-axis curve, although the tenth-octave smoothing of the axial curve in Fig. 1 partially masks the dip's severity. Excluding this dip, the curve fits within

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The Tannoy 615's coaxial configuration pays off in vertical off-axis responses so well behaved as to look just like the horizontal curves.

a window of ± 3.7 dB from 50 Hz to 16 kHz (referenced to 1 kHz) and therefore does not quite meet the manufacturer's specification. Below 40 Hz the response rolls off at about 18 dB/octave and is 10 dB down at 35 Hz from the 1-kHz level. The notch in the response at 110 Hz appears to be related to some internal resonance mode, because it was apparent even in a near-field measurement of the coaxial driver's woofer.

The right and left units matched closely, within ± 0.6 dB, below 16 kHz. Because of the significant response changes caused by the grille, these and all subsequent measurements were taken with the grilles off.

Figure 2 shows the phase and group-delay responses, referenced to the tweeter's arrival time. The phase curve stays within a compact, 180° envelope from 200 Hz to 20 kHz. The group delay is fairly flat above 1 kHz but exhibits minimum-phase irregularities at 105 and 650 Hz due to dips in the axial response (and hence irregularities in the phase response) in these same areas. If these dips were equalized flat with a minimum-phase equalizer, the phase and group-delay responses would become much better behaved.

Figure 3 divulges the system's 1-meter, on-axis energy/time response for 2.83-V signals in two frequency ranges. For the left-hand curve, the test parameters were chosen to accentuate the system's response from 1 to 10 kHz. The main arrival, at 3 mS, is well behaved but broadens at the base, and there is a single significant delayed arrival, at $300 \mu\text{s}$, about 21 dB down. The other curve, which has been shifted to the right by 4 mS for clarity, shows the results of the sweep covering the range from 13 to 22 kHz, where the tweeter exhibits severe peaks and dips. The curve reveals two sharp peaks of roughly equal level separated by about $200 \mu\text{s}$. This behavior could be due to an internal acoustic problem in the construction of the tweeter's compression driver and/or horn. Fortunately, the aberrations are high enough in frequency so that audible problems are minimal.

Figure 4 displays the normalized horizontal off-axis responses of the 615. Normalization has been carried

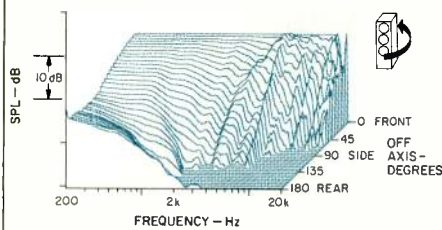


Fig. 4—Normalized horizontal off-axis frequency responses.

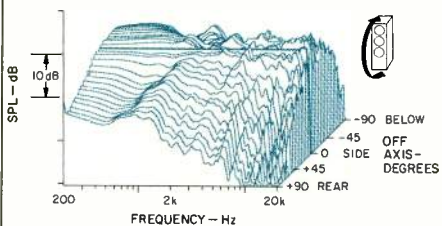


Fig. 5—Normalized vertical off-axis frequency responses.

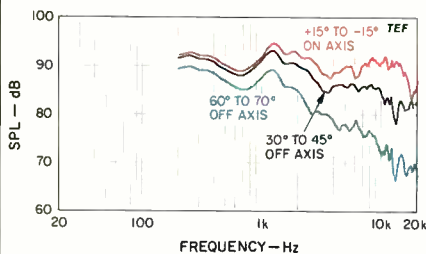


Fig. 6—Mean horizontal responses, from Fig. 4 data; see text.

out only up to 16 kHz; normalizing the on-axis dip above this frequency would create a misleading hump in the off-axis response, shown at the rear of the graph. The horizontal coverage is very well behaved.

The normalized vertical off-axis responses are shown in Fig. 5. In the center of the graph (front to rear), the

on-axis response is in bold, and the above-axis responses are in the front of the display. The 615 exhibits excellent vertical off-axis behavior, without any aberrations in the crossover region. The curves are so well behaved that they could be mistaken for the horizontal off-axis curves. The coaxial configuration of the Tannoy's mid- and high-frequency drivers pays off abundantly here.

Figure 6 shows the NRC-style mean horizontal on- and off-axis responses. The mean vertical responses are not presented because they were essentially the same as the horizontal responses (except for some greater directivity below 1.5 kHz), a very rare trait. The mean axial ($+15^\circ$ to -15°) horizontal response is very close to the on-axis response. The 30° to 45° mean response is also close to the axial curve but has reduced level above 7 kHz. The 60° to 75° mean response rolls off relatively smoothly above 3 kHz, reflecting the smooth increase of directivity of the dual-concentric driver in this region. Neither the horizontal nor the vertical mean curves had the sharp peaks, varying with direction, that speakers with spaced drivers exhibit at crossover. The individual curves (not shown) that were averaged to make each mean curve were all quite closely packed, also a rare characteristic.

A low-frequency, high-level sine-wave sweep disclosed a solid enclosure with minimal cabinet resonances. Only a moderate top-panel resonance at 300 Hz was evident. The woofers did not exhibit any dynamic-offset effects up to their excursion limits of about ± 0.25 inch. Below 400 Hz, the excursions of the coax woofer cone and the lower woofer were essentially equal. With an input level of 5 V rms, the coax and the lower woofer exhibited a sharp reduction in excursion at 29 Hz, which indicates the tuning point of the passive-radiator vented box. At this frequency, the passive radiator's excursion was quite large. However, at higher levels below 35 Hz, the passive radiator ran out of excursion at about 0.6 inch, peak to peak. At levels above 5.3 V rms, at and near 29 Hz, the system's distortion increased suddenly when the passive radiator reached its excursion limit. Above this level, both bass drivers also rose to their excursion

"Krell... Threshold... Madrigal... Rowland... Research... Coda... Parasound. What!!!

Parasound?

How does Parasound manage a mention with the above said heavy hitters of the transistor amplifier world? Easy, the new 2200 power amplifier from Parasound has the type of power and performance that would be expected from the big guys, were they to build an amplifier at the two grand mark. The fact that the 2200 only costs \$1,585 certainly sweetens the deal, making it a ridiculously great bargain.

But why Parasound?

Actually, this is the amplifier that I had been expecting to see from PS Audio, Superphon or Aragon; a real high calibre audio product that reeks of power, engineering savvy, and bang for the buck. Instead, a small firm from northern California had the sense to recruit one of the best minds in the business — John Curl — to design for them a product capable of superior performance without a typically prohibitive price tag to go along with it. John brought with him a full suitcase of engineering and design experience that few others in the industry could match or even dream of. Remember the "JC" designation on some of the Mark Levinson designs of the 1970's — that's John Curl. More recently, John has enjoyed great critical success with his Vendetta phono section electronics, it being declared "State of the Art" by several of the glossy mags...

THE AMP. The 2200 weighs in at 58 lbs., that's 6 lbs. more than the Krell KST-100 (\$2,700), and only 2 lbs. less than the Madrigal No. 29 (\$2,800)... It has balanced and single ended inputs (XLR & RCA), with a switch to convert to mono operation. The rear of the amp also has two sets of speaker terminals for those who desire to bi-wire... Both sides of the amp are flanked by an impressive array of "Rowland-like" heatsinks... to dissipate the considerable heat generated by the 12 high-bias (over 6 wpc in pure class A) bi-polar output devices per channel. Considering that nearly all listening is done at one or two watts per channel, **the 2200 delivers a lot of class A-biased power.** Inside you'll find two 1.2 kva toroidal transformers (one per channel) and 100,000 mfd of filtered power storage...bypassed by smaller film caps for improved performance... the first amplifier I have seen in a long time that goes so far as to even bypass the larger filter caps in the power supply... **Parts quality throughout is good...**

RAVE REVIEW RAVE REVIEW RAVE REVIEW

HCA-2200 Power Amplifier Designed by John Curl

the transformers, filtering caps, chassis, output devices and resistors are just about as good as you can get.

OPERATION. ...Preamps that worked great with the amp included the Cary SLP-70, the Muse Model One and the Counterpoint Solid 8... However, the 2200 was quite capable of driving, with ease,

any speaker tied to its outputs. **I have operated this amplifier under grueling and strenuous conditions for almost three months without so much as a hint of trouble or breakdown.** ...

THE SOUND. It sounds balanced. No aspect of its operation unduly draws attention to itself. The highs aren't grainy or smeared; the bass isn't bloated; the midrange isn't recessed, or forward for that matter; the stage isn't cramped; and dynamics aren't compressed. **What we have here is an amplifier that flat out refuses to do much wrong, while doing almost everything right.** ...

The 2200 is one of the most powerful amplifiers you will ever come across, controlling loudspeakers with such aplomb so as to seem effortless. Transients with the 2200 can be awesome... Without seeming forward (remember the balance referred to), the 2200 extends into the bass region with incredible authority. Combining this amp with the Chapman T-7 loudspeaker, I was able to shake loose the neighbors fillings and send the dog running for cover under one of the kids beds... but the bass wasn't there unless it was supposed to be...

Clarity and the sense of space on a three dimensional stage were very good. Without effort I could pick out the location of instruments and vocals. Saxophone on "Jazz at the Pawnshop" had an excellent sense of presence, the sax standing clearly apart from the other instruments on the stage. Drums at right rear had perfect placement, and there was a nice feeling of left and right, up and down, as the drummer worked his way around the drum kit ... **this amp has some pretty remarkable abilities when it comes to reproducing**

the feeling of a live event in the listening room. Resolution of inner detail was natural and very revealing, without seeming hyped or exaggerated. Images at the back of the stage were crisp and easy to locate...

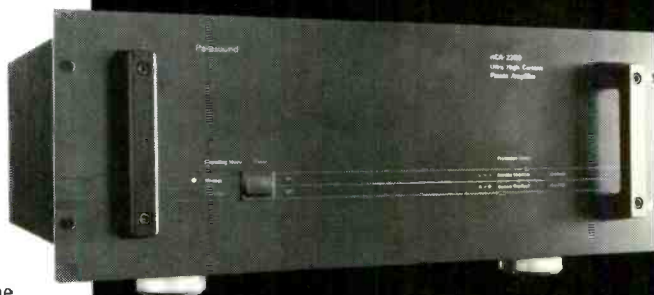
CONCLUSION. When I first listened to the Parasound 2200 I got a funny feeling... regarding how to evaluate it. I'm sitting here with the Allegro Cantata and the Krell KST-100 thinking how *they* defined high-end performance at prices that were starting to be accessible to "Blue Collar Audiophiles", even if it was still a stretch dollar-wise... I will continue looking for and examining products of quality and value so that we can talk about them on these pages, and yes, I prefer talking about Parasound and Fried products... because the Parasound and Fried are **not aimed at people with more money than brains.**

So this is how I'm going to approach the review of the Parasound 2200 power amplifier. I want you to add it to the list of truly fine products that have something special to offer in terms of value regardless of what it's compared to or what anyone else says about it. It stands on its own in terms of build and performance, being basically as good (accurate) as any amplifier that I am aware of, and better (more accurate) than most...

— Martin DeWulf —
Excerpted with permission from Bound For Sound, November, 1991.

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The 615's high sensitivity and high efficiency were apparent from the moment I began my listening.

sion limits, because the loading effect of the passive radiator is negligible when it reaches its limit. Everything was okay at 5.3 V rms, but the system went bananas at 5.4 V rms, an increase of just 0.2 dB! The level must be reduced below 5 V rms to stop this nonlinear behavior. At 25 Hz and below, the input cannot be raised above about 3.5 V rms (only 2 watts into the rated 6 ohms) without the passive radiator running out of gas!

The air-moving capability of the 615's passive radiator is actually quite small in comparison to the capability of the main woofers. A good rule of thumb for system design of passive-radiator vented boxes is to use a passive radiator that has at least two times the air-moving capability of the main radiators. Assuming equal excursion capability, the size of the passive radiator in this Tannoy system should be in the range of four 8-inch woofers, or roughly the size of a single 15-inch woofer!

The crossover consists of all first-order filters with a series RC impedance-correcting network in parallel with the separate woofer. Near-field measurements of the lower woofer showed that its acoustic output rolled off above 400 Hz. Separate measurements of the individual high and low acoustic outputs of the coax (made by separately driving the bi-wire inputs) revealed that the upper crossover is at 1.75 kHz rather than the stated 2.5 kHz. These individual output measurements (not shown) indicated that the acoustic roll-off slopes of the coax are about 12 dB/octave down to the -10 dB point. Beyond this, the outputs roll off much faster. Phase measurements indicated that the individual outputs are essentially in phase at crossover and are 6 dB down. Lobing does not occur in a coax, no matter what the phase relationships of the individual drivers are, because the acoustic centers of the high and low sections are essentially coincident.

The 615's impedance, plotted over the extended range of 10 Hz to 20 kHz, is shown in Fig. 7. Three low points are evident, with the lowest a relatively low 2.9 ohms at 190 Hz. A minimum of 2.9 ohms at the 29-Hz vented-box resonance of the passive radiator system is also noted. The impedance reaches a

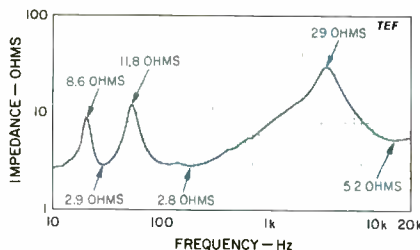


Fig. 7—Impedance.

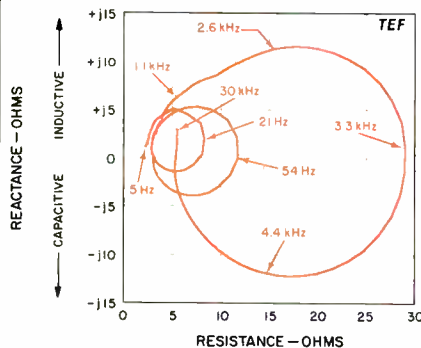


Fig. 8—Complex impedance.

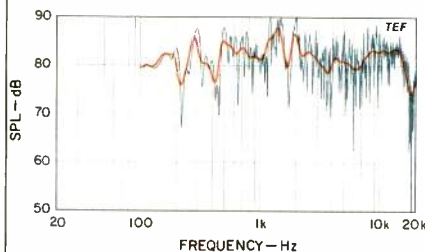


Fig. 9—Three-meter room response.

high maximum of 29 ohms at 3.25 kHz. The total curve thus has a high max/min variation of 10.4 to 1 (29 divided by 2.8). The system will be quite sensitive to cable resistance because of this variation and the relatively low minimum impedance. Cable series resistance should be limited to a maximum of about 0.036 ohm to keep cable-drop

effects from causing response peaks and dips greater than 0.1 dB. For a standard run of about 10 feet, wire of 12 gauge or larger should be used.

The 615's complex impedance, plotted over the range from 5 Hz to 30 kHz, is shown in Fig. 8. The phase of the impedance (not shown) varied considerably, reaching a maximum angle of +50° (inductive) at 18 Hz and a minimum angle of -45° (capacitive) at 5.5 kHz. The Tannoy will be a moderately challenging load for some amplifiers because of its low and relatively reactive impedance.

Figure 9 shows the 3-meter room response with both raw and sixth-octave smoothed curves. The 615 was in the right-hand stereo position, aimed at the listening location, and the test microphone was placed at ear height (36 inches, essentially on the dual-concentric driver's axis) at the listener's position on the sofa. The system was driven with a swept sine-wave signal of 2.83 V rms (corresponding to 1.33 watts into the rated 6-ohm load). The sweep's parameters were chosen to include the direct sound plus 13 mS of the room's reverberation. Between 2 and 16 kHz, the smoothed curve is well behaved and fits within an envelope of ±2.5 dB. Excluding roughness from 1 to 2 kHz, above 500 Hz the smoothed curve is actually quite close to the on-axis response. This indicates that the reverberant-field power response of the speaker is close to its axial response, a direct result of the smooth on- and off-axis response of the dual-concentric driver.

Figures 10 to 12 show single-frequency harmonic distortion versus power level for different musical notes. The power levels were computed using the rated system impedance of 6 ohms and run from 0.05 to 50 watts in 30 steps of 1 dB each.

Figure 10 shows the E₁ (41.2-Hz) harmonic distortion. At full power, the second and third harmonics reach significantly high levels of about 10% and 27%, respectively. Higher order harmonics also reach significant levels. Some compression above 20 watts is noted in the fundamental and in the second and third harmonics. Even including compression effects, at 50 watts the Tannoy generates a fairly loud 99 dB SPL at 1 meter at 41.2 Hz.

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On vocals, the Tannoys presented a very lifelike, up-front sound that was quite pleasing.

In Fig. 11, the A_2 (110-Hz) harmonic distortion, the second harmonic reaches a moderate 5% or so at 50 watts, with the third at only 1.3%. Curiously, the third harmonic reaches an intermediate peak, falls, and then rises to its final value as power is increased. At 110 Hz with an input of 50 watts, the speaker generates a fairly loud 105 dB SPL at 1 meter.

Figure 12 shows the A_4 (440-Hz) harmonic-distortion data. The second harmonic reaches only 2.6% at full power and the third harmonic only 0.44%. At 440 Hz and 50 watts, the system generates a loud 108 dB SPL.

Figure 13 shows the IM created by mixing 440-Hz (A_4) and 41.2-Hz (E_1) tones of equal input level. The IM distortion rises to a significant 22% at 40 watts. Interestingly, the IM distortion does not drop very quickly with decreasing power, remaining at a fairly high 6% even at 1 watt. Overall, the 615 exhibited substantially high distortion in the E_1 (41.2-Hz) harmonic measurement and in the IM test but reasonable distortion at higher frequencies.

The Tannoy's short-term peak-power input and output capabilities are shown in Fig. 14. The measurements were made by applying a 6.5-cycle, third-octave-bandwidth tone burst at each third-octave frequency. The peak electrical input power, seen in the lower curve, was calculated by assuming that the measured peak voltage was applied across the rated 6-ohm impedance. From a low of 2 watts at 20 Hz, the peak input power rises with frequency. It reaches a plateau of about 550 watts at 100 Hz, drops somewhat to 350 watts, and then rises to 2,400 watts above 1 kHz (120 peak volts across the rated 6-ohm load). The depression near 300 Hz was likely due to inductor overload in the woofer portion of the crossover.

The upper curve in Fig. 14 shows the maximum peak sound pressure levels the system can generate at 1 meter for the input levels shown in the lower curve. Also shown here is the "room gain" of a typical listening room at low frequencies, which adds about 3 dB to the response at 80 Hz and 9 dB at 20 Hz. The peak acoustic output rises rapidly with frequency up to 200 Hz, where it reaches a level of about 120 dB. After a slight dip, the output rises

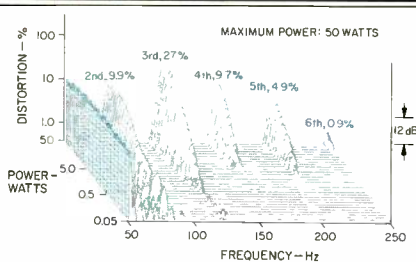


Fig. 10—Harmonic distortion products for E_1 (41.2 Hz).

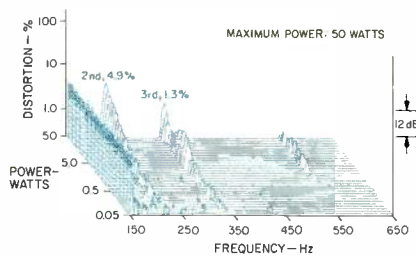


Fig. 11—Harmonic distortion products for A_2 (110 Hz).

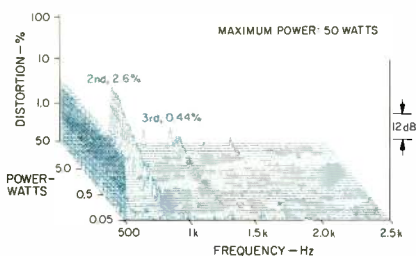


Fig. 12—Harmonic distortion products for A_4 (440 Hz).

to a maximum near 125 dB and essentially follows the ups and downs of the on-axis response. Although this speaker's peak power handling is on the low side, its relatively high sensitivity (efficiency) results in high peak outputs.

Quite usable levels of 100 dB SPL or higher can be attained with one speaker at 35 Hz and above, with room gain, and a stereo pair can reach even higher low-frequency levels with bass material common to both channels.

Use and Listening Tests

The 615s are quite attractive. The black ash finish of the samples I tested fit in well with the furnishings of my listening room, though I find the walnut version even more attractive. For my listening, I used the optional stands (whose large footprint adds stability and which can be filled with lead shot or sand to lower the center of gravity) and the supplied spikes.

Tannoy sent me several very extensive, informative white papers describing many aspects of their "Sixes" line, including such topics as industrial design, materials technology, dual-concentric features, and bi-wiring. The four-page owner's manual, covering the use and installation of the "Sixes" line, suggests that the 615s be placed away from walls and corners and spaced 2 to 4 meters apart, and that the listener sit a bit further from the speakers than they are from each other. The company also suggests removing the grilles for serious listening, which I did. For the best stereo image, the speakers should be pointed either directly at you or with their axes crossing in front of you.

I placed the 615s in my customary locations: 10 feet from the sofa, separated by 8 feet, and well away from the rear and side walls. The speakers were aimed towards my listening position and not tilted back, which placed my ears directly on the axis of the dual-concentric drivers. The equipment lineup consisted of my usual Jeff Rowland amplification and Onkyo and Rotel CD players. Listening was done with and without bi-wiring, using Straight Wire Maestro cables.

On first listening, the high sensitivity and efficiency of the 615s were immediately apparent. These speakers presented a wide, very realistic soundstage with an excellent uniformity of coverage. The speaker's tonal qualities are quite independent of listening position. On the pink-noise stand-up/sit-down test, the 615s actually had slightly better vertical coverage than

The Tannoy 615s deliver excellent stereo imaging and soundstaging plus clean reproduction of high-level transients.

my B & W 801 reference systems, which are very good in their own right!

On pink noise, the Tannoys added a tonal coloration that was not present with the B & Ws. Because of the 615s' evenness of coverage, however, the coloration remained the same no matter where I listened from! Equalization should work well here, because the 615s' unusually uniform directionality would ensure that the equalized signal would sound the same to all listeners. I wish I had had the time to investigate this further.

On program material with high-level bass passages, the 615s tended to muddy the higher ranges when the bass was present. This effect was quite evident on high-level pedal sections of *The Organ Works of J. S. Bach, Vol. 4* played by Jean Guillou (Dorian DOR-90151). On most other program material, the bass level and extension were quite adequate. As long as the frequency range of the program material was limited to 35 Hz and above, these speakers did quite well. On band-limited third-octave pink noise, they could not generate any usable low end on the 20- and 25-Hz bands if driven at a level that did not overload them. With the low-frequency band-limited noise, the onset of overload occurred quite suddenly as level was increased. At higher frequencies, however, the Tannoys generated quite usable levels.

On vocals, such as soprano Julianne Baird singing with Colin Tilney playing harpsichord on *Musica Dolce* (Dorian DOR-90123) or Linda Ronstadt on *Mas Canciones* (excellent traditional mariachi music, Elektra 61239-2), the 615s presented a very lifelike, up-front sound that was quite pleasing.

The Tannoys' high efficiency and sensitivity serve them well in reproducing program material that has high crest factor (ratio of peak to continuous power). This was demonstrated on the recording of fireworks on the Pierre Verany *Digital Test CDs* (PV.788031 and PV.788032). The aerial explosions could be turned up to truly realistic levels on the 615s, but my Rowland amplifiers ran out of gas trying to get the B & Ws up that loud! The 615s also did extremely well on producing the realistic levels and the "horn bite" typical of live trombones and trumpets on

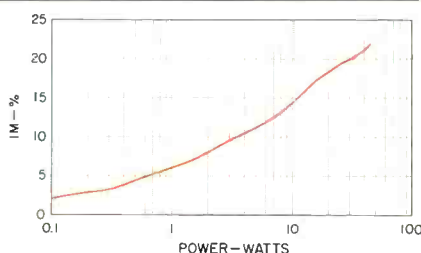


Fig. 13—IM for 440 and 41.2 Hz mixed in equal proportion.

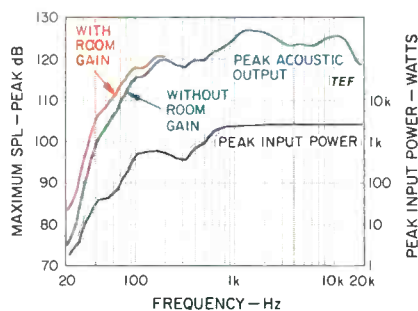


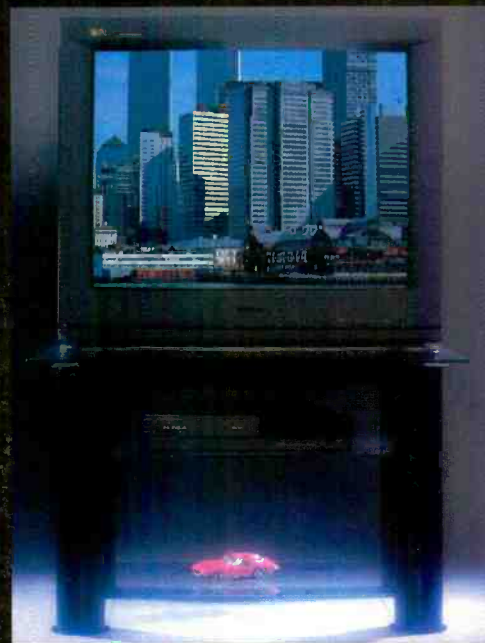
Fig. 14—Maximum peak input power and sound output at 1 meter on axis.

The Age of Swing, Vol. 1 by the BBC Big Band (a super big-band recording, Bainbridge BCD 2511).

To sum up, the Tannoy 615s present quite a package of contrasts. On one hand, they have excellent stereo imaging and soundstage capabilities due to their superb evenness of coverage, and they also provide clean reproduction of high-level transients due to their high sensitivity and efficiency. On the other hand, they exhibit moderately rough frequency response and are vulnerable to overload on high-level, low-frequency program material. Yet on balance, I feel the pluses far outweigh the minuses. These speakers' good looks and reasonable price make them good competitors and quite worthy of audition.

D. B. Keele, Jr.

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THIEL CS2.2 SPEAKER

Company Address: 1042 Nandino Blvd., Lexington, Ky. 40511.
For literature, circle No. 93

The new Thiel CS2.2 is priced at \$2,250 a pair, making it very much a high-end speaker, although it is priced only midway in this company's line. In fact, the Thiel CS2.2 costs only about a quarter of the price of the Thiel CS5, which I use as one of my reference speakers, although I suspect that for most audiophiles, the CS2.2 will be the better loudspeaker as well as the better buy.

The CS2.2 is a floor-standing speaker about 42 inches high, 12¼ inches wide, and 13¼ inches deep. It stands high enough to deliver the midrange and treble directly to the ear when the listener is seated, but low enough so that the speaker does not dominate the room. The relatively narrow front, attractive front slope, and excellent woodwork also make the speaker easy to place.

As for basic design features, the CS2.2 uses a very rigid enclosure that is solidly built to reduce energy storage, and it weighs about 70 pounds. Even at very high sound levels, the enclosure is very well damped and unusually free of any sign of vibration.

The CS2.2 uses four drivers. The three active ones include a 1-inch high-output metal-dome tweeter that operates above 3 kHz, a 3-inch midrange driver that operates from 800 Hz to 3 kHz, an 8-inch very-long-throw woofer that operates up to 800 Hz, and a 6 × 9-inch passive radiator. The tweeter and midrange are close together and are carefully integrated to provide an apparent point source. The CS2.2 uses a complex crossover network, and in what is virtually a Thiel trademark, it's designed for time and phase coherence. The Thiel CS2.2 includes such a wide range of other technical features that they all cannot be covered in a short review, but they are discussed in depth in a Thiel white paper.



The frequency response specification is set at a very demanding ± 2 dB from 35 Hz to 20 kHz, the phase response specification is $\pm 5^\circ$, and time response is 150 μ S for -20 dB.

The tweeter is a metal-dome design whose resonance is out at 26 kHz, while the woofer is a completely new two-cone design that reduces diaphragm resonance and low-level vibration. The front baffle is curved to reduce reflection and diffraction (thus providing cleaner sound and more precise imaging), and sloped to cut time error to less than 0.5 mS.

Specifications are one thing, and actual sound is another. The Thiel CS2.2 shows that a cone speaker design can compete with ribbons and electrostat-

ics for apparent speed and transparency. At the same time, properly positioned, the CS2.2 smoothly integrates its outstanding treble and midrange with a level of bass dynamics and deep bass that few speakers anywhere near its price can touch.

Extended listening to the CS2.2's midbass, midrange, and treble makes it clear that this is a very flat design. It sounds consistently natural with a very wide range of well-recorded classical music, and is also free of any tendency to favor one type of voice over another or one instrument over another. The CS2.2 also blends the frequency extremes smoothly into the midrange. I have criticized some past Thiel speak-

Continued on page 72

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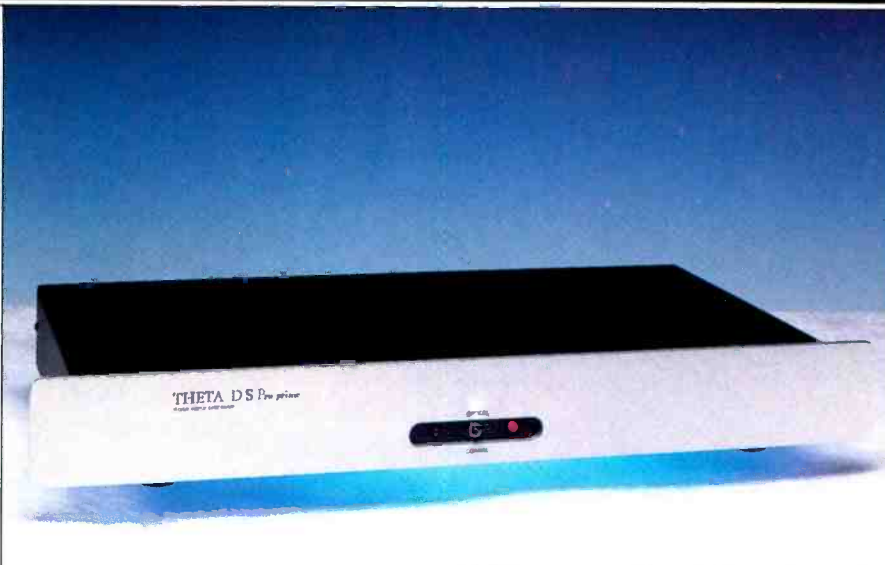
THETA DSPro PRIME D/A CONVERTER

Company Address: 5330 Derry Ave.,
Suite R, Agoura Hill, Cal. 91301.
For literature, circle No. 94

The Theta DSPro Prime, a \$1,250 D/A converter, is basically a one-bit system and is designed to correct four sonic problems that have caused such systems to disappoint many people. The first of these problems is that the image size one-bit systems present seems constant, almost regardless of the performance, which magnifies solo instruments and singers. There is also a tendency to center the image, compressing its spread from right to left. The soundstage is shallow, often two-dimensional. And finally, there is a lack of harmonic detail, or "air." Notes are not harsh, yet they lack overtones and subtle detail, especially with cymbal, guitar, violin, flute, and sometimes voice. Occasionally the term MASH seems all too appropriate.

According to Theta, all one-bit systems to date have used full, 16-bit digital input filters, purchased as chips from Philips, Sony, Yamaha, and others. Such chips seem to be redesigned annually, but their improvements are only incorporated into new units, not those already in the field.

The Theta DSPro Prime is the first audio product to combine true programmable digital signal processing with one-bit D/A conversion. It uses a ROM-driven Motorola DSP56001 microprocessor to provide the first 20-bit, four-times oversampling function. This allows freedom from obsolescence by allowing inexpensive software upgrades. The "four-over" signal is sent to a Signetic/Philips SAA7350 one-bit D/A converter that provides the noise shaping, the one-bit/64-times oversampling, and the conversion. Theta believes the ROM-driven microprocessor provides a digital filter that allows the time domain as well as the frequency domain to be optimized. The sonic benefits Theta seeks from this approach are a fully extended high-frequency response as well as superior imaging, depth, detail, and soundstage realism.

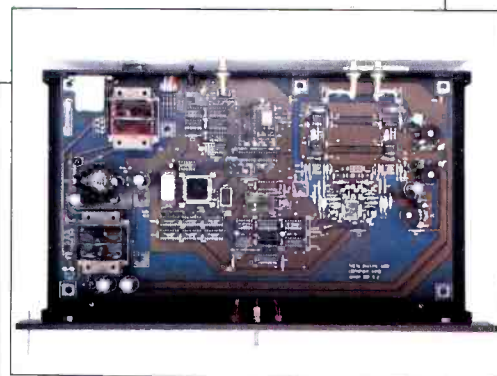


The Prime has other important features. It has large power supplies for both the analog and digital sections, is exceptionally well shielded and free of hum fields, and has a pilot light to show that it is receiving a digital signal (which may seem like a minor feature until you try to trouble-shoot a unit without one). It uses some 71 bypass capacitors per unit to reduce digital hash and noise. The analog section has been specially designed to match the requirements of one-bit D/A converters, rather than adapted from other players, and it has been isolated from the r.f.-generating digital circuits.

While a mix of advanced design features should be provided in an out-board decoder in this price range, I have seen a number of similar units that are far less sophisticated and well made. Several also generated memorable hum fields and required placement well away from phono units and—in one case—from other digital equipment.

We all have heard countless claims about the technical merits of different digital processors, but the real issue is whether a given unit actually delivers superior sound quality. The DSPro Prime does, and this—not Theta's technical claims—is why I have chosen to review it.

The DSPro Prime does not eliminate all of the problems in the other one-bit



and reduced-bit machines I have heard to date, but it does provide significant improvements in each area where the others have fallen short:

- Image size is fully realistic. While all CD players exhibit variations in image size, and only the producer of a given recording can know what image size accurately reproduces the original sound, the DSPro Prime is both realistic and exhibits the proper variation in image size to provide a credible illusion of realism. Unlike other one-bit and reduced-bit units I have heard, the Prime also reproduces the kind of subtle imaging characteristic of top-priced, high-performance DACs.

- The overall soundstage and imaging are still slightly centered, but not to the unrealistic extent of many machines using one-bit technology.

- The depth is good to very good, although it does not rival that of top-of-the-line decoders from Krell, Wadia, and even Theta.

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For the price, I've never heard a processor combine the DSPro Prime's level of upper octave excitement with these sound attributes.

THIEL/continued from page 68

• Harmonic detail, or "air," is also very good. Once again, the more sophisticated decoders that cost well over twice the price of the DSPro Prime do better. The Prime is, however, fully competitive with any of the other decoders in its price range that I have yet heard in its ability to reproduce the essential subtleties of music. It manages to provide an exceptional degree of upper midrange and treble detail without hardness or a loss of harmonic richness.

More generally, the Prime has a well-balanced mix of sound characteristics. Unlike some separate decoders that seem to try to sound different, rather than accurate, there is no exaggeration of the size of the soundstage. Musical dynamics are very well handled, at both low and high levels, and the sound is consistently good with choral music, grand opera, and symphonies like Mahler's Eighth. There are many Compact Disc players that produce minor sonic oddities when playing complex large-scale music.

If I were shaping the sonic palette of the Prime, I would like a touch more bass energy and musical depth. I also might choose an upper midrange and treble balance that is slightly softer and that sounds a bit less forward. This, however, is a matter of personal taste rather than proper performance. I should also note that I have yet to hear a D/A converter anywhere near this price range that could combine such a mix of sound characteristics with the level of upper octave excitement provided by the Prime.

The Theta DSPro Prime is one of a handful of units I have heard in the \$1,000 to \$2,000 price range that really justifies its price. I have also been impressed with the Sony CDP-X777ES and the Proceed PDP-2 and PCD-2, but there is no question that the Theta DSPro Prime offers a unique mix of sound attributes. Further, the Prime makes a major improvement in the sound of many LaserDisc players, and its built-in upgrade capability is a tremendous asset. Digital sound is constantly improving, and any unit that can already deliver outstanding sound—and take advantage of the changes in the state of the art—offers exceptional value for the money.

Anthony H. Cordesman

ers for providing a bit too much treble energy and for appearing to tilt the overall spectrum toward the upper frequencies. This is not a complaint that anyone is likely to make about the CS2.2. Few speakers provide treble this clean and extended.

Similarly, this really is a very different kind of bass than I've heard from past Thiel speakers. It measures very deep, and the CS2.2 can move a great deal of air in real-world listening rooms. Far too many speakers cannot really deliver deep or consistently tight bass at musically realistic power levels. The CS2.2 may not have the low-frequency extension of the CS5 in this regard, but its bass is both more realistic and better integrated with the midrange. It also adds a natural warmth lacking in Thiel's previous small and mid-sized speakers. The only caution I would make is that this kind of bass requires careful attention to placement. Putting the CS2.2 near a room boundary will produce too much bass, and experimentation is needed to avoid room interaction and standing-wave problems. As is the case with all speakers with this kind of bass power, the CS2.2 is not suited for a boomy room. Further, as a 4-ohm speaker, it naturally puts higher demands on the amplifier, and both the bass and the dynamics benefit a great deal from using a high-power high-current amplifier with excellent damping.

The most impressive aspect of the CS2.2 is its level of clarity and definition. I spend a great deal of time listening to ribbons and electrostatics, and, prejudiced or not, I generally find they provide more speed and detail than conventional speakers, and do so with more coherence and integration. I was also listening to a well-regarded electrostatic while I was auditioning the Thiel, however, and the CS2.2 consistently revealed more harmonic and transient detail.

Although it may not be important to the average user, I was also surprised to find that the CS2.2 revealed some of the differences between cartridges and digital decoders better than its big brother, the CS5. I was particularly struck by its ability to resolve the finer details in low-level passages with larger midrange content and on solo guitar. The acoustic guitar is an instru-

ment that virtually all good speakers can reproduce reasonably well, but few can reproduce very well. The Thiel CS2.2 is in the latter category.

The speaker's soundstage and imaging are also very good, as they have the normal characteristics of a monopolar speaker configured to provide an apparent point source. With the speakers positioned about 7 feet apart and angled slightly toward the listening position, the soundstage was wide without any tendency to leave a hole in the middle or to cluster the sound around the speaker. The apparent depth was the apparent depth on the recording; the CS2.2s do not add any depth of their own or lack any of the CS5's ability to reproduce the depth that is actually on a recording.

The size of the soundstage was moderate, at least compared to bipolar and planar speakers. There also was no extra hall effect of the kind you get with speakers with rear radiation, although the clarity of the CS2.2 benefited from the lack of extra reflections and the apparent soundstage was very natural.

The imaging was very precise, with no exaggerations or subtractions, and was stable over a relatively wide listening area. The arc of left-to-right imaging was excellent, with instruments and voices reproduced at the size appropriate to the recording. Back-to-front imaging was good, although some other high-end speakers do a better job of reproducing layers of depth.

Musical dynamics were very good for a speaker of this size, and the CS2.2 reproduces complex and demanding dynamic passages with no apparent trade-offs of frequency range or clarity. This is an outstanding speaker for romantic symphony, grand opera, jazz groups, and the increasing amount of well-recorded power rock. At the same time, it does equally well with chamber music, solo voice, and solo instruments.

If you give proper attention to room placement and the choice of power amplifier, the CS2.2 is a superb choice for real-world audio systems—providing outstanding performance in a moderate-sized speaker that only requires a single amplifier per channel. This is not only Thiel's best product yet, but a best buy. *Anthony H. Cordesman*

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MILAN EASE



Vivaldi: Concerti da Camera, Vol. 1. Il Giardino Armonico; Giovanni Antonini, recorder.

Teldec/Das Alte Werk 9031-73267-2, CD; 47:36.

Sound: A Performance: A+

You're due for a shock on first hearing if you expect more "cookie-cutter" Vivaldi from this CD. The first thing to grab your attention is the breakneck tempi of the fast movements; wide contrasts in dynamic level are next. There is an overwhelming energy and bouncy optimism about these performances that lift them into a whole different area of early-music interpretive style, because this is an original instrument ensemble based in Milan of about 11 players—the only such group in Italy.

Elements that may seem excessive are the exaggerated crescendos and decrescendos, similar to the performance style of the Mannheim School, which came a bit later and in another place. The idea of "terraced dynamics" central to performance practice of baroque music is thrown in the canal by Il Giardino Armonico, and the excitement of the music is tremendously raised by that. Also ditched is the idea that the ensemble sound of these origi-

nal instruments must be thin, wiry, nasal, anemic, and without any foundation in the bass end of the spectrum. Here, the bass will knock you on your hiney. The recording acoustic is very close up, but the instruments' "sound effects" are not intrusive. There is depth and width to the stereo stage and a feeling for the venue's ambience.

Several of the concerti indulge in "sound painting." Opus 10 is often identified (as it is on the cover of the CD booklet) as "La Tempesta di Mare" concerti, and the storm at sea happens quite visually in the Concerto No. 1. Soloist Giovanni Antonini is superb throughout, and he makes a convincing case for the recorder versus other types of flutes used in competing versions. His sweeping "whoops" on the final movement of the first concerto must be heard. If that's historical performance practice, they had more of a sense of humor about the music back then than we do now! *John Sunier*

20th Century Harpsichord Music, Vol. III. Barbara Harbach, harpsichord.

Gasparo GSCD 280, CD; 66:18.

Contemporary music on the harpsichord? Unlikely. But here is Barbara

Harbach, a fetching young lady who can play *anything* on her keyboards, no matter what. Not surprisingly, then, some of the music here was composed for her fingers. It often happens.

Which does not mean that the various composers really know the harpsichord, or what it can do, or could do for a contemporary idiom. It is as yet unwise to judge most contemporary music as to quality. But I was a bit distressed at the prevailing harsh sounds (not helped by a somewhat close-up mike position) that seemed to me more for show, enormously fast and complex, than for a real use of the peculiar sound of the plucked string instrument. Just an impression. The composers will violently disagree, of course.

No use describing the quite different contributions, ranging from longish and effusive in title—"Expansive, Reflective, Frantic"—to short and concise. The important composers are Daniel Pinkham, the Boston celebrity who writes learned and very neoclassic counterpoint out of Bach, and the veteran Samuel Adler, whose two tiny pieces are a refreshing conclusion.

No question that Harbach is a fantastic technician. Maybe it's good just to hear how fast she really can make her harpsichord go.

Edward Tatnall Canby

Victoria de los Angeles, Recorded Live at the Wigmore Hall. Victoria de los Angeles, soprano; Geoffrey Parsons, piano.

Collins 12472, CD; DDD; 61:41.

Victoria de los Angeles is amazing. All voices, however well maintained, become increasingly intransigent with age. De los Angeles obviously has taken care of hers, but time is inexorable. What makes this recording so overwhelming is, in fact, the wit and artifice with which she triumphs over the inevitable. She is utterly the mistress of both her voice and the occasion, a London recital in May 1990.

On the disc (which may omit some numbers of the concert) she begins with five Italian art songs, then sings seven Brahms Lieder. Four Catalan songs are followed by Granados (three), Obradors (three), and De la Torre (one). I suspect that the recital

Illustration: Rick Tulka

proper ended with this Spanish group. It is followed by "Clavelitos," "Blow the Wind Southerly," and the "Séguedille" from *Carmen*—all of which appear to be encores. Texts and English translations are included.

There is an earthiness to De los Angeles' singing now that may jar those who remember her for the relative chastity of her style 30 or more years ago. If she can no longer sustain the tonal purity that was her hallmark, she has substituted for it something that may be even more remarkable. Her present style makes one yearn to hear her do Falla's Seven Popular Spanish Songs, for instance.

Her management of the audience is equally remarkable. The decorous warmth of the applause that greets her entrance is built into visceral howls of approval by the end of the final encore. Greater focus might have been



Victoria
de los Angeles

achieved in the otherwise admirable stereo sound had Collins recorded her in the studio, but it would not have been worth the loss of the audience reaction.

If this CD is not an object lesson in masterful singing, then none exists. It is mesmerizing. *Robert Long*

Bell' Italia: Four Centuries of Italian Music. Eliot Fisk, guitar.
Musicmasters Classics 01612-67079-2, CD; DDD; 66:55.

Sound: A Performance: A +

Eliot Fisk untiringly champions new repertoire and generally shines an intelligent light on the too often staid and stuffy world of classical guitar. Now you can get a taste of this on *Bell' Italia: Four Centuries of Italian Music*, undoubtedly Fisk's most mature and stimulating recording to date. Others have tackled Italian repertoire, but none with such a spirited command spiced with mildly iconoclastic wit.

Unlike typical guitar programs, in this one Fisk juxtaposes transcriptions with guitar originals, a piece from one century with one from another. He begins with a set of sonatas by Domenico Scarlatti, delightfully buoyant miniature symphonies that sound difficult and really are. Fisk moves on to a sweeping, moody aria by Girolamo Frescobaldi that unfolds with an increasing complexity and power. After two wild caprices by Locatelli, he pauses for a darkly colored, introspective reading of Goffredo Petrassi's very modern *Suoni Notturmi*, then leaps into Paganini's exhilarating Sonata No. 4 in D Major, followed by Mario Castelnuovo-Tedesco's bubbling "omaggio a Paganini," the "Capriccio Diabolico," Op. 85. After another modern psychodrama by Petrassi, Fisk concludes with the exciting, lushly melodramatic 17-minute "Le Rossiniane," Op. 119 by one of the guitar's great Romantic composers, Mauro Giuliani.

Fisk's execution is consistently inspired as he balances dynamic flair and expressive rubato with precise tonal clarity. Too many recent classic guitar recordings have regressed into safe rehashes of familiar chestnuts. On *Bell' Italia* Eliot Fisk has taken risks that have paid off in a superb work of revelatory art. *Michael Wright*



Eliot Fisk

William Lawes: Consort Setts for 5 & 6 Viols and Organ. Fretwork; Paul Nicholson, organ.
Virgin Classics VC 7567-91187-2, CD; DDD; 69:30.

William Lawes (1602 to 1645) was one of those "lost" composers stuck in an in-between period of change, quickly forgotten yet clearly a first-rate musical mind. He composed very esoteric and complex contrapuntal music for the last of the old absolute monarchs in England, the unfortunate Charles I, who was too absolute for his nation—he lost his head, literally speaking. Yet that king was a remarkable connoisseur of the arts and especially of music, like so many of the English royalty, and the handsome and well-disposed Lawes wrote for the king's inner court circle. When the king was gone, Lawes was out. A minor tragedy in the midst of a far greater turmoil. When music returned to favor with Charles II, out of France, it was a new sort altogether, very French.

What can we, the general classical listeners, make of this heretofore very

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Top opera houses would covet the cast of superb artists on this recording of Weill's *Street Scene*.

made Kurt Weill a consummate craftsman, so it was entirely in character for him to make a wrenching stylistic adjustment when he immigrated to this country. Less than 10 years earlier, *Die Dreigroschenoper* (a.k.a. *The Three-Penny Opera*), to Bertolt Brecht's gritty text, had made Weill world-famous, and the works following it had continued in a sardonic, almost cynical vein. Never again would he enjoy a genius as a collaborator, but his new, less world-weary, infinitely more optimistic environment itself made a different musical style advisable. As his American years passed, Weill yearned to create true American opera, and in *Street Scene*, with Broadway's Elmer Rice as librettist and Harlem's Langston Hughes as lyricist, he came closest to it.

Top opera houses would covet this cast; two superb artists, Arleen Auger and Della Jones, drop by for one number lasting a mere 4:10. When such major stars as Josephine Barstow, Jerry Hadley, Samuel Ramey, and Angelina Réaux start singing, they do brilliantly. When they speak the copious dialog included here, it reminds you of the gap between dramatic and operatic realism. But the singing itself, from such superlative voices, compensates for a lot. John Mauceri conducts expertly, and Decca/London has recorded it with its customary radiant sheen.

Paul Moor

private court music for a despotic musical king? It isn't easy. But those who know a bit of Elizabethan music, and on perhaps to Orlando Gibbons, will find it tasty. The "consort" is our "chamber group" and a nicer name, too. Similar instruments of different sizes and ranges. The viols, except for the bass, also went out of style when the more popular violin came in. But today, the relatively chaste, nonvibrato sound of the consort of viols has come back and is unique, a kind of humming accordion sound, very blended and smooth.

These are excellent players—Fretwork—and lively enough for the lighter parts of these works, which are "sets" of dance pieces like the later suite. One work, that for two basses, includes the organ, rather incongruously. Lots of breathy sounds, the so-called chuff. Edward Tatnall Canby

Weill: *Street Scene*. Josephine Barstow, Jerry Hadley, Samuel Ramey, Angelina Réaux, et al., vocals; Scottish Opera Chorus and Orchestra; John Mauceri.

London 4333712, two CDs; DDD; 2:28:26.

His Berlin masters, Engelbert Humperdinck and Ferruccio Busoni, had

Beethoven: Symphonies Nos. 6 and 8. Royal Philharmonic Orchestra; René Leibowitz.

Chesky CD 69, CD; 67:09.

I remember René Leibowitz, back in the early '60s, as one of those up-and-coming modern younger conductors who often took over recordings and concerts from the famous veterans, and the orchestra on this CD is the one that belonged to Sir Thomas Beecham. Today, Leibowitz's sound in Beethoven is exactly what I would expect, the very essence of the neoclassic approach in its final period. Which means always a bit dry, concise, and minimal, playing down the Romantic "excesses" as they saw them in those days. Yes, Beethoven's instructions are followed; there are no flamboyant eccentricities. (The older conductors indulged in those,

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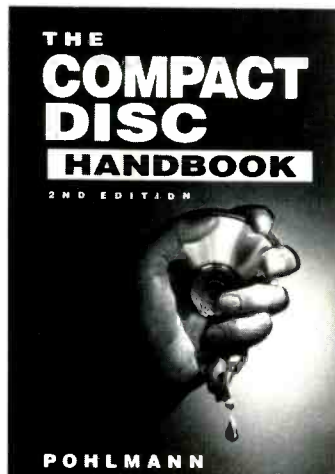


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out of an earlier time.) But instructions followed with the least possible "freedom." Small crescendos, minimal slowings-down, very brief pauses, a general and intentional lack of dramatics. Nothing that can be called "wrong." But this is a very emphatic and noticeable manner of performance, 1961 style. If you buy the CD, you buy this approach too.

Interesting. Our young neo-Romantic classical fans will undoubtedly dislike the play-down, the un-Romantic feel, the somewhat chilly beat, the hurried tempi throughout. But the very young may like it, as minimalism—sort of. Those who still go for Vivaldi and Bach and early rock and jazz will approve. They enjoy the big beat, even when it is a little beat. As for us older listeners who have lived through it all, we can understand what we hear, and probably remember it with nostalgia. That's my viewpoint. But indeed I have changed—I really prefer a bit more expressive playing, even Romantic!

Edward Tatnall Canby

Prokofiev: Piano Music, Vol. 1. Boris Berman, piano.

Chandos CHAN 8851, CD; DDD; 65:59.

Volume 1 of Chandos' projected complete Prokofiev piano music contains his Piano Sonata No. 5 (Op. 38 in its revised form, as Op. 135); Four Pieces, Op. 32; piano versions of the Scherzo and March from the opera *Love for Three Oranges*, and a suite of 10 numbers derived from his *Romeo and Juliet* ballet. To place one major work with several lesser ones on each

The fifth piano sonata by Sergei Prokofiev might be described as classicism seen through a kaleidoscope of polytonality.

volume of such a complete set makes eminent sense, though it sometimes causes pieces to sit somewhat awkwardly together.

The suite and the opera are near contemporaries of the original version of the sonata, but the version recorded here is considerably later than even the ballet. The sonata also is considerably more "serious" than anything else on the disc. It might be described as classicism seen through the kaleidoscope of polytonality. It certainly has more facets and structural complexities than any of the other selections on the disc, whose simple dance forms allow them to be a great deal more accessible.

Because of this, it's a shock to be dumped into the familiar extrovertedness of the *Love for Three Oranges* Scherzo at the end of the sonata's finale. This is a recording that could have profited materially from the original CD random-access plan: Banding for the overall works and indexing for their constituent movements. Failing that, Chandos might have placed the sonata last, so that it could more easily be played all by itself. The only way to do so with the present, fairly standard layout is to program its three movements in sequence.

Boris Berman is an excellent choice for a complete Prokofiev piano discography. There is a certain robustness or directness to his playing that suits the composer admirably, and Berman's command of tonal color is exceptional. This is particularly evident in the opera and ballet pieces, where Prokofiev's orchestral scoring rings in our ears. All in all, this is an auspicious beginning for the series.

Robert Long

J. S. Bach: The Works for Lute. Lutz Kirchhof.

Sony Classical (Vivarte) S2K 45858, two CDs; DDD; 1:41:22.

Bach for the lute? Not many Bach listeners (or performers) are aware of this surprisingly large literature, in many familiar formats including no less than four suites, a partita, and a prelude, fugue, and allegro. Not far from two hours of lute music, here performed on two different lutes.

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The Cleveland Orchestra and Vladimir Ashkenazy balance incisive rhythmic vitality and the sensual lyrical elements of Ravel's music.

when movement after movement, whole suites, turn out to be familiar from other formats, the works for violin or cello solo, for example. Bach, the great transcriber! He could turn anything into anything else, and did so almost daily, to meet the demand for his services. No loss, either. Each transcription, no matter how far-fetched, is musically better than its model. Much of the B-Minor Mass, you may know, is "borrowed" from earlier works with entirely different texts.

There is much accounting in the booklet's notes, written by this lutenist, of the incredible difficulties in playing lute Bach, which Lutz Kirchhof is the first to say is NOT idiomatic. Bach was no lutenist. Much of what he wrote (in ordinary notation, not in the special lute tablature) is extremely difficult for the fingers, sometimes impossible. He was even caught (so to speak) writing two notes at once for the same string! Tunings must be changed in all sorts of tortured ways, pitch and key altered—a music nightmare. No wonder we do not often hear these works in their lute form.

After all the talk, Kirchhof's performance is almost an anticlimax, gratifying withal. Not a trace of difficulty appears anywhere: The music is steady, sharp, ultra clear. And more communicative (if less colorful) than guitar Bach, due to the solid lute bass strings and the much greater flexibility in complex passages—10 courses, two strings apiece, with frets. Classical guitarists will find this CD set fascinating. Might even go out and buy a lute.

Edward Tatnall Canby

Ravel: Ma Mere L'Oye; Rapsodie Espagnole; other works. The Cleveland Orchestra, Vladimir Ashkenazy, conductor.

London 430 413-2, CD; 67:12.

The enduring popularity of Ravel's music is evident in the number of CDs available. Many of these are quite satisfactory both sonically and musically, but this London Compact Disc issue has special virtues. The world-class playing of the great Cleveland Orchestra along with Vladimir Ashkenazy's fine performance balance the sensual lyrical elements with incisive rhythmic vitality. Above all, there are the splen-

didly luminous, rich tonal palette of the recording itself and the wonderfully expressive dynamics.

The London engineers have truly mastered just the right placement of the orchestra in the warm acoustics of Cleveland's Masonic Auditorium. The internal orchestral balances reveal every strand of Ravel's colorful orchestration, and the high definition delineates even the most complex orchestral textures. If these pieces are not yet in your CD library, this is the recording of choice.

Bert Whyte

Dvořák: Piano Trios Nos. 2 & 4. Trio Fontenay. Teldec 2292-46451-2.

Dvořák: Piano Trio No. 4; Brahms: Piano Trio No. 1. Rembrandt Trio. Dorian DOR-90160.

A difficult choice! Dvořák's last trio, No. 4, "Dumky," gets sensitive, appropriately reflective readings in both releases here, though the Fontenay's supple and touching wistfulness gives Teldec an edge. Its fine studio pickup successfully suggests a good chamber music venue but lacks the ripe bloom of Dorian's Troy (N.Y.) hall. The earlier Dvořák's trios are underrecorded, but even as played by the Fontenay, No. 2 is no match for the richness and fervor of the Brahms as realized by the Rembrandt, which is utterly in its element here. The Trio Fontenay has recorded all the Brahms (and, now, Dvořák) piano trios. Let's hope the Rembrandt Trio will follow the Fontenay's musical lead.

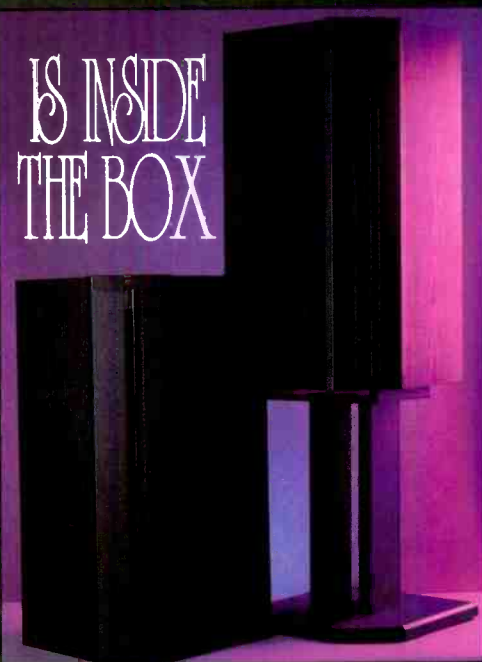
Robert Long

Jan DeGaetani in Concert, Vols. 1 and 2. Bridge BCD 9023 and 9025.

These live Aspen recordings will be cherished by the late soprano's host of admirers. Her outstanding musicianship shines through best, perhaps, in Volume 1's Fauré cycle (*La Chanson d'Eve*, coupled with Jacob Druckman's *Dark upon the Harp* cycle), but her warmth and humanity were never more telling than in Schumann's *Frauenliebe und Leben* in Volume 2 (with "Mondnacht" and a Brahms group). The assisting artists, superbly led by pianist Lee Luvisi, are all first-rate. The pickups are good but not quite up to studio standards, even ignoring the occasional intrusion from the audience. Texts and English translations are included.

Robert Long

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SOUL SURVIVOR



Diva: Annie Lennox
Arista 18704-2, CD; 50:04.

Sound: A Performance: B

Titled with as humorous an attempt at self-definition as John Lennon and Yoko Ono's *Two Virgins*, this first solo album by Eurythmics' former better half is a paradox—intensely soulful vocals but somewhat soulless production. With her slightly reedy yet panther-slick voice and a quite haunting musicality, Lennox weaves and insinuates like the bluesiest of torch singers: The dark and plaintive "Cold" will be sung in champagne-filled rooms for years to come, and the crystalline tension of "Why" could push a broken-hearted lover to suicide (or therapy, at least). As phenomenally as Lennox sings, the production isn't warm enough to complement her.

Swaddled in synth that constructs a sterile world at odds with her smoky voice, *Diva* posits Lennox as an otherworldly queen whose pain and comfort play out on a different, grander scale than ours. Lennox is both lead singer and background singer, majestically overdubbing herself from song to song. Sometimes this heroic design washes over you magnificently, as in "Why" and the utterly beautiful, contemplative "Primitive." When it fails, the dissonance between the power of the expression and the banality of the ex-

pressed is disheartening. Immensely talented, Lennox occasionally seems as removed from the common man as George Bush does: She claims in a press release that the title *Diva* is meant to be ironic, but she also believes the gorgeous cover shot of her is meant to depict faded beauty. Yeah, right. See for yourself.

Lennox wrote eight of the 11 songs here, co-writing two of the others and covering the old Al Dubin-Harry Warren tune "Keep Young and Beautiful"

with a scratchy old-record sound. She sounds delighted and delightful on it—the most human thing on a powerfully sung album.
Frank Lovece

Little Village
Reprise 26713-2, CD; 46:24.

Sound: A Performance: A

Little Village is comprised of John Hiatt on guitar and occasional piano, Ry Cooder on guitars, Nick Lowe on bass, and Jim Keltner on percussion. The band played together before when they recorded Hiatt's excellent *Bring the Family* in an intense four-day blitz in 1987. Everyone wanted to play again, but business got in the way and it took a few years to happen. Once the contractual wrinkles were ironed out and the guys finally got down to their real business of making music, they did a sparkling job.

The 11 songs here are all co-written by the four Villagers. Hiatt sings lead on six, Lowe on two, Cooder on one, and the three singers share the remaining two. This allows a healthy diversity, as each has a distinctive style that complements the others.

"Solar Sex Panel" is a slinky rocker running over a sinewy Cooder riff, while "She Runs Hot," the most upbeat song here, features Cooder's signature slides. "Take Another Look," with a smart Nick Lowe vocal and some swell wide-angle stereo, has a shimmery feel



Photograph: David Gahr

and fun, quirky time-figures. "Don't Bug Me When I'm Working" is a hoot. It features one of Cooder's best solos, some tricky vocal trade-offs, and a cameo "appearance" by Sonny Boy Williamson, whose sampled voice acts as "preacher."

"The Action," with Cooder singing, faintly echoes Huey "Piano" Smith's "Don't You Just Know It" in melody and Captain Beefheart (who Cooder played with early on) in feel. Hiatt's most soulful vocals illuminate the album's three slow songs—the tender "Don't Think About Her When You're Trying to Drive," "Do You Want My Job," with its subtly Hawaiian melody and guitar style, and the six-minute burner "Big Love."

Little Village is an album that gets better with each listen, as its depth and subtlety are revealed bit by bit. The recorded sound is excellent (with some fun stereo effects) and the playing is first-rate, as it should be with these four. The mutual admiration that they have for each other is obvious, and it brings out the best in each. Best of all, the material here is terrific, by turns funny and touching, sweetly sad and tartly rocking. *Michael Tearson*

Deserters: Oyster Band. **Rykodisc RCD 10237.**

With its distinctly Northern England sound—fierce, ancient, drivingly percussive—plus harmonies that would do The Everly Brothers proud, the six-year-old Oyster Band is as glorious and largely undiscovered as Antarctica. *Deserters'* songs of figurative and literal escapees from political and personal persecution ring with a chilling moral conviction. "What we wanted was: To be sure no friends were lost in vain" goes one song about democracy turned banal and horrible—played regrettably yet rocking like thunder. The band's 1987 release, *Wide Blue Yonder*, is even better. Check that out as well. *Frank Lovece*

Dark Sneak Love Action: Tom Tom Club. **Sire/Reprise 9 26951-2.**

The musical lovechild of Chris Frantz and Tina Weymouth (Talking Heads' rhythm section) returns with more songs about being cute and clever. Since album one (1981's *Tom Tom Club*), they've functioned according to

Tom Tom Club



a blueprint of innocuous kitsch that sounds all too much like Japanese pop. In fact, if the Tom Tom Club were a place, it would be in Tokyo. But somehow, this stuff seems to work, as long as it remains lighthearted and carefree. A song about a "sex kiss" is given a disclaimer in its title that it's an "Innocent Sex Kiss," while something as inane as party dip takes on new meaning after being honored by Frantz and Weymouth in "Irresistible Party Dip." To the listener's relief, excess cutesiness on *any* Tom Tom Club record (there's always some) is balanced by the fact that Frantz and Weymouth seem to always have fun with the project—and the fun is contagious.

Michael Bieber

Solace: Sarah McLachlan. **Arista 18931-2.**

Nova Scotia native Sarah McLachlan treads demanding territory, not too far from the likes of Peter Gabriel and Kate Bush. Her songs are passionate—intensely so. You feel her heart is about to burst, and this leads her into mo-

ments of arch preciousness. Yet they're overshadowed by the glories of her accomplishments. *Solace* is McLachlan's follow-up to her striking 1989 debut, *Touch*. Opening with its most direct and best songs, the new album gradually becomes more introspective and nearly opaque before resolving into a celebrative finale of Donovan's "Wear Your Love Like Heaven," which serves as a welcome release. *Solace* is not an easy album, but it's a rewarding one. If you're willing to meet it on its own terms, there are wonderful songs and moments to be savored.

Michael Tearson

Five Guys Named Moe (Original London Cast Recording). **Relativity/First Night 88561-1104-2.**

I once saw that rascal Louis Jordan a couple of years before his death, and it was a wonderful entertainment experience. So, too, is the show that Clarke Peters has assembled to celebrate Jordan's music and wit. The humor and musicality of his songs are emphasized by the energetic performances

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The Judybats

of the six-man cast, all captured in this thoroughly enjoyable recording.

Michael Tearson

Nonsuch: XTC. Geffen GEFC/D-24474.

With *Nonsuch*, XTC demonstrates that experience does indeed count for something. One of the best and oldest post-punk/New Wave bands still active, XTC has created an album that qualifies as the group's definitive work. *Nonsuch* features quality and quantity—17 songs, to be exact—with the use of harmonies a pronounced plus. There are several nods to The Beach Boys' *Surf's Up* period (approximately), and primary songwriter Andy Partridge's enthusiasm for this genre is highly contagious. Producer Gus Dudgeon has done a fine job of bringing out the most tuneful and commercial aspects of the band without abandoning its artistry.

Jon & Sally Tiven

Down in the Shacks Where the Satellite Dishes Grow: The Judybats. Sire 26801-2.

For their sophomore effort, The Judybats have assembled a dozen bright, bouncy songs about enigmatic women, mistakes with lost lovers, and ambivalence about the ones they've got. Though the band includes a female (Peg Hambright), women remain a mystery on *Down in the Shacks*. The Judybats' biggest enemy may be the elegance in lead singer/lyricist Jeff Heiskell's voice: It doesn't match their puckish wit and cozy, strummy music, and it hints that observant men are hiding inside indecisive boys. The Judybats do get points for honesty, though. On "Our Story," Heiskell confesses, "I want you/I know it's crazy but I really want to leave you, too." He further reasons, "Though I hate it when you wake, I still love to watch you sleep."

Toby Haber



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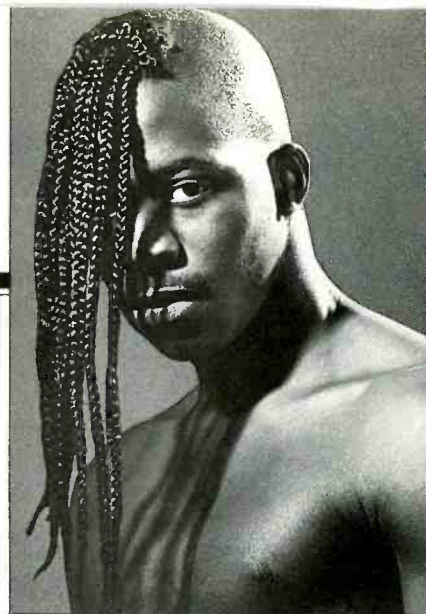
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Me Phi Me comes across like a dub poet surrounded by funk grooves, 12-string guitar, and sound bites, carrying serious messages.



One: Me Phi Me. **RCA 61036-2.**

Don't think of Me Phi Me as a rapper. He's more like a dub poet who surrounds himself with a wall of funk grooves, 12-string guitar, and sound bites. His music is laden with serious messages, especially that of attaining one's full potential as an individual

while contributing to the macrocosm of the human race. Yet as a young African-American, Me Phi Me isn't unrealistic about the questions we're facing in society, since African-American unity and issues of race receive equal time on this album as well.

Michael Bieber

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King of Hearts: Rick Vito. **Modern/Atlantic 91789-2.**

Rick Vito, the newest member of the Fleetwood Mac Alumni Society, checks in with a solo album that packs more punch and wit than expected. A good portion is midtempo rock à la the Big Mac ("Desiree," a duet with Stevie Nicks, is particularly strong), but there is some tasty blues in "I Still Have My Guitar" and a lot of very fine guitar playing, especially in the instrumental shuffle "Walking with the Deco Man."

Michael Tearson

Charcoal Lane: Archie Roach. **High-tone HCD 8037.**

Archie Roach's songs translate a hopeful optimism amidst the appalling despair and misery suffered by his people, the Australian aborigines. There is a rich and subtle eloquence in his mournful voice. Produced in a folksy style by Paul Kelly, himself a terrific songwriter, and Kelly's guitarist Steve Connolly, Roach paints vividly haunting stories and portraits in song. *Charcoal Lane* is a most auspicious debut.

Michael Tearson

Live at the Hollywood Palladium: Keith Richards and The X-Pensive Winos. **Virgin 2-91808.**

This live recording offers a stripped-down and off-the-cuff performance full of charm and personality. Keith's vocals are surprisingly on, and there is a consistency to the band's grooves that was lacking on *Talk Is Cheap*. Although The Stones' guitarist and backbone doesn't play with the muscularity that he once did, his Fender-isms still have an unmistakable voice. Guitarists and rockologists may look to this album as a definitive study of where aging guitar heroes go when they can't trash themselves or their equipment anymore.

Jon & Sally Tiven

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BOSSA NUEVA

Brasileiro: Sergio Mendes
Elektra 61315-2, CD; 52:41.

Sound: A+ Performance: A+

Brasileiro is a stunning achievement in every possible way—from its cover artwork and recording quality to its musical documentation-cum-fusion of var-



ious Brazilian styles, composers, players, singers, and percussionists. The album defines a new high point in Sergio Mendes' career and is a summation of America's 30-year love affair with the music and culture of Brazil.

Mendes spent over a year assembling this album, with five months devoted to finding and recording some of the most powerful and musical percussionists ever documented. This is immediately evident in the opening and closing "Fanfarra," a dialog between an individual percussionist and a 100-strong group of drummers playing a variety of instruments. The dialog continues with the addition of a choir, singing in a circle samba. The call and response of this magnificent choir, assembled by Mendes and heard throughout the album, is splendidly juxtaposed with Vai Quem Vem, a 15-piece Bahian percussion ensemble that seems to have as many tonal colors as a pianist with an extra 88 keys at each end of a Steinway.

Brazilians seem to share a characteristic with jazz musicians in their ability to take other musical forms and completely make them their own. One cut, "What Is This," written and sung by Vai Quem Vem member Carmen Alice, fuses South American rhythms, a flute synth sound, and the traditional berimbau with a beat box for a Bahian rap song, in English nonetheless.

If you're a fan of Quincy Jones, you may be aware that he's a fan of the great Brazilian composer Ivan Lins. Along with his lyricist Victor Martins, Lins contributes the most beautiful piece on the album, "Lua Soberana." Here is a perfect marriage of Mendes' style of North-South American arranging, top L.A. session players, and the Lins/Martins songwriting team.

Other contributions come from Carlinhos Brown, whose "Magalenha" is driven by a triangle played in the hold-release style reminiscent of northeastern Brazilian folk music. Brown's other compositions, "Barabare" and "Magano," both exemplify the strong Brazilian vocal tradition; the former is based on the Bahian "ijexa" rhythm and the latter on a Yoruban chant. "Magano" is especially uplifting, with its rising choral exhortations. The classically oriented composer Guinga con-

tributes "Esconjuros"; its Portuguese lyrics convey a power and majesty that transcend linguistic barriers. So, too, Guinga's "Chorado," sung in the extraordinary tenor of Claudio Nucci.

Mendes' final masterstroke was to include a contribution from the great multi-instrumentalist and somewhat idiosyncratic composer-performer Hermeto Pascoal. On "Pipoca," the samba that Mendes commissioned from Pascoal, singer Joe Pizzulo's voice nicely underlines the female voices.

With *Brasileiro*, Sergio Mendes has created one of the most important records of the year. It's not only a summation of his career but a high point in our enchantment with Brazil. *Al Pryor*

Watcha Gonna Do for the Rest of Your Life: Dirty Dozen Brass Band
Columbia CK 47383-2, CD; AAD; 55:08.

Sound: A Performance: B

New Orleans' Dirty Dozen Brass Band manages to combine some of the strengths of groups like Lester Bowie's Brass Fantasy and The World Saxophone Quartet into a Crescent City wind and horn ensemble without peer. Initially they were part of a wave of off-center artists pushed into the



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McCoy Tyner's intensity and floral-like approach continue to make his work seductive on the quintet date *44th Street Suite*.

limelight during the early '80s by crafty independent labels. *Watcha Gonna Do for the Rest of Your Life*, their third record for Columbia, is a sassy collection of mostly originals composed and arranged by the group's members.

Because their music is not performed with a conventional rhythm section, the Dirty Dozen Brass Band seems to be better at creating vehicles that showcase the artistry of its members, who play what we normally think of as non-soloing instruments. Sousaphonist Kirk Joseph is remarkable. In one moment, his bass lines are whimsical echoes of something between Motown and Tower of Power. Elsewhere, he seems to defy the limitations of the sousaphone by using his embouchure to conjure up an endless variation of sounds.

The Dirty Dozen Brass Band's sound is jampacked with African, Central American, and South American culture. Bearing testimony to the historical legacy of New Orleans itself, this diversity is wonderfully reflected in the music that the ensemble has chosen to record. "Eyomzi" and "Use Your Brain," written by the late South African bassist Johnny Dyani, are the only compositions contributed from outside the band. They demonstrate the Dirty Dozen's ability to bump, grind, and rock with the best bands of the New Orleans tradition. "The Lost Souls (of Southern Louisiana)," written by trumpeter Gregory Davis, is a six-part suite whose movements flow from a dirge-like overture to spiritual elements that evolve into the more rambunctious Latin-tinged section.

Another piece that comes to mind is "Charlie Dozen," a radio-ready contemporary track written by trombonist Charles Joseph. It opens with a funky, second-line back beat and follows with the horns quickly moving from a unison

statement to an ever-growing crescendo of counter melodies. These melodies reach their zenith as a collectively improvised statement, only to return to the original ensemble melody line.

Watcha Gonna Do for the Rest of Your Life is another excellent contribution from an ensemble that has managed to instill a sense of joy and revelry into their music. It took some courage for the group to step away from using well-known guest soloists and crowd-pleasing standards, as they have done on previous records. However, they and we are still rewarded with a fresh and engaging contribution to the jazz idiom. *Al Pryor*

44th Street Suite: McCoy Tyner
Red Baron AK 48630, CD; ADD;
37:29.

Sound: B+ Performance: B+

Sunrise Sunset: The Bob Thiele Collective featuring David Murray, John Hicks, Cecil McBee, and Andrew Cyrille

Red Baron AK 48632, CD; ADD;
60:53.

Sound: B+ Performance: A-

McCoy Tyner has been rather prolific the last 18 months, and additional sessions are scheduled to be released this year. Although saturation may catch up with "John Coltrane's pianist," his continued intensity and floral-like approach make his work seductive. It's difficult not to relish delving into *44th Street Suite*, one of four records veteran producer Bob Thiele has issued simultaneously in launching his newest label, Red Baron.

44th Street Suite is a quintet record, with Tyner joined by tenorman David Murray and altoist Arthur Blythe (both of The World Saxophone Quartet), bassist Ron Carter, and Tyner's regular

drummer, Aaron Scott. The date is a mixture of structure and improvisation, covering the likes of Coltrane's "Besie's Blues," Duke Ellington's "Blue Piano," Rodgers and Hart's "Falling in Love with Love" and the 12-minute, two-part title suite, written by Tyner, Blythe, and Carter. What's here is terrific, save a few end-of-song fade-outs—an outdated technique if ever there was one. The CD, however, runs a scant 37 minutes, which is hardly enough time for this formidable ensemble to get its engine motoring.

Thiele's initial release schedule also includes *Sunrise Sunset*, delivered by a group that goes by the name of The Bob Thiele Collective." This appellation arguably overextends the producer's prerogative, particularly when the session fuses the talents of the aforementioned Murray, pianist John Hicks, bassist Cecil McBee, and drummer Andrew Cyrille. This quartet has worked together and in sections previously; musically, each owns equal stature. In that sense, this is a collective.

The fearsome foursome latches on to "Body and Soul," which allows Murray to interpret Coleman Hawkins, one of his mentors, and "'Round Midnight," where, thankfully, the group takes the "'Misty' of the '80s" to higher ground rather than allowing it to waddle amidst the all-too-many hackneyed renditions preserved to date. With the title track, the *Fiddler on the Roof* standard, Murray and Hicks respectfully bend tradition. Regardless of material, this quartet always offers the real deal.

Jon W. Poses

In Walked Thelonious: Walter Davis, Jr. **Mapleshade MHS 51263H.** (Available from Mapleshade Productions, 2301 Crain Hwy., Upper Marlboro, Md. 20772.)

The late Walter Davis, Jr. (who died tragically of untreated diabetes), was a protégé of Thelonious Monk. Here he reinterprets 14 of his favorite Monk tunes, recorded using Mapleshade's purist analog approach on a restored although rather tinny sounding 1911 Steinway. In his treatment of titles such as "Crepuscule with Nellie," Davis never smooths over the jagged-edged Monkisms, while in hard-driving numbers like "Bye-Ya" and "Off Minor," he lets every note stand in sharp relief.

Photograph: ©David Gahr



Steve
Coleman

Davis' pregnant little pauses before some of the more unexpected harmonies sound so exactly like Monk himself it's almost eerie.

John Sunier

Rhythm in Mind: Steve Coleman. RCA/Novus 63125-2.

On *Rhythm in Mind*, Steve Coleman methodically melds old and new compositions as well as veteran musicians and relative newcomers—Ed Blackwell, Von Freeman, Tommy Flanagan, Kevin Eubanks, and Marvin "Smitty" Smith, to name a few. His conception is praiseworthy, but the music is even better. There are orchestral-sounding readings of two Thad Jones pieces ("Slipped Again" and "Zeo") and Coleman's own gorgeously rich yet introspective small-group entry "Sweet Dawn," seemingly written with Flanagan in mind. Bassist Dave Holland contributes the semi-raucous groove "Pass It On," which allows Freeman to sound ultra-modern despite his near 70 years and also gives us the enjoyably incorrigible Smith, who bowls a strike.

Jon W. Poses

Straight Street: Harold Mabern. DIW/Columbia CK 48961.

Harold Mabern is an often underappreciated pianist who's been playing jazz for more than 30 years. Born and reared in Memphis (as was his mentor, Phineas Newborn, Jr.), Mabern has greatly influenced a trio of established, home-grown pianists who are a generation younger than he: Donald Brown, Mulgrew Miller, and James Williams. It was Williams who took it upon himself to produce *Straight Street*.

Mabern is a powerful but delicate keyboardist, falling on the right side of bombastic, for instance, in his reading

of Coltrane's "Crescent." His fluidity is exceptional, and at times he can be lightning quick. But his building of chordal structures centered on octave intervals—à la Wes Montgomery—remains his calling card. The session places Mabern with bassist Ron Carter and drummer Jack DeJohnette and is exceptionally tasteful throughout. It also serves as a fine example of Mabern's succulent, blues-drenched jazz.

Jon W. Poses

Kenny Drew, Jr. Antilles 314-510-2.

Jazz fans will immediately be drawn to the name of pianist Kenny Drew, Jr., whose father played piano with everyone from Dinah Washington to Buddy Rich. On Drew's American label debut, after a couple of records for a Japanese label, legendary producer Jerry Wexler and John Snyder successfully showcase the breadth of his musical eloquence. This album is typical in some respects—a mixture of standards and originals, ballads and uptempos, and solo, trio, and group settings. As a composer, though, Drew displays a wonderful penchant for full melodic development, with lines that are always fluid and complete and with ideas that flow throughout the changes. As a pianist, he has the relaxed self-assurance of a gifted jazz player and the kind of sublime virtuosity and aplomb most often associated with classical players.

Al Pryor

Open Letter: Ralph Towner. ECM 314 511 980-2.

Departing from some of his more ethereal inclinations, guitarist Ralph Towner delves into a more melodic vocabulary. Playing classical and 12-string guitars and synth, and accompanied only by drummer Peter Erskine, Towner ranges from cool jazz introspection to neo-Romantic contemporary classical composition and lighter, Latin-inflected expressionism. On "Infection," ripe with deft interplay between guitar and percussion, Towner even gets down with some fairly progressive polyrhythmic improvisation. Lyrical fingerstyle jazz arrangements of Bill Evans' "Waltz for Debby" and Sammy Cahn's "I Fall in Love Too Easily" round out Towner's most relaxed and genuinely entertaining set in quite a while.

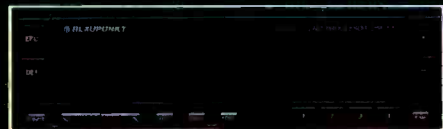
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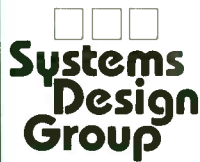
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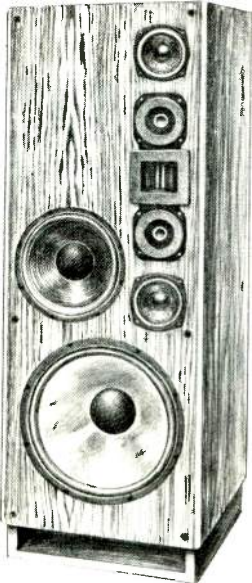
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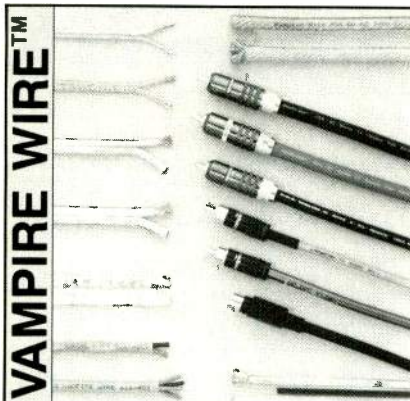
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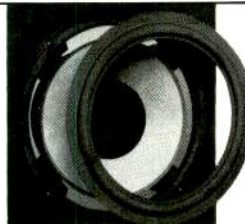
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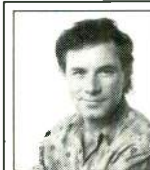
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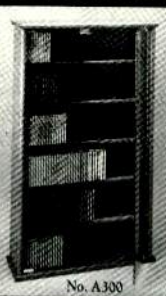
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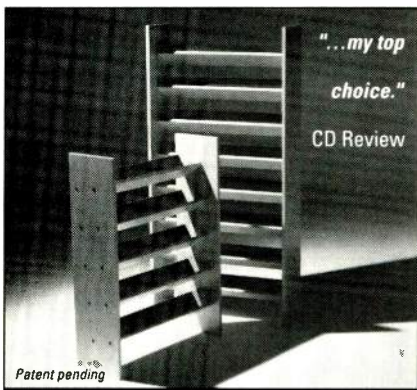
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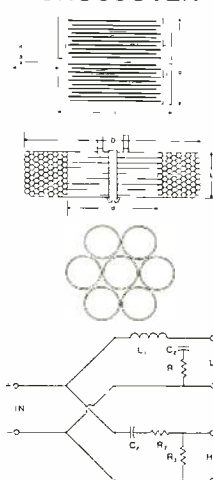
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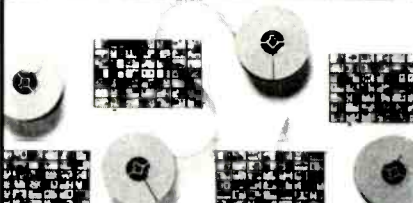
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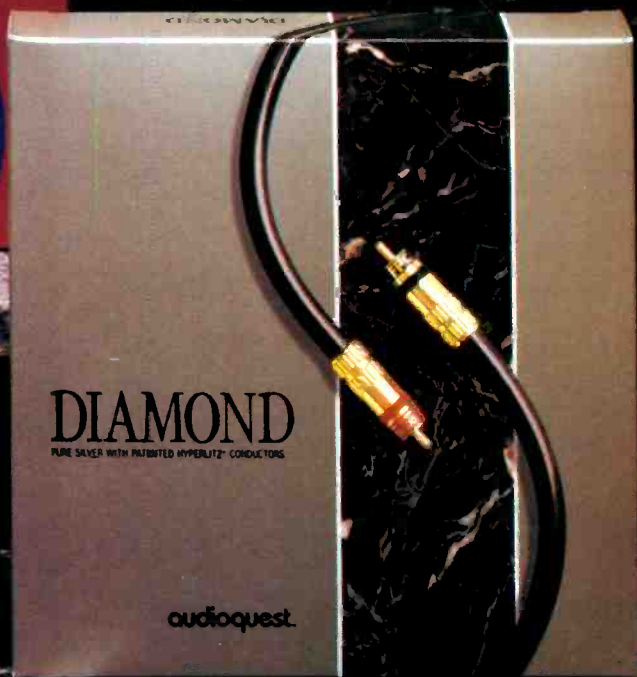
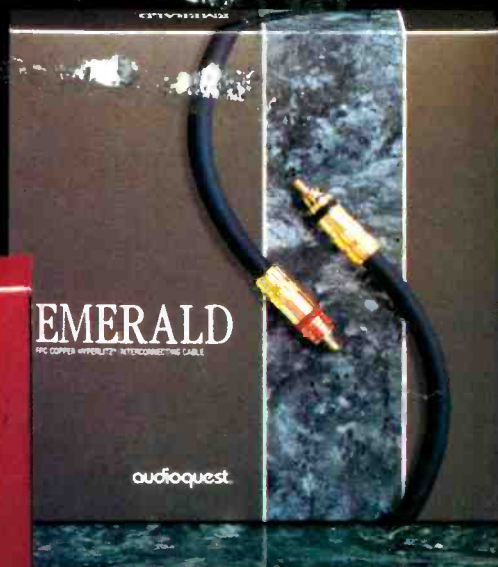
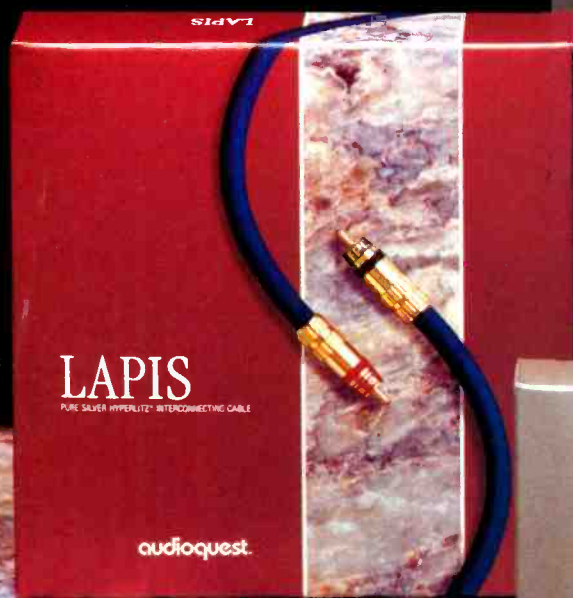
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