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# AUDIO

THE EQUIPMENT AUTHORITY

JANUARY 1997



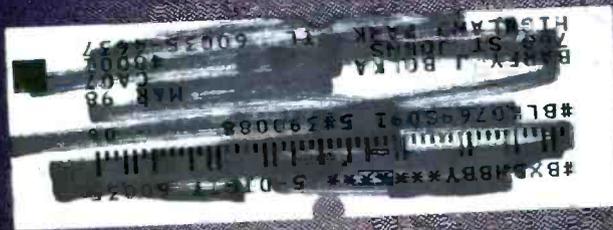
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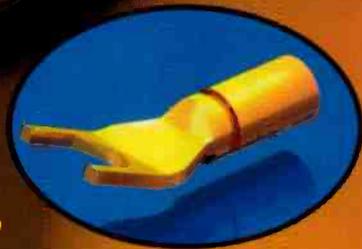
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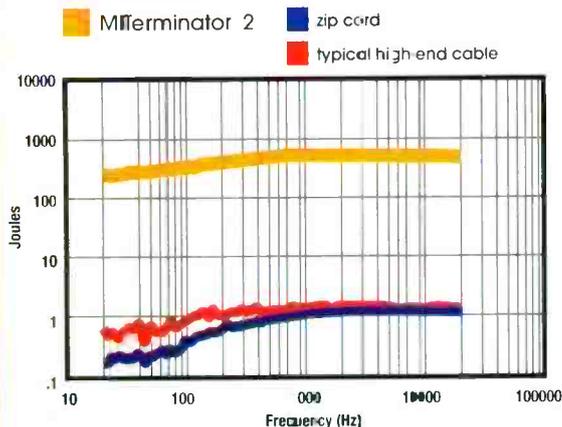


# Why MITerminators sound better

## Superior Final Energy Component

In transmitting electrical energy, cables store and release energy. MIT calls the amount of energy that is stored and released the Final Energy Component. Unfortunately, as shown in the plot, the Final Energy Component in ordinary 12-gauge "zip cord" and a typical high-end cable is non-linear — it changes value with signal frequency. This non-linearity inevitably causes distortion and the loss of both tonality and image integrity.

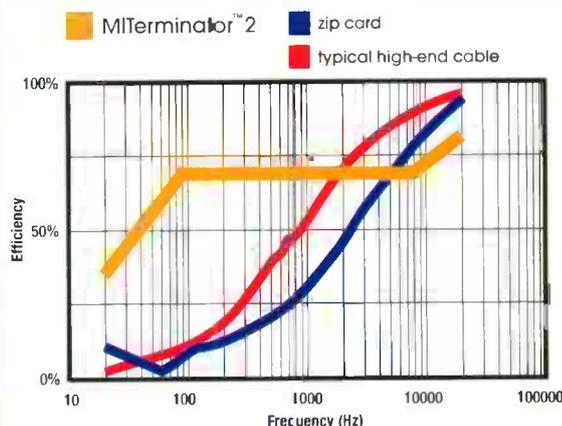
MIT discovered that increasing the Final Energy Component of cables already having outstanding electrical characteristics dramatically improves the overall sound quality. By employing the patented MIT Terminator Networks to store and release energy at the correct levels and times, nonlinearities are greatly reduced or eliminated. This superior Final Energy Component is a major factor in the superb sound quality of MITerminators.



## Superior Efficiency

MIT quantifies how well cables maintain correct phase relationships between audio signals' voltages and currents as Efficiency. When cables maintain correct phase relationships, all of the signals' energy transfers to the next component — to the speaker with 100% efficiency. Ordinary cables' nonlinearities make them much less efficient at low frequencies than at high frequencies, as the plot shows for "zip cord" and for an ordinary high-end speaker cable. The sonic results are noise, distortion, loss of image quality, and excessively "bright" treble sound.

As you can see from the plot, MIT's patented Terminator Networks give MITerminator cables a huge advantage over ordinary cables, raising low-frequency efficiency and "flattening" the overall curve. This means that MITerminator cables deliver far more accurate tonality and imaging, with lower noise than ordinary cables can. Although the plot shows speaker cables, the results also apply to interconnects.



## Superior Imaging

Three-dimensional graphics of a typical listening room represent the sonic image quality produced by three different speaker cables. The blue, red and yellow areas indicate the image size, while the musical notes represents the quality of image focus.

The blue area produced by ordinary 12-gauge cable is tiny, indicating a small, veiled image, and the blurry note indicates that the image is unfocused and poorly defined. The result is a constricted, unconvincing image lacking breadth, depth and life.

The red area produced by a typical "high-end" cable is larger, but is still too small to create a convincing, lifelike soundstage. The blurry note indicates poor image focus within the larger image area. The result is a larger image that only makes the lack of focus and definition more obvious and disappointing.

The yellow area produced by the MITerminator 2 is convincingly large, with the breadth and depth to create a lifelike soundstage. The sharp, clear note indicates solid image definition and focus throughout the audio spectrum. The superior Final Energy Component and Efficiency provided by MIT's Terminator technology deliver a natural, tightly focused and solid image that preserves the integrity of the musical performance. Only MIT's patented Terminator technology can achieve this level of performance in your system.

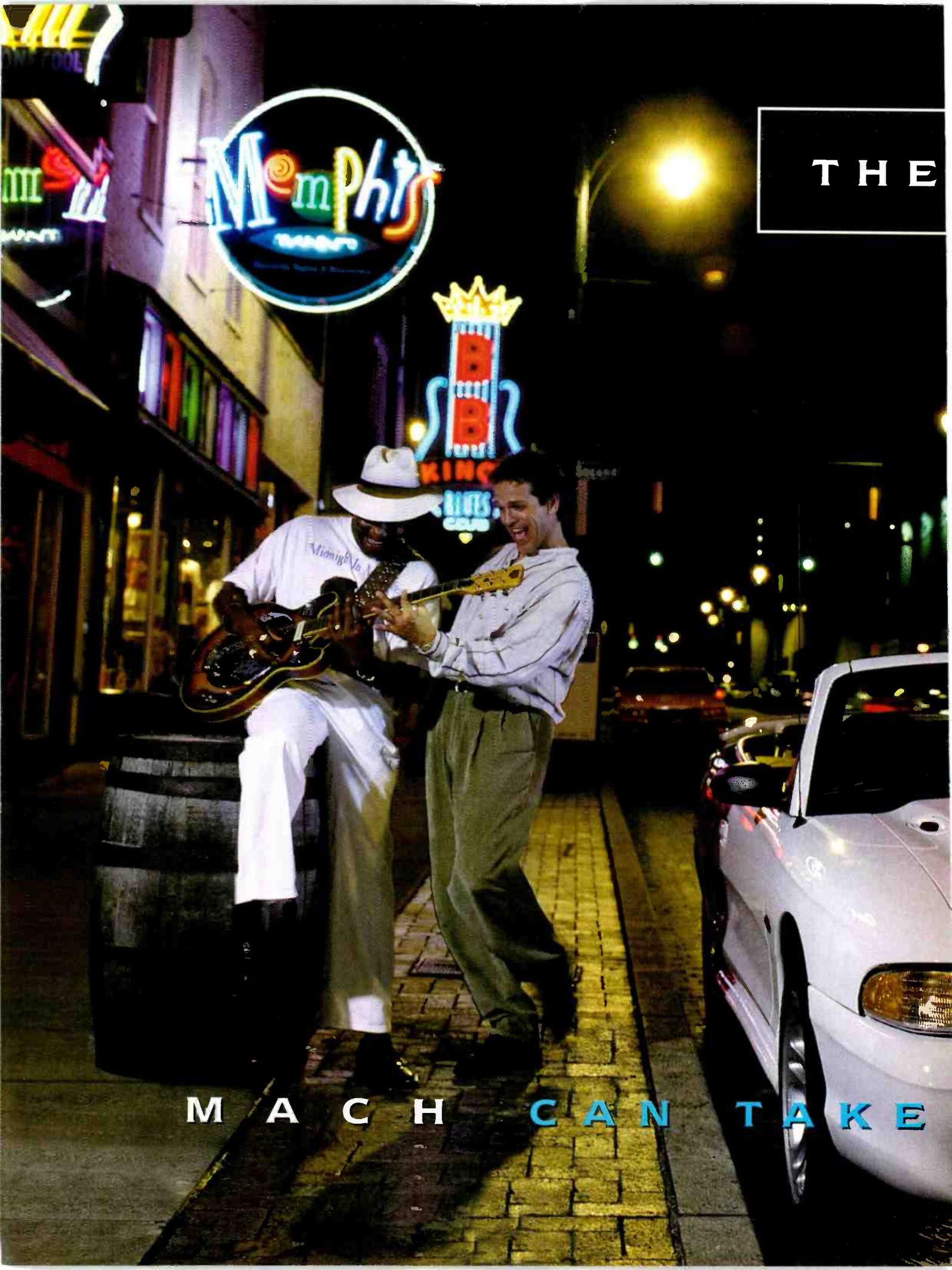


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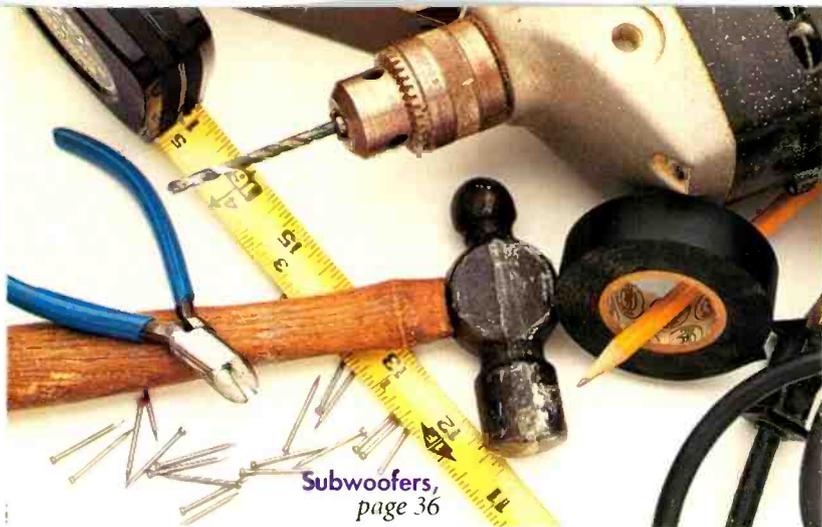
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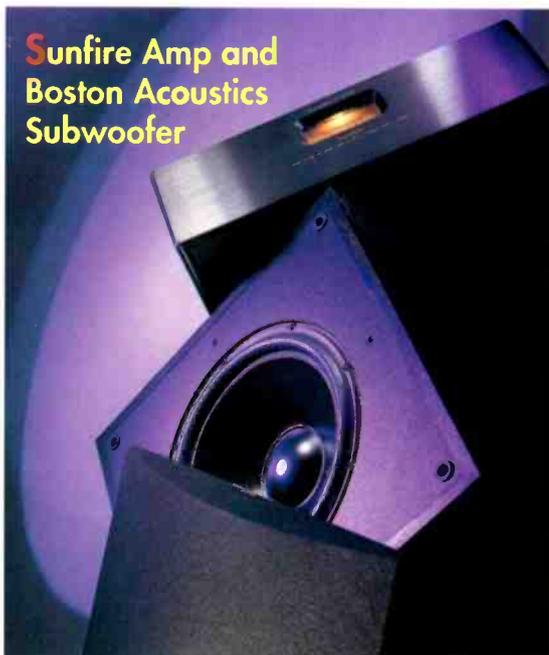
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# AUDIO

THE EQUIPMENT AUTHORITY



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Sunfire Amp and Boston Acoustics Subwoofer

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## PLAYBACK

**RANE SSE 35 HOME THEATER EQUALIZER, DODSON AUDIO DA-217 D/A CONVERTER, AND SCHEIB CD DISCDIVIDERS** ..... 112



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It doesn't take a long memory to remember when subwoofers were pretty much a curiosity in hi-fi. There were a handful of nice ones available—big and expensive, for the most part—and if you happened to be both an audio buff and a pipe organ aficionado, you might actually own one. But that was about it.

Now most major speaker manufacturers have subwoofers in their lines, and the price of entry for buyers has dropped substantially. We can thank home theater and bombastic action-movie soundtracks for that. This new-found popularity stirs up several interesting issues, however.

One is that many contemporary subs aren't true subwoofers by traditional measures. Flat response down to 30 Hz is dandy for soundtracks, but if you're chasing the bottom stop of a big organ, you really do want the next octave down. And there are plenty of boxes now being sold as subwoofers that get down only to 40 or 50 Hz—about the same extension as a typical full-size, full-range speaker. Although these are fine for filling out the bottom end of a set of small satellite speakers or just adding *more* of what you already have, they would properly be called woofers rather than subwoofers.

Another oddity is the conventional wisdom that subwoofers should be turned up louder for movie soundtracks than for straight music recordings. I've been hearing that for probably a decade, yet in my experience, at least, it's not true. The right level for music is the right

level for movies, and vice versa. (I've endured a couple of system demonstrations in which the bass was pumped up so much that dialog became unbearably chesty-sounding, so even if you do want more low end for movies, there's a limit to what's reasonable.) I suspect people just feel more comfortable indulging themselves on soundtracks: What seems tasteless or unsophisticated with music may be



perceived as nothing but good, clean fun with movies. Why, though, should a passion for bass be cause for embarrassment? Frequency response is not a moral issue. Want to feel the rumble? Crank it up (dude).

Maybe the most interesting thing about subwoofers is how they simplify system setup. Speaker placement gets a lot easier when you can deal with low-frequency response separately. The end result, if you do a good job of placing and adjusting the sub, is usually higher overall performance than could have been achieved with a set of speakers operating on their own, full-range, in the conventional manner. We've kind of stumbled into a better way of doing things. So even if you don't care about home theater, it has handed you a new tool for improving your audio system.

# AUDIO

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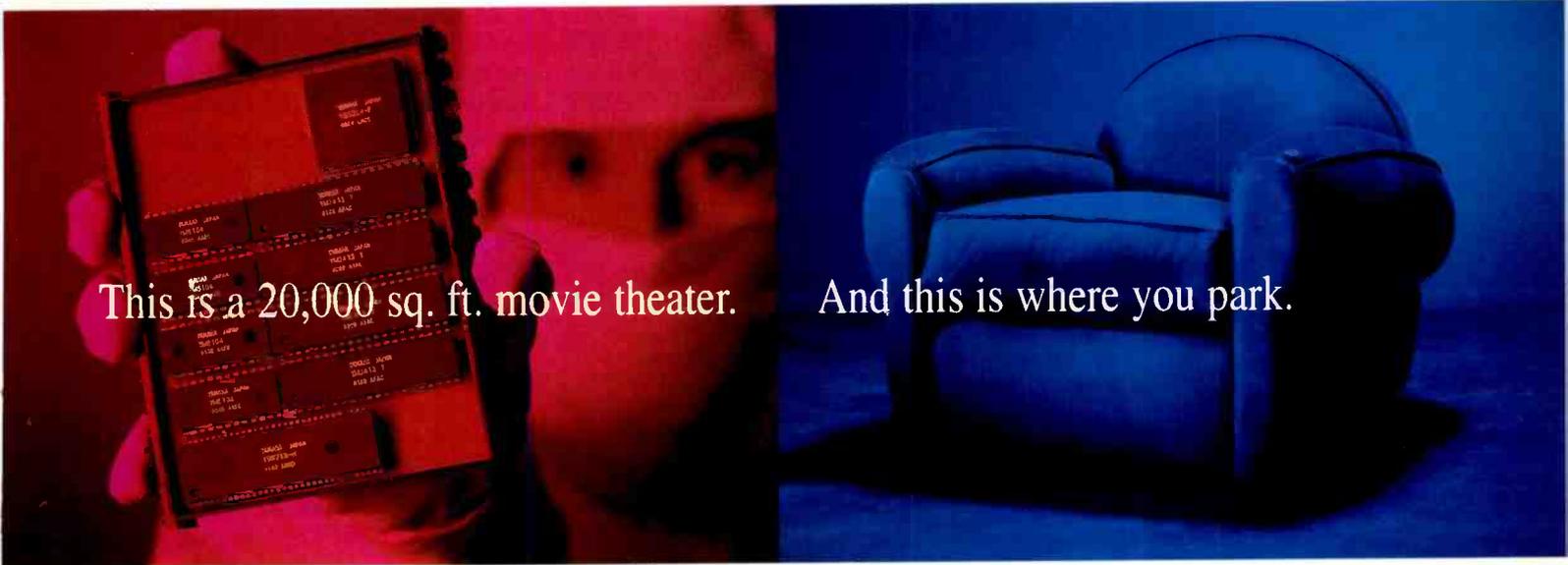


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## Upping the Mix

Dear Editor:

As an amateur musician who dabbles in various realms of pro audio (installations, live mixing, recording, etc.), I was familiar with most of the information in Daniel Levitin's "Mixing It Up: The Modern Art of Studio Recording" (September 1996). However, there are some aspects of professional recording that have baffled me for many years.

Rock albums are the most atrocious recordings I come across. There is so much wrong with them, I hardly know where to begin. For instance, often everything below 60 to 80 Hz is equalized out of the bass guitar and into the kick drum. The result is that the kick drum carries the bottom end while the bass guitar becomes indistinguishable mush, merely mid-bass filler between the kick drum and the other instruments. Dream Theater's *Images and Words* is a prime example.

Drums seem to be the most abused instrument in the studio. Listeners are subjected to such "stupid engineering tricks" as mixing the kick drum much louder than the rest of the drum set (or, in the case of Dream Theater's release, louder than everything else!), as if it were a totally independent instrument. Hi-hats are mixed louder than crash cymbals (as in Heart's self-titled release from 1985), and huge amounts of reverb are added to the snare and toms while the hi-hat is left dry (i.e., no reverb), making it sound like a separate instrument (Dave Matthews Band's *Under the Table and Dreaming*, for instance). Sometimes huge amounts of reverb are added to the entire drum set while the rest of the band is left relatively dry, which makes it seem like the drummer is playing on another planet (Eddie Brickell & New Bohemians' *Ghost of a Dog*). I've also heard combinations of the above.

In addition, I cannot understand the pervasive overuse of compressors and limiters,

which results in CDs that sound almost as flat and lifeless as FM radio. We have two software standards, CD and cassette, with different dynamic range capabilities. And since each manufacturing facility is sent a different master, why can't the CD version be processed with as little compression as possible? In paying a higher price for CDs, we shouldn't be subjected to substantially lower sound quality than the format is capable of.

Speaking of sound quality, it seems anybody can make recordings that sound better than most professionally recorded CDs. For instance, a number of years ago I was asked by some musician friends to record a



few demo songs for their band. We did the recording in rented commercial office space and used plain vanilla Shure SM-57 and SM-58 mikes, an old Sunn mixing console that had seen 10 years of touring duty, and a consumer-grade Akai reel-to-reel recorder running at 7½ ips. No compressors were used because none were available, and the drum set was mixed with only four strategically placed mikes. To be honest, I had low expectations for this recording but hoped it would be at least listenable. To my initial shock and then delight, it sounded fabulous! The percussion, especially the cymbals, had incredible dynamics and resolution, with overall fidelity as good as or better than the best CDs I've ever heard. The bass was clean and tight, with every note discernible. The grand piano, while

not outstanding, at least sounded much better than average.

So the obvious question is: If a rank amateur can produce an outstanding recording with low-end equipment and facilities, why do pros with state-of-the-art gear consistently churn out a mid-fi product?

Wayne A. Pflughaupt  
Katy, Texas

*Author's Reply:* You can't believe how much I sympathize with your complaints. I agree that many, many popular music albums are distressingly low-fi. I'll try to address your concerns as best I can and provide reasons for why this is so.

The first reason is poor musicianship. In many cases, rock musicians are simply not great players (although they may have great musical ideas). Many bass guitarists and drummers are often unable to play their instruments with consistent volume and articulation. Compression, reverb, and EQ are used to even out these inconsistencies. In this category I have to add poor arrangements. Compression and EQ are used with frightening regularity in recordings to "bind together" arrangements that do not allow for the instrumental parts to breathe in and out and to mesh with one another. It's no coincidence that some of the best-recorded and cleanest-sounding songs ever produced in popular music are by the best

arrangers: The Beatles (with George Martin), Steely Dan (Donald Fagen and Walter Becker), Fleetwood Mac, 1975 to 1985 (Lindsey Buckingham), Creedence Clearwater Revival (John Fogerty) and The Carpenters (Richard Carpenter).

In some cases, the primary goal of the recording engineer, producer, and band is not to make a high-fidelity recording but, rather, one that has sonic impact. Many rock musicians don't care nearly as much about hi-fi as we do; what they want is a powerful sound. The Sex Pistols' *Never Mind the Bullocks* and U2's *War* were recorded by masters of high fidelity (Chris Thomas and Steve Lillywhite, respectively) who were going for something else: a massive wall of sonic impact that many listeners found exciting. (I have to say, I think they

Photo: Patrick Klein

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succeeded.) Other examples include The Cult's *Electric* and Led Zeppelin's eponymous fourth album. Similarly, in film, many cinematographers shoot out of focus or with a limited range of hues to obtain certain effects.

Also, after 40 years of making rock 'n' roll records, there is a kind of sound or style that has become conventional. Although it is constantly being modified, we come to take certain aural techniques for granted, as indicative of the genre. For example, in a hard-rock recording, we want to hear the singer's vocal nuances as he goes from a whisper to a bloodcurdling scream, even if the band is playing at the same volume. If the dynamic range of the vocal is compressed, the singer can ride above the band regardless of the actual level at which he is singing. Similarly, there is something pleasing about the sound of a heavily compressed acoustic guitar that cannot be captured by an uncompressed acoustic. (For an example, listen to the Yes single "Owner of a Lonely Heart," produced by Trevor Horn, another high-fidelity-when-he-wants-to-be master.)

Finally, many people seem to prefer the energy of a recording regardless of its high level of third-harmonic distortion. They aren't interested in the technical merits of the recording, only the raw "loud" impact of the sound in their car or gymnasium. As my friend, engineer Jay Kadis says, "The rebellion of youth seems to come across in the seemingly inexplicable preference for low-fi recordings these days."

Thankfully, there are many recordings out there that are high-fidelity masterpieces, with the clarity and naturalness that I think you are looking for. At some point in the near future I hope to write an article for *Audio* describing them, but for starters, check out Donald Fagen's *The Nightfly*, Aimee Mann's *Whatever*, Rosanne Cash's *Interiors*, The Iguana's self-titled debut, k.d. Lang's *Ingénue*, Lyle Lovett's *Joshua Judges Ruth*, and The Beatles' *Abbey Road*. Also, it's fun to start noticing rock's most talented engineers and producers so that you can pick up their latest projects. Some that I like best are Roger Nichols, George Massenburg, Phil Ramone, Bruce Swedien, and David Thoener.—*Daniel Levitin*

## More Web Sitings

Dear Editor:

After reading Ken Kessler's "Mondo Audio" on Web sites and hi-fi related home pages in your July issue, I would like to let your readers know that NHT has a Web site ([www.nhthifi.com](http://www.nhthifi.com)) that contains complete information on our products as well as a dealer locator system for finding their closest NHT retailer.

Randy Dowis  
Director of Marketing, NHT  
Benicia, Cal.

## Errata

In the November 1996 issue, back-panel photos of the Marantz DP870 Dolby Digital surround decoder and the Pass Laboratories Aleph-P preamp were switched. *Audio* regrets the error.

Also, last month's "Fast Fore-Word" should have cited the David Sarnoff Research Center as a member of the U.S. HDTV Grand Alliance, not NBC, and LG Electronics holds only a 55% stake in Zenith and thus does not wholly own the company.



# just listen

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The new 4000 Series continues this unbroken tradition. The unique, stackable, top-loading transport of the CD Player, the Zero Negative Feedback and Discrete Class A circuitry of the Control and Power Amplifiers, the Dual Gate MOSFET and Class A circuitry of the FM Tuner are packaged in a museum-grade, fully remote-controllable system as pleasing to use as it is to view.

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# WHAT'S NEW

## NOMI DESIGNS EQUIPMENT RACK



An oversized top shelf enables the Tempo rack to hold 21-inch TVs; the four fixed shelves below hold audio or video components. The rack comes ready to assemble, in black steel with tempered-glass shelves. Price: \$399. For literature, circle No. 100



## Sharp MiniDisc Recorder

Minicomponent-sized, the MD-R1 has all the usual MiniDisc features, including the ability to combine, split, or move tracks. You can enter disc titles up to 100 characters long, using upper- and

lower-case letters. For copying CDs onto MD, the unit has an optical digital input and synchronized recording with an external player. Price: \$699.95. For literature, circle No. 102



## ROTEL MONO AMP

Its front-mounted heat sink and compact design (about 8 inches on each side) facilitate using the RMB100 amp in multiamp arrays for home theater or biamped stereo systems. The amp is certified for Home THX systems; its rated power is 125 watts into 8 ohms or 200 watts into 4 ohms, from 20 Hz to 20 kHz,  $\pm 0.2$  dB, at 0.03% THD. On the rear panel are two pairs of output binding posts, for easy bi-wiring, as well as switch-selectable balanced and unbalanced inputs. The amp can be set to turn itself off when there's no signal and turn on when a signal is received. No significant

overall negative feedback is used, and the output features two matched pairs of complementary MOS-FET devices. Price: \$499 each.

For literature, circle No. 101

## Cabasse Speaker



The three drivers of the Cabasse Baltic are mounted coaxially, but unlike conventional coaxials, they're shaped into a hemisphere. The manufacturer says this Spatially Coherent Source design behaves like a section of an ideal pulsating sphere, acting as a point source to radiate all frequencies equally in all directions. With a rated frequency range of 200 Hz to 20 kHz, the Baltics are intended for use with a subwoofer. Sensitivity is 92 dB SPL for 1 watt in. Each speaker is 47/4 inches high, with a 14 1/4 x 17 7/8-inch footprint. Price: \$8,000 per pair. For literature, circle No. 103

## Aztec MUTING DEVICE

When your telephone rings or when anyone

volume by a selectable 20 or 30 dB. Until activated by the phone, the Silencer acts like a passive device and is rated to cause no



more than 1.5 dB of insertion loss and 0.3 dB of rolloff at 20 kHz; its maximum THD is rated at 0.01% from 20 Hz to 20 kHz.

The Silencer picks up the phone to make a call, the Aztec Audio Silencer will drop your stereo system's

can monitor two phone lines if they share a jack. Price: \$49.95. For literature, circle No. 104



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Dracula:	
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Mulholland Falls	*1963503
Othello (1996)	*1951805
Sense And Sensibility	*1936301
12 Monkeys	*1937705

## CLUB FAVORITES

Beavis & Butt-Head: The Essential Collection	1963404
Broken Arrow	*1941806
Casino	*1922707
Heat	*1922400
Jumanji	*1918002
Jurassic Park	*1264001
True Lies	*1327105
Bladerunner (Director's Cut)	*1097906
Forrest Gump	*1333202
Waterworld	*1472000
The Shawshank Redemption	*1345503
E.T.: The Extra Terrestrial	*0681106

Dead Man Walking	*1939800
Devil In A Blue Dress	*1498500
Ragtime (Widescreen)	*1959501
Screamers	1933001
Unforgettable	*1952100
The American President	*1923309
And Justice For All	0155903
Black Sheep	1951607
The Fisher King	0687103
Grumpier Old Men	*1922301
How To Make An American Quilt	*1921204
La Femme Nikita	*1427400
Get Shorty	*1502509



THE BIRDCAGE  
\*1970409



EXECUTIVE DECISION  
\*1955905



PRIMAL FEAR  
\*1987601



HEAVY METAL  
\*1486901



BRAVEHEART  
\*1491604



THE RETURN OF THE JEDI (THX)  
\*1415900

Goldeneye	*1920602
Money Train	*1923101
Leaving Las Vegas	*1501808
Never Talk To Strangers	*1502004
Richard III	*1932904
Sabrina (1995)	*1923408
Sudden Death	*1933407
To Die For	*1502707
White Man's Burden	*1502905
Predator	*0364901
Under Siege 2: Dark Territory	*1483007
Bad Boys	*1451806
The Fugitive	*1197706
The Abyss	*0881102
Star Trek Generations	*1382803
Legends Of The Fall	*1371301
Pink Floyd: The Wall	*1293802
Clear And Present Danger	*1326305
Goodfellas	*0969808
Top Gun (Remastered)	*1429406
Tremors 2: Aftershocks	*1507805

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The Empire Strikes Back (THX)	*1415801
Backdraft	*0559005
Batman Forever	*1432509
First Knight	*1460104
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A Clockwork Orange	*1356005
Bridge On The River Kwai (Restored)	*1143809
Rob Roy	*1423201
Aliens (THX)	*1402601
Alien (THX)	*1402502

Apollo 13	*1447903
Die Hard With A Vengeance	*1462209
2001: A Space Odyssey	*0844308
Congo	*1453604
The Wild Bunch- (Director's Cut)	*1388008
Raising Arizona	*1491802
A Walk In The Clouds	*1496504
Virtuosity	*1483601
The Usual Suspects	*1479401
Strange Days	*1502608

## NEW RELEASES

American Graffiti	*1937101
Barb Wire (Director's Cut)	*1963305
City Hall	*1951706
Dark Man III: Die, Dark Man, Die	*1959006
Down Periscope	*1948504
Girl 6	*1948405
The Juror	*1943307
Kids In The Hall- Brain Candy	*1970607
Mary Reilly	*1969203
The Quest	*1971209
Serpico (Remastered)	*1971506
Sgt. Bilko	*1963602

Species	*1452309
The Bridges	
Of Madison County	*1509900
A Few Good Men	*1106301
Immortal Beloved	*1372309
Clueless	*1462506
Ferris Bueller's Day Off	*0427302
The Net	*1469907
Ghost	*0826008
Bram Stoker's Dracula	*1102904
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Babe	*1479302
Copycat	*1490804

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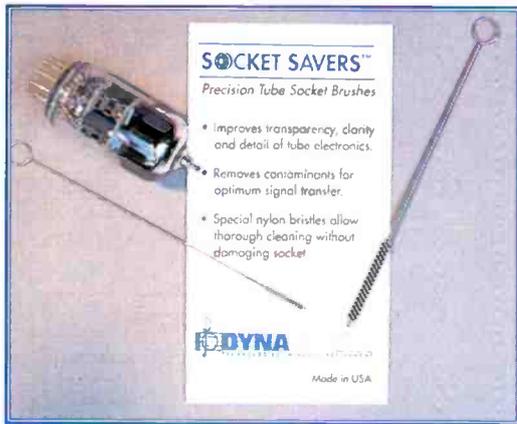
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# WHAT'S NEW



## DYNACLEAR TUBE-SOCKET BRUSHES

It's well known that signal jacks can get dirty or corroded, but it's less well known, in this transistor age, that tube sockets can, too. These sockets can be cleansed with a mild solvent, such as alcohol, and a brush; Dynaclear's Socket Saver brushes come in two sizes, one for octal power-tube sockets and one for miniature nine-pin sockets. Price: \$16.95 per pair. For literature, circle No. 105

## SoleControl Universal Remote

The SC 470 remote control works both via line-of-sight infrared beams and via 900-MHz radio frequencies that go through walls and floors over distances of up to 150 feet. It can control as many as six A/V components, including cable boxes and satellite systems, and commands all original component functions, including sleep timers,



picture-in-picture TV, on-screen programming, and CD-changer disc selection. Price: \$89.99. For literature, circle No. 108



## AUDIENT JITTER-REDUCTION DEVICES

The Audit and Tactic are interfaces that can be used, separately or together, between a digital signal source and a D/A converter, and are available in both S/P DIF coax and AES/EBU balanced versions. The Tactic, based on a proprietary pulse-transformer, is designed to reduce noise caused by ground loops, RF interference, and other sources and to provide flat, resistive input and output impedances to reduce signal reflections. The Audit, a low-noise differential cable buffer, absorbs signal reflections and reduces common-mode noise; it is also said to reduce jitter without reclocking the signal. Prices: Tactic, \$350; Audit, \$395. For literature, circle No. 107



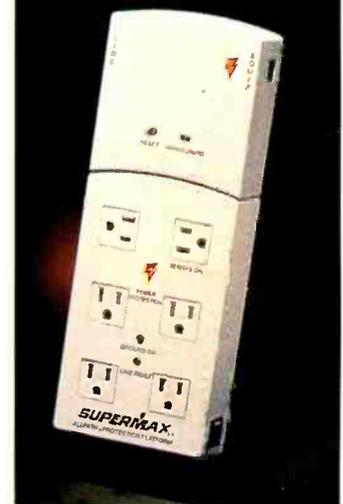
## Maxell Recordable CDs

The recording layers of the CD-R 74H and CD-R 63H recordable CDs use phthalocyanine, which Maxell says increases stability if the discs are exposed to sunlight and improves durability. The CD-R 74H has a capacity of 74 minutes of audio or 680 megabytes of data; the 63H

carries 63 minutes, or 580 megabytes. Both meet Orange Book Part II standards before recording and Yellow Book standards once recorded, and can be used with double- or quadruple-speed CD-ROM recorders. Prices: CD-R 74H, \$11.49; CD-R 63H, \$10.99. For literature, circle No. 106

## Panamax Surge Suppressor

The Supermax AllPath surge protector guards against spikes, surges, and under-voltage. The unit is also said to reduce electromagnetic and RF interference by 50 dB between 100 kHz and 1 MHz. Six receptacles and two modular phone jacks are built in, and modules can be added to handle antenna, cable, and satellite leads as well as extra telephone lines and computer LANs and serial connections. The lifetime guarantee includes a \$5 million warranty on equipment properly connected to the protector. Price: \$149; modules, \$29 to \$65 each. For literature, circle No. 109



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February 1996



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"...the Nucleus has... some of the most solid, well-appraised terminals (BB-4) I've seen on any speaker..."  
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April 1996



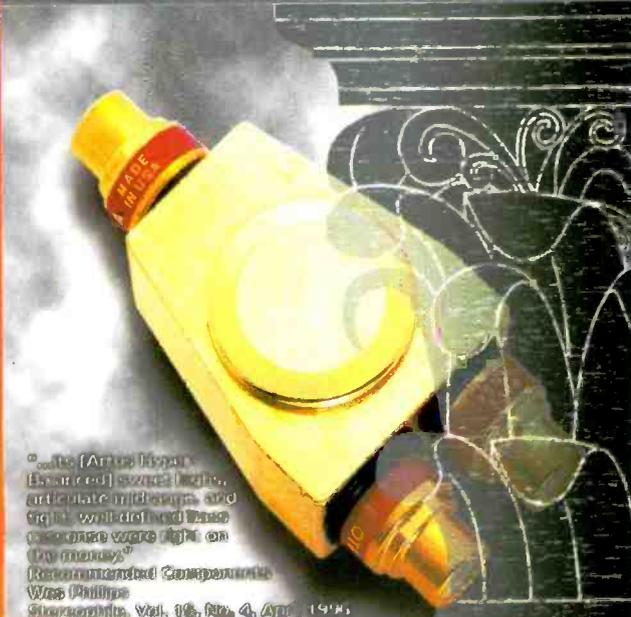
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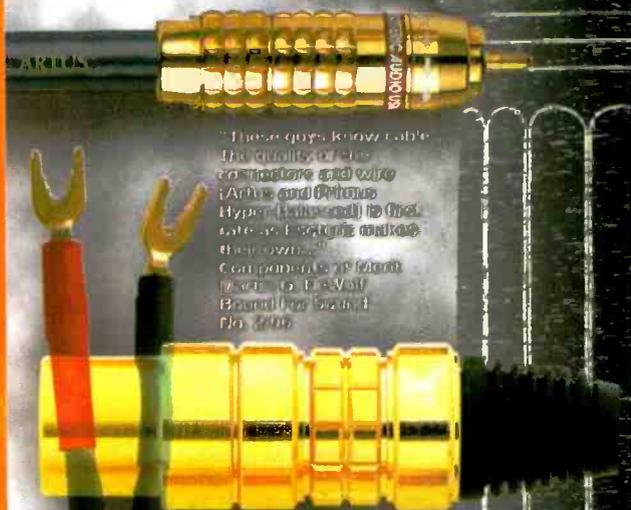
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"...the (Arms Hyper-Base) had) sweet highs, articulate midrange, and tight, well-defined bass response were right on the money."  
Recommended Component  
Was Philips  
Stereophile, Vol. 18, No. 4, April, 1995



"These guys know cable. The quality of the connectors and wire (Arms and Prime Hyper-Base) is first rate and I really make their own."  
Component of Month  
Esoteric Audio USA  
Stereophile, Vol. 18, No. 4, 1995



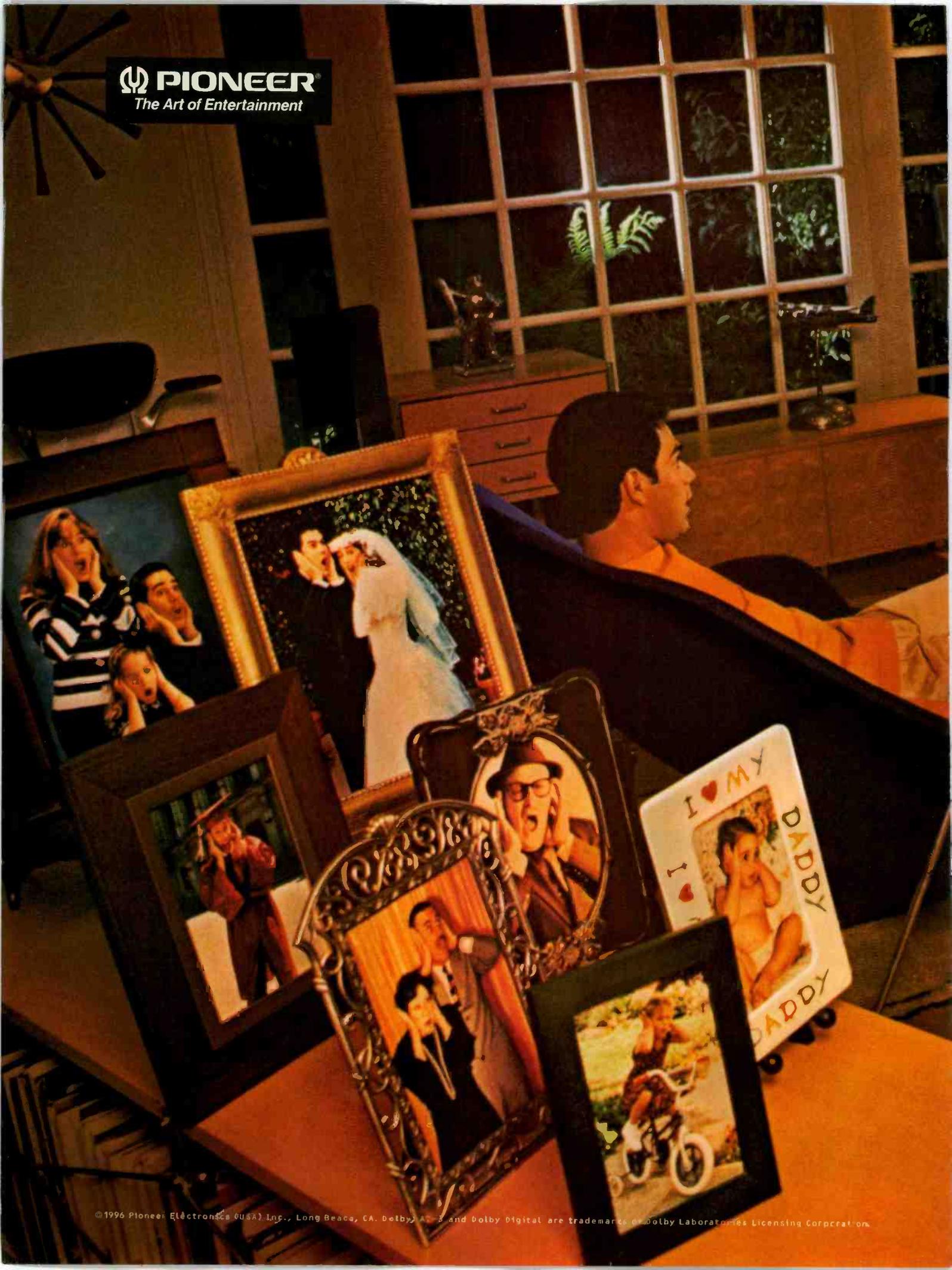
"Of all the interconnects I know well, my top choice is the..."  
Lawrence L. Johnson  
Stereophile, Guide to Home Theater  
Vol. 9, No. 3, 1995

"I'm convinced about the advantages (and) except this cable (Arms) and can recommend it to you easily."  
Component of Month  
March 6, 1995  
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CIRCLE NO. 16 ON READER SERVICE CARD

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When Greg (the guy sitting on the couch in this picture) comes home from work, he wants to relax. And if his idea of relaxation means watching cars crash through burning barrels, we think the experience should be as realistic and dramatic as possible. With that goal in mind we offer the Pioneer Advanced HomeTheater System. Thanks to our Dolby Digital (AC-3™) technology with 6 independent digital channels and a Cinema Wide System projection monitor, Greg sees and hears every moment as if he were really there. And the supercharged performance of his Pioneer LaserDisc player means that when Greg gets bored with crashing cars, he can immerse himself in nearly 10,000 other movies and concerts. The result is equal to (Greg thinks better than) the movie theater experience. Greg feels better already. Call 1-800-PIONEER for the dealer nearest you. Pioneer Advanced HomeTheater. You're surrounded.

### CD Boombox to Receiver

**Q** I want to connect my existing CD boombox to the receiver of my new home theater system so that I don't have to buy a second CD player. However, the boombox has no RCA output jacks, just a mini-jack for headphones. The audio specialist at my local electronics superstore recommended using Monster Interconnect between the mini-jack and the receiver. I keep the boombox volume at 1/4 of its full range and have had no problems. Am I doing the right thing? Am I hurting the receiver?—Name withheld

**A** I see no problem connecting the headphone mini-jack output to a line-level input on your receiver. No harm can be done to the boombox or to the rest of your equipment.

### Persistent Phono Hum

**Q** I hear a persistent hum when playing LPs but not other program sources. The hum is inaudible when I listen to loud musical passages, though it is plainly evident during solos or quiet intervals. When the tonearm is on its rest, there is no hum, even when the platter is turning. But as soon as the tonearm reaches the playing area, I can hear the hum. Is this motor noise? Should I replace my cartridge? Reproduction is generally satisfactory, with two exceptions: the hum and weak performances, at low listening levels, of full orchestra.—Alan B. Pizzuto, Pittsford, N.Y.

**A** I think your cartridge is picking up magnetic fields from the turntable motor. When the tonearm is at rest, the cartridge is far enough away that little or no AC field reaches the cartridge. You could confirm this by setting the volume to a typical listening level and then carefully moving the tonearm out over the revolving platter and back to its rest while listening for the hum to increase or decrease.

Probably the best cure is to replace the cartridge with one having better shielding against hum fields. In my experience, Shure cartridges have among the very best shielding against hum radiated from turntable motors. With some turntables—old direct-drive models, for example—installing a

Shure moving-magnet cartridge has reduced hum to inaudibility when other brands were unusable because of poor shielding. If, however, your turntable has a two-pole induction motor, it becomes very difficult to shield any magnetic cartridge against the fields produced by the motor.

When the hum is eliminated, the full orchestral timbre at low levels will improve. I believe the hum is masking musical detail.

### Proper LP Storage

**Q** What are the ideal methods for storing LPs long-term—say, for the next 100 years? Obviously, there must be an optimum temperature and humidity for storing vinyl. And what about vertical versus horizontal storage? The latter places the weight of the discs on the information-bearing grooves, and over time that might cause bonding between the vinyl and the sleeves. But the vertical position places the weight on the outer lip, and support will still be required over most of the LP's surfaces. I also have heard that certain protective plastic sleeves may give off gases that can, over time, be harmful to vinyl. Is there any basis to these rumors?—Name withheld

**A** Ideal conditions for storing anything long-term are difficult to determine, but conventional wooden enclosures are likely the best for LP storage, especially compared to particleboard. I've heard that particleboard can produce gas over time, which could harm vinyl discs, but I don't know for certain.

A temperature of 70° F with 30% to 40% relative humidity should be good. Very dry conditions will cause jackets and paper sleeves to desiccate and crumble, whereas too moist an environment will produce mildew. So avoid storing LPs in your basement if it tends to be damp, or use a dehumidifier when conditions warrant it.

I recommend vertical storage of records, and I do mean vertical! The only weight at one edge of a disc is the weight of the LP itself. Discs should not lean to one side or the other, because the weight will be unequally distributed, which will cause warping.

I have tried plastic sleeves to protect vinyl as well as lacquer discs, and I was not happy with them. I had serious problems with static electricity as discs were withdrawn or inserted into the sleeves. I was suspicious that the plastic in these sleeves would leach plasticizers from the vinyl, which in turn would harm the discs. I have never verified this. I did switch to paper sleeves, however.

### Digital vs. Analog Tape Speeds

**Q** I know that with analog recording, narrowing the width of a track or recording at slower speeds will result in degraded sound. It seems that this should also hold true of digital tape recording. The track width of a DAT is very narrow, and the tape moves at a much slower speed than an analog cassette machine. Despite the fast-turning heads in a DAT deck, I can't see how good recordings can be made on such equipment.—Tim Coop, Marysville, Cal.

**A** The DAT machine's fast-turning head gives a very high writing speed—that is, the tape's speed across the head gap is quite fast, even though its linear speed is slow. Furthermore, the DAT deck is recording pulses, not a continuously varying analog signal, so the problems involved are quite different. The proof of the pudding is that DAT recorders actually do make CD-quality recordings.

In analog recording, if everything else remains the same and tape speed is reduced, high-frequency response will suffer and noise will increase. Narrowing of the tracks, even when tape speed remains constant, will result in lower output and increased noise from the electronics plus some noise added by the playback process. However, modern tape formulations are coated with very fine oxide particles, which help to maintain high frequencies as tape speed is reduced. Record and playback heads have improved, too, with narrower gaps, which result in good high-frequency response even at slow tape speeds. At one time, if you wanted to make the best recording possible,

If you have a problem or question about audio, write to Mr. Joseph Giovanelli at AUDIO Magazine, 1633 Broadway, New York, N.Y. 10019, or via e-mail at JOEGIO@delphi.com. All letters are answered. In the event that your letter is chosen by Mr. Giovanelli to appear in Audioclinic, please indicate if your name or address should be withheld. Please enclose a stamped, self-addressed envelope.

# Introducing The Tower™ Series By Henry Kloss.

Cambridge SoundWorks' new Tower series speakers combine musical accuracy, very natural tonal balance, precise stereo imaging and an incredibly dynamic presence – all without reinventing the laws of physics.



## “Excellent...First-Rate...Gut-Wrenching Bass... Henry Kloss Has Not Lost His Touch.”

*Stereo Review, Dec. 1996*

Our new Tower series of speakers was designed by Audio Hall of Fame member Henry Kloss (founder of AR, KLH & Advent). They have the wide range, precise stereo imaging and natural tonal balance of our acclaimed Ensemble® series – and add improvements in efficiency, dynamic range and “presence.”

The result is somewhat unusual: speakers combining the dynamic presence of high-efficiency studio monitors, and the precise musical accuracy and pinpoint imaging of low-efficiency “reference” speakers.

### **Tower III by Henry Kloss™**

Tower III is a two-way design using a wide-dispersion tweeter and a single 8" woofer. It combines high sensitivity and outstanding dynamic range with the natural, wide-range sound (including terrific bass) of a generously-proportioned cabinet. It has been carefully “voiced” by Henry Kloss for superb tonal balance and precise stereo imaging. These benefits come at a much lower cost than superficially similar models through a combination of Henry Kloss' design expertise, plus Cambridge SoundWorks' highly efficient direct-to-the-consumer sales policy. Tower III is the most affordable high-performance floor-standing speaker we know of.

Like other models in the series, Tower III is magnetically shielded and features removable black grilles, fully-finished cabinets (front and rear) and gold-plated binding posts. Finished in black ash vinyl. **Factory-direct price: \$599 pr.**

### **Tower II by Henry Kloss™**

Tower II is a three-way system substantially larger than Tower III. It has two 8" woofers, a 5 1/4"

midrange, and a 1" soft-dome tweeter.

The large cone area of Tower II's drivers contributes to an effortless sound quality, giving music a strong feeling of “presence.” That presence, along with Tower II's smooth, musical octave-to-octave tonal balance and precise stereo imaging, produce what we think is the finest speaker system ever offered under \$1,000.

Tower II is finished in vinyl that simulates black ash or Vermont walnut. Bi-wire/bi-amp capable.

**Factory-direct price: \$999 pr.**

*“Tower II can generate gut-wrenching bass and do justice to a first-rate music system. To top it off, the price is right!”*

*Stereo Review*

### **Tower by Henry Kloss™**

The flagship of the series is the three-way, bipolar Tower by Henry Kloss. Bipolar dispersion helps eliminate the “point source” effect of direct-radiator speakers, and ensures a proper stereo effect in many listening positions.

Tower features two forward-facing 8" woofers; a forward-facing 5 1/4" midrange driver; a 1" soft-dome tweeter; and separate rearward-facing midrange and tweeter units identical to those used in front.

Because it has even more cone area, Tower's feeling of “presence” is, if anything, stronger than that of Tower II. That presence, when combined with the three-dimensional sound of Tower's bipolar design, results in sound that is nothing short of incredible. Available in lacquered walnut or black ash veneers, Tower is one of the finest speakers ever offered. Bi-wire/bi-amp capable.

**Factory-direct price: \$1,499 pr.**

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CIRCLE NO. 9 ON READER SERVICE CARD

the tape had to run at 15 inches per second or even 30 ips to obtain good high-frequency response. By contrast, modern analog cassettes, moving at 1½ ips, can rival the performance of some older professional machines running at 15 ips! This is true even though the cassette's track widths are very narrow. However, it should be noted that Dolby noise reduction is still mandatory in cassette recording in order to keep tape hiss at background levels.

In an analog system, background noise is affected by many factors, including tape speed, track width, tape formulation, and electronics quality. With digital recording equipment, noise is determined by the number of bits per sample. Each additional bit improves the signal-to-noise ratio by 6 dB. With 16-bit recordings, this yields a theoretical signal-to-noise ratio of 96 dB.

Are you convinced yet? If not, consider the VCR. Video recording in the VHS system is analog. Tape speed is very slow, even at its fastest speed. Even so, with good tape and fine-gapped, rapidly rotating heads (which, like a DAT, yield a fast tape-to-head speed) the bandwidth is close to 4 MHz!

That's 4 million Hz! (Incidentally, the Hi-Fi stereo audio portion is frequency-modulated onto a subcarrier and recorded by two extra heads on the spinning video head drum.)

### Vanishing Surround

**Q** *The surround level from my home theater system seems to vary from a roar to a whisper. Is there something wrong with the Dolby Pro Logic decoding circuit in my receiver?*—Ben Shepherd, Fanwood, N.J.

**A** If you consistently get full surround from some movies and no surround from others, the ones without surround probably have mono soundtracks. (Dolby Pro Logic decoders will generate some surround output from any stereo recording, surround-encoded or not.) If the surround comes on and off when you're playing specific tapes, your VCR is probably not tracking those tapes properly; this happens a lot with rented and other well-worn tapes. Poor tracking can make the VCR switch back and forth between the stereo Hi-Fi tracks and the monophonic linear track on the tape. Many VCRs will flash "Norm" or

"HiFi" on your TV screen (or on the VCR's front-panel display) whenever the tracks switch.

If the surround channel cuts in and out suddenly, with no consistent relationship to the tape you're playing, your receiver could be at fault. But before having it checked, examine the wiring to your surround speakers: Stray tendrils of wire between the red and black terminals of your speakers or receiver can also cause this effect.

If you are watching tapes you've recorded of TV shows broadcast in MTS stereo (such as "The X-Files"), which are often Dolby Surround-encoded, bear in mind that some broadcasters use processing to exaggerate the stereo and surround effects or to compress dynamic range. This may cause erratic operation of the Dolby Pro Logic decoder in your receiver, producing decoded surround effects that can be quite bizarre.

### Low-Pass Subwoofer Output

**Q** *If my subwoofer has a built-in low-pass filter that's adjustable from 40 to 100 Hz, is there any advantage to having a surround processor with a low-pass filtered sub-*

Your dad thinks you oughtta Get A  
Your buddies THINK you oughtta come SO you  
Your Brother thinks you oughtta Come

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woofer output? Will a full-range subwoofer output work just as well?—Dominic Lount, Sterling Heights, Ohio

**A** As long as you already have a low-pass filter in your subwoofer, I see no advantage in having a separate low-pass filter in a surround processor unless it is steeper than the one in the sub and the latter can be bypassed or, at some point, you change to a passive sub, which you could drive with an auxiliary amplifier and the low-pass filtered output from the processor.

Of course, the surround processor might also have an appropriate high-pass filter for the satellite speakers. Chances are that such a filter will not be adjustable. If this is so, you should set the adjustable filter in your subwoofer to match the crossover frequency of the processor's high-pass filter. On the other hand, many powered subwoofers already have a built-in high-pass filter to keep low frequencies out of the satellites and thereby reduce distortion. Try adjusting the low- and high-pass filters' crossover frequencies so that their rolloffs overlap in a manner that avoids any suck-out or dip in response between 100 and 200 Hz. Experiment.

### Feeding a CD Player To a Power Amp

**Q** I play only CDs, so I'm thinking of hooking up my CD player directly to my power amp. Will bypassing my preamp improve the sound? Is there a problem if my player lacks a volume control? Need I be concerned with losing the ability to adjust channel balance? And can this setup play mono CDs?—Fernando S. David, Scarsdale, N.Y.

**A** Running your CD player directly into your power amp will eliminate any noise or distortion the preamp might add. But if your preamp is reasonably good, I doubt you'll be able to hear the difference between your system's sound with and without it.

There had better be a volume control somewhere in the system, or you run the risk of overloading your amp's input, your speakers, your ears, and your neighbors. I suggest using a player with a manual volume control whose setting you can see before you turn your system's power on. If your player lacks a volume control and your amp does not have input level controls that are easily accessible, you'll need to intro-

duce a volume control between the player's output and the amp's input.

It is a good idea, in any case, to turn the player on first, followed by the power amplifier; this will avoid transients that might damage your system. If your amp has a turn-on delay, which prevents signals from being fed to the loudspeakers immediately at power up, it is safe to turn both devices on at the same time.

Some power amplifiers have level controls, but using them can be awkward. This is especially true when the power amplifier is in an inconvenient place. Also, power amps have a control for each channel, which is less convenient than a preamp's master volume control.

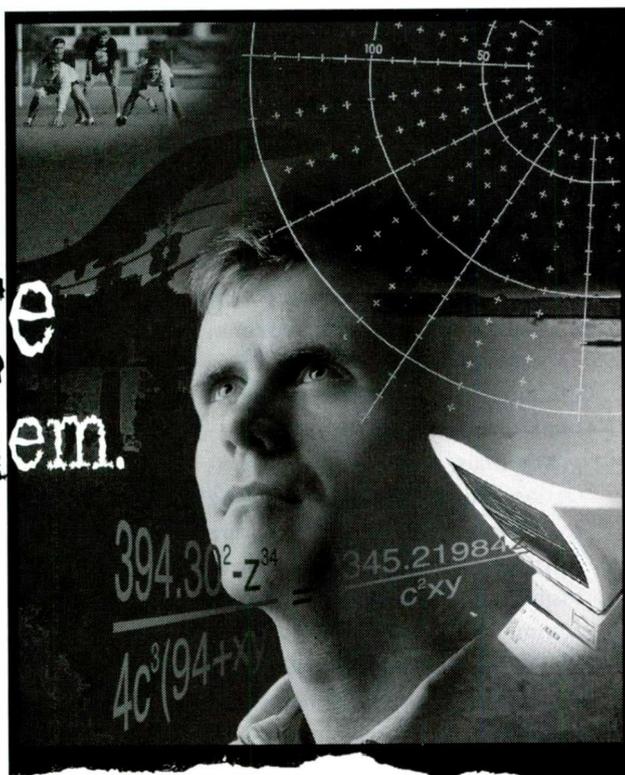
If you rarely use your balance control now, you won't miss it. Otherwise, you will. But if your amp has separate level controls for each channel, you can use them for balance adjustment. On the whole, I'd keep the preamp for the control convenience and features it provides.

Mono CDs have the same signal recorded on both channels, so playing them will be no problem. **A**

job out at the airport.

work at the garage  
can hang out with them.

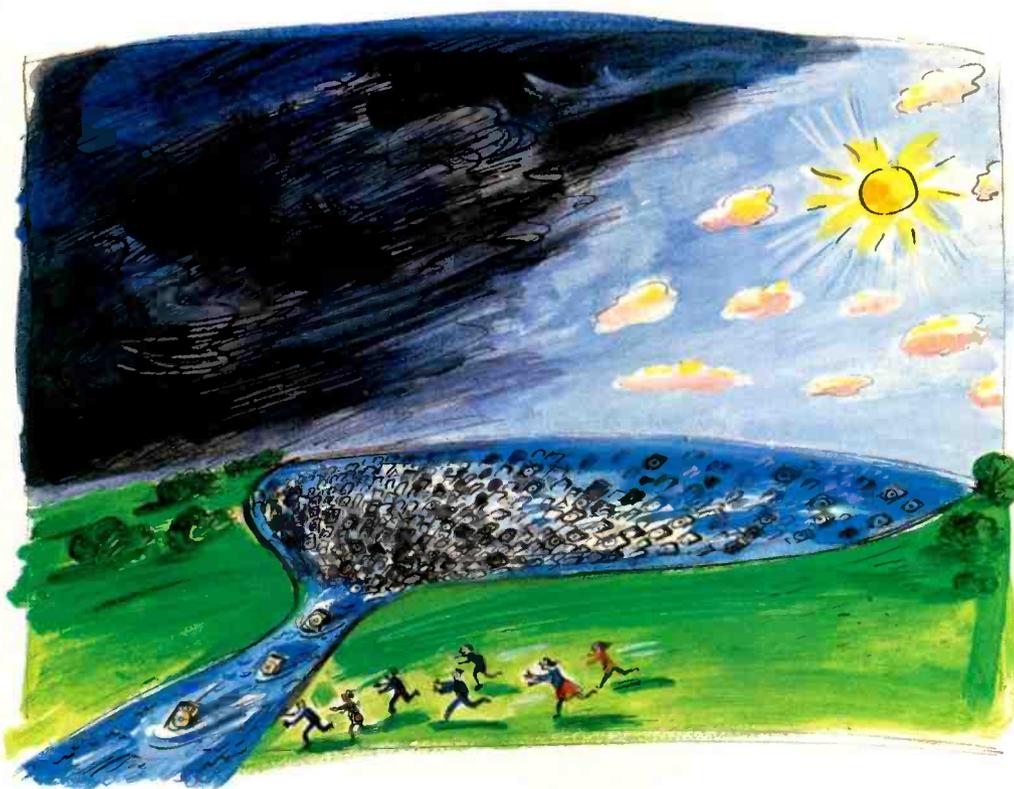
work at the plant.



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# BREAKING THE DVD LOGJAM



For months, DVD progress was caught in a logjam of many conflicting interests, with movie studios, computer manufacturers, record companies, and consumer electronics manufacturers trying to barrel down the same narrow river at once.

The main issues concerned protection systems. Movie studios and record companies wanted to ensure that consumers (always viewed with suspicion by the media makers) and commercial pirates could not use DVD's digital virtues to make copy after copy of copyrighted works. Yet, computer companies pointed out, consumers still needed the ability to make copies of computer software. Furthermore, film studios don't release movies all around the world at once. To prevent premature DVD sales from killing a film at the box of-

ice, studios wanted a player sold in, say, Latin America to be unable to read DVDs sold for release in the United States.

The talks ground on for months ("Spectrum," June 1996) while hardware prototypes stayed in manufacturers' labs. But at the end of October 1996, some agreements were reached. As a result, the first few DVD movies, players, computer DVD-ROMs, and DVD-ROM drives are likely to reach the U.S. market about when this issue hits the newsstands, with lots more to come. (In Japan, a trickle of players and discs went on sale last November but were quickly recalled to resolve compatibility problems between hardware and software.)

The October agreements cover an SCMS-like encoding system to limit consumer copying, a regional flag

system to protect film release dates, and an encryption scheme. The encryption system, based on Matsushita technology, has been modified, following suggestions from Intel and IBM, to use less computational power in decoding. The new scheme allows the encryption of only key frames in the MPEG-compressed picture ("Video CD: A Coding Challenge," December 1994); other frames could be encrypted if desired. Encrypting just the key frames would frequently suffice because other, unencrypted, frames could not be decoded without the key frames' information.

Press releases from industry groups trumpeted the agreements last October, but some issues remain unresolved as I write this. According to *Audio Week*, an industry newsletter, the studios agreed conditionally, pending independent tests to see if the encryption scheme is really fool-proof. (If these tests lead to changes in copy protection, buyers of the early Japanese machines might have to take them back for modification.)

Another unresolved problem is DVD's packaging. Some are espousing a version of the longbox used for years with CDs. Environmentalists, who got the wasteful CD longbox killed, are bound to fight it.

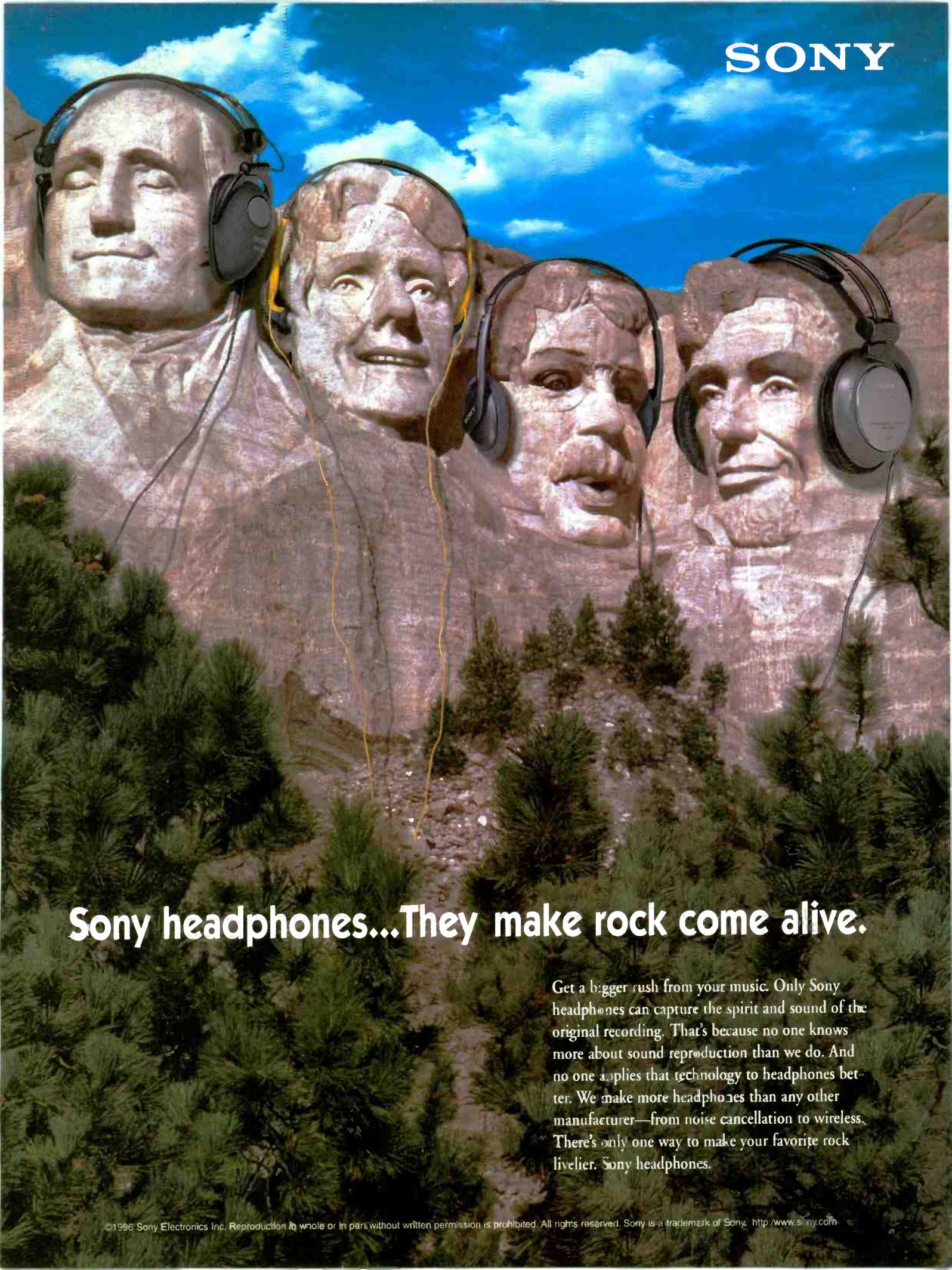
For audio, some fundamental issues still remain up in the air. Format standards have been set for soundtracks of video DVDs, but several audio-only formats are in contention. First to raise the audio issue

## UNCAGED NOSTALGIA

The defiantly retro sight of tubes sticking up from an amplifier makes me nostalgic for my vacuum-state youth. My first amp, a Grommes formerly owned by my girlfriend's father, was built that way.

Funny thing, though. When I had the open-topped Grommes, I couldn't wait to get a more modern-looking amp with a cage to cover the tubes!

Illustration: Beata Szpura



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CIRCLE NO. 12 ON READER SERVICE CARD

## THUMBS UP TO BLAUPUNKT

That CD receiver in the photo has three interesting display features—two useful and one pure glitz—a programming feature that has the makings of some real utility, and an accessory that I wish could work with my car stereo.

First, the glitz: Turn on the Blaupunkt Las Vegas (shown) or any of the other models in Blaupunkt's "5 Series," and a message of your choosing scrolls across its display. Jazzy, sure, but to my taste rather ho-hum. More to my liking is its ability, when operating as a CD changer controller, to display user-programmed disc titles while another disc is playing (or as soon as it's selected) rather than withholding that info until you've loaded the wrong disc.

Another useful feature of the 5 Series is a timer that plays a preprogrammed station at a preset time—even if the head unit is turned off, playing a CD, or tuned to another station. As Blaupunkt says, it's a good way to make sure you get the 7:28 traffic report.

I welcome that timer, but I'd find it far more useful if it could be programmed for several events, including those that occur, say, one day per week. That would let me

catch the traffic announcements that 880 AM broadcasts "on the eights" (7:28, 7:38, etc.) and the announcements that 1010 broadcasts "on the ones." It would also ensure I never miss "Prairie Home Companion" or "Schickele Mix" on public radio when I'm driving—at least while my pre-programmed stations are still within range.



The best of Blaupunkt's new features isn't in the head unit at all. The thumb-operated accessory remote, seen on the steering wheel in the photo, controls volume, source and station change, and CD and cassette playback, among other things. The Thummer's price is about \$100; the 5 Series CD and cassette receivers run from \$250 to \$400.

loudly was the Acoustic Renaissance for Audio group ("Spectrum," April 1996). The ARA has called for a flexible system that could trade off 48-kHz or higher sampling rates, 18- to 24-bit quantization, and up to six channels in almost any combination but with only lossless (or no) compression. The Academy for the Advancement of High End Audio (AAHEA), the Consumer Electronics Manufacturers Association (CEMA), and Dolby Labs have since weighed in with similar suggestions.

Three proposed audio formats have generated some debate. Pioneer, while espousing uncontroversial specs (48- or 96-kHz sampling, 16- to 20-bit quantization, and up to eight channels), is pushing for inclusion of 3-inch (8-cm) audio-only DVDs along with the standard 5-inch (12-cm) size. (Philips has also endorsed 3-inch audio DVDs.) Although smaller discs would make possible ultra-portable players, record companies and retailers have found little demand for 3-inch CDs outside of Japan. Even with DVD technology, a 3-inch disc would have somewhat limited capacity: With 96-kHz sampling and 24-bit resolu-

tion, it could hold just 40 minutes of music, less than some LPs. A dual-layer version could match CD's 74-minute capacity; a single-layer disc could carry 122 minutes, using the current DAT standard of 16 bits and 48 kHz. But a full-sized, dual-layer DVD made at 96 kHz and 24 bits could hold 242 minutes.

The Recording Industry Association of America (RIAA) insists that DVD-Audio discs be readable by CD players. (Conversely, DVD players have been designed from the outset to read existing Compact Discs.) Music buyers would then have access to all new recordings without having to replace their CD players, and record companies and stores would not have to deal with separate CD and DVD-Audio inventories.

The RIAA's proposal would raise some real problems for DVD-Audio development. It would be possible for dual-layer DVDs to carry CD-compatible audio on one layer and the new DVD-Audio format on the other. But DVDs are actually two discs bound together, which puts the data layer closer to the surface than in a regular CD. It is not certain that the laser pickups

on current CD players could focus properly to that depth. And there would probably be no way to make backward-compatible discs that take advantage of DVD's potentially longer playing time.

Sony and Philips have proposed using a bitstream format, like Sony's Direct Stream Digital (DSD) system ("Currents," October 1996), instead of the pulse-code modulation (PCM) used by CDs, which runs counter to the preference of the ARA and some others for PCM.

Yes, the logjam's been broken. Now let's duck the oncoming logs! A

### RECORDER RIVALRY

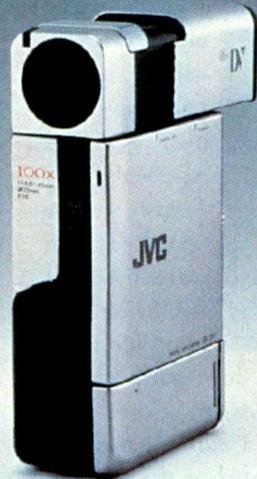
Last fall, Lance Braithwaite of *Video* magazine and I went on a steam-train excursion, each toting a pocket-sized digital recorder that captured 16-bit digital sound. The Sony TCD-D7 I used recorded audio onto a DAT; his JVC GR-DV1 recorded audio and video onto a digital videocassette (DVC).

The JVC, with its built-in video camera, was a little bigger than the Sony but not by much. However, it was a lot smaller and lighter than the 35mm reflex camera I had brought along. And because the JVC can also shoot digital stills, it did the 35mm's job, too.

Both recorders made 16-bit stereo recordings with 48-kHz sampling (and could be used for 32-kHz, 12-bit taping—which the JVC does in four channels). The DAT machine probably did get better sound, mainly because it has manual recording level controls (the JVC does not)

and because I used a good external microphone with it (which Lance could have done with the JVC). The 35mm camera definitely had better resolution, and you can get a good one plus a lens, a mike, and a DAT recorder for a bit less than the GR-DV1's price of about \$3,000. But I expect that, in a few years, the res-

olution of digital camcorders will improve and their prices will fall to the point where such multipurpose recorders will go along on nearly everyone's excursions.



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## AC-THREESOME

can watch my Criterion *Pulp Fiction* laserdisc. (And Jeff Foxworthy can live to see another day.)

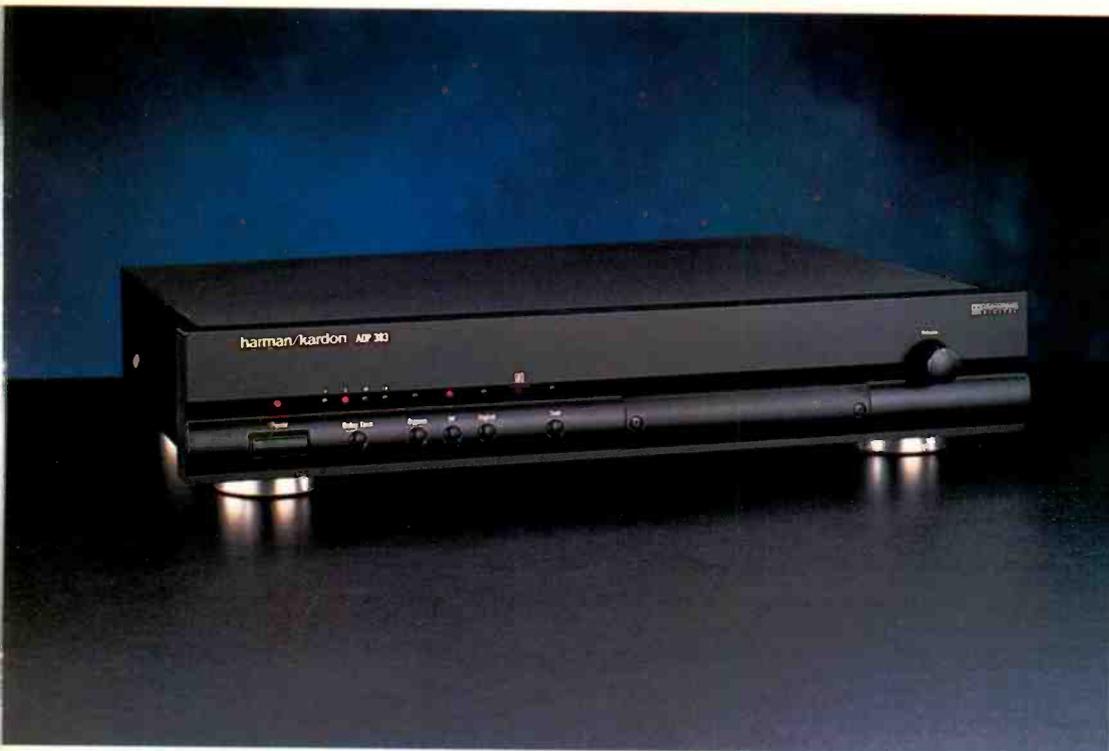
It's for all the reasons above that I jumped like a Frisbee dog when Marantz introduced its \$700 DP870 Dolby Digital decoder (reviewed by Edward J. Foster in the November 1996 issue). Dolby Digital for 700 clams total? No extra RF demod box? With six analog audio inputs, six analog audio outputs, and full bypass that doesn't degrade the sound of my current surround processor? I want my Marantz DP870!

Now Harman Kardon has come out with its version of this box, the ADP303, for \$749. The Harman Kardon and Marantz units have exactly the same innards—the same Zoran AC-3 decoder chip set, the same analog audio circuit, the same power supply—and the same sound. The differences lie in the features. The Marantz has remote-control capability (but no bundled remote; you have to buy Marantz's \$250 RC2000 mega remote or take your learning remote to a Marantz dealer to suck the control codes from his store unit), and there are gold-plated input and output jacks. The Harman Kardon doesn't have remote-control capability, and its RCA jacks are nickel-plated instead of gold. But it does have a nice little panel you can screw on, flush with the front panel over the channel level knobs, so that

no one can mess with the setup. I want my Harman Kardon ADP303!

Since I have never been with twins before, I did the only responsible thing

a reviewer can do: I got both decoders in for an AC-threesome. And, man, am I glad I did! Whether you go for the Marantz or the Harman Kardon, you'll get a great piece of gear. Yes, I've heard all the high-end horror stories about needing a separate box for the RF demodulator be-



**Greenberg's ga-ga over Harman Kardon's ADP303 Dolby Digital decoder.**

I want my AC-3! That's all I hear these days. "If [new product] doesn't have AC-3, it's *dead*, I tells ya!" Maybe it's all the great in-store demos, maybe it's the feverish jabbering of the hi-fi press, but one thing's for certain: Everybody wants Dolby Digital (AC-3) capability in his home theater and wants it snappy.

I want *my* AC-3, too. But like most audiophiles, I'm caught between the road that's too high and the one that's too low. The various Dolby Digital receivers I've tried all sound good but not nearly as good as the Citation, Meridian, and Aragon separates I've got in my He-Man rig. And if you ante up for a high-end Dolby Digital add-on from the big boys, it's grab-your-ankles time: These babies cost upwards of \$2,000, and that's not even counting the sep-

arate RF demodulator box that adds another \$500 to \$1,000! It's like, you can have your high-end AC-3 or have a man killed. Hmmm, discrete digital *Pulp Fiction* or Jeff Foxworthy sleeps with the fishes—gee, can I, maybe, sleep on that?

What I want (what every audiophile wants) is an affordable Dolby Digital decoder that kicks into gear when I play an AC-3 laserdisc, doesn't degrade the sound when it's in bypass mode, and doesn't require eighty-sixing my current surround processor/preamp. No separate RF demod box, no high-end weirdness. Just cheap, good, easy AC-3 in-a-box so I

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cause you don't want RF around sensitive audio circuitry, but I didn't hear anything wrong with the Marantz or the Harman Kardon's built-in demodulator. In fact, although most of the two-box AC-3 combos I've tried (aside from the glitch-free Meridian boxes) suffered from occasional digital hiccups that dumped a loud transient screech into my speakers, neither of these \$700 boxes has given me a hint of trouble after several months in my rig.

The sound quality of both units is excellent, a good notch above the sound of the AC-3 A/V receivers I've tried. Even though the Dolby Digital receivers sound great for receivers, the DP870 and the ADP303 sound quite a bit smoother and cleaner in the midrange and highs. But the shocking improvement is in the bass. With one pair of full-range NHT 3.3s for the front and another for the surround channels (for the equivalent of four 12-inch monster subwoofers), the Marantz and Harman Kardon decoders belted out low frequencies with a tightness and power I haven't heard from even the best AC-3 receivers. I don't get movie soundtrack bass this good from even the Citation 7.0 (although, in fairness, it's an analog matrix surround processor). My current deep-bass champ for laserdiscs is the opening-credit sequence of *Dead Presidents*, which really pounds out the ultra-low bass hits as the onscreen cash goes up in flames. Via the Citation, the disc's Dolby Surround track is plenty meaty, but it does not even approach the jackhammer deep bass thundering out of the Dolby Digital movie decoded by the DP870 and ADP303.

But what about the high-dollar Dolby Digital processors? The best-sounding AC-3 I've heard so far has been from the mighty Meridian 565, the all-out digital surround decoder reviewed by Anthony Cordesman (*Audio*, September 1996) in its Dolby Digital-ready \$4,495 version (\$5,200 if you count the separate Model 519 RF demodulator box). I've enjoyed the 565 and its companion Model 562V A/V controller in my system for several years and recently had the 565 upgraded to AC-3 readiness. So I was eager to compare AC-3 soundtracks via the Meridian rig to the same discs played back with the Marantz and Harman Kardon processors.

In terms of sound quality, the Meridian combo was unmistakably the better Dolby

Digital processor, but the upgrade in sound over the \$700 boxes wasn't as big as their own jump from the various AC-3 receivers I've listened to. Surprisingly, I found almost no difference in bass quality or quantity between the Meridian and the DP870 and ADP303 processors. *Dead Presidents* sounded just as gutsy and detailed in the low end with the affordable Dolby Digital boxes as with the Meridian rig. And while the Meridian did sound marginally cleaner on dialog, the improvement was much

**THESE AC-3 DECODERS  
ARE THE CLOSEST THING  
TO THE PERFECT  
DOLBY DIGITAL ADD-ON  
I'VE SEEN YET.**

smaller than I would have expected, given the differences in technology and price. Every time I switched to either the Marantz or the Harman Kardon, I was surprised by how closely the sound quality of each tracked the Meridian's.

The main difference I heard between the Meridian and the Marantz and Harman Kardon decoders was in the highs. The Meridian had a warm, velvety sheen that gave it a more natural top end than the brighter treble of the Marantz and Harman Kardon boxes. It's the same kind of difference I hear when comparing a good high-end D/A converter to a good budget CD player, and the analogy held up whether I was listening to Dolby Digital movie soundtracks or the 5.1-channel music tracks on the new Dolby Labs AC-3 test laserdisc. The \$700 processors sounded awesome, the Meridian just that much awesomer.

Dolby Digital sound quality aside, the real acid test was how transparent the DP870 and ADP303's bypass mode was. I've gone to a lot of trouble getting my signal chain as neutral and transparent as possible, so the last thing I want is to insert a permanent link that audibly degrades the sound of every other source in the system. I've been burned many a time by supposedly "transparent" bypass modes that really mucked up the sound.

Popping the two processors' hoods, I traced the signal path from the input and

output jacks and found a set of small relays that either tied each unit's outputs to the internal AC-3 decoder or, when the bypass button on the front panel was engaged, tied the inputs directly to the outputs. In other words, selecting the bypass mode with the DP870 or the ADP303 means adding to the signal path for each audio channel a pair of RCA jacks, a few inches of circuit-board traces, a relay, and two 100-kilohm shunt resistors to ground (one each on the input and output jacks). And, of course, the extra length of interconnect from your preamp to the Dolby Digital processor. In my case, it was 1 more meter of Kimber PBJ between the Citation preamp and the AC-3 box, with 5-meter runs of PBJ from there to the Aragon amplifiers.

Once I made sure there wasn't a difference in gain between removing the Marantz and Harman Kardon units from the signal chain and using their bypass modes, I sat down for some critical listening. Overall, I'd say the bypass mode was very clean but not totally transparent. Even in the earlier listening sessions, I'd noticed a slight difference in my system's sound when one of the boxes was in place and set for bypass. The sound was a bit darker on top, with a very slightly recessed upper midrange. And with stereo music, the soundstaging became a bit narrower and smaller. I didn't hear any added hardness or muck of any kind, just the slight tonal and soundstaging differences. I'd classify these changes as similar to those you'd hear between different cables, which may or may not be significant to you. I found the differences just audible enough that I chose to unhook the processors from the rest of the system when I wasn't listening to AC-3 laserdiscs, but I'm an obsessive geek when it comes to this kind of thing. A healthier person would leave the processor in the chain so that Dolby Digital was just a button push away.

Make no mistake about it: These \$700 Dolby Digital decoders are the closest thing to the perfect everyaudiophile AC-3 add-on I've seen yet. They're affordable, easy to set up and calibrate, and come very, very close to the finest Dolby Digital playback available at any price. Whether you opt for the Marantz DP870 or the Harman Kardon ADP303, they are sonic wonders that deliver high-end AC-3 to any separates-based home theater. **A**



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CIRCLE NO. 4 ON READER SERVICE CARD

## AUDIO OSCARS



useless drivel recited by baseball nuts about the most valuable players for the past quarter-century or by Indy-car fans rattling off a litany of non-American drivers.

There are enough statistics in our lives to make lists with names rather than numbers something to cherish. So, for the 1996-1997 season, here are five lists telling you which people and products in the A/V field have won awards around the globe. And the fun part comes in comparing those from the United States with, say, those from Europe.

Alas, the only award I'm aware of at the moment that's been won in Japan is Esoteric Audio Research's Product of the Year from *Stereo Sound* magazine, for the 859 single-ended integrated tube amp.

But consider the AAHEA Golden Note Award winners, those deemed by the U.S.-based Academy for the Advancement of High End Audio to be worthy of the industry's recognition. The nominees are selected through a series of ballots; the short-list is chosen from products picked by journalists around the world. Naturally, all the names of the judges are kept semi-secret, so cases of caviar

or champagne don't suddenly start landing on their doorsteps. But however international the panel of nominating judges might be, AAHEA is still a *very* American organization. Witness the following:

**Analog Source Design:** VPI TNT III turntable with flywheel

**Digital Source Design:** Krell KPS-20i/1 CD player

**Digital Converter Design:** Krell Reference 64

**Signal Processor Design:** Ångstrom 200 surround sound processor

**Tube Electronics Design:** Audio Research Reference 600 mono amplifier

**Solid-State Electronics Design:** Pass Laboratories Aleph 3 amplifier

**Cable Design:** Transparent Music Link Reference interconnect

**Peripherals Design:** ASC Revised Corner Traps and Tube Traps

**Loudspeaker Design:** Wilson WATT/Puppy V

**Loudspeaker Value:** Martin-Logan Aeries

**Aesthetic Design:** B&W Nautilus loudspeaker

**New Company:** Ångstrom/MM Labs

**Reissued Recording:** *Harry Belafonte at Carnegie Hall*, Classic Records

**Original Recording:** *Mighty Sam McClain: Keep on Movin'*, AudioQuest Music

**Most Innovative Technologies:** Meridian 518 noise shaper

Whatever one's personal preferences, the selection is pretty well balanced, with a mix of brands and no outrageous flukes. But out of 15 categories, 13 were won by Americans. Contrast these results with similar offerings from the autumn 1996

hi-fi season in Europe.

Probably the most important of all the European awards are the multinational EISA Awards, which are sponsored by the European Imaging & Sound Association. This group encompasses 38 magazines from 19 countries, with every country in Europe, from Portugal to Russia, represented. The fourth set of awards, announced in

PEOPLE WHO ARE  
INTENSELY PASSIONATE  
ABOUT A HOBBY  
LOVE LISTS.

**A**llegedly, people who are intensely passionate about a hobby—that means you—love lists. Lists feed the same part of the brain that made Trivial Pursuit the game of the '80s. Lists are also the closest we'll ever get in audio to the kind of

Illustration: Nishan Akgulian



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With the introduction of the MV100/t Active Digital Speaker, a twenty year old a/d/s/ dream is fulfilled. The amazing MV100/t utilizes seven outstanding drivers in a focussed vertical array and combines them with 500 watts of frequency dedicated power amplification and a sophisticated time alignment DSP crossover / equalizer in an elegant tower enclosure. The technology is expensive but they sound incredible.

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# a/d/s/

Sound. As it should be.

CIRCLE NO. 1 ON READER SERVICE CARD

the October or November 1996 issues of the participating magazines, makes interesting reading, especially in countries where some of the products aren't even distributed. But there are a couple of products that figure highly in other awards lists, so start making those check marks:

**Advanced Audio System:** Grundig PA3-I/PA3-II

**Amplifier:** Audiolab 8000S

**Audio Recorder:** Pioneer PDR-05  
CD recorder

**CD Player:** Marantz CD-63SE Mk II K.I.  
Signature

**Compact System:** JVC UX-1000

**High-End Audio Integrated Amplifier:**  
Krell KAV-300i

**Home Theater Amplifier:** Kenwood  
KR-V990D

**Home Theater Decoder:** Technics  
SH-AV500

**Home Theater Loudspeaker:** KEF 60S/  
80C/30B

**Home Theater System:** Mission M-Time  
Loudspeaker: B&W DM302

**Home Theater Display:** Sony KL-37 W1  
widescreen TV

Okay, so maybe you wouldn't agree with all the choices, but you have to give a nod to the combined efforts of judges from so many different markets and whatever consensus resulted from their deliberations. But one set of awards is never enough, even within a single organization, so *Home Entertainment* had its own set. And that magazine just happens to be the sister publication of *Hi-Fi Choice*, the U.K. judge for the EISA Awards. However, *Home Entertainment's* relationship to *Hi-Fi Choice* is like that of *Video to Audio*, so the focus is quite different and purely concerned with home theater. But you'll note the odd bit of overlap between the awards.

**Surround Sound TV:** Hitachi C2976TN

**Widescreen TV:** Thomson 81DXC69DLU

**Big-Screen TV:** Ferguson T94N

**Budget Big-Screen TV:** Sony KV-29F1U

**VCR:** Panasonic NV-HD610

**Budget VCR:** Akai VS-G745EK

**Satellite System:** Nokia SAT1800

**Budget Satellite System:** Pace MSS290

**LaserDisc Player:** Pioneer CLD-D925

**Home Cinema Decoder:** Denon AVP-A1

**Budget Decoder:** Technics SH-AV500

**Home Cinema Amplifier:** Kenwood  
KR-V990D

**Budget Home Cinema Amp:** Yamaha  
DSP-A590

**Center Speaker:** Mordaunt-Short T1000

**Budget Center Speaker:** B&W CC3

**Subwoofer:** REL Stadium II

**Budget Subwoofer:** REL Q-50

**Effects Speaker:** Linn AV5110

**Budget Effects Speaker:** Canon SV-15

**Speaker Package:** Definitive Technology/  
M&K System

**Budget Speaker Package:** Mission AV1

**Home Cinema Starter Pack:** Philips  
FW-672P

**"Widget":** Lexicon 500T touch-screen  
controller

**Innovation:** JVC GR-DV1 digital camcorder

**Editor's Award:** Meridian Digital Theater  
System

Along with a few software awards, that was the breakdown for one of the U.K.'s leading home theater magazines. And I suppose you've noticed a teensy-weensy bias toward British brands. Oh, and the obsession with budget gear. This is a peculiarly British disease, partly because pricing in the U.K. (and Europe as a whole) is criminally

THE POWER  
OF SOME AWARDS  
TO MAKE OR BREAK  
COMPONENTS  
IS FOR REAL.

high and partly because the British consumer has been brought up to expect everything for nothing. Which leads us to the most influential audio/video awards in Great Britain, those from *What Hi-Fi?*, the country's leading audio magazine for the fiscally challenged.

In their home country, the *What Hi-Fi?* Awards can inspire such unbridled ass-kissing that it's best to avoid any involvement with companies selling wares for less than \$500 during the summer months. That's when they have their last-minute opportunities to suck up to *What Hi-Fi?* in the hope that their budget amp or two-way speaker will win. And according to respected indus-

try insiders, the power of these awards to make or break a product in the U.K. market is not a manifestation of paranoia; it's for real. Indeed, there was a rumor going around last year that one public relations person was fired because his employer's amp didn't win. Why the sacking? Because the product that wins its category owns that market niche, and someone has to take the blame. Typically and appropriately, the winner in each category is dubbed "The Best Buy" rather than "The Best." So, without further ado, here's what the poor folks in the U.K. will covet in 1997:

**Micro System:** Denon DC-1

**Mini System:** Denon D-F07

**One-Make System:** Marantz CD-63SE CD  
player/Marantz PM-66SE amp/Tannoy  
631SE speaker [Note: Marantz  
distributes Tannoy in the U.K., hence the  
"one-make" status. Go figure.]

**Home Cinema Starter Kit:** Aiwa  
NSX-AV90

**Loudspeakers:** B&W DM601

**Home Cinema Speakers:** JBL MR center  
channel, Tannoy Profile Plus 628, and  
KEF 30B

**Home Cinema Speaker Package:** Mission  
AV2

**Interconnects:** Cable Talk Monitor 2

**Speaker Cables:** Cable Talk Talk 3.1

**Home Cinema Processor:** Yamaha  
DSP-E390

**Home Cinema Amp:** Harman Kardon  
AVI100

**Tuner:** NAD 412

**Amplifier:** Arcam Alpha 8

**Recorder:** Yamaha KX-580

**Home Cinema Source:** Panasonic  
NV-HD605B

**CD Player:** Arcam Alpha 7

If the *What Hi-Fi?* Awards are all but designed to strike fear in the hearts of sales managers, the newest awards on the block are so deliberately low-key that you have to believe *Hi-Fi News & Record Review* when it says that its awards are simply a way of thanking the industry. Whatever the motive, the awards dinner was an event where the knives were aimed at the food rather than at rivals' backs, and just about every winner was warmly received. Although the *Hi-Fi News Awards* are meant to recognize the high end as well as the real world, a de-

cision was made to limit them to products priced at less than £5,000 (\$7,500), so as not to antagonize those who despise expensive equipment. Launched to coincide with the magazine's 40th birthday, the first round of awards included:

**Digital Source Component up to £2,000:**

Marantz CD-63SE Mk II K.I. Signature CD player

**Digital Source Component up to £5,000:**

Audio Synthesis DAX-2 D/A converter

**Analogue Source Component up to**

£2,000: Linn LP12/Lingo turntable

**Analogue Source Component up to**

£5,000: Wilson Benesch turntable and arm

**Amplification Component up to £2,000:**

Musical Fidelity A1000 integrated amp

**Amplification Component up to £5,000:**

Krell KAV300i integrated amp

**Loudspeaker up to £2,000:** Epos ES22

**Loudspeaker up to £5,000:** Quad ESL63

**Audio/Visual Component up to £2,000:**

Meridian 565 processor

**Audio/Visual Component up to £5,000:**

Denon AVP-A1 processor

**Greatest Individual Contribution to**

Hi-Fi: Bob Stuart of Meridian

Now the cross-referencing and Trivial Pursuing: None of the items on the AAHEA list were chosen anywhere else, though Krell, Meridian, and B&W appear with other models on other lists. Marantz's CD-63SE Mk II K.I. Signature Compact Disc player won the EISA and *Hi-Fi News* Awards and figured in *What Hi-Fi?*'s one-brand system in "non K.I." form. Denon's AVP-A1 processor won awards from *Home Entertainment* and *Hi-Fi News*. Mission home theater products were prominent in three awards lists. Technics' SH-AV500 decoder scored with EISA and *Home Entertainment*. The Krell KAV-300i integrated amp won awards from EISA and *Hi-Fi News*. Two Yamaha home theater amps won awards. Kenwood's KR-V990D is the home theater amp chosen by EISA and *Home Entertainment*. The KEF 30B figured in the EISA and *What Hi-Fi?* lists. And Meridian seems to be one of the most respected home theater marques.

What's the point of all this? Aside from the AAHEA Awards, which seem to bear no relation to what the other award-givers think, there's more of a common thread running through European-based awards

**THE OBSESSION  
WITH BUDGET GEAR  
IS A BRITISH DISEASE,  
BECAUSE U.K. PRICING  
IS SO HIGH.**

than most cynics would expect. More than once I've heard awards described as turkey shoots, as games of chance, or, worse, as a

case of the winners being those who wined and dined the most judges. But I was involved with two of the awards, and nobody offered me any payola—so I'm assuming that they're all straight. What's so remarkable is the amount of overlap. Which means that products like the Marantz CD-63, the Krell KAV-300i, the KEF 30B, and the others that earned multiple accolades really must be something special and truly deserving of the honors. If not, would the companies please send payoffs for the 1997 awards to my numbered Swiss account? A

"remarkable" ...  
"flawless" ... "astonishing" ...  
"a landmark" ... "the best"

**CS.5**

“...one of the best speakers available at any price—Thiel's full size CS.5.”  
—Tim Smart, *Business Week*, December 11, '95

**CS1.5**

“The CS1.5 is a landmark speaker of the 1990s...an astonishing speaker.”  
—Sam Tellig, *Stereophile*, Vol. 17, No. 8, August '94

**CS2 2**

“I think they are one of the best, if not the best, performers I have come across.”  
—Andy Benham, *Hi-Fi Choice/U.K.*, Winter '92/93

**CS3.6**

“...the CS3.6s outperform every other speaker I've heard in their price class... a remarkable loudspeaker.”  
—Robert Harley, *Stereophile*, Vol. 17, No. 5, May '94

**CS7**

“Thiel's CS7 loudspeaker is one of the finest sounding loudspeakers that I have heard.”  
—Anthony Cordesman, *Audio*, August '95

**CS5i**

“A completely flawless design.”  
—Nagashima, *Stereo Sound/Japan*, Winter '93



From left to right: CS.5, CS2 2, CS6, CS5i, CS7, CS3.6, CS.5, CS2  
Priced from \$1,450 to \$12,300 per pair. All are carefully hand crafted in a variety of finishes from the world's finest woods.

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# BOOM for the BUCK

BY TOM NOUSAINE

**H**ome theater has transformed audio as we know it. Instead of a pair of huge, full-range speakers massaging the ears of a solitary enthusiast, now we have five- to eight-channel audio/video surround systems thrilling families nationwide, everybody scrambling for access to the system remote. The powered (active) subwoofer provides a solid foundation for the impressive performance gains inherent in the new audio/video system architecture.

The modern powered subwoofer embodies significant refinements in loudspeaker design, with electronic controls and amplifier power carefully inte-

grated into the design of the speaker itself. A typical powered sub has an electronic crossover, a dedicated power amplifier, and a full set of line- and speaker-level inputs and operating controls. But although a good powered subwoofer is a model of economy in design, the performance and features you get do tend to vary with price.

Over the past several years I have had the pleasure of evaluating more than 40 of these beauties. Based on this experience, I'll describe the performance and features typically available for a given cash outlay.

The prices I cite represent the manufacturers' suggested retail prices; naturally, what you actually pay reflects the availability of a brand at local retail outlets and your bargaining skills.

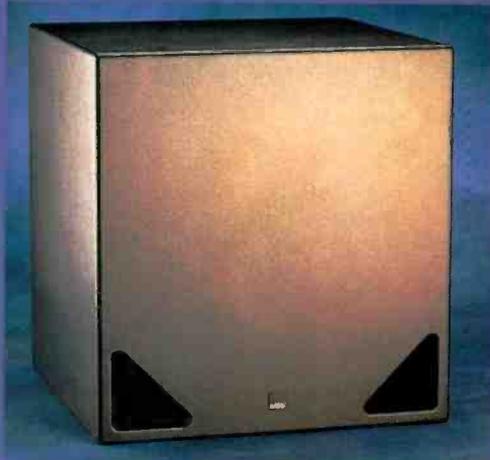
how  
much  
woof does a  
sub buck buy?



ILLUSTRATION: STU SUCHIT

# U P S C A L E

A D S M S 3 / U



A D S \$ 1 , 2 0 0

**Woofer Size:** 10 inches  
**Amp Power:** 150 watts  
**Footprint:** 2 square feet  
**Gross Volume:** 2.8 cubic feet  
**Weight:** 75 pounds  
**Enclosure:** Single-port bandpass  
**Output, 25 to 50 Hz:** 104 dB SPL  
**Bass Extension:** 25 Hz (less than 10% THD)  
**Features:** Variable crossover, phase control, volume control, auto-on, line-level/speaker-level inputs and outputs, and electronic high-pass filter

All the performance figures included here are based on measurements I made in the prime listening position in my 2,135-cubic-foot living room. In other words, they represent performance that is attainable in *your* home, too.

Before we start, we should think about what we expect a subwoofer to do. Because our hearing is less sensitive at low frequencies than in the midrange, the differences in sound quality are primarily related to a subwoofer's low-frequency extension and loudness capability. The lower in frequency a subwoofer can go and the louder it can play down there, the more realistic very low-frequency music and soundtrack material will be. The lowest organ pedal notes should swell and push satisfyingly, and cannon fire from the "1812" Overture or Beethoven's "Victory" Overture should be thrilling and scary, with plenty of pant-flapping, gut-thumping impact and couch-shaking rumble.

Although it was home theater that spawned the subwoofer boom, the only recordings that contain information all the way down to 20 Hz or below are of music. Movie soundtracks have no content below 25 Hz, and most pop music recordings have little information below 30 Hz—even those we often associate with good

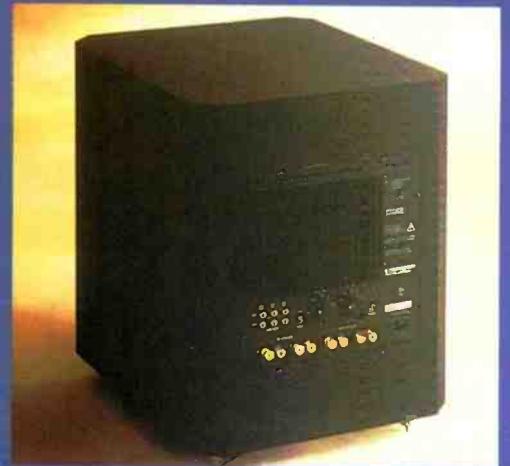
## A basic, high-performing

bass, like Pink Floyd's *Dark Side of the Moon* or Enya's *Watermark*. Still, this is lower than all but a few "full-range" speakers can reach. So the lower a subwoofer will go, and the louder it will play, the better it is—assuming it also has control features that enable practical use (and virtually all powered subs do).

Even if you never listen to pipe organ music or watch movies that have heavy-duty special effects, you should care about subwoofers, because the standard speaker locations that deliver the best high-frequency performance and imaging are not the locations that provide the best response below 100 Hz. And believe me, there is *plenty* of music between 50 and 100 Hz. A separate subwoofer facilitates independent placement of low-frequency reproduction to optimize

# H E A V Y - D U T Y

B & W 8 0 0 A S W



B & W \$ 1 , 6 0 0

**Woofer Size:** 12 inches  
**Amp Power:** 200 watts  
**Footprint:** 2.7 square feet  
**Gross Volume:** 4.5 cubic feet  
**Weight:** 73 pounds  
**Enclosure:** Bass reflex  
**Output, 25 to 50 Hz:** 105 dB SPL  
**Bass Extension:** 25 Hz (less than 10% THD)  
**Features:** Variable crossover, phase control, volume control, auto-on, line-level/speaker-level inputs and outputs, and high-pass filter



# powered sub generally costs from \$500 to \$1,000.

full-range performance. (Corner placement is usually best if the crossover is below 100 Hz; see Fig. 1.)

Given the basic nature of modern program material, an ideal subwoofer should be capable of reproducing frequencies between 25 and about 150 Hz, a range that encompasses most explosions, the sounds of plane crashes, and such instruments as pipe organs, bass guitars, tubas, and bass drums. Low frequencies require a lot of power to reproduce, so we need a relatively large enclosure, a big cone woofer, and a husky amplifier to drive it.

A typical basic powered subwoofer uses a 10-, 12-, or 15-inch cone driver mounted in a sealed, bass-reflex, or bandpass enclosure of 2.5 to 3 cubic feet in volume. The cabinet usually also contains the amplifier, which may be rated at anywhere from 50 to 250 watts. The sub may weigh 65 pounds, give or take, while occupying only about 2.5 square feet of floor space. It goes low enough (roughly 25 Hz) and plays loud enough (about 103 dB SPL from 25 to 50 Hz with less than 10% distortion) to realistically reproduce the gate crash during the opening credits of *Terminator 2* (though some models trade off deep bass below 35 Hz for 3 to 5 dB greater output above 35 Hz).

The typical basic sub has lots of features: a built-in variable electronic crossover, an adjustable level control, a signal-sensing auto-on circuit, a polarity-inversion (phase) control, and possibly an equalization circuit. Its full set of line- and speaker-level inputs and outputs will enable successful integration with practically any existing stereo or multichannel home theater system. A basic, high-performing powered subwoofer usually is priced between \$500 and \$1,000, depending on fit, finish, and features.

There is also a class of smaller powered subwoofers, tiny and rather cute. Practically speaking, they are *not* subwoofers at all: They are often just good woofers. The driver is commonly 6, 8, or occasionally 10 or 12 inches in diameter—separately housed and

## D E E P E R B A S S

HSU RESEARCH HRSW 12V

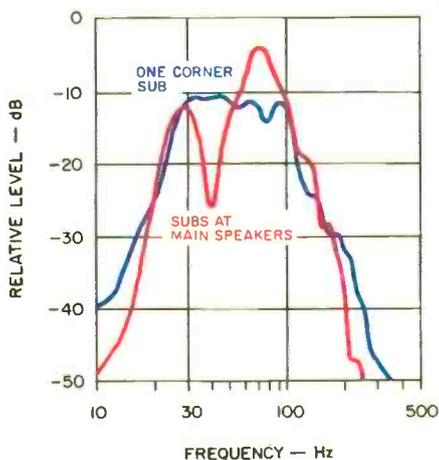


3

HSU RESEARCH \$ 8 5 0

Woofer Size: 12 inches  
Amp Power: 150 watts  
Footprint: 2.9 square feet  
Gross Volume: 5.3 cubic feet  
Weight: 69 pounds  
Enclosure: Portec  
Output, 25 to 50 Hz: 106.5 dB SPL  
Bass Extension: 25 Hz (less than 10% THD)  
Features: Fixed crossover, phase control, volume control, and line-level inputs and outputs

designed for use with a pair of small satellite speakers. Typically these subs are attractive, less expensive (sometimes as little as \$170), lightweight (about 30 pounds), and occupy very little floor space (about 1.2 square feet). However, bass extension is limited to about 30 Hz at less than 10% THD, and output from 30 to 50 Hz is restricted to about 96 dB SPL. The built-in amplifiers are usually rated in the range of 50 to 100 watts, and the enclosure may be a bass-reflex, sealed, or single-port bandpass design. At very low prices, variable crossover controls and input/output facilities may be limited.



**Fig. 1—**Frequency response of corner mono sub compared to that of stereo subs at main speaker locations.

Why would anyone need anything beyond what I've described as a basic powered subwoofer? More features, better looks, deeper extension, and greater output. Why go lower or louder? Like that old cliché about mountain climbing, because it's there. Why go lower than 25 Hz or louder than 103 dB? Because there *is* program material to hear way down there. If you're willing to seek it, you can find it.

At \$1,100 and up, some subwoofers offer special features or upscale styling that may make them attractive to certain people. For instance, the \$1,200 ADS MS3/U houses a bandpass woofer in a stylish 17-inch cube. Bass extends to 25 Hz, and maximum output is 104 dB SPL from 25 to 50 Hz (good, though hardly distinguished in this class). But this subwoofer doesn't look much like a sub. The 10-inch woofer is internal, like all drivers in bandpass enclosures; it communicates to the world through a pair of small, triangular vents at the cabinet's base. The designers included an electronic high-pass filter for the main speakers, a detachable line cord, and recessed, dual-banana speaker-level inputs. I particularly like this

## The sonic differences between

subwoofer for its tough cabinet; it can be lugged around without damage because the driver isn't exposed. The MS3/U's performance is just slightly above average, however, and there are less expensive models that deliver similar performance.

The B&W 800 ASW likewise offers a classy upgrade in style, coupled with greater output capability. It is larger and heavier than a basic subwoofer, and the cabinet is extremely well designed and finished. But is the performance of the \$1,600 B&W that much better than a basic subwoofer's? For many people, perhaps not. It will depend on whether the sub's elegant looks and performance enhancements (such as its ability to play louder) add up to a significant improvement in your particular installation.

In most cases, better performance is the main reason to upgrade your subwoofer. The goals are to go lower and to play louder. These aren't easy targets, because it gets harder and harder to maintain adequate loudness as bass is extended lower and lower. The reason? Reproducing low frequencies requires the displacement of large amounts of air: The displacement needed *quadruples* with each halving of frequency. This necessitates increasingly larger (or more) drivers and enclosures or a major leap in amplifier power and electronic sophistication.

Deeper bass and greater output can be obtained from a sub like the Hsu Research HRSW 12V. At a relatively inexpensive \$850, this subwoofer averages 106.5 dB SPL output from 25 to 50 Hz in a typical living room. Measured statically, it has a half-power (-3 dB) frequency of 19 Hz and will produce an honest 105 dB SPL at 25 Hz with a 10% distortion limit. But there are drawbacks. The tubular enclosure takes up 2.9 square feet of floor space; in fact, you'll need 3.7 square feet because this round sub will not tuck neatly into a corner. The crossover frequency is fixed at 91 Hz. Other crossover frequencies are possible, but you have to specify what you want when ordering or buy plug-in modules later. The HRSW 12V's styling is not in the same league as that of some basic models. Finally, the Hsu sub is available only by mail order.

Velodyne's extensive line of servo-controlled subwoofers demonstrates that advanced electronics can be used to improve performance—at increased cost, however. I tested the \$1,699 F-1500R, a sealed-box subwoofer with a 15-inch driver, which uses servo feedback to minimize distortion and maximize output and bass extension. Velodyne has more than 10 servo subwoofers in its line, ranging from the 10-inch F-1000X (\$949) to the 18-inch ULD-18II THX (\$2,995).

Velodyne servo subwoofers use accelerometers to sense driver excursion, which is compared to the input signal through feedback circuits that apply correction signals to the amplifier to ensure maximum linearity. The system enables an optimal balance of bass extension, output, and low distortion. It also means that you cannot damage the woofer by overdriving it; the driver knows when to quit and won't let you kill it.

## H I G H - T E C H

### VELODYNE F-1500R



VELODYNE \$1,699

**Woofer Size:** 15-inch servo  
**Amp Power:** 250 watts  
**Footprint:** 3.1 square feet  
**Gross Volume:** 5.36 cubic feet  
**Weight:** 79 pounds  
**Enclosure:** Sealed; servo feedback  
**Output, 25 to 50 Hz:** 108.6 dB SPL  
**Bass Extension:** 12.5 Hz (less than 10% THD)  
**Features:** Variable crossover, auto-on, remote volume control, line-level/speaker-level inputs and outputs, and high-pass filter

# subwoofers relate mainly to bass depth and loudness capability.

All this technical sophistication brings a quantum leap in performance: The Velodyne F-1500R will reproduce 12.5 Hz with less than 10% distortion, and it averages 108.6 dB SPL output from 25 to 50 Hz (the range against which I measured its competitors). Even at 16 Hz, it can deliver more than 105 dB SPL. The F-1500R comes with a remote volume control. Drawbacks are sheer size—a larger enclosure—and a stiffer price tag.

You can sidestep the consumer bazaar by stepping into the professional ranks. Bag End Loudspeakers, for example, makes pro-oriented subwoofers that operate entirely below their system resonance frequency of 70 Hz. Bag End's accompanying Extended Low Frequency (ELF) processor compensates for the special characteristics of its woofer/enclosure systems. A pair of Bag End's 18-inch S18E-O subs, combined with an ELF-1 processor and an outboard 250-watt stereo amplifier (user-supplied), can produce an honest 105 dB SPL at 25 Hz. In my measurements, the output from 25 to 50 Hz averaged a healthy 106.5 dB SPL, but this system could not manage to produce significant output below 25 Hz with less than 10% distortion.

Because it is a professional product, the ELF-1 processor has balanced XLR inputs; adaptors will therefore be required for your RCA connectors. All functions are set with DIP switches located under a protective cover. This means that you get both pro-level setup protection and a fussy-to-use subwoofer system. Line-level high-pass adjustments are available, including Bag End's proprietary Concealment circuit, which prevents damage to both the main speakers and the subwoofer under high-output conditions.

As you might expect, the Bag End system is expensive: \$4,236 for a pair of S18E-O subwoofers and the ELF-1 processor. This does not include the cost of an amp, which is not part of the package. Bag End's ELF-M2 and ELF-M processors reduce the price by \$1,362 and \$1,562, respectively. These models have knob-style controls but eschew the full stereo output of the ELF-1 processor; consider them as alternatives. Using a single subwoofer rather than two will also reduce the price by another \$888—at a cost of 6 dB in maximum output.

It may be hard to imagine significant performance improvements beyond what's attainable from the best commercially available subwoofers. The 18-inch Velodyne systems, for example, boast even greater output than the 15-inch model I tested. Producing more output than the monster Velodynes requires even larger drivers, more powerful amplifiers, larger enclosures, and more sophisticated electronics. In my opinion, this simply isn't necessary for complete enjoyment of most recordings; only a go-for-broke, do-it-yourself fool would commit resources to a system that outperforms the most potent commercially made subwoofers.

Interestingly, such people do exist. For example, my own subwoofer uses an 18-inch driver housed in a 25-cubic-foot, bass-reflex enclosure tuned to 12.5 Hz. It will reproduce 16 Hz with less

PROFESSIONAL

BAG END S18E-O



BAG END \$ 4 , 2 3 6

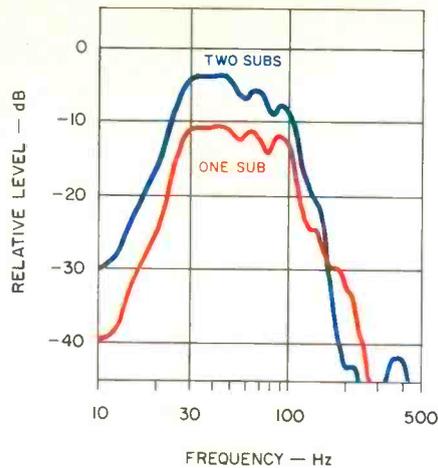
**Woofer Size:** 18 inches (two subs used)  
**Amp Power:** 500 watts total (not supplied)  
**Footprint:** 2.75 square feet (per woofer)  
**Gross Volume:** 5 cubic feet (per woofer)  
**Weight:** 80 pounds each  
**Enclosure:** Sealed; ELF  
**Output, 25 to 50 Hz:** 106.5 dB SPL  
**Bass Extension:** 25 Hz (less than 10% THD)  
**Features:** Variable crossover (DIP switches), volume control, line-level inputs and outputs, adjustable high-pass filter, high- and low-pass protection circuitry, and rack-mount case on processor (with fixed cover)

than 10% distortion and will average more than 110 dB SPL from 16 to 50 Hz when driven by a 200-watt amp through an external electronic crossover. However, I recently measured a system, which belongs to a friend in my audio club, that surely approaches the ultimate. This system comprises eight long-excursion 12-inch woofers mounted in the wall of an attic loft. The attic eave functions as a 450-cubic-foot, infinite-baffle enclosure. The drivers are in concrete-reinforced wall ports, in sets of four drivers each. The system will produce over 112 dB SPL at 12.5 Hz with less than 10%

distortion. The average maximum output, with all eight drivers operating, is in excess of 122 dB SPL at 16 Hz and above.

This is a world-class system, but it, too, is expensive. The parts alone cost approximately \$1,000, including the drivers and materials for the mounting ports. This figure does not reflect the owner's labor or the costs of a custom electronic crossover and a separate two-channel amplifier.

If you feel this level of involvement is over the top, I know of a system that uses four 18-inch woofers mounted below the floor (venting their energy into the room through a heating-like duct) and another sub whose single 30-inch driver is similarly located.



**Fig. 2—**Adding a second subwoofer, in the same corner as the first, yields up to 6 dB more output.

Neither of these installations is cheap. However, because they don't take up floor area for their enclosures, they are the most space-efficient of all subwoofers.

Incidentally, forget about in-wall subwoofers unless they come with their own separate enclosures. Mounting a speaker through drywall doesn't work at low frequencies. Below about 100 Hz, the wall itself begins radiating sound waves out of phase with the subwoofer, thus canceling the output. If you turn up the gain to compensate, the wall begins chattering loudly; pictures in an adjacent room may even fall off the common wall!

You may wonder if sound pressure levels of 120 dB will damage your hearing. At 1 kHz they will, but not at 20 Hz. Most people are regularly exposed to very loud low-frequency noise when a train pulls into a station or a bus pulls up to a stop. Very loud low-frequency sound is not even heard through the ear canals but, rather, through the chest and face. Such high sound pressure levels at extremely low frequencies are not dangerous.

The next obvious question is whether sound at low frequencies can damage your home. The enthusiast with the multiple 18-inch below-floor woofers installed his system about 10 years ago, and no noticeable structural effects have occurred. On the other hand, the owner of the system with eight 12-inch drivers refuses to play it at full output because he's concerned it may knock his garage door off track. It seems that his house has a resonant frequency of about 12 Hz!

So where does this leave us? Most of us will be perfectly happy with a basic subwoofer. Healthy output to 25 Hz will supply realistic reproduction of the low frequencies on CDs and movie soundtracks. Some people will want more bandwidth, and most of them will happily attain it with a commercial subwoofer that is roughly twice as large in overall gross volume but takes up only about 25% more floor space.

Beyond that, the cost of involvement rises rapidly. For example, once you've bought your first Hsu Research, Bag End, or Velodyne subwoofer, the next 6 dB of output requires doubling the displacement and amplifier power—in other words, you have to buy another subwoofer (see Fig. 2) or make a very large personal commitment and build your own. But when Schwarzenegger takes a cleaner, bigger sock in the gut, it will sound all the more impressive and realistic.

A

**B I G B R U T E S**

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M A T E R I A L S & L A B O R



**SINGLE DRIVER**

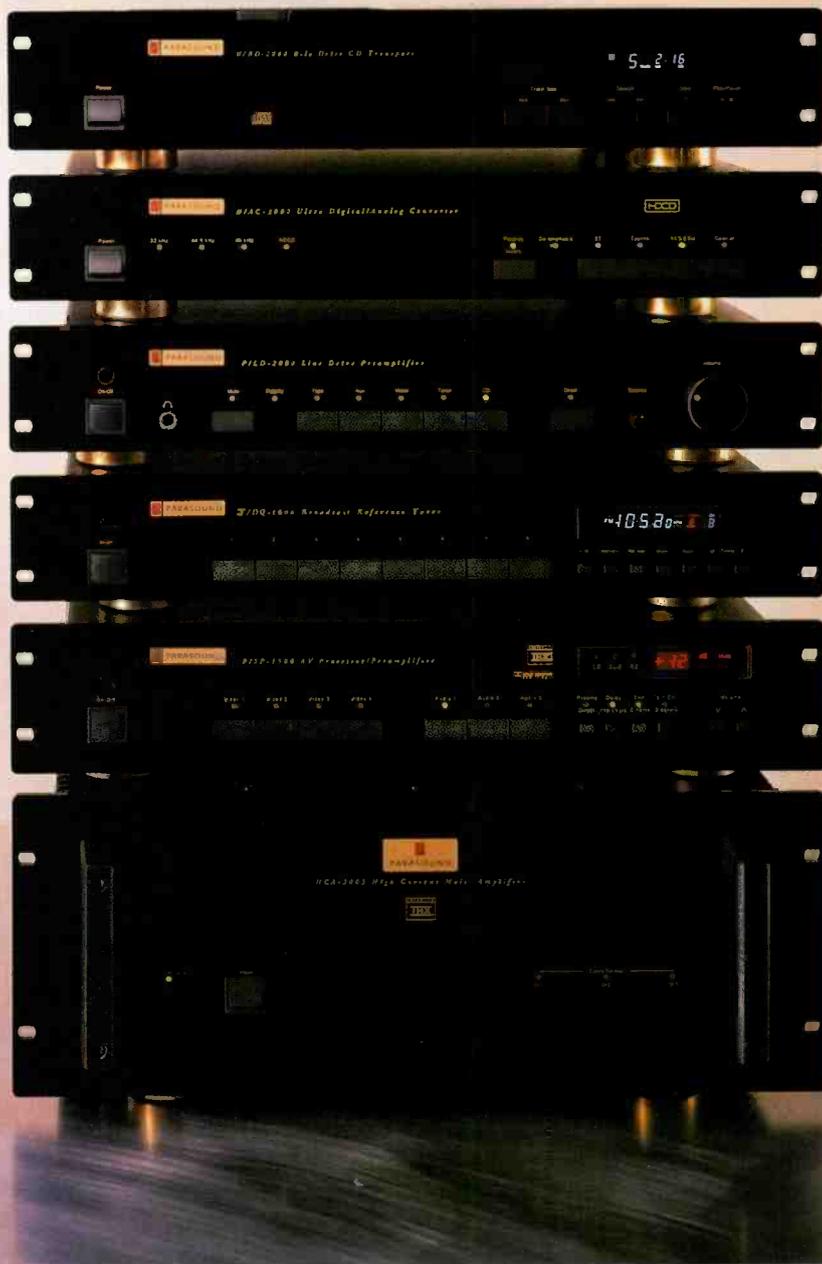
- Woofer Size: 18 inches
- Amp Power: 200 watts (external)
- Footprint: 5.8 square feet
- Gross Volume: 27.5 cubic feet
- Weight: 50 pounds
- Enclosure: Ported
- Output, 16 to 50 Hz: 110.6 dB SPL
- Bass Extension: 16 Hz

**MULTIPLE DRIVERS**

- Woofer Size: 12 inches (eight)
- Amp Power: 400 watts (external)
- Footprint: None
- Gross Volume: 450 cubic feet (attic eave)
- Weight: 200 pounds
- Enclosure: Infinite baffle
- Output, 16 to 50 Hz: 122 dB SPL
- Bass Extension: 12.5 Hz (less than 10% THD)

Photograph: David Hamsley

Be prepared to eat  
*way too much take out food.*



Bring Parasond home and you might never want to leave again. Which is just fine, since we offer a complete menu of high-end products to satisfy any musical taste. You see, we insist on the best designers and the finest ingredients. People like the renowned John Curl, whose audio designs have time and again set the standard for life-like reproduction of music. And premium parts that far exceed what you'd expect to find in components priced from \$250 to \$2,250. All of which means you can now enjoy incredible sound, and still afford to order that extra topping on your pizza.

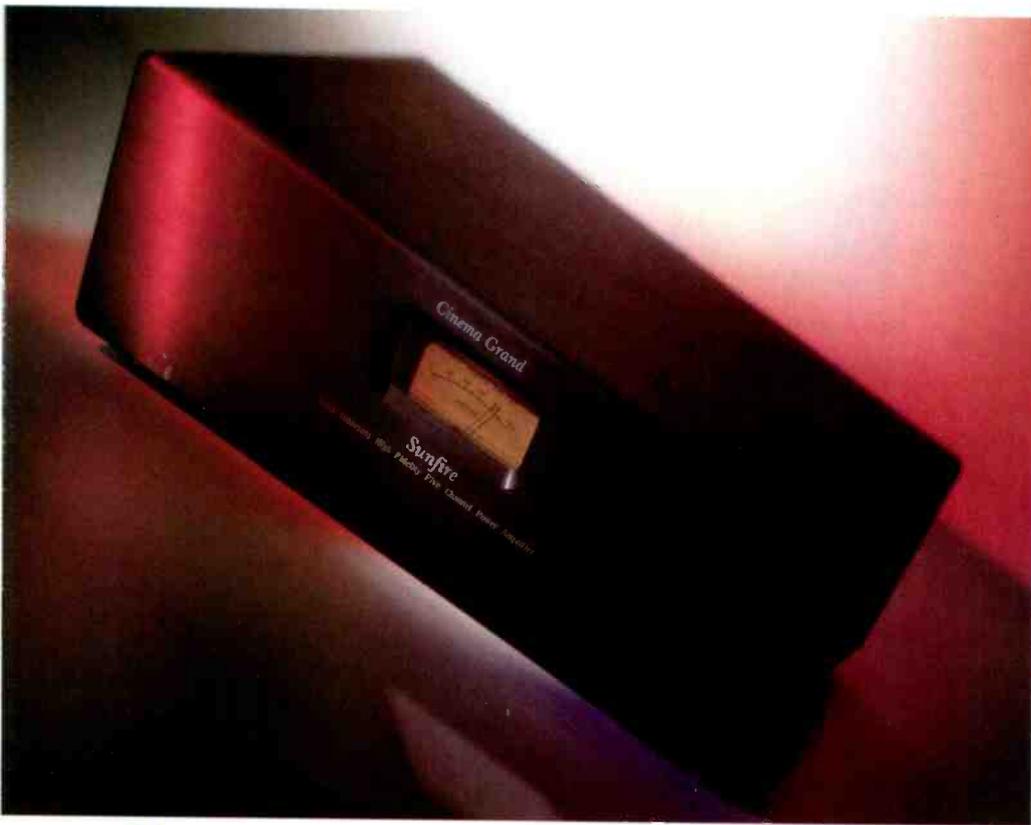


PARASOUND

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EDWARD J. FOSTER

# SUNFIRE CINEMA GRAND FIVE-CHANNEL AMPLIFIER



**A**s the Sunfire owner's manual proclaims on its cover, the Cinema Grand comes "from the mind & soul of Bob Carver," which, as long-time audiophiles have come to realize, means that it will be a novel product, as different from conventional power amplifiers as a power amp can get. Bob describes himself as an "Amplifier Designer, Physicist" and has one of the most fertile minds in audio. Sunfire, his most recent venture, was engendered by his departure from the company that still bears his name, but wherever Bob has been, he's left behind a trail of interesting ideas: Sonic Holography, the Magnetic Field Amplifier, and the Asymmetrical Charge-Coupled Detector to name just three.

Two novelties underpin the Cinema Grand. The first is a "tracking downconverter" that, as the manual states, "allows this amplifier to drive any load to any ration-

**Rated Power, 20 Hz to 20 kHz, at 0.5% THD or Less:** 200 watts per channel into 8 ohms, 400 watts per channel into 4 ohms, or 800 watts into 2 ohms on time-limited basis.

**Dimensions:** 19 in. W x 6½ in. H x 15¾ in. D (48.3 cm x 16.5 cm x 40 cm).

**Weight:** 39 lbs. (17.7 kg).

**Price:** \$2,375.

**Company Address:** P.O. Box 1589, Snohomish, Wash. 98290; 206/335-4748.

For literature, circle No. 90

ally usable current or voltage level." The second is provision of dual outputs on the main (left and right front) channels, "(1) a standard voltage-source (i.e., near-zero-impedance) output for all typical applications and (2) a higher-impedance current-source output, which many prefer for electrostatic, planar magnetic, or ribbon speakers." I'll discuss both of these output choices in more detail presently.

The Cinema Grand isn't bridgeable, but you can get a power boost by bi-wiring your speakers "vertically," i.e., by using separate amplifier sections for the woofer and upper-frequency drivers. Sunfire suggests using the two main channels' "current-source" outputs to feed the upper drivers and using the surround channels (which

**A SIGNAL-TRACKING  
POWER SUPPLY  
MAKES THE SUNFIRE  
CINEMA GRAND  
COOL AND EFFICIENT.**

have only "voltage-source" outputs) to drive the woofers. As an alternative, you can bi-wire your left and right front speakers using both sets of outputs on the main-channel amplifiers (Sunfire again suggests trying the "current-source" outputs for the upper-range drivers and the "voltage-source" outputs for the woofers). Although this doesn't increase available power, as vertical bi-wiring does, it does affect sound quality because of the difference in source impedance at the two outputs.

The main-channel "current-source" outputs aren't current sources in the true technical meaning of the phrase, but they do have a higher source impedance (about 1 ohm) than the "voltage-source" outputs and, in this respect, are more like the outputs of tube power amps than of the solid-state variety. This is the whole point of the issue, as Bob Carver believes that the "current-source characteristic of vacuum tubes is the dominant factor in the soundstage delivery of classic tube amplifiers." In any event, you get your choice: "voltage-source" outputs on all five channels, with "current-source" as well as "voltage-source" outputs on the main front pair.

Photos: Michael Groen

It's not a ball game. Or movie-of-the-week. But, AR's CS 25 HO (High Output) Center / Surround Speaker is the most dramatic improvement in home entertainment you'll ever see - or hear.



For starters, the CS 25 HO has a compact, soft-grip base that fits comfortably atop any TV and doubles as a wall mount bracket with built-in swivel adjustment. The magnetically shielded Focused Array Driver Configuration delivers spacious sound, crisp dialog, and dynamic musical reproduction at any position, with no interference to your system's video signal. Best of all thanks to AR's commitment to value, you'll enjoy audiophile performance and the ultra high efficiency that the CS 25 HO stats of 94dB @ 2.82 volts / meter will deliver...and still have money left over for the popcorn.

Like all AR HO Series loudspeakers, the CS 25 is Dolby Digital AC-3 ready and utilizes our exclusive Voice Balanced Tonal Matching technology to ensure seamless full-bandwidth integration from speaker to speaker - a must for new 5.1 channel digital surround formats.

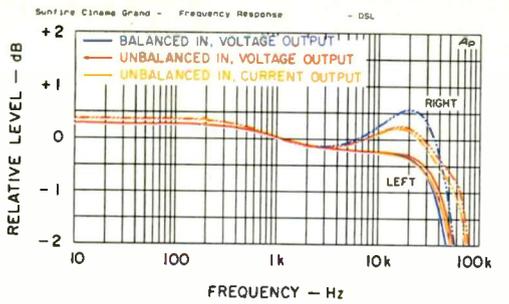
*'The sound had dynamics and punch to spare but also an ease that is uncommon with low- or midpriced systems.'*

*- Thomas J. Norlo  
The Stereophile Guide to Home Theater  
Volume 2, Number 4, Winter 1996*

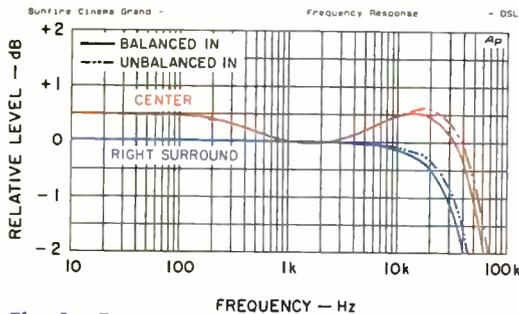
# THE BEST THING ON TELEVISION

To get the rest of the picture, call 1-818-407-4820 for more information including the name of your nearest authorized AR dealer. The CS 25 HO loudspeaker from Acoustic Research. Plug it in. Enjoy the show.

**AR**  
Higher Fidelity

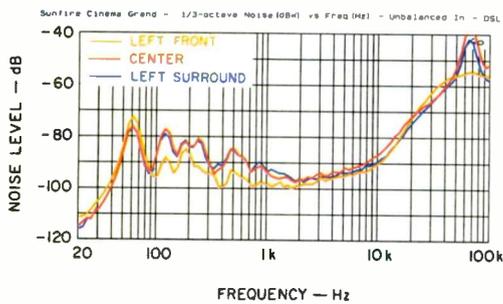


A

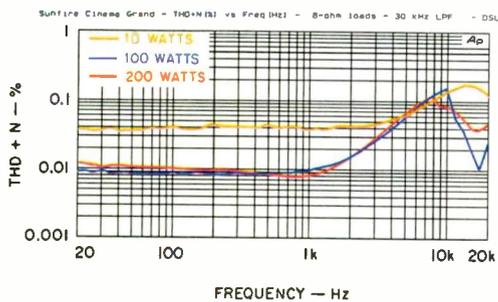


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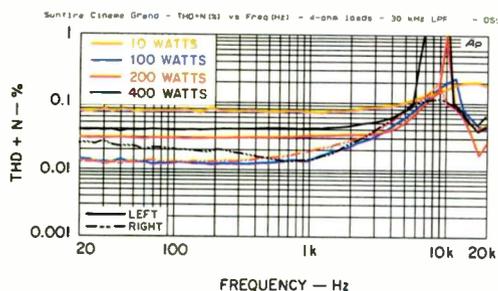
**Fig. 1—Frequency response for main channels (A) and for center and surround (B).**



**Fig. 2—Noise spectra.**



A



B

**Fig. 3—Main-channel THD + N vs. frequency for 8-ohm loads (A) and 4-ohm loads (B).**

Although dual outputs are available only on the main channels, all channels accept both balanced and unbalanced input signals, the former through rear-panel XLR connectors and the latter via adjacent gold-plated RCA jacks. There are two RCAs for each unbalanced input, so you can “loop through” to connect to a second channel of the Cinema Grand for vertical bi-wiring or to feed a second power amp elsewhere. Output connectors are gold-plated multiway binding posts on standard centers. Each accepts single or dual banana plugs, but the hole in the post is too small for the heavy-gauge cable this amplifier deserves.

The front panel is devoid of everything except a centrally located meter that purports to read “Power Supply Energy.” The scale is calibrated from 0 to 500 joules, and the needle normally sits just below the 400-joule mark. Since I never caught the needle anywhere else, I view the meter more as a novel pilot lamp than as an esoteric indicator of technological wonderment. Its gold-tone face and warm, soft glow do give the Cinema Grand a striking appearance.

There’s no power switch on the front; instead, there’s a tiny three-position toggle on the back, which sets the amplifier to turn on when a left front signal is present (and to turn off 2½ minutes after it disappears) or sets it to stay on or off. The Cinema Grand comes with a separate glass base that ensures proper airflow when the amplifier is placed on a carpet and, according to Sunfire, isolates the amp from vibration when it is shelf-mounted. The chassis is rather wider than normal (19 inches), so it would be wise to check the width of your equipment rack.

The Cinema Grand’s rated output capability is prodigious: 200 watts per channel continuously into 8 ohms, 400 watts continuously into 4 ohms, and 800 watts per channel into 2 ohms for a limited

time. Yet the amp runs cool as a cucumber (well, almost!), without a fan or even external heat sinks—a sign of remarkable operating efficiency. This efficiency is directly attributable to the Sunfire’s “tracking downconverter” power supply.

The idea behind the tracking downconverter isn’t new; it’s been one of the Holy Grails that engineers have sought for years



**SUNFIRE'S CINEMA GRAND  
PROMISES TUBE  
OR TRANSISTOR SOUND,  
DEPENDING ON  
WHICH OUTPUT YOU USE.**

and is conceptually similar to the power supply used in the Carver Research Lightstar amp. There’s also a resemblance to multirail, or so-called “Class-H,” amplifiers, although the tracking downconverter is far and away more sophisticated.

These designs all aim at having only as much power-supply voltage as the signal calls for at any given moment, so more of the amplifier’s power goes to the load and less is dissipated across the output transistors. The voltages across the transistors and the load must always add up to the rail voltage. Thus, any part of the rail voltage that’s not fed to the load as signal will appear across the output transistors. Beyond the few volts needed to keep the transistors conducting, the voltage across the transistors increases power dissipation (which is the product of the voltage across the transistors and the signal current through them, integrated over time). Because the power the amp can deliver is limited in part by the output transistors’ allowable power dissipation, extra dissipation from unneeded rail voltage reduces the power these transistors can deliver to the load.

The fixed supply rails of conventional, Class-AB amplifiers always carry the volt-



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AND A STABLE PLATTER MECHANISM,  
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THE RECORD BUTTON.



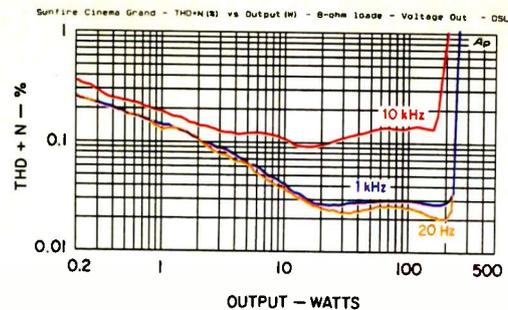
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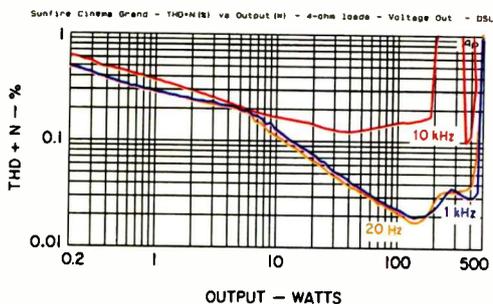
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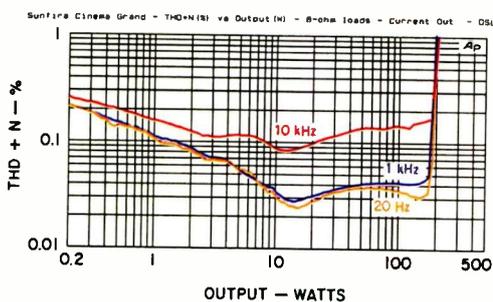
**ELITE**  
BY PIONEER



A



B



C

**Fig. 4—Main-channel THD + N vs. power for voltage output into 8-ohm loads (A), voltage output into 4-ohm loads (B), and current output into 8-ohm loads (C); see text.**

age needed when the amp delivers its rated output power. But most of the time, little of this voltage is needed, and the excess appears across the output transistors. With the tracking downconverter, the power-supply rails are not fixed; instead, they track the audio signal so that the voltage across the conducting output transistor stays at just the few volts needed to keep that transistor operating properly. The output transistors can then conduct huge amounts of current without dissipating a lot of heat. This enables the amp to come far closer than ordinary amplifiers to the theoretical ideal of doubling output power each time the load impedance is halved. And it's the basis of Sunfire's claim that the Cinema Grand is "load-invariant."

The tracking downconverter is actually a PWM (pulse-width-modulated) switching power supply that Sunfire says operates at 135 kHz. The 135-kHz pulse train is filtered by an inductor and capacitor to produce the "DC" rail voltages. (They're not actually DC, because they track the signal.) The rail voltages are determined by the duty cycle of the pulse train, which, in turn, tracks the audio signal.

This setup increases the Cinema Grand's efficiency in two ways. The tracking system minimizes power loss through dissipation across the output transistors. And the switching power supply minimizes dissipation across its own transistors. In a well-designed switching supply, the switching transistors are either fully on (i.e., saturated, so there is little voltage across them) or fully off (in which case there's no current flow). Either way, power dissipation—the product of the voltage and current across the transistors—remains close to zero except at the instant of switching.

The Sunfire tracking downconverter can be thought of as a Class-D (switching) power amplifier that generates the rail voltages needed to supply the bipolar transistors in the actual audio output stages. The downconverter uses high-speed HEXFETs (International Rectifier's name for its power MOS-FETs) to do the switching; bipolar devices are used throughout the Cinema Grand's audio output stages because of their superior linearity.

#### Measurements

With a 135-kHz nominal switching rate, the Sunfire Cinema Grand's power supply can track audio waveforms out to about 10 to 15 kHz; above that range, it follows the envelope of the audio signal rather than the actual waveform. This change from waveform tracking to envelope tracking causes a dramatic drop in efficiency at very high frequencies and leads to some peculiarities in testing. The presence of such high levels of ultrasonic switching energy within the box also leads to test results that require careful interpretation.

The Cinema Grand's frequency response is rolled off above 30 kHz, probably in order to reduce ultrasonic output energy. Since the main-channel response curves taken on my sample were slightly different from those of the surround channels, I've shown a full set of curves in Fig. 1. These curves also reveal the (rather small) difference in response between the balanced and unbalanced inputs and, on the main channels, the negligible difference in response between the "current" and "voltage" outputs—into a purely resistant load, at least. (Because the various curves for each channel are so similar, only the response for unbalanced input and voltage output is listed in "Measured Data.")

As one might expect, the filters aren't completely effective in eliminating the power-supply switching component, and this can be seen in Fig. 2. These noise spectra were taken on the left front, left surround, and center channels, using both balanced and unbalanced inputs. The predominant component occurs around 62 kHz, half the switching rate that Sunfire specifies. Again as one would expect, there was a bit less ultrasonic trash when using the balanced input (not shown) than the unbalanced. However, as can be seen in "Measured Data," there's negligible difference between the A-weighted noise measurements for the different inputs. "Measured Data" also indicates that the unbalanced input is twice as sensitive as the balanced input, which I presume is related to an input topology that keeps both inputs active. (There's no switch on the Cinema Grand to choose between them.)

**THE METER TELLS YOU  
LITTLE, BUT ITS GOLD  
FACE AND SOFT GLOW  
GIVE THE CINEMA GRAND  
A STRIKING LOOK.**

Because the switching-supply signal registers as noise in measurements of total harmonic distortion plus noise (THD + N), and because it can mask true distortion (especially at relatively low power levels), I've chosen to present distortion data taken through a 30-kHz low-pass filter in the ana-

# "MicroWorks Is In The Same League With The Top-Rated \$699 Multimedia System...And Plays Louder Without Distortion. In Terms Of Price For Performance, It's In A Class By Itself." *MacWorld, Dec. 1996*

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satellite speakers, an in-line volume control, and a subwoofer. The subwoofer cabinet encloses a 6½" woofer, a 3-channel amplifier, an electronic crossover and a control panel with two inputs and a bass level control. The satellite cubes are supplied with desktop stands, plus a velcro kit that lets you attach the cubes directly to a computer monitor.

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\* The subwoofers of both systems are designed to be placed on the floor, not on the same surface as the satellite speakers. © 1997 Cambridge SoundWorks.



CIRCLE NO. 10 ON READER SERVICE CARD

## MEASURED DATA

Data taken on one channel is for the left front, unless specified. Unless otherwise noted or implied, all data was taken with 8-ohm loads, using the unbalanced input and the voltage output. Data for THD + N and channel separation is for the worst channel.

### Frequency Response (Worst Case):

Main channels, 20 Hz to 20 kHz,  $\pm 0.33$  dB ( $-3$  dB at 67.3 kHz); center channel, 20 Hz to 20 kHz,  $+0.62, -0.03$  dB ( $-3$  dB at 82.3 kHz); surround channels, 20 Hz to 20 kHz,  $+0, -0.33$  dB ( $-3$  dB at 55.2 kHz).

**Output Power at Clipping (1 kHz, 1% THD):** 8-ohm loads, 255 watts (24.1 dBW) per channel from voltage output and 202 watts (23.1 dBW) per channel from current output; 4-ohm loads, 495 watts (26.9 dBW) per channel from voltage output and 315 watts (25 dBW) per channel from current output.

**Dynamic Output Power:** 8-ohm loads, 255 watts (24.1 dBW) per channel from voltage output and 205 watts (23.1 dBW) per channel from current output; 4-ohm loads, 510 watts (27.1 dBW) per channel from voltage output

and 325 watts (25.1 dBW) per channel from current output; 2-ohm loads, 1,020 watts (30.1 dBW) per channel from voltage output and 460 watts (26.6 dBW) per channel from current output.

**Dynamic Headroom re Rated Power:** 8 ohms,  $+1.1$  dB; 4 ohms,  $+0.9$  dB.

**THD + N at Rated Output, 20 Hz to 20 kHz:** 8-ohm loads, less than 0.118%; 4-ohm loads, less than 0.113% (omitting data around 10 kHz; see text).

**THD + N at 10 Watts Out, 20 Hz to 20 kHz:** 8-ohm loads, less than 0.173%; 4-ohm loads, less than 0.203%.

**Damping Factor at 50 Hz, re 8 Ohms:** Voltage output, 350; current output, 8.2.

**Output Impedance, 1 to 20 kHz:** Voltage output, 22 to 32 milliohms; current output, 980 milliohms.

**IHF Sensitivity:** Unbalanced input, 107 mV; balanced input, 214 mV.

**A-Weighted Noise:**  $-77$  dBW or better, all channels.

**Input Impedance:** 24.2 kilohms.

**Channel Separation:** Greater than 49.7 dB, 100 Hz to 10 kHz.

**Channel Balance:**  $\pm 0.17$  dB.

lyzer rather than the 80-kHz filter I usually use. The THD + N versus frequency curves taken on the main channels' voltage output are shown in Fig. 3 for 8- and 4-ohm loads. The 30-kHz filter suppresses all but the second harmonic at test frequencies above 15 kHz, so the data taken above 15 kHz is suspect; actual distortion may be higher than it appears. However, I believe the curves are reasonably representative: For example, maximum THD + N at 200 watts into 8 ohms registered 0.167% with the 80-kHz filter and 0.118% with the 30-kHz filter. That's not a large difference, and some of it is undoubtedly due to switching noise rather than to distortion.

The discontinuities that appear around 8 to 10 kHz in the 4-ohm, high-power curves (Fig. 3B) seem related to the point where the power supply shifts from waveshape tracking to envelope tracking; as this occurred in only one channel, both channels'

behavior is presented for 200- and 400-watt output. Concurrent with those discontinuities, I noted a substantial increase in power-line current, which indicates a commensurate drop in operating efficiency. With 4-ohm loads, the surge in line current as the 400-watt sweep approached 10 kHz caused the line voltage to drop below 120 volts; I considered the behavior sufficiently anomalous to omit the results around that point for the data presented here.

I also modified my test procedures when measuring THD + N versus output (Fig. 4). Once again, I used the 30-kHz low-pass filter in the analyzer to discriminate against power-supply switching noise, and I ran the high-frequency sweep at 10 kHz rather than at 20 kHz. This was necessitated by the anomalous behavior that occurred when I tried a 20-kHz sweep, but it also permitted the second and third harmonics to get by the filter.

With 8-ohm loads and a 20-kHz test signal, the Cinema Grand behaved strangely as the power level advanced. Once above about 100 watts, the system seemed to cycle in and out of some form of protection, the current drawn from the power line surged up and down, and the data became erratic. Since that didn't happen with a 10-kHz tone and 8-ohm loads, I chose to use that frequency. With 4-ohm loads, however, there's still some strangeness above 200 watts, as you can see in Fig. 4B.

All the curves in Figs. 3 and 4 were taken using the Cinema Grand's voltage output. Figure 4C shows the amplifier's capabilities using its current output to drive 8-ohm loads. The major difference between the voltage and current outputs is the higher source impedance of the latter (about 1 ohm, as opposed to 20 or 30 milliohms), which leads to a concomitant loss in available power. With an 8-ohm load, the loss calculates to be (and measures) 1 dB, and the clipping point drops from 255 watts via the voltage output to 202 watts via the current output. The lower the load impedance, the greater the power loss. With a 4-ohm load, the clipping point drops from almost 500 watts at the voltage output to 315 watts at the current output. With 2-ohm loads, there was a 3.5-dB loss in capability, which means more than half the available power was lost to the internal source impedance. The same held true for dynamic output power, of course.

I did not actually measure the Cinema Grand's efficiency, because there's no sense

**OUTPUT CAPABILITY  
IS A PRODIGIOUS  
200 WATTS TIMES FIVE  
INTO 8 OHMS.**

in performing such a test—no one drives five high-power amplifier channels to their full, sustained output at once except on the test bench. But I could tell from the effect on my lab's line voltage that the Sunfire's efficiency was, indeed, higher than normal. With 8-ohm loads, I could easily drive all five of its channels (a total of 1,000 watts) and still maintain line voltage with my

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Variac. That I could not do so with 4-ohm loads (2,000 watts total) was no surprise.

### Use and Listening Tests

So why would one lay out cold hard cash for a blockbuster power amp and then choose to limit the amount of power that's available? Good question! I guess you'd do it to get that "tube sound" that Bob Carver claims for the current outputs.

I did find that the Cinema Grand sounded different through its current outputs from the way it sounded when its voltage outputs were used, but the difference depended entirely upon the speaker and, in particular, upon the speaker's impedance characteristics. Vis-à-vis amplifier distortion, frequency response, noise, and so forth, I could detect no real difference between the Cinema Grand's two output options. The difference lay entirely in the altered source impedance and in what that implies.

If a loudspeaker has a flat impedance curve, there will be no difference in sound character between the two outputs other than a reduction in maximum output capability with the "current" connection, which is hardly desirable. But loudspeaker impedance usually varies with frequency, which means that using the Cinema Grand's current outputs, with their 1-ohm source impedance, will yield a different frequency response and a different sound from that obtained using the near-zero-impedance voltage outputs. Whether this is more "tube-like" and whether that, itself, is desirable are matters of opinion. I contend that modern loudspeakers are (or should be!) designed to work best with low-impedance amplifier outputs, because they are more common and predictable than high-impedance ones. This is not to say that using the Cinema Grand's current output might not be beneficial with some speakers. An electrostatic that seems overly bright may mellow nicely if the panel is fed from the current output; that's because the impedance of an electrostatic panel usually diminishes with increasing frequency, which will lead to a gradual rolloff in treble response when it's fed from a finite, constant source impedance. Connecting the woofer to the voltage output, as the manual suggests, may also be wise because that output's far greater damping factor (350, as opposed to

about 8) will help control the woofer's cone motion. The main problem I see in using both connections simultaneously in this way is that the difference in source impedance will cause a shift in acoustic output between the two drivers, changing the frequency response.

Personally, I preferred the sound of the Cinema Grand through its voltage output. That's because I basically like the sound of my speakers when they're driven from a low source impedance. (If I didn't, I'd change my speakers and not expect an amplifier to change their character.) The only one of the test anomalies I thought I could hear was the difference in response between the

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QUALITY, WITH  
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POWER RESERVES.**

main- and surround-channel amps. I didn't hear this in my home theater, but in my music listening room I thought I could hear a difference when I switched between using the main and surround channels to drive my primary speakers. The test wasn't blind, however, so I can't be sure that I wasn't kidding myself.

The anomalous distortion characteristics that showed up on the test bench around 10 kHz at high power levels didn't show up in the listening room, probably because they don't occur unless you ask the amplifier to deliver hundreds of watts of 10-kHz power for an appreciable length of time—enough to send your tweeters to the hereafter.

The Sunfire Cinema Grand did have an effortless quality and grace about it. Its power reserves were seemingly boundless, and its ability to drive virtually any load from its voltage output was awesome. Why one would want to muck up perfection with a 1-ohm resistor is beyond me, but I'm told that using fine-gauge wire as a speaker cable—tantamount to the same thing—is the latest rage in the United Kingdom! To each his own. At least Bob Carver has the intelligence not to let his creativity interfere with his good sense and so offers you both options. I'll take the voltage output, thank you! A

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# BOSTON ACOUSTICS VR2000 POWERED SUBWOOFER



**B**oston Acoustics' loudspeaker listing in *Audio's* Annual Equipment Directory (October 1996) takes up well over half a page. The listing comprises more than 40 models, including in-wall, outdoor, and multiple-speaker systems. The VR2000 is Boston Acoustics' most powerful subwoofer. It contains a built-in 300-watt amplifier driving a long-throw 12-inch woofer

mounted in a large, nearly cubical vented box whose volume is 2.6 cubic feet (74 liters). The woofer is on the front of the enclosure, which is covered by a curved, re-

movable molded-plastic grille. On the rear are two ports, an input and control panel, and a large heat sink with 1-inch fins for the internal power amplifier. A 5-foot AC power cord is permanently attached.

**BOSTON ACOUSTICS'  
VR2000 SUBWOOFER  
MEETS THE STRINGENT  
REQUIREMENTS  
FOR HOME THX.**

The input panel's controls and connections enable the VR2000 to be used in any stereo or home theater setup, including those with Dolby Digital (AC-3) decoders. A THX logo indicates that this subwoofer meets Lucasfilm's stringent specifications for bandwidth, acoustic output, and distortion and that it has the required inputs and controls for Home THX.

Home THX and most Dolby Digital systems should be connected to the VR2000's fixed-level line input jack, which bypasses the subwoofer's controls. Stereo and Dolby Pro Logic systems may be connected to that jack or to the variable left and right line-level input and output jacks or speaker-level binding posts (which are spaced to accept double-banana plugs). When its variable inputs are used, the VR2000's volume control and crossover-frequency control (adjustable from 40 to 100 Hz) are active.

The polarity-reversal and power switches are active for all inputs. The former matches the VR2000's polarity to that of your system's other speakers. The latter includes an "Auto" position that turns the subwoofer on when there's a signal and turns it off if there has been none for 10 or 15 minutes.

The VR2000's cabinet is made from ¾-inch medium-density fiberboard and has extensive internal bracing to minimize vibration. An additional large center brace contacts the rear of the 12-inch driver through rubber bumpers. It solidly connects the woofer to the cabinet's rear, which minimizes flexing of the front and rear panels. The woofer's stamped frame holds a large ceramic magnet (4½ inches in diameter and ¾ inch thick); an additional field-bucking magnet, 4 inches in diameter and 0.6 inch thick, is attached to its rear. The resultant assembly is magnetically shielded for operation near TVs or computer displays. The rear panel also contains two large port tubes, 3 inches in diameter and 15 inches long, which are flared on both ends to minimize noise from air movement.

The power amplifier's components are on a 4 x 6½-inch printed-circuit board mounted to the back of the heat sink. The

**Rated Frequency Response:** 21 to 100 Hz, ±3 dB.

**Crossover:** Low-pass, -3 dB point variable from 40 to 100 Hz, 24-dB/octave rolloff; line-level high-pass, -3 dB at 100 Hz, 12-dB/octave rolloff.

**Dimensions:** 18½ in. H x 18 in. W x 21 in. D (46 cm x 45.7 cm x 53.3 cm).

**Weight:** 65 lbs. (29.5 kg) each.

**Price:** \$1,200 each.

**Company Address:** 300 Jubilee Dr., Peabody, Mass. 01960; 508/538-5000.

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remaining area on the rear of the heat sink is taken up by a very beefy power transformer. The circuit itself uses all discrete components except for an IC supply regulator, and it contains a total of six low-level signal transistors and four high-level output power transistors; the latter are attached directly to the heat sink through electrically insulated mounts to transfer heat efficiently. The wiring and printed circuits were very clean-looking and showed very good workmanship.

### Measurements

All measurements (except for peak acoustic output) were made in a large anechoic chamber and were corrected for the chamber's response errors below 50 Hz. I

made the tests with the VR2000's volume control at its mid-point and with input signals of 2.83 volts, equivalent to 1 watt into 8 ohms. (The actual impedance of the Boston sub's speaker-level inputs is much

**BUILT-IN AMPLIFICATION  
LETS THE VR2000  
DELIVER LOUD BASS  
IN ANY SYSTEM.**

higher, about 680 ohms.) My Crown TEF-20 system analyzer (TEF stands for time-energy-frequency), which I have used for all previous reviews, was being repaired and updated when I tested the VR2000, so I borrowed an Audio Precision System One analyzer. My test microphone was the same Brüel & Kjaer 4007 condenser mike I have used for all my reviews during the last seven years.

Figure 1 shows the VR2000's anechoic frequency response at various crossover settings. (Measurements were taken on the woofer's axis and corrected to account for the rear-panel ports' contribution, which I measured separately.) The curves are for nominal crossover settings of 40 Hz (full

counterclockwise), 60 Hz, 80 Hz, 90 Hz (midway between the "80" and "100" marks), and 100 Hz (full clockwise). The measured high-pass frequencies differ somewhat from the subwoofer's indicated settings (see Table I).

With its volume control at mid-position, the VR2000's effective sensitivity was a high 98 to 99 dB SPL at 1 meter and would have been even higher if I had turned up the volume control.

Figure 2 shows near-field frequency response of one of the VR2000's ports (the other's was identical) and of its cone. (Note that this graph's frequency scale is from 10 Hz to 1 kHz instead of the 20 Hz to 20 kHz I use for full-range speaker systems.) The port's output peak and corresponding dip

in the woofer's response at 27 Hz indicate that this is the subwoofer's tuning frequency. The VR-2000 should be able to radiate significant low-frequency energy down to at least one-sixth of an octave below this frequency, or about 25 Hz. The total output is the vector sum of the two responses; at the 27-Hz resonance, however, the port provides virtually all of the acoustic output.

Figure 3 shows the VR2000's second- and third-harmonic distortion versus frequency. (Note that the graph's vertical scale covers 70 dB, a wider range than usual.) These measurements were taken directly above the enclosure, equidistant from the ports and woofer.

With a maximum output of 90 dB SPL in the VR2000's passband (Fig. 3A), the third harmonic never exceeds 53 dB at frequencies above 30 Hz and remains some 35 dB below the fundamental, a very low 1.8% of the fundamental's level. Below 30 Hz, the third-harmonic distortion rises somewhat and is about 20 dB below the fundamental, or about 20%. The second harmonic is even 10 dB lower than the third at most frequencies. (Second-harmonic distortion

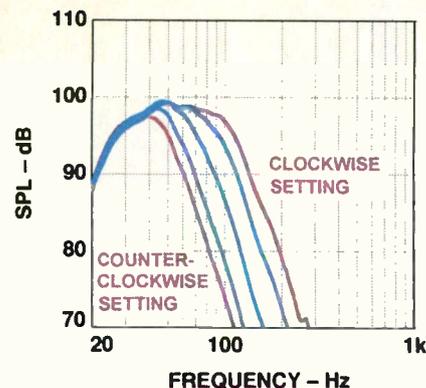


Fig. 1—Frequency response at several crossover settings.

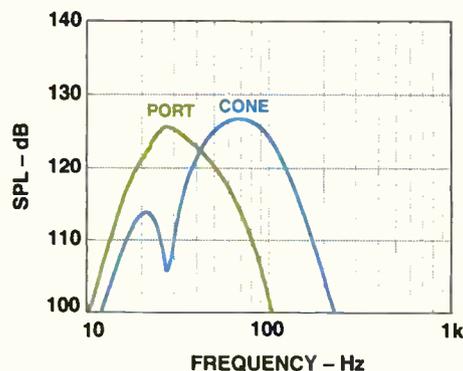


Fig. 2—Near-field frequency responses.

tion indicates an asymmetrical nonlinearity, where a speaker's cone can move more easily in one direction than the other; third-harmonic distortion indicates a symmetrical nonlinearity, which limits the cone equally in both directions.)

At the higher sound pressure level of 100 dB (Fig. 3B), the subwoofer's third harmonic rises at frequencies above 30 Hz but still remains about 30 dB below the fundamental, a commendably low distortion of only 3% to 4%. Below 30 Hz, the third harmonic shoots up to nearly 100%, with the second harmonic not far behind. These tests made the cooling fins of the built-in power amplifier quite hot to the touch.

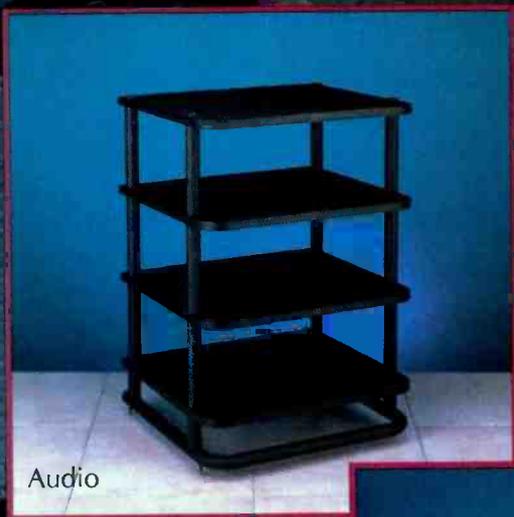
When I fed the VR2000 high-level swept sine waves for the harmonic-distortion tests, its enclosure proved quite rigid and did not generate any extraneous noises. I noted a sharp null in cone displacement at about 27 Hz, the VR2000's resonant frequency. At still lower frequencies, I noted significant dynamic offset of the woofer at high input levels, with the cone shifting out of the gap. The woofer had an effective dis-

Table I—Nominal crossover settings and measured passbands (-3 dB points).

Setting	Low	High
40 Hz	25 Hz	51 Hz
60 Hz	27 Hz	55 Hz
80 Hz	30 Hz	67 Hz
90 Hz	31 Hz	86 Hz
100 Hz	31 Hz	106 Hz

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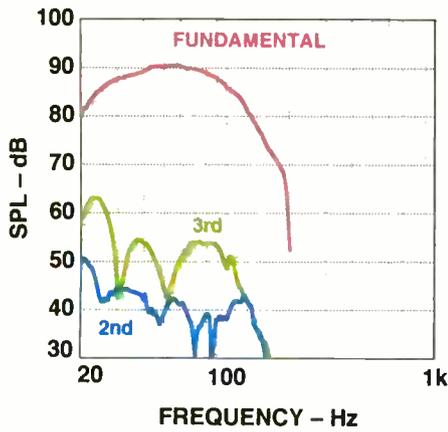
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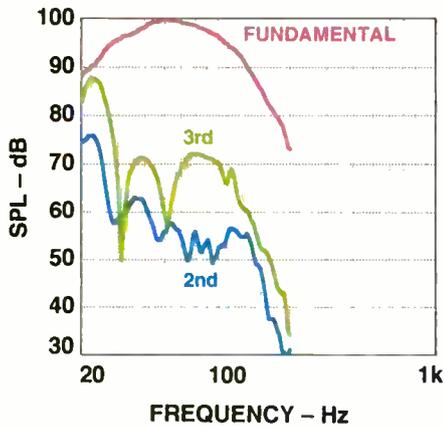
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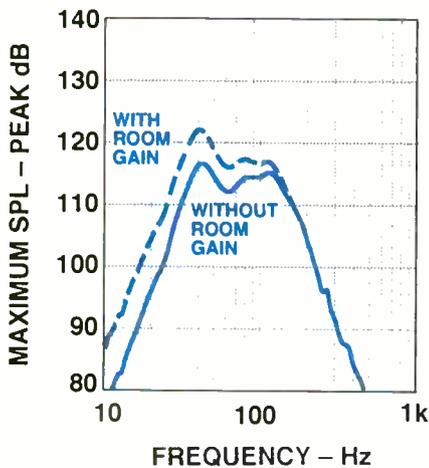


A



B

**Fig. 3—Harmonic distortion, in dB SPL, for output levels of 90 dB SPL (A) and 100 dB SPL (B) at 1 meter.**



**Fig. 4—Maximum sound output.**

placement of about  $\frac{3}{4}$  inch, peak to peak, and overloaded quite gracefully.

In Fig. 4 only the VR2000's short-term peak output capability versus frequency is presented, as my usual curve for peak input

power would be irrelevant (a powered subwoofer draws no significant power from your amp). Note that the graph starts at 10 Hz. The input signal was a 6.5-cycle, third-octave-bandwidth tone burst applied to the speaker-level inputs, and the crossover control was set at 110 Hz. With room gain, the Boston's maximum peak SPL starts at an unusable 86 dB at 10 Hz but then rises very rapidly, reaching 105 dB at 20 Hz. It crosses 110 dB at 25 Hz and 120 dB at 35 Hz before reaching a peak a little above 120 dB at 40 Hz. Above 60 Hz, this subwoofer's maximum level drops somewhat, to about 117 dB; above 120 Hz, the crossover rolls the response off rapidly. In a comparison with a Velodyne F-1500 subwoofer, the Boston VR2000 played about 5 to 6 dB louder in the important region from 30 to 80 Hz; below 30 Hz, the Velodyne's output was much cleaner and more extended than the Boston's. (I reviewed the Velodyne F-1500 in the November 1992 issue; the current version of this subwoofer costs about \$500 more than the Boston VR2000.)

#### Use and Listening Tests

Although the Boston Acoustics VR2000 weighs 65 pounds, I was able to move it around easily by myself. For those who are able to dead lift its weight (I can because I've been working out lately!), the ports provide a convenient handhold; the sub is somewhat easier to lift in this manner when its grille is off.

The VR2000's controls and input and output jacks are logically marked and nicely laid out; I was able to do the initial installation and operation without referring to the owner's manual. Incidentally, that manual is very detailed and covers use of the subwoofer's fixed and variable inputs, controls, placement, wiring, fine-tuning, using two subwoofers, and troubleshooting.

I evaluated the VR2000 in home theater and stereo setups. My home theater, now up and running, contains mostly Pioneer Elite equipment (a PRO98 52-inch rear-projection television, a CLD-99 CD/laserdisc player, and a VSX-99 A/V receiver) plus a Sony SLV-790HF VCR, a set of KEF Reference THX Series speakers (Model Two front left and right, Model 200C center channel, Model AV2 surround speakers, and Model AV1 THX subwoofer), and an alternative subwoofer (the Velodyne F-1500).

My home theater is in a 23 x 21-foot room in my basement. The screen and front speakers take up 11 feet of one 21-foot wall and fire down the 23-foot length. One side wall is broken up by a staircase and a bar area.

When I listened to the VR2000 in my home theater, I used a line-level switcher for A/B comparisons between it and the Velodyne subwoofer. I placed both subwoofers in one corner at the speaker end of

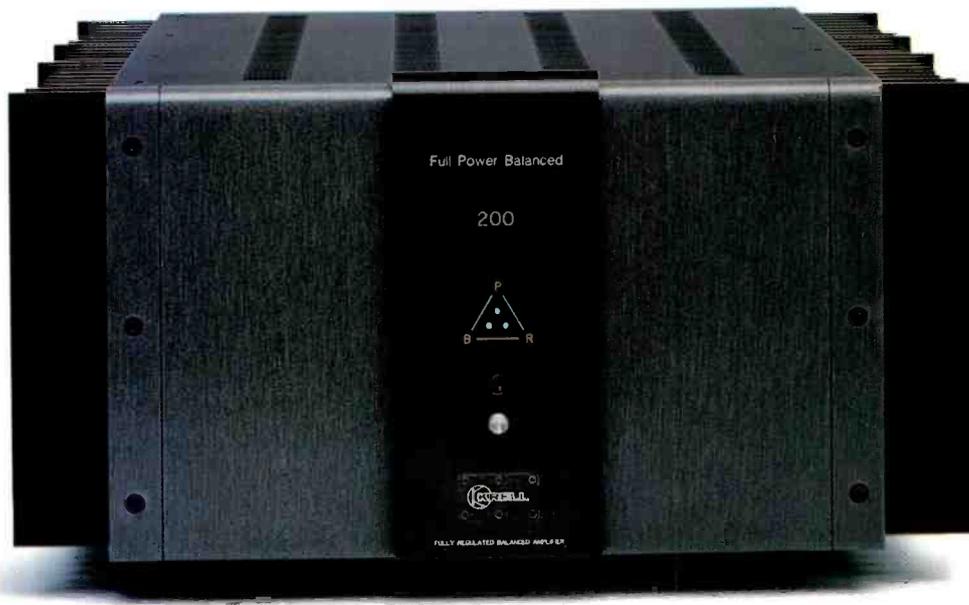
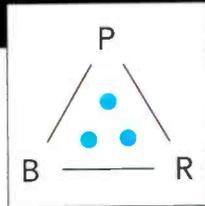
**ABOVE 30 Hz,  
HARMONIC DISTORTION  
IS COMMENDABLY LOW,  
EVEN AT 100 dB SPL.**

the room. I hooked up the VR2000 via its variable inputs and set its crossover frequency to 80 Hz. (Using the fixed input would have prevented me from using the volume and crossover controls.)

I did my first listening while watching the THX widescreen version of *Terminator 2: Judgment Day* (Carolco Home Video 82997-2WS), with the A/V receiver's surround decoder in Dolby Pro Logic mode. The VR2000 handled this movie's bass extremely well, delivering clean, loud, gut-thumping bass that I often preferred to the Velodyne's output. The bass sound effects accompanying the atom-bomb blast that opens the film were incredible (my handwritten notes say "wow!!!"). The VR2000 also did a very good job with the descending glissando chord that accompanies the THX logo in the opening credits. In fact, the Boston had half as much cone excursion as the Velodyne when playing the THX chord at the same level, even though the Velodyne uses a servo-controlled 15-inch woofer in a sealed enclosure and the VR2000 uses a 12-inch driver in a vented enclosure. It's a classic example of how a vented system can outperform a sealed system with a larger woofer.

By the way, this is my first large-screen home theater, and I'm extremely enthused and excited by its capabilities and its ability to entertain. I have long had a world-class stereo system, but rarely would anyone else sit down with me in my listening room sim-

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ply to hear music. As soon as I fire up the home theater, though, everyone wants to join me!

This is also my first prolonged exposure to listening to conventional stereo CDs through a Dolby Pro Logic surround system. On most material, the added realism and increased sense of immersion in the sound field are amazing. When I test speakers on stereo music, my standard pipe-organ bass CD is Mussorgsky's *Pictures at an Exhibition* (Dorian DOR-90117), with Jean Guillou at the Great Organ of the Tonhalle in Zurich. But listening to it in Dolby Pro Logic surround is like being in a cathedral! The increased headroom, provided by five channels of more than 100 watts plus a separately powered subwoofer, gives the presentation an effortless quality most two-channel systems can't match. I have never heard this CD sound this good. And the Boston Acoustics VR-2000 rose to the occasion, providing clean, wall-shaking bass that matched or exceeded the Velodyne's output at all but the very lowest bass frequencies.

On the CDs I use for testing speakers' bass, the VR2000 performed almost flawlessly; it handled everything I threw at it. Often, I strongly preferred the Boston to the Velodyne, particularly on rock. On ZZ Top's *Eliminator* (Warner Bros. 9 23774), for example, the Boston provided a much punchier and more solid low end on kick drum. The Velodyne sounded rather flabby by comparison, but I may have been listening at such high levels that the Velodyne's limiters were restricting it from playing louder. The ZZ Top disc also greatly profited by being played through the home theater system at near-concert levels—again, it was just like being at the concert! I actually listened to this album all the way through, which is something I rarely do when I am reviewing.

On third-octave band-limited pink noise, the Boston had as much or more clean output as the Velodyne in the 32-Hz and higher bands. The Boston did generate some usable fundamental in the 20- and 25-Hz bands, but its output was more distorted than the Velodyne's. At 25 Hz, the Boston suffered from significant dynamic offset, which displaced the cone inward and dramatically increased second-harmonic distortion.

On the 6.5-cycle, third-octave tone bursts from *Test CD for Sound Reinforcement Systems* (available from Synergetic Audio Concepts; phone, 812/923-0174), the Boston could play significantly louder than the Velodyne at the 32-Hz bands and above.

As on the band-limited pink noise, the VR2000's 20- and 25-Hz output was rolled off and distorted.

The SynAudCon test CD also revealed another difference between the Boston VR2000 and the Velodyne F-1500. One test sequence has tone bursts that occur once per second in the left channel and once every 2 seconds in the right channel. When these signals are summed, the bursts from the right channel reinforce alternate bursts from the left. This produces a mono signal whose level

changes by 6 dB from burst to burst. When the Velodyne played this mono signal at high levels, its built-in limiters made all the bursts come out at the same volume level. The VR2000, however, preserved the 6-dB level shift, playing significantly louder than the Velodyne on the reinforced bursts.

The Boston VR2000 performed admirably in all my bench tests and listening sessions. It is one of the highest-performing subwoofers I have reviewed and, at \$1,200, is a very good value. It would make a fine addition to any stereo or home theater system. Only bass junkies who yearn for lots of output below 25 Hz need not apply. **A**



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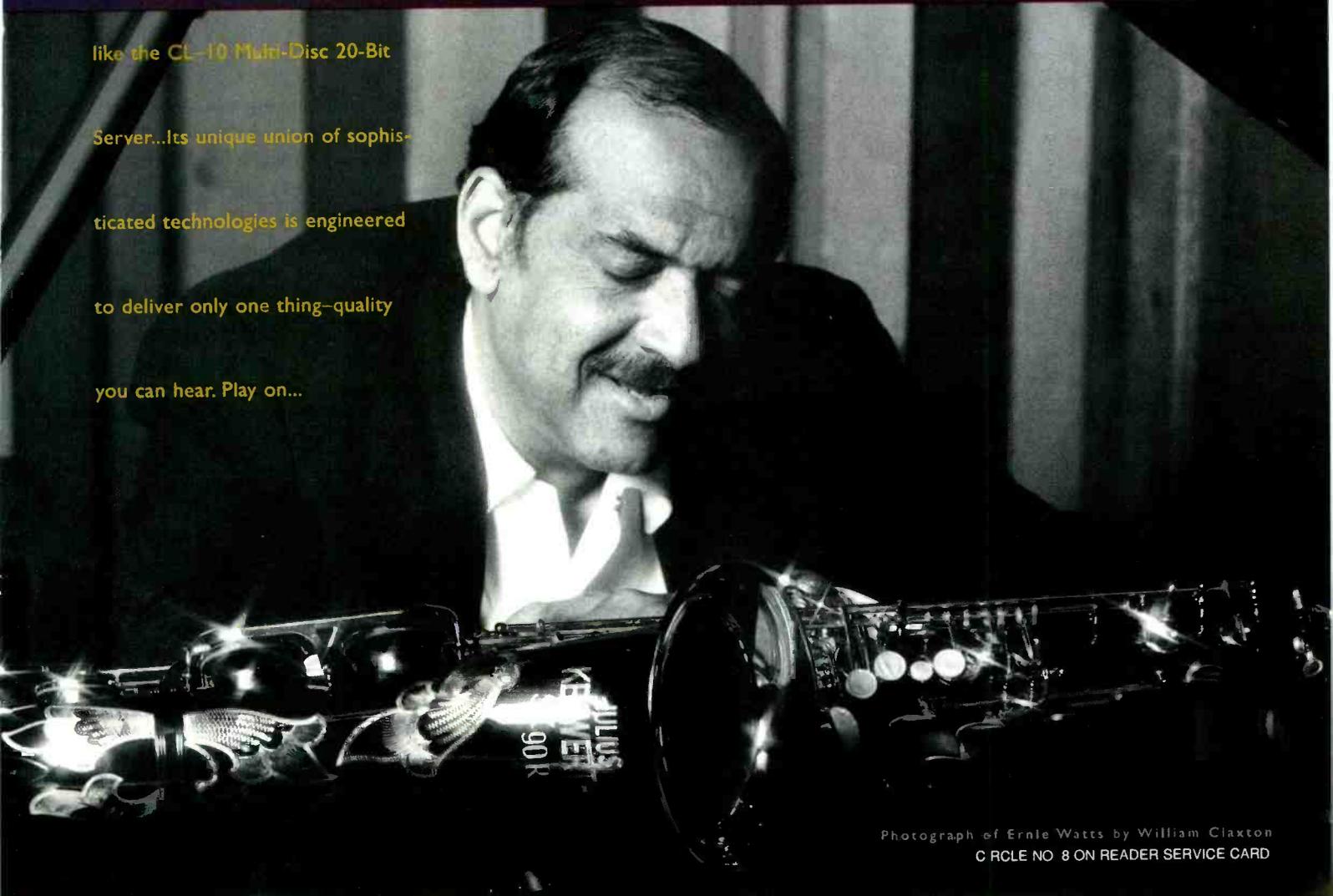
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Photograph of Ernie Watts by William Claxton  
C RCLE NO 8 ON READER SERVICE CARD

EDWARD J. FOSTER

# SONY DTC-ZA5ES DAT RECORDER



can be transferred to CD without using a sampling-rate converter, which might degrade the sound. Since consumers could not record CDs until recently, I guess the industry saw no need for home DAT recorders that could record from analog sources at the 44.1-kHz sampling rate. Now that home CD recorders are available, there is such a need. And the DTC-ZA5ES—and its four-head big brother, the DTC-2000ES—are the first decks I know of that fill it.

On the ZA5ES, the sampling rate is chosen by the “REC Mode” switch, the third position of which, “Long,” invokes a 32-kHz sampling rate and cuts the tape speed in half. This provides twice the recording time, at some sacrifice of bandwidth and some increase in distortion. In the long-play mode, frequency response is specified as 2 Hz to 14.5 kHz,  $\pm 0.5$  dB, with 12-bit nonlinear encoding rather than 16-bit linear.

The choice of sampling rate applies only when you’re recording analog signals. When you’re copying a digital source the original sampling rate carries over to the copy (the ZA5ES does not perform sampling-rate conversion), so the “REC Mode” setting is unimportant. There’s one exception to this: When you’re copying a 32-kHz digital source with “REC Mode” set to 44.1 or 48 kHz, the tape moves at standard speed (but to no advantage, since the sampling rate remains 32 kHz). If you try to record a 44.1- or 48-kHz source in the “Long” mode, the deck ignores that command and records at standard speed, which is as it should be.

The DTC-ZA5ES also features Sony’s Super Bit Mapping (SBM) circuitry. Super Bit Mapping was originally developed for professional use, to approach the sound quality of 20-bit encoding while adhering to the 16-bit CD/DAT standard. It uses digital

**W**hat consumer product has more extended frequency response and better resolution than a CD player—and records, too? The Sony DTC-ZA5ES DAT recorder. Sony has cham-

pioned the DAT format in the professional and consumer markets and has delivered fine products to each. Although I don’t have the numbers to prove it, I suspect that Sony has sold more DAT decks

to consumers than any other company. Actually, there’s not that much difference between consumer and pro DAT recorders. Except for a somewhat sexier appearance

and built-in microphone preamps, its use of unbalanced inputs and outputs and signal levels typical of consumer products, and the imposition of the Serial Copy Management System (SCMS) to prevent multigeneration digital copies, the ZA5ES is remarkably similar to the current Sony professional DAT recorders.

The DTC-ZA5ES does break new ground by enabling consumers to digitize and record analog signals with the 44.1-kHz sampling rate

used by CDs and prerecorded DATs. Professional DAT decks record at either 44.1 or 48 kHz, not because the 44.1-kHz rate is better than 48 kHz but because a 44.1-kHz tape

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**Weight:** 16 $\frac{1}{2}$  lbs. (7.5 kg).

**Price:** \$1,600.

**Company Address:** Sony Dr., Park Ridge, N.J. 07656; <http://www.sony.com>

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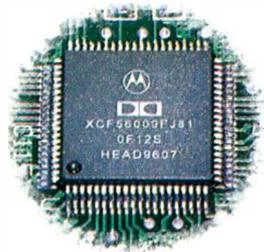
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CIRCLE NO. 41 ON READER SERVICE CARD

## MEASURED DATA

### PLAYBACK CHARACTERISTICS

Channel Balance:  $\pm 0.05$  dB.

Line Output Level for 0 dBFS: 2.12 V.

Output Impedance: Line, 440 ohms; headphone, 100 ohms.

Maximum Headphone Output Power: 50 ohms, 22.6 mW; 600 ohms, 12.4 mW.

### RECORD/PLAY

#### CHARACTERISTICS

Analog Input Sensitivity for 0-dBFS

Recording: Line, 0.51 V; mike, 1.06 mV without attenuator and 11 mV with it.

Analog Input Impedance: Line, 46.2 kilohms; mike, 4.3 kilohms.

Analog Input Overload: Line, more than 10 V; mike, 15.1 mV without attenuator and 157 mV with it.

THD + N at 0 dBFS, 20 Hz to 20 kHz: Analog input, less than 0.0062% with SBM and less than 0.0057% without it; digital input, less than 0.0027%.

THD + N at 1 kHz: Analog input with SBM, below -88.4 dBFS from 0 to -90 dBFS and below -89.1 dBFS from -30 to -90 dBFS; analog input without SBM, below -91.2 dBFS from 0 to -90 dBFS and below -92.6 dBFS from -30 to -90 dBFS; digital input, below -95.8

dBFS from 0 to -90 dBFS and below -97.8 dBFS from -30 to -90 dBFS.

Maximum Linearity Error: Analog input with SBM, 0.47 dB to -90 dBFS and 0.85 dB to -100 dBFS; analog input without SBM, 0.59 dB to -90 dBFS and 1.31 dB to -100 dBFS; digital input, 1.1 dB to -90 dBFS with undithered recording and 0.63 dB to -100 dBFS with dithered recording.

A-Weighted S/N: Analog input with SBM, 95.3 dB with pre-emphasis off and 98.4 dB with it on; analog input without SBM, 96.1 dB with pre-emphasis off and 97.1 dB with it on; digital input, 108.5 dB.

Quantization Noise: Analog input with SBM, -89.6 dBFS; analog input without SBM, -93.2 dBFS; digital input, -97.6 dBFS.

Dynamic Range: Analog input with SBM, 89.2 dB unweighted and 96 dB A-weighted; analog input without SBM, 92.7 dB unweighted and 95.3 dB A-weighted; digital input, 97.6 dB unweighted and 99.7 dB A-weighted.

Separation: Analog input, greater than 72.8 dB, 100 Hz to 17 kHz; digital input, greater than 87.7 dB, 125 Hz to 16 kHz.

crophone preamps in consumer recorders—especially DAT decks, which I consider the best consumer medium for live recording. I'm happy to say that the Z45ES has mike preamps, complete with switchable input attenuators that drop the gain by 20 dB. This prevents overload when you're using sensitive microphones or miking close to the sound source.

A rotary switch selects among five inputs: three analog ("MIC," "MIC ATT," and "Line") and two digital ("Optical" and "Coaxial"). The microphone inputs are gold-plated, 1/4-inch phone jacks on the front. On the back are gold-plated RCA jacks for the analog line inputs and the coaxial digital input and a conventional Toslink socket for the optical digital input. Similar optical and coaxial digital outputs are on the back, and a gold-plated, 1/4-inch headphone jack is on the front. The headphone output has its own level control; all other outputs have fixed level.

When recording analog sources, you set the level with tightly clutched, dual-concentric knobs and monitor it with competent, 23-segment peak-program meters that span the top 60 dB of dynamic range. The meters are augmented by a two-digit "Margin" indicator that monitors both channels and displays the remaining headroom (in decibels) in the higher of the two. The "Margin" indicator covers the highest 10-dB range in 0.5-dB steps and then the range to -40 dBFS in 1-dB steps. The indicator is fast, accurate, and holds the peak level until you reset it by tapping "Margin Reset," a small button above "Phone Level." If a recording

goes over the top, the indicator will flash "0.0" until reset.

The "Fader" button, to the left of "Margin Reset," initiates fade-in or -out. Tapping "Fader" in record/pause mode starts the tape and

initiates a fade-in; tapping during an ongoing recording fades the signal out and places the deck in record/pause. The deck's display tells you what's going on, including the number of seconds remaining in the fade. You can set fade time from 1 to 15 seconds by pressing "Fader" a few times while the tape is stopped and then tapping fast

noise shaping to move quantization noise from the mid-frequency region, where the ear is most sensitive, to the region above 15 kHz, where it is less sensitive. Although the total noise power isn't reduced (it's fixed by the recorded 16-bit words), the system has the potential to sound like it has better resolution because the noise is less audible. Super Bit Mapping functions when analog signals are being digitized (not when you're dubbing in the digital domain), and it is fully compatible with any 16-bit decoder. Although I see no reason not to use SBM, there's a switch on the Z45ES to defeat it.

Another unusual feature of the DTC-Z45ES is its ability, when recording analog signals, to pre-emphasize the treble prior to A/D conversion, with compensatory de-emphasis after playback D/A conversion. The de-emphasis reduces treble noise, thereby improving subjective dynamic

range. Although "emphasis" was included in the CD and DAT standards (an emphasis flag is embedded in the digital bitstream to tell the decoder to use a de-emphasis network), few CDs and DATs are recorded with pre-emphasis because "hot" treble signals (such as in rock and synthesized music) could, if pre-emphasized, overload the A/D converter. The Z45ES gives you the option of pre-emphasizing or not (via an "Emphasis" toggle); that option is likely to be more useful when you're recording natural acoustic instruments than electronic ones.

In the past, I've criticized Sony (and almost everyone else) for not including mi-

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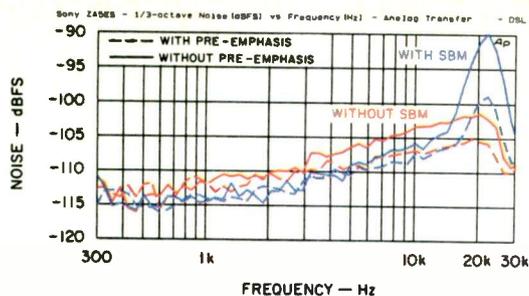


Fig. 1—Record/play noise spectra via analog inputs.

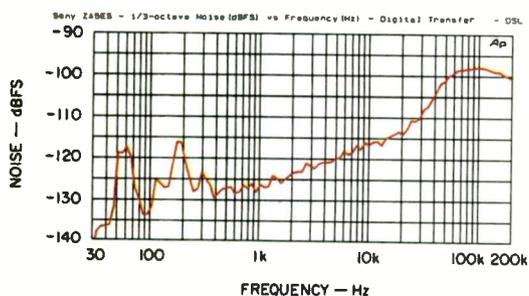


Fig. 2—Noise spectrum via digital input.

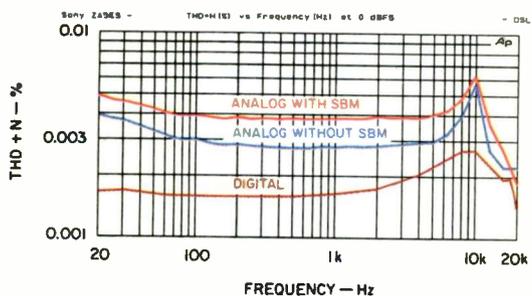


Fig. 3—Record/play THD + N vs. frequency.

forward or rewind. Each tap changes the fade time by 1 second. This is a temporary override of the 5-second factory setting; the deck defaults to 5 seconds the next time power is turned off.

Above the ZA5ES's display are three display-control buttons: "Mode" (which cycles among absolute time, track playing time, tape remaining time, and tape running time), "Reset," and "Clock Set" (which sets the internal clock that adds the time and date to recordings as they are made).

Except for the fast-forward and rewind pads, which are below the display, the transport controls are just below the tape well. Of these controls, "REC Mute" plays an important role in DAT recording. Instead of

leaving an unrecorded blank area on the tape (as skipping ahead with play or fast forward would) or just recording 4 seconds of silence (as a cassette deck's record muting function does), it records absolute time code along with the silence. Without that, the absolute time count would be lost, because it relies on continuous recording from the very beginning of the tape. For the same reason, new DAT cassettes should be recorded from the very start; the ZA5ES automatically inserts a recorded blank leader at the beginning of a tape.

With the DTC-ZA5ES, you use the fast-forward key, rather than a separate button, to initiate an end search; pressing fast forward winds the tape to the end of the recorded area and stops it at the beginning of any blank passage of 9 seconds or longer. Pressing "REC" in a blank section rewinds the tape to the beginning of that section and switches the deck into record/pause. To wind to the end of the tape, first advance to the end of the recorded area, using fast forward, and then press fast forward again.

Start IDs can be written automatically or manually. The "Auto" button toggles between the two modes, and a legend appears in the display when the deck is set for automatic ID writing. When you're digitally dubbing from a CD or DAT, start IDs are written whenever

a new track is detected. When you record from an analog input in the "Auto" mode, start IDs and program numbers are written whenever the input signal rises above a threshold after 3 seconds or more of muting or low signal level. You can write and erase start IDs manually with the "Start ID" pads, "Write," and "Erase." Together with "Rehearsal," these also enable you to reposition or add start IDs after recording. Automatic program renumbering is available via "Renumber."

Assuming that the tape contains start marks and program numbers, tracks can be found with the "AMS" skip pads on the main panel and remote or directly with the remote's 10-button numeric keypad. The

ZA5ES's 29-key remote also controls all transport functions; commands playback of the first 8 seconds of each track ("M. Scan"); programs the deck for track playback in any order via "RMS Check," "RMS Enter," and "Clear"; and sets it up for repeat play of one track or the entire tape with "Repeat." Repeat play continues for five iterations or until canceled, whichever occurs first. A three-position switch above the deck's on/off button sets up the ZA5ES for unattended recording or playback via an external timer.

#### Measurements

The Sony DTC-ZA5ES presented a challenge on the test bench because of its many options for recording analog signals: two sampling rates, SBM or "straight" A/D conversion, and use or non-use of recording pre-emphasis—eight possible combinations. Digital dubbing, on the other hand, was straightforward; I simply copied pertinent portions of the CBS CD-1 test disc and played the tape. Since the disc has a 44.1-kHz sampling rate, the tape was recorded at that rate too.

I decided to limit the analog record/play tests to 48-kHz sampling, reasoning that the digital dubbing tests would establish the characteristics of the ZA5ES's D/A converter at 44.1 kHz. (Except for a minor difference in response to signals above 20 kHz,



**THE ABILITY TO USE  
PRE-EMPHASIS IS HANDY  
WHEN RECORDING  
ACOUSTIC INSTRUMENTS.**

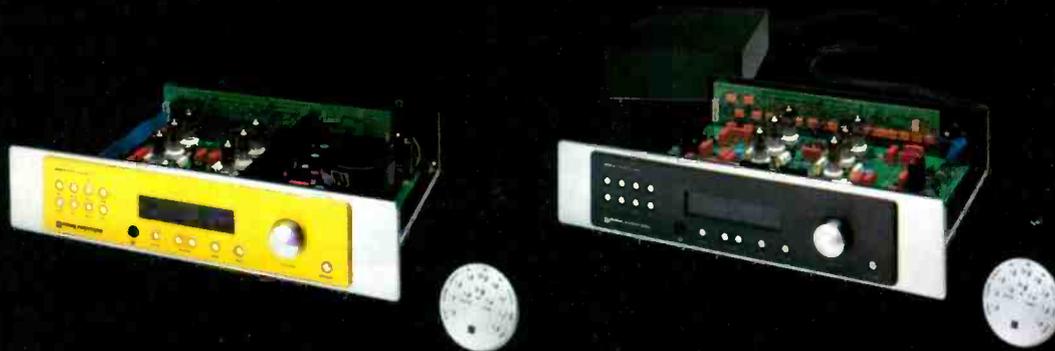
there's no reason why the deck's analog recording performance with 44.1-kHz sampling would be different from that at 48 kHz.) This cut the number of permutations in half but still left the question of whether to use Super Bit Mapping and pre-emphasis. Aside from measurements where I

# NOW WHO'S IN CONTROL?

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	SONIC FRONTIERS LINE-2	SONIC FRONTIERS LINE-1	AUDIO RESEARCH LS-15	CONRAD-JOHNSON PREMIER 14
SEPARATE OUTBOARD POWER SUPPLY	YES	NO	NO	NO
FULLY BALANCED DESIGN	YES	YES	YES	NO
DIRECT COUPLED OUTPUT	YES	YES	NO	NO
INPUTS/OUTPUTS	8/5	8/5	7/4	7/4
FULL FUNCTION REMOTE CONTROL	YES	YES	YES	YES
REMOTE CONTROL HOUSING	ALUMINUM	ALUMINUM	PLASTIC	PLASTIC
REMOTE CONTROL FUNCTIONS	10	10	6	6
DISPLAY/LED DIMMING	YES	YES	NO	NO
RELAY SWITCHING	YES	YES	YES	YES
OUTPUT IMPEDANCE (8E/BAL)	150/300	150/300	300/600	230
REGULATION STAGES	19	15	7	6
STANDBY FUNCTION	YES	YES	NO	YES
BALANCE CONTROL	YES	YES	NO	YES
VOLUME STEPS	191 - 0.5dB	191 - 0.5dB	68 - 0.5 to 3dB	100 - 0.67dB
CONSTANT ON FILAMENT	YES	YES	NO	NO
HEADPHONE AMPLIFIER	YES - Headroom™	YES - Headroom™	NO	NO
BBP "BYPASS" LOOP	YES	YES	NO	NO
MONO FUNCTION	YES	YES	NO	NO
TAPE LOOP - ACTIVELY BUFFERED	YES	YES	NO	NO
IR JACK	YES	YES	NO	NO
RELAY TRIGGER	YES	YES	NO	NO
PHASE CONTROL	YES	YES	NO	NO
DETACHABLE AC POWER CORD	YES	YES	NO	NO
CHASSIS DAMPENING	YES	YES	NO	NO
SMD PCB CONSTRUCTION	YES	YES	NO	NO
TOROIDAL POWER TRANSFORMER	YES	YES	NO	NO
WEIGHT (NET)	33 LBS.	24 LBS.	11.6 LBS.	23 LBS.
ELECTRONICS WARRANTY	5 YEAR P&L	5 YEAR P&L	3 YEAR P&L	3 YEAR P&L
TUBE WARRANTY	1 YEAR	1 YEAR	90 DAYS	30 DAYS
M.S.R. PRICE (US\$)	\$2995	\$1995	\$2995	\$3995

\* The information contained in this chart has been sourced from manufacturer brochures, reviews and physical examinations. It is accurate to the best of our knowledge, as of October 1st, 1996. Sonic Frontiers Inc. makes no warranty, either expressed or implied, as to the accuracy of this chart. Manufacturer specifications are subject to change. Contact them directly to confirm.



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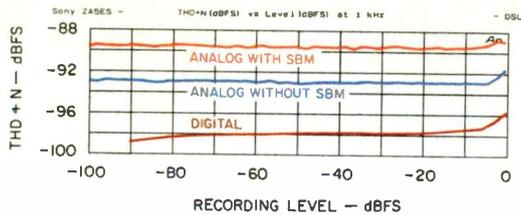


Fig. 4—Record/play THD + N vs. level.

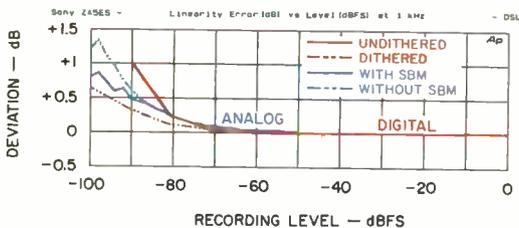


Fig. 5—Record/play linearity error.

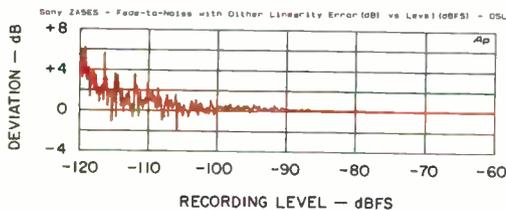


Fig. 6—Fade-to-noise test.

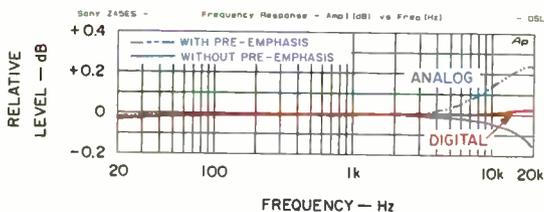


Fig. 7—Record/play frequency response.

thought pre-emphasis might make a difference, I ran the tests with pre-emphasis switched off. Where I thought it might have an impact—frequency response, A-weighted S/N, and third-octave noise plots—I repeated the tests and switched pre-emphasis in. I followed a similar procedure with SBM. However, because SBM has a more far-reaching effect, most of the data was taken both ways. Measurements taken under only one operating condition were made using SBM but without pre-emphasis, since I would normally use the ZA5ES that way.

A word of caution regarding interpretation of data taken with SBM encoding: Su-

per Bit Mapping capitalizes on one of the properties of human hearing, the ear's relatively greater sensitivity in the midrange than in the high treble. Therefore, data taken on a broadband basis is unlikely to reveal a benefit from using SBM. In fact, the numbers are likely to be worse with SBM than without because noise shaping tends to increase the total noise level even as it reduces noise in the ear's high-sensitivity region. Only weighted data or data taken with a narrow filter is likely to show SBM's advantages, and, even then, A-weighting is too gentle to really show the goodies.

To understand what SBM does, refer to the DTC-ZA5ES's noise spectra in Fig. 1. The curves are the result of recording an analog signal with the four possible combinations of SBM and pre-emphasis. The curves were taken on the left channel (right-channel curves were virtually identical), with the recording level set so that a 2-volt line input produced a 0-dBFS recording. I've expanded both scales of the graph so that you can see the differences better.

The curves taken with SBM encoding cross the corresponding curves taken without SBM at approximately 15 kHz. The SBM curves reveal far more noise above 15 kHz than the non-SBM curves; they can differ by 12 dB or more at half the sampling rate. But over the many octaves between a few hundred hertz and 15 kHz, the SBM

curves lie several decibels below the non-SBM curves. When the noise is integrated over this wide range and weighted for the variations in hearing sensitivity, SBM encoding proves subjectively quieter than "straight" conversion. Think of Super Bit Mapping as akin to squeezing the air in a balloon from one end to the other. The amount of air doesn't change, but where it's located does. The difference is that, in this case, the "air" is

noise, and it gets squeezed into a place where we don't hear it as acutely.

The curves of Fig. 1 were taken by recording from the Sony DAT deck's analog line input without an input signal; the input was terminated so that only the recorder's noise would appear in the output. Figure 2 shows the playback noise spectrum after direct transfer of the "digital-zero" track on the CBS CD-1 disc. This graph's scales are more typical of what I usually present (the frequency scale now extends to 200 kHz), but notice how low the curve lies. This is clear testimony to the excellence of this deck's analog output circuitry. Because the curve lies so low, the power-line-related components at 60 and 180 Hz stand out. But note how low they really are: below -115 dBFS. Unless you look carefully at the scales of a graph, curves can easily deceive!

As reported in "Measured Data," A-weighted S/N with digital transfer was a remarkable 108.5 dB. The corresponding analog measurements ranged from 95.3 to 98.4 dB, depending on whether or not I used SBM encoding and recording pre-emphasis. Using pre-emphasis reduced A-weighted noise by 1 to 3 dB; it also swung the balance in favor of SBM because the playback de-emphasis network helps lower the peak in ultrasonic noise that results from using SBM. This is reflected in the tabulated data and can also be gleaned by carefully inspecting Fig. 1.

Figure 3 shows total harmonic distortion plus noise (THD + N) versus frequency for a recording at 0 dBFS. The curve for a digital transfer from the CD-1 disc lies at a remarkably low level, mostly below 0.002% and never above 0.0027%. Chalk this up to Sony's advanced digital filter and D/A con-

verter. The filter is said to use eight-times oversampling, 45-bit internal processing, and dithering to 20 bits before hand-off to the pulse-type DAC. The curves taken with analog signals are

above the digital curve. Their shapes, however, suggest that between 100 Hz and 5 kHz the system bottoms out on input circuit noise rather than A/D converter distor-

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WAS AS CLOSE  
TO PERFECT  
AS I'VE EVER SEEN.**

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tion. The peaks near 10 kHz suggest cross-modulation with the sample clock, but the resulting THD + N is quite modest: 0.0062% with SBM, a trifle less (0.0057%) without.

Figure 4 shows THD + N versus level for a digital copy and for SBM-encoded and non-SBM-encoded analog signals. Again, the non-SBM curve seems better than its counterpart, because the THD + N is almost all noise (indicated by the curves' flat shape) and because the noise was measured on an unweighted basis (numbers can be deceiving). The curve taken for a digitally transferred recording is remarkable—almost perfectly flat and lying near -98 dB, the theoretical limit of a 16-bit system!

As you might expect, the excellent results in Fig. 4 carry over into Fig. 5 (linearity error) and Fig. 6 (fade-to-noise-test). I used a more revealing vertical scale in Fig. 5 than usual because the performance of the ZA5ES is so good. This graph is particularly interesting because it indicates how Super Bit Mapping linearizes the recorder's A/D converter. The curve taken with SBM lies below that taken without it and is very close to the curves taken via a digital dub of the CBS CD-1 disc, which was itself generated and dithered by a computer. Amazing! How can anyone fail to be impressed with a real-life converter that's almost as linear as a computer-generated paradigm?

Of course, you wouldn't be able to see how linear SBM encoding is if Sony's DAC were not equally outstanding. Its performance is seen in the digital-transfer curves in Fig. 5 and in Fig. 6. The latter curve is as close to perfect as I have seen.

The quantization noise test is meant to evaluate conversion noise, i.e., the quantization errors caused by the discrete steps of the digitizing process. Quantization noise is measured unweighted, so it's not surprising to find that the ZA5ES data taken with SBM encoding is a few decibels worse than that taken without. The results for digital transfer from the CD-1 disc reflect the playback converter's characteristics alone; the measurements taken by recording from the analog input combine the quantization noise of both the A/D and D/A converters.

I'm impressed by the Sony's quantization noise numbers, and I'm just as impressed by its dynamic range. Although the test of quantization noise exercises a converter

over its full operating range, dynamic range is calculated from a measurement of distortion and noise with a low-level (-60 dBFS) signal. It is usually measured unweighted as well as A-weighted. The Sony deck's A-weighted dynamic range reveals an advantage to SBM encoding, whereas the unweighted data would have you believe that performance is better without it.

Figure 7 shows frequency response of the ZA5ES. I've greatly expanded the vertical scale to distinguish among the curves. Any



**THE SONY DTC-ZA5ES  
IS A PLEASURE TO USE,  
AND IT SOUNDS  
REALLLY GOOD!**

way you cut it, response is excellent: +0.05, -0.02 dB from 20 Hz to 20 kHz via digital dub; +0, -0.16 dB over the same range for analog signals without pre-emphasis; and just slightly worse for analog signals with pre-emphasis. The difference between the pair of analog curves is due to a slight discrepancy in the Sony deck's pre-emphasis/de-emphasis networks. The difference between the non-pre-emphasized analog curve and the curve taken with the digital dub shows the response of the A/D converter. Channel separation is not presented in a graph, but as you can see in "Measured Data," it's fine.

Line output level of the DTC-ZA5ES was typical of today's consumer digital-audio products, and the output impedance was low enough to be of no concern. Playback-circuit channel balance was exceedingly good. There should be sufficient output for typical consumer headphones, although high-impedance professional 'phones might come up a bit shy. Impedance and

sensitivity of the analog inputs were fine. It's possible to overload the microphone preamp, but thanks to the attenuator, it should function well with a wide variety of mikes. Choose whichever setting makes you crank the recording level control at or above 2½ on its scale. If you do this, the preamp won't clip before the record level indicator tops out.

#### Use and Listening Tests

There was one fly in the ointment, at least on my DTC-ZA5ES sample. When I was recording analog signals with the two sections of the "REC Level" control aligned, substantial channel imbalance occurred. With the control fully advanced, the imbalance was 3 dB, more than enough to skew the image when recording stereo with mike setups that capture differences in intensity rather than time. I corrected the imbalance by adjusting the relative positions of the control's two sections. But because the knobs are clutched tightly, adjusting them would be difficult while making a live recording. I'm not downgrading the ZA5ES on this account because the problem was likely sample-specific rather than a design flaw. Nonetheless, it should have been detected by Sony during quality control.

That said, I'm happy to report that the ZA5ES was a pleasure to use. Compared with other DAT decks in my stable, it was fast and mechanically quiet. Some decks seem to take forever to fast wind a T-120; the ZA5ES zipped through in well under a minute. And it searched a normally recorded tape at 200 times normal speed and audibly cued at 2½ and eight times normal.

The ZA5ES also sounded remarkably good. I mean, *reallly* good. On digital dubs, this is the only DAT deck I've found that challenged the sound quality of my reference CD player. But that's not terribly surprising: My current reference CD player is a Sony CDP-XA7ES, which I expect uses the same (or a very similar) digital filter, DAC, and output circuit as the ZA5ES.

To be frank, I've never seen much point in making DAT dubs of CDs. I use DAT decks for live recording, and the Sony DTC-ZA5ES really shone in that application. Here's a consumer recorder that truly can rival the best professional gear on the market. I've used both and have the live recordings to prove it!

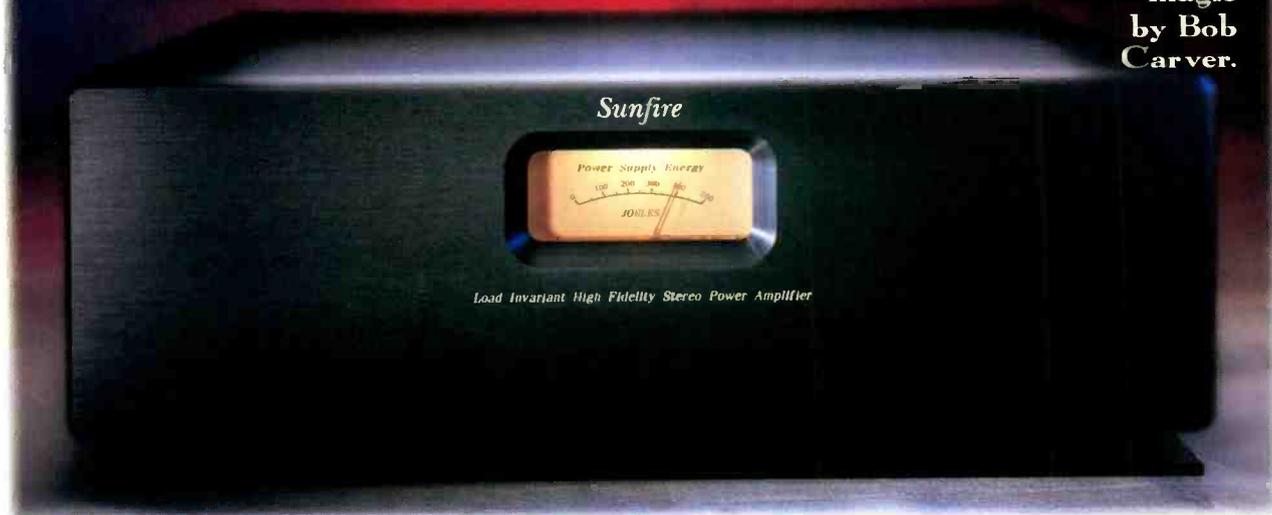


# Imagine.

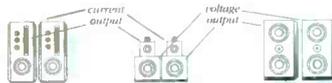
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It's not a 9 watt triode of course, and we wouldn't want it to be, but it does share a very important characteristic with one. It incorporates the current-source (high output impedance) property of a triode—the very property that is *the* dominant factor (perhaps ninety percent) of the sonic magic that makes listening to the classic vacuum tube amplifier so much fun. So when you choose our current-source output connections for your system, you'll have a sumptuous high end, and a midrange that positively glows. At the same time, the new **Sunfire Amplifier**, with its uncanny tracking downconverter, has the ability to raise goose bumps with its awesome power. Using 12 herculean International Rectifier Hexfets, it can drive *any* load to *any* rationally usable current or voltage level.



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You can connect most speakers to the voltage-source output, with its near zero impedance, to experience the powerful dynamics and tight bass you've always wanted more of. Or let's say you own electrostatic, planar magnetic or ribbon speakers, then connecting the higher impedance current-source output can coax forth a sensuous, delicately detailed musical voice associated with low-powered classic tube amplifiers. Or if you're able to biwire, you may just arrive at the best possible interface: voltage output to woofer for incredible bass whack, current output to midrange and treble for a huge three-dimensional soundstage with detail retrieval so stunning that you will often hear musicians *breathing!* Each choice will reveal the delicate musical soul that complements this amp's astonishing muscle and control. And each will lead to a multilayered soundstage so deep and wide it will take your breath away.

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# MANLEY LABORATORIES REFERENCE D/A CONVERTER



**T**he Reference is Manley Laboratories' latest entry in the state-of-the-art D/A converter sweepstakes. From the Manley name cut into its top cover to its attractive gold-colored front panel with contrasting black inset areas, the Reference is an unusual and attractive piece of gear.

The Reference has one ST (AT&T) glass-fiber optical input and three wired digital inputs with both coax and AES/EBU balanced connections. It also has a 24-position stepped volume control. Therefore, if your stereo system has only digital sources, you can use the Reference instead of an analog preamp as your control center.

The circuitry includes an all-new digital section and a new tube output section "borrowed" from Manley's professional division. Although that output section is at line level, not speaker level, it feeds the balanced and unbalanced audio outputs through a transformer; this ensures precisely equal signal quality from both sets of outputs, as the balanced and unbalanced outputs receive precisely the same signal. Dual output-transformer secondaries can be connected in series or parallel to provide proper impedances for connection to home and professional sound systems.

The Manley's front panel has three control areas. On the left are the input selector

and three green LEDs that show the sampling frequency of the input (32, 44.1, or 48 kHz). The center control area has a two-position miniature toggle switch at the top for selecting output polarity, a 24-position rotary level attenuator, and four LEDs at the bottom. The LEDs are divided into two groups, "Data" and "Disc." In the "Data" group, a green LED labeled "Valid" illuminates when there's a readable digital input; a red LED labeled "Error" illuminates if there are momentary data losses, unreadable data, or data errors. It also illuminates during the D/A converter's warm-up time of approximately 30 seconds. When this LED is on, the Manley's output is muted. The LEDs in the "Disc" group indicate if the incoming data is pre-emphasized or if a CD was made with HDCD encoding. In the right-hand control area are the power

**FROM START TO FINISH,  
THE MANLEY REFERENCE  
WAS ONE OF THE BEST  
D/A CONVERTERS  
I'VE TESTED.**

switch (accompanied by a green LED indicator) and a miniature toggle switch (with a red LED indicator) that you can use to add dither to the signal before it reaches the converter proper.

All connections are made to the rear panel. The optical input is a glass-fiber ST type. The other three digital inputs each have balanced XLR jacks, for AES/EBU signals, and unbalanced RCA jacks. The miniature toggle switch for selecting each of these inputs' balanced or unbalanced jack will set the appropriate input terminating resistance for that jack, 75 ohms for coax and 110 ohms for AES/EBU. The analog outputs

**Dimensions:** 19 in. W x 5¼ in. H x 13 in. D (48.3 cm x 13.3 cm x 33 cm).

**Weight:** 25 lbs. (11.3 kg).

**Price:** \$10,560.

**Company Address:** 13880 Magnolia Ave., Chino, Cal. 91710; 909/627-4256; e-mail, emanley@netcom.com; <http://www.manleylabs.com>

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Photos: Michael Groen

*"Any sufficiently advanced technology is indistinguishable from magic..."*

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*Lexicon introduced audio recording professionals to the first digital signal processor in 1971.*

*For the past 25 years, Lexicon digital processors have been relied upon by recording artists, producers and directors in the world's most demanding audio environments.*

The superb new DC-1 Series of Digital Controllers combines Lexicon's legendary digital signal processing capabilities, known to audio professionals the world over, with the latest in home theater technology: highly accurate implementations of Dolby® Pro Logic and Dolby Digital® Surround decoding with all the enhancements of Lucasfilm Home THX® Cinema.

*The new DC-1 is available in three versions with remote control including an advanced Dolby® Digital model.*

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The DC-1 is a sophisticated signal processing computer that can be customized for any audio system. It combines the functions of a preamp, D-to-A converter, surround sound processor and Audio/Video switcher. It puts you in control of the entire home theater environment – from playing digital disks to dubbing a videotape – even controlling the volume of a system in another room.

• **Advanced all-digital technology**

All signal processing, (including filters, equalization & crossovers), is achieved in the digital domain, while true 20-bit Digital-to-Analog converters surpass the performance of exotic stand-alone units. A built-in audio/video switcher incorporates eight analog inputs which can be programmed for any

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• **Superlative audio quality**

We didn't compromise audio quality, control flexibility or the future development of home theater sound. With Dolby Digital decoder circuitry on its own

plug-in card, Lexicon's DC-1 is the only eight channel digital discrete surround sound processor where the future of surround sound is an option – regardless of format – and not just an add-on.

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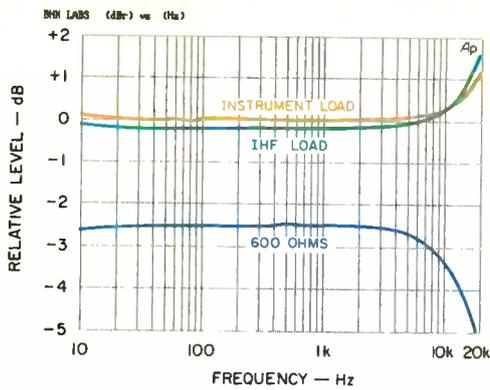


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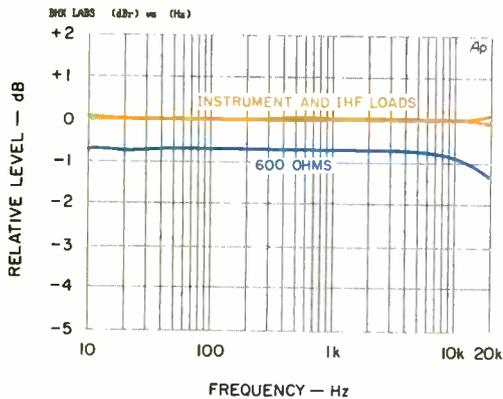
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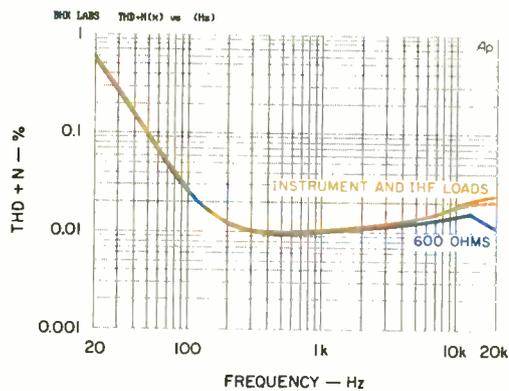


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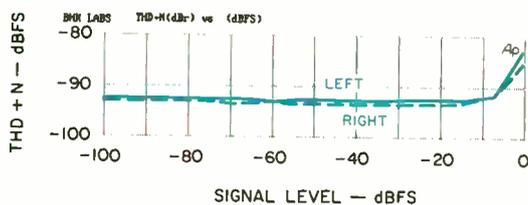


B

**Fig. 1—Frequency response with output transformer windings in series (A) and parallel (B). Dashed curve in the latter is for instrument load.**



**Fig. 2—THD + N vs. frequency; dashed curve is for instrument load.**



**Fig. 3—THD + N vs. signal level.**

also have balanced XLR and unbalanced RCA jacks. Near each channel's outputs is a miniature toggle that switches between series or parallel connection of the output transformer's secondary windings. With these switches set for parallel connection, the full-scale output is 1 volt and rated output impedance is 44 ohms; when the switches are set for series connection, output rises to 2 volts and impedance to 174 ohms. Another miniature toggle switch is used for making or breaking the connection between the chassis and the shields of the unbalanced phono connector outputs and pin 3 of each XLR output. Also on the rear panel are an IEC power-cord socket, an AC line fuse, and a two-position ("110/220") AC voltage selector.

The Reference is robustly constructed. Inside are two large p.c. boards, one for the digital circuitry and the other for the tube output amplifier and power supply. Two hefty power transformers are mounted to the inside of the right side panel. The two output transformers are mounted on a small p.c. board that is attached to the inside of the left side panel. Wiring is neat and workmanlike, and the component parts appear to be of high quality.

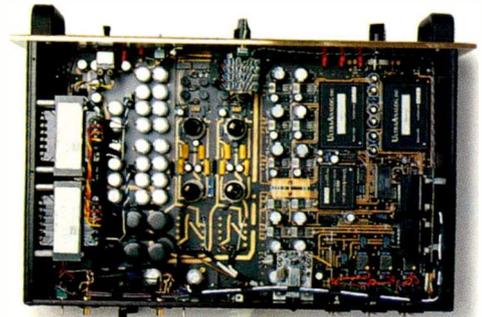
#### Measurements

Output for a 0-dBFS signal was 1.05 volts with the Reference D/A converter's output transformers' secondaries paralleled and 2.1 volts with the secondaries in series, both for instrument loading. The series and parallel connections also affect frequency response, as you can see in Fig. 1. An out-of-band output transformer resonance causes a rise in the high frequencies with instrument and IHF loading and rolls those frequencies off with 600-ohm loads; both effects are more noticeable with the series connection (Fig. 1A) than with the windings in parallel (Fig. 1B). Response did not

change when the level control was set down three clicks (an attenuation of 6 dB). Response was also essentially as shown for pre-emphasized signals with the Manley's de-emphasis engaged, indicating zero de-emphasis error.

Square-wave response (not shown) had the symmetrical ringing typical of eight-times-oversampling filters, but the tops of the ringing waveform were not clipped off, as they are in D/A converters with the commonly used Nippon Precision Circuits (NPC) digital filters. (The Reference's filters are by Pacific Microsonics.) Absolute signal polarity at the audio outputs matched the settings of the front-panel polarity switch.

Total harmonic distortion plus noise (THD + N) is plotted in Fig. 2 for signals at digital full scale (0 dBFS), with the Manley's output transformer secondaries in parallel. Left-channel results are shown; the right



**LINEARITY WAS ESSENTIALLY PERFECT DOWN TO A SIGNAL LEVEL OF -105 dBFS.**

channel behaved very similarly. The rise in the distortion below about 300 Hz was due to some unbalanced DC in the output transformer's primary. When I manually trimmed the DC imbalance, I got about 0.05% distortion at 20 Hz, an order of magnitude better than shown. As you can see in Fig. 3, THD + N at 1 kHz versus digital signal level, a small amount of distortion from the tube output stage rises above the noise level as the signal level approaches digital full scale.

Deviation from linearity is plotted in Fig. 4 for a 1-kHz signal. The Manley's linearity

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Harry Pearson,  
*The Absolute Sound Magazine*  
Issue 107, 1996

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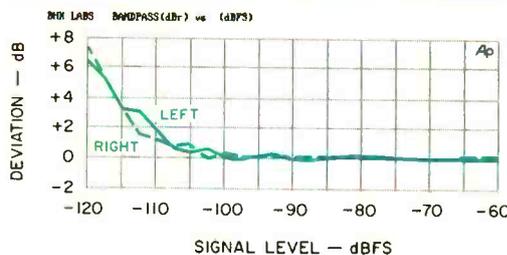
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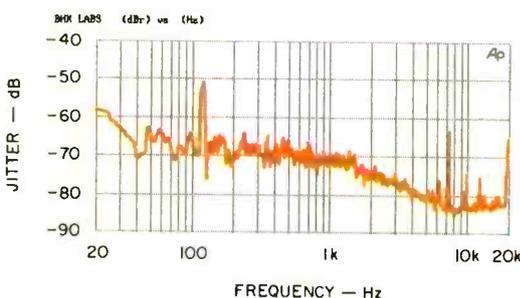


**Table 1—S/N ratios.** Quantization noise was  $-91$  dB in the left channel and  $-90.6$  dB in the right; dynamic range was  $96$  dB in the left channel and  $95.9$  dB in the right.

-120 dBFS Signal		
	LEFT	RIGHT
Wideband	76.4 dB	78.2 dB
22 Hz to 22 kHz	92.2 dB	92.3 dB
400 Hz to 22 kHz	92.8 dB	92.6 dB
A-Weighted	94.9 dB	94.6 dB
Digital-Zero Signal		
	LEFT	RIGHT
Wideband	77.3 dB	78.7 dB
22 Hz to 22 kHz	98.5 dB	99.5 dB
400 Hz to 22 kHz	115.6 dB	101.0 dB
A-Weighted	102.7 dB	103.3 dB



**Fig. 4—Deviation from linearity.**



**Fig. 5—Jitter spectrum.**

is essentially perfect down to  $-105$  dBFS, and its deviation below that is typical for high-performance D/A converters when handling 16-bit data. In the noise-modulation test for low-level linearity (not shown), the curves for 40-Hz signals at  $-60$ ,  $-70$ ,  $-80$ ,  $-90$ , and  $-100$  dBFS all just about overlaid each other, as they should.

The Manley Reference's interchannel crosstalk was  $-98$  dB at 200 to 300 Hz. Below that frequency range it rose to about  $-85$  dB at 20 Hz; above that range it increased at 6 dB per octave, to about  $-68$  dB at 20 kHz. Results were similar in both di-

rections, left to right and right to left.

Table 1 lists this D/A converter's signal-to-noise ratios, quantization noise, and dynamic range with the output transformer's secondaries in parallel. Switching these secondaries to the series connection reduced the Manley's wideband noise levels about 10 dB; this connection lowers the frequency of the output transformer's resonance, causing greater attenuation of the fil-

ter's eight-times-oversampling frequency components.

Figure 5 shows the jitter spectrum at the word-clock input to the DAC chips for a digitally generated test signal via the Manley's AES/EBU inputs. In this graph, 1 dB represents 10 nanoseconds of peak-to-peak jitter, or 3.54 nanoseconds rms;  $-60$  dB is equivalent to 3.54 picoseconds rms. With the exception of the 120-Hz component, which seems to be an artifact of my measuring setup, jitter components are less than 3.54 picoseconds rms over most of the audio frequency range.

Output impedance was 200 ohms with the output transformer's secondaries in series and 54 ohms in parallel. Current draw from the AC line was 0.72 ampere.

### Use and Listening Tests

The CD transports I used during the test period were a Sonic Frontiers SFT-1 and a Counterpoint DA-11A, driving the Manley Reference D/A converter through a Genesis Digital Lens jitter reducer via Illuminati DX-50 AES/EBU balanced cables. Other D/A converters on hand during the review period included a Sonic Frontiers SFD-2 MKII, a Classé Audio DAC-1, and a Dodson Audio DA-217. For a preamp, I used a custom Forssell balanced tube line driver or no preamplifier at all. (The Reference D/A converter's high output, volume control,

# Rotel Report

# 5



*Rotel's RSP-980 provides Dolby® Pro Logic® and THX® certified surround-sound decoding, video switching, and audiophile quality preamp functions for two independent zones.*

## SYSTEM BUILDING

### Building Blocks for Home Entertainment

Are you a bit daunted by the choices involved in putting together a high performance yet affordable home entertainment system? We have a suggestion for you — Rotel.

Since 1963, we've concentrated on one thing: Building the finest, most cost-effective audio and audio/video components available. Judging from the praise we've received from reviewers and magazines around the world, we've done fairly well at it.

Consider, for example, our RMB-100 power amplifier. It's a single-chassis, monoblock amplifier, superbly compact in size and elegant in style. But the real story behind this amplifier is its remarkable power, clarity, and musicality.

An oversized toroid transformer increases efficiency and minimizes noise. Slit foil capacitors enhance power supply speed and purity. The unique dual complimentary differential input/buffer stage (with balanced and unbalanced connectors) includes remote turn-on to simplify system operation. The output stage features matched pairs of MOSFET transistors that combine the warmth of tubes with the punch and detail of conventional bipolar devices. You'll hear the advantages in the subtle overtones of an orchestral triangle or the whomp of a bass drum chasing a Fender Strat across a rock concert stage! And, with 125 watts at 8Ω and over 200 watts at 4Ω, you'll have all the power you'll ever need.



*The RCC-945 — convenience and performance in a six disc CD changer*

### RSP-980 Processor/Preamp

We won't leave you holding the bag trying to control all this power either. Our RSP-980 provides all the sound quality, convenience, and system expansion capability you'll probably ever need.

In the Rotel tradition, the RSP-980 is built around a multi-segment power supply that provides ripple-free operating voltages thanks to high capacity rectifier and regulator ICs. Careful circuit board layout assures that filter capacitor banks are located near associated active circuitry. Analog stages benefit from precision metal film resistors, low ESR capacitors, and high current operational amplifiers.

System flexibility? Seven source inputs and an independently controlled Zone 2 output allow you to choose one source for your main system and another for remote rooms!

The Rotel RSP-980 is an ideal choice for future system expansion. With Dolby Pro Logic decoding, THX certification, video switching for composite and S-video sources, and an on-screen display, the RSP-980 is fully equipped to effortlessly take you into the world of total home entertainment. How's that for painless transition?

### RCC-945 6-disc CD Changer

And, lest you forget that convenience and quality extends throughout the Rotel product line, take a look at our new RCC-945 Compact Disc changer.

The RCC-945 combines a single-play drawer loader with an internal six disc "elevator style" storage bank so you can use it as a single disc player or in multi-disc mode for uninterrupted long term listening enjoyment.

Technically, the RCC-945 is a standout, too. Advanced digital processing includes the same Delta Sigma converters and second order noise shaping digital filter that's earned high praise in our single disc models. The dual D/A converters feed a "no compromise" analog

section featuring the acclaimed Burr-Brown 2604 operational amplifiers. And, of course, the entire audio circuit has been optimized through extensive listening tests.

The sound? Well, let's just

say that it's musically balanced, detailed, and unusually transparent. Not what you might expect from a CD changer. But, quite in keeping for Rotel. After all, we've been building on that tradition for over thirty years.



*"The Rotel RMB-100s deserve serious consideration."*  
Dayna B., *The Audio Adventure*,  
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## CIRCUIT HIGHLIGHTS

The Manley Laboratories Reference D/A converter's digital inputs are relay-selected and routed to the input of an UltraAnalog AES21 low-jitter input receiver. (The three coax and AES/EBU inputs are coupled through wide-bandwidth Scientific Conversion digital audio interface transformers.) Output from the AES21 is coupled into a Pacific Microsonics PMD-100 eight-times-oversampling digital filter and HDCD decoding chip. Next in the signal chain are a pair of custom UltraAnalog DACs, one for each channel. The word-clock input to the DACs is relocked, right at the point of use, by the clock signal from the AES21. Each channel's DAC is a stereo device whose two channels are driven in opposing phase, like the halves of a push-pull amplifier. The difference between the outputs of the



two DAC channels is used as the output signal, to cancel out common-mode artifacts and even-order distortion from the converters. This is a common technique in high-end D/A converters. A five-pole (30-dB/octave), balanced, passive LC low-pass filter follows the DAC outputs and greatly attenuates the ultrasonic frequency components generated by the eight-times-oversampling filter. The outputs of the low-pass filter couple through series resistors into the volume control. This hand-wired control has two switch decks per channel and 23 resistors per deck; each click of the control changes attenuation by 2 dB. The series resistors are shorted out by relay contacts when the Manley Reference D/A converter is decoding HDCD recordings, eliminating the 6-dB output attenuation that Pacific Microsonics specifies for non-HDCD recordings. Changing the

signal level this way, in the analog domain, is said to sound better than doing it in the digital domain, which would reduce non-HDCD signals to 15 bits.

The tube output section is simple and elegant, with the topology of a small tube power amplifier. The first of its two stages consists of a 6072 dual triode operated as a push-pull amplifier, with the input grids driven by the two opposed-phase outputs of the channel's associated volume-control sections. Plate outputs of the first stage are capacitor-coupled to the input grids of the second stage, a 7044 dual triode. Although this tube is a nine-pin miniature type, it has high

current capability and appropriately large plates and cathodes. The plates of the 7044 are coupled across the output transformer's primary, with the primary's center tap connected to the

high-voltage supply. As mentioned elsewhere, the two output secondaries can be switched to a parallel or series connection. Another secondary winding, connected in the cathode circuit of the output stage, provides some local negative feedback. Additionally, push-pull negative feedback is taken from the second stage's plates back to the input stage's cathodes.

Comprising two power transformers and great quantities of electrolytic filter capacitors, the power supply provides unregulated but well-filtered high voltages for each channel's tube output section. Tube heaters are supplied by regulated direct current, which is sourced from a separate voltage regulator for each channel. Affixed to the digital board are 13 voltage regulators for the various digital and analog circuits.

B.H.K.

and multiple inputs make it easy to use this way.) The power amplifiers in my system were a pair of mono Sonic Frontiers Power 3s, a pair of mono Quicksilver M135s with Russian Svetlana 6550C output tubes, and a Crown Macro Reference stereo amp. These amplifiers drove Genesis V and B&W 801 Matrix Series 3 loudspeakers; the B&Ws were augmented from 20 to 50 Hz by a subwoofer in each channel. The speaker and interconnect cables I used were by Transparent Audio. The D/A converters and preamps drew their AC through a TAD Systems Power Purifier.

I have only one nit to pick with the Reference's operation: If I turned it off while my power amplifiers and the Genesis Vs' powered woofers were still on, I heard a moderately loud transient from the woofers.



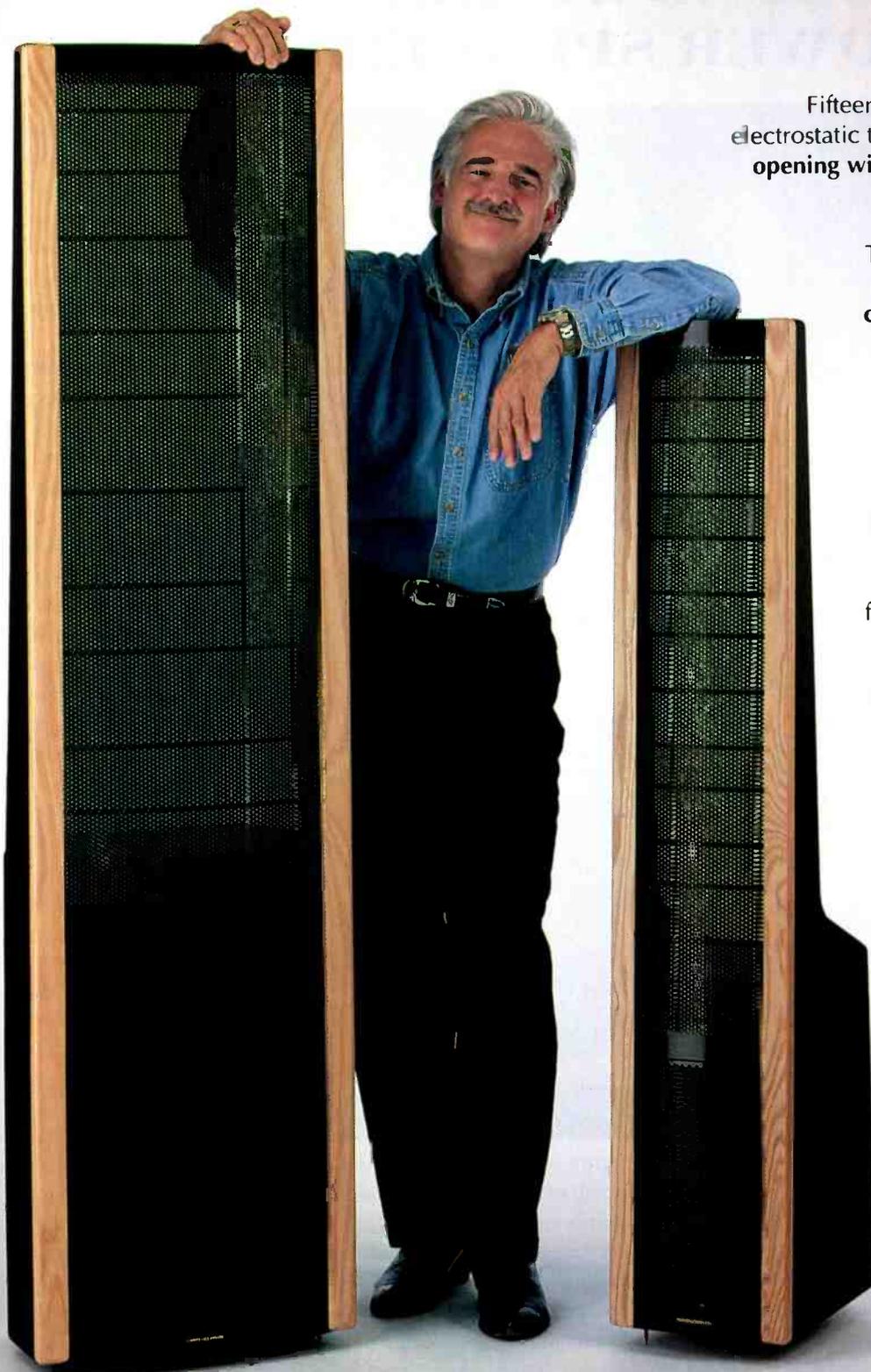
**THE MANLEY'S IMAGING  
WAS WIDE AND DEEP,  
WITH GOOD DEFINITION  
AND NATURAL  
TONAL BALANCE.**

I did most of my listening with the Manley's output transformer secondaries connected in parallel. My initial, continuing, and final impression of the Reference was that it is one of the best D/A converters I have ever had in my system. Connected directly to the Sonic Frontiers Power 3 amplifiers, it produced some of the best sound I've heard yet with the Genesis V speakers. Imaging was wide and deep, with a great sense of air and space. Definition and detail were outstanding, yet sonic irritation was low. Tonal balance over the whole frequency range was natural, with the good weight in the lower midrange that's so often lacking in other D/A converters. Bass was deep, powerful, and tuneful. But more important than the Manley's individual sonic attributes was the overall convincing manner in which it conveyed the music. A



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AURICLE

DANIEL KUMIN

## CAMBRIDGE SOUNDWORKS TOWER SPEAKER



**B**oth Henry Kloss and his most recent company, Cambridge SoundWorks, have a reputation for doing the unexpected. Kloss, a longtime audio pioneer, developed (among other things) the first compact and portable phonographs that could be considered hi-fi, the first truly hi-fi table radio, and the home video pro-

jector—not to mention decades worth of influential speaker designs. Cambridge SoundWorks has done such unexpected things as marketing its products factory-direct and then opening a bicoastal chain of retail factory outlets, producing a portable speaker system whose carrying case doubles as the bass bin when the system is unpacked and set up, and de-

signing interesting speaker systems that show Henry Kloss hasn't lost his touch. So it was unexpected when Cambridge SoundWorks brought out a line of solidly conventional-looking, floor-standing tower-type loudspeakers, of which the dual-woofer Tower is the subject here.

Despite the Tower line's departure from Henry Kloss's tradition of doing the untraditional, these speakers were, in fact, entirely designed and engineered by him. Since designing them, Kloss has semi-retired from the company. He now works a few days per week as a consultant on new products but also turns his considerable talents to matters not necessarily related to hi-fi.

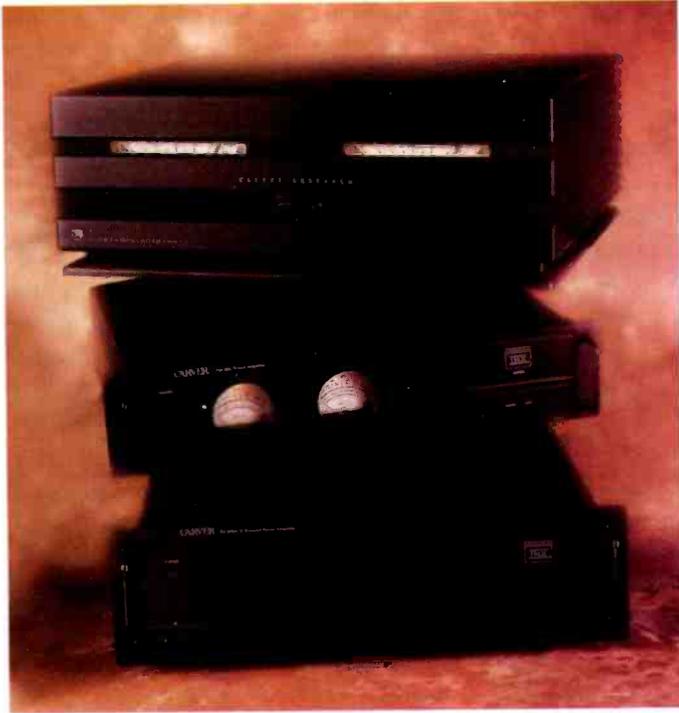
The Cambridge Tower looks a lot like many other speakers in this popular format: waist high, slim, and deep (about 38 x 9½ x 14 inches). The Tower is a bipolar design. Its two 8-inch polypropylene-cone woofers are flush with the finished front baffle, as are a 5¼-inch polypropylene-cone midrange and a tweeter with a 1-inch dome of treated cloth. On the finished back panel is another, identical, mid/tweet pair that fires rearward plus a strongly flared port, about 2½ inches in diameter.

The Towers I received were finished on five sides in a warm, faintly red-toned walnut veneer (black is also available). They were supplied with black knit grilles that covered about three-quarters of the front panel and about one-quarter of the rear. The overall effect was quite handsome and understated, though the gold-lettered metal logo plates struck me as a bit too prominent. The Tower's cabinetry was of decent quality, solid and well finished, but the detail joinery, while fine, was not quite comparable to the best examples of mid-market loudspeakers. The cabinet's construction was con-

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Photos: Michael Groen

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Recommended Component, Stereophile, April 1996  
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## Carver TFM-35x THX Amplifier

Stereophile Guide to Home Theater, Fall 1996  
(Vol. 2, No. 3), Robert Deutsch

**"It's very modestly priced but doesn't sound like it...There are two groups of audiophiles to whom I particularly recommend the TFM-35x: those who are drawn to the tonal qualities of tube amplifiers but don't want the responsibility of their care and feeding, and those who are attracted to the sound of the Carver Lightstar Reference but deterred by the price...In the right system, it can give the big boys a good run for their money."**

## Carver AV-806x Multi-channel Amplifier

Recommended Component, Stereophile, April 1996  
(Vol. 19, No. 4)

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**Cambridge SoundWorks' Tower has six drivers, the four visible here and two more on the back.**

ventional: panels of 3/4-inch MDF, except for the front, which was 1 inch thick. Inside were at least two full-width "windowpane" braces and at least two pole braces. Construction seemed solid all around, though I spotted a few places around the inner peripheries of woofer cutouts where edge routing had caused the inner circumference of the MDF to split or separate slightly—structurally insignificant and, of course, entirely undetectable from the outside.

The midranges are sealed in a heavily stuffed sub-enclosure, made from rolled-paper construction tubes, which runs from the front to the back of the box. The tweeter's metal magnet cover serves as an enclosure for that driver. The Tower's woofer cavity is free of any stuffing or damping material, save for some spun polyester at the top of the cabinet, above the midranges' tube enclosure.

The hand-assembled, 13-element crossover, mounted on the back panel, appeared built from rather heavy-duty components; internal driver-to-crossover and crossover-input terminal wiring was via 18-gauge, crimp-connector jumpers. The drivers seemed solid and well made, with heavy magnet structures (even on the 1-inch tweeter), stamped-steel baskets, and rubber surrounds.

The Tower's terminal block is on its bottom panel, which makes for a very clean-

looking installation but requires that you lay the speaker down to hook it up. The all-metal, five-way terminals are gold-plated. The speaker is shipped with jumpers between the woofer and midrange/tweeter terminals, which can be easily removed for bi-wiring or biampifying. All in all, this is a lot of speaker for \$1,500 the pair—which is precisely the point of CSW's factory-direct and factory-store merchandising strategy.

I used the Towers with a Meridian 508 CD player, a JVC XDZ-505 DAT recorder, and a Citation 7.0 preamp/processor. Even though the Towers' carton is emblazoned "Exceeds the Requirements for Dolby Digital (AC-3)," I played them in plain stereo, as I did not want to muddy the waters with surround signals and additional speakers. Power came from a Parasound HCA-2200II amp. I listened to the Towers alone for extended periods over about a week and then A/B'd them with a very familiar, generally similar (though monopolar) speaker, the B&W 803 Matrix Series 2.

As soon as I fired the Towers up, it was evident that they threw a big image. Presumably thanks to their bipolar output, the Towers' soundstage was noticeably deep

**THE SOUNDSTAGE  
OF THE TOWERS  
WAS STABLE, DEEP,  
AND RICHLY  
THREE-DIMENSIONAL.**

and solid on most material; it had a three-dimensional richness that was very satisfying, if distinctly different from what I am used to from most good conventional speakers. Experimenting a bit with placement showed this effect to vary quite predictably with proximity to the wall behind the Towers. When they were some 4 feet or more out into the room, soundstage depth began to seem exaggerated; when they were less than a foot from the wall, the soundstage mostly disappeared and mid-bass became obviously bloated. I ended up placing the Towers with their front baffles a bit more than 3 feet from the wall, with one speaker about 5 feet from a side wall and the other roughly 4 feet from the wall to its side. (The room is about 21 x 15 feet.)

For the most part, the Towers' deep and spacious sound was a plus on recordings having natural acoustics but tended to slightly blur the pinpoint imaging that so often characterizes high-end hi-fi. In live performance, however, imaging tends to be more diffuse, so the Towers' more ambient but subtly less localized delivery frequently struck me as a shade closer to the truth.

The tonal balance of the Towers was generally natural and accurate, though with a couple of minor question marks. The upper-midrange response was very mildly scooped out, making some female vocals seem to move back slightly in the mix and in the soundstage. (On the other hand, this may well have contributed to the Towers' consistent sense of depth.) On "The Rose" (*Amanda*, Sheffield Lab 10066 G), for example, Amanda McBroom sounded just a touch distant and subtly less distinct or open; at the same time, the piano sounded quite rich, ambient, and "room-y." I also noted upper-octave shimmer from the strings on the same cut. Yet Janis Ian's rather different-colored voice (*Breaking Silence*, Morgan Creek 2959-20023) seemed quite open and smooth.

By contrast, the solo piano bars that open Lyle Lovett's "I've Been to Memphis" (*Joshua Judges Ruth*, MCA MCAD-10475), which are very dryly recorded, did not show any of the same spatial proclivity. I infer that's because there's virtually no ambient information in the recording. With the Towers, Lovett's somewhat nasal and "swallowed" voice sounded just a bit more of both, but the soundstage and in-the-room palpability of this excellently "you-are-there" disc were first-rate.

Top-octave bite and shimmer from percussion, such as the "Hunt" track from Mickey Hart's *Planet Drum* (Ryko RCD-10206), were very good, and the Towers handled busy, transient-rich material well. I did not hear any softening of attacks or compromise of clarity, but I did sense a faintly perceptible recession of top-octave air. When I went back and ran a level-matched (with pink noise) A/B comparison against the B&Ws, I found that this generally busy disc had a bit more detail and slightly more easily decoded rhythmic complexity through the 803s. Subtle cymbal rides, such as those from Phil Woods on *Here's to My Lady* (Chesky JD3), were also a shade

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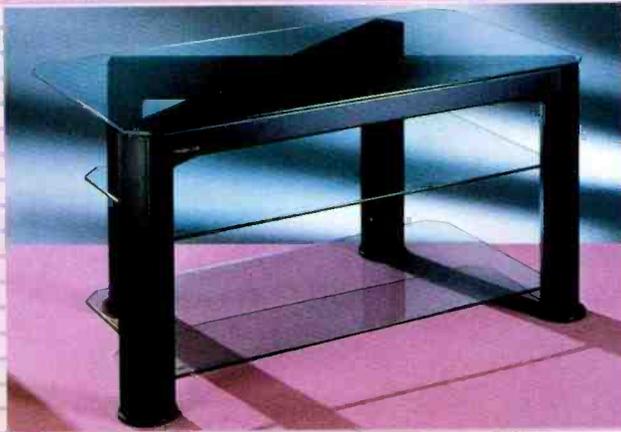
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more laid-back and rearward on the Towers. Yet the Cambridge speakers sounded good with both the Hart and Woods discs, transmitting effectively the power and excitement of Hart's massed percussion and the subtlety of the Woods recording very well.

String tones sounded very good overall on the Towers. Quartet and string orchestra tracks produced rather lush but well-defined and open tones, with a clear sense of acoustic space. And as I would expect from bipolar speakers, off-axis response was noticeably smoother and more even than from most forward-radiating dynamic speakers; this held true in the vertical dimension as well.

Down at the bottom, the Towers were more than solid. They delivered what sounded like largely unfettered output to below 30 Hz, as demonstrated on "Temple Caves" from the Mickey Hart disc, and cheerfully produced deep bass at pretty much any levels I demanded. (The Towers appeared to fall off pretty rapidly below 30 Hz, however.) The bass-drum strikes on "Fanfare for the Common Man," from *Surround Spectacular* (Delos DE 3179), excited the room at levels quite close to those I am

accustomed to from my everyday system's corner-located, 15-inch active subwoofer.

If anything, the Cambridge SoundWorks design might lean just a degree toward the warm side in the octave from 50 to 100 Hz.

**DOWN TO BELOW 30 Hz,  
THE TOWERS' BASS  
SOUNDED UNFETTERED  
AND MORE THAN SOLID.**

Comparing the sound of the Lovett, Ian, and McBroom recordings through the Towers and through the B&Ws, I thought that the Towers sounded consistently a bit richer on the bottom end. Collaterally, the 803s also had a slight edge in bass definition and transient snap when reproducing most bottom-staff instruments.

The Towers were able to play very loudly with no audible complaint on most material. Playing the Copland snippet from *Surround Spectacular* at arguably ridiculous levels

(maybe a few dB SPL above levels in the 15th row at Boston's Symphony Hall) did elicit a couple of woofer-bottoming whacks from the left Tower on the bass drum/tympani blasts. But these levels raised similar signs of distress from the B&W speakers, which cost twice as much. Otherwise, on classical and pop music alike, the Towers would play just about as loud as I asked up to the point of what most people would consider abuse. When I played music about 10 dB above any levels I would normally contemplate in real life, bass guitar and kick-drum shots began to sound a little squished.

The Cambridge SoundWorks Tower loudspeaker should contend very effectively in its hotly competitive class. Its compromises seem intelligently chosen, and its colorations, which are slight by most measures, tend to line up on the euphonic side of the ledger. I never heard the big Cambridge sound unpleasant; on the contrary, it's quite a musical loudspeaker. I expect that those who unpack the Towers and heft them into place will be delighted and count themselves as recipients of uncommon value. A

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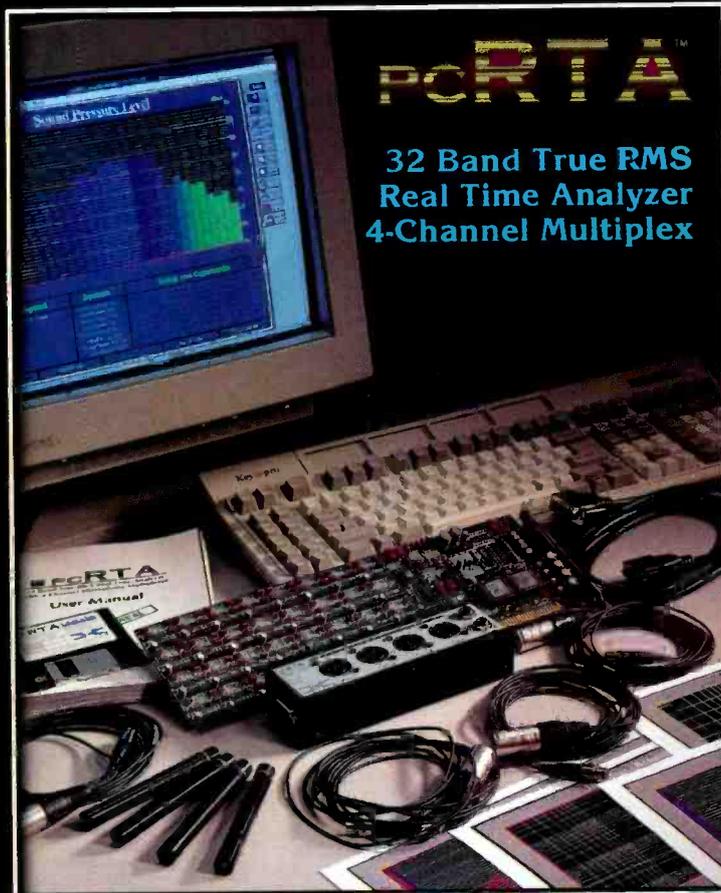
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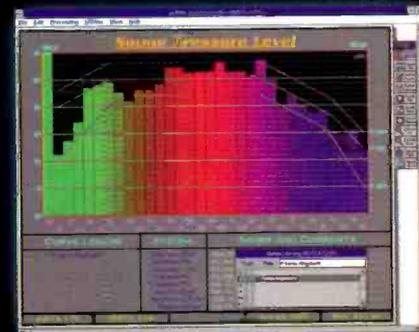
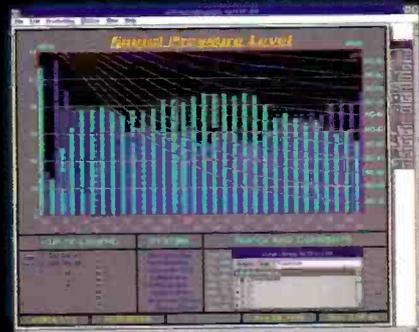
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When you've got questions about Audio and Video,

# see a specialist

**Q** Should home theater speakers match?

**A** Yes! Speakers have long been the center of home theater sound quality discussions. And putting two different brands or types of speakers together is rarely addressed. For example, imagine you have an efficient speaker on the right (efficient speakers need small amounts of amplifier power to play loud) and an inefficient speaker from a different maker on the left. Having each speaker play at the same loudness level would be almost impossible. And efficiency is only one important characteristic. With at least five speakers in a home theater system, the potential for losing theater-like sound is more than likely if the speakers aren't matched. If you had one brand for the front left and right speakers, a second brand for the rear and a third brand for the center channel, your system can never sound right. The technical buzzword for avoiding problems between the various speakers is called timbre matching—making sure all of the speakers in a home theater system work and sound great together. Get all your speakers at one time or over a period of time, but get timbre matched speakers to ensure great sound.

—Wayne T. Puntel  
Audio Craft Co., Inc.  
Cleveland, Ohio

 *audio craft*



**Q** I'm building a new house, what should I consider when putting in my audio system?

**A** The wire. It's the only thing you can't upgrade—once the walls are up your choices are limited. I strongly recommend spending more money on the wire early on, as you're wiring for the future. Not only will you be ready to upgrade your A/V system at any time, you'll also be better prepared to integrate computers and future technologies with the least amount of hassle. Wire quality is very important. The labor cost is the same to run poor quality wire as it is to run good quality wire. Also, I recommend you "home run" the wire, meaning all wire is pulled to a central location, such as a closet or attic, instead of the electrician's standard, "daisy chain," meaning from one room to the next in a circle. You can maximize the investment in your A/V system by using high quality wire throughout your home and running it properly with the future in mind.

—Roberta Lewis  
Home Entertainment, Inc.  
Houston & Dallas, Texas



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**Q** Can upgrading the cables in my A/V system really make a difference, or are they just expensive dealer add-ons?

**A** It's always bewildered us that customers will agonize over the selection of components for their A/V systems, but never consider the compromise to their system's performance wrought by the use of the inferior cables and wire provided with most components. Interconnect and speaker cables are critical links in the signal path; the quality of these cables can affect the performance of your system as much as the components themselves. With speaker cables, large diameter multi-strand wire utilizing high-purity copper yields better bass response and improves imaging from your speakers. With audio and video interconnect cables, better shielding and superior connectors ensure maximum signal transfer and rejection of extraneous noise and interference. The result? For audio signals, an increase in clarity and often improvements in tonal balance; for video, picture quality is visibly improved, brought about by a reduction of video noise and color bleeding. Invest an amount proportional to your component investment and you'll definitely see and hear the difference.

—Richard Hedman  
Pyramid Audio/Video  
Anchorage, Alaska



**Q** Should I use a dipole or conventional type speaker for the rear channels of my AC-3 system?

**A** With the advent of Dolby Digital and AC-3, many of us have come to the conclusion that a conventional speaker seems to perform better than a dipole speaker. With its discreet audio characteristics providing accurate separation and more dynamic range, conventional speakers in an AC-3 system portray effects like explosions, crashes, flyovers, etc. with far greater realism. In addition, high frequencies produced from indirect ambient effects like room conversations, outdoor sounds of birds, people, sirens, etc., have a definitive clarity that many dipole surround speakers are unable to accurately reproduce in AC-3. The conventional speaker will also lend itself to reproducing reasonable amounts of bass effortlessly. Most favorably, we consider the fact of when listening to a system comprised of all conventional speakers that we can ensure that the sonic characteristics of the front and rear channel speakers, matched closely in their performance, will sound dramatically better in AC-3.

—Jim Sanfemio  
Audio Video Alternatives  
Royal Oak, Michigan



AURICLE

ANTHONY H. CORDESMAN

# AUDIO ALCHEMY DDS•PRO CD TRANSPORT AND DDE V3.0 D/A CONVERTER



**D**uring the last few years, Audio Alchemy has packed as much digital technology per dollar into its designs as any firm around. It has also been a major innovator in areas ranging from video processing to jitter reduction, the company's DTI•Pro 32 digital interface (*Audio*, July 1996) being a case in point.

The DDS•Pro is an advanced CD transport priced at \$1,595; the DDE v3.0, Audio Alchemy's new top-of-the-line digital-to-analog converter, retails for \$799 (its op-

tional remote is \$159). These two components can be used individually, together, or in a system with the DTI•Pro 32 digital interface.

The DDS•Pro is a drawer-loading CD transport with a separate dedicated power supply. It uses Pioneer's new-generation Stable Platter Mech-

anism, which loads the CD label-side down to ensure full contact between the CD and the platter. The substantial chassis structure and critical damping, combined with the high mass of the platter, are said to sharply

reduce mechanical and airborne sources of jitter.

The clock signals in the DDS•Pro are generated using a proprietary, high-accuracy, ultra-low-jitter (2-picosecond) internal master reference quartz oscillator, said to be ultra-stable and temperature-controlled. Its external power supply uses four separate transformers and 12 low-impedance regulator/buffer sections to provide low-noise DC. The controller and display interface are both shielded; there is also extensive shielding and a large ground-plane shield on the power supply and clock p.c. board. The AC input has an integral filter.

The DDS•Pro has three outputs: I<sup>2</sup>S (which I will discuss later), AES/EBU, and coaxial S/P DIF (with a BNC connector instead of the more common RCA, though an RCA adaptor is supplied); an ST (AT&T) optical output is optional. Jitter is specified as 5 picoseconds via the I<sup>2</sup>S output and 35 picoseconds via the more conventional coaxial and optical outputs.

The DDS•Pro's full-featured remote is relatively well laid out and marked but has the usual plethora of small, identically sized buttons. The transport itself has an unusual touch-control system on its front panel that's easy to use, although its markings are relatively small. The display is similar to those on most CD transports. Loading is quick, easy, and highly reliable.

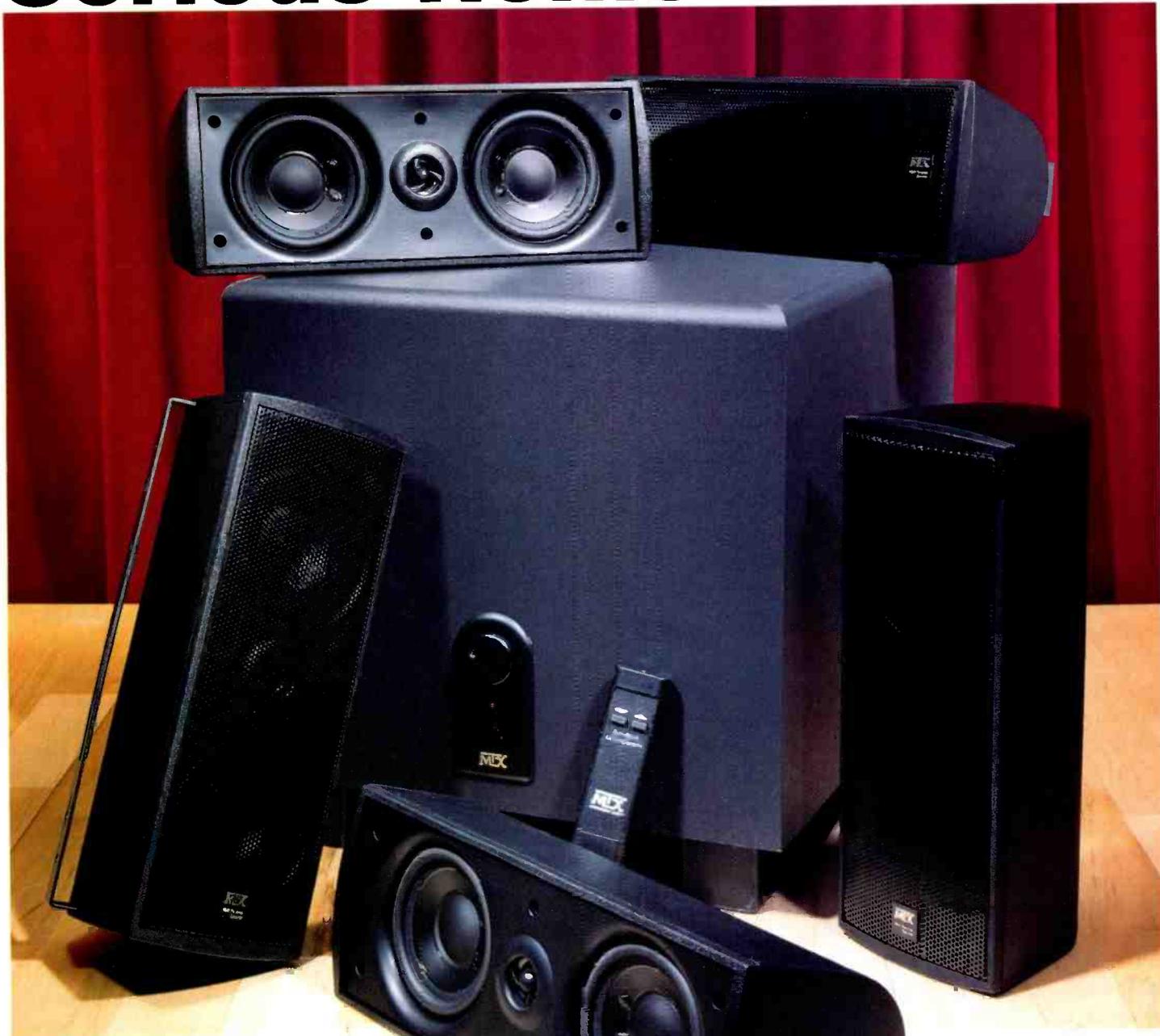
Installing the DDS•Pro presents some minor problems. First, the power supply's cable is so short that the supply and transport must be placed side by side, which requires shelf space about 17½ inches wide, 3¾ inches high, and 13½ inches deep. Handling two units totaling 23 pounds can be a bit awkward. More

**THE DDS•PRO  
AND DDE v3.0  
CAN BE CONNECTED  
USING THE I<sup>2</sup>S  
BUS SYSTEM.**

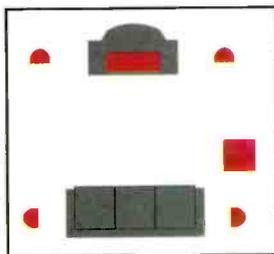
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important, the DDS•Pro runs relatively hot, and its power supply can generate hum if other electronics are placed too near it. It may be tempting to stack the DDE v3.0 D/A converter and DTI•Pro 32 on top of the DDS•Pro. Don't! Keep a few inches of separation between them, and position these components to eliminate hum.

If you are not using the I<sup>2</sup>S bus connection with an Audio Alchemy processor, I would suggest using the AES/EBU output whenever possible. If you have to use a coaxial connection, the BNC connector on the DDS•Pro may be more of an irritant than an advantage because so few processors have BNC inputs and using a BNC-to-RCA adaptor complicates the problem of preserving a true 75-ohm interface. A cable with a BNC connection on one end and an RCA connection on the other would solve the problem, if it had a true 75-ohm impedance—but good luck finding one!

You need to be careful with the DDS•Pro's front panel. Its black-satin finish is unusually easy to mar, particularly at the edges. This care will pay off, however, because the DDS•Pro is one of the best CD transports around. When it's used with any high-quality D/A converter, its performance rivals that of transports up to six times its price. Further, the DDS•Pro does not require the use of accessory feet, clamps, or damping devices to deliver consistently high resolution.

Extensive listening comparisons revealed that the Audio Alchemy Digital Drive System•Pro's midrange and treble resolving power, bass energy, dynamics, and pitch equaled those of some of the most expensive transports. The DDS•Pro performed particularly well in its handling of upper-midrange and treble detail and dynamics.

I would not suggest that you trade in a Mark Levinson transport on a DDS•Pro or give up the combined laserdisc and CD capabilities of a Theta Digital Data II or III. At the same time, the sonic differences between a really good mid-priced CD transport like the DDS•Pro and CD transports in the upper reaches of the high end have always been smaller than many manufacturers (and reviewers) like to admit. I found it extremely difficult to detect any audible differences between such high-end transports and the DDS•Pro. Consequently, I would

strongly advise comparative listening before rushing out to buy a CD transport more expensive than the DDS•Pro. Moreover, a transport/converter combination does not always sound better than an integrated CD player. The Krell KPS-20i is a good example of an outstanding integrated unit, and I previously found Audio Research's integrated player to sound better than that company's separates.

Also, be careful about mixing and matching transports and converters from different makers—particularly units from sophisticated high-end companies such as Mark Levinson, Theta Digital, and Wadia Digital, whose transports and converters usually have a great deal of synergy in terms of sound quality. And when auditioning

**THE PERFORMANCE  
OF THE DDS•PRO  
RIVALS THAT  
OF MANY HIGHER-PRICED  
CD TRANSPORTS.**

transports, use the same D/A converter and interconnection with each. If you use a good cable and a high-quality coaxial or ST optical connection when listening to one transport and a lower-quality cable or a Toslink connection when listening to another, you may wind up comparing the sound of the interfaces rather than the transports.

Audio Alchemy's DDE v3.0 D/A converter is well engineered for the money. This relatively small unit (8½ inches wide x 6 inches deep x 2 inches high) offers a choice of outboard power supplies. It has 20-bit resolution and HDCD processing capability through Pacific Microsonics' HDCD digital filter. The DDE v3.0's linearity is specified as ±1 dB at -110 dB.

The DDE v3.0 features a choice of coaxial, Toslink (or optional ST) optical, and I<sup>2</sup>S inputs. There are left and right analog outputs (delivering up to 3.6 volts) and a coaxial digital output. The front panel carries an input selector, a "Phase" switch, and the usual assembly of pilot lights. A digital volume control is optional.

I evaluated the DDE v3.0 in two ways: first as a stand-alone unit with the S/P DIF

digital inputs used by other manufacturers and then as part of an Audio Alchemy system with the DDS•Pro CD transport, the I<sup>2</sup>S bus connection, and the DTI•Pro 32 digital interface.

The DDE v3.0 delivered very good performance when used as a stand-alone unit with an RCA coaxial or optical S/P DIF cable connection and another manufacturer's CD transport, laserdisc player, and DAT deck. It showed very good upper-midrange and upper-octave resolution and deep bass extension. It also had a low apparent noise floor, very good low-level resolution, and unusually good dynamics. Its upper-midrange and treble timbre had the "air" and transparency to get the best out of good CDs, but the DDE v3.0 was not hard or aggressive on lower-quality or close-miked recordings.

I can take or leave the DDE v3.0's HDCD feature. As with every HDCD unit I've auditioned to date, I'm impressed with the overall quality of the Pacific Microsonics filter, whether it's operating in the HDCD mode or not. But I have no idea whether the good qualities I hear on HDCD recordings have anything to do with the use of HDCD or stem from the recording engineer's love of added upper-octave detail. The DDE v3.0's performance was just as good with top-quality, non-HDCD recordings as with HDCD discs. It is clear that the sonic strengths and weaknesses of good CDs depend more on how a recording is miked and mixed than on any esoteric digital technology used in making them.

The DDE v3.0 had a lower apparent noise floor than many of its competitors, but it was a bit sensitive to hum if put too near a power supply. It also ran a bit hot and so should be placed where it can receive some ventilation.

I do not know of a D/A converter in this price range that produces better sound than Audio Alchemy's v3.0, and you might get even better results if you tried the optional PS3 and PS2 power supplies, accessories I did not audition.

Good as the Audio Alchemy DDS•Pro CD transport and DDE v3.0 D/A converter are as stand-alone units, they have a special synergy when used together because they can be connected via the I<sup>2</sup>S bus system. The I<sup>2</sup>S bus is a Philips protocol; its name is short for "inter-IC sound," and it's fre-

quently used to carry signals between ICs in a great many digital components. It has four separate electrical lines, for the master clock, word clock, bit clock, and data; Audio Alchemy adds a fifth line for de-emphasis information. AES/EBU and S/P DIF digital outputs mix the clock and data signals together and feed them through a single serial line. The D/A converter or signal enhancer that receives this serial signal mix must then convert it back to separate signals for internal use—probably in the I<sup>2</sup>S format.

But with the external I<sup>2</sup>S bus connections on the DTI•Pro, DDE v3.0, DTI•Pro 32, and other Audio Alchemy components, signals can stay in the I<sup>2</sup>S mode as long as they're in the digital domain. The parallel connections require no input receivers. The clocks and data can be fed directly, with no requirement for decoding, and the residual clock jitter is therefore limited to the inherent jitter of the CD transport (or DAT deck, if there are any such decks with I<sup>2</sup>S connections) rather than raised by the communication mechanism.

Using the I<sup>2</sup>S connections did not revolutionize the sound of these Audio Alchemy

components but did improve some aspects. Depending on the CD, the I<sup>2</sup>S hookup improved upper-octave resolution of harmonic detail and other low-level information. There was more depth and air, and the imaging gave a slightly more realistic sense of instrument size and space. The interactions of separate string and woodwind instruments sometimes came through with

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FOR THE PRICE.**

greater resolution, and transients and dynamics, such as those from solo piano and guitar, were clearer. Bass improved in dynamic power and definition, too, although this effect was rarer.

Adding in the DTI•Pro 32 digital interface also helped a bit, but this help was not nearly as great (or as necessary) as it was

when the DTI•Pro 32 was connected via standard S/P DIF connections. The DTI•Pro 32 added a bit more bass energy and dynamics, with a slight improvement in upper-octave detail, and the soundstage expanded slightly.

Nuances count at this level of performance, however, and there was a very clear synergy between the DDS•Pro CD transport and the DDE v3.0 D/A converter that was reinforced by the DTI•Pro 32. The end result, while not a major breakthrough in sonic quality, did make the Audio Alchemy components perform better as a suite than as separates.

If you like classical music, acoustic jazz, and the subtler and better-recorded forms of rock, I believe you will find these differences to be aesthetically important. Certainly, their I<sup>2</sup>S capabilities make the Audio Alchemy DDS•Pro CD transport and DDE v3.0 D/A converter an even more attractive buy if you intend to use them as a team. As separates or as a system, these components do have some tough competitors in their price range, but nothing I know of offers superior sound quality at this price. **A**

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# CLASSICAL RECORDINGS

the two speakers. Hyperion usually does better than this.

The Bartók string quartets, on the other hand, are outstanding. The New Budapest Quartet was captured just the way I like it: in near perspective but with an excellent sense of a fine acoustic space surrounding the players. Moreover, the Quartet plays with a warmheartedness that, too often, is preempted by the aggressiveness of other performances. Highly recommended.

## Leo Brouwer

**Concerto Elegiaco (No. 3) and  
Concerto de Toronto (No. 4)**

Ricardo Cobo, guitar;  
Pro Musica Kiev, Richard Kapp  
ESS.A.Y RECORDINGS CD1040  
CD; DDD; 56:29

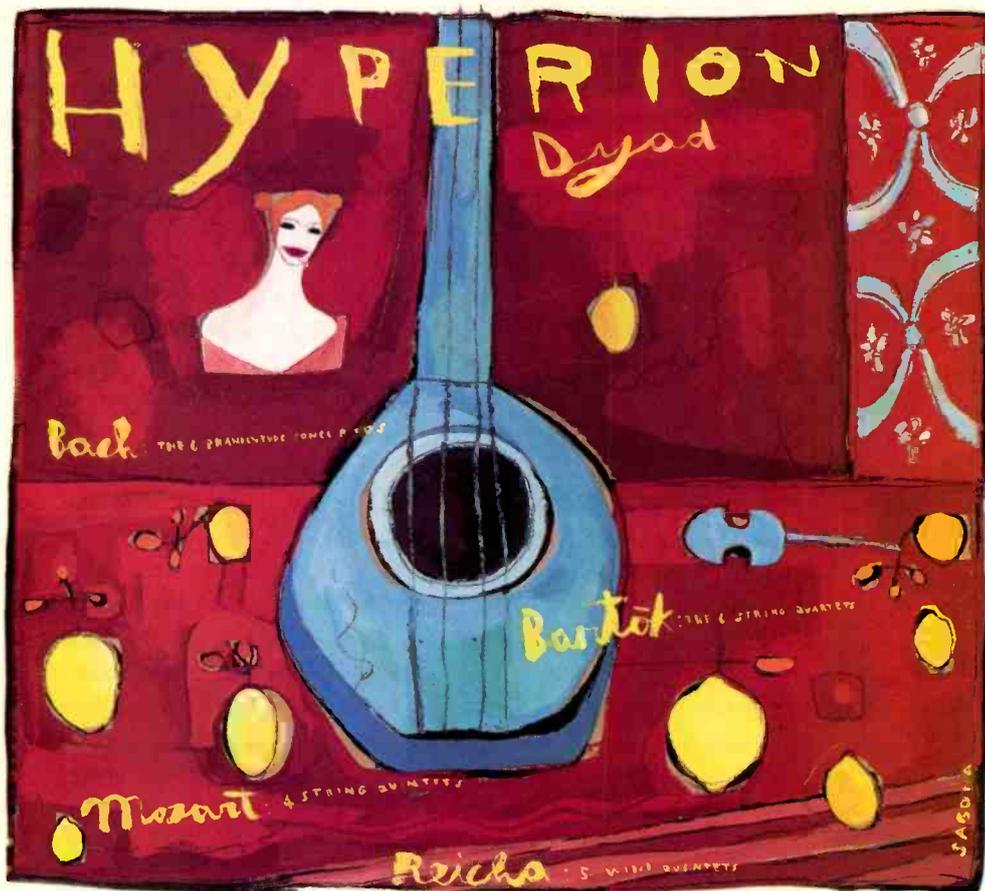
Sound: A, Performance: A

Cuban composer and conductor Leo Brouwer has been one of this century's most prolific composers. But he is especially known for his many guitar compositions, which are always idiomatic of the instrument's many tone colors. In these works he integrates the guitar into the symphonic texture when it is not taking a solo turn.

Brouwer considers these two guitar concertos as portraits of two of the best-known personalities in classical guitar today, Julian Bream (in No. 3) and John Williams (in No. 4). The center movement of the Third Concerto alludes to the intricate ornamentation of Elizabethan music, a focus of many of Bream's recordings. This work's finale pairs the guitar with a marimba and up-tempo Afro-Cuban themes. The Fourth Concerto is a technical tour de force, opening with some gamelan-like figurations on the xylophone. Its middle movement is a set of variations on a theme from the first. The Russian players are excellent, and the balance with Ricardo Cobo's guitar is just right.

These are two fascinating, accessible concertos that are sure to find a ready audience. My question is, why haven't Bream and Williams themselves recorded them? *John Sunier*

Illustration: Marina Sagona



**Bach: The Six Brandenburg Concertos**

*The Brandenburg Consort,  
Roy Goodman*  
HYPERION DYAD CDD22001  
Two CDs; DDD; 1:32:37  
Sound: B, Performance: A to B



**Bartók: The Six String Quartets**

*The New Budapest Quartet*  
HYPERION DYAD CDD22003  
Two CDs; DDD; 2:39:05  
Sound: A, Performance: A



**Mozart: Four String Quintets  
(K. 515, K. 593, K. 516,  
and K. 614)**

*The Salomon Quartet, Simon Wistler*  
HYPERION DYAD CDD22005  
Two CDs; DDD; 2:09:20  
Sound: B+, Performance: A



**Reicha: Five Wind Quintets**  
*The Academia Wind Quintet  
of Prague*

HYPERION DYAD CDD22006  
Two CDs; DDD; 2:04:34  
Sound: A, Performance: A+

Now and then I've heard complaints that Hyperion CDs are just too pricey. My response has been that given the superb standards to which most of its recordings unstintingly adhere, I'm astonished that Hyperion doesn't charge more. But now the label has entered the two-fer market with the Dyad Series, which brings the price down without materially compromising the recordings.

The Bach Brandenburg Concertos are a reissue. Although they may not be the top choice in a period-instrument traversal, they are nonetheless stylish and musically secure. There are a few points of tempo, balance, or phrasing on which I might quibble, but the sonics are of more concern. On my system, the soundstage did not hold together as well as I think it should have; too much of the music seemed to emanate from points near

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*- Wes Philips on the PS-1000, Stereophile Guide to Home Theater Vol. 2, Number 2*



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CIRCLE NO. 29 ON READER SERVICE CARD

# ARVO PÄRT

## Litany, Psalom, and Trisagion

The Hilliard Ensemble, Tallinn Chamber Orchestra, and Estonian Philharmonic

Chamber Choir conducted by

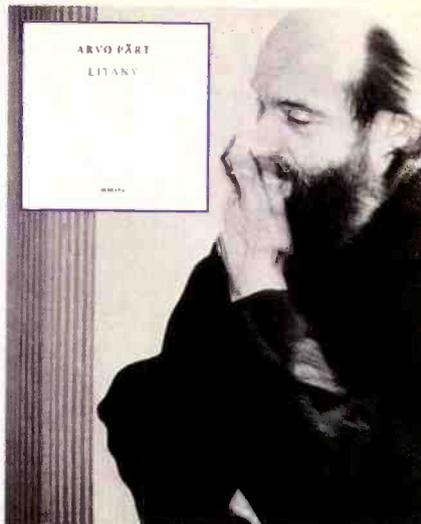
Tonu Kalijuste (on "Litany"); Lithuanian Chamber Orchestra conducted by Saulius Sondeckis (on "Psalom" and "Trisagion")

ECM NEW SERIES 21592, CD; 39:23

Sound: A, Performance: B-

Arvo Pärt's best compositions are a transparent gateway into the beyond, a sparsely ornamented frame through which we get to see the divine. As one of the holy minimalists, Pärt uses Christian texts as the vehicle for his meditations. In "Litany," he uses a set of prayers for each hour of the day by Saint John Chrysostom. The Hilliard Ensemble lifts Pärt's music above Saint John's pleas for forgiveness and divine guidance. As the voices soar, Pärt punctuates the text's anguish and ecstasy with orchestral fanfares and almost dissonant (for Pärt) cadences.

"Psalom" and "Trisagion" are orchestral works that explore dimensions of silence and space. "Psalom" contains a simple melodic phrase that is turned, shaded, and



lit, as if pondering an object. "Trisagion" follows a similar path but builds to a crescendo of urgency and desire, almost a demand for answers. Saulius Sondeckis conducts the Lithuanian Chamber Orchestra with exquisite restraint and detail. You can hear the rosin coming off the bows and strings as each phrase enters from empty space.

Arvo Pärt's music speaks to the same spirit that is touched by medieval chants, Bach's Masses, and the call of a Zen shakuhachi in echoing space. Although the English words root it, perhaps too forcefully, in Christian liturgy, his music transcends religion.

John Diliberto

does Lott in "Le Printemps." I can only assume that her squally patches are due to uncomfortable tessitura.

Ian Bostridge appears only on the second disc, which contains later Hahn songs. This is the first time I'd heard Bostridge; after his widely heralded *Die Schöne Müllerin* for the Hyperion Schubert series, I was at first dismayed by his work here. His first entry, in "Salinum," is tentative and tremulous (tessitura again?). But the pure head tones I'd expected are there, and he gains security as he goes along.

Graham Johnson's piano accompaniments are unflaggingly alert and sensitive, and his notes for the booklet (which includes full French texts and English translations) stand as examples to those who write about music. The recording's unobtrusive excellence is typical of these Hyperion offerings.

Robert Long

## Schumann: Piano Sonatas, Nos. 1 and 2; Etudes Symphoniques; Toccata

Harold Bauer and Percy Grainger, piano rolls

NIMBUS NI 8804, CD; DDD; 71:57

Sound: A+, Performance: A

## Brahms: Piano Sonatas, Three Intermezzos, et al.

Artur Schnabel, Harold Bauer, Myra Hess,

Wilhelm Backhaus, Carl Friedberg,

and Edwin Fischer, piano rolls

NIMBUS NI 8806, CD; DDD; 77:00

Sound: A+, Performance: A

## Debussy: selected piano music

Paquita Madriguera, Artur Schnabel,

George Copeland, Percy Grainger, Myra Hess,

E. Robert Schmitz, Robert Lortat,

Ignace Jan Paderewski,

and Eugène d'Albert, piano rolls

NIMBUS NI 8807, CD; DDD; 70:09

Sound: A+, Performance: A

## Gershwin: Themes from "Rhapsody in Blue" and "An American in Paris"; popular-tune arrangements

George Gershwin, piano rolls

NONESUCH 79287, CD; DDD; 60:08

Sound: A, Performance: A+

## Gershwin: arrangements of popular tunes by him and others

George Gershwin, piano rolls

NONESUCH 79370, CD; 41:30

Sound: A, Performance: A+

Nonesuch and Nimbus are essentially poles apart in what they consider state-of-the-art piano-roll recording. But both approaches have validity, and the results may amaze you.

The Nimbus Grand Piano series builds on the company's Prima Voce CDs. The antique 78-rpm recordings are transferred by playing

The set of Mozart string quintets is not complete, but it contains the most famous of them. The Salomon Quartet, a fine ensemble playing period instruments or reproductions, uses little vibrato but avoids the off-pitch whine that can result. Its sound thus is much less luxuriant than the New Budapest's. And while the surrounding ambience is similar, the soundstage is less cohesive.

The Reicha will doubtless take a place among my favorite CDs. The wit and charm of both the music and the playing had me laughing in delight at many points. As Antonín Rejcha (in his native Bohemia), Anton Reicha (when he was growing up in Germany), or Antoine Reicha (as Hyperion spells it, in deference to his career at the Paris Conservatoire), he was a contemporary and friend of Beethoven. If you haven't discovered Reicha's music—and even if you have—don't miss this recording.

Other first-round Dyad issues: the four orchestra suites of Bach, by the Brandenburg Consort; the cello-and-piano music of Beethoven, with Anthony Pleeth and Melvyn Tan, respectively; the complete piano sonatas of Anton Rubinstein, played by Leslie Howard; and piano quintets by Schubert,

Schumann, and Hummel, performed by the Schubert Ensemble of London. It's a series to watch out for.

Robert Long

## Hahn: Songs

Felicity Lott, soprano; Ian Bostridge, tenor; Susan Bickley, mezzo-soprano; Stephen Varcoe, baritone; Graham Johnson, piano

HYPERION CDA67141/2

Two CDs; DDD; 2:14:00

Sound: A, Performance: B to A

The latest volume in Hyperion's French Song Edition is devoted to Reynaldo Hahn, and it's another winner despite a couple of rough edges. With a total of 51 songs, the use

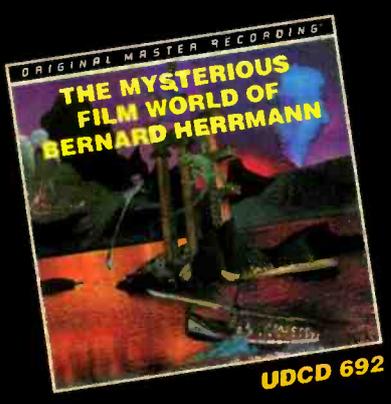


of four different voices (plus chorus on a few songs) is very welcome. Felicity Lott opens the first disc with an exquisite account of "Si mes vers avaient des ailes," surely Hahn's most famous song. Susan Bickley and Stephen Varcoe aren't quite in Lott's class, but they are fine singers and add variety to the collection. Toward the end of the disc, however, both prove in better control than

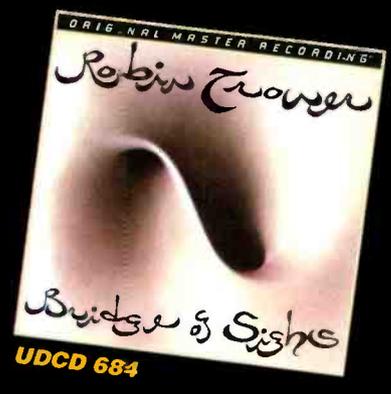
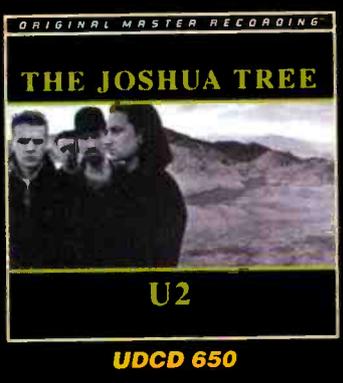
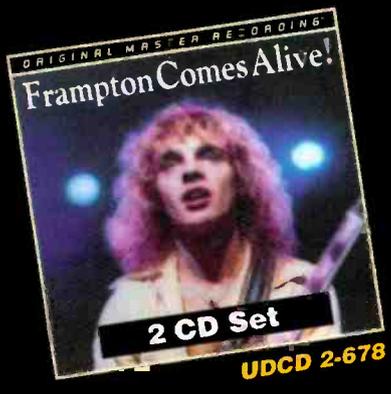
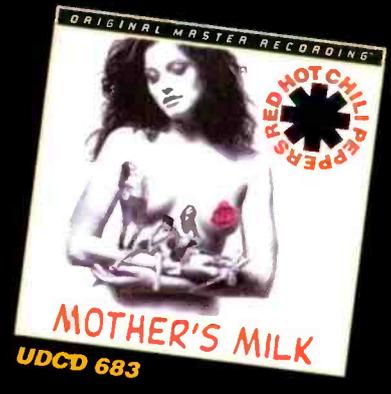


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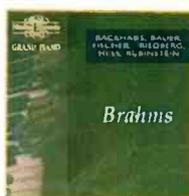


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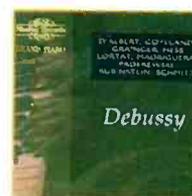




them on an elaborately built acoustic player, which is placed in a fairly large room whose acoustics are good; the resulting sound is picked up with an Ambisonic microphone setup. For the reproduction of Duo-Art piano rolls, the company acquired an Iles-Stonehill robot, whose "expression decoder" (which interprets the dynamics of the pianist) was the work of the late Gordon Iles, described by Nimbus as the "inventor and chief theoretician of the Aeolian Company in England."



Aeolian was the most famous name in "reproducing pianos" during their heyday and the proprietor of the Duo-Art process. The robot therefore represents the ultimate Duo-Art reproducer, made using many Aeolian parts but, according to Nimbus, capable of subtleties that its predecessors lacked. Though Nimbus doesn't specify what sort of piano is used, it has an engagingly rich tone, which is captured in what sounds like the Prima Voce "music room."



I mention Prima Voce with trepidation, because that series seems to arouse passions, both for and against. My own opinion is that while a very appealing theoretical case can be made for the total spatial sensitivity of Ambisonics, the technique does not necessarily produce especially ingratiating stereo sound. Nonetheless, in my listening room the Prima Voce CDs do sound unusually convincing as representations of the playback of acoustic recordings on fine equipment. So perhaps the dimensions or acoustics of my listening room are exceptionally suited to these recordings.

The Grand Piano series is, if anything, even more convincing. Not only do I feel as though I'm hearing a fine *reproducer*, but often it seems that the pianist is right in my listening room. That this is patently illusion is proven, I think, by the lack of differentiation between pianists who, judging from electrical recordings and contemporary criticism, should sound distinctly different. But the illusion is very persuasive. If we fail to hear some of the nuances of technique, we still are getting much of the impulse of a live pianist.

Some of the pianists are recording stars who need no introduction. Others, though they recorded in the electrical era, are better represented by piano rolls. In the Debussy, for example, George Copeland and E. Robert Schmitz were specialists who recorded little despite their influential careers. Also outstanding are the Wilhelm Backhaus excerpts from the Brahms "Paganini Variations." But there is much else that is fine in all three of these Nimbus discs.

Those from Nonesuch were produced very differently and in two different ways. Instead of trying to rebuild its Pianola (a player comparable to the Nimbus robot, but of 1911 vintage and without automatic expression functions), Nonesuch wheeled it up to a Yamaha Disklavier, essentially an electronic update of the player piano but equipped with optical sensors for all key and pedal motions so that it can record as well as reproduce. Gershwin's pre-Duo-Art rolls, which include no expression, were "played" (that is, controlled for speed and expression) by Artis Wodehouse. The resulting Disklavier recording (on floppy disks) was then cleaned up and used to again drive the Disklavier in making this digital recording on



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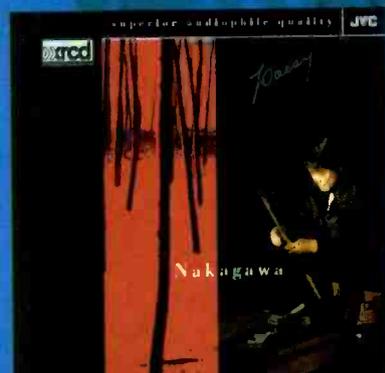


### TIGER OKOSHI

Two Sides To Every Story

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This Stereophile Recording of the Month features M ke Stern, Gil Goldstein, Dave Holland and Jack DeJohnette.



### NAKAGAWA

Poesy

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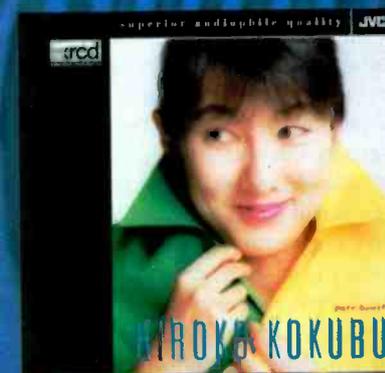


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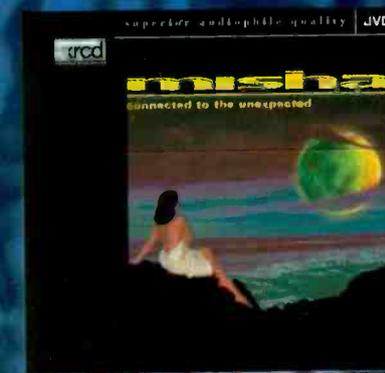


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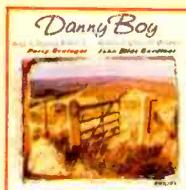


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# PERCY GRAINGER

**Grainger: Danny Boy**  
 (Songs & Dancing Ballads)  
 Monteverdi Choir and Orchestra,  
 John Eliot Gardiner  
 PHILIPS 446 657, CD; DDD; 74:58  
 Sound: B-, Performance: A+

The 14 tracks gathered here offer the heartiest romp through Percy Grainger's music I've yet encountered. John Eliot Gardiner, who's never one to sit prissily upon laurels (his own or anyone else's), lets no hint of preciousness fetter the lusty progress of the Monteverdi Choir. A few world premiere recordings are added to a mix of the familiar and the not-so-familiar. Among the former, even the title tune, "Danny Boy," avoids sounding like a cliché in Gardiner's hands, which is no trivial feat.



Most of this largely folksong-based collection (which, incidentally, was titled *Londonderry Air* for the European market) was recorded at EMI's Abbey Road studio in London. Space is used atmospherically and interestingly in the pickups, and the one defector—to the Guildhall—matches the other cuts well. None convinces me of a "real" acoustic space, although the soundstaging is imaginative enough to disarm criticism in that regard. But it does nothing to enhance the choral pickup, which is a little "gritty" in some passages and often is lacking in detail. Surely Gardiner demands better diction than can be heard here. Still, the overriding properties of the recording are Grainger's ingenious scoring and Gardiner's performances—a winning combination.

Robert Long

the stage of the Academy of Arts and Letters in New York.

The later Duo-Art rolls, which do include expression, were transcribed directly from the rolls to digital code that could drive a MIDI interface. The files were even more heavily edited for musical detail than those from the Pianola. In the case of the "Rhapsody" and "American in Paris," both created by a sort of overdubbing in which the pianist added more notes on a second pass, the notes were actually picked apart so that the MIDI files could drive a pair of Disklaviers. (The latter roll, incidentally, was not actually cut by Gershwin, but by his Aeolian colleague, Frank Milne.)

Outside of Wodehouse's manual intervention on behalf of the expressionless early rolls, modern intervention in the Nonesuch process is in the digital domain rather than the mechanical. Perhaps more important, it appears to have been far more dependent on the taste and skill of those who performed it (including Wodehouse) than anything in the Nimbus process. Yet Gershwin's wit and style come through brilliantly.

Yamaha pianos notoriously sound bright and rather hard, and the Disklavier is no exception. Its tone is shallow and brash when compared to that heard on the Nimbus recordings, but it is suited to the music. If I don't get the same uncanny feeling of the pianist's presence that I do from Nimbus, the farther-reaching modern processing may be the reason.

Robert Long

## Martinu: Chamber Music

Pražák Quartet, Czech Nonet,  
 assisting artists, and soloists  
 PRAGA PR 250097, CD; DDD; 67:10  
 Sound: A, Performance: A

Bohuslav Martinu's chamber music usually displays his talents at their most persuasive; this collection is no exception. It includes his String Quartet No. 7; the Quartet for Clarinet, Horn, Cello, and Side Drum; the Quartet for Oboe, Violin, Cello, and Piano; a Mazurka-Notturmo for Oboe, Two Violins, and Cello; and the Nonetto for Violin, Viola, Cello, String Bass, Flute, Oboe, Clarinet, Bassoon, and Horn—Martinu's valedictory chamber composition, I believe, and one of his most absorbing.

Needless to say, the wide variety of tonal color is one of this album's charms. That variety helps give each piece a very distinct persona. But each composition is crafted by Martinu with characteristically lively textures and lyric grace, and the Czech musicians are naturally at home in his idiom.

The recording, made in Prague, evidently was sponsored by Le Chant du Monde as well as its distributor, Harmonia Mundi. The notes don't specify the venue, but it sounds like a fairly close-miked setup in a good-to-excellent hall.

Robert Long

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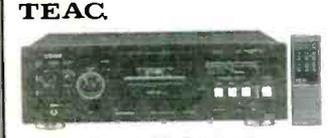
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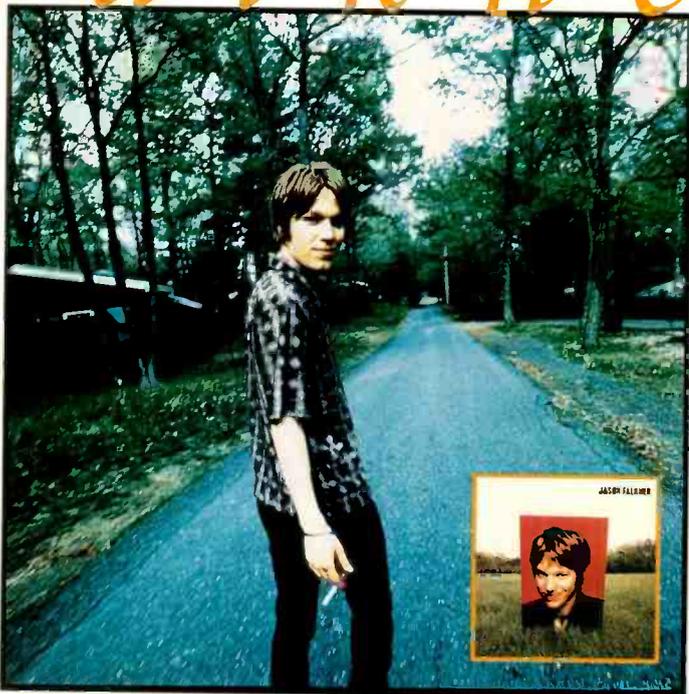
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# ROCK~POP RECORDINGS

## falkner

immense gifts. Such tracks as "I Live" and "Miracle Medicine" brim with powerful melodies and creative guitar tracking, the kind of quality we expect from solid songwriters like Matthew Sweet or Tom Verlaine. "She Goes to Bed" finds a firm middle ground between The Beatles and The Cowsills, while "Before My

Photo: ©1996, Marina Chavez



presents **Author Unknown**

Jason Falkner

ELEKTRA 61941, 44:24

Sound: B+, Performance: A-

**One Mississippi**

Brendan Benson

VIRGIN 41853, 42:59

Sound: B+, Performance: A-

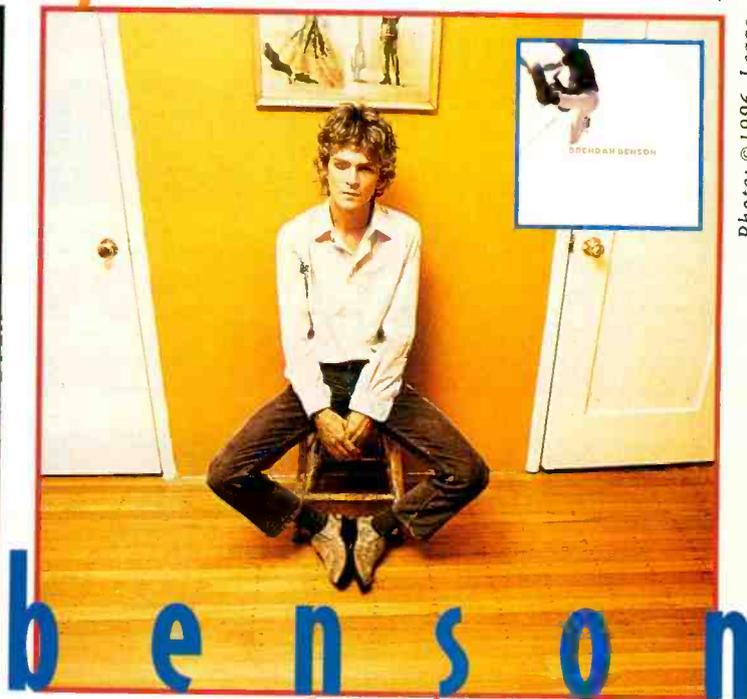


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## benson

his weepy "Elegy in a Country Churchyard," Thomas Gray looked out over a field of gravestones and lamented about all the dead folks who never discovered their calling, who never capitalized on a talent that unknowingly may have been their birthright.

The world is full of talented people, he implied, whether it be butchering, baking, or candlestick making, but few ever get the chance to discover it and take advantage.

Well, Jason Falkner and Brendan Benson can include themselves among the lucky ones. Here are two

seemingly earthy and earnest guys—perhaps they were errand boys in another life—who have realized their talent and potential as musicians, have taken their opportunity by the throat, and are poised to strangle it for all it's worth. In their solo debuts, Falkner's *presents Author Unknown* and Benson's *One Mississippi*, the two artists take full advantage of their musical abilities. Their songs scream with distinction, intensity, and richness.

As former guitarist for Jellyfish and frontman for the underrated Grays, Jason Falkner has already proven himself a first-rate songwriter, even if it was behind the cloak of a band. Now *Author Unknown* proves Falkner can go it alone. Having written, produced, arranged, and performed an album full of clever Beatle-esque and '70s-style pop completely by himself, he has created a nifty pop universe, a one-man musical solar system that shows off his

*Heart Attacks*" is a lovely, waltz-style pop song laced with strings. This is indelible stuff, songs that'll buzz around in your head long after the disc is put away.

Brendan Benson may be a little less subtle, but that doesn't make *One Mississippi* any less enjoyable. More prone to ebullient outbursts of electric guitar ("Bird's Eye View," "How 'Bout You"), the 26-year-old Berkeley boy is a rough-cut Robyn Hitchcock to Falkner's more graceful Difford and Tillbrook. Though a recording rookie, Benson demonstrates a fine grasp of effective hooks ("Crosseyed") and empathetic, sing-along lyrics ("Got No Secrets") while still coming up with some new ideas ("Emma J").

Thomas Gray would probably rejoice in how modern times have provided resources for people to discover their creative selves. He'd also probably notice the sheer quantity of records being churned out by people



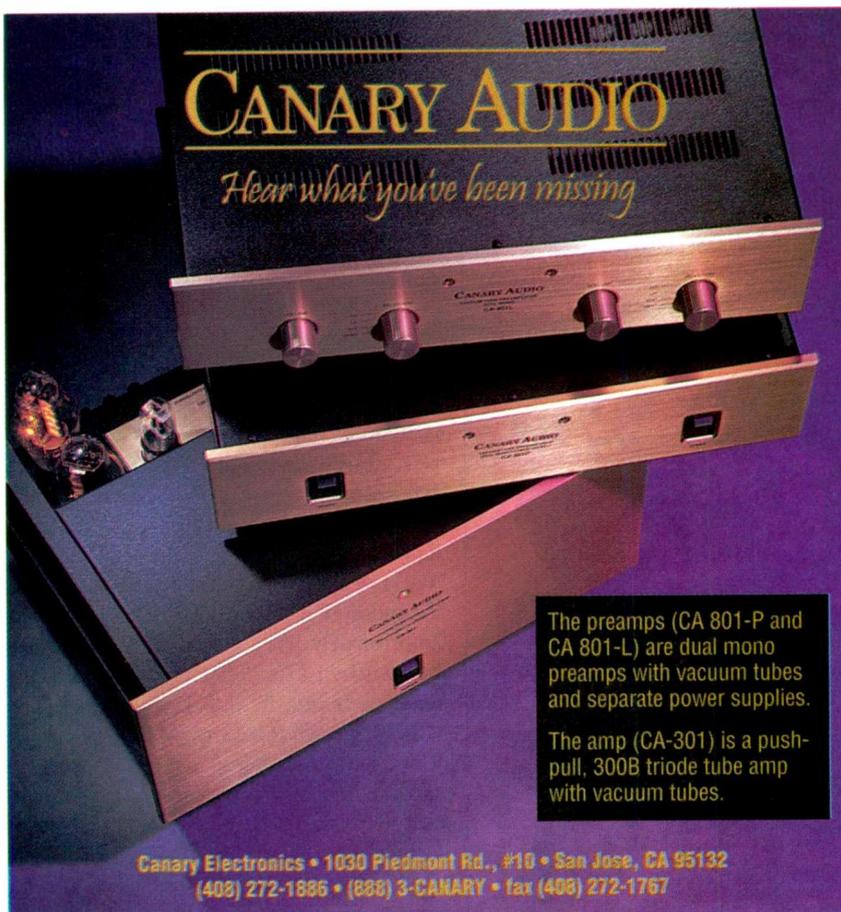
who may have discovered their calling but whose work lacks the kind of inspiration and human spirit he mourned for in "Elegy." But he would appreciate guys like Benson and Falkner, artists answering a true calling. By taking their chances, discovering their potential, and putting wonderful records on the shelves, they bring a kind of redemption to mediocrity and make us want and hope for more.

Bob Gulla

### Dead Cities

*The Future Sound of London*  
 ASTRALWERKS/CAROLINE  
 ASW 6181, 49:57  
 Sound: A, Performance: B

Samplin' fools and electronic storytellers Garry Cobain (no relation) and Brian Dougans, better known as The Future Sound of London, have made an album that could well be considered rave noir. Close your eyes and you're transported to a gray and dreary cityscape that's part *Brazil* and part *Blade Runner*. Old Bill Burroughs is standing on the corner waiting for The Man; the Trans-Europe Express rushes through, headed for Düsseldorf station, and New Jack gangstas struggle to wrest control of the streets from Old World mobsters. "We have explosives," a voice whis-



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## driving BLIND

VANGUARD 79490, 40:05  
 Sound: A-, Performance: B+

Canada's Driving Blind, which previously recorded a pair of albums as Monkeywalk, is not a band that will devastate you and change your life. However, it does make a fine constant companion. On first listen, this album glides by with a minimum of effort, but those grooves, once they grab, have hooks that don't let go. Bill



Ringgenberg and Andrew Frank write songs that are deceptively simple yet quickly sneak under your skin with a percolating insistence. The hallmark is Ringgenberg's smoky voice—a subtle, soulful instrument not unlike Seal's, though less theatrical.

With songs that groove over a combination of live drums, programmed rhythm, and drum loops, Driving Blind's bubbling musical brew still feels uncluttered and direct, all the better for tapping toes. The sound design highlights voice and rhythms. Thankfully, it doesn't slam your ears; Driving Blind, in fact, caresses them.

Michael Tearson

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pers in your ear, and the sound of this futuristic terrorist slipping quickly into the shadows sends shivers up your spine. But, hey, at least you can dance to it.

Or most of it. Drawing primarily on "found sounds" from the media for the full-blown follow-up to 1994's *Lifeforms*, Cobain and Dougans create dense, multilayered tracks that are both coldly mechanical (the ubiquitous techno drum machines) and strangely organic in a gritty, urban way ("Quagmire" features a sample from Ennio Morricone's score for *Once upon a Time in America*, and there are snippets of Run-D.M.C.'s *Tougher Than Leather* in "Herd Killing" and "We Have Explosive"). But The Future Sound of London is at its best when it's moving fast. Unfortunately, like a mystery film that reveals the identity of the killer and ruins the suspense early on, the duo runs out of steam halfway through this 13-track collection.

The Future Sound of London takes a turn into mellow ambient/New Age music with such soundscapes as "Yage" and "In a State of Permanent Abyss," but these tracks don't stand out in that overcrowded genre. And for painting pictures of little fluffy clouds, The Orb or Aphex Twin leaves The Future Sound of London sounding rather retro. However, when it comes to filling the dance floor with happy ravers while simultaneously creeping them out, Garry Cobain and Brian Dougans are without peer.

Jim DeRogatis

## Just Rockin' & Rollin'

Ronnie Dawson  
UPSTART 032, 49:36  
Sound: B-, Performance: B

## Rockinitis

Ronnie Dawson  
CRYSTAL CLEAR SOUND  
CDR 9619, 43:20  
Sound: B-, Performance: A-

Texas rockabilly original Ronnie Dawson is one of those rare performers whose music combines '50s authenticity and '90s relevance. As such, it's not much different from the stuff that was cut at Sun Studios some four decades ago; it's a little more electric and appends the rock with as much roll as it does 'billy, but otherwise, Dawson's spirit is about as true as it gets these days.

Known as the Blond Bomber, Dawson scored a small-scale hit as a teenager with "Action Packed," later revived in the '80s by The Cramps. Even now, at 56, he still has a youthful verve that's thoroughly rock 'n' roll, giving his music an energetic accent that distinguishes Dawson from most of his grayer contempo-

# CHEAP

**Sex, America, Cheap Trick**  
EPIC/LEGACY E4K 64938  
Four CDs, 4:28:22  
Sound: A, Performance: B+

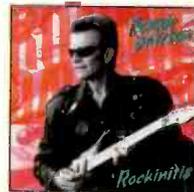
And not necessarily in that order, if you ask any serious, longtime Trick-head. For over two decades, this curious little combo from Rockford, Illinois, has made some of the most cerebral, structurally innovative rock ever stamped on to recording tape: pop-flavored confections that were as sugary as they were metaphorical and multilayered. Visually, the band's eccentricities multiplied—there were the two shag-haired heartthrob pinups (bassist Tom Petersson and Robin Zander, one of this generation's all-time great vocalists) contrasted with a pair of goofily-attired, madcap misfits (rumped drummer Bun E. Carlos and bow-tie-and-sweatered songwriter/guitarist Rick Nielsen). Cheap Trick, it seemed, was tailor-made for cult obsession status.

However, in looking back over Nielsen and his crazy crew's career—which this ambitious, nicely remastered four-disc set attempts to do—there are some painfully obvious snafus. On the surface, you can chart Cheap Trick's decline on a graph, from the halcyon brilliance of the first four albums (*Cheap Trick*, *In Color*, *Heaven Tonight*, and *Live at Budokan*) through strange, awkward experiments (the George Martin-produced *All Shook Up*), and on to

rarities. And, like them, he's found an avid audience in the U.K., where both of these records were recorded.

Both albums are mid-tech affairs in which an enthusiastic pool of revivalist players sound like they have to really trot to keep up with Dawson. *Rockinitis* is the older of the two, cut in 1989, and it's more straight-ahead, with perhaps its best track among 16 fairly high-energy gems being Dawson's own "Knock Down Drag Out," a staple of his live shows. The more recent *Just Rockin' & Rollin'* may gild the lily with horns and guitar leads, but there's a wild streak on both albums that's positively infectious, making them rebel roots music with a timeless appeal. (*Rockinitis* is available from Crystal Clear Sound, 4902 Don Dr., Dallas, Tex. 75247.)

Rob Patterson





# TRICK

some embarrassing, schlocky power ballads in the '80s and early '90s. True believers will want to remember the high points, though, like 1982's inspired creative burst, *One on One*. Which, ultimately, is where this package comes in; it boasts all the wierd, warped, wonderful classics ("Mandocello," "ELO Kiddies," "Auf Wiedersehen," "Clock Strikes Ten," "If You Want My Love") plus a bevy of previously unreleased bonuses: concert obscurities ("Violins," The Beatles' "Daytripper," and Roy Wood's "Down on the Bay"), demo chestnuts ("Fan Club," "Fortune Cookie," and the Nielsen-sung "World's Greatest Lover"), and other studio novelties ("I'm the Man," "Ohm Sweet Ohm," "A Place in France"). There's even a rare, live version of The Velvet Underground's "Waitin' for the Man" and "Heroin"—not exactly your standard Zander fare.



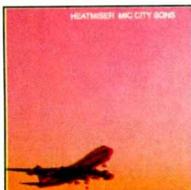
Is *Sex, America, Cheap Trick* a must-own? That's hard to say. The new material is amusing for a few spins through and certainly of interest to the "Cheap Trick, Sex, America" collector. But for the neophyte, it's as good an introduction as you'll likely get to Nielsen's manic, Roy Wood-school genius. *Tom Lanham*

## Mic City Sons Heatmiser

CAROLINE CAR 7540, 38:37  
Sound: B+, Performance: A-

Just as Lou Barlow has become synonymous with Sebadoh, Elliott Smith is the focal point of Portland, Oregon's Heatmiser. Another member, Neil Gust, contributes songs, but the attention always focuses on Smith, who has been releasing solo albums and touring on his own for the past year to unusually high critical acclaim.

It doesn't take a musicologist to figure out who's written what. Gust's songs come at you, pepped up by punk velocity or snarling embitterment, while Smith's purr along with breathy vocals and serpentine melodies. The effect is at times like a Sebadoh album, where the disparate styles consistently jar. With Heatmiser, however, you're never forced to program your CD player to correct



the imbalance. The schizophrenia is lower key—more like The Beatles' "White Album," where the band becomes a support group for the particular songwriter.

Each writer contributes highlights. "Plainclothes Man," "The Fix Is In," and, especially, "You Gotta Move" are Smith's, his sandy voice harmonizing with basic folk-rock instrumentation. What marks them as Heatmiser tunes, as opposed to solo tracks, is the sudden amphetamine shriek the band interjects without warning. Gust pumps up the volume for "Eagle Eve" and "Cruel Reminder," both brilliant indie-rockers. "Pop in G" is the one stylistic oddball tune, a Stones vamp like those old goats haven't vamped in years. The guitars spread-eagle, Keith Richards-style, while Smith or Gust (here I'm at a loss) thankfully careens without Jagger's machismo. The "hidden" 12th track, "Half Right," brings things to a sad-eyed close. *Mic City Sons* benefits from its integrated styles, offering a diversity that its writers could never reach alone. *Rob O'Connor*

## New Adventures in Hi-Fi

R.E.M.

WARNER BROS. 9 46320, 65:34  
Sound: B+, Performance: A

Road life takes its toll, but R.E.M. knows how to use that nomadic experience to its advantage. Recorded mostly during performances and sound checks from 1995's tour, *New Adventures in Hi-Fi* resonates with a common chord of passage, movement, and distance. It also succeeds as a travelog. In addition to song titles and who played what, the booklet cites the cities where each song was recorded, thus making *New Adventures* a disjointed, fish-eye view of America—a bumpy journey but an essential one (at least for the band). Fans should want to take the trip, because this album is arguably R.E.M.'s hardest-rocking and best-sequenced since 1987's *Document*.



The songs here clearly rank among the band's best material. "The Wake-Up Bomb" cuts a glam-rock path, and the exit track, "Electrolite," is heartfelt and campfire-esque. Guitars predominate throughout: rollicking and clumsy, slide, e-bowed, affected, distorted, layered, and just plain amped. At times things kick like a loud mule with distemper. Case in point: "Departure," which pairs a wall of big guitars with singer Michael Stipe's rapid-fire lyrics. Still, *New Adventures* revels in dynamics and variation, with an emphasis on frayed looseness that tolerates some occasional mistakes. The abundance of inspiration makes it apparent that R.E.M. is getting better and better with age. *Tom Ferguson*

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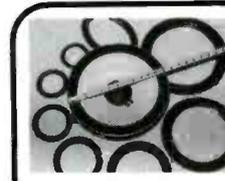
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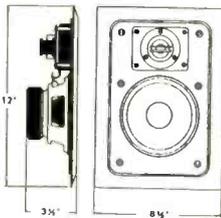
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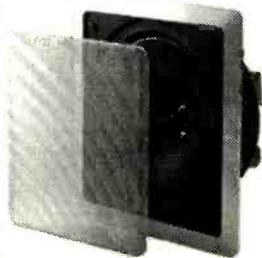
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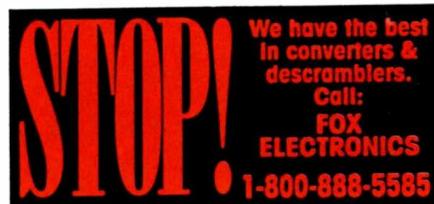


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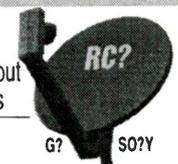
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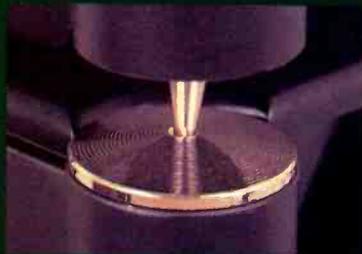
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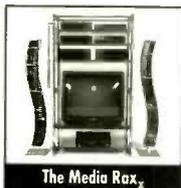
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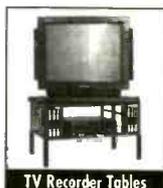
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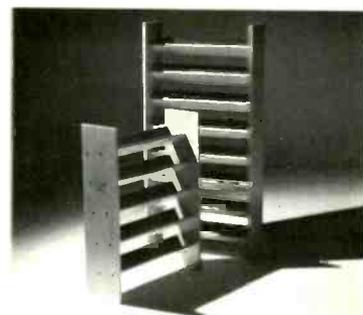
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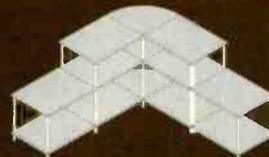
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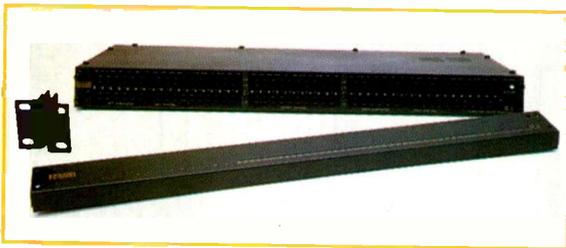
# PlayBack

## RANE SSE 35 HOME THEATER EQUALIZER

Equalizers that supply up to 12 dB of boost or cut (especially the boost) can really cause trouble for listeners who believe that if a little EQ is good, then a lot is better. Fortunately, the Rane SSE 35 (\$699) offers a maximum of only 6 dB of boost or cut, which facilitates fine-tuning home theater acoustics with no potential for gross overcompensation that can lead to distortion and noise.

The SSE 35, designed primarily for Dolby Pro Logic multichannel use, has 1/2-octave EQ from 25 to 100 Hz for two mono or stereo subwoofers and 2/3-octave EQ from 160 Hz to 16 kHz for the main and center channels. Other features are rack-mounting ears, a cover plate, L + R or separate L and R subwoofer switches, EQ bypass, an 80- or 125-Hz low-pass crossover, and a ground-lift switch. The Rane has no master gain control, and the equalizer sliders are

GRADE: B+



rather small. However, I had no trouble whatsoever making the adjustments.

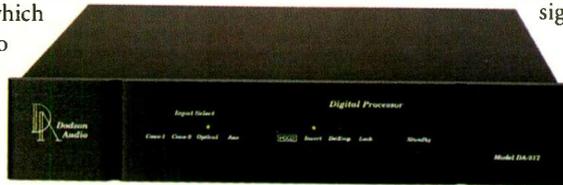
I installed the SSE 35 between my Dolby Digital (AC-3) preamp and a three-channel amp, and then I routed the two subwoofer output signals (each switched to L + R) to the inputs of a powered sub, with its internal crossover defeated. Using an SPL meter and a test CD, I EQ'd the front speakers a tad in the crossover region to compensate for a slight measured (and audible) deficit. The change was subtle, yet positive. Unlike some low-cost equalizers I have used, the SSE 35 added no extra line-level noise. A bypass switch enables instant before-and-after comparisons. My only quibble with the SSE 35 is its lack of an on/off switch. (Rane: 10802 47th Ave. West, Mukilteo, Wash. 98275; 206/355-6000.) John Gatski

For literature, circle No. 120

## DODSON AUDIO DA-217 D/A CONVERTER

I received the DA-217 D/A converter for review as a result of designing a simple jitter-detector circuit for Dodson Audio. The company never built the jitter detector, but when production began on the Model DA-217, Ralph Dodson asked me to measure the jitter on a sample and let him know how I thought it sounded. The jitter on the word clock signals to the DAC chips was amazingly good.

The DA-217's designers paid attention to proper handling and routing of digital signals within its four-layer p.c. board. Each of two, selectable, incoming unbalanced S/P DIF signals is immediately converted to two, phase-balanced, 75-ohm signals. These signals are then routed to the input signal selector and digital receiver via inner-layer traces in the p.c. board. This facilitates proper signal transmission-line characteristics, thus minimizing



GRADE: A+

generation of internal jitter. Further, all digital receiver output signals are converted to 75-ohm balanced form for delivery to the digital filter and finally to the DAC chips. The best-sounding components were chosen for the analog section after many hours of listening, a focused approach that yielded an exceedingly good converter. The sound of this unit was among the best I've heard, with superb transparency and detail. (The DA-217 is \$2,995 plus \$125 for the AES/EBU or \$175 for the AT&T connector option. Dodson Audio: 8881 Pipestone Way, San Diego, Cal. 92129; 619/484-8199.) Bascom H. King

For literature, circle No. 121

## Scheib CD DiscDividers

I've been buying CDs for 14 years, and my collection has long since overflowed its original shoebox into a big StoraDisc CD rack ("PlayBack," December 1995). I file my CDs alphabetically, but with yards and yards of them, each labeled in small type behind reflective plastic, I needed some way to navigate my shelves more quickly and find where my "Orchestral" CDs ended and my "Organ" discs began.

Just in the nick of time, I found CD DiscDividers, from Scheib Associates. They're plastic dividers, each the size of a CD's jewel case except for a protruding tab. The dividers have rounded corners and are made of sturdy 20-mil PVC plastic. A sheet of tab-sized labels includes 32 preprinted with musical categories (such as "Classical" and "Hip Hop"), 52 with the letters of the alphabet, and a dozen blanks. But because my categories differ from Scheib's and my handwriting stinks, I made up my own labels, using Avery #5267 return-address labels in my laser printer.

Alas, CD DiscDividers come only in packs of 12 (at \$7.95) and—double alas—are available only to members of BMG Music Clubs; I'd like to see economy-size packs of, say, 50 or 100 available and at record stores—or at least those that cater to serious collectors. (Scheib Associates: 3024 Waters Rd., Amsterdam, N.Y. 12010; 518/384-0355.) Ivan Berger

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GRADE: A

# TUBE COMPONENTS WITHOUT THE TUBES.

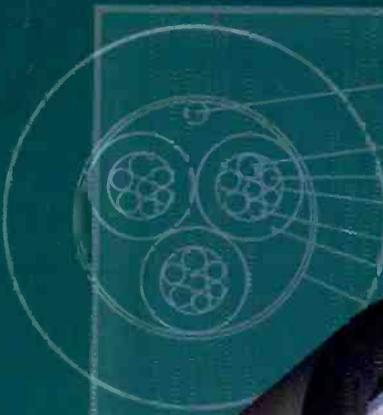
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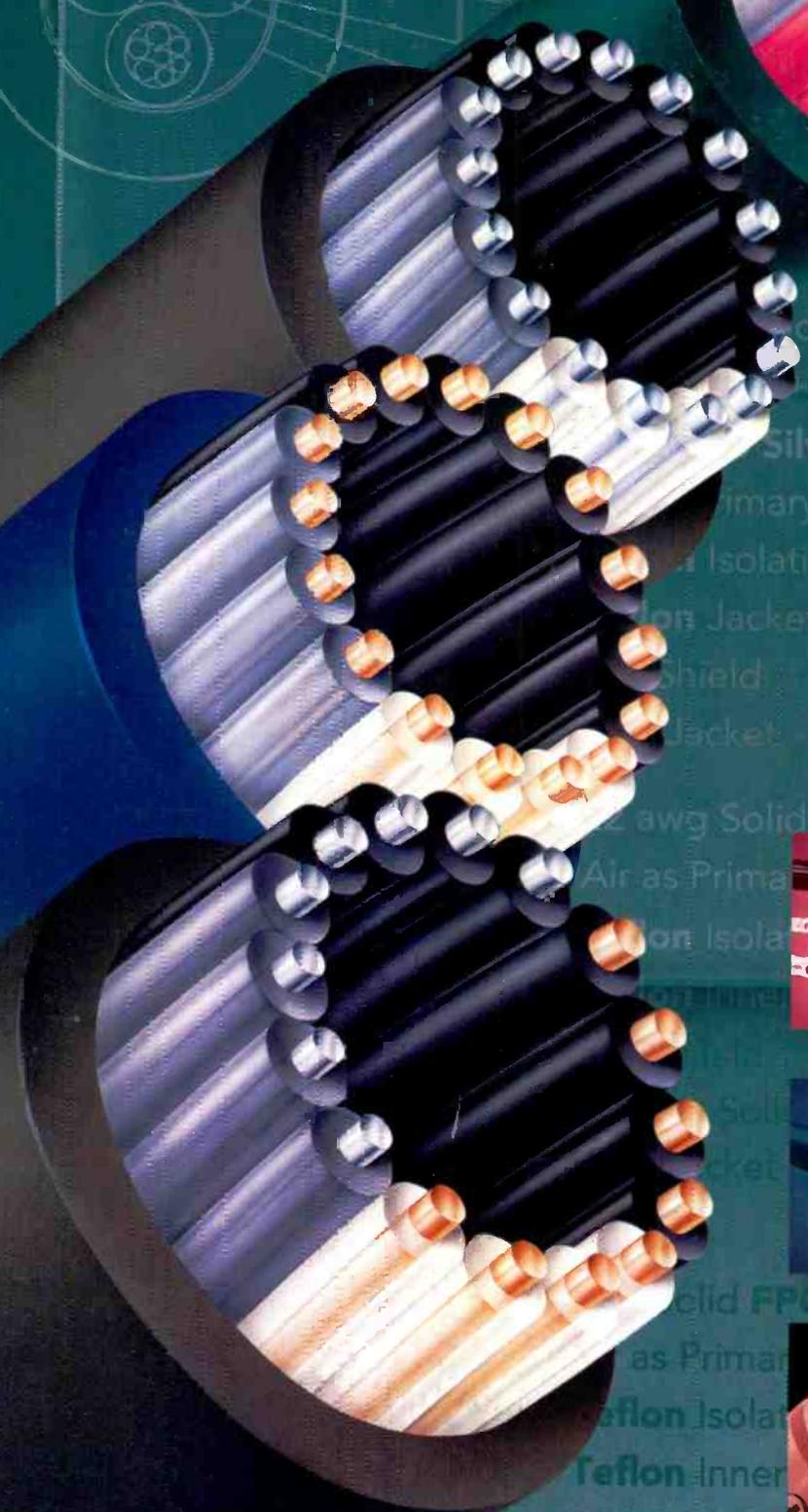
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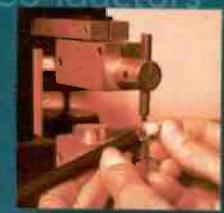
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