

AUDIO

THE EQUIPMENT AUTHORITY

JANUARY 1996

JITTER
A HIDDEN PROBLEM
IN DIGITAL SOUND?

CLASSIC DESIGN
McINTOSH
CD PLAYER

MARANTZ'S
BATTERY-POWERED
BEAUTIES

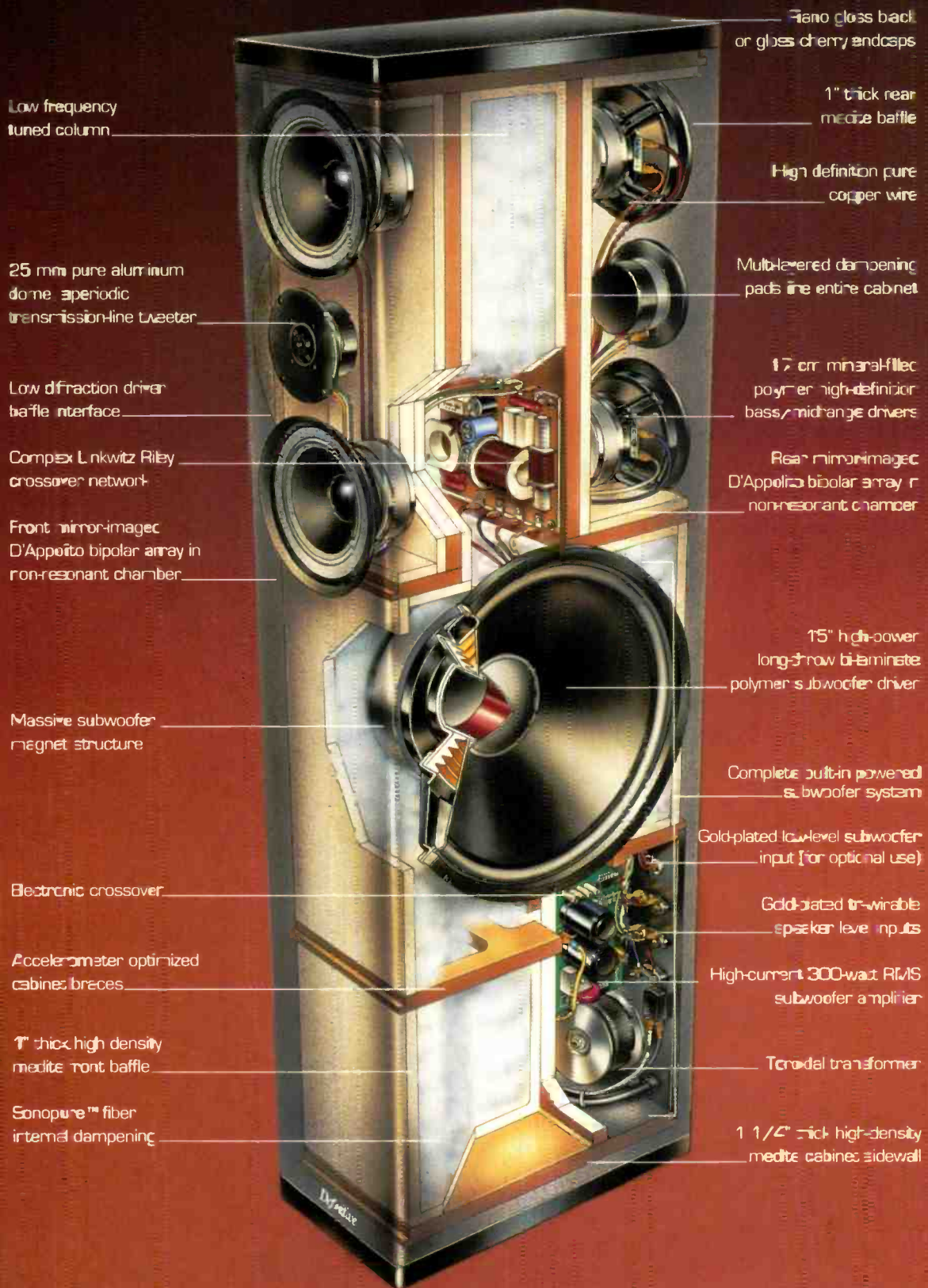
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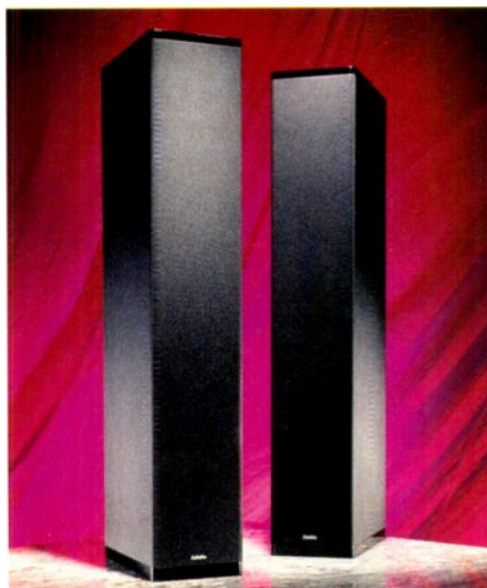
—Julian Hirsch, *Stereo Review*

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—Julian Hirsch, *Stereo Review*

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See our dealer list on page 98

The Ultimate Home Theater

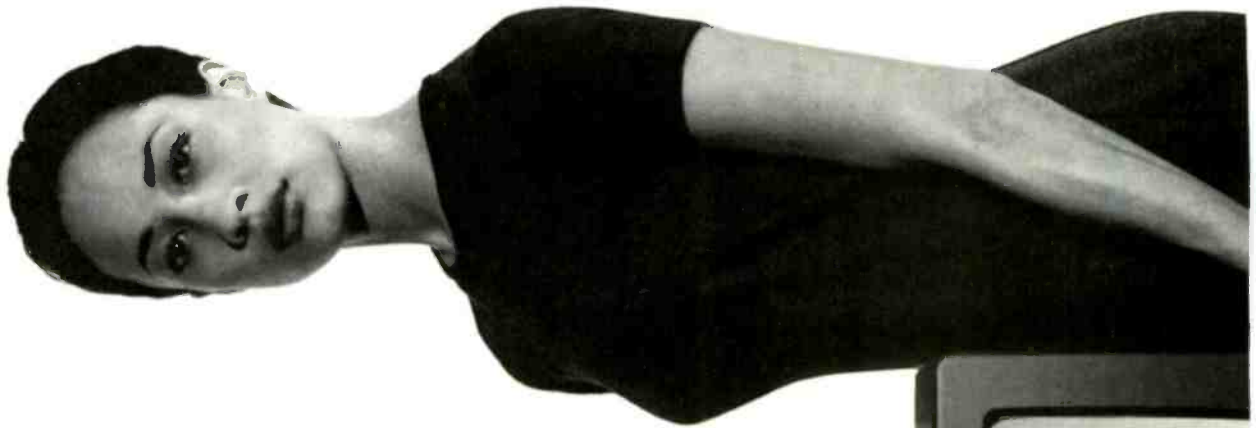
In addition to being an audiophile's dream, the BP2000s are also the main speakers in Definitive's AC-3 ready Ultimate Home Theater System. This astonishing system is absolutely the finest sounding available. It recreates a "you are there" spatial reality that actually puts you into the soundspace of the original cinematic action.

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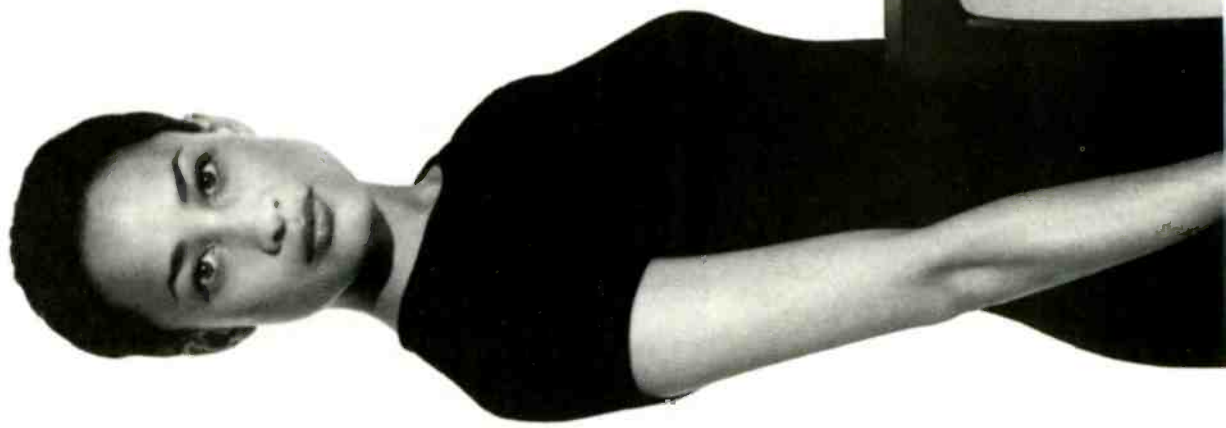
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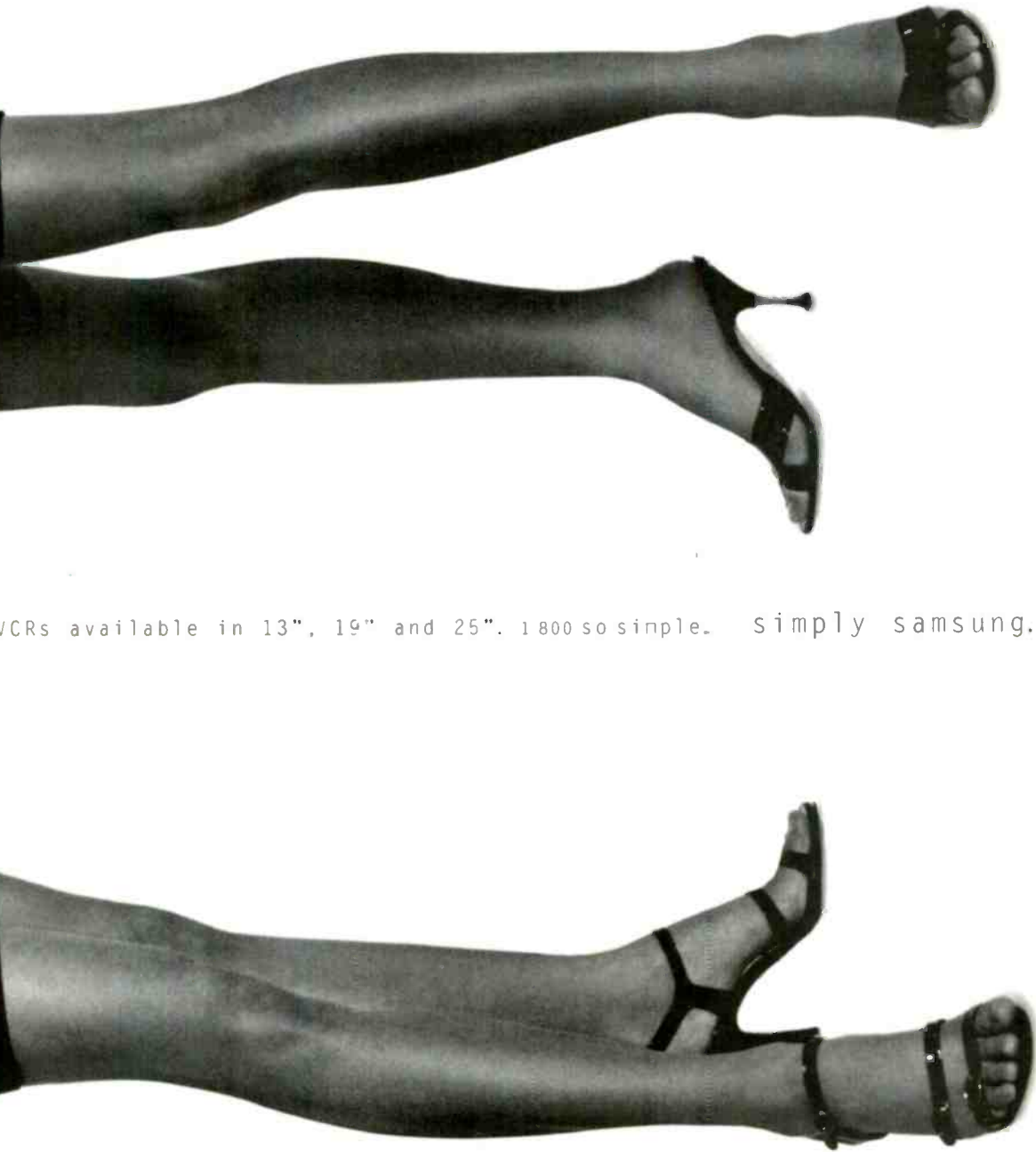




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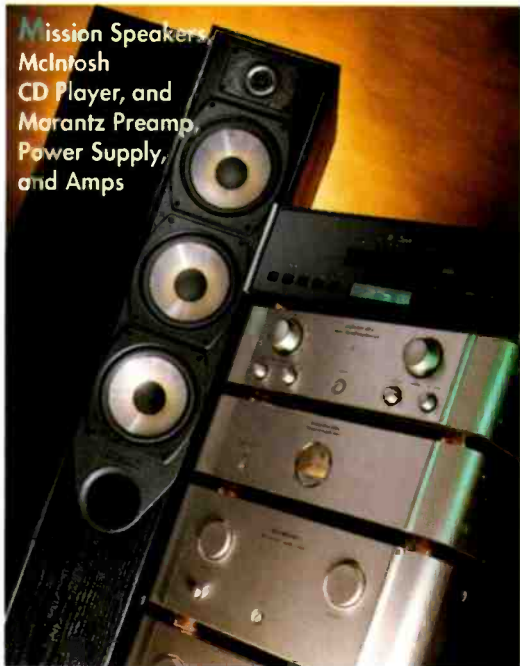
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Mission Speakers, McIntosh CD Player, and Marantz Preamp, Power Supply, and Amps

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Audio Publishing, Editorial, and Advertising Offices, 1633 Broadway, New York, N.Y. 10019

Subscription Inquiries: Phone, 303/604-1464; fax, 303/604-7455



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T H E A R A G O N C O L L E C T I O N

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Aragon's Qualifications

Aragon amplifiers are internationally recognized as the pinnacle of power and refinement. The press in America, Europe and Asia have honored the U.S. made Aragon with accolades and awards. Because of their sculpted beauty and remarkable accuracy Aragon components have joined Stradivarius violins in the permanent collection of one the world's most prestigious museums.

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CIRCLE NO. 30 ON READER SERVICE CARD

A few months ago, a friend and fellow hi-fi journalist called me up about a column he was writing for a Toronto newspaper on how various people first got interested in audio as a hobby. The ensuing conversation set me to reflecting about where we are today versus where we were then.

By "then" I mean about 1972—the year I returned to college for my senior year, carrying with me the Citation 12 power amp I'd built during the summer. The selection of that amplifier, and of the other components for the system I eventually assembled, was based on more research than I had imagined possible. I had started out simply to indulge my enjoyment of music with a good system for reproducing it, expecting not to return to the topic for a good long while, only to find myself fascinated with the process itself.

To me, the decade from that year to the introduction of the Compact Disc constitutes an era of sorts. A lot was happening in audio. The business grew rapidly through most of that time, and the basic technology got polished up to the point where the signal path to the loudspeaker could be very clean and transparent. CD was the cap on that. Not to say there wasn't (and isn't) still work to be done in that chain, but the distance yet to be traveled on the road to perfection now seems much smaller than that already traversed.

CD opened the door to a new era in audio, which is still unfolding. Once a signal is in digital form, it is both more robust and much more malleable than the analog original. If you can think of something you'd like done with a digital signal, it probably is possible. But the CD, in particular, also contains the seed of something I think is even more enticing—freedom from the fundamental two-channel limitation of the phonograph record. An audio-only CD made with the new high-density disc technology developed for DVD (digital videodisc) could easily hold a couple of hours of uncompressed, 20-bit, discrete five-channel sound, for example.

At this point you may be thinking back to the era before CD, to the '70s, when quadraphonic sound crashed and burned. The conventional wisdom on the failure of quad is that it was done in by format rivalries. I'm sure that didn't help, but such competition is not invariably fatal (witness the 33½ versus 45-rpm battle of years gone by or VHS versus Beta), and I don't think it's what killed quad. I think two other issues were much more important. One was the

need to place two more speakers at the back of the room, preferably identical to the ones in front and forming a symmetrical, rectangular array with the listening position right at the center. That was not an easy thing for most people to do, especially at a time when there were few good speakers that were not also fairly bulky. The other problem was sound quality. I never heard a demonstration of quad that actually sounded good. Given that I spent a lot of time in those days hanging around hi-fi stores, aggravating salespeople, I suspect pretty much nobody else did either. Added inconvenience for little or no perceived benefit is hard to sell.

If you look around today, on the other hand, you'll find lots of people with not just four speakers in a room, but five or six pumping out Dolby Surround. Thanks to an improved channel layout, a plenitude of good small speakers, and widespread acceptance of the satellite/subwoofer concept, it's a lot easier to set up for multichannel audio than it used to be. Plus, it really does sound better than stereo this time around.

The best is yet to come, however. With LPs, we were literally stuck in a groove—a groove with two walls and thus ill-suited for conveying more than two channels of information. Now we are on the brink of digital technology that will enable convenient, low-cost delivery of high-quality, discrete multichannel music through the same systems many of us already have installed for home theater. Breaking the shackles of two-channel stereo will bring both great opportunity for enhanced realism and many challenges with respect to maintaining the level of reproduction quality we've come to expect from high-performance audio systems.

Which brings us, circuitously, to the question I've been asked so many times in the couple of months since I became editor of *Audio*, about my plans for the magazine—a big question that commands a long answer. One part of it, though, is that the magazine should stay more on top of the technological developments driving us forward today at such a rapid pace. I'm having more fun with hi-fi now than I've had in a long time. The next few years promise to be very exciting, for audio in general and for *Audio* in particular.



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ART DIRECTOR
Cathy Cacchione
ASSOCIATE ART DIRECTOR
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MANAGING EDITOR
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SENIOR CONTRIBUTING EDITORS
D. B. Keele, Jr., David Lander, Edward M. Long

CONTRIBUTING EDITORS/ARTISTS
David L. Clark, Anthony H. Cordesman,
Ted Costa, John Diliberto, Frank Driggs, John Earle,
Edward J. Foster, John Gatski, Joseph Giovanelli, Dawn Joniec,
Ken Kessler, Bascom H. King, Robert Long, Paul Moor,
Jon W. Poses, Jon R. Sank, John Sunier, Michael Tearson,
Jon & Sally Tiven, Michael Wright

V.P./GROUP PUBLISHER
Tony Catalano 212/767-6061

V.P./ADVERTISING DIRECTOR
Scott Constantine 212/767-6346

GENERAL MANAGER Greg Roperti
BUSINESS MANAGER Christine Z. Maillet
PRODUCTION DIRECTOR Patti Burns
PRODUCTION MANAGER Dana L. Rubin
PROMOTION COORDINATOR Dominique A. Leupi
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ADVERTISING
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CIRCLE NO. 39 ON READER SERVICE CARD

44th St., Suite 1010, New York, N.Y. 10036; fax, 212/840-2234. For information regarding Thorens, write to 84-05 Cuthbert Rd., Kew Gardens, N.Y. 11415; fax, 718/849-7698. We hope both Dual and Thorens will appear in the next Directory.—T.C.

Parts, in a Pinch

Dear Editor:

I recently ran into a little problem where I need your advice. I own an Akai GX650D reel-to-reel recorder, which I bought in 1982. It has direct drive with dual capstans and appears to be built like a tank. I assumed I would not need to replace it in my lifetime. However, I am currently in need of replacement pinch rollers, Part No. MP67888. As you know, Mitsubishi gained ownership of Akai in the 1980s. Upon calling Mitsubishi, I learned these pinch rollers are no longer available. It seems somewhat discouraging to believe that the nonexistence of these \$10 parts would determine whether I replace a \$1,200 machine. Thanks for any help you can provide.

Gary Wahlgren
Redondo Beach, Calif.

Editor's Reply: We know of two companies that may be able to help you. Because they may have a generic part rather than a direct replacement, you'll have to deal in inches, not part numbers. In the past, the following firms supplied parts similar to the one you want: Projector-Recorder Belt (W9390 State Rd. 59, Whitewater, Wisc. 53190; 414/473-2151) and Advanced Belt Technology (150 Industrial Park Rd., Middletown, Conn. 06457; 203/632-2211).

Errata

We regret that Polyfusion Audio was inadvertently omitted from the last Annual Equipment Directory (October 1995). Polyfusion Audio, makers of amps, preamps, D/A converters, and a CD transport, can be reached at 30 Ward Rd., Lancaster, N.Y. 14086; fax, 716/681-2763.

Also, TLT (Transmission Line Technologies) is located in Georgia and not, as listed in the Directory's Company Addresses, in California. TLT's correct address is P.O. Box 313, Winder, Ga. 30680; fax, 404/867-8567.

A Satisfied Customer

Dear Editor:

I was thrilled beyond words to find your listing for the Lirpa Labs 1 Mk K3 preamp in your Annual Equipment Directory (October 1995). I bought a Lirpa Stealth Digital Surrealism Processor back in 1991 when I saw it in your publication. Trusting your staff's impeccable credentials and expertise, I immediately ordered one directly from the factory. I was eager to sample the unit's sonic excellence, hoping that it would be as good as the claims for it. But the instant I turned on the power, the damned thing completely disappeared. I mean, I simply could not see it at all! And when I reached for the instruction manual, darned if it was nowhere to be found either.

Anyhow, I've been eagerly waiting for you to mention Lirpa again so that I might purchase more of the professor's high-end equipment.

Rd. Giarc Llerrem
Sallad, Xet.

DSS a Delight

Dear Editor:

It struck me as interesting that in the "DSS Debate" in the October 1995 issue, the enthusiastic "pro" letter came from a DSS owner and user and that of the two "con" letters, one was from someone who had never seen or used DSS but liked seeing a product he didn't want to buy slammed. And the other was from a user who agreed that the picture quality of various source channels varies at the source.

In fact, DSS is outstanding. As someone who has had DSS since its introduction, I feel Anthony H. Cordesman was off base in his criticism of the system (August 1995). But I think part of some people's dissatisfaction might be because there were, from time to time, frequent digital artifacts in the various channels last June to August, as channels were added at the same time DirecTV's third satellite was being put on line. This called for wholesale readjustment of the transmission algorithms, and—as I found out a year earlier when the second satellite went on line—it takes a little while

to perfect the load shift. By September all such artifacts had completely vanished.

I paid more than list price to order my DSS system through the mail, and to say I am delighted with it would be a major understatement!

Eric Norberg
Portland, Ore.

CD Portables: Lost and Found

Dear Editor:

I'd like to thank Edward M. Long for his review of CD portables in "Digital Memories for Road or Track: Five CD Portables" (September 1995). I took his recommendation of the Panasonic SL-S490 and am most impressed with it, especially in the car. Now we can listen wherever we go, regardless of the road conditions!

Also, after reading Steve Haller's request (in last October's issue) for assistance in locating a cover for his Sony tape deck, I thought perhaps *Audio* could help me in my own search. I have a Sony D5 Discman and would like to find a carrying case and battery pack (the EBP-9LC), which are no longer available from Sony.

If any of *Audio's* readers can help, I would appreciate it if they would contact me.

Jon Oakleaf
1330-13th St.
Moline, Ill. 61265

Missing in Action

Dear Editor:

I am quite surprised that the turntable section in your most recent Annual Equipment Directory (October 1995) has no listings for Dual or Thorens turntables. Does this mean that those makers are no longer represented in the United States?

William E. Parker
Antioch, Calif.

Editor's Reply: It is our policy to list every manufacturer that returns our Directory forms. Many pains are taken to include everyone, but some companies fail to respond in time or do not respond at all. The latter is true for both Dual and Thorens. Dual can be reached c/o Euro-Tech, 19 West



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WHAT'S NEW

Meadowlark Audio Speaker

The Meadowlark Audio Kestrel has a footprint of only 8 x 9 inches and stands 36 inches tall. Its slanted baffle, isolated from the cabinet, holds a 6½-inch woofer with transmission-line loading and a 1-inch tweeter. The first-order crossover is externally mounted, to prevent microphonics. Rated response is 38 Hz to 20 kHz, ±2 dB. Rosewood, bird's-eye maple, and ebony finishes are available. Price: \$995 per pair.

For literature, circle No. 100



M & K Sound THX Subwoofer

Unlike most other subwoofer systems, the MX-150THX from M & K Sound is said to meet Home THX standards without requiring a pair of cabinets. The reason is a 12-inch, push-pull, dual-driver configuration that is claimed to virtually eliminate even-order harmonic distortion while doubling sound output per watt of amplifier power. This sub's built-in amp delivers 150 watts rms, with a Headroom Maximizer I circuit to prevent amp clipping. For those without Home THX controllers, the subwoofer incorporates a crossover that rolls off at 24 dB/octave above 80 Hz and at 36 dB/octave above 125 Hz. Price: \$1,295.

For literature, circle No. 103

MIRAGE SPEAKER

The front and rear panels of the Mirage M890i carry matching 1-inch titanium-dome tweeters and 5½-inch polypropylene woofers, yielding a bipolar radiation pattern suitable for both front- and surround-channel application. Response is rated as 38 Hz to 22 kHz, on axis, and 38 Hz to 20 kHz, 30° off axis; usable bass response (10 dB down) extends to 30 Hz. Nominal impedance is 6 ohms (4 ohms minimum). Price: \$900 per pair.

For literature, circle No. 101



Probe Audio Labs Speaker

The upper section of the Probe Audio Labs Jayde system is a dipole, consisting of an open-baffled, 6½-inch midrange driver and two tweeters (a forward-facing 1-inch driver and a ¾-inch driver facing rear). The vented bass enclosure below holds an 8-inch woofer. Sensitivity is rated a high 92 dB, and recommended power is 25 to 200 watts per channel. Standard finishes are light or black oak veneer. Price: \$3,495 per pair.

For literature, circle No. 104



Mordaunt Short Speaker

With its Performance 860, Mordaunt Short returns to high-end audio. The system uses two 6½-inch woofers, a 4¾-inch midrange, and a 1-inch dome tweeter to deliver frequencies from 35 Hz to 25 kHz. Rated sensitivity is 90 dB, at which level THD is said to be less than 2%. To control resonances, the 860's cabinet is made from Resin Rock (a mix of concrete, Styrofoam, and rubber), and the midrange driver is decoupled from the box. Price: \$2,500 per pair.

For literature, circle No. 102

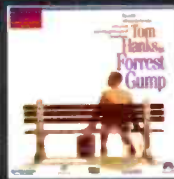


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Higher Learning	*1381805
Immortal Beloved	*1372309
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You sometimes open CD jewel boxes one-handed while you are driving your car, don't you? In case your insurance company disapproves of this, Scosche's Visa-Visor will hold a trip's worth of

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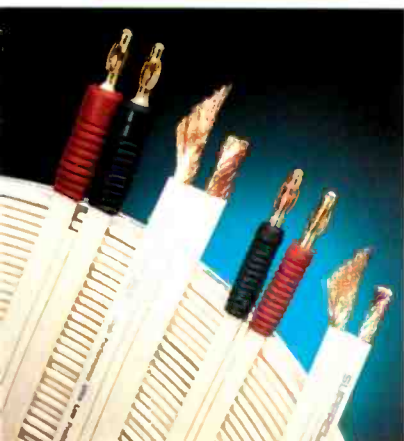


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The L1 line-level preamp, from Lamm Audio Laboratory, combines tubes with high-voltage MOS-FETs. Operation is Class A from input to output,

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MONSTER CABLE FLAT WIRING



Monster Cable's 12-gauge SuperFlat and 16-gauge SuperFlat Mini cables are designed for easy routing along baseboards and door frames or to lie flat under carpets. Adhesive dots included with the cable tack it down; using corner trim (available separately) will give you neatly folded corners. Prices: SuperFlat, \$1.50 per foot; SuperFlat Mini, 75¢ per foot. For literature, circle No. 107

VERSALAB RFI FILTERS

Signal cables, like any wires, can act as antennas for ambient radio signals. Running those cables through Versalab's Red Rollers is said to filter out such radio-frequency interference (RFI) so that it

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GRYPHON AMPLIFIER

Named after a son of Hercules, the Antileon stereo power amp from Gryphon Audio Designs is said to deliver 100 watts per channel in pure Class A, with frequency response flat to beyond 250 kHz. Its "Green Class A" biasing system lets you set bias just high enough to ensure proper Class-A operation with your speakers

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CIRCLE NO. 7 ON READER SERVICE CARD

BRYSTON

"Cambridge SoundWorks Home Theater For



For many speaker designers and manufacturers, home theater is a relatively new idea. But the people who work at Cambridge SoundWorks - including our cofounder Henry Kloss (who also founded AR, KLH and Advent) - have been involved with the concept of home theater from the beginning. In 1969 (years before VCRs and cable TV), Henry Kloss founded Advent, the company that introduced the first home theater audio/video systems - complete with big-screen TVs and digital surround sound. We have had an ongoing relationship with the people at Dolby Laboratories, creators of Dolby Surround Sound, since Henry Kloss introduced the first consumer products with Dolby noise

standard for home theater components.

Because we sell carefully matched and tested home theater speaker systems factory-direct, with no expensive middlemen, you can save hundreds of dollars. We believe the products on these pages represent the country's best values in high performance home theater components. Audio critics, and thousands of satisfied customers, agree.

Stereo Review said

"Cambridge SoundWorks manufactures loudspeakers



Our Surround Speakers

magnetically shielded so they can be placed near a TV or computer monitor. *Center/Surround IV* is a compact, one-way speaker identical to our *Ensemble® IV* satellite speakers. **\$49.99.** *Center/Surround III* is a small, affordable two-way speaker. **\$79.99.** *Center Channel* is identical to a Cambridge SoundWorks *Ensemble* satellite (but with magnetic shielding). **\$159.99.** *Center Channel Plus* uses an ultra-low, ultra-wide design that is ideal for placement above (or, with optional support stand, below) a TV monitor. **\$222.99.**

Surround Speakers

Cambridge SoundWorks makes two "dipole radiator" surround sound speakers. Dolby Laboratories recommends dipole radiator speakers for use as surround speakers. *The Surround* has a very high power handling capacity and is often selected for "high end" surround sound systems. *Audio*, describing a system that included *The Surround* said "In many ways the surround sensation was every bit as good as far more expensive installations." **\$399.99 pr.** The smaller *The Surround II* is arguably the country's best value in a dipole radiator speaker. **\$249.99 pr.**



Our Center Channel Speakers

that provide exceptional sound quality at affordable prices." *Audio* suggested that we "may have the best value in the world."

Center Channel Speakers

Cambridge SoundWorks manufactures four speakers for use as center channel speakers in Dolby Pro Logic home theater systems. All four are

reduction over 20 years ago. And now at Cambridge SoundWorks we believe we have set a new price-to-performance



Our Popcorn

Opens The Way To Killer An Affordable Price.”

Stereo Review

Powered Subwoofers

The original *Powered Subwoofer* by Cambridge SoundWorks consists of a heavy-duty 12" woofer housed in an acoustic-suspension cabinet with a 140-watt amplifier and a built-in electronic crossover. *Stereo Review* said it provides "deep powerful bass...31.5 Hz bass output was obtainable at a room-shaking level... they open the way to having a 'killer' system for an affordable price." **\$699.99.**



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Our Powered Subwoofers

Our *Slave Subwoofer* uses the same woofer driver and cabinet, but does not include the amplifier or crossover. It can only be used in conjunction with the *Powered Subwoofer*. **\$299.99.** The new *Powered Subwoofer II* uses a 120-watt amplifier with an 8" woofer. **\$399.99.**

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We have assembled a number of home theater speaker systems that consist of center channel, surround and main stereo speakers. The combination we show here is our best seller. It includes our critically acclaimed *Ensemble* dual subwoofer satellite speaker system, our *Center Channel Plus* and a pair of our best surround speakers, *The Surround*. You could spend hundreds more than its **\$1,219.97** price without improving performance.

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CIRCLE NO. 9 ON READER SERVICE CARD

Erratic Tape Levels

Q *When I record or play low-level signals, the output from many of my analog cassettes (even brand-new ones) rises and falls like waves, sometimes ceasing altogether. This happens even when I record from digital sources. I have been able to raise the low signal levels by using a stack of cascaded signal processors, but the results are not perfect. Do I need a different kind of processor?—R. Anidjar, Holon, Israel*

A Since you experience this erratic performance with both analog and digital program sources, we can rule out the program sources themselves. And since you don't mention the problem occurring except on tape, I presume we can rule out your amp and preamp.

A common cause of wavering sound levels in analog cassettes is partial erasure of the tapes by a magnetic field. If the edge of the cassette faces a strong nearby magnet, the tape will be partially erased; as the tape unwinds in playback, you'll alternately hear strongly erased sections (from the part of the tape nearest the magnet) and weakly erased sections (from the parts that faced away from the magnetic field).

Another possibility is that something in your deck's record or playback circuits needs repair. If the problem occurs with prerecorded tapes and tapes you have recorded, check the playback section; if it happens only with tapes you made yourself, the recording section is more likely at fault. It also pays to check the cables going to and from your recorder. And try feeding your tape deck's output signal into a different input on your preamp, to make sure that input isn't at fault.

You did not mention whether you were using your signal processors before the problem first arose. If you were, one of them might be causing the difficulty. Try eliminating all processors from your signal chain, and run all signals directly from your program sources to your deck and from the deck directly to your preamp, integrated amp, or receiver. If the problem disappears, one of your processors is at fault. Try

adding your processors back into the signal chain, one at a time, and listen after each addition to see which processor brings the problem back. Pay special attention to processors that directly affect volume, such as compressors, expanders, or noise gates. If you have a noise gate, make sure you've set its threshold properly so that it does not remove low-level signals.

CD-to-CD Level Variations

Q *My "DDD" CDs seem to have significantly less sound output than my "ADD" discs. Because of this, I often have to adjust the volume from disc to disc. Why is this so? Or is it just my ears?—Steve Kim, Lawrence, Kans.*

A I often find differences in level between CDs regardless of whether they are digital all the way (DDD) or originate from analog sources (ADD). However, it could be that digital masters tend to be made with less limiting and compression, which would make their dynamic ranges wider but their average levels (and thus perceived loudness) lower. And because mastering engineers don't usually have to fully modulate a CD, they may not always take the trouble to ensure that they do.

CD Surface Imperfections

Q *Over the past two or three years, I have been gradually replacing my LPs with their CD counterparts. Most writers say that a CD will have a long and useful life unless air reaches its aluminum surface and oxidizes it. But about a quarter of my CDs show small imperfections, such as chips or cracks in the plastic, black or white particles embedded in the plastic, fingerprints, adhesive-tape marks, marks that seem to be on the aluminum surface, scuffs or scratches on the surface of the "playing" side, and a colorful sheen on the aluminum surface that could represent a stain or a separation from the plastic. Dealers are not usually thrilled to accept returns on the basis of these common irregularities. (I must admit that most of these discs play fine.) Which imperfections will cause air leakage and premature disc failure? This is very im-*

portant to me because I am building up a collection, and many CDs go out of print quickly.—William Woelfer, Lancaster, Pa.

A I know of no way to tell whether a CD that plays well when new will fail later. None of my discs have failed, regardless of their surface appearance, yet some of them date from CD's earliest days, when production techniques were perhaps less refined than they are now. The "colorful sheen" you mention is probably normal, caused by the way light interacts with the disc's pits. Small scuffs and scratches are usually invisible to the player's optical system, which is focused beyond them, on the aluminum layer. Fingerprints should wipe off easily with a damp cloth (just wipe from the center of the disc out, not in circles that parallel its rim). You might also want to get one of the repair kits designed to cover up scratches and other imperfections, as these products might keep air from attacking vital areas of the disc.

Speaker Impedances

Q *I usually don't listen to music and movies at high sound levels, but sometimes I do like to crank it up. If I get new speakers, will a 6-ohm loudspeaker whose impedance dips to 4 ohms give me any problems?—James Damiano, Dunwoody, Ga.*

A Whether a loudspeaker whose impedance dips as low as 4 ohms will prove troublesome depends on your amplifier (or the amp section of your receiver). Most amps can handle this impedance; those that have 4-ohm power ratings should certainly be able to. You're more likely to run into problems if you drive two pairs of 4-ohm speakers at once, but your amp's manual should warn you if such loads might cause distortion or damage the amp.

Big Bass in Small Rooms

Q *A store owner recently told me that it would take a room 55 feet long to reproduce a 20-Hz wave. If that's true, anyone buying speakers capable of reproducing really*

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 to 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.

low bass would be wasting his money. But if he's right, how can headphones produce bass when there's only an inch or so between their diaphragms and the listener's ears?—Jim Kichak, Palmer, Alaska

A Substantial bass can be produced in small rooms. The problem is not room size but room acoustics, which can be trickier when the room is small. Positioning speakers and listeners so that good bass will be heard is often difficult. Standing waves can make some bass frequencies loud at certain spots and almost inaudible at others. The larger the room, the more uniformly bass is distributed and the lower the frequencies at which standing waves occur.

In headphones, we're not dealing with waves but with changes in air pressure. Because of the tight coupling between the 'phones and your ears, the diaphragms act like pistons, forcing the air in your ear cavity to move with them. Break the coupling by pulling the earphones a fraction of an inch away from your head, and the earphones' bass will disappear.

Unbalanced Headphone Sound

Q When I listen to my new receiver through my new headphones, I find that one channel of the 'phones is slightly louder than the other. This is especially noticeable on monophonic recordings. Is this normal?—Name withheld

A It is not normal, assuming that your receiver's balance control is centered. The problem could lie with either the receiver or the headphones. You can check this by plugging your 'phones into someone else's system or borrowing another pair of 'phones and plugging them into your receiver. If borrowed 'phones sound fine in your receiver or your 'phones sound unbalanced on another system, then your receiver must be okay and your headphones need service or replacement. The opposite results would mean your headphones are okay and your receiver should be fixed.

Assuming the fault lies in your receiver, check to see if the sound is still unbalanced through speakers, with the receiver's balance control centered. If the sound is balanced, you have narrowed the problem to the voltage-divider circuit from which the receiver's headphone output is derived. Before sending it for repair, check the cleanliness, condition, and seating of the 'phone connectors.

Variable-Speed Tape Playback

Q Back in the '40s, '50s, and '60s, many of my relatives' conversations were recorded on a number of different open-reel tape decks. I would like to transfer these recordings onto cassette, but some of the recorded voices are noticeably higher in pitch than they should be. Apparently, some of the tape recorders ran a little slower than the one I am using for the transfers, an Ampex 1461 having three fixed speeds. Can the Ampex be modified so that tape speed can be adjusted?—John Park, Placentia, Cal.

A The speed of your particular tape machine's capstan motor depends on the frequency of its power source. If, therefore, you can find a source of variable frequency at sufficient power, you can connect the motor to this source. You would adjust the speed until the pitch of the voices on your old tapes seems right to you. You should disconnect the capstan motor from the rest of the electronics but not feed the electronics from your variable-frequency source, lest the source be "dirty" and introduce buzzes into the audio.

Some years ago I had a problem like yours, and I used a DC-to-AC converter. These devices, designed for boats or RVs, produce 117-volt, 60-Hz AC from 12-volt DC. By substituting a potentiometer for one of the resistors in the converter's oscillator, I was able to vary the frequency above and below 60 Hz. At its maximum output of 200 watts, my converter would draw about 25 amperes. Though a tape deck typically draws a lot less power, usually far less than 50 watts, the drain on the DC source will still be fairly high. You must either use a hefty 12-volt power supply or an automobile battery. (If you're using a battery indoors, be sure to vent it when it's being discharged or recharged.)

If you have a high-power audio amplifier that has a 600-ohm output (frequently found on public-address amps), you may be able to drive the motor from it, feeding in the signal from an audio-frequency generator set to about 60 Hz. Make sure that the amplifier can handle the necessary power level on a continuous basis; even if it can, it will run warm.

Revox (and others) made open-reel decks with variable-speed motors. It might be worthwhile to locate a machine of this type for your application. **A**

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ALMOST GOLDEN



This, to my regret, is scheduled to be the last "Audio ETC." After 49 continuous years with *Audio*, this is a thing I am not yet able to believe, though I am trying. So it is farewell.

We are all numerologists at heart. A few years back, I realized that my genes for aging were out of sync—I didn't feel half as old as I ought to, nor do I now. And so my numerical sense began craving for a 50th anniversary! So soon. And especially considering that *Audio* would also reach its 50th at the same time, at which point I might retire in the grandest numerical glory while helping the magazine celebrate as only I can do—the sole living member of the original *Audio* team and still in astonishingly good health. Well, numbers or no, it seems this is not to be. My Friday the 13th is 49. And so I

join the intrepid California Gold Rush Forty-Niners, who could not wait for 50 either.

Enough lamenting. I do not feel any need to defend this column, which has veered more and more toward personal audio history as time has marched on. Events that, for me, were simply everyday when they occurred now seem to be incredibly distant and forgotten, ripe for renewal and for revaluation. So, in that mode, I bring you our Beginning as perhaps only I remember it within the audio community.

AUDIO?
I HAD NEVER HEARD
THE TERM BEFORE
I MET C. G. McPROUD
IN EARLY 1947.

It was not the first time I had witnessed a special phenomenon, an established organization giving shelter to a fledgling enterprise desperately in need of support in order to get started. In 1924 my literary father founded *The Saturday Review of Literature* in New York, breaking away from the then conservative *New York Post*, where he had edited a weekly *Literary Review*. *The Post* was sold; the new owners promptly tossed out *The Literary Review*. Now, my Dad was the smoothest raiser of hard cash that I have ever known. In no time he got the money he needed, walked away from *The Post* with his entire staff intact, and started a new sheet—almost overnight—in the very image of the old. In no time it was well established, too, with spacious (relatively) offices and a dignified newspaper format. Money helps.

Only a short time later, Henry Seidel Canby (that is, Dad) was visited by a group of young men who had been his students at Yale University. They had a brand new magazine idea but absolutely no means to carry it out—could he advise? Yes. But what they most urgently needed (of course) was a place to work, one where they could hatch their unborn baby. My father was sympathetic, and in short order this junior crowd moved right into a spare room or two in *The Saturday Review* offices. There they stayed for a considerable time until they could afford a work-

place of their own. The new baby was christened *Time*, the Weekly News Magazine.

Audio? Move forward some 20 years to that turbulent, expan-

sive period right after World War II, when at last "the duration," as we liked to call it, ended. Then all heaven broke loose! Four years of enormous exertion dedicated only to war work had stalled progress in every sort of civilian area. Everything

Illustration: Rob Blackhard

had been "frozen"—either suppressed, rationed, or fixed in a prewar mode.

The first issue of this magazine, then called *Audio Engineering*, appeared in May 1947. As you can imagine, it was a remarkably early example of the new urge to catch up. (The first new cars, merely repeats of 1941 models, came in 1948.) Before that May, planning and production obviously had taken quite a while, though we were actually a conversion of an earlier and long-time mag called *Radio*, with which our new

**AUDIO ENGINEERING
WAS A BOLD TITLE
FOR A NEW
TECHNICAL/CONSUMER
MAGAZINE.**

Managing Editor and driving force (later Editor and Publisher), C. G. McProud, had been associated. And so, January, 49 years ago this month. Thinking must have begun even before that time and, I feel

sure, was largely due to McProud's vision and drive, though others obviously were aware that a new and separated technological area within the electrical field, audio, was overdue.

Audio? Where the term came from I do not know. Certainly I had never heard it before I met McProud, also early in 1947. Certainly, too, it was unknown to a public that had bought millions of phonographs and radios with "audio" inside! And unknown to most engineers as well. So our name, *Audio Engineering*, was a bold and forward-looking title for a new technical/consumer magazine.

But there was more to our Beginning, and mine with it—a surprise to many now though no more than everyday common knowledge in the field when it happened. There is a similarity between our then title and that of the organization called the Audio Engineering Society (AES). And that is no coincidence.

McProud was always scheming and was a calculated step or more ahead of himself in his pragmatic thinking. This was no idealist! He was a tough hombre when he wanted to be, which was often enough, and as ruthless as the next operator in any argument. But he had a most curious farsightedness that isn't supposed to go with such operators—rather with intellectuals, artists, and such. Otherwise, you understand, I would not have had the slightest chance of

becoming a member of the audio community at that time.

McProud merely heard me one day on my (live) WNYC radio program, a commentary on music (strictly classical), with 78-rpm records for illustrations. Within minutes, I like to think, he located me by phone and asked me over to his place, only a few blocks away. I remember nothing of that interview except McProud's Siamese cats, which when Mac said "Pssst!" would simultaneously jump 6 feet in the air. No matter. I was in! And very soon *Audio Engineering* took off, making an auspicious beginning.

At the same time, one other group of engineers—no, not young college grads this time—was working on a parallel idea for a new organization closely related, the AES. And who was right in there but McProud. The idea was a splendid one, actually, and at a very favorable moment, but the gentlemen lacked the wherewithal to launch such an expensive operation. More to the point, they desperately needed what every professional organization must have, an official journal.

I do not think they had to ask McProud and our new magazine for help. I expect he offered it, very quickly. This was part of his larger plan. By no means did all of his grand and pragmatic ideas come off, but this one did. The magazine *Audio Engineering*, this very magazine, became the official *Journal* of the nascent Audio Engineering Society. A separate section of each issue was prepared by the founders of the new Society, an organization still in the trauma of birth, like *Time* in the '20s. I wonder how many of today's AES officers are aware of this history.

Of the three AES titles that are presently mine, the first, Charter Member, was not my idea. McProud required it—or, should I say, ordered it. At that stage the Society was looking for names, I guess, and the more the better. My other two titles are another story—Fellow of the AES and, of course, through the passage of time, Life Member.

As you may imagine, the AES *Journal* in our magazine lasted only as long as was comfortably needed for the AES to establish its own publication, exactly as with *Time*

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and *The Saturday Review*. In both cases the contribution to what became two enormous enterprises was crucially helpful, if on a minuscule scale.

I wickedly think that C. G. McProud hoped to keep our connection going indefinitely, to the greater glory of his magazine. But that was only human, an understandable part of a sometimes vaulting ambition.



IN HIS FIRST YEARS AS PUBLISHER, McPROUD PRACTICALLY PUT THE MAGAZINE TOGETHER HIMSELF, BY HAND.

For all his scheming, he was the hardest worker I have ever known. In his first years as Publisher, he practically put the magazine together himself, by hand—then, often after midnight, he would stash the copy into his big Cadillac and drive all night from Mineola, far out on Long Island, to (I think) York, Pennsylvania, where he would oversee the actual press operation the next day. That was part of the plan too.

The conversion of our title to plain *Audio* was cleverly managed in a way that has always made me laugh. Instead of a dramatic (or not so dramatic) overnight change, the word "Engineering" simply began to shrink on the cover, while the other word, "Audio," got bigger and bigger. In a painlessly short time, "Engineering" faded away, and when it vanished nobody even noticed.

At my own 49th anniversary, I wish I could depart as painlessly! Not possible but, anyhow, happy 50th to all and—so long. A

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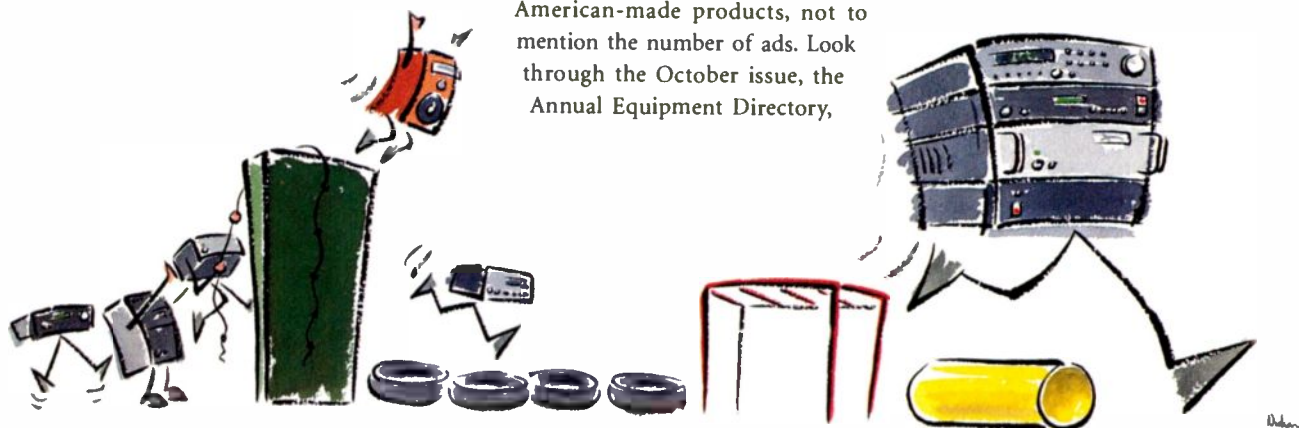
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BEAVIS AND BUREAUCRATS

Globalization is something we've been taking for granted for years. I mean, the popularity of *Baywatch* has probably done more to convince the world that all American women wear D-cups than anything since Jane Russell in *The Outlaw*. And you've got Italian teenagers spouting "cool" and "sucks," courtesy of Beavis and Butt-head, while the French think that the Americanization of the planet has gotten so out of hand that they're trying to

where else. And a company that opts out of selling in Europe because the new rules are so stupid will deny itself access to roughly a third of the global market for hi-fi. I don't have the exact population figures in front of me, but the whole of the European Economic Community (EEC) has close to 300,000,000 potential hi-fi buyers, far more than in the United States.

Why is this relevant to an *Audio* reader? Look through this magazine. Count the number of reviews about American-made products, not to mention the number of ads. Look through the October issue, the Annual Equipment Directory,



make the use of English illegal in business and advertising.

Hi-fi went global decades ago, with a common language, internationally recognizable specifications (even the Germans have all but dispensed with DIN standards when it comes to audiospeak), and the use of English legends on faceplates everywhere but Korea. Yet schisms remain, so it's appropriate that my first column of 1996 deals with what Europe's governing (commercial) body is doing to consumer electronics. They've created an "us versus them" scenario that's splitting the planet into two markets: Europe and every-

where else. And nearly every one of these companies owes much of its health to export. The Japanese may own the mass market, but the specialist sector is firmly Euro-American, with the emphasis on the latter. High-end audio is one of the few luxury industries that's dominated by American manufacturers. And now this near-monopoly is under threat.

Before you start thinking protectionism and trade barriers, I should tell you that what's happening in Europe is not specifically designed to prevent the spread of imports

through the region. Every manufacturer of products that take AC from the wall has to meet the new standards, regardless of country of origin. European companies are in the same boat as the Americans, the Japanese, the Chinese, or anyone else, so this really isn't a case of the Germans protecting the Germans or the French protecting the French. (Surprise, surprise!) Rather, it's a case of the dunderheads in Brussels making life difficult for everyone across the board, and the only people who'll suffer will be consumers. And small, specialist manufacturers. And their employees. And their suppliers. And their distributors and dealers and . . .

Very briefly, the new regulations are designed to make sure that we in Europe don't harm ourselves. It's a brand of thinking so bereft of logic that we still cannot believe it's actually happening. Before giving you

specifics, let me offer some analogies. It's as if a government decided, because some child cut himself with a steak knife, that in the future all knife blades must be dull. Or because another child poked himself in the eye with a pencil, all pencils must have a minimum diameter of 2 inches—er, sorry, 50.8 millimeters—but no point.

There are a few stories, possibly apocryphal, that attempt to explain how this grannyish approach to electrical goods came about. Naturally, on a continent almost exclusively using voltages between 220 and 250 volts, people are a mite neurotic

Illustration: Nishan Akgulian

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about things with AC cables. And the Scandinavians have grown particularly tetchy about myriad forms of radiation, e.g., that which pours forth from your PC monitor. Add this all up, and you have fingers pointing at computers and mobile phones—the fastest-growing market sectors in history—as the causes of this decade's greatest safety woes. With all that stray RF, it's surprising we're not all walking around with green hair and three heads, eh?

Because Brussels likes to overreact, the mandarins have painted/tainted everything with the same brush: If it uses AC power, then it's evil and potentially lethal and our citizens must be protected. However, the new limits on emission of, and susceptibility to, RF are indicative of the stupidity that the legislators have exercised, accusing all hi-fi products of the same presumed sins as mobile phones and computers. Don't these cretins know that the audio community has been fighting stray RF for decades? That "we" use power supplies so overengineered, compared to the crap in the typical PC, that you'd have to turn to the military to improve on them?

The mobile phone/computer problem is but one alleged source of the EEC's concern, however. The other is something that Ripley's will have fun with in 50 years. Apparently, some toddler managed either to take an AC cable and plug it into daddy's loudspeaker or to take a speaker cable and plug it into the wall, which is possible because certain European countries have AC plugs that are nearly interchangeable with 19-millimeter (¾-inch) spaced bananas. Because this unsupervised brat stuck something into the mains, every electrical appliance, hi-fi component, and anything else electrical now has to have completely insulated plugs and sockets—even if the plugs or sockets don't carry or conduct AC.

That's right. Banana plugs, RCA-type phono plugs, and naked spade connectors are all under threat, as are all-metal binding posts and phono sockets. With the exception of existing XLR-type hardware, it looks like every hi-fi component sold in Europe will have to wear newly insulated socketry. And even if this adds only \$1 to each product, you can imagine what it will do to the cost of already expensive imports overall.

But it gets better. The rumor mill abounds with tales of no more phono

stages because they're rife with RF. Other sad tales relate to electrostatic speakers: How do you keep a dimwitted Eurobrat away from a grid awash with 10,000 volts? And were you, perhaps, wondering about the heat issue? Apparently there's a temperature above which no exposed part of any

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consumer product must go. Will we see tube amps with cages the size of washing machines, to ensure that the surface temperature remains low enough? Just imagine what life will be like, too, for companies making hair dryers, waffle irons, toasters, clothes irons, or anything else in which heat is crucial to operation. Will the Euro-stove of the future be required to heat up food by wishful thinking?

Conspiracy theorists have already gone to work with this one, though they needn't have. The governing body of the European Economic Community has proven for decades that it embodies bureaucracy gone awry, with nonelected officials making life hell by banning cucumbers that curve too much, certain types of beers and traditional sausages, etc. As if they haven't enough serious stuff to deal with, like pollution, government corruption, screwed-up currencies, and unemployment. But the conspiracy buffs have a nice theory for this latest turn of events. It goes like this:

Flaunting the new rules is a criminal offense. One can go to jail for selling a product that has no sticker certifying it meets the new standards or for selling a product that does have the sticker but doesn't meet the standards, so the stakes have become absurdly high. Testing, for example, could cost as much as \$1,500 per product. Now, that isn't too painful for the manufacturer whose line has only three models, but even the tiniest high-end manufacturer might have a half-dozen or more. For two preamps, two power amps, a CD transport, and a DAC, a company is looking at \$9,000. And that nine grand might otherwise have

paid for a lot of advertising or wages or parts. If you think about it, which companies can laugh off \$9,000 or even \$900,000? Simple: the European and Japanese giants. Hell, they won't even be paying outside testers because they're wealthy enough to have their own test laboratories. So one wag suggested that these punitive costs are a way of wiping out scores of small, even insignificant, specialist manufacturers in one fell swoop. But, you're thinking, why should a company with sales in the billions worry about, for example, some manufacturer of tube amps with sales of \$1.5 million per annum? Simple: Add up the sales of all of the high-end brands, and you'll see that the chunk of the market they're taking is not so small after all. But even if it amounted to pennies, it's been suggested that the giants would still want to wipe out the specialists for one other, almost bizarre reason: ego.

Big as they are, the giants hate to see themselves outsold, in any market sector, by the little guys. That's especially true of the

IT LOOKS LIKE EVERY HI-FI COMPONENT SOLD IN EUROPE WILL HAVE TO WEAR INSULATED SOCKETRY.

Japanese giants, who presumably had no part in foisting these absurd rules on Europe. What's the one market sector where the Japanese giants have almost no presence at all outside of Japan? The high end. We all know that the major brands make high-end goodies, virtually none of which stands a chance in the United States or Europe. So if you wipe out all the opposition, bang! You can start shipping out your awful flagship dross to markets now starved of proper high-end wares.

But that just might be paranoia. I, for one, don't think that anyone at Matsushita or Philips or Sony really cares about the high-end market, because they don't want to deal with lunatic audiophiles, irrational retailers, psychotic journalists, or flavor-of-the-month market instability. They have far bigger fish to fry, so I still put this whole mess down to simple bureaucratic idiocy. Which, alas, we didn't take seriously when

the regulations were first announced, more than five years ago.

It was horrifying to learn, as recently as last June, that most American high-end manufacturers either hadn't even heard about the new regulations or thought they could ignore them. But the forces have been mobilized, and the EIA (Electronic Industries Association) and AAHEA (Academy for the Advancement of High-End Audio) are doing all they can to smooth the way for American manufacturers. Special mention must go to Michael Elliott of Counterpoint,

who's been helping all and sundry wade through the mass of regulations. And early reports suggest that the larger and better established high-end companies—Madrigal, Krell, and McIntosh spring to mind—have already dealt successfully with the various issues.

Just after this reaches print, I will be visiting the Las Vegas CES. I'm just hoping that, when I write my show report for the European magazines, I won't be tormenting the readers with tales of yummy hardware that will be illegal in Europe. A

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the trouble with



ately there's been a lot of discussion about jitter as a source of degradation in digital audio reproduction.

Although the engineers designing the gear have always had to deal with jitter, most audiophiles have probably been left somewhat mystified regarding the causes and consequences of this seemingly new threat—something to dread without knowing quite why. Jitter can add noise and distortion to the analog output signal you eventually listen to, but depending on its severity and where it occurs, you may never hear its effects at all.

by *Ken C. Pohlmann*

Jitter is fundamentally different in that it consists of timing errors in the transitions that represent bits in a digital data stream, which normally are controlled by very precise quartz-oscillator clocks designed to keep the intervals between them exactly even and correct for the sampling rate. Because we don't listen to the digital signal itself, jitter's effects are indirect rather than direct and, unlike wow and flutter in analog

levels will not prevent error-free transfer of digital signals from one device to another. When a signal enters or leaves the digital domain, however, conversion must be performed with very low jitter to prevent significant distortion from being added to the playback signal. In extreme cases, a converter's clock might have to maintain timing accuracy to within as little as 20 picoseconds, or 0.0000000002 second.

Figure 1 can help you visualize what such a specification means. Digital jitter can be defined as the time displacement of a clock signal versus a jitter-free ideal reference. The bottom two pulse trains in the figure

What is digital jitter, where does it come from, and how much does it really matter?

Perhaps the most common misconception about jitter is that it is essentially the digital equivalent of wow and flutter in analog systems. There is a germ of truth in that idea, in that both are in the category of what are known generically as time-base errors—inaccuracies or, more to the point for our purposes, instabilities in signal rate. In the case of LP playback, for example, the turntable is supposed to rotate the disc at exactly 33 $\frac{1}{3}$ rpm. The inevitable moment-to-moment deviations from that precise speed constitute wow and flutter and manifest themselves audibly (when they are large enough) as pitch instability. The greater the wow and flutter, the more wobble there will be in the reproduced sound. This mechanically induced distortion of the analog waveform also occurs in analog tape systems.

reproduction, never sound like fluctuations in signal speed, even though that is their root cause. What jitter *can* do is create data errors in the bitstream or add noise or distortion to the signal when it is converted from digital back to analog. So if the jitter in a bitstream is allowed to become too great, sound quality may deteriorate.

Jitter can arise when data is read back from a storage medium (such as a CD), transmitted, or processed through circuits such as digital filters and A/D (analog-to-digital) or D/A (digital-to-analog) converters. The extent of the damage caused by jitter, and the complexity of implementing cures for it, depend on where in the signal chain the jitter occurs. Relatively high jitter

are just time-shifted versions of the top one, which indicates a period of uncertainty around each ideal transition time. Jitter may occur as random variations in the timing of pulse edges (white-phase jitter), or it may be related to the width of a clock pulse ("white FM" jitter) or to other periodic or aperiodic events ("correlated" jitter).

One way of observing jitter is to use an oscilloscope to display an "eye pattern" (Fig. 2), consisting of multiple, overlaid

Ken C. Pohlmann is a professor of music engineering at the University of Miami in Coral Gables, Florida. He is the author of several books, including Principles of Digital Audio, Third Edition (McGraw-Hill, New York, 1995), from which much of this article was drawn.



jitter

waveforms of the digital signal. Indistinct amplitude variations in this pattern indicate noise, whereas shifting signal transitions show jitter. As you can see, noise closes the pattern vertically, while jitter closes it horizontally.

An eye pattern shows the dynamic variations in the signal, but a more insightful method applies the data signal to an FM demodulator connected to a spectrum analyzer; this will make the type of jitter plain, as

well as its amplitude and frequency. Random jitter exhibits a broadband spectrum and raises the noise floor in the analog signal reconstructed from the data. Periodic jitter, on the other hand, will appear as a single spectral line, at a low frequency for a slow clock variation or at a high frequency for a fast variation; the reconstructed signal may contain FM sidebands or modulated noise. A jitter measurement may be expressed as a peak-to-peak value or as a root-

mean-square (rms) value; ideally, the measurement's bandwidth should be specified. No single number can define the jitter's spectral content.

Interface Jitter vs. Sampling Jitter

It is important to differentiate between interface jitter (which occurs in digital-to-digital data transfer) and sampling jitter (which occurs when converting data into and out of the digital domain). Interface jit-

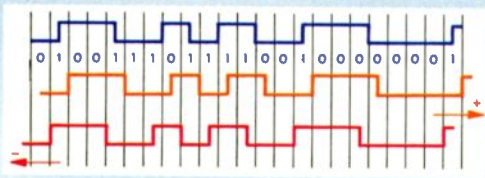


Fig. 1—Variations in signal timing result in time-base errors, known as jitter.

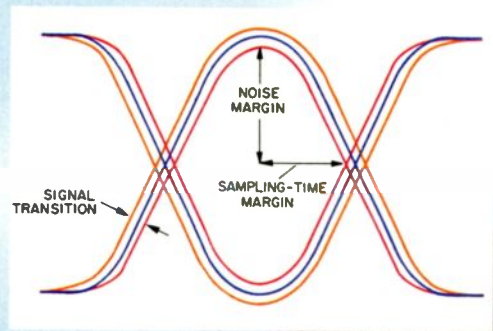


Fig. 2—The eye pattern shows noise and timing variations in digital signals.

ter is not a concern unless it causes uncorrected errors in the received signal. The receiver circuit of a digital input usually will be able to read correct data values in spite of relatively high jitter (and noise) levels in the data, but extreme jitter can diminish the

Although a PLL can provide some jitter reduction, it may not be complete. Consequently, the clock recovered from jittered data will usually be jittered as well. That's significant because jitter remaining in the data stream after it has been received can cause potentially audible artifacts in D/A conversion. Jitter can occur throughout the signal chain and will accumulate (or can be attenuated) as it passes from one circuit to another. Care should therefore be taken at each stage to decouple the bitstream from the jitter, so data is passed along without data error or conversion artifacts. Fortunately, even a badly jittered signal can be reclocked to an accurate and stable time base, a process known as jitter attenuation. In other words, it is possible to remove jitter from a data signal.

Transport Jitter

Speed variations in tape and disc transports (especially the former) can create jitter in the data signal. Such variations are

Although phase-locked servo systems can maintain relatively accurate and constant transport speeds, there will still be variations in the data rate off the disc or tape. Such jitter can be removed by reclocking the data through a buffer memory, however. Buffering is normally required anyway (in CD players, for example) for data demodulation and error correction, so transport speed variations need not be a factor in the jitter ultimately seen by the D/A converter. The reason buffering can be used to eliminate transport jitter is that the data output rate from memory can be independent (within reason) of the input rate. Consequently, an inconsistent data input from the disc or tape does not prevent precise data output. However, the clock controlling the data readout from memory must be decoupled from the input clock, because it is the output clock's jitter level that will determine the jitter level of the output data.

Jitter in Data Transmission

Jitter occurring when a data signal is conveyed through a transmission channel can have many causes. The magnitude of transmission jitter often depends on cable

Jitter can cause noise and distortion in A/D or D/A conversion.

performance to the point where the signal can no longer be retrieved, at which point data errors would result.

In most applications, digital audio data is coded to make it "self-clocking." Downstream circuits can then recover the clock that was used to create the data stream, enabling them to reestablish the time base and lock onto the data signal. It is therefore important for the receiving circuit to synchronize with the incoming bitstream. For example, in the face of unregulated speed variations in a digital tape recorder, a receiving circuit using a clock with fixed frequency would not be able to resynchronize the signal, even if its rate were nominally equal to the signal's clock rate. For this reason, receiving circuits commonly use phase-locked loops (PLLs) to align their clocks with the data rate of the incoming signal.

caused by eccentricities in the rotation of capstan and spindle motors or other drive components. Clocks and servos must be designed to limit mechanical speed variations, and input and output data must be buffered to absorb timing variation, at least to the point where the data can be passed to or from the transport without error.

Servo control circuits are used to read timing information from the data and generate a speed-correction signal for the tape or CD transport (Fig. 3). In many cases, a phase-locked loop is used to control the servo. Speed control can be achieved with a PLL by comparing the synchronization words in the bitstream (coded at a known rate) to a reference and directing a speed-control servo voltage to the transport to dynamically minimize the difference.

characteristics. In general, the wider a cable's bandwidth, the lower the jitter level. (For example, data may be literally error-free with a bandwidth of a few hundred kilohertz, but a bandwidth of several megahertz may be necessary for satisfactorily low sampling-jitter levels.) Data cables are also prone to mismatched impedances and signal reflections from cable ends, so proper termination is important.

Whatever the cause of jitter introduced by the transmitting source and cable, potentially (depending on whether the data will be subjected to conversion) the receiver has two tasks to perform: data recovery and clock recovery.

When data is transferred but will not be converted to analog at the receiver, only data recovery is necessary. Interface jitter is only a factor if it causes data errors at the receiver. (For example, when transferring

data from a CD player to a DAT recorder, then to a workstation, and back to the DAT recorder, only interface jitter is relevant to the data recovery.) Nevertheless, jitter attenuation may be required at some points in the signal path so that data errors do not occur. Relatively high jitter levels can be tolerated in transmission (for example, data with 10 nanoseconds of peak jitter can be conveyed without error).

When the data is to be converted to analog, however, clock recovery is also required. Clock jitter is detrimental to clock recovery because it may compromise the receiver's ability to derive a stable clock reference for conversion. Depending on the D/A converter design, jitter attenuation may be essential for satisfactory conversion.

A receiving circuit derives a clock signal from the input data, uses the clock to recover the data, and then regenerates a low-jitter clock, using it as the internal time base to reclock the data. (For example, a receiver might read a synchronizing field from an input data frame, place the data in a buffer, regenerate the clock, and then output the data with the accuracy appropriate to the destination.) Using a phase-locked loop to remove interface jitter can yield a sample clock that is accurate enough to avoid potentially audible jitter modulation products. To do this, an interface phase-locked loop accepts the received signal as a timing reference, measures the phase error between the reference and its own output, and uses the error to regulate a voltage-controlled oscillator (VCO) within the loop. Once locked, the oscillator will run at the reference frequency, yet be decoupled from the reference, preventing jitter from passing through the PLL on the output data or output clock.

Some receiver circuits use a two-stage clock recovery process. The first step is clock extraction: The received clock is synchronized so that the data can be decoded error-free in the presence of jitter. An initial PLL uses data transitions as its reference; the PLL is designed to track jitter well, but not attenuate it. At this stage, the sample clock may have jitter, so the recovered data may be sent to a buffer. The second step is jitter attenuation: A second PLL, with low-jitter clock characteristics, locks to the sample clock and retimes it with an accurate reference, providing jitter attenuation. The

new, accurate clock is used to read data out of the buffer.

Anyone who routinely copies data between floppy and hard disks can vouch for the reliability of digital cloning. Unlike the noise floor in analog copying, jitter is not inherently cumulative in digital copying. However, prior to D/A conversion, it is important for a receiver to limit jitter because the clock circuits used in many converters derive a timing reference from the received clock. Alternatively, any converter must clean the jittered signal, to recover a suitable low-jitter clock.

Jitter in A/D and D/A Conversion

Jitter must be controlled throughout the digital audio chain, but it is most critical at conversion points. Jitter must be minimized in the clocks used for both A/D and D/A converters to keep noise and distortion in the output analog waveform as low as possible. Because jitter in a clock signal can increase as the signal moves through wires or circuit-board traces, the low-jitter clock should be placed physically close to the converter.

For lowest noise and distortion, audio samples must also be acquired at the A/D converter with an accurate time base. That is, the sampling rate must remain as nearly constant as possible, with precisely equal intervals between samples. The effects of jitter on an A/D converter's clock can be similar to the frequency modulation used in FM radio: The input frequency acts as the carrier, and clock jitter acts as the modulation frequency. Jitter tolerances tighten as the audio signal frequency increases. Steve Harris [see References] has shown that if white-noise clock jitter with a 2-nanosecond peak level is applied to a successive-approximation, 16-bit A/D converter that does not use oversampling, then that converter's theoretical dynamic range of 98 dB will be degraded to 91 dB (Fig. 4). Harris estimates that peak jitter of less than 400 picoseconds will result in artifacts that decrease the dynamic range by less than 0.5 dB. By other estimates, a jitter specification of 250 picoseconds

will allow 16-bit accuracy from a full-amplitude, 20-kHz sine wave. Only then will the jitter artifacts fall below the quantization noise floor.

The integrity of samples taken from a perfectly clocked A/D converter will be degraded if the D/A converter's clock is jittered, creating the problem of the right samples at the wrong time. The time deviations introduced by jitter will result in increased noise and distortion in the output

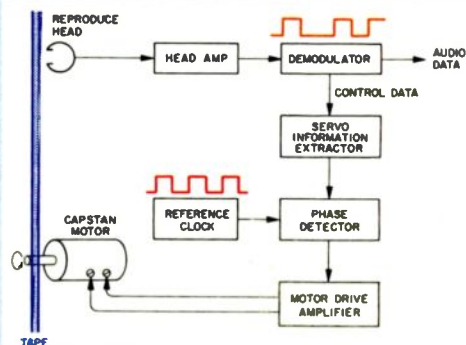


Fig. 3—A pulse-extracting servo-control loop can be used to regulate a digital tape's speed.

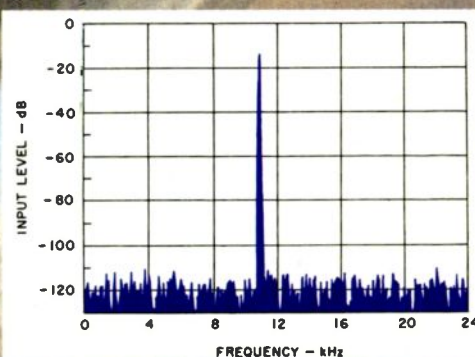
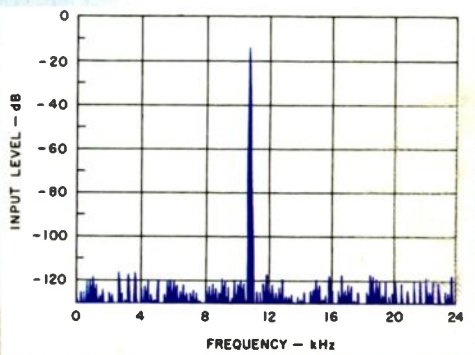


Fig. 4—Simulated noise spectra without clock jitter (A) and with white-noise clock jitter at a peak level of 2 nanoseconds (B). (After Harris, JAES.)

analog signal. Fortunately, the distortion in the output waveform is a playback-only problem; the data itself may be clean, awaiting only a more stable conversion clock. The samples are not wrong; they are only being converted at the wrong times.

The severity of jitter's effect on D/A conversion is related to the type of converter. The worst case for white-phase jitter on a conventional resistor-ladder multibit D/A converter occurs with a full-amplitude signal at half the sampling frequency. Depending on converter design, a jitter level of no

Because jitter control is critical at the D/A converter, and accurate sampling-clock recovery is always challenging at the converter, it is more efficient to create a highly accurate master clock directly at the converter and send this clock signal back to the transport, thus controlling jitter at the outset. This is more difficult to engineer when the transport and converter are separate components than when they are integrated, though "master-clock synchroniza-

Conclusion

Jitter must be controlled at every stage of the digital audio chain. Jitter at an interface is relatively benign, and if a receiving circuit can recover a data signal without error, jitter is not a factor. This is why data can be easily cloned from one device to another without error. Jitter is more critical when sampling, however; an A/D converter must be accurately clocked, and clock recovery is also important prior to D/A conversion.

Although jitter is difficult to measure and completely specify, traditional analog

Keeping jitter low is harder when the transport and D/A converter are separate.

more than 1 nanosecond is necessary to obtain 16-bit performance from a resistor-ladder converter. A tolerance of half that level, 500 picoseconds, is not unreasonable.

Some digital components may contain clocks with poor stability, in which case jitter may cause artifacts to appear just 70 or 80 dB below maximum output. When an oversampling digital filter is used in front of a resistor-ladder converter, the converter's sensitivity to random (white-phase) jitter is reduced in proportion to the oversampling rate. Low-frequency (correlated) jitter is not affected by oversampling, however.

Low-bit D/A converters can be very sensitive to clock jitter or not particularly sensitive, depending on their architecture. When the converter output is a true 1-bit signal, jitter pulses have constant amplitude. In a single-bit converter in which the output is applied to what is known as a continuous-time filter, random jitter is signal-independent, and jitter pulses will appear in the output even when no signal is present. A peak jitter level below 20 picoseconds may be required to achieve 16-bit noise performance from a 1-bit converter with a continuous-time filter. Some low-bit converters use switched-capacitor ("discrete-time") output filters; because a switched-capacitor filter will settle to an output value regardless of when a clock edge occurs, it is inherently less sensitive to jitter. A properly designed switched-capacitor converter's jitter tolerance is similar to that of a resistor-ladder converter operating at the same oversampling rate.

tion" facilities are becoming increasingly common in at least high-end CD transports and D/A converters. In most cases, the converter component must receive the digital bitstream and carefully recover a low-jitter clock. Audiophiles have sometimes reported hearing differences between different kinds of digital cables. That could be attributable to a D/A converter whose design is inadequate to recover a uniformly stable clock from the input bitstream. But a well-designed D/A converter with a stable clock will be immune to any variations in the upstream digital signal path, as long as data values themselves are not altered.

measurements, such as total harmonic distortion plus noise (THD + N), can be used to evaluate the quality of any output signal and will include effects caused by jitter. Indeed, given the wide variation in jitter sensitivity of different converter designs, such measurements are a far more reliable index of performance than measurements of the jitter level itself. For now, jitter is probably not a significant limiting factor in well-designed, high-quality digital audio equipment, but as new generations of digital formats and components come to market, with longer word lengths or higher sampling frequencies, the jitter tolerances required to maintain full performance will become more critical. A

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A R T O F V I N Y L

MOBILE FIDELITY'S

HERB BELKIN

ALTHOUGH THE SPECIALIST PRESSINGS WE CALL "AUDIOPHILE DISCS" HAVE BEEN AROUND SINCE THE 1950s, THE WATERSHED LABEL OF THE GENRE HAS TO BE MOBILE FIDELITY SOUND LAB. WHEN IT EMERGED IN THE LATE 1970s, IT DID ONE THING THAT MOST OF THE OTHERS WERE INCAPABLE OF DOING: MOBILE FIDELITY OFFERED KILLER PRESSINGS OF FAMOUS MATERIAL. INSTEAD OF SOME OBSCURE HAS-BEEN BORING YOU TO DEATH WITH AN ORGAN RECITAL OR SOME GERIATRIC JAZZER CAUGHT NEAR-DEAD DURING HIS LAST JAM, MOFI'S TITLES INCLUDED WORKS BY THE ROLLING STONES, STEELY DAN, THE BEATLES, FRANK SINATRA, THE KINKS, NATALIE COLE, AND OTHER ARTISTS WHO NEEDED NO INTRODUCTION.

HERB BELKIN, THE COMPANY'S PRESIDENT SINCE 1979, HAS STEERED THE LABEL FROM ITS PURE ANALOG ORIGINS INTO THE DIGITAL ERA AND BACK AGAIN, ENSURING THAT MOBILE FIDELITY PLAYED A MAJOR PART IN WHAT HAS BEEN REGARDED AS THE LP'S REVIVAL. HE TOOK THE TIME TO TALK WITH ME AT THE SUMMER CONSUMER ELECTRONICS SHOW, DISCUSSING IN HIS INIMITABLE MANNER SUCH TOPICS AS THE INSANITY OF OPENING AN LP PRESSING PLANT IN THE 1990s AND THE CONTINUED SURVIVAL OF ANALOG IN THE DIGITAL ERA.

K.K.

Before the tape recorder was switched on, we were discussing matters of "audiophile credibility."

And you clarified something that's been troubling me for months,

about Mobile Fidelity and how it's perceived. I think we actually do ourselves a disservice by being straight and honest. We don't hype anything. And I think that we've become a company taken for granted by people like you.

By me?!

No, not you personally. But you've helped me realize something. I'll give you an example. It's not really negative, but this is the reality: When [names a competitor] leaves the scene—which they will—they will have brought nothing to the business other than clever selection of repertoire and marketing. They're not a technology company, and they have no investment in technology. They rent their engineer, they rent their cutter, they rent their pressing-plant space.

On the other hand, all we do is keep building technology.

We build a record plant, and nobody gives a damn. I've gotta tell you something—it's the most unusual record plant on earth. It's built like a

CD plant. The few people who have come to it stand there with their mouths open! I can't get anybody interested in it. And you know why? We've been doing this the right way for so long that it's ho-hum to people. It's crazy. And you made me realize it.

People seem to acknowledge that you put your money where your mouth is and made a factory. That has not gone unnoticed.

I understand. But if we ballyhooed stuff and made up lines of bullshit about what we're doing and who we are, we'd get much more attention. It makes me...

You're not exactly what I'd call "ignored." You get a large amount of press, more mainstream press than any of the other specialist audio labels.

THE AUDIO INTERVIEW

BY KEN KESSLER

Only because we're so much bigger. This year Mobile Fidelity will do more business than the rest of the audiophile record industry combined. And it has nothing to do with any of them. It has to do with a perception people have.

But you're almost considered mainstream!

My pet peeve right now is that there's a particular audiophile reviewer whose only bitch with us is that he doesn't like our repertoire. He doesn't talk about the content of what we've done; he's skeptical about why we've picked something. What a stupid thing to do! Let him spend 4 or 5 million dollars on a company, and he can pick the ones *he* wants.

Perception-wise, and that's the point I'm trying to make, I don't know if there is anything that I can do about it. That reviewer has never written up the GAIN [Greater Ambient Information Network] mastering system, which is much more interesting than anything anyone else is doing. I look at the coverage of HDCD, and I'm amazed. HDCD is unproven. Nobody has it; there is no HDCD yet! [This interview took place before the release of the HDCD-

processed Neil Young *Mirror Ball* CD and the release of the majority of latest-generation CD players with HDCD-ready D/A converters.] I'm gonna get the fourth or fifth machine, because if it works, I'm gonna integrate it into GAIN. I don't know if it's going to work. Half the people who have listened to the HDCD sampler disc sit there and say it's terrific, while the other half say it's not very good.

It's not been that easy a ride for HDCD.

I don't know yet myself. The chip concept is an excellent idea, and if it works I'll incorporate it into our GAIN program. We've already figured out how to do it, to tell you the truth. That's what we're about. Every day, we've got to figure out a better way to do what we did yesterday. That's what our job is. It ain't about making money. We're lucky that in the last five years we've made enough to build a plant, to do other things. But nobody remembers that there was Nautilus and Direct-Disc Labs and Crystal Clear and Sweet Thunder. You know what? There were 22 audiophile record companies between 1978 and 1984—where are they now? Oscar Ciornei of Sheffield Lab told me this morning that he's recording new artists, and Telarc has become a mainstream classical and jazz label. Which leaves us just with Tam Henderson of Reference Recordings. Chesky didn't exist in those days. So it's Reference Recordings and Mobile Fidelity.

When did LPs start to taper off for Mobile Fidelity?

It's simple. In the fall of 1990, I was in Japan for a meeting with the Victor Company—JVC. The managing director of the audio disc plant told me that JVC had come to the decision that the plant where they made our LPs would be torn down and rebuilt as a CD plant. We had six months to decide what to do, to give them some orders and then they would be done. That was the end of it.

At that point we proceeded to order a year's supply of LPs. We mastered some more things and sent them off to JVC, while I went off on an odyssey trying to find a new partner to make phonograph records. I went to Sweden, Switzerland, Japan, Germany, Taiwan, and Korea. Everywhere I went they were closing down pressing plants. I wound up with three choices. There were companies in Switzerland and Bremen, Germany, and there was RTI in California. I chose the company in Bremen.

As we were working out the details of making these high-quality records, PolyGram announced that they were closing down their plant, and they gave all of their pressing business to the company in Bremen. They then turned to me and said, "We don't have time to Mickey Mouse with you." So after spending months with samples and tests, I was out on the street again.

So what did you do?

Now my choices were down to two. I returned to Switzerland, and lo and behold, the plant there had agreed to be the backup for Bremen if they overloaded. So again I'm out in the street. This took me up to early 1993. I then offered to buy into RTI and made Don McGuinness a proposal. He then told me that he had just signed a contract with Scientology and didn't need a partner. So I said, hey, that's terrific. By now I'm in the latter part of 1993. And then, as so very often happens in life, serendipity entered into it.

I got a call from a guy I had known years before, who said that Westwood One, a radio syndicating company, owned a plant that previously had made records for Nautilus and Crystal Clear. Westwood One had used it for 10 years to satisfy Army/Air Force networks and their own, and they decided to go to CD. So they told the employees that if they wanted to keep their jobs, they had to find a way to fill the plant up. They called me.

I went down there in a flash and said okay, let's start. Three months go by, and we're beginning to get some fair samples. Then Westwood One was sold to a big radio company.

That took about 60 days, and we then got a call from the guys we were working with. They said, "We just heard they're going to close our plant. They don't care about you. However, we told them that you might be interested in buying it."

I called the head of finance and said, "I'm interested in buying the plant. Give me a number." He gave me a number, we negotiated, and we had a deal. But when I went down there to sign the papers, he announced that they had one change to make. Now, this plant had been in Burbank, California, for 19 years, and they said, "We'll do the deal except you have to take on the responsibility with the Environmental Protection Agency for what's there under the ground."

I said, "Excuse me? Who knows what you guys have done?" They did plating there. So I said, "I can't do that." And they said, "We're not going to sell you the plant unless you do that. We have some-

SERENDIPITY
HAS REALLY
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HAVE ALLOWED
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AND PROSPER.

THE AUDIO INTERVIEW
WITH HERB BELKIN

body who'll buy it that way." So I said, "Good luck," and I left. Because I knew that couldn't be true.

The guys who were running the place were beside themselves because they could see themselves out of work. About a month went by, and I got another call from the head of finance. He said, "The only way we can sell you the plant is if you accept this responsibility. You didn't get this from me, but if you make an offer to buy the equipment, I think maybe we can make a deal."

How many pressing machines did they have?

Eight. They were the finest presses made, by Toolex Alpha, a company in Sweden. Two of them were still in the original packing; they had never been used. Two others were the most recent models that they had made before production stopped in 1984.

Again, serendipity occurred: I could not have made the 200-gram record if I had been in business with RTI. Their presses were not capable of making 200-gram LPs. So I couldn't have done what I wanted to do in the end if I had gone the other way.

In all of life I've discovered that "genius" is generally an after-the-fact phenomenon. Serendipity has really played a great part in the events that have allowed us to survive and prosper. And this was one of them. I was bound and determined at one time to make a deal with RTI. But we could not have made the record we are making today, which we call the Anadisc 200. I could make a real UHQR (Ultra High Quality Recording) with the presses we have, which is an additional 20 to 30 grams.

Is 220 to 230 grams the maximum that's sensible? Beyond that, is the extra vinyl superfluous?

I think so. My belief is that the 200-gram level [with Anadisc] is going to do exactly what the 220 to 230 would have done without it. That's what I'm hoping. Time will tell. That was the idea; I didn't want to make several forms of records.

In the briefest of terms, please describe Anadisc 200.

Anadisc 200 is the coming together of two different technologies, one having to do with pressing. We use our own vinyl formulation and our own proprietary approach to pressing, manufacturing on a 200-gram record. We press no more than 450 strikes from a set of stampers, and then it's finished. That's the physical end.

The other end, which is how an Anadisc gets to the point of the stampers, is the GAIN system. Nelson Pass designed the electronics, specifically for half-speed cutting, eliminating all of the historic impediments to clear information transmission. We think we have a state-of-the-art system. Normally there's about 42 different stages in the signal path, compared to five with Nelson's work.

So it shortens the signal path?

Absolutely.

And you were immediately blown away by the audible gains?

You bet.

I seem to have gotten us off track and interrupted your tale.

Well, we did arrive at an agreement to buy the Westwood One plant. Mobile Fidelity bought everything in the building that could be moved. We put the entire factory on flatbed trucks, a wagon train that wended its way from Burbank to Sebastopol [in Northern California]. It was very quick. But then we put everything in storage. I felt that if we were going to do this, we should do it the right way. I decided we should design a plant from the ground up, and I wanted it to be as competitive with a CD factory as possible.

All LPs, whether commercial or audiophile, were made in commercial factories, with special attention given when the records were audiophile. We had an opportunity to build the first *audiophile* pressing plant. And because of the community in which we're located, we could also make it an environmentally friendly one.

It took us six months to build the plant. We have air, moisture, and electrical filtration. We placed certain pieces of equipment in soundproof environments, we brought in the most energy-efficient boilers we could find, and we built our own cooling system. We took every conceivable step to make this, by '90s standards, a state-of-the-art factory for LPs.

Even better than what the Japanese had at the LP's peak?

Oh, yeah. Our Japanese supplier had a great factory, but it was intended to make commercial records and only a couple of presses were allocated to us. It was clean, though, like our factory is. I mean, you can have a picnic on the floor in our factory. You go to any other plant, and the difference is almost shocking. But we went one better:

Nothing goes outside. We recycle all of the water, and there are zero emissions and no leakage from this plant. The technology really didn't exist when the Japanese were making records. This is a 100% environmentally friendly pressing facility. And we return nothing to the atmosphere, to the sewers, the water system—zero.

There is nothing else like this plant. People who have come up have been awed, truly awed.

Are you doing pressing for any other labels?

No, although there are two or three people who we might work with. We look at our plant as an R & D facility. We have not put all eight presses on line; we have four on line right now.

Which came first, Anadisc 200 or the new pressing plant?

They were completely separate. When we brought Nelson Pass, Mike Moffat, Tom Tan, and our own in-house engineers together to start reviewing what would become the GAIN system, we looked at it from every aspect, starting with the tape machine. And that included a path through the digital in and out, as well as a path through the analog outputs. That was the beginning—we were going to do that no matter what, because it was my belief that we would find the right way to make the phonograph record again.



So for what parts of the process do you still have to go outside?

Just two parts. In terms of supplies, we don't make lacquers, which are the transfer vehicle from tape to LP format. That's alchemy—it's not even black magic. We have two domestic suppliers, Apollo in California and Transco in New Jersey. Each of them is also a resource for styli, which is the other replenishable aspect of disc mastering. We bring those things in.

The other part is plating. We work with Ed Tobin to create some unique steps in plating. We have a good relationship, a mutually reinforcing one, and he is the best. And again, plating is an art. [Mobile Fidelity, like Classic Records and some other companies still pressing vinyl], used the services of the legendary Ed Tobin at James G. Lee Record Processing for this crucial stage in production. Tragically, Tobin was murdered not long after this interview took place. At the request of his clients, Tobin had been training two other employees in the skill of LP plating.]

What was the first LP to come off the presses?

Muddy Waters' *Folk Singer*. The first records came at the end of 1993; we had to have them in time for the Consumer Electronics Show, shortly after New Year's Day. We pushed ourselves beyond what we thought we were capable of. We made those records, but we didn't feel that we were truly operational until the following May.

What problems did you encounter?

The mistake we made was acting on our own exuberance. We took those first LPs to CES, and we returned with orders. But we then had to make these things, and we weren't that good. We still aren't. This is a work in progress; I don't know if we'll ever be as good as I want us to be. The nature of what we do is that we're... unfinished goods. Our reject rate at the time of the Muddy Waters album was 50% for the first quarter. We have now gotten our reject rate down to about 12%. I think 10% is probably attainable.

It all has to do with attention to detail. If the people who are making records don't have the discipline that we require, they don't have that attention to detail. So we literally have to "grow" our own staff. The biggest fights I have in the whole company are with the guy who runs our plant. For 20 years he's been making records, and he thinks we're crazy. We have to quality-control him, and he's the guy who's supposed to be quality-controlling us. It's a great game.

Each of our machines is like a child. They have different temperaments, different personalities. So we're confronted with different kinds of problems. We're currently rebuilding each of our presses, one at a time. We're only going to put six up and will save two for cannibalizing and to use as prototypes if we have to machine parts. And if we have the demand, we'll start a second shift.

Some audiophiles would like to think that the future is black and round and analog, and there have been articles in the mainstream press about a vinyl revival.

It's several cult things, a mixture of several different influences. You

have these alternative bands, like Nine Inch Nails and Pearl Jam, who want to ensure that their fans have an opportunity to buy a cheaper version of their music, which the LP still would be. That was their belief. They forced their labels to get initial pressing runs in vinyl, which created a certain buzz.

And there still remains a limited digital backlash. I'm not sure it has anything to do with content. Digital, at its inception, promised an exceptional amount that it should never have promised. And people bought into it based on those promises. With a great deal of patience, they waited. And now, more than 10 years down the road, a lot of those promises have not been fulfilled. So many people believe that although digital is interesting and convenient and quiet, it is different. After they've had an opportunity to experience analog again, they're not sure that the quiet and the convenience are worth the difference. And that's what this is all about. The LP is not for everybody and is not a threat to the mainstream music manufacturer. The LP is a return to the audiophile's roots, but this is probably less true for the older audiophile than the younger one, frankly.

I've had young people come into our booth at shows, and I've sat them down and played them recordings, A/B'd stuff in blind tests.

Every time, they've preferred the LP over the CD. They think I'm lying to them when I tell them the results. We have a store at Mobile Fidelity, and people come out of the listening area talking to themselves. Because they really do hear the difference.

So you're pleased with the response to your return to LP manufacturing?

Absolutely.

How long was Mobile Fidelity without vinyl?

Three and a half years.

Was it hard getting back into selling LPs?

The sad thing is, during that time the nature of retail changed so dramatically. Now we're getting into the sad testimony of what's happened to the retail business, not only in America but in other parts of the world. The guys who are the big users and movers of CD have no interest in the niche business of vinyl, and the hundreds and thousands of small independent audio and record retailers have been annihilated by huge superstore chains. I have people now whose only role is to search out and find small independent retailers where we can place our LPs. Because as a policy, Mobile

Fidelity will not sell its vinyl releases to the chains.

Tower? Strawberry's?

No, sir. If they want to buy them from a distributor, they might be able to do that, but I'm not selling to chains. I feel an enormous sense of guilt in growing and being successful and having left a lot of my independent dealers behind who couldn't compete. This product is exclusively available to specialists. That's the way I want it to be. I want our LPs to be in the hands of people who have collectors and audiophiles as customers, who would use our LPs as reference discs and will also buy them because they're in love with the concept. So, no, we will not make them available to mass merchandisers. A

MOBILE
FIDELITY IS
A WORK IN
PROGRESS. I
DON'T KNOW IF
WE'LL EVER BE
AS GOOD AS I
WANT US TO BE.

**THE AUDIO INTERVIEW
WITH HERB BELKIN**

10 details
to look for
in your next
amplifier.





1. Enough power to rock a city block.

Great sound takes a lot of power. That's why Adcom's GFA-5800 power amplifier is built around an enormous toroidal transformer. The kind that makes most high-end stereo buffs listen and take notice. It has the highest power-to-weight/space ratio of any transformer design on the market. And because it is designed with totally separate secondary windings and independent ground

connections, each channel is completely isolated from crosstalk and AC line interference. Clear, powerful sound.

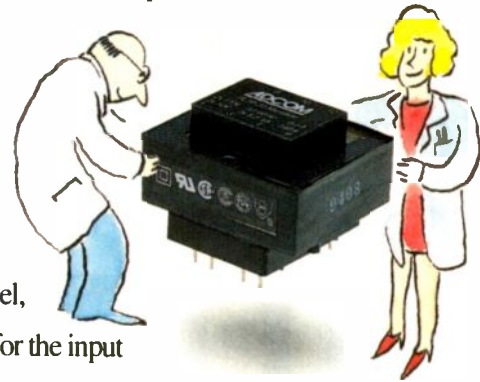
The kind your neighbors love to hear.

2. Front end power. In addition to the GFA-5800's main toroidal transformer, two separate "front end" transformers are also used. These additional devices isolate the front end input stages from the main output section.

And by using two transformers, one for the left channel and one for the right channel,

any peak demands from the output stages will not decrease the operating voltages for the input

sections. This design also contributes to ideal separation at the inputs for better soundstaging and more precise imaging.



3. Huge power supplies. Adcom's GFA-5800 power amplifier does something that most amps only dream of. It has exceptionally large capacitors, (over 100,000 microfarads of total filter capacitance), that are able to store large amounts of DC current for supply to the speakers. This large storage capacity means that the amp won't be starved for power when you're driving low impedance speaker systems. Now your speakers and your music sound the way you expect them to, all the time.

4. Circuitry that's in a class by itself. The GFA-5800's glass epoxy circuit board

is a testament to simplicity of organization and outstanding sound. Using single-ended Class "A"

circuitry in the front end, Adcom's GFA-5800 delivers the pure sound that other amplifiers

only talk about. And because the gain devices are biased by constant current

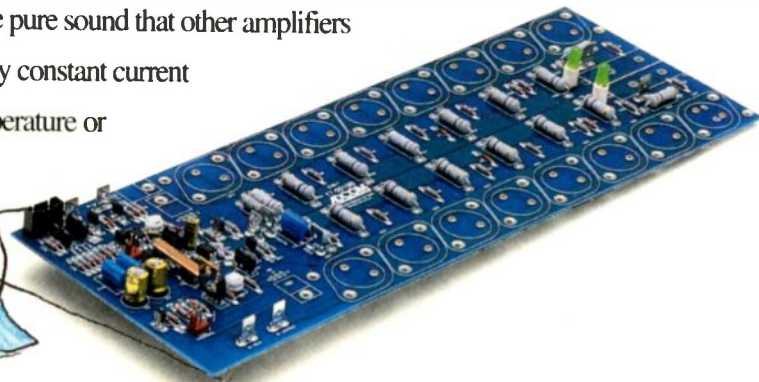
sources, they won't change their bias under changing temperature or

dynamic conditions. All devices are

precision matched for flawless performance

and negligible distortion, producing a high

damping factor and higher output currents.



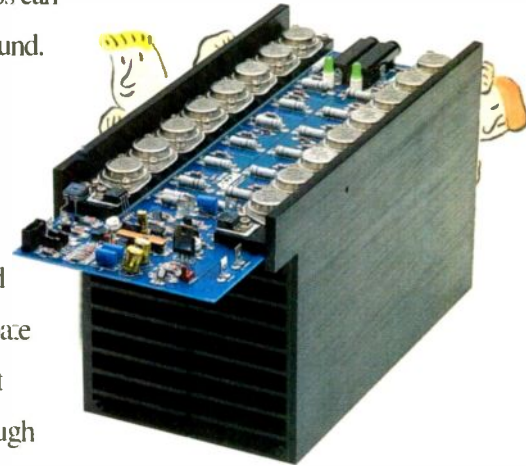


5. Transistors that sound like tubes. All transistors in the signal path of the Adcom GFA-5800 are 100% International Rectifier Hexfets. Hexfet circuits are reference grade, hybrid MOSFET transistors. These innovative circuits surpass conventional MOSFET technology, providing superior performance, consistency and reliability. Hexfet circuitry produces all the punch and muscle of bipolar devices with the sweeter sound of tube amps. The use of Hexfet circuits creates an efficient board with

direct gain paths. The GFA-5800 only has three gain stages while comparable amps can have five stages or more. The shorter the path of power resistance, the better the sound.

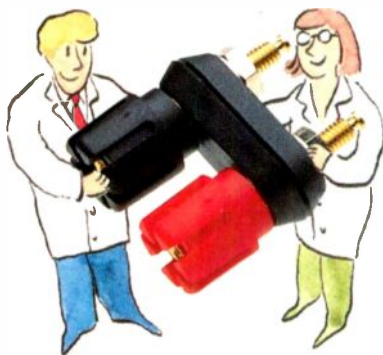
6. Cool running heat sinks. Making a reference class amplifier that delivers superior sound under all conditions is one thing.

Making sure it runs cool enough so it won't overheat is another. With Adcom's GFA-5800 you get both. Because of its oversized toroidal transformer, front end transformers and MOSFET circuits it requires an active cooling system to dissipate the heat that all superior power amplifiers create. By combining a state-of-the-art heat sink design with a micro-sized cooling fan, the GFA-5800 can blow air through a tunnel in the heat sink and dissipate up to 1500 watts on a continuous basis. This way your hottest tunes can stay cool.



7. No hassle speaker hook ups. The GFA-5800 comes with versatile binding posts for

easy speaker hook-ups. Accepting either standard stripped or "tinned" wires, single or dual banana plugs or spade lug connectors, the GFA-5800 is a great match for any system. And since it can drive virtually any speaker system, regardless of its impedance, even the most demanding speakers will sing beautiful music. Additionally, the GFA-5800 also comes equipped with two sets of binding posts for each channel. These extra binding posts allow the GFA-5800 to accommodate speaker systems that have "bi-wire" capabilities for extra output compatibility.



8. Great sound from the outside in. Adcom makes sure that the sound created by your other components is flawlessly transferred to the GFA-5800's balanced power and optimum circuit technology.

The GFA-5800 is equipped with two types of input connectors for complete compatibility, "Tiffany style", gold-plated RCA jacks and XLR jacks. The GFA-5800's professional grade three pin XLR jacks provide both positive, negative and shield properties. The result is a balanced line connection between the GFA-5800 and your other components. This connection is almost immune to electromagnetic and radio frequency interferences and provides a great reduction in "common mode noise".



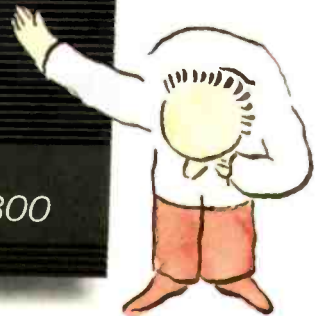
9. More quality than you bargained for.

Dollar-for-dollar the Adcom GFA-5800 out-performs any power amplifier on the market. Its dependable technology and efficient use of the highest quality parts makes it one of the most sought after audiophile products in recent years. And because it's an Adcom component it will benefit from a high resale value and an outstanding dealer service network. After you hear the GFA-5800 you'll agree that it's an incredible value in high end audio.



10. Make sure it's an Adcom.

The most important detail to look for before you buy your next amplifier is the Adcom name. Adcom audio components are designed to be second to none. It's this driving passion for accurate, musical sound and performance that has made Adcom components sought after by the discriminating audiophile. Through its combination of technology and innovative engineering techniques, the Adcom GFA-5800 is quite possibly, the best amplifier you may ever hear. From its toroidal transformer and giant capacitors to its revolutionary heat sink assembly and reference grade Hexfet circuitry, the Adcom GFA-5800 was built to be the best amplifier money can buy. Listen to all the details the GFA-5800 has to offer at your Adcom dealer today. We're sure you'll agree that the GFA-5800 is truly a sound investment.



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McINTOSH MCD7009 CD PLAYER



Anyone who has been around the audio industry for as long as I have can't help but reminisce over the early days of high fidelity, when brands like Fisher, H. H. Scott, and Harman Kardon dominated not just American hi-fi but the world's. And always at the top of the list was McIntosh. All

but Harman Kardon are now owned by Asian giants. But McIntosh, though now owned by Clarion, a Japanese company, is a case apart. McIntosh still designs and, for the most part, assembles products in upstate New York.

Physically, ergonomically, and cosmetically, the McIntosh MCD-7009 is most distinctive. It's large for a CD player, and its glass front panel glows invitingly. Five good-sized and well-spaced sculpted buttons lie on each side of the central display. On the left are "Open/Close," "Repeat," "Stop," "Pause," and "Play"; on the right are "REV" (reverse), "FF" (fast forward), "Back" (track skip backward), and "Next" (track skip forward). The last button, which is red instead of black, is "Power." A red lamp above "Open/Close" blinks as the tray opens and closes and glows continuously when a disc is loaded. Another lamp, above "Pause," indicates when that function has been activated.

From the remote, you can control all aforementioned functions except opening and closing the disc tray and turning power on and off. You can also access tracks directly via numbered buttons on its keypad. The remote's keypad and "Clear" button, together with a "PGM" button, can be used to program as many as 20 tracks for playback in any order. Program memory is retained even after the selections have been played or stopped. The program memory is released by pressing "PGM" once again or by pressing "Stop" twice.

Dimensions: 5 $\frac{3}{8}$ in. H x 17 $\frac{1}{2}$ in. W x 15 in. D (6.8 cm x 44.5 cm x 38.1 cm).
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You can check the memory by using the "Review" key; each tap displays the next program in the queue. Individual programs can be deleted by using "Review" to access the specific program and pressing "Delete." You can add programs by advancing to the desired point in the queue with "Review" and then entering the new program with the remote's numeric keypad—even after programmed playback has begun. "Delete" can also be used in conjunction with the numeric keypad to skip over particular tracks; the remaining tracks will then be played in consecutive order. You can inspect what's left in

the queue by following the "review" procedure outlined above. This McIntosh player also can be programmed to pause at

any point (for example, when you want to turn over a cassette that you're dubbing onto) by using "Pause" as if it were another program in the queue. When you're reviewing the contents of the program memory, the MCD7009 displays track number, program number, and total programmed playback time, so it's easy to determine when you have accumulated enough time to fill one side of your cassette. When you're playing a lineup that contains a pause



**THE MCD7009
IS DISTINCTIVE
PHYSICALLY,
ERGONOMICALLY,
AND COSMETICALLY.**

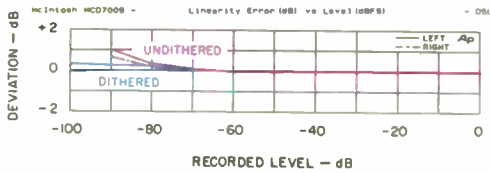


Fig. 1—Linearity error.

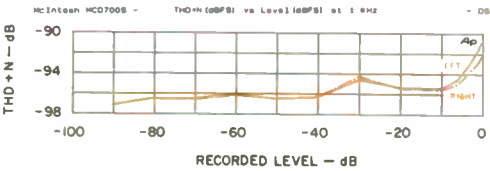


Fig. 2—THD + N vs. level.

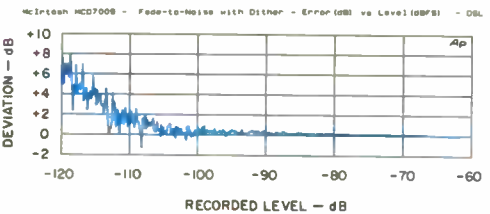


Fig. 3—Fade-to-noise test, with dithered signal.

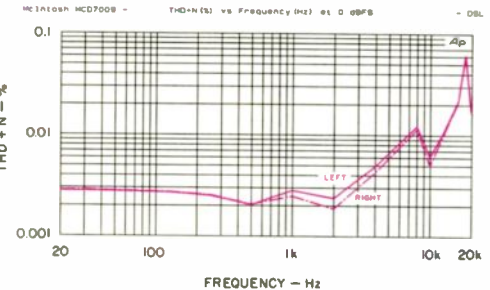


Fig. 4—THD + N vs. frequency.

command, the total-remaining-time display shows the time remaining to the pause point. You can program more than one pause into the queue but not consecutive pauses (which, in any event, would be meaningless).

The “Single” button can be used to play one track simply by pressing it and entering the track number. The single-play mode is released by pressing “Single” again. “Single” can also be used in conjunction with “Repeat” to repeat a single track. Used alone, “Repeat” replays the entire disc; if you use

the “A-B” button to mark start and stop points, “Repeat” replays that particular section of the disc. Musicians find this handy to analyze a specific passage, and it’s a feature relatively few players provide these days. If a program lineup has been memorized, “Repeat” replays the contents of the memory.

The remote carries “Index” search keys, another now-rare feature that I appreciate. An “Auto Space” pad inserts about 4 seconds of silence between tracks, and it can be toggled on and off. When the “Fade” key is pressed during play, the output level gradually diminishes and the MCD7009 pauses; pressing “Fade” again will resume play and fade the level up.

The “Time” button selects display of elapsed time on the current track, remaining time on the current track, or total remaining time on the disc (or to the next programmed pause). I found the display unusually legible.

The back panel is straightforward: gold-plated RCA jacks for the analog line outputs and coaxial digital output, a Toslink optical digital out, and two means of interfacing with McIntosh preamplifiers or system-remote components: a “Data In” jack for components that have a McIntosh “CD Data Port” and a seven-pin DIN jack for those that don’t. A small slide switch enables you to defeat the digital outputs when they’re not used.

Measurements

All of the test measurements were made with the CBS CD-1 test disc. Where only one data point is given, it is for the left channel or, where the possibility of significant interchannel differences prompted separate measurements, for the worse channel.

As far as these test results go, McIntosh devotees will find relatively little to complain about. Converter linearity, in particular, is exemplary, as seen in the plot of linearity error (Fig. 1) and the plot of total harmonic distortion plus noise (THD + N) versus level (Fig. 2). It’s relatively rare to

find a CD player whose worst-case linearity error is barely more than 1 dB at -90 dBFS—and that’s on an undithered track of the test disc. With a dithered track, the -90 dBFS worst-case (left-channel) error is only 0.29 dB (0.34 dB at -100 dBFS), and the right-channel error is virtually zero all the way down! The fade-to-noise curve in Fig. 3 tells a similar story, with an average error of less than 2 dB down to, perhaps, -113 dBFS.

Linearity measurements are made using 1-kHz recordings, where full-scale distortion can be expected to be low. The MCD7009 fares relatively less well in the test of THD + N versus frequency, which is taken at a series of points from 20 Hz to 20 kHz (each tone recorded at full level). As you can see from Fig. 4, distortion rises gradually above 2 kHz and spikes up sharply at 18 kHz. This likely results from a combination of high-frequency conversion inaccuracy (perhaps due to jitter) and a marginal reconstruction filter that permits intermodulation of the signal’s harmonics with the carrier. The rather unusual rise in frequency response above 8 to 10 kHz, seen in Fig. 5, lends credibility to my hypothesis about the MCD7009’s reconstruction filter.

On the more plebeian side, this player’s output level was about a decibel greater than the “standard” 2 volts, the output impedance was adequately low, and its chan-

MEASURED DATA

- Line Output Level:** 2.2 volts at 0-dBFS recorded level.
- Line Output Impedance:** 1,100 ohms.
- Channel Balance:** ±0.03 dB.
- Frequency Response:** +0.32, -0 dB, 20 Hz to 20 kHz.
- THD + N:** At 0 dBFS, less than 0.061%, 20 Hz to 20 kHz; at 1 kHz, less than -91 dB from 0 to -90 dBFS and less than -94.7 dB from -30 to -90 dBFS.
- Linearity Error:** At -60 dBFS, 0.01 dB; at -70 dBFS, 0.15 dB; at -80 dBFS, 0.42 dB; at -90 dBFS, 1.07 dB.
- A-Weighted S/N for Infinity-Zero Signal:** 118.3 dB re 0 dBFS.
- Quantization Noise:** -91.8 dBFS.
- Dynamic Range:** Unweighted, 95.7 dB; A-weighted, 98.5 dB.
- Channel Separation:** Greater than 114.9 dB from 125 Hz to 16 kHz.

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nels were exceedingly well balanced. The channel separation was superb in both directions, averaging about 115 dB, and A-weighted noise from the “digital-zero” track of the test disc was vanishingly low. Taken together, these specifics testify to excellent analog circuit design and layout. This opinion is reinforced by spectral analyses of the digital-zero and -60 dBFS, 1-kHz tracks of the test disc (Fig. 6). Hum related to the power supply, the only “line” components of significance within the audio band, is about -120 dBFS at 120 Hz and -125 dBFS at 240 Hz from the digital-zero track on the test disc.

The quantization noise and dynamic range tests exercise the D/A converter (the former over the converter’s full range, the latter using the 1-kHz, -60 dBFS test track). Therefore, this data reflects converter noise and distortion as well as the noise and distortion contributed by the analog circuitry. Although the MCD7009 did not do particularly poorly in these regards, it set no new records either—and, indeed, could be better.

Use and Listening Tests

I could not help but be dazzled by the McIntosh MCD7009’s tasteful illumination, clearly defined controls, user friendliness, and well-conceived features. Nor could I be anything but impressed by its smooth, silent operation. Its disc tray, for instance, glides open and closed with the surefootedness and silky smoothness of a pampered cat. Unfortunately, I did not find the player’s sound as silky or as surefooted as its mechanism.

I have always been impressed with Mitsuko Uchida’s ability to coax bell-like clarity from the tenor and soprano registers of her piano while maintaining a solid bass foundation. Yet on the MCD7009, her new recording of Schumann’s “Carnaval” and “Kreisleriana” (Philips 442 777) seemed plagued with an unusual treble brittleness coupled with a relatively weak bass line. Further, I found it difficult to distinguish between the two violins Itzhak Perlman used to record the J. S. Bach solo sonatas and partitas (Angel ZDCB 49483). Accord-

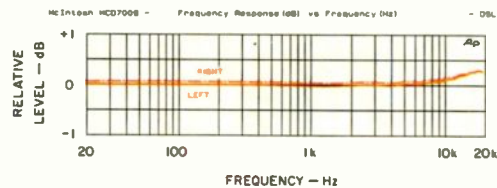


Fig. 5—Frequency response.

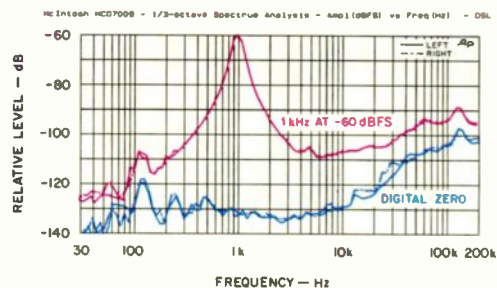


Fig. 6—Third-octave spectrum analysis.

ing to Perlman’s notes, he used his Guarneri del Gesù for most of the recording but the Stradivari of 1714 for the C major and A minor sonatas. On some players I can distinguish between the instruments, but both were rather scratchy on the MCD7009.

Matters improved somewhat on works of larger scale: the Borodin symphonies with Neeme Järvi and the Gothenburg Symphony (DGG 435757), the Handel “Messiah” by The English Concert conducted by Trevor Pinnock (Archiv 423631/2), and the Bach-Malloch “The Art of Fuguing” conducted by Lucas Foss (Sheffield Lab 10047-2-G). The MCD7009 was especially adept at preserving the ambient “tails” that are particularly well recorded in the Handel work, and I found the width of the soundstage quite good. It lacked depth, however, and I still felt the sound was overly bright in the treble and lacked a really firm bass foundation.

The nostalgia that McIntosh causes to rise in my soul may work to its disadvantage, for I must admit this feeling likely influences the standard to which I hold the company. The MCD7009 is not a bad player, and I would not wish to discourage anyone from buying it. But in my opinion, it is not a great player, and I find it hard to accept less than greatness from this venerable company.

The Experts On M&K Satellites And Subwoofers



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V-125



D. B. KEELE, JR.

MISSION 735 SPEAKER



Quick: Which speaker company is Number One in sales in the United Kingdom? KEF? B & W? No, it's actually Mission, according to GFK, a leading statistics-gathering firm in the U.K. Mission was founded in 1977 and is now part of the Verity Group, which includes two other well-known U.K. speaker companies, Wharfedale and Quad.

Last summer I visited the plant where Mission manufactures its high-end loudspeakers and electronics. I was extremely

impressed with the production and warehouse facilities, which operate with a level of automation, efficiency, and cleanliness that I have not seen in any other speaker plant. Farad Azina, Mission's founder, had the plant designed to be environmentally friendly, using natural resources sparingly and minimizing pollution.

Currently, Mission exports two lines of speaker systems to the United States, the recently introduced 73 series (\$249 to \$1,099 per pair) and the upscale 75 series (\$800 to

about \$2,000 per pair), which has been on the market since early 1994. The company will soon add a completely revised and updated Cyrus electronics line to its U.S. offerings, including amplifiers, preamps, CD players, and home theater components.

The Mission 735, at the top of the 73 series, is a tall, slender tower that contains four drivers: two 7-inch woofers, one 7-inch woofer/midrange, and a 1-inch tweeter. Although Mission describes the 735 as a three-way system, it is actually a modified two-way design with three identical woofers. The bottom two operate in a vented box, the top one in a smaller sealed chamber. All three work at low frequencies, while at higher frequencies the bottom two woofers are rolled off and the top woofer operates as a midrange driver up to the crossover frequency (specified as 3.2 kHz), where the tweeter takes over.

The 735's cabinet is made from medium-density fiberboard; the front panel is $\frac{3}{4}$ inch thick, and the rest is of $\frac{5}{8}$ -inch material. In addition to a shelf that divides the cabinet into two chambers, there's a single internal brace that connects the side panels in the larger bottom chamber, to minimize side-panel vibration. Spikes are provided and can be screwed into the bottom panel of the cabinet.

A custom-designed, injection-molded front baffle, made from a mica-loaded polypropylene, covers the front of the cabinet and, according to Mission, provides optimum acoustic loading for the drivers. The molded front baffle is also said to partially decouple the tweeter from the woofers, to reduce intermodulation distortion. The port, $2\frac{3}{4}$ inches in diameter and 5 inches

Rated Frequency Response: 60 Hz to 20 kHz, ± 2 dB; +0, -6 dB at 35 Hz.

Recommended Amplifier Power: 25 to 150 watts.

Dimensions: 41 $\frac{3}{4}$ in. H x 8 in. W x 13 in. D (105.9 cm x 20.3 cm x 33 cm).

Weight: 35 lbs. (15.9 kg) each.

Finish: Satin black ash.

Price: \$1,099 per pair.

Company Address: 400 Matheson Blvd. East, Unit 31, Mississauga, Ont., Canada L4Z 1N8; 905/507-0777.

For literature, circle No. 91



The tweeter is partially decoupled from other drivers by the molded panel design.

long, is molded into the bottom of the panel. The port is flared at its exit to reduce turbulence, and it contains an internal strengthening vane that gives it a distinctive look. The grille frame, made of injection-molded plastic, attaches to the front panel with a combination of pegs and press-fit couplings.

The molded front panel looks like a single structure with separate mounting bezels for each driver. In fact, however, it is four interlocking subpanels with the bezels molded in. To gain access to the bottom woofer requires removing each of the three higher interlocking subpanels, which are fastened by a total of 16 screws. The port is on the bottom of the fourth subpanel. It took me several minutes and a lot of head-scratching to figure all this out!

The three long-excursion, 7-inch woofers have see-through polypropylene diaphragms with rubber surrounds, mounted in stamped-frame baskets. A large ferrite magnet generates high magnetic flux for the 1¼-inch-diameter voice coil. The

**THE MISSION 735'S
VENTED-BOX WOOFERS
ROLL OFF TO LET ITS
SEALED-BOX WOOFER
HANDLE THE MIDRANGE.**

closed-back, Ferrofluid-cooled tweeter is a ring-radiator design with a 1-inch metal/polypropylene dome. The dome itself is covered by a protective metal screen.

The 735 employs what Mission describes as a "straight-path crossover network [that]

minimizes component-induced distortion, which would otherwise color complex, dynamical passages." The crossover is wired point-to-point and mounted on the back of the input connection cup, at the bottom of the rear panel. It contains just four components: one resistor, two ferrite-core inductors, and one capacitor, all of high quality. Connections between the crossover, drivers, and input panel are made with 18-gauge stranded wire. The wire is soldered to the crossover and connected to the drivers with clips.

The bottom two woofers, which are connected in series, are fed through a large inductor that forms a first-order low-pass filter at about 260 Hz (the -3 dB point, as determined by electrical measurement). The top woofer is fed by a much smaller inductor that forms another first-order low-pass filter, at a higher frequency. The tweeter is driven from a series resistor-capacitor network forming a first-order high-pass filter. No driver-impedance compensation networks are used. At low frequencies, all three woofers operate together, with the top woofer in parallel with the series combination of the bottom two.

Input connections are via a pair of five-way binding posts on the bottom rear of the cabinet. The terminals are spaced ¾ inch apart, so standard double-banana plugs will work. The two sets of terminals normally are linked by straps that can be removed for bi-wiring or bi-amplification. Wire up to ½ inch in diameter (10-gauge) can be accommodated by the terminals.

Measurements

The Mission 735's on-axis anechoic frequency response is shown in Fig. 1. Measurements were taken 2 meters from the front of the cabinet, on an axis between the woofer/midrange and the tweeter, 4 inches down from the top of the cabinet. A signal of 5.66 volts rms was applied (equivalent to 4 watts into the rated 8-ohm nominal impedance) and then referred back to 1 meter

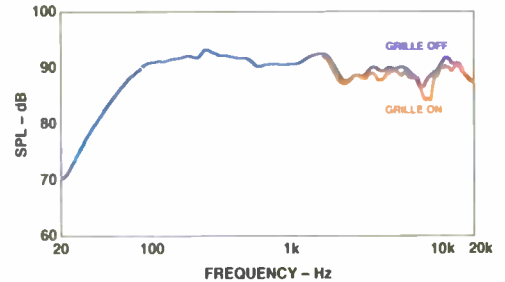


Fig. 1—One-meter, on-axis frequency response.

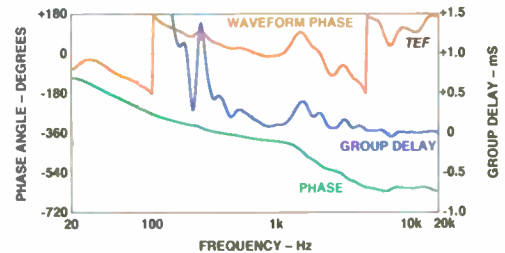


Fig. 2—On-axis phase response, group delay, and waveform phase.

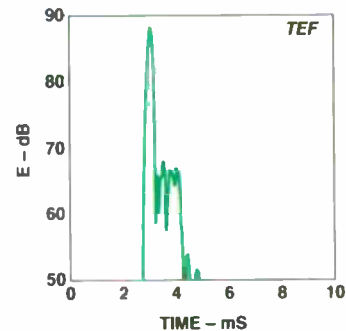


Fig. 3—Energy/time response.

with a 2.83-volt rms input (equivalent to 1 watt into the rated 8 ohms). I used a combination of ground-plane and elevated free-field measurements to derive the curve shown, which was averaged with a tenth-octave filter.

The curve in Fig. 1 is fairly smooth, with minimal roughness. It fits a fairly tight, 7-dB, window (+3, -4 dB referenced to 1 kHz) between 55 Hz and 20 kHz. The overall curve's level drops somewhat above 2 kHz, with two moderate dips at 2.2 and 8 kHz and a peak at 12 kHz. Below 2 kHz, the curve is flatter, with a slight rise between 80 and 500 Hz and a hump between 1 and 2 kHz. Below 50 Hz, the response rolls off at

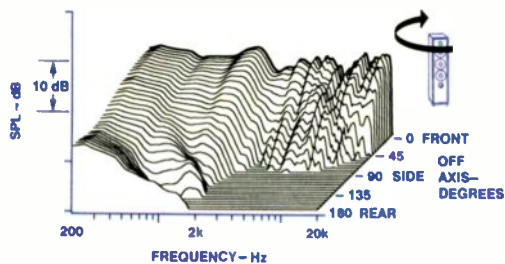


Fig. 4—Horizontal off-axis frequency responses.

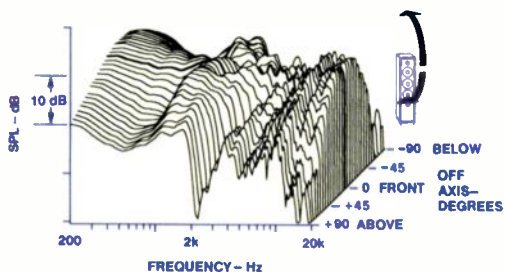


Fig. 5—Vertical off-axis frequency responses.

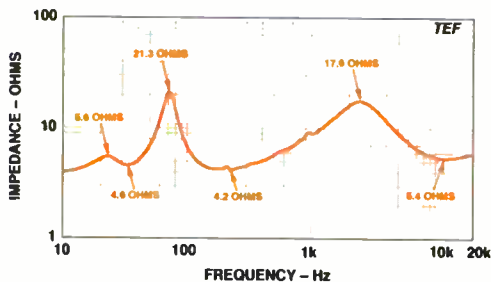


Fig. 6—Impedance.

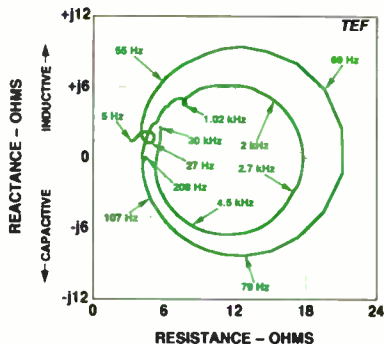


Fig. 7—Complex impedance.

about 12 dB/octave. With 90 dB as a reference, the response is 3 dB down at 55 Hz and 6 dB down at 45 Hz. Below 8 kHz and above 10 kHz, as you can see in Fig. 1, the grille causes only minor response variations. Between about 8 and 10 kHz, however, the grille reduces the response some 3 to 4 dB.

The Mission 735's sensitivity, from 250 Hz to 4 kHz, averaged out at 90.5 dB, just slightly above the manufacturer's 90-dB rating. The right and left speakers matched fairly closely, ± 0.75 dB from 100 Hz to 20 kHz.

Figure 2 shows the phase and group-delay responses of the 735, referenced to the tweeter's arrival time. The phase curve is quite smooth and well behaved. Averaged between 500 Hz and 3 kHz, the group delay indicates that the woofer/midrange output is delayed behind the tweeter's by about only 0.25 millisecond. The delay is due to a combination of electrical delay through the crossover and physical misalignment of the drivers' acoustic centers.

The waveform phase curve in Fig. 2 primarily indicates that waveforms will not be preserved over any significant bandwidth. (This is typical of all but the handful of speakers specifically designed to maintain near-constant waveform phase.) Only between about 400 Hz and 1.2 kHz does the waveform phase stay near zero, which means that waveshapes may be preserved somewhat, in positive polarity, for signals band-limited to this range. The jumps in waveform phase at 90 Hz and 5.1 kHz result from the way the curve is plotted, not from any discontinuity in the speaker's response.

Figure 3 shows the 735's energy/time response. The test parameters accentuate the speaker's response from 1 to 10 kHz, which includes the upper crossover region. Although the main arrival, at 3 milliseconds, is quite sharp and narrow, it is followed by lower-level

arrivals, 21 to 22 dB down and delayed about 0.2 to 1.2 milliseconds.

The 735's horizontal off-axis responses are shown in Fig. 4. (The bold curve at the rear of the graph is on-axis response.) These curves are quite well behaved and exhibit no high-frequency rolloff above 10 kHz in the main listening window, within $\pm 15^\circ$ of the forward axis. The good curve-to-curve uniformity indicates broad and even horizontal distribution.

Figure 5 shows the vertical off-axis responses. (The bold curve in the center of the graph is on-axis response.) In the main listening window, $\pm 15^\circ$ from the forward axis, the response is quite uniform on and above the axis. Below the axis, however,

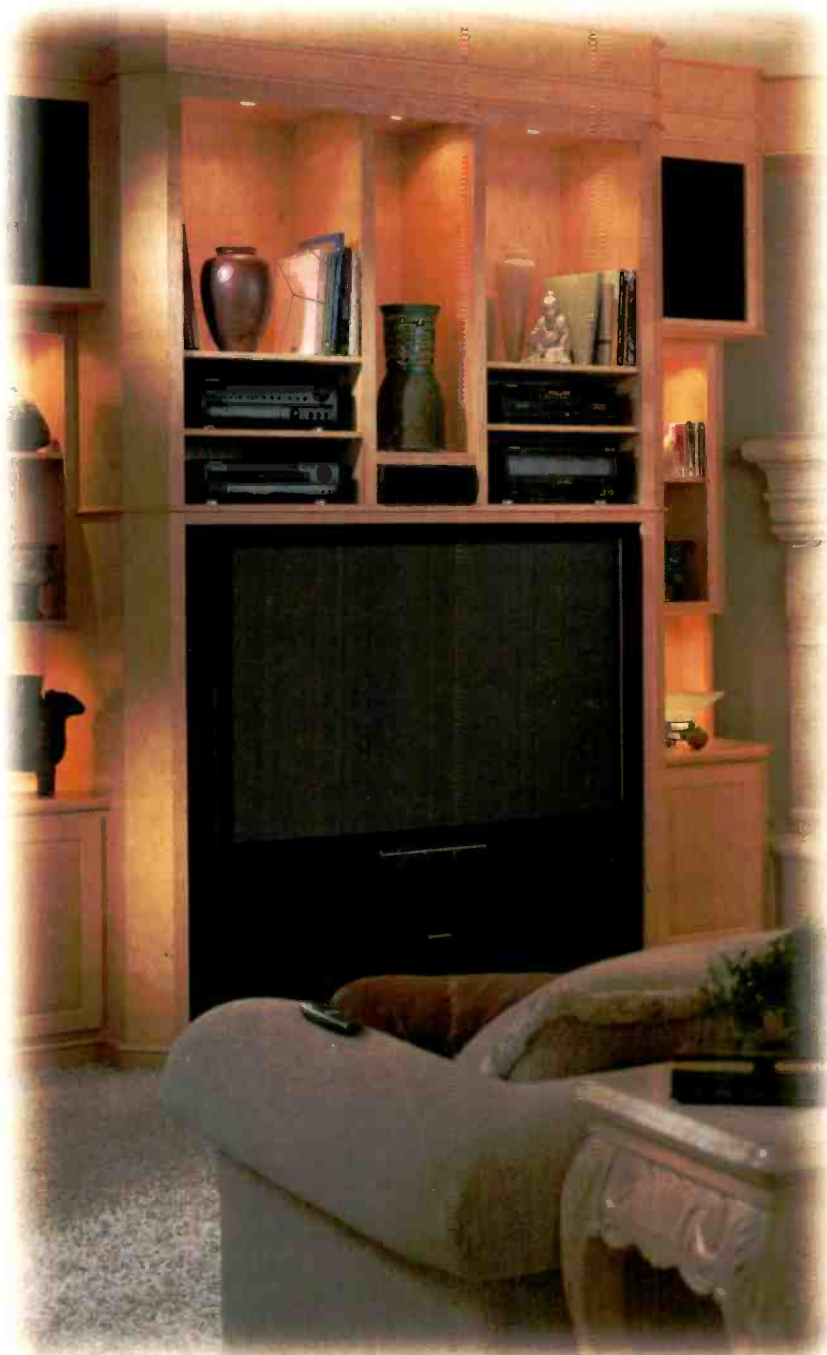
OFF-AXIS RESPONSE IS QUITE WELL BEHAVED, WITH NO ROLLOFF ABOVE 10 kHz IN THE MAIN LISTENING AREA.

there is a hole in the vicinity of the crossover frequency, between 3 and 7 kHz (not clearly seen in the graph). This indicates that the woofer/midrange and tweeter are partially out of phase through this range. Fortunately, the directional lobe at crossover points up rather than down. My comparison of on-axis responses, with normal and reversed tweeter polarity, revealed that the crossover frequency was closer to 5 kHz than the specified 3.2 kHz.

Figure 6 shows the 735's impedance magnitude. The impedance characteristic of a vented box shows up in the bass range, with peaks at 22.5 and 70 Hz flanking a dip at 34 Hz, the approximate box tuning. Uncharacteristically, however, the lower-frequency impedance peak is far lower in amplitude than the upper peak. This is because the bottom two vented-box woofers operate in parallel with the top woofer, which is in a closed box. The dissimilar impedance characteristics of the two different loading methods causes the widely different peak amplitudes. The 735's overall impedance variation between 20 Hz and 20 kHz is a moderately high 5 to 1 (21.3 divided by 4.2). Cable series resistance should be limited to a maximum of about 0.06 ohm to

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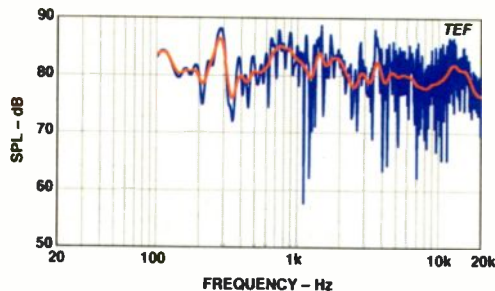
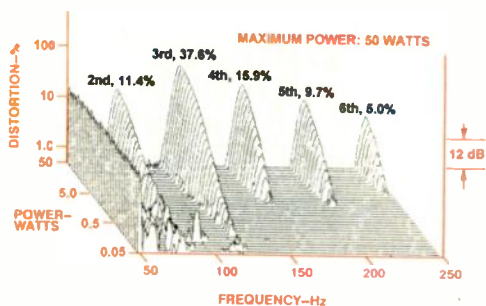


Fig. 8—Three-meter room response.



A

B

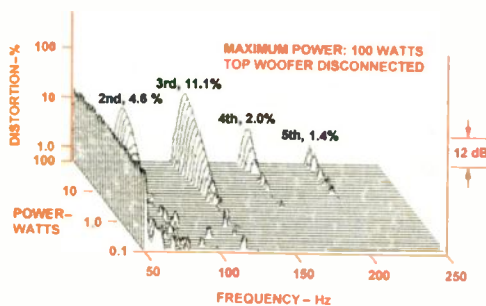


Fig. 9—Harmonic distortion for E_1 (41.2 Hz), with woofer/midrange connected (A) and disconnected (B).

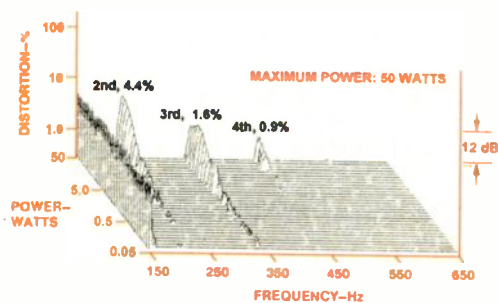


Fig. 10—Harmonic distortion for A_2 (110 Hz).

keep cable-drop effects from causing response peaks and dips greater than 0.1 dB. For a typical run of about 10 feet, that would mean using 14-gauge (or thicker), low-inductance cable.

The complex impedance is plotted in Fig. 7 over the range from 5 Hz to 30 kHz. Two large loops, corresponding to the impedance peaks at 70 Hz and 2.5 kHz in Fig. 6, dominate. The lower-frequency impedance peak at 22.5 Hz shows up as a small loop in the center left of Fig. 7. The minor impedance irregularities seen in Fig. 6 show up in Fig. 7 as very small loops at 208 Hz and 1.02 kHz. These very small loops are often due to internal acoustical or panel resonances of the speaker's enclosure.

A high-level sine-wave sweep revealed a fairly rigid cabinet. There was only one noticeable wall resonance (at 280 Hz), which involved the sides and top of the sealed chamber at the top of the cabinet. The 7-inch woofers had a fairly generous excursion capability of about 0.4 inch, peak to peak, and they overloaded quite gracefully. I detected no dynamic offset at any frequency or drive level.

The high-level bass sweeps made it immediately apparent that the sealed-box woofer/midrange was not high-pass filtered and hence operated all the way down into the bass range. This was evident because this driver's excursion was significantly greater than that of the bottom two woofers all through the bass range. This made the woofer/midrange much more susceptible to overload, which generates distortion, and it would always reach its excursion limits before the bottom two woofers.

The unequal excursions are due to the series connection of the bottom two woofers, which cuts their individual voltage drives (and hence their excursion) by half, and to their vented-box loading. At high levels at the 34-Hz tuning frequency of the vented box (where the box

loading minimizes cone excursion), the bottom woofers' excursion was hardly noticeable while the woofer/midrange cone moved considerably.

Figure 8 shows the 3-meter room response, with both raw and sixth-octave-smoothed data. The 735 was in the right-hand stereo position and aimed laterally at the test microphone, which I placed at ear height (36 inches) at the listener's position on the sofa. The system was driven with a swept sine-wave signal of 2.83 volts rms (corresponding to 1 watt into the rated 8-ohm impedance). The direct sound and 13 milliseconds of the room's reverberation are included. Overall, the averaged curve is well behaved and balanced and does not exhibit any extreme peaks or dips. The averaged curve fits a fairly tight, 10-dB, window. Prominent characteristics include a peak at 285 Hz followed by a dip at 340 Hz, both in the upper-bass (or lower-mid) floor-bounce region. There's a slightly broader peak between 700 and 900 Hz.

Figure 9A shows the 735's E_1 (41.2-Hz) harmonic distortion. Immediately evident are the high levels of distortion all the way

THE WOOFERS HAD FAIRLY GENEROUS EXCURSION, AND THEY OVERLOADED QUITE GRACEFULLY.

to the fifth harmonic. Particularly high are the third harmonic, nearly 38%, and the fourth, almost 16%. When I was conducting this test, it was obvious that the woofer/midrange was causing most of the distortion because of its great excursion. At maximum power at E_1 (20 volts rms, or 50 watts into the rated 8-ohm impedance), the woofer/midrange's excursion was past its limit, at about 0.45 inch (peak to peak), while the excursion of the bottom woofers was less than one-third as great.

The unequal distribution of power to the woofer/midrange and the bottom woofers prompted me to redo this test, this time with the woofer/midrange disconnected. I raised the input power by 3 dB, to 100 watts (28.3 volts rms), to compensate for the drop in acoustic output caused by the



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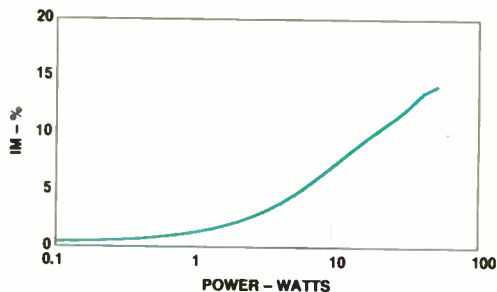


Fig. 11—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

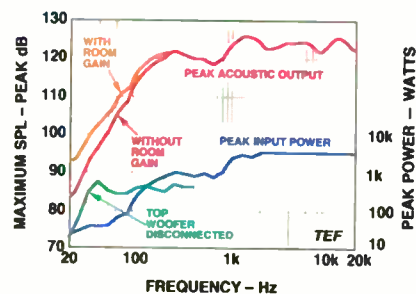


Fig. 12—Maximum peak input power and sound output.

absence of the woofer/midrange's acoustic output. The results are shown in Fig. 9B. Even at twice the power, the distortion is now considerably lower. The maximum distortion is only 11.1% at the third harmonic, and the fifth harmonic, at 1.4%, is very low. (The sixth harmonic was below the measuring floor of my analyzer.) With the Mission 735 connected normally and driven by a high-level sine wave at or above 15 volts rms (28 watts) in the bass range, the speaker sounded distorted and stressed. However, with its woofer/midrange disconnected, it sounded quite clean and effortless, even at levels of 28.3 volts rms (100 watts) and higher.

As seen in Fig. 10, the A_2 (110-Hz) harmonic distortion rises only to 4.4% second harmonic, 1.6% third, and 0.9% fourth. (Higher harmonics were below the floor of my test gear.) At this frequency, most of the distortion was again generated by the woofer/midrange.

The A_4 (440-Hz) harmonic distortion (not shown) was very low. It reached only 1.1% at the second harmonic and 0.7% at the third. (Maximum power was 50 watts for this test.)

Figure 11 shows intermodulation distortion versus power, a test using tones of 440 Hz (A_4) and 41.2 Hz (E_1) of equal power. The IM rises smoothly and reaches a moderate 14% at full power.

The 735's short-term peak-power input and output capabilities are shown in Fig. 12. (The input level was raised until the speaker sounded subjectively bad or the output waveform was quite distorted. I then calculated the peak input power by assuming that the measured peak voltage was applied across the rated 8-ohm impedance.) The peak input power starts somewhat low (20 watts), stays fairly low until 80 Hz (where it rises to 80 watts), and then rises rapidly to a plateau of about 900 watts between 200 and 800 Hz. At higher frequencies, the maximum peak input power rises rapidly, to about 3.5 kW, and then levels off.

Because the 735's ability to handle power was relatively modest below 100 Hz, I again disconnected the woofer/midrange and reran this test. That energized only the vented-box portion of the speaker, which contains the bottom two series-connected woofers. As can be seen in Fig. 12, the input power handling greatly increases between 20 and 125 Hz. At 40 Hz, it is 600 watts, almost 17 times higher than the 35 watts it had been previously, or 12.3 dB! The peak acoustic output will not increase this much, because the efficiency is lower at 40 Hz, by about 3 dB, when the woofer/midrange is disconnected. However, the effective increase in output will still be about 9 dB, or eight times more power, a very significant amount! Above 125 Hz, the maximum output of the bottom woofers drops below that of the three woofers combined, because of inductor-core saturation.

The peak acoustic output is also shown in Fig. 12, with the speaker connected normally. With room gain, the maximum peak sound-pressure level starts at a usable 94 dB at 20 Hz and then rises rapidly to cross 100 dB at 30 Hz, 110 dB at 62 Hz, and 120 dB at 130 Hz. The output then falls just a little, to 119 dB at 630 Hz, before rising into the very loud range of 122 to 126 dB above 1 kHz.

If you judge the Mission 735's bass output by the frequency at which the maximum output crosses the 110-dB SPL point (the lower the better), then this speaker is about two-thirds down the list of all systems I have tested. Yet even though it is fairly far down on the list, it is still ahead of

**AT 35 POUNDS APIECE,
THE 735s WERE EASY
TO LIFT AND REPOSITION,
EVEN WITH THE SPIKES
ATTACHED.**

such well-known speakers as the Thiel CS5 and Meridian D600. Operating the 735 with only the vented section working would lower the 110-dB point from 62 Hz down to about 37 Hz. The 735 would then be only one-third down from the top of my list.

Modifying the crossover to add a high-pass filter to the woofer/midrange would make the 735 a true three-way system. The vented-box section would then operate unrestricted and not be throttled back by the woofer/midrange. This would also significantly lower the Mission's bass distortion and increase its maximum low-frequency output.

Use and Listening Tests

When the Mission 735s were delivered to my lab, I was pleasantly surprised by the lightness of the cartons, compared to some heavyweights I have reviewed lately. Mission provided handholds on the sides of the cartons (a nice touch), so it was very easy for me to carry them alone. These speakers were also very easy to unpack. Once unpacked, the speakers were again easy to move around, as they weigh only about 35 pounds apiece. It was also easy to hook them up, because their rear terminals are quite accessible.

My review samples were quite good looking. The cabinet's molded front panel was a definite plus, giving the speaker a fresh, up-to-date look. Fit and workmanship were on a par with the best I've seen. The grille fit well and was easy to remove and replace, but the plastic frame appeared to be fragile and not very rigid; it may not withstand rough handling.

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competent
performance;
what I got
was magic”**

Thomas J. Norton

Stereophile Guide to Home Theater Vol. 1 No. 2

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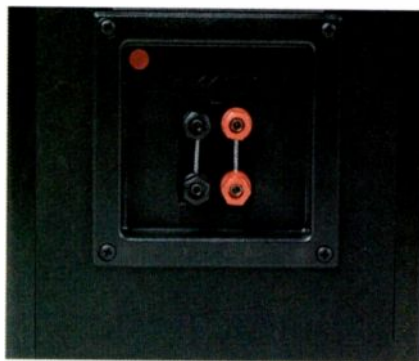
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The spikes were easy to attach to and remove from the bottom of the cabinet. By virtue of the speaker's light weight, I could easily lift it off the floor, with the spikes attached, and reposition it. On my thick carpeting, the 735 was somewhat tippy, side to side, when the spikes weren't attached; applying a lateral force of only about 2½ pounds on the top was enough to push the speaker over.

The 14-page instruction booklet is well written and very informative and covers the entire Mission loudspeaker line. The manual stresses that the speakers be subjected to a "running-in" period of 10 hours before you use them. I fulfilled this requirement by driving the 735s with a 10-volt rms, 20-Hz sine wave for 8 hours. The manual begins with a long list of "DO NOT"s, including an exhortation against the use of filters, tone controls, or equalizers. Other sections cover hookup, positioning, grilles, spikes, cables, bi-wiring, biamping, and ancillary equipment. A very useful technical section explains such terms as coloration, transient response, dispersion, and sensitivity.

The manual strongly recommends that all Mission speakers be placed 8 inches away from the wall behind them and that they should not be toed in or angled toward the listener. The distance from the side wall should be a minimum of 1½ feet. I positioned the Mission 735s both where I usually place speakers, 8 feet apart and far from the rear and side walls, and also much closer to the wall behind them. I experimented with both straight-ahead and angled-in orientations, listening 10 feet away from the speakers. When the 735s were close to the front wall, the bass took on a woolly and somewhat loose character, so I did most of my subsequent listening with them farther out in the room.

Octave-to-octave spectral balance on pink noise was quite acceptable, but the 735s did exhibit some tonality. When they were canted in, I heard some midrange tonal changes when I stood up. These variations were reduced when the systems were aimed straight ahead, as recommended. When I was sitting down, the sound was essentially the same with either aiming. On music, the sound was less direct and more reverberant when the speakers were aimed straight ahead. I preferred them canted in and did most of my listening that way.



Input terminals can be unstrapped for bi-wiring or biampification.

Listening gear included Onkyo and Rotel CD players, Krell's KRC preamp and KSA250 power amp, Straight Wire cabling, and B & W's 801 Matrix Series 3s as comparison speakers. The 735s required 3 to 4 dB of attenuation to match the lower sensitivity of the 801s.

The first CD I listened to was one that I brought back from my trip to the U.K., a sampler of choral works sung by the King's College Choir of Cambridge, *The Sound of King's* (EMI Classics CDZ 7 628 2). With this choral material, the sound was full-bodied and well balanced; overall, the 735s sounded quite similar to the B & W 801s. The Missions were slightly less smooth in upper mids and highs as compared to the B & Ws, although not obviously so. Vocal sibilants were emphasized somewhat.

**THE 735s IMAGED WELL,
SOUNDED NATURAL,
AND HANDLED ALL BUT
THE MOST BASS-HEAVY
MUSIC NICELY.**

On wide-range, complex orchestral music containing significant bass, the 735s made a very good account of themselves. They could be played loudly and cleanly when the material demanded it. However, on music containing high levels of low bass but without much else going on—such as the strong bass drum whacks on track 1 of *Winds of War and Peace* (Wilson Audio WCD 8823)—these speakers produced generous levels of bass, but with a character that was clearly distorted. Don't expect gut-

busting deep bass from the 735s. Yes, they can do justice to loud rock music, such as from Queen, AC/DC, and ZZ Top (I'm showing my rock 'n' roll age here). Although the 735s' bass was not as kicky as that of the 801s, I nevertheless found it quite satisfying.

On third-octave band-limited pink noise, the 735s did not generate any usable fundamental output in the 20- and 25-Hz bands; all I heard was distortion. They did come on fairly strong at 32 Hz, generating usable fundamental output but still with significant distortion. Close listening revealed that most of the distortion was coming from the woofer/midrange, as one would expect from the measurements. The story was much the same in the 40-, 50-, 63-, and 80-Hz bands.

The 735s did a worthy job on male speaking voice, with a character and balance quite similar to that of the 801s. Female vocals were also reproduced well. There was a bit of forwardness and sibilant emphasis, but the sound was very clean and had no harshness.

Stereo imaging and soundstage recreation were excellent. I heard just a slight forward movement of solo instruments. Stereo focus and stability of a mono center image were particularly good. Treble reproduction was crisp and clear, with good extension and no wiriness on orchestral strings.

The 735s' dynamic ability and quick transient response were readily apparent on Dean Peer's solo bass guitar on a super demo CD, *U-cross* (Fahrenheit FR 9403). These speakers' high sensitivity paid off well here.

In summation, the 735s performed admirably in most of my bench and listening tests. Only in bass capability did they present a dichotomous picture. On one hand, the Missions did quite well with the majority of bass-heavy selections, particularly those coupled with wideband spectral content. On the other hand, they fared poorly with material having high-level content restricted entirely to very low frequencies. In other respects—dynamics, spectral balance, stereo imaging, transient response, dispersion, coloration, and naturalness—the 735s did a very credible job and should be seriously evaluated, particularly considering their reasonable price. **A**

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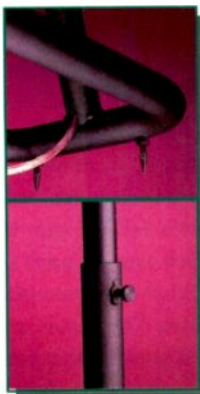
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EQUIPMENT PROFILE

BASCOM H. KING

MARANTZ SM-5 AMP AND SC-5 PREAMP



The SM-5 amp and the SC-5 preamp are the first Marantz components that I have ever formally reviewed, and what impressive gear this is!

There are those who feel that battery power supplies are best for audio equipment, and someone at Marantz evidently agrees, because the SM-5 and SC-5 share the BB-5 battery power supply. This supply, included with the SC-5, will also be available separately, which will enable SM-5 amps to be used with other preamps. The SC-5 preamp is completely powered from the BB-5, but the SM-5 amps use the BB-5 only for front-end power; the amps' output stages are powered by a conventional supply derived from the AC line.

In the SC-5 preamplifier, wide-bandwidth HDAM (High-Definition Amplifier Module) gain blocks, made of discrete devices, are used instead of the usual ICs for all amplification functions. Unusually, the

volume control is said to be implemented actively rather than passively. Instead of a balance control, separate level-trim controls, adjustable in 1-dB steps, are used for each channel. Unbalanced inputs are provided for a CD player, two tape recorders, five other line-level sources, and MM or MC phono. Additionally, there is one pair of balanced inputs, a pair of balanced outputs, and a multipin connector for the BB-5 power supply. The front-panel controls, all but one of which are rotary knobs, fall into two groups: selector switches (for input, phono mode, and "Rec Out") on the left and volume and level-trim controls on the right. At the bottom center of the panel is a pushbutton on/off switch.

The SM-5 amp has three selectable inputs, two unbalanced and one balanced, which could be useful for those with no preamp but several line-level signal sources. Front-panel controls consist of two calibrated rotary input-level knobs, a rotary input selector, and a pushbutton power switch. Rear-panel facilities include inputs, speaker connectors, a normal/bridged-mode slide switch, a connector for the BB-5 power supply, an IEC AC-cord socket, and an AC line fuse. I was impressed with the speaker connectors, which use large knobs to control thick, movable plates that clamp wire or spade lugs inserted into top openings on the connector assembly. Much to my amazement, they would accept and hold the thick, angled spade lugs on my Cardas speaker cables.

Marantz says the BB-5 can power one SC-5 and one SM-5 in stereo mode for about 7 to 8 hours. With two SM-5s going, the operating time on batteries decreases to about 5 to 7 hours. A front-panel meter shows the DC voltage available. Three front-panel pushbuttons allow selection of battery charge, AC operation while charging, or DC operation from the batteries.

All three components appear to be constructed of aluminum. The internal side pieces, front subpanels, rear panels, and bottom (but not top) covers are copper-plated. In the SC-5 preamplifier, a copper-plated subchassis is bolted to the side pieces; the main audio p.c. board is mounted to this subchassis with standoffs. A thick piece of felt covers the top surface of the subchassis, presumably to damp mechanical vibrations. The inside surfaces of the SC-5's side dress panels are similarly lined with felt.

On the main audio board, copper shields separate the phono section, the two output sections, and the

area where balanced input signals are converted to the unbalanced form used by the subsequent circuitry. Each functional area has two of the potted HDAM gain blocks plus a handful of such external parts as discrete transistors, ICs for servo functions, resistors, and capacitors. The phono section has two larger potted modules that presum-

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ably contain the moving-coil circuitry. Signals are carried to and from the main audio board by shielded cables. The main volume control is a beautiful, machined cylindrical piece, an Alps unit I haven't seen in any other equipment.

The BB-5 also has a subchassis, upon which all its components are mounted. The two batteries are nominal 12-volt types, rated at 3.4 ampere-hours apiece.

The SM-5 power amplifier contains two large heat sinks and a potted toroidal transformer, among other components. An internal shield separates the left-channel heat sink from the input amplifier module and from the signal input jacks on the rear panel.

In general, parts and build quality of these Marantz components are typical of

high-grade Japanese equipment—excellent but not quite up to the standards of elegance and perfection that I have encountered in the best American high-end gear.

As in most other preamplifiers with balanced and unbalanced inputs and outputs, the SC-5 converts balanced input signals to unbalanced ahead of the main signal selector and volume control. Relays are used for signal switching. The selected input signal passes to the main volume control, which (regardless of Marantz's claim) is a conventional passive

potentiometer. There are, however, active level controls in the SC-5: the level-trim controls that are used instead of a balance control. The attenuation resistors in these controls are actually shunt feedback resistors for the output amplifiers, which are fed directly from the preamplifier's volume control. Each output amp uses two HDAMs per channel, with a servo circuit to keep DC offset close to zero.

The HDAMs themselves apparently consist of a differential front end followed by a complementary gain stage that, in itself, can't drive much of a load. Every HDAM in the SC-5 is therefore followed by a two-stage complementary emitter-follower output buffer that is included in the particular circuit's negative feedback loop. In the phono preamplifier block, each HDAM is preceded by a discrete input stage. An RIAA-equalization feedback loop encloses the whole circuit. Switching between MM and MC gain modes is accomplished by changing the shunt feedback resistor.

In the SM-5 power amplifier, the selected input passes to the 1-dB/step input-level attenuators. The relay switching network that selects stereo or bridged mode feeds four HDAMs, two per channel, connected as unity-gain noninverting buffers. Another HDAM is the input stage for what I would

Table I— Output noise levels for SC-5 preamp's line section, with unbalanced input and output. Volume-control settings shown are full counterclockwise (CCW), full clockwise (CW), and worst-case (WC, which was typically at -6 dB). Unbalanced inputs were terminated with 1 kilohm, and balanced inputs were terminated with 600 ohms per phase.

Bandwidth	Output Noise, microvolts					
	LEFT			RIGHT		
	CCW	CW	WC	CCW	CW	WC
Wideband	39.9	52.7	53.7	40.0	65.0	110.0
22 Hz to 22 kHz	11.8	29.4	21.2	12.5	25.0	45.0
400 Hz to 22 kHz	8.4	11.3	13.7	9.0	18.0	45.0
A-Weighted	6.8	10.2	11.2	7.5	18.0	50.0

Table II— Output noise levels of SM-5 amplifiers.

Bandwidth	Output Noise, microvolts	
	LEFT	RIGHT
Wideband	119.8	122.2
22 Hz to 22 kHz	37.8	37.9
400 Hz to 22 kHz	37.0	36.8
A-Weighted	28.6	28.6

term the power amplifier proper. This is followed by an unusual arrangement of a complementary J-FET source-follower stage driving a complementary bipolar common-base stage, which in turn feeds a complementary cascode voltage amplifier. The output stage is a triple Darlington emitter-follower with four output transistors per channel.

Measurements

All of the following measurements were made with the BB-5 in AC-power mode. Using the battery-power mode made no difference in any of the tests. The majority of the measurements for the SC-5's line output section are for unbalanced input and output. If a characteristic was noticeably different in the balanced mode, it is noted.

Gain and sensitivity measurements for the SC-5 were essentially equal in both channels. Line-amp gain from the unbalanced input was 20 dB at the unbalanced output, nearly 7 dB higher at the balanced output, and -0.5 dB at the tape output; with balanced input, gain was about 1.5 dB lower in each case. Phono gain for MM input averaged 55.4 dB to the unbalanced output, 61.4 dB to the balanced output, and about 34.6 dB to the tape output; MC gain was just about 22.2 dB higher for all outputs.

AMP

Power Output: Stereo mode, 100 continuous watts/channel into 8 ohms or 200 watts/channel into 4 ohms; bridged mono, 400 continuous watts into 8 ohms.

Dimensions: 17 $\frac{7}{8}$ in. W x 8 $\frac{3}{4}$ in. H x 17 $\frac{1}{2}$ in. D (45.4 cm x 21 cm x 44.7 cm).

Weight: 70 $\frac{1}{2}$ lbs. (32 kg).

Price: \$7,000 each; requires BB-5 power supply.

PREAMP

Dimensions: 17 $\frac{7}{8}$ in. W x 5 $\frac{1}{2}$ in. H x 13 $\frac{3}{4}$ in. D (45.4 cm x 13.8 cm x 34.7 cm).

Weight: 29.8 lbs. (13.5 kg).

Price: \$8,000; includes BB-5 power supply.

BATTERY POWER SUPPLY

Battery Life: With one SM-5 amp and one SC-5 preamp, approximately 7 to 8 hours per charge; with two SM-5 amps in bridged mode and one SC-5 preamp, 5 to 7 hours per charge.

Dimensions: 17 $\frac{7}{8}$ in. W x 5 $\frac{1}{2}$ in. H x 13 $\frac{3}{4}$ in. D (45.4 cm x 13.8 cm x 34.7 cm).

Weight: 35 $\frac{3}{8}$ lbs. (16 kg).

Price: Included with SC-5 preamp.

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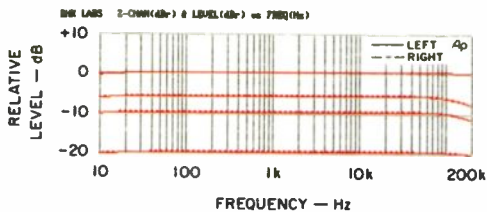


Fig. 1—Frequency response of SC-5 preamp vs. volume setting.

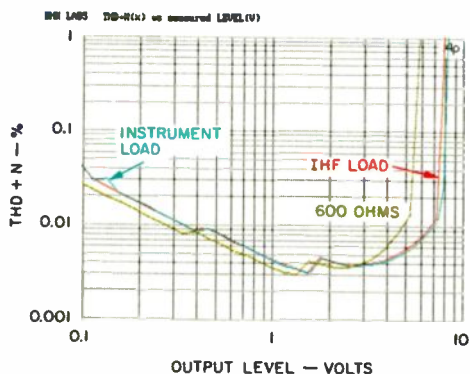


Fig. 2—THD + N vs. output level, SC-5 preamp.

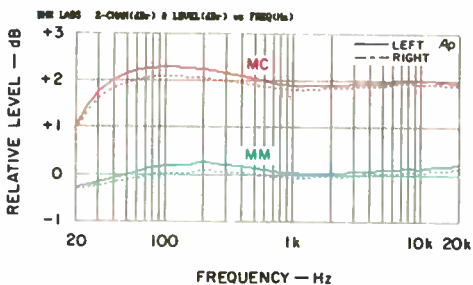


Fig. 3—RIAA equalization error.

The SC-5 preamp has no AC cord.



Line-section sensitivity for unbalanced input was 49.7 millivolts at the unbalanced output, 25 mV at the balanced output, and about 532 mV at the tape output. For balanced inputs, the results were about 60, 30, and 648 mV, respectively. Phono sensitivity with unbalanced output was about 850 microvolts for the MM input and 66 μ V for the MC input, while sensitivity with the balanced output required just about half

those figures. Phono sensitivity at the tape outputs was about 9.3 mV for MM and 727 μ V for MC.

Frequency response as a function of volume-control attenuation for both channels is shown in Fig. 1. Clearly, the SC-5 is a wideband design. Further, a rough idea of the interchannel balance error can be gathered from the figure. At the -6 dB point, the volume-control circuit has its lowest high-frequency cutoff point. At lower settings, response flattens out again, as shown by the -20 dB curve. Response remained constant at lower settings (not shown) and at various level-trim settings. Interchannel balance error was within 0.5 dB down to 96 dB of attenuation, and actual attenuation was within 4 dB of the front-panel markings between -40 and -80 dB. With the volume control at maximum and gain trim at -6 dB, rise and fall times (with instrument loading at an output level of ± 5 volts) were about 380 nsec, which corresponds to a -3 dB point (or an equivalent bandwidth) of some 920 kHz. With an IHF load, the rise and fall times increased to 500 nsec, for a bandwidth of 700 kHz. With the volume set to -6 dB, rise and fall times increased to about 1.4 μ sec, for an equivalent bandwidth of some 250 kHz. This is, indeed, one fast circuit!

The SC-5 did not invert signal polarity with unbalanced or balanced input and output. However, polarity was inverted for balanced input with unbalanced output (and vice versa).

Common-mode rejection of the balanced inputs (not shown) rose at about 6 dB/octave from a level of -60 dB at 10 Hz to a bit less than -10 dB from about 10 kHz up; this was a bit disappointing for what appears to be sophisticated circuitry. Both channels behaved identically.

Total harmonic distortion plus noise (THD + N) is plotted in Fig. 2 for unbalanced input and output of a 20-kHz signal.

As can be seen, the IHF load slightly lowers the output level at the onset of clipping, and the 600-ohm load is driven at low distortion to above 5 volts rms. In the balanced input and output mode (not shown), maximum output was about 13 volts before clipping, with instrument or IHF loading, and distortion reached a low of 0.001% to 0.002% for outputs of 5 to 10 volts. With a 600-ohm load (which is really 300 ohms per driving phase), maximum output was about the same level seen in the figure. The SC-5's distortion performance is quite good.

The preamp's interchannel crosstalk was down more than 80 dB from 20 Hz to 4 kHz; it rose at 6 dB/octave to about -67 dB at 20 kHz. High-frequency crosstalk was

**RISE AND FALL TIMES
DEMONSTRATE
THAT THE SC-5 PREAMP
IS ONE FAST CIRCUIT!**

better in the balanced input and output mode, remaining more than 80 dB down at 20 kHz.

The SC-5's output noise as a function of bandwidth and volume-control position is listed in Table I for unbalanced input and output. An intermittent sputtering noise in the right channel at the -6 dB volume setting prevented my getting all the noise data desired for that channel, so the left-channel data is more representative. I also measured IHF signal-to-noise ratio (S/N for 500 mV in and out) for all input and output conditions. I found the S/N at the unbalanced outputs was a bit lower when measured for unbalanced input (95.5 dB for the left channel, 90 dB for the right) than for balanced input (97.7 and 94 dB, respectively). However, S/N at the balanced outputs remained constant for either type of input, measuring 93.0 dB in the left channel and 91.5 dB in the right.

The Marantz preamp's input impedance was 10.2 kilohms for balanced inputs, independent of volume setting. With the unbalanced inputs, the input impedance was 5.2 kilohms with the volume control down in

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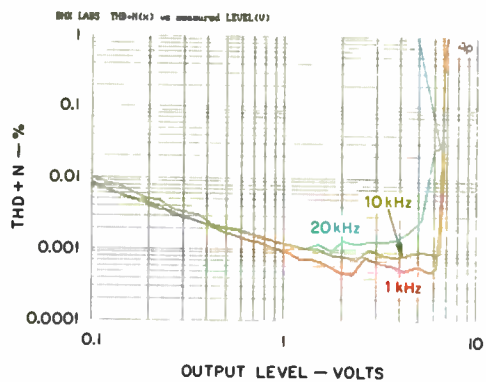


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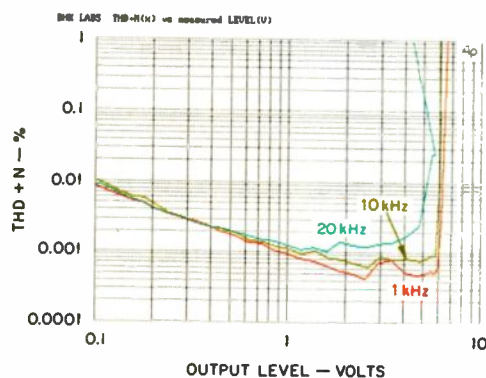


Fig. 4—THD + N vs. output level with instrument load (A) and IHF load (B), MM phono section.

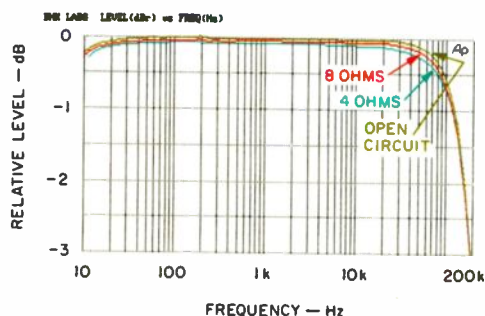


Fig. 5—Frequency response of SM-5 amp.



The SM-5 amp has unusual speaker connectors.

the working range and 4.5 kilohms with the control fully up. Output impedance was 100 ohms for the unbalanced outputs and 200 ohms for the balanced outputs. The DC offset, measured at pins 2 and 3 of each channel's XLR output jack, was a maximum of 1.4 mV.

RIAA equalization error of the SC-5's phono section is plotted in Fig. 3. Results are shown for instrument loading; IHF loading reduced the overall output level by some 0.8 dB and the high-frequency response at 20 kHz by about 0.07 dB.

Figures 4A and 4B show THD + N in the MM mode. The strange foldback in the 20-kHz curves is a real phenomenon. At frequencies near or above 20 kHz, the SC-5's phono circuit virtually paralyzes whenever a certain input level is reached. While distortion is assuredly rising at this point, the circuit starts to clip, thereby reducing the output voltage. Luckily, this occurs at input levels no one is likely to encounter. When I attempted to measure phono overload versus frequency, the circuit's overload behavior prevented my getting data above about 5 kHz. At 1 kHz, however, input overload was an ample 125 mV. In the MC mode, the high-frequency input overload was better, enabling me to get data up to 10 kHz. Input overload at 1 kHz was about 15 mV for this mode.

Phono-circuit interchannel crosstalk, with the undriven channel's input terminated by a 1-kilohm resistor, was better than -85 dB up to 1 kHz and rose at less than 6 dB/octave to -68 dB at 20 kHz. With the IHF simulated MM source, the crosstalk peaked at -45 dB at 10 kHz. With the MC input terminated with 100 ohms, crosstalk was better than -85 dB up to about 3 kHz and then rose at 6 dB/octave to -68 dB at 20 kHz. For both the MM and MC

inputs, crosstalk behavior was very similar in the left-to-right and right-to-left directions. Phono S/N for either channel was 72.7 dB in MC mode and 72.5 dB in MM mode.

For the SM-5 power amplifiers, most of the data presented here is from a single amp. The four channels in the two amplifiers performed very similarly in the vast majority of my tests.

Amplifier gain measured a little over 26 dB, and input sensitivity was just about 137 mV. These results are for either channel and for both balanced and unbalanced input. For bridged operation, gain was approximately 32 dB, and sensitivity was 68.7 mV.

Frequency response at 1 watt/channel, in stereo mode and with unbalanced input, is plotted in Fig. 5. (Response was very similar for unbalanced input in the stereo mode and for unbalanced and balanced inputs in the bridged mode.) As can be seen, the -3 dB point (bandwidth limit) is close to 200 kHz. Rise and fall times at an output level of ± 5 volts into 8 ohms were 1.8 μ sec at the normal (full clockwise) setting of the input level controls. With the amplifier's input level controls set 6 dB below maximum, rise and fall times increased to 2.2 μ sec, and bandwidth was reduced to about 160 kHz. Square-wave measurements (not shown) revealed a slight overshoot at an output level of ± 5 volts into 8 ohms. This overshoot, which is unusual in a modern solid-state power amp, was present in all four channels of the two SM-5s. When a 2- μ F capacitor was paralleled across the 8-ohm load, the resultant ringing was minimal and well damped. Some amount of tilt could be seen in the 40-Hz square wave.

Figure 6 shows THD + N and intermodulation distortion versus power output in bridged mode. (The curves for the stereo mode were similar but with lower power levels.) The fact that the power level at clipping does not come close to doubling as load impedance is halved demonstrates the relatively loose regulation of the SM-5's power supply. This amp will have good dynamic headroom, as we shall see. A graph of bridged-mode THD + N versus frequency, for various power levels into 4 ohms (Fig. 7), shows admirably little increase in distortion at high frequencies.

The SM-5's output noise levels, for stereo operation with unbalanced input, are listed

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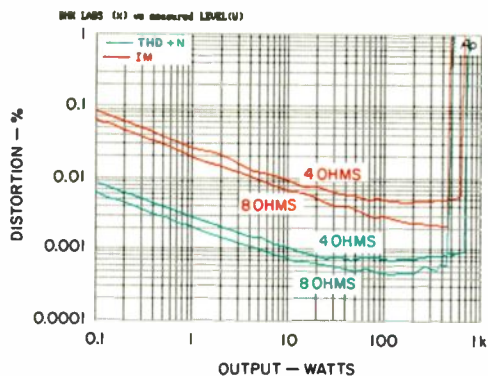


Fig. 6—THD + N and SMPTE-IM distortion vs. power, SM-5 amp.

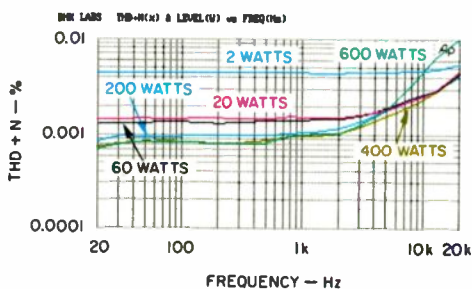


Fig. 7—THD + N vs. frequency, bridged mode, SM-5 amp.

in Table II. The results are outstandingly low. The IHF S/N ratio for the same conditions was 99.9 dB. It dropped imperceptibly, to about 99.75 dB, with balanced input; for bridged operation, S/N was 96.4 dB with unbalanced input and 96.2 dB with balanced input.

Damping factor was 277 for the left channel and 261 for the right channel up to about 800 Hz. It then fell to about 68 at 20 kHz. In the bridged mode, the damping factor was about 165 up to about 800 Hz again; it fell to about 40 at 20 kHz.

In the test of dynamic power, the SM-5 amp could deliver 175 watts/channel into 8 ohms at the beginning of the IHF tone-burst signal and 163 watts/channel at its end. With 4-ohm loads, the results were 325 and 264 watts/channel, respectively. Corresponding figures for dynamic headroom were 2.4 dB for 8-ohm loads and 2.1 dB for 4-ohm loads. In bridged mode, power into 8 ohms was 676 watts at the start of the burst and 576 watts at its end; with a 4-ohm load, those figures were 1,104 and 800 watts, respectively. Corresponding dynamic headroom for 8-ohm loading was 2.3 dB.

Steady-state power at the visual onset of clipping in stereo mode was 147 watts/channel into 8 ohms and 245 watts/channel into 4 ohms. In bridged mode, clipping power was 503 watts into 8 ohms, 732 watts into 4 ohms, and 866 watts into 2 ohms. Driving one channel into a 1-ohm load yielded ± 38 volts, for a peak current of ± 38 amperes.

Input impedance was 11 kilohms for unbalanced mode and 21.5 kilohms for balanced mode. Output DC offset for one SC-5 was 0 mV for the left channel and -0.7 mV for the right. For the other amp, it measured $+3.6$ and -3.2 mV, respectively.

The AC line draw when the SM-5 was first powered up on a fairly cold morning was about 440 mA; it stabilized at about 600 mA when the amplifier warmed up. When the amp was really heated up, line current remained essentially unchanged, which indicates excellent output-stage thermal stability.

Use and Listening Tests

Phono equipment in my system during the review period included an Oracle turntable, a Well Tempered Arm, and Stanton's 981HZS moving-magnet cartridge used with my own preamp (a tube phono stage with a passive signal selector and volume control) or a Quicksilver

Audio preamp. For CDs, a Counterpoint DA-11A transport drove Museatex Bidat, Sonic Frontiers SFD-2 MKII, and other (experimental) D/A converters. Additional signal sources included a Nakamichi ST-7 FM tuner, a Nakamichi 250 cassette recorder, and a Technics open-reel recorder. In addition to the preamplifiers mentioned above, I used a Forssell tube balanced line driver and a First Sound II passive model. Power amplifiers used for comparison were a Crown Macro Reference, a pair of Quicksilver Audio M135s, and an Arnoux 7B digital

switching design. My loudspeakers were B & W 801 Matrix Series 3s, augmented from 20 to 50 Hz by my two subwoofer systems, each of which has a JBL 1400Nd driver in a 5-cubic-foot ported enclosure.

For my initial listening tests, I set up one Marantz SM-5 power amplifier in stereo mode but did not use the companion SC-5 preamp. The amplifier sounded quite good but was slightly closed in and darker tonally than the Arnoux switching amp I had been using. I then tried the Crown Macro Reference and thought that the Crown sounded a bit clearer and more spacious than the Marantz amp. I was impressed with how close these two amplifiers sounded, however.

I next listened to the same Marantz SM-5 with the SC-5 preamplifier and with the Forssell line driver, to assess the sonic characteristic of the SC-5. The Marantz preamp seemed to soften the sound and reduce spaciousness, a sin of omission that made the music enjoyable and easier to listen to but took away some of its vitality, drive, and space.

After I completed the measurements, I set up both SM-5s in bridged mode along with the BB-5 power supply and SC-5 preamp for my final listening session. Whoa! In the bridged mode, these amps do kick butt! Bass impact was great, and the overall sound of the combination was musically lush and smooth. It was, however, still a little lacking in resolution and spaciousness compared with my reference setup. I think that the SM-5 amplifiers are more neutral than the SC-5 preamplifier.

I was surprised that the SC-5 wouldn't run on battery power when the BB-5's AC cord was disconnected. This could be a mild disappointment for those tweaks (including me) who suspect the sound might be better with no physical connection to the AC line.

The Marantz equipment was very pleasurable and sensuous to use, and the volume control on the preamp felt especially wonderful. In conclusion, I think that Marantz has created some impressive top-of-the-line components. **A**

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Bad Company <i>10 from 6</i> (Atlantic)	34•1313
The Beach Boys <i>Greatest Hits</i> (Capitol)	12•2903
David Bowie <i>Changes/Bowie</i> (Rykodisc)	41•2247
James Brown <i>The CD of JB</i> (Polydor)	42•5025
Chicago <i>Greatest Hits 1982-89</i> (Reprise)	40•1166
Eric Clapton <i>The Cream of Eric Clapton</i> (Polydor)	12•1665
Joe Cocker <i>Greatest Hits</i> (A&M)	32•0911
Elvis Costello & the Attractions <i>The Very Best of...</i> (Rykodisc)	11•8968
Creedence Clearwater Revival <i>Chronicle/Hits</i> (Fantasy)	30•8049
The Doobie Brothers <i>The Best of... Vol. 2</i> (Warner Bros.)	13•3306
The Doors <i>The Best of The Doors</i> (Elektra)	35•7616/39•7612
Eagles <i>Greatest Hits Volume II</i> (A&M)	31•7768
Emerson, Lake & Palmer <i>The Best of... (Victory)</i>	12•9775
Fleetwood Mac <i>Greatest Hits</i> (Warner Bros.)	37•5782
Foreigner <i>Records (Greatest Hits)</i> (Atlantic)	31•8055
Grateful Dead <i>Skeletons from the Closet</i> (Warner Bros.)	37•8406
Elton John <i>Greatest Hits</i> (Polydor)	47•1011
John Lennon <i>The John Lennon Collection</i> (Capitol)	40•5308
Paul McCartney <i>All the Best!</i> (Capitol)	45•9776
The Steve Miller Band <i>Greatest Hits 1974-78</i> (Capitol)	29•0171
Elvis Presley <i>The Number One Hits</i> (RCA)	12•5591
Lou Reed <i>Walk On The Wild Side</i> (RCA)	12•5351
Smithereens <i>Blown to Smithereens—Best of...</i> (Capitol)	12•2895
James Taylor <i>Greatest Hits</i> (Warner Bros.)	29•1302
Neil Young <i>Decade</i> (Reprise)	12•9254/39•9253
F. Zappa <i>Strictly Commercial: The Best of...</i> (Rykodisc)	13•4452
ZZ Top <i>Greatest Hits</i> (Warner Bros.)	43•8010



I WANNA MOSH WITH YOU

Tori Amos <i>Under the Pink</i> (Atlantic)	47•3207
Beastie Boys <i>Ill Communication</i> (Capitol) ▲	48•4808
Belly King <i>Sire/Reprise</i>	11•8687
Better Than Ezra <i>Deluxe</i> (Swell/Elektra)	12•2960
Bjork <i>Ros</i> (Elektra)	13•2043
The Cranberries <i>No Need to Argue</i> (Island)	11•0478
Deep Blue Something <i>Home</i> (Interscope)	13•7273
Goo Goo Dolls <i>A Boy Named Goo</i> (Warner Bros.)	12•1178
Green Day <i>Dookie</i> (Reprise)	47•6549
The Jayhawks <i>Tomorrow the Green Grass</i> (American)	11•8695
Letters to Cleo <i>Wholesale Meats and Fish</i> (Giant)	13•4320
New Order <i>The Best of...</i> (Warner Bros./Gwest)	11•1393
R.E.M. <i>Monster</i> (Warner Bros.)	10•3929
Tripping Daisy <i>I Am An Elastic Firecracker</i> (Island)	13•5608
Various <i>Encomium: A Tribute to Led Zeppelin</i> (Atlantic)	12•1434
Violent Femmes <i>Add It Up</i> (1981-93) (Reprise/Slash)	46•6656

BLAST FROM THE PRESENT

Bryan Adams <i>So Far So Good (The Hits)</i> (A&M)	46•7738
The Black Crowes <i>America</i> (American)	11•1369
Eric Clapton <i>From the Cradle</i> (Reprise)	10•1873
Sheryl Crow <i>Tuesday Night Music Club</i> (A&M)	47•6531
Del Amitri <i>Twisted</i> (A&M)	12•0733
Melissa Etheridge <i>Yes I Am</i> (Island)	46•6763
Gin Blossoms <i>New Miserable Experience</i> (A&M)	46•3737
Buddy Guy <i>Slippin' In</i> (Silvertone)	11•0171
Bruce Hornsby & The Range <i>The Way It Is</i> (RCA)	12•5096
Chris Isaak <i>Forever Blue</i> (Reprise)	13•0203
Edwin McCain <i>Honor Among Thieves</i> (Lava/Atlantic)	13•5285
John Mellencamp <i>Dance Naked</i> (Mercury)	48•5755
Tom Petty <i>Wildflowers</i> (Warner Bros.)	11•0155
The Police <i>Live</i> (A&M)	12•9494/39•9493
Bonnie Raitt <i>Longing in Their Hearts</i> (Capitol)	47•7505
Rod Stewart <i>A Spanner in the Works</i> (Warner Bros.)	13•1342
Rod Stewart <i>Unplugged... And Seated</i> (Warner Bros.)	48•4444
Sting <i>Fields of Gold: The Best of Sting</i> (A&M)	11•3555
10,000 Maniacs <i>MTV Unplugged</i> (Elektra)	46•9775
U2 <i>The Joshua Tree</i> (Island)	35•4449
Various <i>The Unplugged Collection Vol. 1</i> (Warner Bros.)	11•0874



See reverse side for details

MUSIC TO BE PIERCED BY

AC/DC <i>Back in Black</i> (Remastered) (Atco)	12•0337
Blind Melon <i>Soup</i> (Capitol)	13•4866
Bush <i>Sixteen Stone</i> (Trauma Records)	11•8885
Candlebox <i>Candlebox</i> (Maverick/Sire/Warner)	48•5185
Collective Soul <i>Collective Soul</i> (Atlantic)	12•2192
Danzig <i>Danzig 4</i> (American)	48•9377
Dream Theater <i>Awake</i> (eastwest)	10•8613
Filter <i>Short Bus</i> (Reprise)	12•5997
Kiss <i>Smashes, Thrashes and Hits</i> (Mercury)	42•3731
Megadeth <i>Hidden Treasures</i> (EP) (Capitol)	13•3959

Vince Neil <i>Caved In Stone</i> (Warner Bros.)	13•4619
NIN <i>The Downward Spiral</i> (TVT/Interscope) ▲	47•6739
Jimmy Page & Robert Plant <i>No Quarter</i> (Atlantic)	10•8977
Pantera <i>Far Beyond Driven</i> (eastwest) ▲	46•8926
Primus <i>Tales From The Punchbowl</i> (Interscope) ▲	12•7852
Rush <i>Chronicles / Hits</i> (Mercury)	42•3780/39•3785
Scorpions <i>Live Bites</i> (1988-95) (Mercury)	12•6912
Soundgarden <i>Superunknown</i> (A&M)	47•5186
Stone Temple Pilots <i>Purple</i> (Atlantic)	46•5963
Toadies <i>Rubberneck</i> (Interscope)	10•2491
Type O Negative <i>Bloody Kisses</i> (Roadrunner) ▲	46•9023

TWO EX-NINE INCH NAILERS ARE IN THIS GROUP.



See reverse side for details

MUSICIANS MARRIED TO TV STARS

Bon Jovi <i>Cross Road</i> (Greatest Hits) (Mercury)	11•0395
Van Halen <i>3.1.50</i> (Warner Bros.)	34•3582

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Phish *Live* (Elektra) 13•1607/39•1607



Rusted Root *When I Woke* (Mercury) 10•3606



Hootie & The Blowfish *Cracked Rear View* (Atlantic) 48•7553

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▲ 13•1623



"Batman Forever"
Soundtrack (Atlantic)
13•0765



TLC CrazySexyCool (A&M)
11•0650

GLOBE TROTTERS

- The Chieftains *The Long Black Veil* (RCA Victor) 13•7075
- Enya *The Celis* (Reprise) 10•1618
- Bob Marley & the Wailers *Legend* (Tuff Gong/Island) 33•7857
- Ziggy Marley & ...Free Like We Want 2 B (Elektra) 13•3736

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- All-4-One *And the Music Speaks* (Atlantic) 12•7845
- Phil Collins *Serious Hits...Live!* (Atlantic) 44•8944
- Amy Grant *House of Love* (A&M) 10•1667
- Elton John *Made in England* (Rocket/Island) 12•2184
- Madonna *Bedtime Stories* (Maverick/Sire/Warner) 11•0429
- Sarah McLachlan *Fumbling Towards Ecstasy* (Arista) 47•3389
- Bette Midler *Belle of Roses* (Atlantic) 13•2191
- Aaron Neville *The Taoheed Heart* (A&M) 12•5948
- Real McCoy *Another Night* (Arista) 11•3662
- The Rembrandts *IP* (eastwest) 12•2408
- Seal *Seal* (Sire/Warner Bros.) 48•4741
- Michael W. Smith *I'll Lead You Home* (Reunion) 13•4361
- Take That *Nobody Else* (Arista) 13•5806

YO CHECK IT!

- Brandy *Brandy* (Atlantic) 11•0502
- Coolio *It Takes a Thief* (Tommy Boy) ▲ 12•9627
- Adina Howard *Do You Wanna Ride* (eastwest) ▲ 12•4057
- Montell Jordan *This is How We...* (PMP/RAL/Island) 12•3091
- Method Man *Tical* (RAL/Def Jam) ▲ 11•4082
- Monica *Miss Thang* (Rowdy/Arista) 13•0914
- Old Dirty Bastard *Return to the 36 Chambers* (Elektra) ▲ 12•2382
- Shaquille O'Neal *Shaop-Fu: Do Return* (Jive) 11•0635
- Raekwon *Only Built 4 Cuban Linx* (RCA/Loud Records) ▲ 13•7141
- Salt-N-Pepa *Very Necessary* (Next Plateau/London) 46•7837
- Snoop Doggy Dogg *Doggystyle* (Interscope/Death Row) ▲ 46•5955

IT'S A WU-TANG CLAN THANG!

WHO LOVES YA, BABY?

- Anita Baker *Rhythm of Love* (Elektra) 10•1121
- Boyz II Men *II* (Motown) 10•2681
- Toni Braxton *Toni Braxton* (A&M) 46•4362
- D'Angelo *Brown Sugar* (EMI) 13•1714
- Foerplay *Elizir* (Warner Bros.) 13•4890
- David Sanborn *The Best of David Sanborn* (Reprise) 11•0585
- Barry White *The Icon is Love* (A&M) 11•1286
- Vanessa Williams *The Sweetest Days* (Wing) 11•4256
- Yanni *Live at the Acropolis* (Private Music) 47•5178

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MUSIC WITH A PLOT

- "The Bodyguard" (Arista) 44•8159
- "Clueless" (Capitol) 13•3900
- "Don Juan De Marco" (A&M) 12•5955
- "Empire Records" (A&M) 13•4932
- "Murder Was the Case" (Interscope) ▲ 11•2714
- "Reality Bites" (RCA) 12•4818
- "The Show" (Def Jam) ▲ 13•4791
- "Tommy" (Highlights) Orig. B way Cast (RCA Victor) 13•4155

YEE-HAH!

- Brooks & Dunn *Wavin' on a Sunday* (Arista) 10•2277
- Confederate Railroad *When and Where* (Atlantic) 13•1698
- Faith Hill *It Matters to Me* (Warner Bros.) 13•4908
- Alan Jackson *Who I Am* (Arista) 48•6233
- The Judds *The Essential Series* (RCA) 13•7026
- Sammy Kershaw *The Hits Chapter 1* (Mercury) 13•6796
- Alison Krauss *Now That I've Found You: A Collection* (Rounder) 12•0345
- Tracy Lawrence *I See It Now* (Atlantic) 10•2582
- John Michael Montgomery *John Michael* (Atlantic) 12•1467
- Travis *Trit* *Greatest Hits—From The Beginning* (Warner Bros.) 13•6812
- Shania Twain *The Woman In Me* (Mercury) 11•9768
- Dwight Yoakam *Dwight Live* (Reprise) 12•8389



See details below

LAUGH 'TIL YOU PUKE

- Jeff Foxworthy *Games Rednecks Play* (Warner Bros.) 13•3322
- The Jerky Boys *The Jerky Boys* (Select) ▲ 10•7961
- The Jerky Boys *Jerky Boys 2* (Select) ▲ 10•7979
- A. Sandler *They're All Gonna Laugh...* (Warner Bros.) ▲ 12•1749



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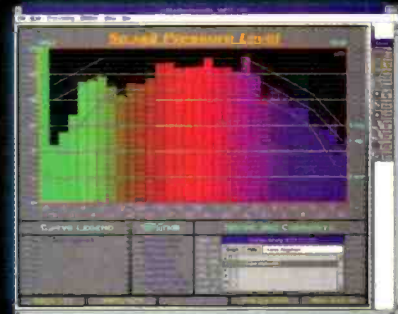
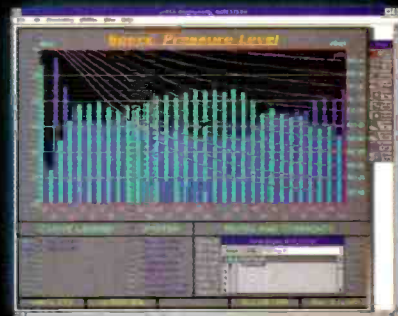
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DAVID L. CLARK

JBL HT SERIES THX SPEAKERS



A complete HT system from JBL consists of seven speaker boxes: three identical front speakers, two dipole surrounds, and two subwoofers. At \$3,000, this is one of the least expensive systems to earn the Lucasfilm Home THX certification for small rooms (less than 3,000 cubic feet). What's more, the HT Series basks in the glow of JBL's prestige for having produced the first THX-certified movie-theater system, in 1983, and the no-compromise Synthesis Home THX systems (see "Currents," September 1992).

The HT system is intended for use with a THX-certified surround decoder or receiver. Such components differ from standard Dolby Pro Logic units in that higher minimum performance is mandated, and circuitry is added to modify the signals slightly and provide an electronic crossover between main speakers and subs. Left, cen-

ter, and right THX speakers are intended to be fed with a signal high-passed at 80 Hz, with the subwoofer fed from a matching 80-Hz low-pass filter. These outputs are not usually available from a standard Pro Logic decoder or receiver, although you can achieve good results with one if its center channel is set to "normal." However, you will also need an external electronic crossover to high-pass the left and right speakers as well as to derive a subwoofer signal.

All HT Series cabinets have simple, functional styling and are finished on all sides in a black wood-grain laminate with removable dark-gray knit grilles. Connection is via recessed five-way binding posts. No controls or adjustments are provided on

any of the speakers. Medium-density fiberboard, 3/4 inch thick, is used throughout, with some additional bracing in the subwoofer cabinets. Overall, quality is high and rigidity of the cabinet walls is adequate. The 22 individual drive units in the system appear to be of three types: 12-inch drivers in the subs plus 5-inch woofers and 1-inch titanium-dome tweeters in the fronts and surrounds.

The three identical front speakers, Model HT1F, each employ a vertical array of four magnetically shielded drivers—a pair of tweeters in the center, flanked by a pair of the 5-inch woofers. This is a fairly common solution to the THX requirement for limited vertical high-frequency dispersion to reduce ceiling and floor reflections. It works through reinforcement of the sound on axis, where path lengths to the drivers are equal, and through cancellation of sound above and below axis at frequencies where the path-length difference causes varying degrees of phase shift.

The HT1D surround speakers achieve the Home THX requirement for a dipole radiation pattern through an approach I have not previously encountered. The challenge facing the designer is in making the transition from dipole operation at middle and high frequencies to monopole operation at low frequencies. True dipole operation would allow the out-of-phase radiation from the speaker's opposing faces to cancel more completely with decreasing frequency. But that's not ideal for dipole surrounds, because some bass is required from them. Although the HT1D does have matching woofers on opposite faces of its cabinet, the cabinet is divided internally

**THE SYSTEM DELIVERED
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ENVELOPING AMBIENCE,
AND A WIDE AND DEEP
MUSICAL SOUNDSTAGE.**

into two different types of enclosures: The woofer firing toward the front of the room gets a larger, vented enclosure to extend its response, whereas the woofer firing toward the rear gets a small sealed en-

closure to limit its response so that it won't cancel any of the front woofer's low-bass output. Very clever.

The two HT1S subwoofers can best be described as "classic." Each has a 12-inch woofer with a free-air resonance of 25 Hz in

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a 4-cubic-foot vented box tuned to 25 Hz. A pair is required to produce enough output to qualify for Home THX certification. Although neither JBL's claim nor my measurements show an anechoic response flat down to 25 Hz, this frequency is reproduced cleanly and with adequate volume in a 2,000-cubic-foot room.

Sometime in the second quarter of this year, the pair of HT1S subs will be replaced by the HTPS300 powered subwoofer. This new unit, which uses two 12-inch drivers placed back to back to counteract each other's external magnetic fields, is rated flat down to 25 Hz. However, it will also raise the HT system's price to \$3,500. (The HTPS300 alone will sell for \$1,500.)

Measurements

Figure 1 is the vertical polar response of the HT1F speakers in four octave-wide frequency bands. Overall, the driver array works as it should, but there are problems. For one thing, the spectrum of the sound that does reflect from the ceiling or floor is particularly nasty. Even though the octave-band averaging tends to smooth the response, 12-dB variations can be seen at +30° and -30°. Audibly, this is a tonal comb-filter effect. (On the other hand, if directivity is not well controlled, as in a typical stereo speaker, the reflected sound also causes a comb-filter effect when it combines with the direct sound.) A second potential problem is extreme vertical directivity at very high frequencies, caused by the HT1F's double tweeters. Check the 16-kHz curve in Fig. 1. If the listener moves up or down by 5°, the response drops 5 or 10 dB in the top octave. A shift of 5° is the difference between sitting up straight and slouching—forget about standing or sitting on the floor.

During my testing, I found that one of the subs produced much higher distortion than the other. Investigation revealed that its spider had been misaligned when it was glued to the voice-coil form. This resulted in the cone being pushed 5 millimeters (a little less than ¼ inch) rearward at its rest position. An input signal would cause the cone to move forward much easier than it could be moved further back, thus distorting the waveform. I promptly received a replacement system from JBL, which corrected the problem.

One-meter, on-axis frequency response of one HT1F and one HT1S is plotted in Fig. 2, along with maximum output of a single HT1S sub when it was driven to 10% total harmonic distortion plus noise (THD + N). A pair of subs, required for Home THX certification, should, if properly placed, produce nearly 6 dB more output than a single sub. I regard the plot as exceptionally flat, although the bass extension is a bit disappointing. Also, the HT1F curve was measured from a point exactly centered on the speaker's vertical axis; you will have to aim the HT1Fs carefully to get such flat response at your ears.

My measurements showed that the HT1D surround speakers' dipole cancellation went away quickly below 200 Hz, extending flat response from the forward-mounted driver array down to 70 Hz. In the treble, the tweeters on the opposing cabinet faces extend the response to 20 kHz. Response on the dipole's null axis, which should be aimed at the listening position, averaged 20 dB below the response directed to the front or rear of the room. As with other dipoles I've tested, the null axis is too narrow to perfectly cover a group of listeners, but the overall effect is to provide ambience without the pinpoint localization that is so undesirable in this application. The HT1Ds do an excellent job of that.

Use and Listening Tests

I set up the HT Series according to JBL's instructions. The left, center, and right speakers were spaced 4 feet apart and 3 feet out from the 13-foot-wide front wall of my listening room. Surrounds were placed high on the side walls, to the sides of the listening position, and 10 feet from the front speakers. After some experimentation, I

stacked the subs in one front corner to obtain maximum bass extension. With its 8-foot ceiling, my listening room's volume is 2,000 cubic feet, comfortably within the 3,000-cubic-foot upper limit for which the HT Series is THX-approved.

After initial listening, I felt a need to boost the bass progressively more below 50 Hz, so I inserted an equalizer in the subwoofer path. (The alternative of simply turning up the subwoofer resulted in a "tubby" sound from too much 80-Hz output.) The subs handled the boost well. You

FRONT SPEAKERS

Frequency Range: 70 Hz to 20 kHz.

Sensitivity: 87 dB for 1 watt at 1 meter.

Nominal Impedance: 8 ohms.

Dimensions: 10 in. W x 17½ in. H x 8½ in. D (25.4 cm x 44.5 cm x 21.6 cm).

Weight: 21 lbs. (9.5 kg) each.

Price: \$1,200 per set of three.

SURROUND SPEAKERS

Frequency Range: 110 Hz to 20 kHz.

Sensitivity: 87 dB for 1 watt at 1 meter.

Nominal Impedance: 6 ohms.

Dimensions: 9¼ in. W x 13¾ in. H x 7¾ in. D (23.5 cm x 35.2 cm x 19.7 cm).

Weight: 15 lbs. (6.8 kg) each.

Price: \$800 per pair.

SUBWOOFER

Frequency Range: 35 to 80 Hz.

Sensitivity: 91 dB for 1 watt at 1 meter.

Nominal Impedance: 6 ohms.

Dimensions: 25¼ in. W x 21½ in. H x 17¾ in. D (64.1 cm x 54.6 cm x 44.8 cm).

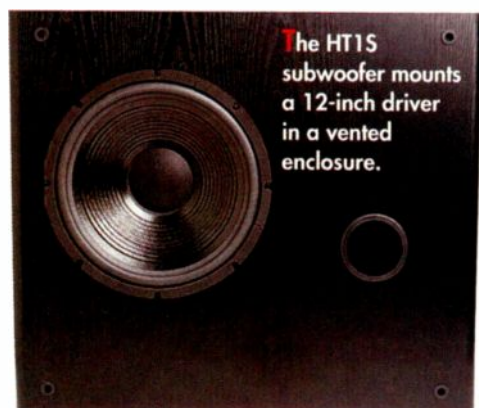
Weight: 62 lbs. (28.1 kg) each.

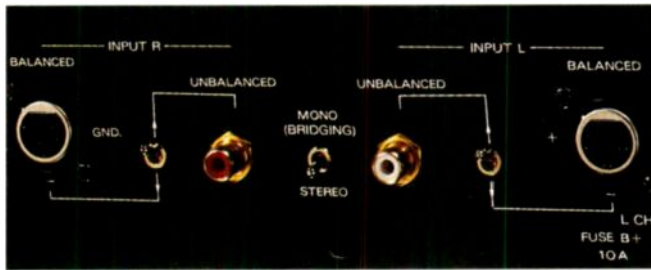
Price: \$500 each.

System Price: \$3,000 (three front speakers, two surround speakers, and two subwoofers).

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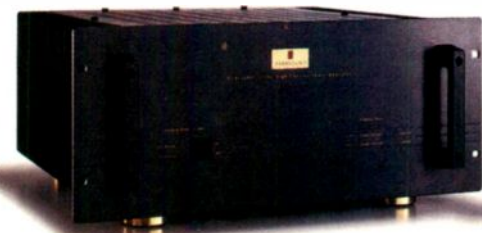
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"...A BENCHMARK PRODUCT AGAINST WHICH OTHER AMPLIFIERS CAN BE MEASURED."

— STEVEN STONE, STEREOPHILE, VOL. 17 NO. 3, MARCH 1994

But what did surprise us, as well as flatter us, was being thrown into the ring with \$12,000 monoblock behemoths. The result of this apparently absurd comparison? Not carnage, but rather: *"...the Parasound HCA-2200" gives them all a run for the money, and even beats 'em in flexibility and price."* He continues, *"...a pair of HCA-2200"s performed with Apogee full-ranges on a par with a pair of Boulder 250 AEs and four VTL Deluxe 300 amps. Dynamic impact and attack were excellent...Compared to the VTL300, the HCA-2200" had a greater sense of extension..."*

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can look at this equalization in two ways: The JBL subs may be criticized for lacking flat response to the lowest frequencies or praised for their ability to handle the power added by the boost. Most woofers distort badly when low-frequency boost is attempted. My take on it is that, in the end, I was able to get what I wanted, which is rare.

The JBL system passed critical laserdisc imaging test passages, such as a campfire scene in *Indiana Jones and the Temple of Doom* (Paramount LV 1643), with high marks. This particular scene requires that voices at the campfire remain locked in the center, in the midst of ambient jungle sounds, while the heroine screams from different locations in the background. Through the HT speakers, flyover scenes had good spatial continuity and timbral match to the fronts. Dialog was focused, centered, and up front, just as it should be. Music was rendered with a wide and deep soundstage, with the surrounds providing a beautiful sense of enveloping ambience often missing in mere stereo. Rifle fire cracked and explosions whumped with seemingly endless dynamic range. Bass did not thud and drone, as I have heard it do on many underpowered subwoofers when pushed into more or less continuous compression.

I also used the HT system to play stereo music from CDs, in the "correct" two-speaker-with-subwoofer mode and with Dolby Pro Logic processing. I actually preferred the Pro Logic mode, with the center speaker's gain reduced slightly. Conventional two-channel stereo forces me to sit exactly on the centerline of the speaker pair to get the best, or even acceptable, imaging. I find this restriction odd—especially when someone joins me, because only one person can enjoy the sound fully. (We could sit one behind the other, but that seems even more odd.) Stereo with surround decoding, especially with a good music-enhancement mode (as long as it is free of added reverberation) can widen the sweet spot into a sweet area and improve ambience repro-

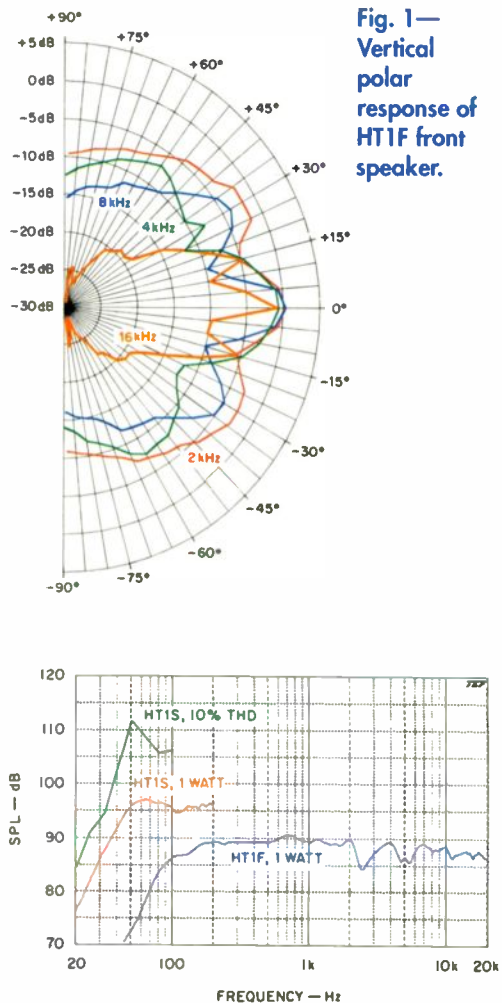


Fig. 1—Vertical polar response of HT1F front speaker.

Fig. 2—Frequency response of HT1F front speaker and HT1S subwoofer, plus maximum (10% THD + N) bass output of HT1S.

duction. The JBLs did a credible job, although I've heard better stereo-only speakers in the \$3,000 price range.

My new 35-inch ProScan monitor arrived just in time for these tests. The combination of a large direct-view monitor with the JBL HT Series speakers seemed perfect for a serious home theater system in a moderate-size room, particularly one where wide viewing angles and bright ambient light may be desired. Since this setup is installed at my place of business, lunch hours have stretched as employees linger in the listening room and just "... have to finish this side." We all go in there after hours to experience our newest laserdiscs on the JBL THX system. We love it. Now, get it out of here, so we can get some work done! A

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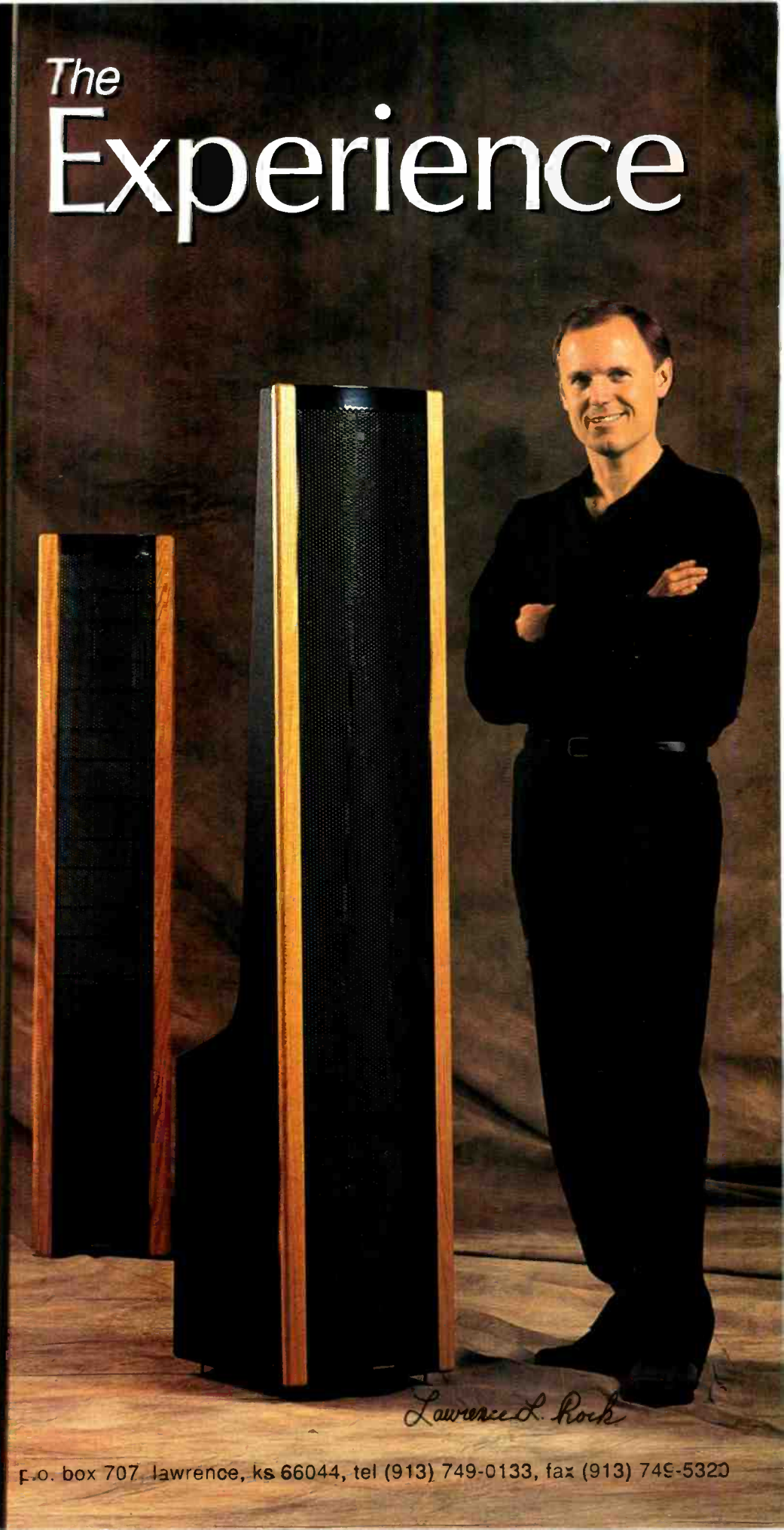
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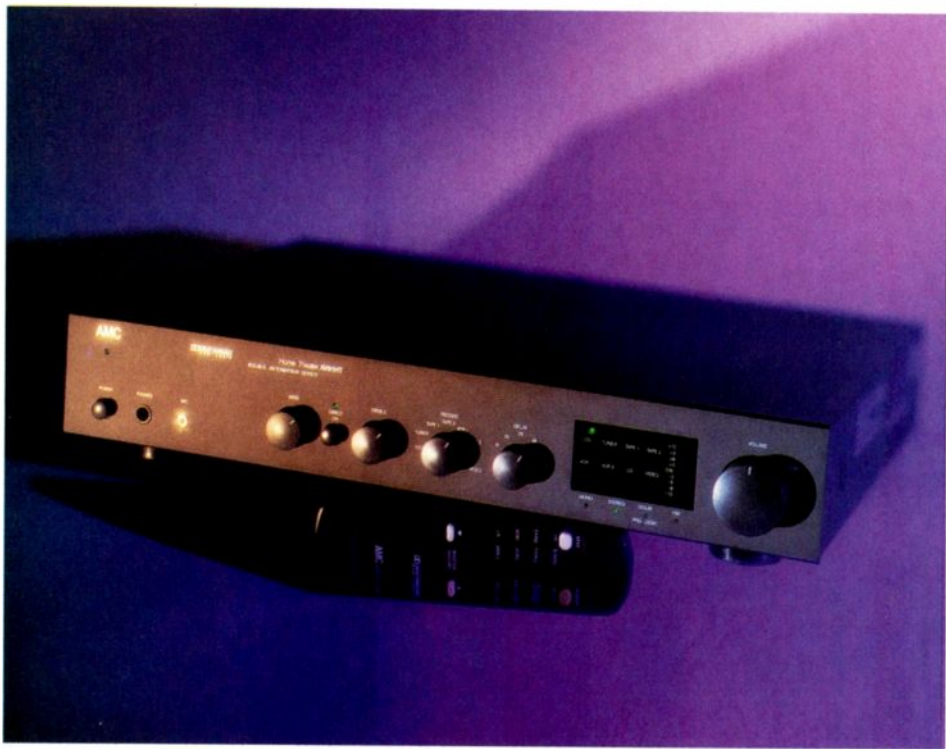
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AMC AV81HT PREAMP/ SURROUND PROCESSOR



Although its parent organization, Taiwan's IEEE Group, has been manufacturing components for other companies for close to two decades, AMC has only recently emerged in the United States. The AV81HT preamp/processor is marketed under AMC's H.O.M.E. Automation banner, which the company describes as offering "total system integration for both audio and video in your living and working environment." The AV81HT is actually

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one of two versions of the same basic component, the other being the Home THX-certified AV81THX. Although it lacks the re-equalization, timbre-matching, and decorrelation circuits that form the electronic heart of THX, the AV81HT does provide very high-quality Dolby Pro Logic decoding and ample flexibility (video switching included) to control all but the most comprehensive home theater systems. At \$750, it's a strong contender in the affordable performance arena. It's also upgradable to full Home THX status for an



additional \$550. (Although you can buy the AV81THX for \$100 less than the HT-plus-upgrade price, you have to ante up \$1,200 all at once. Some audiophiles may find the stepping-stone approach well worth the mild premium.)

Coming out of the box, the AV81HT impressed me. It's not a large unit, especially for a home theater preamp/processor. It stands only 3 1/8 inches tall (feet included) and is 17 inches wide. A surface 14 inches deep will leave plenty of room for cables, as the chassis itself is only a little more than 11 inches from faceplate to back-panel RCA jacks.

The AV81HT's basic circuitry is well done. The highly praised Analog Devices SSM2125A IC performs Dolby Pro Logic processing, and the almost ubiquitous Sanyo LV1000 provides digital delay for the surround outputs. There's no cutting-edge technology here, but the basic board layout is very clean. Yes, there is a spider's web of wire harnesses connecting various boards, but that's almost inevitable when complex circuits are implemented on comparatively simple double-sided boards.

The AV81HT is refreshingly simple, as there's a welcome absence of seldom-used features. This shows on the front panel, where just five knobs and two buttons stand between you and whatever sonic nirvana you're chasing. And with its 16 carefully

grouped and color-coded keys, even the remote's a model of restraint.

Ergonomically, however, AMC picked a somewhat different drum-

mer to march to. It's not wrong, mind you, just different. For instance, there are no front-panel controls to select input or operating mode; you'll find them only on the remote. There is a control on the front panel to select record source, however, and a rotary knob for surround-channel delay

Photos: Michael Groen

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time. But there's no such delay control on the remote, where it would be more useful.

The rotary controls are a bit odd to the touch. The plastic knobs are molded to accept a thick, small-diameter casing around their sides—sort of a fat, tacky rubber band your fingers won't slip off as you're turning the knob. There was a little delay between turning the master volume knob and feeling the pot's resistance. The knob was tight on the control shaft, so I assume this was due to some slack in the clutch assembly of the motor used for remote volume control.

One of the AV81HT's strangest features is its use of six rear-panel 3/4-turn trim pots for level adjustment of the six outputs (left, center, right, surrounds, and subwoofer), to compensate for different loudspeaker placements and sensitivities. Although it's not the first time I've seen this approach on a surround processor, I have strong reservations about this particular design. The rear-panel placement makes calibration adjustments very awkward, but a more serious problem is that these pots can't be friction-locked once they've been properly set. Their

exposed position invites inadvertent change.

To smooth the calibration process, the AV81HT comes with a microphone that plugs into a front-panel receptacle. A vertical LED array behind the display window acts as a sound-level meter when you activate the processor's internal test-signal generator. The idea is fine: You put the microphone in your favorite viewing/listening position, activate the generator, and adjust each channel's output via the rear-panel pots as you sequence the signal generator's output through your speakers. (The center LED in the array turns amber when you're within a dB of the predetermined reference level.) But this seemingly simple process is tremendously awkward in practice. The LED array is on the front panel, and the pots are on the back. The only way I could watch the first while adjusting the second was to put a mirror in front of the processor and stand behind it. Then I could adjust a pot and trigger the remote's "Test" button to advance to the next speaker. The meter's long settling time is also a bit disquieting: You're never sure whether you've moved the pot enough until the meter tells you you've moved it too far. You could argue that manual trim pots don't impose the signal-to-noise penalties that some microprocessor-controlled adjustment circuits do. Even if that's true, I don't think the resulting inconvenience is worth the nominal performance boost.

Once adjusted, however, the trim levels held remarkably well, regardless of the master volume-control's setting. There was very little tracking deviation as I moved up and down a fairly wide range of playback levels. The LED array has no SPL scale, but I verified initial setup level of 84 dB (± 1 dB) with a recently calibrated Radio Shack sound-level meter. When I reduced the master gain by 20 dB (as measured for the front left channel), all channels remained within the ± 1 dB window except for the subwoofer output, which was 2 dB down. At an intermediate average of 77 dB, the subwoofer output was just 1.5 dB low. Not bad at all.

After calibrating the AV81HT, I listened extensively to a variety of audio-only and A/V sources. The sound quality was quite good. My main digital source was a Rotel RDD-980 CD transport feeding an Adcom GDA-700 D/A converter. Amplifiers includ-

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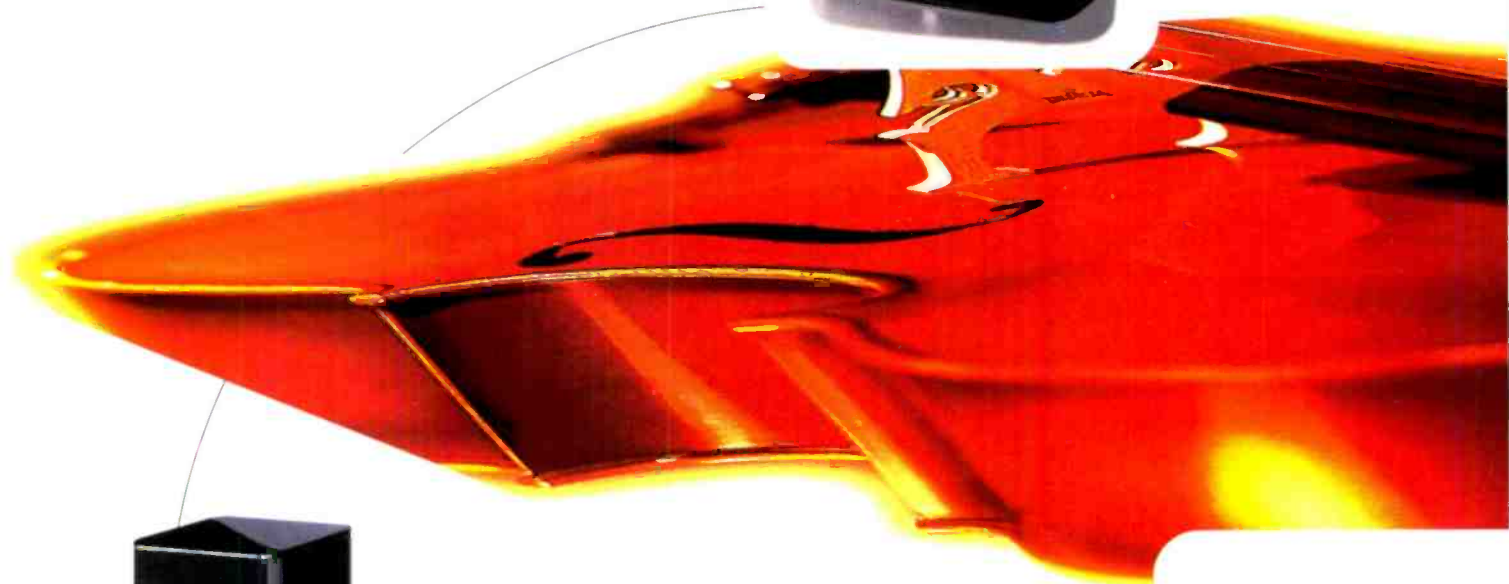
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ed a Kenwood KM-X1 (THX-certified six-channel) and an Adcom GFA-55511 (stereo). Stereo listening was through a pair of Spendor LS3/5A speakers biamped with a Janis W3 subwoofer. A KEF Reference 100 center-channel speaker and a second pair of LS3/5As (an older Rogers variant) completed the home theater array.

Two aspects of the AV81HT's sound really impressed me. The first was a very pleasing presentation of a wide variety of music. Although I've never heard the "stunning" preamplifier differences some audiophiles

and reviewers seem to revel in, the AV81HT (at least in stereo mode) added nothing unpleasant. Neither did it diminish enjoyment of music I know fairly well. I was particularly taken with Radka Toneff's evocative rendition of Jimmy Webb's "The Moon Is a Harsh Mistress" on the Toneff/Dobrogosz *Fairy Tales* disc (Odin CD03). Although an old recording ('82 or thereabouts), it usually brings any high-frequency aberrations or dynamic limitations into sharp focus. The AV81HT sailed through this with nary a trace of grunge or constriction.

The second pleasant discovery was that someone at AMC apparently did a decent amount of listening when choosing the characteristics of the unfortunately named "PBX" operating mode. Call it what you will, it's one of the best surround enhancement modes I've yet heard for music reproduction: pleasant, refined, and enjoyable over the long haul. It brings the soundstage forward just a bit and deepens the apparent area behind the front speakers—and does this without the rear-channel intrusiveness I've noticed in almost all other music-surround modes offered by other processors.

A word of warning about AC connections: Keep the AV81HT plugged into an unswitched outlet, and use the front-panel or remote power switch exclusively. Otherwise, if you accidentally cut off power to the

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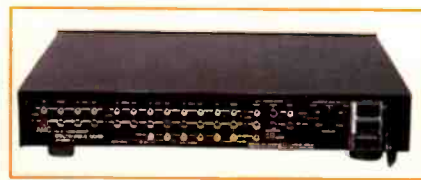
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AV81HT, it will express its displeasure with a decidedly audible pop through your sound system. If you then reapply power before your amplifiers have been off long enough for the power supplies to discharge, you'll hear something far louder and much more unpleasant. (You will make this mistake only once, however, unless you enjoy checking tweeters periodically.) I suspect that the AV81HT's output relays open only as part of a turn-off sequence initiated by a power-down command. It would be far better if they automatically tripped whenever the power supply collapses.

How to summarize my reactions to AMC's AV81HT? It's affordable, flexible, and more than sonically competent. Although the good stuff is hidden under a somewhat quirky, ergonomically challenged exterior, the AV81HT is a damn fine preamp/processor. A



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Audio Etc...

Q What's the difference between a bipolar and dipolar speaker?

A Emerging recently to the forefront of speaker technology have been two diverse designs of speaker systems called bipolar and dipolar. These speakers look similar from the outside, both have two complete sets of drivers, one set on the front and the other set on the rear. But each speaker system functions differently. The bipolar speakers front and back drivers move at the same time with the music and are used as your main speakers in stereo and your front right/left speakers in a home theater system. A well designed bipolar speaker will give you a 3-D sound without losing the main focus of the exact placement of the sound of instruments, singing, dialogue and movie sound track pin pointing. On the other hand, the dipolar speakers have come into existence primarily within the home theater realm. The dipole surround speaker fires information both to the front and back at opposing times of each other, reflecting off the wall and into the room. Since the front and back of this speaker are out of phase of each other, the surround speaker has a cancellation zone within the movie viewing area. Thus, the focus of sound transcends forward to the movie screen with the surround speakers enveloping the listening area.

—Steve Lindemann
Fred's Sound of Music
Portland, Oregon



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Each month, Audio Magazine's newest feature "See a Specialist", will showcase some of the finest audio/video dealers from across the country. The dealers, chosen as a result of recommendations from equipment manufacturers, Audio Magazine staff and industry organizations, will exemplify the best audio/video dealers from New York to California. The chosen dealers will offer solutions to problems that can best be handled by a specialty audio/video retailer.

If you would like to submit questions to dealers in your area please write to See a Specialist, c/o Audio Magazine, 1633 Broadway, NY, NY 10019

Q I don't seem to be getting enough sound from my rear speakers and my receiver's rear amplifiers are rated at only 15 watts per channel. What can I do?

A Many low and medium priced receivers have marginal power for the rear channels. If your receiver has line outputs for these channels, it's a simple matter to add an external amplifier to beef things up. This could be a basic power amp, or you could use a line input on an integrated amp or stereo receiver. If you have no line outputs, several companies make small units that will convert the speaker level outputs from your receiver to line level, allowing you to use the above strategy. An alternative might be to replace your rear speakers with more efficient models. A 6 dB increase in speaker efficiency, from say 88 dB to 94 dB, would make your 15 watts perform like a more muscular 60 watts.

—Lyn Perry
Wilshire TV & Stereo West
Thousand Oaks, California



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Q Should I bridge my stereo amplifiers to get more watts? If I do bridge them, will this allow me to get better sound from my speakers?

A Usually not. Most stereo amplifiers, except if they are high performance or expensive amps, sound better and perform better unbridged. When unbridged, most stereo amps are stable down to 4 ohms for long durations and maintain their printed specs. When bridged, amps are stable only as low as an 8 ohm load and their specs are no longer valid. Practically speaking, these amps in bridged mode are then unacceptable to drive most speakers, which have a nominal impedance of 4-6 ohms and can go below 2 ohms at certain frequencies. This can cause the end user of bridged amplifiers damage to both speakers and amps.

—Steve Campbell
In Concert, Inc.
Huntsville, Alabama



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HAPPY SHOPPING!!!

MARTIN-LOGAN SL3 SPEAKER

was in a hurry, the first time I put the Martin-Logan SL3s into my living room. I stuck them where they looked right, turned them on, and let out a deep "aaah!"

But then I had to move the SL3s back against the wall to make room for a big gathering. Later, with the aid of a knowledgeable, sharp-eared friend and the copious instructions in the excellent owner's manual, I spent most of an afternoon trying to set them up exactly "right," to no avail. Frequency response sounded irregular, and imaging fell apart as soon as we moved our heads a few inches from the sweet spot. My friend left, and I abandoned the scientific approach, stuck 'em where they looked right, and went "aaah!" again. (For the record, the speakers are now about 3 feet from the front wall and about 4 feet from each side wall of my 14 x 22-foot room—a near-match of distances that should not work but, this time, does. They are also almost imperceptibly toed in.)

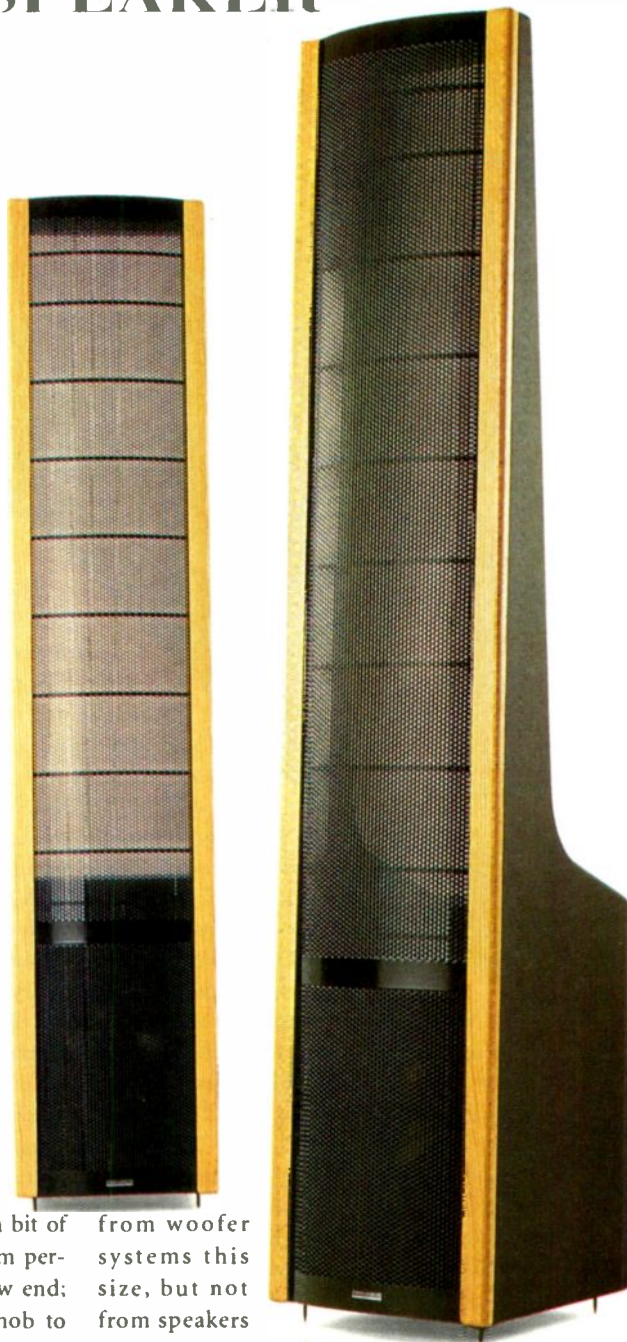
This difficulty in setup stems from the speaker's dipole nature. Sounds pour with equal facility from the front and rear of the SL3's curved, electrostatic midrange/tweeter panel. That means everything above about 250 Hz is coming at you not only from the speaker itself but, a few milliseconds later, from the wall behind it. Both sounds bounce a bit off other room surfaces as well. So dipoles tend to involve the room's acoustics in the final sound to a much greater extent than do conventional, monopole speakers. In the right room and properly positioned, dipoles can give you a very live and open sound—but making sure you have the right room and finding the proper position can be tricky. I'd expect the sound of my own setup to improve once I cover the wood-paneled

wall behind the speakers with bookshelves, which should break up and disperse the reflections without massively absorbing them. Yet such is the nature of dipole sound that, until I install the shelves, I won't know for sure.


Below 250 Hz, the sound is not dipolar, because a conventional, 10-inch cone woofer in a small enclosure takes over. The crossover is a steepish 12 dB/octave and seemed seamless once I had the speakers properly placed. The SL3's specs cite response of 30 Hz to 24 kHz, ± 2 dB, and what I heard when the speakers were in the manufacturer-recommended position came pretty close to that (although I can't vouch for it all the way up to 24 kHz). In fact, I even reduced one speaker's bass output by 3 dB, using the two-position switch on its rear panel. However, in the final position I picked, the bass seemed pretty well gone by 40 Hz, though the sound still seemed well balanced and not thin. If you're not too proud to use tone controls, a bit of bass boost solves the problem perfectly in all but the very low end; turning my bass-control knob to somewhere between 1 and 2 o'clock fixed things up without making the midrange too heavy. I'd want to use a subwoofer to discreetly augment tones below 50 to 60 Hz or so, but I could live a long time without one. This is the kind of bass I'd expect

from woofer systems this size, but not from speakers costing \$3,195 per pair.

Yet I'm still going "aaah!" In my final setup, I get terrifically smooth, natural response and an image that's firmly locked in when I move around. Pink noise is remarkably smooth, though its balance does al-



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ter slightly when I move my head (an effect not noticeable on music). I also get an unprecedented feeling, in adjacent rooms, that there's live music in my living room, an effect I attribute to the SL3s' dipole nature. I'm not getting as much depth as I did with other placements, but I am getting a wide spread. Obviously, I have a bit of fine tuning to go—those tricky dipoles again.

Since the SL3s stand 64 inches tall, they can overwhelm some rooms' decor. My wife nonetheless thought them quite handsome, perhaps because the partial transparency of the upper half keeps them from looking massive. That height can also make these

**SETTING UP
THE MARTIN-LOGAN SL3s
TAKES A LOT OF CARE,
BUT THE SOUND WILL
AMPLIFY REWARD YOU.**

speakers tippy on deep carpets, as their footprint is a mere 13 x 14 inches each. Screwing the supplied spikes into the bottom of each cabinet solves that problem and also ensures you won't accidentally move your speakers out of their hard-found optimum positions. And the SL3s are noticeably shorter than the Sequel IIs that they replaced. (The model name was changed, says Martin-Logan's Gayle Sanders, "because we could not see making sequels to Sequels indefinitely.")

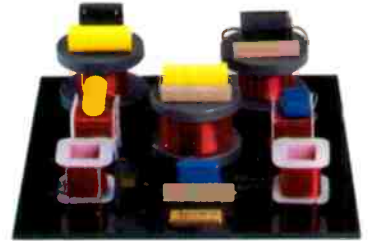
The input terminals, near the floor on the rear panel, have hexagonal metal nuts instead of the usual fluted plastic ones, which makes connections easier to tighten. Removable links enable bi-wiring or bi-amping. The terminals accept large spade lugs and pretty hefty wires, but not banana plugs. Recommended amplifier power is 100 to 200 watts per side, and rated sensitivity is 89 dB.

Like all electrostatics, the SL3s require a DC polarizing voltage, taken from a power supply that must be plugged into your wall. However, rated power draw is only about 2.5 watts per side, and signal-sensing circuitry shuts the power off if there's no input for a while. Turn-on time when signal resumes is just 2 seconds.

My overall reaction? The aaahs have it. A

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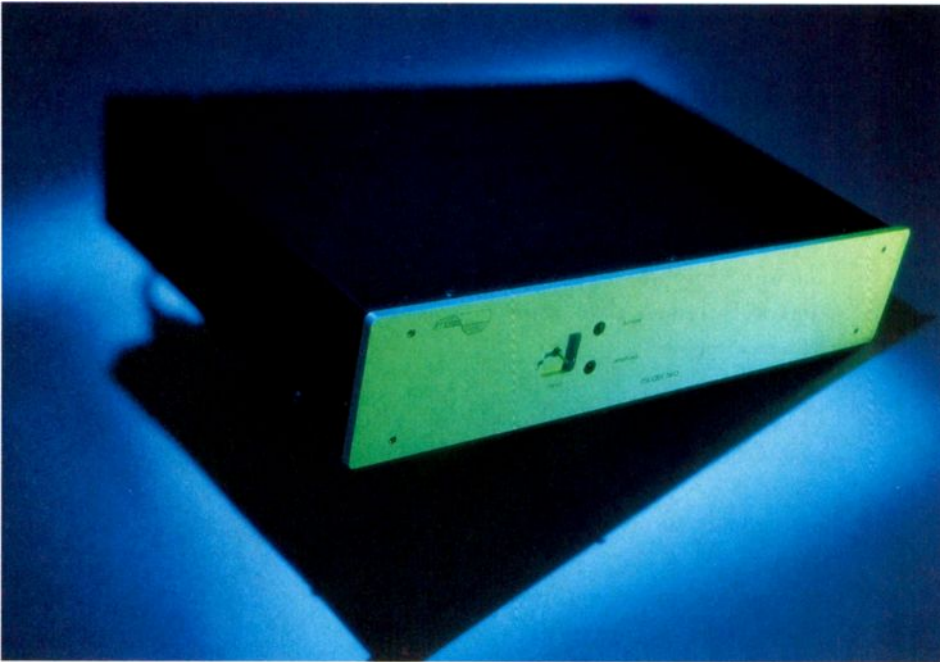


Record Producer Randy Royce

AURICLE

JOHN C. HALLENBORG

MUSE ELECTRONICS MODEL TWO D/A CONVERTER



Manufacturers that develop D/A converters and market them in the \$1,500 to \$2,000 range encounter plenty of competition, as this type of product has for several years been well represented by a welcome selection of such machines. The experienced audiophile has come to expect a lot from these components—sophisticated, beefy power supplies; attractive, well-crafted chassis and faceplates; solid construction; and clean, uncolored sound. Muse Electronics joins the fray with its \$1,700 Model Two, a machine with all the above-mentioned qualities and more. Muse, es-

tablished in 1988, also offers five models of solid-state amplifiers, a solid-state preamp, a new outboard phono stage, and three powered subwoofers. The company's electronics share a clean look of minimally etched aluminum faceplates in either black or silver; straightforward, heavy-duty construction; as well as high-quality jacks, plugs, and switches.

The Model Two D/A converter was designed by two of Muse's top people, who clearly set out to deliver more than a hint of cost-no-object performance at a judicious price. They have created a very capable machine that includes a few design in-

novations that should successfully differentiate it from the competition.

Internally, the Model Two's circuits are laid out on three p.c. boards, separated from one another to minimize interference. The signal arrives at the digital-filter board through either of two 75-ohm, S/P DIF inputs with BNC connectors. (An adaptor is provided for standard coaxial connection; a 110-ohm, XLR-connected AES/EBU input is available for \$300 and an ST optical input for \$200.) The inputs are selected via a three-position toggle switch on the front panel. A blue light indicates that the converter has locked onto the incoming signal (it will accept sampling rates from 32 to 48 kHz). There's no on/off switch and no indication (other than chassis temperature) of whether or not the converter is active until a signal is applied.

Through precision pulse transformers, the signal is passed on to a specialized receiver that uses a phase-locked loop to synchronize to the incoming data stream. Left- and right-channel information is passed along with timing signals to an application-specific processor that provides eight-times oversampling and digital low-pass filtration. (Another \$300 option is Pacific Microsonics' digital filter and HDCD decoder chip set, a code cruncher that has

gained a considerable following in the months since its introduction. Muse Electronics does not recommend the HDCD alternative, but simply

offers it to those who specifically desire it.) The signal is then reconfigured into 20-bit words and sent via a serial data port to the DAC board proper.

The DAC circuit board is the largest of the three and incorporates a number of innovations, some of which are the subject of patent applications. Extremely high-speed differ-

**THE MUSE MODEL TWO
MUST BE CONSIDERED
AT THE FOREFRONT OF
\$2,000 D/A CONVERTER
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ential receivers are used to maintain signal quality. The signal is relocked in that section, after which a logic circuit attempts to eliminate jitter introduced in the digital-filter stage. From this point on, the circuit is designed to prevent fluctuations in the ground or the power supply from affecting timing accuracy. At the heart of the board are four of Burr-Brown's highly regarded PCM-63K-P DAC chips, one pair for each channel. Each individual chip operates as a 19-bit device, but the pairs are configured to function as 20-bit DACs with excellent

linearity around the critical zero-crossing point. Current-to-voltage conversion is achieved in each channel by means of a single resistor ahead of a passive signal-reconstruction filter. The analog output from the reconstruction filter is buffered and amplified by a single gain block that provides both balanced and unbalanced outputs. As delivered from the factory, the Model Two's output from a full-scale digital input is 1 volt—half (6 dB less than) that of most other DACs. So in most systems, the preamp should be capable of appreciable gain.

The main component of the power-supply board is a special multiple-secondary transformer. Power is supplied to the main DAC board through shunt regulators and Class-A (constant-current) sources. Each channel benefits from a dedicated power-transformer winding. Power for the input receiver and digital filter comes from separate windings. Supply regulation is provided locally, and power for the front-panel indicators is delivered by discrete driver components. Connection to 115-volt AC service is via an IEC power cord.

For auditioning, I fed the Muse Model Two from a Denon DCD-1015 CD player and from a Forsell CD transport. Other components in my system included a Convergent Audio Signature preamp, a pair of

**THE MODEL TWO'S
DESIGN INNOVATIONS
SHOULD SUCCESSFULLY
DIFFERENTIATE IT
FROM THE COMPETITION.**

Kebschull 35/70 monoblock tube power amps, and a pair of Brentworth Type I loudspeakers. Cables were Kimber Silver throughout.

Fed by the Denon player, the Model Two performed very well, responding predictably to the uneven quality of various CDs. Some of the recordings were produced in the mid-1980s, when few excellent-sounding discs were made. However, the latest generation of CDs from audiophile labels (Chesky, Dorian, Clarity, and others) produced bell-like immediacy and robust dynamics. Clearly, all the basic fundamentals were properly reproduced. On major-label discs, various multitrack recording techniques were readily discernible. Samuel Barber's Adagio for Strings, with David Zinman conducting the Baltimore Symphony Orchestra (Argo 436288-2 ZH), was characterized by deep soundstaging, harmonic richness, and proper maintenance of separate orchestral sections. Through the Muse Model Two, a fresh performance of Vivaldi's "The Four Seasons," by the Orpheus Chamber Orchestra with Gil Shaham (Deutsche Grammophon 439933), set a modern standard

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Robert Harley, *STEREOPHILE*, Vol. 18, #11, Nov. 1995

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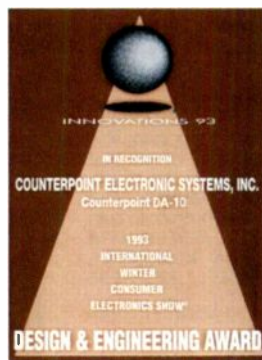
On the DA-10

"So what kind of animal is the Counterpoint? It is very much in the top league. But above all else, it is future proof. So as well as being both exotic and sexy, the Counterpoint is goddam sensible.."-Alvin Gold, *Audiophile Magazine*, U.K.

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In Vienna, noted musicologist Dr. Ludwig Flich put the DA-10 in **REFERENCE CLASS**, the highest rating.

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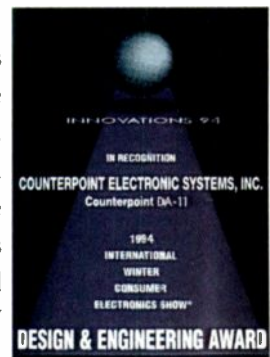


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"If a transport can ever be described as near ideal, then the DA-11 deserves that accolade...That's the kind of musical involvement that this transport/dac(DA10/11) has on offer: the music comes alive in the living room."-Eric Braithwaite, U.K.

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for this classic piece. And through the Forsell/Muse combination, Shaham's mastery of both his violin and the music overlaid a deliciously woody harmonic texture.

The playback of music for piano is perhaps the best simple test of a component's capabilities. On Earl Wild's performance of Rachmaninoff's Variations on Themes of Chopin and Corelli (Chesky CD58), each note was set forth by the Denon/Muse combination with a liquid concentricity that manifested a taste of the real instrument. Putting the Forsell in the chain improved the effect while adding very subtle ambient cues that I could hear only late at night, when background noise was nearly nonexistent. The Muse could hardly be faulted in going about its business, although some tube-ophiles might prefer the more rounded sound of DACs with vacuum tubes in the output. Such machines tend toward a richer, more forgiving character.

In dissecting the Muse Model Two's sound, I assessed high frequencies by using CDs heavy with cymbals, violins, flutes, and piano. The Chesky brothers somehow get the "nth" degree of shimmer from cymbals

in their latest generation of recordings, and the Muse was up to the task of reproducing them; feathery brush strokes, for example, decayed clearly and cleanly into blackness.

In the midrange, Dawn Upshaw's bright portrayals of Canteloube's Songs of the Auvergne, with Kent Nagano leading the Lyon Opera Orchestra (Erato 96559), were free of any stridency or unevenness that might point to deficiencies in the hardware. Canteloube's regional classics were very finely delivered, as Upshaw gives what amounts to a tutorial on singing.

Susannah McCorkle's interpretation of Carlos Jobim's "Waters of March," on *From Bessie to Brazil* (Concord Jazz CCD-4547), was stunning. So smooth and precise was the sound that it was easy to forget that a collection of resistors, capacitors, and so forth was involved in listening to the Forsell driving the Muse.

Son Seals's *Nothing but the Truth* (Alligator ALCD-4822) is a no-nonsense blast through the electric heart of modern blues. It's easy to appreciate his guitar's forte, harmonics, through the Muse, despite the frenetic construction of his songs.

For comparison, I set the Muse Model Two head to head against two more expensive machines: Theta Digital's DS Pro Generation III, a reference unit of a year or two ago, and the Audio Logic Model 34, a single-bit machine that has a tube analog stage. The good news for potential buyers of the Model Two is that there was not much to tell it apart from the Theta, which sold for \$4,000 not long ago. The \$4,400 Audio Logic had a laid-back quality that some listeners would prefer, and it would do well in systems suffering from two-dimensionality. Also, the Audio Logic has that tube magic that you either want, need, or consider a euphonic coloration to be avoided.

The Muse Model Two performed flawlessly throughout the audition period—not an unusual occurrence, but one worth noting. It must be considered among the few machines at the forefront of the \$2,000 D/A converter offerings. Whatever flaws it might have were so minor that they could well be attributable to the recordings or to gremlins in other parts of the reproduction chain. Overall, a very nice job by the Muse Electronics crew. A

"IN ACCURACY, SMOOTHNESS AND STELLAR GOOD LOOKS, THE CROWN JOULES DON'T HAVE MUCH COMPETITION."

DON KEELE, AUDIO MAGAZINE

I COULDN'T BELIEVE MY EARS. I WAS EXPERIENCING ONE OF THOSE AUDIO MOMENTS THAT I WILL SOMEDAY TELL MY GRANDCHILDREN ABOUT. MY EARS COULD SEE THINGS NEVER BEFORE SEEN WITH A NATURAL PRECISION I WASN'T SURE REPRODUCED MUSIC WAS CAPABLE OF. WITH LIVE RECORDINGS THE JOULES WENT FAR BEYOND THE USUAL CROWD NOISES AND TINKLING GLASSES....IT WAS AS IF I COULD HEAR THE SMOKE IN THE ROOM AND THE HUMIDITY OUTSIDE. NOT MANY SPEAKERS CAN DO THIS. IN THIS REGARD, THE PERFORMANCE OF THE CROWN JOULE IS AN ALMOST SINGULAR EXPERIENCE.

UNDERSTAND THIS, THE CROWN JOULE IS A 2-WAY OF THE HIGHEST RANK, A DESIGN DESERVING THE UTMOST RESPECT. LIKE IT'S MAKER, THIS SPEAKER HAS CHARACTER COMBINED WITH THE ABILITY TO GET YOUR ATTENTION AND KEEP IT. FOR THE MONEY IT'S FLAT OUT EXCEPTIONAL, IT IS ONE OF THE FINEST BOOKSHELF SPEAKERS MONEY CAN BUY.....MAYBE THE BEST!!! AND FOR THAT REASON THE CROWN JOULE IS TRULY A COMPONENT OF EXCEPTIONAL MERIT. WHERE ELSE CAN ONE FIND A BIT OF AUDIO STATE-OF-ART FOR UNDER \$2,000.00.

MARTIN DE WULF, BOUND FOR SOUND

MAGIC COMES IN ALL SHAPES AND SIZES. THE CROWN JOULE WITH SUBSTRATE IS A RELATIVELY INEXPENSIVE MAGIC CARPET THAT REALLY FLIES. IF YOU LOVE MUSIC, THESE SPEAKERS WILL GIVE YOU WHAT YOU PAY FOR, MUSIC. THE CROWN JOULES WITH SUBSTRATES REMINDED ME MOST OF MY OLD AVALON ASCENTS, AND WHEN YOU CONSIDER THAT THE AVALONS WERE OVER THREE TIMES THE PRICE, THAT'S SAYING SOMETHING INDEED. MOST NOTABLY THEY OFFER AN IMAGE DENSITY AND PALPABILITY IN THE MIDRANGE WHILE PRESENTING A DEEP AND WALL TO WALL, WIDE SOUNDSTAGE. THIS IMAGE DENSITY, THIS UNETCHED BUT DETAILED SOLIDITY, IS WHAT GIVES THE JOULES WITH SUBSTRATES THEIR ABILITY TO TAKE YOU FOR A WONDERFUL MUSICAL RIDE AT A REASONABLE PRICE. BUT THE JOULE ALONE, AT IT'S PRICE, MAY BE PEERLESS. HOW MUCH DO I LIKE THESE SPEAKERS?.....I BOUGHT A PAIR.

MICHEAL GINDI

STUNNING, GORGEOUS AND SENSUAL LOOKING. THE CROWN JOULES REALLY DID SOUND LIKE MUCH LARGER SYSTEMS, WITH BIG SPEAKER EXTENDED BASS. AT MODERATE LEVELS, THE CROWN JOULES SOUNDED SURPRISINGLY SIMILAR TO THE B&W 801 MK.III, IN BOTH VOICING AND QUANTITY OF BASS AND IN BASS EXTENSION. IT WAS HARD TO TELL THEM APART. IN ACCURACY, SMOOTHNESS AND STELLAR GOOD LOOKS. THE CROWN JOULES DON'T HAVE MUCH COMPETITION. I GIVE THEM A HIGH RECOMMENDATION.

DON KEELE, AUDIO MAGAZINE

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Warranty Period (Dealer Installed)	5 years	3 years	1.5 years	2 years	1 year	3 years	2 years	1 year

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VPI TNT III TURNTABLE WITH FLYWHEEL



The search for ultimates in high-end audio is a search through extreme technologies for extreme performance, very often at an extreme price. In the case of VPI's TNT III turntable with flywheel, such an investment pays off with superb sound quality—showing that the best in analog can still equal the best in digital. But the investment is not negligible; the standard TNT III costs \$5,000, plus \$800 for a dedicated stand with a heavy acrylic top. The version I assessed here, which substitutes an extra-heavy flywheel

for the normal one, is \$6,000, plus \$900 for its matching stand (whose larger top is made of medium-density fiberboard).

Let me not give the erroneous impression that only the most expensive extremes count. Despite the advances usually found in many expensive top-of-the-line products, you do not have to pay such prices

to enjoy LPs; you can enjoy them for remarkably little money simply by buying good used LP components, many of which are available at bargain-basement prices. You can spend less than \$1,000 for a cartridge, tone-

arm, and turntable and get 80% to 90% of the performance you'd get if you'd spent \$10,000 or more. VPI, for example, has excellent turntables at lower prices, such as the HW-19 Junior (about \$1,000 with a good tonearm and cartridge).

I do not, however, personally practice the restraint I preach. I audition every expensive cartridge, tonearm, and turntable I can, and I treasure each new small increment in performance. In fact, it is this search that makes me admire the current version of the TNT so much.

Like several other top-quality turntables, the VPI TNT III is the product of years of steady evolution and improvement. Throughout this evolution, I have enjoyed its sculpture-like styling and have consistently considered it a contender for the title of best turntable at any price. The TNT is also a practical investment (as practical as high end gets), since VPI has a proven track record of service and commercial stability, and each new version of the TNT has been upgradable. Each TNT has also been easy to set up, well made, free of mechanical and operating noise, stable in sound quality under all operating conditions, and reliable in performance. I consider these five traits essential in a high-end turntable.

The TNT III's chassis floats on four suspension springs. This provides exceptional stability when each spring is properly loaded and allows

the use of virtually any tonearm without having to adjust the turntable. The acrylic and aluminum platter supported by this chassis is also quite heavy,

with a 15-pound lead-ring insert to reduce wow and flutter and the residual effects of stylus drag. It turns on a precision-machined bearing, 4 inches long, with support bushings widely spaced at the top

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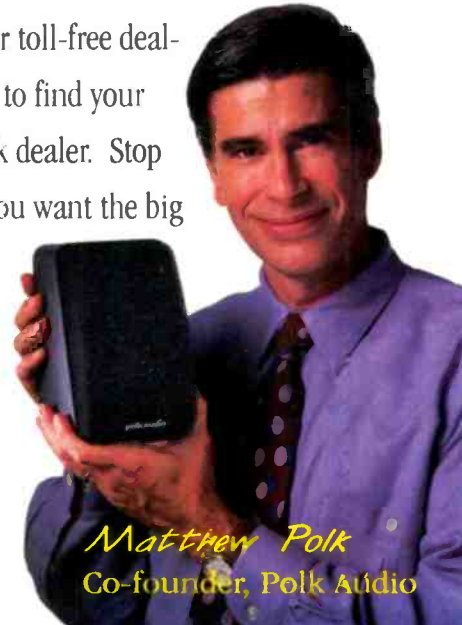
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Matthew Polk
Co-founder, Polk Audio

and bottom to provide stable, totter-free rotation. A screw-down record clamp is used, offering most of the advantages of vacuum clamping; this is effective in coping with moderately warped records, and it avoids the potential pump noise and vibration of a vacuum system.

A well-proven synchronous motor rotates the TNT III's platter. VPI believes that the self-correction in a servo leads to audible modulation of rotation speed and that direct-drive motors set up too much vibration in the turntable. To make the motor quieter, it is now mounted in a recess at the top of a 21-pound cylinder machined from nonmagnetic stainless steel.

A redesigned electronic power-line conditioner (PLC) allows precise adjustment to any speed, from 33½ to more than 45 rpm, with a separate toggle switch to change the basic two speeds. This supply is said to allow the motor to operate at the point where it becomes synchronous, which reduces motor vibration and improves the match

**I'VE ALWAYS THOUGHT
THE TNT A CONTENDER
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between the motor's torque and the belt loading. The PLC feeds the motor current at 54 Hz for 33½ rpm (and 72.9 Hz for 45 rpm), for further isolation from any 60-Hz power-line problems that might modulate the output of the PLC. The motor pulley is now oversized, to compensate for the resulting reduction in motor speed. This required some redesign of the TNT III's isolated drive system, which is said to reduce noise transmission to the platter, provide very stable rotation, cut down background noise, and allow better reproduction of low-level detail.

The turntable's drive system now uses passive side pulleys to load the belt and smooth out the residual cogging of the motor. This three-pulley drive provides better balanced rotation, helps neutralize the side load inevitable in single-pulley designs, and reduces rumble and wear on the bearings.

The standard TNT III has a flywheel on the motor to remove any remaining pulses that might be transmitted from the poles of the synchronous motor. The version I tested had a far heavier flywheel, which was located between the motor and the platter. According to VPI, this flywheel, turning at around 500 rpm, gives this TNT III version as much inertia as a 1,600-pound turntable turning at 33½ rpm. Although I cannot verify this claim, I can state that the TNT apparently does have even better speed stability and an even lower noise floor.

No turntable can be reviewed without considering its coloration of sound via the tonearm, cartridge, and mounting system used to audition it. I used the TNT III with four different tonearms: the Wheaton Triplanar IV, Lustre, and Eminent Technology Two tonearms and a modified Bohsei AC-300 tonearm rewired with Discovery cable. Similarly, I used a wide range of current and older cartridges—including products by Argent, AudioQuest, Benz-Micro, Decca, Koetsu, Monster Cable, Ortofon, ScanTech, and Sumiko. The AudioQuest AQ 7000NSX and ScanTech Clavis (imported by Lyra) were my main choices.

Setup was remarkably easy. The TNT III gave me all the space I needed to mount any arm. I could repeatably switch tonearm mounting boards without having to adjust springs, weights, or damping for any arm. The TNT III's shape, plus its dustcover's transparent base and fully removable top, allowed me to easily check cartridge alignment and to set azimuth, vertical tracking angle, and tracking force. These may be blessings only reviewers take advantage of, but they're blessings nonetheless.

The TNT III had remarkably small sonic interaction with different tonearms and cartridges. I heard no colorations I had not previously experienced with the cartridges and tonearms I used in my listening tests.

I used the VPI TNT III on the dedicated stand and on a RoomTune Justarack, both of which were in my listening room. I also set it up in my equipment room, well away from the speakers, so I could check for any effects of acoustic breakthrough. Mass and the proper suspension tell: There was remarkably little difference between the sound when the VPI TNT was in the room with the speakers and when it was elsewhere, even at very loud volumes.

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The most striking aspect of the TNT III was its exceptional ability to minimize noise and also to provide rock-solid stability of pitch. Audiophiles who have not experimented extensively with turntables or heard really good analog signal sources may not appreciate just how much detail is on many LP records and how much less noise is apparent with a really excellent turntable than with a merely very good one.

The VPI III helped get an amazing amount of music out of even the oldest members of my LP collection. This was especially striking with solo recordings—particularly of lute, guitar, piano, and harpsichord. Surface noise seemed to drop, and the music seemed to bloom. The natural character of the instrument was more apparent, and the small sound cues that humanize a performance were clearer.

I am a particular fan of chamber music, and some of the best records I know of were issued years ago on the Accent label—many recorded in Belgium, in rooms or halls where I heard similar performances when I worked for NATO. The VPI allowed another touch of realism in terms of clear ambi-

ence, imaging, and soundstage life to these records. In some ways, the VPI served as a time machine, taking me back to music I had lived through.

I also enjoyed an improvement in musical dynamics. This was most striking in the reproduction of low-level dynamic and transient information. Further, I got an excellent sense of space. The TNT III did not alter or expand the soundstage on a record but did do a remarkably good job of allowing the full width and depth of the soundstage to be properly reproduced.

While I scarcely have perfect pitch, I have always been sensitive to even small amounts of wow and flutter, both of which the TNT III appeared to contribute very low amounts. Coupled with a lack of mechanical noise, this reinforced the feeling of being at a live performance rather than just hearing one reproduced.

The VPI system does allow superb deep bass—and bass that challenges the best digital sound in terms of extension as well as definition and control. In lab tests, I realize that the bass of digital components measures much better than that of analog com-

ponents. And yes, I can more accurately hear very low-frequency response with my test CDs than with my collection of LP test records. But at its best, analog bass is nonetheless superb.

This same neutrality in timbre is offered in the midrange and top octaves, and the TNT III helps keep both timbre and resolution consistently clear from the beginning to the end of the record. Vacuum clamping may work slightly better and produce slightly more consistent sound with some records than the TNT III's screw-down clamp, but nothing I have heard does a better job with as wide a range of records.

The TNT III is a truly excellent turntable, a new benchmark in the evolution of analog sound. A combination of this turntable with a top tonearm and cartridge will provide immensely musical and involving sound. There's no question that digital technology can provide far less measurable distortion, but I have great doubt that a digital system can provide more pleasure. If you are willing to pay a premium for great LP sound quality, the TNT III can give you magic for your money. A

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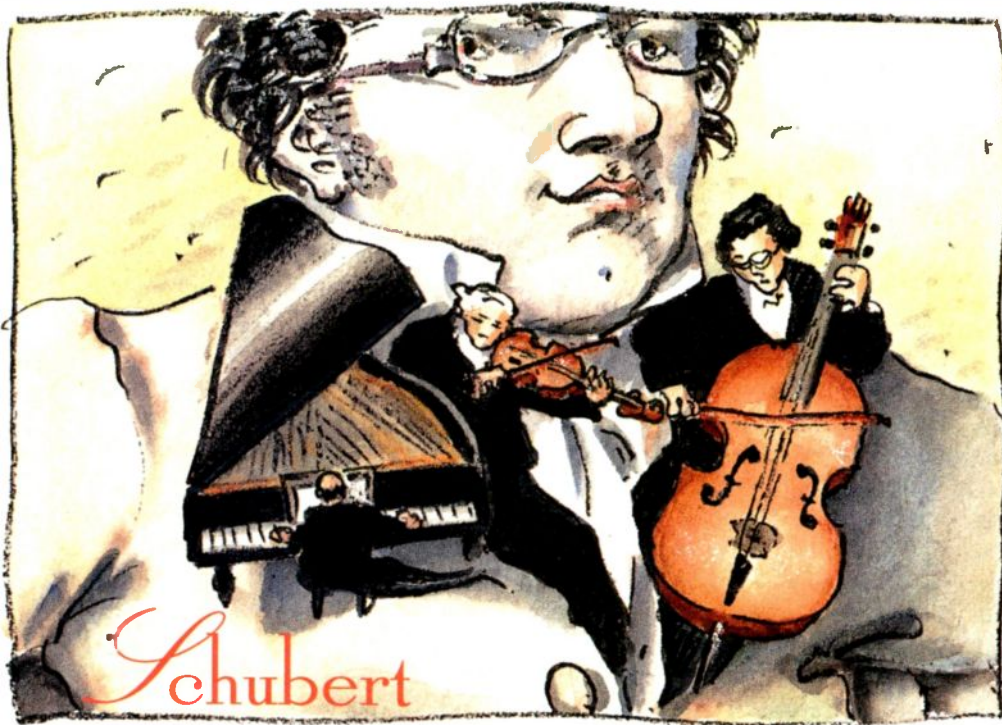
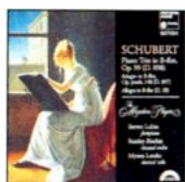


Illustration: Philippe Lechien

Schubert's first thoughts on a slow movement for that Trio, and a charming early Allegro that Schubert called a "sonata" movement.

The Mozartean Players are fortepianist Steven Lubin, "classical" violinist Stanley Ritchie, and "classical" cellist Myron Lutzke. Obviously, we're talking so-called authentic style here. Their sound is, in fact, lean and lithe, with minimum vibrato. The arresting freshness and alertness of their playing makes conventional performances sound heavy and overblown by comparison. These are wonderfully sensitive and supple readings, marred only slightly—and only occasionally—by rubato or dynamics that, in overarticulating a minor structural point, cause the overall line to falter a bit.

The recording venue on the Purchase campus of the State University of New York is not the hall whose acoustics I've admired in other hands. This one sounds a little less fulsome here, in keeping with the spare sound of The Mozartean Players, but still very attractive. Spatial differentiation is as crisp as the performances; the close-up perspective is surrounded by a radiant, if restrained, ambience. *Robert Long*



Schubert: Piano Trio in B Flat (Op. 99), D. 898; Adagio in E Flat, D. 897; Allegro in B Flat, D. 28

The Mozartean Players
HARMONIA MUNDI FRANCE
HMU 907094, CD; 59:43
Sound: A, Performance: A-



Schubert: Piano Trio in E Flat (Op. 100), D. 929

The Mozartean Players
HARMONIA MUNDI FRANCE
HMU 907095, CD; 59:23
Sound: A, Performance: A-

Between these two discs, we appear to have everything Franz Schubert ever wrote for piano trio, and there's not a note I would willingly give up. Only the E-Flat Trio was published (as Op. 100) during Schubert's lifetime; that edition followed Schubert's instruction to his publisher that the Finale be cut by some 100 bars. Although this performance (like every other I've heard) honors the request, the original version is also included, as an "appendix." The booklet notes

suggest that Schubert was excessively compliant to the conventional view, in which this extremely long Trio was seen as outlandishly so, and that the music is more whole in the original form. I tend to agree; it's great to be able to hear the Trio either way.

The other full-scale Trio, in B Flat, was never offered for public performance or publication until after Schubert died, and its history is less clear. What is clear is that both Trios date from within a year or two of his death and represent his genius in full cry. When the B-Flat Trio was published (as Op. 99, so that for many years it was known as "No. 1"—which, in order of composition, it seems it was), Robert Schumann seized on it as a masterwork that overshadowed the already familiar Op. 100. Both Trios are superb and have deservedly remained staples of the chamber repertory.

Also included with the B-Flat Trio are a lovely Adagio (published post mortem as a "Nocturne" for piano trio), which evidently represented

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Sound: A, Performance: A

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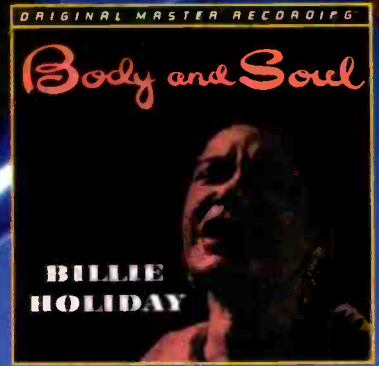
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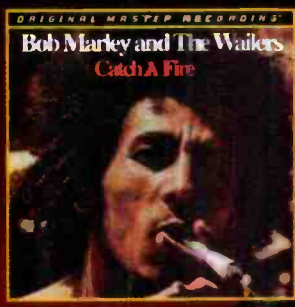
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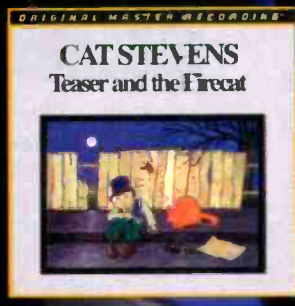
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G L E N N B R A N C A

Symphony No. 9 ("L'ève Future")

*Camerata Silesia Singers Ensemble;
Polish Radio National Symphony,
Christian von Borries*

POINT MUSIC 446-505, CD; 58:56
Sound: B-, Performance: C

When electric musicians transfer their music to orchestral instruments, something gets lost in translation. The power of Jimi Hendrix's "Purple Haze" comes from overdriven, distorted electric guitars as much as melodic invention, and no matter how "down" the Kronos Quartet gets, they'll never achieve that kind of intensity.

That's Glenn Branca's dilemma as well. He's best known for his "guitar armies," in which he created a wall of distorted overtone layers. It was a glorious, all-encompassing sound mass, as exhilarating in its own right as the

texture sounds of György Ligeti or Krzysztof Penderecki.

Symphony No. 9, "L'ève Future," is scored for orchestra and voices, however, and performed by the Polish Radio National Symphony. Its elongated melodies arc and flow, played out over choirs and like a slow-motion wash. But as Branca can do when he leaves downtown and enters the classical art world, he loses it, abandoning the

very elements that made him distinctive in the first place. His choral writing, in particular, sounds labored, and the "la-la" section of the symphony borders on parody. "Free-form," the other work by

Glenn Branca on this album, strives for a more Philip Glass style of melodic minimalism. Yet even here it seems as if Branca missed the electric juice that contributed such texture to his earlier works. *John Diliberto*



Czerny: Quatuors Concertants (for four pianos), Op. 230 and Op. 816

Baynov Piano Ensemble
ARS PRODUKTION FCD 368 331
CD; DDD; 49:54
Sound: A+, Performance: A+

The name Carl Czerny may strike terror in the hearts of many adults who, as children, were subjected to the dense, difficult, and boring finger exercises that were overused by far too many piano teachers. In fact, his exercises and etudes make up only about a 10th of his catalog of more than 2,000 compositions.

Adaptions and transcriptions for the piano were the major part of the output of the 19th-century Viennese composer/piano teacher. Most melodies came from operatic "hits" of the day, most of which are now out of the repertory. Czerny excelled in passages of brilliant virtuosity and velocity, and he didn't even stop at music for a single keyboard!

One of Czerny's arrangements of a Rossini opera overture indicated "Up to 8 Pianos." The two Quatuor Concertants were written for a fund-raising concert to assist Danube flood victims. The four pianos were played mainly by female members of the nobility, and Czerny was careful to give each woman exact-

ly 19 pages of sheet music to avoid jealousy. Bellini, Auber, Meyerbeer, Flotow, and Mozart are among the opera composers quoted in the pieces. Mozart's melodies stand out, as expected, as does Paganini's familiar theme "La Campanella."

Tomislav Baynov founded his ensemble about six years ago to perform unusual piano works written for six or more hands. On this disc, all four pianos are clearly spaced out in the soundstage, and the technical demands are fully met by all six pianists. It's something like hearing Horowitz, squared! *John Sunier*

Bruckner: Symphony No. 8 (Haas Edition)

NDR Symphony Orchestra, Günter Wand
RCA VICTOR RED SEAL 09026 68047 2
Two CDs; DDD; 1:27:52
Sound: A, Performance: A+

Günter Wand has previously made live recordings of four other Anton Bruckner symphonies with these same orchestral forces and in the same hall in Hamburg, the Musikhalle.



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- GA- Audio Warehouse; Savannah; Ken's Stereo Jet; Macon; Laser Disc Enterprises; Atlanta; Merit TV; Columbus; Stereo Connections; Valdosta; Stereo Festival; Atlanta; Stereo Shop; Martinez
- HI- Audio Center; Honolulu
- IA- Archer Audio Video; Ft Dodge; Audio King; Cedar Rapids; Des Moines; Audio Video Logic; Des Moines; Audio Visions; Sioux City; Camera Corner; Davenport; Hawkeye A/V; Iowa City; Waterloo
- ID- Ullimate Electronics; Boise; Wise Buy; Idaho Falls
- IL- United Audio Cts.; Chicago; & Suburbs; Camera Corner; Bloomington; Cars & Stereos; Rockford; Jon's Home Ctr.; Quincy; Sd Forum; Crystal Lake; Select Sd; Naperville; Sundown A/V; Springfield
- IN- Audio Video Lifestyles; Fort Wayne; Ovation Audio; Clarksville; Indianapolis
- KS- Accent Sound; Overland Park; Advance Audio; Wichita; Audio Junction; Junction City; Manhattan
- KY- Ovation Audio; Lexington; Louisville
- LA- Alterman Audio; New Orleans; Metairie; Sound Advice; Baton Rouge; Wright's Sound Gallery; Shreveport
- MA- Goshkin; Chestnut Hill; Saugus; Goodwins Audio; Boston; Shrewsbury; Nantucket Sound; Hyannis
- MD- Audio Buys; Annapolis; Gaithersburg; Laurel; Rockville; Waldorf; Grainhouse; Ball; Elliott City; Soundscape; Baltimore
- ME- Cookin'; Portland
- MI- Peca's; Detroit; Roy's Classical Jazz; Holland; Classic Stereo; Kalamazoo; Grand Rapids; Front Row A/V; Flint; Court St. Listening Room; Midland; Saginaw
- MN- Audio Designs; Winona; Audio King; Minneapolis; & Suburbs; Rochester; St. Cloud; Audio Perfection; Minneapolis
- MO- Independence A/V; Independence; Sound Central; St. Louis
- MS- McLelland TV; Hattiesburg; Players A/V; Ridgeland
- NY- Car & Home Stereo Ctr.; Billings; Rocky Mt. Hi Fi; Great Falls
- NC- Audio Video Systems; Charlotte; Audio Visions; Wilmington; Now Audio Video; Durham; Greensboro; Raleigh; Winston Salem; Audio Lab; Wilmington; Tr City Elect.; Concord
- NE- Custom Electronics; Omaha; Lincoln
- NH- Cookin'; Nashua; Manchester; Newington; Salem; S. Nashua
- NJ- Hal's Stereo; Trenton; Monmouth Stereo; Shrewsbury; Wall; Sound Waves; Northfield; Woodbridge Stereo; West Caldwell; Woodbridge
- NM- Ultimate Elect.; Albuquerque; Sound Ideas; Albuquerque
- NV- Ultimate Elect.; Las Vegas; Upper Ear; Las Vegas
- NY- Audio Breakthroughs; Manhasset; Audio Den; Lake Grove; Audio Expressions; Newburgh; Audio Junction; Watertown; Clark Mus.; Albany; Syncoast Stereo; Escage; Manhattan; Nanuet; Hart Elect.; Ithaca; Vestal; Innovative Audio; Brooklyn; Listening Rm.; Scarsdale; Rowe Camera; Rochester; Sound Mill; Mt. Kisco; Yorktown Hts.; Speaker Shop; Amherst; Buffalo
- OH- Contemporary Sounds; Ok City; Labs Premium Audio; Tulsa; Photo World; Bartlesville; Ultimate Electronics; Tulsa
- OH- Audio Cra'; Akron; Cleveland; Mayfield Hts.; Westlake; Audio Etc.; Dayton; Paragon Sound; Toledo; Threshold Elect.; Heath
- OR- Bradford's HiFi; Eugene; Chelsea A/V; Portland; Beaverlton; Kelly's Home Ctr.; Salein; Lanson's; Medford; Roseburg; Stereo Plant; Bend
- PA- Audio Junction; Pittsburgh; Gary's Elect.; State College; GNT Stereo; Lancaster; Hart Elect.; Blakely; Kingston; Hi Fi House; Abington; Broomall; Camp Hill; Harrisburg; Listening Post; Pittsburgh; Palmer Audio; Allentown; Stereoland; Natrona Heights; Studio One; Erie; The Stereoshop; Greensburg
- RI- Stereo Discount Ctr.; Providence
- SC- A/V Design; Charleston; Custom Theater & Audio; Myrtle Beach; Upstairs Audio; Columbia
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- Mexico- Contact Grupo Voli men; Mexico City

when recording live. In fact, the sonic impact of everything in this superb series beats any studio recordings of these works.

The Eighth is the pinnacle of Bruckner's symphonic art, with greater size and complexity than even Beethoven's Ninth. The wind and percussion sections are greatly reinforced, adding to the powerful sonic impression. The familiar block-like architectural structure of earlier Bruckner symphonies is developed into a towering musical cathedral. One music scholar summed up the Eighth as "Struggle and despair, victory and resignation. . . united in a unique apotheosis. . ." *John Sumier*

Chadwick: Symphonic Sketches; Malpomene Overture; "Tam O'Shanter"

Czech State Philharmonic; José Serebrier
REFERENCE RECORDINGS
RR-64CD, CD; 62:50
Sound: A, Performance: A

Audiophiles have long known this small San Francisco label for the exceptional sound quality of its recordings, and now it introduces the latest wrinkle in CD technology,



High Definition Compatible Digital (HDCD). That alone will pique the interest of some.

Massachusetts Yankee George Whitefield Chadwick (1854 to 1931) never exactly became a household name, but the more time passes, the more he becomes recognized as an important seminal figure in the

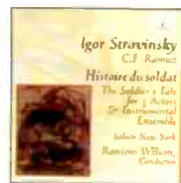
history of American serious music: Charles Ives studied with Horatio Parker, and Parker in turn had studied with Chadwick.

One musical virtue especially stands out here: Chadwick's downright, unabashed tunefulness. From time to time, you have the fleeting impression he must have quoted some of his themes from, say, Stephen Foster. José Serebrier and his talented orchestra, the Czech State Philharmonic of Brno, make the most of it in every regard. *Paul Moor*

Stravinsky: The Soldier's Tale

Ron Bohmer and Reed Armstrong, actors;
Sally Goodwin, narrator;
Solisti New York, Ransom Wilson
CHESKY RECORDS CD122
CD; DDD; 66:25
Sound: B+, Performance: A

Many exciting versions of Stravinsky's miniaturized Faust legend have been preserved on recordings, so this one has some heavy competition. The seven-member chamber ensemble is top-drawer, with kudos to violinist Erica Kiesewetter. Actors Ron Bohmer and Reed Armstrong make the mini-drama come alive, and Sally Goodwin offers a welcome variation on the usual use of a male narrator.



Actions on the soundstage are superbly conveyed by Chesky's use of a single, vacuum-tube Blumlein mike and the choreography of the musicians, actors, and sound effects

ROMANTIC FRENCH FANTASIES

The French symphonic organ school was made possible by the mechanical innovations of organ builder Cavallé-Coll. With these aids to a variety of tonal and expressive effects, and more brilliant finger work, the music became more romantic and orchestral.

The dozen tracks here range from early César Franck to late Marcel

Dupré, and all are performed in the superb acoustic environment of the Mormon Tabernacle on one of the world's best-known pipe organs. The present Aeolian-Skinner instrument possesses 147 voices, 206 ranks, and 11,623 pipes.

Selection of the works obviously demonstrates not only the bombast and

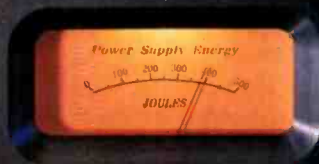
power possible with the king of instruments but also subtler, more lyrical qualities. The Franck Fantasie is the lengthiest, the delightful French Rondo of Léon Boëllmann the shortest and lightest.

The long reverberant time of the Mormon Tabernacle doesn't lend itself especially well to rapidly moving passages, and John Longhurst generally adopts appropriately leisurely tempos.

Bruce Leek's live-to-two-track, 20-bit recording captures both the spatial layout of the thousands of pipes and the reverberant field of the gigantic acoustic space itself. Nether regions of the organ's pedal system are cleanly preserved for subwoofer excitation. *John Sumier*

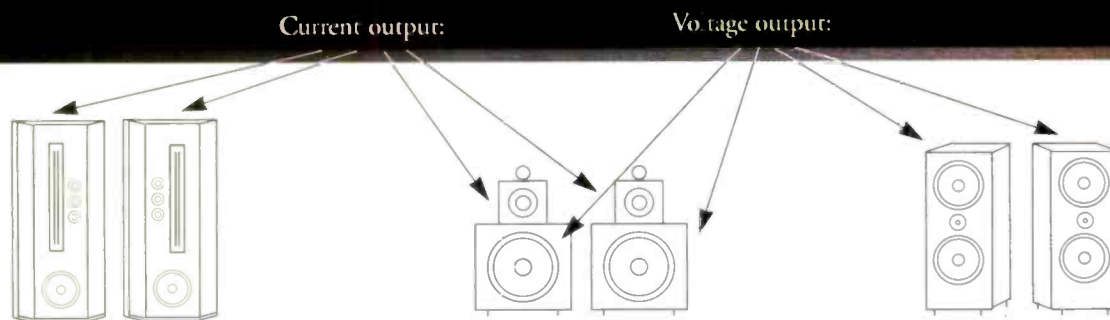


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around it—all enhanced by the clarity of the company's high-resolution digital recording. Those of the opinion that imaging and sound-staging make no difference in listening enjoyment should sit in front of speakers that image well and audition this CD. It's also very effective via any ambience surround system.

Unfortunately, there are some uneven voice levels, and the natural acoustics of the recording site are of a reverberant indoor space—not the outdoor environment in which most of the drama takes place. This creates a troubling contradiction between story sense and acoustic location.

John Sunier

**Vasks: Cantabile;
English Horn Concerto;
Message;**

Musica Dolorosa; Lauda

Normunds Schnee, English horn;

Riga Philharmonic Orchestra,

Kriss Rusmanis

CONIFER CLASSICS 75605 51236

CD; DDD; 76:43

Sound: A-, Performance: A

For the West, one positive fallout of the end of the Cold War has been better access to some glorious recent music from Eastern Europe

and Russia. In this instance, the passion and courage demonstrated by the brave people of Latvia in demanding their liberty is reflected in music from one of their leading living composers, Peteris Vasks.



Conductor Kriss Rusmanis is half Latvian.

Because of his keen interest in the music of Latvia, Lithuania, and Estonia, he became acquainted with many of the leading composers of those countries and performed their music. A planned series on Conifer devoted to new music from this region begins with the powerful and affecting works of Vasks.

Vasks has ties to the Polish school of composition and admires Lutoslawski, Górecki, and Penderecki. Yet one may find his more melodic style closer to that of Arvo Pärt. There are a number of very emotional climaxes, and emphasis is placed on music for strings and on long, sad melodic lines. All of this can be heard in the "Elegy II" movement of the haunting English Horn Concerto. Vasks refers to Eastern European roots full of sadness and suffering but says such tragic history gives, in artistic terms, "a terrific impulse to be creative, to express our emotions."

The titles of two of the works establish their mood: "Cantabile" and "Musica Dolorosa." "Message" is a fascinating piece for string orchestra, percussion, and two pianos that in some sections echoes Bartók's "night music pieces." The composer describes "Message" as a battle between the forces of good and evil. The final work, "Lauda," is a song of praise to Latvia. There are allusions to folk dances, and such unexpected percussion instruments as temple blocks and bongos are used.

John Sunier

**Labyrinth: Works by York, Krouse,
Copland, Basie, Eagan, Sousa;
Traditional Works**

LAGQ

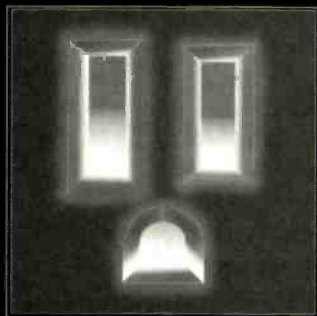
DELOS DE 3163, CD; DDD; 62:48

Sound: A+, Performance: A+

For its third Delos CD, the dynamic foursome of American guitarists, the LAGQ (yes, the group formerly known as the Los Angeles Guitar Quartet), turns its American-made guitars to 11 pieces by American composers. "Simple Gifts" from *Appalachian Spring* and the "Hoe-down" from *Rodeo* are among the expected Copland transcriptions. Busy LAGQ member and composer Andrew York brings to the album three varied pieces, including "Bantu," which is a cross between African drumming and Dave Brubeck.

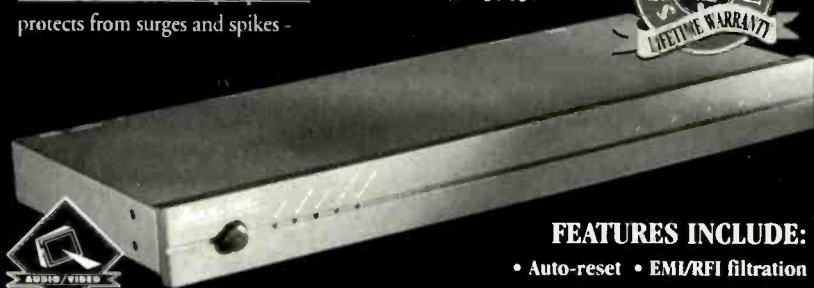


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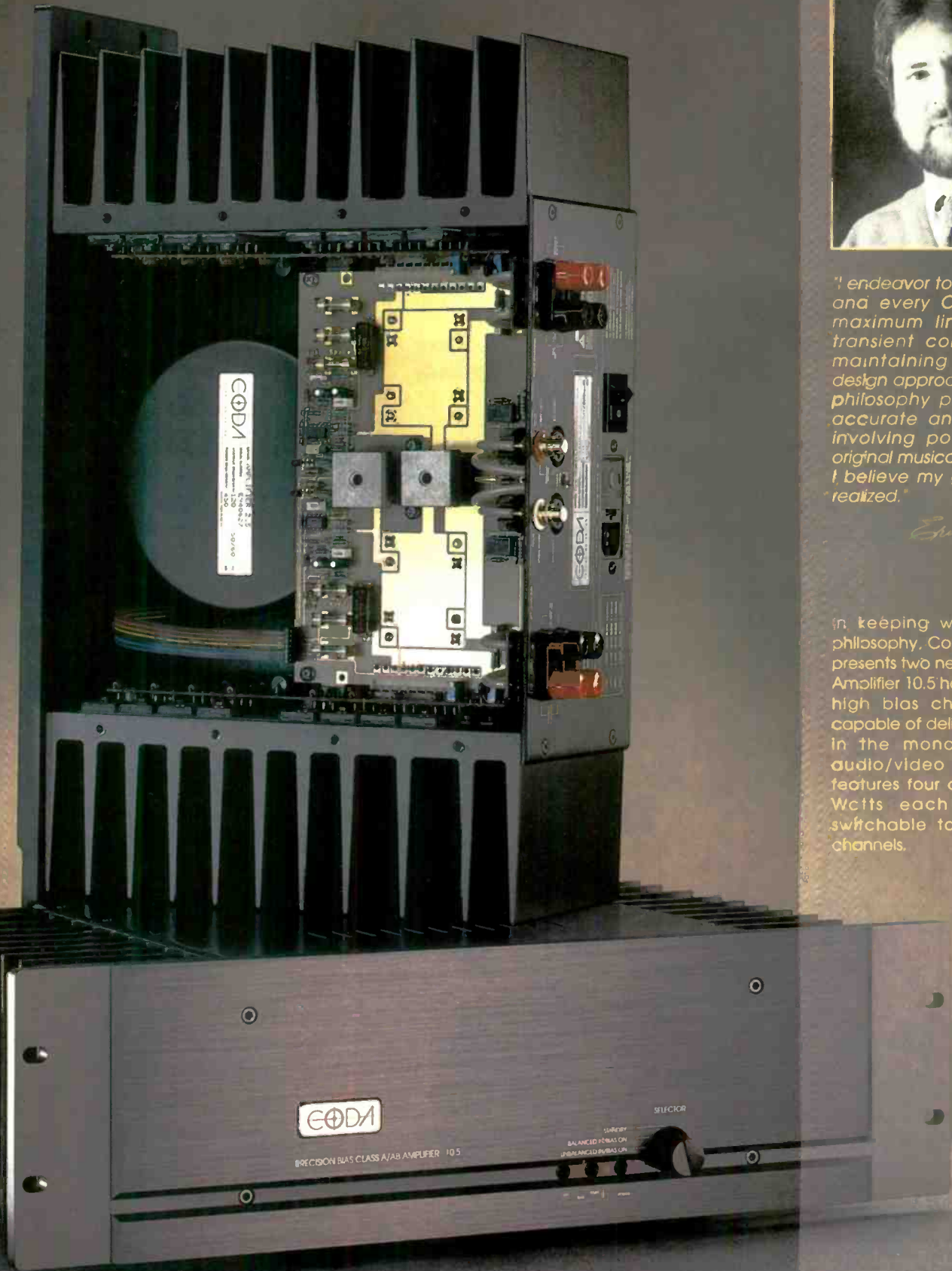
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Eric Sauter

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Three guitars of the LAGQ are similar six-string Spanish guitars, and the fourth, a seven-string, allows an extended range. The similar pitch range of all four makes possible an equality of solos and the passing around of themes, which is not always possible in guitar quartets using a "family" of differently pitched instruments. Location of the four guitarists in front of the listener is precise and almost binaural in spatial realism.

The CD's title, *Labyrinth*, comes from a 21-minute epic by Ian Krouse, which is based on a Led Zeppelin theme. Krouse uses the theme as a kind of "portal" between the worlds of

rock and contemporary classical music. Two of the players must tune differently, and pitchbending, bottleneck slides, flat-picking, and even singing are part of the musical language.

John Sunier

Bryars: The Last Days

Balanescu Quartet

ARGO 448 175, CD; DDD; 72:43

Sound: B, Performance: B+

Gavin Bryars has received a lot of attention in the last few years for his renovated early works, *The Sinking of the Titanic* and *Jesus'*

Blood Never Failed Me Yet (Point Music). But those pieces date back 25 years, and in the inter-



terim, the British composer has been creating beautiful and rarefied chamber music. That's what is on *The Last Days*, a collection of two string quartets and a violin duet performed by the Balanescu Quartet, the ensemble of choice for contemporary British composers. And it is certainly the right choice.

Alexander Balanescu and company extract every nuance from the sublime melodies of Bryars' elegiac yet austere pieces. Bryars is one of the few composers who can write exquisite-ly beautiful lines and avoid the temptation to schlock it up. His String Quartet No. 1 is set on a slowly repetitive ground pattern that shifts from member to member while the others emerge with long, arcing solos. But Bryars is not constrained by his minimalist tendencies. He abruptly shifts gears into a more strident, almost Bartók-like cadence, full of ominous foreboding.

On "The Last Days" (the piece for two violins), Bryars weaves a gorgeous theme that recalls his earlier work, "The Old Towers of Lobenicht." But here it is stripped down to just two violins, played by Balanescu and Clare Connors, in a tone poem for the end of the world. I rather like the sound of rumbling traffic bleeding through the studio walls; in my opinion it gives "The Last Days" an even more ominous tone.

By their nature, Bryars' quartets don't have the lush appeal of his exquisite chamber pieces, but they reveal the structural depths of a composer who can operate in a classical tradition or an avant-garde one, and make of them something of his own.

John Diliberto

Mendelssohn:

Piano Works, Vol. I

Benjamin Frith, piano

NAXOS 8.550939, CD; DDD; 71:23

Sound: A, Performance: A

Included in this first volume are the Six Preludes and Fugues of Op. 35, the Three Caprices of Op. 33, and the "Perpetuum Mobile" in C, Op. 119. It's a delightful collection, expertly and lovingly played and picked up in clear and appropriately intimate sound. So interesting are the Six Preludes and Fugues—which give ample evidence of Mendelssohn's familiarity with Bach but proceed very much in their own way—that it astonishes me I've never before heard them.

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Robert Long



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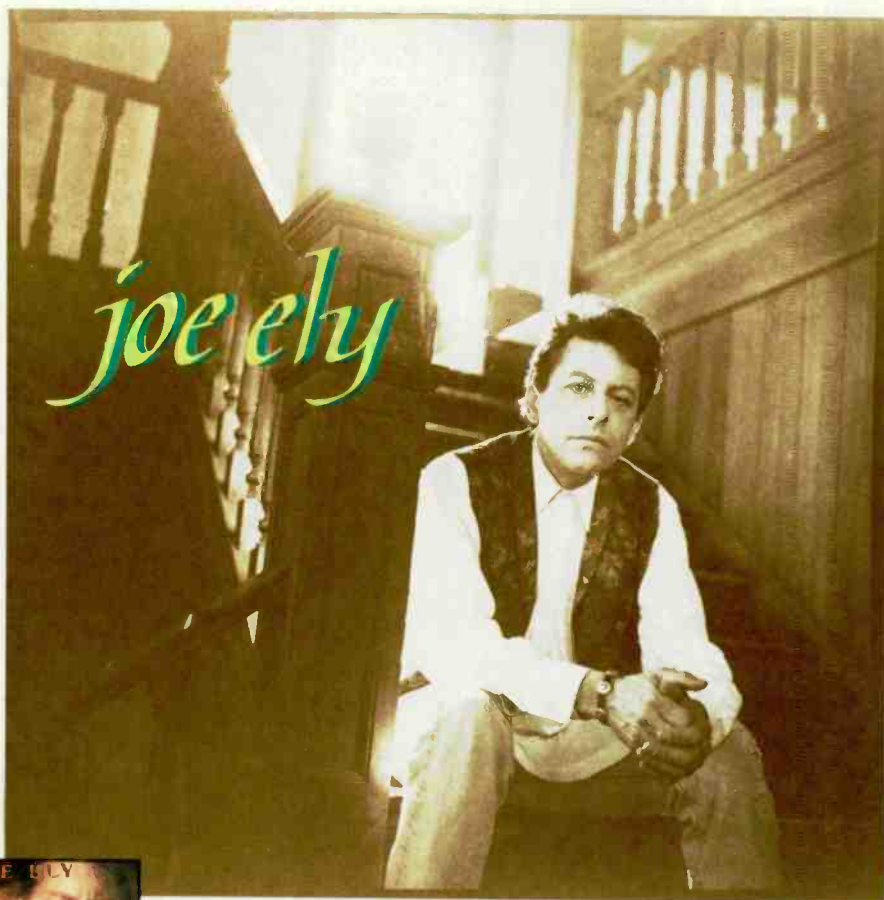
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ROCK~POP RECORDINGS



Letter to Laredo

Joe Ely

MCA MCAD-11222, 51:50

Sound: A-, Performance: B+

Of Joe Ely's 10 albums, *Letter to Laredo* is easily the most western, and that's specifically attributable to flamenco guitarist Teye, who is a welcome addition to Ely's crack band. The Spaniard's guitar supplies the album with a unifying thread that reinforces the lyrical thrust of songs about desperados—men and women on the run.

From *Laredo*'s opener, "All Just To Get to You," to its closing "I'm a Thousand Miles from Home" (both songs buoyed by Bruce Springsteen's harmonica), the album is a travelogue of human trouble. In Tom Russell's epic *corrida*, "Gallo Del Cielo," Carlos Saragosa steals a gamecock

and tries to win back his stolen lands by gambling on the rooster's fighting. In "Letter to Laredo," an escaped

man reveals that he was convicted because he lied to protect his love. "Saint Valentine" is the story of a tragic figure in a dented Continental.

Ely almost always covers a song from his compadre, Butch Hancock, and on this album it's "She Finally Spoke Spanish to Me," a sequel to the classic "She Never Spoke Spanish to Me." When she finally spoke, it was "Adios!"

Joe Ely is a great romantic character with an abundance of charisma; he's a terrific songwriter, singer, and showman who has never received his due. Though *Letter to Laredo* doesn't have the rocking whip-crack fire of its predecessor, the overlooked *Love and Danger*, it's a thrilling document in its own right. And a wonderfully detailed recorded sound brings warmth and texture to Ely's emotional reads. *Michael Tearson*

Joe Satriani

RELATIVITY 1500, 60:24

Sound: A+ Performance: A+

Guitarist Joe Satriani broke through in a big way back in 1987 with *Surfing with the Alien*, his platinum-selling debut for Relativity. A virtuoso of the highest order, Satriani continued making waves on Relativity with a series of instrumental

Burned

Electrafixion

ELEKTRA 61793-2, 47:13

Sound: B+, Performance: B

Anachronisms during the synthesizer-dominated '80s, Ian McCullough and Will Sergeant turned to guitars—especially electric 12-strings—to create a neopsychedelic, gothic blend that included Mideast-ern fiddles and various exotica. Their band, Echo and The Bunnymen, was a necessary alternative to nearly everything else coming from their home base in England. Ten years later and years after Echo's dissolution, McCullough

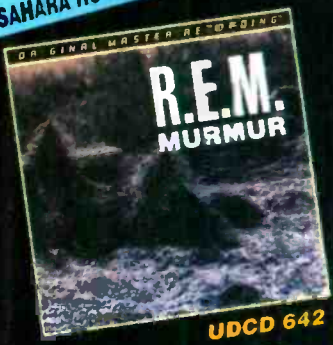


and Sergeant have reunited for a new project in which jangly guitars are subbed for noisy, fuzz-toned ones, and drums have a grandiose sound that borders on bombastic. Electrafixion retains Echo's penchant for modality, but this time it's with a harder, more aggressive sound. And with vocals, drums, and the overall mix drenched in reverb, *Burned* almost feels like a live set.

These songs don't get any better than good, nor do they ever approach what McCullough accomplished on his two fine solo records. But there's a guitar-driven sound on *Burned* that is unique and deserves to be heard. *Mike Bieber*

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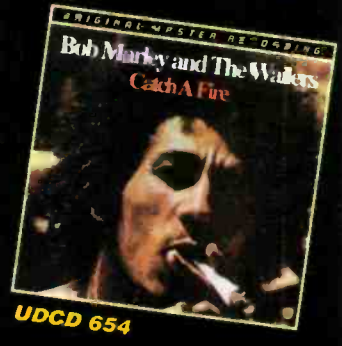
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outings that seethed with metal-esque energy without resorting to any of the tired clichés associated with that genre.

On his seventh Relativity release, there's newfound urgency and directness in Satriani's playing. Rather than dabbling in dense textures with layers of overdubbed guitars or relying on high-tech harmonizers and other state-of-the-art outboard gear, Satriani goes right for the throat by using a powerful back-to-basics ensemble. This group includes such players as rhythm guitarist Andy Fairweather-Low and drummer Manu Katche.



On hard-hitting numbers like "Cool #9," "S.M.F.," and "Moroccan Sunset," Satriani plays with a minimum of effects, digging for his bluesy roots with the screaming fervor of a Stevie Ray Vaughan. Satriani's earthy take on the Mississippi Delta blues tradition, as heard on "Look My Way," is at once authentic and Hendrixian. He flaunts those mind-boggling guitar-god chops on "Killer Bee Bop," a ferocious heavy-metal romp, and on "Luminous Flesh Giants," an imposing bit of metal-esque maelstrom.

Veteran producer/engineer Glyn Johns, who spun the dials on such rock classics as The Rolling Stones' "Honky Tonk Women" and The Beatles' *Let It Be* album, is largely responsible for the very clean, singing tone that Satriani achieves throughout much of this brilliant-sounding CD. The sparser arrangements and cleaner, more deliberate approach really allow Joe Satriani's genius to shine through, resulting in what is his finest, most fully realized recording since *Surfing with the Alien*.

Bill Milkowski

Ballbreaker

AC/DC

EAST/WEST 61780-2, 49:53

Sound: B+, Performance: B

Let Them Eat Rock

The Upper Crust

UPSTART 026, 37:00

Sound: B+, Performance: A

Album after album of loud, obnoxious, blatant, sexist, blues-driven old-school hard rock doesn't leave much to say except that some things never change. The Rick Rubin-produced *Ballbreaker* is more of the same from

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AC/DC. Hardly a masterpiece, it works primarily for one reason: Angus. Angus Young is a truly superb guitarist, unhurried and soulful, but he's got an aggressively ferocious, British hard-rock tone. He gives attitude and stamina to otherwise tired, obsolete "crotch rock," typified by titles like "Cover You in Oil," "Hard As a Rock," and "Caught with Your Pants Down." With their signature double-tracked wall of guitar, AC/DC still provides a catharsis that's obviously more physical than intellectual, even when their songs are merely okay.

The Upper Crust, who owes much to early AC/DC of the Bon Scott era, takes the bawdy humor one step further by writing and performing from the perspective of the 18th-century English aristocracy and under the guise of names like Lord Bendover, the Duc d'Istortion, etc. This also entails powdered wigs, pantaloons, and songs that satirize snobbery and social stratification. The gimmicks work by combining the big, vintage hard-rock sound with humor that's pure joke band. On "Let Them Eat Rock," Bendover goes out of his way to sound like Bon Scott while singing "I myself have felt the pang of hunger/But I know about one thing worse/That's the way I feel after a 12-course meal/When I feel like I'm about to burst." From here it only gets funnier and louder.



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Mike Bieber

Washing Machine

Sonic Youth

DGC DGCD 24825, 68:23

Sound: A, Performance: B

In the early '80s I regarded Sonic Youth as a bunch of no-talent, no-playing, no-hearing charlatans; detune a guitar and thrash and wail in the realms of "skronkified" atonality—what's the big deal? Or so I thought. And I was right; these folks were charlatans of the highest order. But somewhere along their long and winding road, Sonic Youth began to deal with song forms. And their 11th album strikes me as more intriguing, more substantial, and more—dare I say it—accomplished and challenging than the last couple of R.E.M. offerings. Imagine a collaboration between Patti Smith, Sonny Sharrock, Arthur

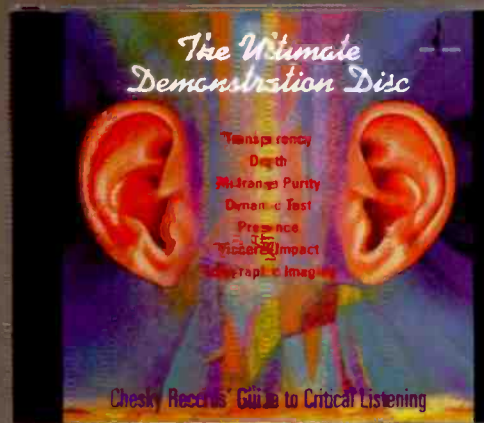
Lee, Glenn Branca, and The GTOs, and you might understand where *Washing Machine* is coming from. Noise-guitar mavens Thurston Moore and Lee Ranaldo wrap their corrosive overtones and feedback squalls into the context of cohesive, albeit simple, pop tunes. Vocalist/bassist Kim Gordon delivers the angst factor on "Panty Lies" and then dips into a campy Shangri-Las-type bag on "Little Trouble Girl," a '50s girl-group number with ap-



propriate chick-singer backup from Kim Deal of The Breeders and Memphis icon Loretta Velvet. Gordon saves her toughest vocals for the trashy, two-chord title song, which builds to a glorious white-noise track out to rival Hendrix's "EXP."

Moore and Ranaldo unleash with sick abandon on "Becuz," which sounds like a nod to Patti Smith's version of "Because the Night." They combine for some industrial-strength sonics on "Junkie's Promise," a driving number that recalls The Rolling Stones' two-guitar rave-ups on *Get Yer Ya-Ya's Out*.

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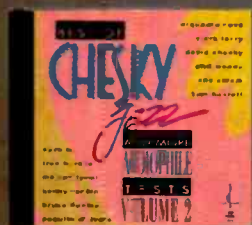
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And their droning guitar work on "Saucer-Like" owes more than a bit to Roger McGuinn and The Byrds' "Eight Miles High" (a tune originally inspired by John Coltrane's modal excursions on the tenor sax).

Sonic Youth reaches its lyrical peak with "Unwind," a lovely pastoral ballad that Moore suggests will appeal to The Moody Blues set. It's a tad more twisted, given those detuned wind harps, but mellow nonetheless. The ambient "Skip Tracer" is the other side of the coin to "No Queen Blues," a brutal display of grinding wah-wah grunge on a vamp. But the centerpiece of *Washing Machine* is "The Diamond Sea." In this 20-minute anthem for "the charred youth of today," as Moore calls it, Sonic Youth runs the gamut from kinetic rhythms to poetic moments of introspection to waves of scary white noise. Powerful and disturbing stuff. Bill Milkowski

The Grassy Knoll

ANTILLES 314 527 908-2, 62:33

Sound: B+, Performance: B+

The Grassy Knoll is what the recently reincarnated King Crimson could've been if they didn't have to carry all their historical baggage and worry about putting clever pop songs on their album. They create progressive rock seared by fusion generators, hip-hop sampling, free-jazz saxophone wailing, and industrial noise.

The Grassy Knoll favors the 180-degree turn, slash-and-burn approach of John Zorn's Naked City band, but with a rocker's sensibility for melody and groove. If those aren't enough reference points, just think of the last time music had your feet dancing and your head spinning. John Diliberto



Mumtaz Mahal

V. M. Bhatt/Taj Mahal/N. Ravikiran

WATER LILY ACOUSTICS

WLA CS-46-CD, 44:08

Sound: B, Performance: A

A few years ago, V. M. Bhatt—who plays an instrument called the Mohan Vina—made the magical *A Meeting at the River*, a fusing of blues and raga, with Ry Cooder. Bhatt's new collaborator is bluesman Taj Mahal, and the recorded result, *Mumtaz Mahal*, is equally wonderful, tilting more toward blues this

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time. It has a lighter, more playful feel, as Bhatt and Chitra Vina master N. Ravikiran work around Taj Mahal's guitar and voice with the exotic sounds of their exotic instruments.



The opening selection, the wordless "Coming of the Mandinka," is the album's most raga-like. It sets a tone for the set, which includes an 11½-minute exploration of "Come on in My Kitchen," Taj's "Rolling on the Sea," the gospel standard "Mary Don't You Weep," the Leiber-Stoller classic "Stand by Me," and the reggae favorite "Johnny Too Bad." The album closes with "Curry and Quartertones," an impromptu discussion by Taj of the album's creative process, revealing the warm fellowship of the session. *Mumtaz Mahal* is an ever surprising, ever delightful flower that unfolds before us. (P.O. Box 91448, Santa Barbara, Calif. 93190.)

Michael Tearson

Peel Slowly and See

The Velvet Underground

POLYDOR 31452 7887-2, five CDs; 6:28:00
Sound: A, Performance: A+

Years ago, Brian Eno remarked that while not many people bought The Velvet Underground's records, everybody who did went on to form his own band. If ever there was a group whose influence stood in stark opposition to its commercial success, VU was it.

From 1965 to 1968, The Velvet Underground recorded four albums that provided a soundtrack to New York's avant-garde scene, songs describing the gritty side of life in the '60s—a contrast to the "flower power" years

in which the band germinated. These odes to alienation, sexual frustration, and drug addiction are incongruously mixed with out-and-out pop music (such as "I Found a Reason" from the album *Loaded*)—a model of how to combine accessible



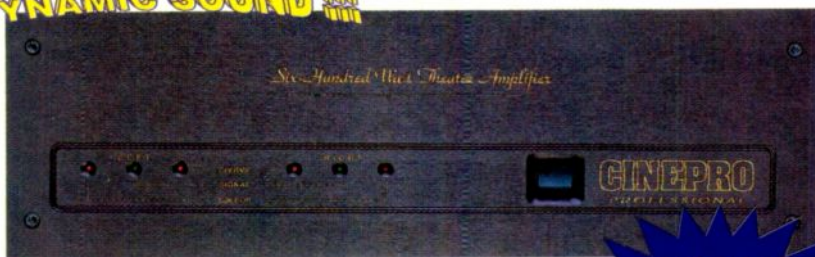
music with honest, penetrating lyrics. *Peel Slowly and See* contains all four VU albums in their entirety, supplemented by all available studio outtakes, demos, and live recordings, presented in chronological order. An added bonus is journalist David Fricke's excellent 20,000-word essay.

Daniel Levitin

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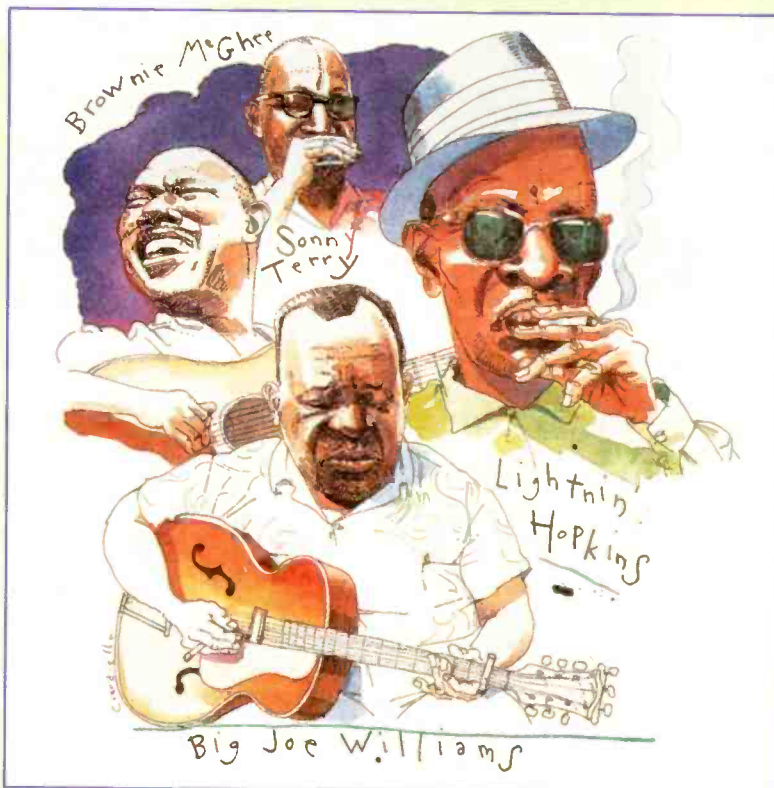
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RECORDINGS



The Capitol Blues Collection

Various Artists
CAPITOL; 11 CDs
Sound: C to B+,
Performance: B to A+

Before hearing even a note, you know that this collection was no rush job; the packaging, annotation, mastering, and even the vibrant cover art demonstrate Capitol Records' commitment in doing justice to these historical recordings. Noted blues expert Pete Welding was intimately involved with this series, and his care for the music shines through. There are some real gems here.

The jewel in the crown is the Muddy Waters/Memphis Slim set called *Chicago Blues Masters, Vol. 1* (CDP 8 29375 2). It was recorded primarily live with a small combo at Carnegie Hall in 1959. This group plays with such restraint that every nuance comes across clearly, and the hall's resonance adds space to the sparse arrangements. This disc cap-

tures Chicago's premier blues ambassadors in their prime, and its only flaw is a heavier concentration on Memphis Slim and not nearly enough Muddy—he sings on only four of the disc's 17 songs, although

he plays on the Memphis Slim tracks.

No less brilliant is the three-disc T-Bone Walker set, *The Complete Capitol and Black & White Recordings* (CDP 8 29379 2), which shows off this guitar innovator's 1940s recordings. Although not a household name, Walker was a musician's musician whose approach was extremely influential on B.B. King and (oddly enough) Chuck Berry. In fact, much of what we hear in today's blues and rock guitar styles can be traced back to T-Bone Walker.

The Capitol and Imperial labels were not in the vanguard of the blues movement, so their vaults are a bit limited. The collection's live Son House item, *Delta Blues and Spirituals* (CDP 8 31830 2), is interesting in how it captures a great blues artist in his later years, but most of its versions of these songs pale compared to the studio recordings and don't wear well on repeated listenings. Roy Brown's best work was done prior to signing with Imperial, and while there's merit in his contribution to this series, *The Complete Imperial Recordings* (CDP 8 31743 2), his Deluxe/King recordings (for most of which he wrote his own material, unlike here) are far superior. The remainder of the titles—*Rediscovered*

Pure Emotion

Chico O'Farrill
MILESTONE MCD-9239-2, 49:47
Sound: B+, Performance: A

For his first solo recording in 30 years, master composer/arranger Chico O'Farrill has assembled a Latin big band capable of handling some very complex music.

Now in his mid-70s, O'Farrill has built a 50-year career around Afro-Cuban jazz, a rhythmically infectious genre initially viewed by many as only a fad. But the basic charm of this music has caused it to endure—endure, become popular, and evolve. O'Farrill has been at the forefront of the movement all the while, and this particular album shows why.

From the opening bars of the tumultuous "Igor's Dream" to the sensitive romantic bolero "Pura Emoción" to the modern Latinized versions of "Perdido" and "Get Me to the Church on Time," O'Farrill's hard-charging, percussion-laden brassmen make the most of every written nuance, milking every emphatic solo to the max.



A 12-minute variation on the unlikely theme "La Cucaracha" provides the goods with which to judge el maestro's vast

talent. Employing two French horns and an extra trumpet for added color and power, O'Farrill turns a simple folk song into a tour de force. And he has created an aptly titled album. *James Rozzi*

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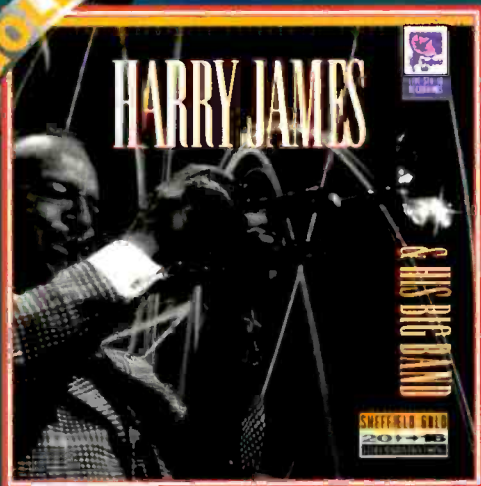
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Blues (CDP 8 29376 2), the Sonny Terry collection *Whoopin' the Blues* (CDP 8 29372 2), and Lil' Son Jackson's *Complete Imperial Recordings* (CDP 8 31744 2)—concentrate on second-level artists or on artists for whom these recordings were an adjunct to their primary work.

Still, Capitol should be congratulated for reissuing this music properly, and we hope this series will continue. Let's hope it will also push them toward making some new recordings, perhaps creating a new home for current blues musicians.

Jon & Sally Tiven

A Better Understanding

Sonny Fortune

BLUE NOTE CDP 7243 8 32799 2 0, 57:20

Sound: B+, Performance: B+

After his successful Blue Note debut devoted to Thelonious Monk's music, saxist/flutist Sonny Fortune has gone "from all-Monk to all-me." And though *A Better Understanding's* nine tunes are his own, formative influences are evident. "It's a Bird" captures a be-bop head, paced à la Charlie Parker. "Long Before Our Mothers Cried" mines an Afro-Cuban

groove courtesy of percussionists Jerry Gonzalez and Steve Berrios and is an obvious nod to Fortune's former employer, Mongo Santamaria. And "Tribute to a Holiday" wraps the



chord changes of "You Don't Know What Love Is" around the memory of a singer named Billie.

As usual, Fortune's crisp, lilting tone and fierce attack on fast tunes are captivating; equally compelling are the contexts he's assembled on this outing, which range from duo to septet. Fortune is one of the few players whose improvisations on flute stand up well; his duet with pianist Kenny Barron on "Never Again Is Such a Long Time" offers suitable proof. On "Awakening," he's overdubbed two alto flute parts to achieve shell-like overtones.

It was Fortune's fiery saxophone work that powered The Elvin Jones Jazz Machine a few years back, and it ignites this effort even more. His alto jabs playfully with bursts from Gonzalez (who doubles on trumpet) and trombonist Robin Eubanks on "It's a Bird." It rides a mile-wide groove on "A Swing Touch," and his soprano horn nearly takes flight on the opening and closing tracks. Like Sonny Fortune's previous release, this album is a sleeper jazz hit.

Larry Blumenfeld

The Sea

Ketil Bjørnstad

ECM CD 78118-21545, 74:42

Sound: A+, Performance: A+

On *The Sea*, Norwegian pianist and composer Ketil Bjørnstad "develops further the ideas and sounds" of his previous album, *Water Stories*. Like its predecessor, *The Sea* features guitarist Terje Rypdal and percussionist Jon Christensen. A new addition is cellist David Darling.

Bjørnstad's inspiration for both albums is the fjords, rivers, glaciers, mountains, and ocean of Norway's untamed western coast. Acknowledging that the grand piano is also a string instrument, many passages meld it with the singing strings of Darling's cello for rich sound-color combinations that sometimes conjure up an entire string section.

The new improvisational heights achieved in *The Sea* wash over the musical partitions



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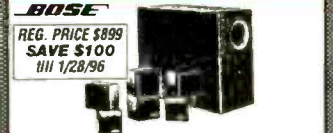


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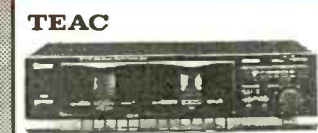
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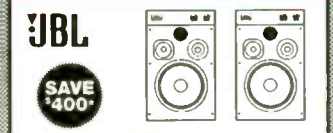
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John Sumier

Blues of the Month Club

Joe Louis Walker

VERVE 314 527 999-2, 58:06

Sound: B+, Performance: B+

Over the past several years, bluesman Joe Louis Walker has consistently satisfied with

his gospel-tinged vocals, raw and funky guitar work, and accomplished songwriting. With



former Stax stalwart Steve Cropper at the producer's helm of his third release for Verve, Walker turns in another typically strong offering accompanied by his crack band, The Bosstalkers.

Walker's gospel influence comes across with authority on "You've Got To Lose," an Ike Turner original churchified by the presence of The Spiritual Corinthians as back-

ground vocalists. He convincingly stakes out some R&B territory reminiscent of Otis Redding on the upbeat "Lost Heart" and then digs into a Delta gutbucket feel on the slide-guitar showcase "Bluesifyin'," which invokes such towering influences as Howlin' Wolf, Lightnin' Hopkins, and Muddy Waters. And Walker's knack for pop hooks is perhaps best exemplified on two catchy originals, "Hidden Feelings" and "Get It Right," both featuring The Memphis Horns.

Another striking aspect of Walker's talent comes across on "Your Lyin' Eyes," a finger-style solo acoustic blues done up in the old-time Delta tradition of Son House and Mississippi John Hurt. It's this kind of earthy authenticity that separates Walker from would-be bluesmen who cater to the yuppie and buppie set. This guy is indeed the real deal, a fact that becomes all the more obvious after one listen to the sly, hip shuffle blues, "I'm Not Comin' Over."

Robert Cray may pack fans into big theaters, but Joe Louis Walker has my vote as blues MVP of the year. *Bill Milkowski*

Damn!

Jimmy Smith

VERVE 314 527 631-2, 61:52

Sound: A, Performance: A+

Verve, the record company with a rep for resuscitating careers of veteran artists via excellent concepts, has come up with another beauty. They've taken the baddest Hammond B-3 organ player on the planet, matched him with the hottest Young Turks on the scene today (along with a few classy veterans for good measure), and recorded an album of funk and pop classics. The results are bound to make any die-hard Jimmy Smith fan stand back, shake his head in disbelief, and mutter "damn!"



There are no rococo ballads or schmaltzy show tunes here, as has often been the case with Smith's albums. *Damn!* is nothing but an energized, pure-burn blowing session, which makes its spirit reminiscent of Smith's great 1957 sessions with a young Kenny Burrell, Lou Donaldson, and Art Blakey.

The venerable Bernard Purdie lays down the drum groove on the funky opener, James Brown's "Papa's Got a Brand New Bag."

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Smith, of course, eats it up before giving a little solo time to trumpeter Roy Hargrove. The funk continues on Horace Silver's earthy ode to his mother, "Sister Sadie," and returns on Herbie Hancock's "Watermelon Man." A swinging rendition of Bobby Timmons' "This Here" features the late, great drummer Arthur Taylor in perhaps his last recorded performance. Trumpeters Nicholas Payton and Hargrove trade solos with Smith on Dizzy Gillespie's "Woody 'n' You" and reprise their solo bravado alongside saxophonists Mark Turner and Ron Blake on a blazing septet rendition of Charlie Parker's "Scrapple from the Apple."

Other young guests—like guitarist Mark Whitfield, bassist Christian McBride, and saxophonists Tim Warfield and Abraham Burton—heat up the proceedings with gutsy solo work of their own. But they all must take a back seat when Smith unleashes his mighty B-3. It sounds like these young chopsmeisters invigorated the old master; the energy level of this session is up a few notches from Smith's last outing, a 1994 trio record titled *The Master* (Blue Note). Apparently, Jimmy Smith loves a challenge.

Bill Milkowski

Another Place

Jerry Granelli

INTUITION INT 2130-2, 51:28

Sound: A-, Performance: A

Jerry Granelli understands the art of structured improvisation and freedom within form, which is the reason *Another Place* was one of the finest examples of collective improvisation in 1995. Granelli's melodic style of drumming takes his group from atonal, almost classical abstractions to gut-bucket improvisations with the same skillful hand.

Granelli has assembled an amazing group. Jane Ira Bloom is emerging as one of the few true heirs to Steve Lacy's soprano style. Her lines are quirky yet fluid, her improvisations rarely following the standard path. Anthony Cox, who also composed a couple of the best tunes on the album, is a cerebral bassist who never forgets his role as the music's root force. It's nice to hear vibraphonist David Friedman in a more challenging context, but it's underrated trombonist Julian Priester, with his uncanny gift for atmosphere and melody on the slide instrument, who is the real treat.



Another Place takes clear advantage of three decades of jazz on the edge. Whether it's barn-burners, such as "Opener," or the more impressionistic "Hello Nellie," this ensemble plays with the collective intuition of a New Orleans band but with the freedoms won at the outer reaches of jazz.

John Diliberto

Family

Roy Hargrove

VERVE 314 527 680, 77:46

Sound: B+, Performance: B+

On *Diamond in the Rough*, Roy Hargrove's fiery 1990 debut for RCA/Novus, the gifted 20-year-old trumpeter came charging out of the gate in a hurry to prove himself. Hargrove's technical command and diamond-hard attack quickly established him as a hot new lion on the scene. No longer in a hurry to prove anything, Hargrove takes his time and settles into a more reflective calm on *Family*, his most personal project to date.

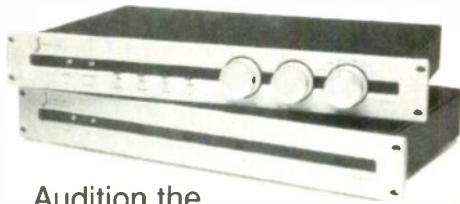
Backed by his working quintet of pianist Stephen Scott, drummer Gregory Hutchinson, bassist Rodney Whitaker, and saxophonist Ron Blake, Hargrove opens on a luxurious note with "Vclera," a ballad dedicated to his mother. He later returns to a mellow vein on Hoagy Carmichael's "The Nearness of You," featuring a luscious tenor solo by David "Fathead" Newman. An expressive reading of guest bassist Christian McBride's hauntingly beautiful ballad "A Dream of You," which sounds inspired by John Coltrane's "Central Park West," brings back this relaxed, lyrical bag. Hargrove stays there for "Pas de Trois," a graceful waltz with pianist John Hicks, and the gorgeous Jimmy Van Heusen/Johnny Burke ballad "Polka Dots and Moonbeams." But perhaps his most revealing moments are on the Larry Willis-penned "Ethiopia," an intimate, meditative duet with bassist Walter Booker.

Wynton Marsalis, one of Hargrove's early mentors, guests on Fats Navarro's jaunty "Nostalgia," which includes some lively exchanges between the two trumpeters. Hargrove reserves his signature burn and high-note bravado for Cedar Walton's "Firm Roots" and for originals like "Another Level" and "Brian's Bounce." Elsewhere, he makes his case with understated elegance and, as always, an eye toward tradition.

Bill Milkowski

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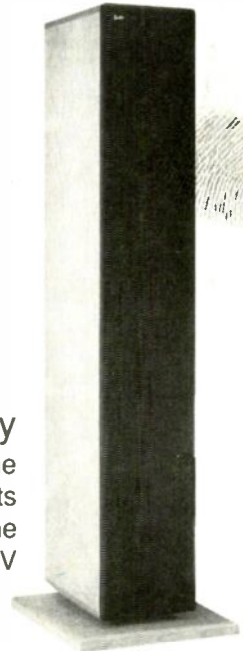
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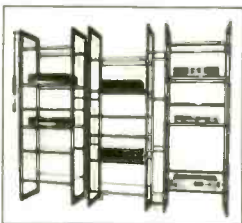


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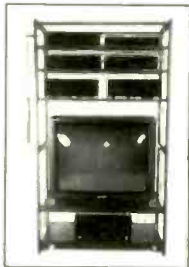
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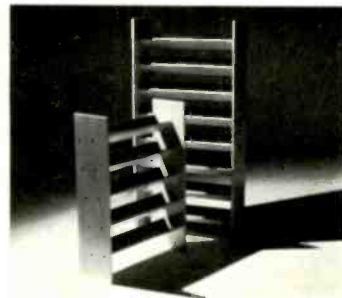
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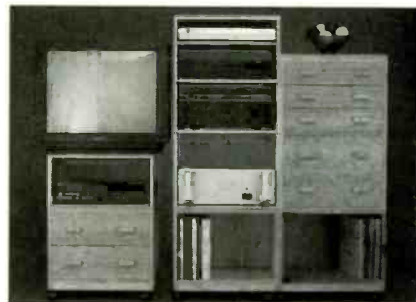


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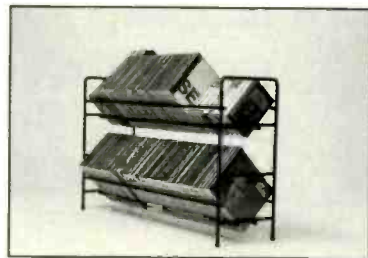


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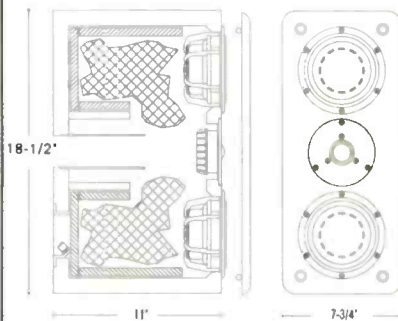
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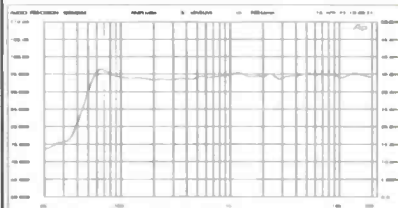
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PlayBack

Audio-Technica AT-ML150 Phono Cartridge

Prior to auditioning the new AT-ML150 phono cartridge, I had not seriously listened to an Audio-Technica-equipped turntable since the late 1970s and early '80s. Back then, the A-Ts sounded bright when compared to the Shures, Micro-Acoustics, and Grados that I was using.

The AT-ML150 (\$400) has changed that long-held impression. The Vector Aligned Dual Magnet Design cartridge (claimed to improve frequency response accuracy) is equipped with a MicroLine stylus and gold-plated beryllium cantilever, said to improve channel separation.

The cartridge was easy to set



GRADE: A-

up on my vintage Luxman PD-264 and performed well at a 1.4-gram tracking force.

Using several direct-to-disc jazz records from the late 1970s and some recent Mobile Fidelity vinyl releases, I found the AT-ML150 to be a neutral-sounding cartridge with very good stereo imaging and solid, defined bass. With typical discounts, I'm sure this phono cartridge can be had for a good price.

John Gatski

For literature, circle No. 120

Onkyo TX-SV919THX Receiver

I'm not always impressed with THX certification as an indication of quality in audio equipment. The Onkyo TX-SV919THX receiver is, however, an exceptional unit. It may not have the quality of the best high-end A/V separates, but it combines good overall sound, an excellent Dolby Pro Logic decoder, acceptable digital signal processing, and very good amplifiers in one compact unit. Meeting THX standards may not do much to improve the sound quality of most separate power amplifiers, but in this receiver, it does seem to mean a significant improvement over most receivers' amps. The TX-SV919THX has 100-watt front and 50-watt rear amplifiers that no audiophile need be ashamed of. This receiver does, however, need to be used with moderately efficient speakers that present loads above 4 ohms. Although the Dolby Pro



Logic and Home THX processing are a bit noisier at high volumes than I would like, the Onkyo provides good sound quality; there's just a mild loss of transparency, data, and upper-octave clarity. It also has intelligent ergonomics, a truly well-written instruction book that most U.S. high-end firms could usefully emulate, good remote controls, and programmable DSP features that allow you to tailor the theater, stadium, concert hall, nightclub, and arena settings to something approaching real life—instead of the fixed presets

common to most equipment. The rear panel's connections are intelligently laid out and easy to use with normal audio/video interconnects and speaker cables. The Onkyo TX-SV919THX receiver sells for

GRADE: B+

\$2,099.95. That's scarcely cheap, but I have heard many high-end A/V systems with far more costly components that did not sound as good.

Anthony H. Cordesman

For literature, circle No. 121

Staedtler Erasable Cassette Labels

Your rating of this kit, which enables temporary or permanent labeling of audio cassettes, might be anywhere from A to C, depending on your needs. To mark the glossy labels (18 are included), you can use the kit's supplied black-ink pen (a rainbow of other colors is available separately), and the "permanent" writing can be removed easily and cleanly with the supplied plastic eraser. Unlike some paper versions, the full-coverage labels are stiff enough to go on easily without wrinkling. They stick firmly but may be difficult to remove after long attachment. The pen has too broad a point to permit tiny, detailed descriptions, and the labels sit a bit awkwardly on the fancy contours of some premium cassettes. So, while my wife (a singer) loves them for rehearsal tapes, I prefer typewritten file-folder labels for library copies. The price is \$4.98; similar kits are available for videocassettes and floppy disks.

Robert Long

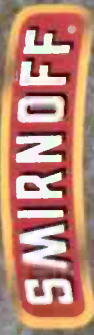
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