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# AUDIO

**SETTING UP FOR  
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Movies and Music**

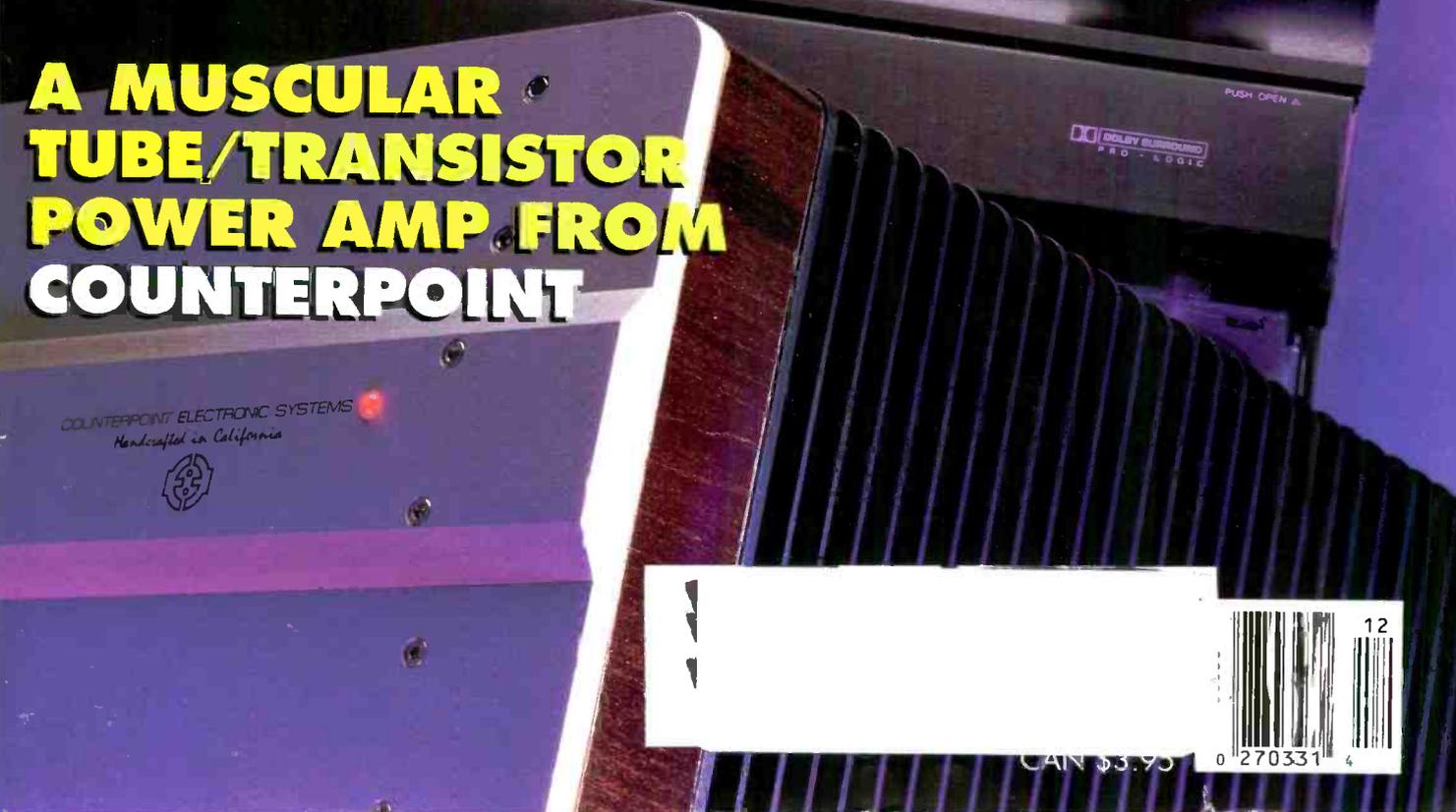
THE EQUIPMENT AUTHORITY  
DECEMBER 1995

**A/V VIRTUOSITY**

**DENON AVC-2800  
SURROUND AMP**

**SONY'S NEW  
GENERATION  
MINIDISC DECK**

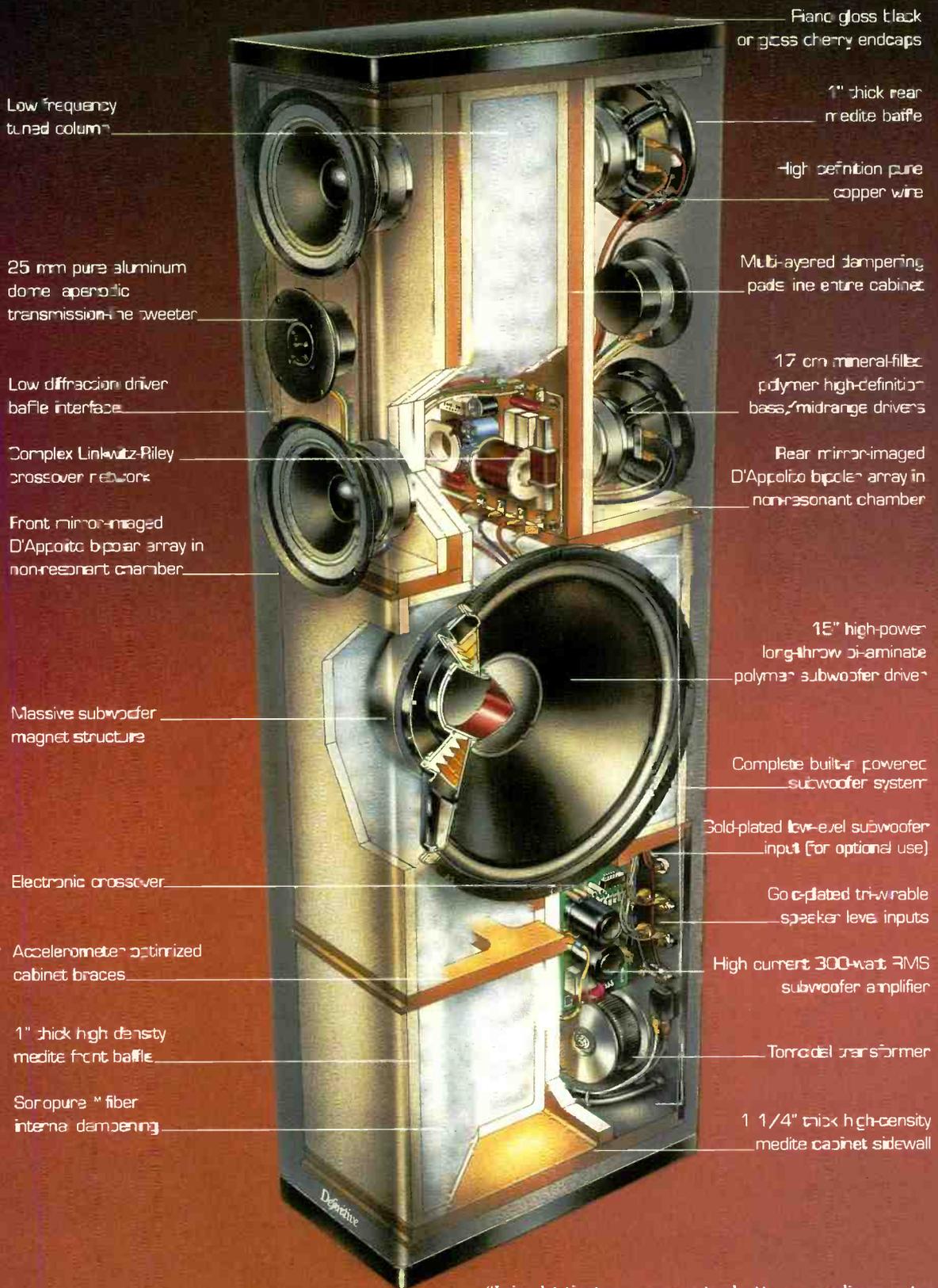
**A MUSCULAR  
TUBE/TRANSISTOR  
POWER AMP FROM  
COUNTERPOINT**



12

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# Inside Definitive's BP2000



"I doubt that you can get a better sounding system for less than several times the price of the BP2000."

-Julian Hirsch, *Stereo Review*

# Definitive's New BP2000 Brings You the Ultimate Listening Experience!

*"The first speaker I have been able to audition in my own familiar surroundings that has given me that special thrill that usually costs ten or more times its price to obtain."*

—Julian Hirsch, *Stereo Review*

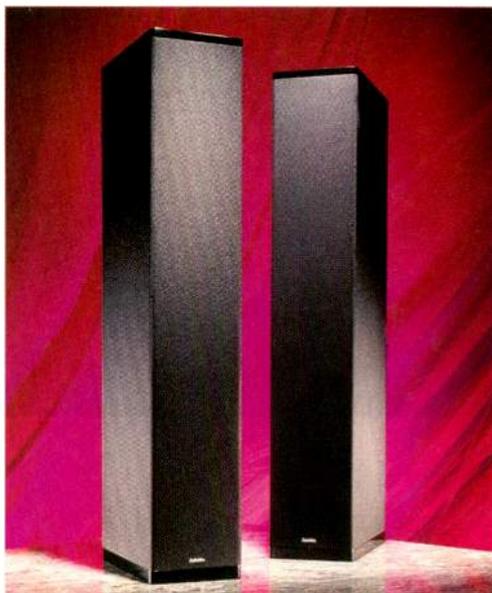
*"Frankly, if circumstances allowed, I would choose these speakers for myself."*

—Julian Hirsch, *Stereo Review*

## **Speaker of the Decade**

Now, with the BP2000, Definitive literally reinvents the loudspeaker. We have combined a six-driver dual D'Appolito bipolar array with a built-in (side-firing) 300-watt powered 15" subwoofer. (Yes, a complete powered subwoofer built into each speaker!) The result is extraordinary sonic performance beyond anything you've ever heard.

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Each revolutionary bipolar BP2000 (\$1499 ea.) has a built-in 300-watt RMS powered 15" subwoofer for ultimate performance.

CIRCLE NO. 14 ON READER SERVICE CARD

See our dealers list on page 12.

## **The Ultimate Home Theater**

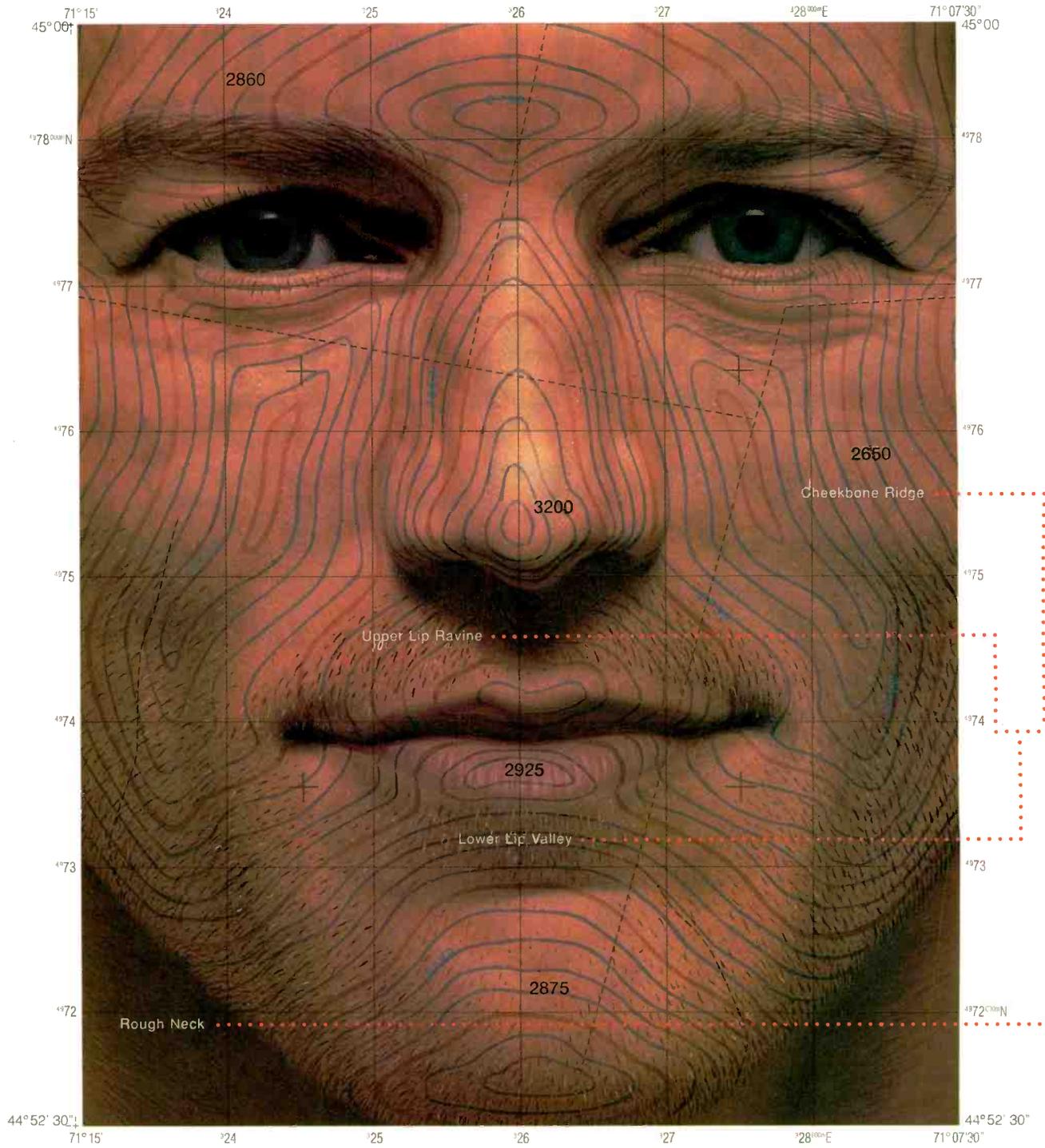
In addition to being an audiophile's dream, the BP2000s are also the main speakers in Definitive's AC-3 ready Ultimate Home Theater System. This astonishing system is absolutely the finest sounding available. It recreates a "you are there" spatial reality that actually puts you into the soundspace of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

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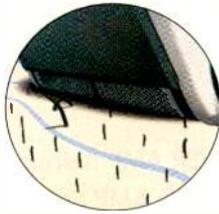
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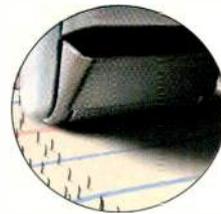
Traveling through difficult terrain requires the proper vehicle. The Braun Flex Integral.



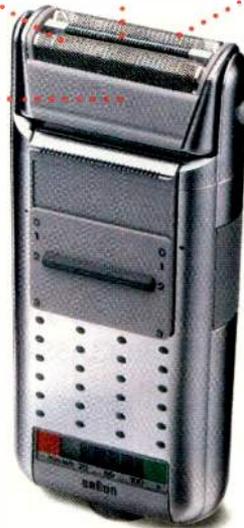
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*One foil removes short hairs.*



Stage 2  
*An integrated cutter—longer hairs.*



Stage 3  
*The second foil completes the job.*



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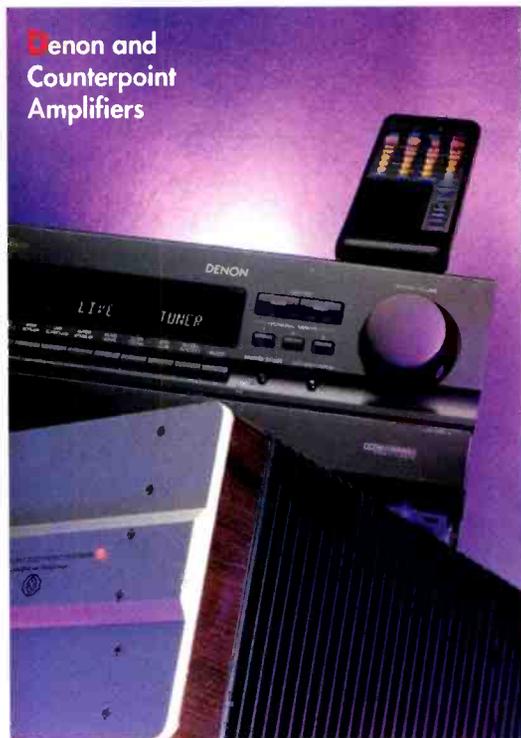
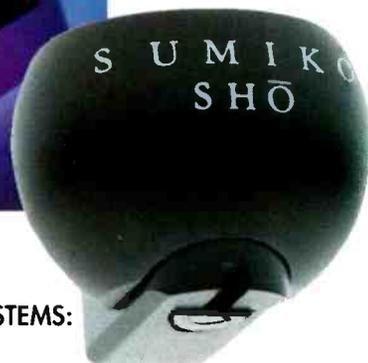
# AUDIO

THE EQUIPMENT AUTHORITY



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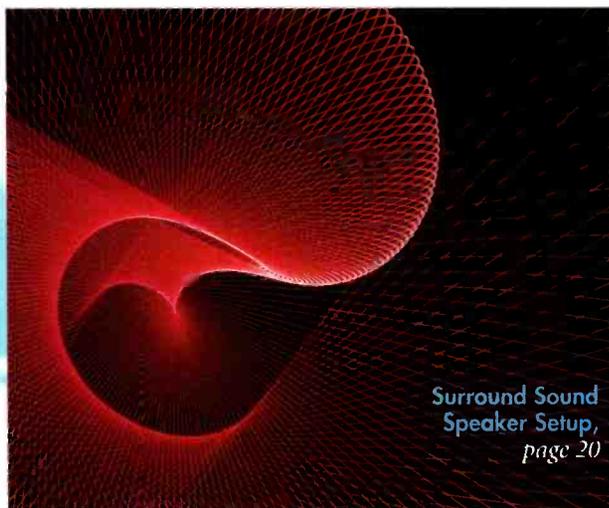
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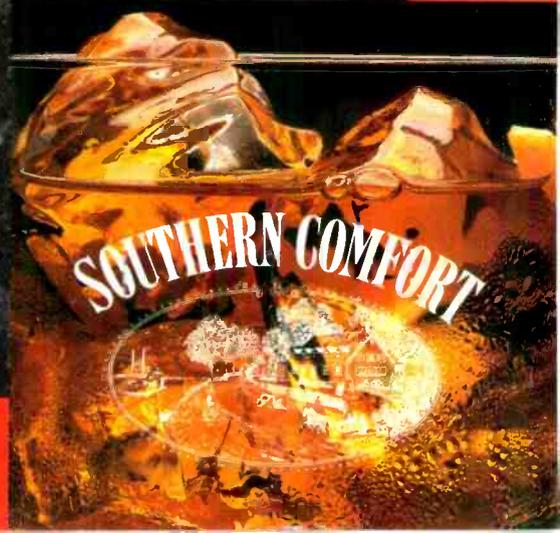
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CIRCLE NO. 40 ON READER SERVICE CARD

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AUDIO/DECEMBER 1995

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Towering atop the Standing Module 15 from Newform Research is a monopole ribbon tweeter, 15 inches tall and 3/4 inch wide, designed to offer transparent, open sound and a well-focused soundstage. Below it is a 5-inch woofer in an enclosure with a compact 6 x 9-inch footprint. Response is rated as 68 Hz to 20 kHz, ±2.5 dB, so the manufacturer suggests the system be used with a subwoofer. Price: \$945 per pair; delivered direct from factory. For literature, circle No. 100

# WHAT'S NEW

## SOUND DYNAMICS POWERED SUBWOOFER

**A** forward-firing vented design, the THS-10 powered subwoofer from Sound Dynamics uses a 10-inch driver. The internal amplifier is a MOS-FET design rated at 100 watts continuous, with automatic on/off switching and adjustable low-pass crossover frequency. Response is rated



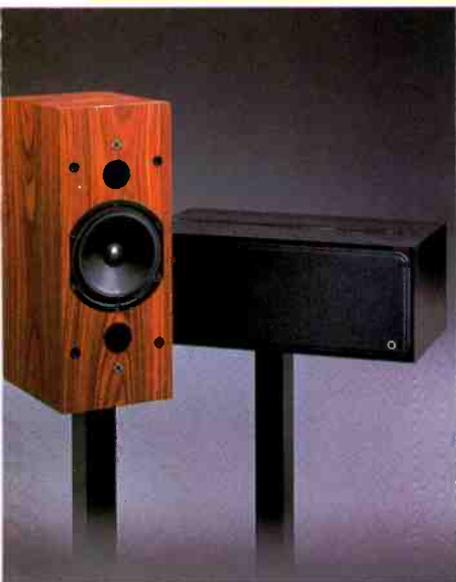
down to 35 Hz. The subwoofer is finished in black-ash vinyl. Price: \$500 each. For literature, circle No. 101

## QUADRATURE SPEAKER WITH DSP

Digital signal processing precorrects signals fed to speakers in the new DSP line from Quadrature Audio Technologies, complementing each speaker's own transfer characteristics to achieve amplitude and phase accuracy in the final acoustic output. The DSP 5 model, shown here with its Omnilinc processor, incorporates a 10-inch woofer, 5 1/2-inch midrange, and 1-inch dome tweeter. Rated sensitivity is 88 dB SPL for 1 watt at 1 meter. Price: \$5,200 per pair. For literature, circle No. 103



## THIEL HOME THEATER SPEAKER



The SCS2 is an elongated bookshelf design and Thiel's only non-floor-standing model. Coaxial mounting of its 6 1/2-inch woofer and 1-inch tweeter keeps frequency-response and dispersion characteristics essentially the same whether the speaker is placed horizontally or vertically; this facilitates its use as the main front and center speakers of a home theater system or as a stereo pair. Magnetic shielding allows use near a TV screen. Standard finishes are walnut and black wood, with others available. Price: \$925 each. For literature, circle No. 102

## ATLANTIC TECHNOLOGIES HOME THEATER SPEAKERS

System 220, from Atlantic Technologies, includes six speakers. The 222 PBM subwoofer has a built-in, 125-watt power amp with optically isolated anti-clipping circuitry and a 10-inch, long-throw woofer. The 223 C center speaker, with a 1/2-inch tweeter flanked by two 3/4-inch woofers, can be tilted up or down to suit its mounting position and has variable EQ. Left- and right-front speakers are 221 LRs, with 1/2-inch tweeters

and 4-inch, air-suspension woofers. Surrounds are 224 SRs, each with two 3/4-inch drivers in an angled dipolar configuration. Mounting options for the 221 LR and 224 SR include key-hole brackets and threaded mounting holes, and in-wall mounts are available for the 224 SR. Prices: System, \$1,146; 221 LR, \$219 per pair; 222 PBM, \$499; 223 C, \$199, and 224 SR, \$229 per pair. For literature, circle No. 104





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CIRCLE NO. 31 ON READER SERVICE CARD

# *The Road Kill Diaries*



**June 8**

**Wandered out into the road.**

**Heard music pounding.**

**Figured I had time to cross.**

**Didn't.**

**PIONEER SUBWOOFERS.** Nothing says "move it or lose it, varmint" like raw bass pounding out your window. Our subwoofers are designed with specially blended materials to handle up to 450 watts of pure power. They also come in a variety of car-friendly shapes and sizes. So, go ahead and put a ton of bass in your system. And give nature a chance to dig that crazy beat. Call 1-800-PIONEER for a dealer near you.

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 ID- Ultimate Electronics Boise/Wise Buy Idaho Falls  
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 MS- McLelland Hattiesburg/Players A/V Ridgeland  
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## SIGNALS & NOISE

### DSS Redux

Dear Editor:

Having subscribed to *Audio* for many years, I found the exchange in the August issue between Anthony H. Cordesman and James Harper regarding RCA's Digital Satellite System ("A Gourmet Dish or a Pot of Trouble?") to be particularly interesting.

Cordesman is a respected audio reviewer, and I have read many of his articles in *Audio* and other magazines. However, as a DSS owner, I believe his overall criticism of the system misses the mark.

First, he launches into a diatribe concerning the competence and integrity, or lack thereof, of DSS retail salespeople. What he fails to point out is that they, like other purveyors of goods and services, frequently vary in their honesty, knowledge, and ability to market or service any product. From my experience, DSS retailers are no better or worse than average. Why single them out just because their product is a huge success? Cordesman also discusses system installation and program costs. I agree that installation is best done by a professional. Although I am not particularly handy with tools, I do have several friends (not engineers or general contractors) who have successfully installed the system themselves. As for programming costs, I have never seen any DSS advertisement that directly asserts or implies that the ultimate costs result in a savings over cable TV. The system is marketed as providing more choices and better quality than cable, and frankly, I know of no knowledgeable person who would dispute that claim.

Of all of Cordesman's criticisms, I find his comments regarding the quality of DSS audio and video to be the most troubling. I don't know what company provides his cable, but from my house, the best day on cable never approaches the quality of DSS video—and I'm talking about using the coax/F-connector hookup, which DSS concedes produces the worst picture. When I use the S-video method, which DSS recommends for best quality, there is no comparison at all. My 70-inch Mitsubishi produces a stunning picture that surprises me each

and every time I fire it up. I agree that the overall quality varies with the source, but isn't that comment applicable to most media? Blame the film companies, not DSS, if *Wild, Wild West* is not the perfect example of color accuracy, detail, or contrast.

As for audio quality, Cordesman derisively states that the music channel sound is "roughly equal to that of the cheapest CD players." This represents a backhanded compliment, because even the cheapest CD players routinely outperform the comparably priced turntable/cartridge/vinyl combination, FM, standard TV broadcasts, and virtually all commercially recorded cassettes. I seriously doubt that even those exclusively classical-listening, tube-loving audiophiles would disagree with this general proposition.

I am sure this is unsatisfactory for the golden ears of Cordesman, accustomed to only the finest equipment that most Americans can't buy. Despite the fact that DSS audio quality does not equal the performance of my separate components, it is quite good. I have recorded several musical selections on DAT and compared them with both the CD and vinyl versions. The difference is audible, but it is sheer folly, in my opinion, to argue that it is so significant as to render the DSS signal "no better than local cable." My local cable reception (audio and video) doesn't come close to DSS.

I don't know which planet Cordesman hails from, but he needs to come down to earth when evaluating DSS. It represents an incredible advance over standard cable in probably all homes but his.

Dale M. Wiley  
Danville, Va.

Dear Editor:

Regarding Leonard Weldon's defense of the RCA Digital Satellite System ("Signals & Noise," October), I cannot sit idly by. Weldon writes, for example "... I'm absolutely amazed at the picture clarity and color accuracy on the DSS system compared to any other satellite or cable system I've seen." True, DSS does deliver a clearer picture than many cable systems, but if

Weldon had really compared it to other satellite systems, he wouldn't be nearly as pleased.

Let's compare DSS with a more traditional satellite system—a 10-foot dish receiving C-band programming via VideoCipher RS—on the same monitor, since both provide the same channels. Anyone who does this will discover three things: The C-band picture is sharper than DSS (DSS provides 400 lines only under test conditions with a stationary test pattern), the C-band picture has better color accuracy (DSS is sometimes greenish), and the DSS picture is delayed slightly as compared to the C-band. This last point is very important, because except for pay-per-view movies, all DSS programming is first received on conventional C-band equipment, then digitized and compressed by about 100 to 1, and finally retransmitted to the DSS satellites. By definition, the C-band picture is correct, and any modification produced by DSS transmission is an error. The C-band signals that drive DSS contain none of the imperfections that are common in DSS pictures. The real cause of channel-to-channel variations is the difference in bandwidth that each channel is allocated on DSS.

After viewing DSS more carefully, many viewers—but not all—will notice watery edges around all moving objects, breaking up into pixelized squares under four common conditions: Fast, nonlinear camera movement; large subject movement (as you see in sports); very fast cutting (such as in music videos, commercials, and program intros); and rapidly fluctuating light (such as a celebrity being deluged by popping flash photographers).

DSS is an amazing system, compressing hundreds of channels onto two satellites, but videophiles interested in the *best* video should consider the only true broadcast-quality system available for home use, the C-band, large-dish satellite.

Gary Davis  
Culver City, Cal.

*Editor's Reply:* Mr. Weldon did not specify a particular alternative satellite system in his letter, so it is possible he was referring mainly to PrimeStar rather than C-band. And with any satellite system, including C-band, performance will depend to some extent on the particular installation. One per-

son I know of with both C-band and DSS systems says DSS compares well most of the time. Incidence of motion artifacts on DSS should decrease as MPEG-2 coding comes on line, though we'll have to wait and see on that.—M.R.

### Lirpa Labs Exposed

Dear Editor:

Is the company known as "Lirpa Labs" real? Look up their listings in the October 1995 *Audio* Directory issue, and you will see what I mean. Is this company a joke? (I'm not laughing.) The specs for this stuff are ridiculous! How can they get away with this? Is there something I am missing here? I am flustered by what I have read.

Bill Bescrpt  
Fairless Hills, Pa.

*Editor's Reply:* We're glad that you paid such close attention to our Annual Equipment Directory listings. The answer to your questions is a simple one: Yes, Lirpa Labs is a joke. Professor I. Lirpa (April 1 backwards) and his inventions appear in every April issue of *Audio* in some form. Past Lirpa incarnations have ranged from classified ads through full equipment reviews. In the name of good fun, Lirpa Labs entries also are listed in the Directory.—T.C.

### Helping Hands

Dear Editor:

I was pleased to see Robert Long's capsule review of Ian Hobson's recent Arabesque recording of *The Complete Piano Variations of Johannes Brahms* in the August issue. I would, however, like to correct one error in the text. The other two hands in the four-hand pieces are not attributable to Ian Hobson's "alter ego" or "the magic of multidubbing," as Long conjectures in his review. These extra hands actually belong to Hobson's wife of 22 years, Claude Hobson, who is an accomplished pianist in her own right. If there is an alter ego involved here, it is that which stands as a testament to their strong commitment to one another.

Once again, it was a pleasure to read Long's review, and we encourage him to keep an eye out for Ian's next installment of *The Complete Beethoven Sonata Cycle*.

Norman D. Ryan  
American International Artists  
New York, N.Y.

AUDIO/DECEMBER 1995

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## Kimber Klassifieds

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*Ensemble* is Cambridge SoundWorks' very best speaker system. It involves no compromises in performance, no cost-saving shortcuts. As a result, its performance stands head-to-head with audiophile tower speakers selling for well over \$1,000 a pair, yet its unique four-piece design literally disappears in your room.

There is no other speaker system like it.

**Designed to perform in your home – not in a laboratory.**

It has always been true that speaker placement in the listening room has a significant effect on the sound of any speaker system. No matter how a speaker may perform in a laboratory or a specially-designed showroom, at home the acoustics of the listening room significantly affect the sound.

Most positions in a room where you might place a speaker tend to emphasize one portion of the musical range, and tend to de-emphasize some other portion of the musical range. For example if you place a conventional speaker close to a room corner which will enhance the bass response, that location may hinder the upper ranges of music.

*Ensemble's* unique four-piece design eliminates this dilemma.

**Big sound without the big boxes.**

*Ensemble* consists of four separate speaker units; two for each stereo channel. Two

powerful, but ultra-slim subwoofers reproduce the deep bass, while two compact satellite units reproduce the rest of the range.

By separating the low bass from the rest of the musical range, *Ensemble* is able to reproduce just the right amount of energy across the musical spectrum, without turning your listening room into a stereo showroom.

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*"Crisp, balanced sound, stereo imaging is phenomenally sharp – some of the best I've heard...some of the speakers I'm comparing it to cost \$1900 to \$2800"*

*High Performance Review*

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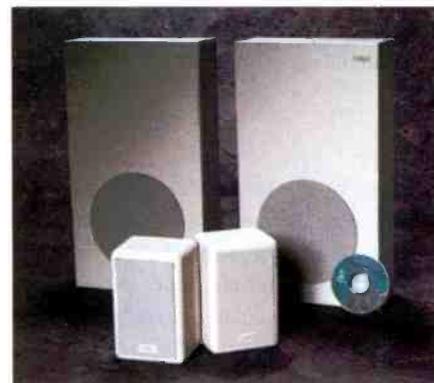
You can place the subwoofers on the floor, up against a wall, or in a corner – all places that allow them to reproduce bass notes efficiently. These locations are also often out-of-sight, which can be a real decorating advantage. The satellite speakers can then be placed out in the room, at ear level, positioned to create a realistic stereo image. They can be hung directly on the wall, placed on shelves, or mounted on stands.

**Why two subwoofers?**

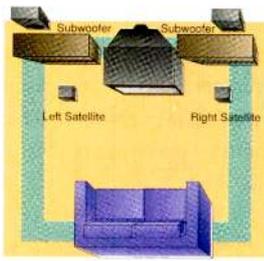
Subwoofer/satellite speaker systems that use one subwoofer can and do sound terrific (in fact, we offer a full range of single-subwoofer systems). But for the ultimate in

brehtaking, accurate sound reproduction, and the most powerful bass performance, you should have two subwoofers. Here's why:

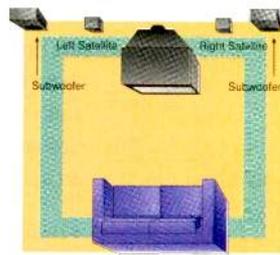
- *Increased sound pressure levels and power handling capability.* Quite simply, *Ensemble's* dual subwoofer system, with its two 8" long-throw woofers, will play louder and take more power than single-subwoofer speaker systems, including our own. This is even more significant if you are using *Ensemble* in a home theater, since authentic low bass sound effects in movies require extra-powerful bass output.



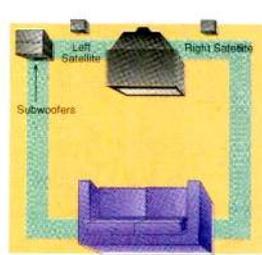
*Ensemble is now available with either its original charcoal Nextel finish with black subwoofers, or a new version with white hand-finished satellites and white vinyl subwoofers for no additional charge.*



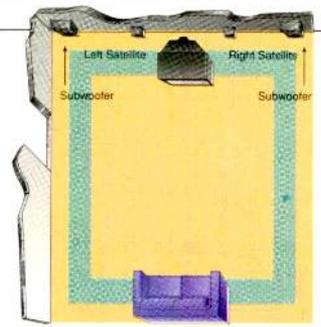
Ensemble's ultra-slim (4 1/2") subwoofers can be put in out-of-the-way places – even behind or under furniture.



Ensemble's dual subwoofers accurately reproduce the stereo bass on some modern digital recordings, adding to imaging realism.



Ensemble's dual subwoofers can be placed together in a corner to achieve very high bass output for reproducing low-frequency movie sound effects with incredible realism.



In larger rooms with big openings into other rooms, Ensemble's dual-subwoofer design assures uniform bass throughout the room.

• *Uniform bass response throughout the listening room.* Depending on room acoustics and speaker placement, a system can produce bass "nulls" and "peaks" in different areas of

**Cambridge SoundWorks "may have the best value in the world."**

Audio Magazine

a room. Two subwoofers can solve that problem. To quote *Audio* magazine, "At low frequencies, strong and widely spaced room modes are occurring... some locations have a lot of bass while others lack bass. When two subwoofers are placed in the room, better uniformity of bass response is obtained."

• *Ultimate placement flexibility.* It is our experience that room placement is the ultimate key to real-life performance of any given speaker in any given room.

Ensemble offers more placement flexibility than any other speaker we know of. Its subwoofers are only 4 1/2" thick, so you can actually put them in places where no other subwoofer would fit: under furniture, on top of bookshelves or behind draperies. You can also put one on one side of the room, and the other on the opposite side, which turns out to be correct placement in many cases.

• *Two-channel bass on modern recordings.* Some modern recordings, especially two-microphone recordings of full orchestral works, have stereo bass imaging. *Audio* magazine says, "Using two subwoofers provides more realistic bass and takes

advantage of program material with fully stereo bass."

**No compromises. No shortcuts.**

Don't be fooled by Ensemble's price. It's affordable because of our efficient factory-direct sales system.

• The satellites are genuine two-way designs with separate 4" mid-bass/mid-range drivers and 1 3/4" tweeters with integral domes. The satellite cabinets are solidly constructed of resonance-resistant MDF for optimum acoustic performance. Each one is hand-finished in scratch-resistant, suede-like Nextel or durable white paint.

• The speaker drivers used in the satellites and subwoofers are of the highest quality. The 8" long-throw woofer drivers, designed by Henry Kloss and manufactured by Cambridge SoundWorks, use a unique, integrated heat sink for increased power handling capacity.

• Each satellite and subwoofer contains the precise response-tailoring crossover circuitry it requires. This allows you to choose from several different ways to wire the entire system.

• Both the satellites and subwoofers use gold-plated five-way connecting posts.

• Durable, acoustically transparent metal grilles protect the speaker drivers, instead of the inexpensive cloth grilles used by many systems.

• Last but not least, the entire Ensemble system has been painstakingly fine-tuned (or "voiced") by Henry Kloss for proper octave-to-octave tonal balance. Because it

does not give undue emphasis to any one octave of music, Ensemble has a rich, natural, accurate sound normally associated with the best (and most expensive) of conventional speakers under laboratory conditions.

**"smoother than many more expensive speakers...it is hard to imagine going wrong with Ensemble.."**

Stereo Review Magazine

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CIRCLE NO. 9 ON READER SERVICE CARD

**Are "tower" speakers better?**

A great many people presume that very large, very expensive "tower" speakers are inherently better than subwoofer/satellite speakers. Nothing could be further from the truth. If you were to take apart a high quality tower speaker and Ensemble, you'd see both use premium quality drivers, crossovers and cabinets. The physical volume of the cabinets

enclosing each speaker driver is carefully matched to the demands of that driver. With Ensemble you get all the quality components and precise engineering of premium tower speakers – built into four smaller cabinets instead of two large ones. Separate cabinets give you room placement flexibility to get optimum performance in your listening room.

## Hunting Good Old LPs

**Q** *I am a die-hard audiophile who still savors LPs. Since the mid-'50s, I've spent a great deal of money on the best possible turntables, tonearms, and phono cartridges; having heard CD reissues of some of my LPs, I think that the LPs are just plain better. Over the years, I've learned a lot about which issues of a particular recording have the quietest pressings, etc. Is there a book available that discusses LPs from an audiophile standpoint, one that includes information about discs specially produced for us? For example, do you know of a book listing all of the RCA Living Stereo pressings, Red Seal and otherwise? Also, has a book been published about the history of RCA Records?—Eddie Lepore, Everett, Mass.*

**A** I have no information in my files regarding publications about vinyl discs solely from the audiophile perspective. What I do have are addresses of several publications that deal with old phonograph records in general (and sometimes include price guides). I think they may point you in useful directions, so I'm listing them below.

I located two books about the history of RCA Records: *The Collector's Guide to Victor Records* by Michael Sherman (Monarch Record Enterprises, 1992) and *The Fifty Year Story of RCA-Victor Records* (Radio Corporation of America, 1953). Also, be on the lookout for a commemorative disc that RCA issued for its 75th anniversary. It's filled with interesting anecdotes and musical examples.

By the way, Roland Gelatt's *The Fabulous Phonograph, 1877-1977* is an excellent treatment of the overall history of records and recordings. It might be hard to find, though; the most recent ("second revised") edition of this informative book was published by Macmillan in 1977.

As to publications, the ones listed below were in operation as of my deadline:

- *Antique Phonograph Magazine* (502 East 17th St., Brooklyn, N.Y. 11226; 718/941-6835; editor, Allen Koenigsberg). Also called *Antique Phonograph Monthly*, this magazine deals primarily with the pre-vinyl

era but includes some LP coverage too. A sample issue is available if you send them seven first-class postage stamps. (Your request through the mail may be honored sooner than a phone call.) Various price guides are available as well.

- Books Americana, Inc. (P.O. Box 2326, Florence, Ala. 35630; 205/757-9966). This company publishes *The American Premium Record Guide*, covering the years from 1900 to 1965.

- *Gold Mine* (700 East State St., Iola, Wisc. 54990; 715/445-2214). A magazine for music collectors that covers vinyl. The same people also publish the *Gold Mine Price Guide to Collectible Record Albums*.

## New Surround in Old Gear

**Q** *I own an old receiver that has lots of inputs, and it includes a processor loop. Although the receiver served me well for years, I decided to upgrade. I bought a surround receiver but am disappointed with it, especially because it lacks so many features found on my old, tried-and-true model. Can I somehow use the surround portion of the new receiver to achieve home theater sound while using my oldy but goody to supply sound to the main front channels?—Paul H. Longeway, address withheld*

**A** What you want to do is certainly possible if your original receiver can meet certain conditions. If its volume control adjusts the output of its processor loop, you can use the processor output to feed an appropriate line-level input on the surround receiver. You will have to set the processor-loop switch to "Processor" (or some such marking) unless the receiver offers live processor outputs even with this switch in the "Bypass" position. If the output from the main receiver goes dead in bypass, use "Y" connectors on each channel of the processor output. One branch will loop back to the processor input; the other will feed the surround receiver and, thus, the surround processor and the back or side speakers. (You could use the same setup if you had pre-out/main-in connections instead of a processor loop.)

If, on the other hand, your surround receiver has preamp-out jacks for the front left and right channels, you could connect them to line-level inputs on the old receiver and use it to drive the front speakers. That's probably the better approach, if you can do it.

## Life Span of New Blank Cassettes

**Q** *Do new blank cassettes have a long shelf life? I have some blank cassettes that are between two and four years old and are still in their wrappers. Is it possible that they have deteriorated to the point where I shouldn't use them?—Danny Tse, San Lorenzo, Cal.*

**A** Tapes, blank or otherwise, have finite life spans. That span depends on many factors, such as the tape's chemistry and fabrication. Some tape formulations have rather short lives, while others have relatively long ones. I have had tapes fail after three years, and I have tapes dating from the late 1960s that still appear to be in good condition.

I suspect that tapes that are still in their original, sealed boxes will last longer than those that have been opened, because the wrapping should slow down evaporation of plasticizers. However, if these tapes have been stored in extremely high heat or humidity, I would question whether they should still be used.

## Excessive Subwoofer Level

**Q** *I own a passive subwoofer that has a dual voice coil and a rated impedance of 4 ohms. A crossover network built into the subwoofer permits wiring satellite speakers to terminals provided for this purpose. When I use this subwoofer with my two satellite speakers, whose impedance is 6 ohms, the subwoofer is too loud.*

*Since my amplifier has two sets of speaker terminals, what would happen if I hooked the subwoofer to one set, hooked the satellites to the other (via a high-pass network), and set the amp's speaker selector to feed both? Would the satellite terminals on the sub-*

---

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

woofer need to have dummy loads across them so that the crossover would still work properly? If this wouldn't work, can I go inside the cabinet and add some resistance in series with the subwoofer's two voice coils to reduce its output? Would this mess up the crossover frequency?—Ken Massey, Indianapolis, Ind.

**A** The solution I'd suggest is leaving your system wired as it is and adding an equalizer. This can be used not only to tame your too-loud bass (once you've found just which controls to adjust and how far to adjust them) but also to adjust your system's bass to correct for differences in program material.

I really don't like attenuating the input to a subwoofer by adding series resistors. There would be, as you suspect, some change in the crossover point, and it would waste power.

Bypassing the subwoofer's crossover output, as would be necessary if you did attenuate the subwoofer, would probably also affect your system's frequency response. If your subwoofer's crossover is strictly a low-pass filter for the woofer itself, you won't lose anything by bypassing. But there is probably a high-pass filter for the satellite terminals, to ensure that your satellites' and subwoofer's outputs won't overlap in the crossover region. Bypassing would allow the overlap, causing either a 'suckout' or boominess, depending on the subwoofer's polarity.

### Passive Preamps and CD Player Specs

**Q** I have read that when one uses a passive preamplifier, a CD player should have both high output level and low output impedance. What will be the effect of using a CD player having both high signal output level and high output impedance?—Name withheld

**A** A passive preamplifier basically consists of a selector switch and a volume control, with no active stages. There are also, however, a few units that use gain-of-one active buffering for the tape outputs.

Passive preamplifiers can only reduce, not amplify, the signals fed into them. (Some such preamplifiers do have active phono stages, but this does not affect their use with CD players.) Therefore, any signal source fed into them should have reason-

ably high output, to ensure that there will still be enough signal to drive the power amp after whatever attenuation the passive preamp might supply.

Most CD players have output levels of about 2 volts, which should be high enough. In fact, an audio system requiring that full 2 volts would probably be unable to provide adequate volume from tuners, tape decks, and so on, whose output levels are usually more modest.

Most CD players that I have worked with have had reasonably low output impedances, ranging between 100 and 1,000 ohms. The only possible harm I can see from a high output impedance is if the pre-amplifier uses low-resistance volume and balance circuits, which might be done to minimize high-frequency losses when the volume control is set to its middle position. If the volume and balance circuitry's input resistance is 10 kilohms or more, I see no problems with the output impedance of most CD players. The rule here is that the input impedance should be at least 10 times that of the output impedance of the device driving it. This will reduce distortion and bass loss.

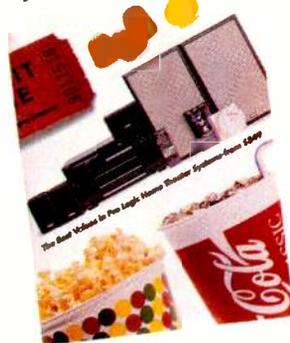
### Audio Archiving on VHS

*Your excellent answer to Ronald Riemer's question about archiving radio programs (February 1995) was interesting and encyclopedic. I'd like to add two comments.*

*First, using VHS for audio archiving could present a serious complication in future years, when VCRs that can track audio signals in the absence of video signals may not be available. I know of one current VCR that cannot play audio-only tapes, even though its predecessors from the same company can do so. The archivist would be prudent, therefore, to include a video signal along with the audio being recorded.*

*Second, special A/D converters have been made for recording digital audio onto videocassettes. If Mr. Riemer can find one, it would let him combine the long play and tape economy of VHS with the advantages of digital tape recording (no tape hiss and no cumulative degradation with each generation), without falling into the DAT trap. My guess is that VHS gear will still be available 25 years from now, whereas DAT machines will be very hard to find.—Lawrence B. Barnes, Bellflower, Cal.*

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BY HENRY KLOSS



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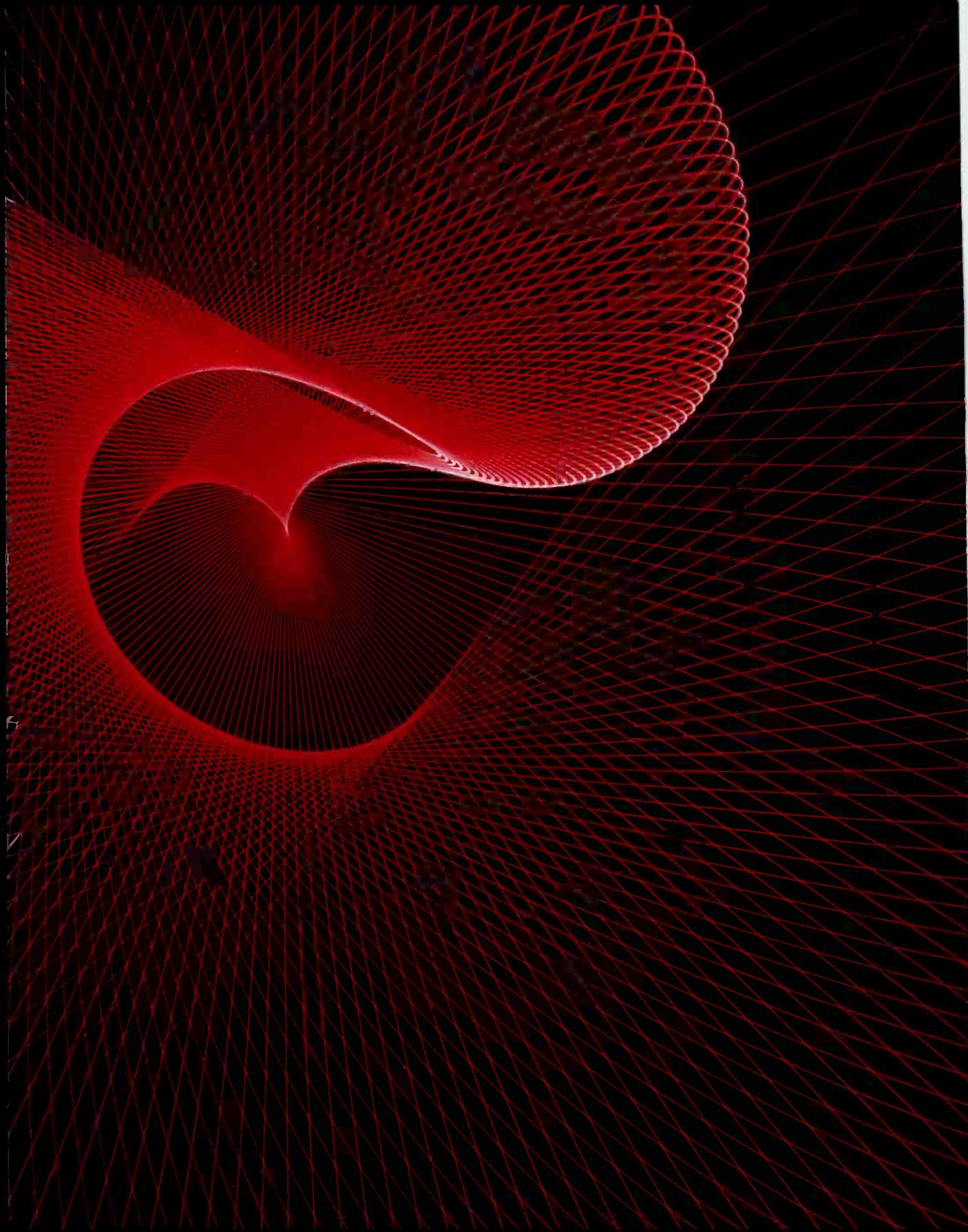
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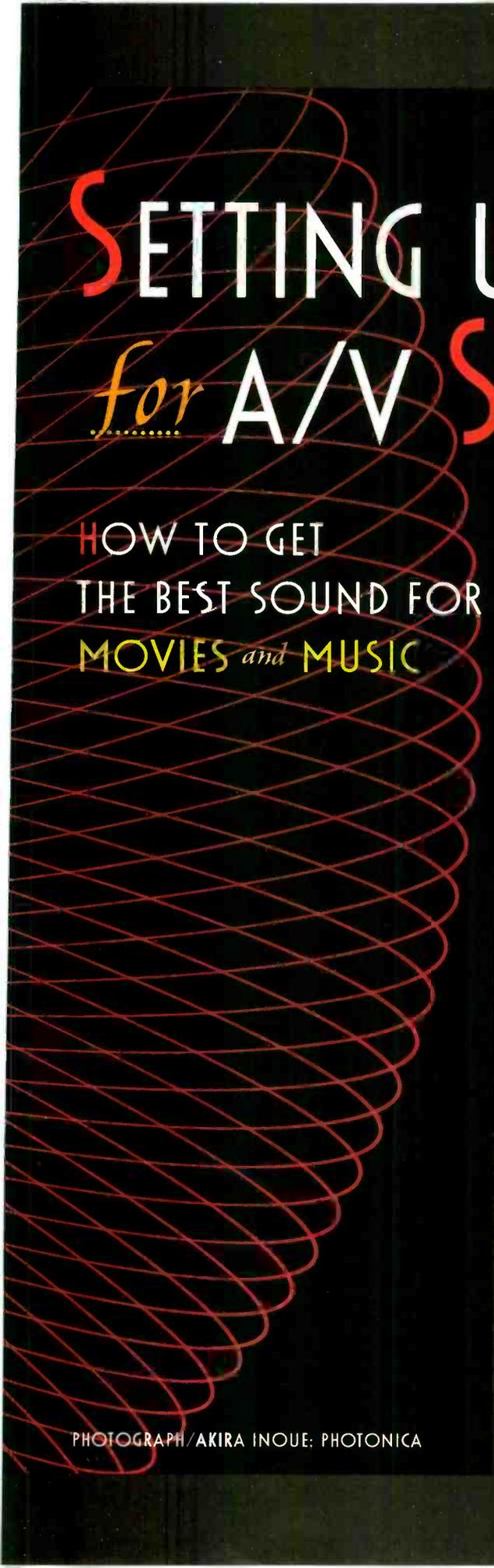
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# SETTING UP SPEAKERS *for* A/V SYSTEMS

HOW TO GET  
THE BEST SOUND FOR  
MOVIES *and* MUSIC

At present, few guidelines exist for choosing and setting up speakers to provide optimum performance for *both* music and home theater. Manufacturers, reviewers, dealers, and audiophiles alike are experimenting with different approaches. Some of the latest classical recordings on the Delos label demonstrate very effectively that a Dolby Pro Logic processor can contribute improved ambience and realism to music, with few traces of the coloration and musical degradation common to the typical "hall," "concert," or "jazz" enhancement settings now provided on most A/V preamps and receivers. And an increasing number of movies also include music with important surround-channel information or mix their music tracks with directional sound effects.

Subwoofers present particularly difficult setup problems. While crossovers at frequencies of 80 Hz or below can work well in many systems, it is still easy to wind up with audible discontinuities. Often you get a mix of output from the subwoofer and main speakers that thickens or warms the mid-bass and reduces definition and transient response. That can be tolerable with some movie soundtracks and simple forms of rock, but it dulls the sound of classical music, jazz, and more demanding rock recordings, and it takes the excitement out of soundtracks' sudden bass transients and passages where bass detail is as important as bass boom. And while

*by Anthony H. Cordesman*

PHOTOGRAPH/AKIRA INOUE: PHOTONICA

corner placement is usually a good way of minimizing the effects of room interaction, it can present problems with crossovers that allow the subwoofer to produce significant upper-bass and lower-midrange energy. In such cases you may need to experiment extensively with placement to find the position that yields the smoothest mid-bass. It is often desirable to set the low-pass filter frequency as low as possible, especially if the slope is relatively shallow. A setting of 80 Hz is about as high as you can go without some sonic compromise, and settings of 50 to 60 Hz are often preferable.

Several additional setup issues affect virtually all small self-powered subwoofers. For example, a higher gain setting may be preferred for home theater than for music; raising subwoofer output on movie soundtracks often sounds better than using the bass boost that may be available in a pre-amp or receiver. By all means, experiment to find the gain settings that are best for home theater and music, marking them on the gain control's dial.

Some experimenting may be needed to determine whether to use a subwoofer's built-in high-pass filter (if one is provided) to feed the front left and front right speakers. I normally use the high-pass filter when I need to minimize the excessive warmth and other problems that can be caused by interaction between the subwoofer and the main speakers. And such a filter is a necessity with small dedicated satellite speakers. For the most part, however, I find it preferable to run large main speakers full-range.

You need to use common sense regarding listening levels. It's probably a good idea to listen to a few action films early on and get over the idea that deep bass equals World War III. Don't try to overdrive the subwoofer or room to get superbass—all you will get is distortion and one-note boom. Turn the subwoofer down at the point where soundtracks or music acquire a slight boominess. Listen for vibrating furniture and objects, move or damp them, and enjoy deep bass in a natural way, not as a substitute for the midrange and treble.

As for center-channel speakers, a number of supposedly shielded models have caused magnetic-interference problems with the picture when placed on top of my 35- and 40-inch monitors. I have found that placement much preferable to under the moni-

tor, however, where the speaker's output interacted more strongly with the floor, changing the timbre and smearing the sound. Also, the front edge of the speaker should be extended far enough in front of the TV so that reflections off the edge of the TV are kept to reasonable limits.

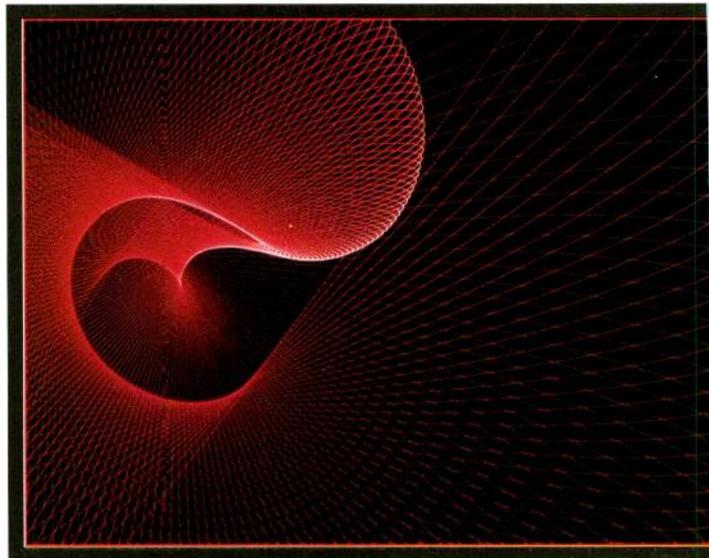
Similar recommendations apply to placing a center-channel speaker relative to the screen of a front-projection TV. You need to realize that the same problems with diffraction and reflection apply to all the speakers in home theater systems that apply to stereo speakers. To get the best dispersion or timbre from a center-channel speaker, you must place it forward of the edge of the TV's screen. In fact, every speaker in a home theater system should be placed so that furniture, the floor, room boundaries, and other surfaces do not interfere with the sound at the listening position.

Another important matter is the actual choice of center speaker. It is essential that the center speaker have the same timbre, or "voice," as the front left and right speakers and roughly the same treble dispersion. Even buying all three speakers from the same manufacturer does not necessarily guarantee that, however. Use of identical drivers for most, if not all, of the frequency range is a good sign. But that's not necessarily something you can tell by inspection, and the crossovers are, of course, hidden from view. The best test is listening, preferably comparing the center speaker to just one of the main speakers. Use mono program material that doesn't have too much bass content, to prevent the comparison from being thrown off by differences in low-frequency extension between small center and larger main front speakers.

This is not to say that bass performance is irrelevant for center speakers. Although a small one may be cute or easy to place, limited mid-bass output will almost always degrade sound quality. All Dolby Pro Logic and AC-3 decoders enable you to choose

between limited and full-range response for the center channel (shunting low frequencies in the center elsewhere when desired), but it is still preferable that the center speaker's response be down by no more than a few dB at 80 Hz or so.

You may also want to experiment with using the processor's phantom center mode and no center speaker, especially if your TV screen is smaller than 31 inches. The best Dolby Surround recordings (especially the soundtracks of LaserDiscs produced under the THX program) always seem to sound



best with a center speaker, however, and my limited experience with AC-3 suggests that a center speaker is essential for good results with it. Unfortunately, most Dolby Surround recordings overemphasize the center channel, sometimes to the point of producing mono with surround special effects. With those, you may get a better overall sonic effect by using the phantom center mode, spacing the left and right front speakers closer together, and moving your listening position a bit to the rear.

In setting up the front speakers, you will have to experiment to find the best distance between the left and right speakers—and between them and the center channel. There are no "correct" distances. For home theater and TV, the sound image will always be bigger than the visual image (unless you are using a front projector and a large screen). As a result, you can never match the audio and video images exactly, and you have to experiment with movie soundtracks and TV audio to find the spacing that gives you the overall illusion you like best.

If you are as interested in music as in home theater, you may well prefer the distance between speakers that gives you best performance with music. In that case, I would recommend that you begin by setting your preamp or receiver to the two-channel stereo position or to the position with the least possible processing and delay. That almost inevitably gives you one of the best settings for serious musical listening, although you may have to disconnect the center channel or set its volume to zero in some systems. Then, while listening to a

shelves. Getting the best musical and home theater performance with small box speakers means putting the front left and right speakers on stands, keeping those speakers away from the walls and corners, and aligning them in terms of distance, height, and timbre.

Alignment of the front speakers for equal distance from the listening position produces only limited benefits, but it does slightly improve stereo imaging and musical definition. Ideally, your left and right speakers should not be placed parallel to the center speaker. Instead, place the three speakers in a slight arc, with the left and right speakers approximately the same distance from the normal listening position as the center speaker. This alignment minimizes the impact of the Haas effect, so that your hearing won't give the sound from the center channel priority over the sound from the left and right channels. It

heavy mini-monitors at the heights needed for audio/video. In the interim, I suggest that you use a 28-inch speaker stand or a 30- or 36-inch stand sold in furniture stores for sculptures and art objects.

Aligning the fronts of the front left and right speakers at an angle where their timbre matches that of the center speaker without giving excessive treble can also offer benefits with some models. Many speakers do not sound best at the listening position when the bottoms of their cabinets are parallel to the floor, even if they are placed at optimal height. Many floor-standing speakers can be adjusted by using longer spike settings in front, to angle the tweeters toward the listening position. Unfortunately, most stands for small speakers are not adjustable in height or speaker angle. Regardless of audio folk wisdom, the chances are negligible that a small monitor will sound its best when spiked to a rigid stand that has a flat top. And, as discussed above, the stand's fixed height has only a slight chance of being suitable for your installation: You will almost never get the best sonic blend between midrange and tweeter. Using rigid speaker stands *may* reduce cabinet resonance (although often they simply shift its spectrum), but at a cost. In many cases, it is more important to tilt a speaker to get the most musical upper octaves than to try to make minor reductions in the speaker's cabinet resonance.

Try using wedges, flat-head screws, adjustable spikes, or folded paper to tilt your front speakers for the best upper-octave blend at your normal listening position. That usually means raising the fronts of the left and right speakers, but it often also means raising the back of a center speaker mounted on top of a TV set. With speakers having outstanding treble dispersion, you may not hear the effect. With other speakers, a little tilting may make the treble suddenly come alive, eliminate an annoying high-frequency edge, or "lock in" the match between the the sound of the left and right speakers and that of the center speaker.

In setting up surround-channel speakers, you must decide whether to place them so that mainly reflected sound is heard at the listening position or to place them on stands or on the walls so that they face each other, parallel to the listening position, and emphasize the direct signal (I prefer the for-

TO GET BEST PERFORMANCE FROM SMALL SPEAKERS, PUT THE MAIN FRONT SPEAKERS ON STANDS, KEEP THEM AWAY FROM WALLS AND CORNERS, AND ALIGN THEIR DISTANCE, HEIGHT, AND TIMBRE.

regular CD or LP, alter the distance between the left and right speakers until you achieve the best stereo imaging.

If you use a center speaker, you should then shift to surround operation. Using the mode with the least signal processing and delay, slowly raise the center-speaker level to the point where it provides both good stereo imaging with music and clear dialog with movie soundtracks. That should give you a seamless soundstage from left to center to right, and a soundstage that works very well with music. You may find you want to increase the distance between the left and right speakers or raise the volume of the center channel for home theater purposes. Nevertheless, I often get the best results in setting up a home theater and music system when I follow this procedure, usually ending up with center-channel output several dB lower than when I set the levels strictly according to the processor's speaker-balance test signals.

I have long since abandoned attempts to mount speakers on walls or leave them on

is relatively easy to set up your speakers in this way if you use floor-standing speakers or small monitors on stands. Simply put one end of a tape measure at the listening position, measure the distance to the center speaker, and then move the left and right speakers forward so that all three speakers are roughly the same distance from the listening position. This setup technique is strongly recommended by at least one producer of Dolby Surround recordings.

Height alignment offers another improvement in sound quality. Put the left and right speakers at roughly the same height as the center speaker, or at least put them high enough so that reflected sound from the floor and furniture does not alter their timbre and imaging relative to the center speaker's. Ideally, the best way of doing this would be to use a stand whose height is adjustable. In practice, such stands are currently available only for relatively small speakers, and most do not go up to the proper height. There is a real need for speaker stands that can hold relatively

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mer). Treble-beaming problems make some speakers unsuitable for the second kind of setup in surround-channel use. There is very little discrete surround information in most Dolby Surround soundtracks, and diffuse sound seems to produce more convincing ambient information with movies and better results in reproducing virtually all music recordings. However, I would still suggest that you experiment with both direct and diffuse radiation. Begin by playing only the surround speakers, using soundtracks that have a lot of ambient information and the Delos Dolby Surround recordings of classical music. Find out what sounds really emerge from the surround speakers; this may surprise you. Notice the differences you hear when you change between direct propagation and reflected surround-channel sound. Then, add in the sound from the three front speakers, and notice the differences you hear from different ways of positioning the surround speakers with the full system operating. I also suggest that you keep the level of the surround speakers down to the point where you hear a slight amount of ambience and not equal loudness from every direction. A little ambience goes a long way.

An increasing number of manufacturers make dipole surround speakers, and some (Polk Audio, for example) have models that can be switched between dipole and bipole modes. If you have a choice, these speakers work better than front-radiators with most Dolby Surround recordings.

The kind of speaker setup I have described is demanding, and no doubt many people will be fully satisfied by far less exact methods of speaker placement. Nevertheless, I suspect you will find that good setup is critical to getting the best out of good speakers and that it will produce far better results than simply putting speakers where decor dictates. I can also assure you that you will hear the benefits with good Dolby Pro Logic receivers; you don't need to have expensive, high-end electronics to hear these differences.

In any case, don't expect miracles with home theater: It is still largely a low- to mid-fi medium—particularly with old movie soundtracks and virtually all TV programs. There are, however, a steadily increasing number of soundtracks containing a great deal of detail and directional infor-

mation in the front channels, useful ambient information in the rear, and subtlety as well as car chases and explosions. (*The Last of the Mohicans* is a good example of this.) THX-mastered LaserDiscs usually provide outstanding sound even without Home THX processing and speakers, and most of the better movies released in the last two years reflect a steady improvement in the ability of mixing engineers to use sound effectively. Good setup can help any system reproduce this information in ways that greatly improve home theater. At the same time, I find that combining good speakers with good setup is far more important to getting good results from stereo recordings. I can get far better musical performance at home out of properly set-up speakers than I hear in most manufacturer demonstrations, and a well set-up system can deliver far better sound than a poorly set-up system using speakers costing several times as much.

Using a full home theater system in the Dolby Pro Logic mode can produce surprisingly good musical performance. Until I heard the Delos Dolby Surround CDs, I had found Dolby Surround to be mediocre for reproducing music. Most of the Dolby Surround music recordings I had heard reminded me of the audio garbage that came out when the industry was trying to sell quadraphonic sound: All effects and no soul. Well-engineered recordings, like those John Eargle has done for Delos, show that talent and taste definitely make a difference. (I recommend, in particular, a two-disc Delos set, *Surround Spectacular*. One of the discs is a sampler of surround music; the other contains test signals for stereo and surround setups.) While even the best Dolby Pro Logic processors and recordings are not as transparent as the best stereo CDs and high-end stereo preamps, the added ambient information in Dolby Surround can more than make up for a slight loss of resolution. These Dolby Surround recordings offer real hope for the future. Like some of the pioneering Ambisonic recordings and discrete four-channel tapes, they indicate that discrete five-channel digital recordings will almost certainly offer producers and engineers the ability to make good use of home theater systems in adding ambient life and concert-hall realism to music.

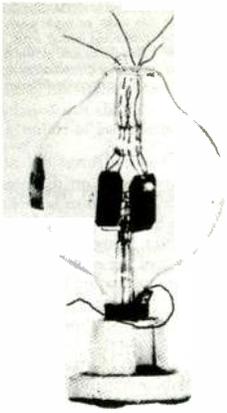
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CIRCLE NO. 12 ON READER SERVICE CARD



BY B. ERIC RHOADS

If you ask most people who invented radio, the name Marconi comes to mind. Usually KDKA Pittsburgh is the response when you ask about the first radio station. But were these really radio's firsts? Out of curiosity, and in the interest of good journalism, I set out to find the answers.

But was the inventor of radio the person who discovered that electromagnetic waves could be sent through the air or the person who actually

sent them? Was it the person who sent signals the farthest or the one who first transmitted signals with voice? Was the first station the first commercial one to be licensed or the first licensed experimental station? The answers aren't clear.

The term "wireless" itself is relatively broad. Within the wireless category are many subcategories and industries, of which radio broadcasting is just one—as is wireless telegraphy, wireless ship-to-shore communication, and so on.

To trace the development of wireless we must first track events leading up to the discovery of electricity. Though some documentation goes further back, electricity as a science began in 1600 when Dr. William Gilbert, Queen Elizabeth I's personal physician, invented the electroscope, which detected electromagnetic energy in the body. He coined the word "electricity." From that point forward many people had their hand in the development of electricity—among others, Benjamin Franklin, Alessandro Volta, and Georg Simon Ohm. For brevity's sake, I'll discuss wireless after electricity was discovered.

The real interest in wireless began with Samuel F. B. Morse's 1837 invention of the telegraph, which required wires (a very expensive proposition). In 1867 a Scottish mathematician, James Clerk Maxwell, formulated the "electromagnetic theory of light." This theory holds that light is a type of energy consisting of electric and magnetic fields oscillating at right angles to one another as they propagate through space. Light, radio waves, and other forms of electromagnetic energy are distinguished from each other by their frequency of oscillation. Although Maxwell was correct about this, he was incorrect in postulating the existence of a medium, called ether, to carry these waves.

*This article was adapted from Radio Ink's July 10-23, 1995 issue, commemorating the 75th anniversary of radio. The original article is included in the author's new book, Blast from the Past: A Pictorial History of Radio's First 75 Years. The book is available from Streamline Press (800/226-7857) for \$45.50 or, in a collector's edition, for \$80.50. Prices include shipping and handling.*

# who really invented

Top left

LEE DE FOREST'S AUDION TUBE.

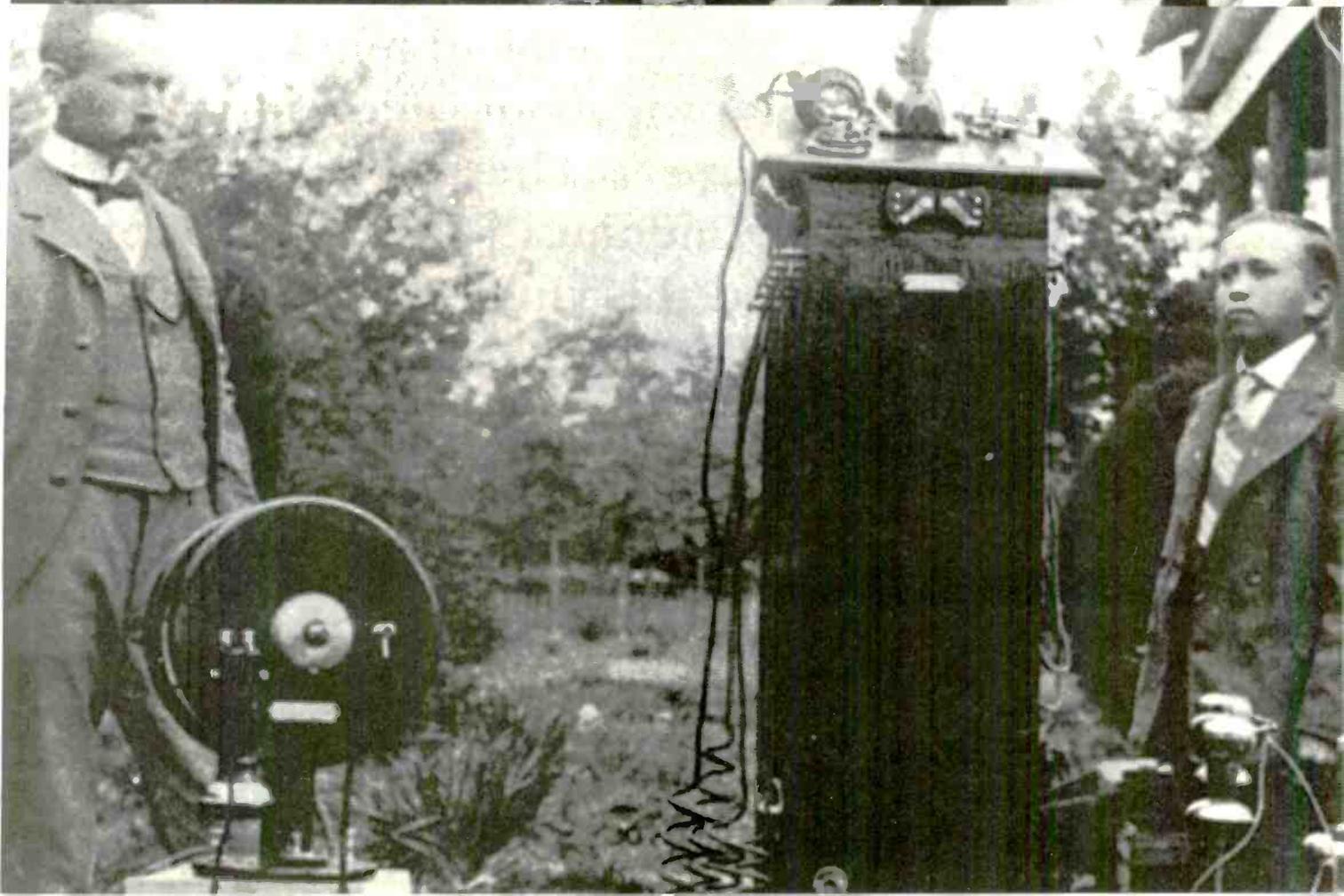
Top right

IOWA STATE'S PHYSICS DEPARTMENT GIVING A PUBLIC DEMONSTRATION OF THE WIRELESS AT THE 1915 IOWA STATE FAIR.

Bottom right

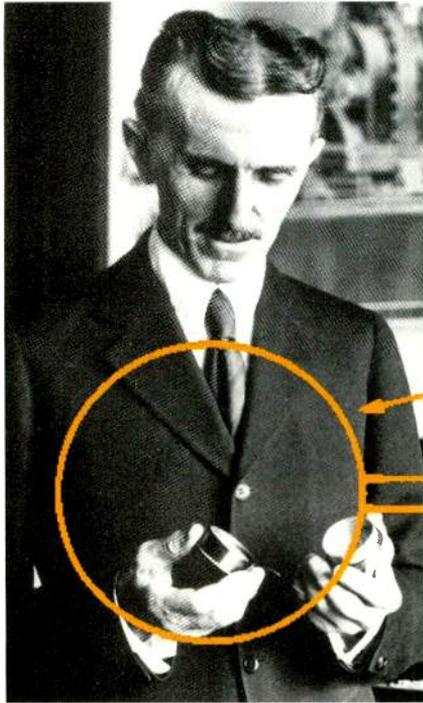
NATHAN B. STUBBLEFIELD AND HIS SON POSING WITH HIS WIRELESS TELEPHONE, DEMONSTRATED ON HIS FARM IN MURRAY, KENTUCKY, 1892.

Photographs/Courtesy of Radio Ink Magazine

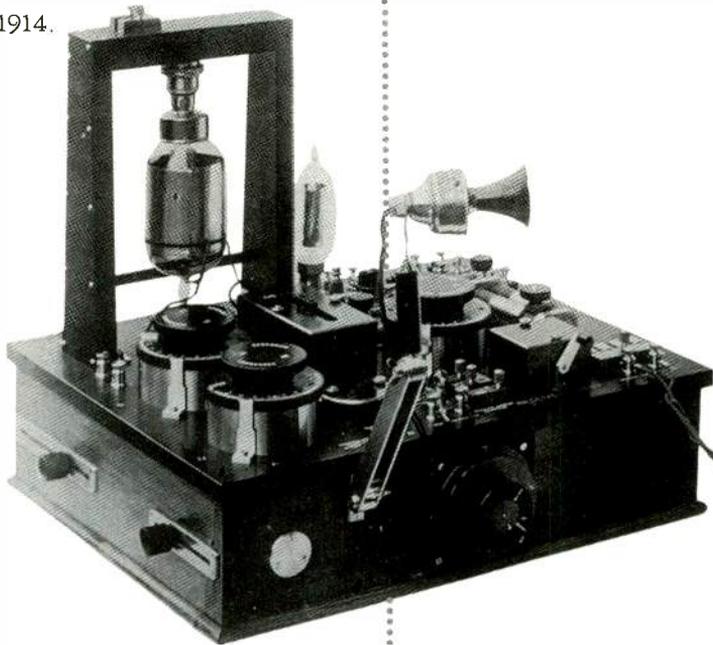




**Right**  
 .....  
 NIKOLA TESLA  
 WITH HIS  
 INVENTION,  
 THE TESLA  
 COIL, WHICH  
 CREATED HIGH-  
 FREQUENCY  
 OSCILLATIONS.



**Below**  
 .....  
 DEVICE USED  
 BY MARCONI  
 TO TRANSMIT  
 SIGNALS  
 BETWEEN  
 VESSELS  
 ANCHORED OFF  
 THE ITALIAN  
 COAST,  
 CIRCA 1914.



In 1865 a Washington, D.C. dentist, Dr. Mahlon Loomis, explored wireless. He developed a method of transmitting and receiving messages using the earth's atmosphere as a conductor. Loomis sent up kites, 18 miles apart, from two West Virginia mountaintops. The kites were covered with a copper screen and connected to the ground with copper wires. The wire from each kite string was connected to one side of a galvanometer; the other side was held by Loomis, who was ready to make a connection to a coil buried in the ground. The receiving station connection, between the meter and the buried coil, was always closed; whenever the circuit was closed at the transmitting end, the galvanometer at the receiving station actually dipped. Congress awarded Loomis a \$50,000 research grant to pursue his experiments.

In 1885, Sir William H. Peerce and A. W. Heaviside sent signals to one another, at a distance of 1,000 yards, with two parallel telegraph lines and an unwired telephone receiver in the middle. This was the discovery of induction, or crosstalk.

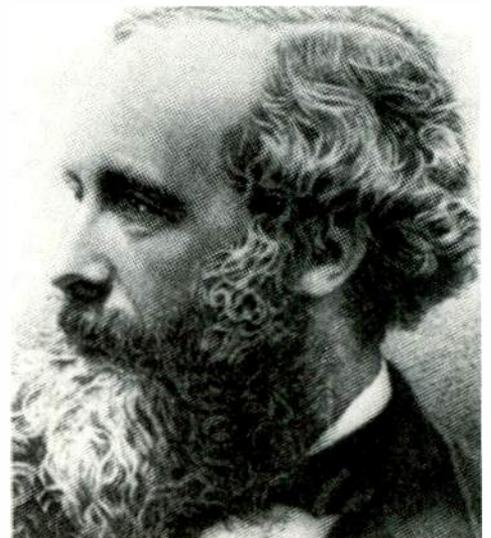
The real experiments leading to radio's discovery started with Heinrich Hertz in 1886. Some call him the father of radio because his experiments stirred the interest of Guglielmo Marconi; radio waves were commonly called Hertzian waves in the early days. Hertz studied Maxwell's theories and, while attempting to develop further data, actually set up the first spark transmitter and receiver. The transmitter consisted of a Leyden jar and a coil of wire, the ends of which were left open so that a small gap was formed. For the receiver, Hertz used a similar coil at the opposite end of the room. When the jar was charged, sparks flew across the gap not only of the connected coil but also of the coil on the other side of the room. He then measured the velocity of the waves conveying the energy to the far coil and found they had the same speed as light, 186,000 miles per second.

In 1892 a French inventor, Edouard Branly, created the "coherer," a tube containing loose zinc and silver filings, with contact plugs on each end. The shavings would stick together after the first spark was received; a method of separating them for the next signal was necessary. Popov, a Russian, came up with the idea of using a vibrator and the hammer of an electric bell to strike the tube and cause the filings to separate.

### Tesla, Marconi, and Stubblefield

Nikola Tesla, a Serbian, suggested a means of conduction using the earth in 1893. In 1895, Mar-

**Right**  
 .....  
 JAMES CLERK MAXWELL,  
 A PROFESSOR AT  
 CAMBRIDGE UNIVERSITY,  
 DEVELOPED HIS THEORY  
 OF ELECTROMAGNETISM  
 IN 1867.



coni experimented with Hertzian waves and was able to send and receive messages over 1¼ miles. Marconi made great strides when he created transmission between two ships that were 12 miles apart. He then solicited and secured investors for the Marconi Wireless Telegraph Company, the first to commercialize wireless. Marconi was 23. By 1899 he had covered distances of 74 miles. That same year he adopted Sir Oliver Lodge's principles of tuning circuits, perfecting them and obtaining a patent in 1900. In December 1901, when Marconi sent the first transatlantic signal, inventor H. Otis Pond told Tesla, "Looks like Marconi got the jump on you." Tesla replied, "Marconi is a good fellow; let him continue. He is using 17 of my patents." Tesla's attitude toward Marconi changed after years of litigation between them. Tesla later referred to Marconi as "a donkey."

Tesla had come up with something different and superior to what Hertz had originally developed. He created a series of high-frequency alternators producing frequencies up to 33,000 cycles per second (33,000 Hz). This was the forerunner to high-frequency alternators used for continuous-wave radio communication. Tesla went on to build the Tesla coil, an air-core transformer with primary and secondary coils tuned to resonate—a step-up transformer that converts high current with low voltage to low current with high voltage at high frequencies. It is used today in all radios and televisions.

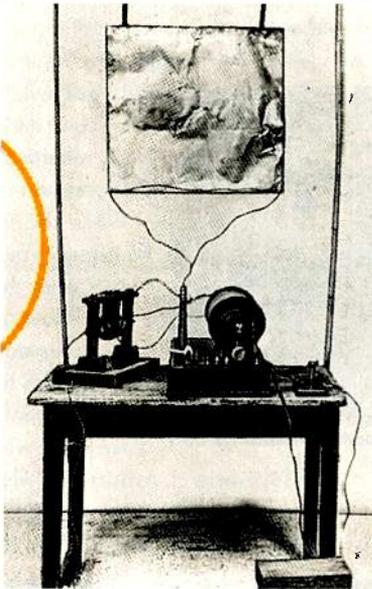
In 1892 a Kentucky farmer and inventor, Nathan B. Stubblefield, publicly demonstrated wireless. Not only did he broadcast signals, but he also was able to broadcast voice and music. Stubblefield demonstrated wireless again in 1898, to a distance of 500 yards (documented by *The St. Louis Dispatch*). He demonstrated a ship-to-shore broadcast on the Potomac River in Washington, D.C. on March 20, 1902, and received Patent No. 887,357 for a wireless telephone on May 12, 1908. Stubblefield was so afraid that someone would steal his invention, he sheltered it from everyone. Although he had been offered \$500,000 for his invention, he turned it down, believing it was worth more. Stubblefield envisioned the device in motorcars (as shown on his patent). After another demonstration in Washington, his "secret box," with his apparatus inside, was stolen (documented February 13, 1912), and he believed that his invention was copied. Following his failed attempts for acceptance, he went into seclusion and became a pauper.

### Fessenden, de Forest, and Fleming

In 1900, Prof. Reginald A. Fessenden realized that Marconi's work was limited to telegraphy and wanted to find a way to transmit and receive telephony (voice). He began experimenting with continuous-wave transmissions, which led to the perfection of the arc transmitter. He also developed an alternator, with a higher frequency, thus eliminating the spark gaps, which wasted energy. Fessenden's work was to become a milestone in the development of

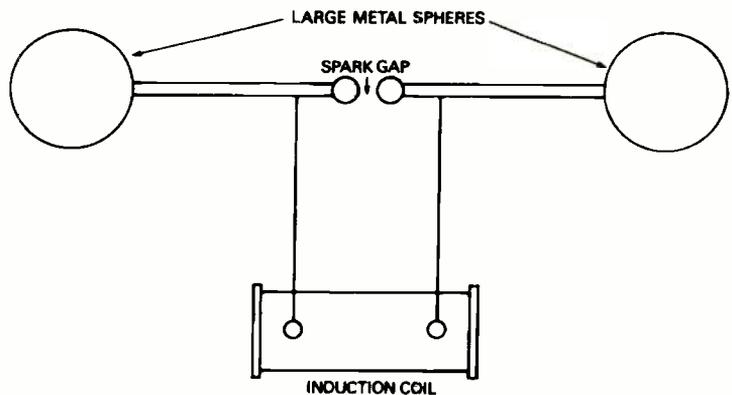
radio. Simultaneously, Lee de Forest built a wireless outfit, also less cumbersome than Marconi's. He used the electrolytic detector, as did Fessenden, which later led to legal conflicts between the two. (De Forest spent years in litigation with many other inventors and was often accused of taking credit for the inventions of others.)

While working for Marconi in 1904, J. Ambrose Fleming developed his two-element (diode) vacuum tube, the Fleming valve. Though significant, the invention was short-lived because of de Forest's invention of a three-element (triode) vacuum tube. De Forest's tube later became known as the audion tube, said to be the most significant invention in radio. Unfortunately, de Forest could



**Left**  
 .....  
 IN 1895, MARCONI USED AN ANTENNA AND GROUND AT BOTH THE TRANSMITTER AND RECEIVER TO ACHIEVE A TRANSMISSION OVER 1¼ MILES.

**Below**  
 .....  
 HEINRICH HERTZ, SOMETIMES CALLED THE FATHER OF RADIO, BUILT THE FIRST SPARK-GAP TRANSMITTER TO STUDY MAXWELL'S THEORIES.



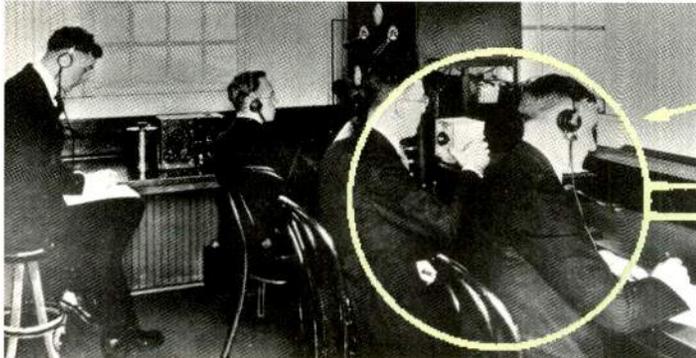
not interest the public in buying stock in his company, so he sold the rights to American Telephone & Telegraph for \$500,000. The decision made by AT&T, thought to be foolish at the time, later proved to be the investment that made the company.

On Christmas Eve in 1906, Fessenden delighted listeners up and down the East Coast by broadcasting voice and music from Brant Rock, Massachusetts. His transmitter used a high-frequency alternator based on Tesla's designs and principles. The program consisted of music from phonograph records, a violin solo, and a speech by the inventor. Fessenden's program did not prove to be a pioneering effort, however. For several years radio remained a com-



*Below*

THE DEBUT BROADCAST  
OF PITTSBURGH  
STATION KDKA  
ON NOVEMBER 2, 1920.



munications medium devoted to sending and receiving messages; it was especially valuable to the armed forces during World War I. The broadcasting potential was not realized until after the war, though David Sarnoff in 1916 envisioned the possibility of a radio receiver in every home. (Sarnoff later became head of the Radio Corporation of America and the National Broadcasting Company.)

In 1906, G. W. Pickard discovered that minerals made an excellent detector, which led to the invention of the crystal detector. It was not only effective but inexpensive, and made the availability of wireless receivers more widespread.

### The Radio Act of 1912

In 1910 the U.S. government required all ships to have a wireless telegraph. In 1912 the Titanic hit an iceberg and sent the first SOS signal, which was heard by a nearby ship that came to the rescue of many survivors. It was later learned that another ship was closer, which would have resulted in more lives being saved—yet that ship had

only one wireless operator, who happened to be off watch when the Titanic went down. This resulted in the Radio Act of 1912, requiring that two operators be employed on all ships, with constant watch.

When the Titanic sank, a young wireless operator at the Wanamaker radio station in New York City was able to receive signals from the distressed ship and its rescuers. He gathered reports about the rescue work and a list of the survivors so that the anxious world could be advised. This 21-year-old stayed at the telegraph for 72 hours. His name... David Sarnoff. It was this 1912 event that first made the public aware of the importance of the wireless.

In 1913, Edwin H. Armstrong (who much later invented FM radio) created a way to increase the sensitivity of receivers. This regeneration system ended up in litigation with de Forest, who claimed to be the inventor. Ultimately de Forest prevailed. De

Forest also continued to perfect the audion tube he had sold to AT&T. It now had the ability to function as an oscillator (generator of high frequencies). This led to the oscillator circuit created by W. E. Hartley. The result was improved long-distance transmission of speech, the forerunner of radio broadcasting.



### The First Stations

In 1916, ham radio operator Frank Conrad, who was also an engineer for Westinghouse Electric, began broadcasting programs from his garage on amateur station 8XK in Wilkesburg, Pennsylvania. The broadcasts were enthusiastically received by other radio amateurs who liked hearing music over the wireless. A

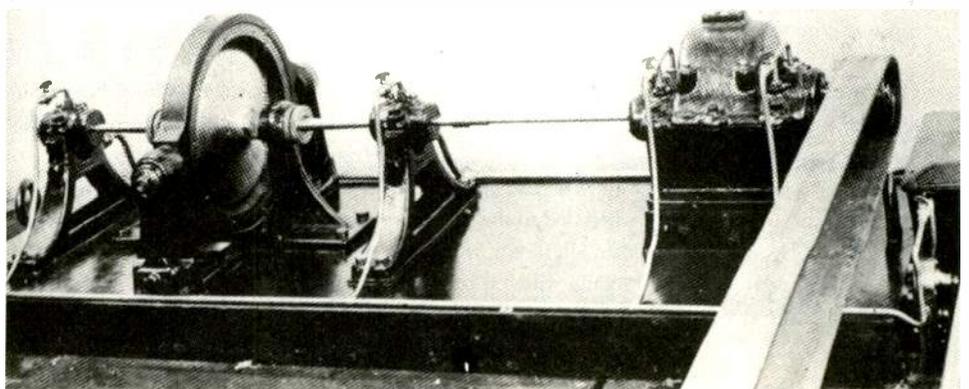


*Top right*

ANNOUNCER AND  
SPORTSCASTER  
HAROLD W. ARLIN  
OF KDKA.

*Bottom right*

REGINALD A.  
FESSENDEN'S  
HIGH-FREQUENCY  
ALTERNATOR.



newspaper article generated so much interest that Westinghouse decided to build a station for the purpose of broadcasting. The station, KDKA, was rushed to launch its first broadcast, the election returns of the Harding-Cox presidential race in 1920. It was the first program to reach a sizable audience (perhaps 1,000 people—mainly amateur radio operators and Westinghouse employees). The returns were read by Leo Rosenberg, who later claimed to be the first professional radio announcer. KDKA also hired the first full-time announcer—Harold W. Arlin, who became the first sportscaster to do play-by-play football. Newspapers (2,000 across the country) became so enamored with the medium that they printed daily broadcast schedules, not yet realizing that they were promoting a competitive medium. KDKA was responsible for the first remote, the first broadcast religious service, the first broadcast from a theater, and the first broadcast prizefight—all in 1921. (It's interesting to note that Westinghouse, which owned KDKA, was founded by George Westinghouse, the first owner of an electric company to employ the principles of alternating current. Westinghouse had obtained that technology through a relationship with Nikola Tesla, who held the patent and also had the patent on wireless transmission.)

But was KDKA the first station? Though its November 2, 1920, debut is considered the official start of radio broadcasting, other stations were operating before then. Earlier that same year, in Detroit, WWJ (using call letters 8MK) began regular broadcasts. And much earlier, in 1912, Charles David Herrold began 24-hour broadcasts of music and information at his station in San Jose, California. The amateur station was well known around the Bay Area. (It eventually became KQW and then KCBS.) In 1913 the Physics Department at Iowa State University began wireless demonstrations and is documented by a newspaper article to have done one such demonstration at the Iowa State Fair in 1915. (It became station 9YI and, later, WOI.) With groundwork dating back to 1904, the University of Wisconsin in Madison experimented with voice and music transmission in 1917. (Its calls were 9XM and, later, WHA.)

The first commercial was claimed to have been sent out by station WEAJ in New York City in 1922. That claim is disputed, however, because in KDKA's initial broadcasts announcers mentioned a record store in exchange for records to play on the air, as did KQW announcers in San Jose.

### Radio's Father

So who was the father of radio? Although we have traditionally credited Marconi, there is much doubt that he was the true father of radio. He was very industrious, highly inventive, and had the

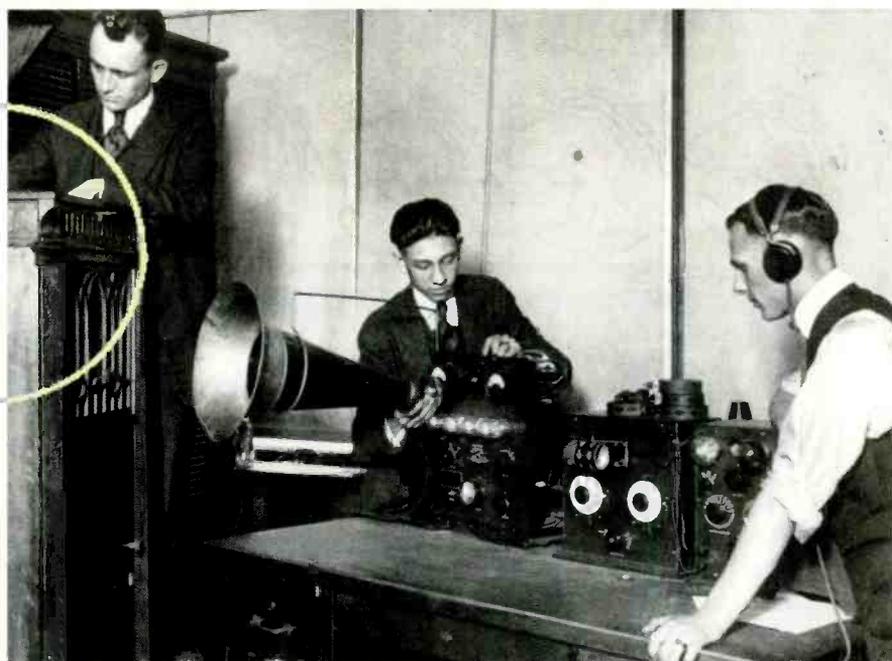


Left

DAVID SARNOFF RECEIVING TRANSMISSIONS ATOP THE OLD NEW YORK WANAMAKER STORE

Below

IN 1920, WWJ DETROIT BEGAN REGULAR BROADCAST PROGRAMMING.



strongest and most successful entrepreneurial spirit of any of radio's fathers. He made excellent commercial applications for wireless telegraphy. However, my exhaustive research points to Nikola Tesla, who had disclosed wireless and the technology at a lecture in 1893, preceding Marconi's wireless inventions and practical demonstrations. In fact, a U.S. Supreme Court decision in 1943 held that Tesla was the father of radio. Marconi's first patent was issued in 1900 and Tesla's in 1898.

But what about Nathan Stubblefield, who had demonstrated wireless in 1892? If you go to the town square in Murray, Kentucky, you'll find a statue of Stubblefield inscribed with the words "Murray, Kentucky. . . Birthplace of Radio." Could it be that a forward-thinking, albeit eccentric, farmer from Kentucky outwitted the intellects of Tesla, Marconi, Edison (who once worked on wireless experiments and also won a suit against Marconi for patent infringement), and others? Could Stubblefield's stolen apparatus have surfaced as someone else's invention? No one will ever know for sure. Documents prove Stubblefield's early demonstrations of an actual working wireless system to have occurred one year before Tesla's lectures about radio, which were prior to his working experiments. The Supreme Court ruled that Tesla is the father of radio—and Marconi is not. The question remains whether the honor truly belongs to Nathan Stubblefield.

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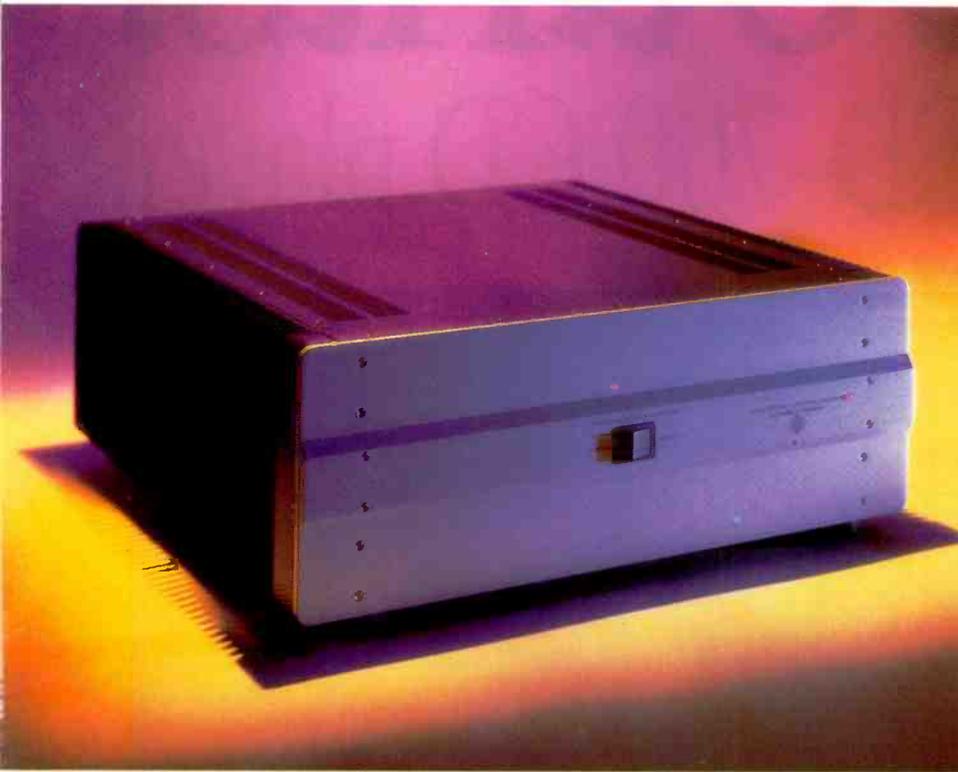
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# COUNTERPOINT NPS-400A AMPLIFIER



Having enjoyed reviewing Counterpoint's SA-220 power amp (July 1990 issue), I was pleased to see the NPS-400A arrive on my doorstep for testing. The "NPS" stands for Natural Progression Stereo. Counterpoint's NPS models are a continuation (a natural progression, if you will) of the technology developed for its Natural Progression Monaural (NPM) Insulated-Gate Bipolar Transistor (IGBT) amplifiers. The NPS-400A and its smaller brother, the NPS-200, use the same tube power supply and differential voltage-amplifier stage as the NPMs. However, unlike the NPMs, the NPS models have regular bipolar transistors in the output stage instead of IGBTs.

One claimed advantage of the design, low distortion without overall feedback, is accomplished by constant-current loading of the front-end amplifier tube, in conjunc-

tion with the very high transconductance of the solid-state output stage. The topology is also said to make the amplifier's sound load-independent. The NPS-400A is a dual-mono amplifier, i.e., its two channels are not connected electrically. This—plus such details as a rugged chassis (assembled from aluminum, copper, and steel), a 2-kVA power transformer, high-quality parts, and conservative design—are intended to help make it a long-lasting and good-sounding amp.

The front panel sports a large "Operate/Standby" rocker switch in the middle and a status LED just to the right of the Counterpoint logo. For each channel, the

rear panel has two sets of five-way binding-post outputs, a speaker fuse, an RCA connector for unbalanced input, and an XLR connector for balanced input. Each channel also has a small toggle switch that shorts the inputs—a godsend for those of us who want to plug and unplug input leads without blapping speakers or having to bother turning off the amp. Every power amplifier should have these! In the middle of the back panel is a toggle switch to select normal or balanced input. Another toggle switch selects stereo or bridged-mode operation; panel markings warn that only the channel A input should be used in bridged mode. A socket for the IEC power cord is at the bottom center of the rear panel.

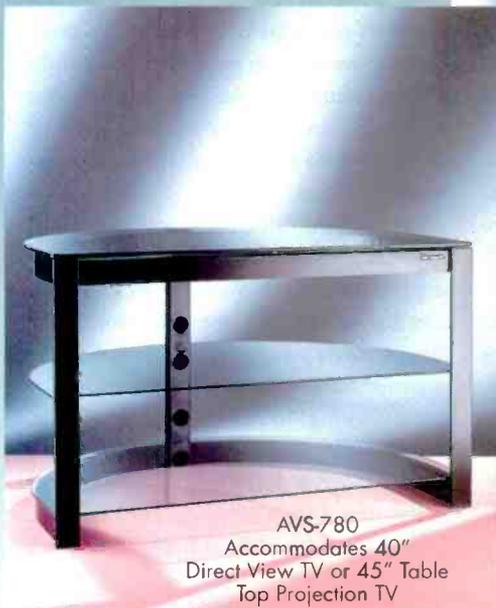
## Circuitry

Roughly the central third of the amp's interior is taken up by an appropriately beefy EI-lamination power transformer and eight filter capacitors. On either side of the power supply, and parallel to the bottom of the amplifier, are the channel-module circuit boards, which contain most of each channel's signal and control circuitry. The output and driver transistors are mounted to the inside of the side-mounted heat sinks, with their leads soldered to the amplifier circuit boards.

A small circuit board carries the input connectors and the input-mode and shorting toggle switches. This board plugs into each amplifier board via connectors at each of its ends. Workmanship and parts quality appear to be of high order in this amplifier—no sheet-metal screws here, just machine screws threaded into Pemm nuts.

**THE NPS-400A IS  
A HYBRID DESIGN, WITH  
A TUBE INPUT STAGE  
AND TRANSISTOR  
OUTPUTS.**

The NPS-400A's input stage is a differential amplifier using a 6DJ8 twin triode. A constant-current source, composed of a cascode connection of two bipolar transistors, sinks the current from the tubes' cathodes, which are directly tied together (no feedback resistors), to a negative supply. A similar current source, of opposite polarity, feeds the plate of the tube at the input stage's output. Such an arrangement allows maximum gain and best linearity from the tubes. This stage provides all the



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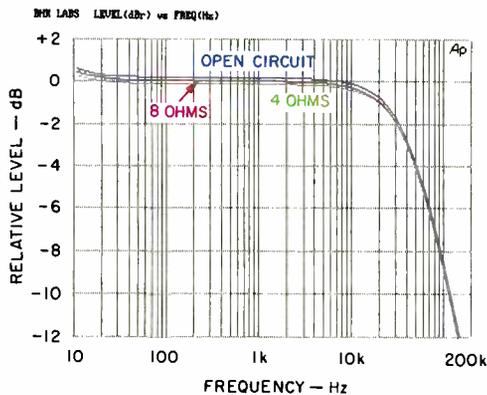


Fig. 1—Frequency response.

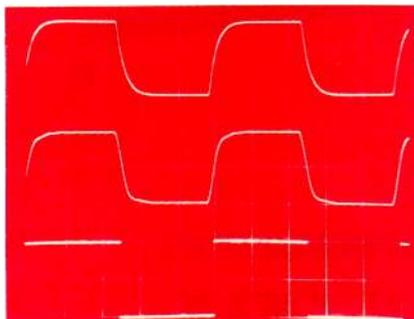


Fig. 2—Square-wave response, 10 kHz into 8 ohms (top), 10 kHz into 8 ohms in parallel with 2 μF (middle), and 40 Hz into 8 ohms (bottom).

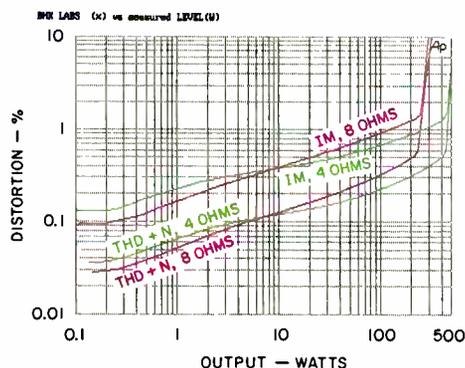


Fig. 3—Distortion vs. power, THD + N at 1 kHz and SMPTE IM.

voltage gain and swing required by the output stage, whose own voltage gain is very close to one.

Even though the output stage amounts to a three-stage complementary emitter follower, the implementation has a rather un-

usual first-stage topology and bias arrangement. In the standard approach, the emitters of the first stage connect to the bases of the second stage, and the emitters of the second stage connect to the bases of the output transistors. Further, the transistors for handling the positive load direction are all NPN types and are all PNP types for the negative load direction. In the output stage of the NPS-400A, however, the transistor types in the first stage are of opposite polarity to those in the second and third stages. This enables the input-stage bases to be tied together instead of being spread by the bias regulator, as in the standard approach.

The output signal from the tube front end is capacitor-coupled into the bases in the first stage of the output. Controlled current sources are connected between each first-stage emitter and its related supply rail. A separate bias circuit is based to ground instead of floating up and down with the signal, as in the standard approach. The bias circuit has two outputs, one for each of the aforementioned current sources. The bias circuit's output is controlled by a circuit that senses heat-sink temperature; this keeps the output stage's quiescent current more or less constant, as the bias regulator does in the standard approach. An output offset servo is connected into the bias circuit to keep the final d.c. offset very close to zero. One of the main advantages of this approach is that it eliminates the need for shunting impedances at the front of the output stage. No overall feedback loop is used—in fact, there is, deliberately, no signal feedback save the intrinsic current feedback in the output stage's emitter followers.

The Counterpoint amplifier is switched from standby mode to operating mode by turning on the heaters in the tube rectifiers. This also closes a relay that feeds power to the turn-on delay circuit. (This circuit changes the front panel's LED from red to

flashing yellow during the turn-on delay.) Note, however, that the output stage and the front-end tube heaters are fully powered and warmed up even when this amplifier is in standby mode. The NPS-400A has no protection circuitry other than well-sized fuses on the output-stage rails and speaker outputs.

Counterpoint's excellent service manual includes a section on—get this—"Adjusting the Amplifier's Voice"! The company says that by adjusting several resistors in the output stage, a technician can change the *apparent* treble response from neutral (the factory setting) to maximum or minimum without affecting the *measured* frequency response. What does change is the current in the output stage's input emitter follower, from 2.7 mA (maximum treble) to 5.0 mA

## SPECS

**Power Output:** Stereo, 200 watts/channel into 8 ohms, 400 watts/channel into 4 ohms, or 700 watts/channel into 2 ohms; bridged mono, 650 watts into 8 ohms or 700 watts into 2 or 4 ohms.

**Gain:** Voltage, 28.5 dB; current, 112 dB.

**Input Sensitivity:** IHF, 106 mV rms for 1 watt into 8 ohms; to rated power, 1.5 V rms.

**Input Impedance:** 100 kilohms plus 470 pF.

**Frequency Response:** +0, -3 dB, from below 10 Hz to 50 kHz.

**S/N:** 90 dB, IHF-weighted, re: 1 watt.

**Damping Factor, 8-Ohm Load:** 88 at 1 kHz.

**Output Impedance:** 0.09 ohm.

**Maximum Output Current:** 200 amperes, peak to peak, into 0.1 ohm, for 1-kHz pulse (20 mS on, 480 mS off) at 20 V, peak to peak.

**D.C. Offset:** Less than 10 mV.

**Power Requirements:** 160 watts at 120 V a.c.

**Dimensions:** 19 in. W x 7½ in. H x 19¾ in. D (48.3 cm x 18.9 cm x 50 cm).

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

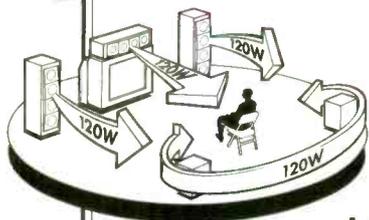
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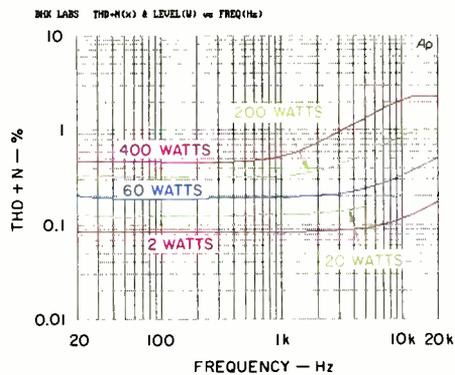


Fig. 4—THD + N vs. frequency into 4 ohms.

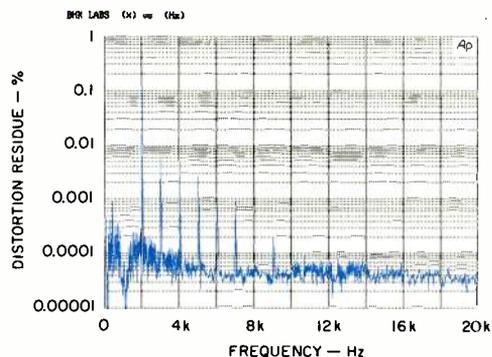


Fig. 5—Harmonic-distortion spectrum for 1-kHz signal at 10 watts into 8 ohms.

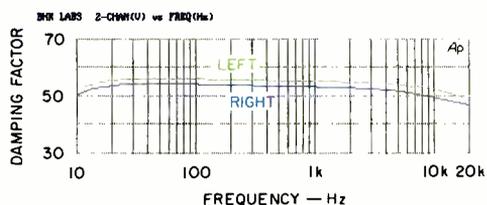


Fig. 6—Damping factor vs. frequency, into 8 ohms.

Table I—Output noise levels. The IHF S/N was 87.2 dB for the left channel and 87.9 dB for the right.

Bandwidth	Output Noise, $\mu\text{V}$	
	LEFT	RIGHT
Wideband	304.2	333.7
22 Hz to 22 kHz	192.4	191.5
400 Hz to 22 kHz	142.5	133.0
A-Weighted	122.8	114.1

(minimum). The service manual details how the dealer can do this to adjust the amplifier to a customer's preference.

#### Measurements

The NPS-400A's voltage gain and input sensitivity were the same in balanced or unbalanced mode. For the left channel, gain was 29.4 dB and sensitivity was 96.3 mV; results for the right channel were 29.8 dB and 91.2 mV, respectively. All subsequent testing was done in the unbalanced mode unless I have otherwise noted.

Frequency response with open-circuit, 8-ohm, and 4-ohm loading is plotted in Fig. 1. The uniform spacing of the curves suggests a relatively constant output impedance. The slight rise in response below about 20 Hz may be deliberate, to enhance the audio quality of the bass. This amp's high-frequency bandwidth (to the  $-3$  dB point) appears to be about 38 kHz. Rise and fall times with 8-ohm loading came out to about 9  $\mu\text{s}$ . Square-wave response is shown in Fig. 2. Note the absence of ringing in the middle trace, where 2  $\mu\text{F}$  was paralleled across the 8-ohm load resistor. The absence of low-frequency tilt in the 40-Hz trace (bottom) indicates excellent, if possibly lifted, sub-audio frequency response.

Common-mode-rejection ratio (CMRR) for the left channel's balanced input was good, better than 60 dB over the whole audio frequency range. For the right channel, CMRR was also better than 60 dB up to about 400 Hz but decreased at a rate of 6 dB per octave above 400 Hz; it ended up at about 27 dB at 20 kHz.

Distortion is shown in Fig. 3 for the right channel, which had higher distortion than the left. In solid-state amplifiers, distortion typically rises as load impedance is reduced. This holds true in the NPS-400A below 8 watts, but

above this power level the distortion is lower into 4 ohms than into 8 ohms. Figure 4 shows THD + N as a function of frequency and power with 4-ohm loading. At power levels up to 60 watts, the rise in distortion at high frequencies is modest, but it becomes steeper at higher power levels. A spectrum of the harmonic-distortion residue at the 10-watt level into 8 ohms (Fig. 5) reveals that the second harmonic dominates by at least an order of magnitude. In my opinion, the NPS-400A's distortion performance is quite good for an amplifier that doesn't use feedback.

Damping factor relative to an 8-ohm load is presented in Fig. 6. As can be seen, the damping factor is quite constant over

THE NPS-400A'S  
DISTORTION  
WAS QUITE GOOD  
FOR AN AMP  
THAT USES NO FEEDBACK.

the audio range, which is desirable but unusual. For some reason, the output impedance that I measured was about 68% higher than specified by Counterpoint. To verify my results, I used another method, which involved taking the data I had obtained for Fig. 1. The outcome was about the same.

Interchannel crosstalk was measured in both unbalanced and balanced modes. Generally, it was down better than 100 dB, in either mode, up to 4 to 5 kHz. The crosstalk then rose to between  $-90$  and  $-96$  dB at 20 kHz, depending on input mode and direction.

Output noise as a function of measurement bandwidth is listed in Table I. Overall noise levels are not quite state of the art but should be inaudible in most situations.

Dynamic power for 8-ohm loads was 298 watts at the beginning of the 10-mS, tone-burst test signal and 289 watts at its end; for 4-ohm loads, the figures were 561 and 512 watts, respectively. With the outputs attainable at the beginning of the burst, dynamic headroom was 1.7 dB for 8 ohms and 1.5 dB for 4 ohms. With a 1-ohm load on one channel only, the peak output voltage attainable at the visual onset of clipping was  $\pm 57$  V at the beginning of the burst and

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$\pm 50$  V at its end. This works out to a peak current of  $\pm 57$  amperes into the 1-ohm load. Attainable steady-state power at the visual onset of clipping was 247 watts into 8 ohms and 429 watts into 4 ohms, corresponding to a clipping headroom of 0.92 dB into 8 ohms and 0.3 dB into 4 ohms.

Output d.c. offset was less than 1 mV in either channel. The a.c. line current surged up to some 2.5 or 3.0 amperes when the NPS-400A was first turned on. As the amp came up to operating temperature, line current settled down to about 1.4 amperes.

#### Use and Listening Tests

During the review period, the equipment in my system included an Oracle turntable fitted with a Well Tempered Arm and a Stanton 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. A Counterpoint DA-11A CD transport was used with a Museatex Audio Bidat, a Sonic Frontiers SFD-2 MKII, and other (experimental) D/A converters. Other program sources were a Nakamichi ST-7 FM

tuner, a Nakamichi 250 cassette recorder, and a Technics open-reel recorder. Additional preamplifiers were Forssell tube line drivers and a First Sound II passive model. The power amplifiers I used for comparison were Crown's Macro Reference, a pair of Quicksilver M135s, and an Arnoux 7B digital switching design. The loudspeakers were B & W 801 Matrix Series 3s, augmented from 20 to 50 Hz by my subwoofer system (which has a JBL 1400Nd driver in a 5-cubic-foot ported enclosure on each side).

When I first put the NPS-400A in my system, I immediately liked it. I heard a certain musical rightness that made me keep it in my system for a week before I had any desire to listen to another amp. At the time, I was using the Forssell tube preamp and a prototype Genesis Digital Lens jitter-reduction device between the Counterpoint CD transport and the Sonic Frontiers D/A converter. Before taking the Counterpoint amp to my lab for bench tests, I switched to the Quicksilver M135 tube amps. When I played *Belafonte Returns to Carnegie Hall* (Mobile Fidelity MFC D 782), I did notice a greater sense of audience space with the Quicksilver M135s.

After the bench tests, I began my listening evaluation of the NPS-400A in earnest. To my ever-growing library of reference CDs, I recently added two discs that have unusually good string sound. These are Alfred Schnittke's *Concerto Grosso No. 1* (BIS-CD-377) and *Carulli/Molino: Guitar Concertos* (Philips 426 263-2). Playing these with the NPS-400A creates a palpable, non-strident, and believable portrayal of the way bowed strings sound. The NPS-400A is not one of those amps whose resolution, apparent or real, jumps out and says "listen to me!" Instead, I was struck by the honesty of the musical reproduction. Tonally, it was just a wee bit dark and rolled-off compared to my reference amps. Its bass reproduction was outstanding, however, with great authority and wallop.

My one criticism of the NPS-400A is that it doesn't have a true on/off switch! Since I wasn't willing to pay for keeping a power-hungry component on all the time, I had to unplug and replug the line cord to turn the amp off and on. Arrgggh!

I surely enjoyed my stay with the NPS-400A. Overall, it's a great-sounding amp, one that I can strongly recommend. **A**

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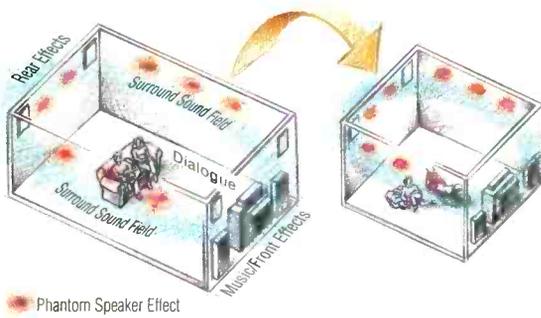
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# DENON AVC-2800 A/V SURROUND AMP



I prefer to maintain separate environments for viewing and music listening, and fortunately, my work justifies my doing so. Although I don't consider separate rooms absolutely necessary, the gaping maw of a projection TV strikes me as out of place when listening to Bach. With separate music and theater rooms, I have little use for an FM tuner in the latter and, for that reason, approached the Denon AVC-2800 A/V surround amplifier with considerable interest.

The AVC-2800 has many of the features I look for in a home-theater control center: A decent number of audio and video inputs, S-video jacks for every video connection, externally linked main-front preamp outputs and power amp inputs, subwoofer and center-channel line outputs, and even extra audio and video outputs and the switching

needed for multiroom operation. As far as connections go, only surround-channel line outputs are lacking, which is a shame since the surround-channel power amps are the ones most likely to be compromised in an integrated product. The AVC-2800 is, in fact, simply the rump end of Denon's AVR-2500 A/V surround receiver, shorn only of its tuner and RDS "SmartRadio."

Both components use Denon's Dynamic Discrete Surround Circuitry (DDSC), which swaps the single-IC Pro Logic processor for "a discrete-component design in which individual circuits can be optimized for superior performance." (Now, where have I heard that before?) In DDSC, the three front channels are processed in the analog domain; the surround signal is digitized by a delta-sigma A/D converter, processed by a DSP that runs proprietary Denon algorithms, and converted back to analog by an 18-bit ladder D/A converter "for lowest quantization noise and mini-

imum zero-cross distortion." As with the DAC, Denon claims 18-bit resolution for the ADC "to give the DSP circuitry high-quality signals to work with."

Since the AVC-2800 is really an AVR-2500 without a tuner, it has as many surround features as the full receiver. For example, the DDSC processor offers four DSP-simulated sound-field modes ("Rock Arena," "Jazz Club," "Classic Concert," and "Matrix"), in addition to four enhanced movie modes ("Wide Screen," "Live Surround," "Super Stadium," and "Mono Movie") and plain-vanilla "Dolby Pro Logic." In the "Pro Logic," "Wide Screen," and "Live Surround" modes, you have the usual choice of center-channel operation: Normal, wide, and phantom. In the other modes, the center isn't used.

Surround-channel delay is adjustable in 1-mS steps from 15 to 30 mS in "Pro Logic"; in "Matrix" mode, it's adjustable from 0 to 360 mS, in 3-mS increments from 0 to 30 mS and then in 30-mS steps to 360 mS. Except with "Pro Logic" and "Matrix" processing, room size and effects level also can be adjusted to suit individual preferences. There are five rooms to choose from ("Small," "Med-S," "Med," "Med-L," and "Large") and 15 choices of effects level. The settings, along with the program source to which they apply, can be stored in one of the amplifier's three "Personal Memory" slots. ("DAT/Tape Monitor" is selected by its own button rather than by the main selector, so this setting can't be stored in one of these memories.) A sequencing noise

**SURPRISINGLY,  
THE AVC-2800 DELIVERED  
MORE OUTPUT  
INTO 8-OHM LOADS  
THAN INTO 4-OHM LOADS.**

generator and level adjustments for center and surround (accessible via the remote) are provided for balancing sound levels; input gain and interchannel balance are adjusted automatically.

The output stage for each front channel is configured from discrete components and rated at 85 watts into 8 ohms with 0.05% THD over the usual band of 20 Hz to

Photos: Michael Groen

20 kHz. The surround outputs use ICs and are rated at 25 watts each into 8 ohms with 0.1% THD at 1 kHz. According to the owner's manual, no channel is rated to drive a net load of less than 6 ohms, which rather limits your choice of loudspeakers (although Denon has told Audio that 4-ohm loads are permissible).

The AVC-2800 offers an extensive array of video inputs: Two VCRs ("VCR-1" and "VCR-2") and a videodisc player or TV tuner ("VDP/TV") on the back, and an independent "Video AUX/Game" input on the front. You can record on either or both of the VCRs. Both S-video connectors and composite-video phono jacks are provided for each video input and recording output as well as for the main viewing monitor. As usual, S-video and composite-video signals are routed separately through the system, so you must be consistent about the wiring or double up and use both types of connections. On the audio front, inputs are provided for a "CD" player, "Tuner,"

"DAT/Tape" deck, and moving-magnet "Phono." The pin jacks are not gold-plated.

Two sets of multiway binding posts are provided for the main stereo speakers. These are on standard centers and can be used with dual banana plugs. However, the manual warns that you must exercise caution when using two sets of speakers simultaneously, since each must be rated at 12 ohms or more. Spring-clip terminals are used for the surround speakers (one set) and as many as two center speakers. I fail to see the purpose of accommodating two center speakers when both must be rated at 12 ohms or more, since I'm unaware of any that fit the bill. On the main-front channels, you can connect two pairs of speakers and activate only one pair at a time, but there's no way to do so with two center speakers.

## SPECS

### POWER AMP SECTION

**Rated Output into 8 Ohms:** Main, 85 watts/channel with 0.05% THD, from 20 Hz to 20 kHz, two channels driven; center, 85 watts with 0.05% THD, from 20 Hz to 20 kHz; rear, 25 watts/channel with 0.1% THD, at 1 kHz, two channels driven.

**Permissible Loads:** Main output terminals, A or B, 6 to 16 ohms; main output terminals, A + B, 12 to 16 ohms; center, 6 to 16 ohms; rear, 6 to 16 ohms.

### PREAMP SECTION

**Input Sensitivity/Impedance:** Line, 150 mV/47 kilohms; MM phono, 2.5 mV/47 kilohms.

**Frequency Response:** 10 Hz to 50 kHz,  $\pm 3$  dB.

**Tone-Control Range:** Bass,  $\pm 10$  dB at 100 Hz; treble,  $\pm 10$  dB at 10 kHz.

**S/N Ratio:** 92 dB.

**Distortion:** Line stage, stereo mode, 0.01% at 1 kHz for 1 V; phono stage, 0.03% at 1 kHz for 3 V.

**Maximum Headphone Output:** 284 mW (8 ohms).

**RIAA Equalization Accuracy:**  $\pm 1$  dB, 20 Hz to 20 kHz.

**S/N Ratio:** 74 dB, A-weighted, 5-mV input.

**Rated Output/Maximum Output:** 150 mV/8 V.

### VIDEO SECTION

**Input and Output Level:** Standard video, 1 V, peak to peak; S-video, 1 V, peak to peak, for Y (brightness) channel and 0.286 V, peak to peak, for C (color) channel.

**Frequency Response:** Standard video, 5 Hz to 8 MHz,  $+0, -3$  dB; S-video, 5 Hz to 10 MHz,  $+0, -3$  dB.

### GENERAL SPECIFICATIONS

**Power Requirements:** 5 amperes at 120 V, 60 Hz.

**Dimensions:** 17 $\frac{1}{8}$  in. W x 6 $\frac{3}{8}$  in. H x 17 $\frac{1}{2}$  in. D (43.4 cm x 16.1 cm x 43.3 cm).

**Weight:** 25 $\frac{1}{2}$  lbs. (11.4 kg).

**Price:** \$950.

**Company Address:** 222 New Rd., Parsippany, N.J. 07054.

For literature, circle No. 91

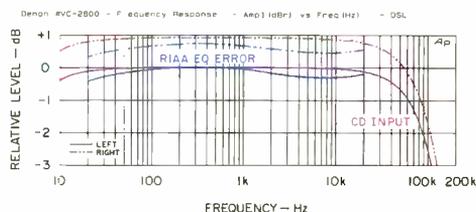


Fig. 1—Frequency response and RIAA EQ accuracy.

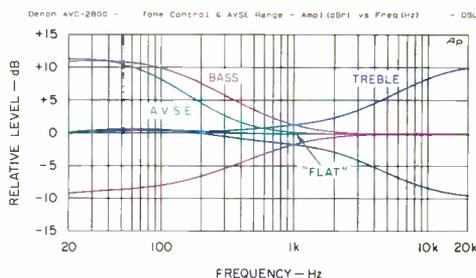
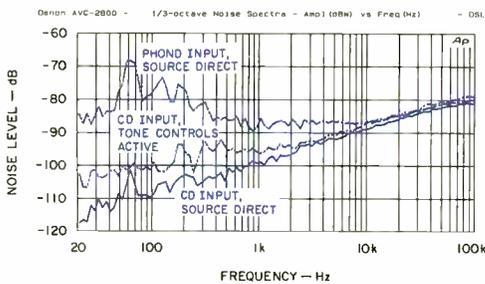


Fig. 2—Frequency response with tone controls and "A.V.S.E." bass boost.

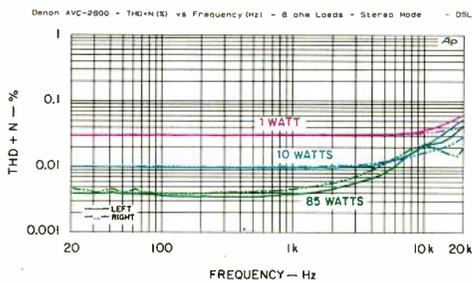
The main speaker switches lie behind a hinged door at the base of the front panel. There also are a cluster of DSP adjustment pads: "Effect" switches DSP on and off, "Parameter" chooses the setting to be altered ("Room Size" or "Effect Level"), "+" and "-" do the adjusting, and "Clear" returns to factory settings. Two pads behind the panel, "A.V.S.E." and "Cinema," toggle the amp's bass boost and THX-like treble roll-off filters, respectively.

There are five more pads behind the door. "Center" and "Rear" independently switch those channels on and off, "Center Mode" chooses among normal, wideband, or phantom operation in the "Cinema" modes, while "MultiSource" enables you to record a source other than the one currently playing and to send its signal to the back-panel "Multi Source" jacks for listening in a second room. "Video Select" enables you to monitor a video source different from the audio source that's been chosen and so can be used for simulcast reception. "Bass," "Treble," and "Balance" knobs, each with center detent, also are behind the door, as are the "Video AUX/Game" inputs and a headphone jack.

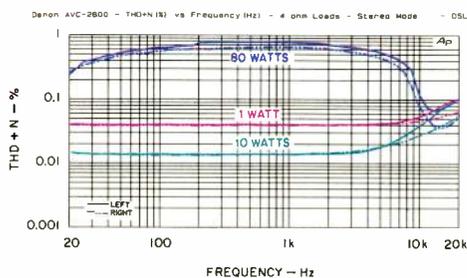
Ten operating-mode selectors are strung out below the display. On the far left of the front panel is the "Power" pad; on the far right is a motorized "Master Volume" knob.



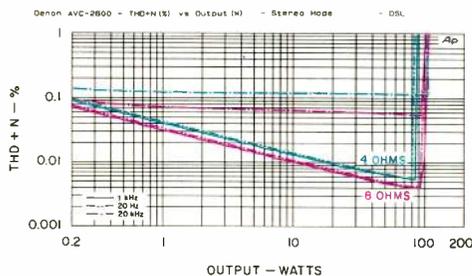
**Fig. 3—Noise vs. frequency.**



**A**  
**B**



**Fig. 4—THD + N vs. frequency for 8-ohm loads (A) and for 4-ohm loads (B), stereo mode.**



**Fig. 5—THD + N vs. output, stereo mode.**



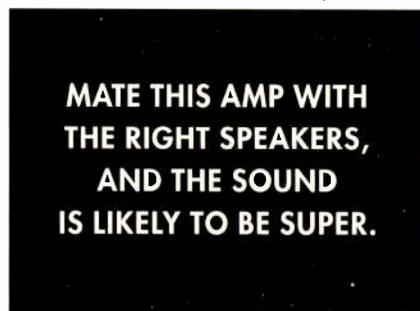
Between the display and the volume control are “Function” selectors that separately select among the various audio and video sources, and below them are the three “Personal Memory” pads and “Source Direct” and “DAT/Tape Monitor” buttons.

With the exception of the bass, treble, and balance controls, the adjusters behind the door on the main panel also are hidden behind a door on the remote. Here too are the “Center” and “Rear” level adjustments and pads to toggle the “T. Tone” sequencer and “On Screen” displays—functions that are not controllable from the AVC-2800’s main panel. A “Panel” pad steps through the current settings, including those stored in each of the three “Personal Memory” banks; ultimately, it turns the main-panel display off completely. I didn’t find a reference to this pad in the owner’s manual (which is rather sketchy for so complex a product), but that’s how it seems to function. Also not mentioned in the manual are the remote’s “RDS” and “PTY” pads. Presumably the same remote is used for the AVR-2500 receiver, and these pads control its tuner section’s RDS features.

The AVC-2800’s remote is one of the increasingly rare (and desirable) programmable types, i.e., you can “teach” it the codes of other manufacturers’ equipment. But you may not need to: The remote is preprogrammed with the codes of many other manufacturers and may work for you as is. A two-position slide switch near the active end of the transmitter enables you to choose whether the control keys command audio or video equipment. A three-position switch adjacent to the slider chooses whether the keys control a “CD” player (“VDP” in the video world), a tape “Deck” (“VCR” for video), or a “DAT” (“TV” in video). This arrangement gives the remote great flexibility with a relatively small number of keys.

## Measurements

In various respects, the AVC-2800 is an admirable unit. As you can see in Fig. 1, basic frequency response is quite flat with the tone controls bypassed, and phono (RIAA) equalization error is pretty negligible. But as these graphs show, channel balance is none too good. Left and right channels differ by almost a dB, and there’s no way to correct it in the “Source Direct” mode. Fortunately, as you can see in the “Flat” curve in Fig. 2, engaging the tone controls doesn’t affect basic response drastically; it’s within +0.5, –0.0 dB across the audio band, and the ultrasonic –3 dB point (not seen in the graph) was even further out than when the tone controls were bypassed. Figure 2 also



shows the range of the bass and treble controls and the effect of the A.V.S.E. circuit. The results are pretty typical; the tone-control range maxes out at about  $\pm 10$  dB, and the A.V.S.E. bass boost is a bit more than that. The details are listed in the Measured Data Table.

The results for A-weighted noise listed in the Table (which, on the whole, are quite good) were obtained in the “Source Direct” mode, but the noise spectrum analyses in Fig. 3 suggest they’d be only a few dB worse if the tone controls were engaged. As you can see, the AVC-2800 is reasonably free of power-line-related components when the line-level (CD) input is used. There are stronger components at 60, 120, and 180 Hz when the phono input is employed; this is to be expected, both from the additional gain of the phono stage and from the effects of RIAA equalization.

Input impedance and sensitivity measured from the CD and phono inputs were typical of today’s integrated amps; output levels and impedance measured at the tape-recording jacks also were typical. Input overload at 1 kHz (defined here as the input level at which distortion reaches 1%) was somewhat less generous than I’d hoped to

# The Velodyne 15" Subwoofer: Controlling Brute Force Through Superb Engineering

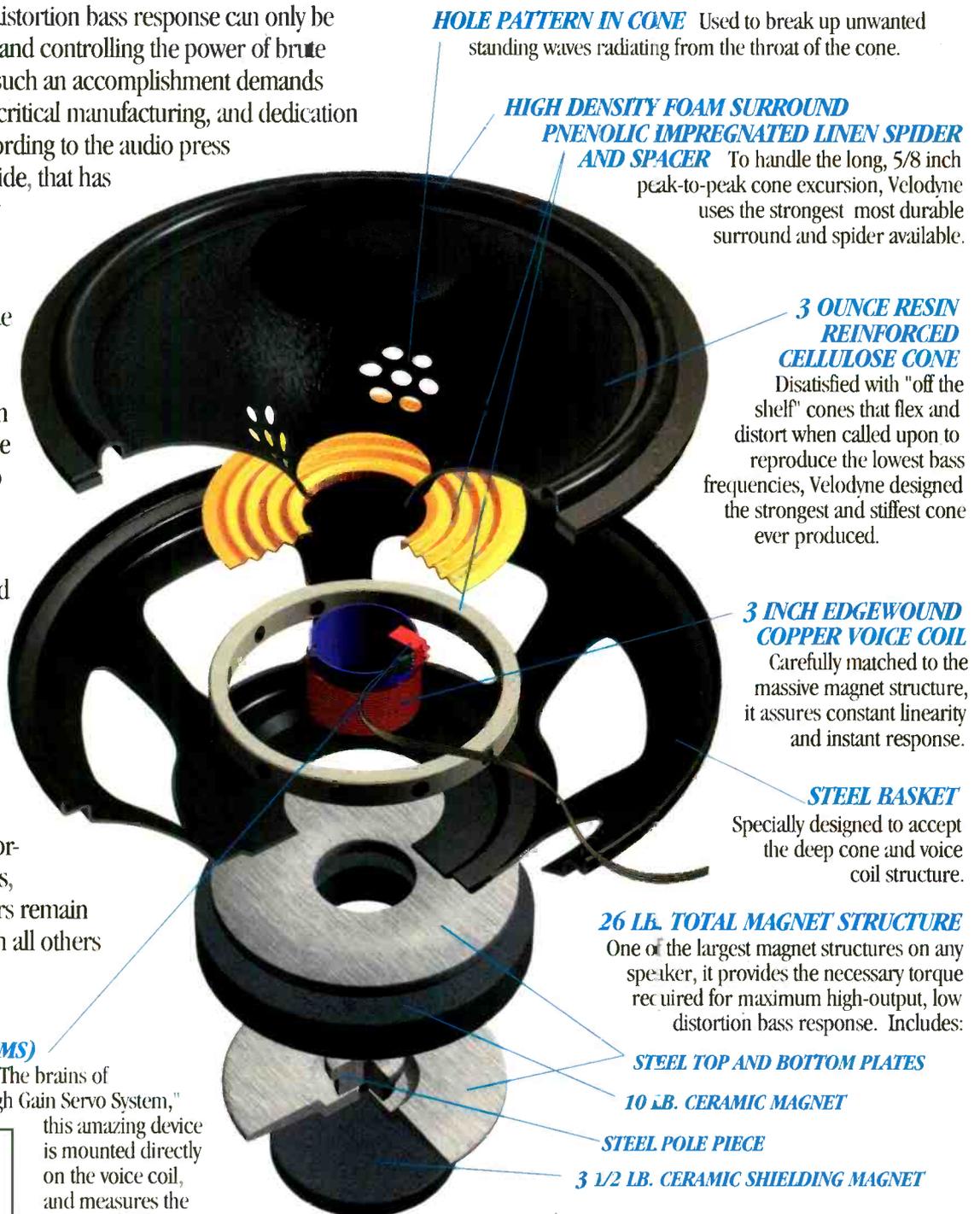
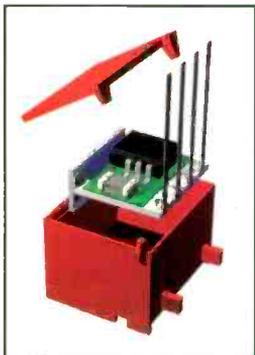
High-output, low distortion bass response can only be achieved by creating and controlling the power of brute force. Perfection of such an accomplishment demands superb engineering, critical manufacturing, and dedication to ideals: A feat, according to the audio press and listeners worldwide, that has been attained only by Velodyne Acoustics.

More than a decade of engineering excellence has generated Velodyne's "High Gain Servo" speakers to the forefront of the audio industry.

Velodyne's patented speakers are built in-house, to the most exacting specifications, using the finest materials available. With their superb design, engineering, and error-correction electronics, Velodyne's subwoofers remain the standard by which all others are judged.

## LOW MASS (2.5 GRAMS)

**ACCELEROMETER** The brains of Velodyne's patented "High Gain Servo System," this amazing device is mounted directly on the voice coil, and measures the actual movement of the driver. The information is sent to a circuit, which makes corrections for any deviations from the pure input signal. This "error correction" circuit virtually controls the motion of the driver, and eliminates distortion.



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**HIGH DENSITY FOAM SURROUND  
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peak-to-peak cone excursion, Velodyne uses the strongest most durable surround and spider available.

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Disatisfied with "off the shelf" cones that flex and distort when called upon to reproduce the lowest bass frequencies, Velodyne designed the strongest and stiffest cone ever produced.

**3 INCH EDGEWOUND  
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Carefully matched to the massive magnet structure, it assures constant linearity and instant response.

**STEEL BASKET**

Specially designed to accept the deep cone and voice coil structure.

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One of the largest magnet structures on any speaker, it provides the necessary torque required for maximum high-output, low distortion bass response. Includes:

**STEEL TOP AND BOTTOM PLATES**

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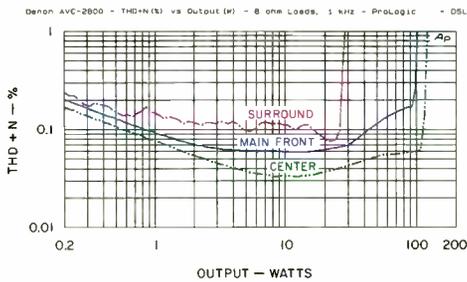
**STEEL POLE PIECE**

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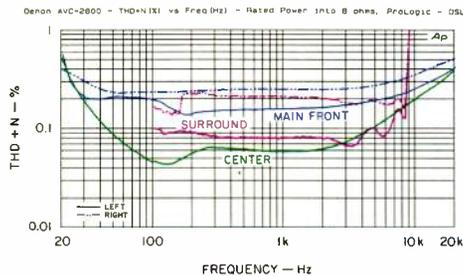
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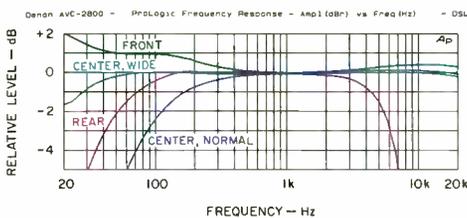
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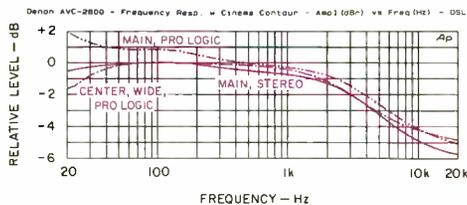
**Fig. 6—THD + N vs. output, Dolby Pro Logic mode.**



**Fig. 7—THD + N vs. frequency, Dolby Pro Logic mode.**



**Fig. 8—Frequency response, Dolby Pro Logic mode.**



**Fig. 9—Frequency response in stereo and Dolby Pro Logic modes, with "Cinema" contour engaged.**

see. However, it's certainly adequate from the high-level input and reasonably sufficient from the phono input if you don't use too "hot" a cartridge. In any event, the input circuit clipped gradually, and I could push in signals about 3.5 dB higher in level before reaching 3% THD.

Channel separation was quite good, better than 54 dB (worst case) over the most important range. The subwoofer crossover point (-3 dB at 73 Hz) was reasonably well chosen, but the filter's slope of 6 dB per octave is too gradual, in my opinion.

The AVC-2800 ran pretty hot during testing, which may explain why Denon found it necessary to protect it so carefully by limiting the steady-state output current and rating the amp for use with loads of a minimum of 6 ohms. With 8-ohm loads, the AVC-2800 meets its specs without difficulty. As seen in Fig. 4A, THD + N at 85 watts per channel into 8 ohms is less than 0.05%, worst case. But with 4-ohm loads (Fig. 4B), the amp simply can't deliver the goods on a steady-state basis. With a continuous output of only 80 watts per channel, distortion is already a hefty 0.8%.

Figure 5 shows THD + N versus output power, in stereo, with 8- and 4-ohm loads. (Although the results are shown for the left channel only, both channels were driven for the test.) As you can see, the AVC-2800 can deliver more output into 8 ohms than into 4 ohms. Interestingly, the 20-kHz 4-ohm curve extends to a higher power level than the curves taken at low frequencies, and then it bends back upon itself in a most unusual manner. The 20-kHz curve "runs faster" than the others, which suggests to me that Denon's protection circuitry is frequency- as well as time-dependent.

The time dependency of the protection circuit was further confirmed when I compared the data for dynamic power and continuous

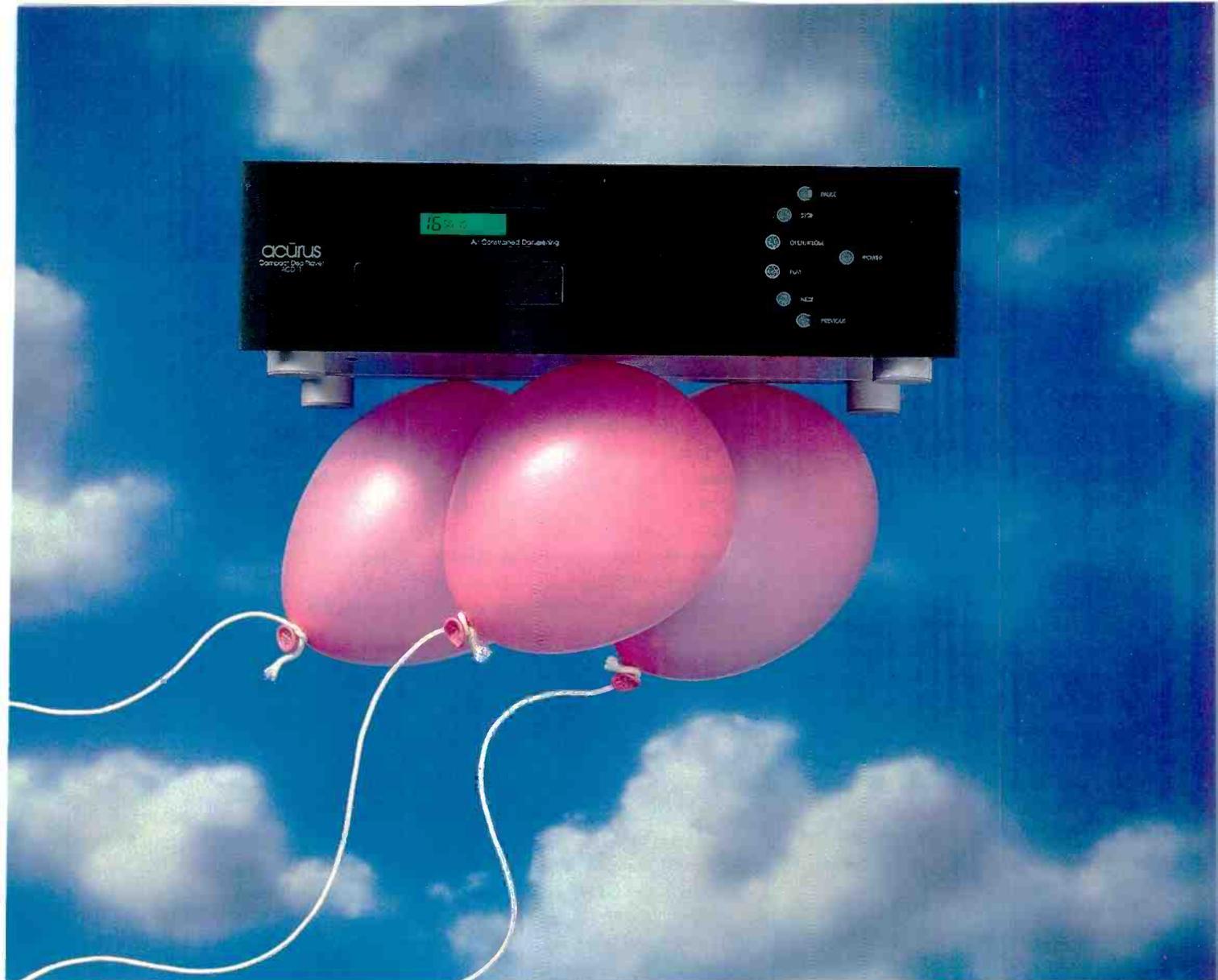
power. Although the AVC-2800 could manage no more than 85 watts per channel into 4 ohms continuously, it delivered 190 watts per channel into 4 ohms when fed the 20-mS EIA tone burst. With 8-ohm loads, the continuous power was higher (110 watts per channel), but the dynamic power was lower (125 watts). Damping factor was reasonably high (145) and output impedance reasonably uniform across the audio range; it hit a maximum of 160 milliohms (equivalent to a damping factor of 50) at 20 kHz.

With Dolby Pro Logic processing and 8-ohm loads on each channel, I measured output levels of 105 watts each on the front left and right channels, 120 watts in the center, and 28 watts per channel in the surrounds (Fig. 6). These measurements were taken with a 1-kHz tone configured to exercise the specific channels being tested; the results I've cited correspond to the points where THD + N reaches 1%.

Figure 7 shows THD + N versus frequency with Dolby Pro Logic processing and with each channel driven to rated output (i.e., 85 watts for each front channel and 25 watts for each surround channel). Distortion is less than 0.57% from 20 Hz to 20 kHz in the main-front channels and less than 0.4% from 22 Hz to 20 kHz in the center channel. Surround-channel distortion isn't bad either, less than 0.25% across the full Pro Logic surround-channel band.

Figure 8 shows the frequency response of each channel with Pro Logic processing and without Denon's "Cinema" contouring, while Fig. 9 depicts response of the main-front channels, both in stereo and with Pro Logic processing, with the "Cinema" contour engaged. The center-channel response ("Wide" position) with Pro Logic processing and "Cinema" contouring is also shown.

Basic Pro Logic response is quite good. There's a 2-dB rise in 20-Hz response in the main-front channels, which pretty much compensates for the almost equal droop in the center ("Wide" mode) response. From an energy standpoint, the AVC-2800 should be reasonably flat at 20 Hz. However, the curves do not track through the mid-bass, where the sound was just a trifle chesty. With "Normal" operation, center-channel response is 3 dB down at 85 Hz, which is fairly close to the target. In the surround channels, response is down 3 dB at 40 Hz



## ANOTHER ACURUS FIRST—THE CD PLAYER WITH AIR SUSPENSION

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ACD stands for Air Constrained Dampening, the highly advanced Acurus suspension system. At the core of our double isolation system is a newly developed microcellular elastomer which constrains the air within the cellular structure to dampen vibrations. The custom designed drive mechanism floats on two of these air suspension systems. The laser lens is made from fine optical glass versus the plastic lenses typically found in CD players. The clamping mechanism covers a far larger area of the disc than usual. This combination of technology yields a CD drive with unsurpassed laser focus and accuracy.

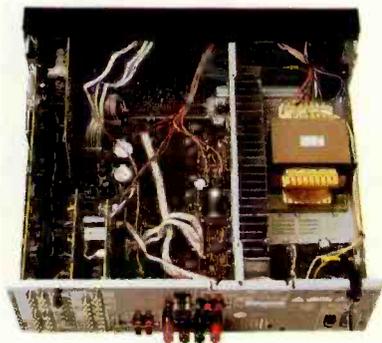
### THE D/A CONVERTER

The advanced one bit digital to analog converter portion is mounted directly to the drive for the shortest possible signal path. This eliminates signal path induced jitter. As is typical of Acurus components the analog stage consists of a glass epoxy circuit board versus the paper boards found in most players. The resistors are 1% metal film and the capacitors are of tight tolerance poly composition. This creates a fully discrete analog stage at a level found only in costly external D/A converters. To protect your system from digital noise entering through the AC line a line filter is added to the ACD-11's power supply.

The Acurus ACD11. Now you can have Accuracy from the U.S. in a CD player.

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An internal view of the Denon AVC-2800.

and at 6.1 kHz, results that are, more or less, typical.

A-weighted noise ranged from -75.8 dBW in the surround channels to approximately -78 dBW in the three front channels, so theoretical signal-to-noise ratios referenced to rated output would range from just under 90 dB in the surrounds to somewhat better than 97 dB in the front trio. Steady-state channel separation at 1 kHz was decent but not stellar. I attribute this to imperfect input balancing, a situation that would vary from unit to unit. Worst case for my test sample (21.7 dB) occurred between the center and right front; separation from rear to right front was just a bit better (24.1 dB).

#### Use and Listening Tests

I find so much to like about the Denon AVC-2800—its excellent facilities for composite- and S-video signals, the sheer number of inputs provided, its multiroom flexibility, its universal remote, and more—that I'm frustrated by its shortcomings. The most serious of these, its limited ability to drive low-impedance loads, relates strictly to the power amplifiers, an area in which I have heretofore considered Denon to rank among the best Japanese vendors.

Admittedly, the AVC-2800 drove a decent amount of power into 4-ohm loads in the ELA dynamic-power test, which uses a tone burst designed to mimic the dynamics of music better than a steady-state sine wave does. But the EIA tone-burst test (which I had a good bit to do with creating many years ago) was based on rather limited data, mainly from classical music. And the AVC-2800 is designed for home theater videos, which I expect contain peaks that are far longer and louder.

As a result, the AVC-2800's sound quality depends to a greater extent on the speakers you use than it should. Mate this amp with speakers that are "easy" to drive, and the results are likely to be quite good. Mate it with

speakers that are "difficult" and ask it to play loud, and the results may not be as good. The AVC-2800 met its specs; it doesn't claim to be able to drive low-impedance loads. But I expect more from Denon than that. A

## MEASURED DATA

### FRONT CHANNELS, STEREO MODE

**Output Power at Clipping (1% THD), Both Channels Driven:** With 8-ohm loads, 110 watts (20.4 dBW) per channel; with 4-ohm loads, 85 watts (19.3 dBW) per channel.

**Dynamic Output Power, Both Channels Driven:** With 8-ohm loads, 125 watts (21.0 dBW); with 4-ohm loads, 190 watts (22.8 dBW).

**Dynamic Headroom, re: 8-Ohm Rated Power:** +1.6 dB.

**THD + N, 20 Hz to 20 kHz:** At rated output, less than 0.046% into 8 ohms; at 10 watts out, less than 0.054% into 8 ohms or less than 0.102% into 4 ohms.

**Damping Factor at 50 Hz, re: 8 Ohms:** 145.

**Output Impedance:** At 1 kHz, 60 milliohms; at 5 kHz, 75 milliohms; at 10 kHz, 110 milliohms; at 20 kHz, 160 milliohms.

**Frequency Response:** With tone controls bypassed, 20 Hz to 20 kHz, +0, -0.15 dB, with -3 dB points below 10 Hz and at 109 kHz; with tone controls at detent, 20 Hz to 20 kHz, +0.51, -0 dB, with -3 dB points below 10 Hz and at 114 kHz.

**RIAA Equalization Error, 20 Hz to 20 kHz:** MM phono input, +0.07, -0.36 dB.

**Tone-Control Range:** Bass, +9.8, -8.0 dB at 100 Hz; treble, ±8.4 dB at 10 kHz; "A.V.S.E." contour, +10.5 dB at 50 Hz.

**A-Weighted Noise, re: 1-Watt Output:** CD input, -80.9 dB; MM phono input, -72.6 dB.

**Input Impedance:** CD input, 47.1 kilohms; MM phono input, 47.1 kilohms plus 200 pF.

**Sensitivity:** CD input, 17.2 mV for 0 dBW, 159 mV for rated output; MM phono input, 0.29 mV for 0 dBW, 2.68 mV for rated output.

**Input Overload at 1 kHz, 1% THD:** CD input, 5.7 V; MM phono input, 96 mV.

**Recording Output Level:** CD input (0.5 V), 0.49 V; MM phono input (5 mV at 1 kHz), 0.29 V.

**Recording Output Impedance:** 660 ohms.

**Channel Separation, CD Input, 100 Hz to 10 kHz:** Greater than 54.4 dB.

**Channel Balance, CD Input:** ±0.45 dB.

**Subwoofer Crossover:** -3 dB at 73 Hz and -6 dB at 140 Hz, with 6-dB/octave slope.

### DOLBY PRO LOGIC MODE

**Output Power at Clipping, into 8 Ohms:** Main front, 105 watts per channel (20.2 dBW); center, 120 watts (20.8 dBW); rear, 28 watts per channel (14.5 dBW).

**THD + N at Rated Output, into 8 Ohms:** Main front, less than 0.57%, 20 Hz to 20 kHz; center, less than 0.40%, 22 Hz to 20 kHz; rear, less than 0.24%, from below 100 Hz to 8.4 kHz.

**Frequency Response:** Main front, 20 Hz to 20 kHz, +2.0, -0.0 dB, with -3 dB points below 10 Hz and at 86 kHz; center (wide), 20 Hz to 20 kHz, +0.1, -1.6 dB, with -3 dB points below 10 Hz and at 80 kHz; center (normal), 85 Hz to 80 kHz, +0.1, -3.0 dB; rear, 40 Hz to 6.15 kHz, +0.1, -3.0 dB.

**"Cinema" EQ:** Main front, -3 dB at 6 kHz and -5.7 dB at 20 kHz; center, -3 dB at 5 kHz and -4.8 dB at 20 kHz.

**A-Weighted Noise, re: 1-Watt Output:** Main front, -78.2 dB; center (wide), -77.8 dB; rear, -75.8 dB.

**Channel Separation at 1 kHz:** Left front to rear, 41.2 dB; right front to rear, 49.0 dB; center to rear, 32.0 dB; left front to center, 55.6 dB; right front to center, 52.2 dB; rear to center, 29.9 dB; right front to left front, 49.7 dB; center to left front, 32.4 dB; rear to left front, 41.1 dB; left front to right front, 57.8 dB; center to right front, 21.7 dB; rear to right front, 24.1 dB.

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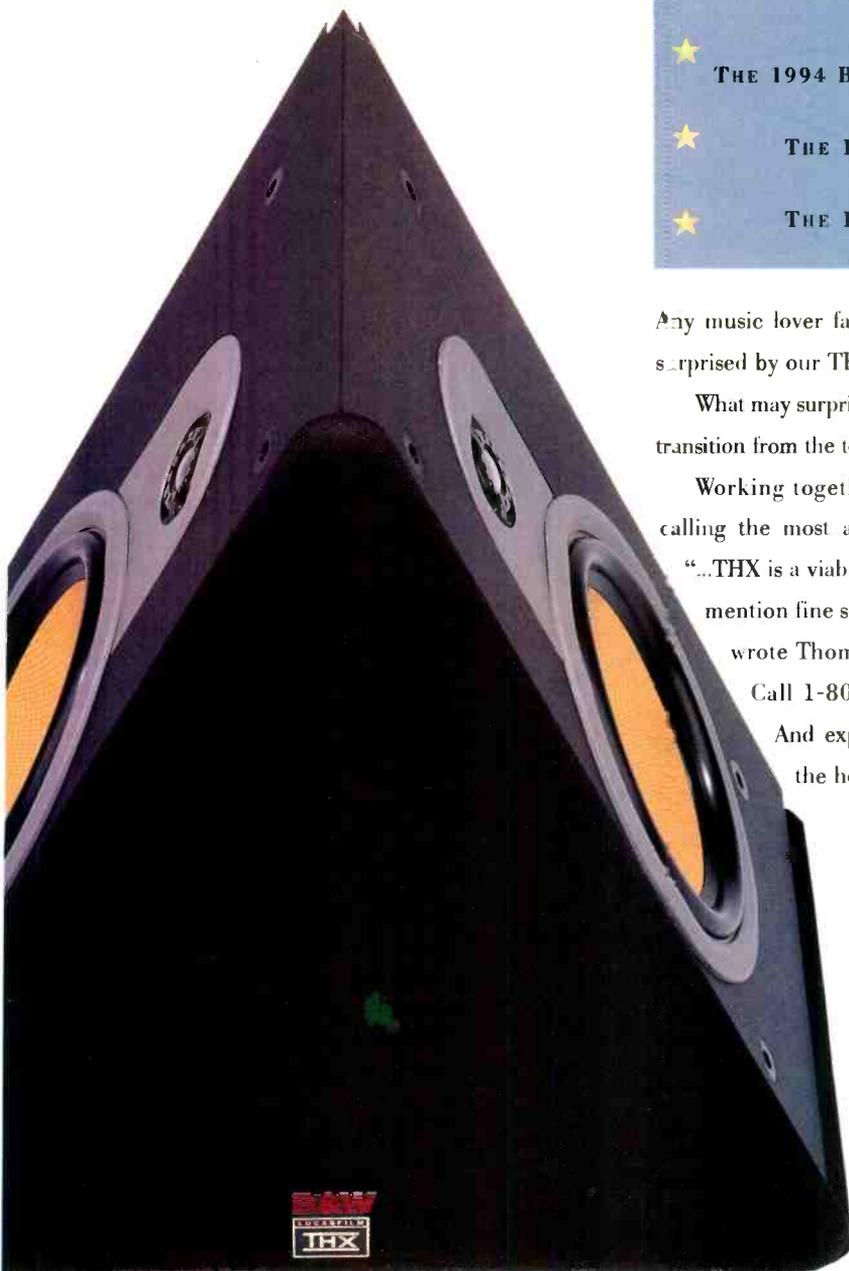
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EDWARD M. LONG

# SENNHEISER HDC451 NOISE-CANCELLING EARPHONES

Some 50 years ago, in the small north German community of Wennebostel, not far from Hanover, Fritz Sennheiser started his company with the MD2 dynamic microphone, which quickly became a success among broadcasters. In 1960, Sennheiser introduced the MD421, which is still its best-selling dynamic microphone. Because the transducers in dynamic microphones are very similar to those in modern earphones, it was only natural that Sennheiser would eventually produce high-quality earphones. In 1968, the company introduced the classic Model HD414, the world's first open-air earphone. Until then, it seemed inconceivable that earphones could produce good bass unless they were sealed around the listener's ears. The Sennheiser HD414 proved that it could be done. Jörg Sennheiser, son of the founder and head of Sennheiser since 1982, continues the company's tradition of designing and producing innovative microphone and earphone products, including wired and wireless types, that are used by professionals and audiophiles alike.

The Sennheiser Model HDC451 is a high-quality earphone featuring an electroacoustical system, called NoiseGard, that cancels outside environmental noise. Outside noise is picked up by a microphone set into the back of each earcup. The signals



## SPECS

**Transducer Design:** Dynamic.  
**Coupling to the Ear:** Supra-aural (open air).  
**Frequency Range:** 20 Hz to 18 kHz.  
**Impedance:** 270 ohms.  
**Weight:** 3.9 oz. (110 grams).  
**Price:** \$269.  
**Company Address:** 6 Vista Dr., Old Lyme, Conn. 06371.  
 For literature, circle No. 92

from the two microphones feed the input of a two-channel electronic circuit into the two earcups. These signals are filtered, inverted, amplified, and then mixed with the direct signals from your music source and fed to the earphones' drivers. Because the electronic noise signals are the same as the outside acoustical noise at the earcup, but of opposite polarity, they cancel much of the outside noise usually heard by a listener. When the NoiseGard circuit is on, normal outside conversation can still be heard, but at a slightly reduced level.

The NoiseGard electronic circuitry in the earcups is powered by two 1.5-volt batteries that are housed in a box measuring 3 x 1½ x ¾ inches; the box has rounded edges, a belt clip, and a lid that slides off for battery replacement. The earphones are wired directly to the electronics box by a thin cord that is about 51 inches long. The input of the box has a 22-inch-long cord with a stereo mini-plug that connects to the jack found on portable cassette or CD players. (Sennheiser includes an adaptor so that the mini-plug can be used with standard, ¼-inch, phone jacks. For airline use, an adaptor with ⅜-inch stereo female to dual ⅜-inch mono jacks is also included.) A recessed

switch on the electronics box turns the noise-cancelling circuit on and off. Nearby is a green LED that glows when the noise cancellation is turned on. The direct signal from the music source is always fed to the earphones, so the HDC451s continue to operate if the batteries go dead and the NoiseGard ceases to function.

The one-piece headband is made of spring steel and plastic, with a rubber pad on the underside that rests on your head. The plastic bails on the headband have detents that hold them in place after you adjust them to fit the earphones to your head. Separate plastic earcup swivels encircle the

Photo: David Hamsley

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earcups, three-quarters of the way around. These have pins set at 90° from the main swivel pins, which allows the earcups to swivel in two directions and provides a good fit for a wide range of listeners. The ear cushions are cotton-covered foam.

The Sennheiser HDC451s are relatively lightweight and are comfortable during extended listening. They seem to be secure enough for jogging, and even with the noise

**FOR EXTENDED LISTENING,  
THE RELATIVELY  
LIGHTWEIGHT HDC451s  
REMAIN COMFORTABLE.**

cancellation switched on, outside sounds can be heard well enough that there should be no safety hazard.

I tried the HDC451 earphones with several CD and tape players, and they provided more than adequate sound level. Their sensitivity measured 94 dB SPL for a 0.52-volt (1-mW) input. The input impedance of the HDC451s appears to be high enough

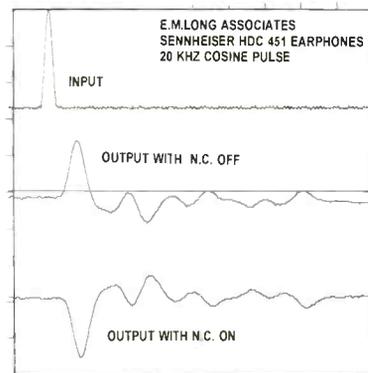


Fig. 1—Cosine-pulse test.

because it didn't affect the frequency response or output level when I used them with a variety of sources.

The Sennheiser HDC451 earphones had a smoothly rising frequency response from below 100 Hz to 3.5 kHz; a dip occurred at 4 kHz, and then the response rose again until about 8 kHz. Above 8 kHz, there were some dips and peaks out to 15 kHz, where the response rolled gently down to 20 kHz. Response was the same, whether NoiseGuard was on or off.

Figure 1 shows the output of the HDC-451 earphones for a 20-kHz cosine input

## EARPHONE EVALUATION

PARAMETER	RATING	COMMENTS
Overall Sound	Very good	"Forward and clear" and "Bright and clean"
Bass	Good	"Good bass but not exceptional" and "Adequate bass"
Midrange	Very good	"Forward and precise" and "Good articulation of voices"
Treble	Good	"Slightly subdued top" and "Not as bright as reference 'phones"
Overall Isolation	Low	"NoiseGuard reduces low sounds" and "Outside sounds can be heard"
Bass	Low	"Rumbling reduced with NoiseGuard on"
Midrange	Low	"Conversation is still possible even with NoiseGuard on"
Treble	Fair	"High sounds reduced slightly"
Comfort	Good	"Comfortable fit" and "Headband padding could be better"
Value	Good	"NoiseGuard system is very good" and "Worth the price"

**GENERAL COMMENTS:** Bright and forward, with good articulation. Good when travelling or when outside noise would be disturbing. Adequate bass. Clear and precise sound. Good value.

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pulse. The top trace is the input pulse, and the middle trace shows the output with the noise-cancelling circuit turned off. The polarity is the same as the input and is positive. I measured phase versus frequency of the HDC451, and the phase response was uniform except where the dips and peaks occurred in the frequency response mentioned above, which indicates that the HDC451 is a minimum-phase device.

The bottom trace in Fig. 1 is the amplitude versus time response of the HDC451 earphones with the noise cancellation

turned on. The polarity is negative, and most of the members of my listening panel could hear a difference when the noise-cancelling circuit was switched on and off. Since I had previously obtained identical frequency response curves with noise cancellation on and off, I can say with certainty that the difference the panel members heard was not due to discrepancies in frequency response.

The listening panel's comments indicated that the HDC451's bass reproduction is reasonably good, although without the real-

ism and impact of the Stax Omega reference earphones. The frequency response of the HDC451s appears to be somewhere between that of the direct and diffuse-field response characteristic of the human ear. On selections from Eduardo Mata and the Dallas Symphony Orchestra's *Billy the Kid*, on *Dorian Sampler, Vol. V* (DOR-90005), panel members commented: "Bass impact less than Stax," "good bass but not exceptional," and "adequate bass." While listening to "All of You," on *Dial & Oatts Play Cole Porter* (dmp CD-495), the panel commented on the midrange. Among their remarks were: "Piano and sax very forward and precise" and

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—Tom Miiller, *The Audio Adventure*



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"cymbals have body and warmth." "Cantate Domino," from *Earth Chants* by The Madrigals of SBHS (Sheffield Lab 10049-2-F), elicited these comments: "Good articulation of voices" and "good presence." "Tico Tico," from *Beachcomber: Encores for Band* by the Dallas Wind Symphony, conducted by Frederick Fennell (Reference Recordings RR-62CD), yielded remarks from the panelists that the treble range was "not as bright as reference 'phones" and had a "slightly subdued top." The panel members all agreed that the treble was good with the Sennheiser HDC451s but was not as smooth and extended as it was with the reference Stax Omegas.

The effective range of the NoiseGard system seems to be from slightly below 100 Hz to above 500 Hz. In a moderately noisy environment, the enjoyment of music is definitely enhanced when the noise-cancellation system is turned on. The HDC451s did a good job of reducing vehicular rumble and noise, and I can recommend them to anyone who rides public transportation. I found them easy to operate and very useful, especially in situations where background noise was a problem. Sennheiser's HDC451 earphones are a very good value for anyone who enjoys listening to music while travelling. A

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EDWARD J. FOSTER

# SONY ES MDS-JA3ES MINIDISC RECORDER



**S**ony displayed uncharacteristic modesty when introducing MiniDisc a few years back. New technologies are usually launched with much hoopla and fantastic claims about sound quality. Not in this case. Sony merely claimed that the sound was better than analog cassette and the medium a lot more convenient. Another claim was that they were simply rejuvenating the Walkman market they had originally created.

For several years prior to MD's launch, I had been involved with perceptual-encoder development and was convinced that the sound with such devices could really be quite good despite the tremendous reduction in data rate. I didn't think ATRAC (Sony's encoding system) was quite there at launch time, but it was on the right track (pun intended). Besides, the "smarts" in these toys lie on the encoding side, so im-

provements in encoding algorithms can be introduced later without sacrificing compatibility with existing hardware. At the time, I was more bullish than Sony's public demeanor suggested they were, but in private they agreed that better encoders were in the cards.

Apparently, Sony is now sufficiently proud of its technology to launch an MD recorder in its prestigious "ES" line. What's more, they have outfitted it with 20-bit D/A converters, in recognition that the sound quality of perceptual encoders can occasionally push a 16-bit system to its limits.

The MDS-JA3ES lists for \$1,100. While that may seem pricey, people have shelled out that much and more for cassette decks with far fewer features and worse sound.

The MDS-JA3ES sports digital and line-level analog inputs and outputs and, wonder of wonders, microphone inputs too!

(Mike inputs are rare on cassette decks these days, which drives musicians—and others—berserk.) The optical and coaxial digital inputs accommodate just about any digital source, especially since the deck automatically converts 32- and 48-kilosample/second data to MD's 44.1-kHz sampling rate. In fact, there's even a way to use the MDS-JA3ES as a 20-bit sampling-rate converter to record on other equipment. (The digital output is strictly optical.)

A rotary "Input" switch selects the source: "Analog," "Optical," or "Coaxial." All wired ins and outs are gold-plated, as are the pair of mike phone jacks at the lower right of the front panel and the ¼-inch stereo headphone jack at the lower left. When a plug is inserted into the left mike input, the MDS-JA3ES switches from line to mike (assuming you've selected "Analog" with the "Input" switch). If a plug is inserted only into the left mike jack, the signal is recorded in mono on both tracks. Plugging a second mike into the right jack converts to stereo recording.

A "MIC ATT" lever near the jacks inserts a 20-dB attenuator to preclude preamp overload and renders the MDS-JA3ES usable with high-output microphones. A "Phone Level" control next to the headphone jack (and the deck's unusually powerful headphone amplifier) make the deck useful with virtually any headset. Clearly, Sony has live recording in mind. When you're recording from analog sources, tightly clutched "REC Level" knobs adjust the level; from digital sources, adjustment is neither needed nor possible.

## SPECS

**Frequency Response:** 5 Hz to 20 kHz, ±0.5 dB.

**Playback S/N:** Greater than 102 dB.

**Wow & Flutter:** Below measurable limits.

**Power Consumption:** 22 watts.

**Dimensions:** 16⅞ in. W x 5½ in. H x 13⅜ in. D (43 cm x 12.5 cm x 34.5 cm).

**Weight:** 2.7 lbs. (6 kg).

**Price:** \$1,100.

**Company Address:** Sony Dr., Park Ridge, N.J. 07656.

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#1 (of 17 tested subwoofers).  
—Sound & Image

V-125



The "AMS" jog knob, to the left of the "Input" selector, scans through tracks and, when you are labelling discs or tracks, dials through the character set. Arrow keys below "AMS" elicit audible search through a track in either direction. The "Edit/No" pad, above "AMS," cycles through the editing modes, with the current option displayed on the dot-matrix screen; there are modes for erasing, combining, moving, and naming tracks. Once the desired function appears, the "Yes" pad activates it. In labelling, you also press "Yes" to accept the displayed alphanumeric character selected by the "AMS" knob; pressing that knob inserts a space.

Editing and labelling also can be performed from the remote, which has the English alphabet and nine graphic symbols as alternate functions on 35 of its 57 keys. Some 25 keys directly access the first 25 tracks on the disc, while ">25" permits entry of larger numbers on a digit-by-digit basis. For three-digit numbers, ">25" is pressed twice before entering the digits.

When you're using the remote control for labelling, three "Write" keys replace some functions of the "Edit No/Yes" panel pads. "Name" initiates labelling, "CAPS" toggles between upper and lower case, and "NUM" shifts between numeric and alpha usage of the dual-labelled keypad. The remote's disc search keys provide access to individual characters, so that they can be changed with the "Clear" button. The main-panel search keys perform in a similar manner, but in this case, "AMS" is used for character selection.

At the right of the front-panel display, a 5 x 5 matrix section indicates which of up to 25 tracks are available for recording. If the disc was prerecorded, a grid appears

around the matrix; if it's a recordable MD, there's no grid. Numbers for tracks preceding the current track are extinguished to indicate which one is playing; if there are more than 25 tracks on the disc, a ">25" legend appears. This "Music Calendar" is a permanent feature of the display.

The main portion of the display has three modes that are chosen by "Display" keys on the remote or front panel. In playback, these modes are track number with elapsed track time, track number with remaining track time, and track name (which briefly appears anyway, when track playback begins). If the disc is stopped, the display choices are total number of tracks and total playing time, remaining recording time (on recordable MDs), and disc name. When recording, you can check the time remaining on the disc by tapping "Display." In playback, you can check a track name by

**MEASUREMENTS MADE  
VIA THE ANALOG  
AND DIGITAL INPUTS  
ARE AMAZINGLY SIMILAR.**

tapping the remote's "Scroll" pad. If the track has been "stamped" with the date and time, you can check that information by tapping "Date Recorded" on the remote. The disc name, number of recorded tracks, and total playing time always appear momentarily when a disc is loaded.

The "M.Scan" key on the remote initiates sequential music scan. Normally, the deck plays the first 6 S of each track, but this can be increased to 10 or 20 S by tapping "M.Scan" an appropriate number of times. The MDS-JA3ES permits random playback ("Shuffle Play") as well as programmed play; its repeat mode will simply replay the contents of the program memory or the complete disc, or it will continuously shuffle the track arrangement. A specific section of the disc can also be marked for repeat play, a feature some musicians look for.

When copying from MD to cassette, the MDS-JA3ES will insert 3-S blank spaces between tracks or auto pause after each track; the remote's "A.Space" key controls both functions. The deck is capable of timer-

controlled playback or recording, using its internal clock; however, after timer recording, you should switch to standby mode within two or three days so the deck can record the Table of Contents (TOC) information on the disc. When used with Sony CD players, the MDS-JA3ES will synchronize and transfer track numbers if the dub is done via a digital connection (which also elicits SCMS action). If you dub with an analog connection, you can use the "LevelSync On" mode to automatically index track numbers during silent periods. Although any level-sensing system can be fooled, erroneous track marks on a Mini-Disc can be edited out later. When you're recording from a digital input, the MDS-JA3ES also monitors for "digital silence" and has two ways of dealing with it. When "Auto Cut" is on, the deck goes into record/pause mode after 30 S and replaces the 30-S interval with a 3-S blank space. With "Smart Space" on, the deck instantly replaces silent periods that approach 30 S with 3-S blanks; it continues recording thereafter.

#### Measurements

In the lab, I tested the MDS-JA3ES both as a playback deck, using the Sony MD Audio Test 1 disc, and as a record/play device. For record/play measurements, I digitally transferred the CBS CD-1 test disc, using the deck's optical link, and made recordings from the analog line inputs while using the Audio Precision System One as a signal source. (When using the analog input, I set record level so that 2.0 V in produced a recording at full digital scale.) By today's standards, the MD Audio Test 1 disc (a duplicate of Sony's YEDS-1 test CD) offers a limited test sequence; I used it simply to establish a 0-dB reference and to measure A-weighted S/N ratio, quantization noise, and the dynamic range of the deck in playback. Some of my results can be gleaned from the charts; other results are in the "Measured Data" Table and reflect only the worse channel's data.

Line output level was just a tad higher than normal, and output impedance was fairly low. Preamps will see the MDS-JA3ES as simply another "CD player." Headphone output was unusually generous; the headphone output's impedance seems to be chosen to ensure fully adequate sound

**The remote control has an alpha keypad for entering track and disc titles.**



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*- Corey Greenberg, Home Theater Technology, Volume 2, No. 7*



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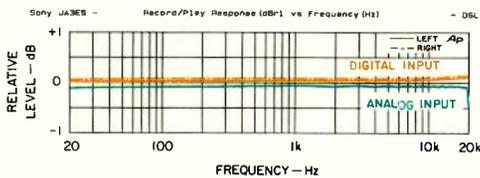
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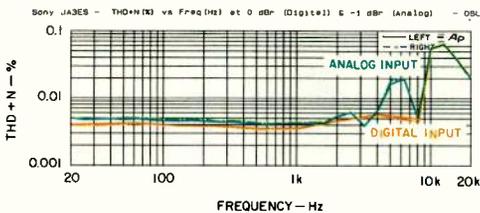
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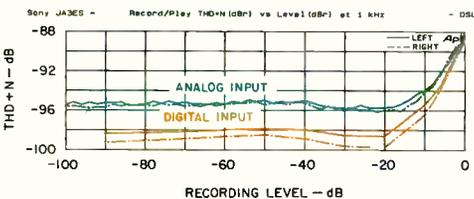
† All systems shown include a powered subwoofer.



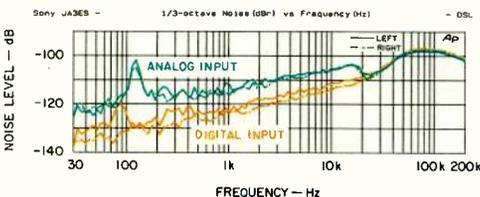
**Fig. 1—Record/play frequency response.**



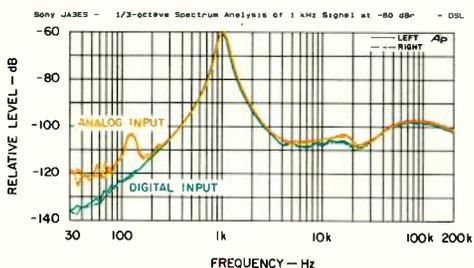
**Fig. 2—Record/play THD + N vs. frequency; see text.**



**Fig. 3—Record/play THD + N vs. level.**



**Fig. 4—Record/play noise spectrum.**



**Fig. 5—Record/play spectrum of 1-kHz signal at -60 dBfs.**

pressure levels with a wide variety of 'phones. With a matched load (120 ohms), output power was 88 mW, with about 70 mW available for typical low-impedance consumer 'phones and almost 50 mW when using professional 600-ohm headsets.

The A-weighted S/N ratio (measured from the "digital-zero" track) was an impressive 107 dB on the right channel and a few dB worse on the left. This suggests that, from a noise standpoint, Sony's analog output circuitry is capable of handling decoded digital signals of more than 17 bits. Quantization noise (a test that exercises the D/A converter) was less than -92 dB, which places the D/A converters in the MDS-JA3ES within a dB or so of the best I've measured.

The data I obtained for dynamic range was enigmatic, in that I got better numbers from the copy of the CBS CD-1 disc than I did when playing the Sony test MD. I attribute the discrepancy to inaccuracies in the Sony MD test disc and tend to believe the better numbers—which, at about 98 dB unweighted and 100 dB A-weighted, were spectacular! On the other hand, measurements of quantization noise, made with the digital dub, were about 0.8 dB poorer than those made with the MD test disc; this may be because I had to use different test frequencies.

I will discuss digital and analog record/play data together, since the curves taken in the two modes are overlaid on all the graphs. When comparing the data, remember that the analog measurements include the response errors, distortion, and noise of the analog input electronics as well as inaccuracies in the A/D converter, while the digital measurements do not. This being the case, I find it amazing how similar the analog and digital record/play data are to each other and, in fact, to the playback data.

For example, within the limits of experimental error, I got almost

identical data for quantization noise taken in record/play via the analog and the digital inputs—and both were very close to that taken with the Sony MD test disc. This suggests that Sony's A/D converter introduces no granularity of its own. Measurements of dynamic range made with analog input were 2 to 3 dB poorer than those with digital dubbing (reflecting, no doubt, analog-circuit noise). However, on an A-weighted basis, the results were actually superior to those when I used the Sony MD Audio Test 1 disc.

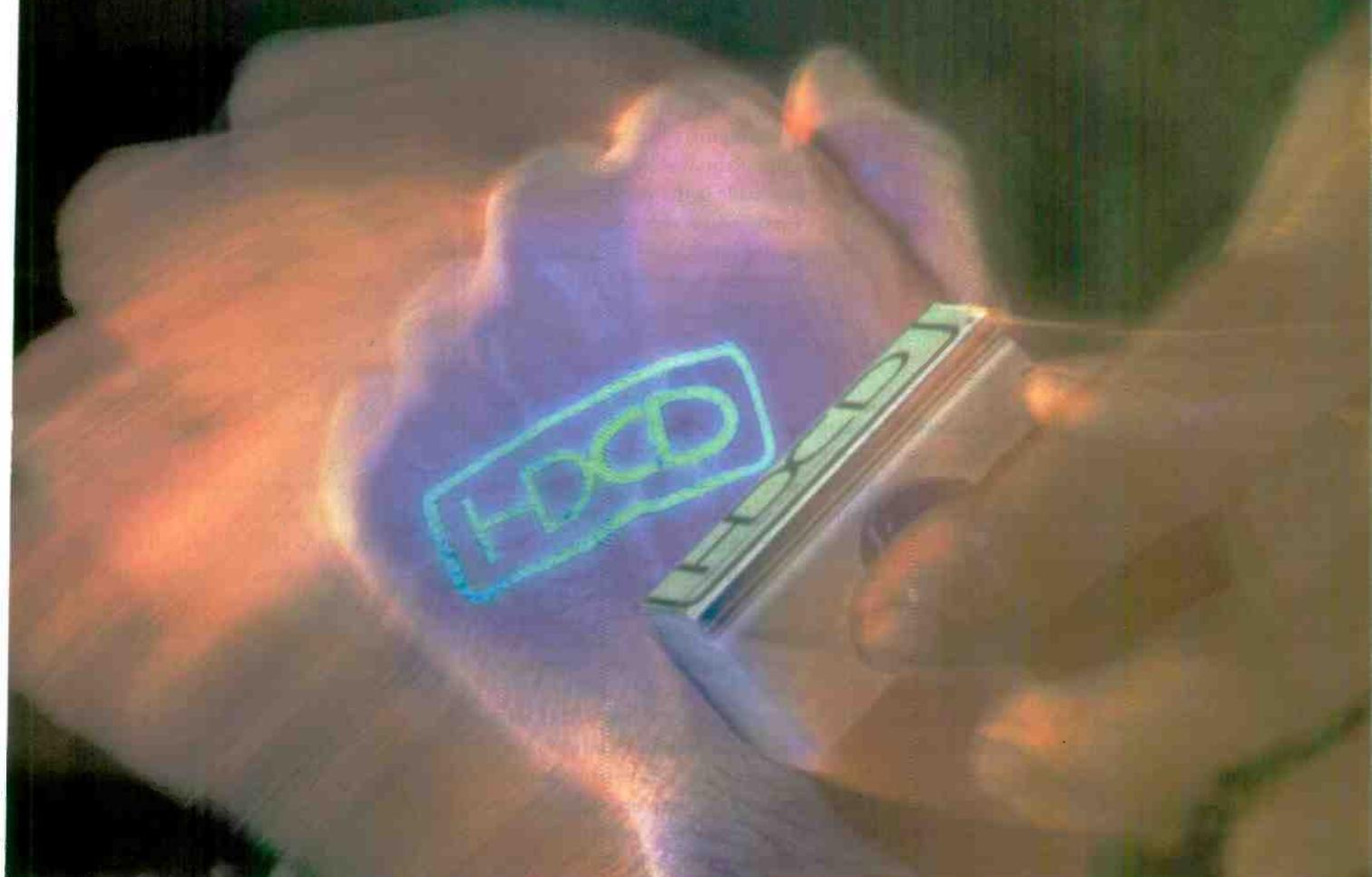
Furthermore, the curves for analog and digital record/play frequency response (Fig. 1) overlaid each other almost perfectly and are flat across the entire audio spectrum, despite the need for an anti-aliasing filter when I was recording from the analog input. You can just see the effect of the filter at 20 kHz, where response is down about 0.4 dB in the analog curves.

Except in the region between about 2 and 8 kHz, the curves of analog and digital THD + N versus frequency (Fig. 2) also overlaid each other fairly precisely. This implies that, except in this region, the predominant source of error is the D/A converter rather than the A/D converter. I must admit to having fudged a trifle; the analog data was taken at -1 dB re: digital full scale (-1 dBfs), since I found that the left channel's converter approached overload at 1 kHz and 0 dBfs, causing a marked increase in distortion. Since the distortion disappeared with a very slight reduction in level, I thought it made more sense to take the data at -1 dBfs. The lesson to be learned is, don't let this deck's overload indicator come on when you're recording.

You can see what I mean in Fig. 3, which depicts THD + N versus recording level at 1 kHz. There's no fudging here; you can see the left-channel analog curve turn up sharply as it approaches 0 dB. Perhaps I should have fudged, however, because the turnup likely occurs closer to 0 dB than the graph shows. In the "Measured Data" Table, I list THD + N (1 kHz) as being under -70 dBfs at levels from 0 to -90 dBfs with the analog input; had I reduced the maximum level from 0 to -1 dBfs, the distortion would have come in under -89 dBfs. That's how fast things change when you approach overload in a digital system. Figure 3 also shows that THD + N with analog input bottoms out between -95 and -96 dBfs,

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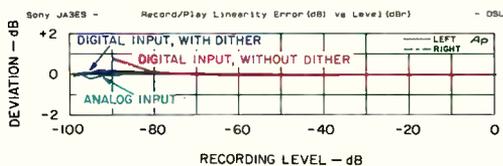
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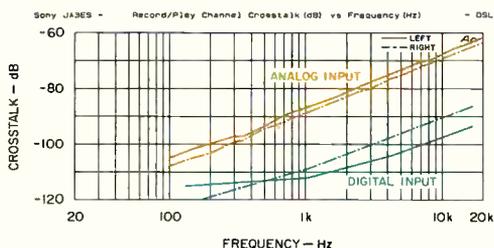
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**Fig. 6—Record/play linearity.**



**Fig. 7—Record/play crosstalk.**

whereas, with digital copying, it goes down another 3 to 4 dB. I'm sure the difference simply reflects noise in the analog input's electronics, and I'm really impressed by how little difference there is.

Figure 4 compares the noise spectra of recordings made via the analog and digital inputs. There's a bit of power-supply hum at 120 Hz when using the analog input, but it's very far down (below -102 dB) and is inaudible. Other than that, the two spectra compare favorably throughout the audio band except that the noise with analog input is higher in level than that with digital dubbing. In both sets of curves, note the absence of sample-rate-related components at 44.1 kHz and its harmonics. The same applies to the curves in Fig. 5, taken by recording a -60 dBfs, 1-kHz signal.

Noise from the analog input circuit also showed up in the A-weighted S/N; the results were 7 to 10 dB poorer when I recorded from the analog inputs than from the digital inputs. Although the difference seems large, it is hardly important since even the analog S/N ratios approached those of a 16-bit digital recording. In fact, a bit of noise in the input electronics can be beneficial, because it "dithers" the conversion processes and thus helps linearize transfer to and from the digital domain. (Before the benefits of dither were widely

appreciated, some people noticed that the A/D converters that sounded best often had a higher noise floor than the others.)

Figure 6 demonstrates the analog input's linearity and also shows the remarkable performance of Sony's converters. With the undithered computer-generated bitstream copied from the CBS CD-1, Sony's D/A converter exhibits no meaningful error from 0 to -80 dBfs; with a computer-generated dithered bitstream, there's no meaningful error even at -100 dBfs! Remarkable! Even more remarkable is the extraordinary linearity when recording from the analog inputs: Including inaccuracies from both the A/D and D/A converters, linearity error never exceeds 0.1 dB from 0 to -100 dBfs!

Figure 7 shows crosstalk between the channels in both the analog and digital recording modes. As you might expect, there's more crosstalk with analog input because of the additional circuitry. I consider the degradation insignificant since channel separation is more than adequate in both modes.

#### Use and Listening Tests

I found a few foibles with my review unit, an early sample of the MDS-JA3ES. (I wasn't able to squelch the "Auto Cut" on a digital transfer, for example. This may have been a moot point, because my sample came with a preliminary manual that was less than clear on some points.) On the whole, however, I found the MDS-JA3ES a pretty straightforward deck to use, both with the panel controls and from the remote. When labelling tracks and discs, I did prefer using the "AMS" jog knob to the keypad on the remote; it was faster, and I made far fewer mistakes.

The human auditory memory is notoriously brief, and I didn't have another MD deck to make A/B comparisons with the MDS-JA3ES. To the extent that I can rely on past experience, I'd say that the MDS-JA3ES represents a substantial step forward in MD sound quality. Some of the improvements are likely due to this deck's extraordinarily competent converters and analog electronics, for even prerecorded MDs seemed to sound bet-

ter than I remember them sounding on other decks. But although excellent converters and analog circuitry are necessary for good sound, and these characteristics can be documented by measurement, they are not sufficient when it comes to perceptual coders. For now, these coders must be judged by ear.

## MEASURED DATA

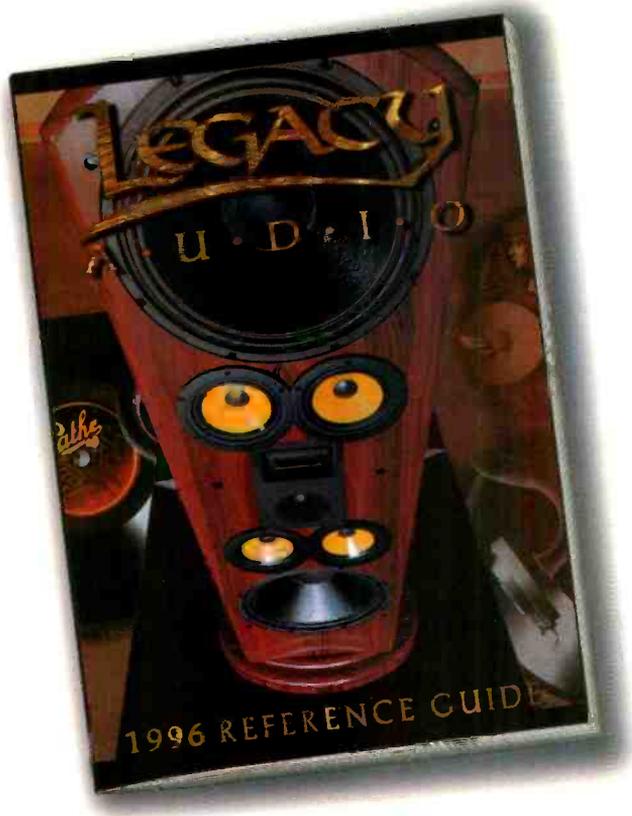
### PLAYBACK

**Line Output Level for 0 dBfs:** 2.11 V.  
**Output Impedance:** Line, 890 ohms; headphone, 120 ohms.  
**Maximum Headphone Output Level:** 6.50 V.  
**Quantization Noise:** -92.1 dBfs.  
**Dynamic Range:** Unweighted, 96.0 dB; A-weighted, 96.9 dB.

### RECORD/PLAY

**Input Sensitivity for 0-dBfs Recording:** Line, 0.50 V; mike, 0.76 mV without attenuator and 7.5 mV with attenuator.  
**Input Impedance:** Line, 47 kilohms; mike, 5.4 kilohms.  
**Input Overload:** Line, 8.0 V; mike, 9.0 mV without attenuator and 120 mV with attenuator.  
**THD + N at 0 dBfs, 20 Hz to 20 kHz:** With analog input, less than 0.062%; with digital input, less than 0.062%.  
**THD + N at 1 kHz:** With analog input, less than -70.0 dB from 0 to -90 dBfs and less than -94.8 dB from -30 to -90 dBfs; with digital input, less than -89.0 dB from 0 to -90 dBfs and less than -98.1 dB from -30 to -90 dBfs.  
**A-Weighted S/N, for Infinity-Zero Signal:** With analog input, 97.3 dB; with digital input, 104.8 dB.  
**Quantization Noise:** With analog input, -91.3 dB; with digital input, -91.4 dB.  
**Dynamic Range:** With analog input, 95.0 dB unweighted and 97.6 dB A-weighted; with digital input, 97.7 dB unweighted and 99.6 dB A-weighted.  
**Channel Separation, Left to Right:** With analog input, greater than 62.1 dB from 100 Hz to 20 kHz; with digital input, greater than 85.9 dB from 125 Hz to 16 kHz.

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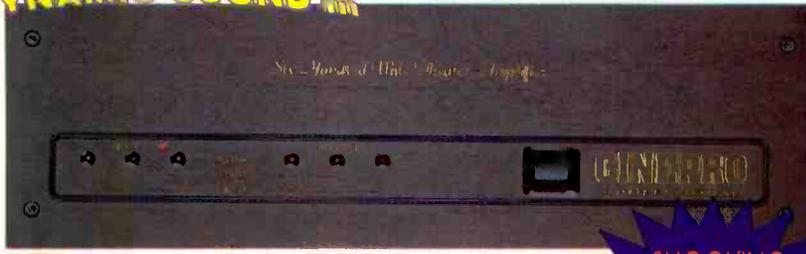
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My ear tells me that Sony has made a substantial improvement in the MD encoding algorithm as implemented in the MDS-JA3ES. The recordings I made with this deck sound substantially better than those I had made previously. I base this judgment upon dubs of several CDs—the European

Broadcasting Union's *Sound Quality Assessment Material* test CD (EBU SQAM), *Tracy Chapman* (Elektra 9 60774-2), and a few others—that I use regularly when evaluating perceptual encoders. The SQAM disc, which was designed specifically for subjective evaluation of sound, has recordings of individual instruments as well as of voice, orchestral music, pop music, etc. Several of these cuts, notably those with sharp transients, are difficult for transform encoders like ATRAC to handle. While I still could discern a trace of pre-echo on some percussion instruments (such as the claves, castanets, triangle, and glockenspiel), I'm convinced that the MDS-JA3ES handled them in a much much cleaner fashion than previous MD decks did.

The same holds true for dubs made from first-rate CDs. Yes, occasionally the MD copies sounded a bit thicker and a bit harsher than the originals. Yet without the originals for A/B comparison, I'd have little to complain of; I've heard much worse sound on CD. Under the most trying conditions and with program material known to be difficult on a transform algorithm, I can still discern a difference in quality. Nevertheless, the Sony MDS-JA3ES's version of the ATRAC algorithm comes as close to MD perfection as I've heard. With the majority of program material, I think you'll find it essentially transparent. **A**



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ANTHONY H. CORDESMAN

## CLASSÉ AUDIO CA-400 AMPLIFIER



**T**he sound of Classé Audio's CA-400 amp is such a major departure for the company that it almost seems as if this firm had suddenly decided to go "multicultural," combining the practicality and objectivity of the Anglo-Canadian with the *joie de vivre* of *le Canadien Français*. Classé's products have always been exceptional, but they have also been a bit polite and correct. The company's products are known for great detail and transparency, excellent overall timbre, and very good sound-staging, but they have not been state of the art in sheer dynamics, deep bass, or musical impact.

The CA-400, however, has a new level of dynamic excitement. There is

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deep bass with power and "slam," and a real ability to make music come fully alive, all without losing any of Classé's previous virtues.

The Classé CA-400 sells for \$4,995—on the reasonable side of unreasonable for a high-end stereo amplifier. It is a nicely styled unit, but its features are simple. The front panel has a power on/off switch and two colored LEDs that indicate whether power is on or whether the protection circuitry has been triggered. (If it is triggered, you must turn the power off and back on to reset the amplifier.) About the only tricky aspect of the CA-400 is that you must remember that the *red* LED tells you it is on and working, and the flashing *green* light warns you that it needs to be reset.

The rear panel has balanced and RCA inputs, and two pairs of excellent screw-down output terminals, which produce much better contact with spade lugs than the usual bind-

ing posts. There is a switch to toggle between stereo and mono; another switch selects balanced or unbalanced input.

Classé Audio does not give exhaustively detailed specifications, but they do reveal that the CA-400 provides the power you'd expect from an amplifier that weighs in at 120 pounds. Its output is 400 watts stereo into 8 ohms and 800 watts into 4 ohms. Bridged for mono—and it sounds just as good in that mode as in stereo—it produces 1,300 watts into 8 ohms and 2,600 watts into 4 ohms. Its S/N is specified as better than 100 dB, sensitivity is rated at 1.9 V for rated output, input impedance is 70 kilohms, and frequency response is rated as  $\pm 0.1$  dB from 20 Hz to 20 kHz.

The most striking thing about the CA-400's technology is that its dramatically changed sound character comes from roughly the same Class-AB circuit topology as in previous Classé power amplifiers. The CA-400 now has a very low-impedance power supply that provides a much faster discharge than earlier Classé designs, such as the M-1000. The CA-400 amp uses a 3-kVA transformer versus 2 kVA for the M-1000 (thereby increasing its current capacity by 50%) and uses a Schottky bridge rectifier for faster recovery.

While the M-1000 had two large 35,000- $\mu$ F capacitors per channel in its power supply, the CA-400 uses two dozen 4,700- $\mu$ F capacitors. As a result, the CA-400 has 112,800  $\mu$ F per channel, versus 70,000  $\mu$ F for the M-1000. Classé Audio believes that connecting a series of smaller capacitors directly to output devices produces a much faster discharge and reduces power-supply interactions, and that this pays off in terms of better dynamics and greater detail.

The CA-400's basic circuit topology is the same as in previous Classé amps, but true differential-amplifier circuits are used from input to output. The input section uses J-FETs, because Classé feels they are easier to drive and have more stable d.c. offset

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than bipolar devices. The amplifier is d.c.-coupled from input to output, with no blocking capacitors in the main signal path. In fact, the only capacitor anywhere in the amplifier circuit proper is a small one in the feedback network.

The voltage gain stage uses bipolars for their high current capability, and the predriver uses MOS-FETs to improve isolation and because they make better drivers. Classé has also changed the physical layout of the circuitry. In previous designs, the differential amplifier circuit board was bolted

to the heat sinks, but Classé found this introduced microphonics. The CA-400's circuitry is in the center, to mechanically decouple it from the output transistors.

The main output devices are bipolar transistors that have higher power than those in previous Classé amps. They are high-current devices, wired so they are equidistant from the power supply and circuit board. Classé feels this higher power-handling capability lowers distortion and provides a more stable circuit. The CA-400's new p.c. boards and revised layout re-

duce the length of all wiring and connections by up to 70%.

The protection circuitry is excellent. I used the CA-400 with a number of two- and three-way speakers, and inevitably made all the ham-handed mistakes common when hooking up complex systems. In every case, the Classé protection circuitry kicked in, I simply turned the amplifier off and on, and it functioned perfectly. No fuses, no fuss, no service work. Nice!

The CA-400 preserves the key sonic virtue of Classé's previous amplifiers: It is remarkably neutral and objective, never emphasizing one aspect of sound quality over another. For example, it never gives up transparency for power or dynamics for sweetness. Further, it does not trade depth for soundstage width or alter the upper octaves to make them more euphonic or to highlight added detail. The CA-400 adds a degree of life and energy to these virtues, with musical excitement rivalling

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the best musical dynamics and transient response I have heard in any tube or Classé A designs.

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The deep bass is state of the art, with the power, extension, and control to get the best bass out of demanding speaker loads like the Thiel CS7 and out of high-performance subwoofers from VMPS or from Apogee's Studio Grands. It also can provide the "slam" and dynamics I have previously associated with Krell and Jeff Rowland Design Group amplifiers. If you really believe that all amps sound alike or that you can throw in just any old power amplifier to drive a subwoofer, try the CA-400.

The mid-bass and lower midrange are excellent, even more dynamic than on the

M-1000. The added dynamics help bring musical life to many slightly lean-sounding CDs without adding unrealistic warmth. Transient performance is excellent. On voice, piano, and strings, the CA-400 preserves musical balance and neutrality and again adds a touch of life and excitement.

The CA-400 does not have "sweet" upper octaves, but it never adds emphasis or hardness. It does an outstanding job of reproducing the "air" and harmonics of music with excellent transient detail and the bite and excitement missing in many other power amplifiers.

The real advantage of high power (if it's really clean) is an improved ability to reproduce musical changes and dynamic transients at all levels of music—not the ability to play loudly enough to dull a pair of "golden ears." The CA-400 has this power, and does a much better job of reproducing dynamics than most other high-power amplifiers. It can really get the best out of those speakers which are capable of very fast and dynamic response; few amps can. Each new generation of top high-end amplifiers seems to reveal more musical detail: The CA-400 is notably cleaner than the M-1000, which was cleaner than its predecessor, the DR-25.

The CA-400 has an added degree of depth missing in the M-1000, and provides more detailed back-to-front and left-to-right imaging. Yet the image is not etched or artificial, and the soundstage is as open as the recording and speakers permit. The CA-400 does a superb job of reproducing the low-level ambience of live recordings and can reveal the differences between concert halls.

The CA-400 is very quiet, with no mechanical noise or humming and with no hum or hiss apparent even when your ear is near the speaker. It is state of the art in removing the apparent electronic haze from low-level signals and in freeing the music from the bonds of the electronics.

The amp performed well with electrostatics, ribbons, and difficult dynamic loads, including Apogee Studio Grands, Thiel CS7s, B & W 801 Matrix Series 3s, Spondor BC-1s, and Quad ESLs. This is about as wide a range of loads as any audiophile is likely to encounter.

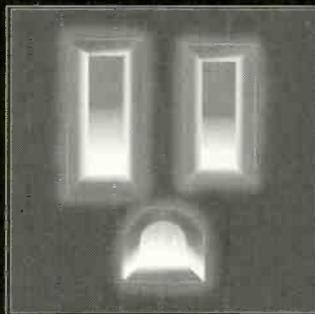
I have long given up on trying to relate amplifier sound quality to amplifier class,

particular circuit features, or the tube-versus-transistor debate. In the past year I have heard excellent sound from virtually every circuit topology common in the high end. I am struck, however, by just how much the CA-400 differs in sound quality from the M-1000 as the result of what seem to be relatively small changes in its design. I am also struck by the fact that the CA-400, a Class-AB amplifier, competes directly in sound quality with the latest Class-A amps.

I don't praise this amplifier casually; I used the Classé M-1000 as one of my refer-

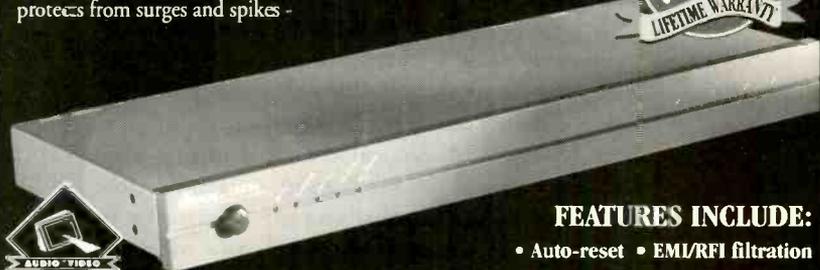
ence amps because it had an extraordinary combination of neutrality, transparency, and power. It did an excellent job of revealing the character of the equipment I reviewed without imposing a sound character of its own. The CA-400 retains these virtues, but adds a deeply involving musical excitement and the kind of deep bass that bassaholics die for. Many superb high-end power amps are available, each with its own special virtues. The CA-400 is one you can't afford to miss when auditioning the best around. A

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## DIRECT ACOUSTICS SILENT SPEAKER



**R**oom surfaces and their proximity to a speaker can have a significant effect on the reproduced sound, depending on the reflection or absorption characteristics of the surface. Sound that bounces off these surfaces is delayed with respect to the direct sound from the speaker. The closer the speaker is to the surface, the shorter the delay of the reflected sound. Reflected sound can augment or cancel the direct sound at certain frequencies. Many people prefer to place speakers well away from as many room surfaces as possible, and some sit relatively close to

the speakers so that the direct sound dominates. This practice can, with many speakers, increase the apparent width and depth of the stereo image and also better define the location of the performers.

A few speakers, however, are specifically designed for optimal performance when placed in close proximity to one or more room surfaces. Winslow Burhoe of Direct Acoustics (formerly with Acoustic Research and KLH, and founder of EPI) has designed such a product, the Silent Speaker—a two-way model in a somewhat unusual cabinet. It has a small (9½ x 12¾-

inch) footprint and a forward-sloping top on which are mounted a 1-inch dome tweeter and a 6½-inch woofer. The cabinet front is 21½ inches tall, the back 25 inches tall. The grille, a sheet of ¼-inch-thick hardboard with a cutout around the drivers, is covered by black double-knit cloth. The grille is attached to the speaker baffle with double-sided tape and is intended to be left in place to enhance the performance of the drivers.

A bass reflex design, the Silent Speaker has an internal duct, rectangular in cross section, that curves upward within the cabinet from a vent (11½ inches wide and 7/8 inch high) at the base of the front panel. The duct extends well up into the enclosure and across the full width of the cabinet.

Direct Acoustics says the Silent Speakers got their name “because their sound is so life-like that you cannot tell that you are listening to speakers.” This is further explained by the premise that “when speakers make sounds which are not on the recording or don’t make sounds that are on the recording, they are making their own sound, that is, they are not silent.” The owner’s handbook discusses placement, design details, cables, amplifiers, and other equipment and also includes definitions of many relevant terms.

Silent Speakers are designed to be placed on the floor, with their backs

up against the wall. They are mirror imaged, and the tweeters are to be placed to the inside. Speaker logos are on the cabinet fronts, under-

neath the woofers, to make left and right identification easy. The drivers are mounted on the sloped tops of the speakers to minimize standing waves and room resonances. The woofer has a long voice coil and soft suspension to enable long excursions

**BASS WAS VERY GOOD,  
AND REMARKABLE  
IN VIEW OF  
THE SILENT SPEAKERS’  
SMALL SIZE.**

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For literature, circle No. 96

# Surround yourself with music instead of compromise.



"Based on our time with the SDP1, surround sound is the essential next step in home music reproduction...

Most importantly, the two main channels pass through to the main amplifier, untouched. Execution is half the battle and ARC has applied their high standards to the SDP1. This is reflected not only in the build quality, but in the design of the digital delay circuitry and the circuits that derive the ambient and center channel information. The approach is purist...

We want to buy into the illusion that a live music event is happening in our homes... The ARC SDP1 helped me get much closer to that illusion...

Adding surround sound through the SDP1 was like switching from solid state to tubes without sacrificing the resolution...

The SDP1 weaves its most powerful spell on concert recordings...

With the SDP1, the listener cannot avoid involvement and it takes much less effort to suspend disbelief...

The SDP1 removes the wall; it restores the continuum of sound between the instruments and the listener. This effect is subtle but profound. It is a revolutionary improvement in the credibility of reproduced music."

By Tom Miller  
Reprinted from  
**THE AUDIO ADVENTURE**  
April 1995, Vol. 2, Issue 4

## PURE. SIMPLE. NATURAL. The critics agree.

"The Audio Research SDP1 plays music with superb sonic fidelity, much better than other surround processors.

As things stand today, the Audio Research SDP1 is clearly focused at the listener who is unwilling to compromise the basic sonic fidelity and spatial imaging of the front stage space, who is unwilling to settle for less music than he hears today from his high end stereo system.

On music recordings, all the musical information is up front in this front stage space. All other surround processors degrade this vital information. Only the SDP1 does not.

In fact, the SDP1 can enhance this front stage information. The SDP1 can help the center stage space become deeper, richer, and more realistic, enhancing the believability of the musical event on stage. It can even improve the apparent fidelity of instruments playing center stage. The natural musical nuances of each instrument can be more clearly heard when each instrument is surrounded by its own portion of believable stage space.

Congratulations to Audio Research for having the courage to uphold their tradition

and stick to their guns. It's paid off with a unique surround processor that redefines the fidelity standard for music lovers interested in surround sound."

By J. Peter Moncrieff  
Reprinted from  
**IAR HOTLINE!** 68-70  
December 1994

"For those of us who have succumbed to the enticements of surround-sound for music, Audio Research's SDP1 is... cause for rejoicing because someone has finally done music surround right..."

Audio Research is, to my knowledge, the first company to offer completely distortionless stereo channels in a surround decoder...

I wasn't surprised to find the SDP1 the best-sounding surround decoder I've ever heard—or, rather, not heard...I could hear no "sound" from the decoder whatsoever... I guarantee you won't find another surround decoder that has any less effect on the front channels than this one...

If you have any misgivings about getting into surround-sound for your music listening, the Audio Research SDP1 should dispel them. It passes the all-important front channels completely unscathed, it does as good a job as any decoder can with the surround channels..."

By J. Gordon Holt  
Reprinted from  
**STEREOPHILE**  
Vol. 18, No. 8, August 1995

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CIRCLE NO. 4 ON READER SERVICE CARD

for deep bass reproduction. The European-designed soft-dome tweeter uses magnetic fluid for voice-coil cooling. The drivers are crossed over at 18 dB per octave. The approximately 3/8-inch-thick cabinet material is described as "heavy, non-porous wood." My review samples were finished in black vinyl that had the appearance of ash wood grain. The finish was first-rate, and one would be hard pressed to determine by eye that it was not black-painted wood. A genuine wood-veneer version is offered at extra cost. The speakers are available direct from the manufacturer at \$486 per pair for the vinyl-covered version.

Everyone who saw the speakers in my system commented favorably on their appearance, as well as their designated placement against the front wall. One friend commented that the slanted baffles will prevent people from setting drinks or other objects on the speakers and from using them for seats.

The speakers were driven from a Carver TFM-42 power amp via Kimber 4PR cables. At the front end, I used a Carver CT-17 tuner/preamp. The speakers used for com-

parison were Mach 1 M-Twos—two-way acoustic suspension models with front-baffle driver placement. Sources were a Sony CDP-C315 CD player, a Dual CS5000 turntable used alternately with Shure V15 Type V and Ortofon X1MC cartridges, and the Carver tuner. I listened to acoustic jazz, vocals, classical music, and vintage rock.

**THESE SPEAKERS  
GAVE ME A SENSE  
OF HEARING  
THE ORCHESTRA  
SPREAD BEFORE ME.**

I first tried the Silent Speakers on the floor, well away from any walls and then, as recommended in the owner's manual, with their backs only about 3 inches from the wall. I liked the sound both ways, although there were differences. (Most of my listening was with the speakers in the recommended position against the wall, where they nearly disappear visually.) The sound

was a bit warmer with the speakers close to the wall, and the soundstage was not quite as deep. In either position, the Silent Speakers' bass was strong down to 40 Hz and still very much present at 20 Hz, although down a few dB.

The Silent Speakers created a wide and spacious soundstage, with imaging that was a bit diffuse and a sound that was slightly less detailed than that of the Mach 1 M-Two speakers. The sound extended well beyond the outside edges of the Silent Speakers and was a bit recessed, as if heard from a distance, with the soundstage slightly lower than the listener. It reminded me of the sound of a live performance from front-row balcony seats. Bass was very good, and remarkable in view of these speakers' size. The strong bass and good dynamic range added to the realism of the reproduction. The speakers reached deep enough to vibrate the floor with timpani, organ, and double bass. I had a sense of hearing the orchestra spread before me, with good center fill. The character of pink noise and of music with prominent highs changed between seated and standing positions, becoming



**"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



CROWN JOULE W / SETTING



CROWN JOULE W / SUBSTRATE



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CIRCLE NO. 45 ON READER SERVICE CARD

# COUNTERPOINT DIGITAL—A Promise kept.

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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.**

"With their very first foray into digital, Counterpoint has scored a quadruple coup...If one longs for the days of analog tube sound...the moderately priced DA-10 will have them smiling from ear to ear, as they relax with their CD's as never before."—an IAR BEST BUY, **J. Peter Moncrieff.**

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

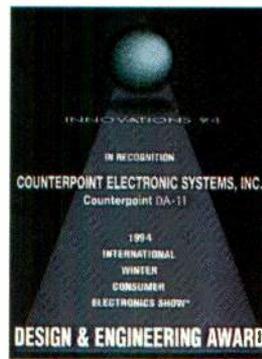
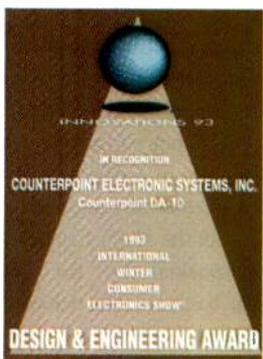
In Japan, the DA-10 was selected as **COMPONENT OF THE YEAR** by **Stereo Sound.**

## On the DA-11

"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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"Mixed in with the big boys (\$7,000 plus prices (sic)) the Counterpoint survived remarkably unbloodied...each had its own strengths. The DA-11? Its strength is its unparalleled delicacy and overall coherence."-**KEN KESSLER, HFN&RR, UK.**



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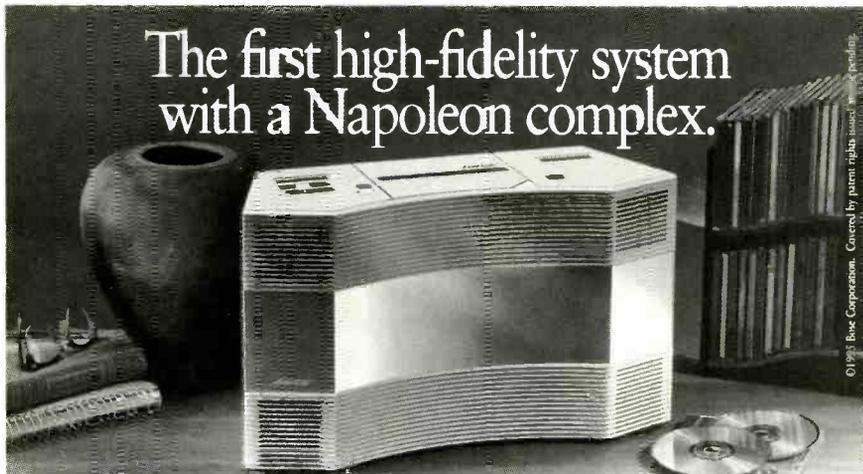
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slightly softer when I was seated (and thus farther off the driver axes). The soundstage was not as deep and layered as with the Mach 1 speakers but still had a three-dimensional character.

I tried a few cuts from *Jazz Sampler & Audiophile Test Compact Disc, Vol. 1* (Chesky JD37). The sound from the "Over" track of the stereo-image test reached a height of about 5 feet; "Lateral" was smooth and even, and "Depth" gave a good sense of the acoustics of the recording space at different distances from the mike. "Up" curved slightly inward from each speaker. On Ana Caram's "Viola Fora de Moda" from *Rio After Dark* (Chesky JD28), the highs were sparkling and clear, the bass solid, and Caram's voice warm. The piano sound was full on David Chesky's *Club de Sol* (Chesky JD33), but the initial keystrokes were a bit soft. Various cuts on Dave Brubeck's *Jazz Impressions of New York* (Columbia CK-46189) were rendered with appealing smoothness and breadth. Beethoven's Symphony No. 3, "Eroica," by the Met Orchestra under James Levine (PolyGram POL 925), was re-created with appropriate majesty and emotion. The orchestra was spread in front of, and slightly below, my listening position. Julie London's voice on *All Through the Night* (Liberty LST-7434) retained the characteristic textures that are evident from other fine speakers.

The Silent Speakers' sensitivity was a bit lower than that of the Mach 1s, possibly a trade-off for deeper bass, but they played quite loudly with sufficient amplifier power. The sound was warm and full, mellow and forgiving, with an addictive smoothness and spaciousness. Highs were never harsh or fatiguing. Although performers were properly located on stage, the imaging was not of the pinpoint variety, again typical of sitting at a distance from a live performance, particularly in a reverberant space. A solo performer could thus sound a bit "wider" than with the Mach 1 speakers.

The Silent Speakers have the ability to transport you back to a favorite concert hall's balcony seat while spreading the performers before you. They do not have the analytical "up-front" character or finely etched detail of many high-end speakers, but that may not be your preference. And for such attractive sound and appearance, they are unquestionably a fine value. **A**

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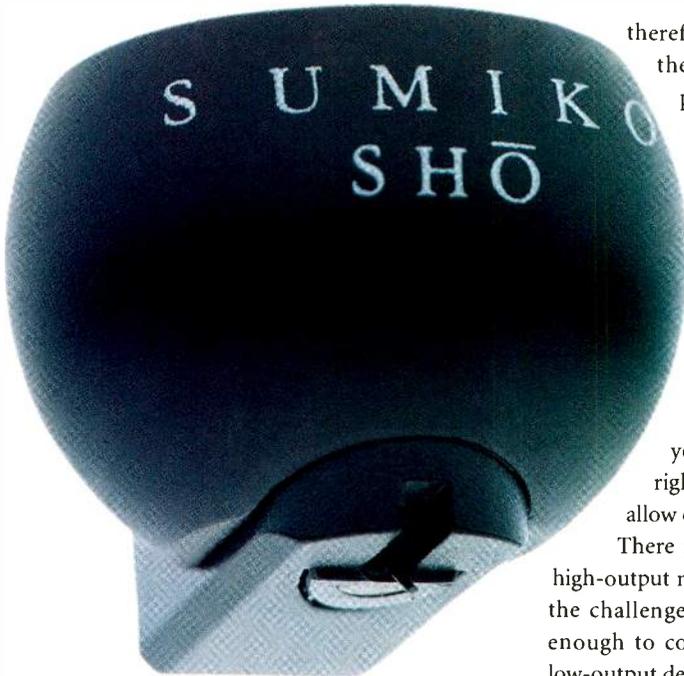
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CIRCLE NO. 39 ON READER SERVICE CARD

# SUMIKO SHO REFERENCE PHONO CARTRIDGE



Every once in a while, someone from the high end comes along with a product that meets the real-world needs of audiophiles. The Sumiko SHO Reference cartridge is just such a product. Far too many phono cartridges place stratospheric prices on fragile, very low-output designs that break, that are not fully compatible with most preamps, or that have trick stylus shapes but come with poor setup instructions.

The Sumiko SHO Reference is a moving-coil cartridge whose output is high enough to drive any preamp with a moving-magnet input. It is,

Company Address: P.O. Box  
5046, Berkeley, Cal. 94705.  
For literature, circle No. 97

therefore, ideally suited to the best high-end tube preamps and to the many otherwise outstanding solid-state preamps that do not have equally outstanding circuitry for low-output MC cartridges. Equally important, this cartridge provides reference-quality sound yet still makes all the right design trade-offs to allow easy setup.

There is nothing new about high-output moving-coil cartridges; the challenge is to find one good enough to compete with the best low-output designs. Virtually all past and present high-output moving-coil cartridges sacrifice either accuracy of timbre or accuracy of resolution. Most sacrifice both.

Sumiko's SHO Reference makes very few sonic sacrifices of any kind. I cannot tell you what part of the SHO design makes it sound so good, other than by citing Sumiko's technical literature, which states that the cartridge uses "multiple density progressive suspension," an "ultra low-mass double-ring magnet generator," and a "floating former inside a Unified Radial Flux Field." (Hold on to the dilithium crystals, Scotty, we're entering a designer-hype

anomaly!) I can tell you that the SHO is a descendant of Sumiko's DTi, which was arguably the best high-output moving-coil cartridge produced before the SHO. I can also tell you that the SHO's design emphasizes practicality. The SHO Reference's specified output is 2.3 mV at 3.4 cm/second at 1,000 Hz—enough to drive any decent preamp with a moving-magnet gain stage.

The SHO has a very solid, 8-gram body with excellent shield and grounding that keeps hum at a minimum. The body is drilled to accept bolts from the top, and is set up for optional use with a Linn tonearm. Its mounting allows exceptionally tight coupling between the cartridge body and the tonearm.

The SHO tracks best at 2.0 to 2.1 grams, has a dynamic compliance of  $13 \times 10^{-6}$  cm/dyne, and has a PA (extended elliptical or fine-line) diamond stylus. Its combination of tracking weight, compliance, and stylus shape allows the SHO to do a very good job of tracking with virtually all of today's tonearms. The SHO tracks as well as or better than any moving-coil cartridge I have auditioned, on both test records and on musical recordings.

I prefer what the SHO's stylus extracts from the record groove to the sound I hear from many cartridges that have the more complex stylus

configurations that are now in vogue. It is easy to claim a trick stylus shape produces better sound; it is difficult to prove that these benefits actual-

ly exist. And can anyone optimally set up a cartridge having such a stylus without endless tweaking?

The sound of the SHO emphasizes the resolution of natural musical detail, while many cartridges with trick stylus shapes emphasize the reproduction of high-frequency detail—detail of a kind I doubt the recording

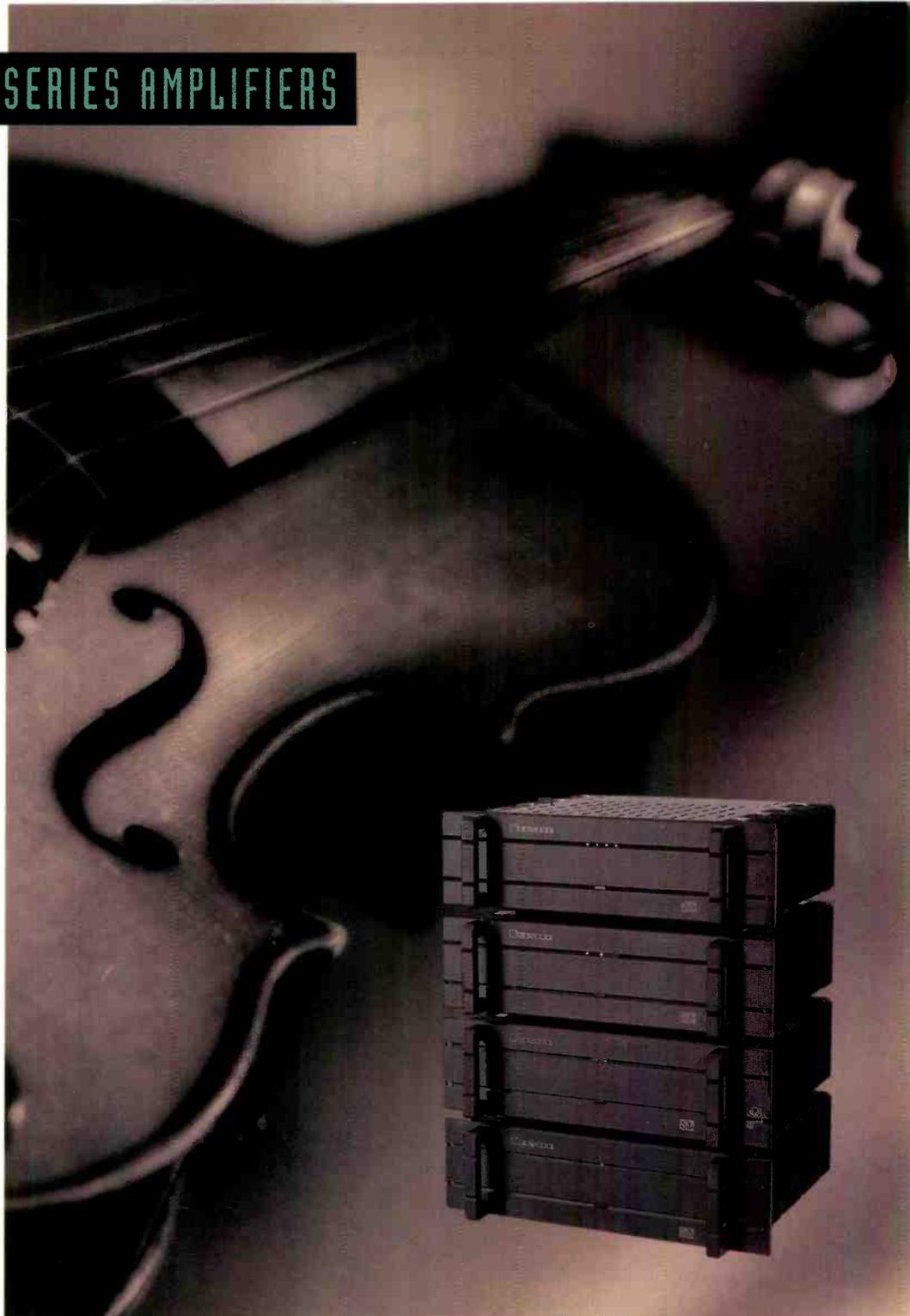
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*Stu McCreary, Positive Feedback, Vol.5 No.3*

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engineer ever had in mind. The SHO does a very good job of providing consistently fine sound from the outer to the inner groove.

The SHO is easy to adjust to get the best sound it can deliver, and it comes with practical setup instructions and diagrams, the type that should be required with every cartridge. Sumiko shows you exactly how to set the SHO's azimuth and stylus rake angle; these instructions proved to be exactly right for my sample of the cartridge. Poor azimuth setting can have a significant impact on the soundstage and upper-range smoothness of all cartridges; poor stylus rake-angle adjustment acts like a dynamic equalizer and robs the cartridge of life. (Be forewarned: The diagrams in the SHO's instruction manual are correct in showing that this cartridge needs a slight *negative* stylus rake angle.)

The Sumiko SHO has impressive specifications. Frequency response is said to be  $\pm 1.4$  dB from 20 Hz to 20 kHz, and  $\pm 2$  dB from 20 Hz to 40 kHz. Channel separation is said to be greater than 28 dB from 200 Hz to 10 kHz, and channel balance better than 0.5 dB at 1 kHz. Although I cannot confirm these specifications in a lab, the SHO performed very well with test tones and frequency sweeps on my test records, using the standard preamp-input loading of 47 kilohms.

As you might expect from its frequency response specifications, the SHO Reference is not a "romantic" cartridge; it is an accurate one. It does not have euphonic colorations, and does not alter musical dynamics or the soundstage perspective in new and "creative" ways. You will not hear upper-midrange peaks or a euphonic roll-off with the SHO. Instead, the SHO has unusually flat response and musically natural dynamics. While most cartridges make these aspects of a record sound different from CD or tape, a carefully adjusted SHO is remarkably neutral. You'll get a surprising amount of deep bass energy and detail for a phono cartridge (although this is an area where the better digital components now outperform the best in analog). You'll receive the smooth musical midrange you expect from the best moving-coils. You'll also get a surprisingly detailed and smooth upper-octave balance, and as many true highs as the grooves allow.

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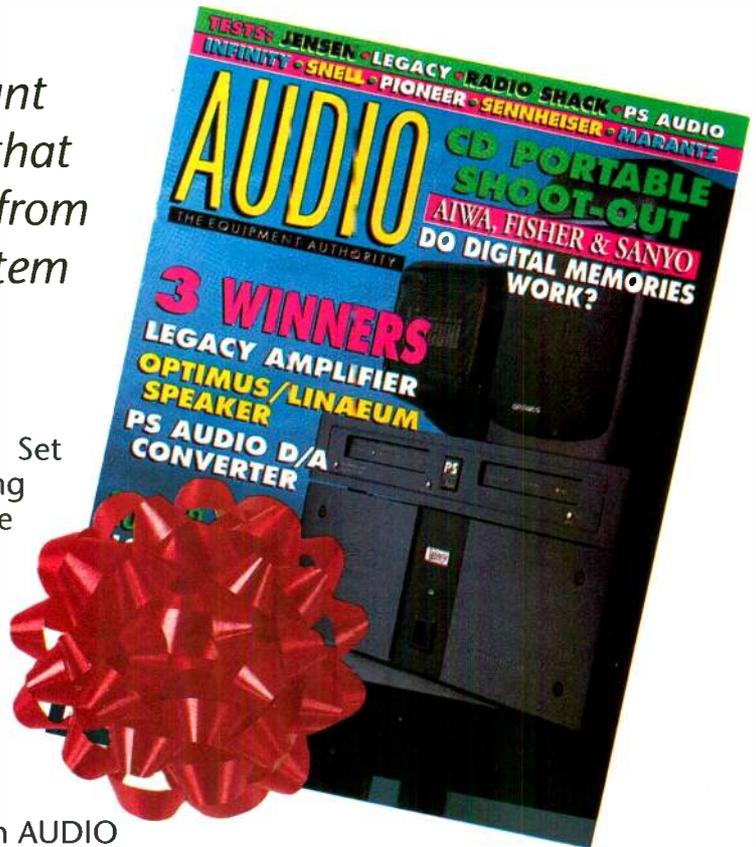
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The SHO has a special ability to resolve low-level detail; in general, I feel analog has certain advantages in this area over CD and DAT. The SHO is very dynamic when the recording is dynamic; it outperforms the sound of many CD players in this respect. Yet it is not the kind of cartridge that acts as a glorified expander. It does not compromise accuracy with false excitement or artificially "live" dynamics.

These sound characteristics give the SHO advantages that many of today's low-output moving-coils lack. Therefore, you do

not have to tune your system around the colorations of the cartridge to get the best results, which would degrade your system's performance with other signal sources. A great deal of the analog-versus-digital debate comes from audiophiles who have built their systems around a colored analog signal source and then found that other sources didn't sound as good. Surprise! Flat response and realistic dynamics really *do* matter.

The SHO has an outstanding soundstage, with none of the surprises in stage imaging,

depth, and width all too common in low-output moving-coils. This neutral soundstage may make the SHO Reference less attractive to those looking for a special kind of "magic" rather than accuracy, but there's much to be said for hearing what is actually on the record.

The SHO's sole drawback is that its transparency and resolution of detail are not quite up to the standards set by the very best low-output moving-coils. But, on the other hand, the resolution of the SHO is as good as or better than the resolution of many low-output moving-coils costing more than twice as much. Further, the overall musicality of the SHO Reference rivals that of any cartridge. The SHO does an

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THE SHO REFERENCE'S  
OVERALL MUSICALITY  
RIVALS THAT  
OF ANY CARTRIDGE.

outstanding job of balancing different sound qualities to make voice and instruments sound musically realistic.

I like the Sumiko SHO for the same reason I like "natural"-sounding low-output moving-coil cartridges, such as the Audio-Quest AQ 7000NSX. The SHO offers the best in analog without trying to offer the "best" in euphonic colorations. It is a cartridge that reproduces the performance rather than processes it.

If you already have a preamp with a superb moving-coil gain stage or an outstanding moving-coil pre-preamp, there are cartridges that present the Sumiko SHO cartridge serious competition. The Audio-Quest AQ 7000NSX, the Clearaudio Signature, and the Koetsu Rosewood II offer a wide range of different, and musical, sounds in the SHO Reference's price range of \$1,800, although Sumiko offers some generous trade-in provisions. (If you are on a budget, consider Sumiko's Blue Point Special, a "best buy" at \$295.) If, however, you have a tube preamp or your solid-state preamp lacks a truly outstanding moving-coil gain stage, the SHO Reference makes a lot of sense since it offers outstanding musicality by any standard.

A

AUDIO/DECEMBER 1995

82

**THE SONOGRAPHE  
SA250 POWER AMPLIFIER**

by conrad-johnson design

# A PINCH-HIT



It was your classic good news, bad news scenario. My beloved Goldmund Minimesis 8 power amplifier was down, through no fault of its own (felled by a wayward upstream component). Regardless, I was without my reference amp. That's bad news. The good-news was that I just happened to have a spare amp hanging around (it's great to be a reviewer).

The amp on hand was the modest-looking Sonographe SA250 designed by conrad-johnson. At \$995, it's only about 15% of the Goldmund's price. So my expectations were, shall we say, somewhat tempered.

What a surprise! From the first note, this amp will put a big smile on your face. It was immediately apparent that the SA250 is faithful to the music. It is free from distracting distortions. I found myself relaxing and just listening to the music.

As to the amp's sound, it follows the *faceplate theorem*. [First posited by Art Dudley, editor of the wonderful new quarterly magazine, *Listener*. - Ed.] This theorem holds that amplifiers sound like the color of their faceplate. The black faceplates of Levinson gear foreshadow a dark-ish sonic character. Goldmund? The light silver faceplate suggests its airy sound. The Sonographe has a beautiful burnished gold faceplate, and damed

ing "thwack" and a truly propulsive quality.

So, do we have here a Goldmund-killer at one-sixth the price? Almost, but not quite. There is an ever-so-slight glaze, which prevents the Sonographe from delivering the absolute pristine clarity of the real thing. The Sonographe's dynamics are also somewhat less vivid, but not to a large degree. It still clearly conveys the music's emotions. In fact, I had a difficult time really pinpointing the amp's limitations until I switched to analogue source material. With LP, not quite all of the source information gets through. I listened quite a bit, for example, to the Classic Records re-issue of the legendary RCA Living Stereo recording of *Pictures at an Exhibition* (LSC-2201), a fabulous recording. Transients were clean, e.g., the triangle on "Tuileries", and dynamics peaks were also very good. "Gnomus" should have some literally scary moments, and it did. Violins were lush throughout, and the brass was realistically metallic. But the SA250 lost some depth, width, presence, and sheer impact. As a result, the amp is SLIGHTLY less involving. But, as I hope this description has made clear, it still delivers a good 90 per cent of the performance you get from a state-of-the-art amp.

I have tried to figure out why the Sonographe's limitations, minor as they are, were so much more apparent using LP than with CD. My conclusion? There is more information coming from my high-rent Goldmund analogue front-end than CDs can yet deliver. Thus, the Sonographe's resolution limits only become noticeable when there's that much information. This is a real testa-

# Home Run

if the sound isn't "golden." That is, the SA250's sound is warm. Never clinical, never analytical. It does not harshly expose problems that may be upstream, or downstream for that matter. Rather, it is forgiving and sunny.

From this quick sketch you may conclude that the amp is rounding things off and lacks resolution. Not so! The resolution is high enough that, when using CD as a source, there is no loss of detail in comparison to the ultra-high resolution Goldmund. This kind of resolution not only renders musical details clearly, it enables first-rate imaging. In fact, the Sonographe really excels in the latter department. Images are solid: instruments never wander around the soundstage. All this without a trace of artificial edge. Wonderful! And, still, I am not done enumerating this amp's strengths.

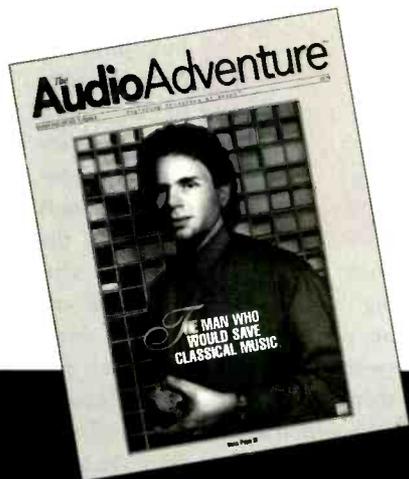
The SA250 had absolutely no problem driving my B&W 801 Series III loudspeakers, which are only moderately sensitive. There was never any strain, even when playing rock and roll *loud*. Further, the bass was tight and deep. This, no doubt, played a part in the unit's rhythmic coherence. On Richard Thompson's "Beat the Retreat", from his must-have retrospective *Watching the Dark*, the drum appears mid-track with a convinc-

ment to the amp, and indicates that unless you have a cutting edge front-end, you're not likely to run up against those limits.

As for practical considerations, the SA250 ran cool and had nice big binding posts in back. The only setup tip I offer has to do with AC polarity. The orientation of the AC plug dramatically affects the amp's sound: clearly there is only one correct orientation. conrad-johnson has very conveniently marked one side of the line cord red and the other black. If you want to hear what this amp can really do, it is essential that the polarity be correct — the wiring in your house will determine which side of the plug faces up. C-J also took the interesting step of using a non-polarized plug. I like to think this is so you'll easily be able to switch back and forth and prove to yourself that things like AC polarity really do make a difference!

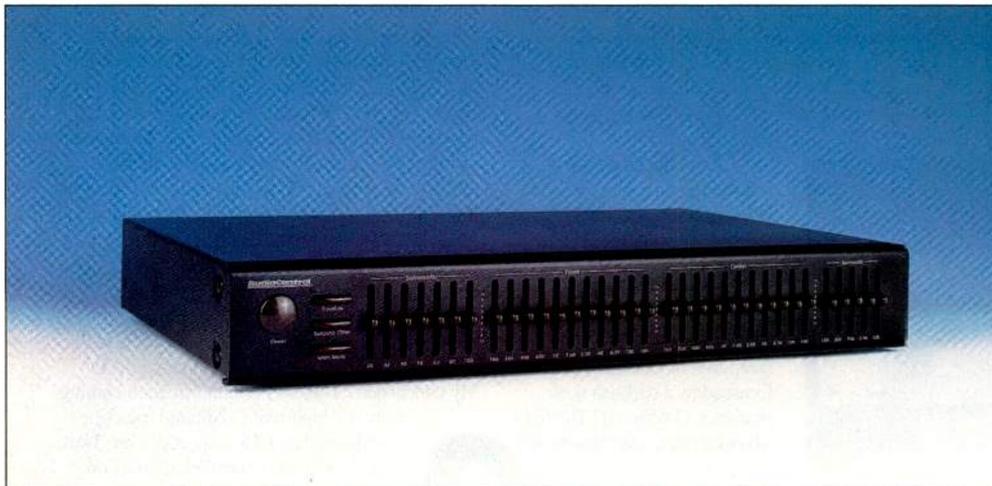
We have, here, an amp for the ages. It is never fatiguing, yet, it delivers resolution, frequency extension, soundstaging and tonal accuracy that compete with the very best of today's amplifiers. Most of all, though, it conveys and is faithful to the music.

Alan Taffel



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# AUDIOCONTROL RIALTO EQUALIZER



**L**ike many purists, I usually avoid tone controls and equalization in my main audio system, preferring line-level preamps and such to keep the signal as uncomplicated as possible. However, I see nothing wrong with using a good equalizer for home theater, to help smooth out the bumps and complexities of matching up to seven speakers, especially since room acoustics are often less than ideal.

AudioControl, which has been manufacturing equalizers in the U.S. for nearly 20 years, created the Rialto specifically for home theater use. The Rialto (\$579) is a seven-channel EQ that features separate frequency-control sections for each set of home theater channels. The front left and right section contains an 11-band, 0-octave set of slider controls (160 Hz, 250 Hz, 400 Hz, 630 Hz, 1 kHz, 1.6 kHz, 2.5 kHz, 4 kHz, 6.3 kHz, 10

kHz, and 16 kHz). The center-channel section features the same frequency controls, while the surround section sports five bands (centered at 150 Hz, 300 Hz, 700 Hz, 2.5 kHz, and 12 kHz). The subwoofer section offers seven-band, 1/2-octave control (25, 32, 40, 50, 63, 80, and 100 Hz) for its two channels.

AudioControl should be commended for including a very good sub crossover, a 90-Hz, 24-dB/octave Linkwitz-Riley low-pass filter. The Rialto can be used with a Dolby AC-3

system when the subwoofer is operated in the "Independent" mode. This enables two subwoofer channels to be fed through the Rialto from a separate set of inputs, independent of the other channels. When the sub input is in the "Front" mode, the subwoofer audio is extracted from the front-channel inputs.

Factory specifications include a bandwidth of 20 Hz to 20 kHz, ±1

dB, and a rated distortion level of 0.008%.

The EQ boost/cut is 12 dB per control, and except in the center section, each slider controls two channels. The front panel has switches for power, EQ in/out, and an 18-dB/octave infrasonic filter. A "Wide" mode switch for the front channels is intended to enhance separation when speakers are close together. Around back are input and output jacks for each channel, an input gain button (high/low) for processor matching, a subwoofer input mode button, separate output level controls (for surround, center, front, and subwoofer), and an output-voltage LED. An accessory outlet also is provided.

The Rialto should fit easily into any system built around a separate surround processor or A/V preamp, but if you use an A/V receiver or integrated amp, it will have to have pre-out/main-in loops for all five channels. In my case, the Rialto was ideal since I use multiple amps and an external processor. Setting up the Rialto was relatively easy, requiring only one extra set of cables (not included) for each hookup. The center and surround output feeds from my surround decoder were routed to the designated inputs on the EQ. From the output jacks, cables were connected to the appropriate amplifier inputs.

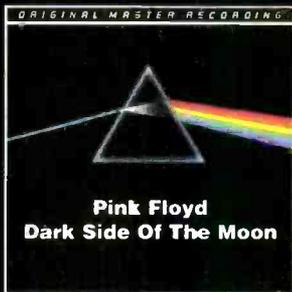
Because of the number of amps

and the separate EQ sections involved, setup seemed to be complicated. But once in place, the Rialto integrated well with my system. I set the section output levels by the

**THE RIALTO CAN HELP  
SMOOTH OUT THE BUMPS  
AND COMPLEXITIES  
OF MATCHING  
UP TO SEVEN SPEAKERS.**

book. AudioControl suggests turning the preamp almost all the way up, playing the source audio signal (with all amps off, of course), and then adjusting the output level of each section until the 1-V level indicator begins to light. Once the levels

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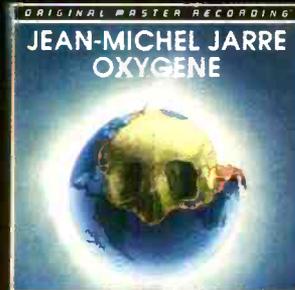
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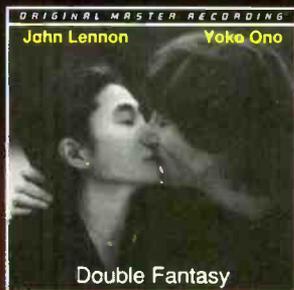


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**Nature's Encore**



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were matched, I used test tones from a CD and an inexpensive sound-level meter to determine where my home theater's response was deficient before equalizing. Using pink noise and a real-time analyzer would have been better, but the tones and the handheld meter were adequate.

Based on the sound-level meter's readings, the system's response before equalization was deficient in the 20-Hz region (about 15 dB down compared to the output at 40 Hz). There was also a peak, greater than 10 dB, at 75 Hz and a similarly nasty

spike at about 2 kHz. (I took these measurements at the listening position.)

Although the Rialto has a separate subwoofer section, those controls also affect the low bass of the front channels. By adding 6 dB of boost to the 25- and 30-Hz sliders, the overall bass response (at the listening position) came up to within a few dB of the 40-Hz level, which I left flat. Although distortion from the subwoofer probably increased somewhat with the boost, it was not audible. The 75-Hz anomaly seemed due to a combination of cabinet

resonance and placement of the speakers closer to the walls than recommended. Yet I was able to notch that down by reducing the level at 80 Hz by 8 dB. (On music recordings, that adjustment eliminated a heaviness on male voices and a hollowness on piano.) The 2-kHz peak was tamed by notching down 8 dB on both the center-channel and front sliders. Overall, the equalized response was now relatively uniform except above 15 kHz, where it fell off. However, I did not boost the 16-kHz controls because I suspected that the sound-level meter's microphone may have had its own roll-off above 15 kHz.

Overall, the Rialto worked great. The low bass on several LaserDiscs became more obvious after equalization—without adding boominess. An annoying heaviness I had heard in dialog containing male voices also vanished.

The Rialto's only negatives were mechanical. Although an AudioControl technician assured me there is muting in the system to avoid turn-on noise, an audible "thump" emanated from the speakers when I turned the EQ on after the amps or at the same time. To avoid this, I simply powered up the Rialto before turning on the amps. Also, I heard a bit of switching noise when going in and out of the EQ, infrasonic filter, and "Wide" mode. (By the way, the "Wide" mode did not appreciably increase stereo spread in my setup, although that could easily have been because the front left and right speakers were already widely spaced.)

If you like to tweak, the Rialto is a high-quality, versatile EQ for your home theater. It provides much more control than most receiver and preamp EQs, and it has a very good subwoofer crossover. (You can change the cutoff frequencies for the subwoofer crossover and the infrasonic filter with plug-in modules available from your dealer, or you can roll your own if you like.) Plan on devoting some time to the task of equalizing, especially if you are taking actual measurements. Doing it by ear alone seems easier but may actually take longer, and if you are like me, the numbers are important, too. (This requires a basic sound-level meter, or a real-time analyzer and a pink-noise source for even more comprehensive measurements.)

In terms of price, features, and quality, the Rialto is a definite best buy. **A**

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Japan's leading cable authority, Summer 1995

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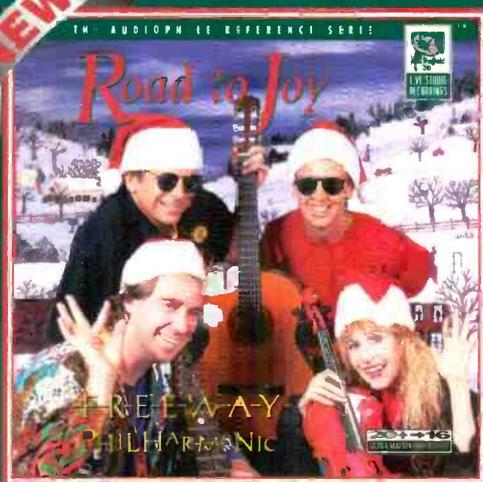
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**Q** Which component in my system should I upgrade to get the greatest improvement in sound quality?

**A** The weakest component. No kidding! The components in your system should be well matched to one another in both compatibility and relative sound quality. If you have high quality speakers, amplification and cabling but have a mediocre CD player, upgrade the CD and/or D/A converter and your system will sound much better. If you have an excellent sounding source, amplifier and interconnects with lesser quality speakers, upgrade the speakers. The best way to improve the sound of your system is to upgrade the component which most degrades the sound. You'll get the biggest bang for your buck this way. If you aren't sure which component in your system is the weakest, consult an audio specialist. By the way, if you ask this question of a salesperson and they don't say something relatively close to this explanation, run! You're in the wrong store.

—Ford Montgomery  
Chelsea Audio  
Beaverton, Oregon



**CHELSEA**  
AudioVideo

**Q** I want to upgrade my stereo system now, but I keep hearing about the new Dolby surround system, AC-3. What should I do?

**A** Most manufacturers are presently introducing electronics with Dolby AC-3, although it is at the higher end of their product line. Whether you upgrade electronics now or later, if you are upgrading speakers you should be aware that the rear channels are very important. In AC-3 use, they are full range, full powered speakers just like your front and center speakers. In fact, five identical speakers for left, right, center and rear is perfect. You should also factor in a powered subwoofer (or two) as AC-3 has dedicated outputs for subwoofers. These speakers would work great on your present surround system and would be ready for AC-3 in the future. Enjoy!

—Tom Bartle  
Wright's Sound Gallery  
Shreveport, Louisiana



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If you would like to submit questions to dealers in your area please write to :  
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**Q** I recently completed construction on my listening room, but now that I moved my audio gear in, it sounds harsh compared to my den. I've seen anechoic chambers in magazines, but I hate the look. What can I do?

**A** One of the most overlooked aspects in a home audio system is the acoustic treatment of the listening area. The natural properties of most building materials give rooms a very bright and harsh echoing effect, drastically corrupting imaging and staging. Since your room is custom constructed, you can start by buying the best pad and a fairly thick carpet to deaden the floor area. There are several unobtrusive room treatments available to curb excess ve reflexivity, ranging from simple acoustic wall panels to freestanding sound absorbing modules. However, with the variables of room size, ceiling height and furnishings, improper placement or excessive use of these treatments can occur, leading to unwanted "overdeadening" of the area. Your local audio specialist can be a tremendous aid in recommending the proper products and placement required to restore the musicality of your equipment in its new home.



—Brad D. Bclotin  
Wild West Electronics  
Reno, Nevada

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ELECTRONICS**

**Q** I would like to purchase a big screen television. Should I get a direct view or projection type?

**A** The type and size of the television will depend on the size and seating arrangement of your room. If your viewing distance is 10 feet or less, a direct view with a 30" to 35" screen will work best. If your seated area is 15 feet or greater, the projection set will work well. A basic formula to prevent noticing scan lines would be that your viewing distance should be 3 to 4 times the diagonal screen measurement. Also remember that room light, windows, skylights, etc. will have less effect on direct view than with projection types.

—James Nelson  
Nelson's  
Topeka, Kansas



**NELSON'S**

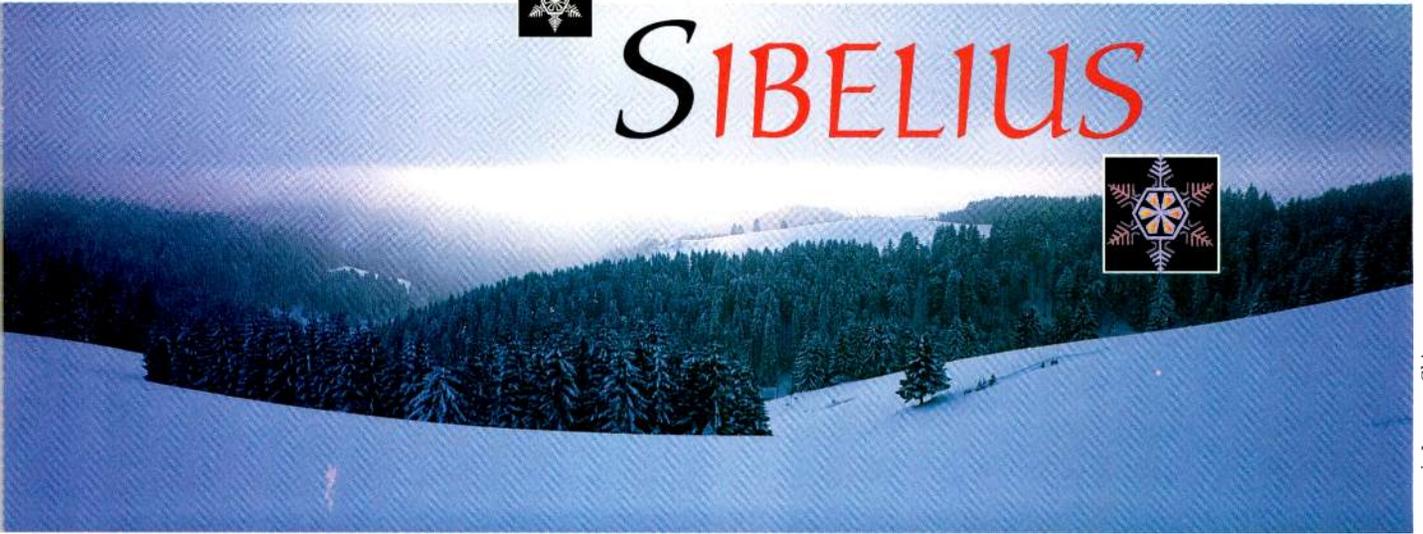
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# CLASSICAL RECORDINGS

pretations capture the fervor and excitement of both. Symphony No. 2 is the best known of the seven, probably because of its great tunes and masterful orchestration, which



## SIBELIUS



Photograph: ©1995, Koji Yamashita/Panoramic Images, Chicago

**Jean Sibelius: Symphonies 1-7**  
*Finnish Radio Symphony Orchestra,*  
*Jukka-Pekka Saraste*  
 FINLANDIA RECORDS  
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 Three CDs; DDD; 3:39:18  
 Sound: A-, Performance: A

**T**hrough his re-creation of the melodic patterns of Finnish music, Jean Sibelius became a central figure in the nationalist art of Finland. His music also reflected his country's hopes for independence. The basic grandeur and sweep of Sibelius' music carries the listener through its often somber moods. Transitions are given great importance, and lengthy melodic solos balance the Northern gloom.

The seven symphonies are the best expression of the composer's genius. While this new collection bravely pits the young Finnish conductor Jukka-Pekka Saraste against such CD-preserved Sibelius interpreters as Ashkenazy, Colin Davis, Karajan, Bernstein, Järvi, Rattle, and Kajanus, the presumed advantage of a Finnish conductor leading a Finnish orchestra in a performance of Finland's greatest composer's music is borne out.

The set was recorded live in the historic great hall of the St. Petersburg Philharmonia, where Tchaikovsky, Berlioz, Wagner, and Sibelius all conducted their own music. The recordings faithfully preserve a sense of the hall's reverberant acoustics; only a somewhat "cupped" sound, with the orchestra set back slightly, prevents the highest grade. (A side benefit is the well-known respectful silence of Russian audiences—few, except perhaps headphone listeners, would likely identify these as live recordings.)

Though each symphony is a mature and highly individual work, the first two show the composer in the shadow of both Germanic tradition and Tchaikovsky, and Saraste's inter-

seems to conjure up the great Northern spaces and stillness.

Symphony No. 4 is the most compressed and baldest in drama and intensity of the seven. It is almost avant-garde in its economy of means and grim Nordic expressionism. Saraste tempers the desolation, pointing up the interesting anatomy of this bony symphony.

The lengthy, serene Fifth is a meditation on inner strength as a way of dealing with the turbulence of the First World War. Saraste conveys the mystical spiritual feeling here, providing a strong contrast to the Fourth's mood. Saraste's emphasis on the glorious main theme of the finale confirms my feeling that this is the Finnish composer's best tune.



**ROBERT SCHUMANN**

**Dichterliebe; Liederkreis;  
Seven Heine Songs**

*Wolfgang Holzmaier, baritone;*  
*Imogen Cooper, pianc*  
 PHILIPS 446 086-2  
 CD; DDD; 76:42  
 Sound: A, Performance A

**B**oth song cycles are settings of Heine poems, so this is an all-Heine series that packs the CD with most of Schumann's greatest songs (with all due respect to his *Frauenliebe und -leben*). Holzmaier is among the best singers one could hope for in this repertory, and pianist Cooper is very good. If you are limiting your collection to one disc of Schumann lieder, I know of no better choice than this CD. The pickup is self-effacingly fine. *Robert Long*



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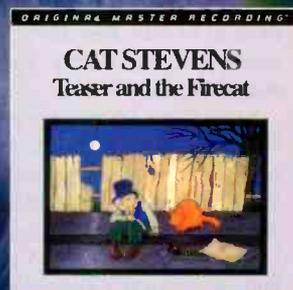
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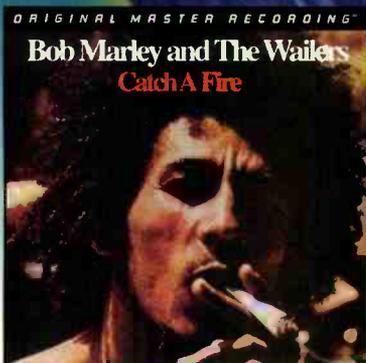
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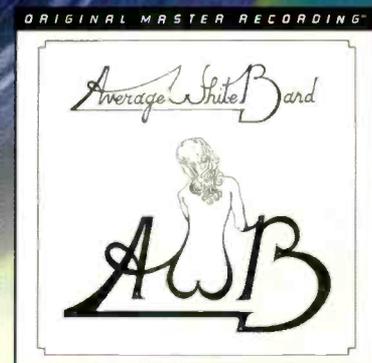
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Saraste clearly delineates the differing overall moods of the seven symphonies. The recording transmits the hall's rich acoustics and supports the wide scope of the musical landscape.

This is a most attractively packaged set, with striking photography throughout, even to Nordic landscapes on the three discs themselves plus the liner behind the CDs. The note booklet is in several languages (15 pages in English), and the Finnish musicologist provides a detailed guide to the symphonies, though collectors lacking 20/20 vision will need a magnifying glass for the approximately 5-point type.

John Sunier

### The First Recordings of the Boston Symphony Orchestra

Karl Muck and Serge Koussevitzky, conductors  
BSO CLASSICS 171002, CD; ADD; 1:13:38  
Sound: See text, Performances: A

For the benefit of any whippersnappers in the class, I can clearly recall when a 12-inch, 78-rpm record, made of highly breakable shellac, contained an average of 4 minutes and 20 seconds of music per side. That meant such a work as Rimsky-Korsakov's *Scheherazade* required about half a dozen such records—and weighed a ton.

Recording with microphones didn't even begin until late in 1925. The Boston Symphony's librarian at the time of the October 1917 Karl Muck recordings described the weird setting in the seventh-floor auditorium of the Victor Talking Machine Company's office building down in Camden, New Jersey: "The [Boston Symphony's] first-desk men sat outside the [igloo] on high stools and played directly into [wooden] horns of their own, but others had to run out when they had a prominent part, blow it into a horn, and run back in and join the orchestra."

Until 1917, that primitive state of phonograph recording—directing sound into a sort of wooden funnel that set a stylus vibrating in the spiral groove of a revolving wax disc—had scared the Victor company away from any group even approaching the size of a symphony orchestra. When Victor did work up the courage to make a try, it hauled down to Camden perhaps the finest orchestra in the world at that time: The Boston Symphony, under its great German-born conductor Karl Muck.

The straitjacket of time per surface meant all sorts of cuts and compromises that today would get a recording company pilloried. This collection of the first Muck recordings—Beethoven (only a portion of the Seventh Symphony's finale), Berlioz (a surprisingly



## Songs by Richard Strauss

**H**ere Hyperion gives us yet another gem. The program is wonderful: Varied, full of both meat and sauce, combining a couple of beloved favorites with some delicious relative rarities, and yet cohesive and rounded. The performers are even more wonderful. Marie McLaughlin's fundamentally lovely voice possesses both the heft and the flexibility to meet Strauss's wide-ranging demands, and she has a command of tone color and nuance without which this would be just another well-prepared Strauss recital. She is just spectacularly good.

And what can one say of Graham Johnson, who continues to prove that he is one of the world's great accompanists? There is no intent to denigrate the calling in that statement. A fine accompanist needs all

the capabilities of a fine solo pianist (except, perhaps, the ability to play the right notes without a score handy), plus a special sensitivity to the artist he or she is accompanying. Johnson has mastered all this, and his notes for the Hyperion Schubert Edition and elsewhere prove his scholarship as well. (Indeed, since the Schubert Edition is essentially his project, music lovers owe him a special debt of gratitude beyond admiration for his musicianship.)

Then there is the recording itself. The booklet doesn't betray where it was made, but Hyperion has somehow contrived to project precisely the feeling one gets in about the seventh row of a really fine recital hall. It is uncanny, and it certainly adds materially to the experience of listening to this CD. Don't miss this one.

Robert Long

Marie McLaughlin, soprano;  
Graham Johnson, piano  
HYPERION CDA66659  
CD; DDD; 63:02  
Sound A+. Performance A+



leisurely Rákóczy March, almost a stroll really), Tchaikovsky (the Fourth Symphony's finale, which at 8:10 required two sides), Wagner (Prelude to Act III of *Lohengrin*), and Wolf-Ferrari (the Overture to *Susanna's Secret*)—serve mainly as an historical document, impressive proof of the giant strides the recording art has made in four generations.

By contrast, the engineers behind this CD have worked wonders on the Koussevitzky 78-rpm recordings of Stravinsky's suite from *Petrouchka* (plus the Pas de Deux from his *Apollon Musagète*) and the second suite from Ravel's ballet masterpiece *Daphnis et Chloé*. In addition, Brian Bell's album notes give a horrifying but valuably bemusing account of how xenophobic American yahoos flagitiously hounded Karl Muck into prison during the jingoist insanity accompanying this country's entry into World War I—the year he had made these recordings.

Musically fascinating—but don't expect anything even near what we think of today as high fidelity.

Paul Moor

### Schubert: One Piano, Four Hands

Piano Duo Schnabel  
SHEFFIELD LAB 10054-2-F, CD; 66:30  
Sound: B, Performance: B+

Karl Ulrich Schnabel recorded some two-piano works with his father, the legendary Artur. However, with his late wife, and now with Joan Rowland, he has cultivated the rather different four-hands tradition as the Piano Duo Schnabel. Putting both players at the same keyboard complicates the logistics of pedaling and elbow management, but it allows much

more intimate communication between the performers and thus promotes unanimity of ensemble. Moreover, many composers from Mozart's time to the turn of the present century wrote for what was a popular parlor sport of the era: Getting more out of a piano than two hands—particularly amateur ones—could manage.

Nobody wrote more enduring four-hand music than Schubert, and most of his best pieces are here. The most obvious omission is the Grand Duo (at one time incorrectly assumed to be a piano reduction of the lost "Gastein" Symphony). The most familiar of those included is the F Minor Fantasy, Op. 103, which is certainly a major work. The other major offering is the far less familiar Variations in A Flat on an Original Theme, Op. 35. But even the many smaller pieces are welcome.

The duo plays knowingly and well. At times the unanimity of impulse is less than perfect—enough so to keep you aware that you're hearing two individuals and not a 20-fingered freak, but not enough to damage the unanimity of overall purpose. The recording, made with Sheffield's 20-bit Ultra Matrix Processing technique, yields extremely convincing dynamics and piano tone, though the surrounding ambience is a bit hard-sounding. And the close miking used tends to emphasize the *secco* qualities in the playing and undercut the richness and sweep of the Schubertian line. It's a small point, but then Sheffield is known for taking care with small points.

Robert Long



**Ravel: Orchestrations (of Mussorgsky, Chabrier, Debussy, and Schumann)**

*Orchestre National de Lyon,  
Emmanuel Krivine*

DENON CO-78929, CD; DDD; 60:02

Sound: A+, Performance: A-

What a nice idea! Ravel admittedly was a master orchestrator, but we seldom hear his genius in this sphere so vividly showcased. Mussorgsky's "Pictures at an Exhibition" is familiar enough, and the Debussy Sarabande and even his Danse are hardly arcane. But I had not previously heard his orchestrations of Chabrier (Menuet Pompeux) or Schumann (five pieces from "Carnaval"). Delicious, each and every one.

Krivine conducts his excellent orchestra, and Denon records it, with fine attention to the detail of the chosen subject: Ravel's orchestrations. One hears into them and can savor Ravel's achievement in exceptional style. More sweep and power are achieved by others in some passages of the Mussorgsky, but this version is to be treasured for precisely what most conductors gloss over in their quest for drama: An intimate examination of the skill and sensitivity that Ravel brought to his orchestrations. *Robert Long*



**Haydn: The Seven Last Words (piano version)**

*Jos van Immerseel, fortepiano*  
CHANNEL CLASSICS CCS 6894

CD; 56:40

Sound: A, Recording: A

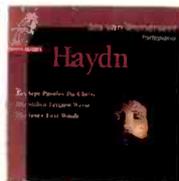
This curious work was once one of the most celebrated pieces in the entire Haydn catalog, more famous and more revered than such neighboring late works as "The Creation." It is not long, not effusive. After the solemn introduction, there are just seven brief contemplative slow movements in a row, each titled by one of the well-known utterances of Christ on the cross before his death. These are followed by a brief musical explosion signifying the earthquake or whatever that ensued (rending the veil of the temple). In a short period, other versions of "The Last Seven Words" were prepared, ranging from piano solo to a full oratorio, all approved—if not actually written out—by the composer.

The music is not dramatic except in a subdued and occasionally poignant way. Each piece is a small sonata in itself, a humble contemplation in musical sound, not descriptive in any overt fashion. You might call it exalted background church music, a set of musical prayers upon Christ's death. But there are depths, as so often in Haydn. This pianist,

playing a really beautiful modern fortepiano based on the relatively gentle Walter pianos from Vienna, of the sort Haydn himself used, is a superbly understanding performer. He brings forth a profundity of impact that few pianists could match today, and does so with the simplest of means. The last "word," Christ now reconciled and beyond all doubts ("Father, why hast Thou forsaken me?"), displays the death by an ever fainter volume until the last notes are barely audible. Sounds corny—it just about undid me. Very moving.

Needless to say, Jos van Immerseel is much more than a keyboard man. The authorita-

tive notes are by him, in great and interesting detail. His use of the fortepiano, too, is profoundly knowledgeable—how stark the octave passages, how smooth the repetitive (and when played on the modern piano, boring) accompanying figures, neither faint nor blurred, always clear but never to interfere with the melodic lines. That's just not possible on today's piano! This, as I must constantly say, is how Haydn meant it. *Edward Tatnall Canby*



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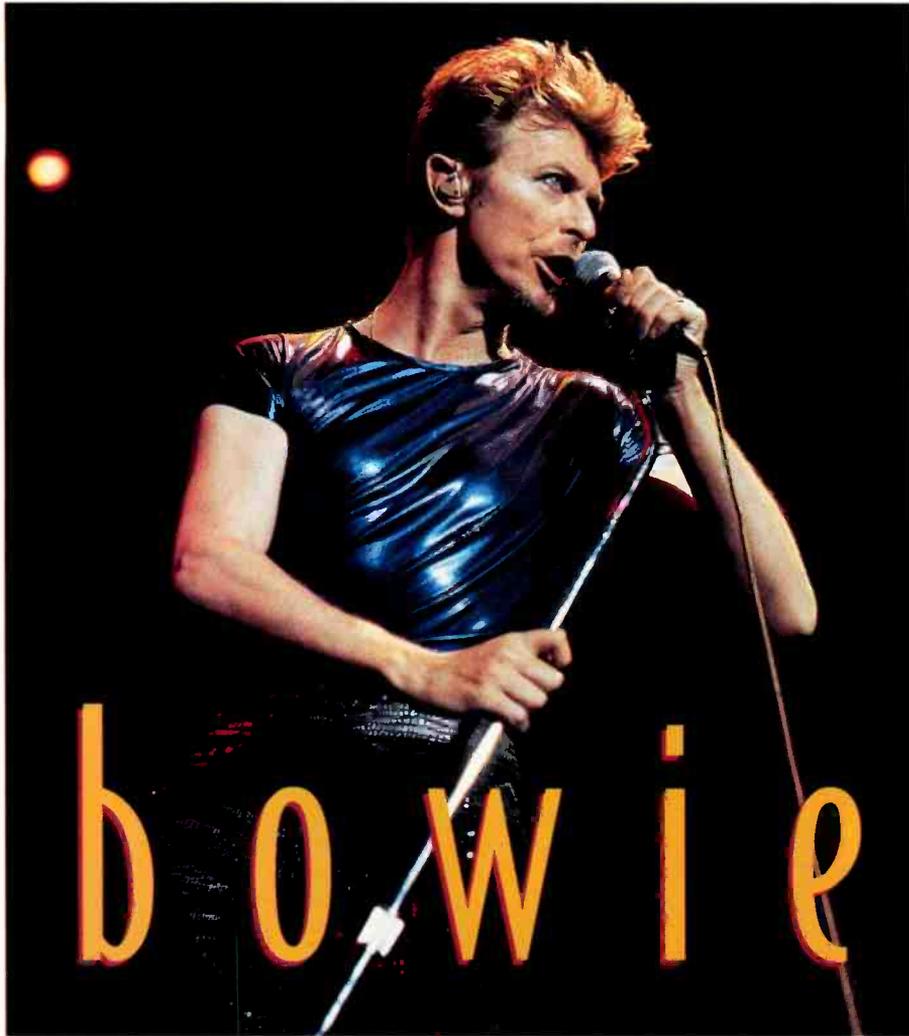


Photo: Ken Settle

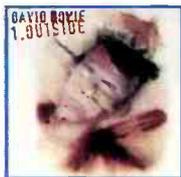
## Outside

David Bowie

VIRGIN 7243 8 40711 2 7, 75:00

Sound: A-, Performance: B+

David Bowie's most artistically successful albums are the mid-1970s trilogy he made in collaboration with Brian Eno. *Low*, *Heroes*, and *Lodger* are noted more for their adventurous sound design than memorable tunes, "Heroes" and "Ashes to Ashes" notwithstanding.



Some of his more commercially successful albums were early works like *Ziggy Stardust* and *Diamond Dogs*, where Bowie

assumed personas to convey his music. He's combined the two approaches on his latest CD, *Outside*, which pays homage to his past but exists in the present.

The concept of *Outside* takes the National Endowment for the Arts controversies, such as the one over Karen Finley's performance art, to their extremes of self-mutilation and gore. Bowie's central character, Nathan Adler, is a detective for Art Crime, Inc., and the lyrics are based on his diary. The often oblique words are rendered through Bowie's use of cut-ups, in which he scrambles his phrases semi-randomly. It gives the narrative an illusory quali-

ty, although diary excerpts that accompany the CD shed some light, albeit smoke-filtered and lurid.

Eno's production presence is evident on most of the album, from the overall sense of atmosphere to the crushing electro-beats of "The Heart's Filthy Lesson" that sound like they could've come from Eno's last song album, *Nerve Net*.

Bowie has found the right venue for Reeves Gabrels' whiplash guitar solos and grinding textures, which are perfectly suited to Bowie's techno-rhythms. Mike Garson provides the counterpoint with avant-garde cocktail-jazz piano, increasing the sense of strife and alienation.

*Outside* may not yield Bowie the hits that have eluded him for about a decade, and given the pop success of Nine Inch Nails, his experiments may sound conservative. Yet *Outside* is a mature and carefully formed work, calculated to appeal to an audience that has unknowingly been influenced by a sound he made 20 years ago. The difference is we may still be listening to *Outside* 20 years from now.

John Diliberto

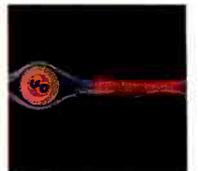
## Exit the Dragon

Urge Overkill

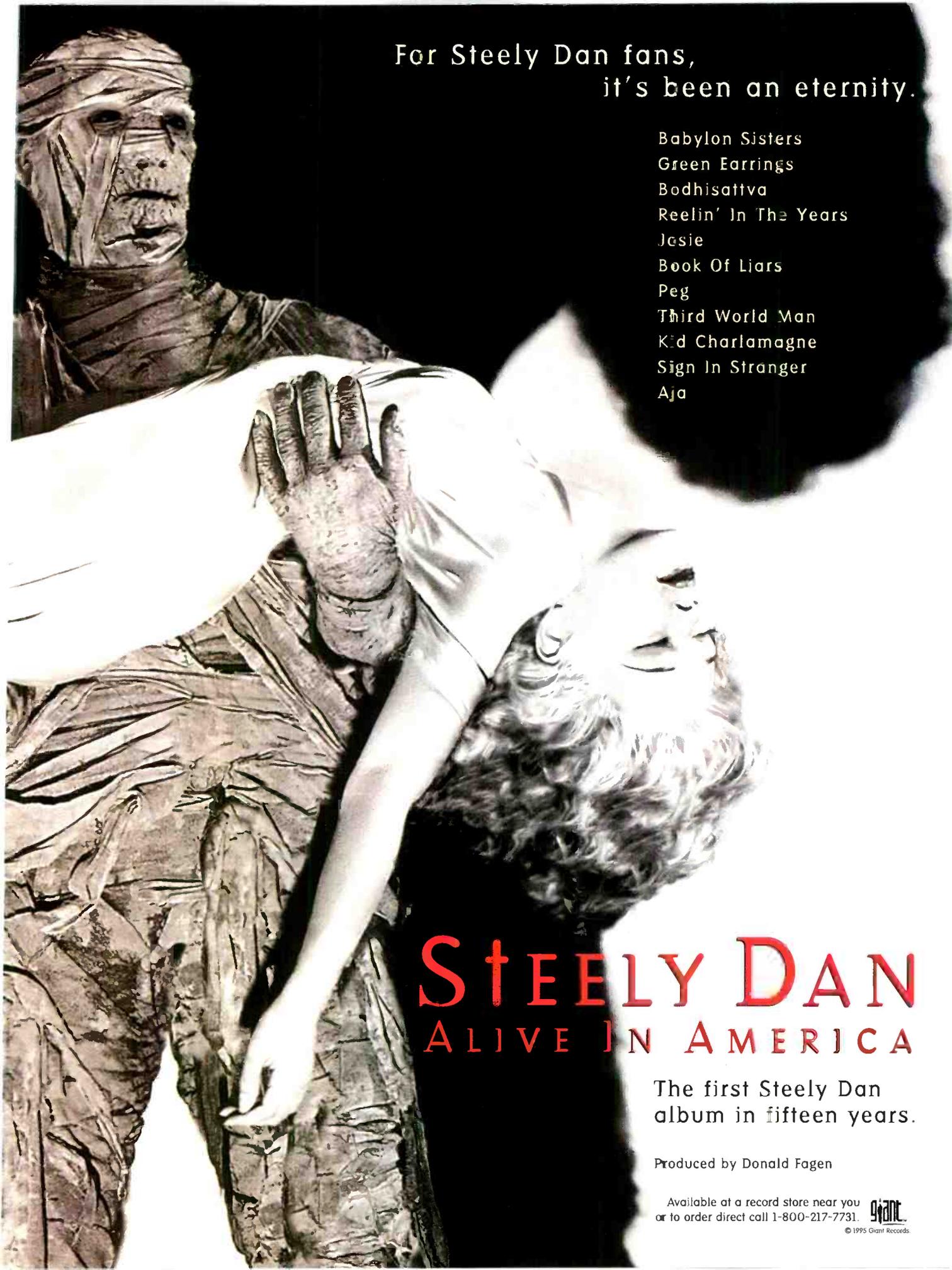
GEFFEN GEFD-24818, 61:03

Sound: A, Performance: B+

Supposedly, Urge Overkill's martini-and-Mylar rock-star shtick was a tongue-in-cheek nod to a lifestyle that seemed unattainable. In some ways, the joke backfired; with attitude, matching suits, and big, gold pendants bearing a big, *stupid* band logo, they flaunted '70s gaudiness with a flair that often made a bigger impression than their music. That's not the case with *Exit the Dragon*.



Despite an ongoing fascination with bad '70s dinosaur rock (this time they borrow from Grand Funk Railroad and worse), UO knows how to put a post-punk spin on an old sound. "Jaywalkin'" and "The Break"



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reveal this knack best, grabbing the listener immediately with a dry, raunchy guitar sound that belongs on an 8-track tape blasting from a GTO yet sounds too good not to have been recorded 20 years later.

At times, the Chicago trio goes beyond the realm of bawdy arena rock, venturing into some even cheesier territory. "View of the Rain," for example, with its electric piano and hokey lyrics ("Take a look inside yourself"), almost revives Three Dog Night's corniness. On a very positive note, *Exit the Dragon* peaks with the infectious "Take Me"—as close to

vintage power pop as Urge Overkill is likely to get. As Urge Overkill's kitsch grows increasingly tired, their music appears to be getting more interesting.

Mike Bieber

**Mirror Ball**

Neil Young

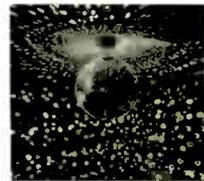
REPRISE 9 45934-2, 55:21

Sound: B+, Performance: A-

Perhaps *Mirror Ball* is Neil Young's way of saying "let's get stoopid"; it arrived roughly one year after Kurt Cobain's passing (the premise, of sorts, for Young's '94 album, *Sleeps*

with *Angels*). It rocks loud, hard, and furious, with a kind of energy that, arguably, Crazy Horse couldn't provide at its "My My, Hey Hey" primal best.

Enter Pearl Jam. After encore and award show encounters with their mutton-chopped hero, Young invited them to back him up on *Mirror Ball*. And, no surprise here, Pearl Jam sounds absolutely, insanely good without their bitching-and-moaning lead singer.



These four-on-the-floor, caveman-friendly songs bear the simplicity of right-there constructions—like Sir Neil was yelling out the changes while Mike McCready's and Stone Gossard's vintage Marshalls whomped in the background. *Mirror Ball* is a simple album, but substantial and intelligent. As Neil says in the leadoff single, "let's go downtown." Yeah, let's.

Mike Bieber

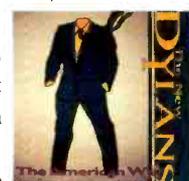
**The American Way**

The New Dylans

RED HOUSE RHR CD 75, 43:01

Sound: B+, Performance: B+

The New Dylans, upstate New York's best-kept secret, combine literary smarts with melodic, dare I say "jangly," roots rock. In fact, their prose is elegant enough to outweigh their music.



But it doesn't. Reese

Campbell and Jim Reilly excel at creating soundtracks for their 11 "great American novellas," which address the plight of the working class, corporate greed, environmental issues, and basic human dilemmas. Campbell and Reilly are in protest mode much of the time: "The Most Evil Man in the World" takes aim at corporate polluters and the wheels in their machines who live otherwise virtuous, churchgoing lives, while "Wal-Street USA," with a line like "Man, where's your hardware store/Look at you now, boy/Stocking screws on a selling floor," is a pretty obvious shot at the controversial chain store. Listening to *The American Way* after you've watched *60 Minutes* is not recommended.

Yet it's exactly this kind of honesty that makes The New Dylans more than just a good band with decent songs. The music is com-

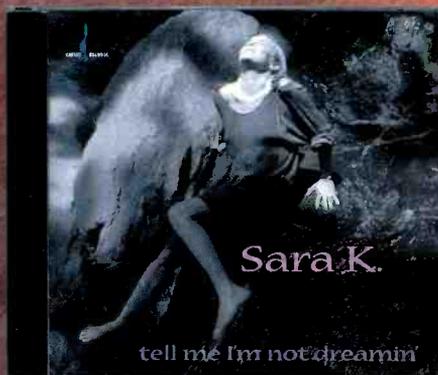
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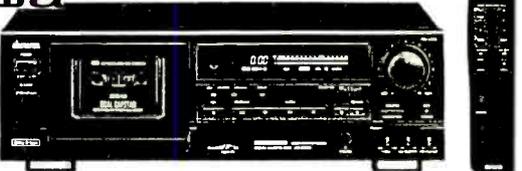


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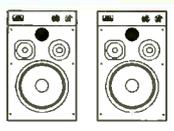
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Mike Bieber

**Celebration on the Planet Mars:  
A Tribute to Raymond Scott**

*The Beau Hunks Sextette*  
KOCH KOC 3-7909-2, 56:34  
Sound: B+, Performance: A+

Fresh from their triumphant album of Leroy Shield's Laurel & Hardy/Little Rascals music, The Beau Hunks return with a fabu-

lous collection of knotty but fun pieces by the late Raymond Scott, a true American original.

Scott's music has enjoyed a revival lately, appearing in episodes of *Ren & Stimpy*, *The Simpsons*, and *Animaniacs*, among others. Early on, it was a staple in the scores of *Looney Tunes*. The performances by the Dutch Beau Hunks Sextette are sparkling, vibrant, and witty enough to capture the lunacy behind titles like "War Dance for Wooden Indians," "Dinner Music for a Pack of Hungry Cannibals," "Square Dance for Eight Egyptian Mummies," and "Bumpy Weather over

Newark," and they also capture the swing and zing of these breezy yet difficult pieces. Of the 19 selections, nine overlap Columbia's fabulous collection of vintage original recordings, *Reckless Nights and Turkish Delights* (CK 53028), but both albums are brilliant, and in my library, indispensable. Each of them is superbly annotated by Irwin Chusid, who was involved with the production or reissue of both releases.

Michael Tearson



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*Emmylou*



**Wrecking Ball**  
Emmylou Harris

ELEKTRA/ASYLUM 61854-2, 53:07  
Sound: B+, Performance: A

Emmylou Harris has been a premier country artist for 20 years and a pioneer in country's back-to-basics movement. Most of all, she's a wonderful and distinctive singer.

Unfortunately, Nashville has paid scant attention to her records in recent years; her 1993 Asylum debut, the satisfying and luminous *Cowgirl's Prayer*, was largely ignored by country radio. This is why she's tried something completely different with *Wrecking Ball*.

Produced by Daniel Lanois, *Wrecking Ball* has hardly a trace of country in it. Instead, its

## The Meeting Pool

*Baka Beyond*

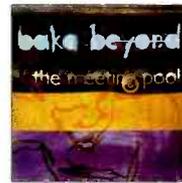
HANNIBAL HNCD 1388, 51:16

Sound: A, Performance: A

This is what you would call fusion music in the truest sense. Serving as Baka Beyond's foundation are field recordings Martin Cradick and his wife, Su Hart, made when they lived with the Baka Pygmies of Cameroon (the original, unadorned field recordings appear in the Hannibal catalog as *Heart of the Forest*, HNCD-1378) plus other songs learned from

the Bakas. Add to the mix Cradick's guitar, mandolin, kora, balafon, and ngombi (field harp), the Celtic and gypsy flavors of Paddy le Mercier's fiddle, Senegalese percussionist Sagar N'Gom, and vocalists Su Hart and Kate Budd, and you have a heady brew indeed.

The liner notes acutely describe the Baka's music as "at the same time energetic and relaxing." Baka Beyond expands on that paradox with a superb recording of sundry exotic instruments, full of lusciously rendered textures and details. The quality of the field recording is exemplified by the wonderful



sound of water drumming—literally the rhythmic slapping of water—at the coda of "Ancestor's Voice."

The eight selections all enjoy a leisurely pace (none is under 5 minutes), ensnaring the listener in a catchy, happy web of sound. Language is no barrier at all here, as the spirit of the pieces communicates keenly.

Like Baka Beyond's previous album, *Spirit of the Forest*, *The Meeting Pool* is a wondrous delight.

Michael Tearson

# Emmylou



sound is gauzy and swirling, much like Lanois' own albums, his *Joshua Tree* production for U2, and his associate Malcolm Burn's production work on Chris Whitley's 1991 debut. Fittingly, the album's key sidemen are Lanois, Burn, and U2 drummer Larry Mullen, Jr.

The songs—a canny lot—center the album as a cycle about yearning and loss. Lanois contributed the opener, "Where Will I Be," which establishes the album's theme, and his autobiographical "Blackhawk." The title song is from Neil Young's *Freedom* album. Harris slows it down a turn to fully tap the song's longing, as Young personally adds haunted harmonies here as well as on Lucinda Williams' "Sweet Old World." Steve Earle's "Goodbye" is simply gorgeous, as is a waltz rendering of

Dylan's "Every Grain of Sand." But perhaps the oddest song choice—and one of the most memorable—is Jimi Hendrix's "May This Be Love," sung in duet with Lanois. The fuzz tones go

over the top here, but this song keeps coming back to me at the oddest times. The finale, a Harris/Rodney Crowell collaboration called "Waltz Across Texas Tonight," serves as a dreamy benediction.

Recording an album in a style wholly alien to her accustomed country genre has liberated Emmylou's singing, allowing her to go for the core of a song more freely and without reservation. She responds fully, making *Wrecking Ball* a glorious album.

Michael Tearson

Photo: Grey Strick

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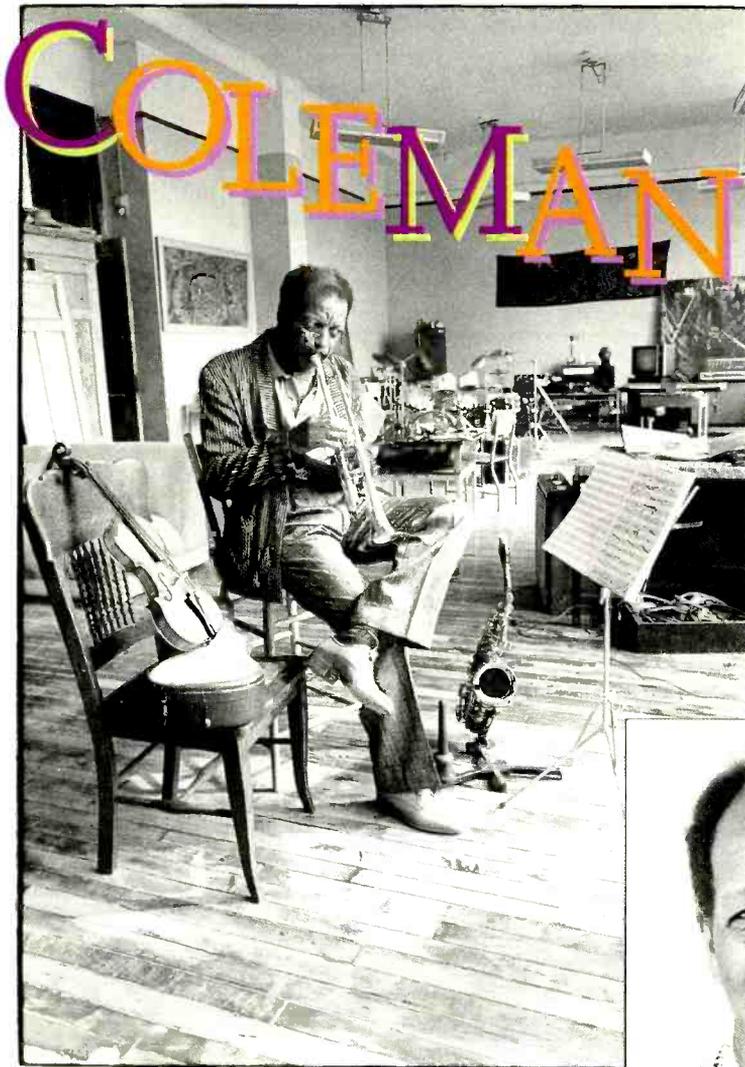
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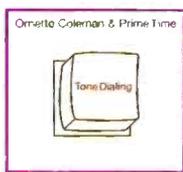
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314 527 483-2, 66:03  
Sound: B-, Performance: B

no one can ever accuse Ornette Coleman of turning blinders to contemporary music. In 1976, he adapted his improvisational concepts to funk rhythms and electronic instrumentation, which resulted in *Dancing in your Head*. In 1995, he's embracing hip-hop effects, grooves, and (on one track) rapping. It's as if Coleman's influence on groups like



The jangling, pointillistic guitars of Chris Rosenberg and Ken Wessel, and the slip-sliding bass lines of Bradley Jones and Al MacDowell, babble around Ornette's alto like Times Square traffic. Ornette's son, producer and drummer Denardo Coleman, keeps a central pulse while spinning polyrhythmic whirligigs with tabla player Badal Roy. Keyboardists Chris Walker and Dave Bryant keep

up a wash of sounds and effects that fills in every corner of this music. Ornette's sound is still rooted in the urban environment, even when he adapts a Bach prelude.

Coleman's solos have become more conventionally melodic over the years, and his song forms have become shorter and shorter. Hence, his gift for extended improvisation is rarely exploited. Several tunes here don't even top three minutes in duration. Ornette covers a lot of ground, some of it surprisingly conventional, including the Latin rhythms of "Guadalupe" and a gorgeous ballad called "Kathelin Gray."

There is unbridled joy in Ornette's playing. And no matter how abstruse the theory behind his music or how virulent the politics behind it, when Coleman plays, he sings as if he's testifying in a church. But the gospel never sounded like this.

John Diliberto

## A Cab Driver's Blues

Mem Shannon  
HANNIBAL HNCD 1387, 54:26  
Sound: B, Performance: B+

One of the most annoying things in the world is to walk into a funky bar in Anytown, U.S.A. and encounter suburban college boys singing about "going down to the crossroads and falling down on their knees" or about "working hard in a steel mill and bringing home all their pay." It ain't real, boys.



There ain't no steel mills in Levittown or Winnetka, no mystical crossroads in Sacramento or New Haven. Which is what makes *A Cab Driver's Blues* so refreshing. Mem Shannon is indeed a cab driver in New Orleans, as well as a rich-throated soul singer, an accomplished guitarist, and a clever songwriter. Tunes like "Play the Guitar, Son," "One Hot Night," and "Taxi-cab Driver" are all autobiographical, and if Shannon's gritty, humorous

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insights aren't real enough for you, there are a handful of spoken-word interludes of him interacting with the passengers in his cab-widened tourists, bitter prostitutes, hostile lawyers, drunken conventioners, streetwise hustlers, and the like. Credit producer Mark Bingham with that brilliant bit of audio *vérité*.

As a player, Shannon's approach to the blues is devoid of the typical clichés. His blues-drenched solos are laced with unpredictable filigrees and stinging figures that communicate with a natural vocal quality. He flaunts slick flamenco flourishes on acoustic guitar on "Play the Guitar, Son" and then spins some cool, jazzy licks on the swinging "Me and My Bed." Shannon and his, solid backing band throw down thick, funky grooves on "The Boogie Man" and "Got To Go." And on tunes like "Maxine" and the hilarious "If This Ain't the Blues," he sings with the earthiness of a seasoned bluesman whose dues are paid in full. Here's hoping that with the release of *A Cab Driver's Blues*, Mem Shannon won't have to drive that damn cab anymore.

Bill Milkowski

## Carved in Stone

*dmp Big Band*

dmp CD-512, 48:16

Sound: A, Performance: A

Rerecording big-band classics is not a new idea (the decades-old Time-Life series *The Swing Era* comes to mind), but it's an idea

whose day will come every time the medium for sound reproduction makes significant strides. In *Carved in Stone's* case, dmp sound wizard Tom Jung has produced an outstanding 20-bit recording using the Circle Surround system, which the label says is "the first surround system designed specifically for music reproduction." (The system's developer, Rocktron, says a Circle Surround decoder is required for best surround performance but that other types of matrix decoders, including those designed for Dolby Surround playback, will work.)

This brassy set of a baker's dozen would cook regardless. A smoldering ensemble of New York's premier musicians has given these swing-time staples perhaps their finest readings ever. From the Basie book, there's "April in Paris," "Shiny Stockings," "L'I Darlin," and "Cute"; Ellingtonia includes "Take the A Train" and "Satin Doll"; Glenn Miller and Tommy Dorsey check in with "Song of the Volga Boatman" and "Opus One," respectively; Woody Herman's *oeuvre* covers "Early Autumn" and "Four Brothers"; and Stan Kenton is represented by "Malaguena" and "Intermission Riff." All cuts are extremely well played in the appropriate style.

In a departure from similar projects of the past, the soloists here do not attempt to recreate the original recording solos verbatim. Featured trumpeter Lew Soloff's approach is

## An American Diary

Mike Mainieri

NYC RECORDS NYC 6015-2, 67:08

Sound: A, Performance: B+

For *An American Diary*, vibist Mike Mainieri recasts the works of some wildly disparate American voices—from Copland and Barber to Cage and Zappa—to draw some parallel lines. These themes are further fleshed out in Mainieri's own compositions and those of his stellar bandmates.

The voices of reedman Joe Lovano, bassist Eddie Gomez, and drummer Peter Erskine fill up the pages of Mainieri's *Diary* with fascinating dialog and fluent dialects; still, this is Mainieri's story most of all, set somewhere within the deep dulcet tones of his vibes and marimbas, and struc-

tured along the chronology of his own personal musical development.

Mainieri's mastery of four-mallet technique enables him to embrace orchestral voicings. Pleasant surprises abound throughout: Leonard Bernstein's "Somewhere" becomes a modal waltz, Roger Sessions' "Piano Sonata No. 1" begins with Lovano's clarinet gliding gracefully above Gomez's delicate bass work, and Frank Zappa's "King Kong" truly swings. And on his original "In the Universe of Ives" (based on Charles Ives's unfinished "Universe" Symphony), Mainieri assembles layer upon layer of xylophone, all moving in carefully aligned orbits.

Such sonic invention is further enhanced by the depth and clarity of the 20-bit digital mastering.

Larry Blumenfeld



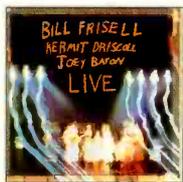
exemplary. He often alludes to a particular, familiar riff played on the original recording and then takes off in his own direction, producing exciting results. *James Rozzi*

**Live**

*Bill Frisell/Kermit Driscoll/Joey Baron*  
GRAMAVISION GCD 79504, 71:33  
Sound: B+, Performance: A

Bill Frisell, one of the few real originals in contemporary music, is captured on *Live* at a creative peak with a band he's been playing with for years. As a guitarist, Frisell is a musical Cuisinart with soul and taste. Country and western, jazz, rock, blues, and noise guitar elements permeate the playing of this distinctly American musician, but ultimately it always sounds like Bill Frisell.

He can, by turns, be painfully serene, glaringly dissonant, or daringly raunchy, as if he's playing with a lick of greased hair across his face, a cigarette dangling from his mouth, and



a pack of cigarettes rolled up in a sleeve that reveals a garish tattoo. Or he can essay a sweet ballad, like John Hiatt's "Have a Little Faith in Me," with charm and grace. All these personalities emerge when Frisell plays, sometimes within the same song; it's a legacy of his days with saxophonist/composer John Zorn.

It takes a pair of intuitive improvisers to follow Frisell's lead, and he has them in bassist Kermit Driscoll and drummer Joey Baron. They shift from country swing to laconic ballads, playing both with equal dexterity. They join Frisell like obsessed shipmates, ready to go on any journey. And Frisell has many places to take us. *John Diliberto*

**For One Who Knows**

*Javon Jackson*

BLUE NOTE CDP 7243 8 30244 2 1, 50:02  
Sound: A-, Performance: A-

Javon Jackson's second release for Blue Note is a true co-op, with six highly creative players digging deeply into the distinctive frameworks provided for improvisation. It's sensible that the former Jazz Messenger tenor saxophonist record for the premier hard-bop label, as his emerging style is an updated composite of Blue Note's best (Hank Mobley, Sonny Rollins, John Coltrane, Tina Brooks...).

The co-op angle stems from how the players get inside the music and from the solo time that Jackson gives to his talented sidemen. Rising piano star Jacky Terrasson literally tears into several robust pieces, joyfully exploring the percussive side of the piano. Drummer Billy Drummond and percussionist Cyro Baptiste work synchronistically, pushing the project beyond these latitudes into the realm of other Americas. And bassist Peter Wash-



ington provides the harmonic and rhythmic backbone, giving solid foundation where needed while following when the soloist chooses another route.

Acoustic guitarist Fared Haque, whose own eclectic first release fell short, supplies the finishing touches that help make *For One Who Knows* first-rate. His tasteful chordal accompaniments are interspersed with polished lines that add the final luster to a colorful set. *For One Who Knows* expresses Javon Jackson's desire to stretch beyond the status quo. *James Rozzi*

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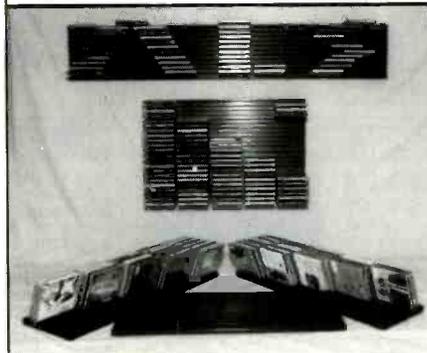
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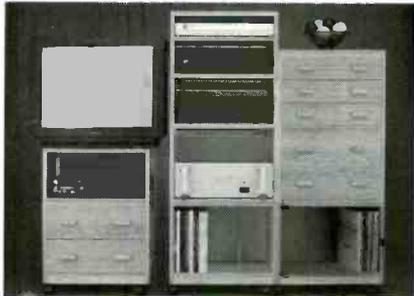
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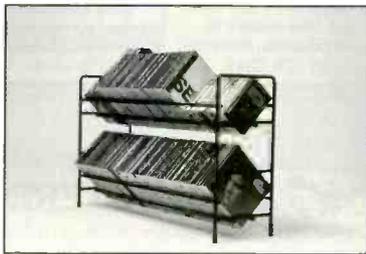
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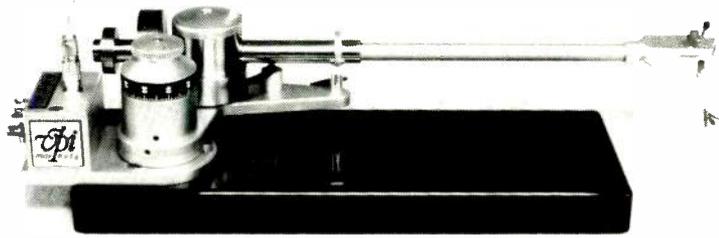


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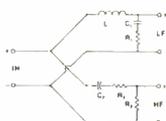
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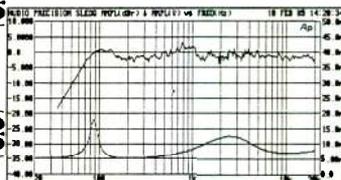
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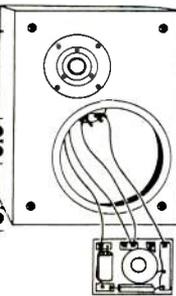
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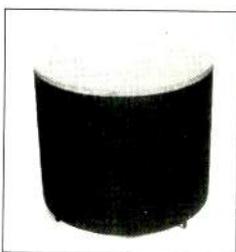
Gary Reber, *Widescreen Review* Vol. 3 No. 1, March 1994

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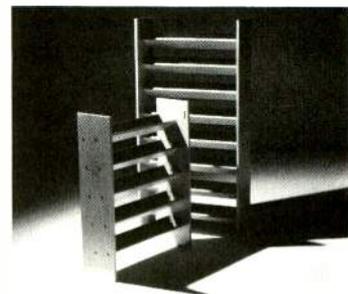
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# PlayBack

## FINE LINE AUDIO FL3D-100

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Passive surround processors usually work with the stereo difference signal from a stereo amplifier's two positive speaker terminals, but the Fine Line Audio FL3D-100 passive PhaseAround decoder works with line-level signals.

The FL3D-100 has three selectable stereo inputs. It also has three pairs of outputs: The front channels, the rear channels, and two full-range L + R outputs—one for a center channel plus a second output for a powered subwoofer or a separate mono system. A front-panel knob controls overall volume;

there's also a rear-panel loudness-compensation switch.

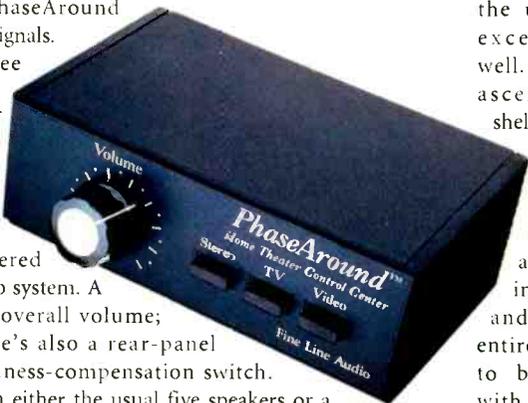
**GRADE: A+**

With either the usual five speakers or a three-speaker (center and two surrounds) system, one channel of your amplifier feeds the center speaker, while the other channel feeds a mono signal to the two surrounds. One surround speaker is then wired in reverse polarity, to create a more diffuse sound.

While the PhaseAround system may not equal the impact of Dolby Pro Logic with THX when viewing noisy action movies, you may prefer the Fine Line's approach with music. Specially encoded sources are not required—all stereo has some L - R information.

Purists who want to avoid signal degradation may wish to use the FL3D-100 only for the two rear speakers, but I noticed no degradation when I also fed my front channels through the unit. At \$149 (plus \$7 shipping) this is my current best buy in perfectionist surround sound for music. **John Sunier**

For literature, call 800/828-7200



## Newport Classic Binaural CD

**I** predict that this Newport Classic binaural CD of Saint-Saëns's Symphony No. 3, "Organ," and Richard Strauss's "Also Sprach Zarathustra" (NCAU-1000...) will become a collector's item. The numbered, limited-edition recording features the Pasadena Symphony conducted by Jorge Mester with Hector Olivera as organist. It was recorded in 20-bit format to hard disk using the Neumann KU 100 dummy-head binaural microphone system. I listened with Stax SR-Omega, Sennheiser HD580, and Grado SR125 earphones and with stereo and surround speaker systems; it sounds fabulous on them all. The spaciousness is marvelous, and the low C on the organ pedal is awesome! The gold CD lists for \$49.95 and comes in a special case. **E.M.L.**

**GRADE: A+**

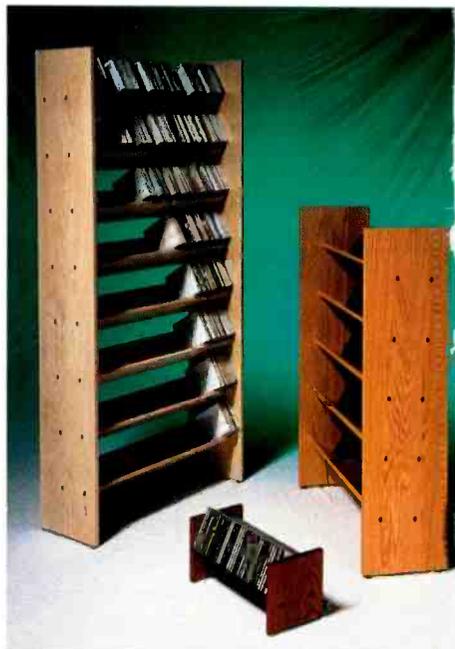
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## Storadisc Library Series CD Storage Units

The Library Series from Storadisc comprises two CD storage units, both 31½ inches wide x 11 inches deep. A five-shelf model, 41¾ inches high, holds up to 360 discs, while its 63½-inch, eight-shelf sibling holds up to 576. Conceived and produced by an architectural designer, the units look elegantly simple, and are well-constructed with fine materials. Placed in a friend's home, which is furnished with high-end, handcrafted cherry furniture, a cherry Storadisc model looked perfectly in place. Functionally, the unit works exceptionally well. As the tier ascends, each shelf is set back a bit from the shelf just below it. This puts album titles in clear view and allows an entire collection to be scanned with ease. Non-slip shelf backing permits even a single disc to stand on its own, a feature that makes the grouping of CDs an extremely simple process.



Assembly took me exactly half an hour, and it involved no

**GRADE: A+**

more than the inserting and tightening of four oversized Allen-screw fasteners per shelf, using the supplied wrench, and screwing in four levelling feet.

Storadisc offers the Library Series in hardwoods with six standard finishes, and custom finishes and sizes are available on request. Prices start at \$495 for a five-shelf unit in white or red oak. Similar units are offered for videocassette storage. **D.L.**

For literature, call 800/848-9811



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