

AUDIO

**GOOD SOUND
vs.
BAD SOUND**
**TRICKS OF THE
AMPLIFIER TRADE**

THE EQUIPMENT AUTHORITY

NOVEMBER 1996

TESTED

**PARASOUND'S
3-CHANNEL
MUSCLE AMP**

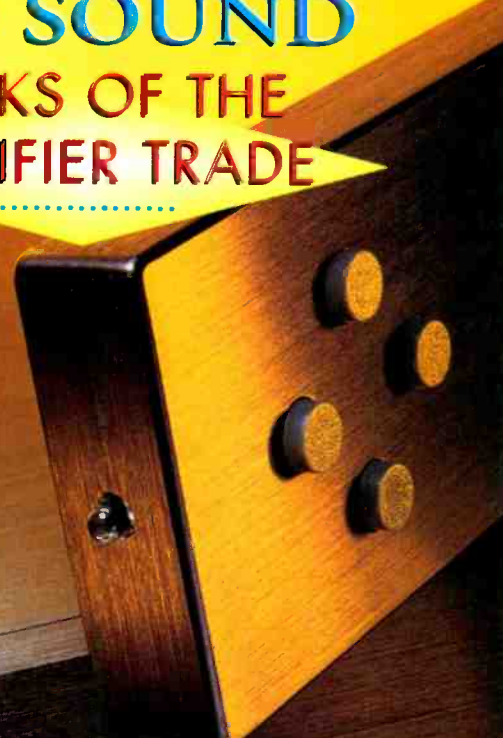
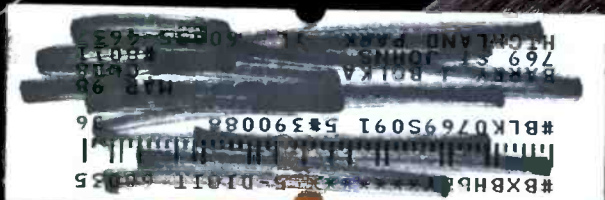
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INNOVATION
FROM PASS LABS**

ALSO TESTED

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SPEAKERS FROM
EOSONE, PARADIGM,
& DIGITAL PHASE**



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LS3



LS15



LS22



LS10



LS5MKIII

SOLID STATE



D130



D300



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CD2



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CIRCLE NO. 4 ON READER SERVICE CARD

You Need More Than Just Cable.

Any cable can transmit electrical signals from one component to another, or from an amplifier to the speakers. But transmitting music takes more than just cable. The shapes of musical waveforms are incredibly complex and critical signal timings are measured in microseconds. Ordinary interconnecting cables or speaker cables cannot faithfully preserve these complex musical relationships across the full musical spectrum.

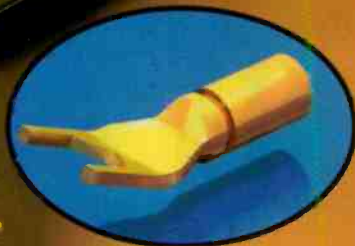
That's why MIT's founder literally invented high-performance interconnects and speaker cables. MIT® holds seven basic patents in high-performance cable and interface design. These fundamental technology patents mean that only MIT can bring you interconnects and speaker cables scientifically designed to eliminate the non-linearities and distortions caused by other cables, no matter whether the others cost tens of dollars or thousands.

If you choose your system components with care, listening for the subtleties of music that distinguish great components, then you need MITerminator™ interconnects and speaker cables. The hard science behind MITerminators reveals the full musical potential of your high fidelity stereo system. Until you use MITerminators you'll never know how good your system can sound.

Patented MIT Terminator Network

MIT's patented Terminator Networks are the heart of MIT's sonic superiority. These unique networks enable MITerminator interconnects and speaker cables to deliver better bass, clearer midrange and smoother treble sound, and to enhance the image, focus and soundstaging of every recording you listen to.

MIT's fundamental technology patents are your assurance that only MIT interconnects and speaker cables can transmit all of the sound quality that your program sources and stereo system components are able to deliver.



iconn™ interchangeable connector system

MIT's exclusive iconn system for speaker cable connectors is so innovative, it has a patent pending, and every MITerminator speaker cable has it. Thanks to iconn's five interchangeable connector types, you'll always have the right connector to fit the terminals on your amplifier and speakers. iconn's gold-plated connectors assure ultra-low contact resistance and contamination-free connections for best sound quality.

New RCA connector

MITerminator™ interconnects now have new high-performance RCA-type connectors. These machined, gold-plated connectors feature bifurcated center-contact pins and multi-contact shield connections for unimpeachable signal integrity. They properly match the cable for highly efficient energy transfer and outstanding sound quality.

With MITerminator interfaces starting at just \$39.95 interconnect and \$79.95 speaker (MITerminator 5, not shown), MIT performance is truly affordable for any system.

More Than Just Cable!™

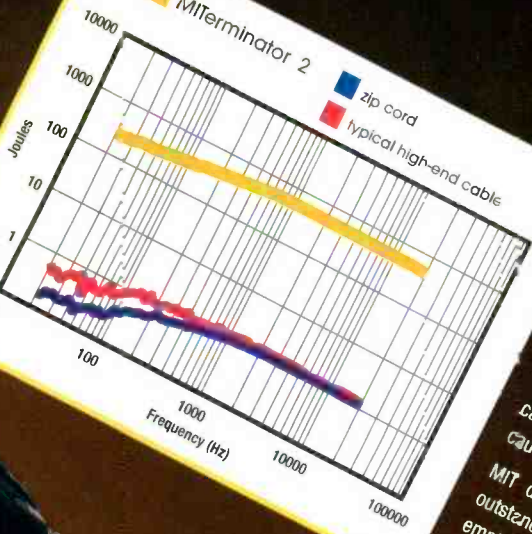


Why MITerminators sound better

Superior Final Energy Component

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

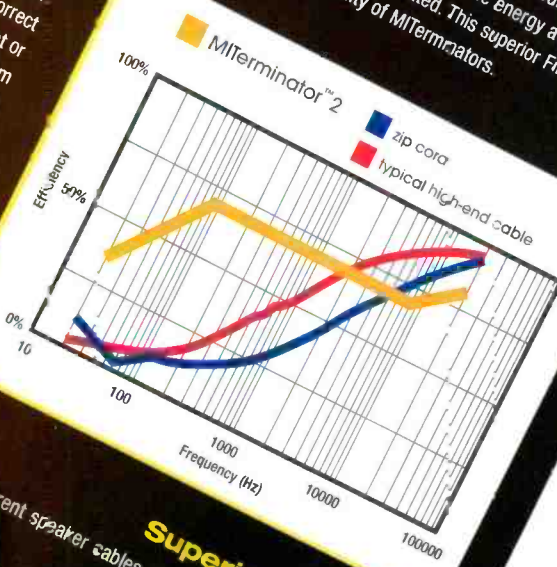
MIT discovered that increasing the Final Energy Component of cables already having outstanding electrical characteristics dramatically improves the overall sound quality. By employing the patented MIT Terminator Networks to store and release energy at the correct levels and times, nonlinearities are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



Superior Efficiency

How well cables maintain correct phase relationships between signals and currents as they transfer to the next component or cable is an important characteristic. Ordinary cables' non-linearities make them inefficient at high frequencies, as the plot shows. The sonic results are a "bright" treble sound.

MITerminator Networks give cables, raising low-frequency efficiency, means that they have lower distortion than ordinary cables.



Superior Imaging

Blurry speaker cables. The blue, red and yellow areas that the image is unfocused and poorly defined. The blurry note indicates poor image focus and disappointing.

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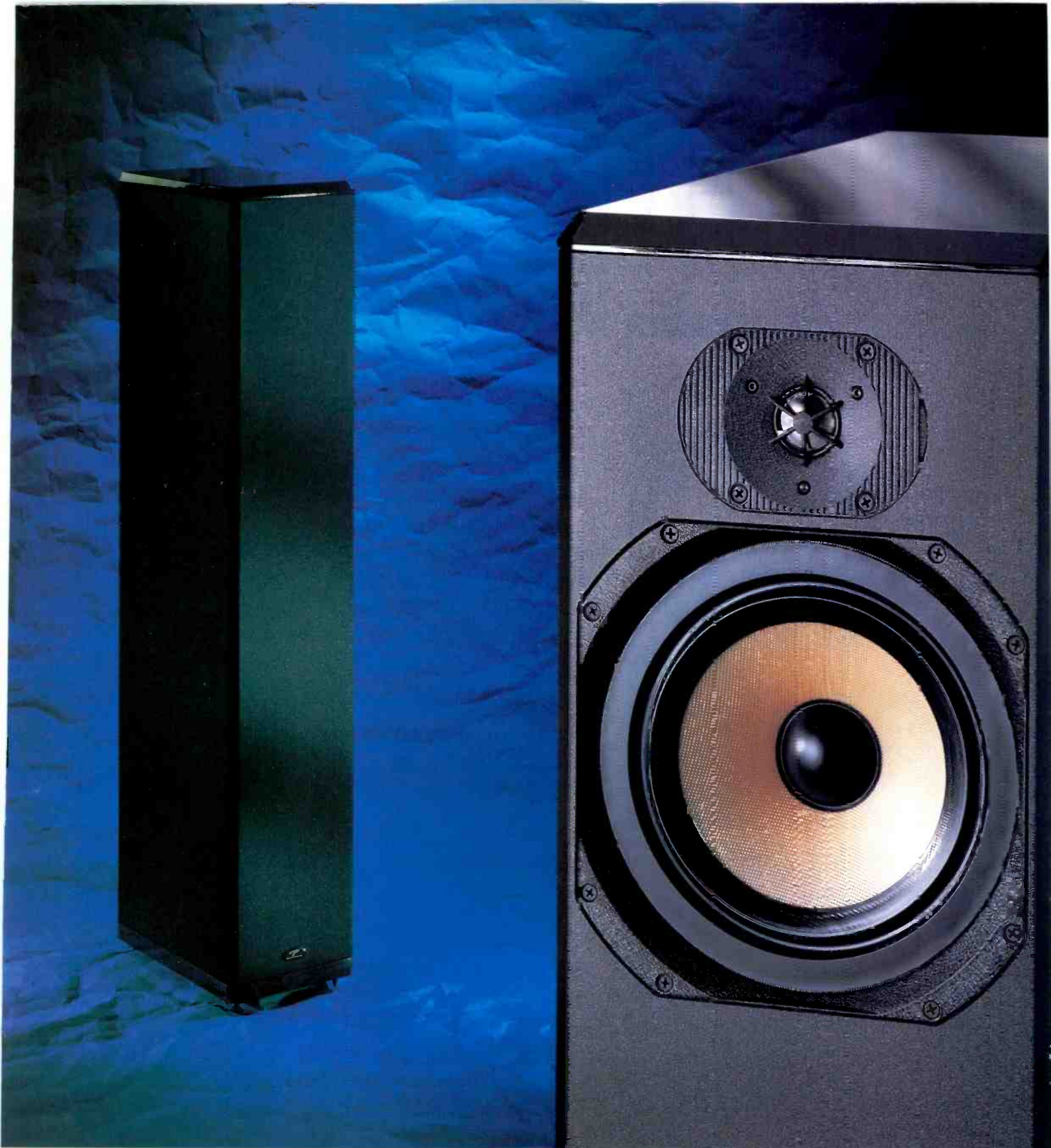
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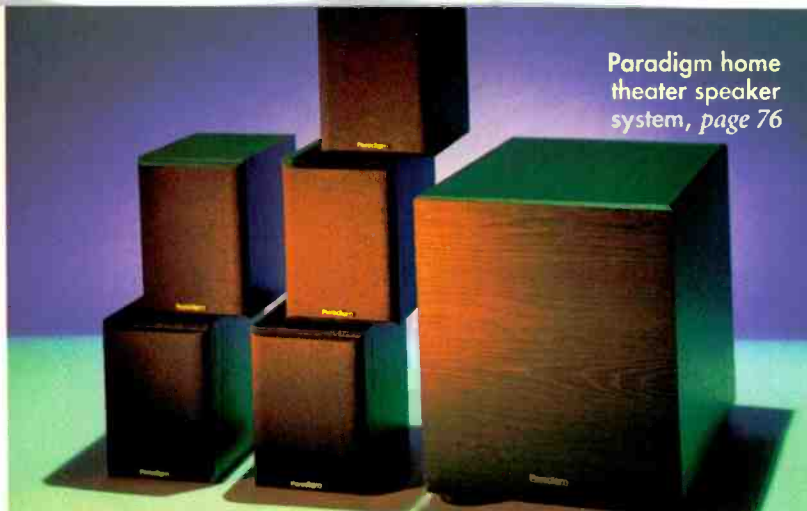
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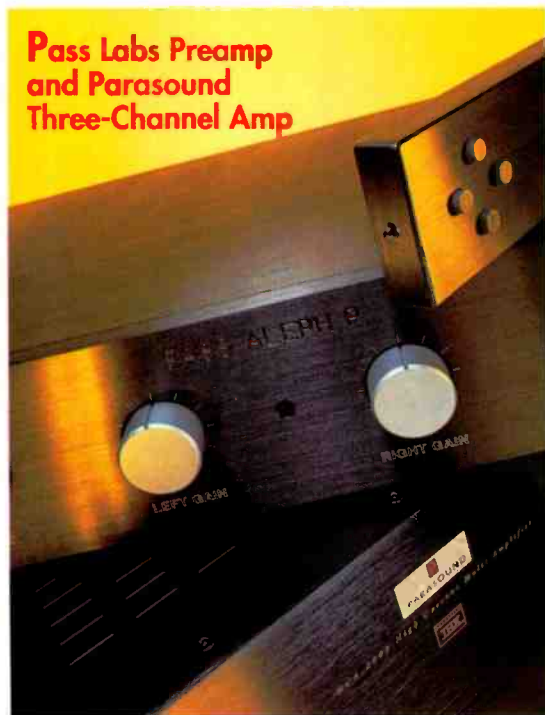
CIRCLE NO. 24 ON READER SERVICE CARD

AUDIO

THE EQUIPMENT AUTHORITY



Paradigm home theater speaker system, page 76



Pass Labs Preamp and Parasound Three-Channel Amp

FEATURE

PURE POWER: AMPLIFIER DESIGN & SOUND QUALITY Tomlinson Holman..... 26

EQUIPMENT PROFILES

PARASOUND HCA-2003 THREE-CHANNEL AMP Daniel Kumin..... 32

DIGITAL PHASE AP-2.1 SPEAKER D. B. Keele, Jr. 42

MARANTZ DP870 DOLBY DIGITAL SURROUND DECODER Edward J. Foster..... 52

PASS LABORATORIES ALEPH-P PREAMP Bascom H. King..... 60

AURICLES

EOSONE MILLENNIUM HOME THEATER SPEAKER SYSTEM Anthony Cordesman 70

PARADIGM MICRO/SB-90 HOME THEATER SPEAKER SYSTEM Corey Greenberg 76

DIRECTORY ADDENDA

ANALOG INTERCONNECTS 82

DIGITAL INTERCONNECTS..... 94

DEPARTMENTS

FAST FORE-WORD Michael Riggs 8

LETTERS..... 10

WHAT'S NEW 12

AUDIOCLINIC Joseph Giovanelli 14

SPECTRUM Ivan Berger 18

MONDO AUDIO Ken Kessler 22

RECORDINGS

CLASSICAL 98

ROCK/POP 104

JAZZ & BLUES 108

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PLAYBACK

KIMBER KABLE SPEAKER CABLES, BIRÓ t2c DIGITAL INTERFACE, AND CASTLE ACOUSTICS ISIS SPEAKER 120

Biró digital interface, page 120



Marantz surround decoder, page 52



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PURE MISCHIEF

SMIRNOFF

Last month's Annual Equipment Directory proved an embarrassment of riches. Although we had anticipated some increase in size over last year, based mainly on the addition of cables to the mix, we were not quite prepared for the magnitude of that jump. Not only did the cables section turn out to be larger than expected, but there was a net increase in the size of the rest of the Directory, as well. The upshot is that part of the cables section (analog and digital interconnects) has spilled over into this issue. Listings start on page 82. If you need addresses or phone numbers for any of the manufacturers, you'll find them at the end of the main Directory in the October issue.

Speaking of equipment, I just returned from the CEDIA (Custom Electronic Design and Installation Association) convention in Dallas. As the name implies, this event is oriented primarily to the A/V custom-installation business, but over the last few years it has become an increasingly important showcase for manufacturers of all types of audio and video gear.

Not surprisingly, the single biggest topic of conversation was DVD (which was being demonstrated continuously at the Toshiba booth). There have been intensifying, off-the-record, "you didn't hear it from me" rumblings in recent weeks from various interested parties that an agreement between hardware vendors and the movie studios on copy protection and other outstanding issues is all but a done deal. I'm writing this in the middle of September, which means that if these rumors are true, DVD might launch as early as November (Panasonic already has announced that it will begin selling players in Japan then), and with

a reasonable number of software titles available to support the introduction. It will be a relatively "soft" launch compared to what was originally anticipated, meaning that it won't reach full thrust until early next year, but at least the waiting will be over. Keep your fingers crossed.

Meanwhile, the floodgates are about to open on processors, preamps, and receivers incorporating Dolby Digital (AC-3) decoding, which should dovetail nicely with the arrival of DVD. The main reason is that the Motorola 56009 implementation of AC-3 decoding has finally received Dolby's blessing. Quite a few manufacturers seem to prefer the Motorola DSP chip to the Zoran processor that up until now has been the only game in town. What I've heard is that the Zoran chip, though perfectly capable, is somewhat more finicky and less flexible than the Motorola. (Contrary to persistent hype, it's not a question of performance.) In any event, expect to see—and hear—a lot more Dolby Digital in the coming year.

One last trend: I saw an unusual number of intriguing small speakers from companies like Energy and PSB. This is a category that really has been emancipated by the growing reliance on subwoofers to handle deep bass. Expect more on some of these diminutive beauties in future issues.



AUDIO

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Do It Blind

Dear Editor:

I salute you for your new policy of publishing full-length technical debates in your "Letters" section; it adds tremendously to the appeal of *Audio*. I was dismayed, however, by the absence of something very basic in the two exchanges of letters published in the August issue. Neither the debate between Tony Federici of Mondial Designs and your reviewer Ed Foster nor that between Keith Johnson of Reference Recordings and contributing editor D. W. Fostle makes the slightest reference to *double-blind* listening tests at *matched levels*. The issue in both controversies is sound quality—the alleged "brightness" of the Aragon 8008ST amplifier or the alleged superiority of HDCD sound to the sound of conventionally recorded CDs—so why is the obvious decision-making methodology treated by these practitioners as if it didn't exist?

I am not referring exclusively to A/B/X comparisons. That is probably the best protocol for listening tests, the one used in the laboratory of *The Audio Critic*, but others are also valid, such as the same/different protocol, for example. There are only two unbreakable rules: level matching (within ± 0.1 dB) and no peeking (at the nameplates, that is, or any other clue). Everything else—the duration, location, and pacing of the test, the music system used, the program material, the switching mechanism, the speed of switching, and so on—is negotiable. All objections—on the Internet or in the subjective audiophile press—to this proven methodology have consisted of specious attacks on the negotiables. No one has been able to explain what superior insights are to be gained from mismatching the levels or peeking at the nameplates. I have noted numerous instances of false conclusions resulting from levels mismatched by as little as 0.3 to 0.4 dB. That kind of level disparity is experienced as a difference in quality rather than loudness.

A significant segment of the high-end audio community regards the double-blind methodology and its objective con-

clusions as bad for business, an embarrassing family secret that one doesn't talk about, or, as a last resort, something to be denied. I trust that *Audio* does not share that view.

Peter Aczel
Editor and Publisher
The Audio Critic
Quakertown, Pa.

Polarity Pointers

Dear Editor:

Edward M. Long's interesting article on polarity reversal ("Upside Down Sound," July) could have been more complete by giving readers some important background information for a better perspective on this controversial subject. New readers of *Audio* might not know that it is easy to fool yourself into thinking that you "hear" ephemeral things like polarity effects, when it is often just the power of suggestion. I have been convinced that I heard polarity when I could see the reversing switch positions, but when I had another person operate the switch, out of my view, I couldn't tell which position sounded better. Of course, some audio effects can still be heard, even in blind tests, but you can't know whether it is truly an audible effect or whether you are simply fooling yourself unless you do a blind comparison.

Also, the presence of about 1% second-harmonic distortion in the loudspeakers (quite common at high volume!) can artificially make polarity reversal audible. The more distortion, the more audible the change. But in the absence of such distortion, polarity reversal has always been completely inaudible on stereo music played over speakers, which is what most of us listen to. At least, I have never seen a published report of a blind test of the audibility of polarity inversion that demonstrated otherwise.

Dan Shanefield
Piscataway, N.J.

Author's Reply: I am aware that it is easy to fool yourself into believing that you can hear things that are not actually there. It is

also true that some things take a little training before you can hear them easily. That is why I suggested the use of earphones and some patience. I agree that even-order distortion (second, fourth, etc.) is asymmetrical and will produce a different sound for positive and negative polarity. However, I have found that listeners have more difficulty hearing the effects of polarity reversal at loud levels (above 90 dB SPL) than at lower levels. This is most likely because of distortion in the ear. With a stereo presentation over loudspeakers, many people hear a change in the depth of the image—a center vocal being forward or recessed, depending on the polarity. I hope this clarifies things a little.—E.M.L.

The Plot Thickens

Dear Editor:

I applaud Edward M. Long's decision, in his review of the Sonance DL1200 subwoofer (*Audio*, September) to show the loudspeaker's phase response using a *linear* frequency plot. This enables you to deduce group delay directly from the slope of the phase plot. Group delay equals the change in phase divided by the change in frequency (actually, $-\Delta P/\Delta F$). Unless the frequency axis is linear, you can't see or calculate it from the phase plot. Group delay that is constant with frequency is a desirable characteristic for best transient response.

Also, you can examine the phase intercept. This is where a line drawn tangent to the slope of the phase plot at any frequency, when extended, intercepts the phase axis at zero frequency. It is desirable for the phase intercept to be 0° or $180n^\circ$ (where "n" is any integer). The worst value of phase intercept is $90n^\circ$.

As D. B. Keele explained in his review of the Optimus Pro LX5 loudspeaker (*Audio*, April 1995), these factors help describe the transient response of a loudspeaker. Ever since *Audio's* loudspeaker reviews began reporting phase response, I have had to manually replot the phase response to determine these parameters—a tedious and somewhat inaccurate procedure.

May I also suggest extending the frequency axis down to 0 Hz to make the phase intercept easier to see.

John Sehring
via AOL

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Main Speakers.

The left and right speakers in *MovieWorks* use a two-way, shielded design. They are acoustically similar to the satellite speakers in our acclaimed *Ensemble*® speaker system, which *Audio* magazine called "the best value in the world."

The Center Speaker.

The center speaker is a wide-dispersion, high-output shielded design with two 3 1/2" midrange drivers and a tweeter identical to that in the main speakers. Its low profile makes it ideal for use above or below a TV monitor.

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For the rear channel, we chose an acoustically matched dipole radiator speaker. Each speaker has two high-frequency drivers – one facing forward, one to the rear. They send out-of-phase signals to the front and rear of the room, where they reflect off walls, "surrounding" the listener. We feel dipole speakers are ideal for home theater – including Dolby Pro Logic and Dolby Digital (AC3) systems.

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Home Theater magazine-3/96

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Stereo Review-9/96

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WHAT'S NEW

MEADOWLARK AUDIO



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The Petrel's three drivers are housed in a first-order transmission-line enclosure with an elastically decoupled baffle. Its grille is frameless. The crossover

is mounted externally, to reduce microphonic effects. Available finishes are rosewood, ash, and ebony veneer. Price: \$700. For literature, circle No. 100



Kinetic Audio Speaker

Drivers in the Labyrinth four-way system are diagonally staggered to prevent interference between the wavefronts from the woofer and mid/woofer, and the speakers are supplied in mirror-imaged pairs. The 12-inch woofer and 1½-inch dome tweeter use variations on transmission-line enclosures. Baffle edges are chamfered to reduce diffraction; all level controls and fuse holders are at the front, for easy access. Rated frequency response is 18 Hz to 18 kHz, ±1.5 dB (±2.5 dB from 14 Hz to 22 kHz), and rated sensitivity is 91 dB. Standard finishes are oak or walnut; rosewood (shown) available at extra cost. Price: \$6,500 per pair; bases, \$250 per pair. For literature, circle No. 101

Infinity Speaker

Planar drivers (one EMIM midrange and two EMIT tweeters) handle the frequencies above 160 Hz in the Infinity Sigma speaker. A 6½-inch mid-bass coupler and 12-inch woofer, both with injection-molded graphite cones, handle the lower frequencies. The enclosure, which has gently curved side wings to reduce diffraction, measures 58¼ x 18½ x 16¼ inches.



▲ Frequency response is rated as 30 Hz to 42 kHz, ±2 dB; rated sensitivity is 87 dB SPL for a 2.83-volt input; rated impedance is 4 ohms. Price: \$10,000 per pair. For literature, circle No. 102



KLIPSCH SPEAKERS

Horn loading, rare in satellite speakers, is common at Klipsch. The Rebel Series satellites have horn-loaded tweeters mounted within their woofer horns: sensitivity of the satellite is 93 dB SPL at 1 meter for 1 watt. (A matching center speaker is available.) The powered sub has a 50-watt high-current amplifier with full crossover functions and automatic turn-on and shutoff. The Rebel KSS-3 sub/sat system has a rated frequency response of 40 Hz to 20 kHz, ±3 dB. Price: \$749. For literature, circle No. 103

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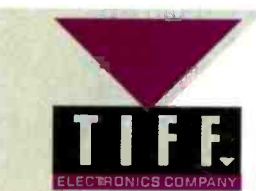
"...the TDC-3 was an excellent digital link... The TDC-3 is a great buy."

"If you are looking for interconnects in this price range and appearance is important, these cables [TDC-3] require an audition..."

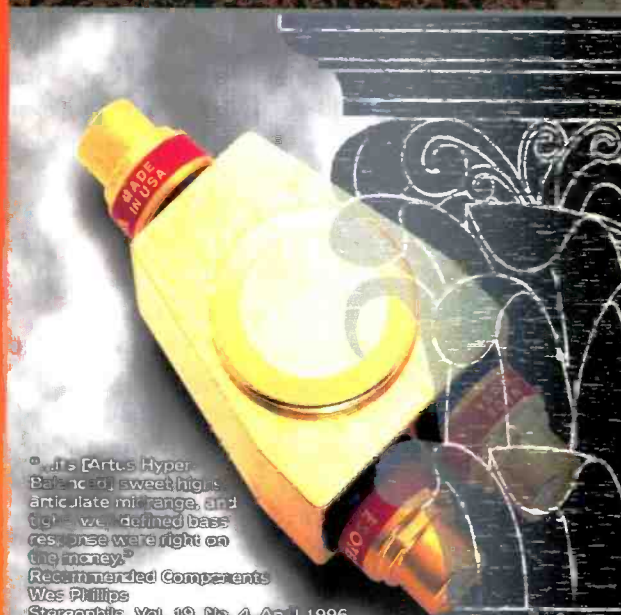
"Great subtle shading and very good dynamic range with... excellent imaging and timing..."
Dayne B.
The Hi-Fi Mussy
The Audio Adventure
February 1996



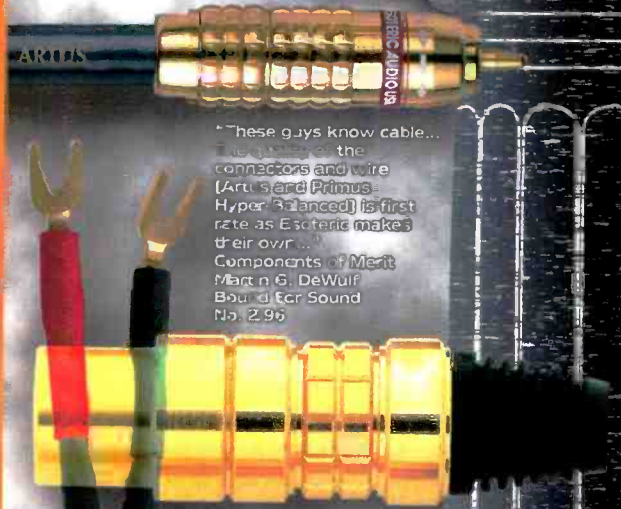
"...the Nucleus has... some of the most solid, well-spaced terminals [BP-4's] I've seen on any speaker..."
Fred Kaplan
FI
April 1996



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"...arts [Artus Hyper-Balanced] sweet high, articulate mid range, and tight, well-defined bass response were right on the money."
Recommended Components
Was Phillips
Stereophile, Vol. 19, No. 4, April 1996



"These guys know cable... The quality of the connectors and wire [Artus and Primus-Hyper-Balanced] is first rate as Esoteric makes their own..."
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Martin G. DeWulf
Bourdier Sound
No. 2, 96



"Of all the interconnects I know well, my top choice is Esoteric's Tech 25i series..."
Lawrence B. Johnson
Stereophile Guide to Home Theater
Vol. 1, No. 1, 1995

"I'm enthusiastic about the strength and sound of the Esoteric cable [Litz-Patt] and can recommend it here avidly."
Components of Merit
Martin G. DeWulf
Bourdier Sound
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CIRCLE NO. 35 ON READER SERVICE CARD

Basic Terms

Q *There is much I don't know about electronics. Would you explain the meaning of MHz, kHz and ohms?—Richard Zachary, Winooski, Vt.*

A To understand either kHz or MHz, you must first understand Hz. Waves (radio, sound, ocean, etc.) move in cycles, rising and falling before returning to their starting point. The higher a wave's frequency, the more cycles it goes through per second. But rather than use those English words or their local equivalents, the world refers to cycles per second as "hertz," abbreviated "Hz"; this is in honor of Heinrich Hertz, a 19th-century physicist who researched the nature of radio waves.

Sound consists of air vibrations that occur between about 20 and 20,000 times per second, the nominal limits of human hearing. The frequency range of sound is therefore 20 to 20,000 Hz. The latter is frequently abbreviated, however, by using the metric prefix "kilo-," which means "times 1,000." So the upper limit of audible sound is about 20 kilohertz, or 20 kHz for short.

Radio waves, which are repeating electromagnetic waves rather than air vibrations, typically go up into the millions of hertz and beyond. Thus, we use the prefix "mega" (times 1 million), or "M" for short. An FM station at 88.3 MHz is therefore broadcasting at a frequency of 88,300,000 cycles per second. (Actually, if it's FM, its frequency will deviate by about 200 kHz on each side of that figure.)

The ohm (named after Georg Ohm, an even earlier physicist) is a measurement of electrical resistance, a property that opposes the flow of electric current and turns it into heat. Since "ohm" is a short word, it's usually spelled out, though sometimes symbolized by the Greek letter omega (Ω). Thousands of ohms are called kilohms ($k\Omega$), millions are called megohms ($M\Omega$), and thousandths of an ohm are milliohms ($m\Omega$)—note the distinction between the "M" (millions) and "m" (thousandths) prefixes!

Other units you're likely to run into in audio are amperes (A) and milliamperes

(mA), which measure current, and voltages measured in volts (V), millivolts (mV), and microvolts (μV). These and other, less common, units are all named after early scientists, just as the ohm and the hertz are.

Tube Amps With Hot Power Transformers

Q *I just obtained some 1955 tube power amps whose power transformers get very hot (I've measured temperatures as high as 140° F). As far as I can tell, the amplifiers are not drawing excessive current, even though they're still using their original filter capacitors. The labels on these amplifiers say that they will operate safely at 50 Hz, which would make their transformers run even hotter! The power transformers in most modern amplifiers don't run nearly this hot. What do you think about all this?—Donald Bisbee, Columbus, Ohio*

A I think that the transformers of most amps made in the '50s did run hot, but they were designed to take this heat. You say that the amplifiers are working properly. Make sure that those old filter capacitors are not themselves running warm. That would be a sign of leakage, which would add to the current drawn from the power transformer. If these amps have bias adjustments (which they probably do), be sure they're set properly so that the output tubes don't draw too much current. You should consider replacing the grid-coupling capacitors on the output stages of your amplifiers. If they leak, the grids will be driven more positive than they should, again forcing the output tubes to draw too much current.

Many amplifiers of this vintage operate in Class A, which maximizes output-stage linearity but minimizes efficiency. Such amps draw full current at idle, which also helps keeps the transformers hot.

High Quality, Low Power

Q *Why do some high-end amplifiers with low advertised power ratings sound much better than lower-end amps that advertise more power?—Name withheld*

A Power in and of itself does not tell us anything about the sound of the amplifier. Making an amplifier or receiver more powerful does not enhance its sound until you reach a level where its extra power is demanded. There's no reason a 100-watt amp should sound any better than a 10-watt amp when both are actually delivering only 7 watts.

An amplifier's sound is affected by a number of other factors that have nothing to do with power. These include noise, distortion, damping factor, and so on. The way an amp or receiver handles the complex load presented by your speaker is a factor, too.

These factors can be affected by the quality of components used, the design and construction of the power supply, the amount and type of feedback, the class of operation, and other design choices. Further, your perceptions of an amplifier's or receiver's sound can be colored by your impressions of such other attributes as size, design, finish, and reputation. Even if these attributes don't actually enhance a component's sound, they may enhance your enjoyment of it.

Off-Speed Recordings?

Q *Over many years of collecting, I have discovered that thousands of recordings (LPs, cassettes, and even CDs) play either sharp or flat in relation to A = 440 Hz and that the running times I measure with a stopwatch are often different from the timings listed in the recording's notes. Why?—Ken Smith, Hamilton, Ont., Canada*

A The discrepancies in running times can have several causes. For one thing, the total running time of a recording will exceed the sum of the tracks' individual running times because of the pauses between tracks. But if the total running time is stated and you measure a different total time, there is a speed discrepancy.

If the discrepancy is always the same (e.g., every LP you time runs, say, 6% slow and every CD runs 2% fast), the problem

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CIRCLE NO. 2 ON READER SERVICE CARD

probably lies in your equipment. (Even quartz-lock speed controls don't guarantee absolute speed accuracy.)

If the discrepancies vary—some recordings running slower than specified, some faster—mastering errors may be the cause. It could be that a tape made on one deck was played back for mastering on a deck whose speed differed slightly or that a key component, such as the turntable of the record-cutting lathe, was running off speed. But in my years as a record-mastering engineer, I and every colleague I knew took great pains to prevent such errors. When I gave the client the total running time for a recording, including silences, I knew that he would come up with precisely the same running time when he played it on properly adjusted equipment. I have, however, heard of a few cases where the original recording was deliberately played a bit fast during mastering so it would not run too long—I even had to do it myself once, when a client insisted I fit his 61-minute master onto a C-60 cassette.

Pitch deviations from A = 440 Hz are not necessarily related to speed discrepancies.

We have been conditioned to think that standard concert pitch is based on an A of 440 Hz. But pitch has varied (and still varies) from place to place, and there has been a gradual rise in pitch for over a century. Hence, old music, especially on "original instrument" recordings, may be pitched lower, for a more authentic sound. And many recordings may be pitched a little high, to sound brighter. (Many musicians advocate using A = 442 Hz as a standard for this reason.)

Even assuming the musicians used the 440-Hz standard, their pitch probably won't be correct unless they tune up with a tuning fork just before recording—and unless that tuning fork is correct. (Someone once gave me a tuning fork that actually rang at 442 Hz, not the 440 Hz stamped on it. Had I used this fork in any of my live sessions, the overall pitch would have been sharp.)

The temperature of the concert hall also affects the pitch. The oboe is often used as a standard that other instruments are tuned to match. If we tune to an oboe and the hall is hot, the pitch will be sharp; if the hall is

cold, it will be flat. I have listened to a recording in which an orchestra and an organ had the same pitch at the beginning of the piece but were a quarter tone apart by its end, because the air around the orchestra had heated up more than the air around the organ!

Surround Without Wiring

Q I recently moved into a new home whose layout and construction put large, perhaps even insurmountable, difficulties in the way of wiring surround speakers. The house is on a slab, which eliminates the option of underfloor wiring (and complicates undercarpet wire runs). The ceilings are 9 feet high, and the walls are stuffed with insulation (it took the DSS installer three days to run one cable through one wall). The attic is a maze of beams, joists, and more insulation. I've seen advertisements for wireless speakers; although such speakers seem intended for placement in other rooms, can't they be used for the surround channels? And how good would wireless speakers be for surround? Can better speakers be substituted for those

Your dad thinks you oughtta Get A

Your buddies THINK you oughtta come SO you

Your Brother thinks you oughtta Come

ANYBODY EVER ASK YOU WHAT YOU WANT TO DO?

If you're mechanically inclined, the Air Force could be the perfect place for you. Where else could you learn about Tactical Aircraft Maintenance, Aerospace Propulsion, and everything in between while earning a good salary and learning to

included in wireless systems? Because my primary interest is music, I am not willing to make too many sacrifices in the name of surround sound (and my wife has a strong say on ugly installations).—Wayne B. Howard, Warner Robins, Ga.

A Before you consider wireless systems, consider running the surround-channel wiring along your walls' base molding. This can work in many installations.

The little speakers that come with most of the wireless systems I have heard just don't do much. They're too small, and their amplifiers have too little power to give you all the bass you'll want. Aside from that, their overall sound can be quite good. Also, I don't know of any that give you the diffused sound you'd want from surround speakers. And you cannot substitute better speakers or amps.

The JBL SoundEffects system included a transmitter and a matching receiver with line-level output, as well as a power amplifier designed to fit under the receiver. These items were available separately but may now be hard to find because they have

recently been discontinued. The newer JBL WRKW-1000 system has a similar transmitter, but its receivers and amps are built into the speakers; again, however, this system's speakers are not designed specifically for surround use.

Mike and Mike-Preamp Noise

Q My mike mixer's rated equivalent input noise is -116 dBV. However, when I connect mikes to this mixer, especially Neumann U87s, I hear an unacceptable level of noise. I didn't hear this noise when I was using a Shure mixer. My present mixer has 1% resistors, Mylar capacitors, and socketed BA4560 op-amps. Is there a quieter op-amp I could substitute—or better yet, that could directly replace the BA4560s?—John R. Benham, Spokane, Wash.

A I don't know any suitable chips, but Audio's readers may. Check semiconductor reference books and write to semiconductor makers for information.

But unless you hear this noise in playback of actual recordings, you can probably ignore it. I make live choral and chamber recordings with a ribbon mike feeding a

DAT recorder through an old Advent mike preamplifier. I hear noise if I turn the gain up all the way, but even though this music is rather quiet and the ribbon mike's low output requires high gain settings, I don't hear noise in playback.

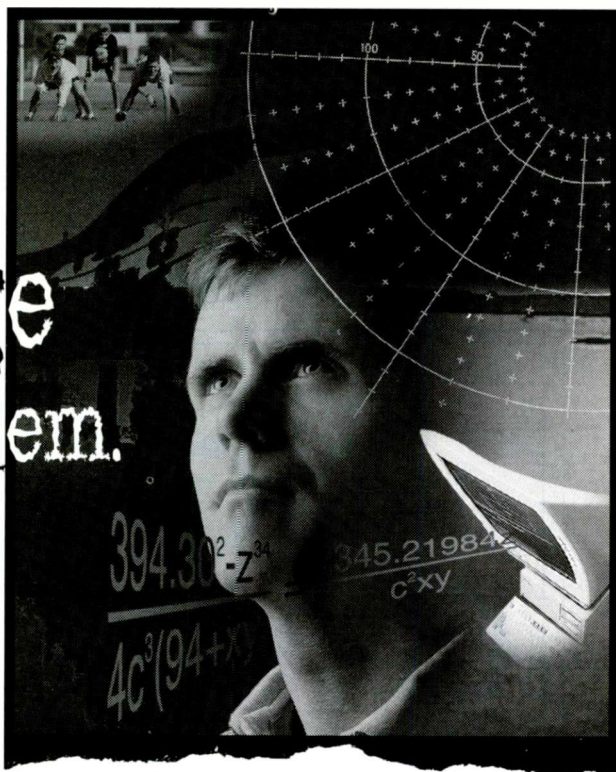
Your gain settings can also be a factor. If the noise you hear originates after the mike stages, you can usually cure it by running the master gain lower and opening up the mike inputs more. (But don't open up the mike inputs to the point of overload.) Also, I wonder if you hear more noise with your Neumanns than with other mikes because of an impedance problem. My Advent preamps, quiet as they are, become noisy if fed by high-impedance sources. See if you can set the U87 mikes to a lower impedance; that would load the input circuits of your mixer, which should lower noise. I wonder if you got better results with the Shure mixer because its inputs could be set to accept high-impedance mikes.

And could it be that your mixer is quiet but your mikes are noisy? The electronics in condenser mikes like the Neumanns can generate noise, especially as they age. **A**

job out at the airport.

work at the garage
can hang out with them.

work at the plant.



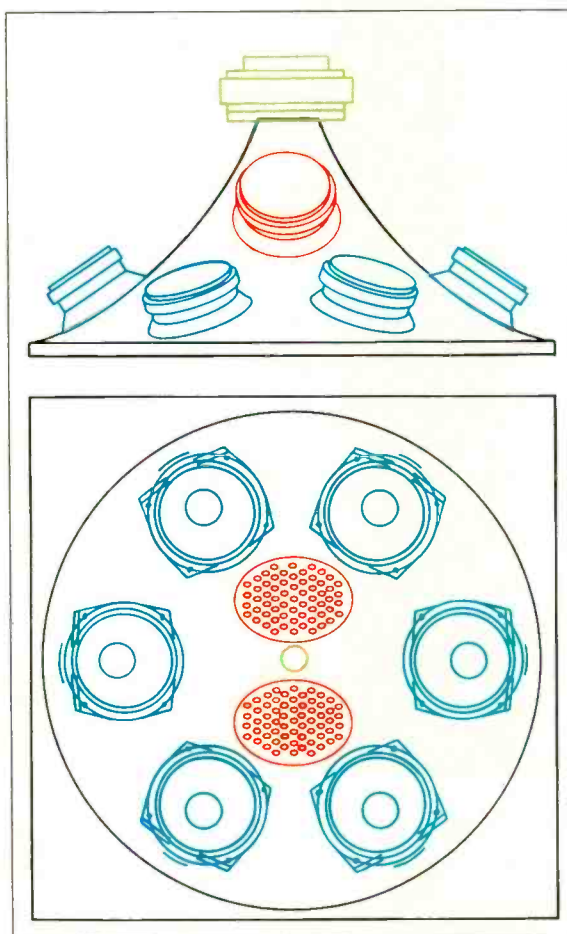
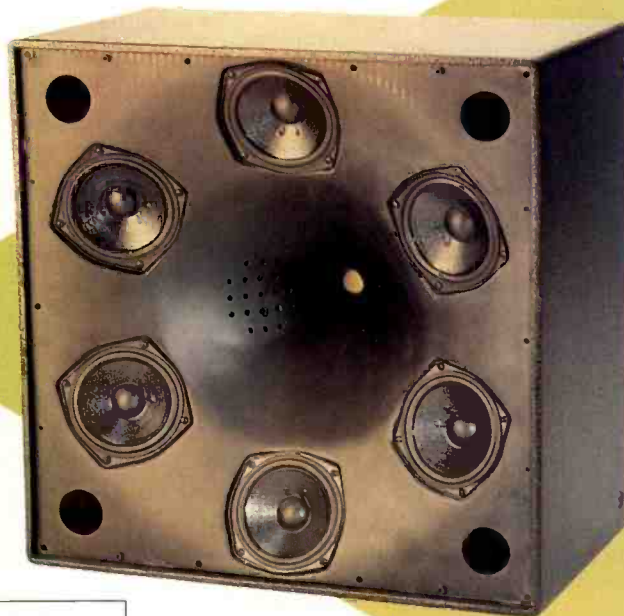
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INSIDE-OUT COAXIAL

The coaxial speakers we consumers buy are usually for cars. Their advantages include low cost, easy installation, and minimal lobing. Similar reasons account for coaxials' use in large, distributed sound systems, such as those in ballroom ceilings.

Similarity, however, is not identity. Ballroom speakers use horn tweeters, which have higher output and higher efficiency than the domes used in car-sound coaxials. Most horns also project the highs in an asymmetrical,



In Eastern Acoustics Works' CP621, the tweeter horn has six woofers mounted around its flared rim.

Two extra drivers in the horn's throat cancel throat reflections.

rectangular pattern, not the circular pattern projected by domes. And the woofers' directivities vary according to the wavelength of the frequencies they handle: The longer bass wavelengths spread around the room, while the shorter waves of the lower midrange tend to beam a

bit. In a car, where woofers are small and listeners sit close to them, this is not a problem; in a ballroom, where woofers are larger and listeners may be 30 feet below, it is.

Eastern Acoustic Works, of Whitinsville, Mass., says it has solved these problems by

turning the coax inside out. In its Model CP621 Phase Aligned Array speaker, the tweeter horn is a large, rounded hexagon for more symmetrical treble dispersion. Six 5¼-inch woofers around the rim of the horn's flare couple together to provide the effective radiating diameter of a 21-inch woofer; this makes the low frequencies more directional. At the same time, the use of multiple drivers—spaced far enough apart that they *don't* couple at middle frequencies—should decrease midrange beaming.

Two more 5¼-inch drivers mounted in the throat of the horn are used to cancel throat reflections from the radially coupled woofers. This technique helps optimize power response below the crossover point.

A neat idea, but don't expect to see it in car stereo: Each CP621 measures about 2 feet square.

OUR CALLING

Somewhere in our Annual Equipment Directory, in last month's issue, are some errors. We don't know what they are, yet, but we assume we made a few—we're human. And if you look real hard, you'll find some errors made by the manufacturers and importers who supplied the data. But the only errors of that kind you'll find will be the ones we failed to catch.

Some errors, we cannot catch. For example, if a manufacturer says he has a 12-inch woofer when he meant to say 10 inches, or his amp delivers 150 watts instead of the 130 he wrote down. But we do note a lot of entries that strike us as errors—and that almost always are.

Take equalizers, for instance. Since the audio band (20 Hz to 20 kHz) is about 10 octaves wide, multiplying the number of equalizer bands by the width of each band should yield a result of about 10. An octave equalizer usually has 10 bands, a third-octave equalizer has 30 or 31 bands, and so on. A 10-band, 1/3-octave equalizer or a 31-band octave model *could* be built, but the former couldn't cover the whole audio band without gaps and the latter's overlapping bands would make it hard to set. So when a few manufacturers gave us answers like those, we called for verification. The reply, each time, was "Oops!" Then there were

THE MISSING LENGTH

The list of blank-cassette lengths has just gotten shorter. Our Annual Equipment Directory lists no cassettes in 45- or 46-minute lengths, though they were quite popular some years ago.

This should be no surprise. The demand for such cassettes came from people who wanted tapes just long enough for copying LPs, most of which ran for more than 30 but less than 45 minutes; for that use, C-60 tapes seemed wasteful. Today, when most recordings are CDs, with a maximum length of 74 minutes or so, it makes more sense to buy C-74, C-75, or C-76 cassettes. Even so, only two companies (Sony and Denon) listed such tapes this year. The most popular lengths are the traditional C-60, C-90, and C-120s.

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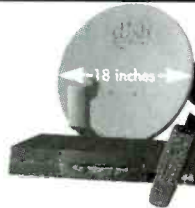
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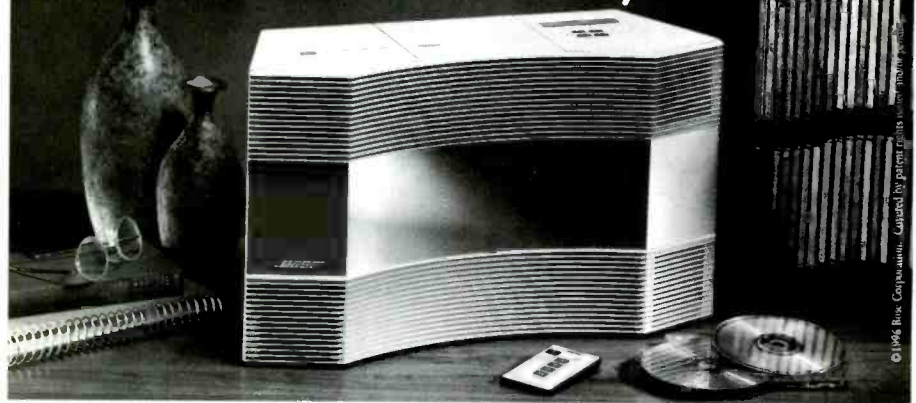
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Beethoven was only 5'4!"



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CLASSICAL MISMATCH

Pop-music stations of all types tend to play best-selling records. (If the station's sufficiently uncreative, that's *all* it will play.) Even the oldies stations play the biggest hits of yore. But commercial classical stations do not.

Over the years, many classical stations have developed rules to keep listeners from tuning elsewhere: no new music or old recordings, nothing in a minor key (especially in the morning), nothing on odd (read: authentic period) instruments, nothing long, and absolutely no vocals.

The catch is that much of this "forbidden" music sells very well. There seems to be a boomlet in historical reissues and in period-instrument recordings. Many modern works are best sellers. And vocals (choral, song, or operatic) have claimed an increasing share of *Billboard's* annual Top Classical Albums chart. In recent years, vocal recordings have gone from one-third to two-thirds of the top 15 albums. And for three years straight, the top-selling classical album of the year has been a vocal.

In *Billboard's* August 10, 1996 issue, Senior Writer Bradley Bamberger found that many classical-radio program directors are aware of—and defend—this dichotomy. A few commented that programming should not be shaped by record sales, as far more people listen to

the companies that stated in one column that their preamps handle only line-level signals—but nevertheless gave specs for MM or MC phono signal-to-noise ratio. (And the ones that said a preamp handles only phono signals yet has tone controls and a tape monitor loop; that would be possible but, again, darned unlikely.) Crossover listings have always been a headache. A typical error there is for a company to say it has a three-way crossover with one fixed crossover frequency. And so on, category after category.

classical radio than buy classical CDs. Tom Bartunek, of New York's WQXR, added that CD listeners can skip tracks they dislike, but FM listeners cannot. Actually, they can—but only by switching stations or turning the radio off, both actions program directors are hired to discourage. College and public radio stations, whose revenues are less directly tied to the sizes of their audiences, tend to be more adventurous.

Anthony Rudel, of SW Networks' syndicated Classic FM, said, "Buying a CD and listening to the radio are two completely different things. Putting on a CD at home is an active listening experience. People use the radio as an accompaniment to other activities."

He has a point. And for each listener there are probably some mixes of music and activity that don't work well. I, for example, cannot write or edit while listening to vocals, even if the language is as incomprehensible as Uzbek to me. But I can drive, swim, carpenter, and do a lot of other things to vocals.

Yet I hope the sense of classical music's breadth doesn't get squeezed out of FM. One of the most magical listening experiences of my life was hearing Bartók's Concerto for Orchestra for the first time, on a Pontiac car radio tuned to WQXR. How likely is someone to encounter that on radio today?

Companies give us wrong information for a number of reasons. Sometimes they misinterpret a question. Sometimes they confuse one spec with another. Sometimes they shoehorn the wrong spec in because they don't have the right one. Often, a product's specs and features aren't finalized by our deadline, so the manufacturers give us a few preliminary details or, in some cases, their best guesses.

We occasionally notice that a manufacturer left important information out, such as a product's unique features (usually be-



cause he didn't know just where they'd fit in) or just what the product happens to be for. If we're familiar enough with the product to spot the omission, we'll call and ask for more details.

Frequently, companies give us information that's correct but makes no sense to anyone outside the company. When they give us proprietary terminology, we'll usually ask them what it means and translate it. If the BlowBox speaker enclosure turns out to be a type of vented box, we'll list it as "vented." Some manufacturers object, but we're actually doing them a favor: The people who already know what a BlowBox is will know that's what we mean by "vented" in that maker's listings; the people who need to get information from those listings the most are precisely the ones who won't know what a BlowBox is.

The fun and easy part of this is calling to find out what a manufacturer intends when his meaning isn't clear or his data seems erroneous. The newer and more innovative the technology, the more likely we'll have to call, because old descriptions don't quite fit new designs. Sometimes a manufacturer will spend a while on the phone working out just how to describe something novel; it's then a challenge for us to boil it down to as few words as possible.

The Directory keeps everyone here busy, every summer. (No one at *Audio* ever gets a summer vacation.) But it's important. From now until next October, we'll be among those looking things up in the Directory, too.

EVOCATIVE AUDIO

It's easy to think of home theater as a video phenomenon. It's not.

It took multichannel sound to turn plain video and TV into home theater. And although today's movies integrate sound and picture better than TV programs (which are mainly illustrated radio), they still depend on sound—especially music—for their full effect.

And audio can sometimes do more to make an experience come alive again than even full-color moving images. I remember keeping photos of a woman who'd broken up with me but erasing all my tapes of her voice. The photos were only artifacts (and her beauty made them well worth keeping); the voice was *her*.

Photograph: ©FPG International, 1996



The Theater

The DSP-A3090 lets you choose from 30 sound field modes. From L.A.'s Roxy and New York's Cellar Club, to churches and concert halls around the world. Seven-channel amplification sends 80 watts to each of the main, center and rear speakers, plus 25 watts to both front effects speakers. Analog, video and S-video, plus RF, coaxial and optical digital inputs link you to today's and tomorrow's Dolby Surround AC-3 components.



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And this is where you park.

We did leave out a few hundred seats, some plush carpet and the kid screaming in the 13th row. But what we've given you instead is something no home theater owner has ever heard before.

- The theater. • It's the expansive acoustic environment that gives a trip to the movies its sense of grandeur. And until recently, it just wasn't possible from a sound system designed to coexist with a sofa, an easy chair and a pair of potted plants. • But that was before decades of Yamaha experience in sound field measuring and processing, custom integrated circuit design and audio microchip fabrication culminated in the new DSP-A3090 Digital Sound Field Processor. Introducing unique technology that creates the unmistakable sensation of a first-run theater's acoustic spaciousness. Combined with the unparalleled accuracy and dynamic range of Dolby® Surround AC-3.™ Every director



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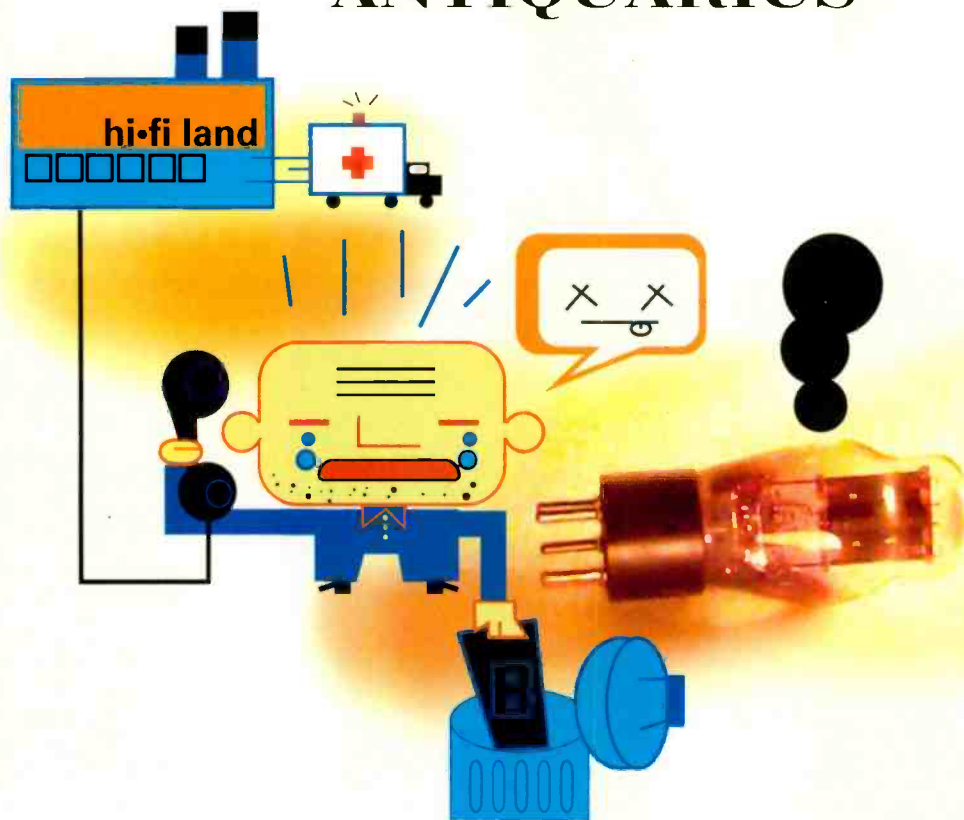
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AUDIOPHILIA ANTIQUARIUS



Keeping tabs on the hi-fi “underground” is much easier when you’re active in it. And for 20 years my pet passion in hi-fi has been collecting, refurbishing, and using vintage audio gear, one of the sub-cults that makes up hi-fi’s underbelly. Which means that I’m (unashamedly) typical of the geeks ridiculed in the best of the audiophile “light bulb jokes.” Substitute “hi-fi journalist” for “audiophile” and you have a gag for a slightly different audience:

Q: How many audiophiles does it take to change a light bulb?

A: Three. One to change the bulb and two to argue about how much better the old one was.

Naturally, vintage hi-fi enthusiasts aren’t too popular with the manufacturers, who’d prefer it if you refreshed, upgraded, or simply updated your system from time to time

**WILL A
FORD DEALER
CARRY PARTS
FOR A '58 T-BIRD?**

with a new purchase. But there are some companies, most notably McIntosh and Quad, that positively relish the fact they have customers for life (many of whom won’t outlive their purchases because Quad and McIntosh products are so reliable). It is, after all, a selling point

you just can’t buy; now that’s an image “to die for.”

Recently, I made the trip up to Quad to speak with Ross Walker. The subject? The continual sniping at Quad because of the company’s current suspension of repairs to the original Quad electrostatic loudspeaker. Quite simply, the diaphragms in the original Quad ESL (1956-1981, R.I.P.) were treated with a chemical no longer produced by the original supplier; at the time of writing, Quad is looking for alternatives. Unfortunately for Quad, the original ESL is one of the most cherished speakers of all time and devoted owners would rather give up music than listen to anything else, so there’s a constant flood of elderly Quads in for servicing. And the owners can get a bit cranky if deprived of their beloved ESLs.

The nature of internet forums is argumentative and too often based on supposition rather than fact. One oft-repeated question is, “Why doesn’t Quad simply utilize the material from the current speaker?” After a few such missives were posted on the Sound Practices forum (sound@mail.tpoint.net) regarding the old Quads, I volunteered to present the questions directly to Ross Walker, of Quad. Rather than quote Ross, whose language can turn salty after a few glasses of wine, I’ll reproduce the salient points of the reply he crafted for that particular forum:

For the last 40 years we have applied a mixture to the Mylar (treble) and Saran (bass) diaphragms, which was based on a compound made by ICI (a large paint manufacturer) and which worked well. This compound is no longer made, and ICI will not make small quantities for use on electrostatic loudspeakers. We now have to find a new material that will give the right resistivity and that does not change significantly with temperature, humidity, or time. Most materials that look promising tend to change with one or more of these factors. The material has to have low mass and be easy to apply to Mylar. It helps if it doesn’t fall off. We now

Illustration: Claudia Newell

have two interesting compounds that appear to have promise, but until we know how they behave in the long term we have to be cautious.

Of course we tried the ESL-63 diaphragm coating, but that has a higher resistivity and does not work adequately in the original ESL. The 63 stator design is completely different, and it is not feasible to make original ESL parts using 63 technology.

We are continuing to research new materials, and we will be successful. We just can't say when. Quad has never promised to supply parts for any product for any length of time, but we do try harder than most companies to offer support to our customers. The original ESL was first manufactured 40 years ago and last manufactured 15 years ago. The fact that we are spending time, effort, and money to find a solution is evidence that Quad has a strong commitment to its customers. Every other manufacturer would tell you precisely where to put a 40-year-old product that needed servicing, and it would need a lot of pushing and shoving to get it there. The Quad ESL-63 continues in production, and we do not have some devilish scheme to try to persuade customers to buy them by taking out the old ESL.

In addition to answering directly the questions about the current state of Quad ESL repairs, Ross also raised a number of questions about long-term ownership, about obsolescence, and—though not stated as such—about this industry's unique position in producing the only consumer goods that are supposed to be immune to obsolescence. Although many would like to think that every hi-fi manufacturer drives around in a Lamborghini, checking the time on a Patek Philippe and patting a bellyful of beluga caviar, a number have been driven into nonprofitability by the unrealistic demands of consumers, who expect the manufacturers to keep their amps or speakers or what have you working for decades and for negligible fees. Or, to put it another way, will a Ford dealer carry parts (and at

reasonable prices) for a 1958 T-bird? What would Jeep say if you were to ask them to upgrade your 1989 Cherokee to 1996 specs? Will Nikon convert your F2 into an F4? Even better: Has Intel offered to upgrade your 286 chip to a Pentium for a nominal—and I mean nominal—fee?

Far be it for me to rail against self-abnegating customer support and upgrade programs that keep stuff alive way past the sell-by date. I admire any company that carries spare parts going back further than the five-to-10-year period that seems to be the industry's arbitrary time limit on such availability. Linn, for example, can and will update any LP-12 turntable, going all the way back to 1972, to current specifications. But how much further than other consumer durables makers does the hi-fi industry have to go to make its customers feel that they've gotten their money's worth?

Take Ross Walker's points and apply them to as many manufacturers as you can in other fields:

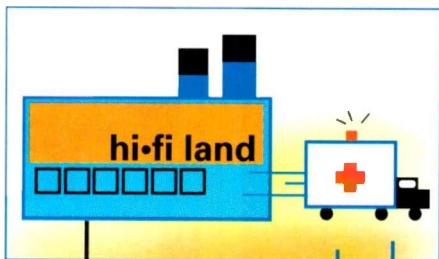
- “Quad has never promised to supply parts for any product for any length of time, but we do try harder than most companies to offer support to our customers.”

He's not kidding, either. A visit to the factory reveals stocks of tubes for the old Quad II, bulbs for the Quad 33 preamp, capacitors for the 303 power amp—all products that never made it past 1980. I shudder to think how much that spares cache is worth.

- “The original ESL was first manufactured 40 years ago, and last manufactured 15 years ago, and the fact that we are spending time, effort, and money to find a solution is evidence that Quad has a strong commitment to its customers.”

Again, irrefutable—unless you can name another company in another field (or in hi-fi, for that matter) still reaching into its coffers to finance the sustenance of equipment that went out of production before the CD was launched.

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•“The Quad ESL-63 continues in production, and we do not have some devilish scheme to try to persuade customers to buy them by taking out the old ESL.”

Again, inarguable. If Quad wanted all of its ESL owners to ditch their speakers in favor of the new model (now in its 15th year), the company would have ceased repairing the old model years ago.

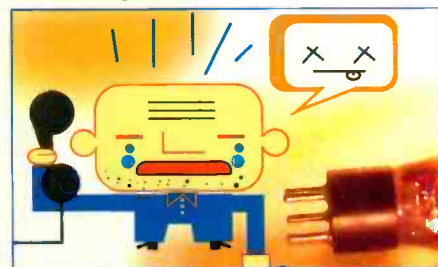
Lest this appear like a love letter to Quad, note that the same concerns apply to any number of other companies old enough to have equipment out in the field nearing its second, third, or even fourth decade of use.

Thorens is still pestered for idler wheels for TD-124 turntables; Acoustic Research—which isn’t even in the same state in which it was established—probably gets the odd request for AR turntable belts and AR-3A tweeters [It does—*Ed.*]; and Revox probably has to maintain a stock of heads for G36 open-reel decks. But what is deemed reasonable, when almost all other industries have a single decade as a cutoff point for parts backup? Are audiophiles as unreasonable as the manufacturers think they are?

One industry insider, who wishes to remain anonymous, told me that most of the

major companies have a policy of holding spares stock for up to five years. He was speaking of his own employer, too. A competitor told me the same. And nobody says a word when they find that, suddenly, his 19-year-old cassette deck or receiver, which he thoroughly abused in college and continued to use into his 30-something/40-something years, is no longer serviceable. If, on the other hand, a high-end manufacturer says that it no longer has parts for a component of similar age, suddenly that manufacturer is deemed a villain. How come?

Simple: The odds are that the high-end preamp or speaker cost a lot more, so the consumer feels entitled to a much longer aftermarket service period. But again, this doesn’t wash with most other industries, regardless of the price of the item. (We’re not talking about the one-to-three-year



**AUDIO CONSUMERS
EXPECT MANUFACTURERS
TO KEEP AMPS
OR SPEAKERS
WORKING FOR DECADES.**

warrantees that come with most consumer goods; the law protects you there, if only up to a point.) Go on: price a replacement front bumper for a 1968 E-Type Jag.

Companies like McIntosh, Linn, and Quad are exceptional. But the rest do their best to keep old gear alive. So if one day you find that you can no longer buy a volume control for your circa 1977 preamp, just divide the original purchase price by the number of years you’ve owned the product. That’s the real price you paid for all that enjoyment: pennies per day.

Then try to think of anything else that gives you so much pleasure for so little outlay. And then give that preamp or turntable or loudspeaker the honorable funeral it deserves. A

“remarkable”...

“flawless”... “astonishing”...

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CIRCLE NO. 31 ON READER SERVICE CARD

BY TOMLINSON HOLMAN

Nearly 10 years ago, *Stereo Review* reported on a listening

Amplifier Design & Sound Quality

test of a number of power amplifiers ("Do All Amplifiers Sound the Same?", January 1987). The test was carefully done, using double-blind comparison, careful level matching, and other experimental controls. Perhaps oversimplified, the results were widely taken to mean the author found that "all amplifiers sound alike."

Is that all there is to it? Is power amplifier design at such an advanced state that amplifiers indeed *do* sound alike? Or, if they can sound alike under certain prescribed conditions, are there other potentially relevant conditions under which they do not? And in that case, what criteria should be used to distinguish them?

In the intervening 10 years, I have determined that many amplifiers may in fact sound alike under certain circumstances—but under other conditions, many do not, and for a variety of reasons. Many of these characteristics were first discovered through listening, and those discoveries verified by controlled listening tests, before a laboratory test was devised

to pinpoint the cause. This is as it should be. Rather than attempting to "hear" a measurement, it is better first to hear a difference on a blind test and then find a way to measure it. No matter how sincere the intentions of the experimenter, seeing a measurement and then listening can lead to the self-fulfilling prophecy that the measurement explains the listening results.

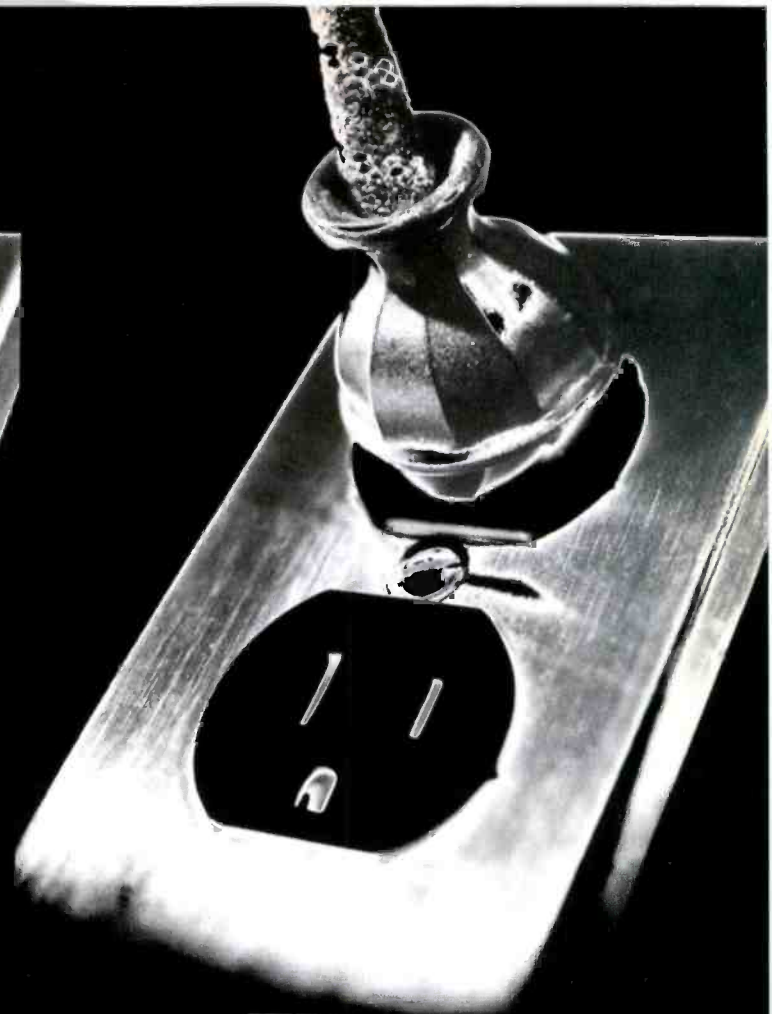
I would emphasize that many amplifier listening tests lack the kinds of experimental controls used in the *Stereo Review* study. This makes it easy for the scientifically oriented to dismiss the work of others with "But did you employ the proper experimental controls?" It is worth noting, however, that crossover distortion in transistor power amplifiers was first discovered, I believe, not by an engineer but by a listener who heard a problem with early solid-state designs. It was only when an engineer measured the right characteristic (low-level distortion) that this "new" distortion came to light and was eliminated as a problem.

On the other hand, valuable as such listening can be, it also has its pitfalls. For example, it has repeatedly been shown that even small level differences can influence the outcomes of listening comparisons, with the slightly louder amplifier winning. So, in order to keep the playing field level, volume differences must first be eliminated. Then, of course, the A/B comparison switching must be shown to be adequately transparent on its own, and other experimental controls, such as blind listening protocols, must be incorporated to exclude other extraneous factors that might bias the results. Controlled listening comparisons serve as a check, validating obser-

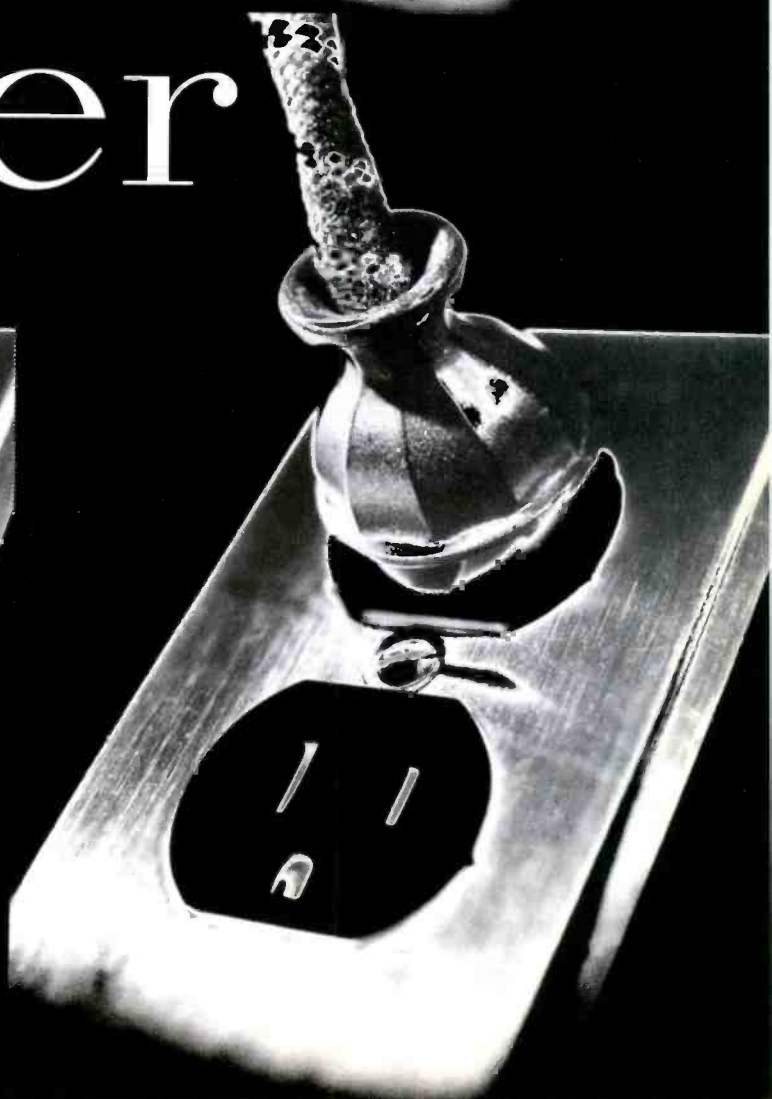
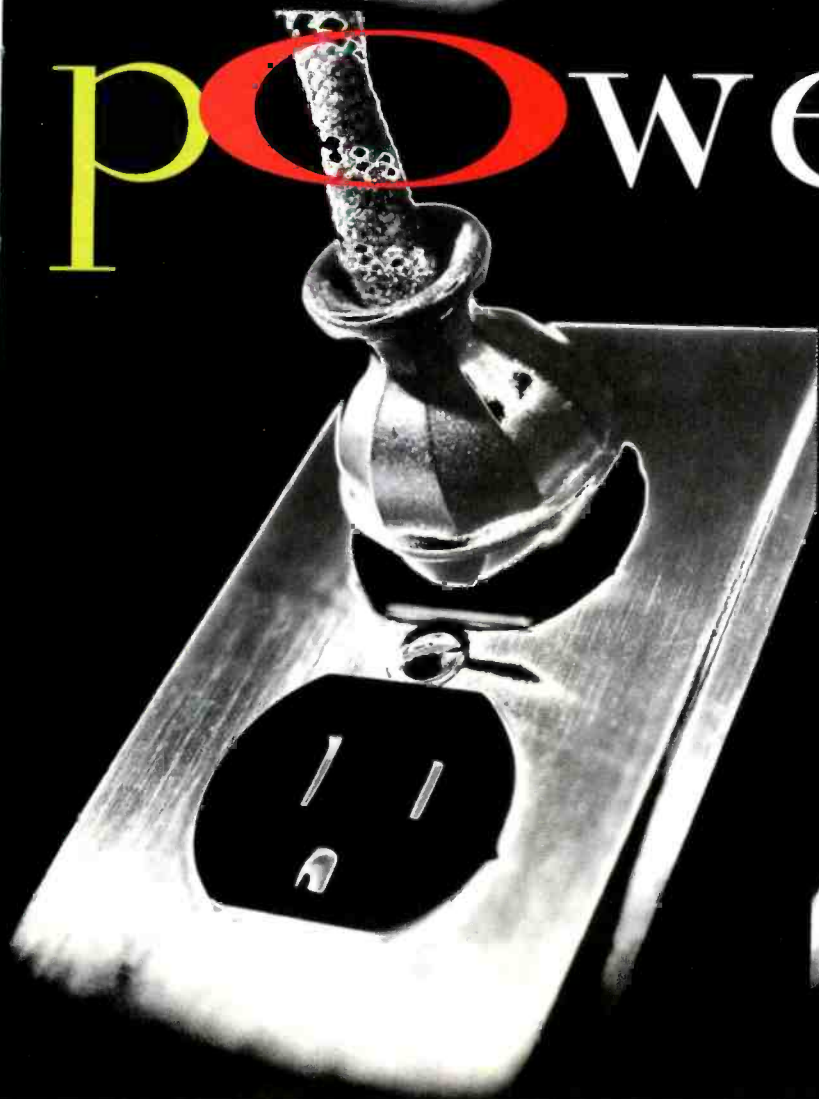
Tomlinson Holman is the President of TMH Corporation. He is a Fellow of the AES "for contributions to amplifier design" and editor of the forthcoming two-volume AES Anthology on Amplifiers.

PHOTOGRAPH: © 1996 LEE FRIEDMAN/GRAPHISTOCK

pure



power



variations of genuine sonic effects while culling out spurious ones that would be a waste of time to investigate further.

With those details out of the way, here are seven factors that have proven to have audible consequences or that there is good reason to believe would influence sound quality under some conditions. They are: absolute polarity, frequency-response vari-

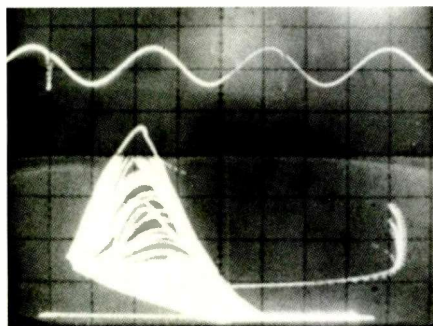


FIG. 1—A PROTECTION-CIRCUIT “SPIKE” ON THE WAVEFORM (UPPER LEFT) AND THE RESULTING VOLTAGE/CURRENT EXCURSION ACROSS THE SAFE OPERATING AREA OF ONE-HALF THE AMPLIFIER’S OUTPUT STAGE (LOWER RIGHT); SEE TEXT. SAFE AREA SCALE: 10 VOLTS PER DIVISION, HORIZONTAL; 5 AMPERES PER DIVISION, VERTICAL.

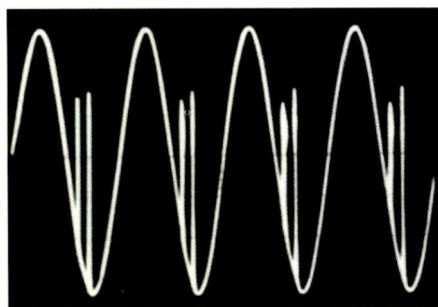


FIG. 2—PROTECTION-CIRCUIT SPIKES IN TWO OTHER POWER AMPLIFIERS.

ations, protection-circuit misbehavior, output power into real speaker loads, behavior when clipped by asymmetrical signals, high-frequency distortion, and noise.

ABSOLUTE POLARITY: While most everyone involved in audio knows about the requirement to keep *relative* polarity (sometimes called phase) correct—by matching speaker wiring across channels, for example—it has also been demonstrated conclusively that the *absolute* polarity of some signals is audible. This means that a positive variation in air pressure (compression) due to sound at the source should be represented by a positive variation from the loudspeaker. Since the entire record/playback chain from microphone to loudspeaker is usually undefined for any individual recording, chances are probably about 50/50 that any particular recording has correct polarity (assuming that the recording can meaningfully be said to have a specific polarity). So the polarity-inversion switch on some preamplifiers might be useful. (If your system lacks this feature, a four-pole, double-throw switch can be wired between your amplifier and the loudspeakers to flip the polarity of both speakers at once. For a wiring diagram, see “Upside-Down Sound,” July 1996.)

Changes in absolute polarity are not, by any means, audible on all recordings for all listeners, but they are audible on *some* recordings for *some* listeners. The reason is that the ear is not equally responsive to positive and negative sound pressures. (The effects of polarity have actually been known for years: In the 1950s, the Todd-AO sound studio checked the absolute polarity of its film sound systems from microphone through to loudspeaker.)

Amplifiers, preamps, and other audio components can invert polarity; an even number of inversions (as when the power amp and preamp both invert) will cancel out, and a system that does invert polarity can be corrected simply by swapping each speaker’s positive and negative wires. But if an inverting amp is substituted for a noninverting one, or vice versa, the change may be audible on that account.

FREQUENCY-RESPONSE VARIATIONS: While most amplifiers have almost perfectly flat response when feeding purely resistive loads, frequency-response variations can occur when feeding complex, real-

world loads. Such effects, when they exist, are usually caused by interactions between the amplifier’s output network and the impedances of the cables and loudspeakers. Most amplifiers have networks of resistors, inductors, or capacitors between the output devices and the loudspeaker terminals. The network isolates the output stage from the direct effects of the wide variety of impedances that could be connected to the amp. For example, if an especially capacitive speaker cable were to be connected directly to the output devices, with no intervening network, the amplifier could oscillate. Such oscillation usually is ultrasonic, so it’s rarely audible, but it may burn out tweeters and possibly destroy the amp.

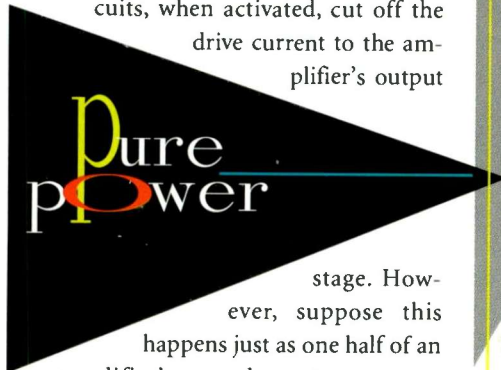
The output-isolation networks, on the other hand, can readily have audible effects, given all the possible cable and loudspeaker combinations that an amplifier may face. The potential for significant impedance interactions between amplifier output and loudspeaker can be evaluated via an amplifier’s high-frequency damping factor, but few amplifier makers list this specification. Damping factor is the ratio of the amplifier’s output impedance to a standard load impedance. The higher its broadband damping factor (not just its low-frequency damping factor), and thus the lower its output impedance, the better an amp can drive a wide range of load impedances without variation of its frequency response. This can be very significant in some instances, since an amplifier’s frequency response *at the loudspeaker terminals* is a critical determinant of its sonic performance. Even a 0.5-dB response difference over an octave or two will be clearly audible. An amplifier with a damping factor that does not remain high across the full audio band is more likely to exhibit such load-induced response deviations than one whose damping factor does remain high.

PROTECTION-CIRCUIT MISBEHAVIOR: For several years, I have been a judge in an amateur loudspeaker design contest (nowadays held by Brian Smith, at Just Speakers, in Concord, California). Since the designs of these speakers are not constrained by marketability, some can present a tortuous load impedance to an amplifier; some well-known amplifiers have simply not been able to drive them properly. If the combination of output voltage and current required to

drive the load with the signal exceeds an amplifier's "safe-area capability," the amp has no alternative but to behave very badly—chopping up the waveform, for instance, sometimes at levels that are not very high. Anyone can easily hear when this happens!

An amplifier's "safe operating area" (SOA) is defined by the voltage and current limitations of its output stage. When these limits are exceeded, catastrophic failure may occur if the amplifier does not protect itself by limiting the signal or shutting itself off. Protection circuits usually operate by monitoring output voltage and current while the amplifier plays, then taking remedial action if either of these parameters goes beyond the safe operating area.

The difficulty comes in defining what remedial action to take. Many protection circuits, when activated, cut off the drive current to the amplifier's output

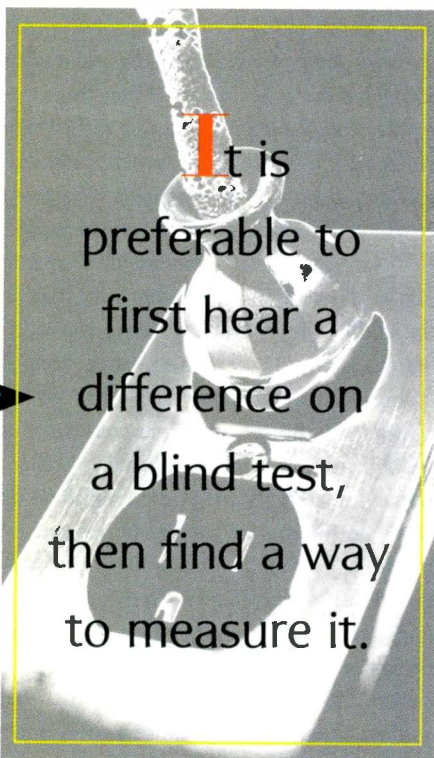


stage. However, suppose this happens just as one half of an amplifier's complementary output stage is feeding current to an inductive speaker load. An inductor's fundamental property is that it opposes changes in current (a capacitor, by contrast, opposes changes in voltage). The protection circuit cuts off the relatively small output-stage drive current in order to get the high current from the output stage to immediately stop flowing into the inductive speaker load. But since the inductive load opposes changes in current flow, the current will continue to flow for a short while, dragging the voltage along with it. Depending on where the current is coming from, this could destroy the amplifier—the very mechanism set in place to protect the amplifier could be its undoing.

Figure 1 shows just such an event. At the upper left is a sine wave with a voltage spike caused by an amplifier protection circuit's attempt to shut the amp down. The lower half shows the safe area of one-half of the amplifier (the other half is symmetrical to it). The brief excursion way over to the right is the protection-circuit spike, pro-

ducing simultaneous high voltage and high current in the output transistors (90 volts at 15 amperes!). Few output transistors will tolerate this for long. Figure 2 shows similar behavior in other amplifiers, each playing into a loudspeaker load.

One way to resolve this problem, often adopted in high-end amplifiers, is simply to put in so many output transistors that protection (other than fuses) is unneeded. But as Paul Klipsch once told me, "Engineering is doing for a dollar what everybody else



does for five." So, while piling on the output devices does keep the output stage within its safe area by brute force, that solution seems inherently inelegant. A better approach is to put in a more than adequate number of output transistors to enlarge the safe area and to disconnect the loudspeaker from the amplifier with a relay when that wide safe area is exceeded. This way, you know that there is no intermediate state where the protection circuit is affecting the sound in any way or making the amplifier less reliable.

OUTPUT LIMITING: When an amplifier is called on to provide more voltage or current than it can deliver, it will clip (flatten) the top and bottom of the waveform. Distortion is high at an amplifier's clipping point and increases rapidly at power levels above clipping.

Not all amplifiers sound the same when clipped. Some amplifiers, for example, have relatively soft clipping characteristics, with distortion rising gradually as the amp's power limits are reached and exceeded; other amplifiers tend to have lower distortion before the clipping point but a much faster rise in distortion above that.

One limitation of the 1987 amplifier listening test was that the amplifiers were never overloaded, or clipped. This seems reasonable at first glance, but, since music is all over the map dynamically and loudspeaker sensitivities also cover a wide range, it is nearly impossible to say that an amplifier will never be clipped during its lifetime of playing music.

It is, however, obvious that the more powerful an amplifier, the less often it will be driven into clipping. If your room, speaker sensitivity, and listening preferences lead you to clip a 100-watt amplifier from time to time, you'll hear less clipping from a 200-watt amp, less still from a 400-watt, and so on. Having adequate power to avoid clipping is certainly important. This can become prohibitively costly, however, especially if the amplifier is overdesigned to achieve it.

In this respect, optimal design depends greatly on the speaker loads the amplifier will be required to drive. For years, amplifier designers concentrated on output power ratings into standardized load resistors (8 ohms, 4 ohms, and so on). Yet speaker loads are not resistors and can require substantially more current than their nominal impedance ratings and Ohm's Law would suggest. So, in recent times, concern has shifted increasingly to having adequate current capability. Unfortunately, I believe the emphasis has now swung too far in this direction. If an amplifier's current capability is translated into doubling of the power output as the load resistance is halved (e.g., 100 watts into 8 ohms becomes 200 into 4 ohms and 400 watts into 2 ohms), users with speakers approximating an 8-ohm impedance are underutilizing the amp's capability. The output transformers on tube amplifiers provided a way around this: Taps on the transformer optimized the amplifier's current-to-voltage ratio for the nominal impedance of the speaker. Hardly any solid-state amplifiers have such a capability, however, with such exceptions as some McIn-

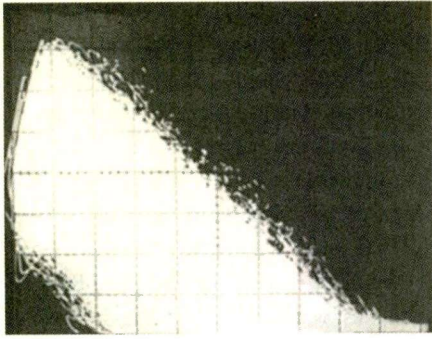


FIG. 3—VOLT-AMPERE PLOT FOR ONE-HALF THE OUTPUT STAGE OF A POWER AMPLIFIER PLAYING COMPRESSED FM MUSIC INTO A HIGH-QUALITY LOUDSPEAKER OVER A PERIOD OF TIME. VOLTAGE ACROSS THE OUTPUT STAGE IS HORIZONTAL, CURRENT VERTICAL.

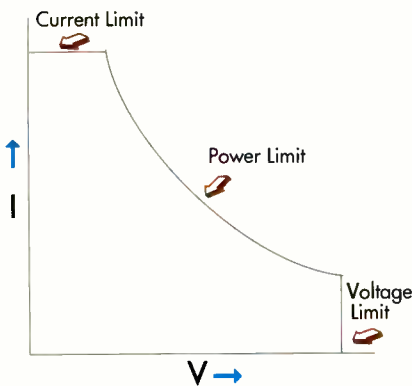


FIG. 4—THE SHAPE OF A TYPICAL VOLT-AMPERE SAFE AREA OF AN AMPLIFIER OUTPUT STAGE. THE LIMITS CHANGE WITH TEMPERATURE AND PERCENTAGE OF TIME SPENT IN EACH REGION.

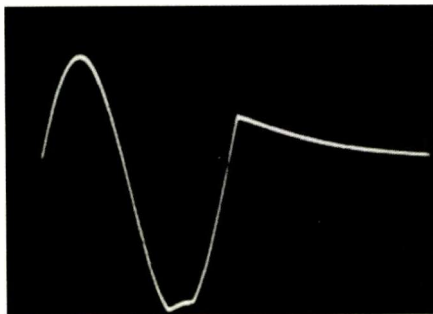


FIG. 5—AN ASYMMETRICALLY CLIPPED WAVEFORM. CLIPPING OF JUST THE BOTTOM OF THE WAVEFORM LEADS THIS AMPLIFIER TO THE DISTURBANCE IN ITS BASELINE FOLLOWING THE CLIP.

tosh models using output autoformers (one-winding transformers) and my own Apt One (whose power transformer could be switched to produce higher current for low-impedance loads or higher voltage for high-impedance speakers).

The ability to drive the actual load impedance of a loudspeaker on real signals I call an amplifier's "elbow room." The reason can be seen in Fig. 3, which shows the excursions caused by a highly compressed FM radio signal into the safe area in one-half of a power amplifier output stage driving a high-quality loudspeaker. Note that the maximum envelope of the excursions forms a more or less straight line, from upper left (high current) to lower right (high voltage). The amplifier is not clipping, but it is playing at a fairly high level. The point at which this envelope intersects the amplifier's safe area curve (of the shape shown in Fig. 4) is not at either extreme, but rather in the middle. Thus, the most relevant consideration is not the maximum voltage output (the basis of conventional 8-ohm power ratings) or the maximum current output (which might be an additional specification), but the power that the amplifier can dissipate *internally* (not the power-output rating). And the power amplifier specification that best correlates with this capability is probably an unexpected one: All other things being equal (such as class of amplification), it is the weight of the amplifier that matters most! That's because a more massive heat sink can support greater power dissipation through the output transistors. But note that the strongest correlation to weight in *Audio's* Annual Equipment Directory (October) is price.

One way around the problem of having to dissipate so much power in the amplifier in order to properly supply the load is more efficient amplification. Most audio amplifiers are Class AB, in which two output halves alternately share the duty of driving the load, with a small, constant bias current to stitch the two halves together without excessive distortion around the crossover. They have more or less fixed power supply rails. The output stage acts as a kind of variable gate between the power supply and the load, and it must dissipate the difference between the two. At the instant of a high output voltage, there may also be a high output current (if the load is primarily re-

sistive), but this is potentially not the hardest signal to handle, because it means that there is little drop *across* the output transistors and so not much resulting power dissipation at that instant. A more difficult situation is the intermediate case, where, say, half of the rail voltage has to be supplied. The current will be lower than in the full-output case, but the output stage has to drop the "other" half of the voltage, and the combination of voltage and current results in real power being dissipated *inside* the amplifier—it gets hot. This is another way to look at the amplifier's safe area.

Now, if instead of Class AB, other classes of operation, such as Class G, are used, which effectively vary the supply voltage with the signal demand, more efficient operation becomes possible and internal dissipation is reduced. This is what makes practical some contemporary high-powered five-channel receivers, which could not otherwise dissipate enough power within their chassis to deliver in the same space and weight what a couple of years ago was only a two-channel model.

CLIPPING BEHAVIOR ON ASYMMETRICAL SIGNALS: Audio signals are often asymmetrical, but virtually no test signals are. While not in the category of high audibility, amplifier misbehavior on asymmetrical signals can be very significant, if only because it can cause loudspeakers to break. Figure 5 shows what happens when a power amplifier is clipped on only one side of the waveform, which could occur with a piano waveform, or speech, for instance. The vertical displacement of the signal and long recovery time after the clip are evidence of a problem. This would cause the connected woofer cone to be pushed out of its box and possibly damaged. I learned about this from a studio application where the user could see there was a problem that was causing his monitors to break. Although the loudspeaker would usually get blamed for failure, in this instance it was a power amplifier flaw that caused the loudspeaker to fail.

The defect was a result of coupling capacitors located where they could take on the wrong charge during clipping and would have to "re-equilibrate" after the clip by charging to a new condition. The remedy for this is to not use coupling capacitors between amplifier stages and to use a DC servo around the amplifier to reduce out-

put offset voltage, rather than a coupling capacitor to break the feedback loop at DC.

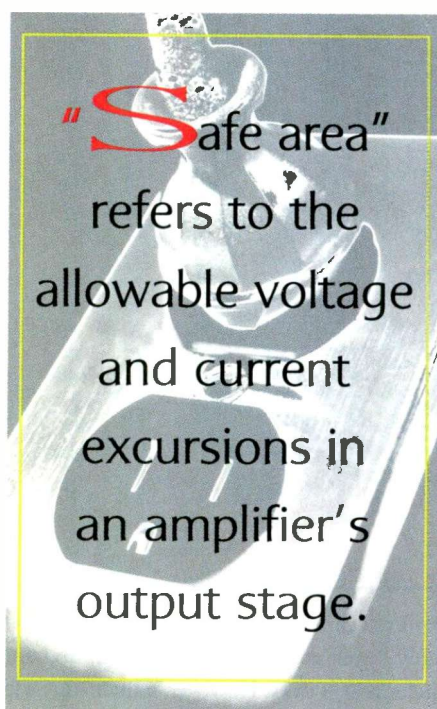
HIGH-FREQUENCY DISTORTION: Amplifiers tend to distort more at high frequencies, largely because their feedback typically falls as frequency goes up (and as the circuit's innate distortion is rising). Above 10 kHz or so, *harmonic* distortion measurements are poor indicators of audible problems, since the harmonics are ultrasonic. But another type of distortion, difference-tone intermodulation, can be plainly audible at high frequencies if it becomes great enough. Difference-tone IM is measured using two high-frequency tones, such as 19 and 20 kHz. If the amplifier is nonlinear, it will produce a 1-kHz difference tone from these two high-frequency signals; since the high-frequency tones provide no psychoacoustic masking at 1 kHz, the 1-kHz tone is audible, whereas simple harmonic distortion from these tones would not be.

Music rarely includes two high-frequency tones that aren't harmonically related, but music signals approximating the characteristics of noise are possible. So a more relevant test might be to drive an amplifier with audio-band noise from which a portion of the spectrum, such as the midrange, has been filtered, to see how much of the filtered frequency region is filled in by distortion products generated within the amplifier. This is a test that potentially could correlate well with listening and that would exercise more distortion mechanisms than simple THD or intermodulation tests. Since no one currently performs such a test, however, high-frequency THD should still be given some weight; it probably does correlate with performance on the noise test, even if it's not directly audible.

There are at least four primary sources of distortion that lead to performance that, if not audibly degraded, is at least not exemplary, and that perhaps could be shown to be audible in some instances by the noise test. One is the basic open-loop distortion, reduced by feedback, but nonetheless present and often dominant. Although all amplifier stages have their own distortion mechanisms, often the high-voltage-gain second stage in power amplifiers is the main source. Here it arises because of the high voltage swing on the output "talking back" to the input of the stage across the collector-base junction of the primary trans-

sistor. One way it can be overcome is by using a cascode connection of two transistors "stacked." In this configuration, the output is better isolated from the input of the stage, with less effect as the output swings across a wide voltage range.

Another source of distortion is lack of drive capability for the output stage. This may happen in both bipolar- and FET-output amplifiers but is a likely culprit in the case of the FET output type. Although the output stage's FET has a very high input impedance at low frequencies, the impedance is capacitive, and so it falls dramatically with increasing frequency. Unless enough drive current is available to charge the capacitance, distortion will result.



A third source is the quality of the amplifier's global feedback resistor. Since there is a very high voltage swing across this resistor in high-power amplifiers, any variation in its resistance with voltage causes corresponding gain changes with voltage, which is another definition for distortion.

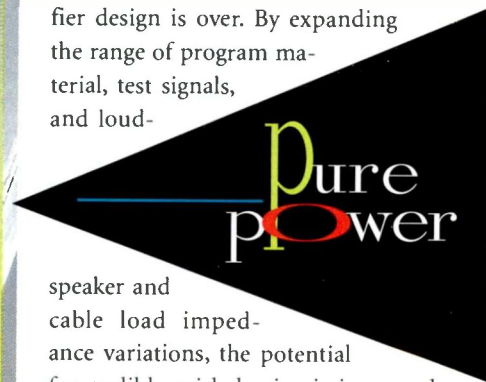
The fourth source of distortion is magnetic fields resulting from the high currents in the wiring and printed circuit board traces. The power-supply lead wires carry current for only half of the signal (for a positive supply, for example) and create a corresponding "half-wave" magnetic field around them. If the magnetic field is intercepted by circuit-board traces, harmonic distortion may be added to the signal.

NOISE: Audible noise, usually in the form of hiss, although very low in many power amplifiers, has come into increasing prominence today. The reason is that there are commonly more amplifier channels in use than ever before, as multichannel audio becomes widespread, and loudspeaker sensitivity for the satellite portion of subwoofer/satellite systems is fairly high by the standards of traditional wideband speakers. These conditions conspire to make amplifier noise audible at levels that previously would have been inaudible.

Any of the seven factors described above could be involved in producing audible differences among power amplifiers. Although we may be at the state where, with good amplifiers driving loads within their capability on controlled program material, they can indeed achieve audible transparency (and thus sound the same at matched levels), that does *not* mean that power amplifier design is over. By expanding the range of program material, test signals, and loud-

speaker and cable load impedance variations, the potential for audible misbehavior is increased. While not all of the amplifier design failings discussed have been shown to produce effects that are directly audible, and some will be relevant only at elevated signal levels or under otherwise unusual or difficult conditions, they still require consideration by anyone seeking a consistently high level of sound quality.

Audio amplifier design seems to follow fashion. A few years ago, it was transient intermodulation distortion (TIM) that was in fashion; today "retro" audio, in the form of low-power tube amplifiers, is making a comeback in the high end. These trends seem to be supported by the inability of the marketplace to absorb more than one idea at a time. In truth, however, amplifier design is always a balancing act, with a great many factors involved. Real but frequently overlooked design problems *can* affect both audible performance and reliability under realistic operating conditions. A



DANIEL KUMIN

PARASOUND HCA-2003 THREE-CHANNEL AMP



Ten years ago a three-channel amplifier might have seemed about as useful to the average audio fan as a three-legged hog (the wonderful joke regarding which will have to appear another time). Today, however, as most anyone who has visited a hi-fi shop or read an audio (or *Audio*) magazine in the past decade can testify, three-channel amps make perfect sense. Take one high-performance, separates-based stereo system, add a three-channel amplifier, mix in Dolby Pro Logic (or Dolby Digital) processing and a few new loudspeakers, and you've made the transition to surround-sound home theater.

The obvious way to deploy such an item is in driving the "front stage" of a home theater—that is, the left/center/right speaker trio that delivers about 85% of home theater's acoustic goods. A typical installation

will relegate the pre-existing (and presumably lower-power amp) to surround-channel ("rear") duty. However, a three-up amp might just as easily drive center and surround speakers in conjunction with a stereo model or surround and subwoofer with another three-ly; you might even buy a three-channel amp to power a stereo-and-subwoofer loudspeaker array, with no thought to surround.

But it seems self-evident that most three-channel jobs are destined for the L/C/R triumvirate. A factor easily overlooked in such cases is the excellent chance that, no matter how elaborate the home theater system in which it finds itself, the amplifier will spend a good portion of its life reproducing plain-vanilla stereo (and even mono) from non-Dolby and classic films, "regular" TV broadcasts, and, of course, stereo music recordings with no surround encoding. Un-

der such conditions the left/right channels of the three-channel amp will need all the headroom and power of an equivalently excellent stereo model.

This would appear to be much the idea behind Parasound's HCA-2003, the latest of the San Francisco firm's High-Current Amplifier series, with its three 200-watt channels. Like many of Parasound's recent models, the 2003 was designed by John Curl, one of the godfathers of modern wideband amplifier engineering. The amp meets Lucasfilm's Home THX criteria for power amplifiers and is so certified, and it is specified as delivering 300 watts per channel into 4 ohms and as having a peak current capacity of 60 amperes per channel.

The manufacturer lists a number of the 2003's technical high points, among which are: independent power supplies for each channel via a common, 1.2-kVA power transformer equipped with separate windings for each channel; 90,000 microfarads of "computer-grade" supply filtering; separately regulated driver-stage power supplies; and "hand-picked," complementary MOS-FET high-voltage drivers.

The Parasound's output devices are 12 complementary pairs of beta-matched, 50-MHz, 15-ampere transistors; these are direct-coupled to the load without benefit of any LCR output networks; "linear-tracking, instantaneous-acting DC servos" perform DC guard duty. Parasound says the input stage is a cascode Class-A circuit, using matched, complementary J-FET pairs, and the company specifies overall operation as "high-bias" Class A/AB. This indicates a substantial zone of Class-A operation,

Rated Continuous Power Output, 20 Hz to 20 kHz, All Channels Driven: 8-ohm loads, 200 watts x 3; 4-ohm loads, 300 watts x 3.

Rated Distortion: Less than 0.05% THD at full power, less than 0.006% THD at typical levels.

Dimensions: 19 in. W x 7 in. H x 16 in. D (48.3 cm x 17.8 cm x 40.6 cm); height with feet, 7 $\frac{5}{8}$ in. (19.4 cm).

Weight: 54 lbs. (24.5 kg).

Price: \$1,650.

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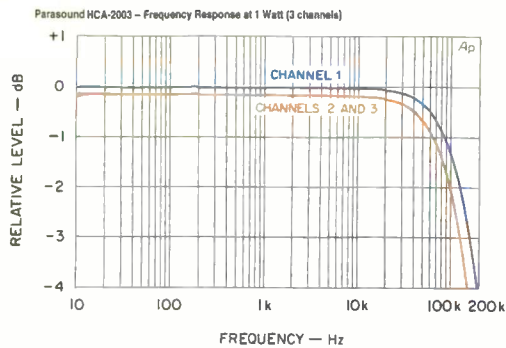


Fig. 1—Frequency response.

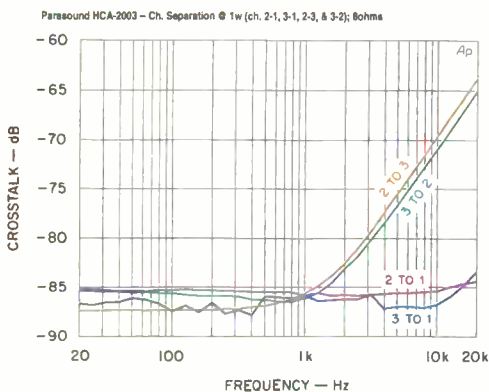


Fig. 2—Channel separation.

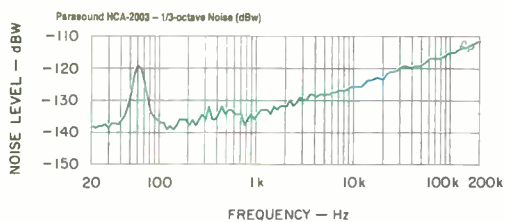


Fig. 3—Noise analysis.

which tends to be confirmed by the 2003's distinctly warm idling and low-output behavior—just cool enough to lay your hand on comfortably for quite a while.

The HCA-2003 is—well, “big” is probably as good an adjective as any. Measuring some 19 x 7 x 16 inches, the amp tips the scales at a hefty 54 pounds. Construction was not fancy but very solid everywhere I looked, sporting heavy-gauge sheet metal front and rear and top and bottom and with very large heat-sink extrusions forming the sides of the chassis. The sinks have generous ribbing 1¼ inches deep, and their profiles are thoughtfully rounded to cut down on the cuts and scrapes that sharp-cornered heat sinks so frequently inflict. I appreciated equally the presence of rack handles both front and rear, which make it almost

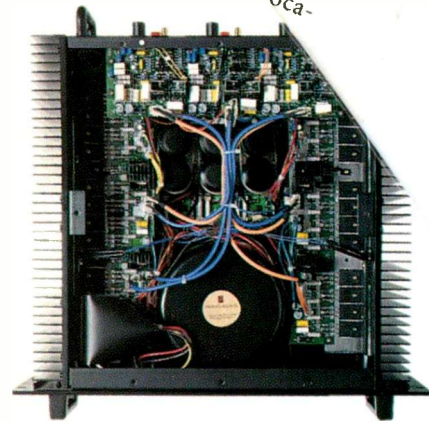
easy for a reasonably fit individual to move the Parasound amp around without a subsequent call to the osteopath. The whole business is painted in basic audio black—once again, not fancy, but professionally applied. And I applaud the use of high-visibility white for the rear-panel lettering, even though the front gets higher-class (but less legible) gold-toned graphics; now, that's thinking.

Front-panel features are limited to a heavy rocker switch for power and five LEDs. One LED glows red for power-on and standby modes, automatically switching to green about 6 seconds after a cold start, as circuits stabilize. Across the way is a trio of red LEDs, marked “Current Overload,” one for each channel. The manual says that these “indicate overload of the power supply just before the onset of audible distortion. . . in virtually all listening situations, these LEDs will rarely illuminate.” Parasound was as good as its word: In all my listening, none of the three so much as glimmered. Later, on the bench, I found out why: Even when the amp was driven into long-term voltage clipping that virtually turned the signal into square waves, the LEDs stayed dark. Putting a screwdriver across an output did the trick, tripping a relay as well.

Around back, the big Parasound supplies identical facilities for each channel: a solid-looking, gold-plated five-way (¾-inch, on-center) binding-post output pair; a high-quality, gold-plated RCA input jack; and a nice, finger-sized knob for input level (as opposed to the screw-trims sometimes found). Each level control is marked “THX Level” at its wide-open position and has generous travel back to zero. There is no facility for channel bridging, which seems sensible enough for a three-channel amp. Filling out the rear panel are a screw-out fuse holder (15 amps) and a socket for an IEC three-wire power cord; the supplied 14-AWG power cable is said to be a “custom designed audiophile-grade” item.

A trip inside the HCA-2003 appeared to confirm its maker's claims as to specific

componentry. It also revealed a considerable regulation of top-quality parts, with grade V throughout and plenty of top-grade parts did not seem to have been applied in bypass caps. Premium components and lower-cost noncritical and used in main circuit boards are locally



**I WAS QUITE IMPRESSED
BY THE HCA-2003'S
EFFORTLESS CAPABILITY
FOR WIDELY DYNAMIC,
FULL-RANGE SOUND.**

and feature some unusually heavy traces on power-transistor and power-supply paths; the relatively limited hand wiring is very tidily terminated, wire-tied, and shrink-tubed into place.

Measurements

It's worth noting that the HCA-2003 survived all the test-bench abuse I could throw its way. This included a certain amount of deliberate stress, as in attempting to light the aforementioned overload indicators, and the odd incident of the accidental variety: principally, one particularly boneheaded moment when I inadvertently sent about 10 volts to its inputs for an extended period—yikes! The Parasound tried mightily for a few seconds to produce the requested 3,000 watts and then shut down, but it powered right back up after a brief cooling-off period (for both amp and operator) without complaint. Interestingly, although the

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

Tower II by Henry Kloss™

Tower II is a three-way system that is substantially larger than *Tower III*. It features two 8" polypropylene woofers, a 5 1/4" polypropylene midrange driver, and a 1" soft-dome tweeter. A flared low-frequency vent is located at the lower rear of the enclosure.

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

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

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Because it has even more cone area, *Tower*'s feeling of "presence" is, if anything, stronger than that of *Tower II*. That presence, when combined with the three-dimensional sound of *Tower*'s bipolar design, results in sound that is nothing short of incredible – *spectacularly* realistic. Available in lacquered walnut or black ash veneers, we think *Tower* is one of the finest speakers ever offered. It is bi-wire/bi-amp capable. **Factory-direct price: \$1,499 pr.**

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CenterStage is a two-way, three-driver center channel speaker that complements our *Tower* speakers. It matches the tonal balance of all three models. Its bass reach is significantly greater than most center speakers, thanks to its dual-vent enclosure. The dynamic range of its long-throw drivers is enough to handle the most demanding of video soundtracks, while their dispersion is broad enough to include all listening positions. It is finished in black vinyl. **Factory-direct price: \$349**

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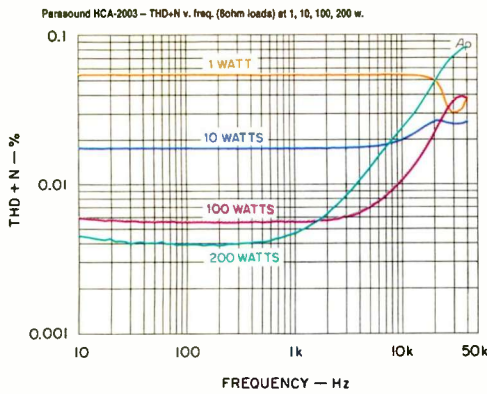
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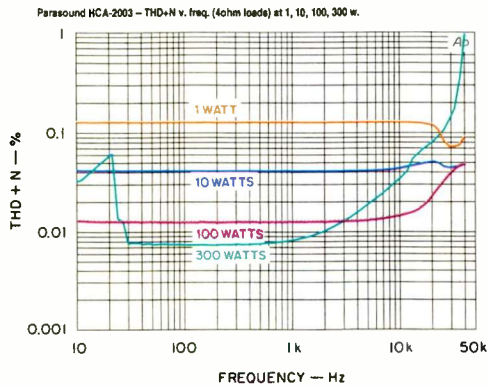
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A



B

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

2003 does *idle* rather hotter than many typical amps, it *ran* surprisingly cool, never getting too hot to at least touch comfortably, even after having run full power on all channels for long periods of time; this, doubtless, was thanks to its very substantial heat-sinking.

Frequency response was very flat at all power levels. Figure 1 shows all three channels at 1 watt; channels are flat to well within 0.1 dB, but a slight channel imbalance puts channels 2 and 3 at 0.12 and 0.16 dB, respectively, below channel 1. On all channels, the -3 dB points were well below 10 Hz and at around 150 kHz, and useful output reached beyond the 200-kHz measurement capability of my generator/analyzer. This is very extended and satisfyingly flat reproduction.

Figure 2 displays channel separation at 1-watt levels into 8-ohm loads; I have only shown four of the permutations, as the others were similar enough to be redundant. This is excellent performance, in my experience, especially for a multichannel amp where space, and hence board-trace routings, can be cramped.

The HCA-2003 proved to be a notably quiet amplifier, with A-weighted noise measuring -99.1 , -99.3 , and -99.6 dBW on the three channels. Figure 3 shows a third-octave spectrum of the noise (also relative to 1 watt), from 20 Hz well into the ultrasonic region. It is very low, and the absence of 120-, 180-, and 240-Hz power-line artifacts is impressive. There is a clear peak at the 60-Hz fundamental power-line frequency, but let's keep in mind that this reaches only -120 dBW!

At rated power, total harmonic distortion plus noise (THD + N) remained below 0.05% with 8-ohm loads and 0.08% into 4 ohms. Figures 4A and 4B show THD + N for the two cases. Note that these plots extend up to 40 kHz (and down to 10 Hz) and that the Parasound maintains good linearity well into the ultrasonic and infrasonic regions (the 4-ohm, 300-watt plot peaks at only 1.4%, just off-scale).

Figures 5A and 5B show the Parasound's power output versus distortion with 8- and 4-ohm loads on all three channels. The closely bundled curves for 20 Hz and 1 kHz are pretty conventional, revealing performance that's dominated by noise right up to the clipping point, with the very direct onset of clipping typical of most solid-state amps. The 20-kHz plots, however, have gradually rising (but still negligible) distortion, beginning at around 100 watts.

The amplifier clipped at about 265 watts while driving 8 ohms and 323 watts with 4-ohm loads, easily meeting its specs of 200 and 300 watts. On IHF tone bursts I saw 288 watts into 8 ohms and 487 watts into 4 ohms, for about 1.6 and 2.1 dB of dynamic headroom, respectively. (A side note: Roughly 1,500 simultaneous watts from one amp is a lot of poop. At full cry, the 2003 sucked down my AC line current by a couple of volts; this surely is representative of real-world conditions, but it might well have done a bit better with a stiffer AC line.)

As is often the case, 8-ohm dynamic headroom compared to steady-state clipping power (as opposed to the on-paper spec's rated power) was practically nil; 4-ohm dynamic headroom above the sine-

wave clipping point was much more substantial. Parasound specifies the 2003's dynamic headroom as "greater than 2 dB," without stating the load impedance; I'm happy to give them the benefit of the doubt here, thanks to the 2003's excellent all-around performance.

Use and Listening Tests

I inserted the HCA-2003 into my usual home theater/hi-fi system, putting it to work driving the three front speakers, currently a pair of B&W 803 Matrix Series 2s with a single B&W HTM center-channel unit. All of these qualify as moderately sensitive speakers, and my usual amplifier (an 80 watt x 6 job that also drives the surrounds) has never seemed particularly underpowered. In the interests of science, I ran the system full-range, with no subwoofer, for most of my listening, in order to

MEASURED DATA

Output Power at Clipping (1 kHz, 1% THD + N): 265 watts/channel into 8-ohm loads, 311 watts/channel into 4-ohm loads.

Dynamic Output Power: 288 watts/channel into 8 ohms, 487 watts/channel into 4 ohms.

Dynamic Headroom: 1.6 dB into 8 ohms, 2.1 dB into 4 ohms.

THD + N, 20 Hz to 20 kHz: At rated power, less than 0.05% into 8-ohm loads and less than 0.079% into 4 ohms; at 10 watts out, less than 0.027% into 8 ohms and less than 0.053% into 4 ohms.

Damping Factor re 8 Ohms: At 50 Hz, 566; at 20 kHz, 354.

Output Impedance: 15 milliohms at 1 kHz.

Frequency Response at 1 Watt: 20 Hz to 20 kHz, $+0$, -0.16 dB; -3 dB below 10 Hz and at 140 kHz.

Sensitivity: 102 mV for 1 watt (0 dBW) out, 1.435 V for rated output.

A-Weighted S/N: 99.1 dB at 1 watt out into 8 ohms.

Input Impedance: 51 kilohms.

Channel Separation: Greater than 74 dB, 20 Hz to 20 kHz.

Channel Balance: Within 0.13 dB or better.

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 Audio Concepts; Long Beach; San Gabriel; Bay Area Audio; San Jose;
 Boots Camera; Fresno; Christian Hansen; West Area; Coast Satellite;
 Atascadero; Santa Maria; Creative Stereo; Santa Barbara; Ventura;
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 CO- Audio Vision; Grand Junction; Lisle Up; Denver; Boulder,
 Colorado Springs; Soundtrack; Denver & Suburbs; Boulder, R.
 Collins; Colorado Springs.
 CT- Al Franklin's; Greenwich; Carlson's Audio Video; Danbury;
 Roberts Audio Video; New London.
 DC- A Suburbs; Myer-Emco.
 DE- Sound Studio; Newark; Wilmington.
 FL- Absolute Sound; Winter Park; Audio Advisors; West Palm Beach;
 Audio Center; Deerfield Beach; Audio Video Store; Tallahassee;
 The Audiohaus; Vero Beach; Cooper for Stereo; Clearwater;
 Hoyt Stereo; Jacksonville; Palm Audio; Destin; Sensuous Sound; Tampa;
 Sound Components; Coral Gables; Sound Ideas; Gainesville;
 Sound Insight; Ft. Pierce; Sarasota; Daytona Beach; Stuart A/V; Stuart.
 GA- Audio Warehouse; Savannah; Ken & Stereo; Jcl.; Macon;
 Laser Disc Enterprises; Atlanta; Mani TV; Columbus;
 Stereo Connections; Valdosta; Stereo Festival; Atlanta.
 HI- Audio Center; Honolulu; Waipahu.
 IA- Audio King; Cedar Rapids; Des Moines; Archer Audio Video;
 Ft. Dodge; Audio Video Logic; Des Moines; Audio Vision; Sioux
 City; Camera Corner; Davenport; Bankers A/V; Iowa City; Waterloo.
 ID- Ultimate Electronics; Boise; Wise Buy; Idaho Falls.
 IL- United Audio Centers; Chicago & Suburbs; Camera Corner;
 Bloomington; Carz & Stereo; Rockford; Good Vibes; Champaign;
 Jon's Home Cl.; Quincy; Sound Forum; Crystal Lake;
 Select Sound; Naperville; Sundown A/V; Springfield.
 IN- Classic Stereo; Ft. Wayne; Mishawaka; Good Vibes; Lafayette;
 King; Great Buys; Evansville; Ovalion Audio; Clarksville; Indianapolis.
 KS- Accent Sound; Overland Park; Advanture Audio; Wichita;
 Audio Junction; Junction City; Manhattan.
 KY- Ovalion Audio; Lexington; Louisville.
 LA- Allerman Audio; New Orleans; Metairie; Lake Charles Music; Lake
 Charles; Sound Advice; Baton Rouge; Wright's Sound Gallery; Shreveport.
 MA- Cookin'; Chestnut Hill; Saugus; Goodwins Audio; Boston;
 Shrewsbury; Nantucket Sound; Hyannis; Northampton Audio;
 Northampton; Pittsfield Radio; Pittsfield.
 MD- Gramophone; Baltimore; Ellicott City; Myer-Emco;
 Gathersburg; Beltsville; Rockville; Soundscape; Baltimore.
 ME- Cookin'; Portland.
 MI- Pecari's; Detroit; Troy; Classical Jazz; Holland; Classic Stereo;
 Kalamazoo; Grand Rapids; Stereo Center; FRAV; Flint;
 Court St.; Listening Room; Midland; Saginaw.
 MN- Audio King; Minneapolis & Suburbs; Rochester, St. Cloud;
 Audio Designs; Winona.
 MO- Independence A/V; Independence; Reference Audio; Sedalia;
 Sound Central; St. Louis.
 MS- Ideal Acoustics; Starkville; McLelland TV; Hattiesburg;
 Players A/V; Ridgeland.
 MT- Aspen Sound; Missoula; Avitel; Bozeman;
 Car & Home Stereo Cl.; Billings; Rocky Mt. Hi Fi; Great Falls.
 NC- Audio Video Systems; Charlotte; Audio Visions; Wilmington;
 Now Audio Video; Durham, Greensboro, Raleigh, Winston Salem;
 Audio Lab; Wilmington.
 NE- Custom Electronics; Omaha, Lincoln.
 NH- Cookin'; Nashua, Manchester, Newington, Salem, S. Nashua.
 NJ- Hal's Stereo; Trenton; Monmouth Stereo; Shrewsbury; Sound Waves;
 Northfield; Woodbridge Stereo; West Caldwell; Woodbridge.
 NM- Ultimate Elect.; Albuquerque; Sound Ideas; Albuquerque.
 NV- Ultimate Elect.; Las Vegas; Upper Ear; Las Vegas.
 NY- Audio Breakthroughs; Manhasset; Audio Dan; Lake Grove;
 Audio Expressions; Newburgh; Audio Junction; Waterford;
 Clark Music; Albany, Syracuse; Stereo Exchange; Manhattan, Nanuet;
 Hart Elect.; Vestal; Innovative Audio; Brooklyn; Listening Room;
 Scarsdale; Rows Camera; Rochester; Speaker Shop; Arnhem, Buffalo.
 OH- Audio Craft; Akron, Cleveland, Mt. Field Hts., Westlake;
 Audio Etc.; Dayton; Classic Stereo; Lima; Paragon Sound; Toledo;
 Threshold Audio; Heath.
 OK- Ultimate Electronics; Tulsa; Photo World; Bartlesville.
 OR- Bradford's HiFi; Eugene; Chelsea A/V; Portland, Beaverton; Kelly's
 Home Cl.; Salem; Larson's; Medford, Roseburg; Stereo Plant; Bend.
 PA- Audio Junction; Pittsburgh; Gary's Elect.; State College;
 GNT Stereo; Lancaster; Hart Elect.; Blakely, Kingston; Hi Fi House;
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 Stereo Shoppe; Selinsgrove, Williamsport; Stereoland; Natrona
 Heights; The StereoShop; Greensburg; Studio One; Erie.
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 SC- A/V Design; Charleston; Custom Theater & Audio; Myrtle Beach;
 Unstair Audio; Columbia.
 SD- Audio King; Sioux Falls; Sound Pro; Rapid City.
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 WA- Aspen Sound; Spokane; Definitive Audio; Bellevue, Seattle; Evergreen
 Audio; Silverdale; Pacific Sight & Sound; Wenatchee; Tin Ear; Kennewick.
 WVA- Sound Post; Princeton.
 WI- Audio Emporium; Milwaukee; Absolute Sound & Vision; Sheboygan;
 Hi-Fi Heaven; Appleton, Green Bay; Sound World; Wausau.
 WY- Stereo; Cheyenne; Cheyenne; Cheyenne; Cheyenne; Cheyenne.
 Puerto Rico- Precision Audio; Rio Piedras.
 Canada- A B Sound; Calgary, Edmonton, Kelowna, Vancouver &
 Suburbs, Victoria; Advance Electronics; Winnipeg; Bay Floor Radio;
 Toronto; Digital Dynamics; Clearbrook; Great West Audio; London;
 Metacore; Montreal; Linton's; New Market Ontario; Peak Audio;
 Halifax; Sound Room; Vancouver; StereoLand; Windsor;
 Treble Cl.; Ottawa.
 Mexico- Contact Grupo Volumen; Mexico City.

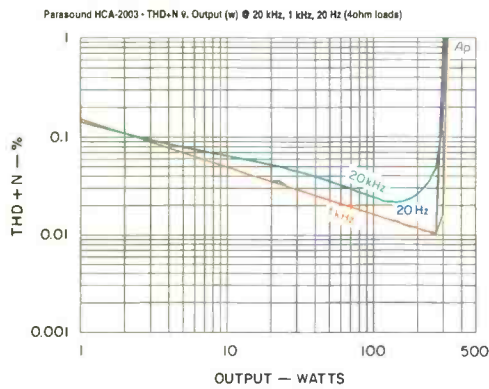
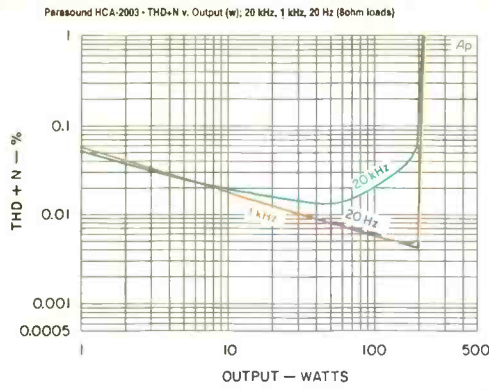


Fig. 5—THD + N vs. output for 8-ohm loads (A) and 4-ohm loads (B).

stress the Parasound as fully as possible and to eliminate any aural confusion; for the same reason I did the bulk of the listening with the surround channels off, in “Dolby-3”-like stereo/surround and three-channel-mono setups. My system’s front end employed Citation’s excellent Model 7.0 preamp/processor and Meridian 508 CD and Marantz LV-500 laserdisc players.

I was quite impressed by the 2003’s rather effortless ability to deliver very widely dynamic, full-range sound in the absence of a subwoofer. The amp played the system loud enough that, even in my largish (about 2,300-cubic-foot) room, identifying the “onset of audible distortion” was to some degree debatable: It might have been the amp, but it might also have been my ears, which seem a bit less receptive to very high SPLs with each passing year. In any event, playing even the noisiest scenes from my favorite big-action laserdiscs, such as the train/bus crash from *The Fugitive*, to name one, and at several dB above the THX reference level (absurdly loud, in all honesty), failed to elicit any audible strain from the HCA-2003 amplifier.

Noise was not a problem with the big Parasound. With the amp idling and my ear to the tweeter, the noise sounded just about perfectly “white” and just barely audible. There were virtually no perceptible hum components, and in contrast to many other multichannel amps I’ve encountered, the 2003 was entirely free of audible mechanical hum or buzz.

On high-impact musical segments, such as the Copland “Fanfare” snippet from Delos’ *Surround Spectacular* demo CD (DE 3179), the 2003 acquitted itself with a smooth, no-sweat delivery of some very substantial, low-end-rich transients. There was no sense of the fat, glugging tinge that even an excellent amp, when momentarily swamped by such transients, tends to display. Clean, natural-ambience jazz ensemble recordings—such as The Holmes Brothers’ *Jubilation* (RealWorld 92127-2), in which the drums and voices are very realistically captured—produced neutral and open sound, free of any “extra” air or brightness yet clear and detailed. Dense, full-orchestra reproduction proved equally clean. Complex textures were transparently rendered in a believable acoustic space. A disc of Nielsen wind concertos and orchestral miscellany (Sony Classical SK 53276) sounded organically whole; the lifelike effects of numerous delicate, low-level flute and clarinet nuances—and of the composer’s characteristic, pressure-wave brass-choir attacks—were about equally notable.

If forced at gunpoint to assign a character to the 2003, I might log it just barely on the “warm and rich” side of the ledger rather than on the “cool and analytically detailed” side. This is not to say that the big Parasound was not transparent, but it did not exaggerate shimmer or airiness and it was reliably free of any sense of hardness or edge. Bottom-octave depth and control were outstanding: If anyone needs an amplifier for a three-subwoofer home theater, the 2003 would seem ideal! As a three-legged answer to some modern multimedia audio needs, Parasound’s HCA-2003 deserves serious consideration.

A Breakthrough! “Definitive’s New BP2002 Achieves An Impossible Dream.”

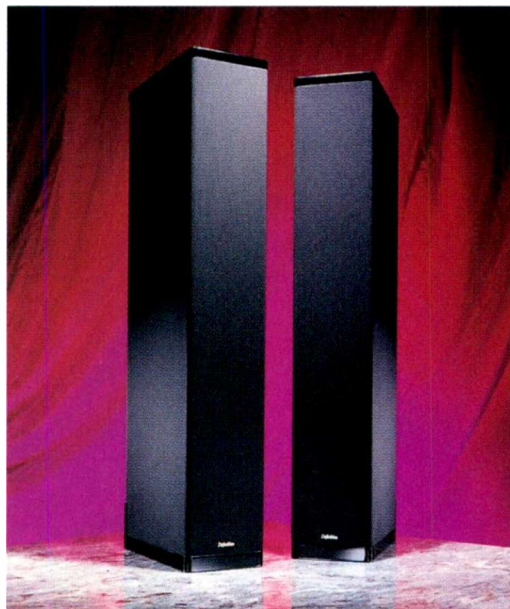
—Peter Moncrieff, *International Audio Review*

At \$999 ea., the bipolar BP2002 with dual built-in 125-watt powered 12" subwoofers approaches the ultimate performance of Definitive’s reference flagship BP2000.

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DIGITAL PHASE AP-2.1 SPEAKER

Like all Digital Phase speakers, the AP-2.1 is sold directly by the manufacturer, rather than through dealers, and uses a patented bass technology called Acousta-Reed. Invented by the company's president and founder, Daryl Powell, this design uses two sets of internal vibrating "reeds," formed by parallel slots cut in two internal wooden shelves, that are said to cancel the back waves of the woofers and improve the system's bass response. The reeds, which couple acoustically to the woofers, are also said to increase the total moving mass of the system and thus enable the use of smaller woofers to reproduce the bass; smaller woofers can provide more uniform coverage and superior transient response.

The AP-2.1, the second version of the AP-2, looks quite similar to the AP-1 that I previously tested (*Audio*, December 1993) and that is still available at \$1,250 per pair. The AP-2.1, however, uses two of Digital Phase's small 6½-inch woofers rather than one in order to provide greater bass output. The speaker is a conventional-looking rear-

ported tower. These shelves (also called baffles, plates, or platters in Digital Phase's literature) have slots cut into them to form a series of eight side-by-side fingers, or reeds. The ends of the six inner reeds are free to vibrate; the two end reeds are attached to the sides of the cabinet.

All internal surfaces of the cabinet, except the inside of the front panel, are covered with sound-absorptive acoustic felt, ¼-inch thick. Even the tops of the shelves



Rated Frequency Response: 35 Hz to 20 kHz, ± 1.5 dB.

Rated Sensitivity: 91 dB at 1 meter, 2.83 V rms applied.

Rated Nominal Impedance: 8 ohms.

Rated Power Handling: 150 watts.

Dimensions: 42 in. H x 14½ in. W x 13 in. D (106.7 cm x 35.9 cm x 33 cm).

Weight: 76 lbs. (34.5 kg) each.

Price: \$1,700 per pair in honey oak or black oak.

Company Address: 6223 Lee Highway, Suite #205, Chattanooga, Tenn. 37421; 800/554-7325.

<http://www.mindspring.com/~dgpow/dphase.htm>

For literature, circle No. 91

ported tower. Its two woofers are mounted above a dome tweeter. Two large, flared port tubes, 1¼ inches long and 3 inches in diameter, are on the rear of the cabinet, just below the input-connection cup.

The AP-2.1's cabinet, built of 1-inch medium-density fiberboard, is very strong. Its ample bracing includes two ¾-inch high-density-fiberboard (HDF) shelves that run from one side of the cabinet to the other, one shelf extending halfway back from the cabinet's front and the other extending halfway forward from the rear.

that form the reed assemblies are covered with this material. (The AP-1 used fiberglass instead of felt for absorption.) The grille is framed in ¾-inch HDF, with plastic projections that mate with holes in the front panel. The drivers are recessed so that their rims are flush with the front panel, which is covered in black vinyl. A heavy, hardwood base extends beyond the edges of the cabinet.

The polypropylene cones of the long-throw 6½-inch woofers are impregnated with carbon fiber. Each cone is anchored to

Photos: Michael Groen



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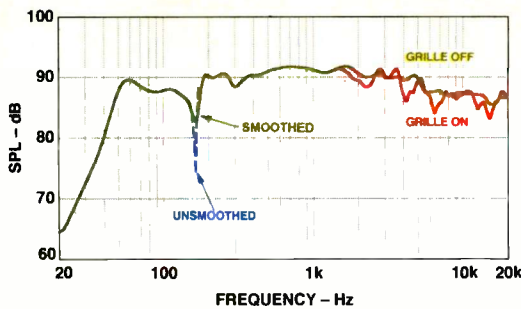


Fig. 1—On-axis frequency response.

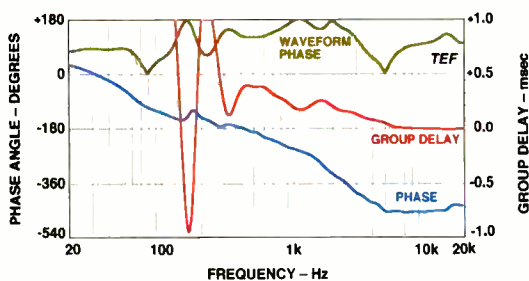


Fig. 2—On-axis phase response, group delay, and waveform phase.

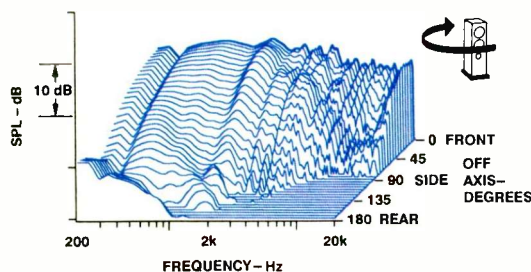


Fig. 3—Horizontal off-axis frequency responses.

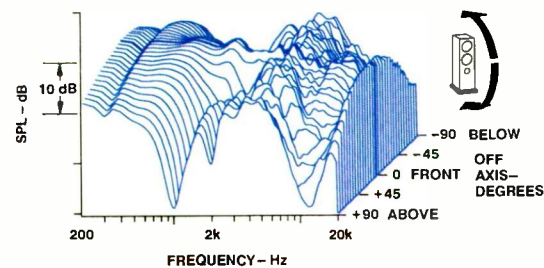


Fig. 4—Vertical off-axis frequency responses.

the woofer's basket by a butyl rubber surround and is driven by a two-layer voice coil wound on an aluminum former.

The 1-inch tweeter's voice-coil former is integral with its spun titanium dome; this one-piece construction is said to be lighter and to dissipate heat better than a conventional two-piece design. The tweeter's dome is protected by a nonremovable screen, which also holds a phase plug in place and is said to improve the tweeter's dispersion. A high-energy neodymium magnet keeps the tweeter small; the magnet is self-shielded. This driver, too, is suspended by a butyl rubber surround.

The AP-2.1's crossover is mounted on a 3¾ x 5½-inch printed-circuit board mounted behind the bottom woofer on the rear panel. Top-quality components are used, including air-core inductors (wound with oxygen-free pure copper wire) and 400-volt metal-film polypropylene capacitors. The crossover is quite simple, consisting of second-order (12-dB/octave) high- and low-pass filters, but its actions are designed to combine with the drivers' own rolloff characteristics to produce an in-phase, fourth-order (24-dB/octave) Linkwitz-Riley acoustic crossover. All internal connections are made with 14-gauge oxygen-free copper audiophile cables, which are soldered to the crossover and input terminals but are connected to the drivers with clips. Input connections are via a large set of gold-plated, bi-wirable binding posts on the rear.

Measurements

The AP-2.1's on-axis frequency response, measured in a large anechoic chamber, is shown in Fig. 1; the measurements were taken at the listening height recommended by Digital Phase, halfway between the two woofers (34 inches above the floor). The main curve, made with the speaker's grille removed,

has been smoothed by averaging with a tenth-octave filter. The dip seen at 166 Hz is sharper than the smoothed curve can show, so I've also included the unsmoothed data in the dip's vicinity. The upper-frequency response with the grille on is also shown unsmoothed.

If you exclude the sharp dip, the smoothed curve fits a fairly tight, 6-dB, window (+1, -5 dB, referenced to 1 kHz) from 47 Hz to 20 kHz. Except for a slight downward tilt of about 1.6 dB/octave above 1.6 kHz and the 166-Hz dip, the overall curve is quite smooth and well behaved. The high-frequency downward tilt could easily be corrected by a slight boost from a typical treble control.

**THE BOX'S SIZE
MADE THE WOOFERS
LOOK SMALL, BUT
THEY SURE DIDN'T
SOUND THAT WAY.**

The grille significantly roughens the response above 2 kHz and adds several fairly narrow peaks and dips of about ±2.5 dB deviation. Above 20 kHz, the tweeter smoothly rolls off and is down only about 12 dB at 30 kHz. Very few dome tweeters are this well behaved above 20 kHz, where most dome resonances occur. Averaged from 250 Hz to 4 kHz (giving equal emphasis to each third-octave frequency band), the AP-2.1's sensitivity measured 90.6 dB, only 1.4 dB below Digital Phase's 92-dB rating. Between 2 and 4 kHz, one speaker was a bit more than 1 dB softer than the other (which is still quite close). But outside of this range, the right and left speakers matched within a very close ±0.5 dB from 100 Hz to 20 kHz.

To check the crossover, I measured the frequency response with the tweeter's polarity reversed, by changing the connections at the bi-wire terminals. Reversing the tweeter's polarity created an octave-wide triangular dip in the response (not shown), centered at 2.6 kHz. Since the dip created by this reversal was only 12 dB deep, rather than infinite, the AP-2.1's crossover is not quite a pure in-phase Linkwitz-Riley type, but it comes very close. The 12-dB dip also

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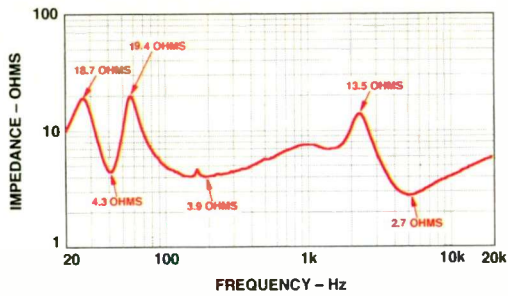
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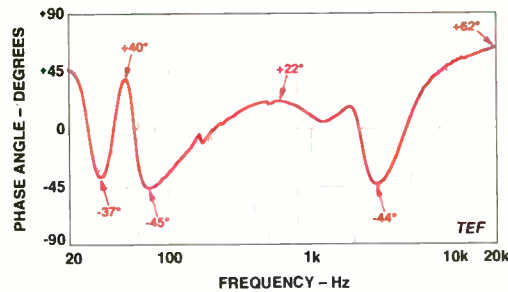
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A



B

Fig. 5—Impedance magnitude (A) and phase (B).

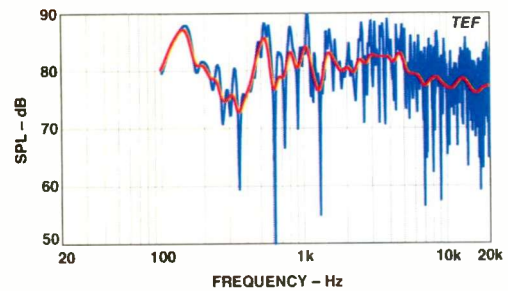


Fig. 6—Three-meter room responses.



Two large, flared port tubes and gold-plated bi-wirable binding posts dominate the AP-2.1's rear panel.

revealed that the AP-2.1's drivers are not quite in phase at crossover; they differ by about 28° when connected properly. This will cause some, but relatively little, lobing at crossover.

What caused the high-Q dip at 166 Hz? By comparing response measurements (not shown) made near the woofer and near the port, I learned that the dip was due to phase interference between the woofers and the radiation from the port. The port's radiation peaked at 166 Hz; this peak had a high Q of about 8, and its output was actually 3 dB greater than the port's output at the speaker's vented-box resonant frequency of 40 Hz! Fortunately, high-Q response dips are far less audible than broader, low-Q deviations.

Figure 2 shows the AP-2.1's phase and group-delay responses, referenced to the tweeter's arrival time. Also shown is the waveform phase, which directly indicates waveshape fidelity in specific frequency ranges. The phase curve is mostly well behaved, except in the vicinity of 166 Hz, and decreases about 210° between 1 and 10 kHz. (When averaged between 1 and 4 kHz, the group-delay curve indicated that the woofer lagged behind the tweeter by a fairly short 0.2 millisecond.) The speaker's curve for waveform phase indicates that waveshapes will not be preserved over any significant frequency spans, but this is normal for conventionally designed loudspeakers. All three curves exhibit significant changes in the vicinity of the 166-Hz response dip.

Figure 3 shows the AP-2.1's horizontal off-axis responses; the bold curve at the rear of the graph is the on-axis response. The curve-to-curve uniformity indicates very wide and even horizontal coverage. In the main horizontal listening window, within $\pm 15^\circ$ of the axis, the response is extremely uniform, with the curves within ± 0.5 dB of one another all the way to 20 kHz!

Figure 4 shows the vertical off-axis responses; the bold curve in the middle of the graph is the response on the suggested listening axis, between the two woofers. The curves are quite uniform except in the range from 3 to 8 kHz, where the response narrows significantly. Fortunately, for angles ranging from 5° below the axis to 10° above it, the response is quite uniform and flat. At angles below -5° , significant dips develop at and near 2.2 kHz. The polar pattern of the speaker through the crossover range is skewed slightly upward.

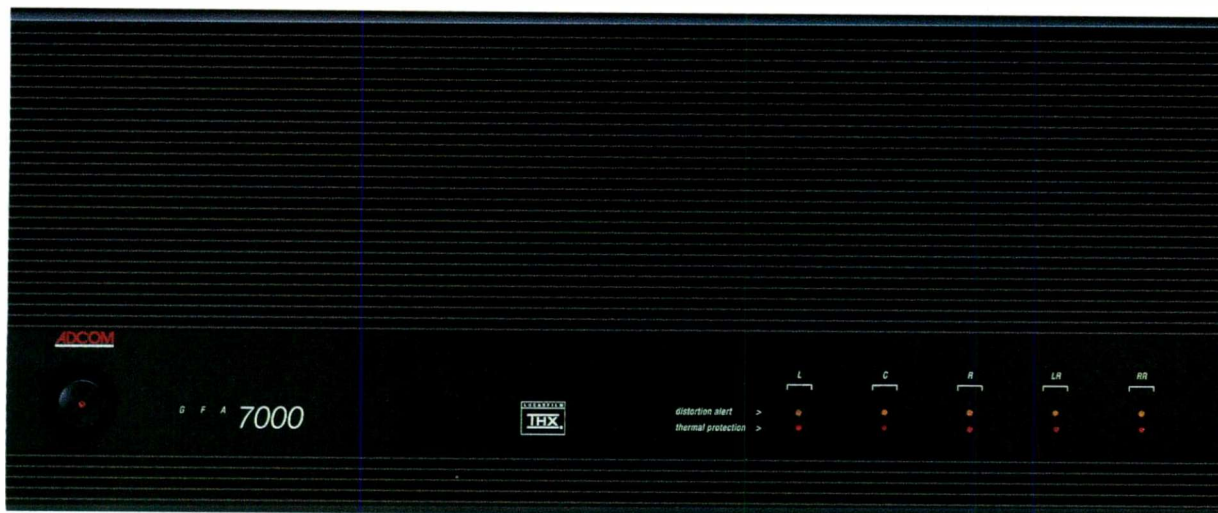
In the graph of the AP-2.1's impedance magnitude versus frequency (Fig. 5A), the two peaks and a dip that characterize vented enclosures are clearly evident below 100 Hz; the dip at about 41 Hz shows the approximate frequency of the vented-box tuning. The maximum impedance, 19.4 ohms, is reached in the bass range at 60 Hz, the vented system's upper impedance peak. The minimum impedance, 2.7 ohms, occurs at 5.5 kHz, just above the crossover. An impedance anomaly is clearly evident at 166 Hz, the frequency of the high-Q dip in the anechoic frequency response.

The AP-2.1's impedance varies over a wide range of 7.2 to 1, so if you want to ensure that your cables cause no response peaks or dips greater than 0.1 dB, cable series resistance should be limited to 0.036 ohm or less. For a typical run of about 10 feet, that would require 10-gauge (or heavier), low-inductance cable.

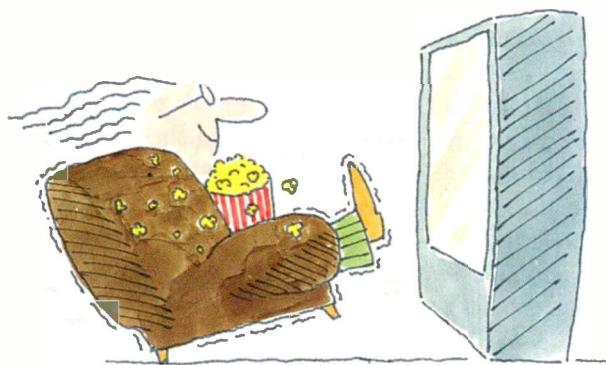
Figure 5B shows impedance phase versus frequency. The maximum phase angle, $+62^\circ$, occurs at 20 kHz; the minimum, -45° , occurs at 70 Hz. A phase glitch occurs at 165 Hz. The wide variations in the AP-2.1's impedance phase and magnitude, and the low minimum of 2.7 ohms, mean that the AP-2.1 will be a moderately difficult load for some power amplifiers. However, any competent high-end amp, used with cables having low resistance and inductance, should drive the AP-2.1 very well.

When I swept the AP-2.1 with high-level sine waves, I noted only one significant box resonance, a slight buzz at about 225 Hz. I was impressed with the speaker's clean output in the bass range above 31 Hz. Port wind noise was very low, and no dynamic offset of the woofers was evident. The vented-box loading worked very well and reduced the cone excursion at box resonance

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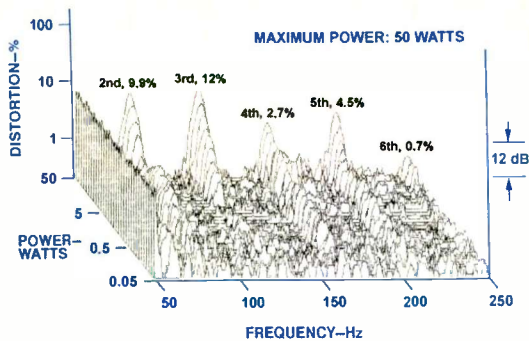


Fig. 7—Harmonic distortion for E_1 (41.2 Hz).

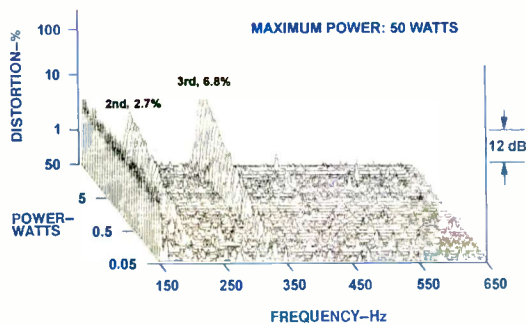


Fig. 8—Harmonic distortion for A_2 (110 Hz).

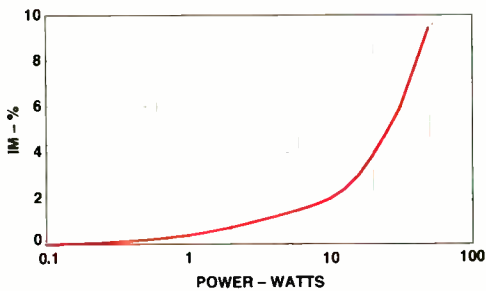


Fig. 9—IM distortion for A_4 (440 Hz) and E_1 (41.2 Hz).

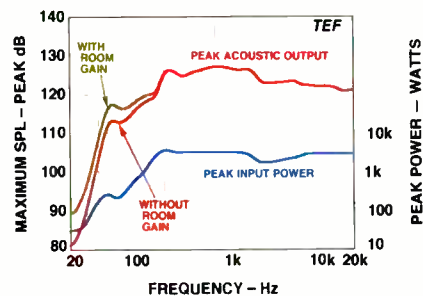


Fig. 10—Peak input power and sound output.

by a significant 66%. A solid reduction in excursion was noted at 42 Hz, the speaker's vented-box resonance. The woofer's maximum peak-to-peak excursion was a healthy 0.53 inch, with moderate distortion.

When I listened from behind the cabinet, where the ports are, the 166-Hz peak in port radiation was quite audible. When the ports were covered, the sound level at this frequency dropped significantly. This indicates some type of internal mechanical or acoustical resonance, such as a standing wave within the cabinet, which can be heard through the port.

Figure 6 shows the 3-meter room curve for the AP-2.1, with both raw and smoothed data. The speaker was in the right-hand stereo position, and the test microphone was at ear height (36 inches) at the main listening position on the sofa. If you exclude peaks at 140 and 530 Hz and a dip at 350 Hz, the averaged curve fits a fairly tight, 8-dB, window. Even if these peaks and dip are included, the curve fits an acceptable, 11-dB, window. The averaged curve is fairly well behaved, although it is a bit rough and exhibits several peak-and-dip combinations and a slight high-frequency depression above 5 kHz.

Figure 7 shows the AP-2.1's E_1 (41.2-Hz) harmonic distortion. The second harmonic reaches a moderate 9.9%, while the third rises to 12%. The fourth and fifth harmonics reach 2.7% and 4.5%, respectively, with higher harmonics below 0.7%. At 1 meter in free space and with 50 watts input, the speaker generates a very usable 100 dB SPL at 41.2 Hz.

The A_2 (110-Hz) harmonic distortion is shown in Fig. 8. The only significant distortion is a low 2.7% second harmonic and a higher 6.8% third at 50 watts input. In free space and with a 50-watt input, the AP-2.1 generates a fairly healthy 105 dB SPL at 110 Hz

when measured from 1 meter away. The A_4 (440-Hz) distortion (not shown) rose at most to the low level of 0.75% second harmonic; all higher harmonics were below 0.4%. The speaker also generated a subharmonic at 220 Hz (half the fundamental frequency) that reached a moderately high 8.8%. This could be associated with the 166-Hz anomaly; I did not investigate further.

Figure 9 shows the IM versus power created by tones of 440 Hz (A_4) and 41.2 Hz (E_1) of equal power, over the range from 0.1 to 50 watts. The IM rises gradually and reaches a moderate 9.5% at full power (a good result, considering that both frequencies are reproduced by the same drivers). Even at that distortion level, the AP-2.1 sounded fairly clean on this test.

Figure 10 shows the AP-2.1's short-term peak power input and output capabilities. The peak input power starts at a moderate 35 watts at 20 Hz, rises quickly to about 280 watts at 50 Hz, falls slightly, and then rises to a plateau of about 3,400 watts between 200 Hz and 1.5 kHz. After falling slightly in the crossover region, it rises again, to about 3 kilowatts, at higher frequencies. With room gain, the maximum peak SPL starts at a barely usable 89 dB at 20 Hz and then rises very rapidly to a plateau of about 117 dB

I WAS IMPRESSED WITH THE DIGITAL PHASE AP-2.1'S CLEAN OUTPUT IN THE BASS RANGE.

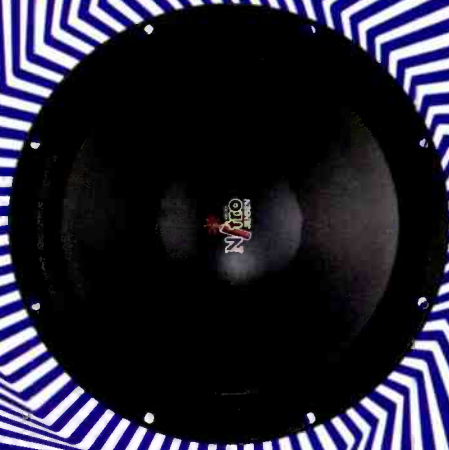
near 50 Hz. The peak output then rises quickly, to a high 125 to 127 dB between 200 Hz and 1.6 kHz, before falling smoothly to about 121 dB at 20 kHz.

The signals used for the peak input and output tests are sixth-octave tone bursts. When the AP-2.1 was driven with the 160-Hz burst, much hangover and smearing could be seen on the oscilloscope and heard. In all other bands, the AP-2.1's output was quite clean; the start and stop of each burst were reproduced very accurately.

Use and Listening Tests

The AP-2.1 speakers are very handsome, attractive, and solidly built. Digital Phase is

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to be commended for its cabinetry, workmanship, and choice of wood finish. The honey oak finish of my review units was gorgeous, while the cabinets' curved surfaces contributed very positively to the fine styling. The solid-oak base fit the look perfectly. Everyone who saw these speakers commented on their good looks.

The woofers seemed quite small compared to the size of the box, but they did not sound small when I fired up the AP-2.1s in my listening room. The bass was very clean and extended and compared extremely well with the bass of my B&W 801 Matrix Series 3 speakers. On some music, such as rock and jazz, I actually preferred the bass of the Digital Phase speakers. Only on program material that had significant bass below 30 Hz was the AP-2.1 bested by the 801.

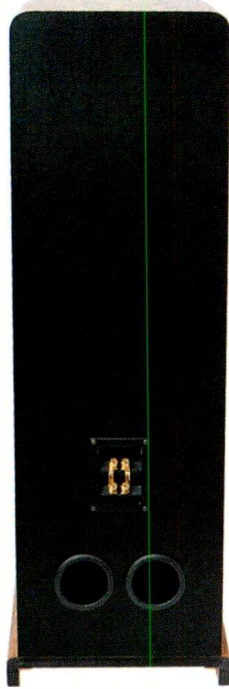
The Digital Phase owner's manual, which covers the whole AP series, is a 19-page booklet. It discusses wiring and connections, placement, cleaning and finish, technology, and the warranty. The informative section on speaker placement suggests playing a test CD that has a range of low-frequency test tones and moving the speakers around until you find a spot where the test tones are about equally loud. Digital Phase suggests placing the speakers symmetrically (both the same distance out from the wall behind them and equidistant from the side walls) and aiming them in toward the listener. Thus, their axes will cross at or in front of the primary listening position. The manual also suggests using absorption and diffusion to tame reflections from hard surfaces.

I listened to the Digital Phase speakers with gear that included the Krell KRC pre-amp and Crown Macro Reference power amp, Straight Wire Maestro cabling, and the B&W 801 Matrix Series 3 speakers I use for comparisons. I placed the AP-2.1s about 7 feet apart, 2½ feet from the side walls, and 4 feet from the wall behind them; I aimed them toward my listening position. Connections were not bi-wired. I listened from a couch about 7 feet from the speakers.

I started with an excellent blues sampler disc from Boston Acoustics, *Up Close 20 Featuring Mighty Sam McClain* (Audio-Quest 1031). McClain's voice sounded very clean and well balanced, while the bass was robust and smooth. The AP-2.1s actually reproduced the low bass at a slightly higher

level than the B&Ws. The acoustic guitar was reproduced crisply, with good delineation of the strings. Relative to the B&Ws, however, the treble was somewhat subdued overall.

On another excellent, very clean, minimalist-recorded sampler, *Reel One* (Pope Music PM2002), soprano Lori Lieberman's voice on the first three tracks came through clean and clear, with no harshness. On track 2, where Lieberman sings a duet with herself, both parts were very distinct tonally



With flawless imaging and soundstaging, great bass performance, and some mighty fine looks, the Digital Phase AP-2.1 stands tall.

and could be followed easily. The percussion on the *Carmen* ballet music, tracks 4-7 of the same disc, was very dynamic and exhibited a powerful bass underpinning.

The AP-2.1s also performed excellently on the pink noise stand-up/sit-down test, their timbre remaining essentially unchanged when I stood up. The horizontal coverage was likewise excellent. Octave-to-octave spectral balance on pink noise was good, exhibiting minimal tonality (the treble was, again, more subdued than on the B&Ws). Except for really low bass, below 30 Hz, the AP-2.1's output was slightly greater than the 801's.

On third-octave, band-limited pink noise, the AP-2.1s generated no usable bass output in the 20- and 25-Hz bands, quite usable output at 32 Hz, and robust bass output at 40 Hz and above. Once I matched the AP-2.1 and 801 midrange levels (which required attenuating the AP-2.1s by 4 dB), the Digital Phase speakers were noticeably

louder than the B&Ws at 40 and 50 Hz and were slightly louder in the 63-Hz band. Port wind noise was very low.

While the anomaly noted earlier at 166 Hz caused a sharp dip in the anechoic response, it increased the output in the 160-Hz band when I listened to band-limited noise in a room. When I played my special 6½-cycle tone bursts (on *Test CD for Sound Reinforcement Systems*, available from Synergetic Audio Concepts at 812/923-0174), the 160-Hz tone burst sounded quite smeared on the AP-2.1s, somewhat like a bongo drum being hit. The 801s, however, sounded quite clean and crisp on this signal, with sharp attack and decay. Blocking the AP-2.1's ports by stuffing them with towels considerably reduced the 160-Hz bongo-drum sound. Could I hear this problem on normal program material? Most times not, but I could hear problems in the upper bass that added a heaviness and bloatedness to male speech and some music. (Room effects tend to mask response problems in this frequency range.)

The AP-2.1s handled music that stresses many speakers, such as loud rock with heavy bass, easily and with much aplomb. And these Digital Phase speakers handled classical music with heavy bass (such as large kettle drums and pipe-organ pedal notes) equally well.

Are the Acousta-Reeds responsible for the AP-2.1's excellent bass performance? My tests suggest not, and I suspect that the shelves within the cabinet, by lengthening the path through the enclosure, may be responsible for the 166-Hz anomaly I found. I think the AP-2.1's outstanding bass performance results simply from its application of a well-designed vented box, driven by a pair of well-designed, high-excursion, low-distortion woofers. The AP-2.1s performed flawlessly in other respects as well, such as imaging and soundstaging, center-image stability, smoothness, and the ability to play loud and clean. Can I recommend the AP-2.1? Very much so, but with two reservations: its subdued high end (which is easily corrected, if desired, with a slight treble boost) and its lower mid/upper-bass resonance problem (which is not so easily corrected). Still, the AP-2.1's combination of stunning good looks, extended and powerful bass response, and excellent overall performance is hard to beat at its price. **A**



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MARANTZ DP870 DOLBY DIGITAL SURROUND DECODER



While billed as a Dolby Digital (AC-3) demodulator/decoder, the Marantz DP870 can also serve as a complete surround controller for home theater systems that lack 5.1-channel control facilities. Based on the Zoran DSP chip, the DP870 can decode Dolby Digital surround programs whether they arrive in RF

form from a laserdisc (the only way they're available at the moment) or as straight digital bitstreams from future sources such as DVD and HDTV. It can also accept discrete 5.1-channel audio signals from DTS decoders or other systems yet to come.

Three inputs are available for AC-3 signals: the RF input for laserdisc players and both optical (Toslink) and coaxial (RCA-jack) digital inputs for future Dolby Digital sources. Each input can be selected independently, so one can connect up to three Dolby Digital sources and switch among them with the DP870's selector.

Since laserdisc players convey Dolby Digital on an RF carrier, the DP870 demodulates such signals internally to isolate the bitstream for decoding.

In addition to three Dolby Digital inputs, the DP870 has six analog audio inputs, which can be used to connect another 5.1-channel decoder or for pass-through of the output from a Dolby Pro Logic or other surround processor. When the input selector's "Bypass" button is pressed, sound fed to these audio inputs is routed directly to the six output jacks and thence to whatever amplifiers are downstream.

This arrangement enables the DP870 to be used with a variety of other equipment—for instance, an A/V receiver that has a six-channel direct input, such as the Marantz SR-96 that I reviewed in August, or the company's SR-870 or SR-770 models. In this case, you'd use the receiver normally for conventional program material and select its six-channel input to listen to Dolby Digital flowing from the DP870.

You can also use the DP870 with an A/V preamp/processor (the Marantz AV-600, for example) coupled to independent power amps or with earlier generations of A/V receivers, such as the SR-92/SR-92 Mark 2 or SR-82/SR-82 Mark 2. For that matter, you can use the DP870 with *any* A/V receiver or integrated amp that has pre-out/main-in jack pairs for the five main channels and a subwoofer output connection. In such cases, you'd route six-channel audio from the processor/preamp or receiver preamp outputs to the DP870's six audio inputs and feed signals back to the receiver (or to separate power amps and a powered subwoofer) from the DP870's six output jacks. To listen

to Dolby Digital Surround, you'd choose the AC-3 source with the DP870; for non-encoded or Dolby Pro Logic Surround, you'd switch the DP870 to "Bypass."

Also note, however, that the Marantz DP870 controls only *audio* signals; video switching remains the province of the A/V receiver or ancillary processor/switcher. Depending on the system configuration, you may have to change the settings of both components to switch program sources and

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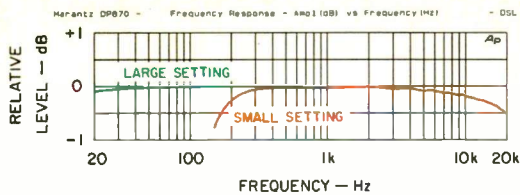


Fig. 1—Frequency response, Dolby Digital (AC-3) mode.

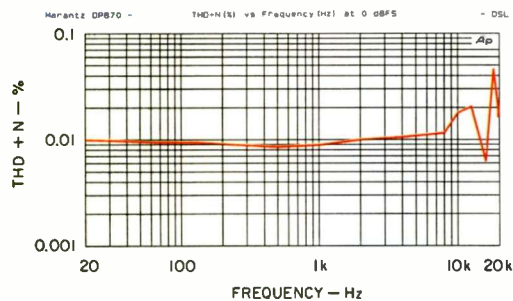


Fig. 2—THD + N vs. frequency, D/A converter.

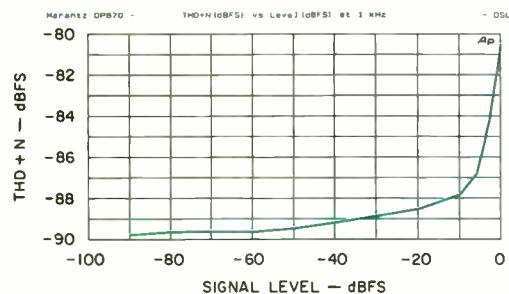


Fig. 3—THD + N vs. output level.

get the sound and picture you desire. For example, if you are watching a laserdisc and either forget to switch the DP870 from “Bypass” to “RF” (or to choose the six-channel input if you’re using a receiver so equipped), you’ll be hearing Dolby Pro Logic surround, not Dolby Digital. This can be confusing until you get used to it, but it’s unavoidable when audio and video portions of a program are split and handled by separate components.

In addition to the six audio input jacks and corresponding output jacks (all gold-plated RCAs), there is a two-channel line output (also using gold-plated RCAs) that, according to the manual’s clumsy translation, “provides two channel audio output of Dolby Pro Logic encoded signal, when the unit is in the ‘Bypass’ mode. When the unit is in other mode, these jacks provide only left and right signal of decoded Dolby

digital.” I haven’t figured out a use for these jacks (except possibly to feed a system in another room), but they’re there.

Two RC-5 remote control jacks (the only non-gold jacks) are provided to transfer remote control signals to and from the DP870. A slide switch above the jacks chooses whether the DP870 responds to internal or external control.

The speaker-setup controls, on the back panel, consist of two two-position and two three-position slide switches. The switches are labeled “Front Spk.” (“Large/Small”), “Surr. Spk.” (“Large/Non/Small”), “Center Spk.” (“Large/Non/Small”), and “Sub. W Spk.” (“On/Off”). When set to their respective “Small” positions, bass below 100 Hz is redirected from the front, center, and surround channels to the subwoofer. When the center or surround switches are in the “Non” position, full-bandwidth audio is redirected from the selected channels to the front. The switches don’t operate directly on the signals but actually set the DP870’s microprocessor; in fact, the changes don’t take effect until you’ve turned the system off and on. An unswitched AC outlet rated at 200 watts is provided by

Marantz as a convenience.

The front panel has a power switch on the far left, a master volume on the far right, and, to its left, an array of six level trim controls, one for each channel, each with a center detent. To the left, near the power switch, is an array of buttons, and above them a corresponding set of display lamps. The left button selects delay time (0, 5, 10, or 15 milliseconds), the next four choose the input (“Bypass,” “RF,” “Optical,” and “Coaxial”), and the last two initiate “Test” and “Mute.” An extra lamp in the display indicates the presence of an AC-3 signal. (The remote control was not available in time for my review, so I have no comment on its operation.)

Measurements

As I’ve mentioned more than once, the laserdisc that Dolby Laboratories produced

to evaluate AC-3 decoders leaves much to be desired. For example, the response sweeps are so rapid that the Audio Precision System One has difficulty keeping pace and ceases to track the sweep as soon as the response deviates from “flat.” For similar reasons, crosstalk and distortion measurements on Dolby Digital are confined to one frequency (1 kHz) and one level (0 dBFS).

Since the Marantz DP870 has digital as well as RF AC-3 inputs and, if fed a 16-bit linear PCM signal from a CD player, will dutifully return it to the analog domain, I decided to test this system both as an AC-3 decoder (using the Dolby test laserdisc) and as a linear PCM decoder utilizing the CBS CD-1 test CD as a source. This enabled me to evaluate the performance of the D/A converters, digital filters, and analog output electronics more fully than is possible using the Dolby disc. That’s important, because 16-bit linear PCM data is reconstructed from the Dolby Digital bitstream by the Zoran chip and converted back to analog by these very same D/A converters.

I’ve divided the data table into two parts to indicate the conditions under which the data were collected. All the graphs shown were taken using the CBS test CD as a



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source, but I did run response sweeps using the Dolby Digital test laserdisc and tabulated the range over which the Audio Precision System One tracked and the maximum deviation in response over that range. The sweeps taken using the Dolby test laserdisc overlay those using the test CD so closely



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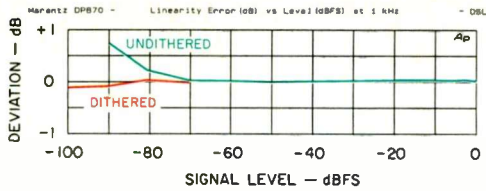


Fig. 4—Deviation from linearity.

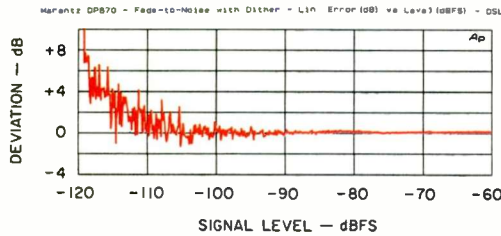


Fig. 5—Fade-to-noise test.

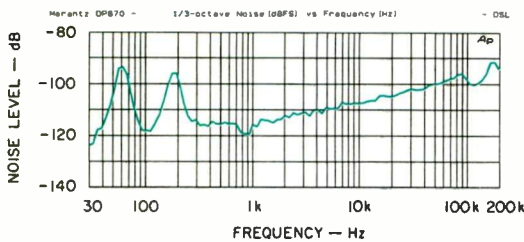


Fig. 6—Noise spectra vs. frequency.



Inputs for three Dolby Digital sources are on the back panel.

that I think it's safe to assume that the response of the five main channels is essentially as shown in Fig. 1—i.e., flat within +0 dB, -0.5 dB from 20 Hz to 20 kHz. The main curve in the figure was taken with the front speaker switch in the "Large" position; the secondary curve that begins to roll off just above 200 Hz was taken with the switch in the "Small" position.

For the record, I took all data with the volume fully advanced and the level-trim controls for the five main channels set at their center detents. As you can see from the table's "Dolby Digital Characteristics" section, the output levels in the five primary channels were matched within ± 0.42 dB,

while the low-frequency effects (LFE) output was almost 9 dB higher, so I turned the LFE trimmer fully counterclockwise to bring its output essentially in line with that of the primary channels. In general, the trimmers have a range of just under ± 10 dB.

Note also that the table shows there's more than adequate output level (3.16 volts), and the channel separation measured at 1 kHz in the AC-3 mode is excellent. Worst-case separation (right front to left front) is 77.7 dB, with most of the numbers about 10 to 20 dB better than that.

Total harmonic distortion plus noise (THD + N) at 1 kHz and 0 dBFS, using the Dolby Digital signal, are tabulated for each channel. (The datum for the LFE channel is taken at 30 Hz.) Within the limits of measurement error, THD + N in the left-front channel using the Dolby Digital test laserdisc agrees with the corresponding datum taken using the CD test disc. The latter indicates that, on a single-channel sine-wave basis, the D/A converter and analog electronics, rather than the Zoran AC-3 decoder, set the performance limits.

Referring now to Fig. 2, you can see the D/A converter's THD + N versus frequency measured using the 0-dBFS tracks of the CBS test CD. Over most of the audible range, distortion barely exceeds 0.01% and, except for a bad point at 18 kHz where the beat product reaches 0.0485%, contamination hardly tops 0.02% under worst-case conditions. I consider that pretty darned good performance.

Figure 3 shows THD + N versus level at 1 kHz, again using the CBS test CD as a signal source. Distortion drops rapidly from -80.4 dBFS at 0 dBFS (equivalent to 0.0095%) to -86.8 dBFS (0.0091%) at -6 dBFS. This suggests that at maximum output the analog electronics may be contributing a bit to overall distortion. From -30 dBFS to -90 dBFS, THD + N remains below -88.8 dBFS.

Figure 4 shows linearity error versus level using the undithered recordings of the CBS CD-1 disc to -90 dBFS and, separately, the

dithered signals from -70 dBFS to -100 dBFS. As you can see, the results are superb. Linearity error is nonexistent to -70 dBFS in either case and to -80 dBFS on the dithered tracks. Linearity error on an undithered -90 dBFS recording is less than 0.7 dB, and that figure drops to 0.14 dB when

THE DP870 HAS GREAT DYNAMIC RANGE, IT'S CLEAN, AND IT'S QUIET.

dither is added. Even at -100 dBFS, linearity error is a mere 0.17 dB on a dithered signal. Superb performance!

Figure 5 shows a fade-to-noise plot taken on the left-front channel, while Fig. 6 is a $\frac{1}{3}$ -octave spectrum analysis of residual noise in that channel. As you can see from Fig. 5, linearity error averages a mere 1 dB at -110 dBFS. Figure 6 suggests the presence of some magnetically-induced hum at 60 and 180 Hz, but there's no trace of power-supply ripple at 120 Hz and its harmonics. The whole lay of the noise curve is quite "low," and very smooth, which helps deliver the excellent 97.8-dB A-weighted signal-to-noise (S/N) figure shown in the table. Quantization noise, which includes conversion artifacts, is higher (-85.7 dBFS), but this figure is nothing to sneeze at. Dynamic range measured according to JIS standards is a superb 89.6 dB unweighted and 95.9 dB A-weighted.

Use and Listening Tests

Clearly, the Marantz DP870 breezed through the bench measurements without a hitch. But from the human-engineering viewpoint, there are a few complaints (although "complaint" might be a tad too strong a word). I've already outlined the potential confusion that may arise with thinking you're listening to an AC-3 laserdisc in Dolby Digital when in fact you're really listening in the Pro Logic mode. The DP870 isn't alone in this regard; it's a common logistical problem whenever an outboard decoder/processor is integrated with existing equipment. Still, Dolby Digital Surround laserdiscs have been with

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MEASURED DATA

D/A CONVERTER CHARACTERISTICS

Output Impedance: 470 ohms.

Frequency Response: 20 Hz to 20 kHz, +0, -0.5 dB.

THD + N at 0 dBFS: Less than 0.0485%, 20 Hz to 20 kHz.

THD + N at 1 kHz: From 0 to -90 dBFS, less than -80.4 dB; from -30 to -90 dBFS, less than -88.8 dB.

Maximum Linearity Error to -90 dBFS: Undithered recording, 0.69 dB.

Maximum Linearity Error to -100 dBFS: Dithered recording, 0.17 dB.

A-Weighted S/N (Infinity Zero re 0 dBFS): 97.8 dB.

Quantization Noise: -85.7 dBFS.

Dynamic Range: Unweighted, 89.6 dB; A-weighted, 95.9 dB.

DOLBY DIGITAL CHARACTERISTICS

RF Input

Maximum Output Level at 1 kHz: Main

left front at 0 dBFS, 3.16 volts.

Output Level re Left Front: Right front, -0.51 dB; center, +0.06 dB; left surround, -0.78 dB; right surround, -0.73 dB; LFE, +8.87 dB.

Frequency Response: Left front, 20 Hz to 18.2 kHz, +0, -0.45 dB; right front, 20 Hz to 18.8 kHz, +0, -0.43 dB; center, 20 Hz to 18.7 kHz, +0, -0.41 dB; left surround, 20 Hz to 18.7 kHz, +0, -0.40 dB; right surround, 20 Hz to 18.7 kHz, +0, -0.40 dB; LFE, from below 20 Hz to more than 78 Hz, +0.15, -0.13 dB.

THD + N at 1 kHz, 0 dBFS: Left front, 0.0091%; right front, 0.0095%; center, 0.0110%; left surround, 0.0112%; right surround, 0.0084%; LFE at 30 Hz, 0.0525%.

Channel Separation at 1 kHz: Minimum, 77.7 dB (right front to left front); maximum, 112.3 dB (left front to LFE).

us for some time now, and AC-3 has been selected as the primary audio system for DVD in North America and other NTSC markets. (And despite the last-minute efforts of the DTS camp to muddy the waters, I expect the FCC will stay the logical course, keeping Dolby Digital as the audio standard for HDTV.) By now, I would have hoped that current-generation A/V receivers and outboard boxes would have been integrated

to the extent that they would automatically detect the presence of an AC-3 bitstream and choose it over Dolby Pro Logic. The task isn't difficult; it just requires some foresight.

I'm also somewhat put off by the front-panel level-trim controls. If you use the DP870 with the Marantz SR-96 receiver (reviewed in the August issue), you can leave the trimmers at their center detents and calibrate the system using the latter's noise sequencer and electronic level controls. That's because the SR-96 stores the level setting for each channel separately for its six-channel input. But with a less adroit receiver, or with separates,

you must use the DP870 trimmers to calibrate. That's a nuisance. Panel knobs are easy to knock out of whack, and setting them in the first place becomes a two-person operation—one at the controls, the other either listening or watching a sound-level meter at the primary viewing location.

'Nuff complaints already! The Marantz DP870 tests exceptionally well, and it is a remarkably fine-sounding decoder. And

THE MARANTZ DP870 TESTS EXCEPTIONALLY WELL, AND IT IS A FINE-SOUNDING DECODER.

its six-channel pass-through switching capability makes it unusually versatile. It may not have the front-channel time-alignment adjustments of some other Dolby Digital Surround decoders, but

it's got great dynamic range, it's clean, and it's quiet. And, who knows, maybe some of that good sound is because Marantz chose not to use electronic level controls. (They have been known to induce noise and distortion, after all.) When integrated with the SR-96 A/V receiver (which is how I used it and how many Marantz enthusiasts will), most of my complaints fade into oblivion. **A**

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PASS LABORATORIES ALEPH-P PREAMP



The Aleph-P was the first preamp produced by Pass Laboratories. The company says "it integrates power MOS-FET devices and single-ended Class-A operation in a simple topology in order to deliver the most natural sound possible." The excellent owner's manual goes into great detail about the philosophy of the design as well as how to use the preamp. The manual is not dry and humorless but

sounds like a real human being wrote it. (Nelson Pass, in fact, was the author.)

The control setup is a bit unusual. Between the input selector at the left and the overall volume ("Level") control on the right are knobs for left- and right-channel gain. Having gain controls enables you to optimize the match between the input signal level and the rest of the preamp. This prevents overloading the gain stages and matches the signal to the "Level" control (which follows the active circuits) so that you won't be stuck using just a few steps at one end of the control's range. Having separate gain controls for each channel lets you use them to adjust balance, too. Both the signal-selector and "Level" knobs can be rotated continuously, with no end stops, since they are actually digital encoders that operate via a microcontroller. A ring of blue LEDs around each of these knobs shows the input selection and level setting. A sensor for the supplied remote (which controls in-

put selection and volume) is centered in the front panel.

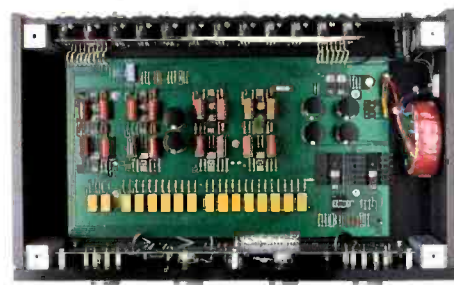
The four inputs and the main and tape outputs are represented on the rear panel by pairs of XLR balanced jacks above pairs of high-quality RCA unbalanced jacks. (The Aleph-P comes set up for unbalanced input signals, with U-shaped, gold-plated jumpers shorting pin 1 to pin 3 in each of the XLR balanced input connectors. To use the balanced inputs, you merely remove the shorting jumpers.) An AC power-cord socket and line fuse holder are also on the rear panel.

Construction of the Aleph-P is beefy and robust, to put it mildly. The front panel and side pieces appear to be of 1/2-inch-thick aluminum, and the top and bottom covers and rear panel are made of 1/4-inch alu-

minum, all bolted together with Allen-head machine screws into inch-thick bars at each enclosure corner.

There are three printed-circuit boards inside the Pass Labs preamp. One of them, on the inside of the rear panel, links all the input and output connectors and signal-switching relays. The main board, which fills most of the chassis bottom, is a beautiful study in layout functionality and simplicity. The third p.c. board interconnects the front-panel controls and indicating LEDs. It also carries the microcontroller that operates the attenuator and source-selector relays according to the position of the front-panel "Level" and source-selector knobs. A generous-sized toroidal power transformer is mounted to the preamplifi-

UNIQUELY, THE ALEPH-P HAS ACTIVE CIRCUITS SANDWICHED BETWEEN TRUE GAIN CONTROLS AND AN ATTENUATOR.



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Dimensions: 19 in. W x 4 in. H x 11½ in. D (48.3 cm x 10.2 cm x 29.2 cm).

Weight: 25 lbs. (11.3 kg).

Price: \$4,000.

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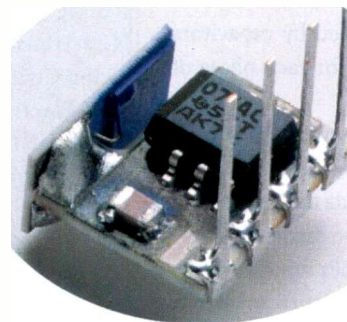
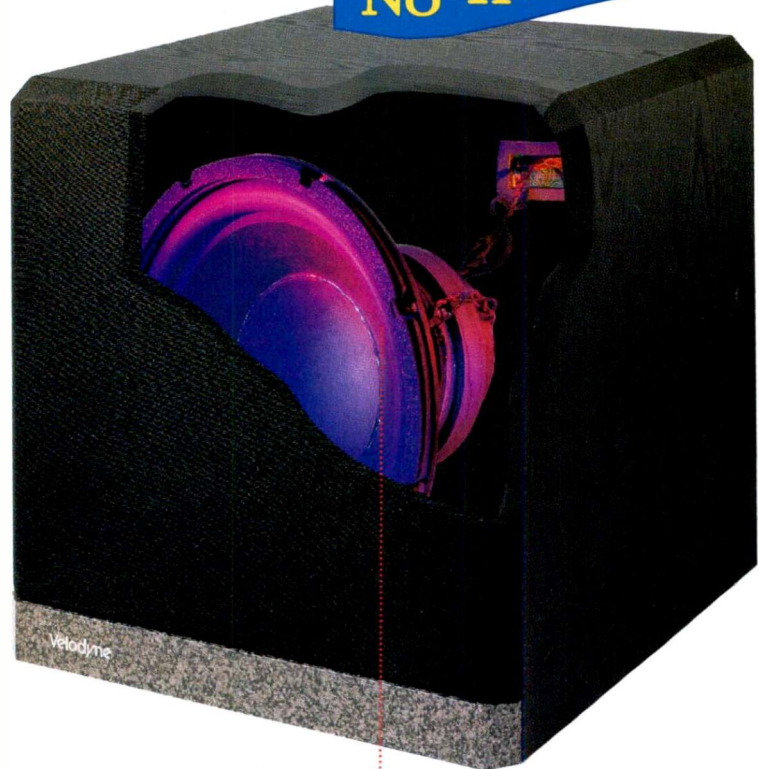
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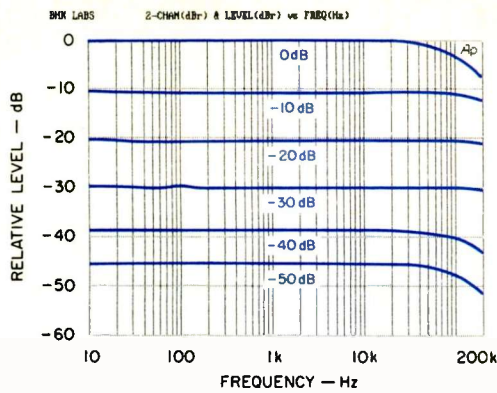


Fig. 1—Frequency response at various level settings.

er's right side piece. Construction and parts quality are of a high order.

Circuit Highlights

The Aleph-P's circuitry is completely balanced, from input to output, which is uncommon. Its overall topology, however, is not just uncommon but definitely unusual. In virtually all other preamps, the signal passes from the selector switch through balance and volume controls and then into the line amplifier. In the Aleph-P, the selected signal is applied directly to the input of the line amplifier, while the front-panel "Level" knob indirectly (via the microcontroller) operates a relay-controlled output attenuator that feeds the preamp's main outputs.

The circuitry for the line stage is a single-stage differential amplifier using a pair of MOS-FET transistors. The drain of each MOS-FET is fed from a MOS-FET constant-current source, and each source is connected to a MOS-FET constant-current sink. The drains are coupled by capacitors to the output attenuators for each phase of the signal.

Negative feedback is applied from each MOS-FET's drain back to its signal input gate. Since the drain outputs are opposite in polarity to these gates, the feedback is inverting, which calls for series input resistors for voltage (as opposed to current) drive. These resistors determine the preamp's input impedance. Their values are set, in conjunction with the circuit's relatively low open-loop gain, to produce nominal unbalanced input impedance of 10 kilohms and balanced input impedance of 20 kilohms.

An interesting attribute of such a circuit is that its gain can be set by the amount of

resistance connected between the sources of the MOS-FETs. In fact, that is exactly what is done by the front-panel gain controls. These controls enable optimum adjustment of circuit gain for different signal-source levels so that the output level control and amp stage are in their optimum operating ranges. The manual for the Aleph-P states that it can drive low-impedance loads without distortion and can even drive a 0-ohm mixer junction without any distortion!

The Aleph-P's outputs are automatically muted at turn-on, turn-off, and any time the AC line voltage drops to a point where the regulators would be unable to perform their job.

Measurements

Measuring the Aleph-P's gain and sensitivity is not a simple matter, as these are functions of the level- and gain-control settings. They are also affected by the output load on the preamp, and this effect will vary with the level setting, since the preamp's output impedance varies with the output attenuator setting (which is controlled by the front-panel "Level" knob). In addition, you can use an internal switch to lower the gain by 12 dB in the unlikely event that you expect an input signal to exceed 18 volts. This switch was set for the normal mode in all tests. The two channels of the Aleph-P

closely matched in performance characteristics, so results are presented for the left channel unless otherwise noted.

With the front-panel gain controls at maximum, gain from either the balanced or unbalanced inputs was 13.5 dB to the unbalanced main outputs and 18.6 dB to the balanced main outputs; setting the gain controls at minimum reduced the readings by just under 22 dB. At either setting, gain from the balanced input to the unbalanced tape output was -9.3 dB but was 0 dB from unbalanced input to unbalanced tape output; gain from either input to the balanced tape output was also 0 dB. Sensitivity measurements are presented in Table I.

Frequency response is shown in Fig. 1 for input and output with instrument loading and with the gain controls fully clockwise. (Results were about the same with the gain trims fully down and with unbalanced input and output.) Although response within the audio band is flat at all volume levels, there are rolloffs above the audio band at the highest and lowest level settings. The rolloffs at the higher settings result from the low-pass filter formed by the output impedance and the capacitance of my test leads. As the level control is turned down, the output impedance drops and the high-frequency response improves until there is hardly any rolloff with 20 to 30 dB of attenuation. With further attenuation the output impedance becomes still lower, yet the

EQUIPMENT USED

I used the following equipment in the listening tests for this review:

CD Transports: Sonic Frontiers SFT-1 and Counterpoint DA-11A.

CD Electronics: Genesis Technologies Digital Lens anti-jitter device; Sonic Frontiers SFD-2 MKII, Classé Audio DAC-1, Dodson Audio DA-217, and Manley Reference D/A converters.

Phono Equipment: Oracle turntable, Well Tempered Arm, Accuphase AC-2 moving-coil cartridge, and Vendetta Research SCP-2C phono preamp.

Additional Signal Sources: Nakamichi ST-7 FM tuner, Nakamichi 250 cassette recorder, and Technics 1500 open-reel recorder.

Other Preamplifiers: Audio Research

LS22, Spectron 10, and Forssell balanced tube line driver.

Amplifiers: Sonic Frontiers Power-3 mono tube amplifiers, Quicksilver M-135 mono tube amplifiers with Svetlana 6550C output tubes, and Spectron 1KW digital switching amplifier.

Loudspeakers: Genesis Technologies Genesis Vs and B&W 801 Matrix Series 3s augmented from 20 to 50 Hz by two subwoofers.

Cables: Analog cables by MIT and Transparent Audio; digital interconnects (AES/EBU balanced), Illuminati DX-50 and Audient Technologies Datrix Reference active cabling used with Audient Tactic and Audit cable driver and receiver.

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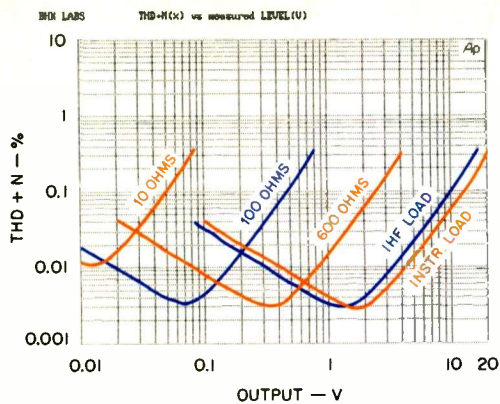
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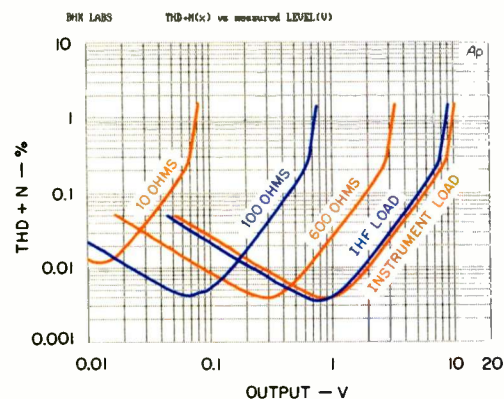
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* The subwoofers of both systems are designed to be placed on the floor, not on the same surface as the satellite speakers. © 1995 Cambridge SoundWorks.





A



B

Fig. 2—THD + N at 1 kHz vs. output level and load for balanced (A) and unbalanced (B) outputs.

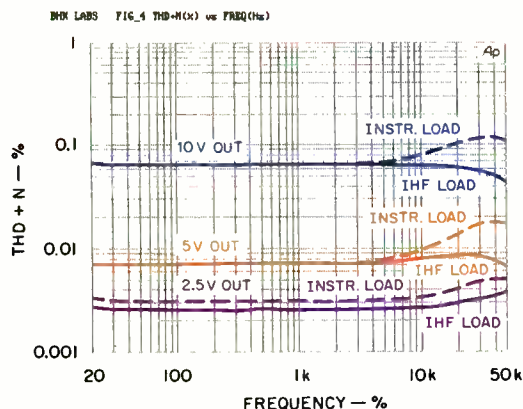


Fig. 3—THD + N vs. frequency for various gain settings.

high-frequency rolloff returns; I cannot account for this. With IHF loading, the -3 dB point dropped from 100 kHz to about 60 kHz in the worst case (“Level” clockwise), but the change in response essentially disappeared at attenuations of 20 dB or more. Tracking between channels was extremely good, thanks to the use of high-precision resistors in the output attenuators.

Because of the output attenuators’ design, the output impedance varied with attenuation. Output impedance at the balanced outputs got as high as 2 kilohms with the level control turned all the way up. Turning the level control down, however, swiftly reduced the output impedance, which dropped to less than 200 ohms for attenuations of 20 dB or more. Output impedance will likely be less than 200 ohms in most conditions of use. Impedance at the unbalanced output was half that at the balanced output.

Balanced input impedance was about 20 kilohms with level and gain controls fully clockwise and increased to 34 kilohms with level clockwise and gain trims counterclockwise. Unbalanced input impedance was about half that of the balanced input.

Common-mode rejection ratio (CMRR) indicates how well a balanced input rejects noise signals applied to both its positive and negative pins; when measured at the unbalanced output jacks, it also indicates how well each phase of the input signal is represented in the unbalanced output signal. With the level control at its maximum position and with gain trims at maximum, CMRR exceeded 56 dB at 20 kHz and 60 dB below 4 kHz at the unbalanced output jacks; with the gain controls at their 1 o’clock positions, CMRR was about 42 dB at 20 kHz and was bet-

ter than 50 dB below 800 Hz. For balanced outputs and gain at maximum, CMRR was 87 dB at 20 kHz and better than 100 dB below 3 kHz. Performance on this test was very good.

Figure 2 shows 1-kHz total harmonic distortion plus noise (THD + N) versus output level for various loads. The measurements in Fig. 2A were made via the balanced input and output and with gain and level controls at maximum, the conditions under which output impedance is the highest. With this high impedance, the drop in output voltage with decreasing load impedance is at its maximum. But note that the input voltage is the same for all five curves, so the circuit is being driven just as hard, despite the changing output voltage. The distortion was predominantly third-harmonic.

The measurements in Fig. 2B are for unbalanced output, again with gain and level settings at maximum. Here, the maximum output for light (high-impedance) loading is about half what it is for balanced output, and there is a noticeable upturn in the distortion curves where even-order distortion starts to increase. These changes of slope don’t occur in Fig. 2A because balanced outputs inherently cancel even harmonics. With the preamp set for 10 dB of gain with instrument loading, distortion was about a third of that seen in Fig. 2A.

The fact that the distortion curves in Figs. 2A and 2B have about the same shape for the various loadings supports the manufacturer’s claim that the Aleph-P could drive a 0-ohm load with low distortion. Consider Fig. 2A: The curves for 10-ohm and 100-ohm loading reach 0.02% distortion at about 22 and 220 millivolts, respectively; in each case, the preamp is delivering about 2.2 milliamperes of output current. At lower output voltages (and correspondingly lower currents), distortion would be lower still. (This is obscured by the noise component of the THD + N at the bottom of the 10-ohm curve.) By extrapolating, we can see that the circuit could indeed provide 1 to 2 milliamps into a 0-ohm load at low distortion.

Figure 3 shows THD + N as a function of frequency with instrument or IHF loading. Input voltage was 1 volt with “Level” fully up. The gain controls were turned up full for the 10-volt output curves and were turned down to get the other measurements. The 1,000-picofarad capacitance of the IHF load reduces both high-frequency distortion and out-of-band noise. Since the noise component of a THD + N measurement includes noise above the audio band,

Table I—Input sensitivity at maximum and minimum gain.

	Sensitivity, mV	
	MAX. GAIN	MIN. GAIN
Any Input to Unbalanced Main Out	105.8	≈1310
Any Input to Balanced Main Out	58.8	729.9
Balanced In to Unbalanced Tape Out	1462	1462
Unbalanced In to Unbalanced Tape Out	500	500
Any Input to Balanced Tape Out	500	500

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the IHF load yields lower overall THD + N at 2.5 volts out, where the noise accounts for more of the reading than the distortion does. Distortion performance of the Pass Labs Aleph-P is very good, and it will likely contribute only negligible distortion in actual use.

Interchannel crosstalk was generally quite similar in each direction and was better in the balanced than in the unbalanced input and output modes. With unbalanced input and output, crosstalk was down by more than 80 dB below 4 kHz, increasing to about 70 dB down at 20 kHz; with balanced input and output, crosstalk diminished to -100 dB below 6 kHz and about -92 dB at 20 kHz.

Because the level attenuator is at this preamp's output instead of its input, it attenuates output noise, too. Therefore, this preamp produced some truly low output-noise levels, on the order of several microvolts. With a fixed input level of 500 millivolts, gains set at maximum, and level set for 500 millivolts output, the IHF signal-to-noise ratio ranged from 100 to 103 dB. With level set at maximum and gain controls set for

500 millivolts output, readings ranged from 86 to 89 dB.

Use and Listening Tests

The Aleph-P impressed me right away as a very good-sounding preamp. My initial listening notes indicated that definition and detail were very good, as were space, dimension, imaging, and soundstaging. I noted some slightly irritating sound on a few of my CDs that are difficult to make sound good, but this irritation cleared up when I changed my interconnect and speaker cables; with the new cables, the Aleph-P sounded very good indeed. There was now a musical ease to the reproduction that made music a real pleasure to listen to. Regardless of the cables I used, I felt the bass was not as prominent or strong and had less "slam" than with the other preamps I had on hand. Bass detail and realism were still very good, however. All in all, the Pass Aleph-P is an excellent preamp that serves the music well.

When I first tried out the preamp, the volume started mysteriously and uncontrollably turning itself full up. The cause, I



**THE PASS ALEPH-P
IS AN EXCELLENT PREAMP
THAT SERVES
THE MUSIC WELL.**

discovered, was simply that the remote control's volume-up button had stuck, and the remote happened to be pointing at the Aleph-P. Aside from that, the preamp functioned perfectly both in the lab and in the listening room.

My experiences with this preamp made me wish I had the chance to listen to some of Pass Laboratories' famed single-ended solid-state power amplifiers. The Aleph-P is an excellent-sounding preamp that will likely give trouble-free service for a very long time. A

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RC-2000 AT A GLANCE

- Replace all of your existing remotes and control your entire A/V system with one, easy-to-use remote.
- Convenient Macro keys store up to 20 commands each that can be sent automatically in sequence.
- LCD window and keypad illuminate automatically when the room is dark.
- Ergonomically designed, with logically grouped functions and clear labels.
- Large LCD window displays as many as 32 special commands for each component.
- Renaming feature lets you customize the LCD display with component and function names you choose.
- Hundreds of built-in commands for popular Marantz models and other components using the Philips RC-5 remote control language. DSS command functions provided.

ALL YOU NEED IS ONE

Built-in and learned functions give you complete control of infrared-operated components such as:

- TVs and monitors
- Cable boxes
- A/V receivers
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- VCRs
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- Cassette decks
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DSS INSIDE!

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BUILT-IN ILLUMINATION

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DEATH. TAXES. TOO MANY REMOTES.

(we can fix that last one)



With some help, at least one of life's certainties can be negotiated. Take the half-dozen hard-to-use remote controls that came with your home theater equipment. Why so many? Because no one has produced an affordable, powerful, and sensible remote that can replace your extensive collection.

Now, thanks to Marantz, all you need is one.

Introducing the Marantz RC-2000. Designed with input from leading custom A/V installation experts, the RC-2000 is the first learning remote that gives you complete, convenient control of your entire entertainment system.

In contrast with other learning remotes, the RC-2000 has an intuitive keypad layout with highly visible labels, plus advanced convenience features such as Macro keys that transmit up to 20 commands each at the push of a button. Imagine: One button can activate your entire home theater system, set the input selectors, adjust the surround mode, and even start the movie – all in the order you choose, and even with timing intervals you may need. This is what remote control should be all about.

"...the Marantz RC-2000 is the answer to my prayers... It looks to be a real solution to one of home theater's most troublesome and overlooked aspects – system control."

Lawrence E. Ullman,
Stereophile Guide to Home Theater, Summer 1996

Despite its powerful capabilities, the RC-2000 sets up in minutes, a decided advantage over expensive controllers that require professional installation and programming. Powered by a 33-MHz notepad computer chip, the RC-2000 can learn hundreds of infrared remote commands, enough to handle even the most sophisticated A/V systems. Got satellite? The RC-2000 is already loaded with commands for popular DSS brands, plus hundreds of additional commands for Marantz and other brands that use the Philips RC-5 remote control language. You can even rename component labels and functions with names you choose.

Of course, what good is all of this control capability if you can't see what you're doing?

An illuminated keypad and back-lit LCD display make the RC-2000 perfect in darkened home theaters. A built-in light sensor automatically activates the illumination feature when the room is dark, and disables it to save battery power when the room brightens. The illumination can also be activated instantly at the touch of a button. An advanced memory backup system protects all of your customized features and learned codes, and even alerts you when it's time to change the batteries. The RC-2000's powerful programming features allow you to customize it to match your exact requirements for precise and total control of your entire entertainment system.

So what should you do with your old remotes? Absolutely nothing.

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When you've got questions about Audio and Video,

see a specialist

Q

Do I need a bigger amp for my rear speakers?

A

The key to enhancing rear speaker performance is not a bigger amp, but the new Digital Surround Sound process, also referred to as AC-3. Dolby Surround AC-3 delivers six separate channels of sound. Dolby Pro-Logic Surround provides a single limited bandwidth (100-700Hz) rear channel which is typically played back through two channels of amplification and two speakers. In comparison, Dolby AC-3 provides separate (discrete) left-rear and right-rear channels, with full-bandwidth (3-20,000Hz) for more precise localization of sounds and more realistic ambience. If you already have a Dolby Pro Logic Surround system, you will need a Dolby Surround AC-3 demodulator/decoder and a stereo VCR or laserdisc player with AC-3 RF signal output. If this is not in your budget, good results also can be achieved with another new iteration of surround sound: DDSC (Dynamic Discrete Surround Circuit). Improvements are easily heard: lower THD by about 30%, increased separation front, back and side to side. Also, 18-bit digital conversion for surround and effects channels for much higher fidelity and fuller bass response even in the rear channels.

—Rory Reckelbus
Soundquest
El Paso, Texas



SOUNDQUEST
Home Theater • Video • Car Audio

Q

Why is sensitivity important when evaluating loudspeakers?

A

Sensitivity can be a very misleading guide to judging loudspeakers. Sensitivity is defined as how a loudspeaker performs with a given input, at a specific distance, on axis. One myth is a more sensitive speaker sounds better than a loudspeaker with less sensitivity. The phrase, more sensitive speaker, simply means that the speaker will play louder at the same input power. This is most obvious when performing an A/B test of two different speakers. One speaker will inevitably be louder. This type of test tends to trick less experienced listeners into thinking the louder speaker sounds better. Many times, a loudspeaker manufacturer will sacrifice a more sensitive speaker for one with a better response to improve over-all sound quality. As a smart consumer, you should keep the following in mind before performing a sensitivity test: the best way to compare two different loudspeakers is to listen to a track on one speaker, then restart the same track and listen to it again on the second speaker.

—James Correll, David Clements,
& Jeff Stevens
The Electronics Shop
Frederick, MD



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SHOP



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

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

Q Why am I always blowing up tweeters?

A The most common cause of tweeter failure is from using a power amplifier or receiver that is too small for the volume levels you are trying to achieve. When an amplifier is pushed past its maximum output level, it is driven into a condition called clipping. This is when the amp is cutting off the top and bottom of the waveform that it is trying to reproduce. These clipped signals are loaded with high frequency energy that pass through the crossover network of the speaker to the tweeter, causing the tweeter to overheat and be damaged. Clipping is caused by turning the volume control up too high. Although a volume control can be turned to maximum rotation, the amplifier generally runs out of unclipped power before you reach this point. The amplifier's output is determined by the input level, the volume control setting and how much bass, treble and loudness boost is added. Most power amplifiers will reach their maximum power at about one o'clock on the volume control. To determine a safe level to operate an amplifier at, increase the volume to where you can just hear distortion and then back it down a bit. This should prevent future tweeter failure.

—Peter Svec
Audio Labs, Inc.
Des Moines, Iowa



Q Why should I buy my equipment from a local audio and home theater specialist as opposed to a large chain store?

A You may think that you would get the best deal from a large department store because of their "low price guarantee," but the cheapest price doesn't always mean the best deal. In the long run, quality products and quality services will always be a better deal. Large stores survive on their volume of sales. Their goal is to get your money quickly and move on to the next sale. Your local specialist survives on having satisfied repeat customers that tell their friends about the experience. These referrals are the life blood of their business. Also, large stores typically sell you what they want (products that will make them the most money). Your local audio and home theater specialists will take the time necessary to help determine the product that best meets your needs. Audio specialists are very selective about what products they carry. In order to differentiate themselves, they must sell higher quality products at an excellent value. To complete your sale, a large store takes your money and thanks you. A specialist considers the sale done after you have taken the product home, been assisted with the proper installation, and has fully trained you so you can operate your new system. No chain store can say all that and have a totally satisfied client base.

—Tom Gleeson
Audio FX
Sacramento, CA



EOSONE MILLENNIUM HOME THEATER SPEAKER SYSTEM

Eosone is a new company, but it has a veteran designer: Arnie Nudell, who has been responsible for some exceptional reference speakers from Genesis Technologies and Infinity (see "The Audio Interview," July). Eosone's sales literature calls Arnie a "legend." I'm not sure this is either accurate or flattering, since the dictionary defines legend as "a story handed down for genera-

tions. . .believed to have a historical basis, although not verifiable." Fortunately, Arnie is neither an elf nor Elvis, and the Eosone Millennium system provides the kind of technology and sound quality you expect from a hit instead of a near myth.

As you'd expect from Arnie, this is not your usual home theater package of five pet-sized coffins and a disco-bass subwoofer with a built-in amp. For example, in most home theater systems, the surround speakers (and, usually, *only* the surrounds) are dipoles. In the Millennium system, every speaker *except* the surrounds acts as a dipole over at least part of its range, a technique Eosone calls Radiant Surround Field technology. The company says this broadens the optimum listening area while reducing sound-blurring reflections from your room's side walls and your TV screen. A properly designed dipole speaker can reduce side-wall reflections because the speakers radiate forward and backward in opposite

phase, with the result that the two wave fronts cancel at the sides, yielding nulls in those directions. When the speaker and the room work well together, this produces a cleaner sound from the front-channel speakers, a feeling of added space, and a broader listening area with more stable imaging.

The Millennium system comes at a time when audiophiles want more and more from home theater speakers. They expect excellent stereo performance, with outstanding dynamics, bass power, and extension. They want the speakers' timbres to be so well matched that there is a seamless blend of sound across the front. They also want the speakers to produce surround effects that approximate those in a top-quality theater installation. They want to be able to get all this in a variety of listening rooms, with electronics that can range from an ordinary A/V receiver to high-quality separate components. And all these demands are exacerbated by new discrete-channel digital surround formats, such as Dolby Digital (AC-3), which offer better bass dynamics, more detailed surround information, and far less time smear and sonic confusion than Dolby Pro Logic.

Unlike the many speakers Nudell has designed as ultimate statements,

Company Address: 2550 Britannia Blvd., Suite F, San Diego, Cal. 92173; 800/347-1876.
For literature, circle No. 94

the Eosone Millennium system is intended to deliver the kind of performance demanding consumers want at a price most can afford. For \$2,879 you get five well-designed speakers plus two powered subwoofers built into the left and right front speakers. More important, you receive very good performance with both music and home theater.

The front left and right speakers are RSF 1000 tow-



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Can I hear it?

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Why are your prices so low?

We commit to long production runs. This



allows us to buy better parts in quantity, at the best possible prices. We keep our circuits simple. Fewer parts and shorter signal paths deliver better sound. And, fewer parts means we can afford better parts. We can pay close and critical attention to the parts we do use. We can evaluate each transistor, capacitor, resistor, switch - even wire - to determine how well it works and how good it sounds.

"B&K Components offers good value. They sound great!" - Sensible Sound

But that is only part of the story.

We make sure that each unit sounds the same. We test each resistor, transistor, and capacitor for value, tolerance and functionality to be sure they meet our standards before we solder them to a circuit board. Then we test all subassemblies. Finally, we put each completed unit through a variety of bench tests to ensure its quality and longevity. Then, because the human ear is the ultimate - the only - arbiter of sound quality, we regularly pull

gear off the production line, take it home and listen to music on it. This attention to quality and detail allows us to produce great products at reasonable prices.

Our products speak for themselves.

Do you hear the bite of the cymbal? The energy and emotion of the sound-track? Do the voices

sound right? Do you hear the beauty of a solo violin? If you get the harmonics right...if you reproduce vocal and instruments correctly...then everything else typically falls into place, including detail, resolution, clarity, imaging, soundstage, rhythm, pace, timing. And getting the movie effects, voices, and music right makes our audio/video system the complete package for both music and movies.

"Astonishing, staggeringly wonderful!"

- William L. Madison, WI

"Wow!... Why, oh why didn't I do this earlier?"

- Eric L. Streamwood, IL

Please take the time to listen to B&K's components and judge for yourself. You are gifted with the greatest device ever invented for measuring the quality of hi-fi gear, your ears. At B&K, high end A/V means high performance, not high price.



These measure 49 x 12½ x 18½ inches, weigh 116 pounds each, and are solidly built for the money (\$1,100 apiece). Each tower is divided into an upper passive section and an active section below it that contains the subwoofer and its amp and crossover. The tower's overall bandwidth is rated at 26 Hz to 22 kHz.

The passive section, which operates from about 85 Hz on up, holds two 6½-inch woofers, one 4-inch midrange driver, and two ¾-inch tweeters. One woofer and one tweeter fire to the rear, in opposite phase to the front drivers, so the passive section acts as a dipole. Sealed subenclosures are provided for the woofers and the midrange driver. The specified crossover frequencies are 850 Hz and 5.2 kHz for the front-firing drivers and 5 kHz for the rear. Nominal impedance is 8 ohms.

The active subwoofer section uses two 10-inch woofers in a bass-reflex enclosure powered by a built-in 120-watt amplifier with a low-pass filter adjustable between 50 and 100 Hz. (The high-pass to the passive section is simply a capacitor, providing a fixed, 6-dB/octave rolloff below 85 Hz.) Like most stand-alone powered subs, each tower's subwoofer section has both preamp-level and speaker-level inputs, which are switch-selected. The manual recommends using the preamp-level input only when your system provides a preamp-level subwoofer output. (You'll still need to connect your amp to the other terminals, of course, to feed the passive section.) Preamp-level output jacks let you feed the bass signal from one channel's subwoofer section to the other's, so you won't have to run two long cables from your preamp or receiver. Eosone suggests defeating your system's low-pass filter, if it has one, and using the low-pass filters in each tower's amp. The amplifier turns itself on when it senses a signal and turns off when there's been no signal for 10 minutes or so.

The RSC 300 center-channel speaker's rated bandwidth is 90 Hz to 22 kHz. On the front baffle of the sealed enclosure are two 5¼-inch shielded woofers flanking a ¾-inch tweeter. An additional ½-inch tweeter radiates to the rear; it, too, is in opposite phase to the front drivers, making the speaker a dipole above its 3-kHz crossover frequency. The RSC 300's nominal impedance is 8 ohms. It weighs 16 pounds, mea-

sures 7 x 17 x 8 inches, and costs \$250 if you buy it separately.

The RSR 350 surround speakers (\$430 per pair) have a rated bandwidth of 70 Hz to 22 kHz. There are three drivers: two angled ¾-inch tweeters and one 6½-inch woofer (again, in a sealed enclosure), with the crossover at 4 kHz. Whereas most surround speakers are bipoles or dipoles that radiate sound from opposite baffles, note that the Eosone surrounds are monopoles with two tweeters angled to achieve dispersion. The RSR 350s each weigh 17 pounds and measure 12 x 15 x 5½ inches; wall mounts are supplied.

**FOR LESS THAN \$3,000
YOU GET FIVE
WELL-DESIGNED
SPEAKERS PLUS TWO
POWERED SUBWOOFERS.**

I began by listening to the Eosone Millennium system in stereo, and it performed very well for a system at this price. The RSF 1000s provide more upper-midrange and treble energy than most speakers, which helps them do an unusually good job of reproducing musical harmonics and imaging detail. And in general, the stereo soundstage, dynamics, transient performance, and bass response of the Eosone towers are very good for the money.

At the same time, the balance of upper octave energy means you must pay more attention to the quality of the associated electronics. The RSF 1000s reveal the problems in the "music" or "hall" modes of many A/V amplifiers and receivers, which over-process the music in ways that suggest their designers have never heard live acoustic music. Stick with the stereo or stereo-plus-derived-center-channel mode, and you should have no problems.

Not surprisingly, the Eosone Millennium system really came to life when I shifted from stereo listening to home theater. It immediately became clear that this system was designed by someone who cares about soundtrack information, not just sheer power. The Eosones can deal with the most demanding special effects yet still do an excellent job of re-creating subtle ambient de-

tails such as forest sounds, rain, street noise, and the other delicate effects found on the best soundtracks.

Not unexpectedly, the RSF 1000s provided very good musical sound when used with a sophisticated surround processor like the Meridian 565, which delivers a high-quality bass signal. But they also performed gratifyingly well in stereo with such moderately priced, high-quality surround decoders as the Adcom GTP-600 and Marantz AV-600.

The Eosone Millennium is priced at a level where it does have to make *some* compromises for home theater purposes. For instance, you can find a more dynamic system with better and deeper bass output, although you will likely have to pay at least \$1,000 more. The Millennium system does, however, produce excellent bass for the money, and it has the virtue of doing so while providing well-defined bass and transients without boom or overhang. It also enables you to turn up the deep bass to theater levels without audible distress. And its overall mix of bass, midrange, and treble dynamics makes good movie soundtracks truly exciting. The Millennium even did a creditable job when I played *Judge Dredd*, a laserdisc that has more gratuitous deep bass than any other Dolby Digital soundtrack I've heard.

The RSC 300 center-channel speaker anchors the home theater performance of the Millennium system. Even in stereo listening, it can help the RSF 1000 towers by providing center fill, a more stable sound field, and better imaging (particularly if your surround processor has a derived center-channel setting designed by someone who really cares about music). The RSC 300 might benefit from a bit more bass extension (or from the use of the "small" center-channel or "normal" mode on your surround electronics), but its timbre and imaging blend very naturally with those of the RSF 1000 front towers.

The RSR 350 surrounds also match the other speakers' timbre very well and have the extended frequency range, dynamic capability, and imaging detail necessary to perform well with Dolby Digital soundtracks. The Eosone surrounds also reproduced music with Dolby Surround or Ambisonic encoding better than most surround speakers in their price class.

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If there's one practical caveat I have about the Eosone Millennium system—especially if your processor or receiver does not provide Home THX re-equalization or a good treble filter—it is to suggest that you pay careful attention to the system's treble balance. Although the Eosone Millennium offers exceptionally good imaging and conveys unusual amounts of detail and surround effects for the money, many soundtracks are still mixed with too much treble energy for home listening. Most A/V electronics now take this characteristic into account and have filters designed for use with flat speakers. But make sure you have such electronics before you buy the Eosone speakers for home theater use.

I did find the Eosones easier to set up and position than most home theater speakers. The RSC 300 center channel is large enough to deliver very good performance yet small enough to fit on top of most TVs. It also has excellent video shielding, which means it won't impair picture quality. The RSF 1000 towers are tall enough to provide a left/right image that will integrate well with the center channel in most installations, and I have

found that the use of two built-in subwoofers often produces more realistic and better-defined bass in reasonably priced speaker systems than a separate subwoofer does.

The front-channel towers and the RSC 300 required a minimum of angling and fiddling with the distance from the speakers to the wall behind them. (This almost made

THE MILLENNIUM SYSTEM IS COMPETITIVE WITH ANYTHING IN ITS PRICE RANGE AND HAS SEVERAL DISTINCTIVE VIRTUES.

up for the *terrible* instruction manuals!) I also found that the RSR 350s' radiating characteristics provided good surround with a variety of soundtracks, including demanding Dolby Digital material, after only a little tinkering with placement.

It is much harder to judge a speaker that delivers value for money than one where

price is no object, because the former has more competitors and the trade-offs it has to make are more obvious. Nevertheless, the Eosone Millennium is competitive with any system I know of in its price range and has a number of distinctive virtues.

The Millennium delivers smoother and more accurate bass than almost all of its competitors that rely on single separate subwoofers. Its left and right front speakers do a very good job with music. The center channel is well matched in timbre to the main speakers, and the surround speakers are considerably better than many in their price range. In fact, I prefer their dispersion characteristics to those of most dipole and bipole designs, particularly with Dolby Digital soundtracks.

Buying any home theater speakers, including the Eosone Millennium system, involves a trade-off. If stereo is all you want, you can get better sound for the same money if you buy two unamplified speakers than if you buy a system that must provide five speakers, subwoofers, and built-in amplification. But then, of course, you would not have home theater. **A**



just listen

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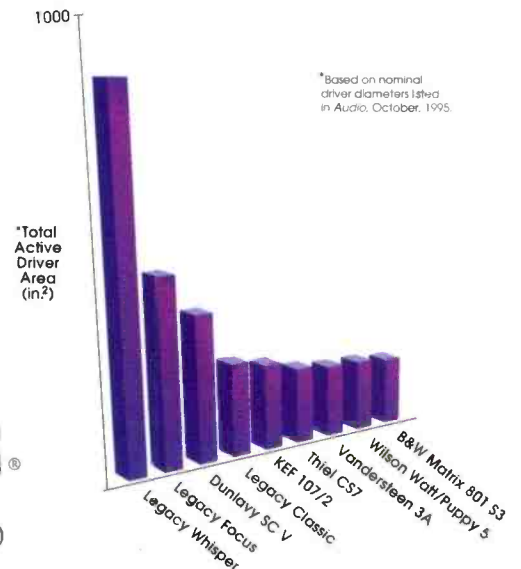
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You like wood? Me too. Wood looks good, smells good. And because it's so rigid when mulched, glued, and turned into "medium-density fiberboard," or MDF, it's great for building speaker cabinets. But if you're a budget-minded audiophile, recent loudspeaker trends suggest you'd better get used to a new material if you want to stay in this game without spending dearly. It's called "plastic."

Company Address: c/o Audio-Stream, M.P.O. Box 2410, Niagara Falls, N.Y. 14302; 905/632-0180.
For literature, circle No. 95

That's right, the latest trend in affordable high-end loudspeakers is to use plastic for cabinets instead of wood. While many utility speakers have appeared in plastic enclosures, now even high-end designers are looking at ways in which they can continue to manufacture affordable speakers at the bottoms of their lines and still bring a profit in the face of rising production costs and customers who now want 5.1 good-sounding speakers for what they used to pay for two.

**I CAN'T BELIEVE
THAT FIVE SPEAKERS
AND A SUBWOOFER
FOR \$540 CAN SOUND
THIS GOOD.**

In the last few months, I've listened to plastic-box speakers from a fair number of well-regarded manufacturers, and I have to say that based on what I've heard, I'm not ready to welcome the Plastic Speaker Era with the same open-armed glee as I did the Radius Toothbrush Era. Even with the best of these plastic-box speakers, there's a distinctly odd coloration in the midrange that I've never heard from any of the speakers these same companies build with wood cabinets.

Maybe I'm just used to the woody resonances of traditional loudspeakers, but the plastic-box speakers definitely have a less natural sound overall. Do they sound better than a TV set's own speakers? For the most part, yes. Do they approach the sound quality of entry-level audiophile speakers like the \$350/pair NHT SuperOne that I reviewed in the August issue? Not in the slightest. And that doesn't bode well for budget-philes and quality-minded civilians of all stripes who will be looking to buy a good set of affordably priced home theater speakers in the coming years.

I was visiting Canadian loudspeaker manufacturer Paradigm recently, and I got to talking about this very issue with Bill VanderMarel, the company's director of sales and marketing. When I told him about all the plastic-box speakers I'd been hearing lately, VanderMarel agreed that it was becoming harder and harder to use real wood cabinets at the lower price points, especially for six-pack home theater speaker systems priced under a grand. But when I told him about listening to the cool little \$400 Cambridge SoundWorks Ensemble IV package of five tiny plastic satellites and a shoebox subwoofer and how I thought it was the best value in a

Photo: Michael Groen

Rotel Report

4



The RTC-970 is a videophile's delight with an audiophile's soul. It combines a Dolby Pro-Logic surround sound decoder with a high-quality AM/FM tuner for performance and convenience.

HOME THEATER

Home Theater: New Horizons, Old Concerns

Transitions are often difficult. Making any move — say, for instance, to a home theater system — is something of a balancing act. After all, what's the point of three or four more channels if they don't sound as good as the two you already enjoy? That's why music lovers think of Rotel's award-winning sonic heritage when facing the here-and-now reality of home theater.

Consider Rotel's new RTC-970 Surround Sound Tuner/Preamplifier, an impressive centerpiece for a home entertainment system. The RTC-970 decodes Dolby® Pro Logic® sources with precise all-analog circuitry to avoid the harshness common to most digital designs. A special Cinema Mode compensates for excessive high frequency energy in many movie soundtracks. And the RTC-970's Music Modes add progressive spaciousness to music while providing accurate and convincing reproduction.

An informative on-screen display makes initial set-up and calibration easy and also helps you get the most out of your system every day. You can choose any of up to four audio-only and four audio/video sources for your main system while selecting a different one for enjoyment elsewhere in your home!

Regardless of the source you choose, your ears will applaud Rotel's remarkable audio circuitry. Careful power supply design, meticulous parts selection, and painstaking board layout lie at the heart of the RTC-970's outstanding performance.

The RTC-970 also puts discrete multi-channel digital audio squarely in your future. There's a connector specifically designed for outboard Dolby Digital/AC-3 processors like our soon-to-appear RDA-980. That makes your upgrade path simple and totally free of pre-planned obsolescence.

RSP-985 THX Surround-Sound Processor

Do you already own a high quality music system? Do you loathe the thought of relegating it to a dark closet? Then consider the new Rotel RSP-980 Surround-Sound Processor for adding all the performance and flexibility you'll ever need to your existing music system.

Full THX® circuitry augmented by precision A/D and D/A conversion means you'll hear a movie's soundtrack exactly as the director intended you to. Wide-bandwidth video switching for both composite and S-video sources and special "Zone 2" outputs increase your current system's flexibility. Audio circuitry featuring high

precision metal film resistors, low ESR capacitors, and high current operational amplifiers means you won't lose anything either. Of course, a DB25 connector

means you'll be able to add Dolby Digital/AC-3 (or DTS . . . or whatever) at any time, now or in the future.

RB-985 5-channel amplifier

Whether building your home theater from scratch or adding to an existing system, this amplifier is the answer. With 5 channels each delivering 100 high current watts, the RB-985 puts plenty of power in a highly efficient and convenient package.

The RB-985 exemplifies Rotel's commitment to quality: A massive 1500VA toroid transformer combines with oversized, high capacity filter capacitors and precision regulators to provide extraordinary smooth operating voltages. Each of the RB-985's 20 output devices is rated for 130 watts and 15 amperes of current. This high reserve design assures uncompressed and dynamic reproduction of today's music and video sources.

Placing the RB-985 in your system is easy. A multi-pin connector, allowing single-cable hook-up, complements an array of

gold-plated RCA jacks. Rugged, heavy duty binding posts accept a variety of audiophile-grade speaker cables.

The Rotel RSP-980 THX Surround Sound Processor expands your cherished music system.



The THX approved RB-985 delivers the powerful sonic boom of a movie explosion with 5 x 100-watts of power.

Our point is simple: Rotel gives you several approaches to home theater. Each product is different because your needs are different. But each one shares a common family heritage of extraordinary sound quality, backed by a five year warranty on amps, preamps, and processors. That's the Rotel tradition. And, even in the midst of change, we'll never forget it.



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home theater speaker combo under a grand, his Canadian eyes lit up like the aurora borealis.

"Five of my Micro minispeakers and the matching SB-90 subwoofer list for \$540, eh? That's only \$140 more than the Cambridge system, and you get real wood-cabinet speakers and a much bigger subwoofer, eh? They're not video-shielded, but if you've got a rear-projection TV, that's no problem—interested, eh?"

You bet your back bacon I was interested! I hadn't heard anything under a grand that was significantly better-sounding than the little Cambridge combo, so I was eager to see if Paradigm could really pull it off. A quintet of tiny plastic speakers and a shoebox-sized sub for \$400 is one thing, but \$540 for five real-wood two-ways and an 8-inch subwoofer would be an Old Testament-grade miracle—if they sounded good.

A few weeks later, two big boxes appeared on my doorstep, one containing the SB-90 subwoofer, the other the five Micro minispeakers. Right off the bat, it was obvious that this was a more audiophilic system. The Micros are full-bore, two-way minispeakers with real wooden cabinets finished in black wood-grain vinyl. And instead of a shoebox-sized sub with a 5¼-inch woofer, the Paradigm SB-90 is much bigger and more massive, with a Paradigm-built 8-inch driver. All told, it was hard to believe the Micro/SB-90 rig was only \$140 more than the Ensemble IV combo.

At 8½ x 6 x 8 inches, the Micro is Paradigm's smallest bookshelf speaker. A Paradigm-built 5-inch woofer is crossed over at 3 kHz to a ¾-inch OEM-sourced dome tweeter, while a small-diameter port on the speaker's back panel extends the system response down to a claimed 70 Hz. The Micro looks a lot more expensive than any \$70 speaker should, and it's here where Paradigm's clever cost-cutting comes into play. The wood-framed cloth grille looks removable, but it's not: If you're all dolled up and ready for a night of cross-dressing, don't try to remove the Micro's grille or you'll break a Lee press-on. Paradigm also shaves a few dollars by mounting the Micro's crossover components directly to the drivers' own terminals and eliminating the added materials cost of a p.c. board entirely. It's touches like these that enable Paradigm to design a speaker with good drivers and a wooden

cabinet and still keep the price to just 70 clams a pop.

The SB-90 subwoofer measures 15¾ x 12¾ x 17 inches. Like many budget subwoofers, the SB-90 is a bandpass design: The 8-inch woofer is mounted in a separate sealed box within the SB-90's cabinet, with all of the woofer's woofing vented out of two flared ports located on the subwoofer's



**SUBSTITUTING A CC-50
FOR THE CENTER CHANNEL
WILL PREVENT
SCREEN PURPLING
ON A DIRECT-VIEW TV.**

back panel. In normal use with a Dolby Surround system, the SB-90 is hooked up between the amplifier and the main pair of Micros, so its internal 100-Hz crossover rolls off the bass before it gets to the satellites. The Micros used for the center and the two surrounds are hooked up directly to those outputs on the A/V receiver.

The Micros are not video-shielded, so setting one on top of a direct-view TV may cause some screen purpling. Paradigm suggests substituting its shielded, two-way CC-50 center-channel speaker (\$139) for one of the Micros in systems used with a direct-view CRT set. Rear-projection TVs aren't affected at all by this, and I certainly had no problems using a Micro on top of my Pioneer RPTV.

I listened to the Paradigm speakers in my living room, driven in turn by both a \$549 Harman Kardon AVR 20 MKII A/V receiver and my He-Man reference rig: Aragon 4004 Mk II and Acurus 200X3 amplifiers, a Citation 7.0 surround processor/preamp, Theta Digital's Data III laserdisc/CD transport and DS Pro Generation V D/A converter, an RCA DSS system (modified with an S/P DIF digital output to drive the Theta D/A

converter), Kimber PBJ interconnects and 4TC speaker cable, Canare 75-ohm digital/video cable, and API Power Pack AC line filters. Both the main and surround pair of Micros sat on 24-inch-tall stands, with the center-channel Micro sitting on top of the Pioneer big-screen TV, flipped upside down so the tweeter was closer to the top of the screen.

I'd been duly impressed by the sound of the \$400 Cambridge SoundWorks speaker package last year, but the Paradigm system jumps performance up several levels toward true, audiophile-approved sound. It's not perfect, but I can't believe that five speakers and a subwoofer for \$540 can sound this good. The CSW Ensemble IV may be the best inexpensive sub/sat speakers out there, but the Paradigm Micro/SB-90 system offers genuine entry-level high-end sound for just 140 clams more (or 209 clams more with a CC-50 at center).

Tonally, the SB-90 subwoofer dominated the mix, giving the system a big, ballsy balance. Coupled with the Micros' warm, downward-tilted treble, this made for a big, sweet, instantly likable sound that's all out of proportion to the Paradigm's bargain-basement price. The combination of the SB-90 and the five Micros sounded smooth, detailed, and so utterly free of the laundry list of sonic problems that plague most inexpensive speakers that it was a pleasure to leave the Paradigms hooked up for weeks in my living room. Far from tolerating them, I really enjoyed listening to them day after day and night after night as laserdiscs, CDs, and DSS audio all came through loud and clear. Believe me, this is *not* a "cheap 'n' cheerful" budget rig; I've heard "home theater" systems from some of the best-known high-end lines that sounded far worse overall than what I was hearing from this \$540 Paradigm combo.

The SB-90 proved itself to be an excellent budget subwoofer, with surprisingly high output for its size. All things being equal, bandpass subwoofers like the SB-90 enjoy greatly increased output capability at the expense of signal linearity—lotsa deep-bass roar per cubic inch, but not nearly as tight and well defined as good sealed or ported designs. And that's pretty much what I heard from the SB-90. It's got a big, meaty sound that goes real low and loud on movie



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soundtrack effects, but it does lack the tautness and clarity I'm used to from my reference speakers. Still, just the fact that it can deliver honest, room-rattling deep bass at all when the whole system costs just \$540 is astounding. Although high-end home theaters certainly deserve better bass quality, a bandpass subwoofer like the SB-90 is undeniably the best choice for a budget system that's trying to go as low and loud as possible with a small woofer in a small box.

Driven full-range with the SB-90 out of the system, the Micros still sounded sweet and slightly rolled off on top, with a very clear and open midrange that made for excellent intelligibility on soundtracks featuring complex dialog. Many cheap speakers sound so muffled and nasal that dialog is hard to follow, but the Micros are excellent in this respect. And while I would've preferred a bit more life in the upper octaves, the Micro's downward-tilted high-frequency balance was a blessing when listening to trebly laserdisc soundtracks and DSS programming. I think the 5/8-inch tweeter that Paradigm uses in the Micro strikes just the right balance for a budget design meant for

long-term listening enjoyment with movies and music.

One thing you *don't* want to do is crank the Micros up on bass-heavy program material without the SB-90 subwoofer hooked up in-line with them. I heard considerable driver doubling and porthole asthma when

**THE SB-90 SUBWOOFER
DOMINATED THE MIX,
GIVING THE SYSTEM
A BIG, BALLSY BALANCE.**

the Micros tried going it alone at high levels, so rolling off the bass in the signal fed to them is mandatory if you want to be able to reach near-theater levels at home. With the SB-90 subwoofer's crossover in the path, the Micros were able to handle just about any action film I threw at them without audible strain.

Without a doubt, the greatest testimony to the Micro/SB-90 system came from my

girlfriend, Chloe. When I first hooked the Paradigms up in my listening room, I just plopped them on top of my reference speakers around the room and swapped the speaker cables over to the budget speakers. After a few days of listening to them while watching laserdiscs and DSS, Chloe turned to me in the middle of a movie and asked me what the little speakers on top of the NHTs were doing there. I told her they were a set of speakers I was reviewing.

"Are we listening to them or the big ones?" she asked.

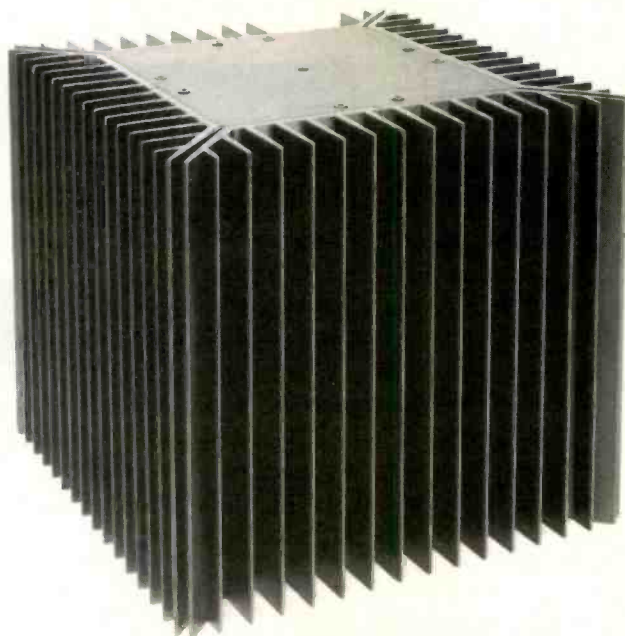
"Them."

"Well, how much do 'them' cost?"

"Five hundred and forty bucks."

"Wow, they sure sound *normal* for such cheap speakers." That about says it all, I think. At \$540, the Micro/SB-90 package is a serious steal. Without a doubt, this is the best-sounding home theater speaker system I've heard for under a grand. If you want to get into home theater but thought all you could afford was Lilliputian plastic speakers, you need to audition the Paradigm rig before you flash the plastic. Wood I steer you wrong? A

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ANALOG INTERCONNECTS

TYPE U — Unbalanced B — Balanced	FINISHED CABLES							Notes	
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices		Available in Bulk?
	ACROTEC	6N-A2010 6N-A2030 6N-A2040 6N-A2050 6N-A2110 6N-A2200 6N-A2080 8N-A2090	U B U U U U U B	6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 8N Copper 8N Copper	RCA Neutrik XLR RCA RCA RCA RCA RCA Neutrik XLR	1-1.5 meters 1-2 meters 1-1.5 meters 1-1.5 meters 1-1.5 meters 1-1.5 meters 1-2 meters 1-2 meters	500.00-550.00 250.00-450.00 300.00-370.00 160.00-190.00 400.00-450.00 250.00-300.00 850.00-1495.00 700.00-1200.00	No No No No No No No No	Gold-plated connectors; bi-axial. Gold-plated connectors. For high-RF environments; carbon shield. Gold-plated 6N copper connectors; bi-axial. Gold-plated connectors.
	ALPHA-CORE	MI RCACU MI XLRCU MI AGRCA MI AGXLR	U B U B	Copper Copper Silver Silver	RCA XLR RCA XLR	0.5-16 meters 0.5-16 meters 0.5-16 meters 0.5-16 meters	60.00-1950.00 60.00-1950.00 270.00-1950.00 344.00-2950.00	No No No No	
	AMERICAN HYBRID TECHNOLOGY	AHT Ultra Resolution	U	Copper	WBT RCA	3.3-40 feet	330.00-790.00		
	AMERICAN RECORDER TECHNOLOGIES	NER	U	Copper	Neutrik RCA	0.5-5 meters	59.00-119.00	Yes	Mogami cable.
	APATURE PRODUCTS	High Definition AV-Poly CD-1	U U U	OFc OFc OFc	Accu-Lock RCA RCA RCA	Any Any Any	40.00-500.00 20.00-400.00 10.00-200.00	Yes Yes Yes	407-strand tri-axial. Single, twin, or tri-wire. As above.
	AUDIANT TECHNOLOGIES	Cadenza Cadenza Balanced	U B	Copper/Silver Copper/Silver	RCA XLR	1-5 meters 1-5 meters	295.00-600.00 395.00-700.00	No No	
	AUDIO ELECTRONICS	High Definition Interconnects	U	Copper	RCA	1-6 meters	62.50-125.00	No	
	AUDIO INSURGENTS	Phi Beta Squared Phi Beta	U U	Copper Copper	RCA RCA	1-10 meters 1-10 meters	189.00-783.00 139.00-589.00	No No	Custom lengths. As above.
	AUDIO MAGIC	Dragon Scepter Apprentice Presto Excalibur Spellcaster Sorcerer Illusion	U U,B U U U,B U,B U,B U,B	Silver-clad Copper Silver-clad Copper Silver-clad Copper Silver-clad Copper Silver-clad Copper Silver Silver Silver	RCA RCA DIN Lockable RCA Lockable RCA Lockable RCA Lockable RCA WBT Lockable RCA WBT Lockable RCA	Any Any Any Any Any Any Any Any	39.00/meter pair 69.00/meter pair 99.00/meter pair 149.00/meter pair 199.00/meter pair 399.00/meter; balanced, 449.00 649.00/meter; balanced, 699.00 1599.00/meter; balanced, 1799.00	No No No No No No No No	Unshielded. Z-Core design. As above. As above. As above. As above. Ribbon conductors.
	AUDIO MATIÈRE	Naissance Presence		Silver/Copper Silver/Copper	Locking WBT Locking WBT	1-1.47 meters 1-12 meters	289.00-356.00 †		Source to preamp. Amp to preamp. †\$498.00, first meter; \$320.00 per additional meter.
	AUDIO NOTE	AN-A AN-C AN-V AN-VX	U U U U	Copper Copper Silver Silver	RCA RCA RCA RCA	1-10 meters 1-10 meters 1-10 meters 1-10 meters	50.00 up 100.00 up 300.00 up 900.00 up	Yes Yes Yes Yes	Balanced conductors; Litz. As above. Litz. As above.
	AUDIOQUEST	Emerald X 4 Pro Jade Turquoise Topaz Ruby Quartz CS-12 CS-32 Mini Adapter X Mini Adapter Z Mini Adapter Pro Jumper Cables	U U U U U U,B U,B U U U U U U	Copper Silver Long-grain Copper Long-grain Copper Copper Copper Copper Long-grain Copper Copper Copper Long-grain Copper Copper Silver Silver	JIS to RCA JIS to RCA RCA RCA RCA RCA, XLR RCA, XLR RCA RCA RCA † † † RCA	1.2 meters up 1.2 meters up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 1 meter 1 meter 1 meter 0.1 meter	150.00/1.2-meter set 275.00/1.2-meter set 25.00/meter pair 39.00/meter pair 65.00/meter pair 98.00/meter pair 165.00/meter pair 25.00/meter pair 45.00/meter pair 39.00/meter pair 65.00/meter pair 225.00/meter pair 39.00/meter pair	No No Yes Yes Yes No No No No No No No No No	Tonearm cable. As above. CL-3 rated; symmetrical coaxial. CL-3 rated; double-balanced. Double-balanced. Triple-balanced. As above. CL-3 rated. As above. Connects portable to preamp. †3.5mm miniplug to RCA. As above. As above. Replaces pre-out/main-in U connectors.
	AUDIO RESEARCH	LitzLink 2	U,B	Copper	RCA, XLR	0.5-9 meters	210.00 up	No	Available in 0.5-meter increments.
	AUDIOSTREAM	A-400 A-500 A-600	U U B	OFHC OFHC UCC	RCA RCA RCA	1.7 meters 0.5, 2.0 meters 1 meter	9.95-26.95/pair 37.95-44.95/pair 79.95/pair	No Yes No	Double-shielded; gold connectors. Double-shielded; Turbo Ground gold connectors. As above.
	AUDIOTRUTH	Opal Emerald Lapis Diamond X 2 Diamond X 3	U,B U,B U,B U B	Copper Copper Silver Silver Silver	RCA, XLR RCA, XLR RCA, XLR RCA XLR	0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up	225.00/meter pair 350.00/meter pair 495.00/meter pair 725.00/meter pair 975.00/meter pair		Air-Hyperlitz; triple-balanced. As above. As above. As above. As above.
	AURAL SYMPHONICS	AS-One Gen 5	U,B	Silver/HCOFC	RCA, XLR	1-13 meters	485.00-1445.00	No	Helical signal path.
	BEL	"The Wire" P1	U	Copper	RCA	0.5 meter up	157.00 up	No	Custom lengths.
	BRYSTON	RCA 1-Meter RCA 2-Meter XLR 1-Meter XLR 2-Meter Custom RCA/XLR	U U B B U,B	Copper Copper Copper Copper Copper	RCA RCA XLR XLR RCA, XLR	1 meter 2 meters 1 meter 2 meters Any meters	120.00 160.00 120.00 160.00 40.00/meter pair	No No No No No	

See October issue for company addresses

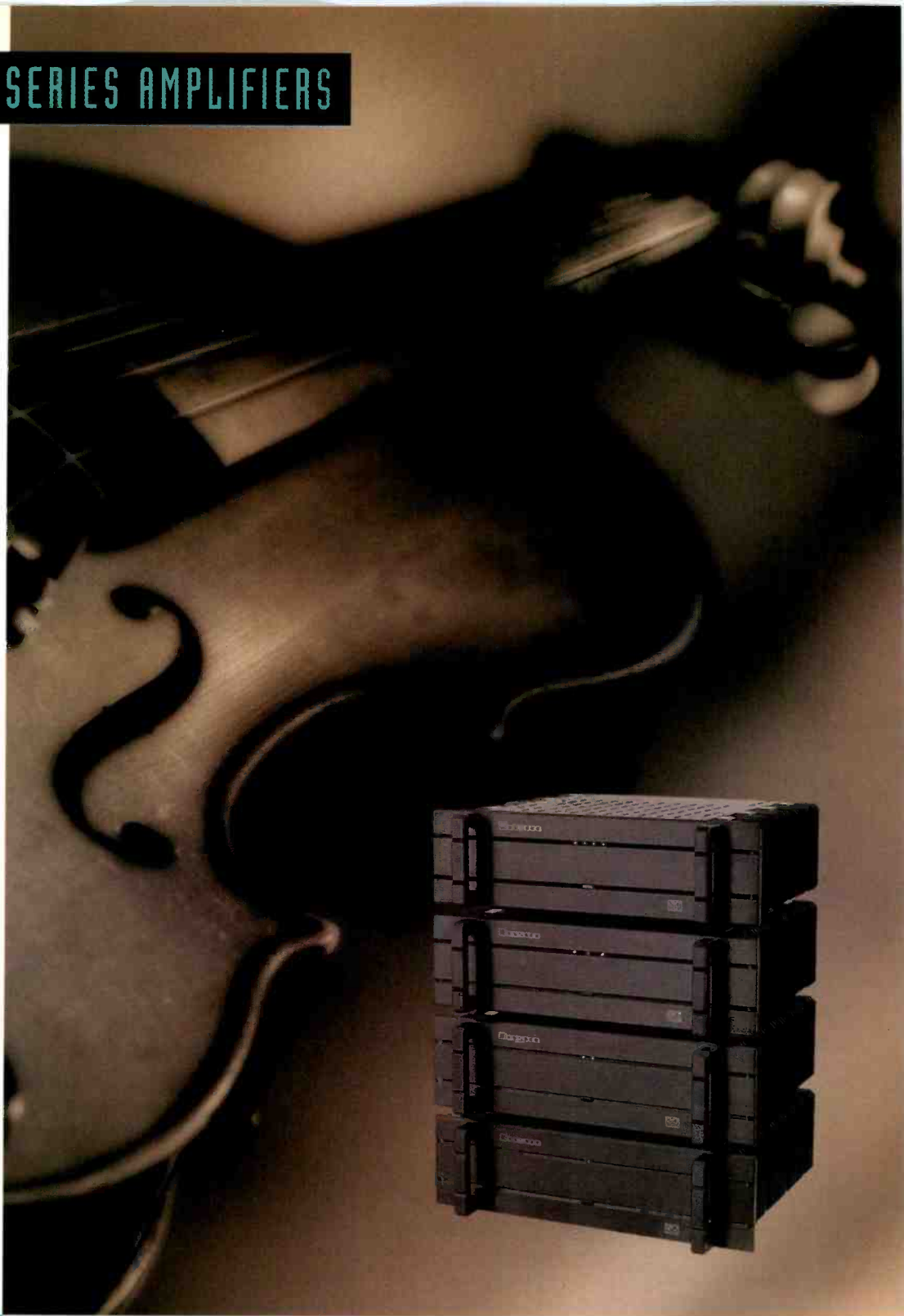
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ANALOG INTERCONNECTS

TYPE U — Unbalanced B — Balanced	FINISHED CABLES							Notes	
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices		Available in Bulk?
	CABLE TALK	Improved 2 Monitor 2 Professional 2 Reference 2	U B B B	Copper Copper Copper Copper	RCA RCA RCA RCA	0.5-1 meter 0.5-1 meter 0.5-1 meter 0.5-1 meter	69.95-79.95 119.95-149.95 199.95-259.95 359.95-449.95	Yes Yes Yes Yes	Signal return flow system. Multi-ground technology. Three-core interconnect.
	CALRAD ELECTRONICS	55-707 55-1011G 55-1000 55-999 55-930 55-800 35-525 10-140	U U U U U U U B	Silver Copper Copper Copper Copper Copper Copper Copper	RCA RCA RCA RCA RCA RCA RCA †	6, 15 feet 3, 25 feet 10 feet 6 feet 1.5, 20 feet 3, 6, 10 feet 1 foot 5, 10, 15 feet		Yes Yes Yes Yes Yes Yes Yes Yes	Dual oxygen-free cable; double-braided shield. Gold-plated connectors; dual cables. Dual cables. As above. As above. Gold plugs. Y-adaptor. †XLR plug to RCA and phone plugs.
	CAMELOT TECHNOLOGY	Sir Galahad	U	Copper/Silver	RCA	3-6 feet	85.00-115.00	Yes	Custom lengths; custom Teflon connectors.
	CAMPAIGN DESIGNS	Aonacreon	U	Silver	RCA	1-20 meters	250.00-3000.00	Yes	
	CARDAS AUDIO	Golden Cross Interconnect Cross Interconnect Quadlink-Five Interconnect 300B Microtwin Interconnect Crosslink	U,B U,B U,B U,B	Copper Copper Copper Copper Copper	RCA, XLR RCA, XLR RCA, XLR RCA, XLR RCA, XLR	0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up 0.5 meter up	550.00 up 298.00 up 159.95 up 85.95 up 56.00 up	No No No No Yes	
	CELLO LTD.	String 1	U,B	Copper	Fischer, RCA, XLR		†	Yes	†1-meter pair (RCA), \$320.00; 10-meter pair (Fischer), \$1556.00.
	CUSTOM CONNECTIONS	Hi-Rez Audio Hi-Band Audio Benchmark MkI Audio Benchmark MkII Audio Groneberg Audio	U U,B U,B U,B	Copper Copper Copper Copper Copper	RCA RCA RCA, DIN RCA, DIN RCA, DIN	1-5 meters 0.5-5 meters 0.5-5 meters 0.5-5 meters 0.5-5 meters	20.00-50.00 35.00-75.00 99.00-200.00 129.00-250.00 239.00-400.00	Yes Yes Yes Yes Yes	Molded gold ends. Custom lengths; silver-soldered. As above; multi-pair. As above. As above.
	DISCOVERY CABLE	TC-One Mark II Signature Plus Four	U U,B U,B U,B	HPOFC HPOFC HPOFC HPOFC	RCA RCA, XLR RCA, XLR RCA, XLR	1-4 meters 1-8 meters 1-12 meters 1-12 meters	80.00-200.00 240.00-730.00 450.00-1990.00 650.00-2850.00	Yes No No No	Twisted pair. As above; shielded. Twisted pair, dual shield. Twisted quad, dual shield.
	DPA DIGITAL	Slink White Slink Black Slink	U U,B U,B	Copper/Silver Copper/Silver Copper/Silver	RCA Opt. Opt.	1-5 meters 1-10 meters 1-5 meters	89.00-185.00/pair 149.00-635.00/pair 498.00-1338.00/pair	Yes Yes Yes	Twisted pair.
	DUNLAVY AUDIO LABS	ULC-Standard ULC-Reference ULC-Balanced	U U B	Copper Copper Copper	RCA RCA XLR	1-7 meters 1-7 meters 1-7 meters	90.00-470.00 225.00-675.00 395.00-995.00	No No No	8-pf/foot capacitance. As above. As above.
	EMERSON	AV2627 AV2628	U U	Copper Copper	RCA RCA	6 feet 6 feet	9.00 4.00		Allows connection of two cables to one input or output.
	ENSEMBLE	Supraflux	U,B	Copper	RCA, XLR	0.5-20 meters	37.50 up	Yes	Triple-shielded.
	ESOTERIC AUDIO U.S.A.	Artus Hyper-Balanced Primus Hyper-Balanced Technus Twin-Symmetry Tech 2ii Twin-Symmetry Graphis II Tubular Geometry Musica 500 Musica 200 Musica 100 Tech 2THX THX High Performance Line-Level Interconnect THX Ultra Performance Silver Line-Level Interconnect	U,B U,B U,B U,B U U U U U,B U,B U,B	Silver-plated Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Silver-plated Copper	RCA, XLR RCA, XLR RCA, XLR RCA, XLR RCA RCA RCA RCA RCA, XLR RCA	0.5-6 meters 0.5-6 meters 0.5-6 meters 0.5-6 meters 0.5-6 meters 1 foot up 1.5-16 feet 1.5-16 feet	400.00-2050.00/pair 325.00-1120.00/pair 120.00-615.00/pair 85.00-330.00/pair 55.00-220.00/pair 30.00-86.00 20.00-40.00 10.00-26.00	No No No No No Yes Yes No No Yes	Custom lengths. As above. As above. As above. As above. Optional EasyLink RCAs. Optional Musica 200 RCAs. Home THX certified. As above.
	FINESTRA DESIGN GROUP	Argento Signature Argento Series 1 Argento Series 2	U U U	5N Silver 5N Silver 5N Silver	RCA, XLR WBT RCA, XLR RCA, XLR	0.5-5 meters 0.5-5 meters 0.5-5 meters	1400.00-6000.00 950.00-3800.00 475.00-2000.00	No No No	Litz; Teflon insulation. As above. As above.
	FM ACOUSTICS	Precision Interface Technology CA-25000 Series Precision Interface Technology CA-25000 Phono Cables	U,B U,B	Copper Copper	RCA, XLR RCA, 5-Pin DIN, XLR	0.6-300 meters 0.6-300 meters	990.00 up 990.00-1880.00	No No	
	GOLDMUND	Lineal Interco	U		RCA	1 meter up	890.00 up	No	
	HIGHWIRE AUDIO	700 Ai 700 Bi 700 Pi	U B U	Silver-plated Copper Silver-plated Copper Silver-plated Copper	RCA XLR RCA	1-10 meters 1-10 meters 1-2 meters	398.00-1298.00 448.00-1348.00 398.00-498.00	No No No	RFI suppression. As above. As above; phono.
	HOVLAND	Phono Cable	U,B	Silver-plated Copper	RCA-RCA, RCA-DIN, XLR	0.5-1.5 meters	795.00	No	Optional balanced XLR, \$40.00 additional.
	JARRETT-WAUTERS RESEARCH	Passage	U,B	Copper/Silver	RCA-RCA, RCA-DIN, XLR-XLR	1-8 meters	95.00-335.00	No	Teflon insulation.
	JENA LABS	Soloist Mini Twin Gemini Quad Helix Sine-Weave Quad Sine-Weave Seven RCA	U U U U U U	Copper Copper Copper Copper Copper Copper	RCA RCA RCA RCA RCA RCA	1.5-100 feet 2-100 feet 2-50 feet 2-50 feet 3-30 feet 3-30 feet	130.00 up 220.00 up 300.00 up 600.00 up 1000.00 up 2000.00 up	No No No No No No	\$20.00 per additional foot. \$27.00 per additional foot. \$32.00 per additional foot. \$48.00 per additional foot. \$80.00 per additional foot. \$180.00 per additional foot.
	(Continued)								



Are you looking for a high performance home theater

Eosone's Powered Subwoofer gives the deep bass response, and dynamic range necessary for getting maximum enjoyment from movies and music.

Shielded satellites + powered subwoofer— perfect for home theater

system, but wondering how to fit 6 speakers into your room and still leave room for furniture and family?



Discover the "... skin tingling, room shaking bass"*

which passive subwoofer

systems simply cannot match.

Audio Hall of Fame speaker designer, Arnie Nudell, has developed the perfect solution—subwoofer/satellite systems, featuring powered subwoofers and Radiant Surround Field™ technology.

"... ranks with the best"*

* Excerpted from review of RSS702, Stereo Review, July 1996

Radiant Surround Field™ technology creates a broader listening area so everyone in the room, regardless of position, hears superior sound and spatial effects. Surround sound performance is raised to new heights through this remarkable technology.

"Impressive Performance"

Stereo Review, July 1996

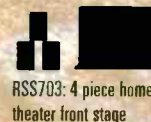
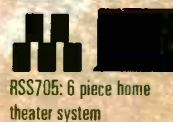


Rear-firing tweeter ensures the fullest sound possible

Shielded satellites perfect for home theater

For more information or store locations call 1-800-347-1876

Eosone RSS systems are available in three configurations:



ANALOG INTERCONNECTS

TYPE U — Unbalanced B — Balanced	FINISHED CABLES							Notes
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	
JENA LABS (Continued)	Radiant Path RCA	U	Copper	RCA	3-15 feet	4000.00 up	No	\$360.00 per additional foot.
	Trinity	B	Copper	XLR	3-50 feet	600.00 up	No	\$48.00 per additional foot.
	Sine-Weave Five	B	Copper	XLR	3-50 feet	1200.00 up	No	\$100.00 per additional foot.
	Sine-Weave Seven XLR	B	Copper	XLR	3-30 feet	2000.00 up	No	\$180.00 per additional foot.
	Radiant Path XLR	B	Copper	XLR	3-15 feet	4300.00 up	No	\$400.00 per additional foot.
	Phono Soloist	U	Copper	DIN-RCA	5-7 feet	190.00-210.00	No	Optimal right-angle, \$50.00 additional.
	Phono Gemini RCA	U	Copper	DIN-RCA	5-7 feet	480.00-540.00	No	As above.
	Phono Gemini XLR	B	Copper	DIN-XLR	5-7 feet	480.00-540.00	No	As above.
Ultra Ground	U	Copper	Bare, Spade	2-50 feet	46.00 up	No	Shielded; includes ground wire.	
JPS LABS	The Superconductor	U	Aluminum/Copper	Locking RCA	0.375 meter up	154.00 up	No	Copper shield; copper-clad aluminum center.
JVC	CN-630 HG	U	Copper	RCA	3 meters	40.00		Gold-plated plugs.
	CN-700 Pro Series	U	LCOFC	RCA	0.5-2 meters	90.00-110.00		As above.
KIMBER KABLE	PBJ	U,B	Copper	RCA, XLR	0.5 meter up	59.00/pair up	Yes	Varstrand design.
	KC1	U,B	Copper	RCA, XLR	0.5 meter up	78.00/pair up	Yes	As above; shielded.
	Silver Streak-SE	U	Copper/Silver	RCA	0.5 meter up	120.00/pair up	Yes	As above.
	Silver Streak-Bal	B	Copper/Silver	XLR	0.5 meter up	173.00/pair up	Yes	As above.
	KCAG	U,B	Silver	RCA, XLR	0.5 meter up	225.00/pair up	Yes	As above.
KCTG	U,B	Silver	RCA, XLR	0.5 meter up	390.00/pair up	Yes	As above; larger conductor bundle.	
KLYNE AUDIO ARTS	Dragonfly Wings DWS	U	Copper	RCA	0.7-6 meters	450.00-1250.00	No	
	Dragonfly Wings DWSH	U	Copper	RCA	0.7-6 meters	495.00-1295.00	No	Shield for phono.
	Dragonfly Wings DWB	B	Copper	XLR	0.7-6 meters	475.00-1275.00	No	
LAT INTERNATIONAL	IC-200-D	U	Silver-clad OFHC	RCA	1 meter up	139.00 up	No	Teflon insulation.
	IC-200-D	B	Silver-clad OFHC	XLR	1 meter up	159.00 up	No	As above.
	IC-100-D	U	Silver-clad OFHC	RCA	1 meter up	79.00 up	No	As above.
	IC-100-D	B	Silver-clad OFHC	XLR	1 meter up	99.00 up	No	As above.
	IC-80	U	Silver-clad Copper	RCA	1 meter up	54.00 up	No	As above.
	IC-50	U	Copper	RCA	1 meter up	34.00 up	No	Double-shielded.
LEGACY AUDIO	Legacy Lattice	U	Copper	RCA	0.5-5 meters	85.00-250.00	No	Shielded directional shunt.
LEGEND AUDIO DESIGN	Legend VI	U	Silver	RCA	1-3 meters	1200.00-2280.00		
	Legend IV	U	Silver	RCA	1-3 meters	515.00-1135.00		
	Legend II	U	Silver	RCA	1-3 meters	295.00-655.00		
LINDSAY AUDIOPHILE	Gray Woven	U	Mu-Metal	RCA	1 meter up	245.00 up	No	
	Gray Woven	B	Mu-Metal	XLR	1 meter up	325.00 up	No	
	Gray Satin	U	Mu-Metal	RCA	1 meter up	345.00 up	No	
LINN	Analog Interconnect	U	Copper	RCA	1-50 meters	80.00/pair up	Yes	
LUMINOUS AUDIO TECHNOLOGY	Synchestra Signature	U	5N Silver	RCA, XLR	0.5-10 meters	400.00-2270.00	No	
	Synchestra	U	5N Silver	RCA, XLR	0.5-10 meters	190.00-1520.00	No	
	Monarch	U	Silver-clad OFC	RCA	0.5-10 meters	80.00-450.00	No	
	Lynx	U	Copper	RCA	Any	30.00 up	No	
MACH 1 ACOUSTICS	Single Ended Flexible	U	Copper	RCA	1-10 meters	250.00-1150.00	Yes	Foamed-Teflon dielectric; double-shielded; 50-ohm.
	Single Ended Semi Rigid	U	Copper	RCA	1-5 feet	250.00-450.00	No	Foamed-Teflon dielectric; solid copper shield, 50-ohm.
	Balanced Flexible	B	Copper	XLR	1-10 meters	350.00-1500.00	Yes	Foamed-Teflon dielectric; triple-shielded; 100-ohm.
MADRIGAL AUDIO	CZ Gel-1	B	Copper/Silver	XLR	0.5 meter up	375.00 up	No	Controlled-impedance cable; custom lengths.
	CZ Gel-2	U	Copper/Silver	RCA	0.5 meter up	375.00 up	No	As above.
MARIGO AUDIO LAB	MR8.8 Fractal	U	Copper	RCA	0.75-7 meters	545.00-2395.00/pair	No	1 meter (standard), \$595.00.
MIT	MITerminator 5	U	Copper	RCA	1-12 meters	40.00-100.00/pair	No	
	MITerminator 4	U	Copper	RCA	1-12 meters	60.00-135.00/pair	No	
	MITerminator 3	U	Copper	RCA	1-12 meters	90.00-200.00/pair	No	
	MITerminator 2	U	Copper	RCA	1-12 meters	130.00-340.00/pair	No	
	MITerminator Proline	B	Copper	XLR	1-12 meters	195.00-575.00/pair	No	
	MI-330 Terminator	U	Copper	Locking RCA	1-12 meters	195.00-565.00/pair	No	
	MI-330 Plus Series Two	U	Copper	Locking RCA	1-12 meters	250.00-680.00/pair	No	
	MI-330 Tube Terminator Series Two	U	Copper	Locking RCA	1-12 meters	350.00-930.00/pair	No	
	MI-330 High Energy Terminator Series Two	U	Copper	Locking RCA	1-12 meters	350.00-930.00/pair	No	
	MI-330 Phono Terminator	U	Copper	Locking RCA	1.5 meters	295.00/pair	No	
	MI-330 Proline Terminator	B	Copper	XLR	1-12 meters	495.00-1235.00/pair	No	
	MI-350 CVTerminator	U	Copper	Locking RCA	1 meter up	995.00/pair	No	Custom lengths.
	MI-350 CVTerminator Twin	U	Copper	Locking RCA	1 meter up	1295.00/pair	No	As above.
	MI-350 CVTerminator Proline Twin	B	Copper	XLR	1 meter up	1495.00/pair	No	As above.
	MI-350 CVTerminator Reference	U	Copper	Locking RCA	1 meter up	1995.00/pair	No	As above.
	MI-350 CVTerminator Phono Reference	U	Copper	Locking RCA	1.5 meters	2495.00/pair	No	
	MI-350 CVTerminator Proline Reference	B	Copper	XLR	1 meter up	2995.00/pair	No	As above.
	MONARCHY AUDIO	AR-2	U	Silver	RCA	3 feet	199.00/pair	No
MONSTER CABLE (Continued)	M1000i	U,B	Copper	RCA, XLR, Ground Control	0.5-8 meters	150.00-980.00/pair	Yes	Bandwidth Balanced; Time Correct windings.
	M756	U	Copper	RCA	1-4 meters	300.00-750.00/set	No	As above; Home THX certified.
	M351 Sub Interconnect	U	Copper	RCA	2.5-8 meters	40.00-100.00	No	As above.
	Interlink Reference	U	Copper	RCA	0.5-6 meters	75.00-350.00/pair	Yes	Bandwidth Balanced; Time Correct windings.

Make enough trouble and people always start talking



At Carver, we've found that making trouble is usually the first step in making real audio progress. For nearly twenty years we've built audio components around controversial design concepts in order to break through traditional price/performance barriers.

The three amplifiers shown here continue that tradition. The awesome Lightstar Reference is our most articulate technical statement ever as well as Carver's blueprint for the future. The lessons we learned during its development are now common denominators for every Carver amplifier design. As a result, people are talking about the latest Carver amplifiers in terms usually reserved for far more expensive models, such as "innovative," "powerful," and even "magic."

To achieve this level of performance, technology and value in a single precision chassis, we design and build these amplifiers in our own factory just outside Seattle, Washington. Hear the technology that has the experts talking at your authorized Carver dealer.

Carver Research Lightstar Reference Amplifier

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

"Innovative, powerful (350 Wpc) power amplifier that impressed RD [Robert Deutsch] with its dynamics and sense of power in reserve, while sounding impressively neutral."

Carver TFM-35x THX Amplifier

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

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

Carver AV-806x Multi-channel Amplifier

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

"I was expecting competent performance; what I got instead was magic," enthused TJN [Thomas J. Norton] about the six-channel Carver... 'My favorite current multichannel amp.'"

CARVER

ANALOG INTERCONNECTS

TYPE U — Unbalanced B — Balanced	FINISHED CABLES							Notes
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	
MONSTER CABLE (Continued)	Interlink 406	U	Copper	RCA DB-25	1-4 meters	140.00-210.00/set	Yes	As above; Home THX certified. As above. As above. Bandwidth Balanced; Time Correct windings.
	Interlink 206	U	Copper	RCA DB-25	1-4 meters	80.00-140.00/set	Yes	
	Interlink 201	U	Copper	RCA	2.5-8 meters	30.00-60.00/pair	No	
	Sub Interconnect	U	Copper	RCA	0.5-8 meters	35.00-100.00/pair	Yes	
	Interlink 400 MkII	U	Copper	RCA	0.5-8 meters	25.00-80.00/pair	Yes	
Interlink 300 MkII	U	Copper	RCA	0.5-8 meters	20.00-60.00/pair	No		
Interlink 250	U	Copper	RCA					
MUSICAL CONCEPTS	Super Connect IV	U	Plated Copper	RCA	0.5 meter up	59.00 up	Yes	Triple dielectric; custom lengths.
MUSICAL DESIGN	Aura	U	Plated Copper	RCA	0.5 meter up	125.00-195.00	Yes	Triple dielectric; custom lengths.
MUSIC-LINK	Image-.5FT	U	OFHC	RCA	1-20 feet	195.00-2095.00/pair	No	Litz; unshielded; shielded version available. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above.
	Image-.5FT	B	OFHC	XLR	1-20 feet	255.00-2725.00/pair	No	
	Image-1FT	U	OFHC	RCA	1-20 feet	345.00-3670.00/pair	No	
	Image-1FT	B	OFHC	XLR	1-20 feet	455.00-4825.00/pair	No	
	Image-2FT	U	OFHC	RCA	1-12 feet	645.00-4220.00/pair	No	
	Image-2FT	B	OFHC	XLR	1-12 feet	845.00-5520.00/pair	No	
	Image-2CD	U	OFHC	RCA	1-12 feet	745.00-4870.00/pair	No	
	Image-2CD+	U	OFHC	RCA	1-12 feet	745.00-4870.00/pair	No	
	Image-3FT	U	OFHC	RCA	1-6 feet	945.00-3320.00/pair	No	
	Image-4FT	U	OFHC	RCA	1-6 feet	1245.00-4370.00/pair	No	
	EMS-1	U	OFHC	RCA	1-20 feet	65.00-635.00/pair	No	
	EMS-1	B	OFHC	XLR	1-20 feet	85.00-845.00/pair	No	
	EMS-1.5	U	OFHC	RCA	1-20 feet	115.00-1160.00/pair	No	
	EMS-1.5	B	OFHC	XLR	1-20 feet	145.00-1570.00/pair	No	
	EMS-3	U	OFHC	RCA	1-12 feet	175.00-1110.00/pair	No	
	EMS-3	B	OFHC	XLR	1-12 feet	225.00-1490.00/pair	No	
	EMS-4	U	OFHC	RCA	1-12 feet	245.00-1620.00/pair	No	
EMS-5	U	OFHC	RCA	1-12 feet	345.00-2270.00/pair	No		
EMS-6	U	OFHC	RCA	1-12 feet	445.00-2920.00/pair	No		
EMS-7	U	OFHC	RCA	1-12 feet	545.00-3570.00/pair	No		
MUSIC METRE	Silver	U,B	4N Silver	RCA, XLR	0.5-50 meters	250.00-2500.00	No	
	Signature	U,B	6N OFC	RCA, XLR	0.5-50 meters	175.00-1300.00	No	
	Calibre	U,B	OFC	RCA, XLR	0.5-50 meters	115.00-865.00	No	
	III	U,B	OFC	RCA, XLR	0.5-50 meters	95.00-545.00	No	
THE NATURAL CHORD	Dichord	U,B	Copper	RCA, XLR	0.5-2.5 meters	175.00-315.00	No	Custom lengths.
NIRVANA AUDIO	S-L Series	U,B	Copper	WBT, XLR	1-25 meters	†	No	Proprietary Litz geometry. †\$695.00 first meter, \$200.00 per additional meter.
NORDOST	Magic 1	U	Copper	RCA	1 meter	40.00	No	Four-conductor flat cable; extruded Teflon insulation. Eight-conductor flat cable; extruded Teflon insulation. As above. Ten-conductor flat cable; stranded extruded Teflon insulation. As above. 36-conductor; extruded Teflon insulation. As above. 19-conductor; Teflon insulation. As above. 16-conductor. As above.
	Black Knight	U	OFC	RCA	0.6-5 meters	70.00-240.00	No	
	Black Knight XLR	B	OFC	XLR	0.6-5 meters	100.00-270.00	No	
	Blue Angel	U	Silver-plated OFC	RCA	0.6-5 meters	100.00-370.00	No	
	Blue Angel XLR	B	Silver-plated OFC	XLR	0.6-5 meters	130.00-400.00	No	
	Blue Heaven	U	Silver-plated Copper	RCA	0.6-5 meters	170.00-560.00	No	
	Blue Heaven XLR	B	Silver-plated Copper	XLR	0.6-5 meters	200.00-590.00	No	
	Red Dawn	U	Extruded Silver OFC	RCA	0.6-5 meters	330.00-1040.00	No	
	Red Dawn XLR	B	Extruded Silver OFC	XLR	0.6-5 meters	360.00-1070.00	No	
	SPM Reference	U	Silver Alloy	RCA	0.6-5 meters	900.00-2700.00	No	
SPM Reference XLR	B	Silver Alloy	XLR	0.6-5 meters	930.00-2730.00	No		
PAC	Pro Reference Interconnect		Silver	RCA	0.5-10 meters	120.00-880.00	No	Twin-axial; Teflon insulation.
PARADOX	Paradox	U	Copper	RCA	1 meter	500.00/pair	No	
PARAVOIX	A201	U	OFC	RCA	1-6 feet	50.00-100.00	Yes	
	A205	U	OFC	RCA	1-6 feet	25.00-50.00	Yes	
PFANSTIEHL	A-A	U	Copper	RCA	1.5-20 feet	2.00-4.00	No	
	AA-AA	U	Copper	Dual RCA	1.5-50 feet	3.00-27.00	Yes	
PHOENIX GOLD	Zeropoint Musical Ref	B	PC-OCC	RCA	0.5-6 meters	50.00-200.00	Yes	Twisted pairs. As above. Optional Y-adaptors. As above.
	Zeropoint Pro	B	OFC	RCA	0.5-6 meters	30.00-75.00	Yes	
	Zeropoint QLX	B	OFC	RCA	0.5-6 meters	40.00-90.00	Yes	
	Zeropoint TRX	B	OFC	Molded RCA	0.5-6 meters	30.00-75.00	No	
	A540 Transbalance	U	OFC	Molded RCA	0.5-6 meters	15.00-45.00	Yes	
A 320	U	OFC	Molded RCA	0.15-6 meters	5.00-15.00	Yes		
PRECISION INTERFACE ELECTRONICS	RCA30	U	Copper	RCA	0.75-20 feet		Yes	Includes ground wire or turn-on lead. As above, dual shield. As above but tripte shield.
	30R	U	Copper	RCA	1.5-20 feet		Yes	
	P47	U	Copper	RCA	1.5-20 feet		No	
	RCA50	U	Copper	RCA	1.5-20 feet		No	
PRISMA	Dual Interconnect	U	Copper	RCA	0.5-3 meters	49.00-75.00	Yes	Custom lengths. As above. As above.
	Quasi Balanced Interconnect	U	Copper	RCA	1 meter up	105.00 up	Yes	
	Balanced Interconnect	B	Copper	XLR	1 meter up	149.00 up	Yes	
PUREST SOUND SYSTEMS	Analog Link I	U	OFC	RCA	0.6-5 meters	68.00/meter	Yes	EMI/RFI suppression. As above. †Solid-core silver with OFC copper.
	Analog Link II	U	HPOFC	RCA	0.6-5 meters	85.00/meter	Yes	
	Hybrid Link	U	†	RCA	0.6-5 meters	135.00/meter	Yes	
	Silver Link	U	Silver	Cardas RCA	0.6-5 meters	185.00/meter	Yes	
PURIST AUDIO DESIGN	Elementa	U,B	Copper	RCA, Neutrik XLR		†		†\$180.00, first meter pair (\$230.00 balanced); \$30.00 per additional 0.5 meter. †\$380.00, first meter pair (\$420.00 balanced); \$40.00 per additional 0.5 meter. †\$440.00, first meter pair (\$490.00 balanced); \$50.00 per additional 0.5 meter.
	Aqueous	U,B	OFC/Silver	RCA, Neutrik XLR		†		
	HDI	U,B	LC Silver	RCA, Neutrik XLR		†		

(Continued)



**SMALL.
POWERFUL.
THE NEW KLIPSCH REBEL.**

Full Range sound from the only horn loaded speaker system small enough to fit anywhere!

Klipsch Horn Technology delivers incredible sonic performance because horn loaded speakers result in greater efficiency, broad dynamic range and high levels of output with low levels of distortion. The Rebel KSS-3 Sub/Sat System achieves a full range frequency response using two satellite speakers and a subwoofer powered by a 50 watt discrete amplifier. Sound is full and accurate from the *trill* of a piccolo to the *thwump* of a bass guitar string. You hear everything. Add a Rebel video shielded center channel and surrounds for a home theater system designed for people who demand great sound but prefer a compact system. 1-800-KLIPSCH

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ANALOG INTERCONNECTS

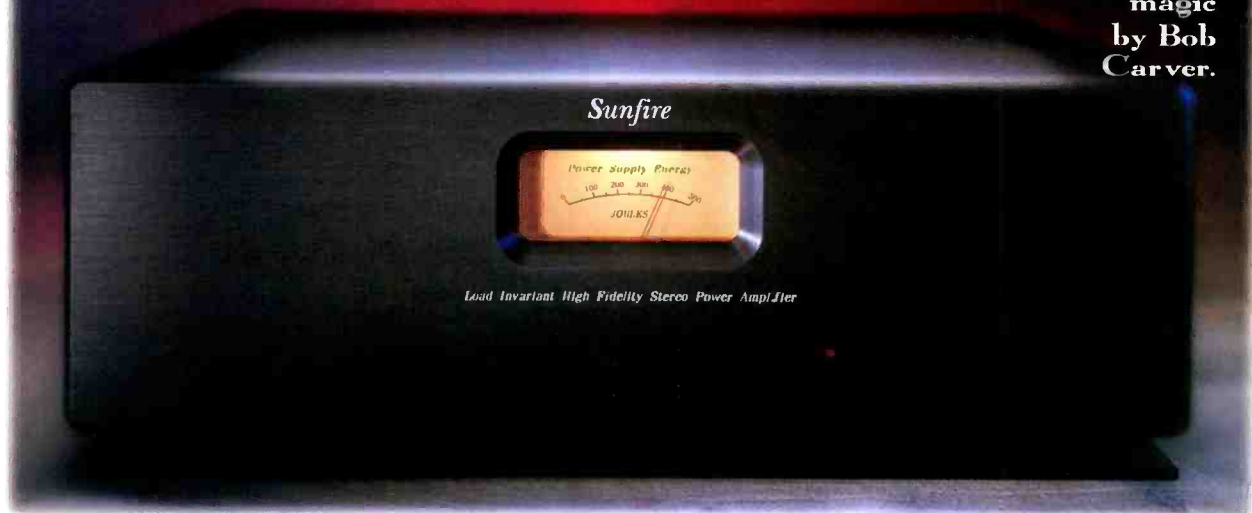
MANUFACTURER	Model	Type—See Code	Conducting Material	FINISHED CABLES				Notes
				Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	Available in Bulk?	
PURIST AUDIO DESIGN (Continued)	Maximus	U,B	Alloy/Silver	RCA, Neutrik XLR		†	†\$760.00, first meter pair (\$810.00 balanced); \$60.00 per additional 0.5 meter.	
	Colossus	U,B	Alloy/Silver/Chromed	RCA, Neutrik XLR		†	†\$1130.00, first meter pair (\$1180.00 balanced); \$80.00 per additional 0.5 meter.	
	Proteus	U,B	Proprietary Alloy	RCA, Neutrik XLR		†	†\$2300.00, first meter pair (\$2350.00 balanced); \$160.00 per additional 0.5 meter.	
	Dominus	U,B	Proprietary Alloy	RCA, Neutrik XLR		†	†\$5000.00, first meter pair (\$5100.00 balanced); \$300.00 per additional 0.5 meter.	
RADIO SHACK	Premium Stereo Patch Cable	U		RCA	3-20 feet	8.99-19.99	Gold-plated pins.	
	Premium Stereo Patch Extension	U		RCA	3 feet	9.99	Jacks to plugs; gold-plated connectors.	
	Standard Stereo Patch Cable	U		RCA	3-12 feet	3.99-6.99		
	Standard Stereo Patch Extension	U		RCA	3 feet	3.99	Jacks to plugs.	
	Standard Patch Cable	U		RCA	1.5-12 feet	1.79-3.49		
	Premium Patch Cable Ribbon	U		RCA	3 feet	16.99	Four gold-plated plugs at each end.	
	Standard Patch Cable Ribbon	U		RCA	3-6 feet	6.99-8.99	Four plugs at each end.	
Premium Stereo Mini-Plug Cable	U		Mini-Plug	6 feet	9.99	Gold-plated 1/8-inch plugs.		
SILVER SONIC	BL-1	U,B	OFC/Silver	RCA, XLR	Any	95.00/meter pair	Yes	
	T-20X	U,B	OFC/Silver		Any		Yes	
SIMPLYPHYSICS	Phaseline Pro	B	Copper/Silver	XLR	0.5-125 meters	395.00-10,000	No	
SOLID CORE TECHNOLOGY	SCT-04 (Cormorant)	U	Copper	RCA	0.5-3 meters	114.00-189.00	No	
	SCT-04 (Cormorant)	B	Copper	XLR	0.5-6 meters	124.00-289.00	No	
SONANCE	MediaLinQ Bronze	U	OFC	RCA	7 inches	4.50	No	
	MediaLinQ Bronze	U	OFC	RCA	0.15-6 meters	5.00-13.75		
	MediaLinQ Silver	U	OFC	RCA	0.5-6 meters	21.75-37.50	Y-adaptor.	
SONORAN AUDIO DESIGNS	Cactus Connect Signature	U,B	Copper	RCA, XLR	0.5-10 meters	250.00-1200.00	Yes	
	Cactus Connect MkII	U,B	Copper	RCA, XLR	0.5-10 meters	157.00-784.00	Yes	
SOUND IMAGES	SI Signature	U,B	Copper	RCA, XLR	1-2 meters	350.00-650.00	No	
	SI 1	U,B	Copper	RCA, XLR	1-10 meters	250.00-1600.00	No	
	SI 99.99997%	U,B	Copper	RCA, XLR	1-10 meters	140.00-590.00	No	
SOUNDSTREAM TECHNOLOGIES	Streamline	U	Copper	RCA	1-5 meters	16.00-33.50	No	
	DL*1	U	OFC	RCA	0.5-5 meters	27.50-60.00	Yes	
	SL*1	U	Copper	RCA	0.5-2 meters	36.00-60.00	Yes	
	HRV*1	U	Copper	RCA	1-5 meters	18.00-35.00	Yes	
	4SP SN*1	U	Copper	RCA	500 feet	.70/foot	Yes	
SOUND & VIDEO	AudiFlex Gold I	U	Copper	RCA	0.5-3 meters	111.00-138.00/pair	No	
	AudiFlex Gold II	B	Copper	XLR	0.5-3 meters	118.00-144.00/pair	No	
	AudiFlex Gold V	U	Copper	RCA	0.5-3 meters	118.00-144.00/pair	No	
SPECTRAL AUDIO	MI-330	U	Copper	RCA	3-40 feet		No	
	Ultralinear Terminator							
	MI-350	U	Copper	RCA	3-35 feet		No	
STINGER ELECTRONICS	Stinger Drone Series	U	OFC	RCA	0.5-20 feet	4.50-12.00	No	
	Stinger Venom Series	U	OFC	RCA	0.5-20 feet	7.00-23.00	No	
	Stinger Queen Series	U	OFC	RCA	1.5-20 feet	15.36-31.60	Yes	
	Stinger King Series	U	OFC	RCA	1.5-20 feet	22.50-49.30	Yes	
	Stinger Dream Series	U	OFC	RCA	1.5-20 feet		Yes	
STRAIGHT WIRE	Virtuoso (IC)	U,B	Silver/Copper	RCA, XLR	0.5-6 meters	300.00-1950.00	Yes	
	Maestro II (IC)	U,B	Coated Copper	RCA, XLR	0.5-6 meters	195.00-1075.00	Yes	
	Solo (IC)	U	Silver/Copper	RCA	0.5-3 meters	240.00-725.00	Yes	
	Rhapsody II (IC)	U,B	Coated Copper	RCA, XLR	0.5-6 meters	120.00-450.00	Yes	
	Encore (IC)	U,B	Coated Copper	RCA, XLR	0.5-6 meters	80.00-300.00	Yes	
	Laser Link II (IC)	U	Coated Copper	RCA	0.5-6 meters	56.00-210.00	Yes	
	Symphony (IC)	U,B	OFC	RCA, XLR	0.5-6 meters	44.00-110.00	Yes	
	Flexconnect II	U	OFC	RCA	0.5-6 meters	34.00-100.00	Yes	
	Musicable II	U	OFC	RCA	0.5-6 meters	26.00-70.00	Yes	
	Harmony	U	OFC	RCA	0.6-6 meters	18.00-45.00	Yes	
Concerto	U	OFC	RCA	0.6-6 meters	13.00-36.00	Yes		
SYMDEX SYSTEMS	Beta	U,B	HCOFC	RCA, XLR	1 meter	195.00/pair	No	
	Omicron	U,B	HCOFC	RCA, XLR	1 meter	395.00/pair	No	
SYNERGISTIC RESEARCH	T.H.C.	U	Copper Matrix	RCA	3-10 feet	49.00-90.00	No	
	Alpha	U,B	Copper Matrix	RCA, XLR	2-50 feet	77.00-376.00	No	
TARA LABS	Prism 11	U	OFC	RCA	0.6-2 meters	25.00-42.00	No	
	Prism 22	U	OFC	RCA	0.6-10 meters	33.00-204.00	No	
	Prism 33	U	OFC	RCA	0.6-10 meters	52.00-239.00	No	
	Prism 55	U,B	OFC	RCA, XLR	0.6-10 meters	88.00-398.00	No	
	Prism CD	U	OFC	RCA	0.6-2 meters	39.00-79.00	No	
	RSC-CD	U	OFC	RCA, XLR	0.6-10 meters	90.00-730.00	No	
	RSC Prime	U,B	OFC	RCA, XLR	0.6-10 meters	114.00-690.00	No	
	RSC Reference Generation 2	U,B	OFC	RCA, XLR	0.6-10 meters	180.00-1046.00	No	
	RSC Master Generation 2	U,B	OFC	RCA, XLR	0.6-10 meters	320.00-2142.00	No	
	RSC Decade	U,B	Consonant Alloy	Locking RCA, XLR	0.6-10 meters	497.00-3695.00	No	
		U,B	Consonant Alloy	Locking RCA, XLR	0.6-10 meters		No	

Imagine.

A muscular 600 watt amp with the soul of a 9 watt triode.

The new Sunfire stereo amp:

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by Bob
Carver.



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



Choice of Outputs.

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

Performance that's difficult to believe.

The basis for all this is designer Bob Carver's versatility. He's worked successfully for over 20 years with both tube and solid state designs, and he understands the intrinsic subtleties of each. For the new Sunfire, he insisted on an enormous 138 ampere peak-to-peak output current capability with 600 watts rms per channel continuously into 4 ohms and 2400 watts rms into 1 ohm on a time-limited basis*. Courtesy of 24 massive Motorola triple-diffused output devices, each capable of 20 amperes without taxing current reserves. Imagine all that in a single amp. Or better yet, visit a **Sunfire** dealer. That's where you'll hear for yourself how Bob Carver's **Sunfire Amplifier** makes it all come together.

Sunfire

...from the mind & soul of Bob Carver

"If you are getting ready to spend more than \$2,175 on an amplifier—don't—at least not until you've given the Sunfire a listen. Highly recommended in the \$2000 to \$25,000 price class"

*F.I.C. 500 watts continuous per channel, both channels driven into 8 ohms from 20 Hz to 20 kHz with no more than 0.5% THD

For additional information on Sunfire, and especially the uncanny tracking downconverter, use the reader service card or write to Sunfire Corporation, PO Box 1589, Snohomish, WA 98290 • (206) 335-4748

The Sensible Sound

Issue Number 54

SPRING 1995

CIRCLE NO. 30 ON READER SERVICE CARD

ANALOG INTERCONNECTS

TYPE U — Unbalanced B — Balanced	FINISHED CABLES							Notes
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	
TED'S EXCELLENT CABLE	Dimension Reference	U	OFHC Silver-clad Copper	RCA	2-12 feet	75.00-105.00/pair	No	Custom lengths, \$3.00/pair/foot additional. As above but \$30.00.
TICE AUDIO	IC 1A IC 1A	U B	OFHC	RCA XLR	1-6 meters	225.00-495.00 270.00-594.00	Yes	TPT-treated jacket. As above.
TIFF ELECTRONICS	TIC-1 TIC-2 TIC-3	U U,B U,B	Copper Copper Copper	RCA RCA, XLR RCA, XLR	0.5-6 meters 0.5-6 meters 0.5-6 meters	80.00-350.00 120.00-560.00 150.00-700.00	Yes Yes Yes	Coaxial; custom lengths. Twisted pair; custom lengths. Multi-conductor; custom lengths.
TRANSPARENT CABLE	MusicLink Reference Reference XL Single-Ended MusicHord The Link MusicLink MusicLink Plus MusicLink Super MusicLink Ultra Balanced MusicLink Balanced MusicLink Plus Balanced MusicLink Super Balanced MusicLink Ultra Balanced MusicLink Reference Reference XL Balanced	U U U U U U U U B B B B B B B	Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper Copper	RCA RCA RCA RCA RCA RCA RCA RCA XLR XLR XLR XLR XLR XLR XLR	1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters 1-6 meters	1900.00-2700.00 4200.00-6000.00 45.00-150.00 90.00-290.00 145.00-435.00 240.00-590.00 450.00-990.00 850.00-1350.00 210.00-735.00 470.00-975.00 830.00-1330.00 1600.00-2100.00 3500.00-4300.00 7700.00-9500.00	No No Yes Yes No No No No Yes No No No No No No	Networked cable. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above. As above.
VAMPIRE WIRE	CC SC/II SC/IV CCC/II AI/2 SL	U U,B U,B U,B U,B U,B	Copper Silver-clad Copper Silver-clad Copper Copper Copper Silver	RCA RCA, XLR RCA, XLR RCA, XLR RCA, XLR RCA, XLR	0.5-7 meters 0.5-7 meters 0.5-7 meters 0.5-7 meters 0.5-7 meters 0.5-7 meters	19.00-70.00 78.00-175.00 110.00-305.00 45.00-110.00 195.00-585.00 250.00-1550.00	Yes Yes Yes Yes Yes Yes	Continuous-cast copper. As above.
WIREWORLD	Solstice II Oasis II Atlantis II Equinox II Polaris II Eclipse II Silver Eclipse II Gold Eclipse II Equinox II Balanced Polaris II Balanced Eclipse II Balanced Silver Eclipse II Balanced Gold Eclipse II Balanced	U U U U U U U U B B B B B	Grain-optimized Copper Grain-optimized Copper Grain-optimized PC Copper Grain-optimized PC Copper Grain-optimized PC Silver Grain-optimized PC Silver Grain-optimized PC Copper Grain-optimized PC Copper Grain-optimized PC Silver Grain-optimized PC Silver Grain-optimized PC Copper Grain-optimized PC Silver Grain-optimized PC Silver	RCA, BNC, DIN RCA, BNC, DIN RCA, BNC, DIN RCA, BNC, DIN RCA, BNC, DIN RCA, BNC, DIN XLR XLR XLR XLR XLR	0.1-200 meters 0.1-100 meters 0.1-100 meters 0.1-100 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters 0.1-50 meters	30.00/meter pair 50.00/meter pair 90.00/meter pair 130.00/meter pair 200.00/meter pair 300.00/meter pair 600.00/meter pair 1000.00/meter pair 130.00/meter pair 200.00/meter pair 300.00/meter pair 600.00/meter pair 1000.00/meter pair	Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes Yes	Symmetrical coaxial; Teflon insulation; CL-3/FT-4 rated; ¼- and ½-inch phone connectors. As above but MP Teflon. As above. Symmetrical coaxial; MP Teflon insulation; ¼- and ½-inch phone connectors. As above. As above. As above. Symmetrical coaxial; MP Teflon insulation; CL-3/FT-4 rated. Symmetrical coaxial; MP Teflon insulation. As above. As above. As above. Symmetrical coaxial; MP Teflon insulation; CL-3/FT-4 rated. Symmetrical coaxial; MP Teflon insulation. As above. As above. As above.
XLO ELECTRIC	XLO/VDO ER-4 XLO/VDO ER-5 XLO/Pro Type 150 XLO/Pro Type 100 XLO/Pro Type 100p XLO Electric/Standard Type 0.1 XLO Electric/Standard Type 0.1s XLO Electric/Standard Type 0.2 XLO Electric/Reference Type 1 XLO Electric/Reference Type 1s XLO Electric/Reference Type 2 XLO Electric/Reference Type 3a XLO Electric/Signature Type 1.1 XLO Electric/Signature Type 1.1s XLO Electric/Signature Type 2.1 XLO Electric/Signature Type 3.1	U U	OFHC OFHC Copper Copper Copper 4N OFHC 4N OFHC 4N OFHC 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper 6N Copper	RCA RCA RCA RCA RCA RCA XLR RCA RCA RCA RCA RCA RCA RCA RCA RCA RCA RCA RCA RCA	1 meter up 1 meter up	† †	Yes Yes	Four-conductor. †\$100.00, first meter pair; \$69.00 per additional meter. Two-conductor. †\$50.00, first meter pair; \$20.00 per additional meter. †\$49.95, first meter pair; \$20.00 per additional meter. †\$99.00, first meter pair; \$69.00 per additional meter. †\$119.00, first meter pair; \$69.00 per additional meter. †\$175.00, first meter pair; \$125.00 per additional meter. Floating Faraday-cage shield. †\$240.00, first meter pair; \$190.00 per additional meter. †\$210.00, first meter pair; \$150.00 per additional meter. †\$275.00, first meter pair; \$200.00 per additional meter. Floating Faraday-cage shield. †\$375.00, first meter pair; \$300.00 per additional meter. †\$330.00, first meter pair; \$250.00 per additional meter. Phono cable; floating Faraday-cage shield. †\$400.00, first meter pair; \$250.00 per additional meter. Teflon dielectric. †\$625.00, first meter pair; \$500.00 per additional meter. Teflon dielectric. †\$725.00, first meter pair; \$600.00 per additional meter. Teflon dielectric. †\$675.00, first meter pair; \$550.00 per additional meter. Teflon dielectric; full floating Faraday-cage shield. †\$750.00, first meter pair; \$500.00 per additional meter.

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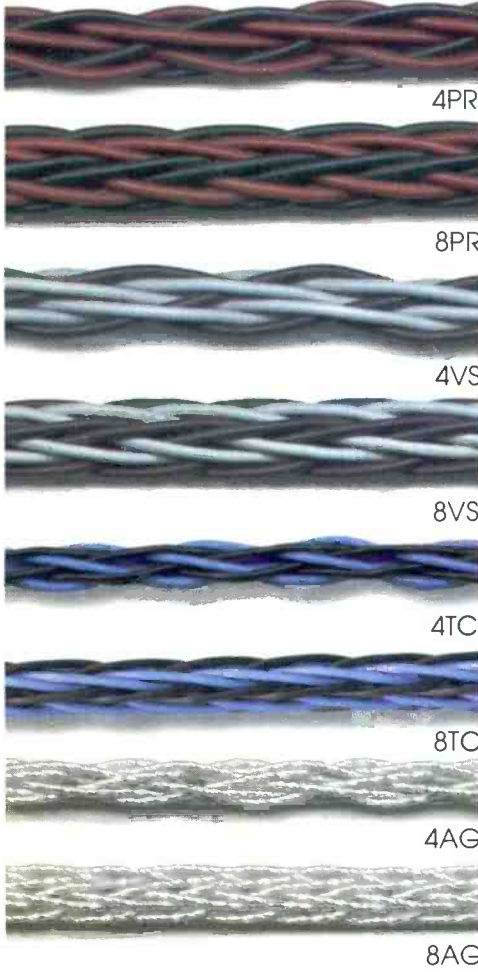
DIGITAL INTERCONNECTS

TYPE	FINISHED CABLES							Notes
	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	Available in Bulk?	
MANUFACTURER								
ACROTEC	6N-D5010		6N Copper	RCA	0.6-1 meter	200.00-250.00	No	Gold-plated 6N copper connectors.
AMERICAN HYBRID TECHNOLOGY	AHT Ultra Resolution	U	Copper	RCA	0.5-2 meters	175.00-250.00		
ANALOG RESEARCH	U-Byte 1	U	Copper	BNC	6 meters	50.00	No	75-ohm.
	U-Byte 2	U	Copper	BNC	6 meters	200.00	No	As above.
APATURE PRODUCTS	BL-4 Accusound Silver (2+2)	U,B	Silver	RCA, XLR	Any	70.00-1000.00	Yes	SMA, mini-BNC, and angled connections optional. Black Beauty RCA connector.
	Digital Datalink	U	Silver	RCA, BNC	Any	60.00-500.00	Yes	
Fiber Optic	O	Polished Glass	Pre-radiused ST	Any	120.00-1000.00	Yes		
Black Beauty BL-2+2	U,B	OFC	RCA, XLR	Any	50.00-500.00	Yes		
AUDIENT TECHNOLOGIES	Datrix Standard	U	Copper	RCA, BNC	1.5-3 meters	185.00-250.00	No	75-ohm; AES/EBU version available. As above.
	Datrix Reference	U	Copper	RCA, BNC	1.25-3 meters	350.00-450.00	No	
	SDI	U	Copper	RCA, BNC	0.1 meter	60.00	No	
AUDIO ALCHEMY	DST	U,B	Copper	BNC	1 meter	259.00	No	Powered RS422; includes power supply. Transformer-coupled; removes digital ground loops.
	Clearstream	U	Copper	RCA	1 meter	89.00	Yes	
AUDIO INSURGENTS	ByteRight V.5.1	U	Copper	RCA	1-10 meters	289.00-1063.00	No	Custom lengths. As above. As above. As above.
	ByteRight V.4.1	U	Copper	RCA	1-10 meters	229.00-904.00	No	
	ByteRight V.3.1	U	Copper	RCA	1-10 meters	129.00-489.00	No	
	ByteRight V.2.1	U	Copper	RCA	1-10 meters	60.00-222.00	No	
AUDIO MAGIC	Sceptor	U,B	Silver-clad Copper	RCA, DIN	Any	39.00/meter	No	Ribbon conductors. I ² S interconnect for Audio Alchemy products.
	Spellcaster	U,B	Silver	Lockable RCA, DIN	Any	249.00/meter	No	
	Sorcerer	U,B	Silver	WBT Lockable RCA, DIN	Any	349.00/meter	No	
	Illusion	U,B	Silver	WBT Lockable RCA, DIN	Any	799.00/meter	No	
Mystic			Silver-clad Copper	DIN	Any	99.00/meter		
AUDIOPRISM	Digital RX	U	Copper	RCA	1-3 meters	250.00-500.00	No	
AUDIOQUEST	Digital One	U	Silver-plated Long-grain Copper	RCA, BNC	0.5 meter up	30.00/meter	Yes	Double-balanced. As above. Triple-balanced. Brass ferrule.
	Digital Two	U	Silver-plated Copper	RCA, BNC	0.5 meter up	75.00/meter		
	Digital Pro	U	Silver	RCA, BNC	0.5 meter up	225.00/meter		
	AES/EBU Two	B	Silver-plated Copper	XLR	0.5 meter up	135.00/meter		
	Optilink X	O	Synthetic	Toslink	1-12 meters	98.00/meter	No	
	Optilink Z	O	Quartz	Toslink	1-12 meters	245.00/meter	No	
Optilink Pro 1	O	Fused Silica	AT&T ST	1-12 meters	175.00/meter	No		
AUDIO RESEARCH	Digitalink	U		RCA, BNC	1-1.5 meters	200.00-250.00	No	
	Digitalink	B	Copper	XLR	1-1.5 meters	130.00-145.00	No	
AUDIOTRUTH	Optilink Pro 2	O	Fused Silica	AT&T ST	1-12 meters	295.00/meter	No	Triple-balanced. As above.
	Lapis AES/EBU	B	Silver	XLR	0.5 meter up	297.50/meter		
	Diamond AES/EBU	B	Silver	XLR	0.5 meter up	487.50/meter		
AURAL SYMPHONICS	Aural Optical Gen 1	O	Glass	AT&T ST	1-2 meters	200.00-300.00	No	75-ohm; includes ground wire. Dual twin-axial design; includes ground wire. 75-ohm; includes ground wire. Dual twin-axial design; includes ground wire.
	Optimism	O	Glass	AT&T ST	2 meters	595.00	No	
	Digital Standard Gen 2i	U	Copper	RCA, BNC	1-2 meters	195.00-345.00	No	
	Digital Standard AE	B	Copper	XLR	1-2 meters	390.00-570.00	No	
	Digital Statement Gen 2i	U	Copper	RCA, BNC	1-2 meters	400.00-780.00	No	
	Digital Statement AE	B	Copper	XLR	1-2 meters	650.00-950.00	No	
BEL	"The Wire" P1D	U	Copper	RCA	0.5 meter up	80.00 up	No	Custom lengths.
CABLE TALK	Digital 2		Copper	RCA, BNC	0.5-1 meter	179.95-224.95	Yes	70- or 110-ohm.
CAMELOT TECHNOLOGY	Excalibur			RCA	3 feet	125.00	No	Includes "Stone" pulse-train optimizer. Teflon construction. As above; I ² S interface cable.
	Excalibur II		Copper/Silver	XLR	3 feet	125.00	No	
	Excalibur III		Copper/Silver	5-Pin Mini-DIN	3 feet	125.00	No	
CAMPAIGN DESIGNS	Silurian	U	Copper	RCA	0.75-2 meters	175.00-350.00	Yes	
CARDAS AUDIO	Lightning High-Speed Digital		Copper	RCA	0.5 meter up	215.00 up	No	
	AES/EBU		Copper	RCA	0.5 meter up	215.00 up	No	
	High-Speed Data Transmission Video/Digital		Copper	RCA	0.5 meter up	58.00 up	No	
CUSTOM CONNECTIONS	Hi-Rez Video	U	Copper	RCA	1-5 meters	15.00-40.00	Yes	Molded gold ends. Custom lengths; silver-soldered. As above; multi-pair. As above. As above.
	HDTV Video		Copper	RCA	0.5-5 meters	35.00-75.00	Yes	
	Benchmark MkI Digital	U,B	Copper	RCA, DIN	0.5-5 meters	69.00-150.00	Yes	
	Benchmark MkII Digital	U,B	Copper	RCA, DIN	0.5-5 meters	79.00-180.00	Yes	
	Groneberg Digital	U,B	Copper	RCA, DIN	0.5-5 meters	129.00-249.00	Yes	
DANIELS AUDIO	Alpha	B	OFC	RCA, DIN, XLR	0.5-7 meters	39.00-339.00	No	Litz twisted pair. As above; shielded/tonerarm cable available. As above.
	Epsilon	B	OFC	RCA, DIN, XLR	0.5-7 meters	89.00-619.00		
	Omega	B	OFC	RCA, DIN, XLR	0.5-7 meters	149.00-1329.00		
DISCOVERY CABLE	Digi-Cable	U	HPOFC	RCA, BNC	1-10 meters	80.00-440.00	Yes	
DPA DIGITAL	Digi-Link	U	Copper	RCA	1 meter	59.00	No	
	Opti-Link	O	Glass	Toslink	0.75 meter	44.00	No	
EIDOLON RESEARCH	JB-4	U	Copper	RCA, DIN	0.5-10 meters	80.00-600.00	No	
	JB-8	U	Copper	RCA, DIN	1 meter	275.00	No	
ENSEMBLE	Digiflux 75	U	Copper	RCA, BNC	0.5-20 meters	75.00 up	Yes	Double-shielded.

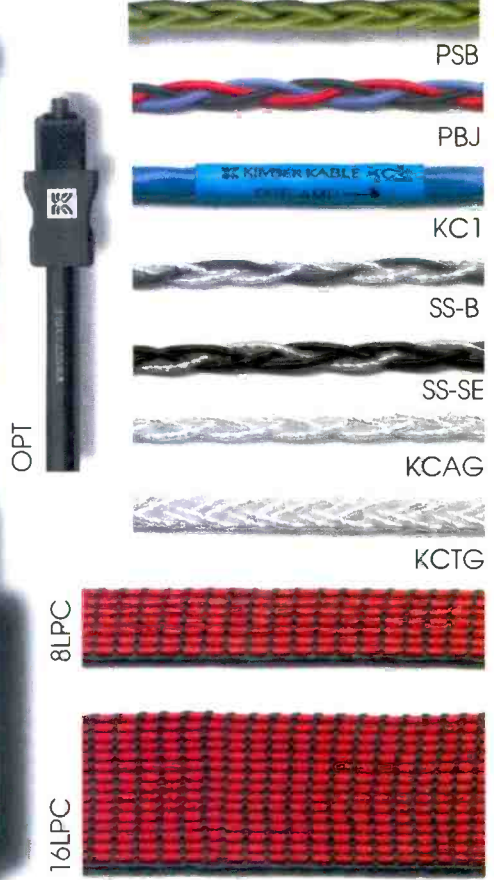
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AUDIO/NOVEMBER 1996

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CIRCLE NO. 38 ON READER SERVICE CARD

DIGITAL INTERCONNECTS

TYPE	FINISHED CABLES							Notes
	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices	Available in Bulk?	
MANUFACTURER								
ESOTERIC AUDIO U.S.A.	Numeric Graphis 75	U,B U	Silver-plated Copper Copper	RCA, BNC, XLR RCA, BNC	0.5-2 meters 0.5-6 meters	165.00-450.00/pair 40.00-120.00/pair	No No	Custom lengths. As above.
GOLDMUND	Lineal	U		RCA	1.5 meters up	495.00 up	No	
HIGHWIRE AUDIO	700 Di	U,B	Silver-plated Copper	RCA, BNC, XLR	1-2 meters	198.00-248.00	No	
HOVLAND	Hovland-Pincus Interconnect	U,B	Silver-plated Copper	RCA, XLR	3-25 feet	275.00-935.00	No	Custom lengths; optional balanced XLR, \$40.00 additional.
ILLUMINATI	DV-30 DV-60 DX-50 Orchid	U U B B	Proprietary Silver Proprietary Silver	RCA, BNC, F RCA, BNC, F XLR XLR	0.5 meter up 0.5 meter up 1.5 meters 1.5 meters	55.00 213.00 350.00 750.00	Yes No No No	
JENA LABS	Gemini Digi-Link RCA-RCA Gemini Digi-Link RCA-BNC Gemini Digi-Link BNC-BNC Integer S-PDIF RCA Integer S-PDIF BNC Trinity AES Integer AES	U U U U U B B	Copper Copper Copper Copper Copper Copper Copper	RCA BNC-RCA BNC RCA BNC XLR XLR	3.8-6 feet 3.8-6 feet 3.8-6 feet 3.8-6 feet 3.8-6 feet 3-6 feet 3-6 feet	150.00-190.00 200.00-240.00 250.00-290.00 400.00-590.00 500.00-690.00 360.00-432.00 720.00-864.00	No No No No No No No	
JPS LABS	The Digital Superconductor The Impressionist One	U B	Aluminum/Copper Copper	RCA, BNC Mini-DIN	0.375 meter up Any meters	99.00 up 99.00 up	No No	75-ohm transmission-line impedance. I ² S bus.
JVC	XN-100 HF Series XN-700 Pro Series	U U	Glass Glass	Toslink Toslink	1-2 meters 0.5-2 meters	20.00-25.00 100.00-150.00		Pure quartz glass fiber.
KIMBER KABLE	OPT AGDL TGDL	O U,B U,B	Proprietary Polymer Silver Silver	Toslink RCA, XLR RCA, XLR	0.5 meter up 0.5 meter up 0.5 meter up	40.00 up 112.00 up 195.00 up	No Yes Yes	Varistrand design. As above; larger conductor bundle.
KLYNE AUDIO ARTS	Dragonfly Wings DWD Dragonfly Wings DWDB	U B	Copper Copper	RCA, BNC XLR	0.7-6 meters 0.7-6 meters	225.00-625.00 250.00-650.00	No No	
LAT INTERNATIONAL	DI-20-D DI-20-D	U B	Silver-clad OFHC Silver-clad OFHC	RCA XLR	1 meter up 1 meter up	69.00 up 79.00 up	No No	Teflon insulation. As above.
LEGEND AUDIO DESIGN	Legend Digital Reference Legend Digital I	U U	Silver Silver	RCA RCA	1-2 meters 1-2 meters	349.00-558.00 250.00-400.00		
LINN	Digital Interconnect	U	Copper	RCA, BNC	1-50 meters	102.87 up	Yes	
LUMINOUS AUDIO TECHNOLOGY	Allegro Allegro Signature	U U	Copper Copper	RCA, BNC RCA, BNC	0.5-10 meters 0.5-10 meters	89.00-410.00 130.00-690.00	No No	AES/EBU available.
MACH 1 ACOUSTICS	Digital Flexible Digital Semi Rigid	U U	Copper Copper	BNC BNC	1-10 meters 1-5 feet	195.00-1095.00 195.00-295.00	Yes No	Foamed-Teflon dielectric; triple-shielded; 75-ohm. Foamed-Teflon dielectric; solid copper shield.
MADRIGAL AUDIO	MDC-1 Pro MDC-2 FatBoy	B U	Copper/Silver Copper	XLR RCA, BNC, XLR	0.5-10 meters 0.5-10 meters	243.00-1050.00 243.00-1050.00	No No	
MARIGO AUDIO LAB	Apparition Series 2	U	Copper	RCA, BNC	0.75-1 meter	549.00-595.00/pair	No	
McCORMACK AUDIO	Wonderlink Digital I Wonderlink Digital I Balanced Wonderlink Digital II	U B U	Copper/Silver Copper/Silver Copper/Silver	RCA, BNC XLR RCA, BNC	0.5-1.5 meters 1-1.5 meters 0.5-1.5 meters	195.00-253.00 275.00-325.00 69.00-89.00	No No No	Custom lengths. As above. As above.
MIT	MITerminator 3 Digital Digital Reference Proline Digital	U U B	Copper Copper Copper	RCA Locking RCA XLR	1-2 meters 1-2 meters 1-2 meters	100.00-125.00/pair 325.00-395.00/pair 695.00-795.00/pair	No No No	75-ohm. AES/EBU.
MONARCHY AUDIO	DR-1 DR-2 DAB-1 DR-3	U U B U	Silver Silver PCOCC Copper	RCA RCA XLR RCA-BNC	3 feet 3 feet 3 feet 3 feet	199.00 99.00 49.00 49.00	No No No No	Solid Teflon dielectric. As above.
MUSICAL CONCEPTS	Super Connect IV	U	Plated Copper	RCA	0.5-3 meters	49.00-72.00	Yes	Triple dielectric.
MUSIC-LINK	DOC-1+ DOC-1+ DOC-2+ DOC-2+ DOC-3+ DOC-3+ DOC-4+ DOC-4+	U B U B U B U B	OFHC OFHC OFHC OFHC OFHC OFHC OFHC OFHC	RCA XLR RCA XLR RCA XLR RCA XLR	1-12 feet 1-12 feet 1-12 feet 1-12 feet 1-12 feet 1-12 feet 1-12 feet 1-12 feet	115.00-720.00 145.00-970.00 195.00-1295.00 265.00-1695.00 295.00-1945.00 395.00-2595.00 395.00-2595.00 525.00-3440.00	No No No No No No No No	Litz; unshielded; shielded version available. As above. As above. As above. As above. As above. As above. As above.
MUSIC METRE	Fidelus Digital Signature Digital	U,B U,B	OFC OFC	RCA, BNC, XLR RCA, BNC, XLR	0.5-50 meters 0.5-50 meters	150.00-450.00 87.50-200.00	No No	Air dielectric.
NIRVANA AUDIO	Transmission	U	Copper/Silver	RCA, BNC	1.5 meters	595.00	No	75-ohm.
NORDOST	Moongio Moongio AES/EBU	U B	Silver Silver	RCA XLR	0.6-1.5 meters 0.6-1.5 meters	180.00-240.00 225.00-300.00	No No	Coaxial twisted pair; Teflon insulation. As above.
PARADOX	Paradox	U	Copper	RCA	1 meter	250.00	No	
PARASOUND	LightLine DataBridge Balanced DataBridge	O U B	Glass Copper Copper	AT&T ST RCA XLR	1 meter 1 meter 1.5 meters	120.00 90.00 99.00	No No No	
PRISMA	Prisma-Link	U	Copper	RCA	1-1.5 meters	75.00-95.00	No	Custom lengths.

DIGITAL INTERCONNECTS

TYPE	FINISHED CABLES							Notes	
	MANUFACTURER	Model	Type—See Code	Conducting Material	Connector Type	Minimum and Maximum Lengths	Minimum and Maximum Prices		Available in Bulk?
U—Unbalanced B—Balanced O—Optical	PUREST SOUND SYSTEMS	Digital Link I Digital Link II	U U	OFC OFC	RCA BNC	0.6-5 meters 0.6-5 meters	45.00/meter 65.00/meter	Yes Yes	75-ohm. As above; EMI/RFI suppression.
	PURIST AUDIO DESIGN	Colossus Digital Colossus Balanced AES/EBU Proteus Digital Proteus Balanced AES/EBU	U B U B				† † † †		75-ohm ±10%. †\$340.00, first meter; \$60.00 per additional 0.5 meter. 110-ohm ±10%. †\$390.00, first meter; \$110.00 per additional 0.5 meter. 75-ohm ±1%. †\$525.00, first meter; \$100.00 per additional 0.5 meter. 110-ohm ±1%. †\$625.00, first meter; \$100.00 per additional 0.5 meter.
	SILVER SONIC	D-75 D-110	U B	OFC/Silver	RCA, BNC XLR	Any Any		Yes Yes	75-ohm; foam Teflon dielectric. AES/EBU; Teflon dielectric.
	SIMPLYPHYSICS	Byteline III	U	Copper	RCA, BNC	1-20 meters	200.00-2100.00	No	Silver coaxial shielding; Teflon dielectric.
	SONORAN AUDIO DESIGNS	Cactus Connect Signature Cactus Connect MkII	U,B U,B	Copper Copper	RCA, XLR RCA, XLR	0.5-10 meters 0.5-10 meters	125.00-600.00 80.00-365.00	Yes Yes	Custom lengths. As above.
	SOUND IMAGES	SI Signature SI 1 SI 99.99997%	U,B U,B U,B	Copper Copper Copper	RCA, XLR RCA, XLR RCA, XLR	1-2 meters 1-2 meters 1-4 meters	250.00-400.00 150.00-200.00 100.00-250.00	No No No	Litz; proprietary shielding. Twisted pairs; proprietary shielding.
	SOUND & VIDEO	DigiFlex Gold I DigiFlex Gold II DigiFlex Gold III DigiFlex Gold IV DigiFlex + PLUS	U U U B U	Copper Copper Copper Copper Copper	RCA BNC RCA, BNC XLR RCA, BNC	0.5-15 meters 0.5-15 meters 0.5-15 meters 0.5-15 meters 0.5-3 meters	60.00-190.00 60.00-190.00 60.00-190.00 76.00-222.00 143.00-182.00	No No No No No	75-ohm; gold-plated connectors. As above. As above. AES/EBU 110-ohm; gold-plated connectors. 75-ohm; gold-plated connectors.
	STRAIGHT WIRE	Info-Link Mega-Link Silver-Link II Video-Link STX Toslink		Silver Silver/Copper Silver/OFC OFC Glass Plastic	RCA, BNC RCA RCA RCA AT&T ST Toslink	0.5-2 meters 0.5-6 meters 0.5-6 meters 0.5-6 meters 1-9 meters 1 meter	200.00-540.00 85.00-470.00 43.00-130.00 17.00-50.00 250.00-410.00 49.00	Yes Yes Yes Yes No No	Coated conductor; foam Teflon insulation. Dual shield. 75-ohm. Kevlar-reinforced.
	SYMDEX SYSTEMS	Xi	B	HCOFC	XLR	1 meter	195.00	No	Custom lengths.
	TARA LABS	Prism Digital Prism Luminary RSC Digital 75 RSC Master Digital RSC Decade Digital	U O U U,B U,B	Silver Glass OFC Consonant Alloy Consonant Alloy	RCA, BNC AT&T ST RCA Locking RCA, BNC, XLR Locking RCA, BNC, XLR	0.6-10 meters 1-2 meters 0.6-10 meters 0.6-10 meters 0.6-10 meters	85.00-695.00 185.00-225.00 180.00-1230.00 275.00-2050.00 370.00-2405.00	No No No No No	Gold-plated connectors. As above; rectangular solid-core. As above. As above.
	THETA DIGITAL	Digital Cable Teflinque Balanced Digital Cable Single Mode Laser Linque Cable AT&T Cable	U B O O	Proprietary Alloy Proprietary Alloy Glass Glass	RCA XLR FCPC Single-mode AT&T ST	1-1.5 meters 1 meter 1-2 meters 1-2 meters	180.00-225.00 250.00 180.00	No No No No	
	TICE AUDIO	DC 1A DC 1A	U B	OFC OFC	RCA XLR	1-3 meters 1-3 meters	125.00-200.00 200.00-350.00	Yes Yes	TPT-treated jacket. As above.
	TIFF ELECTRONICS	TDC-3	U,B	Copper	RCA, BNC, XLR	0.5-6 meters	90.00-300.00	Yes	Solid-core; custom lengths.
	TRANSPARENT CABLE	High Performance Digital Premium Digital AES/EBU Digital	U U B	Copper Copper Copper	RCA RCA XLR	1-6 meters 1-6 meters 1-6 meters	90.00-260.00 250.00-750.00 400.00-1200.00	No No No	75-ohm. As above. 110-ohm.
	VAMPIRE WIRE	DI/1	U	Copper	RCA, BNC	0.5-3 meters	100.00-250.00	Yes	Continuous-cast copper.
	WIREWORLD	Starlight II Video/Digital Silver Starlight II Digital A/V Gold Starlight II Digital A/V Silver Starlight II AES/EBU Gold Starlight II AES/EBU	U U U B B	Grain-optimized PC Copper Grain-optimized PC Silver Grain-optimized PC Silver Grain-optimized PC Silver Grain-optimized PC Silver	RCA, BNC RCA, BNC RCA, BNC XLR XLR	0.1-100 meters 0.1-100 meters 0.1-50 meters 0.1-100 meters 0.1-50 meters	55.00/meter 160.00/meter 320.00/meter 160.00/meter 320.00/meter	Yes Yes Yes Yes Yes	Microporous Teflon insulation; CL-3/FT-4 rated. Microporous Teflon insulation. As above. As above; CL-3/FT-4 rated. Microporous Teflon insulation.
	XLO ELECTRIC	XLO/VDO ER-6 XLO/Pro Type 104 XLO/Pro Type 104p XLO Electric/Standard Type 0.4 XLO Electric/Reference Type 4 XLO Electric/Reference Type 7 XLO Electric/Signature Type 4.1 XLO Electric/Signature Type 4.1b	U U U U O U U	OFC Copper Copper 4N OFHC 6N Copper Glass 6N Copper 6N Copper	RCA, BNC RCA RCA RCA, BNC RCA AT&T ST RCA AES/EBU	1 meter up 1 meter up 1 meter up 1 meter up 1 meter 1 meter 1 meter	† † † † 165.00 † †	Yes Yes Yes Yes No No	75-ohm. †\$35.00, first meter; \$8.00 per additional meter. †\$55.50, first meter pair; \$35.00 per additional meter. †\$63.00, first meter pair; \$35.00 per additional meter. †\$89.00, first meter pair; \$64.00 per additional meter. †\$175.00, first meter; \$100.00 per additional meter. Teflon dielectric. †\$325.00, first meter; \$250.00 per additional meter. Teflon dielectric. †\$375.00, first meter; \$280.00 per additional meter.
	YBA	Diamond Cristal	U U	Copper Copper	RCA RCA	1-6 meters 1 meter	520.00-1320.00/pair 300.00/pair	No No	Twelve leads twisted three by three; three shielding levels. Four leads individually insulated, shielded, and twisted together.

CLASSICAL RECORDINGS

Richter

For recording producers, as for so many other hapless individuals peripheral to Richter's career, he has never made life easy. To begin with, he *hates* to record. If he does it at all, he prefers doing it in live performance—but with no recording para-



Sviatoslav Richter in Prague
Various orchestras and conductors
 PRAGA CMX 354001-15
 15 CDs; AAD; 16:44:01
 Sound: B, Performance: A

Edition Sviatoslav Richter
Various orchestras and conductors
 BMG/RCA 74321-29460
 10 CDs; ADD; 11:17:57
 Sound: B, Performance: A



Philips collection—almost all these recordings date from considerably farther back—but for the sheer music they offer, both command serious attention. Both Praga's and BMG/RCA's engineers have accomplished prodigies of rejuvenation in using digital technology to resuscitate old recordings—some of which I knew in their original, primitive LP versions, and would scarcely recognize here.

pernalia visible to him. That means all sorts of technical disadvantages—makeshift, far from optimal microphone placement, background audience racket, the impossibility of retakes, etc. However, with an artist of Richter's supremacy, recording firms have to take what they can get—and feel lucky to get it.

If you examine the fine print on this BMG/RCA set, you discover not

This past March 20th, Sviatoslav Richter observed his 81st birthday. When I reviewed Philips' boxed set of 21 Richter CDs (September 1995), I said he clearly regarded those selections from his recorded repertoire as his legacy. (I also pointed out that today, in the autumn of a life that permitted me, as a Juilliard teenager, to hear such keyboard titans as Josef Hofmann, Vladimir Horowitz, Sergei Rachmaninoff, Moriz Rosenthal, et al., I have come to regard Richter as the equal, and in some instances the superior, of any of those.) Now two other labels have picked up on the legacy idea and come out with their own boxed Richter sets. Whatever their sometimes considerable drawbacks, one must rejoice simply to have them available.

For sound, neither of these new sets can do more than approach the

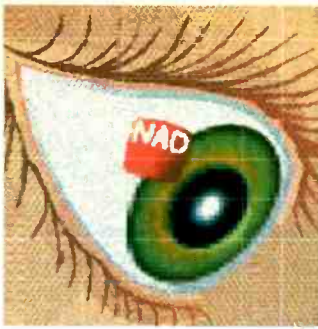
Exotic Dances from the Opera: Music of Rimsky-Korsakov, Richard Strauss, Tchaikovsky, Mussorgsky, Rabaud, Rubinstein, Dvorák, and Saint-Saëns
 Minnesota Orchestra, Eiji Oue
 REFERENCE RECORDINGS
 RR-71CD CD; DDD; 60:36
 Sound: A+, Performance: A

The general concept of this collection takes me back to the early days of the LP or even the first prerecorded stereo tapes. But aside from the *Samson and Delilah* "Bacchante" and *The Snow Maiden's* "Dance of the Tumblers," these eight tracks are not potboilers as were those on early spectaculars, so the CD also cannot be pegged with the standard audiophile-record criticism of "great sound/lousy music or performance."

Fritz Reiner's recording of *Salome's* "Dance of the Seven Veils" may have the raw emotion, but this rendition from the new conductor of the Minnesotans reveals delicate details that were previously lost in the work's dense sonic fabric. Keith Johnson's miking captures a rich and natural acoustic that I've not heard before on symphonic releases from Reference Recordings. His miking channels the hall ambience as a clean and strong stereo difference signal, which (if you have an HDCD decoder) provides an excellent surround sound field through even the simplest of processors. This is a great demo disc and a fine sampler for those who prefer the ballet episodes of many operas to the vocal portions.

John Sunier





218 THX stereo power amplifier

worth looking into

The NAD 218 THX stereo power amplifier is one of the most sophisticated hi fi components we have ever produced. Yet for all its brilliant features and astonishing levels of performance, it remains true to the NAD "no nonsense" design philosophy.



The very first feature you'll notice is the weight of the 218 THX, due partly to the heavy construction of the chassis and iron panel designed for rack mounting. (its advanced specification makes the 218 THX ideal for professional studio use). But the increase in weight is largely due to the massive Hölmgren toroidal mains transformer



WHY SO LARGE AND WHY HOLMGREN?

Apart from being the ideal design for the huge amounts of power it is likely to handle, the Hölmgren offers other advantages:

A conventional transformer can be affected by AC mains to produce hum or even buzzing whereas a Hölmgren transformer isn't. Plus, a Hölmgren transformer because of its unique design, will not affect other adjacent components

A feature which doesn't add much to the weight of the 218 THX but certainly adds to the weight of its performance is the bank of eight capacitors, rather than a single pair. This is a comparatively low cost benefit which makes a better power



supply because several smaller capacitors have a faster recovery time and have less equivalent series inductance and resistance than a single pair.

The 218 THX incorporates fully balanced XLR inputs, allowing the use of long runs of cables between

pre-amp power stages, without the risk of

interference. This thoughtful yet simple feature offers the opportunity to set your system up more flexibly and of course it's a benefit if you are bridging two 218 THX's for mono and locating them nearer your speakers

The circuitry includes left and right channel PCBs, offering lots of benefits. They include less complicated PCB's meaning extra

reliability, more separation of circuits, so like the Hölmgren transformer, less interference going out or coming in. All this, plus lower build cost too.

means more savings again towards the specification of better components

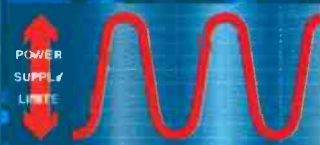
Any amp which is overdriven (unlikely on the 218 THX because it is so powerful) can produce distortion or 'clipping'. The NAD Soft Clipping circuit gently transforms the waveform, rounding

of the peaks, preventing "dynamic overload" and heading off damage to your ears and your speakers, without losing the sense of musical drama.

Hard Clipping



Soft Clipping



There are other more hidden features, too which provide specific benefits. Typically, the 218 THX incorporates extensive non-intrusive protection circuitry. This prevents damage from accidental overload or misuse which can lead to overheating or circuit failure.

Finally, for those for whom the letters THX are somewhat of a mystery, let us briefly explain.

George Lucas, creator of the 'Star Wars' epics, went to extraordinary lengths to ensure that the sound quality of his films exceeded anything Hollywood had

previously produced and he laid down exacting specifications covering distortion, rise, power etc. to encourage manufacturers to develop products which will reproduce his sound tracks to the standard they deserve.

NAD was first with a power amplifier which met these challenging standards and won the right to carry the THX badge. The 218 THX continues this principle of quality first.



So what do you get for your not insubstantial investment at the end of the day?

A thoughtfully designed, utterly reliable, acoustically stunning 2 X 200 watts, bridgeable to a more than you'll ever need 700 watts mono, with more headroom than your window frames will thank you for, which could ever change the way you perceive music.

But with all this capability none of it is a fashion statement. The 218 THX is designed not designer. Every feature of the 218 THX enhances performance and reliability.

That's why our slogan "pure and simple" is as relevant today for equipment as advanced as the 218 THX as it was when NAD was created more than 20 years ago.



NAD pure and simple.

only that all the recordings come from the erstwhile state-owned Melodiya recording firm but also—issued in 1996!—from the long bygone days of monophonic recording. So do many choice items in the Praga set, which mines tapes made from broadcasts of live Richter performances in Czechoslovakia between 1954 and 1988. In both sets, some of those live performances seem to have coincided with serious epidemics of respiratory maladies. Nevermind: Richter remains Richter, and we will not soon—if ever—hear his like again.

He does still perform in public, but rarely (in repertoire far less demanding than the pyrotechnics he once tossed off with such negligent finesse) and only if all peripheral conditions fully conform to his demanding tastes and preconditions. He never liked many aspects of the U.S.A. and years ago eliminated it from his touring itinerary. Especially for Americans, these recordings—many of them both musically and pianistically breath-

taking—will forever bear witness to the Richter phenomenon.

Here we have a unique pianist who combined most of the best characteristics of all his leading contemporaries. As for technique, he took on with consummate ease anything most virtuosos except Horowitz shied away from—but Richter brought them to life with less brittleness and more poetry than that other phenomenon himself did. If you think of Franz

Liszt as a barn-burner, for instance, Richter's interpretation of his music will prove to you the unfair limitations of such a conception.

The limited scope of a single review forces the reviewer to give this coincidental, duplex blockbuster merely a lick and a promise, comparatively speaking. The BMG/RCA set contains a generous portion of Bach: Richter's favorite English Suite (No. 3, in G Minor—recorded in 1948!), the D-Minor Concerto, and (with Anatoly Vedyernyikov) the Concerto for Two Claviers and Orchestra. Until fairly late in Richter's life, Soviet strictures against much contemporary music caused Richter to chafe badly, but here we have conceivably his first venture into the mu-

sic of Béla Bartók: the relatively innocuous 15 Hungarian Peasant Songs transcribed for piano. Few major virtuosos would deign to record Beethoven's Choral Fantasy for Piano, Chorus, and Orchestra; here Richter does—just as he does César Franck's symphonic poem *Les Djinns*, with its important but not conventionally solo-piano obbligato. The Chopin ration includes the C-Sharp Minor Polonaise and the Second Concerto in F Minor. Four further, characteristically esoteric concertos include those by Glazunov and Rimsky-Korsakov, the Prokofiev First, and the Saint-Saëns Fifth. Five of Liszt's Études d'Exécution Transcendante run the musical and technical gamut from introverted poetry to extroverted razzle-dazzle. Hardly anywhere else today will you encounter Tchaikovsky's

merklavier" (Op. 106)—to say nothing of the great "Diabelli" Variations. From Brahms come the esoteric Variations on a Hungarian Song (Op. 21, No. 2), from Mozart five Sonatas, from Rachmaninoff eight Études-Tableaux, from Schumann the Symphonic Études and the great four-movement Fantasy, and from Scriabin the Sonatas No. 2 and No. 5.

Genuine rarities, at least from Richter, include the Weber Sonata No. 3, unfairly forsaken by most contemporary pianists, and two surprise Ravel recordings: the complete "Miroirs" suite (including an "Alborado del gracioso" rivalling Dinu Lipatti's legendary recording) and the "Valse Nobles et Sentimentales."

Both these sets' notes carry bylines unorthodox by U.S. standards: Pierre-E. Barbier for the Praga, Prof. C.

Rueger for the BMG/RCA. The professor evidently knows a lot more about Richter's complicated biography than Barbier seems to—including some tidbits new to even such an old Richter hand as me. Barbier's, while adequate, perhaps primarily demonstrate the ability of a good computer word-processing program's ability to block, copy, paste, and recycle material from one piece of writing to another.

So here, dear reader, you pay your money and you take your choice. In a situation as atypical as this one, other considerations, particularly technological, simply have to fade into second place to the paramount fact

of the music itself. Some of these performances may force you to reconsider the relative importance of the very latest, up-to-the-absolutely-last-minute state of the recording art; a few others may arouse homicidal emotions towards the apparently terminal respiratory cases in the near background, uninhibitedly barking away like walrus. Musically, though, many of these miraculous performances will carry you to unprecedented heights, causing almost overly familiar works to sound fresh, new, and vital and also making you feel fortunate to have shared the same century with the Ukrainian-born, German-Russian-Polish-Swedish-Tartar pianist known as Sviatoslav Teofilovich Richter.

Paul Moor

BRIAN: SYMPHONIES NO. 20 AND NO. 25; FANTASTIC VARIATIONS ON AN OLD RHYME

National Symphony Orchestra of Ukraine,

Andrew Penny

MARCO POLO 8.223731, CD; DDD; 62:44

Sound: A, Performance: A

Since his death in 1972, Havergal Brian's music has become something of a cult object. It may have been out of fashion earlier because he never partook of modernism's most tortuous elements; now, I suspect, it is credited with more profundity than it can legitimately claim, though it is certainly listenable and attractive. Call it proto-postmodern.

The early (1907) Variations are a bit of a romp (and, as the notes point out, rather Sibelius-like). The two symphonies, dating from the 1960s, are more serious in intent and fairly classical in form. They are played knowingly by the National Symphony Orchestra of Ukraine, guided by a British conductor, and are part of an on-

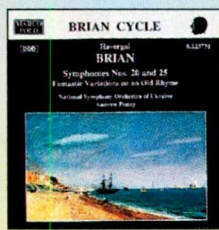
going Havergal Brian cycle on Marco Polo, sponsored by The Havergal Brian Society.

That connection may account for the oddball track numbering. Though the CD comprises three works, with a total of seven movements, there are 35 tracks. Each is referenced in the booklet's analytical notes, which makes detailed study easy. Needless to say, if record producers had stuck to Philips' original guidelines, the internal cues would have been index points, not tracks. As it is, current hardware reflects the producers' sloppy ways, so index points would be useless. But in order to play just Symphony No. 20 you must program 14 tracks into your player!

The orchestra is a fine one, and the pickup captures it in a very convincing concert-hall soundstage, moderately close-to.

Why the exotic venue for such quintessentially British music? In choosing the Ukraine, Marco Polo may have been trying to contain costs on what cannot be a best-selling series. If so, they have found a real bargain.

Robert Long



ORIGINAL MASTER RECORDING™



ULTRADISC II™
The GAIN System



NATURE'S ENCORE



NEW RELEASE UDCD 683



NEW RELEASE UDCD 684

BETTER SOUNDING MUSIC. UPGRADE TO ULTRADISC II™

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Monteverdi: Vesperae in Nativitate Sti. Joannis Baptistae

Hassler Consort, Franz Raml
MDG 605 0593, CD; DDD; 74:04
Sound: A, Performance: A+

Born in 1567, Claudio Monteverdi was the principal link between the music of the 16th and 17th centuries. Because of his monumental contributions to the dawning of baroque opera (notably his great *Orfeo*) and the vitality of his Italian madrigals, he is credited with leading music out of the renaissance and into the baroque. In this regard, he can be compared to Beethoven, who heralded the Ro-

manticism of the 19th century.

But Monteverdi also infused his new style into the church music of his day. He spent many years as the choirmaster of St. Mark's in Venice and composed a number of outstanding sacred works. Unlike most of his contemporaries, Monteverdi treated Biblical texts with the same originality that characterized his secular music. His *Vesperae in Nativitate Sti. Joannis Baptistae* contains an abundance of virtuosic vocal and instrumental technique, stark contrasts, and vivid word painting.



Since it also uses a variety of compositional styles, Monteverdi's Vespers can be difficult to perform with consistency. The Hassler Consort, under the direction of Franz Raml, has overcome these difficulties to present an outstanding interpretation that could be considered a definitive version. The group's attention to every detail is exemplified by its use of a quarter-comma mean-tone temperament. The ensemble, playing on original instruments, is tightly knit and flawlessly in tune. Even listeners leery of early music will instantly notice the resulting beauties of this performance's intonation.

Of the many excellent soloists, the countertenors are particularly fine. Overall sound quality is impressive, and great care was taken in balancing the voices and the instrumental accompaniments. *Patrick Kavanaugh*

Messiaen: Et exspecto resurrectionem mortuorum; Couleurs de la Cité Céleste; Stravinsky: Symphonies of Wind Instruments

Percussion Group of Strasbourg; Orchestre du Domaine Musical; New York Philharmonic,
Pierre Boulez
SONY CLASSICAL SMK 68332
CD; ADD; 57:01
Sound: B+, Performance: A-

Carter: A Symphony of Three Orchestras; Varèse: Déserts; Ecuatorial; Hyperprism

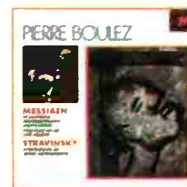
New York Philharmonic; Ensemble Intercontemporain, Pierre Boulez
SONY CLASSICAL SMK 68334
CD; ADD; 48:34
Sound: B+, Performance: A-

Boulez: Pli Selon/Livre Pour Cordes

BBC Symphony Orchestra; Strings of the New Philharmonic Orchestra, Pierre Boulez
SONY CLASSICAL SMK 68 335
CD; ADD; 70:50
Sound: B+, Performance: C+

You have to admire Pierre Boulez. While other composers have been swayed by the minimalist trends of the last 30 years, he has resolutely stayed the course of 20th century atonality. He's a champion of things that go skrack!, whether it's Elliott Carter or Frank Zappa. Like the architect O'Rourke in Ayn Rand's widely read *The Fountainhead*, Boulez will not give in.

These three recordings are part of a Sony Classical series of Boulez reissues illustrating his conducting and compositions. As a composer, he has charted major musical trends of the 20th century, from atonality to works influenced by world music. Olivier Messiaen's



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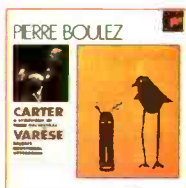
Wes Phillips, *Stereophile*,
Vol. 19, No. 6, June 1996

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"Et Exspecto Resurrectionem Mortuorum" ("And I Await the Resurrection of the Dead") and "Couleurs de la Cité Céleste" ("Colors of the Celestial City") are dramatic, sometimes frightening works employing stringless orchestras with lots of percussion. "Et Exspecto," in particular, sounds like the score for a blasted, post-apocalyptic landscape.

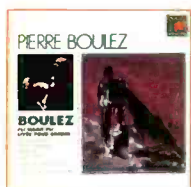
Igor Stravinsky's Symphonies of Wind Instruments shares the same discordant sonic terrain, in a work for winds and percussion that varies from the militaristic to the drama of a Balinese barong dance. It's only at the end of the piece that Stravinsky waxes contemplative with a chorale-like hymn.



While these composers were looking to Asia for inspiration, Edgar Varèse looked to the future of music made with electronic instruments. "Ecuatorial" uses the familiar and eerie Ondes

Martenot. Employing extensive percussion and sounds from the industrial world, like sirens, Varèse's 1923 work "Hyperprism" sounds thoroughly modern. Elliott Carter used conventional instrumental forces, but the expanded use of antiphony and the coloristic orchestrations of his A Symphony of Three Orchestras owe an allegiance to Varèse.

Boulez's own music is indebted to the composers he champions including one of his teachers, Messiaen. But there's a sense of detachment and intellectual play in Boulez's music that always keeps it at a distance. His



pointillistic techniques rarely instill the kind of emotional resonance that you can hear in Varèse's yearning compositions or Messiaen's exotic tone poems. The rarefied domain of Boulez's "Pli selon

pli," a setting of poems by Stéphane Mallarmé is a wonder of sound painting and design, but it is ultimately a tedious and unrewarding listening experience.

Boulez will be remembered less as a composer than as a facilitator; in conducting the works of others and in engineering the electronic and new-music laboratory at IRCAM (the Institute for Musical and Acoustical Research and Coordination, in Paris).

The production values in these recordings, made in the years 1966 to 1983, clearly reflect Boulez's influence. The wide dynamic range will have you jumping out of your seat at times, and the soundstage—even in stereo—shows his predilection for surround-sound performances.

These releases are important historical recordings not only for the breadth of the compositions and the stunning performance, but because their future as recording repertoire is dubious.

John Diliberto

Berners: Les Sirènes; Cupid and Psyche; Caprice Peruvien

RTE Sinfonietta, David Lloyd-Jones
MARCO POLO 8.223780, CD; DDD, 69:23
Sound: A, Performance: A



Stravinsky praised Berners' music, which is closest in style to that of Walton and Constant Lambert. Like Kurt Weill, his earliest work was his

most avant-garde, and these later ballets are much more accessible. Berners involved himself in music for the cinema, and some of this CD's music will suggest that connection. The opening scene of *The Sirens* sounds like an English *Daphnis et Chloë*. The Irish Radio-TV Sinfonietta performs the witty ballets with great élan, and the sound quality is beyond reproach.

John Sunier

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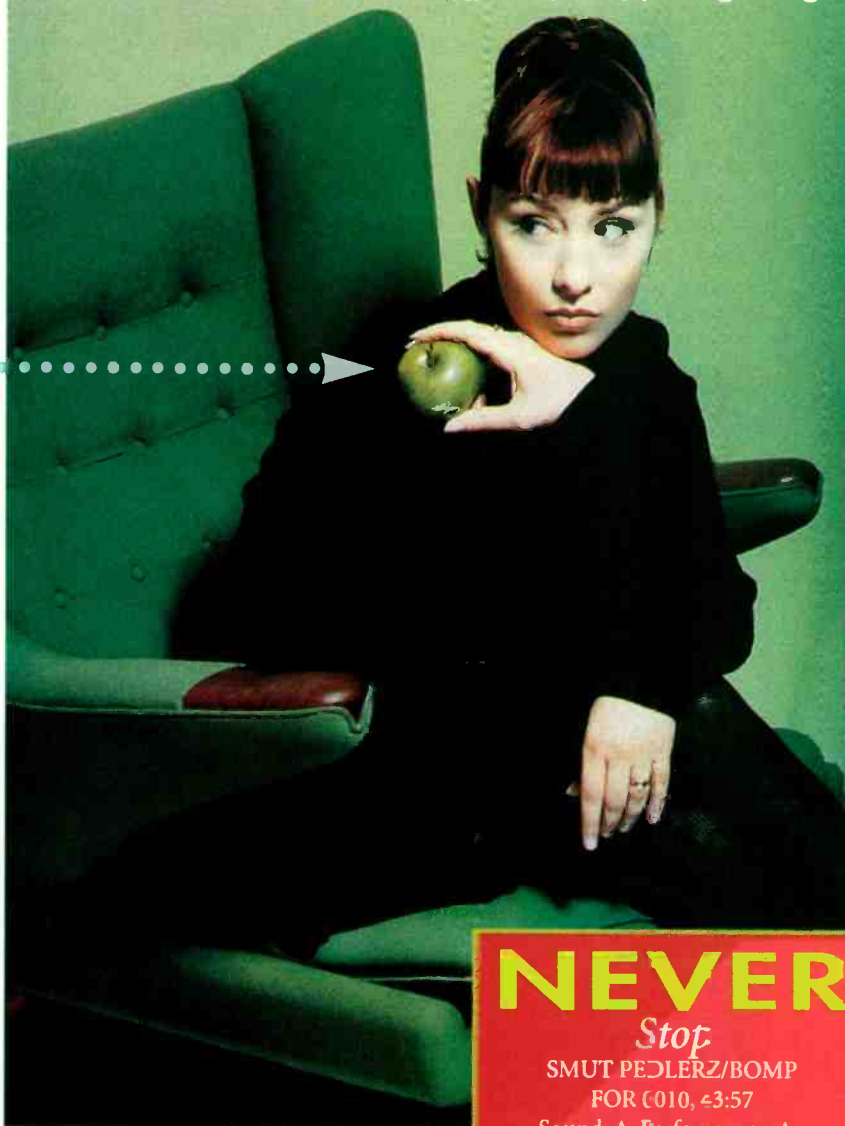


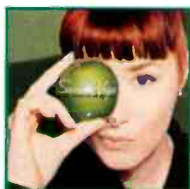
Photo: ©Ebet Roberts

Nine Objects of Desire

Suzanne Vega

A&M 31454 05832, 38:52

Sound: A-, Performance: A



Suzanne Vega knows a lot can happen in four years. She married producer Mitchell Froom, gave birth to a daughter named Ruby, and then gave birth to another remarkable offspring: a new record named *Nine Objects of Desire*.

After the industrial pretense of 1992's ambitious but off-putting *99.9F°*, Suzanne Vega—the one-time literate, coffeehouse folkie—scared us into thinking she aspired to be a female Tom Waits. Her abrasive work

on that album, a bristling, in-your-face response to the fluid folk of her earlier material, seemed to indicate that she'd had it with prettiness.

Fortunately, the pendulum has swung back in favor of a more pleasantly conventional aesthetic on *Nine Objects of Desire*. With startling versatility and chilling accomplishment, Vega successfully spans a spectrum of styles from understated bossa nova to jazzy swing and from ghoulish folk to hip-hop inspired pop. But if that sounds like a bumpy ride, Vega paints all 12 of these tracks from a muted palette, with her mellow voice and excruciatingly tasteful instrumentation the colors at its axis.

Assisted by husband Froom on keys, Pete and Bruce Thomas of Elvis Costello's band (The Attractions) on drums and bass, percussionist Jerry Marotta, and members of Soul Coughing, Vega strips each of these songs down to its core groove and feel, an approach that insinuates her folk past, but also a style that inches toward the audacity of *99.9F°*. The spare arrangements on "Birth-day (love made real)," with its vaguely juju-syle guitar theme, and the

NEVER Stop

SMUT PEDLERZ/BOMP
FOR C010, 43:57

Sound: A, Performance: A-

Mickey Leigh and Simon Townshend could both write books about having famous, legendary older brothers (respectively, Joey Ramone and Pete Townshend) and overcoming the inevitable "living in the shadow" stigma—something that's especially real when your life's calling is the same as your famous sibling's. Leigh, however, doesn't need a book: He has *Never*, a kinetic trio that combines power-pop-punk influences with off-kilter quirkiness and humor reminiscent of early Zappa and Beefheart. The net result has more in common with the Brit-invasion than New York punk.



From the biblical ("With Our Blood," "Back in the Twentieth Century") to the maniacal ("Don't Be So Strange," "Whatchu Think!?!"), provocative ("Proud to be Human"), and hilarious ("Idiot Son of 007"), *Stop's* debut infuses intelligence with potent rock 'n' roll energy. And though Leigh goes for (and attains) dramatic ambience on two echo-drenched, guitar-plus-vocal songs, "With Our Blood" and "The Ballad of Mickey Leigh," *Never*, otherwise, never digresses from the guitar-driven, power-trio template.

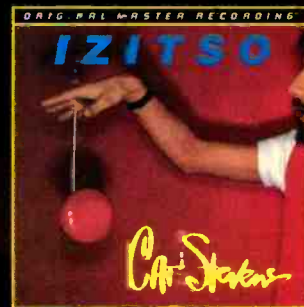
He's been called "a sound-alike little brother," but Mickey Leigh emerges here with his own, distinct voice and approach. While *Never* is a band effort, it's truly one person's sound and vision. Play it loud and never stop. (Available from Smut Pedlerz, P.O. Box 3419, Chino, Cal. 95927-3419) *Mike Bieber*

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hushed acoustic mystery of "Honeymoon Suite" see Vega embracing the folk idiom but not succumbing to it. And cuts like "Caramel," a loungy bit of bossa nova, and the breezy pop of "No Cheap Thrill" possess a sensuality we haven't seen before from the songwriter. The only problem on *Nine Objects of Desire* lies within Vega's narrow vocal range. Given the breadth of musical diversity on the album, it's silly to think that Vega's hushed vocals can swing some of the further stylistic reaches. On both "Tombstone," a prowling, understated song that hauntingly yearns for a growling voice at its center, and "My Favorite Plum," which needs something equally gruff, Vega is unable to keep pace with her own heady arrangements.

But regardless of this minor incongruity, *Nine Objects of Desire* rates as Vega's masterwork thus far, an album that rewards repeated listens and a *coup de grâce* that both advances and perfects her pursuit of a singular pop music expression.

Bob Gulla

Broken Arrow

Neil Young with Crazy Horse

REPRISE 2-46291, 47:43

Sound: A, Performance: A

Neil Young first hooked up with Crazy Horse on 1969's *Everybody Knows This Is Nowhere*, and in the intervening 27 years, their on-again/off-again relationship has yielded some, maybe even most, of Young's finest work: *After the Gold Rush*, *Rust Never Sleeps*, *Ragged Glory*, *Weld*, *Arc*, and *Sleeps With Angels*. This new one's certainly near the top of the heap of this long-running hit series.

In contrast to his last few records, Young's glass of water is now half-full. *Broken Arrow* begins with a declaration: "I'm still living the dream we had/For me it's not over." This optimism runs throughout *Broken Arrow*; he has found satisfaction just staying on life's highway. Young's visceral guitar hasn't lost any of its edge over the years, and when you add some Crazy Horse to the equation, it's like strapping a supercharger onto the beast. The band's definitely in "pile-driver" mode as it lays down some killer grooves on "Loose Change" and "Slip Away."

When Young finally downshifts into his folkie roots on "Music Arcade," he finds himself musing over the long roads travelled: "I didn't really mean to stay as long as I have/So I'll be moving on." After that, there's nothing left to do but play some blues. It's just Young and the guys in some rowdy, noisy club digging into the Jimmy Reed classic, "Baby What You Want Me to Do." Hey Neil, is that a rhetorical question?

Steve Guttenberg



BECK

Odelay

DGC DGCD-24823, 54:15

Sound: B, Performance: A

As inventive wordplay juggler, trash-can-sampling guru, and slacker extraordinaire, Beck Hansen is not your typical workaholic. It's been almost four years since his anthem-for-the-era, "Loser," topped the charts and made him a star, but Beck has been slow to record a follow-up, stubbornly defying corporate convention while polishing his next enigmatic message to the masses. Full of zonked-out lyrics and surreally-melodic choruses, *Odelay* is well worth the wait.

More focused than *Mellow Gold* (which contained "Loser"), *Odelay* captivates with charismatic silliness while proving that Beck's phenomenal hit was no fluke. He may still sound like a slacker with his sleepy vocals and simple country-blues allusions, but Beck is a golden-penned songwriting machine.

Beck's sampling wizardry determines *Odelay's* sonic surprise. Over a slew of "funky drummer" loops, he grafts a zany virtual orchestra. Saucy guitars dance with



easy-listening strings, turntables scratch over wailing harmonicas, and distorted clavinet solo over hep vocals. Many sound snippets (including Zappa, Jobim, and '70s soul band The Emotions) glimmer through the mix, but word has it that much of Beck's sampling mania was shelved because of clearance problems. Still, it's his free-association rambling, along with the musical tomfoolery, that keeps *Odelay* together.

Cryptic, unfathomable lyrics create Beck's otherworldly scenarios. Some are simply inane ("Got a devil's haircut in my mind"), and others arise from Beck's homeless past ("Karaoke weekend at the suicide shack/community service and I'm still the Mac"). While most of *Odelay* is upbeat, occasionally Beck retreats inside, revealing a sad soul under the clown's mask, such as on the Beefheartish "Derelict" and the mournful "Ramshackle."

Depending on your audiophile concerns, *Odelay* is either a wonder of disassociated soundbytes or a rather unnerving lo-fi menagerie. But no one can contest the author's sampling genius or songwriting skill.

Ken Micallef

Load

Metallica

ELEKTRA 61923, 79:00

Sound: B+, Performance: A

Metallica ruled the heavy-metal circuit for more than 10 years until it decided to take a four-year hiatus after the last record (1991's *Metallica*). During this absence, a new sonic pollutant called "alternative" took over the charts, and kids who once banged their heads to Guns 'N' Roses and Megadeth began losing their minds to Nirvana and Smashing Pumpkins. Heavy metal seemed doomed to an extinction more permanent than that of the dinosaurs. So Metallica's members, unwilling to adopt the moniker Alternica, put their troglodyte heads together to fight metal's last stand. And *Load*, the new album, is a not-so-secret weapon.

Like the last disc, *Load* is loaded with scream-along choruses, razor-edged rhythms, and the energy of a generation that feeds off bitterness and anger. But the record is more multidimensional. Instead of relying primarily on staccato guitar riffs and tuneless growls,

the band draws from a fresh array of styles without straying far from its roots. "Poor Twisted Me" and "2 x 4" celebrate boogie blues, while "King Nothing" and "Wasting My Hate" update dark, primal rhythms with state-of-the-art guitar effects and "Mama Said" takes an incisive and poignant stab at country music.

Most notable, however, is the way Metallica has kept up with the times. "Until It Sleeps" draws surreal guitar lines from the workbook of Angelo Badalamenti, and the surging guitar and sinister vocal harmonies of "The House Jack Built" and "The Outlaw Torn" are more than a bit reminiscent of Alice In Chains. True, some of Metallica's older fans might be disappointed by *Load's* lack of barnstorming thrash numbers, and "Hero of the Day" is a bit wimpy for any authentic headbanger. But overall, *Load* is a disc that shows tremendous growth and maturity while ushering heavy metal into its next critical phase.

Jon Wiederhorn



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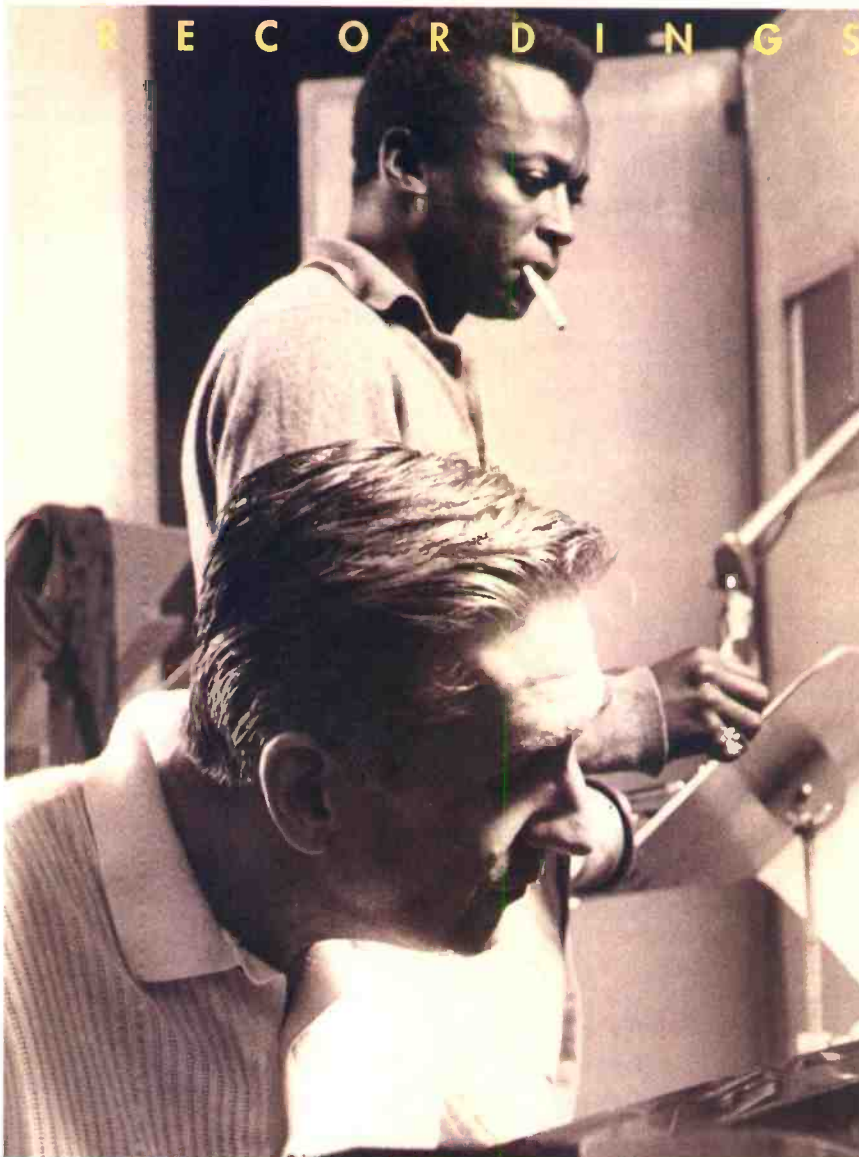
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JAZZ ~ BLUES

RECORDINGS



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ing plant). So, the large group orchestration heard on these six discs were, at least in part, Columbia's reaction to Prestige's approach of recording Miles in loose, small-group blowing sessions. Columbia opted to use its resources and present him in a grand context, and thankfully, Miles had his choice of arranger in Gil Evans.

WAKE UP AND LIVE!

Floyd Dixon
ALLIGATOR RECORDS
ALCD 4841, 58:24
Sound: A-, Performance: A

Is it 1996 or 1956? Listening to Floyd Dixon's rollicking *Wake Up and Live!*, it's easy to mistake it for a lost Delmark or Aladdin recording of the '50s. He's best known for his jump blues hit of 1954, "Hey, Bartender"; yes, that's the one the Blues Brothers covered. Dixon even takes another swing at it, these 42 years later, and with extra meat on his bones, this new version sounds even better. Dixon's a triple threat: a mean piano thumper, a powerful, bluesy vocalist, and on the 16 original tunes in this collection, he proves he's still writing music that boogies with the best. The music's power and authenticity was captured (analog) using vintage mikes and tube preamps, yielding the warm sound of an old blues LP but also a beautifully produced modern recording.



Way back when, Dixon convinced his old buddy Ray Charles to drop his Nat King Cole affectation and reveal his true, bluesier self. And there are traces of Brother Ray's style in Dixon, particularly the phrasing on "A Long Time Ago"; it's not mimicry, just more of a gospel color. Eddie Synnigal's miraculous tenor sax solo elevates this tune to an even higher level. The instrumental "Gettin' Ready" is simply Floyd and the band limbering up; the rehearsal was so good they had to put it on the CD.

Floyd Dixon, a k a "Mr. Magnificent," makes great music the old fashioned way; he fills it with warmth, masterful technique, and fun. Cross your fingers and hope that those qualities never go out of fashion.

Steve Guttenberg



The Complete Columbia Studio Recordings

Miles Davis & Gil Evans

COLUMBIA 67397, six CDs; 7:28:51

Sound: A, Performance: A+

the only disappointment (and it is slight) from this long-awaited boxed set pertains to sound quality; the emphasis on upper partials may be cause for moderate equalization. But when considering Columbia's track record of near disregard for the sound of its early jazz reissues on CD, the inclusion of a high end is a giant step forward.

In fact, everything about this package offers a giant leap for jazz lovers. Similar in packaging to *The Complete Billie Holiday on Verve* box set, the Miles & Gil package is a thick, cloth-bound book with extensive liner notes and CD jackets contained within. Knowledgeable historians and producers contributed to the annotation, great photos abound, and original cover art graces the CD slip covers.

Although Miles's 1955 signing with Columbia was met with some resistance because of the trumpeter's ongoing drug problems, it was no secret that his records sold well while he was under contract to the Prestige label (which used Columbia's press-

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Their first three collaborations, encompassing the years 1957 to 1959, yielded classic results. *Miles Ahead* (in stereo here for the first time), *Porgy and Bess*, and *Sketches of Spain* virtually defined the jazz concerto, with Miles as the only soloist. Regarding its influence on the quickly developing field of jazz orchestration, West Coast arranger Marty Paich once stated that *Miles Ahead* was studied as "the Bible for years and years."

Backed by a jazz rhythm section—usually minus piano—and an assortment of colorful winds, Miles exhibits extreme lyricism on trumpet and flugelhorn, obviously attuned to the array of expressive timbres surrounding him. Beautifully written double-reed, flute, lower-brass, and French-horn parts were the emphasis of Evans' meticulous musicianship. But when inclined, he added the roar of the big band to complete the tapestry.

Each of the first three CDs of this set presents one of the above mentioned LPs and a complete set of alternate or rehearsal takes. Disc four features the less heralded *Quiet Nights*, along with different sextet sessions with vocalist/pianist Bob Dorough and saxophonist Wayne Shorter, which appeared on anthologies years later. Two previously unissued pieces follow: 1963's "The Time of the Barracudas" (written for a stage play of the same name) and the experimental "Falling Water" from 1968 (the last of the Evans/Davis studio collaborations). Several alternates from the *Miles Ahead* session round out disc four.

Disc five gives us more alternate takes from *Miles Ahead* and an enlightening glimpse into the recording process by way of blocks of rehearsal time that include studio chatter from the sessions.

Disc six presents more pieces of the pervasively interesting, unquashable *Miles Ahead* sessions, alternate versions and rehearsal material from *Porgy and Bess*, and rehearsal takes from the *Sketches of Spain* sessions.

Although Davis and Evans were further caught on record with live versions of some of this material, no new ground was broken. What's in this box is the real McCoy—the best of large ensemble jazz, appropriately presented and painstakingly researched by producer and jazz historian Phil Schaap. It's Grammy time. James Rozzi

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AD INDEX

Firm (Reader Service No.)	Page
Acrotec (1)	66
Adcom (2, 3)	15, 47
AudioQuest	Cover IV
Audio Research (4)	Cover II & 1
Axiss Distribution (1)	66
B & K (5)	71
B&W Loudspeakers (6)	57
Bose/Acoustic Wave	19
Brystonvermont (36)	83
Cambridge SoundWorks (7, 8, 9)	11, 35, 63
Carver	87
Chesky Records	102
conrad-johnson (11)	59
Crutchfield (12)	58
Definitive Technology (13)	38, 39
EchoStar	19
Eosone (14)	85
Esoteric Audio (35)	13
J & R Music World (15)	107
Jensen (16)	49
Kimber Kable (38)	95
Klipsch	89
Krell	43
Legacy Audio (17)	75
Marantz	67
Martin-Logan	65
Mitsubishi (18)	73
Mobile Fidelity (19, 20)	101, 105
Monsoon	55
Music Interface Technologies (21)	2 & 3
NAD (10)	99
NEON (22)	37
New West Electronics (23)	109
Paradigm (24)	4
Parasound	51
Pass Laboratories (25)	80
Pioneer	9, 40-41
Polk (26)	53
Radio Shack	81
Rotel of America (27)	77
Sennheiser (28)	74
Smirnoff	7
Sony	33
Sound City (29)	110
Southern Comfort	Cover III
Sunfire Corporation (30)	91
Tandberg (31)	25
Thiel	24
Toshiba (32)	45
Ultimate Technologies (33)	79
U.S. Air Force	16 & 17
Vandersteen (34)	103
Velodyne	61
Wholesale to the Public (37)	111
Yamaha	21, 23

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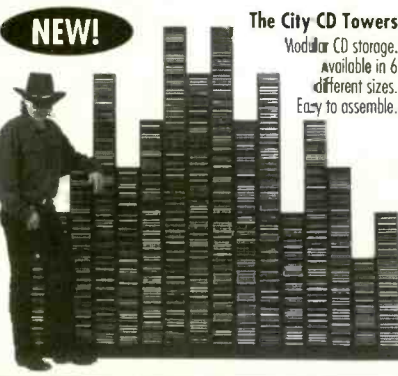
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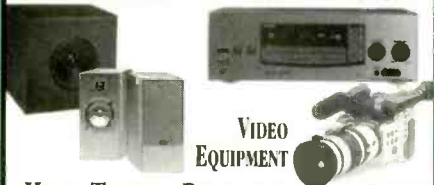
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The midrange utilizes the 15W75 and the D52AF. The lower midrange is reproduced by the 15W75 with a 3" voice coil. The unique design principle of this driver allows for a wide dynamic range and an airiness in reproduction which can master even the most complex musical passages with ease.

The upper midrange is covered by the D52AF. This 2" dome midrange seamlessly fills the gap between the 15W75 and the tweeter, without the use of radical filter circuits.

The Dynaudio Esotec D260 tweeter, is used to cover the upper frequency range. The unique chambering of this tweeter ensures faithful musical reproduction with an airiness usually only obtainable with an electrostatic speaker, yet the D260 still possesses the dynamic range and power handling of a dynamic loudspeaker.

The Result

The FINALE is a concept for the music listener who demands the absolute best, and enjoys the challenge of building an exacting state-of-the-art system for the reproduction of music.

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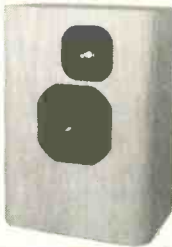
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PlayBack

KIMBER KABLE Speaker Cables

I first used Kimber Kable speaker wires in my old apartment because their braided construction let me flatten them a bit to fit under my rug and they were reasonably priced. When I buried cables in the walls of my new house, I picked Kimber Kables again, for several reasons: I could still afford them. Their jackets are of fire-resistant high-temperature Teflon. And since the cables would run near some AC lines, I liked the fact that their braided construction resists hum pickup, much the way multiple shielded pairs would.

Rather than have loose cables hanging out of my walls, I had my installer place wall plates with binding posts at either end of each cable run. I use shorter lengths of the same cables to connect the speakers to the posts.

I terminated the cables with Kimber's PostMaster spade connectors (\$16 per pair). The PostMasters sandwich a silicone wafer between plated contacts, so they'll stay snug against binding posts that are only

GRADE: A



finger-tightened. The PM-25 fits binding posts from 0.20 to 0.265 inch in diameter; the PM-35s fit into posts measuring 0.28 to 0.345 inch. Both fit wires ranging from AWG #16 (the smallest you should

consider using for speakers) to AWG #6 and come with heat-shrink boots and Kimber's WonderSolder.

The Type 4PR cables I used in my apartment, equivalent to AWG #14, are \$26 for a precut 10-foot length, \$34 for 15 feet. In my walls, I use both AWG #9 Type 8TC (\$10 per foot) and AWG #13 Type 4TC (\$6 per foot), in case I decide to biamp or bi-wire my system someday. Ribbon-flat versions are now available; confusingly, the flat version of the 8TC is the 16LPC (\$14 per foot) and the flat equivalent of 4TC is 8LPC (\$8 per foot).

Ivan Berger

For literature, circle No. 120

Trying to put a Toslink optical digital cable into a coaxial RCA digital jack is like the proverbial square peg in a round hole. It just can't be done, unless you have a box like the biró t2c digital interface, distributed through Audio by Van Alstine. This little box is the least expensive interface (\$75) I know of that allows a DAT, CD, or other piece of digital gear with a Toslink digital output to complete a connection to a coaxial digital input.

Now this box is nothing fancy, just a useful electronic tool powered by a simple wall wart. (However, since jitter is said to be higher via long optical connections, using the t2c to shorten the optical link between your components might reduce jitter in your system.) It came in real handy when trying to connect a laserdisc player



GRADE: B+

with only a Toslink output to a preamp's coaxial digital input. The preamp also had an optical input, but the distance from the player to the preamp was well in excess of 10 feet—about the maximum distance recommended for optical cable runs. So I ran the 6-foot Toslink cable from the LD player to the biró box, then a coaxial cable to the preamp. Problem solved.

I would have given the biró t2c an "A" if it were bidirectional (optical-to-coaxial/coaxial-to-optical). I wanted to take a coaxial CD output to a professional DAT Toslink input, but the biró works in only one direction.

John Gatski

For literature, circle No. 121

Castle Acoustics Isis Speaker

The made-in-England Castle Acoustics Isis (\$529 per pair, standard finishes, \$629, custom finishes) is a nice little speaker. The second smallest speaker in the nine-member Castle family (14 x 7 x 7½ inches), the Isis has a 5-inch woofer and a 1-inch composite dome tweeter. Bass is reinforced by a front-mounted port. Frequency range is from 60 Hz to 20 kHz. Sensitivity is listed at 87 dB (1 watt at 1 meter). Castle speakers come in nine different wood-grain finishes, so they can be matched to almost any decor. My sample pair came in a very attractive oak.

GRADE: B+

Mounted on 24-inch metal stands with their grilles removed, the Isis pair sounded fairly "big," with some audible deep bass, detailed treble and midrange, and a spacious stereo image. They seem to be more suited for acoustic music, jazz, and classical than pop, as bass on some pop recordings got a little plump. There also was a bit of midrange/low-treble hardness on loud dense rock music.

This is a great speaker by itself, but using a compatible subwoofer, such as the Velodyne VA-1012X, to relieve it of the low bass duties would make a killer system for under \$1,500.

The only real minus was the cable connection. The recessed rear compartment was too small for my Alpha-Core 10-gauge flat cables with spade lugs to reach the terminals. I swapped the spades for banana plugs to make the connection.

John Gatski



For literature, circle No. 122



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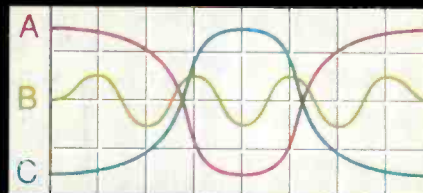
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By itself this chart means nothing. It's what you see on your screen that counts.

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In 1976 Polk Audio® woke up the US audio world with a most unusual speaker cable. Since then, many cable suppliers have introduced innovative and often effective ways to reduce the various types of cable-induced distortion. There have been some bad ideas and some just plain "make it big and they will buy" products... but, there has also been real progress.

Unfortunately, the video arena includes companies touting how their cables solve problems that had been solved by others decades ago. After all, a lot of very competent people have been supplying the world of high-frequency communication for a very long time!

These backward-looking companies claim that "characteristic impedance" is important. This is awfully safe ground... everyone has agreed about this since before most of us were born. CATV cable at the hardware store gets this part right, there's no reason to pay a premium for old news. However, there are many other significant, and often more important variables.

It is ironic that some of the same designers who properly argue that "while measurements are important, they don't tell the whole story," are now retreating to the test bench instead of working to provide new solutions.

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- Hard Cell Foam (HCF) insulation minimizes dielectric

involvement (the way insulation creates distortion by storing and releasing energy). HCF also minimizes damage caused by applying hot plastics to the surface of metal. And, HCF minimizes cold-flow (the deformation of a material under pressure, changing the cable's electrical characteristics and compromising performance).

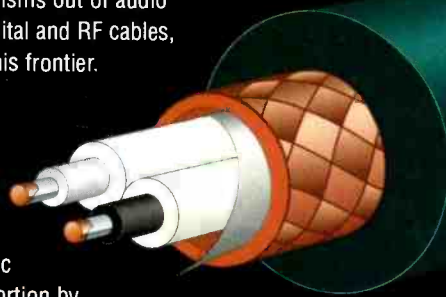
- Special Silver Plated Long Grain Copper reduces distortion and improves signal flow... which in the world of audio would cause a bright and irritating sound. However, in the high frequency domain, SP-LGC provides a dramatic and cost-effective improvement over even the highest grades of pure copper.

Etc., Etc., Etc.

There are many more technical details and underlying theories as to how to reduce distortion in video cables. For more of this information, please ask for our Cable Design brochure... or better yet, go "see" the cables for yourself.



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CABLE DESIGN

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