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APRIL 1997

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Any cable can transmit electrical signals from one video or audio component to another, or from amplifiers to speakers. But, for a great viewing or listening experience, with sharper, more lifelike pictures and richer, more musical sound, you need more than just cable. Ordinary video and audio cables, even "high-end" types, can alter critical signal timings and phase relationships, irreversibly degrading picture and sound quality.

That's why MIT's founder literally invented high-performance interconnects and speaker cables, creating a new category of components called Interfaces. MIT's fundamental patents in high-performance cable design mean that only MIT can bring you Interfaces scientifically designed to eliminate the non-linearities and distortions caused by other, ordinary cables, no matter how expensive they may be.

If you watch and listen for the subtleties of picture and sound quality that are the hallmarks of great viewing and listening experiences, you need MIT's Home Theater Terminator System Interfaces. The hard science behind MIT's remarkably affordable Interfaces reveals the full potential of your high performance home theater system. Until you use MIT Interfaces, you'll never know just how good your system can be.

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MIT's patented Terminator Networks are the heart of MIT's performance superiority. They enable MIT's Home Theater Terminator System interconnects and speaker cables to deliver sharper, clearer, more lifelike pictures and to provide better bass, clearer midrange and smoother treble sound, with enhanced sonic focus, imaging, and soundstaging.

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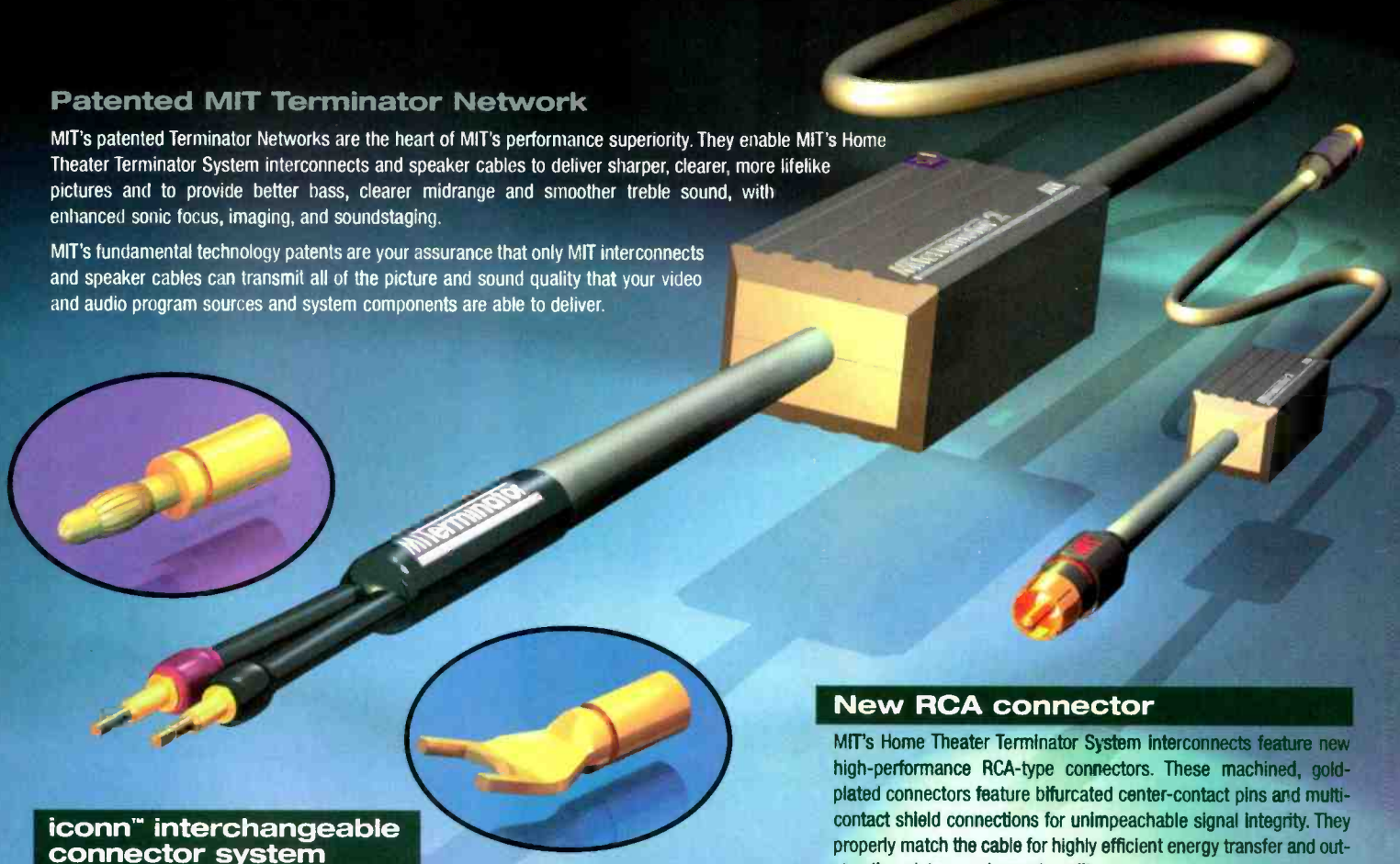

iconn™ interchangeable connector system

MIT's exclusive iconn system for speaker cable connections is so innovative, it has a patent pending, and every Home Theater Terminator System 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 your speakers. iconn's gold-plated connectors assure ultra-low contact resistance and contamination-free connections for best sound quality.

New RCA connector

MIT's Home Theater Terminator System interconnects feature 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 picture and sound quality.

With MIT Home Theater Terminator System Interfaces starting at just $29.95 (MITerminator 6, not shown), MIT's remarkably affordable Terminator technology can improve the performance any system.

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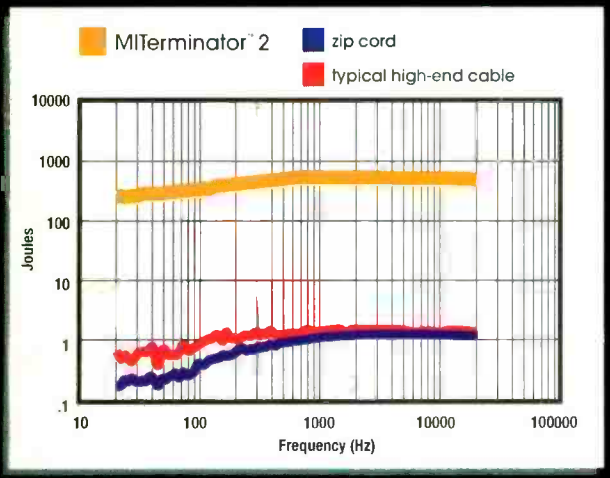
Why MIT Home Theater Terminator System Interfaces perform better



Superior Final Energy Component

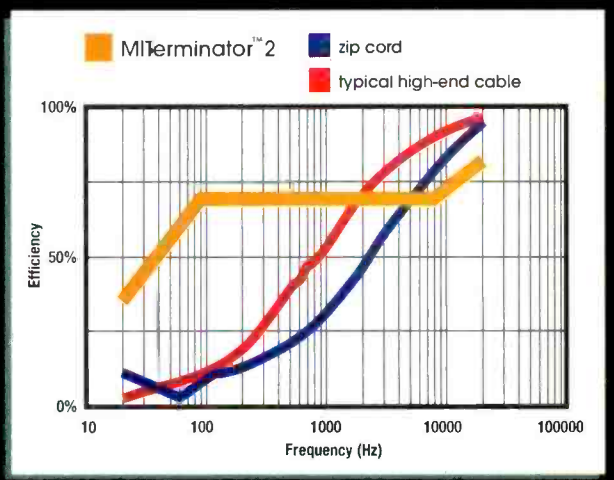
Cables transmit most of the audio signal energy passing through them directly to the next component or to the speakers. They also briefly store and then release small amounts of energy that have huge effects on sound quality. MIT calls this stored and released energy the Final Energy Component. As shown in this representative plot of speaker cables (which are normalized to 1 Joule for clarity), 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 nonlinearity 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 their overall signal 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 signal quality of Home Theater Terminator System Interfaces.

Superior Efficiency

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

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



Superior Imaging

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

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

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

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

Experience the improvements of MIT's Home Theater Terminator System Interfaces in your system!

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CIRCLE NO. 17 ON READER SERVICE CARD

APRIL 1997 VOL. 81, NO. 4

AUDIO

THE EQUIPMENT AUTHORITY

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Panasonic DVD Player and Pioneer Elite DVD/Laserdisc Player

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The Audit Bureau

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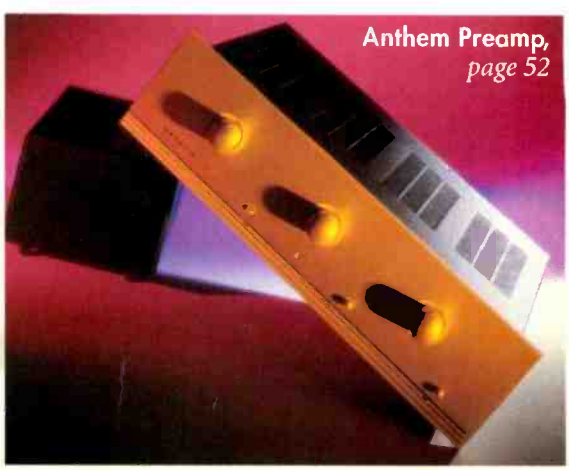

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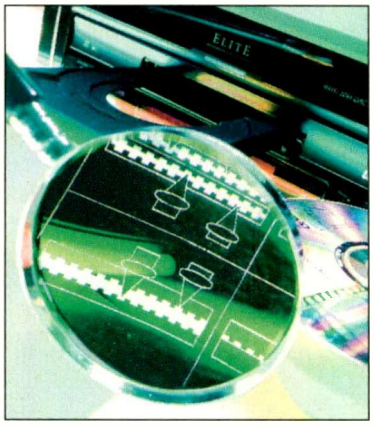
CIRCLE NO. 18 ON READER SERVICE CARD

FAST FORE-WORD

As usual, the audio industry gathered in Las Vegas for a bit less than a week of January to participate in the annual Winter Consumer Electronics Show. And as anticipated, this year's CES was effectively the DVD Show. Announcements of players and marketing plans were all around, as were demonstrations. Just about every full-line, mainstream A/V electronics manufacturer got into the act. And one company, Akai, is using the opportunity to reenter the U.S. market after an absence of several years.

At least as important, however, were the announcements from major movie studios—Warner Bros. and Sony Pictures (Columbia/TriStar), in particular—because the hardware side has been ready to go for months. It will be several years before the depth of the DVD library approaches that of tape or laserdisc, but of course, the same was true for CD versus LP and cassette at its introduction. Warner said it will price DVD releases the same as their VHS counterparts; Sony said its releases would be priced between VHS and laserdisc. And Blockbuster Video joined Sony in announcing a joint DVD rental promotion.



Photograph: © 1997, John Wilkes

Sony's presentation was also notable for its measured tone. The company is approaching DVD very much the way it did CD 15 years ago. Sony's first player will be a premium model, for example. And spokesmen stressed that there is a great deal more to launching a new format than just getting machines into stores. In particular, the DVD mastering and production infrastructure is in its infancy and will take time to develop the sort of capacity now available for other media.

Although not mentioned by any of the format's promoters, another thing I think we must expect, especially in the beginning, is variation in the quality of DVD releases. Good MPEG-2 video encoding hardware in skilled hands can yield superb picture quality, and most of what I have seen from DVD so far has reflected that. On the other hand, it can look pretty bad if handled sloppily, and I've seen some of that, too. As with CD or anything else, the technology itself is not the sole determinant of quality.

If the focus on DVD at this CES was no surprise, the buzz about new speaker technology definitely was. It is so rare for anything fundamentally new to emerge in loudspeakers, yet this year we seem to be awash in innovation, particularly with respect to flat-panel speakers. In that arena, the biggest splash is being made by NXT, a division of the Verity Group (the parent of Mission, Wharfedale, and Quad). Ken Kessler first reported on that development here a couple of issues ago in "Mondo Audio." We expect to have more to say about it and other contenders in the months to come.

Meanwhile, this issue kicks off the DVD era with Ed Foster's introduction to the technology and reviews of two of the first players to hit the market. More to come on that, as well.

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LETTERS

The Pumpkins *Are* Good, By Gish

Dear Editor:

I cannot let Corey Greenberg's "Front Row" column in the October 1996 issue, "King Uszniewicz in '96," go without comment. Greenberg laments that the best of today's bands—Blues Traveler, Smashing Pumpkins, Oasis, The Dave Matthews Band, Hootie and The Blowfish, and Nine Inch Nails—are "boring," "phony," and "the pits." He insinuates that today's rock is homogenized and has been robbed of all the spirit and energy that originally distinguished rock 'n' roll.

Well, this generalization is an outrage, a travesty, and a mistake of Biblical proportions, because The Smashing Pumpkins *do* have one good album: *Gish* (Caroline CAROL 1705-2) [reissued as Virgin V21Z-39663—*Ed.*]. With influences of Hendrix, meticulous drumming, and dueling guitars, this record kicks you in the gut like the best of 'em. Interestingly enough, the best I have ever heard *Gish* sound was on a pair of NHT 3.3 speakers driven by an Aragon 4004 Mk II amp. Mr. Greenberg, if you are lucky enough to find such a system, run to the nearest record store and get a copy for yourself. You will not be disappointed. To borrow a phrase, they just don't make music like that anymore. But I'm not sure they ever did.

Dan Dzuban
via e-mail

Power Meter Reader

Dear Editor:

I bought a Technics SA-TX50 receiver in July and am very happy with it. I was a little disappointed that Edward J. Foster wasn't as impressed with his test sample in his December '96 "Equipment Profile."

I would like to clarify one part of his review. The SA-TX50's tone controls are bypassed only in the THX Cinema mode. Bass and treble are still adjustable in regular Dolby Pro Logic mode and in mono.

I bought this receiver for one main reason: I fell in love with its analog power meters of yesteryear. Its unusually high price may be due to THX certification, but I am very impressed with the sound that now comes from my 14-year-old Acoustic Research AR-91 speakers.

Ben Burke
via e-mail

Down Where It Hz

Dear Editor:

In the January, issue Tom Nousaine wrote about a set of eight 12-inch subs ("Boom for the Buck: How Much Woof Does a Sub Buck Buy?") whose bass extended down to

12 Hz. I'd like to get more information on this setup. What drivers were used? And, when Nousaine says "infinite baffle," does he mean these were front-firing, loaded essentially into a 450-cubic-foot sealed enclosure (where the box happened to be an existing attic eave—with insulation, I imagine)?

Audiophile Mark
via e-mail

Author's Reply: In a recent issue of *Speaker Builder* (No. 5, 1996), there is a detailed description of this sub system, including photos. The system is as you described: infinite baffle, lots of piston area, and woofers with big linear excursion loaded into an attic eave.—*Tom Nousaine*

Does Sunfire Ring True?

Dear Editor:

I enjoyed Tom Nousaine's article on subwoofers ("Boom for the Buck"). With all the subwoofers Nousaine tested, I'm surprised he didn't mention the Sunfire True Subwoofer, which is certainly the most unusual sub on the market. If the Sunfire really delivers tremendous bass with low distortion out of an 11-inch cube for $1,250, it's a breakthrough. I hope *Audio* reports on it in the near future.

Also, I have a question regarding home theater setup. Will bipolar speakers work well for the surround channels in a Dolby Digital (AC-3) setup? I've got direct radiators in front.

Jeff Johnson
via e-mail

Author's Reply: I wrote the article before I got my hands on the Sunfire. It's an interesting sub, in that it is very small, but it delivers only average output—a little less than 100 dB over the range from 25 to 60 Hz. Although it is true that not many "tiny" subs will reach down to 25 Hz, the Sunfire is quite expensive and most notable for its size, not its performance. But it does do some things very well, and it has a really great limiter that won't let you damage it, no matter how ridiculous you get with the volume knob.

To answer your home theater question, bidirectional speakers work best for the surround channels, no matter what the format.—*Tom Nousaine*

Erratum

Our "Equipment Profile" of the Manley Laboratories Reference D/A converter (January issue) contained an editing error. After discussing how the Manley uses 6 dB of analog attenuation for non-HDCD recordings, the review stated that doing this in the digital domain (as some D/A converters do) would "reduce non-HDCD signals to 15 bits." This would be true for a simple 16-bit converter; however, a 20-bit converter's effective resolution would be reduced only to 19 bits, and an 18-bit DAC would still have 17 bits of effective resolution. Our apologies for the error.

Incidentally, the review did not mention that the other three D/A converters used by Bascom King while reviewing the Manley Reference also had HDCD decoding capability. These converters were the Sonic Frontiers SFD-2 MKII, Classé Audio DAC-1, and Dodson Audio DA-217.—*I.B.*

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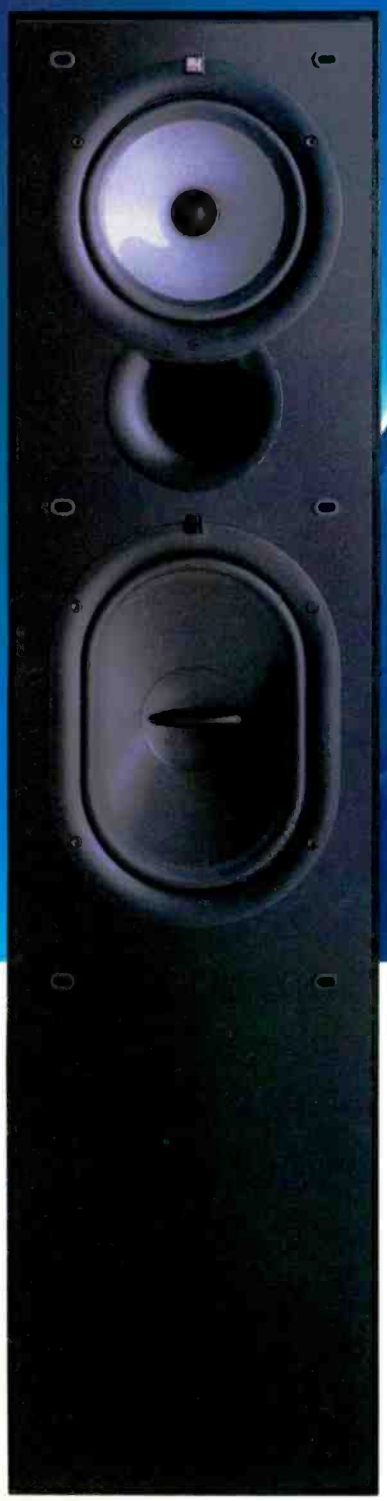

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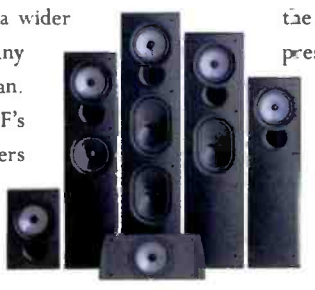

From bookshelf to 3-way floorstander, the entire range is magnetically shielded for Home Theatre use. And because aesthetics are integral to good design, the two largest models incorporate KEF's new 'racetrack' bass unit. With the performance of an 8 inch driver in the space of a 5 inch, it preserves the slim elegant Q Series design.

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WHAT'S NEW

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Molded in modern ABS resin cabinetry and finished in matte black, NewWave is a compact subwoofer/satellite system that is upgradable to a six-piece home theater system. The powered sub, just 11 inches square, houses an 8-inch woofer and a 50-watt built-in amp with auto standby. NHT says usable response extends to 40 Hz. Each 7¾ x 4½ x 4-inch magnetically shielded satellite has a 3½-inch midrange driver and ¾-inch soft-dome tweeter. Variable low-pass and fixed high-pass filters are built in. Prices: complete home theater system, $750; subwoofer and two satellites, $495; home theater upgrade pack (three satellites), $255.
For literature, circle No. 100

CASTLE ACOUSTICS SPEAKER

The Tay is a compact, two-way system built in England. It uses a Castle-designed-and-built 5-inch bass/midrange driver, with 1¼-inch Kapton voice coil and rubber surround, and a 1-inch polyamide-laminated soft-dome tweeter, the latter ferrofluid cooled. The crossover frequency is at 2.8 kHz in a second-order alignment. The port-loaded bass-reflex enclosure measures 17 x 8 x 10 inches and has gold-plated input terminals for bi-wiring. Sensitivity is specified at 87 dB at 1 meter with 1 watt input. Price: $749 per pair.
For literature, circle No. 101

Advent Speaker

As part of the B_2R series (Bach to Rock), the Ru_by is said to offer clear, precise reproduction of all types of music. The bass-reflex enclosure, which measures 15 x 9 x 8¾ inches, houses a 6½-inch long-throw woofer and ½-inch tweeter. Frequency response is rated at 53 Hz to 20 kHz, ±3 dB, with tweeter dispersion specified as ±1 dB to 13 kHz over a 30° angle, vertical or horizontal. The 8-ohm system's peak power-handling capacity is said to be 225 watts. Price: $249 per pair.
For literature, circle No. 102

BOSE HOME THEATER SPEAKERS

The Acoustimass 10 offers a stylish and virtually invisible home theater setup with its five tiny, magnetically shielded, double-cube speaker arrays and compact bass module that can be hidden behind drapes or a couch. The cube arrays, each of which houses a pair of 2½-inch cone drivers, measure just 6¼ x 3 x 4¾ inches. Bose says the arrays' identical drivers produce a consistent timbral and spatial perspective for the main, center, and surround channels. The bass module has three internal 5¼-inch drivers. Price: $1,299 in black or white.
For literature, circle No. 103

"Of the interconnects I know well, my top choice is Esoteric's Tech 2ii series..."

Lawrence B. Johnson
Stereophile Guide to Home Theater, Vol.1, No.1, 1995

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CIRCLE NO. 9 ON READER SERVICE CARD

WHAT'S NEW

Marantz Programmable Remote

The RC2000 learning remote's large, backlit LCD panel has an alphanumeric display that automatically relabels itself when you select the component you wish to control. As many as 32 individual commands for each component can be stored, and macro keys can transmit 20 commands at the touch of one button, in any order you choose. The keypad's buttons are different sizes and shapes and are grouped according to function. A built-in sensor automatically activates backlighting as the room gets dark. Price: $250.
For literature, circle No. 104

Sennheiser Wireless Headphones

The RS 6's transmitter base and companion HDR 6 stereo headphone with integral RF receiver operate at 900 MHz. The system is said to have a range of 250 feet in any direction, indoors or outdoors. Three switchable frequencies are available to ensure clear reception. The lightweight supra-aural headphone has an adjustable headband and is powered by a rechargeable battery that yields up to 3 hours of listening per charge (the base unit has two recharging ports for extra batteries). A built-in filter squelches interference from amateur radio transmissions. Price: $269.95.
For literature, circle No. 107

SONY DVD PLAYER

The DVP-S7000 is definitely high end, says Sony, because a proprietary 10-bit video D/A converter is used following MPEG-2 decompression, to yield picture quality that approaches that of the digital videotape master. Further, a Dual Discrete optical pickup, with separate red and infrared laser diodes, is optimized to track the different pit sizes and substrate thicknesses of DVDs and CDs. There's also a 32-bit microprocessor to enable Smooth Scan, for seamless picture scanning in forward, reverse, or frame-by-frame mode. Composite-video, S-video, and component-video outputs are provided, as are coaxial and optical digital audio outputs. Price: $1,000.
For literature, circle No. 105

Elecom Multimedia Rack

As its name implies, the Expandables rack can be stretched from its original 7½-inch length to 11¾ inches. Fully expanded, it can hold 25 CDs and can also be used to hold audio cassettes, game cartridges, and other media. Two removable dividers can be used to group CDs. The rack is available in black with red trim or in ivory with blue trim. Price: $9.99.
For literature, circle No. 106

ULTECH AUDIO CD PLAYER

Dual 20-bit Burr-Brown D/A converters are used in the UCD-100 Compact Disc player to reduce conversion errors, and HDCD decoding is built in. The UCD-100 also has a multimode time display, flexible track programming, and a remote control. Price: $895.
For literature, circle No. 108

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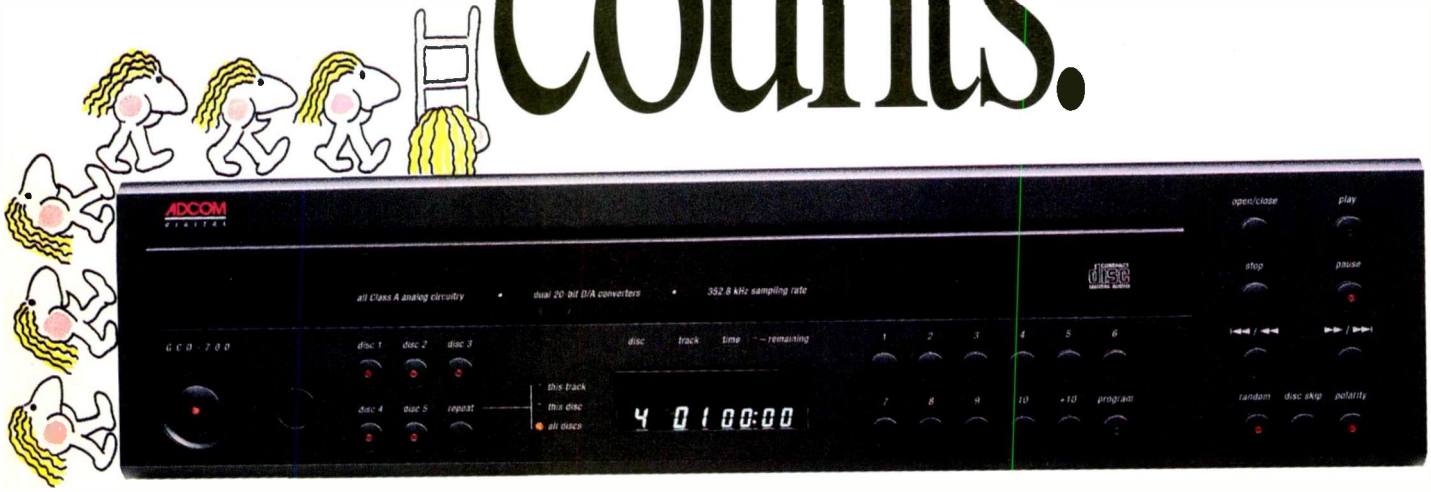

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AUDIO CLINIC

JOSEPH GIOVANELLI

Repairing a KLH 21 Radio

Q *The on/off switch that is part of the volume control on my 20-year-old KLH Model 21 table radio recently failed. I took it apart, and the switch has actually disintegrated. The control is something like a 60-kilohm linear mono with a 30-kilohm tap, but I can't find a replacement. I tried all my usual sources, even Antique Electronics, in Tempe, Arizona, but had no luck. And although I can open up the switch, its body is welded to the volume control. Can you suggest where I might find a replacement? It's a great radio, so I'd hate to lose it.*—Chuck DiGiorgio, via e-mail

A I don't know where parts for your radio can be found. However, assuming that the radio works well in other respects, the volume control should be reinstalled. The wires from the switch can be extended to a place on the chassis where you could install a separate power switch.

If this is not convenient, jump the original switch wires together so that the radio will come on immediately when it is plugged into the wall outlet. Then you can get a switch that can be wired into the power cord, just like the switches sold in lighting stores for table and floor lamps. Thus, you'll have a perfectly fine way to apply or disconnect power from your radio.

Connecting an Equalizer

Q *Living in Argentina, I find it hard to obtain information about audio. How do I connect an equalizer to my new receiver? I connected my tape deck to the equalizer and the equalizer to the receiver's tape 1 input, but I can equalize only the sound from the tape deck. I want to equalize signals from my CD player, VCR, and laserdisc player.*—Matias Helman, via e-mail

A Some equalizers enable the connection of a tape recorder in such a way that recording and equalizing functions will not be lost. Check the owner's manual to see if your equalizer has this ability. However, since you mention using a tape 1 input to connect the equalizer to your receiver, I presume the receiver also has a tape 2 input. If so, hook up its "Tape Out" connections to the inputs of your equalizer. The output from the equalizer should be connected to the tape 2 "Tape In" jacks on your receiver. The tape recorder should be connected to the appropriate jacks of tape 1.

Alternatively, if your receiver lacks a tape 2 connection but has "Pre-Out/Main-In" jumpers, remove those and connect the equalizer's input to the "Pre-Out" terminals and the output of the equalizer to the "Main-In" terminals. This should enable you to equalize any signal connected to your receiver. However, leave the receiver's bass and treble controls centered; use the equalizer to make tonal adjustments so that you won't risk overdriving the equalizer's input section.

Leakage During Recording

Q *After I record a blank interval on a cassette by turning the recording level all the way down, I can very faintly hear the source I was listening to during playback. Shouldn't there be no sound at all? I find this annoying when I want to erase a tape for later reuse.*—Mark D. Mina, Costa Mesa, Cal.

A Ideally there should be no sound recorded onto a tape even when you are listening to an independent program source. In practice, some signal can find its way onto a blank area even when the record level has been turned down fully. At its lowest setting, the record-level potentiometer should have a 0-ohm resistance between its slider and ground. If this resistance is too high (and I don't know how much it has to be in order to be "too high"), signal will get onto the tape. This is more common with CD playback because a CD player's output tends to be higher than that of other program sources.

Some recorders have an audio stage between their input connectors and the volume control. Signal can get around the volume control through common coupling of the circuitry in the recorder's power supply. If the problem just appeared, decoupling capacitors in the recorder may need to be replaced to keep the impedance to stray audio signals at as low a value as possible. If the problem has always been with you, it is likely there is nothing you can do about it other than shutting off program sources while you're trying to record silence.

In any case, don't use your cassette deck to erase tapes. This adds unnecessary wear on its heads and transport mechanism. You can make very quiet erasures by using an AC bulk eraser (such as Radio Shack Catalog No. 44-232). The process is fast, and the tapes will be available for reuse immediately. Be sure to follow the eraser's directions so that you don't introduce any extraneous noise.

Cassette to CD-R Transfer

Q *I want to transfer a live recording I made on cassette tape to CD-R by dubbing the tape to a PC's CD-R drive through a sound card. I need to use a computer CD-R drive because the performance will fill up two 74-minute CD-R blanks. Will I get better sound quality if I first dub the cassette to DAT (thereby taking advantage of the DAT recorder's higher-quality A/D converters) and then transfer the DAT to the computer's hard drive through the DAT deck's digital output? What sampling rate should I use for recording? What cables will I need? Are there any other ways of doing this transfer that would yield better sound?*—John P. Penaloza, via e-mail

A If the sound card on your computer has digital inputs, it would likely be worthwhile to make a digital copy of the cassette with the DAT recorder—provided your DAT deck can record analog signals at the 44.1-kHz sampling rate (48-kHz sampling isn't compatible with CD-R). Dub the DAT digitally, in real time, to the computer's hard drive by using the sound card's S/P DIF inputs. Make sure y hard drive can store at least 74 minu digital stereo, too; that consur chunk of memory. Then you c PC's software to edit an recording to CD-R. Also, I

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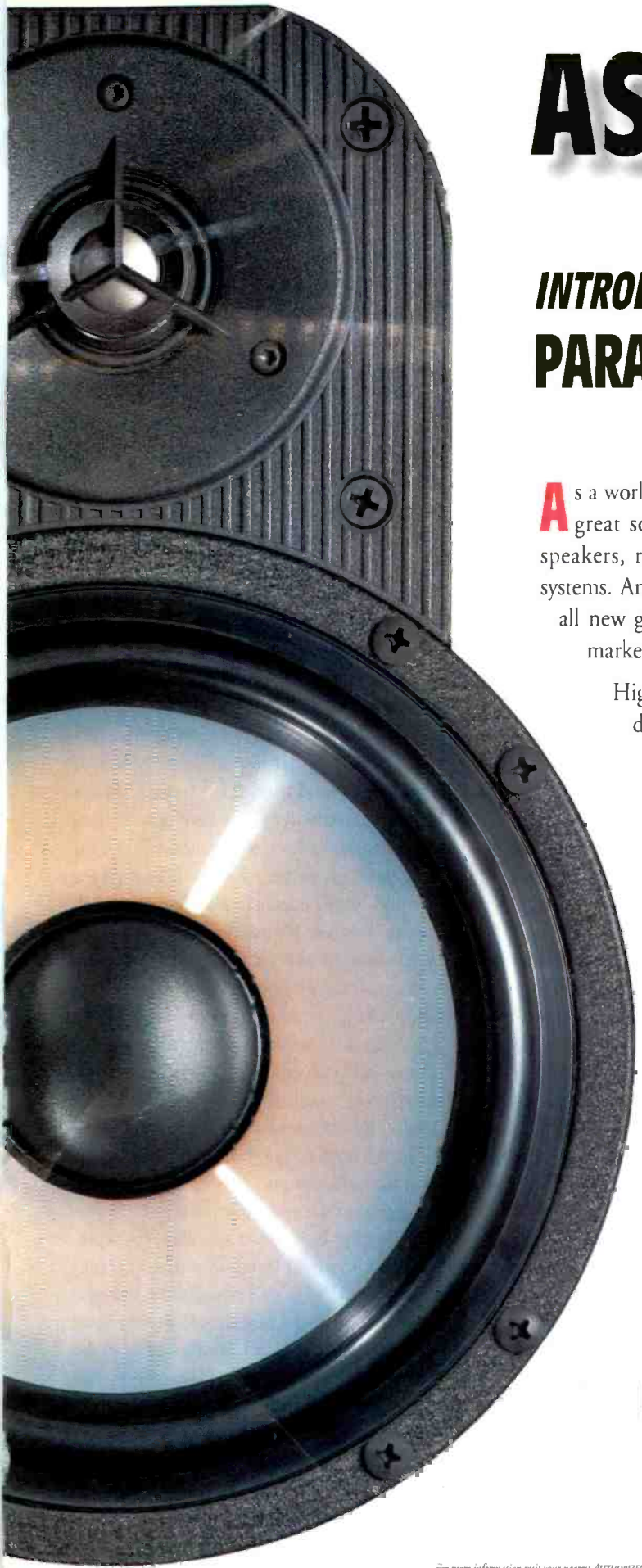

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the cassette to DAT, disconnect the DAT recorder from the computer; otherwise, interference from the computer may affect the DAT dubbing of the cassette.

If your sound card has only analog inputs, there is no advantage to using a DAT recorder as an intermediate step between the cassette and the CD-R. Bypass the DAT deck, and connect the cassette deck to the sound card's inputs. The sound quality of the sound card's converters should be capable of preserving the sonic virtues of your original cassette tape.

Dolby S Retrofit

Q *What is Dolby S, and can I install it in a tape deck that doesn't have it? In what way is it better than Dolby C noise reduction? With prerecorded tapes, how does one know one is getting Dolby S? I was told that some companies use metal tape in prerecorded cassettes, but how are we supposed to know which cassettes have normal, chrome, or metal tape?*—Name withheld

A Dolby S is the consumer version of Dolby Spectral Recording (SR), which Dolby Labs developed for professional recording applications. Although similar in operation to Dolby C noise reduction, it's more sophisticated: Dolby S divides the spectrum into more slices, so low frequencies (along with mids and highs) are also compressed during recording and expanded during playback. This suppresses the low-frequency "roar" that becomes more obvious once treble hiss is lowered (and Dolby C lowers it very well). Although Dolby S confers only an extra 3 to 4 dB of improvement over Dolby C's typical 73 dB of noise reduction, subjectively it's very effective: It essentially makes tape noise inaudible. In theory, a tape deck could be retrofitted with Dolby S noise reduction if the proper ICs could be obtained. However, I don't think it would be worth the time, trouble, and expense involved.

Any prerecorded tape produced with Dolby S will say so somewhere on the packaging or the label. And it isn't all that important for you to know what type of tape is used in prerecorded cassettes, because tiny holes on the rear edge of their shells "tell" most modern cassette decks what type of tape has been used. Mechanical fingers enter the holes and set the deck to the proper bias and equalization. Besides that, virtually all prerecorded cassettes are made with 120-microsecond equalization, regardless of the type of tape used. If 70-microsecond EQ is used, this will be marked somewhere on the cassette.

PCM Recorder Dropouts

Q *My VCR can make PCM digital audio recordings, using the video heads and the portion of the tape that normally carries the video. I get dropouts when playing back some of my tapes. I monitor my sources closely, so I am certain this is more of a playback problem than a recording glitch. Do you have any practical suggestions?*—Ray Magaro, Santa Ana, Cal.

A Are you using cheap tapes? They are likely to have poorly dispersed oxide coating or wrinkled edges, either of which can cause dropouts. At what speed are you recording? Tape at the fastest speed possible; at slow speeds the helical tracks are so close that they overlap, so any imperfect head-to-tape contact will exacerbate data loss and dropouts.

The tape path, including the drum and the control head, may need cleaning, or there may be a misadjusted tape guide that could scratch the tape horizontally (i.e., across the helical tracks), which would likely trigger dropouts. The recorder's tracking may be off. Adjust it during playback to see if the dropouts can be eliminated.

The take-up and hold-back tensions may not be correct. If tension is too loose, poor tape wrap around the head drum will result. That, in turn, will mean poor head-to-tape contact during recording as well as playback. If tension is too tight, the tape will stretch. Edge distortion during playback will make it impossible to reproduce the composite envelope that mimics the video signal.

There could also be problems in your recorder's electronics. These could range from the simple (adjusting the record head's current or playback sensitivity) to the complex (locating and fixing intermittents anywhere in the electronics).

How well does this machine record video? Are there irregularities in the picture? A video dropout may be barely visible to the eye but could mean a huge chunk of lost PCM data. If the video is of good quality and synchronization is rock-solid, the digital circuitry may be at fault. Momentary muting can occu
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through the braided shields of phono patch cords. However, it's usually necessary to run a separate ground wire from the turntable chassis to the receiver. On the other hand, connecting a separate ground wire between the two may sometimes create a ground loop—and exacerbate hum—if the ground is already made through the shields of phono interconnects.

In the original question, the reader stated that no hum was present when the tonearm was on its rest, even when the platter was turning; the hum occurred when the tonearm was over the playing area. If, as you suggest, the cartridge was miswired or lacked a proper ground, the hum would be very loud regardless of the arm's position, unless the motor was just below the playing area. But even when they are correctly wired and grounded, not all cartridges prove to be equally well shielded against hum from different turntables. One cartridge brand produces such bad hum with certain makes of turntables that the cartridge manufacturer offers a kit to help suppress it. A

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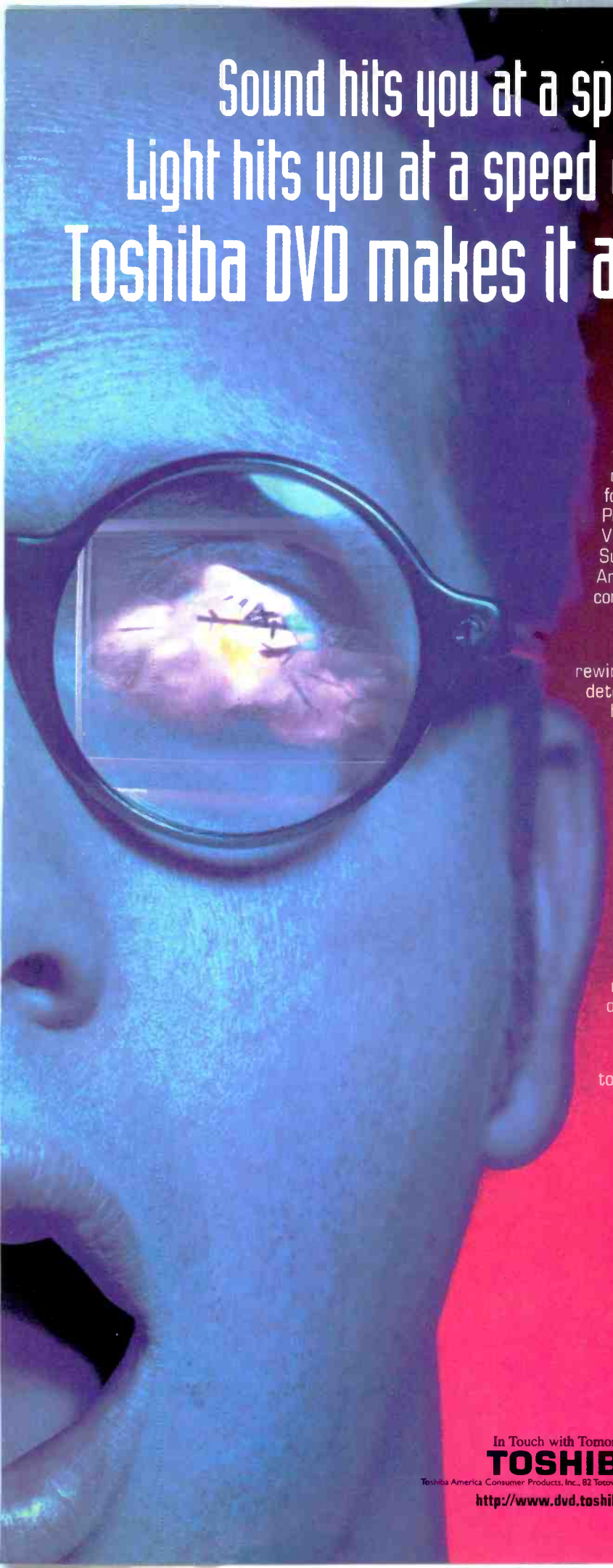

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IVAN BERGER

FULL CARDBOARD JACKET

Savoy's Master Transfers: 78-rpm originals, LP packaging, 20-bit CD sound; below, the Q-Pack.

I didn't think CD packaging could get more retro than the cardboard gatefold packages of Sony Classical's Masterworks Heritage reissues (see March issue). Then, last Christmas, I ran across *J. J. Johnson's Jazz Quintets* (Savoy Jazz CY-78813). Instead of the usual jewel box, it came in a thin cardboard jacket, like an LP. The front of the jacket carried the same graphic—and even the same number (MG 12106)—as an earlier LP incarnation. And the liner notes on the back were a direct (if unreadably small) copy of the original LP notes, right down to advice about playing the record at 33⅓ rpm with a 0.001-inch stylus and the RIAA curve. Like all good LP jackets, it contained a paper sleeve that held the disc itself, and the disc's label side was mostly black, with simulated grooves!

That disc was one of the 32 CDs in Denon's Savoy Jazz MS 20-Bit Master Transfer Collection, a limited edition that will likely be sold out (alas!) by the time you read this. The series featured extra tracks and premium remastering from 78-rpm masters, both of which I appreciate as a listener. But it's the packaging that really endears the J. J. Johnson disc to me. The only way to make it more authentic would be to reissue the original 78s as three-minute CDs that break when you drop them.

But cardboard isn't used just for reissues. Had I looked around the record store a bit more, says *Billboard* magazine, I might have found paper-packed CDs from Neil Young, Pearl Jam, Joni Mitchell, Wilco, Oscar Peterson, and others. Some people in the industry like the cardboard packs, but more seem to be against it. Cardboard jackets cost less than jewel boxes for multidisc albums but cost more for one-disc albums. When stores reorder discs, it takes record companies more time to fulfill the orders, because the plants are geared up for jewel boxes. Cardboard gets dogeared and dirty (though Savoy's cardboard jackets came with durable transparent outer sleeves), and some cardboard jackets won't fit in stores' racks. What record labels and their artists do like is the clarity of the graphics printed directly on the package, with no plastic layer over them.

So why not combine plastic's durability with cardboard's looks? That would give you the Q-Pack, from the Queens Group, a printer

SIMPLE SCIENCE

Want a humbling lesson in how easy it is to fool our ears? An ordinary equalizer can provide one. Try adjusting an equalizer by ear, listening to music (not pink noise) and not looking at meters or displays to tell you what you're doing. When you're done, use the equalizer's bypass switch to compare your "corrected" sound to the original. Surprisingly often, the original will sound better. Even professional audio designers find that the new speaker that sounded wonderful after they'd slaved all day refining it sounds anything but good the morning after. That's why we need to check our perceptions against something objective, such as the equalizer's bypass switch or the instruments in a designer's lab.

One contributor to an on-line speaker newsgroup told of yet another reality-checking system: When he makes a speaker modification that sounds good to him, he tells what he *did* to an out-of-town friend who has the same speakers—but he does not tell what he *heard*. If what the first guy heard was real, the friend will probably report the same effects—if not, either one listener is fooling himself or some other factor is at work.

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V.TV, April/May 1996

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**V.TV, April/May, 1996*

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and packager in Long Island City, N.Y. The Q-Pack is made of very tough, high-impact styrene. Because styrene is opaque, labels are glued to the outside of the box, not slipped inside. Unlike the jewel box, which is made of three pieces, the Q-Pack is in just two pieces: The fingers that grip the CD's center hole are molded into the back, not into a separate disc tray, and the back label covers the resulting hole in the box. The front label wraps over the top, which should make browsing easier. And discs and booklets can be inserted by the same machines that now insert them into jewel boxes. So far, the Q-Pack has been used for *The Rolling Stones Rock and Roll Circus* (Abkco 1268-2), *Siempre Selena* (EMI Latin, 7243-8-53585), N2K's Enhanced CDs of Jazz Central Station's *Global Poll Jazz Winners* (N2KE-10001) and Gerry Mulligan's *Legacy* (N2KE-10002), and Sony's PlayStation video game software.

How do the old and new boxes affect the environment? Surprisingly, according to a letter in *Billboard*, plastic has less effect, because it's easier to recycle.

WORLD'S COOLEST CABLE

An audio system's bass quality depends partly on how well the amplifier damps the speaker diaphragm's uncontrolled motions. An amplifier's nominal damping factor is the ratio of its output impedance to the input impedance of the speaker—the lower the output impedance, the greater the damping.

In practice, however, resistance in the cable between the amp and speaker becomes part of the impedance that the speaker sees; this lowers the effective damping. A superconductive cable, which has virtually no resistance at all, would solve this problem.

Professor I. Lirpa has therefore been following the progress of superconductivity research since monophonic days. Early superconductors worked only at absolute zero (–273° C), which even Prof. Lirpa deemed impractical. But researchers have now developed "high-temperature" superconductors, which can work at the temperature of liquid nitrogen, a comparatively balmy –196° C.

Since a superconductive cable would have to be bathed in liquid nitrogen to work, it would be very thick and very, very, expensive. After checking the cable selections at his local high-end audio salon, Lirpa decided these requirements would not deter prospective buyers and began work on a superconductive addition to his cable line.

The product is not yet ready for market, however. Although the cables no longer leak sufficient cold to freeze listeners' feet, cold still leaks through the junction between the cable and the equipment it's connected to. To owners of Class-A amps, the resultant cooling of amplifier output stages should prove beneficial, enabling the amps to deliver higher power without burning out. But at the speaker end, it's still a problem, freezing the leads that connect the voice coils so they crack when flexed.

Professor Lirpa is still optimistic about the technology: "My motto has always been 'Back to the drawing board!' So I take these things in stride."

LISTENING LIMITS

Even the least romantic of us can't walk down the street these days without hearing music—either the thumpathump of passing cars' sound systems or the tinny tunes leaking from other pedestrians' earphones. Koss, a major earphone manufacturer, has publicized the need for listening at what many consider disappointingly sane levels. Recently, France passed a law limiting the output of all personal stereos sold there to 100 dB SPL. The law also mandates a label on each personal stereo to warn that high-volume listening for long periods can damage hearing. But there are problems. The European Commisson may knock the law down as a unilateral trade barrier. Some experts say that even sound-level measurements made by microphones within the ear don't properly assess sound pressure at the eardrum. And other experts point out that there's no guarantee what level listeners will hear if they replace their earphones with more (or less) efficient models.

How loud are personal stereos now? According to an article in *New Scientist* ("Falling on Deaf Ears" by Tara Patel, June 29, 1996), the French retailer FNAC says most of the personal stereos it sells max out at 113 dB, though some reach 126 dB. (The human threshold of pain is 120 dB, and long-term exposure to sounds above 85 dB can cause hearing loss.) One French audiologist tested 140 personal stereos and found their average maximum output to be about 118 dB. Another audiologist found that full-blast rock from personal CD players is at least 100 dB most of the time, with peaks at about 127 dB.

Still, the experts cited by *New Scientist* disagree about how much all this affects hearing. One researcher found that people who use personal stereos are twice as likely to suffer temporary hearing loss as people who do not but that live concerts probably cause even greater deterioration of hearing. And some scientists in Britain and Sweden believe that the link between short- and long-term hearing effects caused by loud sounds is still speculative.

What about car stereos? Orion now labels its car stereo packages as follows: "Take care of your ears! High powered car audio systems can produce sound pressure levels in excess of 140 dB. Use common sense and wear ear protection when appropriate." Well and good—but remember that it's common sense *not* to wear ear protection when you drive.

Photographs: © H. Armstrong Roberts

LOSING YOUR LEASE ON LISZT

Hearing a recording on the radio is free, but chancy. Even if you listen only to Top-40 hits, you won't always be able to hear the song you want when you want it. Buying the record lets you hear it any time you want, but that costs. Fair enough.

Cassette decks make it easy to tape music off the air, but few people bother. Listening to radio is less relaxing if you have to keep constant track of when to turn the tape on and off to catch the material you want. And the resulting tapes don't sound as good as the radio station's CDs did. People I know who tape off the air tend to record only live concerts (usually in their entirety) or rare performances of long works they already have by other artists. The exceptions are mainly teenagers, who tape this week's hot hits and tape over them when those songs fall from favor.

Digital transmission—by radio, satellite, cable, or Internet—threatens to alter that. If we can dial up music on demand, we can also have our digital recorders waiting. And if a digital broadcast stream carries titles with the music, we could have recorders that start themselves when they read the titles we've preselected. This would probably have a far greater impact on record sales than taping from FM (not to mention AM) ever did.

So how can record companies continue to demonstrate their wares without giving them away altogether? I've heard of a few possibilities, all of which would require changes in technology and, perhaps, law.

One possible solution, now used by some computer makers, is encryption. Every digitally transmitted recording would contain a copyright-protection code. Digital radios would ignore it, but when home digital recorders sensed the code, they'd make only encrypted copies (or none at all). For a small fee, the record company would sell you an unlocking code that would let you play an encrypted copy or make an unencrypted one.

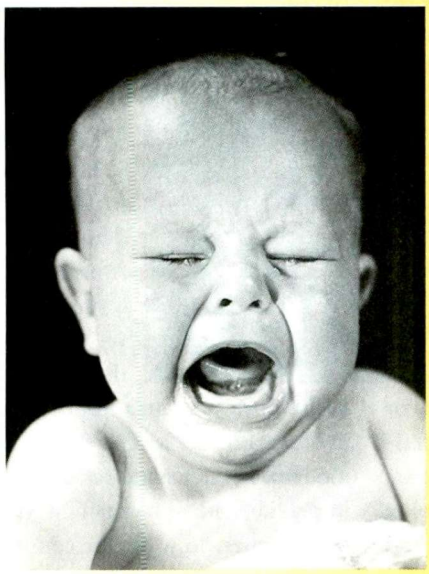
The RIAA's wish list for copyright-protection schemes includes a suggestion that digital transmission systems and recorders allow copyright owners to set playback limits. A subcode would limit the number of times you could play a recorded download or the time period over which you could play it. If you still liked the piece after hearing it, say, three times or after living with it for a week, you'd either buy a commercial copy (complete with liner notes and such) or fork over for a code that would deactivate these limitations.

This seems fair enough, if the codes are restricted to digital downloads. You could listen a few times for free, but you'd pay to keep the recording, just as you do now. What worries me is that the program providers could go from sales to leasing: You couldn't keep a classic recording unless you also kept up annual payments on it. And movie studios that remake classic films might insist recordings of the original films erase themselves when the new version arrives—even (or perhaps especially) if the new version's a pallid shadow of the old.

Incidentally, a new recording system from Optex Communications, in Rockville, Md., seems tailor-made for playback limits. Recordings made with Optex's electron-trapping optical memory (ETOM) system are, effectively, erased by their playback process. That's no big deal, because ETOM players will have dual-laser systems that rewrite the data as it's played. But players could be designed to refresh some data for only a preset time or number of plays.

DANGEROUS BABES

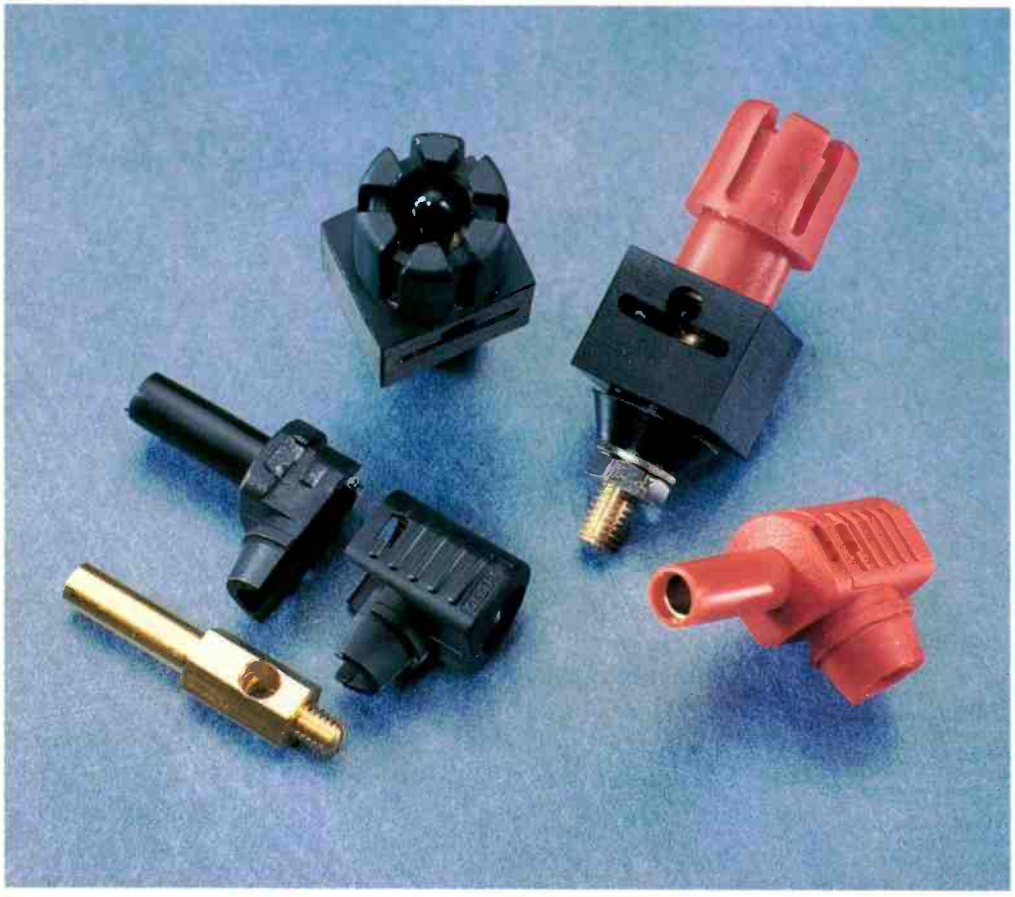
Picking up a screaming baby doesn't always stop the screams immediately—or at all. Could this pose a hazard to the parent's hearing?



Yes, say readers of *New Scientist*, a British weekly. One Swedish reader reported measuring a scream level of 96 dBA at his ear while carrying his month-old daughter on his shoulder—considerably louder than the 85 dBA that Swedish law permits in the workplace. Luckily, kids don't scream all the time and eventually outgrow screaming altogether, so the chance of permanent hearing damage seems to be slight. The Swedish reader calculated that exposure to 96 dBA would have to continue, eight hours per day, for 30 years to give four out of 10 listeners considerable hearing impairment. A parent subjected to that would have long since stopped caring about deafness—or anything else. On the other hand, wrote a reader from New Zealand, parents can suffer a hearing loss that sets in 10 years after babyhood, making them deaf to their kids' requests for money.

KEN KESSLER

PLUGGING THE CONNECTOR GAP



Photos: Courtesy of the British Federation of Audio

My abiding hatred for PCs, especially Windows 95, has resulted in a long-overdue move to the Mac. And it wasn't just the utter instability, the daily crashes, the software bugs, the crudity, or even Bill Gates's smugness that drove me into the Apple orchard. Quite simply, a lifetime of hi-fi's system compatibility spoiled me: I expect things to work. I grew up with plug-and-play, long before Gates co-opted the concept.

Wha-a-a? "Hi-fi's system compatibility?" What has Kessler been snorting? Think about it: Apart from the need to match the characteristics of a phono preamp's inputs (capacitance, resistance, etc.) to those of the phono cartridge's output, setting up a hi-fi system has always been relatively easy and straightforward. Love 'em or loathe 'em, the RCA-type phono plugs and jacks are a worldwide industry standard, so connecting any source to any preamp or integrated amp has never been an issue. True, there have been such aberrations as the ludicrous DIN plug from Germany, often found on old Quad, B & O, Tandberg, Philips, and other Euro-centric hardware, but DIN plugs never posed a serious threat to the ubiquitous RCA phono plug. For the most part, you can connect any tuner, tape deck, CD player (or D/A converter), phono stage (with line-level output), DAT machine, DCC player, or VCR (audio output, of course) to any line-level input. And It Will Work.

WHY BAN THE BANANA PLUG? BECAUSE THE MANDARINS IN BRUSSELS FEEL THAT EUROPE IS AT RISK.

How *well* it works is another matter. The bottom line, though, is that any CD player, tuner, VCR, or tape deck *will* deliver a signal to any amplifier that has a line-level input. Preamp-to-power amp connections? Again, the likelihood of electronic or mechanical (as opposed to purely sonic) mismatches is insignificant. Only two types of connectors are commonly used: RCAs and XLRs, the latter for balanced operation. Indeed, any manufacturer using a proprietary or obscure plug/socket combination should be shot—and quickly, lest we end up like the computer industry.

Even connections between CD transports and D/A converters are straightforward. True, four or five types are in use, but I've yet to see a transport or converter without, at the very least, RCA phono jacks for coaxial digital input and output connection, while the Toslink is pretty much the de facto standard for low-end optical connections. Other options? Either ST optical or XLR. Again, no problems, and all D/A converters can read the digital stream that comes from a CD transport.

Ever tried to install a modem in a PC? A printer from a maker less well known than Hewlett-Packard? How about a scanner? I rest my case. But the Mac? I shoved in a modem, never having set up a Mac in my life, and was e-mailing within five minutes. So while the computer industry awaits the Universal Serial

CARVER

Designed to shatter a few myths. Starting with the one that says nothing's perfect.

Stereophile's Guide to Home Theater *reviewer Robert Harley on the new Carver HTR-880 audio/video receiver (excerpted from the Spring 1997 issue):*

"The circuitry is more like you'd find on a high-end product than an A/V receiver... I was taken aback by the Carver's sound quality. The HTR-880's musical performance is beyond what I've heard from A/V receivers and more in the realm of audiophile separates.

"The HTR-880 excelled in many ways. First, the overall tonal balance is smooth and unfatiguing... it has a much more natural treble rendering than any other A/V receiver I've reviewed... the Carver's soundstaging was far beyond what I've heard from other A/V receivers... I also heard excellent detail resolution through the Carver... the HTR-880 has tremendous dynamic impact and punch... The HTR-880 has a far more refined and sophisticated sound than I expect from a mid-priced A/V receiver.

"The Carver HTR-880 is without question the most musical A/V receiver I've reviewed. Its performance is more like that of audiophile separates than a mid-priced home-theater receiver. Carver's Infinite Decorrelation feature improves the receiver's already good surround performance. I also think the Power Steering technique is a real advance; I never felt the need for more power in either the music or home theater systems.

"The HTR-880 is also the easiest-to-use home theater receiver I've laid hands on... if you can live with one VCR and a single A/V source, the HTR-880's outstanding sound quality, simple operation, and bargain price make it the A/V receiver of choice in a crowded field of lesser products."

Thanks to Mr. Harley's kind comments, just about everyone is looking for the Carver HTR-880 receiver. At $859 suggested retail, we believe it's closer to audio/video perfection than anything else on the market up to twice its price. Best of all, your authorized Carver dealer may still have an HTR-880 in stock. Reserve yours now.

"...the A/V receiver of choice in a crowded field of lesser products"
-Robert Harley, Stereophile Guide to Home Theater, Spring 1997

"...a best buy for home theater."
Kevin Hunt, The Hartford Courant, November 1996

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CIRCLE NO. 6 ON READER SERVICE CARD

Bus and IEEE-1394 (or what Apple calls "Firewire"), we can rest comfortably in the ease of use that audio's founding fathers built into hi-fi components. (Then again, there are noises that IEEE-1394 will be used by the giant multinationals—especially those with interests in computers, video, and audio—to encourage greater integration between your PC and home entertainment components. I can't count the hours, as the Italians say.)

But then we get to speaker terminals, which are a lot messier because manufacturers can use spade connectors, press-connectors that accept only pins or bare wire, screw terminals, multiway binding posts, banana jacks, XLRs, and probably some others I've forgotten. (The worst of all time? Those large binding posts that the Japanese used for years. They wouldn't accept a 4-millimeter banana plug through the top or any bare wire thicker than a toothpick. And because they had a raised collar, you couldn't use spade connectors.) As a rule, however, multiway binding posts seem to be the current norm; you would need cables fitted with some pretty strange plugs for them *not* to work with, say, WBT's big-mutha terminals or the highly popular Monster Cable chassis mounts.

Except for those who have complex, hard-to-terminate cables (multistrand, myriad cores, braided, what-have-you), changing from bare wire to spade connectors requires only a touch of solder or a mere crimp. Besides, how often do you change speakers or cables? And for chronic tweakers and reviewers, there's always a box full of banana plugs that use set screws rather than solder to make the connection to the wire. But even that is about to change.

Once again, it's the Germans who are responsible. They should never be forgiven for the DIN plug, which one designer told me was their way of exacting revenge for their defeat in World War II. Germany's interminable meddling (by virtue of its clout in the European community), along with that of its partner in crime, France, means that the CE regulations continue to confuse, confound, and cost everyone that much more for paranoid, bureaucratic excess. (Typical bit of stupidity: Southeast Asian lime leaves are now illegal throughout Europe, even though Europe is hardly a source of citrus fruit. I'm just glad I don't own a Thai restaurant.) We are now subjected to recent amendments to the European safety standard BS EN60065 (originally set in 1994), an idiotic law relating to consumer electronics that effectively bans

THE BFA'S SOLUTION IS TO USE A PLUG LARGE ENOUGH TO PREVENT ITS INSERTION INTO AN AC SOCKET.

the use of 4-millimeter (banana) plugs for loudspeaker connections to amplifiers.

Why ban the humble but useful banana plug? The mandarins in Brussels feel that the whole of Europe is at risk because a cable-mounted 4-millimeter (or smaller) plug can be inserted into a European AC power socket with possibly fatal consequences. In other words, we can soon expect matches to be banned because we might burn ourselves.

Enter the British Federation of Audio, which is trying to stave off possible chaos by promoting a brand-new loudspeaker connector. The BFA's membership represents more than three-quarters of the British hi-fi loudspeaker industry, so any companies on your side of the pond (smaller than Bose, that is) can stop sniggering. The combined sales of B&W, KEF, Mission, Wharfedale, Celestion, Spendor, Harbeth, ATC, Monitor Audio, JPW, Epos, Tannoy, Mordaunt-Short, Rogers, Heybrook, Castle, Meridian, and a few dozen other British-based companies give the group credibility far greater than, say, that of the massed ranks of the German or French specialist hi-fi manufacturers.

The BFA's solution is to use a plug large enough to prevent its insertion into an AC socket. Unlike the United States, Great Britain, and other countries that have standardized the use of flat pins on AC plugs, most European countries use round pins. It's conceivable, therefore, that any round pin small enough to fit into a hole in the wall can be deemed dangerous. (So when are they going to ban paper clips, knitting needles, and nails?) The BFA connector (as good a name as any and less of a mouthful than IEEE-1394) uses an insulated, recessed plug and an insulated, recessed socket, designed to comply with both European and North American safety standards. It boasts an insulated plug whose outer diameter of 6 millimeters is greater than the 5.5-millimeter orifice of the typical European AC socket. As a bonus, the outer insulation prevents accidental shorting of the amplifier outputs when you're installing a hi-fi system. A recent missive from the BFA states, "Both the plug and the socket are insulated to meet possible issues of 'live terminal' safety on loudspeaker outlets up to and including '100V line' voltage used in sound distribution systems. The design also permits adaptation for use with higher voltages."

Although some of us might bemoan the loss of the familiar banana plug, the BFA connector is said to exceed it in "robustness, versatility and performance." On a more subjective level, which the BFA recognizes as "an important sales factor in separates hi-fi marketing," the new connector "is substantial and heavy-duty, yet retains a silky precision feel, giving a satisfying fit when in place." Additionally, this connector can accommodate insulated 6-millimeter spade terminals on its binding post, and the plug can be adapted to accept both large- and small-diameter loudspeaker cables (terminated with a screw, crimping, or soldering), as required or preferred by the manufacturers who choose to employ it. Which will probably be every sensible brand in the U.K. and any others who wish to sell product in Europe with minimal interference from civil servants.

Credit for the initial work on the BFA connector goes to the British electronics

firm Arcam. The connector has been refined further through cross-industry collaboration in conjunction with European safety authorities. But this is no exercise in xenophobia, the emotion that motivated the Germans to come up with these stupid laws in the first place. Rather, it's a *response* to xenophobia—cutting the industry's potential losses, so to speak. To encourage worldwide acceptance of the connector, the BFA is making full design details available to equipment, component, cable, and connector manufacturers on a license-free basis. (There's a nominal charge of a piffling £100, or $170, to cover costs.)

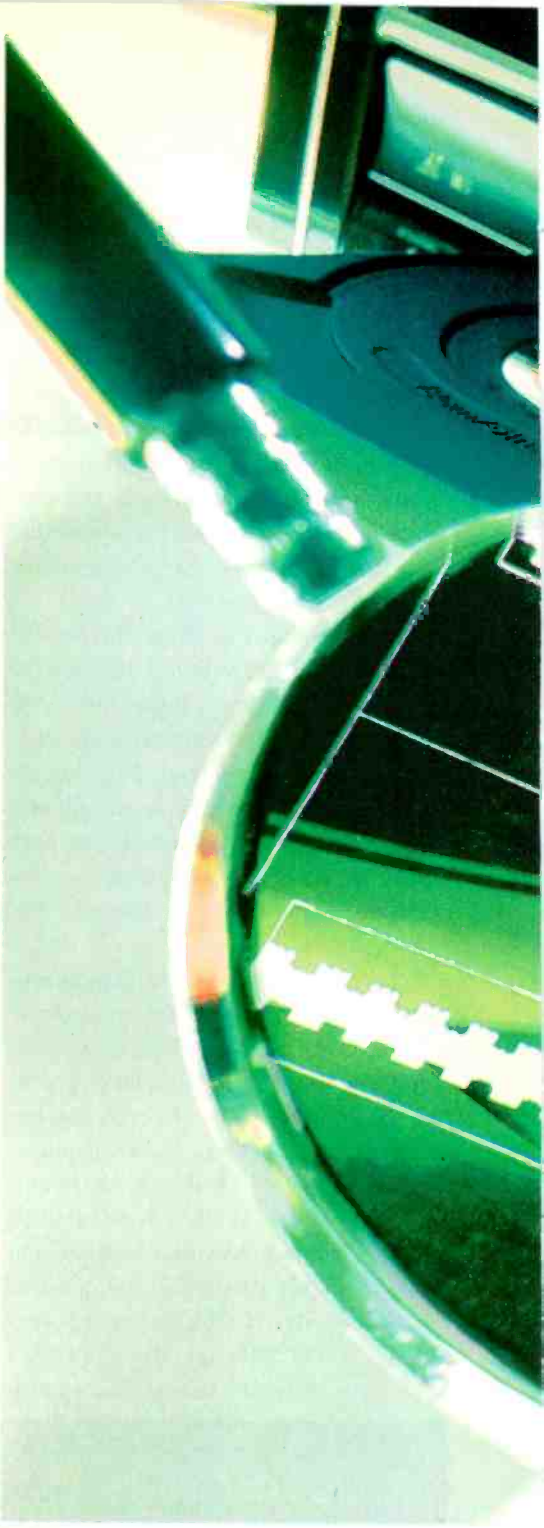
These guys aren't kidding: The licensee "pack" contains full technical drawings (in dead-tree form and on a floppy disk in industry-standard CAD formats), color photographs, details about physical and electrical compatibility and about compliance with safety regulations, samples of both plugs and sockets, and—naturally—copies of the BFA logo. Hey, credit where it's due, okay?

As a writer who has had his fill of incompatible computer hardware, audio false starts, and the industry's failure to standardize new formats with any fluency (witness the DVD mess), I'd like every speaker, amplifier, cable, and connector manufacturer in the world to stifle any not-invented-here tendencies, swallow its nationalistic pride, and contact the British Federation of Audio (Landseer House, 19 Charing Cross Rd., London WC2H OES, England; phone, 01144 171 930 3206; fax, 01144 171 839 4613; http://www.british-audio.org.uk).

TO ENCOURAGE THE CONNECTOR'S WORLDWIDE ACCEPTANCE, THE BFA HAS MADE FULL SPECS AVAILABLE.

This organization has done the necessary work; now the hi-fi industry just has to agree to it. Do it now, and who knows? Maybe we'll hear an announcement at the 1998 Winter Consumer Electronics Show that the American hi-fi industry has just circumvented its exclusion from the European market. A

DVD UNRAVELED



by EDWARD J. FOSTER

Just over two years ago, I saw my first digital videodisc demonstrations, the first conducted by Sony and Philips and the second by Toshiba and Time Warner. I was impressed with both. Despite the similarities in the two systems—both used MPEG-2 video compression and promised discrete 5.1-channel digital sound—it looked as if a format war might break out between them. Eventually, the two consortiums called a truce and settled on a compromise (the "unified format" disc). Thankfully, we will not have to endure another Beta/VHS skirmish.

Sony/Philips called its original format MMCD, which stood for MultiMedia CD and, not too subtly, emphasized the connection with the Compact Disc, for which the two companies hold a large number of patents. Toshiba/Time Warner, apparently wishing to distance itself from the Sony/Philips CD legacy, called its version SD, which simply signified Super Density. The compromise disc, DVD, stands for, well, DVD. Some think it means Digital Video Disc; others claim it stands for Digital Versatile Disc. But I'm told that, in this marvelous world of unification, it means nothing other than "DVD." I guess that's what compromise is all about.

DVD can be looked at in two ways. As a medium, it's simply a way of storing vast amounts of digital data on a 4¾-inch optical disc. (Except for a somewhat golden cast, a DVD looks very much like a conventional CD, even though it can hold much more data.) The other way of viewing it is as a platform for carrying specific types of data: video data in the case of DVD-Movie, prerecorded computer data in the case of DVD-ROM, and audio data for DVD-Audio. Unlike the Compact Disc, which started life as an audio carrier and only after some years had passed was born again in the computer and video industries as CD-ROM and Video CD, DVD will come out of the video and ROM gates virtually at the same time.

Interestingly, DVD-Audio is the straggler. For the present, there's disagreement about sampling rates, word lengths, the number of channels, and so on, which has prevented a DVD-Audio standard from being established. In fact, some participants dispute the need for a dedicated DVD-Audio disc because the DVD-Movie standard permits a fairly broad spectrum of audio formats.

Ultimately, there will likely be recordable DVD, in both write-once and erasable formats. Expect it to be launched by the computer industry before audio/video companies introduce it. I expect recordable DVD's benefits, as a backup medium and as a way of transporting vast amounts of data between computers, to override the concerns of video copyright owners.

(That's a nice way of saying that paranoia is more prevalent in Hollywood than in Silicon Valley.)

INCREASING DISC CAPACITY

The key to cramming more data onto an optical disc—in this case, enough to carry a movie's worth of high-quality digital audio and video—is to shorten the wavelength of the scanning laser. This permits a tighter track pitch on the disc (more tracks per radial inch) and closer spacing of the pits that carry information (more bits per lineal inch). Shortening the laser wavelength is the optical equivalent of going from the 3-mil stylus used for playing 78-rpm records (anyone remember those?) to the 1-mil stylus used for playing LPs. A smaller stylus could trace tinier wiggles, which meant that the grooves on an LP could be packed closer together and the minimum wavelength of the groove wiggles could be a lot shorter. Consequently, LPs could carry a lot more information (i.e., a wider bandwidth) than 78s. Although there aren't any mechanical grooves and wiggles on an optical disc, a similar principle applies.

CDs are scanned by an infrared laser that has a wavelength (analogous to stylus size) of 780 nanometers. A nanometer is a billionth of a meter. Thus, 780 nanometers is equivalent to 0.78 millionth of a meter (micrometer, a.k.a. micron), or about 0.00003 inch. Pretty tiny. The CD track pitch is 1.6 microns, and the shortest pit/land size (distance along the track) is 0.834 micron. Conventional CDs are 1.2 millimeters thick, and the information layer is buried deep within the plastic, up near the label.

To read the disc, a laser beam is focused through the plastic and onto the informa-

PHOTOGRAPH: ©1997, JOHN WILKES

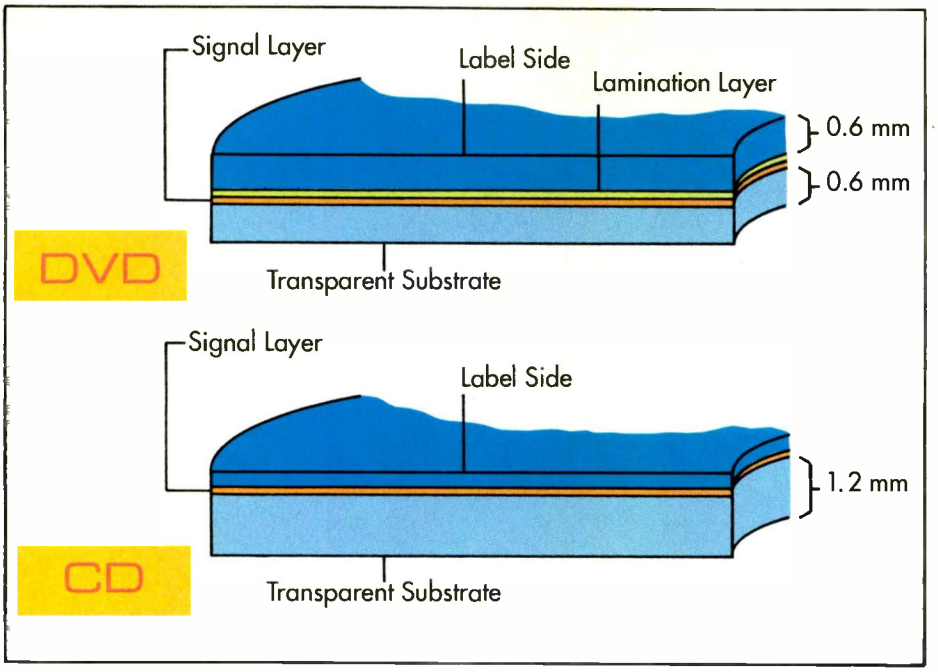


Fig. 1A—*Toshiba's proposed disc, which was adopted, consists of two 0.6-millimeter discs bonded together. This produces a thinner substrate and makes DVD more resistant to warping.*

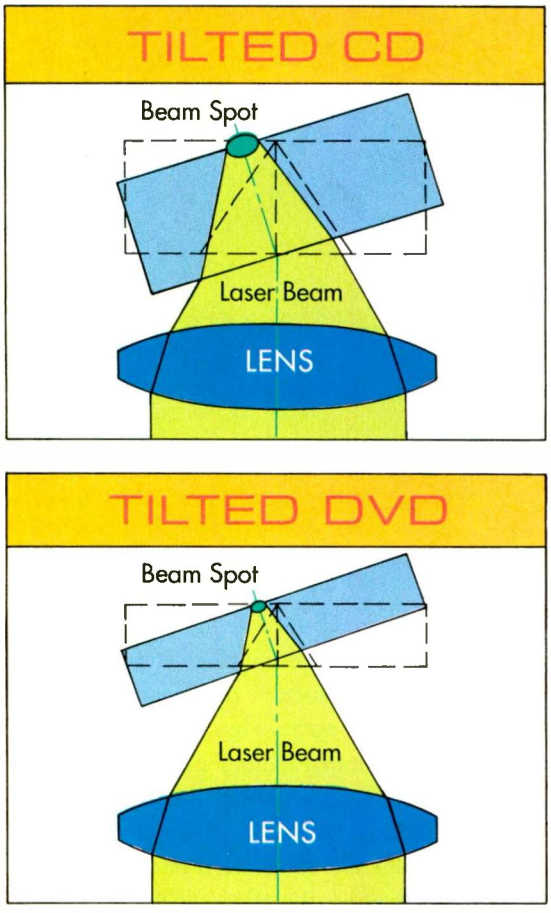


Fig. 1B—*DVD's thin plastic brings the data layer closer to the laser, reducing problems with disc tilt and enabling a smaller beam spot and more tightly spaced pits.*

tion layer. The beam reflects off the layer, travels back through the plastic, and then passes through some optics to the pickup. (The depth of the pit pattern is tailored to the laser wavelength, improving the difference in output between pit and land.) As the beam travels through the plastic, it disperses, which makes it less capable of distinguishing between tightly spaced pits. That's partially what constrains the pitch and pit spacing. A CD can hold approximately 0.78 gigabyte (780 megabytes) of information.

To increase the storage capacity of MMCD, the Sony/Philips system called for the disc to be read by a 635-nanometer red laser. Track pitch and minimum pit/land size were approximately halved (to 0.84 and 0.45 micron, respectively), and the program area was extended a few millimeters closer to the disc's center hole. Changes also were made to the error-correction and modulation schemes to improve the net packing density. The result was an approximate quintupling of storage capacity—from 0.78 gigabyte on CD to 3.7 gigabytes on MMCD.

Sony and Philips suggested it would be possible to double the storage capacity of MMCD once more (to 7.4 gigabytes), by using two information layers. (The technique was developed by 3M.) Either way, MMCD was designed as a single-sided, 1.2-millimeter-thick disc—just like CD. Because of the physical similarity to the conventional CD, Sony claimed that an MMCD could be produced easily, using modified CD presses. And because the information layer was at the same depth as in a CD, it would be relatively easy to develop MMCD players that were backwards compatible with conventional CDs, a major issue with the computer people.

The Toshiba/Time Warner proposal called for a laminated disc made from two 0.6-millimeter discs bonded together (Fig. 1A). The overall thickness is the same as a CD, but the information layer lies halfway through the disc, 0.6 millimeter below the surface. Because the laser beam travels through half as much plastic on its way to and from the information layer, there's less dispersion of the laser beam than with MMCD. Thus, the data pattern can be read with a longer-wavelength (read, less-expensive) laser. Moreover, since the information layer is closer to the surface of an SD disc, disc tilt, or wobble (no disc is perfectly flat), is less of a problem than with a disc whose information layer is farther from the surface (Fig. 1B). SD discs were designed to be read with a 650-nanometer laser yet provide even greater data capacity than MMCD, thanks to a tighter track pitch (0.74 versus 0.84 micron) and smaller minimum pit/land size (0.40 versus 0.45 micron). This bumped the data capacity to 4.7 gigabytes per side, and because it's a laminated disc, it would be easy to double that capacity by pressing both of the disc's sides with data—in other words, producing a double-sided disc.

DOUBLING UP

The computer industry was not too eager about adopting a double-sided disc, which temporarily gave Sony/Philips' two-layer MMCD the edge in single-sided storage. When Matsushita kicked in with a two-layer version of SD, the pendulum swung the other way, ultimately giving rise to the unified format we have today.

The unified DVD has a laminated structure (à la the Toshiba/Time Warner proposal), with a two-layer option (courtesy of Matsushita) and a more robust modulation scheme proposed by Sony. The disc can be read with red lasers having either a 635- or 650-nanometer wavelength. Everybody gets a piece of the action; everybody's happy with the unified format.

There are four possible combinations of DVD (Fig. 2): single-sided/single-layer, with a storage capacity of 4.7 gigabytes; single-sided/double-layer (8.5 gigabytes); double-sided/single-layer (9.4 gigabytes); and double-sided/double-layer (17 gigabytes). Double-layered discs don't have twice the storage capacity of single-layered discs because there's sufficient loss in reflectivity going through the top layer to require a reduction in data density.

Whether double-sided discs will ever see the light of day is questionable, but the possibility exists. (*Editor's Note:* At the January Consumer Electronics Show, Richard Marquardt, vice president of the Warner Advanced Media Operations DVD replication plant in Olyphant, Pa., cited *Gone with the Wind*, which runs 220 minutes, as the sort of movie likely to be produced and marketed as a double-sided disc.—*A.L.*) In any event, even single-sided DVDs use a laminated structure with the reverse side blank. Toshiba says that in addition to increasing the storage capacity beyond that of the original Sony/Philips disc, the laminated composition helps stabilize the disc and prevent warping.

It's helpful to distinguish between DVD, the data-storage medium, and DVD, the digital videodisc. DVD, the medium, has far broader applications than audio/video storage, but *Audio* readers are probably more interested in how DVD will influence home theater than in how it will affect computer applications.

In the summer of 1994, an ad hoc committee—the Hollywood Digital Video Disc Advisory Group—met "to encourage public and industry discussion concerning the development of the five-inch digital video disc." The group came up with a seven-item wish list: "ability to accommodate a full-length feature film, about 135 minutes, on a single disc; picture quality ideally superior to that of current high-end consumer video playback systems such as laserdisc; audio compatibility with matrixed surround and other high-quality presentation systems; ability to accommodate three to five languages on one disc; commitment to an unspecified 'copy-protection system'; multiple aspect ratios, to allow for future widescreen markets; multiple versions of the same program on one disc; and a parental lockout feature."

The unified-format DVD has the potential to fill the bill; whether or not it realizes this potential fully will depend more on Hollywood than on the hardware producers.

VIDEO COMPRESSION

The data rate of uncompressed studio-quality digital video is prodigious. Depending on how you calculate it, the data rate for professional studio video (CCIR-601, D-1) can be as high as 270 megabits/second (there are eight bits in a byte). Without data compression, a 4.7-gigabyte disc would fill up in a couple of minutes—if it could handle such a high data rate, which it can't. The key to the digital videodisc's remarkable capacity is MPEG-2 video compression.

MPEG stands for Motion Picture Experts Group, a joint committee (JTC1/SC29/WG11) of the International Standards Organization (ISO) and the International Electrotechnical Commission (IEC). To date, the group has produced two standards for audio/video compression, MPEG-1 and MPEG-2. MPEG-1 video compression aimed to capture reasonably decent (so-called "VHS-quality") pictures and two-channel sound, at a combined data rate of approximately 1.4 megabits/second, essentially the same as for music CDs. This is the basis of the Video CD, which provides 72 minutes of picture and sound using the conventional CD as a carrier. Although Video CD never took off in the United States, it's been reported that 2 million Video CD systems were sold in China last year. (For an excellent explanation of MPEG-1, see "Video CD: A Coding Challenge," by Robert A. Finger, in the December 1994 issue of *Audio*.)

MPEG-2 video compression is optimized for higher data rates, such as those used by DVD, DSS, and digital cable TV. Furthermore, MPEG-2 video data compression works well with interlaced pictures (the type employed in television broadcasting to reduce flicker) as well as with progressively scanned pictures (preferred by the computer industry). MPEG-1 assumed progressive scanning.

Both systems are based on similar principles: block-based transforms and motion compensation to reduce the spatial and temporal redundancy in the picture, nonlinear quantization to exploit the acuity limitations of human vision, and run-length and Huffman coding to further reduce data rate. Run-length and Huffman coding are "lossless" compression techniques, which means they can be undone and the data retrieved perfectly. The first two are "lossy" compression techniques and cannot be undone perfectly; thus, there's a possibility that artifacts will appear in the decoded picture. Whether you see them depends on picture complexity and how well the encoding and decoding are performed.

Relatively static pictures that have few sharp edges can be encoded at a low data rate and yield excellent results. Pictures that have lots of detail require a higher data rate to prevent visible motion artifacts or picture softening. One of the key features of MPEG-2 compression is an ability to encode at either fixed or variable rates. By adjusting the rate in accordance with picture complexity, an MPEG-2 encoder can optimize the trade-off between data rate and picture quality. For DVD, MPEG-2 video encoders operate at output data rates ranging from 1 to 10 megabits/second, with a nominal average rate of 4.7 megabits/second.

Data is arranged in blocks, with a header that tells the decoder how to interpret the data and an end-of-block symbol that tells it the block is complete. A buffer in the DVD player stores data until it is decoded and organized to produce video at a standard field rate. Other circuitry controls data readout from the disc in order to prevent buffer overflow or underflow. Chrominance (color) and luminance (gray-scale) information is coded independently, which prevents the anomalies associated with composite video (dot crawl, cross-color interference, and so forth). PAL-, SECAM-, or NTSC-composite video is generated in the player, so, in theory, the same disc could serve all markets.

As with MPEG-1, MPEG-2 video compression distinguishes among "I" (intraframe), "P" (predicted), and "B" (bidirectional) pictures. An "I" picture is fully analyzed and encoded. "P" pictures are based on an analysis of how picture macroblocks have shifted from the previous "I" picture (this generates motion vectors) and on the difference between the current picture and the previous "I" pictures (i.e., encoding what video content is new or has changed). "B" pictures are also predicted, but in this case the prediction is in two directions (forward and backward in time) and uses the adjacent "I" and "P" pictures.

"I" pictures require the most data to encode, since each is fully analyzed and encoded independently of all other video frames. On average, a "P" picture requires only half as much data to encode as an "I," and a "B" picture needs only one-fifth as much as an "I." Obviously, the fewer "I" frames that need to be encoded, the lower the data rate. However, you can't push this too far. "I" frames are the anchors for MPEG-2 compression and the only way to clear the palette, so to speak, for an entirely new picture.

There is a normal MPEG-2 picture sequence, or GOP (group of pictures), which governs the order in which "I," "P," and "B" frames appear as well as how often they appear. However, the picture sequence is not cast in stone, and a good encoder can force a new "I" frame to occur whenever warranted by an abrupt shift in scene content.

This brings up an important point. The MPEG-2 video standard (ISO/IEC 13818-2) does not specify an encoding algorithm but, rather, a syntax for conveying data so that MPEG-2-compliant decoders can understand or decipher the bitstream and act upon it. Not all of the encoding tools provided by MPEG-2 need be employed by an

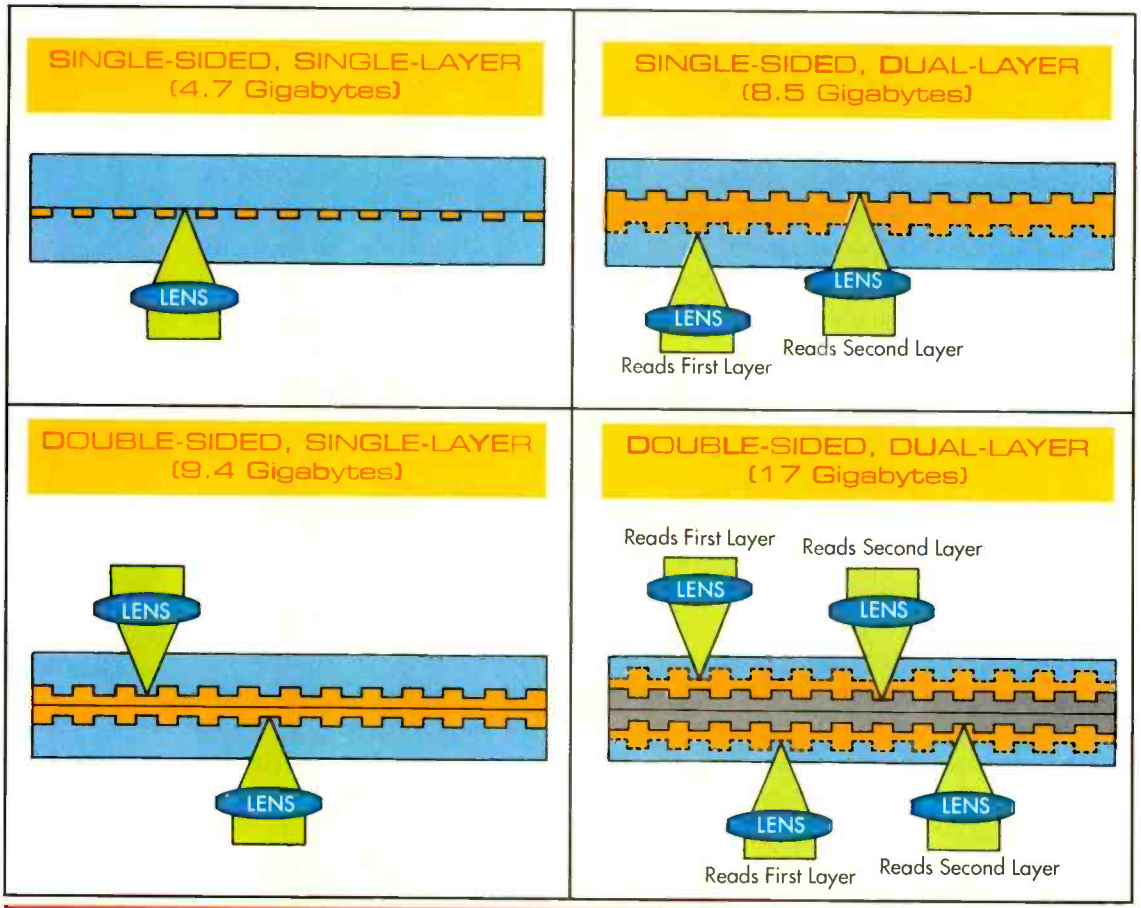


Fig. 2—*DVD supports both single- and double-sided discs as well as single- and dual-layer discs.*

encoder, nor must a decoder respond to all of them—as long as it's not confused by the data it receives. Therefore, the quality of an MPEG-2 picture is not cut-and-dried. It depends on the quality of the encoder (and the skill of the person operating it) and on the quality of the decoder. Encoding a movie or program for DVD is as much an art as cutting a record ever was.

I should also point out that MPEG-2 compression can't take full credit for the tremendous reduction in the data rate between CCIR-601 professional studio video (as much as 270 megabits/second) and DVD (which operates at a nominal average data rate of 4.7 megabits/second). For DVD, MPEG-2 uses 8- rather than 10-bit word lengths (although higher precision in the DC component of the block is provided for); nor does DVD offer the same color definition as CCIR-601 studio video. Nonetheless, as a consumer video format it promises to be far superior to anything we have had before.

AUDIO COMPRESSION

DVD is designed to support discrete 5.1-channel digital surround sound. Although the audio group within MPEG developed an MPEG-2 audio standard (ISO/IEC 13818-3) for DVD, Dolby Digital Surround (AC-3) will be used in the United States and other NTSC-based countries. MPEG-2 audio, which also provides discrete 5.1-channel digital surround sound, will likely be used elsewhere.

Both Dolby Digital and MPEG-2 audio use perceptual encoding to reduce the data rate needed to carry five full-bandwidth audio channels and a low-frequency effects (LFE) channel (3 to 100 Hz). The specifics of the two systems differ and are too complex to cover in detail here. Suffice it to say that the encoding systems are related in concept to those used for DCC and MiniDisc but also exploit the interchannel redundancies of theater sound. The Dolby Digital system used in the United States normally is operated at a 384-kilobit/second data rate for each 5.1-channel soundtrack. Thus, it requires about 2.88 megabytes of storage per minute of program, or about 383 megabytes of storage for a 133-minute movie.

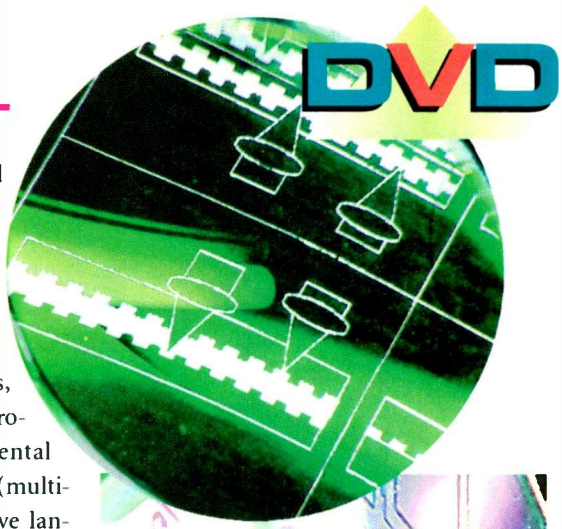
WHAT DVD WILL AND WON'T DO

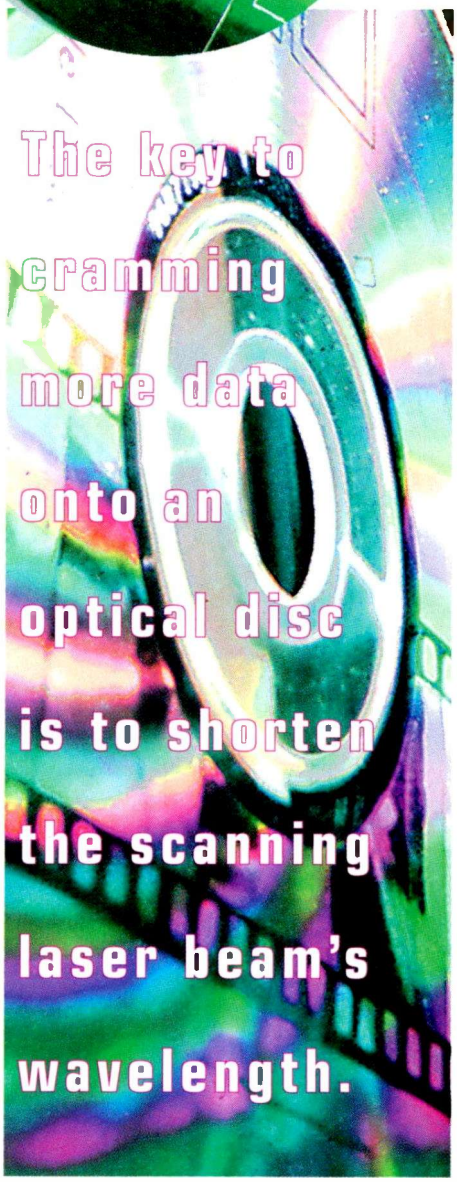
Does DVD fulfill the Hollywood Digital Video Disc Advisory Group's wish list? Individual wishes, yes; collectively, maybe. Hollywood wanted a full-length feature film with picture quality superior to laserdisc, in multiple aspect ratios, with multiple versions of the same program on the same disc (with parental lockout), with multichannel sound (multiplexed and discrete), in three to five languages, and with copy protection.

Let's take the issue of picture quality. I believe it is impossible to make a direct comparison between analog and digital video recording systems, especially when digital compression is used on the latter. The artifacts that each generates are too different. Audiophiles continue to argue whether analog is better than digital or vice versa; the same will probably apply to digital video.

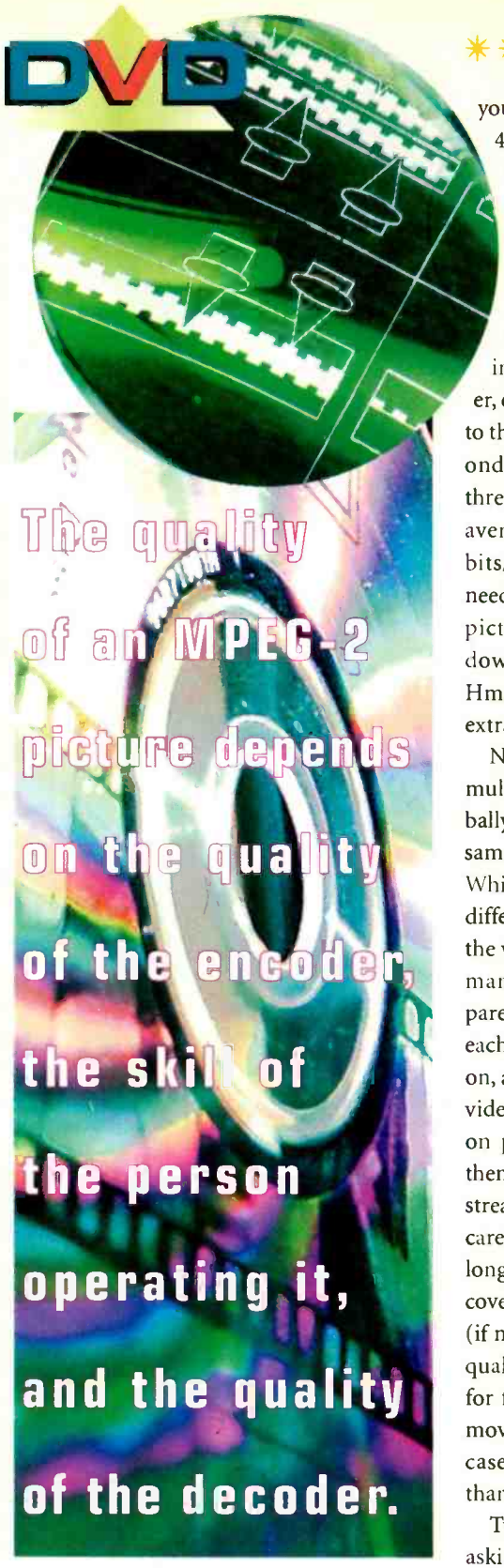
Analog systems are affected by noise and distortion (in the video world, distortion is equivalent to color and luminance inaccuracies) and by limited bandwidth (video resolution). In the analog world, these characteristics are usually determined by the medium: videotape or laserdisc. Digital video quality also depends on bandwidth, noise, and distortion, but in a different way. In the absence of errors, digital performance is determined by the digital system itself, not by the medium. This means that a digital video system can have performance as good as you wish, provided it has a sufficiently high bit rate.

Potential problems arise when digital video is compressed. Compression systems, such as MPEG-2, can introduce motion artifacts (blurring in fast-moving scenes), blocking (portions of the picture appearing like a checkerboard rather than with full resolution), and other anomalies that have no counterpart in the analog world. Whether these are more or less objectionable than the noise, distortion, and (usually) poorer resolution of analog video is a matter of opinion. It may, to a considerable extent, depend on how often these anomalies are evident. Personally, I'll take digital video any day—provided the picture has been well encoded.





As an old mentor used to tell me, "There ain't nothing you can't do with enough power." In this case, "power" means the video bit rate used in encoding. And that's determined by a program's length, the disc's storage capacity, and how many of those wish-list elements are actually implemented. Most of these factors compete for storage space.



AN MPEG-2 EXAMPLE

According to film industry statistics, 92% of movies run for 133 minutes or less. Say you want to record a 133-minute movie with one Dolby Digital soundtrack on a 4.7-gigabyte, single-sided/single-layer disc (the least costly to produce). In this case, you can use an average video data rate of 4.32 megabits per second (4.71 megabits/second minus 384 kilobits/second for one soundtrack of Dolby Digital), perhaps a little less to leave room for subtitles. All in all, that's not a bad bit rate to work at. It should accommodate MPEG-2's typical picture encoding scheme with room to spare. However, every Dolby Digital soundtrack you add to the disc steals another 0.384 megabit/second from the video encoding rate. With three such soundtracks, you're down to an average video rate of about 3.5 megabits/second (slightly below the estimate needed to handle the original MPEG-2 test picture); with five soundtracks, you're down to less than 2.8 megabits/second. Hmm! Do we really want to add all those extra soundtracks?

Next problem. Say you want that nifty multiple-camera-angle feature that's been ballyhooed or the "multiple versions of the same program" that Hollywood requested. While it's true that MPEG-2 syntax permits different video streams to be coordinated so the viewer can switch from one to the other manually or automatically (e.g., via parental lockout of objectionable scenes), each camera angle or version that's tacked on, as far as DVD is concerned, is a separate video recording. These features look great on paper, but if you want to implement them, you need storage for each video data stream. Methinks Hollywood will consider carefully before using these features on very long movies. The studios may suddenly discover they need more expensive multilayer (if not multisided) discs to get good picture quality, or they'll decide to sacrifice quality for features. On the other hand, not many movies reach even 120 minutes, so in most cases the studio will have more latitude than in our worst-case scenario.

Two features sort of come free for the asking, multiple aspect ratios and compatibility with matrix surround systems, but neither may quite live up to expectations. Matrixed surround (Dolby Pro Logic) compatibility is achieved by synthesizing left and right channels (the basis of matrix surround) from the discrete Dolby Digital soundtracks. That's not the same as creating a Pro Logic mix from scratch, when an engineer actually listens to the decoded mix and decides how he should create the optimum blend.

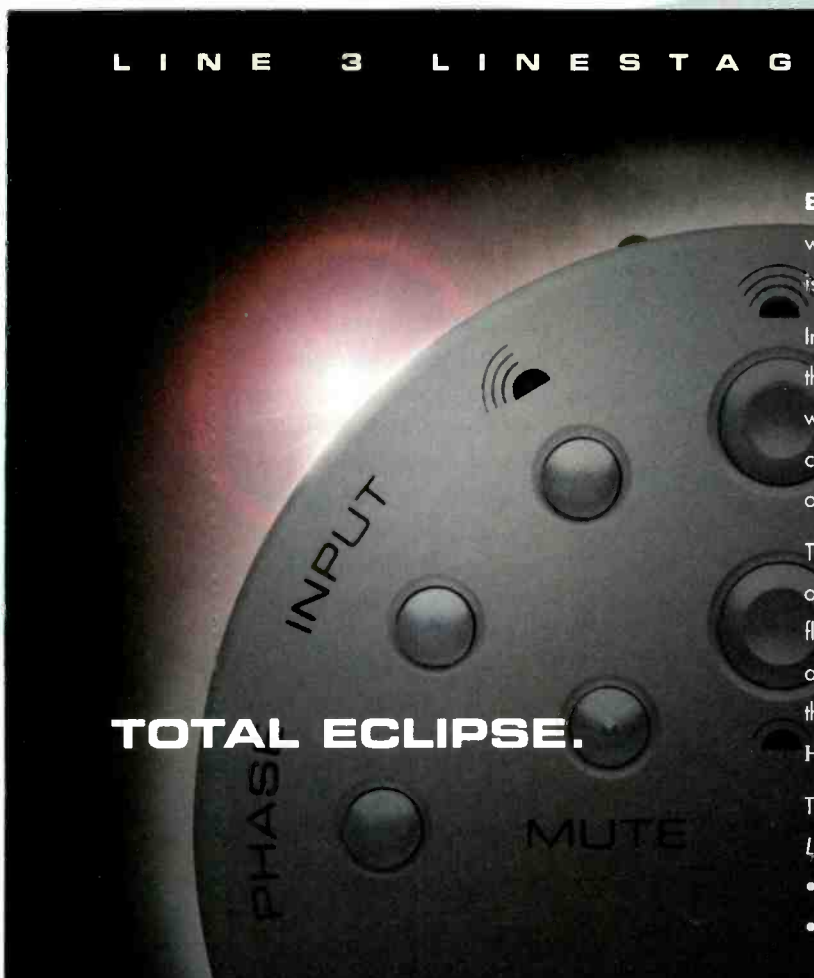
MPEG-2 also provides a way of inserting pan-and-scan information into the data stream so that a decoder knows what portion of a 16:9 widescreen image to use for a conventional TV's 4:3 display. In the 16:9 mode, the DVD player simply ignores the pan-and-scan data and produces a widescreen picture. But the system does not know how to pan and scan by itself; someone must encode the MPEG-2 data with the requisite information. If that information is not present, a 16:9 image is letterboxed on a 4:3 screen with the usual black bars visible at the top and bottom. Furthermore, there's no going the other way; 4:3 source images fill a 4:3 screen but have black vertical bars on either side of a 16:9 screen.

The final consideration, copy protection, has proved the most difficult nut to crack and was a major reason DVD's launch was delayed. An encryption scheme proposed by Matsushita seemed to satisfy Hollywood but not Silicon Valley's PC contingent, which found it required too much computer power to decipher. A modification to the system (proposed by IBM) seems to have satisfied all parties, so we're apparently off to the races.

I believe that DVD will have a greater impact on consumer electronics in general, and on audio/video entertainment in particular, than anything since the Compact Disc. Like CD, however, I expect it to take a while to catch on. And, like CD, the key to success lies in the quality and availability of the software.

I hope I've made it clear that MPEG video encoding is as much an art as a science. It's not simply a matter of loading a source video, punching a button, and walking away, although it probably can be (and perhaps sometimes will be) done that way. Hardware and software are already available that preview source material and create a kind of electronic blueprint for scenes that the MPEG-2 encoding program thinks require higher bit rates. But I expect that true optimization will require human intelligence, in the front office to determine which of DVD's myriad features should be included on the disc and at the encoding station to ensure that it's done with panache. A

LINE 3 LINESTAGE PREAMPLIFIER



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EQUIPMENT PROFILE

EDWARD J. FOSTER

PANASONIC DVD-A300 DVD PLAYER

Panasonic's parent, Matsushita, contributed significantly to the unified DVD format. That being the case, no one should be surprised Panasonic is one of the first to launch DVD in the United States. In fact, Panasonic is releasing two DVD players simultaneously, the Model DVD-A100 ($599.95) and the more upscale Model DVD-A300 that I reviewed.

The two players have the same basic features and functions, but the DVD-A300 has a number of features its sibling lacks. The most notable difference is probably the DVD-A300's provision of full 5.1-channel Dolby Digital decoding and D/A conversion. (Like most DVD players, the DVD-A100 delivers only two-channel analog output, relying on external processors for 5.1-channel decoding.) The A300 also has a front-panel shuttle knob, whose functions are duplicated by a mini-joystick on the universal remote control (which is preprogrammed for TVs of many brands); a karaoke sing-along feature, with microphone input and digital echo; and a second set of rear-panel audio/video outputs. In addition, the A300's fluorescent display panel can be switched off.

Both decks play 5- and 3-inch DVDs (MPEG-2 video with 5.1-channel sound), Video CDs (MPEG-1 video with matrix surround sound), and regular audio CDs. The players sense the type of disc that's loaded (they all look pretty much the same) and adapt automatically. As far as DVDs go, the players can handle single- or double-sided and single- or double-layer discs, provided they're coded for North America. (DVDs may carry codes that make them playable only in specific countries.) For a double-sided disc, you flip manually at the end of the side. The Panasonic players will not read CD-ROMs, CD-Vs, CD+Gs, CD-Rs, Photo CDs, or PAL DVDs.

Discs load conventionally into a central tray and are scanned by a red (655-nanometer) laser through a dual-focus lens that Matsushita developed. This so-called "holographic" lens permits the laser to focus on the information layer of a DVD (approximately 0.6 millimeter beneath the surface) or the information layer of a CD (about 1.2 millimeters beneath the surface).

Transport controls are to the right of the tray: an "Open/Close" bar and buttons for "Stop," "Still/Pause," and "Play." At the far right is a shuttle "Search" knob flanked by a pair of track/chapter "Skip" buttons. To the left of the DVD-A300's disc tray are controls for headphone level and for the karaoke microphone and echo levels. Gold-plated headphone and microphone jacks are directly below their respective controls. The on/off switch is at the far left.

PANASONIC'S DVD-A300 CAN DELIVER EXTRAORDINARY SOUND AND PICTURES.

The "Digital Audio Out" Toslink optical jack on the rear panel carries either a PCM or an AC-3 bitstream, depending on the disc being played. This lets you use an external Dolby Digital decoder or D/A converter, if you wish. According to Panasonic, the optical link can't handle 96-kHz sampled audio; if and when discs with that sampling rate arrive, you'll have to use the A300's internal converters.

Dimensions: 17 in. W x 3½ in. H x 11⅝ in. D (43 cm x 8.8 cm x 29.5 cm).
Weight: 7¾ lbs. (3.5 kg).
Price: $749.95.
Company Address: One Panasonic Way, Secaucus, N.J. 07094; 888/726-2383.
For literature, circle No. 90

Photos: Michael Groen

Next to the optical jack are six gold-plated RCA jacks for 5.1-channel audio. Of these, the "Audio Out (Front)" pair carries straight stereo when you're playing a CD and feeds the left and right front channels from the Dolby Digital internal decoder when you're playing DVDs. Next to the "Audio Out (Front)" jacks are a pair marked "Mixed Audio Out." These carry an analog Dolby Surround mix derived from the internally decoded 5.1-channel sound and are meant to feed a stereo television (or an external Dolby Pro Logic decoder, should you want to use Dolby Pro Logic rather than Dolby Digital Surround).

Composite-video and S-video output connectors come next; somewhat removed from them are three jacks that mate with an optional RF adaptor for use with TVs that have no audio or video inputs. ("Broadcasting" to your TV's antenna terminals on channel 3 or 4, you'll lose stereo and will be relegated to inferior, broadcast-quality video. But the RF adaptor could be useful if, say, you take the DVD-A300 to a vacation home that doesn't have a real home theater.) Near the RF adaptor jacks is a tiny "Attenuator" switch, to be used in karaoke mode.

The manual and on-screen menus are trilingual (English, French, and Spanish), and, for the most part, you'll use the menus and remote control to operate the player. The forward portion of the remote is dominated by a joystick-like "Select" rod that's surrounded by four large pads ("Title," "Menu," and two track/chapter "Skip" pads) and a small one ("Return"). Above this ensemble are "Power" and "Open/Close" bars, and below are "Stop" and "Play" bars. Tilting the joystick forward activates "Still/Pause"; tilting it to the right or left during playback activates forward and reverse search, which speeds up if you tilt the joystick a second time. From pause mode, the same actions elicit slow-motion playback in either direction. The shuttle dial on the DVD-A300's front panel essentially duplicates the joystick's search functions.

THE DVD-A300'S CD PERFORMANCE, A MORE REVEALING TEST THAN YOU MIGHT THINK, WAS OUTSTANDING.

If you load a DVD that carries multiple selections, a title menu usually appears on your TV screen. You select from that menu by using the remote's numeric keypad or tilting the "Select" joystick; you then press "Select" on the remote (or "Play" on the front panel). If the disc has no title menu, playback commences from the beginning, automatically. Pressing the remote's "Title" pad suspends playback and brings back the menu screen; the remote's "Display" key superimposes the title number, chapter number, and elapsed time on the screen. Tilting the joystick moves a cursor from "Title" to "Chapter" on the on-screen menu, after which you can select a chapter in the same ways you select a title. Via similar actions, you can skip to any desired time on the disc.

Repeat-chapter, repeat-title, and repeat-section are available via the remote, and you can place up to three markers to return to scenes you want to view again. There are restrictions, however: The repeat and marker functions work only with discs that carry an elapsed-time code, and sections to be repeated cannot span chapters.

Three of the remote's buttons are for functions unique to DVD. "Subtitle" lets you change the language of subtitles, "Audio" lets you change the language of the dialog, and "Angle" lets you switch between tracks shot from different camera angles. For each of these functions, you tilt the joystick backward or forward to get what you want. Not all discs will carry subtitles, multiple languages, or multiple camera angles, but those that do will have DVD menus, elicited by pressing the remote's "Menu" key and operating the joystick to get to the desired activity. "Return" backs up through nested menus.

The remote's "Setup" key leads to a menu whose submenus let you set defaults for a number of DVD functions. The most novel of these, "Rating," lets you choose to play all titles, forbid "Adult" titles, or show only "Kids'" material; you can set a four-digit password to lock in your selection. From the "TV Screen" submenu, you can choose how widescreen films and programs will be shown on your TV. The "16:9" setting is used for widescreen TVs; for those with the conventional 4:3 aspect ratio, you can opt to show widescreen material letterboxed (full-width, with black bands above and below the picture) or in pan-and-scan mode, with a portion of the picture en-

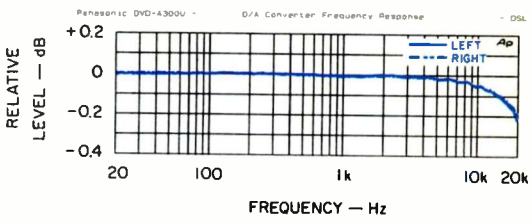


Fig. 1—Frequency response.

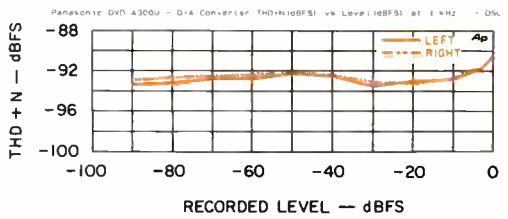


Fig. 2—THD + N vs. signal level.

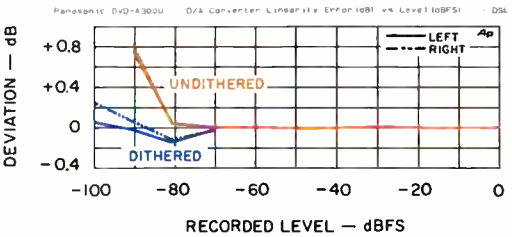


Fig. 3—Linearity error.

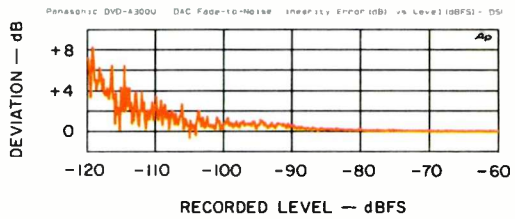


Fig. 4—Fade-to-noise test.

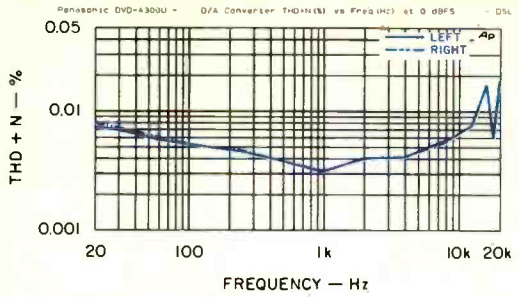


Fig. 5—THD + N vs. frequency.

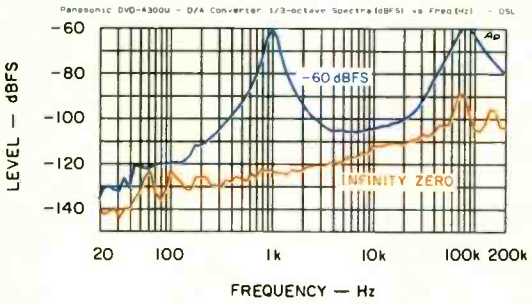


Fig. 6—Noise spectra.

larged to fill the screen. Some DVDs will carry instructions to tell the player what part of the picture should be shown in pan-and-scan mode; widescreen discs that aren't encoded with pan-and-scan instructions will be shown letterboxed.

Other "Setup" submenus let you set the default languages for soundtracks, subtitles, and menus. For soundtracks, you can choose English, French, Spanish, "Original" (the language the film was made in), or "Other ****." The asterisks indicate that you should enter a four-digit code corresponding to the desired language. For example, if a disc's soundtrack is in Urdu, just punch up "8582" to hear it. (The manual lists codes for 124 languages, from Afar to Zulu.) Selecting a subtitle language is quite similar, but here "Automatic" replaces "Original." "Automatic" selects the same language you've chosen for listening and displays the subtitles only if that language isn't on one of the disc's soundtracks.

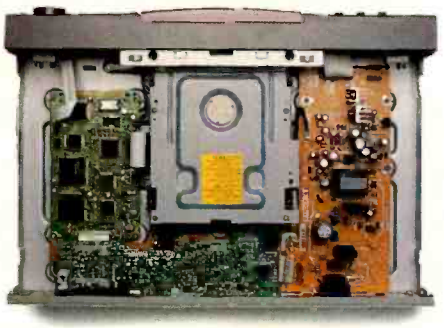
There remain two other "Setup" submenus. One, "OSD Display," turns the on-screen display on or off. With the other, "Surround Sound," you tell the DVD-A300 whether or not center, surround, and subwoofer speakers are in your audio system.

Again, I should point out that some features—parental lockout (the rating system), multiple soundtracks, multiple subtitles, and pan-and-scan—require that the disc be suitably coded. If the information is not on the disc, the feature doesn't function; this has nothing to do with the player.

Measurements

When I had the Panasonic DVD-A300 in my lab, DVD test discs weren't yet available, so I could measure its performance only as a CD player. For the DVD-A300, this is more revealing than it might seem, because playing CDs exercises a player's D/A converters and output electronics in the same way that converting a reconstructed PCM bitstream back to analog would. The D/A conversion and the output circuitry following it govern the sound quality of a DVD player just as they do that of an audio-only CD player. Decoding a Dolby Digital bitstream and reconstituting it to six PCM channels are strictly matters of bit manipulation; decoding should not differ among digital signal processing circuits that perform according to Dolby's strictures.

When evaluated with the CBS CD-1 test disc, the Panasonic DVD-A300 proved to be an outstanding performer. Frequency response (Fig. 1) is so flat and so smooth that I greatly expanded the vertical scale of the graph, in order to reveal the tiny amount of ripple that exists. The D/A converter's total harmonic distortion plus noise (THD + N) versus recorded level (Fig. 2) also is fantastically good, below –90 dBFS on both front channels across the entire test range. Very unusual! Very impressive!



FEW CD PLAYERS CAN CHALLENGE THE DVD-A300'S SUPERB SOUND QUALITY.

Although I didn't expand the vertical scale of Fig. 2 (I thought I'd give you something to compare directly with other, less well-endowed players), I did expand the scale of Fig. 3, which shows converter linearity error versus recorded level. With a dithered recording, worst-case converter nonlinearity is a remarkably small 0.25 dB all the way down to –100 dBFS. Again, impressive, very impressive! Figure 4 shows the fade-to-noise linearity error for the left channel (the right was pretty much the same). Admirable.

At maximum level (0 dBFS), THD + N versus frequency is also excellent (Fig. 5). It hits a minimum at 1 kHz (one reason the curves of Fig. 2 look so good) but remains at or below 0.008% from 20 Hz to 12.5 kHz. Some intermodulation with the sampling rate kicks THD + N up at 16 and 20 kHz, but the contamination is never greater than 0.0182% of the fundamental.

In Fig. 6, third-octave spectrum analyses of residual noise and of a 1-kHz signal at –60 dBFS, there are virtually no signs of power-line-related hum. (Oh, yeah, there is a bit at 60 and 120 Hz, but when hum components are 125 dB down, I consider them zilch!) You'll see small components at twice and four-times the sampling rate, but they're negligible. Over just about the entire audio band, the third-octave noise level rises at 3 dB/octave, an indication that its character is "white," or random. The noise power rises in the presence of the –60 dBFS, 1-kHz signal, but it's still –100 dBFS or below even at 20 kHz. With curves like these, it's not surprising that I got superb figures for the Panasonic's A-weighted S/N ratio and its dynamic range (see "Measured Data"). Quantization noise was impressive, too.

The weakest test results (and they're really not that bad) were for the DVD-A300's channel separation. The worst case was for crosstalk from the left channel to the right channel; right-to-left separation was about 15 dB better.

Output level and output impedance were typical of today's players, and channel bal-

ance was absolutely perfect. If you want to listen through headphones, you'll find more than adequate drive for high- and low-impedance 'phones. I don't think many people will use headphones with the DVD-A300 but why knock a freebie?

For audio, this DVD player is technically outstanding.

Use and Listening Tests

With only two sampler DVDs at my disposal, it was difficult to give the DVD-A300 as thorough a workout as I would have liked. Fortunately, I had laserdiscs of several of the flicks that were excerpted on the samplers—*Twister* and *Free Willy*—so I could make a reasonably direct comparison between the two formats. I say reasonably direct, because the laserdiscs were widescreen and the DVD samplers' excerpts were full-screen, 4:3 only.

COLOR PURITY, CHROMA NOISE, AND SHARPNESS EQUALED OR BETTERED LASERDISC'S.

That said, I'll still take the digital disc. The Panasonic DVD-A300 produced pictures that were at least as sharp as, and arguably sharper than, the laserdisc player's, and the DVD pictures had purer colors with notably less chroma noise. I was rarely aware of motion artifacts (DVD's potential Achilles' heel), at least not to the extent that they were bothersome. The sound seemed somewhat fuller and richer from the DVD-A300, and the surround effects struck me as being a bit more all-encompassing on the DVD—even though the *Twister* laserdisc also had an AC-3 track.

I found Panasonic's remote reasonably intuitive to use, but I couldn't check out all of the player's features. Neither of the discs had subtitles (so the subtitle function was inoperative), only one of the discs had multiple languages (just a few one-line introductions of scenes that immediately reverted to English), and only one disc had a section to demonstrate multiple camera angles. Unfortunately, the resolution and general picture quality in this section were not up to snuff, and I was unable to call up all three of the angles that I thought were provided. (I really don't think that third angle was on the disc, so I'll not fault the player!)

Still-frame picture quality varied, probably because of the frames I happened to stop on. The quality of some still frames was excellent, others were blurred in areas where the ongoing picture would have showed motion, and occasional frames had obvious pixelization in some areas. In some scenes, still-framing was unstable and portions of the picture flickered. The DVD-A300's slow motion is basically a series of still frames strung together, so the same comments apply—although, on the whole, the artifacts were less noticeable in slow motion than in freeze-frame.

The search function was difficult to use on DVDs and almost impossible on audio CDs. The search was really "search," not the accelerated motion you get from VCRs. Pictures didn't "tear" as they do on a VCR, but they did snap from scene to scene with no sense of continuity. The advance was so rapid that it was easy to fly past the point I wanted. The DVD chapter-skip function didn't work properly (though the same buttons worked fine for skipping tracks on audio CDs), and I couldn't set up markers for repeating scenes because neither DVD sampler carried a time code. The samplers had no aspect-ratio instructions, either, so there was no difference between the DVD-A300's three "TV Screen" settings. Finally, the player responded slowly to most commands; if this was player- rather than disc-related, I expect that shifting between alternate video tracks won't be seamless. This could be a problem on discs that contain alternate scenes to offer a choice of story "threads" (or that include PG- and R-rated versions). But again, neither sampler offered these choices, so I can't be sure.

The sound quality of the Panasonic DVD-A300's internal Dolby Digital decoder and D/A converters was superb; few CD players can challenge it. But you can't use the A300's internal decoder unless the preamp/processor or receiver that follows has a six-channel input as well as an analog volume control for all six. (Not every 5.1-channel preamp/processor or receiver does.) If you therefore have to use the A300's digital output and the processor or receiver's Dolby Digital decoder and DACs, you not only forgo the A300's superb analog quality, but you may have difficulty keeping the decoder locked to the bitstream. With one of the Dolby Digital decoders I tried, I heard a click for every scene change and, occasionally, for no apparent reason. I can't be sure whether that was entirely the DVD-A300's problem, but the same decoder worked fine with other AC-3 bitstreams.

A totally new format like DVD can be expected to have a few glitches, especially on early samples of first-generation products. Considering the scope of the undertaking, I'm surprised there weren't more than I found. But clearly, Panasonic's DVD-A300 can deliver extraordinary sound and pictures, given well-recorded discs and appropriate ancillary equipment. A

MEASURED DATA

Output Level: Line, 2.135 V at 0 dBFS; headphone, 4.8 V, maximum.
Channel Balance: ±0 dB.
Output Impedance: Line, 1,050 ohms; headphone, 55 ohms.
Maximum Headphone Power: 600-ohm loads, 32.2 mW; 50-ohm loads, 37.3 mW at 1% THD.
Frequency Response: 20 Hz to 20 kHz, +0, –0.22 dB.
THD + N: At 0 dBFS, less than 0.0182%, 20 Hz to 20 kHz; at 1 kHz, below –90.3 dBFS from 0 to –90 dBFS and below –92.2 dBFS from –30 to –90 dBFS.
Maximum Linearity Error: Undithered recording, 0.83 dB from 0 to –90 dBFS; dithered recording, 0.25 dB from 0 to –100 dBFS.
A-Weighted S/N: –106.3 dBFS for infinity-zero recording.
Quantization Noise: –88.6 dB.
Dynamic Range: Unweighted, 99.1 dB; A-weighted, 101.8 dB.
Channel Separation: Greater than 66.4 dB, 125 Hz to 16 kHz.

EQUIPMENT PROFILE

EDWARD J. FOSTER

PIONEER ELITE DVL-90 DVD/LASERDISC PLAYER

Redefinition time. Combi-player, old definition: A device capable of reproducing laserdiscs and audio CDs. Combi-player, new definition: A device capable of reproducing laserdiscs, CDs, and DVDs—a.k.a., the Pioneer Elite DVL-90, which comes as close to being a universal optical-disc player as you're likely to find.

True, The DVL-90 will play only those DVDs that are coded for Region 1 (North America), but this restriction applies to every DVD player sold here—thanks to the movie moguls who wanted a video carrier that could be used anywhere in the world so that they could restrict its use and thereby defeat that capability. (So, what else is new in Hollywood?) Nor will the DVL-90 handle Video CDs, standard-density discs encoded with MPEG-1 digital audio and video. But those never really took off here, so that omission will not affect many purchasing decisions.

When playing a laserdisc or DVD, the DVL-90 delivers both composite- and S-video signals, with two output jacks for each. Dolby Digital (AC-3) 5.1-channel surround sound from DVD (and those laserdiscs that carry it) isn't decoded within the DVL-90, which means you need a Dolby Digital Surround decoder (and an RF demodulator for laserdisc AC-3) downstream in the system. This is the sensible approach to digital surround; there's no point in paying for more than one AC-3 decoder and six-channel D/A conversion in a system, since you can listen to only one source at a time. The decoder logically belongs in the preamp, processor, or receiver, where it can handle Dolby Digital bitstreams from all sources that carry them.

Pioneer provides multiple ways of conveying Dolby Digital signals from the DVL-90 to an external decoder. For laserdiscs, there's an "AC-3 RF Out (LD)" RCA jack, which, like all other pin jacks on the player, is gold-plated. This output sends the raw RF output from the laserdisc pickup to a demodulator, which extracts the Dolby Digital bitstream and hands it off to the AC-3 decoder. (The demodulator is usually in the same chassis as the decoder, though some processors require an external demodulator that then feeds a standard digital input.) For DVD AC-3, there's a "Digital Out #1" RCA jack (subtitled "PCM/AC-3 Digital") and a Toslink optical connector marked "PCM/AC-3 Digital (OPT.)" and subtitled "Selectable to only PCM using GUI." There's also a second coaxial (RCA-jack) digital output, "Digital Out #2," subtitled "PCM."

THE DVL-90 COMES AS CLOSE TO BEING A UNIVERSAL OPTICAL-DISC PLAYER AS YOU'RE LIKELY TO FIND.

The subtitles are significant. You don't want to send a Dolby Digital bitstream directly to a D/A converter or digital recorder, as neither will understand the undecoded signal. With Pioneer's arrangement, you can cable "Digital Out #1" to an AC-3 decoder (which normally will detect whether the incoming signal is Dolby Digital or PCM and respond appropriately) and "Digital Out #2" (which confines itself to PCM) to a regular stereo D/A converter or

Dimensions: 18⅛ in. W x 5⅝ in. H x 18¼ in. D (45.9 cm x 14.3 cm x 46.3 cm).
Weight: 22.9 lbs. (10.4 kg).
Price: $1,750.
Company Address: 2265 East 220th St., Long Beach, Cal. 90810; 800/746-6337.
For literature, circle No. 91

Photos: Michael Groen

digital recorder. (When a DVD with a Dolby Digital soundtrack is played, "Digital Out #2" carries a Dolby Surround stereo PCM downmix of the Dolby Digital track.) And you can use Pioneer's graphical user interface, or GUI, to substitute the Toslink output for either wired connection.

Accompanying the video and digital audio outputs are two sets of "Audio Out" RCA jacks. These convey ordinary analog stereo when playing CDs and Dolby Surround when playing videodiscs (unless the soundtrack itself is straight stereo or mono). The output level at these jacks is adjustable from the remote, so you must be somewhat careful when using them to record to a VCR. Completing the back panel are miniature in and out jacks, for remote-control interconnection with other Pioneer equipment, and a removable, two-prong IEC line cord.

Operation of the front-panel controls should be self-evident to anyone familiar with laserdisc players. There's a "Power Standby/On" button at the lower left; a two-color LED indicates power status. At the upper right are three buttons that open and close the small ("DVD/CD") and large ("LD") trays and stop the player. Below are larger bars for play/pause and scan/skip forward or backward. The disc-loading mechanism is directly above the display. The display's illumination can be toggled with an "FL Off" button.

On the remote, many of the infrequently used controls are concealed behind a sliding door. These include "Disc Side" to switch between playing sides of a laserdisc, still-frame advance on laserdisc and DVD, and still-frame backup (laserdisc only). A "CHP/Time" button displays, on the first press, the DVD or laserdisc chapter number (track number on CDs) and, on the second press, time, and enables you to search for a different chapter or time using the numeric keypad that's also behind the door. DVD chapter search is limited to chapters within the same title, and DVD time search requires that the disc be encoded with time information. Track/chapter repeat, title repeat, repeat playback of both sides of a laserdisc, and repeat playback of (or return to) a specified location are possible by entering the proper sequence on the "Repeat" and "A-B" keys. Because these functions depend on appropriate encoding of the DVD, not all functions will be available on every DVD.

THE PLAYER CAN REMEMBER RESUME POINTS FOR AS MANY AS FIVE SUITABLY ENCODED DVDs.

Random playback of laserdiscs and CDs is activated with the "Random" button and stopped with "Clear." Programmed playback of suitably encoded DVDs, laserdiscs, and CDs is available with the "Program" button and keypad. It's cleared with "Clear," activated with "Enter" (one of the remote's major controls), and discontinued by pressing "Stop" twice (another of the remote's always accessible controls).

The remote operates the main transport controls via an elliptical, four-button array with a central "Enter" (play) key. The 3 o'clock and 9 o'clock keys activate "FWD" and "REV," respectively. Noon is "Pause," and 6 o'clock is "Stop." These buttons also serve to control the cursor whenever on-screen menus are used. An outer rectangular array of pads provides the skip controls—"Next" at 4 o'clock, "PREV" at 7 o'clock—and three pads ("Title," "Menu," and "Return") that are used primarily (but not exclusively) for DVD playback.

"Aspect," "Subtitle," "Angle," and "Audio" keys are on the remote's main panel and select those functions on DVDs that are encoded with multiple aspect ratios, subtitles, viewing angles, or languages. Aspect ratio is changed via an on-screen menu; subtitles, viewing angles, and languages are chosen in cyclic fashion by pressing the same key multiple times. When you're playing laserdiscs, "Audio" cycles through six presentations: analog stereo, left-channel analog mono, right-channel analog mono, left-channel digital mono, right-channel digital mono, and digital stereo (the choice you'd normally make). When you're playing CDs, "Audio" cycles through three choices: left-channel mono, right-channel mono, and digital stereo. Volume up and down keys adjust the level at the two analog audio outputs.

With the "Last Memo" key, you can mark the point at which you wish to resume playback. The player can remember the resume points for as many as five DVDs (provided they're suitably encoded), which can be removed from the player and reinserted later. The feature is a bit less versatile with laserdisc than with DVD, because the LD must remain in the player. "Last Memo" stores the audio, display, and mode settings (as well as the start point), so playback resumes with the same settings used previ-

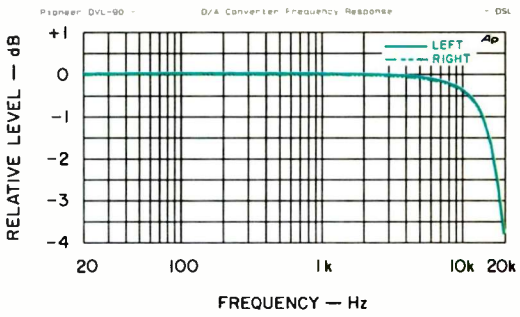


Fig. 1—Frequency response.

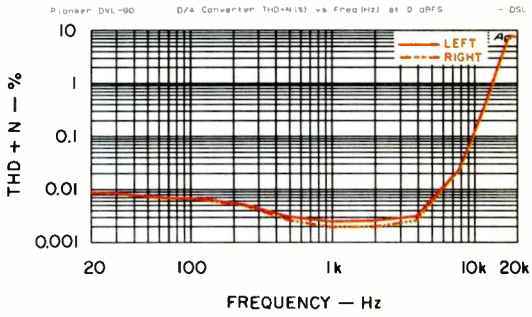


Fig. 2—THD + N vs. frequency.

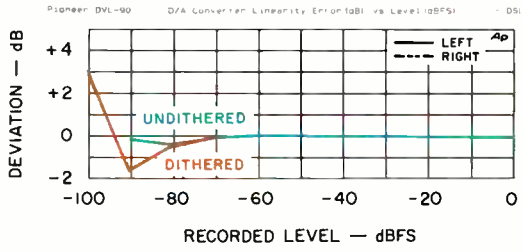


Fig. 3—Linearity error.

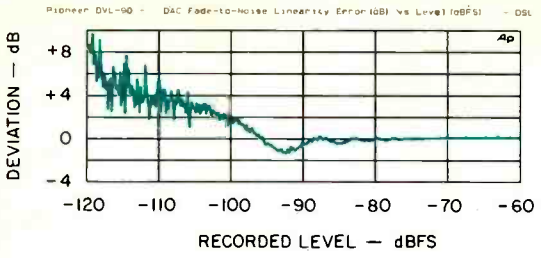


Fig. 4—Fade-to-noise test.

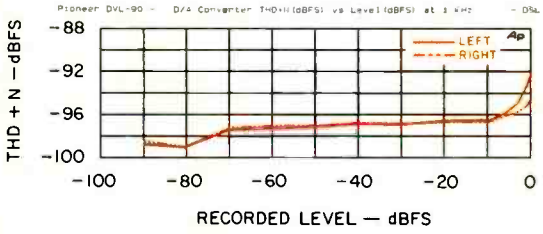


Fig. 5—THD + N vs. level.

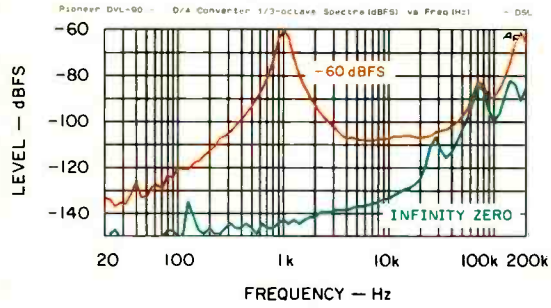


Fig. 6—Noise spectra.

ously. The memory for a disc is automatically erased when playback resumes.

The "Condition" key memorizes your favorite settings for as many as 30 DVDs, but memory will be lost during a power outage. "Mode" brings up four on-screen icons—"Cinema 1," "Cinema 2," "Animation," and "Standard"—that enable certain display modifications when playing DVDs. For example, "Cinema 1" changes the screen background when the player is stopped, "Cinema 2" sharpens picture contrast, and "Animation" brightens colors.

The DVL-90 also offers variable digital noise reduction (V-DNR) for the luminance and chrominance components of laserdisc signals. V-DNR is controlled through one of Pioneer's many GUI on-screen menus. With these menus, you can change parental lockout level, activate a screen saver, change the signal fed to the optical digital interface, check program titles, and so forth. In short, you use the GUI to operate and check almost all of the Pioneer Elite DVL-90's many features.

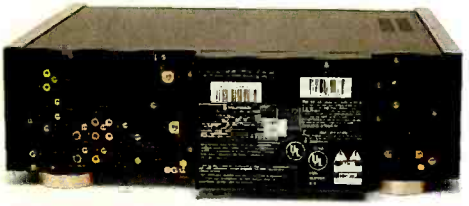
Measurements

Lacking DVD test discs, I couldn't make technical measurements of the DVL-90's DVD video performance. However, I could evaluate its laserdisc video performance using the standard Pioneer test LD. Results were excellent across the board. Luminance-channel response (related to horizontal resolution) was down just a shade more than 6 dB at the highest frequency on the disc (4.1 MHz); luminance (brightness) level was spot on the mark; and chroma level, although low, was less so than typical. (Chroma level relates to color saturation, and video monitors automatically adjust for differences in incoming level provided it's not too far off; this one certainly is well within the normal correction range.)

Chroma phase and differential phase accuracy were as perfect as I can measure, which means that the various shades of color were accurate and that hue didn't vary with scene brightness. The gray scale was perfectly linear, too, which verifies that the player is capable of reproducing subtle brightness differences accurately. I detected a small amount of chroma differential-gain error (shifts in color saturation with changes in scene brightness), but the figure cited in "Measured Data" is well within normal bounds. Clearly, Pioneer has not forgotten how to design a really first-rate laserdisc player.

I measured the DVL-90's audio performance by playing my usual test CD (the CBS CD-1) and monitoring signals at the audio output jacks with the volume control at maximum. Output level and impedance were typical, and channel balance was as close to perfect as can be documented. Channel separation was outstanding, but most of the other audio data bears a word of explanation.

For the past few years, Pioneer has been enamored of its proprietary Legato Link digital-to-analog converter, which it says recreates musical overtones beyond the 20-kHz limit that is imposed by 44.1-kHz sampling, the rate used for Compact Discs. Pioneer has presented technical papers at



THE DVL-90'S RESULTS FOR NOISE AND DYNAMIC RANGE ARE VERY IMPRESSIVE.

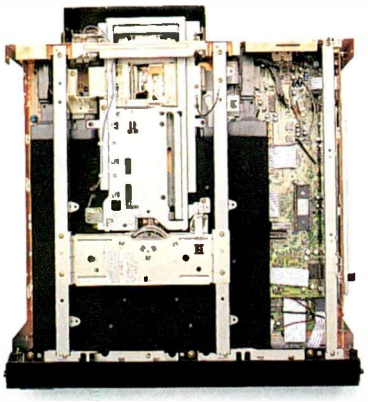
Audio Engineering Society conventions suggesting that response beyond 20 kHz has audible benefits, and the company has strongly supported the use of 96-kHz sampling for DVD audio. In all fairness, the jury is out regarding whether such a high sampling rate is needed.

For now, there's Legato Link, but I confess that I am not a fan of any of its incarnations. I cannot fathom how a circuit can tell which overtones are absent and re-create them with any degree of fidelity. Nor have my tests indicated that this is what actually happens in a Legato Link converter. For example, analysis of the DVL-90's output simply shows additional components that represent intermodulation of the signal with the 44.1-kHz sampling rate. These components vary with signal level and frequency, but not in any musically related manner that I can see. In fact, these components are precisely the type of crossproduct that most designers go to considerable lengths to avoid.

That said, there apparently are enough people who have responded positively to Legato Link for Pioneer to use this system in its high-end Elite series. Since Legato Link produces some rather strange test results, one can argue that the data should be interpreted in light of Pioneer's goals rather than by absolute comparison with the performance data for other products. For example, frequency response taken at 0 dBFS (Fig. 1) begins to roll off above 10 kHz or so

and is down almost 4 dB at 20 kHz. (Note that I've used a vertical scale in Fig. 1 that encompasses this unusually wide range.) Perhaps the response rolls off to "make room" for the spectral components that Legato Link adds without changing the total level of high-frequency energy, but this is not something that's easily verified.

Figure 2 shows total harmonic distortion plus noise (THD + N) versus frequency at 0 dBFS. The curve looks normal out to about 5 kHz but then rises sharply, reaching 0.1% at 10 kHz and a whopping 8.12% at 18 kHz. Obviously, these numbers are orders of magnitude higher than we typically see from a CD player, and spectral analysis revealed that the "distortion" components were the intermodulation crossproducts mentioned above. Since the crossproducts



ANYONE ACCUSTOMED TO VHS TAPE WILL BE BLOWN AWAY BY DVD PLAYBACK ON THE DVL-90.

are purposely introduced, do they represent "worse" or "better" performance? The answer will depend very much on your opinion of the concept underlying Legato Link.

The Legato Link converters in the DVL-90 are quite linear, as the plots of Fig. 3 (linearity error versus level) and Fig. 4 (fade to noise) indicate. Note that these plots are for frequencies low enough that Legato Link doesn't affect the results. The THD + N versus level curve of Fig. 5 is first-rate, but, once again, the data was taken at a relatively low 1 kHz, where Legato Link presumably is quiescent.

The DVL-90's A-weighted noise on the "digital-zero" track was an amazingly low –126.2 dBFS. And, as the spectrum analysis of Fig. 6 shows, power-line hum is absolutely negligible, which testifies to good circuit layout and an excellent power supply. There are a few ultrasonic line components that occur at unusual frequencies—approximately 28, 71, and 141 kHz. (When ultrasonic line components are present, they're usually related to the sampling rate.) These are so small as to be inconsequential, however, and I presume that their unusual placement is related to Legato Link.

The A-weighted noise figure given above relates mainly to the performance of the analog output electronics, which clearly are of excellent design. The quantization noise and dynamic range listed in "Measured Data" include converter effects and therefore are more meaningful. This data, too, is very impressive.

So, Legato Link aside, the DVL-90 has excellent D/A converters. The ultimate judgment therefore boils down to what you think of Legato Link.

Use and Listening Tests

Actually, except for recording or feeding a second system, you probably won't make much use of the DVL-90's own D/A converters in a typical home theater. More likely, audio will pass from the DVL-90 to the preamp, processor, or receiver in digital form for decoding and D/A conversion there. That definitely is the most desirable arrangement when playing DVDs or laserdiscs with Dolby Digital soundtracks. I did, however, connect the DVL-90's analog audio outputs to my preamp/processor and listened to a few CDs via Legato Link. I can't say I've changed my mind; I still find the Legato Link sound hard and unmusical. To each his own.

For the most part, I used the DVL-90 as you probably would. I fed laserdisc Dolby Digital to my processor's RF AC-3 input, DVD Dolby Digital to my processor's "bitstream" AC-3 input, and stereo or matrix Dolby Surround—in digital form—to a PCM digital input on my processor. All D/A conversion, therefore, was performed in the processor, not in the DVL-90. Thus, the preamp/processor and subsequent equipment were the determining factors in establishing sound quality, not the DVL-90. All the DVL-90 need do is feed the processor a solid RF carrier from laserdisc Dolby Digital and a strong bitstream from DVD Dolby Digital so that the demodulator/decoders can do their job without ticks, pops, or other loss-of-sync artifacts. This it did without a glitch, whether I used the optical or the coaxial connections.

I like Pioneer's remote; I found its operation intuitive. You will need illumination to see it in a darkened room, but that's usually the case. When I was playing a DVD, still-frame quality depended on the frame I

Continued on page 56

MEASURED DATA

D/A CONVERTER

Line Output Voltage for 0-dBFS Recorded Level: 2.15 V.
Channel Balance: ±0.01 dB.
Line Output Impedance: 935 ohms.
Frequency Response: 20 Hz to 20 kHz, +0, –3.81 dB.
THD + N at 0 dBFS: Less than 0.1%, 20 Hz to 10 kHz, and less than 8.12% to 20 kHz.
THD + N at 1 kHz: Below –92.2 dBFS from 0 to –90 dBFS and below –96.8 dBFS from –30 to –90 dBFS.
Maximum Linearity Error: To –90 dBFS with undithered recording, 0.44 dB; to –100 dBFS with dithered recording, 3.14 dB.
A-Weighted S/N for Infinity-Zero Signal: 126.2 dB.
Quantization Noise: –96.4 dBFS.
Dynamic Range: Unweighted, 99.3 dB; A-weighted, 101.4 dB.
Channel Separation: Greater than 111.3 dB, 125 Hz to 16 kHz.

LASERDISC VIDEO

Luminance Frequency Response: –0.6 dB at 500 kHz, –2.3 dB at 1.25 MHz, –3.5 dB at 2 MHz, –4.1 dB at 3 MHz, –4.3 dB at 3.58 MHz, and –6.1 dB at 4.1 MHz.
Luminance Level: +0.2 dB.
Chroma Level: –3.3 dB.
Gray-Scale Linearity: No measurable error.
Chroma Phase Accuracy: Within 2°.
Chroma Differential Gain: ≈20%.
Chroma Differential Phase: ±2°.

EQUIPMENT **PROFILE**

D. B. KEELE, JR.

POLK AUDIO RT7 SPEAKER AND PSW300 POWERED SUBWOOFER

Polk Audio's RT (Reference Theater) speakers are designed to perform well in both home theater and two-channel stereo music systems. The line consists of five floor-standing speakers, three bookshelf models, plus a speaker designed specifically for surround-channel application. (All of the floor-standing and bookshelf speakers are magnetically shielded for placement near TV screens.) The two-way RT7 is the largest of the bookshelf models; it's moderately priced at just under $450 per pair.

The subwoofer I reviewed with the RT7s is Polk's PSW300, the most expensive of the company's three powered subwoofers. The combination of the RT7s and PSW300 yields a high-performance satellite/subwoofer system for stereo music; with the addition of a center speaker and a pair of surround speakers, it would make a credible home theater setup. (Polk suggests using its best center-channel and surround speakers, the CS350 and LSf/x, both of which are timbre-matched to the RT7.)

Polk Audio's long-standing research program in loudspeaker design has yielded more than 20 patents since the company's founding in 1972. The RT7 incorporates two proprietary technologies, Dynamic Balance and Acoustic Resonance Control (ARC); the PSW300 uses two others, High Velocity Compression Drive (HVCD) and the Power Port.

Dynamic Balance refers to a combination of materials, component geometry, and construction techniques that Polk says reduces or eliminates driver resonances. It emerged from laser-interferometry research on resonant behavior of vibrating surfaces, done in conjunction with Johns Hopkins University (the alma mater of Polk's founders).

Acoustic Resonance Control uses two ports, of unequal length, to reduce frequen-

RT7 SPEAKER

Rated Frequency Response: 49 Hz to 25 kHz, +0, –3 dB.

Rated Sensitivity: 89.5 dB at 1 meter, 2.83 V rms applied.

Rated Impedance: Compatible with 8-ohm outputs.

Recommended Amplifier Power: 20 to 150 watts.

Dimensions: 19 in. H x 9½ in. W x 11½ in. D (48.3 cm x 24.1 cm x 29.2 cm).

Weight: 27 lbs. (12.3 kg) each.

Price: $224.95 each.

PSW300 POWERED SUBWOOFER

Rated Frequency Response: 28 Hz to 125 kHz, ±3 dB.

Rated Impedance: Speaker-level inputs, 4.7 kilohms; line-level inputs, 22 kilohms.

Dimensions: 18 in. H x 12¼ in. W x 20 in. D (45.7 cm x 31.1 cm x 50.8 cm).

Weight: 49 lbs. (22.3 kg) each.

Price: $799.95 each.

Company Address: 5601 Metro Dr., Baltimore, Md. 21215; 800/377-7655.

For literature, circle No. 92

Photos: Michael Groen

cy response aberrations caused by front-to-back standing waves in a speaker enclosure. Polk says these resonances can give vocals or other midrange sounds a "thick" or "chesty" quality and induce "both frequency and time response errors which audibly degrade the midrange clarity and imaging performance of the speaker." To reduce such resonances, ARC uses destructive interference from the output of an additional port. The length of this second port's duct is adjusted so that its fundamental organ-pipe resonance coincides with the resonance produced by the cabinet's internal depth. The response peak caused by the internal front-to-back standing wave is canceled by the second port's output, which has opposite polarity. The second port also helps tune the cabinet for proper low-frequency operation.

The PSW300 subwoofer's new technologies, High Velocity Compression Drive and the Power Port, were described by Matthew Polk in the May 1996 issue of *Audio* ("More Bass in Less Space"). HVCD is a technique for designing single-tuned bandpass vented woofers whose acoustic output is high and whose enclosure size is minimal; it requires a driver with high moving mass and a very large magnet structure. The Power Port is intended to minimize wind noise and maximize bass output by improving a vented enclosure's acoustic coupling to the room.

The RT7's long-throw, 8-inch woofer has an injection-molded rubber surround and a steel basket; it is magnetically shielded by a second magnet and a steel cup. The surround extends to the edge of the basket, which Polk says damps basket ringing. The speaker's 1-inch dome tweeter combines hard and soft materials, in what Polk calls a Tri-Laminate structure; the dome is formed by vapor-depositing a mixture of steel and aluminum or a soft polymer base.

The RT7's two flared ports, at the bottom of the front panel, are each 1½ inches in diameter but differ in length. The first port is 4½ inches long; the ARC port, which extends to within 2 inches of the speaker's back panel, is 8 inches long.

You may wonder why the ARC port's length isn't exactly equal to the cabinet's depth, which would seemingly make its fundamental organ-pipe resonance equal to that of the standing wave. The reason is that the port's effective acoustic length significantly exceeds its actual length because of acoustical effects at both its ends. And the reason two ports are used instead of one is that a single port of the correct length for the ARC correction would tune the system lower than desired for proper bass response. A second, shorter, port must therefore be added to tune the cabinet to a higher frequency. This port's own organ-pipe resonance could theoretically interfere with the woofer's output. However, because it's shorter, its resonant frequency is much higher and the Q of that resonance is significantly lower than the ARC port's; this makes its effect on response much less significant.

The walls and rear panel of the RT7's cabinet are of ¾-inch medium-density fiberboard, while the front panel is of 1-inch medium-density-fiberboard to decrease panel vibration. No internal bracing is used. Two-inch-thick Dacron batting is used for internal damping. The detachable grille's frame is of ⅜-inch medium-density-fiberboard.

The RT7's nominal crossover frequency is 3.2 kHz. Polk points out that this relatively high frequency "places the crossover out of the critical midrange area where the ear is most likely to hear the nonlinearities and phase shift associated with crossover networks." The crossover consists of a 12-dB/octave high-pass filter ahead of the tweeter and an even simpler, 6-dB/octave low-pass (a single laminated steel-core inductor in series) feeding the woofer. This is accomplished with just six components, including a small bypass capacitor across a larger capacitor in the tweeter circuit. All internal connections are made with 18-gauge stranded wire, which is soldered to the crossover and input terminals but connected to the drivers with clips. Input connections are via a set of large gold-plated binding posts on the rear, which are angled upward for easy access; bi-wiring is not supported.

The PSW300 powered subwoofer is only about 50% larger than an RT7, yet it packs a

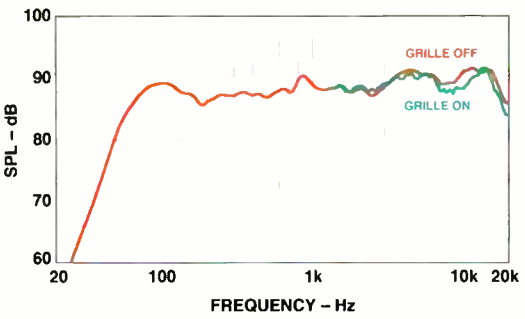


Fig. 1—One-meter, on-axis frequency response of RT7 bookshelf speaker.

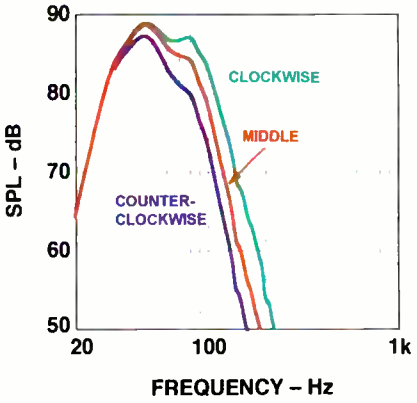


Fig. 2—Frequency response of PSW300 subwoofer for three crossover settings.

Table I—*PSW300 frequency range as a function of the crossover's low-pass control setting.*

	Frequency Range	
Low-Pass Setting	–3 dB PASSBAND	–6 dB PASSBAND
Counterclockwise ("50")	34 to 57 Hz	29 to 69 Hz
Middle ("80")	35 to 63 Hz	30 to 87 Hz
Clockwise ("125")	36 to 87 Hz	31 to 101 Hz

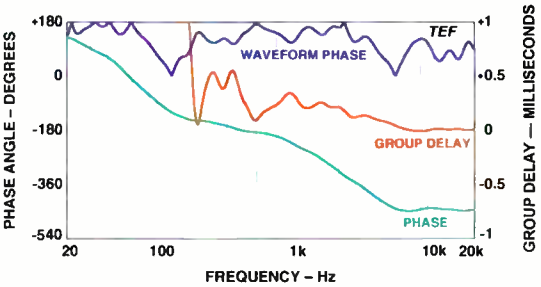


Fig. 3—RT7's on-axis phase response, group delay, and waveform phase.

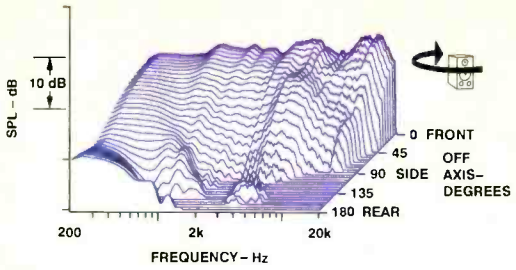


Fig. 4—RT7's horizontal off-axis frequency responses.

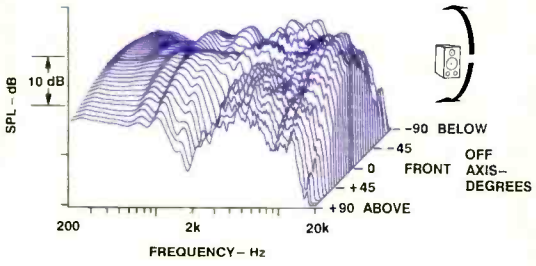
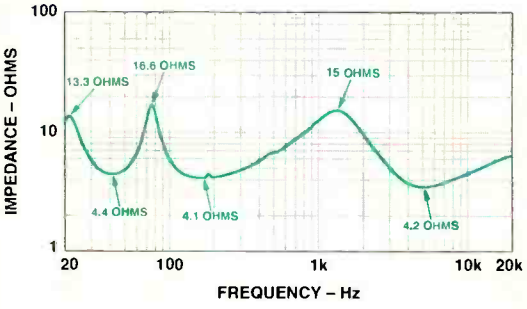
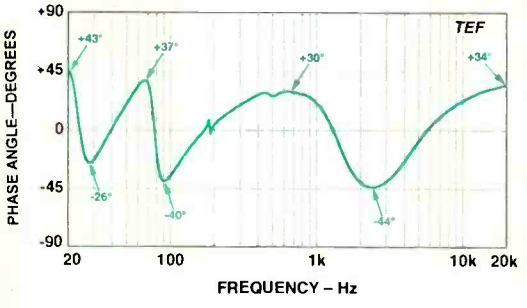


Fig. 5—RT7's vertical off-axis frequency responses.



A



B

Fig. 6—RT7's impedance magnitude (A) and phase (B).

lot of low-frequency wallop. The very robust, 10-inch shielded woofer has a very long excursion capability. Its extremely rigid cone is made of an injection-molded polymer/mineral composite, and the surround is of butyl rubber.

The PSW300's single-tuned bandpass enclosure consists of a closed box on one side of the woofer and a vented box on the other side; the sound output is radiated by the port of the vented box. The PSW300's port is Polk's Power Port. In the PSW300, the port faces downward into a bottom panel, or plinth, which forms the base of the cabinet. A flared cone below the port directs the sound radially, providing a constantly expanding cross-sectional area that smooths airflow. The sound exits the port through a 2-inch gap around the bottom of the woofer. Polk says that this venting method yields far less air turbulence, noise, and energy loss than a standard vent radiating the same acoustic power. Polk also says that radiating the sound around the periphery of the enclosure at floor level provides more efficient loading, increasing bass output and making it more consistent, so that "the PSW300 suffers less from room placement problems than competing, conventionally ported subwoofers."

The rear of the PSW300 houses a 125-watt amplifier whose cooling fins are exposed. The amplifier, with all its controls and connections, forms a sealed, removable subassembly. Like most powered subwoofers, the PSW300 has controls for level and crossover frequency (adjustable from 50 to 125 Hz) and switches for polarity and power (including an auto-on position). Compressor circuitry protects both the subwoofer and its amplifier against overloads. The PSW300 has speaker- and line-level inputs and outputs.

Measurements

The RT7's on-axis frequency response, measured in a large anechoic chamber, is shown in Fig. 1; I made these tests at the height recommended by Polk Audio, with the measurement microphone positioned halfway between the woofer and tweeter. The curve made without the speaker's grille was smoothed with a tenth-octave filter; the curve made with the grille was not smoothed.

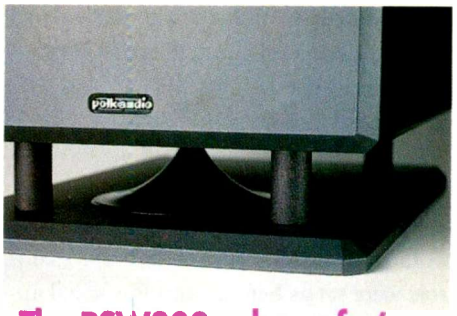
With the grille removed, the RT7's overall response fits a tight window of 5.5 dB (±2.75 dB, referenced to 1 kHz) from 63 Hz to 20 kHz. No sharp peaks or dips are evident in the unsmoothed curve. The grille causes minimal change in response; the main effect is a slight reduction in output between 7 and 12 kHz. The RT7 should sound equally good with or without its grille.

Averaged from 250 Hz to 4 kHz (giving equal emphasis to each third-octave band), the RT7's sensitivity measured 88.2 dB SPL, fairly close to Polk's rating of 89.5 dB. Up to 12 kHz, the two RT7s matched closely, within ±0.5 dB. At higher frequencies, one speaker's output dipped below its mate's; at 14.5 kHz, the difference was about 3 dB. The response of the RT7 that produced the higher output is presented in Fig. 1.

The PSW300 subwoofer's anechoic frequency response, measured 1 meter from the front of the cabinet, is shown in Fig. 2. (The subwoofer's level control was at its midposition, 12 o'clock, and a signal of 2.83 volts rms was applied to one speaker-level input.) These response curves were made with the Polk's low-pass frequency control set to its counterclockwise position (50 Hz), its midpoint (80 Hz), and its full clockwise position (125 Hz). Table I lists the PSW300's –3 dB and –6 dB bandpass ranges (referenced to the peak response, which occurs at about 45 Hz) for each of these low-pass settings.

THE PSW300 HAD IMPRESSIVELY HIGH, CLEAN OUTPUT AND A HEALTHY, 1-INCH PEAK EXCURSION!

Figure 3 shows the RT7's phase and group-delay responses, referenced to the tweeter's arrival time, and its waveform phase. The phase curve is well behaved and decreases about 208° between 1 and 10 kHz, about average for a two-way speaker of the RT7's size. When averaged between 1 and 4 kHz, the group-delay curve indicates that the woofer lags the tweeter by a fairly short 0.18 millisecond. The waveform phase, which directly indicates waveshape fidelity in specific frequency ranges, shows that



The PSW300 subwoofer's Power Port.

waveshapes will not be preserved by the RT7 over any significant frequency span. However, this is normal for direct-radiator speakers whose drivers are on a single baffle plane. Interestingly, the waveform phase undulates between 90° and 180° from 160 Hz to 4 kHz, indicating that waveshapes will be more or less inverted in this range.

Figure 4 shows the RT7's responses off and on its horizontal axis; on-axis response is the bold curve at the rear of the graph. The curve-to-curve uniformity indicates very wide and even horizontal coverage. In the main horizontal listening window, ±15° of the axis, the responses are very uniform, matching each other within 2 dB all the way to 20 kHz.

Figure 5 shows the RT7's responses off and on its vertical axis; the bold curve in the middle is the response on the suggested listening axis, halfway between the woofer and tweeter. The curves are quite uniform except for a significant narrowing in the lower treble. For listeners on the axis or within 10° above it, response is fairly uniform and flat. But below the axis, a significant depression develops between about 1.5 and 7 kHz. (This depression, which reaches nearly –15 dB at 15° below axis, is not clearly seen in Fig. 5. It occurs in the rear half of the plot and is obscured by the on-axis ridge.) The RT7's polar pattern is skewed slightly upward through the crossover range.

In the RT7's impedance-magnitude curve (Fig. 6A), the two peaks and a dip that characterize vented enclosures are clearly evident below 100 Hz; the dip at about 42 Hz is the approximate frequency of the vented-box tuning. The maximum impedance, 16.6 ohms, is at 76 Hz, the vented system's upper impedance peak. The minimum impedance, 4.1 ohms, occurs at 175 Hz. The impedance falls to an almost equally low 4.2 ohms at 5 kHz, a little above crossover. A slight impedance anomaly is evident at 186 Hz, just above the minimum impedance. The RT7's impedance varies over a range of about 4 to 1; to ensure that your cables cause no response peaks or dips greater than 0.1 dB, you would need to limit the series resistance to 0.063 ohm or less. For a typical run of about 10 feet, this would require 12-gauge (or heavier), low-inductance cable.

Figure 6B shows the RT7's impedance phase versus frequency. The phase glitch at 186 Hz corresponds to the slight anomaly in the impedance magnitude at this frequency. Because the RT7's impedance never goes below 4 ohms and the variations in its impedance magnitude and phase are moderate, this speaker will be a fairly easy load for most amplifiers. Two RT7s should not be paralleled on a single amplifier channel, however, unless the amp is rated to drive 2-ohm loads.

The RT7's vented-box loading worked very well, reducing cone excursion at box resonance by a significant 70%. As an experiment, I covered each of the ports in turn and checked the vented-box resonance frequency. With both ports open, the tuning was about 45 Hz. (Resonance measurements can vary by a few Hz, depending on the test methods used.) Blocking the longer port changed the tuning to 40 Hz; blocking the shorter one dropped it to a low 33 Hz. The RT7's woofer had a fairly healthy maximum excursion of 0.4 inch, peak to peak, and it overloaded quite gracefully. I noted some dynamic offset.

To investigate the effect of Polk's Acoustic Resonance Control, I took several additional response curves with the ARC port open and with it blocked. When measured at 1 or 2 meters, the response from 700 to 900 Hz was definitely smoother with both ports open, but the ARC port's cancellation effect did seem

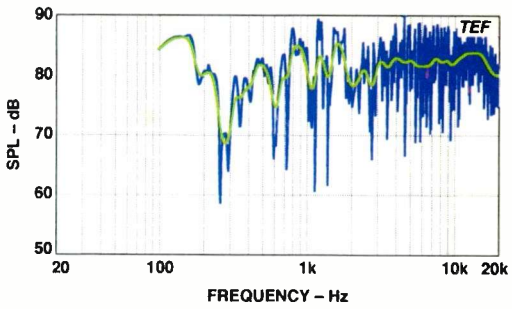


Fig. 7—RT7's 3-meter room response.

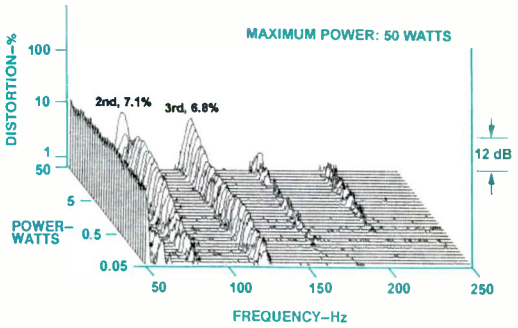


Fig. 8—RT7's harmonic distortion for E_1 (41.2 Hz).

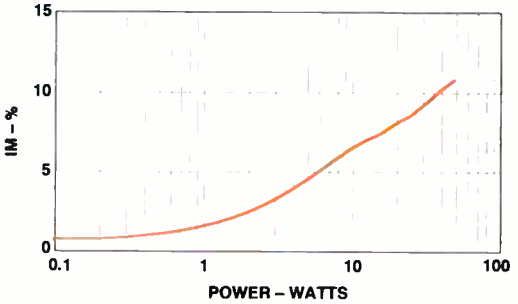


Fig. 9—RT7's IM distortion vs. input power.

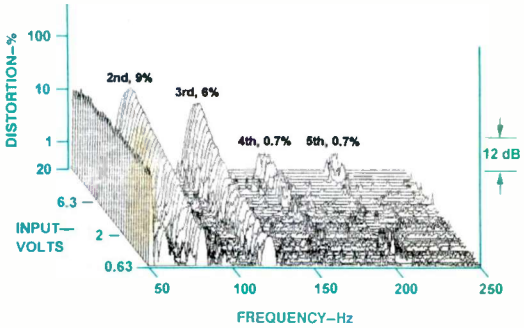


Fig. 10—PSW300's harmonic distortion for E_1 (41.2 Hz).

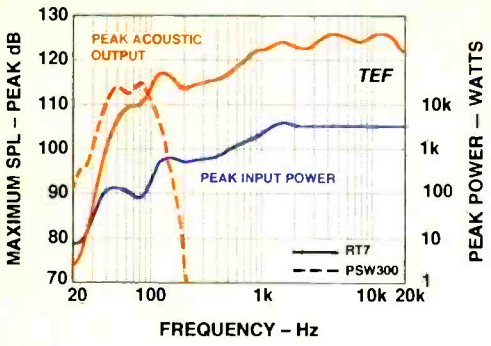


Fig. 11—Maximum peak input power of RT7 and maximum peak sound output of RT7 and PSW300.

quite sensitive to the height of the test microphone. At points closer to the RT7 and below its axis, response was often smoother with the ARC port closed.

Figure 7 shows the 3-meter room curve for the RT7, with raw and smoothed data. The speaker was in the right-hand stereo position and on a 22-inch-high stand; the test microphone was at ear height (36 inches) at the main listening position on the sofa. If you exclude the peak at 140 Hz and the dip at 280 Hz, the smoothed curve fits a fairly tight, 10-dB, window. It fits an even tighter, 7-dB, window above 670 Hz and is quite flat, smooth, and extended above 3 kHz. Overall, the smoothed curve fits a loose, 16.5-dB, window.

Figure 8 shows the RT7's E_1 (41.2-Hz) harmonic distortion. The second harmonic reaches a moderate 7.1% at 50 watts, and the third a slightly lower 6.8%. Higher harmonics were less than 1.5%. At 1 meter in free space and with 50 watts of input, the speaker generates a fairly usable 92 dB SPL at 41.2 Hz.

The RT7's only measurable A_2 (110-Hz) harmonic distortion at 50 watts consisted of a moderate 10% second harmonic and 3.2% third harmonic. The A_4 (440-Hz) distortion rose to a more significant 15% second harmonic, but the third harmonic reached only 2.3%, and higher harmonics were less than 0.5%. In free space and with 50 watts of input, the RT7 generated fairly healthy levels, in the range of 104 to 106 dB SPL at 110 and 440 Hz when measured from 1 meter away.

Figure 9 shows how the RT7's intermodulation distortion (IM) rises as power increases from 0.1 to 50 watts, with a test signal consisting of 440-Hz (A_4) and 41.2-Hz (E_1) tones of equal power. The IM rises smoothly and reaches a moderate 10.8% at full power; that's a good result, considering that both frequencies are reproduced by the same driver.

When I swept the RT7 with high-level sine waves, I noted one significant box-wall resonance at 186 Hz, coinciding with the glitches in the impedance curves. At this frequency, the whole cabinet—sides, top, front, and back—appeared to take off. Both RT7s exhibited this characteristic.

Like the RT7, the PSW300 subwoofer had a significant (though lesser) box-wall resonance. This resonance, at 130 Hz, involved the sides, top, and rear of the box. At 40 Hz and above, the PSW300's ability to deliver clean output was quite impressive, though there was much less clean output below 40 Hz. Fortunately, the acoustic lowpass action of the bandpass enclosure filtered out most distortion. Wind noise from the Power Port was fairly low but still evident on test tones. The 10-inch woofer had a very healthy excursion of more than 1 inch, peak to peak!

TOGETHER, THE RT7s AND PSW300 GREATLY EXCEEDED MY EXPECTATIONS.

The PSW300's E_1 (41.2-Hz) harmonic distortion is shown in Fig. 10 for an input of 20 volts rms applied to one speaker-level input. I set the subwoofer's level control at its middle position and turned up its lowpass frequency control to 125 Hz. (In Fig. 10 the input level scale is in volts instead of watts, because the PSW300 is powered by its built-in, 125-watt amp. Its input impedance is 4.7 kilohms, and thus it draws no real power from the main amp in the user's system. In practice, the input voltage for the distortion levels shown will vary with the PSW300's level-control setting.) The second harmonic reaches a moderate 9%, the third rises to 6%, and all higher harmonics are 0.7% or less. With 20 volts rms applied to the speaker-level input, the PSW300 generates a robust 105 dB SPL at 41.2 Hz, measured at 1 meter in free space.

The peak acoustic output of the PSW300 and RT7, and the RT7's short-term peak power input capabilities, are shown (with room gain) in Fig. 11. (The PSW300's controls were set as before, with the signal applied to one speaker-level input.) The RT7's peak input power, calculated by assuming a resistive 8-ohm input impedance, starts low (7 watts at 20 Hz), rises quickly to a peak of 125 watts at 46 Hz (near box resonance), falls to 75 watts at 80 Hz, and then rises to about 500 watts between 150 and 400 Hz. (At higher input power levels, the RT7's sound between 80 and 500 Hz became harsh and significantly distorted; this may have been caused by core saturation in the crossover's low-pass series inductor.) At higher frequencies, the peak input power rises smoothly; it is about 3,200 watts above 2 kHz.

The maximum peak output of the RT7 starts at an unusably low 74 dB SPL at 20 Hz, rises very rapidly to a 117-dB peak at 126 Hz, and drops to 113.5 dB at 200 Hz. It then rises smoothly, reaching about 123 to 127 dB SPL above 1 kHz.

The PSW300 subwoofer's maximum peak SPL starts at a quite usable 92 dB SPL at 20 Hz, rises very rapidly to reach 112 to 115 dB between 42 and 95 Hz, and drops rapidly above 100 Hz. At 40 Hz and above, the PSW300's bass output was quite impressive. In this test, the PSW300's internal compressor did not limit input level in the 20-, 25-, and 31.5 Hz-bands until after the subwoofer overloaded and began to sound very distorted. But at higher frequencies, the compression ensured that the output was always fairly clean, no matter how high the input. When input level was above the compressor's limiting point, output did not increase any further; the curve was taken just below that point. For maximum output, 90 to 100 Hz would be the logical point to cross over between the RT7 and the PSW300.

Use and Listening Tests

The RT7s I tested were covered on all six sides in black wood-grain vinyl, the only finish available. They were quite good-looking, with or without their grilles. The

cabinet's beveled front edges contributed greatly to the speaker's appearance. When the RT7's grille was off, my eye was drawn to the gasketless woofer, whose surround extends all the way to the edge of the frame; to the two flared port tubes on the bottom of the enclosure; and to the flush mounting of the woofer and tweeter. There are no sockets for attaching spikes.

The owner's manual for the RT7 covers Polk's complete line of RT loudspeakers and is in four languages. Although the manual covers stereo and home theater setups, speaker placement, hookup, required amplifier power, service, and specifications, most topics are not covered in much depth. The PSW300's manual is significantly more detailed.

I evaluated the Polk speakers as a pair of satellites with a subwoofer, not as speakers in a home theater setup. Auxiliary equipment included a Krell KRC preamp, a Crown Macro Reference power amplifier, and Straight Wire Maestro cabling.

I first listened to the RT7s alone, and I was quite impressed with their overall sound and bass extension. Although their bass sounded a bit lightweight versus that of the B&W 801 Matrix Series 3s I use for comparisons, they nevertheless made a good account of themselves on music whose bass was mainly above 40 Hz, such as most pop/rock and jazz. The RT7s' tonal balance was quite similar to the 801s', but the Polks were slightly brighter. Further listening revealed midrange differences between the speakers, with the B&Ws sounding somewhat smoother. Classical music sounded top-notch on the RT7s, with very good imaging and soundstaging.

I then connected the PSW300 subwoofer's input to the RT7's speaker terminals. This provided a proper stereo drive to the PSW300 but did not provide any high-pass filtering for the RT7s. I experimented with different placements of the subwoofer and settled on a centered location against the rear wall, about 3½ feet behind the RT7s. With the PSW300's low-pass frequency set at 80 Hz and its level control at the 11 o'clock position, the Polk setup's bass output was about equal to the B&Ws'. The Polks sounded smoothest when I set the subwoofer's "Phase" switch for reversed polarity. This improved bass sound significantly but still left the RT7s straining on material that had high levels of low bass, because they were not high-passed.

I then changed connections, driving the PSW300's line-level inputs from my preamp and feeding the subwoofer's high-passed line-level outputs to the power amplifier that drove the RT7s. This provided the cleanest sound and the lowest intermodulation distortion on music having high levels of low bass. Connected this way, the sound of the three-piece Polk system changed from merely good to excellent. On most recordings, the Polk setup's bass response equaled or exceeded that of the B&Ws; only on music having high levels of very low bass, below 30 Hz, were the B&Ws superior.

Rear of PSW300 subwoofer.

The RT7s had significantly greater sensitivity than the 801s, requiring some 4 to 5 dB of line-level attenuation to match the B&Ws' sensitivity on wide-band program material. In other words, the RT7s required about 2½ to three times less power than the 801s, enabling them to play as loud with a 50-watt amplifier as the B&Ws could with an amp of 125 to 150 watts!

When I played pink noise through the RT7s, I heard moderate tonal changes through the upper midrange when I stood up. On third-octave band-limited pink noise, the RT7s (without subwoofer) generated no usable bass output, just distortion, in the 20- and 25-Hz bands. Output became barely usable at 32 Hz, was fairly good at 40 Hz, and was good at all higher bands. But from 63 Hz on down, the RT7s were no competition for the B&Ws. Connecting the PSW300 subwoofer essentially leveled the playing field. When I used its line-level input, the sub had quite clean bass down to 32 Hz and usable output at 25 Hz. Although it produced no usable output in the lowest (20-Hz) band, the PSW300 kept distortion and extraneous noises to a minimum when it was driven hard. Between 40 and 100 Hz, the PSW300's output was quite powerful and clean, and it could play somewhat louder than a single B&W 801.

On "Misty," a track on the *The Wonderful Sound of Three Blind Mice* (Golden String GSCD004, a jazz sampler I recommend highly), the RT7s and PSW300 were a true knockout. Piano, bass, and drums had a you-are-there presence that was quite striking. Every note of the piano was very distinct, and the sound of the acoustic bass was smooth and extended. The intimate quality of the jazz combo was well preserved. On "Wild One," a country hit from Faith Hill (*Take Me As I Am*, Warner Bros. 9 45389), the Polks rendered Hill's guitar and voice in a forceful and lifelike manner and preserved the vocal and instrumental dynamics of her performance.

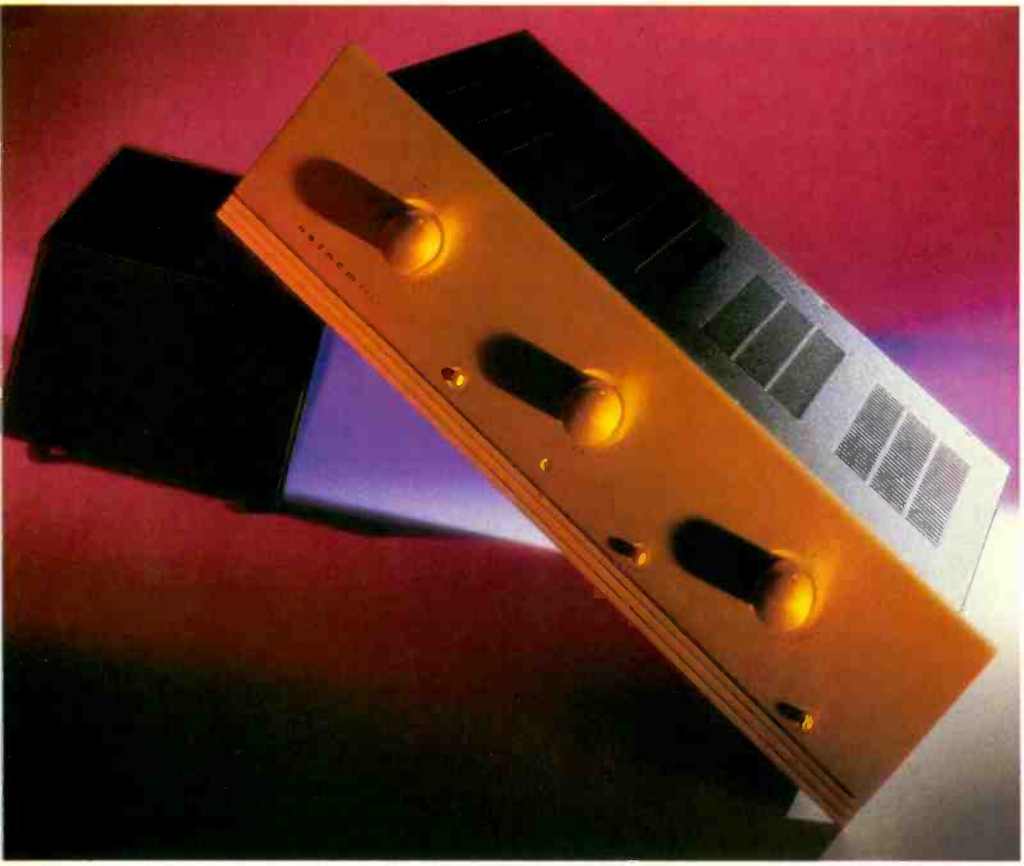
The RT7s' high sensitivity and the PSW300's high output capability served loud rock very well. (It's interesting how a good subwoofer can turn a pair of laid-back bookshelf speakers into a rock 'n' roll powerhouse!) Yet the Polks performed equally well together on full orchestral music. On one of my favorite symphonies, Schubert's Fifth (Bruno Weil conducting the Classical Band, Sony Vivarte SK 46697), the sound was highly detailed and well focused. There was a good sense of hall reverberance and excellent placement of the instruments.

The Polk RT7s, in partnership with the PSW300 subwoofer, provided a level of performance that greatly exceeded my expectations, given their price. They competed well with my B&W speakers, thanks to their smooth and extended response coupled with powerful and smooth bass reproduction, the latter trait one that I would normally associate with much larger systems. Used alone, the RT7s, at less than $500 per pair, would be excellent budget or auxiliary speakers. And the PSW300 should be considered by anyone interested in a reasonably priced (and reasonably sized), high-performance subwoofer for use in a music or home theater system. A

EQUIPMENT **PROFILE**

BASCOM H. KING

ANTHEM PRE-1 PREAMPLIFIER



Anthem is a new series of tube components built by Sonic Frontiers, priced more affordably than the company's flagship line. Besides the Pre-1 preamplifier, the Anthem line includes an integrated amplifier, a power amplifier, and a CD player with HDCD decoding.

Like preamps of yore, the Pre-1 has a phono stage; it also has three high-level inputs, a loop for a tape recorder or external processor, and two sets of main outputs (useful for bi-wiring or to feed active subwoofers). All inputs and outputs are unbalanced and use high-quality phono connectors. Also on the rear panel are a ground terminal (mainly for use with the phono input) and a multipin connector for the external power supply.

TOGETHER, ANTHEM'S AMP AND PREAMP PRODUCED HIGH-END SOUND AT A RELATIVELY AFFORDABLE PRICE.

The Anthem Pre-1's front panel has three knobs, one each for input selection, balance, and volume plus pushbuttons for switching to and from the tape/processor loop, muting, and switching between standby and full operation. The Pre-1's tube heaters are always on; pushing the power switch to "On" just turns on the high-voltage rectifier tube's heater and initiates a turn-on delay. During this delay, the preamp's outputs remain muted until the rectifier tube warms up enough for the high voltage to stabilize. A green pilot LED on the front panel dims during standby, glows during normal operation, and flashes as a reminder when muting is turned on.

The Pre-1's power supply is housed separately, to allow plenty of space for the preamplifier circuitry and to eliminate the possibility of induced hum from the power transformer. The power supply's captive output cable plugs into the preamp chassis; the AC line cord plugs into an IEC socket on the power supply. A power-on LED is on the front of the supply.

The Pre-1 is an attractive piece of gear, its construction very neat and workmanlike. This applies not only to the outside but to the interior, which is nearly filled by the main circuit board. This thick, double-sided board is populated with many high-quality components, including capacitors by MIT, Solen, and Wima. A small p.c. board, attached to the rear panel, carries and connects the input/output jacks and the selector switch (operated by a long shaft from the front-panel selector knob). Another small board, attached to the bottom of the balance and volume controls, holds the gain switches for each channel's line-amplifier stage.

Measurements

IHF sensitivity measurements for the Anthem Pre-1's two gain settings are given in Table I. Frequency response varies somewhat with gain mode and volume setting, but mostly above 20 kHz (Fig. 1). When volume is up full (the "0 dB" curves), the rolloff above the audio band is more pronounced in the low-gain mode; with the

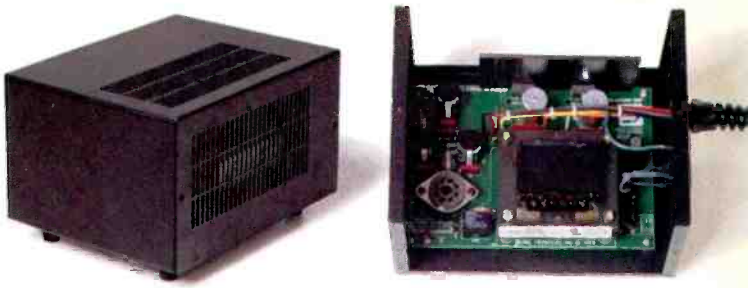
Dimensions: Preamp, 19 in. W x 5¼ in. H x 11 in. D (48 cm x 13.4 cm x 28 cm); power supply, 7⅛ in. W x 5⅛ in. H x 9 in. D (18.4 cm x 13.4 cm x 22.9 cm).
Weight: Preamp, 17½ lbs. (7.9 kg); power supply, 10 lbs. (4.5 kg).
Price: $1,495.
Company Address: Sonic Frontiers, 2790 Brighton Rd., Oakville, Ont. L6H 5T4, Canada; phone, 905/829-3838; fax, 905/829-3033.
For literature, circle No. 93

Photos: Michael Groen

volume set at –15 dB or lower, the high-frequency responses are about the same in both modes. However, if you use the low-gain mode with low-output sources, you'll need higher volume settings and therefore get more rolloff above 20 kHz.

Loading also affects the Pre-1's frequency response. With an IHF load, there's some noticeable rolloff at each end of the spectrum (Fig. 2, measured in high-gain mode with the volume control turned fully up). The low end rolls off because a high-pass filter is formed by the Pre-1's output coupling capacitor and the 10-kilohm resistance of the IHF load. The high end rolls off because of a low-pass filter formed by the Pre-1's output impedance and the IHF load's 1,000-picofarad capacitance. Still, this preamp does well with the IHF load and will therefore drive a reasonably long cable to your power amplifier and will drive most solid-state power amplifiers without a problem.

Rise and fall times varied. At worst, they were 5 to 6 microseconds (in low-gain mode with the volume fully up); they were only about 1 to 2 microseconds in either mode with the volume control down in the –20 dB



Power supply, inside and out.

Table I—*Input sensitivity at maximum and minimum gain.*

	Sensitivity	
Low-Pass Setting	LOW GAIN	HIGH GAIN
Line Input to Main Out	324.7 mV	19.45 mV
Line Input to Tape Out	555.9 mV	555.9 mV
Phono Input to Main Out	1.19 mV	730 µV
Phono Input to Tape Out	2.15 mV	2.17 mV

CIRCUIT HIGHLIGHTS

A relatively new circuit topology, a "mu follower," forms the basis for most of the Pre-1's signal circuitry. This is similar to a cascode connection, where the first of two devices drives the second device through the latter's emitter, source, or cathode. In the mu follower, the first tube's plate drives the second tube's grid via a coupling capacitor. Two resistors are in series between the second tube's cathode and the first tube's plate; one resistor acts as a self-biasing cathode resistor for the second tube, and the other acts as a plate load for the first tube. A third resistor connects the midpoint of these two resistors to the second tube's grid, serving as its grid leak resistor. The output of the circuit is taken from the second tube's cathode. This topology has two benefits. The second tube acts as a cathode follower and multiplies the effective value of the plate-load resistor. And the first tube's gain, unrestricted by output loading, approaches its nominal amplification factor, or "mu"—hence the name, mu follower.

The phono preamp circuit's first stage is a cascode-connected triode. (The tube used, a 6922, can yield quite low noise and, in the cascode connection, is very linear.) The plate output of this tube is capacitor-coupled to the second stage (a 12AT7 triode connected as a mu follower) through an interstage RC equalizer network that performs part of the RIAA equalization. The rest of the equalization is performed by an RC feedback network from the output of the 12AT7 back to its input and by the resulting interaction with the interstage RC network.

Signals coming into the Anthem Pre-1 pass through the selector switch to the switch for its tape monitor loop (or external processor loop), via a 1-kilohm resistor at the input to the monitor switch and another such resistor at the tape outputs. The wiper (output) of the monitor switch then passes to the balance control, which is connected as a variable resistor in series with the volume control. Switching the Anthem Pre-1 to low-gain mode inserts an additional resistor between the balance and volume controls. Switching in this resistor curtails the balance control's adjustment range. It also reduces the circuit's high-frequency response and increases noise, because it raises the impedance seen by the grid of the first stage.

Following the wiper of the volume control is the output amplifier, which, not surprisingly, is a single mu-follower stage. This stage inverts signal polarity (it's to Sonic Frontiers' credit that this is mentioned in the Anthem's specs), so the Pre-1 inverts overall polarity from any input to the main output but not to the tape output.

Power-supply circuitry is quite extensive in this design. In the high-voltage supply, the tube rectifier is followed by a three- stage RC filter that feeds the main high-voltage regulator. In this circuit, which I call a zener follower, a constant-current source feeds a shunt regulator formed from a string of zener diodes. The output of the shunt regulator then feeds the gate of a MOS-FET series pass transistor whose source terminal is the circuit's final regulated output of 245 volts.

Following the main high-voltage regulator are six additional high-voltage regulators, three per channel. A 24-volt zener diode and a resistor are connected in series between each regulator's high-voltage input and ground; the voltage drop through this zener goes through a resistive divider to supply +12 and –12 volts for the regulator's error-amplifier op-amp. The op-amp's output drives the gate of a MOS-FET series pass transistor, whose source terminal feeds about 233 volts to the preamp circuitry; the source terminal's output is also applied to the negative input of the error op-amp. In each channel, separate regulators feed the phono section's first stage, its second stage, and the line output section. Each channel also has separately regulated tube-heater supplies for the phono section and the line output amp. *B.H.K.*

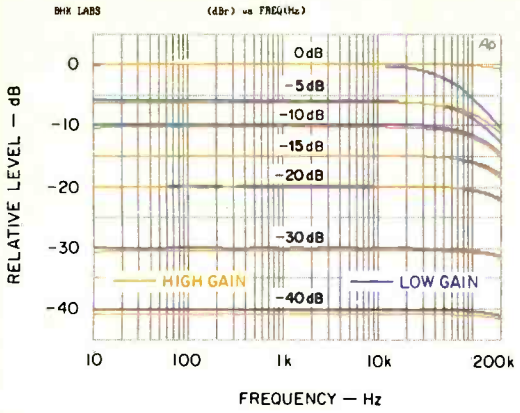


Fig. 1—Frequency response at various level settings.

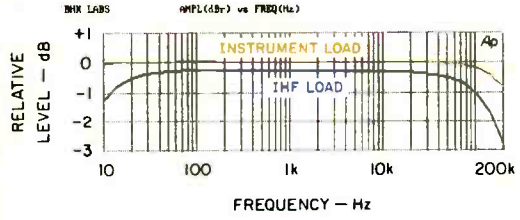
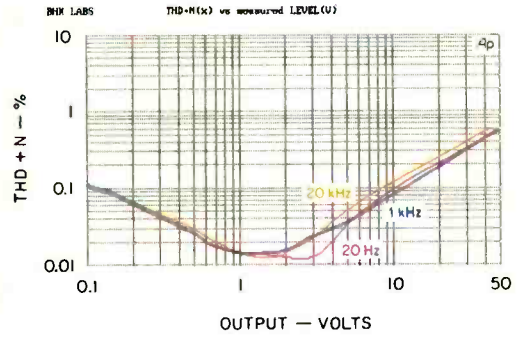


Fig. 2—Effect of loading on frequency response.



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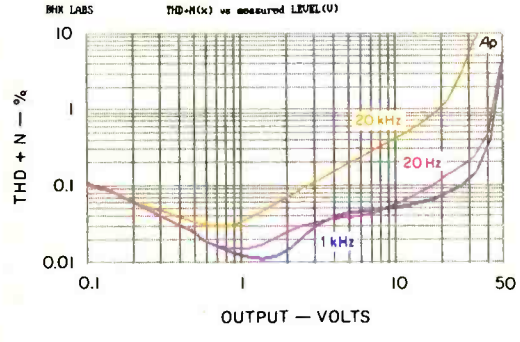


B

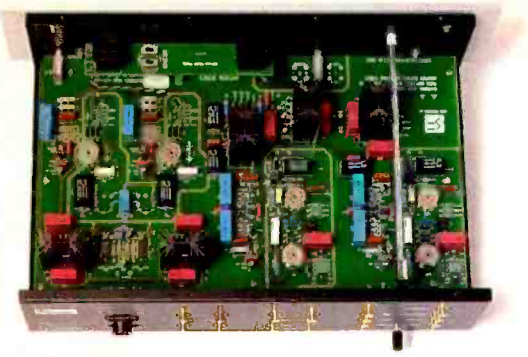
Fig. 3—THD + N vs. output level for instrument load (A) and IHF load (B).

range and reached a low of 0.6 microsecond (in the high-gain mode with volume fully up and with instrument loading). Volume-control tracking between channels was within ±0.5 dB down to –70 dB, which is very good.

The Anthem Pre-1's total harmonic distortion plus noise (THD + N) is plotted as a function of output voltage for the right channel with instrument loading (Fig. 3A) and with IHF loading (Fig. 3B). Note the prodigious output voltage this preamplifier can deliver with low distortion. With the instrument load, the distortion is admirably uniform with frequency; the 1,000-picofarad capacitance of the IHF load does cause somewhat more distortion at 20 kHz than the instrument load does, but that's to be expected.

Crosstalk generally increased with frequency, at about 6 dB per octave over the audio frequency range, and varied with direction and gain mode. The worst case was from the left to the right channel in low-gain mode, where it was –115 dB at 20 Hz, –85 dB at 1 kHz, and –60 dB at 20 kHz. Switching to high-gain mode or measuring from the right to the left channel improved these figures by about 10 dB.

Output impedance did not vary with the gain setting, measuring 385 ohms at 1 kHz for the left channel and 411 ohms for the right. Input impedance, however, varied quite a bit with gain. In the high-gain mode, impedance with the volume control at maximum was just about 24.5 kilohms in either channel; with the volume lowered 20 dB, it rose to 48.3 kilohms. In the low-gain mode, the impedance was too high to reliably measure with my standard technique, but from the schematic, I estimated it as about 417 kilohms. In either gain mode, each channel's input impedance increased by as much as 100 kilohms when the balance control was set to increase the output of the other channel.



THE ANTHEM PRE-1 CAN DELIVER PRODIGIOUS OUTPUT VOLTAGES WITH LOW DISTORTION.

The Pre-1's IHF signal-to-noise ratio in the high-gain mode was 86.1 dB for the left channel and 86.5 dB for the right. In the low-gain mode, the Pre-1 was noisier, with an IHF S/N ratio of 79.6 dB in either channel; this increase was caused by a series resistor used in that mode (see "Circuit Highlights"). In high-gain mode, A-weighted output noise was 43.6 microvolts, worst case. It dropped to 24.1 microvolts with the volume control at maximum and to 17.1 microvolts at the minimum volume setting. In low-gain mode, worst-case noise (63 microvolts) occurred at the maximum volume setting; the noise fell to 16.8 microvolts at minimum volume. The channels matched quite closely, and neither was consistently the noisier.

The phono preamp section's RIAA equalization accuracy is presented in Fig. 4 for the left channel; right-channel response was almost identical. The admirably flat curve made with instrument loading is essentially what you'd get from the Pre-1's main outputs if there were no loads on its tape outputs. With IHF loading, the RIAA response rolls off by about 1 dB at either end. You're likely to get some of that rolloff with a tape deck or external processor connected to the Pre-1 but not as much as can be seen here. This is because the combined capacitance of the deck's or processor's input and the cables feeding it will probably be lower than the IHF load's 1,000 picofarads. If the processor or deck has an input

impedance of 10 kilohms or less, the bass will roll off as shown.

Figure 5, phono overload versus frequency, indicates what output voltages can be attained at 2% THD + N with instrument loading and the input voltages needed to produce this output (left channel shown; the right was almost identical). In an ideal phono preamp, the output voltage would be flat with frequency and the corresponding input voltage would be the exact inverse of the RIAA equalization curve. In the Pre-1, the attainable output voltage is very large, with a corresponding input acceptance of 200 millivolts at 1 kHz. At high frequencies, the Pre-1 departs from the ideal, most probably a sign that the input stage overloads before the output stage does. With IHF loading, the attainable output voltage dropped about 80%, and 1-kHz input acceptance fell to 52 millivolts.

In the pre-equalized square-wave responses of the Pre-1's phono stage with instrument loading (Fig. 6), the 1-kHz traces (middle) reveal both a virtue and a vice of the Pre-1. I have overlaid three 1-kHz traces, for output levels of 2, 4, and 6 volts, peak to peak. Some asymmetry begins to appear at 4 volts out and becomes quite noticeable at 6 volts, a sign that the Anthem's high-frequency acceptance is less than perfect. But the 4-volt square-wave output is still quite good and better than you'd get from many other phono preamps. The 40-Hz trace's tilt (bottom) indicates that response falls off below 20 Hz.

The Pre-1 phono section's left-channel THD + N is plotted in Fig. 7 as a function of output level with instrument loading. (The 20-Hz curve is higher than the others at low outputs because its measurement bandwidth extends down below 10 Hz, whereas the measurements for the other curves are cut off below 400 Hz. This filtering is used when measuring phono stages so that THD readings won't be swamped by low-frequency noise, which is boosted by RIAA equalization.) With IHF loading, distortion was about twice as high, and maximum output was more on the order of 10 to 12 volts.

Interchannel crosstalk via the phono input was better than –80 dB up to 5 kHz and was 68 dB down at 20 kHz. With an IHF dummy moving-magnet cartridge load terminating the undriven channel's input, crosstalk from the left to the right channel was –53 dB at 10 kHz but only –70 dB at 10 kHz in the opposite direction.

ASSOCIATED EQUIPMENT USED

Equipment used in the listening tests for this review consisted of:

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, 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: Quicksilver Audio preamp, Forssell balanced tube line driver, and the reviewer's passive signal selector/volume controller

Amplifiers: Sonic Frontiers Power-3 mono tube amplifiers, Anthem Amp-1 tube amplifier, Quicksilver M135 mono tube amplifiers with Svetlana EL34 output tubes, and Arnoux 7B digital switching amplifier

Loudspeakers: Genesis Technologies Genesis Vs

Cables: Digital interconnects, AES/EBU balanced Illuminati DX-50; analog interconnects, Transparent Cable MusicLink Reference (balanced) and Music and Sound (unbalanced); speaker cables, Transparent Cable MusicWave Reference

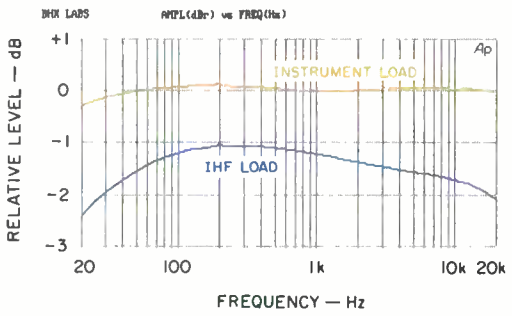


Fig. 4—RIAA equalization accuracy.

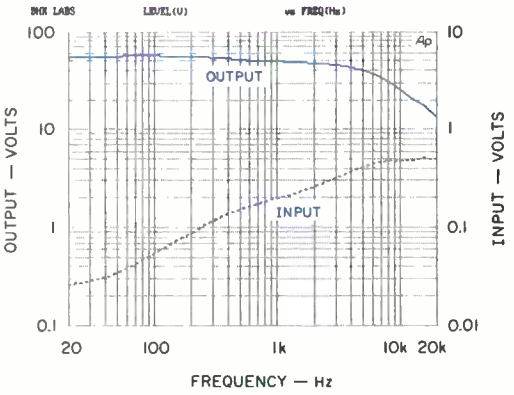


Fig. 5—Phono overload vs. frequency with instrument load.

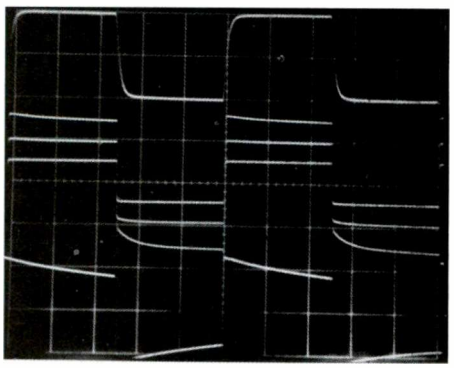


Fig. 6—Square-wave response for 10 kHz at 2 V out, peak to peak (top); for 1 kHz at 2, 4, and 6 V out, peak to peak (middle); and for 40 Hz at 2 V out (bottom).

Rear panel of the Anthem Pre-1.

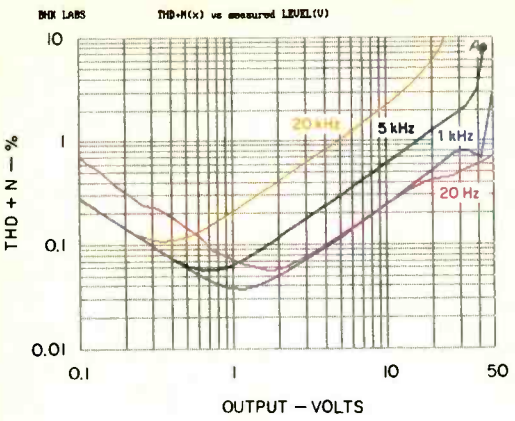


Fig. 7—Phono section THD + N vs. level.

The IHF signal-to-noise ratio from phono input to final output was 75 dB for either channel, based on an assumed input level of 5 millivolts from a moving-magnet cartridge and an output level of 500 millivolts. The Anthem's A-weighted noise, referred to its input, was 0.32 microvolt with the input short-circuited, 0.41 microvolt with a 1-kilohm source impedance, and 0.73 microvolt with the IHF simulated moving-magnet cartridge load, all for the worse (right) channel.

Use and Listening Tests

For my first listening to the Pre-1, I tried the Anthem in a familiar setup, where I use an Arnoux 7B switching power amplifier with either a Quicksilver Audio preamp or my passive signal selector and volume control. Here, the Anthem sounded very good and similar to the other preamps.

PHONO PREAMP NOISE WAS SO LOW THAT I DIDN'T NEED A TRANSFORMER FOR MY MC PICKUP.

I next set up the Pre-1 between a Manley Reference 20-bit D/A converter and a pair of Sonic Frontiers Power-3 mono tube amps, which fed a pair of Genesis V speakers. Because the Anthem Pre-1 has only unbalanced inputs and outputs, I had to switch from my usual Transparent Audio Reference balanced interconnects to Music and Sound (MAS) unbalanced interconnects. I listened for a while with the Manley feeding the Power-3s directly via the MAS cables, and the sound was very good. I then inserted the Pre-1 between the Manley D/A and the Power-3s.

When evaluating components, I feel it's essential to compensate for any polarity reversals they introduce. Because the Pre-1 inverts polarity and the Genesis V speaker has a multipin connector between its woofers and servo amp, I couldn't just reverse one end of each speaker cable; I also had to make up polarity-reversing cables to feed the servo amp's line inputs.

With the Anthem Pre-1 added to my system and polarity corrected, I could detect some loss of "thereness" in the reproduction, but the sound was still very good overall.

The noise level of the Pre-1's phono stage was low enough for me to try feeding a low-output moving-coil pickup directly to the phono input, without bothering to use a step-up transformer. At normal volume settings, I could hear some noise right at the speakers, but the sound was so good that I felt no need for the transformer. I was very pleasantly surprised at how good my records sounded.

To see how the Pre-1 sounded with an amplifier in the same price category, I also paired it with an Anthem Amp-1, a tube power amplifier of 40 watts per channel. With CDs, this combination produced a smooth and spacious musical sound.

The Pre-1 operated flawlessly in the lab and in my various listening systems. All of its controls worked smoothly and had a nice feel. This preamp sent nary a click or pop to the amplifiers when I turned it on or off. Overall, the sound I heard from the Anthem Pre-1 was spacious and detailed, with natural tonal balance. Bass quality, extension, and impact were all excellent. Further, I was pleased that I never heard any undue edginess, in any of my listening systems; to me, that is a major positive attribute.

I liked the Anthem Pre-1 quite a bit. And my experience with the Anthem preamp and amp together convinced me that Sonic Frontiers' Anthem components do, as claimed, deliver high-end sound at relatively affordable prices. A

PIONEER ELITE, *continued from page 45*

stopped at; it could be excellent, blurry, or pixelated in spots, or it might shake as if the decoder were skipping between nonrelated fields. There's no slow-motion capability for DVD, nor is there realistic accelerated motion. In search mode, pictures snap between distant frames with nothing in between.

Chapter skip worked properly on laserdisc and the two sampler DVDs I had. These DVDs did not provide a way to check the subtitle or aspect-ratio features, but I see no reason why they wouldn't function with a properly encoded disc. The samplers did afford a limited way to check the multilanguage and viewing-angle features, and these worked properly.

Subjective video evaluation is at least as problematic as subjective audio evaluation. One's acuity to artifacts varies with seating position, ambient light, and a host of other factors, including what one had for breakfast. That said, I found the DVL-90's default contrast setting somewhat higher than I would like. Pictures were punchy and attractive but, perhaps, a bit much so. Horizontal resolution was excellent, but I was more aware of vertical interlace problems on the DVL-90 than with other video sources. Maybe because of this, I was more aware of dot crawl along straight lines. I also seemed to be more aware of motion artifacts in fast-moving scenes, but I can't claim to have had a vast amount of experience with DVD performance.

Time will tell where the Pioneer Elite DVL-90 ranks among DVD players. At the moment, it has relatively little competition, and it does perform very well. I have no doubt that anyone accustomed to watching VHS tape will be blown away by a DVD played on the DVL-90. There's no comparison in resolution, clarity, or color accuracy. And overall, DVD picture quality was better even than laserdisc's. The DVL-90 also does an excellent job with laserdiscs, however. It's so good, in fact, that I'd not be surprised to find some viewers preferring the LD format, at least initially, for its superior slow-motion and still-frame features and for its currently much deeper software catalog. In any event, with its ability to play almost every type of optical disc on the market—audio as well as video—the Pioneer Elite DVL-90 offers a universal solution, and a very fine one at that. A

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EQUIPMENT PROFILE

D. B. KEELE, JR.

Addendum: DIGITAL PHASE AP-2.1 SPEAKER

In my review of the Digital Phase AP-2.1 speaker (November 1996), I noted a somewhat uneven bass response, a rolloff below 50 Hz, a high-frequency rolloff, and a low (2.7-ohm) impedance at high frequencies. Daryl Powell, president of Digital Phase, called to say that the company's measurements showed solid and smooth response throughout the treble and to below 40 Hz in the bass.

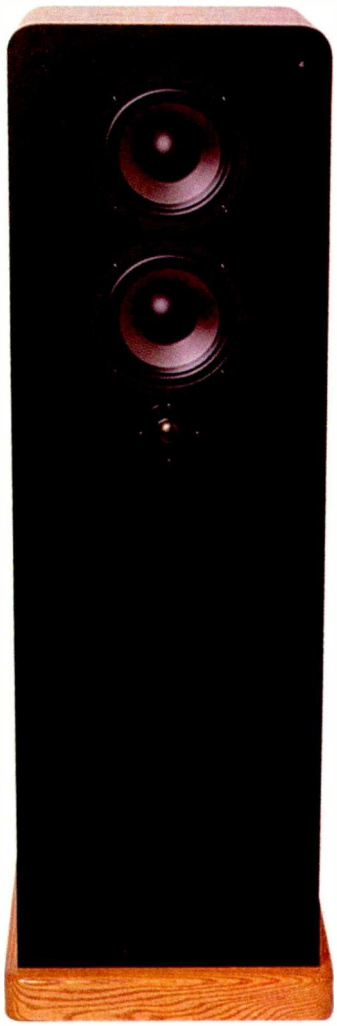

Photo: Michael Groen

The high-frequency rolloff and the low impedance made Powell suspect that the tweeters in the speakers I'd evaluated had been damaged. Such damage could occur in shipping or from the speakers' being overdriven by a prior listener. (To prevent such problems, I always do my maximum power testing on a speaker *after* my other measurements and my listening tests, and I make maximum-power tests on only one speaker of the pair.)

Digital Phase then sent me two new tweeters, which I installed in the original speakers. With these new drivers, the AP-2.1's high-frequency response improved greatly, becoming commendably flat all the way to 20 kHz. The high end, which I had called subdued in the original review, was subdued no longer and had become smooth and extended. This can be plainly seen in the new frequency response graph (Fig. 1), which I made with the speaker's grille off. Pink noise was reproduced quite smoothly, with hardly any tonality. The AP-2.1s were now slightly brighter than the B&W 801 Matrix Series 3 speakers I use for comparisons, but this brightness did not translate into any harshness on cleanly recorded female vocals or other demanding material.

Figure 2 shows the impedance magnitude with the new tweeter installed. The high-frequency minimum impedance has increased from 2.7 to 3.4 ohms (and shifted downward in frequency from about 5.5 to 4.5 kHz).

It turned out that the uneven, rolled-off bass I originally reported was not a characteristic of the speaker; rather, it resulted from response irregularities below 100 Hz in the large anechoic chamber I now use for speaker tests. These irregularities affect bass measurements made with a microphone 2 meters from the speaker. In previous reviews, I had combined the 2-meter low-frequency response data with data from closer mike positions, which minimized the effect of the chamber errors. This was not practical with the AP-2.1, however, because of the very large separation between its woofers and ports.

The response curve in Fig. 1 takes the chamber's low-frequency irregularities into account and includes additional corrections based on ground-plane measurements. Except for the dip at 166 Hz, which is not very significant (and does not appear in measurements made in normal listening rooms), the curve fits a very tight, 3.4-dB, window from 42 Hz to 20 kHz. The low-frequency response is smooth and extends below 40 Hz.

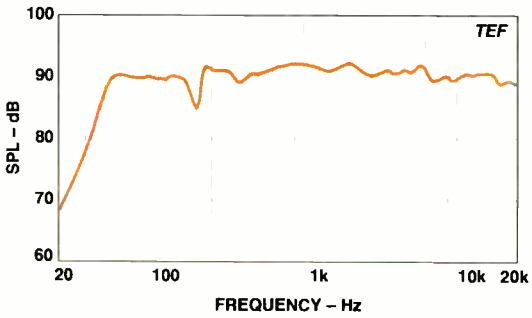

Fig. 1—Frequency response.

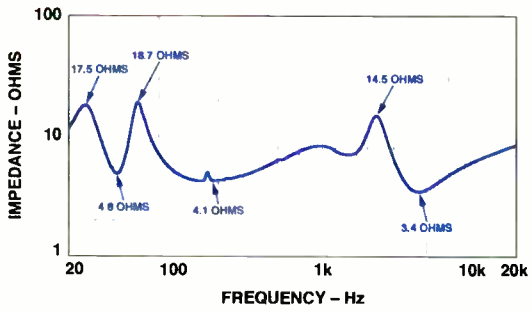

Fig. 2—Impedance magnitude.

To double-check the anechoic measurement of Fig. 1, I retested the AP-2.1 at sev-

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eral different places in the anechoic chamber and with several different microphone positions, made several ground-plane measurements, and examined a ground-plane curve made by Digital Phase. All these curves had different versions of the 166-Hz dip seen in Fig. 1, so I concluded that the test chamber was not causing it. However, the dip's depth varied from curve to curve, obviously varying with the phase relationship at the microphone between the woofers' and ports' outputs. In Digital Phase's curve, the dip was about only 2 or 3 dB deep.

In my original review, I praised the Digital Phase AP-2.1 but expressed two reservations. The first concerned the speaker's subdued high end; with the new tweeters, that reservation is gone, and my already favorable impression of the AP-2.1s has gone up a large step. My second reservation concerned a resonance at 166 Hz, caused by spurious radiation from the ports at the rear of the enclosure. In the follow-up listening tests I made with the replacement tweeters, I paid close attention to the audible effects of this resonance and, as before, could hear it on only a very few CDs. I believe there are two reasons why this resonance is hard to hear. First, it has a high Q, and hence a narrow bandwidth; low-Q, broad-band resonances are far more audible. Second, its effect is masked by standing waves and modal effects in the listening room, which often cause frequency peaks and dips quite similar to the effects of the resonance.

WITH THE REPLACEMENT TWEETERS, RESPONSE BECAME COMMENDABLY FLAT ALL THE WAY TO 20 kHz.

With the flat and extended high end from the replacement tweeters, the Digital Phase AP-2.1s represent even better value for the money than I originally thought. They should be considered by anyone seeking a high-performance tower speaker with extremely good looks (complimented by almost everyone who saw them) and a solid high-end pedigree. A

AURICLE

COREY GREENBERG

THETA DIGITAL CASABLANCA SURROUND PREAMP

When Theta Digital's Neil Sinclair told me more than a year ago that he was thinking about introducing a home theater surround processor, I wondered which category the new Theta would wind up in. Would it be like processors from Proceed and Meridian, which took home theater seriously from the outset and designed innovative, high-performance surround sound preamplifiers that hit all the right notes for music and movie soundtrack processing? Or would the new Theta be another of the oddball processors that eschew even basic Dolby Pro Logic processing in favor of nothing more than active versions of the 30+-year-old Hafler passive sum/difference matrix circuit, meant to subtly enhance stereo music rather than properly decode movie soundtracks?

IS THE CASABLANCA SURROUND PREAMP PERFECT IN EVERY WAY? YES AND NO.

Coming out with a multithousand-dollar surround processor these days that doesn't have Dolby Pro Logic, much less Dolby Digital (AC-3) or DTS, is just plain frightening. And most high-end surround processors that *do* decode Dolby Surround are flawed in other ways, such as having overly wide steps in the channel level-calibration scheme, skimping on the number of inputs because the designer's got no idea how many sources can pile up in a home theater, failing to include proper bass management and subwoofer crossovers, or adding on-screen menus only for the composite video output, not the S-video. Or or or.

At first glance, the Theta Casablanca looks like the biggest, beefiest surround preamp you've ever seen. This thing's *huge*! At 19 inches wide x 16 inches deep x 7½ inches high, and weighing in at a healthy 43 pounds, it's even bigger than Theta's Data III laserdisc/CD transport, which was the biggest slab in my equipment rack before the Casablanca arrived. Why's it so big? Because aside from its multiple oversized power supplies, its design is more akin to that of a personal computer than a hi-fi component. Instead of everything mounted on the same circuit board, the Casablanca is basically a mainframe and power supply on a chassis, with a series of slots that accept Theta's various circuit cards, each handling a different task. Just as a PC has slots for internal modem cards, video cards, sound cards, and so forth, the Casablanca has card slots for digital input, analog audio, video, Dolby Digital/Pro Logic, DTS, and anything else that develops down the road. I think this is a great idea (as does Meridian, which adopted the same kind of PC-like design for its new 800-series electronics). State-of-the-art home theater is such a moving target these days, and a PC-type design makes customization and upgrading as easy as installing an internal modem.

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Photo: Michael Groen

You start with the base model Casablanca, which runs $4,500. This includes the digital input card, which has six coaxial S/P DIF inputs and two Toslink optical inputs, and the analog input card, which has provision for six analog stereo audio sources. The analog card can be thought of as a signal router and high-quality analog preamp, with a gain stage and a stepped attenuator for each of the Casablanca's six audio outputs. The attenuator—which consists of a digitally controlled, precision, metal-film resistor ladder with an active buffer stage on its output—is the last stage before the output jacks.

Unlike other DSP-based surround preamps, such as the Meridian 565 and Lexicon DC-1, the Casablanca has an "Analog Direct" mode that bypasses the A/D and D/A conversion stages entirely to get the best sound from stereo-only analog sources, such as LPs. I say "stereo-only," because the Casablanca doesn't perform any kind of analog surround decoding. If you want to hear Pro Logic surround from an analog source, such as a VCR, the Casablanca converts the analog audio to digital through its high-quality, 18-bit A/D converter and then sends it on to the DSP engine that enables the various surround modes. The Casablanca does have what Theta terms an "Analog Matrix" surround mode, however, which passes left and right signals like bran flakes through a goose, simultaneously tapping them to the A/D converter to derive a DSP-generated L + R center channel and L – R surround channel—essentially a Robo-Hafler circuit. I've never found myself in any listening/viewing scenario where this particular mode was the most appropriate, but at least brawny owners of Audio Research and Naim surround preamps won't be able to kick sand in your face at the beach.

However, you can't run home and plug this thing in right away. You still need to add some D/A conversion cards, which is where the customizing comes in. The Casablanca has three D/A card slots, and Theta offers two grades of D/A cards, Standard and Superior. The 18-bit Standard card is said by Theta to be somewhat better than its $695 Chroma D/A converter, while the 20-bit Superior card is said to fall between its DS Pro Basic III-a ($2,100) and its flagship DS Pro Generation V-a Balanced ($5,600). I happened to have a Generation V-a on hand, so I compared the sound of the Superior card to the V-a plugged into an analog input with the Casablanca in "Analog Direct" mode. Yes, the V-a sounded better, but we're really splitting ant hairs here. I didn't hear much tonal difference, but there was a bit more sense of depth with the V-a than with the Superior card. If I were a rich man, *yada dada deeda dada deeda deeda deeda dee*, I would plug a V-a into the Casablanca for the very best sound from my CDs. But back on planet Earth, I'd be more than happy with Theta's Chroma-grade Standard card for the front-channel audio, much less the 20-bit Superior card.

THE CASABLANCA HAS THREE D/A CARD SLOTS, AND THETA OFFERS TWO GRADES OF CARDS, STANDARD AND SUPERIOR.

With these two grades come further options. You can get a two-channel Superior D/A card if you want the Casablanca to be just a stereo digital preamp. For surround sound, you can stick a single six-channel Standard card in the first slot or a three-channel Superior card in the first slot for the front channels and a three-channel Standard card in the second slot for the subwoofer and surround outputs. Or you can go whole hog and stick Superior cards in both slots for 20-bit processing all around the room. The six-channel Standard card has unbalanced RCA outputs, while the three-channel Superior and Standard cards have balanced XLR as well as unbalanced RCA outputs. And the third slot? Well, that's for when your wife finally leaves your scary ass because you wanted a *third* three-channel card for right front sub, left front sub, and surround sub (figuring if you can go *there*, you're capable of God-knows-what).

The base model Casablanca includes Theta's proprietary DSP surround engine. But if you want to add Dolby Digital, you'll need to get the $500 Dolby Digital board and, if you want to play AC-3 laserdisc soundtracks, the $500 RF demodulator board (DVDs won't need the RF demodulator stage, as they deliver the Dolby Digital bitstream directly via a standard S/P DIF output). The RF demodulator board has two RF inputs plus an AES/EBU digital input, a BNC digital input, and a Toslink optical input; an ST or Theta Single-Mode optical input is optional. DTS decoding requires another $500 board. All three boards were in my review sample.

Although the video card wasn't ready for me to review, it should be available by the time you read this. Forgoing this card means having to plug all of your video sources directly into your video monitor and doing the video switching there while the Theta preamp switches the audio! As I understand it, hard-core video goons do this as a matter of course and look down on anyone who routes video through a surround processor. But, criminy, who wants to punch two remotes every time he switches sources? Theta's video card will handle even the most comprehensive home theater rig; it will have six composite video inputs, four S-video inputs, and full on-screen menus for both types of connection.

All the best surround processors have enough bass management options to cover most systems, but the Casablanca really goes to the mat with its DSP bass crossovers. Not only can you send each individual speaker a full-range signal (or one that's high-pass-filtered to remove the bass in systems where a separate subwoofer handles the low end), but you can adjust the crossover frequency in 20-Hz steps from 40 to 120 Hz. You can also decide how steep a slope you want the high-pass filter to have: 6, 12, 18, or 24 dB per octave (first through fourth order, respectively). And when you decide to bass-manage any of your speakers, the Casablanca is smart enough to send the bass to the front left and right speakers if they're full-range or to a separate subwoofer if one is connected.

Okay, on to the audio modes. In its basic form, the Casablanca has seven modes: "Analog Direct," an all-analog, no-processing, purist stereo pass-through; "Analog Matrix," the Robo-Hafler mode that passes the left and right analog signals and digitally derives an L + R center channel and an L – R surround signal; "Simple Matrix," a full DSP iteration of the Robo-Hafler mode for digital inputs; "Special Matrix," a DSP

mode similar to Dolby Pro Logic but with more extended high-frequency response in the surround channel and what sounds like a subtle stereo-izing there as well; "Dolby Pro Logic" itself, tweaked and polished in the DSP realm by Theta; "Stereo," which is straightforward, two-channel D/A conversion for listening to CDs via a digital transport; and "Mono," which for some strange reason combines the left and right channels into one and sends it to both the left and right speakers. Why it does this, I have no idea, because it would sound much better and more coherent if the mono signal were sent to just the center speaker; off-center listeners won't hear the apparent image jump over to whichever main speaker they are sitting closer to, for one thing. And then, of course, there are the optional surround modes, Dolby Digital and DTS. (I'd love to see other manufacturers offer their own plug-in cards for the Casablanca, like an Audible Illusions phono stage or a Pioneer karaoke board. Karaoke in digital surround would be a turning point for mankind! Why are they keeping this from us?)

Here's another great thing about the Casablanca: This thing is a breeze to set up. Two buttons, "Mode" and "Setup," and an up/down/left/right quartet of cursor controls are on the front panel and duplicated on the remote. "Mode" and "Setup" get you into option menus, and the cursor controls get you where you want to go. As Theta puts it, "The same button that gets you into a menu gets you back out of it." Sounds simple, but believe me, this one thing makes all the difference in the world. Without on-screen menus or even reading the manual, I had the Casablanca dialed in and ready to rumble in no time flat. Theta really scores here for designing a surround preamp that's so comprehensive and yet remains so easy to set up and operate.

THE CASABLANCA IS THE CLEANEST, BEST-SOUNDING SURROUND PROCESSOR I HAVE HEARD.

So how's it sound? Given my strong liking for Theta's two-channel D/A converters over the years, I expected the Casablanca to rock. And looking at the circuit flow chart and feature set, I immediately could tell that Theta had paid full attention to those little areas in which some competitors come up short. Theta must have taken notes about the weaknesses of earlier processors, because it has avoided every one of them. But more important, Theta imported its legendary DSP and D/A conversion and then hung a simple, audiophile-grade analog preamp on the output, avoiding the voltage-controlled amplifiers, digital-domain volume controls, and other sonically compromised approaches to multichannel level control found in other processors. The result is surround sound like I've never heard it before, even from such standard-bearers as the Meridian 565 and the Citation 7.0. The Theta Digital Casablanca is the cleanest, meatiest, and best-sounding surround processor I have heard.

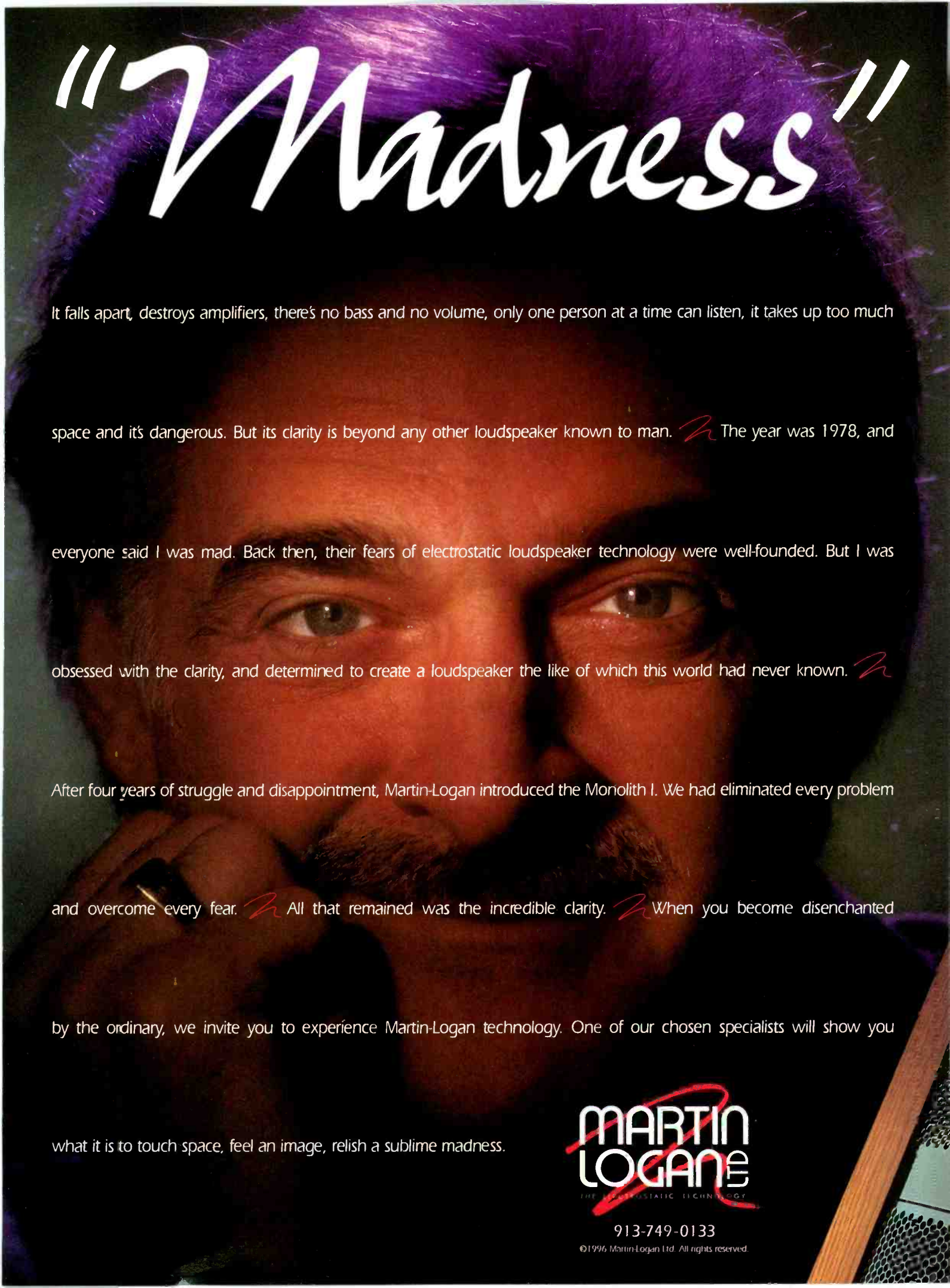
As you might expect from any box sporting the winged Theta logo, the Casablanca has amazing bass. Not just tight and powerful bass but fast, detailed, multidimensional bass, the likes of which I don't hear from the Citation or the Meridian. Bass sounds of all sorts were unraveled by the Casablanca, revealing more complexity and texture than I'd previously noticed. Even something as simple as the opening bass riff at the start of *Apocalypse Now*, when the chopper flies across the screen and The Doors kick off "The End," suddenly sounded like a real electric bass being played by a real guy's finger. (This passage wasn't that clear on the original record and sure didn't gain fidelity when Francis Ford Coppola's technician dubbed it onto the soundtrack, reversing the right and left channels.) It had all the added upper-bass character and color of an old Ampeg tube bass amp.

The Casablanca also beat the other processors in sheer dynamic impact. The Citation is very, very good in this respect, while the Meridian's smoother, gentler character seems to rein in its ultimate fury. But the Theta is the champ here, by a long shot. It's no wonder that an all-out, no-compromise $8,500 processor (the price of the configuration I reviewed) can sound more gutsy and unrestrained than one less than half its price, but the Meridian 565 AC-3/562V combo is right in the Theta's ballpark price-wise, and it doesn't convey anything like the sense of dynamic scale that the Casablanca hurls at the rest of the system. Hearing this difference reminded me of the first time I compared a purely passive preamp to one with a good active buffer on its output. Both sounded pristinely clean and detailed, but the buffered preamp seemed to hurl dynamics at the amp and speakers. Music sounded like it was being played at a faster tempo, and transients leapt into the room like they do in real life. That's precisely the effect that installing the Theta Casablanca had on my reference system. It has never sounded as good as it does with the Theta at the wheel.

The Casablanca sets a new high-water mark for spatial coherence, too. On first listen, it sounded as if its surround channels were lower in level than those of the Citation or Meridian, even though my SPL meter showed perfect channel calibration for all three processors. But after a while, the Theta's subtler, more natural presentation won me over. The Citation's "6-Axis" surround mode throws so much front left and right info back to the surrounds that the sheer quantity of information coming from them can be distracting (even though most of the time it sounds so cool). The Casablanca, on the other hand, carves an accurate sound field that presents the original mix, nothing more and nothing less. It took some getting used to after living with the Citation for so long, but now I'm hooked.

Even in Pro Logic mode, the Casablanca presented surround mixes that sounded precisely anchored, as if I were hearing a good discrete Dolby Digital mix. It's the same kind of improvement I heard when I first compared the sound of a good Philips CD player to the sound of that player's digital output driving a Theta DS Pro Basic D/A converter. In the first seconds of my initial session with the Casablanca, I could tell that its image solidity was markedly better than that of the Citation and Meridian processors. I did most of my auditioning with the Casablanca set for Pro Logic (the "Special Matrix" mode doesn't sound that different, and I found I preferred straight Pro Logic on most movies), but my comments about image solidity apply to Dolby Digital soundtracks as well. The few DTS demo discs I had on hand to audition the

Continued on page 72


"Madness"
It falls apart, destroys amplifiers, there's no bass and no volume, only one person at a time can listen, it takes up too much space and it's dangerous. But its clarity is beyond any other loudspeaker known to man. The year was 1978, and everyone said I was mad. Back then, their fears of electrostatic loudspeaker technology were well-founded. But I was obsessed with the clarity, and determined to create a loudspeaker the like of which this world had never known. After four years of struggle and disappointment, Martin-Logan introduced the Monolith I. We had eliminated every problem and overcome every fear. All that remained was the incredible clarity. When you become disenchanted by the ordinary, we invite you to experience Martin-Logan technology. One of our chosen specialists will show you what it is to touch space, feel an image, relish a sublime madness.
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AURICLE

ANTHONY H. CORDESMAN

REL STENTOR II POWERED SUBWOOFER

It's ironic that one of the world's best subwoofers comes from Britain. Most British speakers lack deep bass, and British hi-fi reviewers sometimes approach low bass as if it were a lower-class aberration, tolerable only in the Colonies. The REL Acoustics Stentor II powered subwoofer rises above—or, rather, delves below—this prejudice. It is musically accurate, and its deep bass and musical dynamics are world-class.

Controls for phase, volume, and crossover frequency are on the rear.

The Stentor II, very definitely a high-end product at $4,000, shows its quality in its sound, not in unusual styling or new technology. Better-finished than most subwoofers, it still looks like just one more big box (23 x 21 x 14½ inches). Only when you try to lift it and find that it weighs 132 pounds do you begin to realize that it is hardly an ordinary subwoofer.

The Stentor II's frequency range is roughly 15 or 20 Hz to 100 Hz, and it has a built-in, 12-dB/octave low-pass filter. Its sole driver, a proprietary 10-inch woofer with a cast magnesium basket, fires toward the floor from its 72-liter ported enclosure.

The Stentor II has a built-in, MOS-FET power amplifier that is said to deliver 200 watts of high-current power and is DC-coupled; like many powered subwoofers, it has a limiter to prevent overloading. On the rear are a volume control and switches for polarity inversion and crossover frequency. The crossover switches, "Fine" and "Coarse," enable you to adjust the nominal crossover frequency from 25 to 100 Hz in 16 gradual steps.

The Stentor II does differ from the pack in two important ways. First, it uses relatively complex resistive loading rather than a standard bass-reflex design. Second, it does not have a built-in high-pass filter; you may need to add one to keep low bass frequencies from going to your main speakers.

Connections to the Stentor II consist of an XLR and two RCA jacks, which are in parallel. The owner's manual tells you how to wire a cable to feed stereo or mono line-level signals to the XLR jack. For speaker-level signals, REL provides a cable with an XLR plug at one end and bare wires at the other. For stereo music, I recommend using the speaker-level connections, which the manual says will provide the highest quality sound. With surround, it might be better to connect your system's subwoofer output to the Stentor II's line inputs; this will enable you to roll off your main and surround speakers' bass below 80 Hz and therefore drive those speakers to higher output levels.

The Stentor II requires extensive breaking in (more than 50 hours) to perform at its best. It also requires a great deal of experimentation with the polarity switch, the "Fine" and "Coarse" crossover switches, and placement to optimize its musical performance and minimize very low-frequency resonances from room interactions.

The instruction manual does a reasonably good job of telling you how to deal with connections and control settings. However, just a single long paragraph is devoted to placement, which greatly understates the value of corner location. (Perhaps the reason the manual says so little about corner placement is that REL presumes the Stentor II will be used with British speakers. Many of these speakers have less bass extension than their American counterparts; when the Stentor II is used with them, its crossover must therefore be set at frequencies high enough to make the subwoofer's output seem directional.)

Before you start experimenting with this subwoofer's placement, I strongly suggest that you read Tom Nousaine's article, "Placing the Bass: Two Subs in a Corner Beats Five in the Round" (*Audio*, June 1996). I

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For literature, circle No. 96

then recommend that you begin with corner placement and next try moving the subwoofer in and out along an 18-inch diagonal until you find where it sounds best. Every room is different. The key to success is experimentation and extended listening; the best result may come from breaking the rules.

Test tones are not enjoyable listening, but they can give you considerable insight into a subwoofer's ability to deliver extremely deep bass, to do so at loud volumes, and to clearly differentiate one bass tone from another. The REL Stentor II's performance with sine-wave test tones and third-octave pink noise was outstanding. Very few subwoofers can reproduce test tones as solidly and cleanly to the depths below 35 Hz as the Stentor II did. It also proved exceptionally clean with sine-wave and pink-noise sweeps. The few colorations I did hear were mostly due to problems of my listening room.

The real test of audio equipment is how it sounds with music, and the Stentor II did a superb job on disc after disc. I played all of my bass spectaculars and a wide variety of organ and bass drum music. This included several very demanding tracks: organ music going down well below 32 Hz (e.g., Frederick Fennell, *Pomp & Pipes*, Reference Recordings RR 58), the usual Telarc bass drum spectaculars, bass synthesizer and bass guitar music (*The Absolute Sound*, Hearts of Space HS-11103), and the famous heartbeats on Pink Floyd's *Dark Side of the Moon*. The Stentor II seemed to fill in the bottom half-octave almost seamlessly, with no added warmth or overhang.

This is one subwoofer whose ultra-low bass contributes to the music rather than dominating it. The Stentor II easily handled the most demanding deep bass from solo instruments, the most complex percussion music (the *Sheffield Drum & Track Disc*, Sheffield Lab 11420, and its LP version), and orchestral music (Eiji Oue with the Minnesota Orchestra on Stravinsky's *Le Sacre du Printemps*, Reference Recordings RR 70).

The Stentor II also delivered outstanding musical accuracy on many LPs and CDs whose deep bass content is limited. On these recordings, subtlety—not power—is required; a subwoofer must deliver tight, musically accurate bass on low- to mid-level signals and do so without coloring the

THE REL STENTOR II IS MUSICALLY ACCURATE, AND ITS DEEP BASS AND DYNAMICS ARE WORLD-CLASS.

music. The Stentor II was almost sonically invisible in such cases. It delivered the amount of bass that was actually there, and only that bass.

A subwoofer this good would be wasted if it were used with a main speaker that has significant bass problems, one whose bass rises just before it cuts off or whose bass response is so weak that it requires a crossover setting much higher than 80 Hz. A cutoff much above 80 Hz could make the subwoofer's location audible and, in my experience, lead to excess warmth in the overall sound.

That said, it should be unusually easy to match the Stentor II to a wide range of high-quality main speakers. It may not have a built-in high-pass filter, but the ability to set its crossover frequency in very small steps from 100 Hz down to 25 Hz helps provide an excellent match between the Stentor II and the bass rolloff of well-designed main speakers. For example, I found that the REL best matched my main speakers at lower crossover frequencies than I am used to using with them. The Stentor II's ability to cross over very low is a major advantage because it reduces the ear's ability to localize the subwoofer or otherwise distinguish it from the main speakers, thereby improving the overall sonic blend. (When used at high crossover frequencies with typical 12- to 18-dB/octave crossovers, most subwoofers can audibly pass lower midrange tones.)

The Stentor II is one of the few subwoofers possessing the speed, dynamic range, and flexibility to match up well with even ribbon and electrostatic speakers. Although a purist might want to use a dedicated crossover with them, I got good performance from the Stentor II with Thiel CS7s, the ribbon drivers in Apogee Studio Grands, and Quad ESL-63s. These very demanding, reference-quality speakers have vastly differing requirements, and the Stentor II did well with all of them.

The Stentor II is considerably more live and dynamic than many powered subwoofers of its size; equally important, it is more musically natural. It does not, however, have the dynamic capabilities of the largest subwoofers and bass towers. After all, there are limits to what a single 10-inch driver can do. If you are looking for the ultimate in deep bass dynamics and power for home theater, I would recommend REL's Studio II subwoofer ($8,000).

The Stentor II performed very well in my audio/video system when I kept listening levels within rational bounds. I could hear the effects of its power limiter when I played extremely demanding Dolby Digital (AC-3) soundtracks at full volume, and it started breaking up at levels where a few other subwoofers, designed to deliver more than 110 dB SPL, are still going strong. On the other hand, the Stentor II experienced these problems only at sound pressure levels well in excess of 105 dB.

The REL Stentor II was remarkably impressive. Unlike many products that claim to be subwoofers, it really did reproduce the lowest depths. It did not alter the sound of organ, percussion, piano, cello, or bass violin. Instead, it smoothly provided, with as much "concert hall" or "live performance" realism as my room allows, the bottom octave or half-octave of bass that the vast majority of full-range speakers can't deliver. Yes, it was also a very good subwoofer for home theater, but artificial spaceship, bomb, and cannon noises are more a test of loudness than of listenability. Audiophiles will value the REL Acoustics Stentor II for the superb way it reproduces the bass in classical, jazz, and acoustic rock music. A

AURICLE

ANTHONY H. CORDESMAN

APOGEE ACOUSTICS SLANT 6 SPEAKER

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For literature, circle No. 97

My love affair with ribbon drivers dates back to the Kelly tweeters in a speaker system that I had as a student, back in the 1960s. Even now, I suspect the Kellys would provide some of the cleanest treble around, though only within their narrow frequency range and their limited dynamic range. But today's ribbons, reflecting 30 years of evolution, offer smoother frequency response (including full midrange coverage), excellent dynamic range, much better dispersion, and reasonable efficiency; they also present relatively normal loads to an amplifier. Ribbons have unique sound qualities and provide a great deal of information and detail in an exceptionally musical, natural form. I am not sure that current ribbons are measurably or audibly "faster" or "cleaner" than the best current dome tweeters. Yet they are certainly competitive with the best domes, and some ribbon drivers have better upper-octave performance than any electrostatic I've heard.

These qualities are a key reason I use the Apogee Acoustics Studio Grand as one of my reference speakers, and the ribbon in the Slant 6 has many of the same advantages. (Apogee is phasing out the "Centaurus" designation that appears on the Slant 6 I reviewed.) However, the Slant 6's ribbon is not a full-range exotic driver but a 26-inch dipole, crossing over at 1.2 kHz to a 6½-inch cone woofer. This hybrid design offers many of the benefits of a full-range ribbon in a less expensive ($2,500/pair) and much smaller package.

The Slant 6 looks surprisingly small, considering its size (14½ inches wide x 14¼ inches deep x 52½ inches high), because its rounded and slanted shape makes it seem less obtrusive. Further, it weighs only 80 pounds, enough to be solidly built without presenting the weight-lifting challenges posed by full-range ribbon loudspeakers.

The 26-inch ribbon in the Slant 6 may be too small to cover the entire midrange or create the broad, spatially fixed image of a full line source, but it sounds exceptionally clean and coherent. It is smooth and sweet but doesn't sacrifice life or dynamic excitement. As a result, this is a highly competitive speaker in one of the most demanding price ranges in the high end.

The Slant 6 demonstrates that hybrid speakers can deliver a remarkably smooth transition between their cone woofers and their ribbon or electrostatic top-end drivers, which was not the case a mere half decade ago. Today's best hybrids minimize the differences in driver directivity, efficiency, and apparent speed that once made such speakers' crossover points all too audible, and they no longer pose dauntingly complex loads to amplifiers.

The Slant 6's woofer has a large voice coil and heavy magnet, placed in a well-designed, solidly built reflex enclosure that produces no audible port noise. The speaker is easy to bi-wire, uses very high-quality speaker connectors, and comes with spikes. A three-position switch enables you to adjust the relative level of the woofer and ribbon, helping to compensate for inevitable interactions between the room and the speaker.

The Slant 6 needs extensive breaking in (I put some 50 hours of music into the speaker before I felt it sounded its best), but this is becoming common and is scarcely a big deal. In spite of rubbish you may hear, breaking-in does not require special CDs or tone generators. Just use FM interstation hiss, or set your CD player to repeat a disc indefinite-

ly while you're at work or out of the room. Moderate volume seems to work fine; there's no reason to annoy yourself or your neighbors.

Do pay close attention to the Slant 6's setup instructions. To get the best imaging and highs, it's critical to adjust the speaker's tilt to optimize its sound at your listening position. (A small mirror is provided to help you get this right.) And pay equal attention to the manual's instructions about placement, spacing, and toe-in—at least as a starting point. The Slant 6 is sensitive to all these factors, perhaps because it is a dipole and has a large radiating area to the rear. I've read ads, articles, and engineering tracts that say dipoles are less sensitive to room effects than other speakers are; all of my practical experience tells me that's not the case.

THE APOGEE SLANT 6 GIVES YOU MANY OF A FULL-RANGE RIBBON'S ADVANTAGES, AT A LOWER PRICE.

Speaker placement and room characteristics always have a major impact on a speaker's sound character, and this seems to be especially true of dipoles. Relatively minor changes in the distance between the speaker and the wall behind it often affect the apparent energy and focus of the upper octaves, softening them or making them seem slightly bright; placing a dipole too close to a side wall or piece of furniture can smear or confuse the soundstage. The absorption or reflectivity of the wall behind the speaker can also affect upper-octave energy and the soundstage, as can placing ribbon drivers too close to furniture or a shelf.

To get the very best out of the Slant 6, you have to go beyond the manual and find how far apart the speakers must be to yield the widest soundstage without loss of center fill, imaging quality, and depth. Tweaking the toe-in may not be vital, but the soundstage is so well focused that you'll miss a lot of sonic nuance if you don't take the time to experiment.

It also takes experimentation to find the room placement that simultaneously gives you the best sound from both the Slant 6's ribbon tweeter and its cone woofer. Fortunately, this was significantly easier than with many hybrid speakers I've tried. To some extent, I credit this to the Slant 6's woofer, which appeared to emphasize speed and dynamics over deep bass power. (Its bass rolloff tapered smoothly below 35 or 40 Hz, without rising to an audible peak.) These woofer characteristics not only improved the sonic match between the ribbon and the cone but also made the Slant 6's bass less sensitive to room placement. In three different rooms, I could position the speaker for optimum midrange and treble performance without making major sacrifices in bass.

Even after I played around with room placement, I found the Slant 6's woofer just a bit warm in the mid-bass, upper bass, and lower midrange. Fortunately, this warmth sounded pleasant with many close-miked recordings and was not accompanied by the bass overhang that blurs detail and compresses musical passages that have lots of deep bass energy. The bass was good, not great. There was a surprising amount of bass energy and detail, and the low bass was audibly present when required. However, as is common with speakers in this price range, real bass power kicks in only above 45 Hz.

The Slant 6 handled percussion transients and dynamics more naturally than most of its competitors and did an equally good job of reproducing bass guitar, synthesizer, piano, and bass viol. Organ notes were well defined, with minimal blurring and little tendency to compress the organ's dynamic range.

I could hear some transition problems in the lower midrange that went beyond a touch of warmth. Although the woofer's sound blended well with the ribbon's, the blend was not as seamless as in some far more expensive hybrids. Because those speakers have larger ribbons or electrostatic panels, their crossover frequencies can be low enough to be nearly unnoticeable. (To make the crossover truly inaudible, it would have to be at 90 Hz or lower.) A lot of the coloration could be minimized by slightly altering toe-in, slightly adjusting the speaker's distance from the wall behind it, and changing the setting of the switch on the speaker's rear.

The Slant 6's ribbon does not cover the entire midrange, as the ribbon of Apogee's Studio Grand ($13,000/pair) does. I found the Slant 6 had a bit too much upper-midrange energy and life above 1 kHz, which sometimes gave it a slightly forward soundstage perspective. To compensate, this speaker offered the exceptional midrange transparency, detail, and speed above 1 kHz of the best ribbons and electrostatics. It had a great deal of upper-octave life and energy, without hardness. There were no significant rough spots. When I moved my head a bit, I heard no sudden shifts in imaging or treble energy. The treble and soundstaging were surprisingly stable over a relatively wide horizontal listening area. You could probably fit two or three listeners into the listening area at reasonable distances.

The Slant 6 had a slight rolloff in the top octave, but this complements most recordings, especially digital recordings. I doubt that even those audiophiles who are used to far more expensive speakers will miss much when listening to the Slant 6, provided their ears are below the top of its ribbon driver. (The Slant 6's upper-octave energy seemed to fall off sharply if I was standing or sitting too high.)

The soundstage produced by the Slant 6 was large and open and had lots of depth. At the same time, the image was of natural size and had excellent stability and focus. This speaker was about as good as Apogee's Mini Grand in its ability to reproduce soundstage depth, soundstage width, and ambience. And it did so even with complex classical music recordings, such as the LP of the Drottningholms Barokensemble's *Barock* (Proprius 7761), which has a very complex mix of tenor voice and strings and a lot of depth and space. One CD passage was especially revealing of the Slant 6's strengths, the seventh and eighth minutes of the Dallas Symphony Orchestra on Shostakovich's Symphony No. 7 (Dorian DOR 90161).

The Slant 6 combined particularly good depth reproduction with good back-to-front imaging. Some speakers tend to do better at left-to-right than front-to-back imaging; others tend to shift instruments away from the center and cluster them near the left and right speakers. The Slant 6 was scarcely perfect in these respects, but its performance was competitive with anything I have heard in its price range.

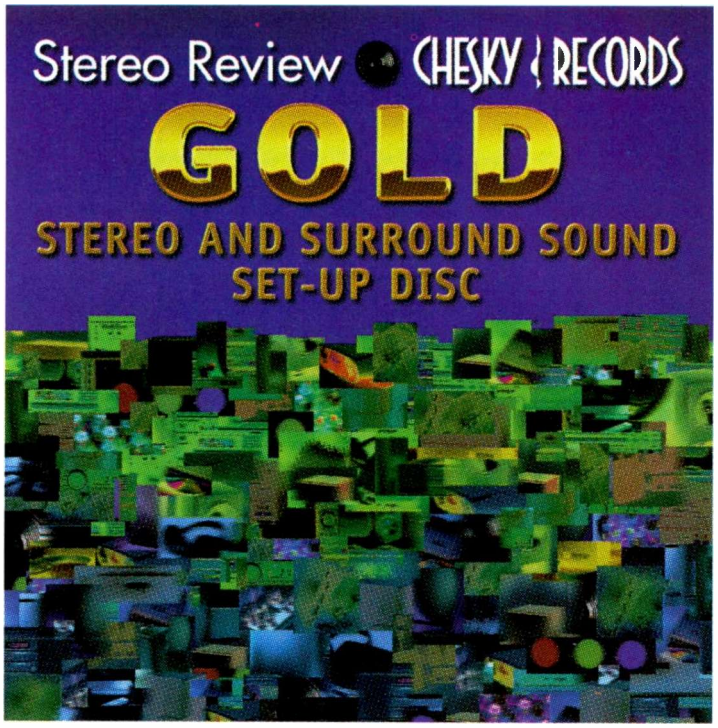
The Slant 6 needs an amplifier that produces far more than 50 watts per channel and one that is load-tolerant. I would not recommend using a solid-state amp that doesn't have considerable current as well as voltage capability or a tube amp that has trouble delivering deep-bass power or controlling woofers.

This speaker is not particularly cable-sensitive. Symo cable seemed to work best with the Slant 6, but a variety of AudioQuest, Discovery, and Wireworld cables performed very well. Goertz cable did less well, and I'd be particularly careful of speaker cables that have trick terminators.

Auditioning the Apogee Acoustics Slant 6 reminded me that very good ribbon drivers are available in very affordable hybrid packages. This speaker brought musical pleasure and life to a wide range of recordings, and its trade-offs were always musically natural, regardless of the instruments or voices being reproduced. Its sound was outstanding, in one of the most competitive price ranges in high-end audio. A

LISTEN AND LEARN

Stereo Review and Chesky Records Introduce The Gold Stereo And Surround Sound Set-Up Disc



Stereo Review and cutting-edge audiophile label Chesky Records have produced a most entertaining and informative set-up disc. This jam-packed (76+minutes) gold CD runs the gamut from basics like speaker channel ID and phasing tests, to fun stuff like *The Wandering Audiophile*, which clearly demonstrates how low frequencies are distributed throughout your listening room, and *The Clap Test*, that just might be the first step to improving your room's acoustics. And you won't even have to reach for your bifocals to read the CD booklet—an announcer talks you through all of the tests and demos. You're free to settle back into your comfy chair while you listen and learn.

Chesky Records' Producer Steve Guttenberg and Writer/Technical Consultant Anthony Chiarella joined forces with Stereo Review's Technical Editor David Ranada to create this must-have Set-Up Disc. Utilizing test tones developed by David Ranada, the primary goal was to make this disc as easy to use as possible, and to fashion a tool that could effectively improve the performance of most Stereo or Home Theater systems. Mission accomplished!

The *Subwoofer Set-Up* tracks will improve the integration and blending of subwoofers with your main stereo speakers; the *Shake, Rattle, And Roll* test reveals the frequencies of your listening room's resonances; there's a section dedicated to optimizing stereo speaker set-up; you'll be amazed by the three-dimensional acoustics of the *Imaging And Soundstage* demo; and for Home Theater fans, there are a battery of *Dolby Pro Logic*™ surround sound tests. This Gold CD also features a generous sampling from Chesky's latest releases, which serve as musical illustrations for each test. Tracks include new music from Chesky's women of song, Rebecca Pidgeon, Sara K, & Ana Caram; Jazz legends Oregon and Paquito D'Rivera; guitar virtuosos Badi Assad and Carlos Heredia; a dash of Mozart; some lovely music from the Westminster Choir; even a "Theater Without Pictures" piece from Igor Stravinsky's "The Soldier's Tale".

There's also a track from Chesky's trailblazing New Age/World Music group I Ching's new CD, "Of The Marsh And The Moon". This CD was recorded with a new process dubbed "Natural Surround Sound". Unlike other surround sound systems which require a decoder and four or more speakers, "Natural Surround Sound" is 100% compatible to any conventional two-channel, two speaker stereo system. Remarkably, this process eliminates "magic" boxes or processing of any kind in the recording chain, or even in post-production. As you listen to the I Ching track, you'll hear ambient sounds well in front of the plane of the stereo speakers! Truly an out of this world music experience!

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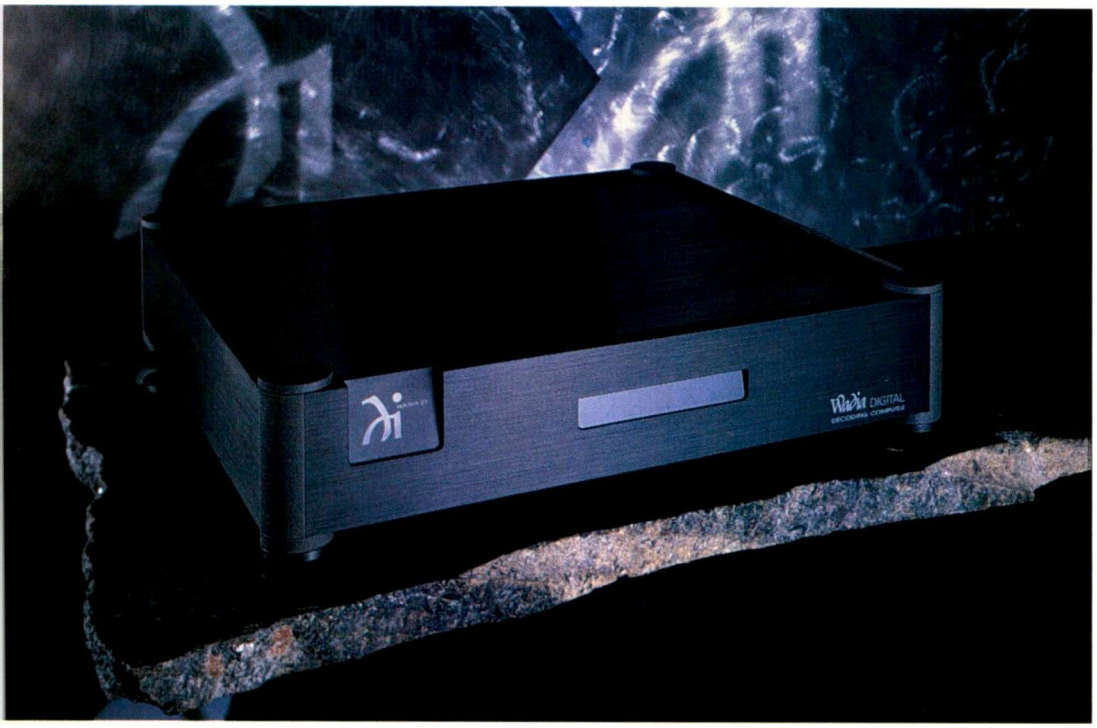
WADIA 27 D/A CONVERTER



It's hard to get a good perspective on an audio component with the technology and price of the Wadia 27 Decoding Computer. What do you get from a D/A converter costing $8,450 that you don't get from less expensive models?

For one thing, the Wadia 27 possesses outstanding technology and specifications, a wide range of useful features, construction quality and styling that belong in the Museum of Modern Art, and superb sound. Expensive as it may be, it meets every test relating to value for money I can think of. Furthermore, the Wadia 27 can be used as a digital preamp, enabling you to eliminate the coloration inevitable in the use of a separate preamp and extra interconnects. The features that make this possible begin with six digital inputs (one AES/EBU input with an XLR connector, two coaxial inputs with BNC connectors, two ST optical inputs, and one Toslink optical input) and versatile analog outputs (the balanced XLR and unbalanced RCA outputs can be used simultaneously, and internal switches can set the audio output voltage to suit your preamp). Equally important are the Wadia's digital volume and balance controls, which are free of any apparent coloration. You can even use the Wadia 27 to control a system containing both digital and analog sources, by adding the Wadia 17 A/D converter.

The Wadia 27's front panel has no buttons or controls, just an alphanumeric display that indicates control settings. Operation is handled by the remote control, which you can use to vary volume in steps of 0.5 dB and channel balance in 0.1-dB steps. It also has muting and absolute-polarity buttons and can be used with any Teac-based Wadia CD transport.

The Wadia delivers 24-bit digital processing by way of two Motorola 56000 DSP chips, and 22-bit digital resolution and throughput via eight Burr-Brown 1702 DACs in full-differential mode. These chips are all surface-mounted; Wadia feels this improves performance because of the shorter lead lengths and reduced number of internal connections. Like most Wadia products, the 27 is easily upgradable: The ROM controlling its software-based digital filtering is socketed for easy replacement, each of its six circuit boards is devoted to one specific function and is removable, and the rear panel is modular. This upgrade capability, which includes the possibility of sampling rates up to 96 kHz, may be of great value if the industry ever moves to a CD technology more advanced than today's system.

The Wadia 27 has full 64-times oversampling, accomplished by performing 16-times Spline resampling in the Motorola chips and four-times first-order LaGrangian resampling in dedicated chips. Because a single DAC chip can't handle 2,822,400 samples per second (64 times CD's 44,100), the resampling chips feed each channel's four DAC chips sequentially, 705,600 samples at a time. The Wadia 27 has a proprietary jitter-reduction circuit called RockLok. The output stage uses surface-mounted Burr-Brown OPA642 current-to-voltage converters and Burr-Brown BUF634P output buffers. The circuits are on four- and six-layer boards with integral ground planes. The power supply uses dual toroidal transformers, 36 individual stages of regulation (plus a four-stage, 60-watt preregulator), and more than 30,000 microfarads of filtering and energy storage.

Company Address: Wadia Digital, 624 Troy St., River Falls, Wisc. 54022; 715/426-5900.
For literature, circle No.98

The cabinet is fairly compact (4⅛ inches high, 17 inches wide, and 16 inches deep). However, it weighs 32 pounds because of its thick chassis panels, which double as heat sinks, and because the transformers are on a subchassis that isolates them electrically, mechanically, and acoustically.

Even though I've heard more D/A converters than is good for my psyche, I can't say how the Wadia (or any other top D/A) sounds in comparison to all its competitors. I have not heard even a quarter of the contenders in the $3,000+ range, but I did compare the Wadia 27 with the $15,950 Mark Levinson No. 30.5 and the $5,595 Theta Digital DS Pro Generation V-a Balanced, two of the finest-sounding converters I have heard.

Listening comparisons with even a few top-quality D/A converters are anything but easy to conduct. Even if you match the converters' output levels within a fraction of a dB, the sound characteristics of the reference system and room interactions introduce extraneous colorations. Further, some CDs sound better with some D/A converters than with others, in ways that are atypical of CDs in general.

THE WADIA 27 HAS OUTSTANDING SPECS AND TECHNOLOGY, ART-MUSEUM STYLING, AND SUPERB SOUND.

I tried to get around these problems by using CDs from many labels, using several different transports (principally the Mark Levinson No. 31.5), and using three different audio systems in different listening rooms. Such listening showed me that many of the sonic nuances that distinguish one D/A converter from another in one system and room are not repeatable in other systems and rooms. There are audible interactions between the converter, the rest of the system, and the room. The most important differences were audible in all three rooms.

That said, my listening experience convinced me that the Wadia 27 will likely be a top performer in any system. Its timbre was consistently accurate in reproducing my reference CDs and DATs that contain natural acoustic performances of classical music, jazz, solo voice, and solo instruments.

There are more euphonic D/A converters than the Wadia 27, and it may not have the warmth or slightly softened treble of some top-of-the line models that use vacuum tubes in their output stages. On the other hand, the Wadia 27's rendition of the overall timbre of strings, woodwinds, brass, percussion, and voice was simply as "right" in reproducing what was on the original CD or DAT as that of any D/A converter I've encountered. Although you can fully appreciate the Wadia 27's timbral accuracy only by listening to a wide range of music, the instrumentals and vocals on Alan Parsons' and Stephen Court's *Sound Check* (Mobile Fidelity SPCD 015) provide a good starting point for understanding why I praise the Wadia's musical realism and accuracy.

The only D/A converter I have heard that produces a slightly more natural timbre on some CDs is the Levinson 30.5, which costs nearly twice as much as the Wadia 27. The Levinson's midrange sounded a bit more natural on strings and piano, although it may not have been quite as realistic as the Wadia in the bass. The Theta unit also had a musically natural timbre but slightly more upper-octave energy than I believe was actually in the recordings.

The Wadia's transients and dynamic response were excellent and musically natural. The Wadia resolved low-level detail, complex musical passages, and complex musical harmonics without any artificial hardness or spotlighting of detail. This high resolution also gave the Wadia an unusual ability to reveal sonic differences between CD transports and various types of CD mastering without adding significant colorations of its own.

I would rank the Levinson 30.5 as slightly superior in sheer resolving power, particularly with very low-level musical passages and old CDs. However, the Levinson's dynamic transients seemed a bit soft, and the match between dynamics and timbre was better with the Wadia. The Theta's dynamics and detail also matched its timbre, but a touch of synergistic coloration made its performance seem closer to the instruments than was entirely natural.

There were some interesting differences among the three D/A converters in specific areas of the frequency spectrum and in soundstage performance. The Theta had the most bass dynamics and energy, the Levinson had the most bass definition and tightness, and the Wadia struck a balance between them (although its sound was closer to that of the Levinson). These differences in the bass emerged clearly in Eiji Oue's recording of several Stravinsky pieces (Reference Recordings RR-70), in *Jacques Loussier Plays Bach* (Telarc CD-83411), and in the National Philharmonic Recording of *The Mysterious Film World of Bernard Herrmann* (Mobile Fidelity UDCD 692). I admit that these bass differences had limited overall musical significance, but they were more immediately apparent than other sonic differences between converters. (I suspect these differences in bass energy and definition may explain why some reviewers refer to one converter as doing more to preserve the beat or rhythm of the music than another. A D/A converter cannot introduce meaningful timing errors in the bass beat, but the "beat" may seem stronger if the bass sounds louder or more dynamic.)

The differences in the midrange and treble related more to the reproduction of dynamic contrasts than to differences in frequency response or timbre. The midrange timbres of the Wadia 27 and Levinson 30.5 were almost the same, but the dynamic contrasts in the Wadia were a little sharper. The apparent midrange response of the Theta Generation V tilted just slightly toward the high end, and dynamic contrasts were sharper than in the other two units.

In the treble region, there were no striking differences among the converters in energy or extension. All three had excellent air and harmonic definition in the top octaves, although the Levinson seemed to have slightly cleaner harmonic detail and the Theta had a touch more apparent treble.

All three units reproduced an excellent soundstage, but the apparent soundstage of the Theta was a bit more forward than that of the other two units. The Levinson's soundstage was more mid-hall, and the Wadia's was just a bit forward of that. All of the D/A converters presented excellent width and depth, but the Levinson and Wadia portrayed a bit more depth than the Theta. Soundstage detail, ambient information, and imaging were very good with all three, but the Levinson had a trace more sound-

stage detail than the other two. Interestingly, my son—who is no fan of either classical music or listening comparisons—picked this difference out consistently in blind comparisons using fairly ordinary recordings (such as the Haydn trumpet concerto on L'Oiseau-Lyre 417610).

Performance did vary according to the type of CD I played, but not always in the ways I would have predicted. Somewhat to my surprise, I did not notice any consistent change in the three converters' sonic characteristics when I played CDs labeled "20-bit" or discs made with advanced mastering technologies like Sony's SBM or JVC's XRCD. Although some CDs did sound cleaner than others, their recording and production values shaped sound quality far more than any specific recording process or D/A converter did. The "techno-hype" on the CD's cover rarely correlated with how good the recording really was.

The Wadia 27 does not have HDCD decoding. But prolonged listening to HDCD recordings through the Wadia and through the Levinson and the Theta in their HDCD modes convinced me that the Wadia's lack of this circuit was no drawback. It also convinced me that HDCD is largely a waste of time. I have been impressed by the overall quality of recent HDCD recordings and of the filter used in HDCD decoding, but playing HDCD discs through the Levinson and Theta did not reveal any musical information that I could not hear from the Wadia. I also detected no musical detail on HDCD recordings that was not available, and just as musically convincing, on many top CDs without HDCD encoding.

It was interesting to use the three D/A converters to listen to the same recordings with and without HDCD. These comparisons are available on *HDCD Sampler 2* (Reference Recordings RR-905CD) and Doug MacLeod's *You Can't Take My Blues* (AudioQuest AQ 1041). Even though the Wadia 27 does not provide HDCD decoding, the HDCD-encoded tracks on the Reference Recordings disc still sounded better than the tracks mastered with Sony's 1630 and KOJ-701ES A/D converters—possibly reflecting the fact that neither the 1630 nor the KOJ-701ES is a state-of-the-art converter. In contrast, the non-HDCD passages on the Doug MacLeod album sounded better than the HDCD-encoded passages. This held true with the Wadia, the Levinson, and the Theta. Apparent dynamic range and soundstage detail were slightly better without HDCD via all three converters, and the upper midrange seemed more harmonic and natural. In fact, the recordings made using the Apogee A/D 1000-20 Super Encoding System sounded as superior to those made with the HDCD encoding system as the HDCD-encoded tracks seemed to those made with the Sony 1630 and KOJ-701ES. And none of these recordings, incidentally, approached the transparency and musical integrity of the best true 18- and 20-bit recordings I have heard.

I also compared the sound of the Wadia to that of top mid-priced D/A converters from Adcom, Audio Alchemy, and PS Audio. On many types of music, the differences between it and the mid-priced units were scarcely to die for. Today's best mid-priced D/A converters are very good indeed. And the differences I did hear again depended on the recording and the associated components. However, there were some sonic differences that were musically significant when I played really good recordings on a really clean system.

Such differences in sound quality involve the same diminishing returns you expect when making an investment in any high-end electronics. You do not get the kind of sharp audible differences you do when you compare top speakers with similar price differences. What you do get is more harmonic detail and natural harmonic integrity—particularly with strings, piano, and woodwinds—and a sweeter, more detailed sound. Soundstage resolution is better, as is the overall quality of left-to-right and back-to-front imaging. Depth is as natural as the recording permits, without the slight foreshortening or slight sense of echo common to the less expensive units. Bass and dynamic contrasts are better defined.

Yes, there are diminishing returns in paying thousands of dollars for a D/A converter. However, the differences are important enough for me to find that a converter like the Wadia 27 is aesthetically competitive with the best in analog sound, while mid-priced converters are not. This is the name of the game in high-end audio, and it gives you the same justification for buying the Wadia 27 that a different set of passions does for buying a Rolex or a Mercedes. A

THETA, *continued from page 62*

Theta's DTS board sounded fine, although I heard nothing in the DTS-encoded laserdiscs or music CDs that suggested any kind of sonic advantage over Dolby Digital. (DTS CDs may someday be filed next to dbx LPs in the Dumb-Ass Audiophile Ideas warehouse. But if you want the option to play whatever titles come out in the format, Theta again has got you covered.)

Is the Casablanca perfect in every way? Yes and no. In terms of sound quality and movie surround processing, it's far and away the best I've heard. But I did not find the music surround modes very interesting or usable. It's not that they're whacked out, like so many of the cheap 'n' cheesy DSP surround modes in typical A/V receivers, but just the opposite. Being nothing more than Robo-Hafler sum/difference circuits, the Theta's analog and digital matrix music surround modes sound relatively dull and just aren't as sophisticated and awe-inspiring as the Citation 7.0's "6-Axis" mode or the Meridian 565's "Tri-Field" mode. Both of these modes take a stereo music signal and generate an intensely vibrant, always appropriate, very natural surround presentation. Yes, the Theta has an L + R center channel and an L – R surround channel, but to my ears they sounded dated and weird on most of my CDs. Maybe these modes would sound better with classical music than with Hendrix, Coltrane, and Sebadoh. As it was, I ignored the matrix modes and used just Dolby Pro Logic for movies and straight stereo for music. The Casablanca's startling sound quality in these modes made it pretty easy to forgive its lack of cool music surround capabilities.

That aside, the Theta Casablanca is an undeniable success. Its combination of simple, intuitive setup and operation; stunning Theta-grade digital sound quality in stereo, Dolby Pro Logic, Dolby Digital, and DTS; and an obsolescence-free design push it to the front of the race for best surround preamp on the market. If your main goal is synthesized music surround from stereo CDs, you will be happier with the Meridian 565 or the Citation 7.0. But you won't get better sound quality in stereo and Dolby Digital/Pro Logic. And if the best is what you're lusting after, the Theta Digital Casablanca should be the beginning of a beautiful relationship. A

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Q I want a home theater but, I don't want speakers all over the place, what can I do?

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—Douglas Sullivan
VIP Systems
Westlake Village, California

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—Chris Perkins
Cookin'
Manchester, New Hampshire

Cookin'

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.

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CLASSICAL RECORDINGS

Illustration: Marina Sagona

Bach: The Well-Tempered Clavier, Part I
Valery Afanassiev, piano
DENON CO-78834-35
Two CDs; DDD; 138:20
Sound: A, Performance: A

The equal-temperament system has been around for so long that most of us have never heard anything else. Yet in Johann Sebastian Bach's day, the subject of temperament—different methods of dividing the octave—was still controversial. Many musicians still adhered to the richness of the pure intervals produced by the older tuning systems. The problem with these older systems was that they were limited to only a few keys (C major, G major, F major), and playing in remote keys (D-flat major, G-sharp minor, F-sharp major) resulted in music that was horribly out of tune.

Brilliant composers such as Bach were not about to limit themselves to only a few keys. Therefore he advocated the "equal-tempered" tuning system, whereby an octave is divided into 12 equal parts. This was an acoustical compromise. Although the pure intervals of the older tuning systems would be unavailable, equal temperament would enable composers to write in remote keys; for Bach, this flexibility was well worth the compromise.

As if to champion equal temperament, Bach composed a set of 24 preludes and fugues—one in each of the 12 major and 12 minor keys—that he called The Well-Tempered Clavier. Bach used this first part, which he finished in 1722, in the education of his sons. He carefully wrote out a copy each for two of them, Wilhelm Friedemann and Carl Philipp Emanuel; these copies still exist today. (Bach finished another set of 24 preludes and fugues in 1744, completing The Well-Tempered Clavier as we know it.)

For almost two centuries, these pieces have been staples for young pianists. The artist of this recording, Valery Afanassiev, knew all of them by heart before he entered the Moscow Conservatory. Each prelude and fugue presents a different aspect of Bach, and The Well-Tempered Clavier has become a milestone in musical thought. As Albert Schweitzer, the eminent organist and Bach scholar, put it, "It is not as though we enjoy The Well-Tempered Clavier as much as we are edified by it."

Although Bach originally composed the work for the clavichord (and it is often performed on the harpsichord), this Denon recording of a modern piano is extremely effective. Afanassiev's playing is thoughtful and sensitive, maintaining a critical balance between the cerebral and the romantic. It is inter-

BERLIOZ

Roméo et Juliette
Olga Borodina, mezzo-soprano; Thomas Moser, tenor; Alastair Miles, bass; Bavarian Radio Choir; Vienna Philharmonic, Colin Davis
PHILIPS 442 134
Two CDs; DDD; 1:36:19
Sound: A, Performance: A

Of all the world's outstanding conductors, none has more sterling credentials for conducting Berlioz than Sir Colin Davis. This recording is everything one might reasonably hope for in a Davis performance in any musical capital of the world—though the distinctively ripe beauty of the Vienna Philharmonic is not likely to be duplicated elsewhere. Still, the slick internationalism leaves one hankering after something a little fresher and a little more idiomatically French. But never mind; it's a fine job musically and sonically. *Robert Long*

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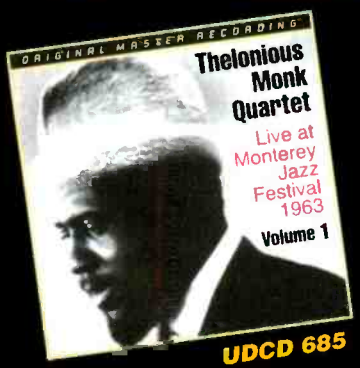

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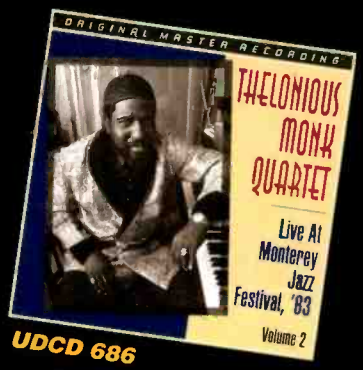

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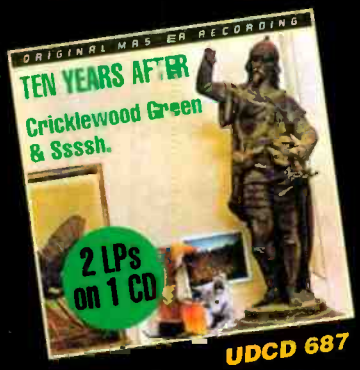

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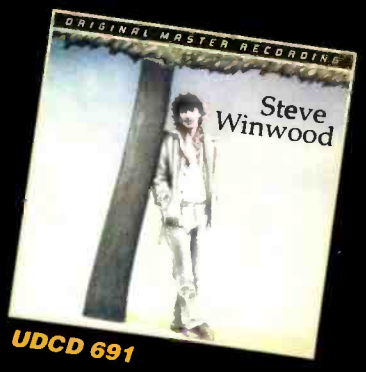

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MANUAL ROSENTHAL

Orchestral Works

Catherine Dubosc, soprano; Orchestra Symphonique et Lyrique de Nancy, Jérôme Kaltenbach
MARCO POLO 8.223768
DDD; 59:17
Sound: B, Performance: A

Manual Rosenthal is remembered primarily as the arranger of "Gaité Parisienne" from bits of Jacques Offenbach's operettas. He also was well established as a conductor. But here he is represented as a composer. There are two orchestral suites—"Les petits métiers," a musical characterization of Parisian tradesmen, and "Musique de table," an eight-course musical repast—plus three brief song cycles with orchestra.

A student of Maurice Ravel and obviously influenced by him, Rosenthal's music nonetheless contains passages that bear a closer relationship to his nearer contemporaries, notably Jacques Ibert and Francis Poulenc. The songs may remind you of Ravel's *Shéhérazade*, but the ebullient and even raucous outbursts in some of the orchestral movements add spice to the "classic cuisine" of his writing.

There are all sorts of sonorities to savor, and this disc could serve as first-rate demo material if the hall where it was recorded were acoustically a little mellower and a little less reverberant. As it is, the soundstage is somewhat diffuse, and musical detail sometimes seems obscured by the ambience. The performances are very solid, however, and the music is, among other things, great fun. *Robert Long*

esting that after a childhood filled with The Well-Tempered Clavier, Afanassiev put it away and "didn't touch it for 27 years." Now, with the experience of an adult concert artist, his interpretation of each movement reveals a maturity of style and remarkable consistency.

Afanassiev is also a writer and poet. His program notes for this two-disc set are fascinating (he sees James Joyce as Bach's literary successor) and include his *Homage to Bach*, a poem depicting the artist's feelings about Bach's life and work through allusions to everything from Shakespeare's sonnets and Webern's cantatas to cups of coffee and Indian monks. Concerning The Well-Tempered Clavier, he notes both its sublimity and its utilitarianism, describing it as "...both a treasure chamber and a prayer. And also a walk between my bathroom and my study." *Patrick Kavanaugh*

Purcell: Dido and Aeneas and Music for Plays & Masques

Boston Baroque, Martin Pearlman
TELARC CD-80424; DDD; 70:01
Sound: A, Performance: A

With so many recordings of *Dido and Aeneas* already available, Telarc must be experiencing a certain *angst* in releasing yet another—particularly one that has no international stars to attract the faithful. In fact, partly by avoiding superstars it has achieved a consistency of approach that has been missing from glittery past productions. This is a period performance that single-mindedly focuses on the opera as musical drama rather than as a musicological demonstration.

The only really unusual element in this presentation is the use of a thunder machine to frame the scene in Act II with the Sorceress and her cronies. Although the sound is neither very convincing as thunder nor particularly apt as drama, it does serve to underscore the change of scene.

If you're looking for a period version of *Dido*, I'd recommend you also listen to

William Christie's version on Erato (4509-98477, reviewed in the August 1995 issue). Christie is more imaginative and marginally more musical, but you may prefer Martin Pearlman's approach, which is at once "straighter" and more overtly dramatic. There is one additional, obvious difference: Erato gives you just the opera (some 52 minutes), whereas Telarc adds a suite of instrumental movements from Purcell's stage works. This is a mixed blessing, however. Unless you indulge in elaborate programming of your player, the

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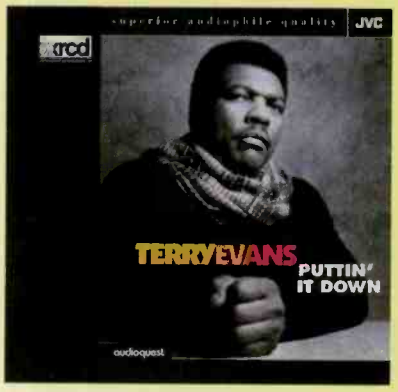

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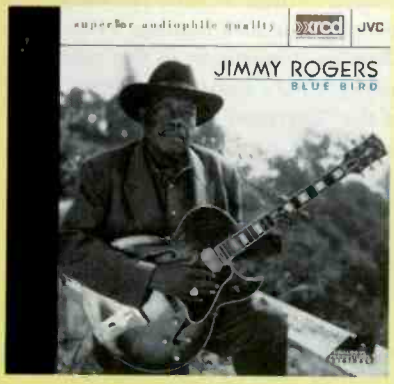

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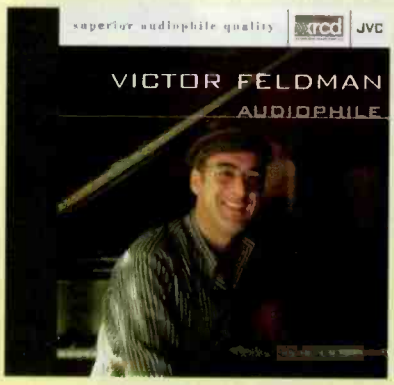

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John Coltrane
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starkness of the silence following the final choral lament is undercut by the extra music. Christie, on the other hand, leaves you ruminating on the tragedy that has just unfolded, for a more penetrating impact.

Telarc recorded its *Dido* in Mechanics Hall in Worcester, Massachusetts, which here lives up to its sterling acoustic reputation. The sound is spacious and, partly because of the performance style, suggests the ambience of a fine theater. *Robert Long*

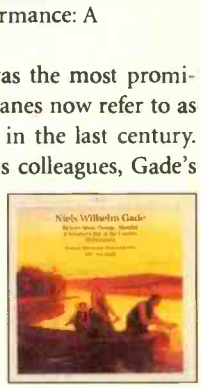
Gade: Elverskud and Spring Fantasie

Soloists, Tivoli Concert Choir and Symphony Orchestra, Michael Schønwandt
DACAPO/MARCO POLO 8.224051
DDD; 62:38
Sound: B+, Performances: A (Elverskud) and C (Fantasie)

Gade: Orchestral Works

Staatsphilharmonie Rheinland-Pfalz, Ole Schmidt
CPO 999 362; DDD; 69:12
Sound: A, Performance: A

Niels Wilhelm Gade was the most prominent figure in what the Danes now refer to as their musical golden age in the last century. Like those of many of his colleagues, Gade's fortunes (and, doubtless, his loyalties) vacillated between his home country and Germany. He served as Felix Mendelssohn's assistant in Leipzig but left when his music fell out of favor among the Germans because, paradoxically, it had lost its Nordicness and become *too* German. At home in Copenhagen, Gade resumed his course as a specifically Danish composer—and, indeed, musical factotum.



"Echoes from Ossian" was Gade's first published work and served as his entrée to German musical society. All the remaining works on these discs date from after his return to Denmark. "Ossian" is a sort of concert overture in which the legendary Scottish bard is somehow transported east of the North Sea. It, the "Hamlet" Overture, and two suites are included in the CPO disc. One suite is "Holbergiana," intended (as was Edvard Grieg's) to celebrate the bicentenary of poet/dramatist Ludvig Holberg; the other is "A Summer's Day in the Country." All of these pieces have their charms, and "Ossian" enjoys a special place in Gade's *oeuvre*, being an historic first as well as very effective music. But the overall emphasis is on Gade as a composer of decorative music; his deeper feelings are expressed elsewhere.

Among other places, in "Elverskud" (usually translated as "The Elf-King's Daughter"). This is a secular cantata drawn from the Danish legend of a bridegroom who, on the eve of his wedding, sleeps on the Elf Hill and spurns the advances of a siren. She consequently casts a spell so that he drops dead on returning home. Whether this tale is used by Danish youths as an excuse for prenuptial carousing, I don't know, but it has frequently been an excuse for creating effective musical settings, as here. The soloists are consistently fine and manage to outpoint the Chandos competition in this piece. Unfortunately, CPO's quartet incorporates only one of the "Elverskud" soloists and is far less satisfactory.

Zoltán Kodály

Kodály: Háry János Suite, Dances from Galánta, and Peacock Variations

Atlanta Symphony Orchestra, Yoel Levi
TELARC CD-80413; DDD; 68:52
Sound: A, Performance: A

Here are all of Zoltán Kodály's best-known orchestral works, done to a rich-voiced turn by Yoel Levy and the Atlanta Symphony and captured in impeccable sound. What more need be said? Perhaps that the Háry János Suite, derived from an eponymous opera, is favorite demo material as well as delightful fare. The other two compositions, though somewhat more post-Romantic in their aesthetic and therefore less sparklingly modern, are also impressive in these readings. And all three pieces, each in its own way, have something to say about Hungary and being Hungarian. *Robert Long*

DONIZETTI

String Quartets, Nos. 10, 11, and 12
The Revolutionary Drawing Room
CPO 999 279; DDD; 57:57
Sound: A, Performance: A?!

It had to happen: Donizetti meets period instruments. Sure, musicology tells us this was pretty much the performance style he would have expected when he wrote these admittedly late-classic bonbons.

But where, in the relatively astringent performances, is the Gaetano Donizetti we all know and love—effusive, sentimental old Donizetti? *Romantic* old Donizetti? Still, on the positive side, the performances are secure and even brilliant, the sound is excellent, and the repertory is delightful. *Robert Long*

Dacapo, working in the Tivoli Concert Hall, achieves a good soundstage, with slightly dry sound. Put it this way: There's a pleasant ambience peeping shyly through the pickup. The sound itself is up to good commercial standards but not as super-clean as that in the CPO disc. The latter also has an even more impressive soundstage and the more convincing concert hall ambience, though no hall is mentioned in the notes.

Which should you choose if you want to sample Gade's music? It depends on your taste. "Elverskud" is the most impressive piece here, the most characteristic of Gade, and perhaps the best performed. "Ossian" comes in second in all three respects. But if you're not a fan of vocal music or don't take sonics extremely seriously, you may be better off with the CPO issue. *Robert Long*

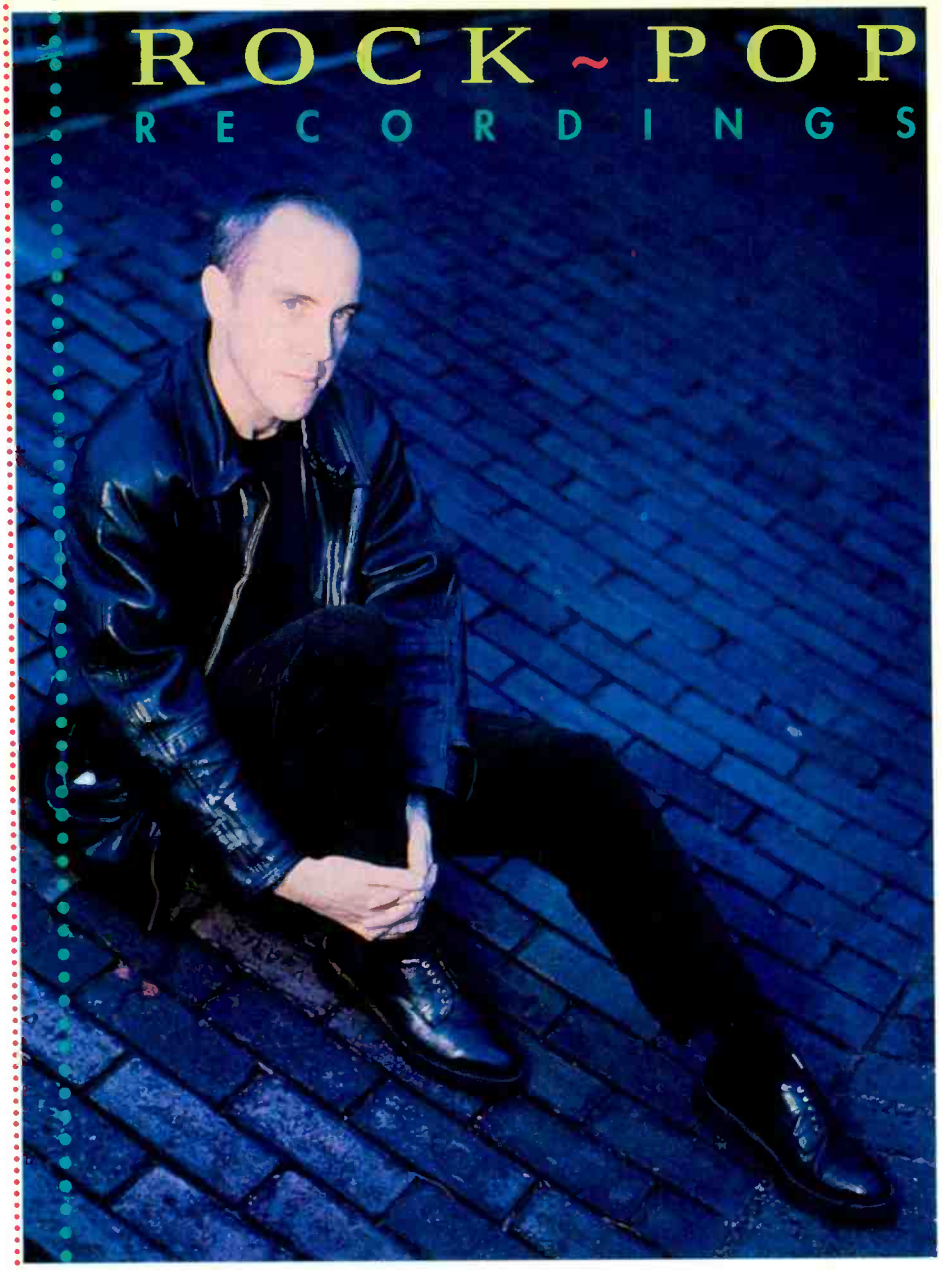
Bach: The Goldberg Variations
Sergey Schepkin, piano
ONGAKU RECORDS 024-107
DDD; 71:53
Sound: A, Performance: A

This beautiful keyboard composition owes its existence to the insomnia of Count Keyserlingk of Leipzig, who employed Johann Gottlieb Goldberg to play the harpsichord for his many sleepless nights. The Count asked Johann Sebastian Bach to write a special piece for this odd purpose, and the result was quite a success. Bach was awarded a golden goblet filled with a hundred gold coins, and the rest of us received one of the greatest theme and variation works in the world of music.

Although some musicologists dispute the details of this famous story, few listeners will dispute the charm of Sergey Schepkin's debut CD of the "Goldberg Variations." Ever since Glenn Gould's celebrated recordings of this masterpiece on the piano (instead of the original harpsichord), more and more pianists have boldly programmed and recorded it. There are those who still prefer harpsichord for this, and still others who will forever cling to Gould's work as definitive. They would do well to hear this recording.

Schepkin's interpretation is sensitive and emotional, and it displays a wide variety of tonal color. He explains, "My idea is to play the piano as if it were a 'superharpsichord': an instrument with a clear and crisp sound, but one that allows for literally millions of degrees of touch and subtle change in sonority." This young pianist succeeds in his objective, and Ongaku Records has captured his many nuances well. For an alternative to Gould, this is a worthy recording. *Patrick Kavanaugh*

ROCK~POP RECORDINGS



Photograph: ©1997, Frank Ockenfels

Never Home

Freedy Johnston

ELEKTRA 61920, 30:22

Sound: B, Performance: A

Freedy Johnston's rangy croon and subtly detailed songs put him in that small cadre of singer/songwriters—Elvis Costello, John Hiatt, and Jim Lauderdale, among others—whose insights ring with clarity, wisdom, and humor. Johnston can wrangle you in with the perfect lyric or resounding chorus, while his melodies recall the glory years of folk pop. For the listener who can see clear of commercial alternative, rap, and country, this "thirtysomething" musician creates a haven of pure, unadulterated melodic joy.

Never Home is chock-full of Beatle-esque melodicism, its absorbing wordplay and full-throttle choruses falling somewhere between *Rubber Soul*'s country/folk lushness and *Revolver*'s guitar-driven punch. Far from being a dumbed-down clone, à la Oasis's Noel Gallagher, Johnston's infectious tunes sting, and his acerbic wit remains intact.

The opening track, "On the Way Out," pounces like Tom Petty dancing with snakes. This mid-tempo boiler weaves a snarling narrative of love abused, as told through the eyes of a petty thief. "Western Sky" describes a trucker's marriage and his solitary nights, endless drives, and isolated phone contact. Conjuring both the romance and loneliness of the road, Johnston sings with an intimacy unknown to songwriters who are more adept at casting off banal one-liners than creating a heart-wrenching scenario.

Just as easily, Johnston plunges into the mean-spirited side of love. "You always tell me that I'm just one more thing to break," opens "One More Thing To Break," about a relationship doomed to failure. Shifting from rocking verses to half-time choruses, the song is layered with lurching guitars and gentle harmonies. "He Wasn't Murdered" recalls Hank Williams and Creedence Clearwater Revival; "Hotel Seventeen," with its entwining strummed

MORPHINE

Like Swimming

DREAMWORKS 50009, 37:43

Sound: B+, Performance: B+

Clever ideas go only so far before becoming predictable and boring. Morphine, which works with only a two-string electric bass, baritone sax, drums, and vocals, has managed to avoid falling into this trap. With *Like Swimming*, the Boston trio successfully broadens its sound, using an organ that sashays in front of a syncopated beat and taking advantage of bassist/vocalist Mark Sandman's forceful presence by placing him front and center. Stretching on "Wishing Well," Sandman yearns and cries as saxophonist Dana Colley coolly saunters in the background. Sandman downshifts to the languid, burnt-out resignation of the title track, which captures the rich nuances of his voice, while the band breaks down walls with the frenetic pace and caterwauling sprawl of noise in the song "Eleven O'Clock."

Morphine's brave new sound is a welcome one. Yet its slabs of sexy, lazy, and smoky mile-long grooves that have always satiated are still intact, proving that good things don't need to come to an end. They just need to be tweaked now and then. *Vickie Gilmer*

guitars, tells of shattered love; and "If It's True" billows with the melancholy grace and irresistible tunefulness of James Taylor.

Freedy Johnston's powerful, romantic melodies captivate your heart, while his engrossing wordplay sticks to your ears. An anomaly in these genre-blurred times, he has the lonely world of the singer/songwriter practically to himself. *Ken Micallef*

Antichrist Superstar

Marilyn Manson
NOTHING/INTERSCOPE
INTD-90086, 77:26
Sound: A, Performance: A

In the more peaceful past, Marilyn Manson's apocalyptic crusade and nihilistic imagery were perceived as a bit of a sham. The band's first album was cluttered with second-rate garage metal, and its ghoulish cover of Eurhythmics' "Sweet Dreams (Are Made of This)" was a blatant self-parody. But forget those naive, artistic expressions, because *Antichrist Superstar* is an eviscerating hate-fest that hums with the volume and clarity of a round of machine-gun fire, foreshadowing the demise of humanity in 16 easy-to-swallow doses of aggressively melodic poison.

Assisted by covenmate Trent Reznor and Skinny Puppy producer Dave Ogilvie, Marilyn Manson has created an album that combines the most daunting aspects of industrial music with the most energizing elements of heavy metal. Gurgling sound effects and grinding samples bubble through pounding beats and buzzsaw guitars, while vocalist Marilyn delivers spiteful lyrics with the voice of a demented despot. "Wormboy" slithers through syncopated beats and a slinky guitar line, climaxing in a chorus vaguely reminiscent of The Breeders' "Cannonball." And "Irresponsible Hate Anthem" rips like a cyclone as Marilyn chants, "I wasn't born with enough middle fingers."

Heed the signs. The end is nigh.
Jon Wiederhorn

Earthling

David Bowie
VIRGIN 7243 8 42627, 48:57
Sound: A, Performance: B+

Whereas the title hints that *Earthling* may be a more "grounded" effort than Bowie's last album, *Outside* (which definitely lived up to its name), this record shows that Bowie still resides in a distinctly different galaxy from his peers. Temporarily abandoning the trilogy theme he started in *Outside*, Bowie instead opts for a "band-oriented" album dominated by the rhythms of techno and jungle (or drum and bass) dance music. But with its dark, cryptic lyrics and sophisticated instrumental solos, this music stimulates the brain as much as it motivates the feet.

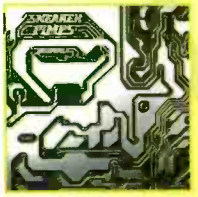
Bowie's first self-produced album since 1974's *Diamond Dogs*, *Earthling* is surprisingly stark and stripped-down compared to the lavishly produced efforts he's released during the last two decades. Although he is credited with performing "guitar, vocals, alto sax, samples, and keyboards" on the album, Bowie gives his band plenty of room to show off. In fact, on "Law (Earthlings on Fire)" he reduces his vocals to a rhythmic chant that blends with the instruments. Guitarist Reeves Gabrels and keyboardist Mike Garson dominate "Looking for Satellites" and "Battle for Britain (The Letter)"; their virtuosic performances and unusual (at least for techno) tones bring a distinctly human edge to the dense beds of pulsating synth bass, static drum machine bursts, and electronic bloops and bleeps. Dwelling in the nether regions of a bass-heavy mix suitable for testing the capabilities of any subwoofer, bassist Gail Ann

SNEAKER PIMPS

Becoming X

VIRGIN 7087 6 12200, 53:02
Sound: A, Performance: A-

Like the Generation Xers they are, Sneaker Pimps fit nowhere. Likewise, their music is untaggable, fitting into no single category. Which isn't to say that their sound doesn't have definable elements. The group's sultry, smoky atmospheres are totally in step with the musical climate in its native Southern England, home of Tricky and Portishead. But guitarist Chris Corner gives the Pimps a trick all their own, taking *Becoming X* through the wilds of southern rock, swamp rock (via some wicked slide guitar), folk rock, and more.



Programmer Liam Howe is equally insistent on stretching musical boundaries. Although his pulsating drums and bass are the Pimps' musical core, his samples and keyboards also dip into Eastern mysticism, ambient electronica, and soulful synth sounds while not forsaking the group's melodicism.

Vocalist Kelli Dayton completes the picture, her baby-doll voice reminiscent of Transvision Vamp's Wendy James but with more attitude. She delivers the cynicism-warped lyrics with all the innocence of a toddler grinning and cooing. . .as she strangles the family cat. *Jo-Anne Greene*

Dorsey and drummer Zachary Alford turn in performances that are felt more than heard.

Earthling may be based on dance music, but it ain't no *Let's Dance* or *Tonight*, for that matter. Although "Little Wonder" is the best pop song Bowie has written in a long time, fans looking for chart-topping hits will have to continue to wait. But those who appreciate his experimental indulgences will certainly enjoy this latest phase of his career. *Chris Gill*

Live at the Isle of Wight Festival, 1970

The Who
COLUMBIA/LEGACY C2K 65084
Two CDs; 1:52:23
Sound: B, Performance: B

When a baby burps, it's like a symphony to those who love and care for him. When Pete Townshend goes "kerrang!" with his guitar, his die-hard fans experience something equally sublime; they'll overlook flaws, flubs, half-baked songs, and anemic performances for any opportunity to hear their baby burp. Which is why *Live at the Isle of Wight Festival, 1970* will probably be embraced by them more than anyone else.

This two-disc album's excellent annotation informs us that The Who hit the stage at 3 a.m and remained there past 5 a.m, playing a set similar to the one heard on the superior, incomparable *Live at Leeds* album.

But though the band is full of spunk, having fun with itself and the audience, the ungodly hour as well as the festival's chaotic, dour mood (check out Murray Lerner's film documentary to witness the mayhem of this giant bummer for yourself) might explain why much of this sounds uncharacteristically weak, at least by Who standards. Yet even at 5 a.m., The Who could squeeze out enough juice and spontaneity to make this music worth hearing. What most jazz greats do with ease, only a few rock bands can do at all. And The Who was one of the best of 'em. *Mickey Leigh*

The Doctor Came at Dawn

Smog
DRAG CITY DC-95, 38:59
Sound: A, Performance: A

Leonard Cohen titled his second album *Songs from a Room*. Pictured on its back cover was a room as sparse and claustrophobic as the album itself. But that room's a luxury condo compared to wherever Smog's Bill Callahan went to create his fifth and most fully realized album, *The Doctor Came at Dawn*.

As Smog's sole member, Callahan specializes in songs of alienation that reflect this solitary state. "And I hope you don't mind/If I grab your private life/Slap it on the table/And split it with a knife," he sings at the end of "You Moved In," the opening track. Throughout *The Doctor Came at Dawn*, Callahan makes his observations in a dry, near-catatonic baritone. Often at odds with the lyrics' unflinching honesty, his restrained delivery complements the music's minimalism perfectly. Stray piano notes and slow, deliberate acoustic guitar picking, for example, create an uneasy sense of imminent disaster. Even the handclaps accenting "Somewhere in the Night," the most upbeat tune here, are rather joyless and seem obligatory.

Doctor's dark tone draws you in like a good mystery, and Callahan's subtle melodies keep you there. The relationship in "All Your Women Things" may be seven years dead, and

Callahan may catalog his obsessions faithfully, but eventually it all comes down to the gentle sway of the notes. The way his voice hangs in the air while the guitar mournfully puts things to rest proves that he's not mired in hopeless self-pity. Rather, it's a compelling way of making sense out of difficult emotions. *Rob O'Connor*

JAZZ~BLUES
RECORDINGS

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Individually Twisted
The Jazz Passengers
featuring Deborah Harry
32 RECORDS 32007, 46:12
Sound: A, Performance: A

Like many avant-thinking visionaries, The Jazz Passengers exist in a parallel musical reality, where tongue-in-cheek irony, cinematic melodrama, playground humor, sublime sensuality, and art-song hipness are *de rigueur*. A simple Passengers performance demands not one but all of these elements, blended together like well-spiced chili. Theirs is a universe where a line meanders rather than directly making its way between two points, touching on as many of these disparate-but-entertaining elements as possible along the way. Or maybe the ensemble is just lucky.

Individually Twisted combines a multitude of jazz styles—most impressively, a kind of over-the-top cabaret flair and an irrepressible East Village attitude. Fronted by ex-Blondie chanteuse Deborah Harry and led by saxophonist Roy Nathanson and trombonist Curtis Fowlkes, The Jazz Passengers leave no niche unexplored, tackling everything from the untamed vibe of Mingus ("Maybe I'm Lost") to glimmery melodramatic pop (a remake of Harry's signature tune, "The Tide Is High"), from be-bop ("Aubergine," sung by guest Elvis Costello) to vaudevillian jazz/pop ("Pork Chop"), from sexy balladeering ("Imitation of a Kiss") to Latin grooving ("Jive Samba, Pt. II"). Completing her metamorphosis from pop nymph to jazz singer, Harry is brilliant as the insouciant star of the show, with lovely phrasing and an irresistibly sexy persona. In her tongue-in-cheek duet with Costello on the Harry James standard "Don'cha Go 'Way Mad," she and Costello (also impressive as a silky jazz singer) hit it off like Ray Charles and Betty Carter (remember

Forever's a Long, Long Time
Orquestra Was
VERVE/FORECAST
314 533 915, 51:12
Sound: A, Performance: A

Long before winning his Grammy awards for producing, Don Was played bass in jazz combos around his native Detroit. But in his own inimitable way, this musician-cum-producer's greatest strength lies in his ability to mix and match musicians with music that is out of their normal realm.

It's evident on *Forever's a Long, Long Time*, the genre-spanning debut from Orquestra Was, his latest musical brainchild following his '80s project, Was (Not Was). In true Don Was quirkiness, Orquestra Was takes the songs of country legend Hank Williams and marries them with jazz/funk arrangements performed by a cast of all-star musicians, including Was (Not Was) alumnus Sweet Pea Atkinson (a truly awe-inspiring singer), trumpeter Terence Blanchard, Herbie Hancock, and Harvey Mason. "Never Again (Will I Knock on Your Door)" wrings out a mature, emotional vocal performance from Sheila E., and legendary MC5 axeman Wayne Kramer kicks out the jams on one of the album's more "out" pieces, "Excuse Me, Colonel. Could I Borrow Your Newspaper?"

Was takes what might have become a loose fabric of styles and influences and has created a sonically satisfying, rich, and diverse album. *Forever's a Long, Long Time* takes Williams' legacy to places that only Don Was would think of going with it. *Hank Bordowitz*

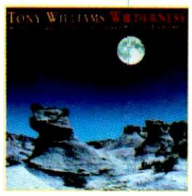
It's Cold O ?), while on "Pork Chop," she sounds n old slapstick pro. Sure, The Jazz Pa s are wacky and excessive in all the dir s they pursue. But in their own hyperc nt way, that's what makes them so ende g and accessible.

In a sense, *ndividually Twisted* looks back at the spectru n of ideas that has made jazz so compelling over the last three decades. Part anachronism, part avant-garde, part reverent, and part irreverent, it's the cure for what ails ya. Which, in this case, may be the retro-fanaticism and neotraditionalism that has plagued jazz in recent times. *Bob Gulla*

Wilderness

Tony Williams
ARK 21 54571, 65:12
Sound: B, Performance: B

In a career spanning more than 30 years, Tony Williams has been anything but predictable. Unlike today's wash 'n' wear jazz icons, who seem as bent on mass acceptance as they are on proselytizing corporate jazz,



Williams has relied on soul-searching music and risk-taking. From the avant freeness of his mid-'60s debut (*Spring*), to epic fusion fusillades with Lifetime in the '70s, to the solid straight-ahead of his '80s quintet sides, he has proved that he's an idiosyncratic, sometimes brilliant leader.

Wilderness encompasses Williams's many phases. Having studied composition for years, he finally debuts on record some of his orchestral works. As on *Spring*, Williams shows some romantic tendencies; his compositions soar majestically, like eagles over a California redwood forest. On "Wilderness Voyager," he solos over strings with the blazing single-stroke rolls that are one of his trademarks. Revolving around the theme of the great expanse of the West, Williams's symphonic works (like those of one of his inspirations, Aaron Copland) are serene and cinematic.

The drummer's forays with a "supergroup"—comprising Stanley Clarke, Pat Metheny, Herbie Hancock, and Michael Brecker—are a little more erratic. Several tracks ("China Road," "China Moon," and "China Town") are open improvs that emulate a looser Lifetime, but they ultimately fall flat; even this heady band is not quite up to blowing boisterous jazz/rock. The experimental "Wilderness Island" fares better (even with Metheny's rockish, overdriven guitar sound); Williams's double-bass drum-prodded solo creates an eerie tension over Hancock's synth washes.

But it's when the band relies on styles closer to swing and ballads that *Wilderness* shines. Metheny's "The Night You Were Born" is a beautiful, melancholy gem, with gorgeous solos over Williams's roving brushwork. Clarke's "Harlem Mist '55" possesses a stately, Gershwin-like beauty, while Williams's "Gambia" floats a bubbling drum groove under a bright melody. "Cape Wilderness" closes the album with a tranquil jaunt of loping drums and wistful piano melody.

An unusual album with lush symphonic passages, ripping guitar, and drum blowouts, *Wilderness* is full of dynamic peaks and valleys, enough to make it a good recording for testing a stereo system. It's an elegant offering from this budding modern composer, one of jazz's true originals. *Ken Micallef*

Tell Me Something: The Songs of Mose Allison

Various Artists
VERVE 314 332 032, 36:58
Sound: B+, Performance: B+

Mose Allison, the enduring singer/songwriter/pianist, certainly deserves a tribute album more than most who have been feted lately. On *Tell Me Something*, when the honoree appears during his own tribute, he unmasks his hosts as pretenders with good intentions. There's no doubt that this project was fueled by admiration and love of this philosopher-cum-jazzman, but hearing Van Morrison, Ben Sidran, and Georgie Fame doing their best Mose impressions is a little, um, strange at times. When Mose finally joins in the fray, you're reminded of how unusual his talent really is.

With so many great tunes to plunder from Mose's penetrating repertoire, the obvious has been avoided—no "Young Man Blues" or "Your Mind Is on Vacation," nor any of Allison's idiosyncratic tunes, such as "Monsters of the Id." Instead, the focus here is on lesser-known jewels. Fame's honey-sweet rendition

of "Was" is pure melancholy pleasure. He drops the mimicry and in the process lets the song sweep him along in its backwards gaze. Ben Sidran's piano chops can't match Allison's, but his vocals perk up "Look Here" and especially "No Trouble Livin'," where he finds and holds onto just the right groove. Surprisingly, most of Morrison's peaks are on shared tracks with Fame, Sidran, and Allison. He makes "Benediction" sound like one of his own gospel-infused tunes, but it's not until the last track, "Perfect Moment," that Van truly enters the Mose zone.

Tell Me Something will surely whet your appetite for Mose Allison's music. So, yes, Morrison, Sidran, and Fame may have succeeded in their tribute after all. *Steve Guttenberg*

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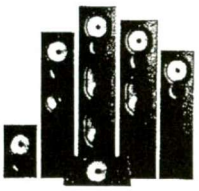

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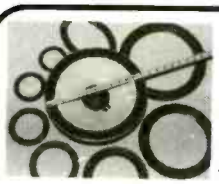

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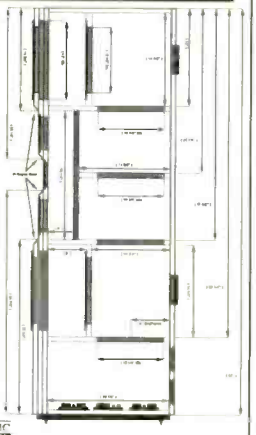

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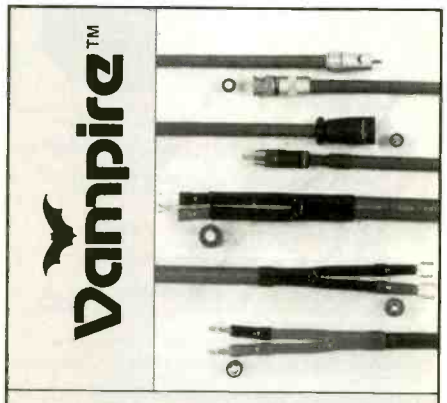

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PlayBack

Elcom Technologies ezAUDIO Multiroom Extender

The ezAUDIO multiroom extender feeds stereo signals from room to room via your home's electric wiring. The system consists of a "wall wart" transmitter and receiver (each 6⅛ x 3¼ x 1¾ inches) plus cables. (It costs $159.99; extra receivers are $89.99 each.) The transmitter has two RCA input jacks for line-level signals—or for speaker-level signals, if you keep your system's volume fairly low. The receiver has controls for volume, balance, bass, and treble. It has three stereo outputs: mini phone jacks for line and headphone use and a pair of RCA jacks for speaker-level signals; its built-in amp is rated at 1 watt per channel into 8 ohms. The transmitter sends FM signals (at 3.58 MHz for one channel, 4.5 MHz for the other); frequency range is rated at 75 Hz to 15 kHz, distortion at less than 1.7% THD at 1 kHz, and S/N at 60 dB. The receiver is subject to hum; it's not noticeable on speakers once the signal gets above background-music level, but it's obvious through headphones. (Plugging in headphones cuts out the signal to the speaker jacks.)

GRADE: B–

When I used the ezAUDIO system in a house whose power lines also carried signals from X-10 remote-control dimmers, there was a crackle of static when the transmitter was connected to my stereo system's tape output but not to a small TV's earphone jack. The ezAUDIO system performed respectably as a convenient, utilitarian system for distributing sound of reasonable fidelity to remote speakers. With proper level adustments, it should work in most houses, but it appears to be incompatible with X-10 dimmer systems, which also use AC house wiring to carry signals. (Elcom Technologies: 78 Great Valley Parkway, Malvern, Pa. 19355; 610/408-0130; http://www.elcomtech.com) Ivan Berger

For literature, circle No. 120

Spirit Notepad Eight-Input Mixer

Want a great-sounding, inexpensive mixer for home recording projects? The little British-made Spirit Folio Notepad ($279.95) is ideal for an occasional remote or DJ gig or for recording home recitals.

Housed in a purple (or gray) plastic case, the mixer has four microphone channels with XLR connectors and phantom powering for condenser mikes. These channels also can accept line-level inputs via ¼-inch jacks. Each channel has separate gain and trim pots to adjust for microphone sensitivity, as well as bass, treble, pan, and effects-send controls. Two sets of line-level stereo channels can also serve as phono inputs via switchable RIAA equalization. Each stereo channel has

GRADE: B+

controls for trim level, gain, effects-send, and balance. The separate monitor-amp output and a tape input have level controls and a headphone jack.

In live-to-two-track music recording, the Notepad produced nice, uncongested sound for the money, and its mike preamp wasn't noisy with condenser or dynamic mikes. The only limitation was its Spartan, two-segment level meter (average and peak). But what do you want for $280? (Spirit by Soundcraft: 11820 Kemper Rd., Auburn, Cal. 95603; 916/888-0488.) John Gatski

For literature, circle No. 121

Radio Shack VoiceMemo Digital Recorder

It sounded like a stupid idea: a solid-state digital recorder with a total recording time of 40 or 80 seconds and *very* limited fidelity (12-bit sampling at 8 kHz and a ¾-inch speaker). But Radio Shack's $29.99 VoiceMemo (Catalog No. 63-944) changed my mind. Useless for music, it's remarkably handy for note-taking and doesn't get lost in my pocket like scraps of paper do. It's voice-activated, so you don't record "dead air," which helps it hold a lot of messages. Normally, nothing shows but a "Record" button and an indicator LED. Other controls are behind a sliding lid: "Play" lets you hear messages one at a time, two arrow keys let you move backward or forward through your messages, and two more buttons erase either the last message played or all of them. The VoiceMemo beeps when it's full. I prefer the factory-set 40-second mode, which seems adequately long and sounds much better. In 80-second mode, the sampling rate drops to 4 kHz; this makes the sound harsh and gravelly, though still understandable. With its combination belt clip and magnet mount slipped off, the VoiceMemo is about the size of six stacked credit cards. (At Radio Shack stores, or call 800/843-7422.) Ivan Berger

GRADE: B

For literature, circle No. 122

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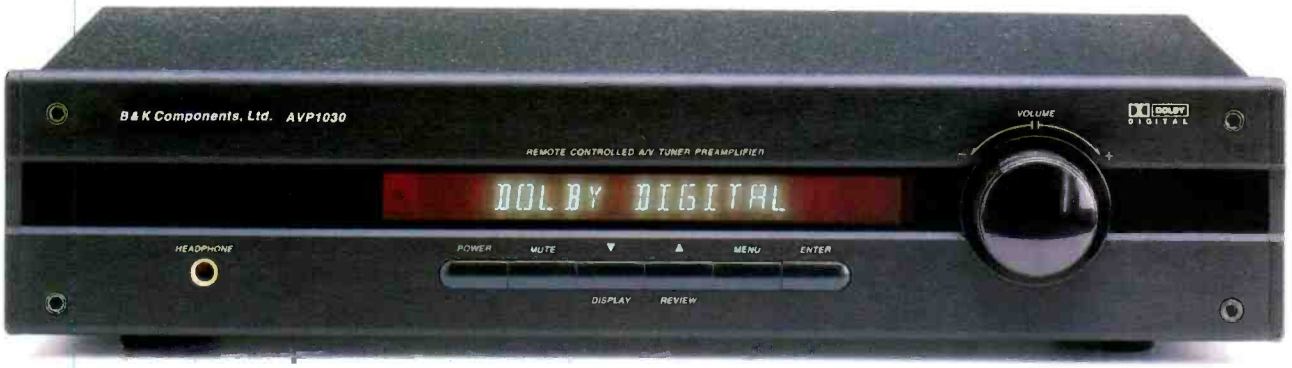

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