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JUNE 1999

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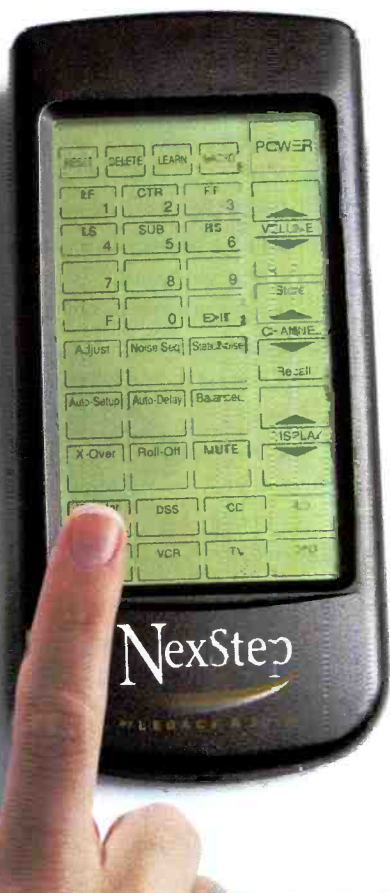


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WHERE HOME THEATER LIVES

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I'm dating myself, but a few years ago it occurred to me that I now think of international phone calls the way my parents did domestic long-distance calls. I don't make them unless I really need to, and I try to keep them short to minimize the expense. ("Hurry up; it's long distance.") Of course, a lot of other things have changed in the world of telecommunications: my local calling zone containing towns in two different area codes now versus no direct dialing then, hundreds of channels on cable and satellite TV now versus (my children look at me like I've lost my mind when I say this) just three channels in glorious black and white then, and so on. And on and on and on. Information moves from person to person, around the world, faster and more fluidly every day.

As in biological evolution, much of this change is gradual, but some is abrupt. Every once in a while, there is a stair-step advance. The most recent example of this in communications is the Internet—the World Wide Web in particular. Now you can meet or exchange information (or misinformation) with people on the other side of the globe, including folks you may never see or talk to and whom you never would have encountered any other way. The cost? Negligible, really, at least to the participants.

But what if you own some of the information that's getting passed around on the Web? Unless you're getting paid for transactions involving your property, you might feel you're getting ripped off. This is what has the record companies so exercised about such things as MP3 (MPEG-1 layer-3, audio compression), which enable easy transmission of recorded music over the Internet. As Corey Greenberg notes in this month's feature, MP3 is not a transparent process, but on a lot of material it can sound quite decent. It's not good enough for an audiophile to consider music that has passed through an MP3 encode/decode cycle onto a CD-R a substitute for the original CD. On the other hand, there aren't so many audiophiles in the world.

What about everybody else? What proportion of the record-buying public would consider music via MP3 "good enough" to forgo paying for something better?

Nobody really knows. I'm inclined to think not very large, particularly given the current level of inconvenience associated with finding, downloading, and playing MP3 files of the music you think you might want to hear. Also, historically, new methods of copying music have tended to expand the total market much more than enough to offset any direct losses; it's been better business to pick up the five dollars on the table than to chase nickels on the floor. I can afford to be wrong, however. If I owned a record company, the risk might loom much larger in my consciousness. And I certainly would be looking into how I could make some money from people who *do* want music via MP3.

But as an audiophile, my main concern is entirely different. What if it turns out MP3 or some similar process actually is good enough for most people? What if the record companies eventually find that they can make more money blasting compressed audio files to customers over the Web than they can selling discs? Though quality has tended to win out, historically, it is hardly guaranteed. Capitalism, by its own methods of Darwinian selection, has a way of boiling off anything we aren't willing to pay adequately for. Usually that's a good thing, but again, no guarantee.

As Paul Simon wrote, "These are the days of miracle and wonder/This is the long distance call." Here's hoping the news at the other end of the line is good.



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Let's Get On with It

I have relied on *Audio* (and other publications) to educate, lead, teach, direct, and assist me in my development as a so-called audiophile over the nearly 50 years I've subscribed to it. During this time, I've built my own folded-horn speakers from scratch (as well as used various amp and tuner kits), progressed to speakers/amplifiers/etc. that I couldn't have dreamed of when younger, and am now into the digital era.

Corey Greenberg's "cry" for a disconnect with current preoccupations that simply refine the antiquitous past is, in my opinion, long overdue ("Front Row," January). Esoteric hi-fi seems, like the spooky fringes of most otherwise legitimate disciplines, to sustain itself on the gullibility of the few who also seem to exist on such fringes, but it deprives those of us who "want to get on with it." A more refined analog circuit/device or a more expensive amp/tube device, while able to capture the fancy of the tea-leaves fringe, should not define or control the direction of a discipline that has progressed to our present state. I want to spend my remaining years exploring the new horizons, not mired in endless searches for the nuances of the past, and to do so in a price range comparable to what Greenberg describes as inhabiting the malls.

My only addition to Greenberg's missive would be a plea to make digital devices more user-friendly; one can then make better sense out of how to hook up a simple AC-3 signal processor/amp sans endless trial and error. If these devices can be made user-friendly for the crowd that inhabits Guitarland, surely they can be made more friendly for us audiophiles as well.

By the way, as a first-time writer of anything to any magazine, Greenberg's article obviously struck a chord, so to speak.

D. Chris Anderson
via e-mail

Familiarity Breeds...

I hesitate to beat a dead horse, but I disagree with some of the observations made by Mark Block regarding blind testing ver-

sus long-term listening ("Point/Counterpoint: Objective vs. Subjective Evaluation," April). Most of your readers are not reviewers; we are passionate hobbyists and music lovers. Most of us can tell, instantly, the effect of *any* new element in the system, be it a new component, a wire, or a change in stylus rake angle or tracking force.

This is because our systems are built over a long period of time and we are familiar with them on a day-to-day basis. Therefore, with an unfamiliar system or venue I would not fare well in a blind test (double or single) or in an experiment where the item being tested is known. In my own home systems, however, I know immediately the effect when a change is introduced (though not necessarily whether it is better or worse). Of course, only one factor at a time should be weighed.

So "just sitting around listening" should not be discredited if the system and room are familiar.

Richard P. Clancy
Ashland, Mass.

Blinded by Science?

As a psychologist and longtime audiophile, I took interest in Steve Guttenberg and Mark Block's "Point/Counterpoint" in the April issue. Psychological research has much to contribute to this debate, since psychology encompasses the study of sensation, perception, motivation, and decision-making, all of which are relevant to this topic. Psychologists have been conducting research on human perception and refining research techniques for more than 100 years, so there is a wealth of knowledge that most audiophiles are unaware of.

One example of a psychological process pertinent to this issue is auditory sensory memory, typically called echoic memory. Echoic memory is a brain function that holds large amounts of incoming auditory information in storage; it has a span of about 2 seconds. After 2 seconds, echoic memory either decays or is processed into immediate memory, which imposes significant limits on the amount of information that is retained. Thanks to echoic memory,

humans are exceptionally good at detecting whether two sounds presented in quick succession are the same or different. Individuals with normal auditory functioning will be quite accurate when asked to detect whether there is a difference between, for example, a pure tone of 700 Hz and a pure tone of 705 Hz, as long as the two tones are presented in quick succession. When the presentation of the second tone is delayed by more than a few seconds, the accuracy of auditory discrimination will drop. Instantaneous A/B tests are far more effective in revealing auditory differences compared to methods in which there is a time gap.

The claim that uncontrolled listening sessions permit the detection of subtle auditory differences not audible with instantaneous A/B comparisons contradicts established scientific findings. There is no doubt that instantaneous comparisons enhance auditory discrimination. Try as you might, you can't change basic sensory and memory functions!

Experimental psychologists use scientific methodologies (such as double-blind A/B testing) when examining sensory perception, because 100 years of psychological research shows that less rigorous approaches lead to erroneous conclusions. Experimental psychologists would give little credence to an uncontrolled subjective report in an auditory discrimination task. Appropriate research methods must be employed if unbiased, reliable conclusions are to be drawn.

Thomas J. Smurthwaite, Ph.D.
Licensed Psychologist
via e-mail

A Different Drummer

I enjoyed Michael Tearson's April review of Emmylou Harris' latest release, *Spyboy*, but he is in error when he refers to Brady Blade as the drummer who appeared on her previous album, *Wrecking Ball*. That was his younger brother, Brian Blade.

Brady is currently touring with Jewel, and Brian—normally the drummer for Joshua Redman and Kenny Garrett—is on tour with Seal.

Steve Snow
via e-mail

Editor's Reply: Thanks for pointing it out. Tearson wasn't at fault here, however; it was an editing error.—D.H.

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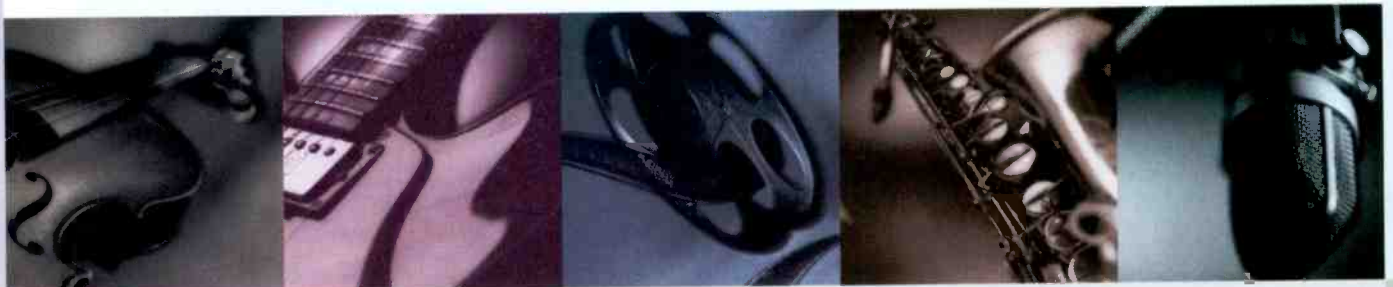
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News Gathering

In his "Audio Site-Seeing on the Web" (March), Gordon Brockhouse mentioned the need for a piece of software called a "news reader." I would like to know how to find it. Is it downloadable?

His article was otherwise most informative and interesting.

*Cyrelle Ratzkin
via e-mail*

Author's Reply: If you're using the current version of Internet Explorer or Netscape Communicator, you already have a news reader. With IE, choose "Read News" under the Tools menu (or click the Mail icon on the toolbar), then choose "Read News." That will launch the Outlook Express mail client and open the newsgroups folder. Click on the newsgroups icon on the toolbar to subscribe or unsubscribe to newsgroups. I'm not a regular Netscape user, but I'll be installing it soon. If you want me to let you know how to use newsgroups with Netscape, please advise.

There are scads of shareware news readers. A good source to download them is [tucows.com](http://www.tucows.com). Go to www.tucows.com, then choose

the operating system you're using. You'll see groups of applications. Choose "News Readers" under the Network Tools heading. Hope this helps.—G.B.

A Floating Point

I would like to correct something in Ed Foster's March "Profile" of the Sony TA-E9000ES A/V preamp. The first use of a 32-bit floating-point DSP chip in a "high-fidelity component" was by Audio Alchemy in the DTI Pro32 resolution-enhancement and jitter-reduction system. The DTI Pro32 used a Texas Instruments TMS320C31 32-bit floating-point DSP.

The latest software upgrade, AD.3 (available from Channel Islands Audio), is a good-quality upgrade for a reasonable cost for this unit. Mine is still working well after three years of ownership.

*Richard Hollis
via e-mail*

More from the Studio

Keep up the home studio coverage! It's nice to finally read reviews of this gear from people who actually know what good sound is. All the pro audio publications are

pretty much a joke. They're so worried about offending one of their precious advertisers that after reading a four-page article, you still don't know whether the product is worth a damn or not. It seems gadgets and gizmos are way more important than sound quality for a lot of manufacturers—sad but true. Maybe Corey Greenberg and his creative and honest writing style will start a new trend, and sound quality will finally come first.

*Brian Pilch
via e-mail*

Call of the North

Having been an ardent reader of *Audio* for many years (dating back to the days when it was known as *Audio Engineering*), I look forward to reading it every month. Regarding Marjorie Beckmann's January letter about preserving the "ancient stuff"—i.e., music of the older generation—I have this to say: Marjorie, I think we have quite a few "Depression babies" and "dinosaurs" in Canada as well. We have so much "stuff" floating around here that we're building a radio station for the Internet. Not only will it have the software and hardware (recorded

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music and equipment) that you mentioned but also a concert hall studio. We'll also have modern gear—multitracking and processing equipment—to enhance the music.

Our forte will be popular standards (known as "big band") and orchestral works performed by groups of 30 pieces and up. We would appreciate hearing from anyone in the world who sees himself in a similar position as Marjorie Beckmann's and mine. I can be reached via e-mail at audiobob@home.com or by regular mail at 939 Western Rd., Bldg. "B," Unit 3, London, Ontario, Canada N6G 1G3.

Robert Hainsworth
via e-mail

Keep Up the Good Work

I've been reading *Audio* for many years now, as well as other publications, and find your magazine to be first-class, second to none. Don't ever change to cover more home theater than two-channel stereo. Sadly, other publications are doing this. Is stereo dying?

D. B. Keele, Jr., and Edward J. Foster are the best of the many equipment reviewers

out there. I enjoy their reviews so much and hope that these gentlemen write for *Audio* for many more years.

John Dronzek
South Bridge, Mass.

Death of a Giant? Ha!

Okay, so I need to get a life, but in my defense, it was at an early age that I grew to await with eager anticipation and then devour from cover to cover the Allied and Lafayette electronics catalogs.

The habit continues to this day: I admit to a similar fetish for *Audio's* Annual Equipment Directory. I don't know how I missed it in the past—old age I suppose—but in the 41st Annual Directory (October 1998), on page 108 in "Tuners," Lirpa Labs is listed as the manufacturer of the Drift Away tuner, a half-pound monolith powered by steam percolation. Well, I want one.

Driven by lust, I retrieved the 40th Annual Directory and found Lirpa Labs to also be the manufacturer of the Model 1Mk K3 preamp. I want one of these as well.

Failing to obtain a phone number in the back of your publication, I frantically attempted to search the company on the Web.

To my dismay (as reported by *CyberTheater*, *the Internet Journal of Home Theater*), this giant and pioneer in high-end audio has disappeared from audio history! Lirpa Labs, apparently, is no more. But rest assured, I will be checking the 42nd Annual Equipment Directory, in the event it raises itself up to percolate once more.

Thanks for the humor. I love your magazine, love audio, and wish I had more money to spend on it (I desperately want a pair of B&W 801s).

Dave Morell
Madison, Wis

Back to Our Regular Programming

Corey Greenberg mentioned in his March "Front Row" that the old Marantz RC2000 remote tended to lose its settings after a battery change. I have an original RC2000 (not a Mk. II) and usually have to replace the batteries once a month—it's a hungry device, no question. In the three years I've owned the remote, it's never lost any of my configurations (I dread the day) despite the batteries having run down past the point of operating the display several

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times. I've noticed that once fresh batteries are installed, the RC2000 always comes up in "RC-5" mode, which gives the impression that the settings have been lost. Simply toggling into "Learn" mode, then cycling back into "Use" instead of "RC-5," has always restored my programming. Perhaps this is what is happening with Greenberg's unit.

*Name withheld
via e-mail*

Just Curious

In "Home Recording for the Digital Millennium" (February), Daniel Kumin wrote, "It is nothing short of astonishing just how advanced cassette music recording became in its 25-year life." I'm curious, what milestone in 1974 (or '75?) is he using as a beginning marker?

*Michael Laskoe
via e-mail*

Author's Reply: None, specifically. I was mostly thinking about Advent's application of Dolby B to the cassette medium, first via the ill-fated deck with a Nakamichi transport that preceded the well-known one with the Philips (or was it Grundig?) transport. [Wollensak, we think.—Ed.]

Yeah, I know: It really all started around 1971-72, if memory serves. But this was a long time ago, and it was, after all, "the '60s," despite what the calendar said (the '60s mostly took place in the '70s, socioculturally speaking), so you have to cut me a little slack here if my memory isn't as clear as it might otherwise have been.

Anyway, at time of writing it had been just about a quarter-century since the awareness of hi-fi/stereo cassette as a useful medium penetrated to the larger part of the audio public. And journalistically, "25 years ago" sounds a lot better than "27 or 28 years back, more or less, umm, sorta. . . ." Thanks for the interest.—*Daniel Kumin*

In Defense of Mr. Greenberg

To those letter-writers who wish to attack Corey Greenberg for his colorful language, get a life! Greenberg's insightful and mildly colorful commentaries are large pockets of fresh air. Time and time again he makes palatable what is often otherwise dull and uninteresting, and for that he should be commended. I find his "Front Row" column to be clever, entertaining, and informative.

In a free and open society, the best way to avoid taking offense to anything is to lock yourself in a room, tape your eyes shut, and put chewing gum in your ears. Keep up the good writing, Corey.

*Ryan Nelson
Cincinnati, Ohio*

Leave Him Be

Regarding the recent rash of Corey bashing in your "Letters" column, I find him to be the most interesting writer on your staff and would rather read his review of a product in which I have no interest than one of your other writers bland ramblings about a product I am interested in.

While I found Edward Tatnall Canby to be unreadable, I respected his knowledge and experience. I simply used my judgment to decide whether to suffer through his column each month. At no point did I try to change him or have him removed from your staff. I would never try to impose my preferences on others, and hope that others have as much respect for my freedom of choice.

*Don McCorkle
College Park, Md.*

Correction and Corey

After reading his "Easy As DSP, ABC, 1-2-3 Baby You and Me" (January's "Front Row"), it's clear that Corey Greenberg has *not* heard a properly done room with DSP room/speaker correction. I have been using SigTech Digital Room Correction for a number of years in a high-resolution system (custom-built room, all Spectral electronics, Avalon Eidolon speakers, and MIT cables). In addition, the room is judiciously treated with tube traps. Even with this, the SigTech makes a huge improvement in the sound.

Greenberg's comment about DSP creating a narrower listening position is just plain wrong. A corrected system has no more of a narrow sweet spot than an uncorrected room does. The SigTech software recognizes this fact and at higher frequencies does less correction over the 50 milliseconds that the system operates. (The SigTech operates in the time domain, not the frequency domain.)

Many articles have been written on the importance of the room in the listening experience. Companies like ASC, RPG, Room Tunes, and others have built passive products to address room problems; some are

quite successful. But passive treatment can go only so far. Why, then, is it a waste of engineering talent to use DSP to get the best out of our systems?

Greenberg seems very high on home theater. A digitally corrected room in a home theater environment (six corrected channels) is also really spectacular. In fact, it is the only way that I know to closely timbre match speakers in a multichannel music or movie system.

Consider this an invitation to have Greenberg visit me in Augusta. And if he gets close, another similar six-channel corrected system is in Atlanta, using Dunlavy speakers and Mark Levinson electronics. Since I personally know of more than "five guys in the world" who own the SigTech system, those other "dickweeds in the audio press" may prove to have been a bit more astute than Greenberg—at least they try to get some facts before they start opining.

*Richard Bromer
Augusta, Ga.*

Digital Wows

Regarding Michael Riggs's February "Fast Fore-Word," I think it is tragic that hunches and beliefs have replaced science in the world of audio. I find it astounding that the most audible advantage of digital recording is also the most overlooked. To make my point, I must first pose a long-winded question.

When the Compact Disc first appeared, many listeners noticed an improvement in the music they heard from FM stations on their car radios. With no exceptions that I know of, FM stations apply gross amounts of compression and equalization to create a sound that their managers believe will best grab the listener. Many of these compressors operate independently on different portions of the audio spectrum, dynamically adjusting frequency response to add punch to the bass and overcome car noise. The highs above 16 kHz are cut off to provide a guard band around the 19-kHz stereo pilot. On a good day in a prime reception area, a radio may achieve a 50-dB ratio of signal to noise. Most transmitters have as much distortion as an average analog tape recorder. So without wide dynamic range, low distortion, or accurate frequency response, how do radio listeners hear a difference?

The one difference that the FM transmitter does not trash is the absence of wow and flutter in a digital recording. The severity of wow and flutter in record players is grossly understated because the measurements are made with steady-state signals. The geometry of the pivoted tonearm with an offset used to compensate for tracking angle introduces frequency modulation distortion that is dynamically related to the modulation envelope of the audio in the groove. This distortion was explained in "Tonearm Geometry and Frequency-Modulation Distortion" by Raymond Kilmanas in the *Journal of the Audio Engineering Society* (Vol. 30, No. 9, September 1982). In layman's terms, the distortion caused by a nontangential tonearm—as used in all but a few esoteric record players—is roughly equivalent to that produced by a tape player with 4% wow and flutter! Would you buy a tape recorder with a specification like that?

When copying open-reel recordings to cassette tape, the wow and flutter is cumulative. When I record myself on the classical guitar, I find the speed fluctuation on my analog recorders clearly audible. Perhaps one of those recorders, which costs thousands of dollars, would do the job much better, but my Sony DAT walkman does just fine for a lot less.

Dennis L. Green
Detroit, Mich.

The Reel Deal

In reference to Michael Riggs's February "Fast Fore-Word," I too have quite a few reel-to-reel tapes that I have dubbed to cassette. I've also dubbed them to MiniDisc, just in case. My equipment consists of a receiver, reel-to-reel deck, cassette deck, CD changer, CD player, turntable, and MD recorder/player. Guess which one I listen to and enjoy the most: the reel-to-reel.

James L. Harris
Houston, Tex.

Don't Stop the Music

We are saddened that the number of classical music reviews has been reduced, only to be replaced by movie reviews. We subscribe to *Audio* because we're music lovers who rarely watch TV. We would especially like to read reviews of works with 32-foot organ stops—so we can use our subwoofers to their fullest.

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Troubled Car Cassette Player

Q Whenever I play a tape on my car stereo (a factory-installed Delco head unit), the high frequencies in the left channel (front and rear) suddenly increase in volume. The radio, however, doesn't have this problem. I cleaned the heads, but that didn't help. Any suggestions?—Josiah Thorne, via e-mail

A I think there is a defect in the feedback circuit, which is used for tape equalization in playback. To reduce tape hiss, cassettes are recorded with a treble boost; during playback, the boost is automatically reduced by a similar amount. This reduces the tape noise by the amount of the treble cut. The boost and cut are usually achieved by using resistor/capacitor (R/C) components in a feedback loop, and it's here that I believe the trouble lies in your system. It might be a cold solder joint, present for years, that only now is surfacing, or perhaps there's a hairline crack in a circuit foil. Either of these defects could cause intermittent operation.

Does the condition become worse when you drive over bumpy roads? If it does, it's a likely indicator of a poor connection or an intermittent component. Do the highs jump around more when the tape player has been running for some time, or is the condition about the same regardless of how long it has been on? When a problem occurs more frequently after a machine has been on for a time, it may indicate that a part is becoming intermittent as the machine's internal temperature rises.

If you're handy with tools, take the player out of your car and run it using a 12-volt DC power supply. Connect the player's output to a speaker so you can monitor the sound and, with the player running, tap various components on the circuit board with a plastic implement, such as the handle of a small screwdriver. If you're lucky, tapping the defective foil or part will trigger the same problem you have in the car. The part might be flawed, but I suggest you examine its solder connections to the circuit board. Try reheating them, using a low-power soldering iron. Repeat this test again,

and if the problem is still present, shine a strong light on the foil etchings near the component. Using a good jeweler's loop, check for hairline cracks in the foil. Solder suspicious points, but be careful not to bridge two adjacent foils with solder.

Those not mechanically inclined, however, should leave this kind of servicing to a professional.

Is Biamping Better?

Q I'd like to buy a component system, and I want the best sound I can get at a reasonable price. I'd prefer active biamping, but if that's too costly, I'm willing to settle for passive biamping. How noticeable is the improvement in sound quality from active or passive biamping compared to the traditional stereo setup?—Evelyne Girard, Ottawa, Ont., Canada

A Any amplifier must be considered an active device because it processes the signal in some way, transforming impedance and producing gain (amplification). But perhaps what you really mean by "passive bi-amplification" is *bi-wiring*, in which the woofer and midrange/tweeter sections of a speaker are individually connected to the same amplifier output terminals with separate sets of cables. Although the sonic benefits are debatable, running two sets of cables per speaker (instead of one) can't hurt: At the very least, bi-wiring lowers total resistance between the amp and the speakers.

In any event, unless you are using an electronic crossover network rather than a passive crossover (the latter is almost always inside the speaker enclosure), bi-amplification will probably not be necessary—especially if your power amplifier's distortion is extremely low. If an amp has potentially audible distortion, it's desirable to divide the audio spectrum into a section for bass and one for midrange and treble, amplifying each separately. This will reduce audible distortion that may result from the modulation of high frequencies by low frequencies (intermodulation distortion, or IM).

In my experience, there have been few instances where biamping improved sonic

performance over simply bridging the woofer and tweeter terminals on the back of each speaker and running a pair of cables back to the power amplifier. (I can already see the mail coming in on this subject!)

When To Use a Subwoofer

Q My Acoustic Research AR-3a speakers, which I bought in 1968, have good low-end response. But will they hold their own against new \$1,000 powered subwoofers? I have always assumed that audio's goal is to replicate live music, and I have usually felt that I was close to listening to the real thing. Contrary to what we are being led to believe these days, aren't mike placement and the work of the recording engineer and the producer more responsible for that elusive feeling of they-are-here or I-am-there than the hardware we use?—Jerome Swabb, Erie, Pa.

A Your speakers have served you well over the years. Obviously, their musical fidelity is able to re-create that elusive feeling of "being there" that we all strive for. You may not need to buy a subwoofer or replace your AR-3a speakers. Over time, of course, many of us get so accustomed to the sound of our own speakers—including all their acoustic inaccuracies and colorations—that we come to consider their sound as a reference.

Having said this, however, you do owe it to yourself to visit a store and audition recent speaker designs. Their performance might equal or surpass that of your ARs. In its time, the AR-3a was justifiably revered for its neutrality and deep bass—which was quite solid down to 30 Hz.

But consider that most speakers' bass output doesn't just remain strong and then cut out all of a sudden. It gradually weakens, or rolls off, perhaps when it gets down to 60 Hz. At 50 Hz, a typical speaker produces slightly less output than at 60 Hz. At 40 Hz, its output may be reduced by 3 dB. And by 30 Hz, the output may be only half as loud as it was at 60 Hz. (In other words, the bass at 30 Hz would be -10 dB.)

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

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The purpose of a subwoofer is to add bass where it may be absent—e.g., at frequencies like 20 and 18 Hz, which are deeper than the reach of your AR-3a speakers—and to reinforce your main speakers' output as their bass rolls off. Recordings of pipe organs, for instance, sometimes extend down to nearly 16 Hz. A large orchestral bass drum has frequency components at 17 Hz, and the extra eight keys on a Bösendorfer concert grand piano extend its bottom octave down to 18 Hz. These frequencies are well below the operating frequency range of your ARs.

Of course, there are subwoofers—and then there are subwoofers. Some have low-frequency response down to about 35 Hz, similar to that of your present speakers. Does this mean that these subwoofers are not useful? Not at all! You could use a small, inexpensive subwoofer to reinforce the bass of mini-monitor speakers whose lowest frequency of any significance might be 60 or 70 Hz. A lot depends on the recordings you listen to. The lowest tone produced by a normally tuned string bass is about 42 Hz, well within the capabilities of such a sub-

woofer—and of your AR-3a speakers. A small subwoofer wouldn't suit me, however, because I listen to organ music and want my system to be flat down to at least 32 Hz. So bass must extend below this point, even though it may roll off rather precipitously below 30 Hz.

Subwoofers are especially useful in home theaters. Movie soundtracks often contain loud, low-frequency sounds, often between 20 and 30 Hz; Dolby Digital (AC-3) soundtracks even have a discrete low-frequency effects (LFE) channel (though it can be folded into the other channels in systems lacking a subwoofer). Home theater receivers, decoders, and preamps usually have line-level output jacks to feed a low-pass filtered signal to a powered subwoofer. That signal may include the LFE channel's information and the summed low-frequency content of other channels.

I've discussed only bass so far, because that's what you asked about. But since the era of your AR-3a, speakers have also improved in other areas. Tweeters, for example, now have broader, better-controlled dispersion and more even off-axis response,

so today's best speakers sound far more open and are better able to convey a sense of spaciousness. I would also say that the best modern speakers are more neutral and musically accurate than the AR-3a. Their frequency response is flatter, especially through the ultra-critical midrange.

Of course, the work of the recording engineer and producer is crucial in creating a realistic-sounding recording. But if that recording is reproduced on a pair of loudspeakers with mediocre dispersion, uneven frequency response, and timbral coloration, much of its beauty and instrumental fidelity will be lost.

A Fuse-Blowing Problem

Q My power amp's left-channel fuse often blows, even though I have installed surge protectors and filters in the AC line. I turn my preamp's volume control fully down before turning on the system, yet the fuse still blows. What should I do?—Name withheld

A I'm almost certain there's something wrong with your power amp's left channel. Disconnect the amp's inputs and check to see if the left channel's heat sink

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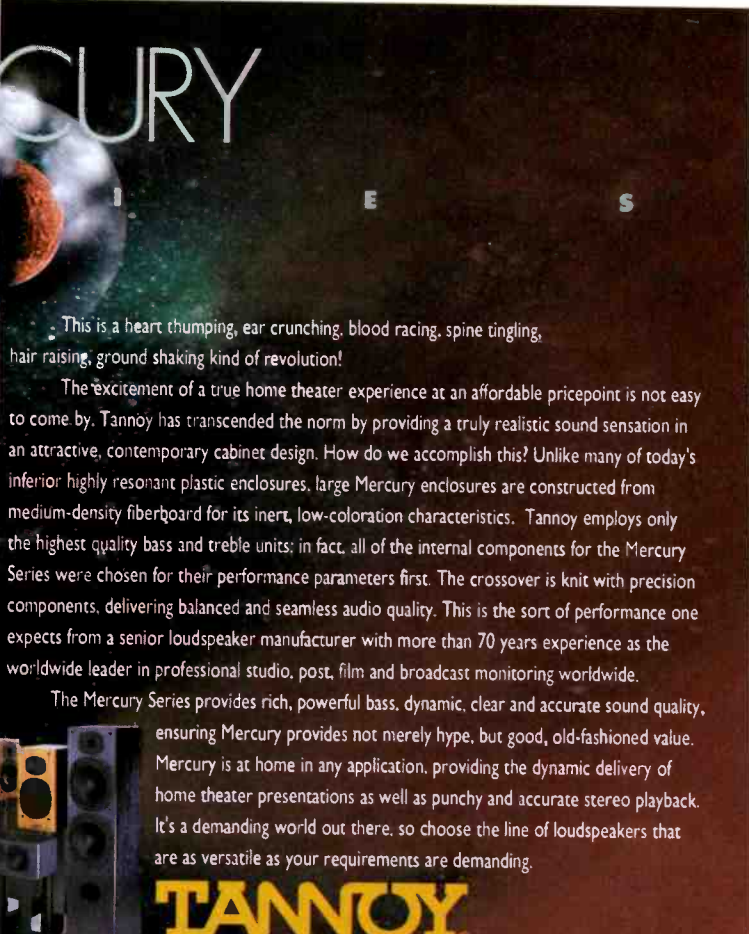


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runs considerably hotter than the right channel's. If it does, then something in the left side is drawing too much current. There could also be serious voltage offset in the left channel. (If you're not handy with test gear, get a technician to measure this.) The offset problem could produce enough current to heat up the heat sink, or, worse, it could heat the left speaker's voice coil and eventually damage it.

If your amp checks out okay, reconnect the component that usually feeds it and repeat the test. Some amplifiers are direct-coupled, and some devices that drive a power amplifier might also be direct-coupled. If there is a voltage offset in that component, it would result in too much current being drawn by one channel of the power amp. Any additional transient pulses would be sufficient to blow fuses.

Incidentally, turning your preamp's volume control fully down before turning on your system is not enough to eliminate transient pulses: I recommend you turn the power amp *on last* and *off first*.

More on Home Audio Signal Distribution

After reading your thoughts about home audio distribution ("Distributing Satellite Music," November 1998), I wanted to share my positive experience using a small FM transmitter to deliver music to different rooms in my house.

I also faced the choice of running cable through my home or using a small stereo transmitter. I chose the FM transmitter because I already have radios in virtually every room of my house, and I did not want the expense and hassle of running cable. My transmitter produces less than 1 watt output but still cranks out an impressive signal. By keeping my power-supply voltage low and using some simple antenna tuning, the signal is pretty much restricted to my property line.

And the signal is outstanding: clean, quiet, and as good as I would ever get from any FM broadcast (and without typical broadcast-signal compression). The concerns you stated about noise (compared to a hard-wired connection) do not match my experience with FM transmission. There are drawbacks, however, that I must reveal.

**Any transmitter emits RF interference, and one of my components (a surround decoder/amplifier) was especially sensitive to it.*

Shielding and transmitter antenna placement are the only cures but workable nonetheless.

**My transmitter occasionally drifts off-frequency, just enough to cause signal distortion. My unit is not a phase-locked loop (PLL) design, and even though I've had to retune it only two or three times, I would still opt for a PLL transmitter if I were ever to set up another.*

**Of course, any transmitter operator must be careful to stay on vacant frequencies and not interfere with FM stations. In major markets, finding vacant slots can be a chal-*

lenge. Some hobbyist transmitters enable operation just outside the conventional FM spectrum, and if your receivers can do the same, that is an option. (Stay off the TV audio band, however.)

Naturally, distributing audio signals through a house by running cable in the walls is not trouble-free either. As you stated, capacitance is always a concern, as is power-line interference. These considerations make wireless signal distribution (via FM or 900-MHz units) an attractive option.—Ray Evans, Orlando, Fla.



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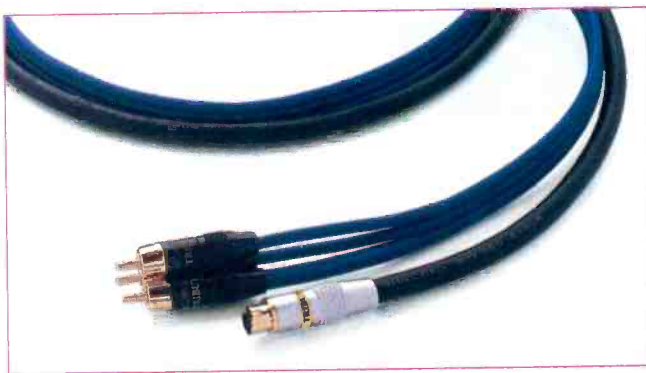
Magnepan's Magneplanar MG12/QR speaker is a full-range, two-way, quasi-ribbon thin-film dipole that measures 52½ x 17 x 1½ inches. Frequency response is rated at 45 Hz to 24 kHz, ±3 dB, with sensitivity specified as 86 dB/1 watt/1 meter (at 500 Hz). The speaker's fabric wrap is available in off-white, "cherry-white," black, or gray, with hardwood trim in dark cherry, natural, or black. Price: \$950 per pair. (Magnepan, 800/474-1646)

M&K THX HOME THEATER SPEAKERS

Qualifying for THX Select certification for use in listening rooms of 2,000 cubic feet or less, the 750THX System comprises LCR-750 THX main front and Center-750THX speakers, Surround-550THX surround speakers, and the Sub V-1250THX subwoofer. All (except the sub) use the same tweeter as M&K's S-5000THX speaker and identical 5¼-inch woofers. The sub's internal 125-watt amp drives a 12-inch, magnetically shielded woofer. Prices: LCR-750THX front, \$599/pair; Center-750THX, \$299 each; Surround-550THX, \$450/pair; Sub V-1250THX, \$799 each. (M&K, 310/204-2854)



Tributaries DVD Cables



Tributaries' DVD Cable Set comprises left and right audio cables, paired with 75-ohm coaxial digital and S-video cables, to connect a DVD player's analog audio, S-video, and digital audio output signals with A/V components. RCA

jacks are gold-plated brass, and the digital audio cable has two layers of shielding to ward off high-frequency noise and interference. Prices: \$60 for 1-meter length, \$70 for 2-meter length. (Tributaries, 800/521-1596)

Sennheiser Surround Processor

Using Toltec 3D processing, the DSP pro is said to convert stereo or Dolby Surround-encoded source material into Virtual Dolby Surround when played back through stereo speakers or headphones. Controls for ambience, "virtual seating," and "virtual environment"—as well as 15 presets (including bass, volume, balance, and Dolby Surround/stereo/mono)—enable customization and fine-tuning of the surround sound. Two headphone sockets and two preset functions facilitate use by two people. Price: \$269.95. (Sennheiser, 860/434-9190)



What's New

Digital Innovations CD Repair Device

Using filtered water as a lubricant in combination with a radial polishing process, the hand-cranked SkipDoctor, from Digital Innovations, is said to remove light-to-medium scratches, abrasions, fingerprints, and other surface imperfections that can cause CD, DVD, CD-R,



and CD-ROM machines to skip. (The company says SkipDoctor will not fix label-side scratches or deep gouges.) A disc is first sprayed with the supplied filtered water, inserted into the SkipDoctor device, cranked one direction, cranked in the other direction, and then removed. Price: \$34.99. (Digital Innovations, 888/762-7858)



B&W Outdoor Speaker

Engineered to withstand rain and sun for years, the WP1 uses a 5-inch woven-Kevlar woofer and 1-inch aluminum-dome tweeter. Side-mounted passive radiators extend bass response down to 50 Hz (-6 dB) yet protect the WP1 from rain. Frequency response is rated at 70 Hz to 20 kHz, ± 3 dB, with sensitivity of 89 dB/1 watt/1 meter. The WP1, available in black or white, includes an adjustable bracket for horizontal or vertical mounting. Price: \$550 per pair. (B&W, 800/370-3740)



INDUCTION DYNAMICS SPEAKER

The ID-1's two 15-inch subwoofers, which operate in push-pull mode, are said to be powerful enough for home theater applications when biamped. These drivers cross over to a 6½-inch woofer at 80 Hz. A 3-inch soft-dome midrange kicks in at 700 Hz, followed by a 1½-inch inverted titanium-dome tweeter at 3.2 kHz. Inductively coupled crossover coils create a brick-wall 30-dB/octave filter, claims Induction Dynamics, thereby restricting each driver to its effective operating range and reducing distortion. Price: \$14,995 per pair. (Induction Dynamics, 913/663-9770)



KOSS HEADPHONES

Intended for travelers and sports enthusiasts, the SportaPro's headband rotates from a conventional position atop the head to the back of the head, so you can wear a cap or hat. For portability, the SportaPro is collapsible and fits into a leatherette case; it also folds flat for storage. Frequency range is rated at 15 Hz to 25 kHz. Price: \$29.99. (Koss, 800/872-5677)

PANASONIC DVD PLAYER

Besides its internal Dolby Digital and DTS decoders, the DVD-A320 has a "Virtual Battery" mode that, says Panasonic, enhances sound localization by preventing AC power-line noise from entering the audio circuitry. A 10-bit video D/A converter enables forward or reverse scanning at 100 times normal speed with no video

distortion. Component-video outputs feed an ultra-clean picture to similarly equipped TVs. An illuminated joystick remote is included. Price: \$499.95. (Panasonic, 800/211-7262)



What's New



DEFINITIVE TECHNOLOGY SUB/SAT SYSTEM

Available in black or white, the ProCinema 100.3 comprises three pieces: the ProSub 100, a slot-loaded, 10-inch subwoofer powered by an internal 125-watt amp, and two ProMonitor 100 satellites molded of PolyStone, a nonresonant, high-density polymer. Each magnetically shielded satellite uses a 5¼-inch

cast-basket woofer and 1-inch aluminum-dome tweeter with a Linkwitz-Riley crossover. Optional ProMonitor 100s can be added, along with a ProCenter 100, to set up a 5.1-channel system. The ProCinema 100.3's overall frequency range is 19 Hz to 30 kHz. Price: \$799. (*Definitive Technology, 410/363-7148*)



ROTEL PREAMP/PROCESSOR

Advanced Motorola DSP chips are the heart of the Model RSP 985, which decodes Dolby Digital, Dolby Pro Logic, and DTS with full THX enhancements. Post-processing D/A conversion is done by three 24-bit ICs. There are six A/V inputs (each with composite and S-video jacks),

six digital inputs (four coaxial, two Toslink), and a discrete, six-channel DB-25 input jack to handle future processing formats. The RSP 985 has multizone/multisource capability plus an on-screen display; it comes with a learning remote. Price: \$1,999. (*Rotel, 800/370-3741*)

Krell MONO AMP

Available with left or right heat sinks or in symmetrical pairs, the FPB 650M is rated to produce 650 watts of Class-A power into 8 ohms, 1,300 watts into 4 ohms, and 2,600 watts

into 2 ohms. The amp's CAST (Current Audio Signal Transmission) circuitry senses and amplifies current rather than voltage, which Krell says makes the FPB 650M immune to the impedance characteristics of the interconnect cable feeding it. Price: \$13,000 each, \$26,000 per pair. (*Krell, 203/799-9954*)



PARASOUND TUNER/PREAMP/PROCESSOR

Besides performing automatic setup and level calibration (with the help of a supplied mike), the AVC-2500 has separate, 24-bit DSP chips for Dolby Digital, DTS, and THX Ultra processing. There are eight digital inputs (four coaxial, two optical, one AES/EBU, and one laserdisc AC-3), six A/V inputs

(composite and S-video), two component video inputs, and six audio-only inputs. Features include a "party" mode that sends a summed mono signal to every speaker, two-zone operation, a 20-preset AM/FM tuner, and a digital attenuator that detects and eliminates digital overload. Price: \$3,295. (*Parasound, 415/397-7100*)





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Spectrum

BY IVAN BERGER

LUSCIOUS LOGIC

Home theater is supposed to be where surround shines. But I haven't really been bowled over by the modest A/V surround system in my bedroom or the multimedia setup in my home office. And though I applaud the addition of surround to home music systems, I've not exactly bruised my palms with clapping. No, the most impressive surround I've heard in the past few months was in two Volvos: the C70 coupe and S80 sedan.

I'd always half-suspected that the car would be a great place for surround. Now that I've heard Circle Surround in my own car and Dolby Pro Logic in the Volvos, I know my suspicions were correct. On the road, surround's main benefit is that it adds ambience—and ambience is very scarce in cars. (Even a big car's interior is a lot smaller than any room in your house that isn't known for its plumbing. And car acoustics are weird, with glass casting harsh reflections and lots of upholstery soaking up

sound and cutting reverberation time. Music wasn't meant to be heard in such spaces.) Surround supplies the big-hall ambience and lets the music breathe. It lets me breathe, too; in surround, I find the music far more relaxing.

You will not get such ambience from car stereo DSP, mainly because it adds extra reverb—especially to the front channels, where it only muddies up the sound. (If that's what you heard at concerts, you'd demand better seats.) Surround decoders, however, extract natural ambience already in the recording.

The ambience from a good surround system helps make up for the car's strange acoustics and the fact that, wherever you sit, you're far closer to one speaker than the others. With surround, the sonic environment of the recording venue overrides the limitations that the car's acoustics impose.

Whether the perspective's accurate is another story. The CDs I've played through Circle Surround and Dolby Pro Logic decoders in cars have included stereo recordings and CDs encoded for Circle Surround, Dolby Surround, and a few other matrixes. Only when the disc and the play-

back system used the same matrix could I trust the instrument locations. And although playing stereo material in surround does not give you exactly what the record's producer intended, it's still magnificent, especially in the car.

Whatever the perspective, instruments were more firmly localized in the C70 and S80 than in my own car. I credit that to the Volvos' factory-installed center-channel



The Volvo C70's center speaker sticks out of the dash.

The buttons controlling surround are conveniently placed at the top of the Volvo S80's head unit.



speakers and to some of the modifications Volvo made to its Pro Logic decoder. Normally, a center speaker firmly localizes sound in the middle of the front sound field. Though that's right where you want it in a home theater, because you're already looking there to watch the screen, it's not necessarily right for the car, where you're facing down the road instead of toward the center of the dash. So Volvo added a Bi-Phantom Frontal Locator circuit, which feeds part of the center-channel signal to the left and right speakers. This localizes the sound dead ahead of you. By turning a center-channel level control, you can move the image toward the car's center line or away from it.

Another change to the basic Pro Logic circuit was made because the Volvos, like

news & notes

● If you can't see the NXT SoundVu speaker on this notebook computer, that's because it's invisible—but it's there. However, you won't see it in stores for a while. SoundVu, which shares part of its technology with NXT's flat-panel speakers, is ultra-thin, transparent, and can be bonded directly to plastic or glass surfaces.

Potential applications include computers, video, and car stereo.

● Lucasfilm now has two Home THX standards. The original standard has been renamed THX Ultra, and a new category, THX Select, has been added to accommodate mid-priced home theater components—including VCRs, which must pass a battery of viewing and listening evaluations and lab tests.

● This futuristic-looking gadget is Sennheiser's Surroundr, a surround sound collar. Because it rests on your shoulders, not your head, it can be heavier than headphones without causing discomfort. And be-

cause it does not turn when your head does, you don't feel the sound field shifting mysteriously as you move. Designed for computer gaming, the Surroundr is \$249.95.

most cars, deliver most of their bass through their rear speakers. To ensure full bass in Pro Logic mode, the low bass is filtered out of the two-channel signal before it goes to the decoder and is fed directly to the surround channel.

With CDs, I could set the Volvo systems for full Dolby Pro Logic decoding, Dolby 3 Stereo (which puts three channels across the front but does not decode the surround channels), or plain stereo. For FM listening, the choices were just Dolby 3 or stereo. According to Hans Lahti, who's worked on Volvo's sound systems since 1995, "You can get funny reactions if you're driving in an area with changing reception quality. When the reception goes between stereo and mono in such areas, the sound in the surround channel cuts in and out." I didn't notice this with the Circle Surround decoder I tried in my car last year, but the rear channels did get noisy when FM reception was poor; I don't know if this would happen with Pro Logic.

I really enjoyed what Dolby 3 Stereo did for FM. It firmed up the soundstage and gave me a sense of fullness and spaciousness without muddying up the sound. Even so, I missed having full surround for FM listening. (Volvo is beginning to supply it on the C70 and should have it on the S80 soon.) The Volvos' Pro Logic circuits produced such luscious ambience from stereo CDs that I'd expect them to do the same from FM.

Both Volvos were comfortable, responsive, and fun to drive, which put me in a responsive mood, and both (especially the S80) were quiet enough to let me hear nuances reasonably well. Yet although their sound systems were similar in principle, they differed quite a bit in detail. The C70's surround system had a double-DIN Alpine head unit, with slots for cassette and a three-CD magazine, and a center-channel speaker that stood out from the dash like an afterthought. The S80's center speaker was faired smoothly into the dashtop contours, and its Mitsubishi head unit had a single-CD slot, no tape player. Both cars had sound-system controls on their steering wheels and tuners equipped for RDS.

The Alpine head unit in the C70 coupe is also used in the C70 convertible and V70 wagon. These three cars have identical dashboards but wildly differing acoustics.

So the head unit carries four equalizer curves and automatically selects the right one for whichever model it's installed in. Why four EQ curves for three models? Because the convertible gets separate curves for top-down and top-up operation—automatically selected, of course. That will let your surround shine where the sun does, weather permitting.

Solid-State Centennial

Officially, solid-state electronics is just over a half-century old, based on the transistor developed at Bell Labs in 1947. Unofficially, it hits the century mark this year, the anniversary of Ferdinand Braun's 1899 patent for a crystal detector. Braun's detector, a semiconductor crystal contacted by a single wire, was the "cat's whisker" of crystal radios; in modern terminology, it was a diode.

Diodes can rectify current, but triodes can amplify it. Throughout the tube era, researchers tried to create solid-state amplifying devices. Julius Lilienfeld, a German scientist, patented a field-effect transistor in 1926 (although there's no proof he ever got it working). Robert W. Pohl, another German, made a solid-state amplifier in 1938 that used salt as its semiconductor, but it was too slow to be practical. William Shockley tried in 1939, without success.

Shockley's later work did lead to the point-contact device invented by his colleagues at Bell Labs, John Bardeen and Walter Brattain, in 1947. But for all the publicity it garnered, it was not the device that started modern solid-state electronics. The credit for that must go to the bipolar transistor, which Shockley invented a month later.



Bell Labs' original point-contact transistor

DVD Recorders? Hold Your Wallet, Not Your Breath

Will DVD recorders supplant VCRs? Probably, but not this year.

There's no shortage of technology available. That's half the problem: too many companies offering technologies that do the job but aren't compatible with one another.

At least three types of recordable DVD are now available for computer use, and only one is claimed to be readable on existing DVD-ROM drives and DVD players.

The other half of the problem is the need for copy protection. It's safe to sell DVD recorders for computer use, but any company that brings out a stand-alone DVD recorder for home theater will almost certainly be hip deep in lawsuits within days. Analog technology's replacement by digital has made the music and film industries a lot warier of home recording than they were even when the movie studios sued Sony in an attempt to kill home VCRs.

Furthermore, there's not much to record on DVD yet. You won't find digital video outputs on DVD players nor, as far as I know, on digital TV equipment. You will find digital audio outputs on DVD players, but virtually all of them downsample 96-kHz audio to 48 kHz. About the only unrestricted digital A/V connections you'll find are the IEEE-1394 jacks on digital camcorders and video editing gear and on a few (mostly Sony and Macintosh) computers.

That will all change once the film, music, and home theater companies agree on a copy-protection system everybody can live with. For now, plenty of competing protection systems are being proposed, with no signs of any gaining the upper hand. I've heard there will be some industry-wide agreement by the end of this year, maybe by

this summer. But even if that does happen, the hardware standards need to be pinned down.

It took about 15 years from CD's introduction until affordable CD recorders hit the stores. It's taken far less time for DVD recording to become possible, and making it practical shouldn't take too much longer. But if recordable DVD takes too long to launch, it will find some newer recording system nipping at its heels.

New Life for Old CDs

What can you do with unwanted CDs and CD-ROMs? Readers of the British magazine *New Scientist* came up with some interesting suggestions. Enver Yousuf of Cookham, Berkshire, proposed stringing them together to make modern versions of 1970s bead curtains. Derrick Hastings of Mill Lane, Cheshire, hangs them above the fruits and vegetables in his garden to scare birds away. Mark Roberts (no address given) turns them into furniture glides. Kriss Buddle, of London, melts them into homemade Frisbees by centering each disc in a cereal bowl, stacking six more bowls above the disc, and heating everything in an oven for 20 minutes. Peter Macinnis, of New South Wales, Australia, having given the matter much thought, submitted a baker's dozen suggestions. The most practical was notching the discs' edges to make circular saw blades for cutting balsa wood and Styrofoam. But my favorite was to put CDs around a goldfish bowl, shiny side in, so the fish will feel less lonely and hemmed in.



news & notes

- Harman Kardon has introduced a DVD player with computer serial ports. The RS-232 and RS-485 ports on its Signature 3.0 are for connection to computerized or touchpanel control systems.

- "Pure Malt" may sound like a strange name for speakers, but it's a logical one: The oak for the cabinets of these limited-edition loudspeakers comes from barrels once used by Sun-tory for aging whisky. Pioneer introduced the model in Japan late last year.

- Power-operated doors are nothing new in car stereos, where they uncover CD and tape slots or make the head unit "disappear" when you



park. Neither reason explains the doors on Kenwood's Excelon car amps. Closed, they cover the controls and cooling fan but can be opened by operating a switch on the amp itself or on an Excelon head unit. And should the amp's temperature reach 176° F, the door will open automatically and the fan will turn on.

- Garrard, once one of the world's largest turntable manufacturers, is back from the dead. Loricraft Audio International, in Marlborough, England, is the current owner of the trademark. It is now rebuilding Garrard 301 and 401 transcription tables and has introduced a new model, the 501.

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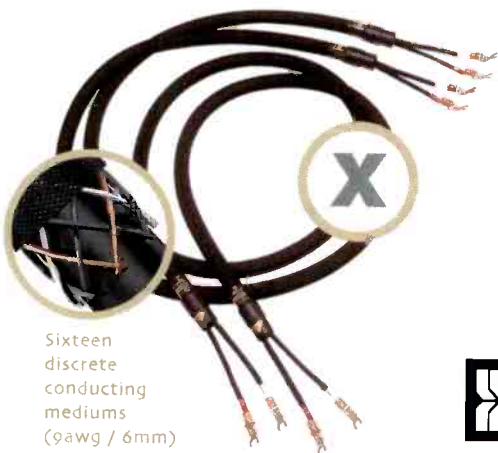
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ONE, TWO, FIVE, TEN ...AND COUNTING

What kind of a number sequence is this? Nothing more than the channel count in the evolution of sound reproduction in the home. We start with mono, progress to stereo, and (ignoring quad) arrive at the five-channel system that now dominates movie sound and is becoming increasingly important for straight music recording. The "ten" in the sequence refers to something altogether new, something that was demonstrated in January at the Consumer Electronics Show in Las Vegas. While first-day attendees were listening to progress reports on DVD-Audio and Super Audio CD at the Convention Center, Tom Holman was busy at the Alexis Park Hotel, site of the high-end audio exhibits, putting the finishing touches on his 10-channel playback system. (He actually refers to it as a 10.2-channel system, because there are two subwoofers in it, but it's the other channels that are of primary interest.)

The roots of this system go back at least to the International Alliance for Multichannel Music in 1996. At this conference, Holman observed that to obtain a significant improvement in spatial impression it is necessary to effectively *double* the number of channels. The biggest problem for Holman was not deciding the number of channels, but where to put them. It would be so easy to waste precious channel capacity by putting some of them where their benefit would be marginal. With that in mind, he surveyed the literature in psychoacoustics to determine where the wide-range speakers in a 10-channel system should logically go.

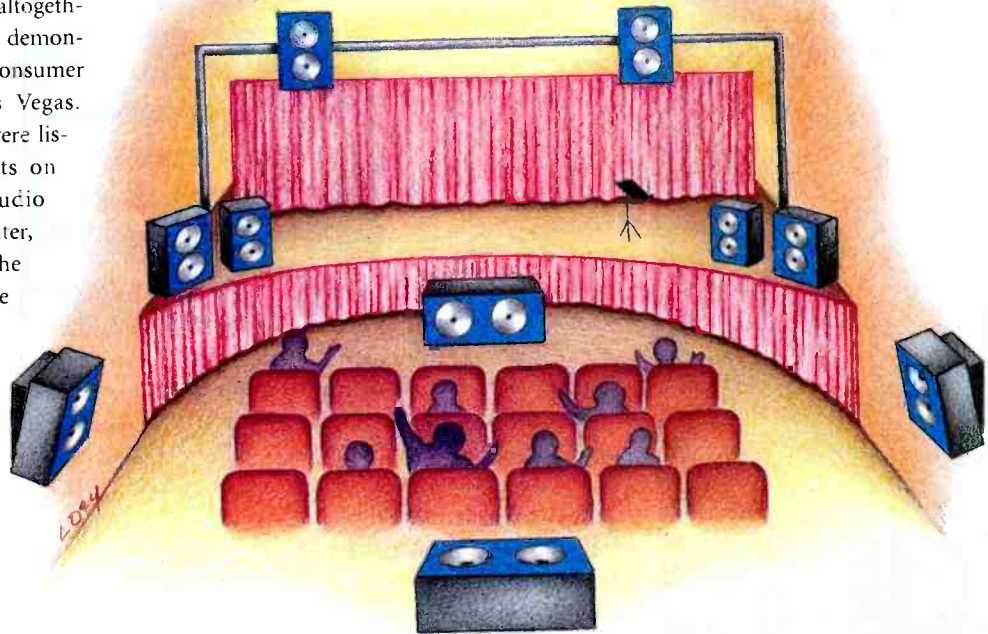
Holman's search corroborated two fundamental observations. First, our ability to localize sound sources is greatest in front of us, where aural and visual cues can be compared and

correlated. Second, our judgments of spaciousness in any listening environment depend a great deal on randomly related reflected sounds from broad zones to the left and right of us. Curiously, our angular acuity in those directions is fairly weak, which is why we turn our heads and look if we want to identify a specific source direction. Holman also considered the nature of sound in typical concert halls, where direct sound from the stage is followed almost immediately by a volley of enveloping reflections from the sides and then by the development of a truly random, global field of reverberation.

Taking these somewhat divergent observations as a starting point, together with the standard five-channel layout of three front speakers and two surround speakers to the sides,

Holman developed his assignments for the additional five channels. He determined that three standard front channels (left, center, and right) are sufficient for a listener to pin down direct on-stage events over a total included angle of about 60°. These needed to be supplemented, however, by a more widely spaced front pair, to reinforce the earliest side reflections. Holman located these channels at angles of about $\pm 60^\circ$ relative to the forward listening axis and in the same plane as the three main front channels.

The next addition was a proscenium pair. In typical concert halls, a great deal of sound is reflected down toward the audience and contributes to a sense of overall envelopment. Holman put the loudspeakers for these channels at a 50° elevation,



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with a horizontal spacing of approximately $\pm 30^\circ$ relative to the forward listening axis. (That is, more or less above the main front left and right speakers.)

The wide-front and proscenium channel pairs are fed from appropriately placed microphones. The primarily reverberant output from these speakers typically arrives at the listener less than 100 milliseconds after the direct sound from the three main front loudspeakers.

The final supplement to the main speaker array was a single rear center surround loudspeaker. The two conventional surround speakers are usually placed at angles of $\pm 110^\circ$ to $\pm 120^\circ$ relative to the forward axis. (That is, slightly rearward of the sides of the listening position.)

They are normally placed higher on room walls than the front channels and are often of dipole design, for increased diffusion. The rear center channel locks in place the back-of-the-room contribution to reproduced reverberation, regardless of head orientation.

With these five new channels, Holman expected the listener would be immersed in an acoustic environment where normal head movements would cause little, if any, impairment of the rock-solid stability of the perceived sense of space. In support of this thesis, he presented a 20-minute music and effects program at CES. The demonstration was conducted in a darkened room so that visual cues—which in the small space would often be quite contrary to the auditory ones—were eliminated.

The program began with a ping-pong game in simple stereo, which in short order became a flurry of balls seemingly coming from everywhere! Two symphonic examples followed. Inasmuch as these recordings are experimental and intended for technical evaluation only, Holman has asked that I not identify their source. The orchestral performances were thoroughly professional, however, and the recording venue was spacious and reverberant.

With one of the recordings, an excerpt from a choral/orchestral performance, I conducted an interesting experiment: I turned off the rear three channels. What I

then heard was a naturally spacious presentation from the front half of the listening room. After all, there were four channels of early reflections in addition to the three channels of direct pickup. Engaging the three rear channels "livened" the overall sound through the addition of more reverberation, but the overall sense of envelopment did not significantly increase.

Another experiment involved cutting off the front four supplementary channels (wide and proscenium) and listening to the three main front channels in combination

**DOUBLING THE NUMBER
 OF CHANNELS HEIGHTENS
 THE SENSE OF REALISM
 AND RELAXES
 SEATING CONSTRAINTS.**

with the three rear channels. A familiar problem cropped up: I always felt the urge to turn up the rear channels to provide the sense of ambience and envelopment that was, in this experiment, missing

from the front of the room. As a result, the level of the rear trio of channels became very critical; what worked for one seating position simply did not work for the seats one row in front or farther back. It's a common problem in five-channel direct/ambient recordings that lack early side-oriented reflections in the surround channels.

So the purpose of doubling the number of channels is not to double the number of point-source positions (although this might possibly be appropriate for certain works, such as Hector Berlioz's *Requiem* or William Walton's *Belshazzar's Feast*, where off-stage brass ensembles are called for). Rather, the purpose in doubling the number of wideband channels is to heighten the sense of realism and, coincidentally, free up the fore-and-aft seating constraints. With a 10-channel system like Holman's, I believe it would be possible to reproduce surround sound quite credibly in a room seating upwards of 40 or 50 people—with just a little breathing space around the loudspeakers.

In the demonstration, Holman also played a passage of pop music that had been extensively "rechanneled" to take advantage of the extended palette of spatially diverse early reflections. It worked well, which means nobody's pop multitrack master tapes can really be called obsolete until some interesting experiments in remixing have been conducted. A

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(DIGITAL) BROADCAST NEWS



Admit it. Although the United Kingdom may be a backwater country desperately aspiring to Third World status, it does on occasion come up with the goods. True, the British Empire is now reduced to a sheep-covered rock in the South Atlantic; the passing of Diana has robbed it of its prime celebrity; Rolls-Royce, Rover, and Bentley are German (*oy gevalt*), while Jaguar and Aston-Martin are American; and British rock circa 1999 simply sucks. But the odd glimmers of excellence, innovation, and bravery remind me of why I was inspired to move here from America. (How curious it is to be vindicated by something as unimportant as this year's British sweep of the Oscars. Say what you like, but fi-

nancing and Gwyneth Paltrow aside, *Shakespeare in Love* is a British flick.)

This time, it's the lead in digital broadcasting. Arcam, though hardly a world player, beat the major-league Japanese brands by releasing the "World's First Digital Radio Hi-Fi Tuner." For nearly a year, the launch of this particular product has given the company something to crow about, the latest instance being a breathless follow-up press release that must have been written with a new word processor that had a function key for "Overstatement."

**ARCAM'S ROB FOLLIS
DESERVES A MEDAL FOR
TRUMPETING THE LAUNCH
OF DIGITAL RADIO
WITH SUCH EBULLIENCE.**

Maybe I'm in the minority, immune to the seductive hype, because I absolutely despise British radio. (It is easy to do if you grew up on the fringes of a reception area where listeners could hear Cousin Brucie, Murray the K, and other DJs whose boots their British equivalents were unworthy of licking.) I find it amazing that anyone, including a PR hack, can show enthusiasm for a medium that has been, and continues to be, hammered by cable, satellite, the Internet, and other media feeding free sound into the home. (Calling it "digital" can't disguise it from being mere "radio.") But Arcam's Rob Follis deserves a medal for trumpeting the launch of digital radio with such ebullience, feigned or real.

Whatever cynicism I'm demonstrating is the byproduct of witnessing myriad format launches for more than a quarter-century. Given that the world was far less jaded in the decade after World War II and probably a nicer place to be, regrettably I was too young to notice that the LP was replacing the 78, mono was losing out to stereo, and tubes were all but replaced with transistors. At the time, I was more interested in Howdy Doody and Captain Kangaroo. But I did witness—first as a consumer, then as a retailer, and finally as a writer—the births or deaths of 8-track, cassettes, Elcaset, pre-Dolby surround sound (quad), dbx, DAT, DTS, CD, DVD, laserdisc, CD+G, CD-I, CD-V, and too many others to allow something as minor

as digital radio to set my pulse racing. I'd be far more impressed by a button on a tuner that can send 50,000 volts to a DJ's private parts

every time he says something inane or plays a Celine Dion track.

Still, in a period best described as a lull—while we wait for DVD-Audio and possibly Super Audio CD to

reach the market—companies like Arcam have to work all that much harder to grab one's attention. Everybody in the retail trade, the audio press, and, yes, the buying public expects a steady flow of new product announcements, but they're usually of the new amp/new speaker/new player variety. Nothing earth-shattering, just introductions of new models, most of which are made in the month of January. What we need on occasion—from, say, March to September—is something truly fresh, if not always truly exciting.

It was Arcam's task, in promoting its Alpha 10DRT digital tuner to alert the world to the first actual digital radio broadcasts. (You in the United States are also in a transitional period at this very moment, only for something far more rewarding: high-definition television. This shows you the difference in priorities: You guys get killer TV; we get to hear overpaid cretins droning on with greater fidelity.) The birth of digital radio reminds me, unfortunately, of the launch in the last decade of stereo TV (via a system called NICAM in the U.K.). Numerous press reports touted the wonders of stereo as applied to television shows; a quarter of my life later, I'm still waiting for the local transmitter to deliver two-channel sound for the BBC networks. Anyway, after a good six-month lead-in, in which it was impossible to escape hearing about the Alpha 10DRT, it was announced on March 15th that true digital radio broadcasts could be plucked from the ether.

Or, as Arcam's Rob Follis put it in a widely dispersed e-mail: "Radio changes irrevocably on March 15 and the U.K. becomes the first country in the world where there is a national Digital Radio network, and thanks to Arcam, the only one where a consumer can walk in to a hi-fi shop and actually buy a Digital Radio."

A little editing wouldn't have hurt, but you get the drift: "We beat the Yanks." Or, rather, "they" beat the Yanks, for I am still—and forever will be—a Yank.

Then the real breast-beating commenced. If Follis were truly a child of the computer era, his press release would have arrived via the Net accompanied by streaming digital audio—in particular, the strains of "Rule Britannia," "God Save the Queen" (not The Sex Pistols' version), and "Land of Hope and Glory." Instead, the release mere-

ly stated, "Digital Radio arrives Mon. 15 March and it doesn't come from Osaka, Seoul, or Silicon Valley." Take that, Asia and America! "U.K. beats the world with national Digital Radio On-Air Now." Ditto! "ARCAM of Cambridge U.K.," it continued, "beats the world to introduce: The World's First Digital Radio Hi-fi Tuner—the Alpha 10DRT." Double ditto!

"Cutting-Edge Digital Technology Designed And Built In The U.K." and "Arcam, the U.K.'s leading manufacturer of quality hi-fi, is proud to announce retail availability

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of the world's first home Digital Radio Tuner (DRT), the Arcam Alpha 10DRT. The Future of Radio starts here!" And "The A10DRT is in full production and from Monday March 15, 1999, will be available nationally through around 100 Arcam hi-fi dealers within range of a BBC Digital transmitter."

Aah, there's the rub: "within range of a BBC Digital transmitter." In other words, everyone who lives outside of London is excluded. Follis, ever the optimist, revealed, "All BBC stations are on-air now and over 60% of the U.K. can already receive BBC Digital Radio programmes. Rapid expansion of the network is planned and Commercial Radio goes live in October 1999.

"Digital Radio," the release said, "is the future—it will replace all current broadcasting over the next decade. There is one fixed technical standard [this is not Betamax]. The future is assured, even for early adopters. Existing MW/LW/FM transmitters will all be turned off within 10-15 years."

Oops, there goes my Sequerra and my Marantz 10B.

"The Alpha 10DRT," the release continued, "is a genuine world first. The first home DRT to be developed and the first to go on retail sale. This is a stand-alone component, easily added to any hi-fi system, much as one would add a new CD Player. The cost is £800 [approximately \$1,280], remarkable value for high performance hi-fi,

incorporating radical new technology. In real terms, it is less than half the price of a CD Player when CD started in 1984 and, once you've bought it, the music is free. Hundreds of units have been pre-sold to radio & hi-fi enthusiasts and broadcasters."

Maybe Pfizer should have used Rob Follis to launch that other great British invention: Viagra.

Under "Reasons to Buy Digital Radio," Follis really let rip with the superlatives:

"Near CD" Digital sound quality—the sound is markedly better than current FM Stereo and blows MW & LW into the dust. All digital programming will be in stereo (except sports commentaries). Connected through a hi-fi system, the A10DRT brings the studio or concert hall right into the home.

"Interference-free reception—no hiss, no snap, crackle & pop, no birdies, just clear, clean sound.

"Existing stations," Follis's release promised, "go national in stereo—Virgin & Talk, currently available nationally in poor-quality mono Medium Wave, will now be available in Digital Stereo, as will Classic FM and BBC Radios One to Five.

"Many new Digital Only stations—the BBC is already transmitting live Parliamentary broadcasts and increased live sports coverage. Extra music programming follows shortly. From October '99 there will be seven brand-new Digital Only commercial stations—the only way to hear them is to buy a Digital Radio.

"Never again turn on the radio and wonder what you are hearing—a built-in display shows full text info on songs, plays, presenters, etc. Tuning is easy because all stations can be found by name." Which is something we've enjoyed in part for years with RDS.

But let's not allow that to undermine the launch. A

Further to my column in the April issue about the British hi-fi industry's changing fortunes, I am pleased to report that Epos has survived its transfer from Mordaunt-Short to Michael Creek of Creek Audio. Epos will be operating as a separate company and may be reached at: 2 Bellevue Rd., Friern Barnet, London N11 3ER, England; phone, 011 44 181 361 6734; fax, 011 44 181 361 4136; epos-acoustics@ibm.com; www.epos-acoustics.com.

It all started, as most things seem to these days now that I've settled into my 30s, with some brash young punk spouting off something that jolted me with a deep fear for the survival of man both as an animal and a society. This kid was a tech monkey, an I.S. geek. You know the drill—young male gearhead, the kind of kid who in my day drooled over hi-fi mags but nowadays doesn't so much read *Wired* as look at the pictures, so he's "up on technology" but thinks Linux sucks his thumb and drags a blanket around.

Our young tech monkey was sitting in on a meeting at the *Audio* offices recently, hunched over a Powerpoint-loaded laptop and jabbing at the keys while his organ grinder, a well-groomed and dynamic fellow in his 40s, gave us a well-groomed and dynamic presentation on that latest of Internet marvels—MP3.

MP3 (full name: MPEG-1 layer-3) is all the rage these days, and with good reason. This popular "freeware" compression format lets you shrink PCM audio files (like CD tracks) down to less than a *tenth* their original size, so you can shoot them over the Net in mere minutes instead of hours. Download any one of the dozen or so free MP3 encoders and playback software floating around the Net (www.MP3.com is where the toys are), and you can turn your PC into a serious audio fun box in the time it takes to peel a ripe tangelo.

The reason MP3 is so hot right now, despite the almost total lack of interesting program material on the Net, is because every goateed cyberpundit is yammering about how MP3 will spell the end of the recording industry. In other words, "Why would I buy CDs or DVDs at Tower if I can just troll the Web for free MP3 files and play 'em on my PC instead?" The operative model here seems to have come from "Why should I pay five bucks for a copy of *D-Cup* when I can download all those daily freebies off alt.binaries.pictures.of.I.don't.care.what.it.is.just.so.long.as.it's.naked?" It's a model that I'm sure covers most, if not all, of the bases in your average goateed cyberpundit's world, but probably not yours or mine.

I mean, I have lots of fun with MP3, but I view it as simply a fast and convenient way to e-mail music back and forth to friends for a quick listen, in a format that sounds pretty good but is obviously not distortion-free. It's certainly no replacement for high-quality music formats like CD or DVD-Audio, although I'm heartened by all the hubbub that MP3's kicking up, because any time kids get juiced about audio, I'm all for it.

But lost in the buzz about MP3 is a rational discussion of just how good it sounds in the first place. This is perfectly understand-

MP3

What Does It *Really* Sound Like?

by *Corey Greenberg*

able. When I first heard an MP3 file, I was pleasantly surprised, and I'm a seasoned audiophile. It's amazing that MP3 sounds as good as it does, considering that more than 90% of the original PCM digital data is tossed out with the coffee grounds and fish heads by the time the MP3 encoder is finished dumbing it down to a Music McNugget. A kid whose primary music system is a boombox, shelf system, or the little plastic speakers that came bundled with his PC could be entirely forgiven for hearing no difference between the two whatsoever. And when one file takes up less than a tenth the space on a hard drive, which one do you think is going to win out?

Back at the MP3 presentation to the *Audio* editors, tempers were flaring. You just don't toss off cheery pronouncements like "MP3 offers CD-quality sound!" and "MP3 can take the place of an entire hi-fi system!" in front of veteran audio pros like Ed Foster and Dan Kumin unless you're looking to get all of the skin blistered off your head, which is pretty much what happened to this poor fellow.



MPEG

PHOTOGRAPH BY CHUCK CAELTON AXIOM

And that's when our young tech monkey, clearly in way over his head, suddenly jumped to his beleaguered boss's defense with, "Hey, guys, MP3's digital, right? So that means it's CD quality!"

Yeesh. As the kid got drowned out in an avalanche of howls, I thought about what he'd said and why. Certainly a young tech monkey of today isn't going to find a review of MP3's sound quality in the pages of *Wired*, or even in most hi-fi mags, for that matter. So instead of giving the kid a lecture he'd just ignore anyway, I decided to sit down and actually do a fair and comprehensive comparison to settle, once and for all, whether MP3 really is "good enough" for music.

Since MP3 is primarily a PC-based audio format, I used two computer setups to compare favorite CD tracks with their MP3-encoded versions. My trusty Dell Dimension XPS desktop served as the first test bed. The Dell is a fully loaded 350-MHz P-II screamer (well, a year ago it may have "screamed like a white woman," as Little Richard used to say, but that was before the new 500-MHz machines came out) with 128 megabytes of RAM, a 16-gig hard drive, a Plextor 8X20 SCSI CD-R drive, and Event's audiophile-grade Gina sound card with 20-bit A/D and D/A as well as S/P DIF digital input and output. This is my main recording rig, and lately it's been hitched up to an NAD Model 116 preamp, which feeds line-level audio to a pair of NHTPro's excellent new M-00 active near-field monitor speakers, crossed over at 80 Hz to an NHT SW3P subwoofer. This has proven to be an outrageously good monitoring system; sitting at my desk with these high-resolution near-field speakers just a few feet from my face, I hear things on CDs plain as day that used to take the almighty resolving power of big Grado headphones to tweeze out of a mix.

But that's the audiophile-approved, best-case scenario. Back in the real world, lots of people work and play on laptops. So almost as a lark, I also did a round of comparisons on an IBM Thinkpad 560X, a 200-MHz Pentium MMX notebook PC with 96 megabytes of RAM, a 2-gig hard drive, external Ricoh SCSI CD-R drive connected via an Adaptec PC card SCSI adaptor, and a built-in Crystal Semiconductor-based sound card of decent (though hardly audiophile-grade) quality. No special playback gear was used with the Thinkpad; monitoring consisted of simply plugging a pair of Grado SR-60 headphones into the IBM's stereo headphone jack! And, of course, the IBM/Grado rig turned out to be the most revealing test of the differences between straight PCM and MP3 digital audio. Whether it's PC-based audio or high-end audio in the living room, it's always the same deal: No matter how much I try to set up an optimized, idealized test bed for reviews, it's always the real-world setup that turns out to be the most illuminating.

To move the CD audio onto my hard drive for the MP3 encoding and the side-by-side comparisons, I used Syntrillium Software's Cool Edit Pro audio editor to convert the stereo CD

tracks to uncompressed Windows PCM .WAV files and to play them back during the listening tests. (A free two-channel-only "lite" version, Cool Edit '96, is available for downloading at www.syntrillium.com.)

Generating MP3 versions of these same audio tracks was a piece of cake with Telos Systems' Audioactive Production Studio MP3 encoder, which compresses .WAV files into MP3 files (you can get a 30-day working trial version of the software at www.audioactive.com). Because Audioactive Production Studio is just an encoder, I used the popular (and free) Winamp MP3 player (www.winamp.com) during the comparisons.

One thing that no one seems to mention when they're jizzing about MP3 is how long it actually takes to make MP3 files. It's not like WinZipping a data file in a matter of seconds; MP3 encoding takes a long time—longer than the song, in most cases. A fast Pentium II rig with lots of RAM helps greatly, but even with my beef-injected Dell desktop, it took a while to make the MP3s. Forget about doing an entire CD in minutes. That's going to take you an hour, while your PC slows down everything else in the process.

It's also been my experience that the ultimate sound quality of MP3 encoding tends to vary not only with the kind of encoder software you use (I've had mixed results with some of the freeware available on www.mp3.com, though anything using the "Fraunhofer" scheme, like the Audioactive encoder, generates good-sounding MP3s) but also according to the kind of music you're working with. Because the compression is so aggressive, it's sensitive to the spectral balance and intensity of whatever audio you feed the encoder. Slow, languid classical music is real easy for MP3 to clone without serious audible consequences. But try compressing

some full-on rock with a steady bass line, loud electric guitars, harmony vocals, and in-your-face cymbals, and you start to hear all kinds of weird, phasy crap filling in the gaps where some of the music used to be.

All that in mind, I chose an assortment of much-loved CD tracks for the comparisons. The MP3 files were held to the same 44.1-kHz sampling rate as CD, with the data rate scaled down to the de facto MP3 standard 128 kilobits per second. Some have reported better-sounding results encoding MP3s at higher bit rates, but that makes for larger files, which kind of begs the question of what exactly are we accomplishing here? In any event, files with bit rates lower than 128 kbps sound pretty nasty, while going higher doesn't improve the sound enough to make a much larger file worth the extra modem time. No wonder, then, that 128 kbps has become the MP3 standard on the Net; it definitely offers the biggest bang per bit with the current generation of MP3 encoders.

Despite all this tech spew, creating an MP3 file from a CD track is really easy. I loaded each CD into the CD-R tray—any standard CD-ROM drive with digital audio extraction (DAE) capability will



work fine in this application—and captured its output with Cool Edit Pro as a straight PCM .WAV file. Then I converted the files to MP3 with Audioactive Production Studio, saving the original .WAV files for later comparison.

The tracks I chose were The Beatles' "Taxman" (*Revolver*), Guided By Voices' "Watch Me Jumpstart" (*Alien Lanes*), John Coltrane's "My Favorite Things" (*My Favorite Things*, recently remastered on Atlantic), and David Bowie's "She Shook Me Cold" and "All the Madmen" (*The Man Who Sold the World*).

The Beatles' "Taxman" features a spare electric rock mix, while the close-knit Lennon/McCartney harmonies present MP3 with the challenge of preserving both voices without audible artifacts. GBV's "Watch Me Jumpstart" is a great song by a great band, but the mix is lo-fi and mainly mono. It serves here as a stand-in for nearly all indie rock today, which is mostly engineered by faux-anarchist dumb-asses posing as "analog minimalists." Trane's "My Favorite Things" is straight-ahead, cleanly recorded stereo '60s jazz, while the two full-on Bowie cuts feature enough searingly recorded cymbals, thick Mick Ronson guitar, and bottomless, out-of-control fuzz bass—not to mention the most RAWK!-inflected vocals of Bowie's career—to tax any perceptual encoder's ability to perform clean, transparent audio compression on a busy, full-range mix. Plus, I just like the music.

I'll cut to the chase: No matter which track I used for the comparison, MP3 didn't even come close to "CD quality." I mean, it's really good for doing a bite-sized Music McNugget to e-mail to your friends, but as something to listen to in place of CDs or, soon, DVD-Audio discs? Not a chance. For those children who may still be up at this hour, Mistah Corey's here to tell you that just because it's digital doesn't mean that MP3 has CD-

quality sound. It has roughly the same degree of grunge and coloration as a cassette dub. In fact, they sound quite similar overall. Depending on the music track, I heard varying degrees of the same three characteristics from every MP3-encoded file I compared to the original PCM track: (1) a noticeable roll-off in the highest octaves; (2) an edgy emphasis in the low treble, which added a tinny, unwelcome distortion to vocals, horns, and guitars; and (3) less low-level detail, such as reverb tails and echoes—the "ambience" that gives the sense that the music is happening in a real room.

Some of the tracks sailed through MP3 encoding with fewer dents and dings than others. The Guided By Voices cut was the only one that didn't suffer significantly from its conversion to MP3, probably because it's a mono recording to begin with and very dirty and band-limited, to boot. Although *Alien Lanes* is one of my very favorite records of the last 10 years, GBV's Robert Pollard recorded it on a crummy four-track cassette "Portastudio." So there's no real low end—no real high end, either—and lots of

cool, shattering distortion that may or may not have been in Pollard's original game plan. I made a very careful cassette dub of this CD for a girlfriend once, and she asked me if it were a boom-box tape I'd made from the last row at one of the band's concerts. Lo-fi in all its glory—MP3 goes with this kind of stuff like Shields goes with Yarnell.

The other MP3 tracks suffered from more audible coloration, though in different areas. The Beatles' "Taxman" lost its top end, while Paul's ripping guitar solo took on a raspier edge. But what stuck out like a sore thumb was what MP3 did to Paul's and John's harmony vocals: The data compression made them sound like one vocal track run through a flanger, with some random, phasy crap swirling underneath. The Coltrane MP3 track sounded pretty close to the CD tonally, but his saxophone came across a bit dirtier and the lively, "wet" studio ambience behind all the musicians dried up considerably.

Each of the Bowie tracks uncovered a different problem with MP3. "She Shook Me Cold" features a monolithic, early Sabbath

sludge riff; later on, Bowie drops out and lets the band move into sort of a power trio tribute to Cream (producer/bassist Tony Visconti even stops playing completely toward the end, just like Jack Bruce used to do in the middle of songs whenever he felt like walking over to the drumkit and punching Ginger Baker's lights out). This Ryko-remastered CD of a 1971 recording pulls off that "loud but clean" thing as well as anything on my shelf, but via MP3 the song loses much of its glossy sheen and the instruments sound like they're scraping against each other. This track suffered the greatest sonic damage from its conversion to MP3. The other Bowie track, "All the Madmen," starts off with Bowie singing over acoustic guitar strums and a flute

section straight out of the Enchanted Forest. After MP3, Bowie's voice loses much of its stark clarity, and the nice, fat studio reverb swimming around his vocal track largely vanishes. The damage here is more subtractive than additive (as in the case of "She Shook Me Cold"), but the fact remains that the sound of both songs is obviously changed, and not for the better, by the effect of MP3 encoding.

If you haven't messed around with MP3 yet, you should give it a go. It's a lot of fun, and you can really get caught up in trading music over the Net and the like. But music lovers—specifically young music lovers—who are looking to MP3 as a primary music-delivery medium will ultimately be disappointed by its sound quality if they ever listen on a good audio system. We should really consider MP3 as merely a cool way to send audio files across the Net quickly and easily without mucking up the sound as badly as RealAudio or other streaming audio formats. If you think of it as the e-mail equivalent of a cassette dub, MP3 makes a lot of sense for a lot of people, including me. But CD-quality sound, it's not. Not by a long shot.

Just because
it's digital
doesn't mean
that MP3 has
CD-quality
sound.

EDWARD J. FOSTER

SONY DVP-S7700 DVD PLAYER



Sony's newest DVD player, the DVP-S7700, looks a lot like its first, the DVP-S7000 (May 1997 issue); they share a distinctive touch, a display panel that normally hides the disc tray and many of the controls. Fortunately, the similarity is not just skin deep. The S7700 is a most worthy successor to the S7000, acclaimed by just about every reviewer (including me) as perhaps the finest DVD player yet produced.

Dimensions: 17 in. W x 4 $\frac{3}{8}$ in. H x 13 $\frac{1}{4}$ in. D (43 cm x 11.1 cm x 33.5 cm).

Weight: 15.4 lbs. (7 kg).

Price: \$1,199.

Company Address: 1 Sony Dr., Park Ridge, N.J. 07656; 201/930-1000; www.sel.sony.com.

But before I go into how good the DVP-S7700 is, let me describe it. First, it has just about every connection you could want. Like the S7000, the S7700 has simultaneous video output in all three consumer formats: NTSC composite, S-video (which is also called Y/C, or luminance/chrominance), and component (color difference). Duplicate sets of composite- and S-video outputs enable you to feed more than one TV. All RCA jacks are gold-plated, including the video jacks, the two sets of stereo analog audio connectors, and the coaxial digital-audio output. As there is also a Toslink optical digital connector, this Sony player can feed virtually any downstream processor.

**SONY'S DVP-S7700
IS A WORTHY SUCCESSOR
TO THE UNIVERSALLY
ACCLAIMED S7000.**

The DVP-S7700 goes beyond its predecessor in being able to pass DTS signals to an external decoder and in having D/A converters that can handle 24-bit audio sampled at 96 kHz. Its digital outputs, however, can't pass 24-bit/96-kHz signals; because of an industry-wide copy-protection agreement, these signals are converted to 16-bit/48-kHz before being handed off to other components. Although the S7700 can read video DVDs and audio and video CDs, it cannot read CD-ROMs, Photo CDs, or the data areas of CD-Extra discs and DVD-ROMs. Thanks to its dual-laser pickup, the S7700 recognizes CD-Rs, which most DVD players do not.

With its front panel closed, the DVP-S7700 looks deceptively simple. On the left are the power switch and its two-color LED for on/standby as well as a gold-plated headphone jack and its level control. On the right are the buttons that control the panel and disc tray. Most of the panel is blank save for the display, three tiny transport buttons, and an LED that indicates when DTS recordings are playing. (No DVD player I know of decodes DTS internally, so those recordings can't be heard via the headphone jack or the analog outputs on the back.) When you press the buttons that control the disc tray or open the panel, the panel swings out and slides down to reveal the tray and additional buttons. To the left of the tray are buttons for setup, video noise reduction, and moving to the previous or next section of a disc. To the tray's right are buttons to display disc titles and menus and to return to the prior menu screen. There's also a four-arrow cluster and an "Enter" pad for navigating the on-screen menus.

All the functions I've described, and more, can be controlled from the supplied remote. Even though the remote is preprogrammed to control a number of companies' TVs and A/V receivers (the default settings are for Sony products, naturally), this isn't a learning remote; you can't "teach" it to recognize additional control codes.

Like the S7000's remote, the DVP-S7700's is slightly wider than the norm, giv-

Photos: Michael Groett

ing it room for buttons that are large enough and far enough apart for normal-sized fingers to operate. Many of the pads can be distinguished by touch. Some of the most important ones glow slightly in the dark, as do the volume and muting controls for your sound system and the buttons for TV channel, volume, and source ("TV/Video").

A ring on the remote can be used as a shuttle or jog control. In shuttle mode, you can change play speed (normal, two levels of slow motion, or fast play at two, ten, or thirty times normal speed) and direction. When you press the "Jog" button (which then lights up), the S7700 switches to frame-by-frame play, forward or back, at a rate determined by how far you turn the ring. A pad at the center of the ring replicates the four-arrow pad on the player's front panel for navigating on-screen menus.

As with most DVD players, the S7700's setup menus present options for dynamic range control (compression for late-night listening) and parental control (to restrict children's viewing of certain discs). You're also given choices for the default language for soundtracks, subtitles, and menus. (Not all DVDs support these features, however.)

Some of the setup options you'd use to match the DVP-S7700's operation to your A/V system are fairly common, too. On the video side, you can set the picture format to 16:9 widescreen, 4:3 letterboxed, or a screen-filling 4:3 "PanScan." Options are more plentiful on the audio side. You can choose to have the Sony's digital outputs deliver Dolby Digital signals to a suitable surround decoder or to deliver a two-channel mixdown if your Pro Logic decoder works in the digital domain (using analog connections would entail needless conversions to and from the analog domain). If your system has no DTS decoder, DTS output can be disabled to prevent noise from being heard when DTS discs are played.

Other setup menus are distinctly uncommon. You can, for example, turn off the digital outputs altogether, to preclude any possibility of contaminating the analog audio with digital noise. You can select a "Sharp" or "Slow" characteristic for the digital filter that removes out-of-band artifacts from the output signal. "Track Selection" lets you choose whether or not the S7700 will give priority to the soundtrack that contains the

most channels. (Some players default to a disc's two-channel soundtrack, which is desirable only if you don't have a Dolby Digital decoder.) You can also switch in an attenuator to reduce analog output level; this will prevent overloading downstream A/D converters.

There's still more to the setup list. You can elect to have a blue or black screen background when the player is stopped. You can choose whether the S7700 starts playing as soon as you apply power to it (timer mode), does nothing until you command it to (normal mode), or goes into one of its two demo modes (mainly for use by dealers). You can set the front-panel display to be bright, dim, or off altogether.

Needless to say, the Sony DVP-S7700 provides the usual DVD features (multi-angle viewing, multiple audio languages, multiple subtitle languages, and so forth) when it's playing a disc that supports them. You can set the Sony for repeat play, programmed play, and random play (though I doubt anyone would want random play of anything but CDs).

You can choose how much information the on-screen display will convey. The simplest level shows where you are on a DVD and the S7700's operating mode. The next level adds info about the DVD's features (languages, camera angles, and surround) and which of them you're using. The final screen shows all of the above plus the current bit rate—interesting to techno-freaks like me.

Information about a DVD's features and where you are on the disc also appear in the DVP-S7700's front-panel display. But what impressed me most was that it shows index numbers on CDs that have them and that you can advance to specific index points. You can't skip from one index point to another (you must enter both the track and index numbers each time)—but to have indexing at all is a rarity these days,

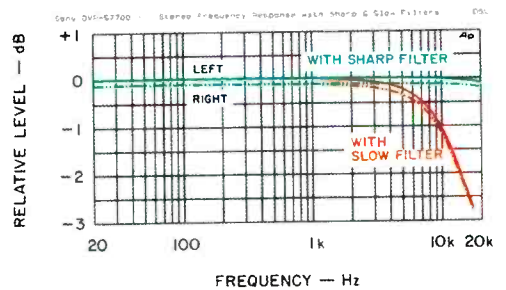


Fig. 1—Frequency response with each filter setting.

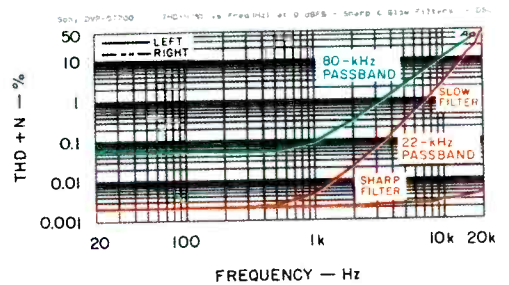


Fig. 2—THD + N vs. frequency; 80-kHz bandwidth used with "Slow" filter only.

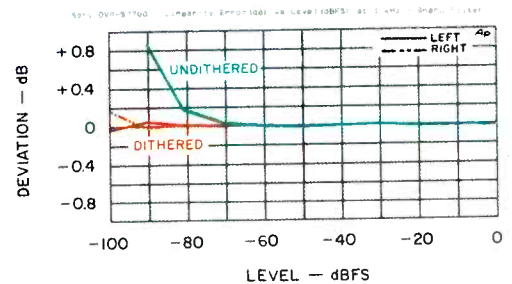


Fig. 3—Deviation from linearity at 1 kHz.

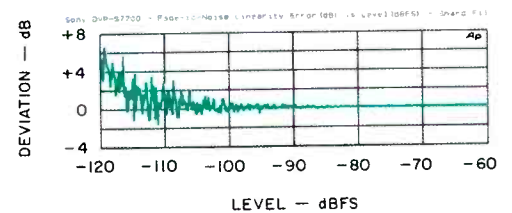


Fig. 4—Fade-to-noise test at 500 Hz.

even in CD players. As you can see, this player is just loaded with goodies.

Measurements

The reason the Sony DVP-S7700 has an audio attenuator became clear when I

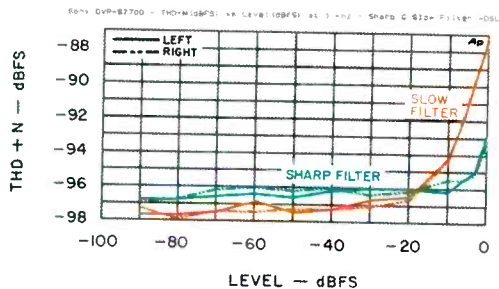


Fig. 5—THD + N vs. level at 1 kHz.

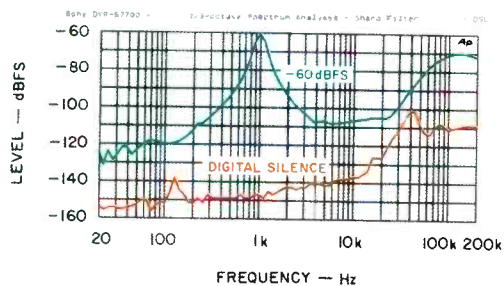


Fig. 6—Noise analyses.

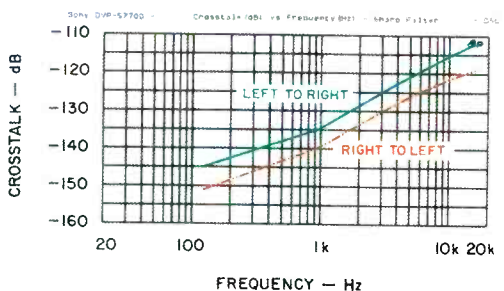


Fig. 7—Interchannel crosstalk.

measured its analog output level for a full-scale (0-dBFS) recording. With the attenuator off, it was 1.5 dB higher than the quasi-standard 2 volts, which could perturb a touchy A/D converter. The attenuator took care of this by reducing the output almost precisely 6 dB. After testing the attenuator, I left it off. The headphone jack also had substantial output, enough to drive just about any headset to an adequate level. Output impedances were fine, although a bit lower impedance on the line output wouldn't have hurt.

Figure 1 shows the DVP-S7700's frequency response with both of the "Audio Filter" setup options. The "Sharp" filter provides maximally flat response up to 20 kHz, then attenuates information very steeply above that point (not seen in the

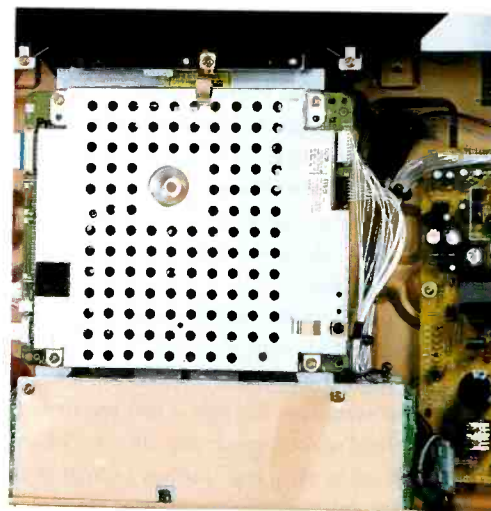
graph). The "Slow" filter, in order to be even marginally effective in reducing beat noise, has to start rolling off within the audio band; even so, the "Sharp" setting reduces aliasing far more effectively. Some audiophiles, chiefly in Britain, are in love with "slow" filters. With all due respect, I find that preposterous! Why would I want to listen to gobs of intermodulation between the clock signal and the music's high notes and overtones? Maybe this hash is supposed to compensate for the treble rolloff the "Slow" filter produces, but I suspect that a few self-styled "golden ears" believe "different" sound means "better" sound.

I made all my audio measurements using both filter settings, to show just how bad things get with the "Slow" filter and also how terrific they are with the "Sharp" setting. I've included results in the graphs and "Measured Data" for "Slow" filtration only when they differed from the "Sharp" results to a significant degree.

Now to return to Fig. 1, there's no ripple in any curve, but the curves taken with the "Sharp" filter are essentially dead flat to 20 kHz while those with the "Slow" setting begin to roll off above 5 kHz. (I stopped the "Slow" curves at 17.6 kHz because the output contained

more intermodulation distortion than true signal at higher frequencies.) Output levels with both settings are almost identical (within 0.03 dB), and the channels are very well balanced.

Although I couldn't plot the two filters' responses above 20 kHz, they can be inferred from the wildly differing curves of total harmonic distortion plus noise (THD + N) versus frequency in Fig. 2. This graph compares distortion for both filters with the standard analysis passband of 22 kHz and for the "Slow" filter setting with my analyzer's bandwidth increased to 80 kHz. Widening the passband may not seem cricket, but a 22-kHz passband makes sense only if the ultrasonic artifacts (residual carrier and beats) in the output signal are so minuscule that they won't cause problems



**THIS IS ONE
DVD PLAYER
THAT BEGS TO BE
SERIOUSLY LISTENED TO.**

and will remain inaudible. But here a 12.5-kHz signal produces a 31.6-kHz beat whose level is fully 21% of the desired signal (only 13.5 dB down), and a 16-kHz tone creates a 28.1-kHz beat at 35.5% (only 9 dB down)! Such high-amplitude beat products can't be ignored. They might be inaudible by themselves, but they could cause trouble in your power amplifier and speakers.

The cure was simple. When I switched back to the S7700's "Sharp" filter, the beats vanished. In Fig. 2, in fact, this player's THD + N with the "Sharp" filter is so low in level that it almost falls off the bottom of the graph. Simply by switching from the "Slow" to the "Sharp" setting, the S7700's D/A converters miraculously go from being among the worst performers vis-à-vis THD + N to among the best!

The choice of filter did not seem to affect D/A converter linearity at 1 kHz (Fig. 3). With dithered recordings—which are, thankfully, about all you can buy these days—Sony's converters are utterly marvelous; DACs don't come any more linear than this!

Figure 4 shows one channel's fade-to-noise linearity error. These results are marvelously good! I averaged the data to remove the statistical variation caused by dithering;

MEASURED DATA

AUDIO

Line Output Level: 2.37 V at 0 dBFS.

Line Output Impedance: 790 ohms.

Headphone Output Level: Maximum voltage, 4.87 V; maximum power, 29.3 mW into 600 ohms and 27.5 mW into 50 ohms.

Headphone Output Impedance: 175 ohms.

Channel Balance: ± 0.06 dB.

Frequency Response: "Sharp" filter, 20 Hz to 20 kHz, +0, -0.12 dB; "Slow" filter, 20 Hz to 17.6 kHz, +0, -2.72 dB.

THD + N at 0 dBFS, 20 Hz to 20 kHz: "Sharp" filter, less than 0.0049%; "Slow" filter, less than 42.8% with 22-kHz measurement bandwidth and less than 60% with 80-kHz bandwidth (see text).

THD + N at 1 kHz: "Sharp" filter, below -92.9 dBFS from 0 to -90 dBFS and below -96.1 dBFS from -30 to -90 dBFS; "Slow" filter, below -87.1 dBFS from 0 to -90 dBFS and below -96.6 dBFS from -30 to -90 dBFS.

Maximum Linearity Error: Undithered recording, 0.86 dB from 0 to -90 dBFS; dithered recording, 0.15 dB from -70 to -100 dBFS.

S/N: A-weighted, 125.7 dB; CCIR-weighted, 119.8 dB.

Quantization Noise: -95.6 dBFS.

Dynamic Range: Unweighted, 98.4 dB; A-weighted, 101.2 dB; CCIR-weighted, 92.1 dB.

Channel Separation: Greater than 111.6 dB, 125 Hz to 16 kHz.

VIDEO

Luminance Frequency Response: 0.5 to 4.2 MHz, +0.4, -0 dB; less than 2 dB down at 5.5 MHz.

White (Luminance) Level: 102 IRE.

Black-Level Accuracy: No measurable error.

Gray-Scale Accuracy: No measurable error.

Chrominance Frequency Response: Less than 12 dB down at 2.75 MHz.

Chroma Level Accuracy: Multipulse method, -0.3 dB; color-bar method, 0% to 2%, depending on color.

Chroma Phase Accuracy: No measurable error at any color.

Chroma Differential Gain and Phase: No measurable error.

Chroma-Luma Time Displacement: No measurable error.

Overshoot: 0 IRE.

Chroma Burst Level: 40 IRE, peak to peak (perfect).

Sync Pulse Level: 41 IRE (1 IRE high).

the noise contribution of the D/A converter and the output amplifier was around -116.8 dBFS (and some of that probably came from my test analyzer). The noise floor is thus down between the 19th and 20th bits—can't say I have ever seen better.

Figure 5 compares THD + N versus level at 1 kHz. I used the same analysis bandwidth (22 kHz) for both filters, to place them on the same footing. (If you look at the 22- and 80-kHz "Slow" curves of Fig. 2 at 1 kHz, you'll see each curve has just begun to rise above its noise floor by about the same amount. This convinced me it would be okay to use the 22-kHz passband for both filters in Fig. 5.) The difference between the two sets of curves in Fig. 5 is not as significant as it might appear, since I've used a very sensitive scale for THD + N in order to make it easier to see. Compared to other converters, Sony's DACs do very well with the "Slow" filter, but with the "Sharp" option, they're simply fantastic! From 0 to

-10 dBFS, distortion is clearly higher with the "Slow" filter. Below -18 dBFS, "Slow" seems better than "Sharp," but the tiny difference (a dB or so) can be traced to reduced high-frequency noise caused by the "Slow" setting's treble rolloff. As far as I'm concerned, the "Sharp" option is preferable in this regard as well as all others.

The DVP-S7700's dynamic range and quantization noise were as fine as I've ever measured—even from CD players. Figure 6 shows noise for a "silent," unmodulated, digital track and for a track modulated with a 1-kHz signal at -60 dBFS. Except between 150 Hz and 4 kHz (where a 1-kHz signal overrides it), noise in the modulated (top) curve is below -100 dBFS at all audio frequencies. The rise above 20 kHz indicates that Sony makes effective use of noise shaping to achieve this remarkable performance. The noise floor is even lower on the "digital silence" curve, because the S-7700's D/A converters mute when the signal is un-

modulated (as do most DACs). Note also the virtual absence of hum (the 120-Hz component at -140 dBFS in the bottom curve is hardly meaningful), which shows that Sony did an excellent job with the S7700's circuit layout and grounding.

Figure 7's plots of interchannel crosstalk look ordinary enough—until you notice how very low the crosstalk is. At 1 kHz, worst-case separation is 135 dB; even at 16 kHz, it's about 112 dB. This is further evidence of Sony's excellent circuit layout and grounding.

Lately I've been critical of the DACs Sony's been using in some products, because I know that the company can make some of the finest D/A converters on this planet. I've yet to find a CD player that sounds better than Sony's CDP-XA7ES or a DVD player that could significantly better the DVP-S7000's sound. Well, Sony is now back in the saddle. The DVP-S7700's converters are nothing short of terrific if you use them with the "Sharp" filter.

With one minor exception, it's hard to fault the S7700's video performance; the results in "Measured Data" read like perfection personified. Chroma response, which is difficult to test accurately, was down a bit more at the composite output than on some players. (And I'm not sure you'd see the slight chroma rolloff on any TV that has composite-video inputs only.) At the component (color-difference) outputs, chroma response held up very well out to the ends of the measurement range, and luminance response was down less than 1 dB at 5.8 MHz. First-rate!

Use and Listening Tests

A player like Sony's DVP-S7700 begs to be listened to, and listened to seriously. Some people who buy it (maybe most) will never take advantage of the excellent D/A converters hidden inside. They'll transfer multichannel soundtracks in the digital domain to a surround processor or A/V receiver and therefore listen to music in stereo via that route, too. But it would be a pity: It's a rare processor whose DACs come close to equaling those in the S7700. If I owned this player, I'd use separate connections for music and home theater. For music, I'd use the S7700's analog output (and I'd make sure I had one of the increasingly rare preamps or receivers that simply pass

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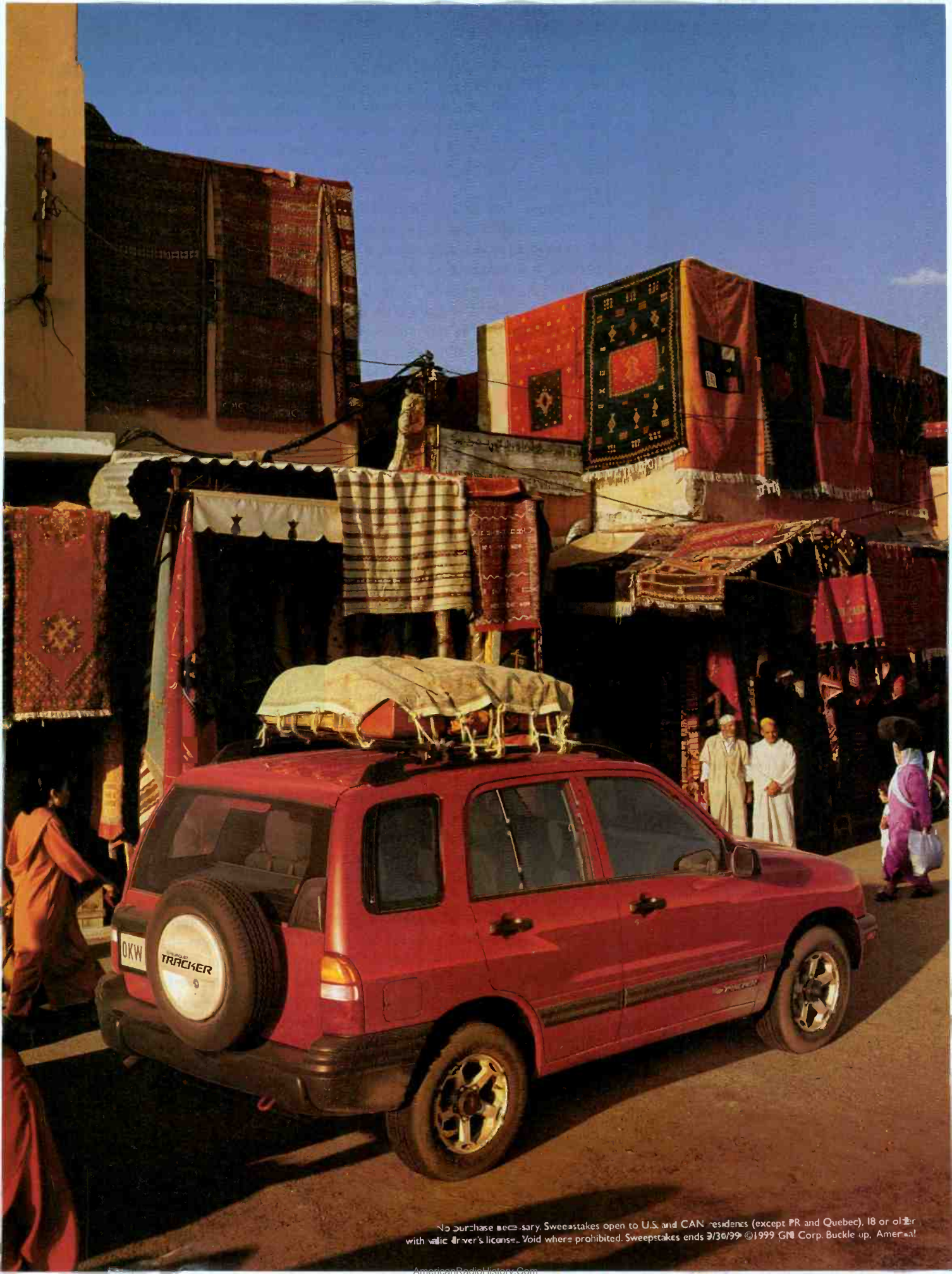
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WINNER SELECTION AND PRIZE: One (1) winning entry will be selected on or about October 15, 1999, under the supervision of D.L. Blair, Inc., an independent judging organization whose decisions are final, in a random drawing from among all correct entries submitted. In the unlikely event no one entrant correctly guesses the specific city and country location of the Tracker, winner will be determined in a random drawing from amongst all entries submitted. Winner will receive a brand-new 1999 four-door Chevy Tracker (approx. prize value: \$19,000 US). No cash equivalent or substitution of prize will be permitted. Winner will be notified by overnight express service and must sign and return an Affidavit of Eligibility and Release of Liability within 15 days of notification, via the return mailer provided. Noncompliance within that time period may result in awarding of the prize to an alternate winner.

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By acceptance of prize, winner consents to use of his/her name, photograph and other likeness for purpose of advertising, trade and promotion on behalf of General Motors without further compensation, unless prohibited by law. Rules are subject to any requirements/limitations imposed by the Federal Communications Commission.

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analog signals rather than screw them up by digitizing them and then passing them through mediocre DACs). Only for movies would I use a digital link, to take advantage of Dolby Digital surround. (I'm assuming you have a Dolby Digital decoder. If you don't, get with it!)

I auditioned the DVP-S7700 both ways. For music, I used it in an all-analog system in my listening room with a Bryston BP-20 preamp, a Bryston 4B-ST power amp, and Mirage OM-8 speakers. In my home theater, I connected it through an EAD TheaterMaster Ovation A/V preamp to a five-channel Adcom amp and Paradigm speakers. I evaluated video on a Pioneer rear-projection monitor.

I put the DVP-S7700 up against my reference CD player, a Sony CDP-XA7ES, the stiffest competition I know of. I wouldn't say the S7700 was quite as smooth and effortless as the XA7ES, but it came remarkably close. Since both machines can play CD-Rs, I dealt up one of my own, a piano recording of Debussy's "Estampes" I made in the Bruno Walter Auditorium of the Performing Arts Library in Lincoln Center. The sound was a tad less fat and a bit drier on the S7700, but its balance was equally good. Overall, the sound was excellent, certainly the best I've heard from a DVD player.

Anne-Sophie Mutter's rendering of the Sibelius Violin Concerto, with Previn and the Staatskapelle Dresden (DGG D112075), was recorded using Deutsche Grammophon's 4D system. (That is about as all-digital as a recording can get: Signals are digitized by stacked 18-bit A/Ds at the microphones, and the resultant 21-bit data is mixed digitally in a proprietary console.) The CDP-XA7ES was a tad smoother on the violin overtones, but I'm not convinced it was "more accurate" in this respect. Image depth was better on the XA7ES, too. But I could really get involved with the sound of the DVP-S7700, which is about the best endorsement I can give.

Ditto for the 20-bit recording of *Music of Manuel de Falla* (Dorian DOR 90210), made in Venezuela with the Simón Bolívar Symphony Orchestra of Venezuela under Eduardo Mata. The S7700 was exceedingly clean and did a marvelous job on the bass clarinet. It reproduced the varying colors of Marta Senn's voice pristinely—again, not with the depth of the XA7ES, nor quite as

smooth and effortless, but an eminently satisfying sound nonetheless. Telarc's recording of Bach's Mass in B Minor (CD 80233), which I'd originally turned to for checking how the S7700 handled index marks, sounded better to me on this DVD player than on my CD machine; the S7700's slightly brighter sound seemed to liven up Robert Shaw's plodding performance and too-careful soloists.

In my home theater, with the EAD Ovation supplanting the S7700's DACs (and sounding marvelous), I paid closest attention to the Sony's video performance and features. The S7700 had the best slow and fast motion I've seen from a DVD player. It never stumbled, always found "I" frames to



**THE SONY DVP-S7700'S
VIDEO RESOLUTION
WAS NOTHING
SHORT OF MAGNIFICENT.**

lock onto, and patched them together in the smoothest fashion imaginable. Further, it worked in reverse as well as it did in forward; what most DVD players do in reverse is best described as ludicrous.

Although I could not see any effect from pushing the DVP-S7700's video noise-reduction button (nor had I measured any effect), this didn't bother me in the slightest; I don't understand why one needs video noise reduction in a DVD player. All the usual DVD features worked fine, and picture resolution was nothing short of magnificent. The tightest portion of the tightest wedge patterns on a test DVD were clean as a whistle, and they extended to 5.8 MHz—about 465 lines. Whatever's on a DVD, the S7700 will resolve it.

The Sony DVP-S7700 is my favorite DVD player so far. I like it even better than the DVP-S7000, and that's saying a lot. Highly recommended! **A**

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D. B. KEELE, JR.

SNELL ACOUSTICS XA 90ps SPEAKER



Seldom do I get really excited about a speaker I am about to test. But when I first received press information on Snell's new five-speaker XA series of high-end stereo and home theater enthusiasts about two active-woofer tower systems that head the line, the XA 90ps (reviewed here) and the XA 75ps. They seemed to have almost every feature I would have included had I designed them

either a diffuse-field dipole pattern or a direct-field monopole pattern.)

The XA 90ps is a large, floor-standing tower with a total of eight drivers. The system has two woofers, two lower midrange drivers, two upper midranges, and two tweeters (one on the front and one on the back). The two 10-inch woofers are mounted vertically on the lower half of the front baffle and are driven by an internal 300-watt amplifier.

The rear panel is all business. Starting from the top, it carries a 1-inch dome tweeter, four large ports, the input termi-

myself. XA, which stands for Expanding Array, is a technique to control vertical directivity down to much lower frequencies than is typical in comparably sized speakers. It is the brainchild of Snell's president and chief designer, David Smith.

Since my (favorable) review of Snell's \$1,400/pair E.5 tower (*Audio*, September 1998), the company has been busy designing and producing new speakers and updating previous models. The Snell lineup now comprises more than 30 speakers in six series. (The models in the XA series also include two center-channel speakers and a surround speaker, the SR 30mp. The latter is an intriguing dual-mode design that can be switched to radiate

nals, and the woofer amp's heat sink, power-cord socket, and controls. These include several bass-related switches and knobs that Snell calls environment-compensating controls. Among them are a single-band parametric equalizer that enables separate adjustment of boost and cut levels, center frequency, and bandwidth; switches for the rear tweeter; and a boundary control affecting mainly the lower midrange. An infrared remote control lets you adjust the tweeter and bass levels and "Bass Shape."

All the XA speakers share the same design philosophy based on the D'Appolito array, a symmetrical driver arrangement named after its originator, Joseph D'Appolito. This array positions identical, parallel-connected midranges or woofers above and below a central tweeter to achieve a completely symmetrical vertical radiation pattern.

A D'Appolito array is fairly common in home speakers, showing up in nearly 10% of the models I have tested for *Audio* in the last decade. Unfortunately, most of these D'Appolito designs have suffered from narrow vertical dispersion at crossover, largely caused by wide separation of the midrange drivers relative to the wavelength of the crossover frequency. Usually, the wide spacing was imposed by the drivers' size, which prevented their acoustic centers from being positioned close together.

Snell minimizes this problem in the XA series by using small midrange drivers and placing them close to the tweeter. Typical speakers have midrange/woofers whose diameters are 4 to 6 inches; the XAs' mid-

Rated Frequency Response: 32 Hz to 22 kHz, ± 3 dB.

Rated Sensitivity: 90 dB at 1 meter, 2.83 V rms applied.

Rated Impedance: 4 ohms, nominal.

Recommended Amplifier Power: 100 to 300 watts.

Dimensions: 54½ in. H x 11 in. W x 19½ in. D (138.4 cm x 27.9 cm x 49.5 cm).

Weight: 125 lbs. (56.8 kg) each.

Price: \$7,000 per pair; available in cherry or black painted oak veneer.

Company Address: 143 Essex St., Haverhill, Mass. 01832; 978/373-6114; www.snellacoustics.com.

ranges are just 2½ inches in diameter! These are combined with a 1-inch dome tweeter (crossed over at 3 kHz), in a compact D'Appolito assembly that Snell calls a midrange-tweeter-midrange (MTM) module. (The MTM, which operates down to 400 Hz, is used in all the XA speakers.) The MTM's tweeter is set into its front panel in a mildly flared depression that restricts its vertical radiation and improves the speaker's time coherence.

The XA 90ps also has two larger, 6½-inch, lower midranges positioned symmetrically above and below the MTM module. This assembly forms a larger D'Appolito array with the MTM at its center. It operates down to 100 Hz, where the 10-inch powered woofers kick in.

**BUILT-IN PARAMETRIC EQ
GIVES THE XA 90ps
MORE BASS ADJUSTABILITY
THAN ANY OTHER SPEAKER
I'M AWARE OF.**

Except for the rear-baffle tweeter, which is a 1-inch dome mounted near the top of the cabinet, all of the Snell's drivers are in a vertical array on the front panel. The two 10-inch woofers appear to be housed in separate, cylindrical black enclosures, slightly larger than the woofers, that extend from the front to the rear of the cabinet. Looks are deceptive, however, because the inside of the enclosure is accessible acoustically to both woofers; together with four vent tubes opening at the back of the cabinet, it forms a large bass-reflex system. The vent tubes, 2½ inches in diameter and 9 inches long, are generously flared.

The woofer cylinders and their metal grilles dominate the front view, lending the speaker an air of power and authority. The top five drivers are covered with a single punched-metal grille that plugs into the front baffle.

The cabinet is very solidly constructed of ¾-inch medium-density fiberboard (MDF), further strengthened by three internal shelf braces. The front baffle is covered with a curved, ¾-inch-thick subpanel that carries the top five drivers and provides a smooth surface to reduce diffraction

effects. The large lower midranges have sealed enclosures, as does the MTM assembly.

On the speaker's rear baffle is an elaborate input-connection panel containing two switches and a pair of bi-wirable double-banana jacks. Along with controls for the woofers' amplifier are knobs and switches for the single-band parametric equalizer. The latter provides a degree of bass adjustability matched by no other speaker or subwoofer I'm aware of. Power is supplied by a standard, three-wire detachable AC line cord.

The XA 90ps's passive crossover, which is nicely constructed and uses air-core inductors, is attached to the inside of the input-connection panel. Heavy-gauge stranded wire connects the drivers to the crossover. The individual sections of the crossover form a second-order high-pass filter for the front tweeter, a first-order high-pass for the rear tweeter, second-order high- and low-pass filters around the small midranges, and a first-order high-pass and second-order low-pass around the lower-midrange drivers. Snell says that although most of the crossovers are second-order electrically, they're fourth-order acoustically, with an in-phase Linkwitz-Riley design.

Except for the lower midranges, which are sourced from Peerless, all the drivers used in the XA 90ps are custom designs made for Snell by Seas. All are magnetically shielded. The woofers are dual-spider designs, in which the driver motor's stationary center pole extends out through the cone, with a second spider connecting them. The extra spider functions as a dust cap and also adds a degree of fore-and-aft stability to the moving system. The center pole doubles as a heat pipe, terminating in a heat sink that is clearly visible when the woofer's grille is removed. The heat sink's appearance contributes to the Snell system's heavy-duty, no-nonsense look.

Measurements

Figure 1 shows the Snell XA 90ps's on-axis anechoic frequency response in several

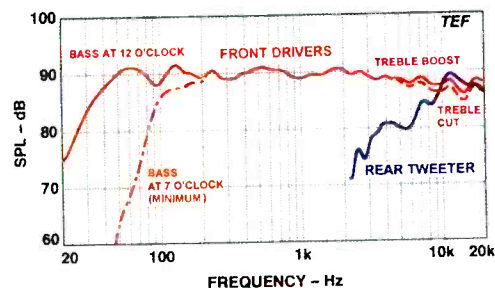


Fig. 1—One-meter, on-axis frequency response.

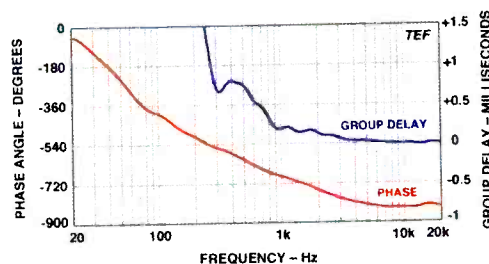


Fig. 2—On-axis phase response and group delay.

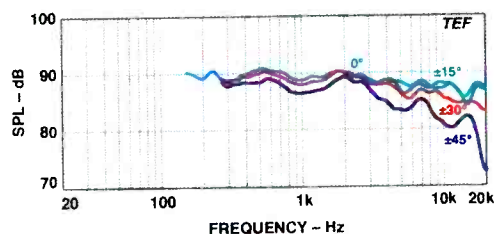
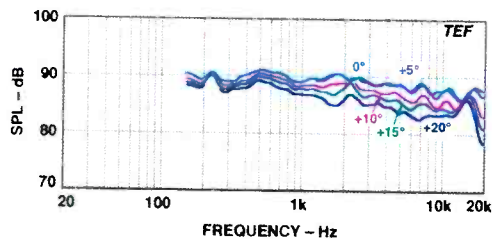


Fig. 3—Horizontal off-axis frequency responses.

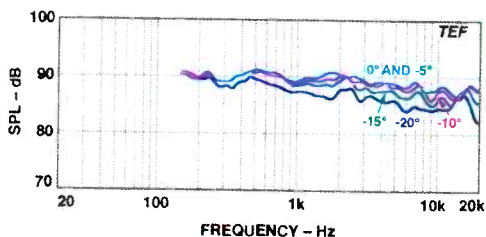
different modes and the response of the rear tweeter. The curves combine ground-plane bass measurements with measurements taken in a large anechoic chamber, with the test microphone 2 meters away and on the front tweeter's axis. The curves were smoothed with a tenth-octave filter.

The curve labeled "Bass at 7 O'Clock" in Fig. 1 was taken with the rear-panel bass level control fully counterclockwise, its minimum setting. Despite the knob's designation, this turns the bass amplifier off. The curve marked "Bass at 12 O'Clock" was taken with the bass control set to its midpoint, the bass parametric EQ off (i.e., the boost/cut level at 0 dB), the remote control's "Bass Level" at 0 dB, and the remote's "Bass Shape" set to "Reference."

The curves in Fig. 1 marked "Treble Boost" and "Treble Cut" were taken with



A



B

Fig. 4—Vertical off-axis frequency responses, above axis (A) and below axis (B).

the remote control's treble switch set to its boost and cut positions and the rear tweeter turned off. (When power to the bass amplifier is killed, an internal relay in the crossover's high-frequency circuit de-energizes and automatically puts the speaker into the treble-cut mode.) Figure 1 also includes response of the tweeter on the rear baffle, taken from the rear of the speaker with the test microphone on axis. Note that in the anechoic test chamber, the rear tweeter, whether on or off, has no measurable effect on the system's front axial response.

The XA 90ps's overall response curve, with the bass amp on and treble boost engaged, is remarkably flat, extended, and free of aberrations; there's a slight downward slope, at about 1.2 dB/octave, beginning at 2 kHz. With the tilt, the curve fits a fairly tight, 5.5-dB, window over a broad range from 34 Hz to 20 kHz. If the slope were compensated for, the curve would fit a very tight window of about 3.5 dB. Above 2 kHz, the rear tweeter's output rises at about 6 dB/octave and roughly equals the front tweeter's output above 10 kHz.

Not shown in Fig. 1 is the effect of the rear-panel boundary switch. It affected the frequency range from about 100 to 300 Hz, with a maximum reduction of only 2 dB at 225 Hz that tapered off to 0 dB at frequencies above and below. Also not shown is the effect of the remote's "Bass Shape" control. Compared to the switch's "Reference" posi-

tion, the "Cinema" setting added a boost above 30 Hz and a cut below that point. The boost reached a maximum of 5 dB at 40 Hz, then tapered gradually to 0 dB above 150 Hz. At 20 Hz, the "Cinema" position supplied about 4.5 dB of cut. In effect, the "Cinema" position supplies a bass boost in the range where typical bass energy in movies predominates (this also applies to bass in rock music, pop, and jazz) and cuts the woofers' drive for lower bass. The low cut will actually improve the Snell system's power handling by acting like a rumble filter for unwanted low-frequency content.

To determine the crossover characteristics between the lower and the upper midranges, I ran a response through the bi-wire connections with the high and low sections of the crossover reversed (not shown). The level was reduced over the range of about 300 Hz to 1.5 kHz; the greatest reduction, 10 dB, was at about 450 Hz, the apparent crossover point. This modest reduction in level indicates that the respective outputs will not be solidly in phase when connected normally. Ordinarily this would cause some lobing error, but because of this speaker's symmetrical D'Appolito-style driver arrangement, no error occurs.

Although not shown in Fig. 1, the grille affected the response above 6 kHz by only ± 1 dB. In other words, you can listen to the Snell with its grille in place and have no worries about its effect. Above 600 Hz, the right and left speakers matched closely, within about ± 0.75 dB. But between 100 and 600 Hz, the match was not as good—one of the speakers produced 1.5 to 2 dB more output than its mate.

The phase and group-delay responses of the Snell XA 90ps, referenced to the tweeter's arrival time, are shown in Fig. 2. The phase curve falls smoothly as frequency increases but levels out above 6 kHz, in the tweeter's range. This phase behavior, similar to that of most other direct-radiator speakers whose drivers are mounted on the same plane, indicates that the acoustic output of the midrange and bass drivers lags the tweeter's. When averaged between 800 Hz and 2.5 kHz, the group-delay curve reveals



The rear panel of the XA 90ps is busy and businesslike.

the lag to be about 0.15 millisecond. Even though this is quite modest, the XA 90ps will not preserve signal wave shapes.

Figure 3 shows the XA 90ps's on-axis frequency response and its horizontal off-axis responses, which are quite smooth and flat even to 30° off axis. At 45° off axis, significant rolloff and undulations are evident above 3 kHz. (The Snell speaker's large size and heavy weight precluded my running the complete set of off-axis measurements that form the basis of my usual "3-D" displays.)

Figure 4A displays the above-axis frequency responses from 0° to 20°, at increments of 5°. The curves are exceptionally smooth and flat. Significant directivity is evident down to below 200 Hz. The only mentionable anomaly is the broadening of response between 14 and 15 kHz, where the off-axis responses exhibit a slight peak.

The corresponding below-axis frequency responses (Fig. 4B) essentially mimic the above-axis curves and are at least as smooth and flat. These vertical off-axis curves are the best I've seen from a non-coaxial multdriver speaker system.

Averaged from 250 Hz to 4 kHz, the XA 90ps's sensitivity measured a high 89.6 dB, essentially the same as Snell's 90-dB rating.

The Snell XA 90ps's impedance magnitude (Fig. 5A) is shown with the rear tweeter on and off and with the boundary switch in the normal position. Overall, the speaker's impedance is quite low, dipping to 2.9 ohms at 210 Hz and to 3.3 ohms at 2 kHz.

In the bass range below 200 Hz, however, the impedance continually rises (except for a wiggle between 80 and 100 Hz). This rising low-frequency impedance is caused by the high-pass capacitor in series with the system's lower-midrange drivers. Above 100 Hz, the Snell's impedance varies from a low of 2.9 to a high of 9 ohms. Based on these extremes, cable series resistance should be no more than about 0.05 ohm to minimize cable-drop effects. For a run of 10 feet, this corresponds to 14-gauge (or heavier), low-inductance cable.

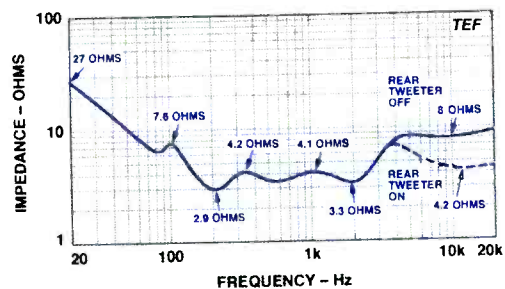
Figure 5B shows the system's impedance phase with the rear tweeter on and the boundary switch in the normal position. Unlike a conventional speaker with unpowered woofers, whose impedance phase approaches 0° at low frequencies, the phase of the XA 90ps verges on a constant negative value of -77° through the low bass. This reflects the series capacitance of the high-pass filter feeding the lower-midrange drivers. Note that if the input impedance were purely capacitive, the phase would be -90°. The -77° implies some resistive component to the input impedance, probably a result of the paralleled resistance of the bass ampli-

vented-box bass system's resonance frequency. The Snell's vent wind noise and turbulence were very low, hardly noticeable even at the rear of the speaker despite high drive levels at box resonance!

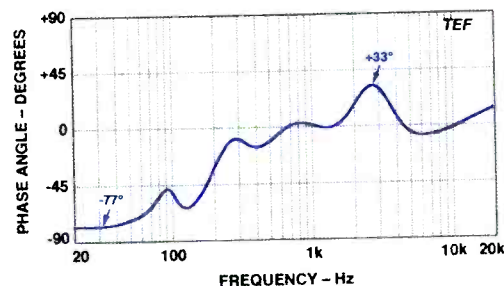
The XA 90ps's four ports presented a rare opportunity to lower the tuning frequency of the vented enclosure and thereby extend the speaker's low-frequency response. (Electro-Voice first popularized this scheme commercially in the early 1970s with its "step-down" tuning.) When I blocked two of the ports by stuffing each with a rolled-up hand towel, the tuning frequency dropped to 28 Hz. When three ports were blocked, the tuning frequency fell to a low 20 Hz.

Detuning is not without trade-offs, however. This trick greatly increases low-frequency output and decreases distortion at and near the lowered tuning frequency, but it decreases a speaker's maximum output and increases distortion at higher frequencies (where the box was tuned originally). For the XA 90ps, this would be a reasonable trade-off because of its already high maximum output at higher frequencies. Although the Snell XA-90ps's deep-bass performance with program material such as pipe-organ pedal notes would improve, this speaker would then perform less well on material containing strong upper bass, such as rock and pop music.

To measure raw and smoothed 3-meter room response (Fig. 6), I placed the XA 90ps in the right-hand stereo position and aimed at my listening seat, where the test microphone was positioned at ear height (36 inches). Below 100 Hz, the response was taken unsmoothed and with a slow sine-wave sweep to highlight any narrow peaks or dips. And to illustrate the effects of the XA 90ps's bass controls, I extended the measurements to a very low 10 Hz. (I usually limit my low-frequency room responses to 100 Hz.) I set the bass controls as follows: overall bass level at 12 o'clock, no EQ (level at 0 dB), rear tweeter off, boundary switch in normal position, remote bass level at 0 dB, remote "Bass Shape" at "Reference,"



A



B

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

THE XA 90ps'S HIGH PEAK ACOUSTIC OUTPUT PLACES IT AT THE TOP OF ALL THE SPEAKERS I HAVE TESTED.

er's input. A maximum phase of +33° (inductive) is reached at 2.9 kHz.

Based on the low minimum impedances, I don't recommend driving two of these speakers in parallel. A single XA 90ps should be a fairly easy load for any competent amp, however; in fact, its high impedance at low frequencies offloads the main amplifier and raises the amp's effective power because it is not supplying high bass energy on bass-heavy program material.

The XA 90ps performed superbly when subjected to a high-level sine-wave sweep. The cabinet walls were virtually vibration-free. The woofer's maximum excursion was a healthy 3/4 inch, peak to peak, and I couldn't detect any dynamic offset. A strong minimum excursion occurred at 33 Hz, the

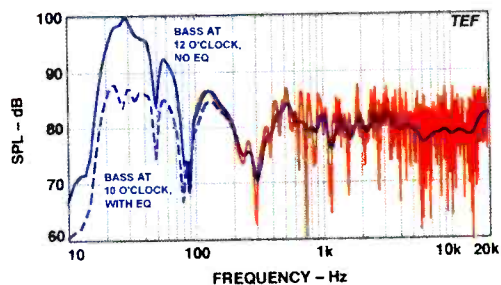


Fig. 6—Three-meter room response.

and remote treble on boost (lots of controls and settings!).

Above 600 Hz, the smoothed curve in Fig. 6 fits a tight, 6-dB, window all the way to 20 kHz. You can see that it is fairly linear except for some ripples between 900 Hz and 3 kHz and a moderate tilt upward above 15 kHz. Between 100 and 600 Hz, the smoothed curve contains peaks at 130 and 530 Hz and a substantial dip at 300 Hz. The range below 100 Hz—which is where the XA 90ps's two 10-inch woofers operate—is particularly interesting. With the speaker's bass controls set to their mid-position (12 o'clock), the XA 90ps provided significant bass boost in my listening room. The boost reached a maximum at 28 Hz, nearly 20 dB greater than the average response above 1 kHz. A sharp dip was evident at 50 Hz, as

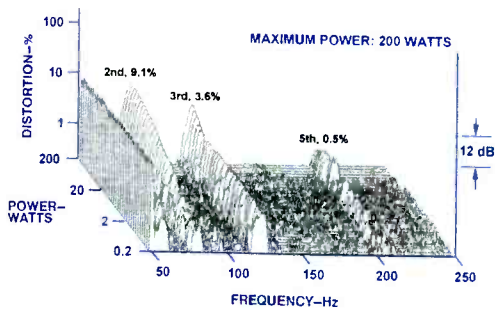


Fig. 7—Harmonic distortion for E_1 (41.2 Hz).

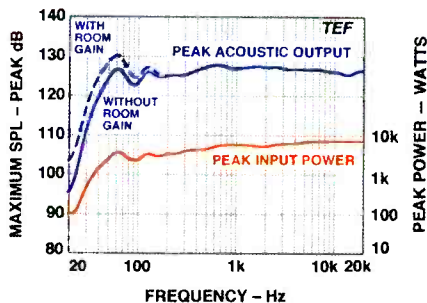


Fig. 8—Maximum peak input power and sound output.

was a wider but much deeper dip between 75 and 100 Hz.

To flatten the response, I turned the rear-panel bass control down to the 10 o'clock position and introduced parametric equalization (PEQ) of -10 dB at 30 Hz with a bandwidth of 0.2 octave (coincidentally, these settings occurred with all three PEQ controls fully counterclockwise). The dashed curve in Fig. 6 is the flattened response. I probably could have gotten the curve a bit flatter had I messed around a little more with the controls.

Notice that I attacked the large peak rather than attempting to fill in the notch between 75 and 100 Hz. Of course, the speaker has only one PEQ filter. However, even if I had additional PEQ filters available, it is usually not good practice to introduce large amounts of localized boost to fill in dips. You run the risk of overloading the speaker, because it probably can't play loud enough at the dip. Moreover, dips are usually quite position-dependent, which means the boost may generate a peak in the response at a slightly different position in your listening room.

The XA 90ps's E_1 (41.2-Hz) harmonic distortion with the PEQ off, the rear-panel

overall bass control at 12 o'clock, and the remote controls set as in Fig. 6, is shown in Fig. 7. At an equivalent maximum power of 200 watts (28.3 volts rms into the rated 4-ohm load), the second and third harmonics rise just to moderate levels, 9.1% and 3.6%. The only significant higher harmonic is the fifth, at a low 0.5%. The speaker sounded quite clean and powerful at this level. At 41 Hz, a 200-watt input to the XA 90ps generated a very loud 111 dB SPL at 1 meter in a free field.

The XA 90ps's A_2 (110-Hz) 100-watt bass harmonic distortion (not shown) consisted of a low 2.1% second harmonic and 1.1% third; higher harmonics were below the floor of the measurement display. The distortion at 440 Hz (A_4) was similarly low, only 2.9% second and 1.2% third.

The Snell speaker's intermodulation (IM) distortion (not shown) versus power, generated by 440-Hz (A_4) and 41.2-Hz (E_1) tones of equal power, reached a very low level of 1.2% at 200 watts.

Figure 8 shows the XA 90ps's short-term peak power input and output (with controls set the same as for Fig. 7). The peak input power starts out strong, 100 watts at 20 Hz, and climbs quickly, through 1 kilowatt at 37 Hz, to reach a high peak of 3.4

**THE SNELL XA 90ps'S
BASS OUTPUT
EXCEEDED THAT
OF SEVERAL SUBWOOFERS
I HAVE TESTED.**

kilowatts at 63 Hz. After dropping somewhat, to 2.1 kilowatts at 100 Hz, it rises smoothly above 700 Hz, into the range of 5 to 6.4 kilowatts. Between 160 and 250 Hz, my test amplifier reached its limit (because of the speaker's low impedance) before the XA 90ps did.

At 20 Hz, the peak acoustic output with room gain starts quite high, at 103 dB SPL, rising quickly through 110 dB at 26 Hz and

a loud 120 dB at a low 34 Hz. After reaching a very high maximum of 129.8 dB at 63 Hz, the peak acoustic output declines only slightly and remains very loud—in the range of 124 to 127 dB—at all higher frequencies. Its very high, flat, and extended peak acoustic output places the Snell XA 90ps at or near the top of all the systems I have tested. Indeed, its bass output exceeded that of several subwoofers I've measured.

Use and Listening Tests

When I first saw the Snells in the truck that delivered them, I thought I was getting a pair of coffins! Each XA 90ps comes in a very rugged wood and plywood container that weighs nearly 70 pounds by itself. This is one of the few shipping containers I have no reservations about reusing when I pack up the speakers and return them to the manufacturer.

The Snell XA 90ps itself is very handsome but quite imposing, with a definite no-nonsense, all-business look. Thanks, in part, to the large cylinders behind the woofers, the Snells look very powerful even when not making a sound. My review samples were supplied in cherry veneer, which is quite good-looking but somewhat on the light side (a black oak finish is available on special order). The construction, fit, and finish of the XA 90ps are of the highest quality.

The XA 90ps is not a speaker you can just unpack, position, and plug in. For best results, its many controls must be set for the desired response when the speaker is in the desired operating position. Having individual bass controls on each speaker enables you to match their response to an asymmetrical listening environment. Although the adjustments can be roughly set by ear, getting best results requires acoustic test equipment—a third-octave real-time analyzer or such computer-based equivalents as the TEF System 20 or MLSSA.

The XA 90ps's 18-page owner's manual, which also covers the XA 75ps and XA 55cr, is well written and covers just about everything you need to know about setting up and using these speakers. Several pages are devoted to the XA 90ps's bass controls and their proper adjustment. I did the initial setup with my TEF analyzer and the final tweaking with an AudioControl SA-3050A real-time third-octave analyzer.

My auxiliary listening equipment included B&W 801 Matrix Series 3 speakers, a Crown Macro Reference power amplifier, Straight Wire Maestro cabling, an Onkyo Integra CD player (Model DX-7711), and a Krell KRC preamp. Snell provides 1¾-inch-long threaded spikes with adjustment nuts for the bottom of the speaker, to help ensure stability on a carpet. I chose not to use them because the speakers were quite stable on their own.

From first to last, listening to the XA 90ps speakers was an extremely enjoyable experience. Their sound was quite lively, dynamic, and smooth, with very even horizontal and vertical coverage. Their bass was very powerful yet clean and effortless at all playback levels, and it extended smoothly down into the lower 20-Hz range. The XA 90ps's bass output equaled or exceeded that of my B&W speakers on everything I played except material having high levels of bass below 20 Hz. It took some 3 to 4 dB of attenuation to bring the Snell's sensitivity down enough to match the B&W's.

I did all of my listening in stereo, with the speaker grilles in place. (I did not use the Snells' LFE bass inputs, because my stereo music setup has no LFE output.) In my listening room, the Snells stood out about 28 inches from a hard-surfaced wall and were canted in toward me. I set their bass PEQ for the flattest response (as shown by the "With EQ" curve in Fig. 6), then covered these controls with the caps Snell thoughtfully provides to keep them from being reset inadvertently. However, I raised the rear panel's bass level control from the 10 o'clock setting I used for flattest response in Fig. 6 to 12 o'clock, then compensated for this by setting the remote's bass level control to -4 dB and the "Bass Shape" control to its "Reference" position. These changes gave me the flattest possible measured response in the room while enabling me to boost bass substantially with the remote control. For rock and sound effects that could profit from accentuated bass levels, I set the remote's bass level to +6 dB and put the "Bass Shape" control on the "Cinema" position (hey, sometimes you just can't get enough bass!).

With everything set for flat frequency response, the bass was very smooth and extended and never unduly emphasized individual notes. Reproduction of male speak-

ing voices was exemplary, with no trace of chestiness or speaking-in-a-barrel effects. Even when boosted, the bass did not exhibit any unwanted one-note resonances; it simply grew louder.

I had a lot of fun adjusting the Snell's many controls, which gave me a freedom to experiment that most other speakers don't. The only downside to having so many controls is complexity and greater potential for mistakes. The remote control's bass and treble adjustments proved very handy. (Even if most audiophile components did not lack bass and treble controls, being able to make these adjustments from your listening position would be a rare pleasure.) The remote's treble boost/cut feature provided a convenient way to attenuate the

**FROM FIRST TO LAST,
I ENJOYED LISTENING
TO THE SNELLS'
LIVELY, SMOOTH,
AND DYNAMIC SOUND.**

highs when listening to, for example, poorly recorded vocalists with spitty sibilants. You can control both speakers at once by pointing the remote at either one, because Snell provides a 12-foot cable to carry remote commands from speaker to speaker. Red lights surrounding the XA 90ps's infrared sensors blink to acknowledge the remote's commands.

I wished the rear tweeters could have been turned on and off from the remote. However, I generally preferred leaving them on. They added a degree of spaciousness and air that I quite liked.

The XA 90ps excelled on a wide range of material: rock, special effects, audiophile-recorded solo female vocalists, complex orchestral music, and chamber music. The soundstage often seemed somewhat closer to my listening position and more up-front than that produced by the B&Ws, because the Snells have narrower, better controlled vertical dispersion. In effect, the Snells have less room sound because of their greater directivity, which makes them very suitable for home theaters.

The most fun I had with the XA 90ps speakers was with two CDs of airplane

sounds: *Round Sounds, Vol. 1* (AC-1006), the sounds of radial-engine prop planes, and *Supersonics* (AC-1008), jet sounds from military A-10 Warthogs, C-5A Galaxies, SR-71 Blackbirds, and others. (Both of these discs are available from Aircraft Records, P.O. Box 1232, Sonoma, Cal. 95476.) The Snells sounded incredible on this material, particularly track 1 of *Round Sounds*, a 1941 Boeing Stearman biplane. When I played the speakers very loud, the plane's sound was extremely realistic, with wall-shaking bass; only the smell of aircraft exhaust was lacking—I actually knocked a couple of pictures off the wall. (Hey, we don't always have to sit around drinking Perrier and listening to string quartets.)

With pink noise, the Snells were just as smooth as the B&Ws and exhibited hardly any midrange or upper-frequency tonality. The XA 90ps passed the stand-up/sit-down test with flying colors, producing no tonal changes when I stood up. On the test of low-frequency third-octave band-limited pink noise, the XA 90ps's output equaled or exceeded the 801's maximum at all bass frequencies from 25 Hz and up. I heard no wind noise from the port, even when listening at the rear of the cabinet, an advantage over the B&W. In the 40-, 50-, and 63-Hz bands, the Snells could play significantly louder than the B&Ws, making the XA 90ps speakers the loudest I have tested. This was well demonstrated by the Snells' very loud, clean reproduction of rock kick drums. The XA 90ps's bass fully equaled the B&Ws' response except on one organ CD that had high-level 17-Hz pedal notes; on that, the B&W won out. However, when I plugged three of the XA 90ps's four port tubes, which significantly lowered its vented-box tuning frequency, the Snell won.

Everything considered, the XA 90ps is a speaker for all seasons: It performs equally well on intimate chamber music, loud concert pop/rock, and sound effects. Its very well-controlled vertical dispersion makes it highly suitable for home theater and stereo listening. Its powerful bass response eliminates any need for subwoofers. Its good looks, its well-built cabinetry, and the extreme flexibility of its highly adjustable bass amplifier make it a good match for any listening environment. At \$7,000 a pair, it is a significant investment but well worth the money. I give it my highest recommendation. A

DANIEL KUMIN

AUDIOCONTROL C-101SE EQUALIZER/ANALYZER



However much we high-end types might deny it (and most of us are reluctant to face the fact head-on), frequency response rules. “Air,” “depth,” “detail,” “bass slam,” and “rhythm”: These and more can be shaded or even turned on their ears by subtle (or not so subtle) modifications of amplitude over frequency. One school of au-

diophile thought—call it the pragmatists—maintains that virtually every tweak we undertake, from room treatments to loudspeaker spikes to C-note-per-foot interconnects, enters its bottom-line effect in the frequency response ledger.

If you really want to influence frequency response, however, there’s no tool like an equalizer. You don’t hear much about EQ in audiophile circles these days, but that does not change the fact that equalization is a powerful and potentially useful way to achieve a wide range of audio goals. AudioControl, the veteran Seattle-area manufac-

turer whose EQ solutions for home, car, and home theater audio systems are widely known for quality and value, has recently introduced an updated version of one of its classic products.

The AudioControl C-101SE is a “Special Edition” of the venerable C-101, a 10-band stereo octave equalizer combined with a 10-band real-time spectrum analyzer (RTA). (The C-101SE also incorporates a defeatable, 18-dB/octave Tchebychev filter at 20 Hz. Like just about everyone else, AudioControl labels this a “subsonic” filter, but “infrasonic” is the more correct term.) The SE mods include some updated componentry for improved dynamic range and a changeover to spiffy, “ice-blue” LEDs (in place of red) for the dancing-column spectrum-analyzer displays.

The C-101SE is constructed in no-nonsense fashion on a comparatively heavy-gauge sheet-metal steel pan with a top/sides cover of the same stuff. Finish of the brushed-aluminum front panel is a rather nice gunmetal tone, which, unfortunately, makes the black panel graphics tough to read in poor light despite their larger than average size.

The controls on the equalizer’s front panel are all pushbuttons, save for a small knob that adjusts display sensitivity (uncalibrated, but with a detent) and, of course, 20 sliders that deliver an indicated 15 dB of boost or cut individually to each channel. Frankly, I have never much understood the left/right controls on program EQs; I wouldn’t know when or why to equalize stereo playback channels differently. (Even in AudioControl’s own manual, none of the application-note examples suggests the use

**EQUALIZATION
IS A POWERFUL AND
POTENTIALLY USEFUL WAY
TO ACHIEVE A WIDE
RANGE OF AUDIO GOALS.**

of split settings.) Eight buttons on the front panel toggle the LED display on or off, select fast or slow response and 2- or 4-dB/LED sensitivity, and turn on or off the equalizer and the in-

frasonic filter actions. There are also keys to apply processing to record-out signals for equalizing tapes, to engage the C-101SE’s own tape monitor inputs, and to activate its on-board pink-noise source for the RTA function. AudioControl describes this

Photos: Michael Groen

Dimensions: 17 in. W x 3½ in. H x 11 in. D (43.2 cm x 8.9 cm x 27.9 cm).

Weight: 13 lbs. (5.9 kg).

Price: \$799.

Company Address: 22410 70th Ave. West, Mountlake Terrace, Wash. 98043; 425/775-8461; www.audiocontrol.com.

generator as a “lab-grade, triple-source circuit that employs special averaging circuits to eliminate inaccurate measurements.”

The controls surround the RTA display, which deploys a vertical column of nine LEDs (eight blue plus one amber in the center) for each of the ten octave bands. These bands are assigned center frequencies of 32, 60, 120, 250, and 500 Hz and 1, 2, 4, 8, and 16 kHz.

There’s also a front-panel phone jack to accept the measurement microphone that is necessary for analysis. The supplied mike,

**THE C-101SE
IS PRETTY MUCH DEVOID
OF MEANINGFUL
DISTORTION.**

said to be lab-grade, is of unspecified origin and has a dynamic capsule about 5 millimeters in diameter.

On the back panel are two quartets of RCA jacks, marked “Main In/Out” and “Tape In/Out”; the C-101SE thus replaces the tape loop it will occupy in most systems, which is a thoughtful touch. Another is an AC convenience outlet, similarly replacing the one the C-101SE very well may use up on your main system component (receiver or preamplifier).

Inside, the C-101SE’s layout was surprisingly simple, occupying a single standard-grade circuit board. Each stereo EQ band consists of a single IC and a half dozen each of resistors and capacitors, no more. Aside from the associated power supply and input/output circuitry, and the slider/control board bolted to the front panel, that’s all there is.

Measurements

The AudioControl equalizer proved to be a very good performer. Noise and distortion were minimal, and its EQ shaping and control looked very good to me.

Figure 1 shows the C-101SE’s frequency response with all sliders at their detents. There is less than 0.5 dB deviation over the entire audio range, which is outstanding considering that these not-quite-flat curves suggest that the AudioControl does not

“tap out” its EQ circuitry at the control detents. Figure 2 plots response of the equalizer’s infrasonic filter, which measures almost spot on its spec of -3 dB at 20 Hz and 18 dB/octave thereafter. With many loudspeakers, especially ported designs, such filtering may be necessary to eliminate intermodulation distortion from warp-spectrum infrasonics, whether on analog LPs, tapes, or the surprising population of CDs that reveal significant content below the audible range (mostly environmental rumbles in the recording venues).

Figure 3 shows the C-101SE’s noise spectrum, relative to a 0.5-volt output, with all sliders at their detents. The power-line peak at 180 Hz is the most notable feature here (the 3-kHz bump is computer-monitor pollution), but it’s still way, way down. I never heard any buzz or hum, even in an ear-to-tweeter test, short of full gain on the preamp master volume.

Figure 4 plots total harmonic distortion plus noise (THD + N) versus frequency under two different conditions. The lower, flatter pair of curves straddling 0.02% are for a 500-millivolt input with all sliders nudged just upwards off their detents. The upper curves, which clearly reveal the ten EQ center frequencies, are THD + N for all sliders set for maximum boost. The average increase is less than an order of magnitude, which tells me that the only real difference here is 15 dB or so of noise—in other words, the C-101SE is pretty much devoid of meaningful distortion.

With all controls detented, the C-101SE accepted 10 volts of signal before clipping its inputs; maxing out all sliders dropped the overload point to 0.9 volt. And with two slider pairs maxed (that of the test frequency plus either neighbor pair), the input overloaded at 1.9 volts. This should be ample headroom for real-world signals with any rational EQ curve. Display sen-

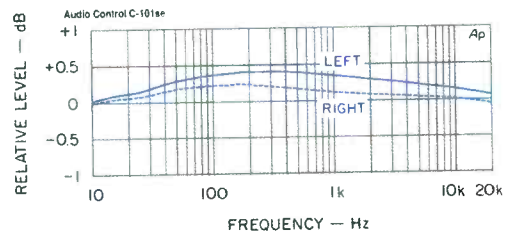


Fig. 1—Frequency response, sliders at detents.

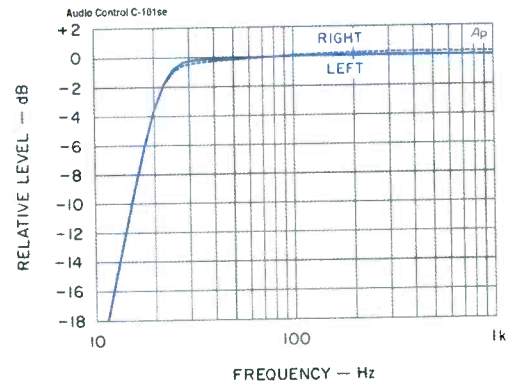


Fig. 2—Infrasonic filter response.

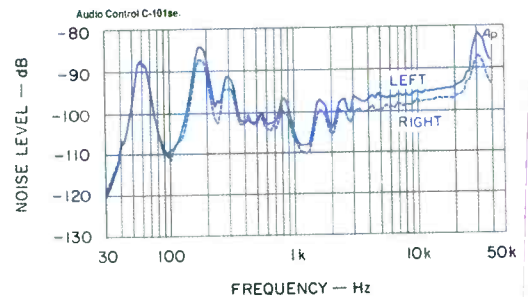


Fig. 3—Noise analysis re 500-millivolt output, sliders at detents.

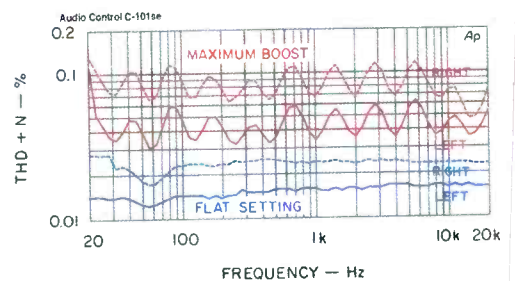


Fig. 4—THD + N vs. frequency at 500 millivolts in, sliders near detents and at maximum boost.

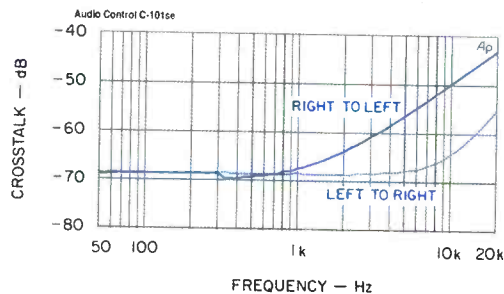
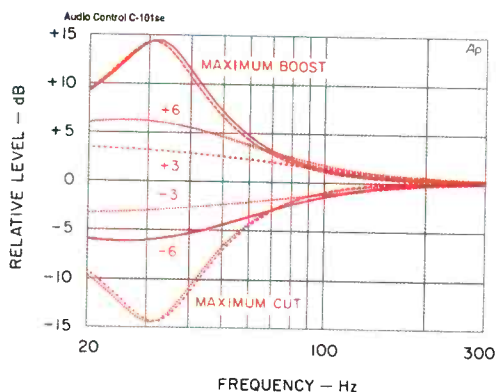
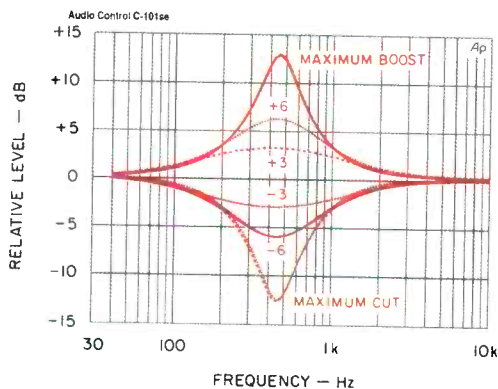


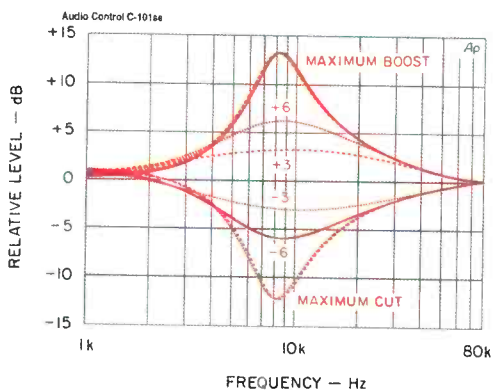
Fig. 5—Crosstalk.



A



B



C

Fig. 6—Equalization contours for 32-Hz band (A), 500-Hz band (B), and 8-kHz band (C).

sitivity was variable over a range of about ± 10 dB.

Figure 5 shows channel separation in both directions. Although there's more leakage into the left channel than into the right, crosstalk in either direction is well below what would be required for any audible impairment.

Abbreviated EQ curve families for three sample frequencies—32 Hz, 500 Hz, and 8 kHz—are shown in Fig. 6. (The amounts of boost and cut indicated are actual values rather than the front-panel indications.) In all cases, the AudioControl's EQ characteristics are consistent and predictable (the remaining bands behaved almost identically). The channels tracked very closely, and overshoot was minimal. In other words, boosting, say, the 500-Hz band did not induce reflexive dips around 50 Hz and 6 kHz. These sorts of interactions are quite common in less expert equalizers and even many bass/treble tone controls. This is important, because it can easily be argued that boosting the 32-Hz band by 6 dB, for example, will—on most music, much of the time—have significantly less timbral impact than a corresponding, unintentional interactive dip of 1 or 2 dB at 500 Hz.

Frequency accuracy was excellent: The actual center frequencies for the curves plotted in Fig. 6 were 31.5 Hz, 450 Hz, and 8.2 kHz. Maximum boost and cut was about 14.5 dB in the bass bands, about 12.5 dB at 500 Hz, and 13.2 dB at 8 kHz. When both bands adjacent to any other were boosted or cut, maximum action in the band in between rose by about 3 dB, as you might expect. All three curve families demonstrate that filter Q increases with gain either way (they're not constant-Q), which is about universal among affordable equalizers. This means that you get more of a shelving action with small settings (Fig. 6A reveals this most clearly), with a progressively

MEASURED DATA

Frequency Response, Sliders at Detents: Left, 20 Hz to 20 kHz, +0.4, -0 dB; right, 20 Hz to 20 kHz, +0.2, -0.1 dB.

THD + N at 500-mV Input, 20 Hz to 20 kHz: Less than 0.02%.

A-Weighted S/N re 500 mV: Left, 99.9 dB; right, 102.8 dB.

Input Impedance: Greater than 100 kilohms.

Output Impedance: 100 ohms.

Sensitivity: 475 mV output for 500 mV input, all sliders at detents.

Display Sensitivity: 330 mV for 0-dB indicated, sensitivity knob at detent.

Channel Separation: Greater than 50 dB, 20 Hz to 10 kHz; 43 dB at 20 kHz.

narrower, more peaking result at large control deflections. I found that all bands' panel markings effectively exaggerated by 1 to 3 dB. In other words, ± 3 dB indicated yielded about 2 dB of boost/cut; ± 9 dB indicated typically induced about 6 dB of gain/attenuation. This could conceivably be feature rather than bug. If so, I applaud it: People often overuse EQ, and slightly overstated panel markings just might help encourage restraint.

In Fig. 7, finally, is an arbitrarily created compound curve, by which I mean to show how the C-101SE behaves with control settings closer to the sort one might actually

I NEVER HEARD ANY BUZZ OR HUM, EVEN IN AN EAR-TO-TWEETER TEST AT MAXIMUM PREAMP GAIN.

use. In this case, the 32-, 60-, and 120-Hz sliders were all set at +9 dB indicated; the 250-Hz sliders stayed at their detents; 500 Hz, 1 kHz, and 2 kHz were set to about -5 dB indicated; and 4, 8, and 16 kHz were all set to -9 dB indicated. The point, as far as it goes, is that the C-101SE's bands integrate nicely, giving you a broad range of shelving actions, "knees," and peaking options to play with.

Use and Listening Tests

I connected the C-101SE into the main tape loops of my system, permitting it to process all sources. For most of the test period, electronics consisted of NAD S100 preamp and S200 power amp.

I began by plugging the supplied measurement microphone into the front-panel jack and firing up the pink-noise generator, locating the mike at my normal listening position. I was surprised to discover that, at least according to the C-101SE's bouncing-LED analyzer, my Platinum Solo speakers were surprisingly accurate at my chair. By this I mean entirely flat (within the C-101SE analyzer's 2-dB resolution) through the midrange, with a rise of perhaps 5 dB between the 120- and 32-Hz columns and a shelf down, about 3 dB, from 4 kHz on up. This, actually, is just about what I would deliberately choose and what most of us probably think "flat" sounds like—in fact, truly flat on this type of analyzer usually sounds awful in real rooms. This result gratified me because, like everybody else's, my system's composition and (especially) setup locations evolved by ear; it's always nice to have your subjective taste confirmed by modern machinery! Equally surprising, I found that the RTA curve remained very similar when the analyzer mike was moved anywhere within a roughly 2-foot cube

centered on the listener's head position; this is good news, since it suggests that ultra-precise listening position is not so critical.

Of course, the AudioControl's full-octave (and 2-dB) resolution is relatively coarse and thus doubtless conceals a multitude of ills. A 10-band RTA cannot be truly useful for analyzing frequency response beyond reporting overall response trend lines, as relatively narrow-band anomalies will not show up. But this is probably for the best, especially in an equalizer/analyzer: Trying to employ conventional analog equalization to iron out narrow response wriggles is almost always futile or worse—a bit like trying to squeeze the goat back out of the python.

I spent some time listening to the C-101SE with all sliders set to their detents, to

see if I could detect its presence in the signal path. Over loudspeakers the answer was just about unequivocally "no." Listening through headphones to top-grade solo piano recordings, I decided that I could just discern a difference. This was very difficult to characterize. There was no perceptible change in noise floor and no change in response *per se*. But the stereo image of the hall-sound "air" seemed *just* perceptibly wider with the AudioControl in the loop than it did without it. (This turns out to have been an interesting psychoacoustic result; see the "Measurements" section, and take another look at Fig. 1.)

I tried a very minimalist EQ curve on my system, reducing the top-octave shelving by about 1 dB and pushing down the bottom end's up-tilt, as a whole, by a couple of dB (this resulted in a very slight dip at around 120 Hz). On Natalie Merchant's *Ophelia*, a rather nicely recorded pop CD (Elektra 62196), the effect was to focus the treble a bit more sharply and to add a trace of bass definition. I didn't bother debating with myself whether the system was "better" or "worse" with the equalization engaged or disengaged, but I was satisfied that it sounded about equally high-quality either way; the rest is a question of taste.

I also tried the C-101SE as a true program equalizer. Traffic's *Mr. Fantasy* is one of my best-loved pop titles but is rather regrettably balanced, dropping like the proverbial stone below about 100 Hz and above about 12 kHz. Dialing in the classic "smiley face" curve, with a slight mid-smile notch to reduce the disc's slight midrange honkiness, made a world of difference. But there's sort of a catch: I am so used to the album's thudding, low-cal bass and dull, splatty treble that hearing it with at least some foundation and sparkle in place sounded almost—well, *wrong*. It was a bit like those digitally reconstituted recordings of famous virtuosi, such as Cortot: Without all the scratching, popping, and hissing, it

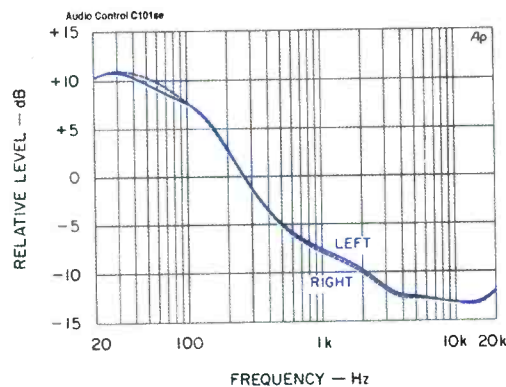


Fig. 7—Sample equalization curve, sliders set to +9 dB (at 32, 60, and 120 Hz), to 0 dB (at 250 Hz), to -5 dB (at 500 Hz, 1 kHz, and 2 kHz), and to -9 dB (at 4, 8, and 16 kHz).

**THE C-101SE'S BANDS
INTEGRATE NICELY,
GIVING YOU
A BROAD RANGE OF
OPTIONS TO PLAY WITH.**

just doesn't convey quite the same historical awe.

With the analyzer mike unplugged, what you see in the C-101SE's LEDs is the spectral activity of the incoming signal. The display is uncalibrated, since it is only meant to show relative levels, but I found that with the sensitivity knob at the detent it takes

330 millivolts to light the amber "0" LED midway up each band's nine-LED column. This sensitivity is actually a little low for most acoustic music (classical and jazz), but a slight twist of the knob fixes that.

The AudioControl C-101SE is an impressively high-performance signal processor, given its affordable price. It's impossible to speak of a program equalizer as transparent in the audiophile sense—after all, equalizers are *supposed* to make an audible difference. But the AudioControl was as able to induce subtle, potentially useful alterations as to cause overexaggerated, musically destructive ones. In other words, as with any weapon, the onus of wielding the C-101SE's considerable power responsibly lies with the user. Thus applied, it can prove a valuable and versatile tool.

BASCOM H. KING

TACT AUDIO MILLENNIUM DIGITAL AMPLIFIER



The TacT Audio Millennium does an amplifier's job, converting a low-level input signal to one that can drive speakers. But, says TacT, it's not an amplifier: It's a digital-to-analog (D/A) converter that "just happens to put out enough current and voltage to drive speakers directly." To the best of my knowledge, it's unique.

Four selectable digital inputs and a volume control enable the Millennium to serve as a digital preamp as well as a D/A converter and power amp. You can add four analog sources by plugging in an optional analog-to-digital (A/D) converter (due late this year at about \$1,500).

The TacT Millennium's output stage is essentially that of a switching (Class-D) amplifier. The signal reaching this stage

consists of pulses of varying width that switch rapidly between power-supply rails; this is called pulse-width modulation (PWM). At the amplifier's output, the train of variable-width pulses is sent through a low-pass LC filter to turn it back into an analog signal that can drive a speaker. But that's just a small part of the Millennium's circuit, and the differences between it and conventional switching amplifiers outweigh the similarities.

A Class-D amplifier accepts analog input signals, which are applied to a modulator that converts their varying voltages into pulses of varying width. The pulses switch (usually at around 500 kHz) between fixed-voltage supply rails. Negative feedback is typically applied to help linearize the process. Because the output signal's level is

set by the signal level feeding the modulator, any volume control in a Class-D amp must precede the modulator.

The TacT Millennium accepts only digital input signals. So instead of an analog-to-PWM modulator, it uses proprietary, Equibit digital signal processing (DSP) to convert the incoming PCM (pulse-code modulation) data stream to PWM (see block diagram, Fig. 1). This conversion is an open-loop process that does not depend on negative feedback from the amplifier's output for linear operation. (For more details, see "Equibit Conversion.") Before this conversion takes place, however, the PCM input signal is run through a sampling-rate converter to reduce any jitter in the incoming signal (and to change the sampling rate to 44.1 kHz, if the need arises; the Millennium can accept sampling rates of 32 to 48 kHz and word lengths of 16 to 24 bits).

One of the most important differences between the TacT Millennium and a Class-D amp is its system for controlling volume. You can't vary a digital signal's level by putting a volume control in the input data stream, as you would with an analog amp.

**TACT'S DIGITAL AMP
CAN ALSO BE LOOKED AT
AS A D/A CONVERTER
WITH ENOUGH OUTPUT
TO DRIVE SPEAKERS.**

And analog volume controls at the amplifier's outputs would require costly heavy-duty components and would waste much of the amp's power as heat. Instead, TacT Audio de-

Rated Power: 8 ohms, 150 watts/channel; 4 ohms, 2 ohms, or 1 ohm, 250 watts/channel.

THD + N: 0.015%, 20 Hz to 20 kHz, at 150 watts out into 8 ohms.

Dimensions: 17¾ in. W x 5¾ in. H x 16¼ in. D (45 cm x 14.5 cm x 41.3 cm.).

Weight: 62 lbs. (28 kg).

Price: \$10,295.

Company Address: 201 Gates Rd., Little Ferry, N.J. 07463; 201/440-9300; www.tactaudio.com.

vised a clever way to control the level at the Millennium's output stages without using a conventional volume control.

Amplifier output stages are essentially valves that control the flow of power from a supply to a load, continuously varying the flow according to the signal's level. Output level is a function of the signal and of the power available from the supply. Analog amps control volume by varying the signal level that reaches the output stage, and Class-D amps do it by varying the signal level fed to the modulator. But the Millennium's volume control changes the power from the output stage's supply rather than

DIFFERENCES BETWEEN THE MILLENNIUM AND CLASS-D AMPS FAR OUTWEIGH THE SIMILARITIES.

the signal level reaching that stage. (To change the signal level reaching the output section would have required recomputing the signals at the DSP stage, lowering their modulation level as the volume was turned down. That would have reduced signal quality by reducing the number of bits per sample at low volume settings.)

The output stage gets its power from a switching supply that alternates rapidly between its full voltage (+55 volts DC) and 0 volts. Turning the Millennium's volume control sends the supply a digital command to change its duty cycle, the amount of time it's switched on rather than switched off. Reducing the supply's duty cycle reduces its average output because it is delivering full voltage less of the time. This reduces the power available from the output modules.

For example, with a fully modulated (0-dBFS) digital input signal and the volume at its maximum setting (99.9 dB), the supply voltage is at its maximum and the amp produces its maximum power. At a volume setting of 74.3 dB, the supply voltage is down to about 3 volts, for an output of about 0.5 watt. Below 3 volts, however, the supply's performance drops; any further volume reductions are achieved in the DSP stage, by changing the modulation level of the pulse train feeding the output modules.

One potential drawback of this volume-control system is that it might not provide enough signal level from low-level digital recordings to get reasonably loud sound from inefficient speakers. Apparently, the same thing occurred to TacT, as it has brought out a new version of the amp with 12 dB more gain. (The company says this upgrade will be available to owners of the version I tested for about \$200 to \$300.)

The Millennium's actual output circuit is a full-bridge design built around four MOS-FET output devices. Great care and effort were expended in the layout, shielding, and drive-waveform optimization for this output stage in order to keep electromagnetic radiation acceptably low.

Even if you didn't know how the Millennium amp worked, its ultra-modern look would suggest there was something special to its design. The sculpted front panel draws your eye to the display and to the large, heavy volume-control ring that revolves around it on ball bearings. The display tells you the volume setting, which source is selected, and whether the amp has locked onto the input signal. A button to the left of the display selects analog signal sources (if the optional A/D converter is used), and a button to the right selects digital inputs. The power switch is at the lower left. The included remote duplicates the front panel's functions and adds controls for output polarity, maximum volume, and display brightness.

On the rear panel are three S/P DIF digital inputs (one RCA jack and two BNC connectors) and an XLR jack for AES/EBU digital signals. The selected digital signal is also fed to an S/P DIF RCA-jack output. A five-

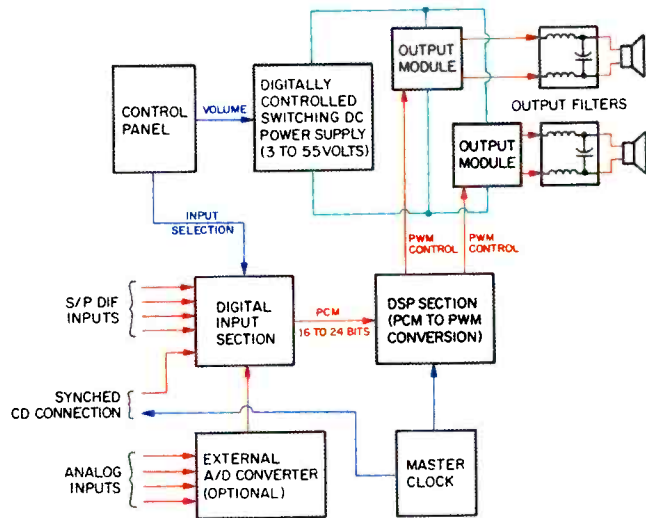


Fig. 1—Block diagram.

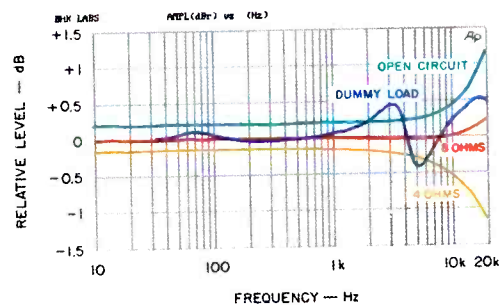


Fig. 2—Frequency response as a function of loading.



Fig. 3—Square-wave response for 3 kHz into 8-ohm load (top), 3 kHz into 8 ohms paralleled by 2 μF (middle), and 22 Hz into 8 ohms (bottom).

pin XLR jack labeled "Clock Gate" can be used for synchronized connection to a CD player, locking the player's clock to the Millennium's for reduced jitter. (Using this jack disables the AES/EBU input and bypasses the sampling-rate converter.) TacT says even cheap CD players can be modified

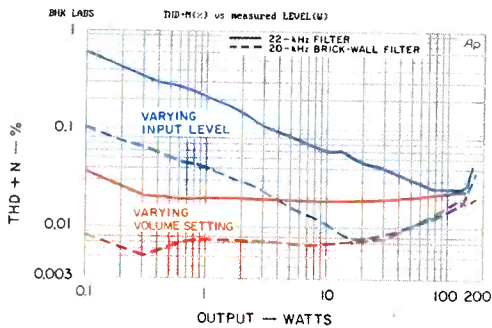


Fig. 4—Effect of various test methods on THD + N vs. power output; see text.

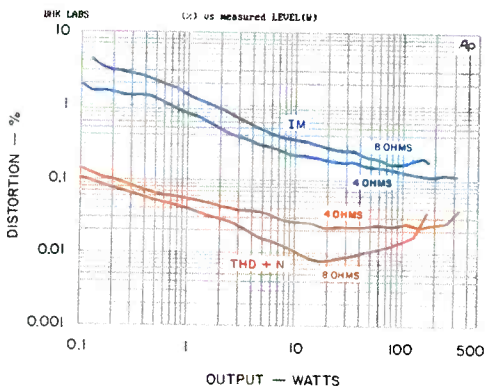


Fig. 5—THD + N at 1 kHz, and SMPTE IM distortion, vs. power output with fixed volume setting and varying input level.

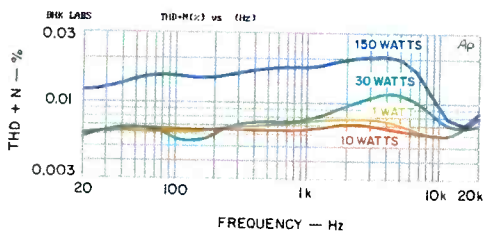


Fig. 6—THD + N vs. frequency.

for this connection; the company will sell modification kits (for about \$450) for installation by the technician of your choice.

Another five-pin XLR jack is provided for the optional external A/D converter. As an alternative, TacT will be offering RCS, a room-correction system. This will include four analog inputs and will perform A/D conversion as well as time-domain equalization customized for your room and speakers. The internal version of RCS will be about \$2,250, including microphone; the

external version (which adds digital inputs and outputs, a graphic display, and other features) will start at about \$2,950 with mike. A three-pin XLR jack is provided on the Millennium's rear panel for the internal RCS module's mike.

A DB-9 serial port serves several purposes: connecting a computer used for setting up the RCS module, interfacing with Crestron home-control systems, and installing software upgrades. Two very high-quality, gold-plated five-way speaker binding posts per channel and an IEC line-cord connector round out the rear panel.

The Millennium is beautifully constructed of machined aluminum. The front panel is an impressive 1½ inches thick, making the rear panel's ¾-inch thickness seem modest by comparison. Vertical aluminum plates, about 5 inches in from either side, act as heat sinks, and a plate between them supports a large toroidal transformer. The main processing board has its own shield of milled aluminum. Machined, gold-plated bars connect each channel's output filter to its speaker terminals. The amp's bottom and its U-shaped top and side cover are black, contrasting nicely with its silvery front and rear panels.

Measurements

Except where noted, I used 16-bit test signals sampled at 44.1 kHz. The two channels behaved very similarly; results are presented for the right channel unless otherwise noted.

Frequency response for a variety of loads is plotted in Fig. 2. Interestingly, the Millennium's output impedance interacts with the NHT dummy speaker load to boost the output above the amp's open-circuit output level at 3 kHz or so. The response variations seen for the dummy load will probably be audible if your speaker's impedance characteristics are similar to this load's. Output impedance (computed by comparing the amp's 8- and 4-ohm output levels) was 0.16 ohm, which is reasonably low.

EQUIBIT CONVERSION

Although the Equibit converter does not use negative feedback, it does recompute its output pulse widths to compensate for nonlinearities in the conversion from PWM to analog audio at the Millennium's output. The converter also uses oversampling and noise shaping to get around some limitations of PWM and of PCM-to-PWM conversion. The PCM signal is passed through an eight-times oversampling digital filter (which steps up the data rate to 352.8 kHz, the DSP section's switching frequency), and then the data's 16-bit words are truncated to 8 bits. Noise shaping compensates for the resulting drastic increase in noise and distortion and restores dynamic range. A corrective signal is generated from the least significant 8 bits, which were removed by the truncation, and it pushes the added noise and distortion up to inaudibly high frequencies. *B.H.K.*

For my square-wave analysis (Fig. 3), I selected test signals of 3 kHz and 22 Hz instead of my usual 10 kHz and 40 Hz. The Millennium's passband, like that of most digital audio gear, is limited to just over 20 kHz, so the harmonics that make a 10-kHz square wave square would have been filtered out and the trace would have become a sine wave; at 3 kHz, the amplifier passes enough odd harmonics to define the wave shape. I selected 22 Hz because I could easily generate a digital square wave at that frequency. At 3 kHz, the waveform when the Millennium was feeding an 8-ohm resistive load (top trace) is symmetrical and its shape indicates the linear phase characteristic of an FIR (finite impulse response) low-pass filter; rise and fall times were 20 microseconds. Adding a 2-microfarad capacitor across the 8-ohm load (middle trace) makes the waveform asymmetrical and increases overshoot, both signs of nonlinear phase characteristics. There's virtually no tilt in the 22-Hz trace (bottom), a sign of very extended low-frequency response. The ringing seen in this trace is not related to the TacT's performance but was caused by

the absence of harmonics above the tenth in the test signal.

When testing total harmonic distortion plus noise (THD + N) versus output in analog amps, it's customary to control the output by varying the input level. That would be misleading, however, when testing a digital amp like the Millennium. As you can see in Fig. 4 (plotted at 1 kHz with an 8-ohm load), lowering the input level raises measured THD + N because lowering level in the digital domain reduces the number of bits per sample. Keeping the signal level

**THE TACT MILLENNIUM
SOUNDED VERY SMOOTH,
COHERENT, DETAILED,
AND INVOLVING.**

(actually, modulation) constant while varying the volume setting, as you normally do while you're listening, yields much better performance.

Note also the effects of changing the measurement passband. There is significantly more noise and distortion with my Audio Precision test system's 22-kHz, 36-dB/octave low-pass filter than with its 20-kHz brick-wall filter, whose cutoff is even sharper. This is because of the noise shaping involved in the Equibit PCM-to-PWM conversion. The results with the 20-kHz brick-wall filter are a better indication of what you'll actually hear, because noise above 20 kHz is inaudible (though it may affect tweeter performance in other ways).

The curves in Fig. 4 do not suddenly shoot up at the end as the amp goes into clipping—this amp cannot clip. Distortion does turn up a bit as we approach the amplifier's maximum output, 178 watts per channel into 8 ohms (higher than the rated 150 watts), but the Millennium cannot be driven beyond that point. The curves I made while varying input level end at 0 dBFS, the highest possible digital level, and the input was a constant 0 dBFS for the curves made while varying the volume setting. Furthermore, because the TacT amplifier's power supply did not sag over time (or with changing AC line voltages down to 108 volts), there was little difference be-

tween its dynamic and steady-state power.

Figure 5 shows distortion (THD + N at 1 kHz and SMPTE IM) versus power output for 4- and 8-ohm loads. For these tests, the Millennium's volume control was at maximum and the digital signal level was varied. Measured SMPTE IM was higher than I expected (although it's mostly noise), for reasons I cannot satisfactorily explain; a quick check of CCIF two-tone distortion yielded better results. Here, too, the curves end without shooting into clipping. The 4-ohm curves extend a bit past 300 watts, again surpassing the amp's power rating.

For Fig. 6, a plot of THD + N versus frequency at several power levels, I used a fixed digital signal level of -0.2 dBFS to eliminate even the faintest possibility of clipping and varied the Millennium's volume setting to change output power levels. At higher power levels, distortion rises with frequency; the drop in distortion above about 5 kHz was caused by my 20-kHz brick-wall filter, which attenuated the resultant harmonics.

These days, there's a lot of discussion about new recording formats with word lengths up to 24 bits and sampling rates to 96 kHz. The Millennium can't handle 96-kHz signals (a Mk. III version, now in the works, will be able to) but can handle up to 24-bit signals. You'd expect increasing the word length to reduce deviation from linearity, at least at low signal levels. This was true when I switched from 16- to 20-bit data (Fig. 7). I saw no further improvement when I tried 24-bit data, because those extra four bits were down in the noise floor. Increasing word length can also reduce distortion. If I'd used 20-bit instead of 16-bit signals for Fig. 4, the distortion measured with the 20-kHz filter and varying input level would have been about 15% to 20% lower; however, the results taken by varying the Millennium's volume setting would not have changed much.

Figure 8 shows the distortion spectrum when the Millennium was reproducing a

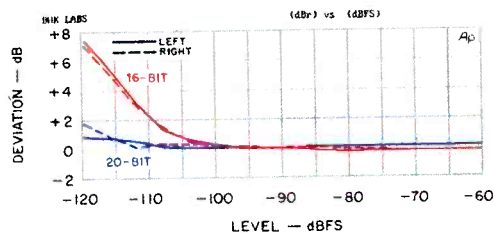


Fig. 7—Deviation from linearity as a function of level and data word length.

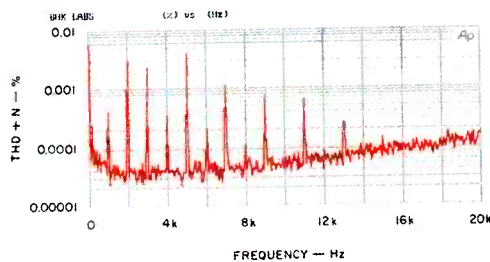


Fig. 8—Spectrum of harmonic-distortion residue for a 1-kHz signal at 10 watts out into 8 ohms.

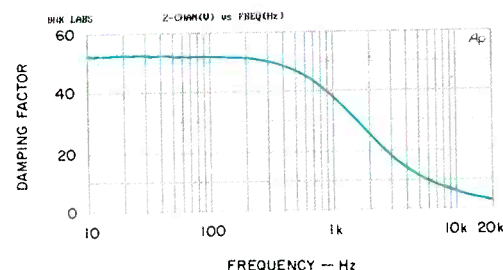


Fig. 9—Damping factor vs frequency.

1-kHz tone at 10 watts into 8 ohms. Above 2 kHz (the second harmonic), the odd harmonics dominate, but they're too low in level to make the sound harsh. If this data were plotted on a logarithmic rather than a linear frequency scale, you'd also see the noise starting to ramp up rapidly above 10 kHz because of the rise in high-frequency noise (mostly beyond the audio range) caused by the amp's noise shaping.

The Millennium's noise shaping also explains why my measurements of output noise varied quite a bit with bandwidth. With a "silent" digital signal and the TacT amp's volume turned all the way down to 0 dB, wideband noise was 16 millivolts (mV); a narrower test bandwidth, 22 Hz to

ASSOCIATED EQUIPMENT USED

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

CD Equipment: Classé Audio DAC-1 and MSB Technology Link DAC 2 D/A converters, PS Audio Lambda Two Special and Sonic Frontiers Transport 3 CD transports, Sony CDP-707ESD CD player, Pioneer DV-414 DVD player, Genesis Technologies Digital Lens anti-jitter device, MSB Technology ADD-1 Digital Audio Director switcher and A/D converter, and DGX Audio DDP-1 digital preamplifier used as an A/D converter

Phono Equipment: Kenwood KD-500 turntable, Infinity Black Widow arm, Win Research SMC-10 moving-coil cartridge, and Vendetta Research SCP2-C phono preamp

Additional Signal Sources: Nakamichi ST-7 FM tuner, Nakamichi 1000 cassette deck, and Technics 1500 open-reel recorder

Preamplifiers: First Sound Reference II passive, First Sound Presence Deluxe line stage, modified Quicksilver Audio LS, and Dynaco PAS-2

Amplifiers: Arnoux Seven-B stereo switching amp, Quicksilver Audio M135 and Quicksilver Audio Silver 60 mono tube amps, and Sumo Polaris and Parasound HCA-3500 solid-state stereo amps

Loudspeakers: B&W 801 Matrix Series 3 speakers used as subwoofers with Dunlavy Audio Labs SC-III speakers; Tannoy Churchill and Genesis Technologies APM-1 speakers

Cables: Digital interconnects, Illuminati DX-50 (AES/EBU balanced); analog interconnects, Vampire Wire CCC/II and Tice Audio IC-1A; speaker cables, Kimber Kable BiFocal-XL and Madrigal Audio Laboratories HF2.5C; Tice Infinite Speed Reference power cable

22 kHz, yielded a far lower reading of 330 microvolts (μV), or 0.33 mV. A-weighting, which counts higher frequencies more than lower ones, yielded a reading of 600 μV . Raising the volume setting to 80 dB just about doubled the band-limited and A-weighted noise (to 620 μV and 1.1 mV, respectively) but did not increase the noise significantly enough to influence the wide-band result.

Raising the digital input level to -138 dBFS did not appreciably change these measurements. However, when I tried my even narrower 20-kHz brick-wall filter, the noise for a -138-dBFS input dropped to 28 μV with the volume set at 0 dB and to 85 μV with the volume at 80 dB. Increasing the input word length to 24 bits just about halved the 85- μV reading, to 44 μV .

With the volume set to 99.9 dB, its highest setting, the output noise did increase considerably: The output noise with 16-bit words rose to 6.2 mV but was much lower, 850 μV , with the 20-kHz brick-wall filter. Increasing the input word length to 24 bits lowered the 850- μV result to 398 μV .

The Millennium's damping factor is plotted in Fig. 9. The amp's volume-control

tracking was well-nigh perfect down to -77 dBFS (which was as far as I measured). Channel balance at all volume settings was off by a relatively inconsequential 0.29 dB.

Conventional gain and sensitivity measurements don't apply to an amplifier that accepts only digital input. The nearest equivalent result I can give is that the TacT Millennium delivered 1 watt into an 8-ohm load with a signal level of -22.3 dBFS.

Interchannel crosstalk for a 0-dBFS digital input, with the Millennium's volume set for about 20 volts out (50 watts into 8 ohms), was down more than 110 dB from 20 Hz to 10 kHz and increased to -93 dB at 20 kHz. Under more realistic conditions (a digital input of -10 dBFS and the Millennium's volume set at 80 dB), crosstalk was no higher than -110 dB up to about 4 kHz and increased to -83 dB at 20 kHz. In each case, the results were about the same from left to right as from right to left.

The TacT Millennium drew 0.39 ampere from the AC line at idle, 0.4 ampere with each channel putting out 1 watt into an 8-ohm load, and 0.66 ampere with each channel putting out 10 watts into 8 ohms. This is considerably higher efficiency than you'd

get from a conventional Class-AB solid-state amplifier of similar power capability. For example, a 100-watt Class-AB amp I happened to have on hand in my lab drew 0.84 ampere at idle, 0.98 ampere at 1 watt/channel out, and 1.6 amperes at 10 watts/channel; a Class-AB amp rated at the same 150 watts/channel as the Millennium would draw even more.

Use and listening Tests

The TacT Millennium's sound was very smooth and involving. From the first, I found it more coherent than that of most amps, with less harshness when playing difficult material at loud levels. Ambient reflections from the walls of the recording venue were very clearly reproduced. One critical listener thought the high frequencies were a little grainy compared to the sound from some of my tube power amplifiers used with a First Sound Reference II passive preamp.

Of the digital program sources I listened to through the Millennium amp (see "Associated Equipment Used"), I generally preferred the sound from the Pioneer DV-414 DVD player. This is one of the very few DVD players I know of that can deliver 96-kHz digital output, but since the Millennium can't handle this sampling rate, I set the Pioneer's output for a 48-kHz sampling frequency. This enabled me to play some of the great-sounding 96-kHz/24-bit discs from Chesky and Classic Records through the Millennium. These discs still sounded more transparent, however, using the DV-414's D/A section or external 96/24 D/A converters through either of my First Sound preamps into Quicksilver Audio Silver 60 tube amps.

I couldn't play some CDs realistically loud through the Millennium amp, because the material on those discs had a high peak-to-average ratio. For example, Ron Tutt's drum solo on track 5 of *The Sheffield Drum Record* (Sheffield Labs CD-14/20) could not quite reach live levels when the Millennium was driving Dunlavy SC III or Genesis APM-1 speakers but almost made it with the more efficient Tannoy Churchills. Still, I got more than enough volume from the vast majority of CDs I played.

I also played analog sources through the Millennium, using either MSB Technology's ADD-1 Digital Audio Director or

DGX Audio's DDP-1 Digital Convolution Preamplifier as an A/D converter. (TacT's optional A/D converter was not available at the time.) The sound was generally quite good, but I felt there was more resolution and transparency when I played these same sources through the First Sound preamps and Quicksilver tube amps. I ascribe this difference to CD's (and the Millennium's) sharp high-frequency cutoff at 20 to 21 kHz. Analog sound has wider bandwidth, even if it is rolling off at very high frequencies. Audio DVDs sampled at 96 kHz have about double the high-frequency response of CDs, and I think this is why they sound more transparent to me than the best CDs.

I've been experimenting with digital signal processing for speaker correction, using Genesis Technologies APM-1 speakers. This correction flattened the frequency response and time-compensated the output for maximum coherence at a 1-meter listening distance. With and even without correction, these speakers were so good that they gave me a terrifically clear sense of how good the TacT Millennium really was. Although I will revisit my analog electronics with these speakers, the TacT digital amplifier sounded so fine with them that I had no immediate need or desire to do so.

I absolutely loved the feel of the Millennium's large, heavy flywheel-type volume control, and I could easily set the volume to whatever level sounded best by pressing the remote's volume up/down buttons. However, it was difficult to use the remote for selecting a particular decibel setting. If I held either volume button down, I'd overshoot the mark; repeatedly pressing and releasing the buttons changed volume by only about 0.2 dB per press, so it took a frustratingly long time to get to the desired setting. My only other criticism is that the protection circuitry (which guards against shorted outputs, DC at the speaker outputs, overheating, and improper AC line voltages) is a mite touchy; it put the amp in standby mode a number of times for no apparent reason.

All in all, the TacT Millennium is a very fine, musical amplifier. I don't think it eclipses good-sounding analog electronics, but its sound is very satisfying, and I definitely liked its presentation. I enjoyed music through it immensely. A

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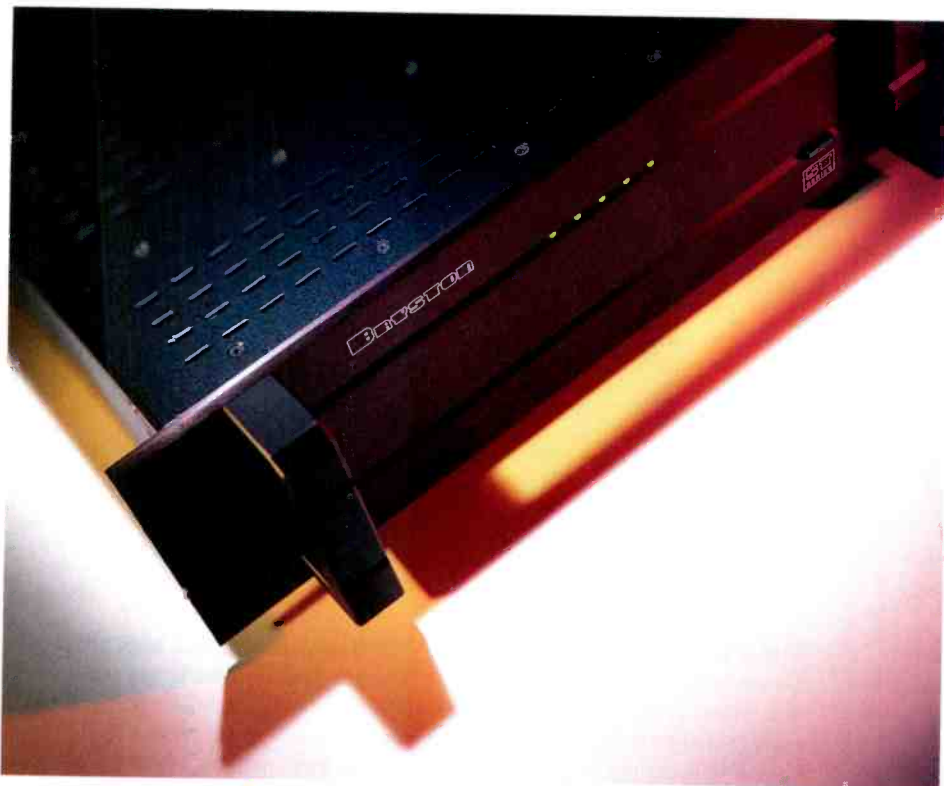
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BRYSTON 9B-ST FIVE-CHANNEL POWER AMP



As we wind up this millennium, we've come to a point in the half-century history of hi-fi where most reviewers are so much dumber than the vast majority of their readers that their opinions are actually taken to mean the *opposite* of what they're supposed to. So instead of reading hi-fi reviews nowadays, we mostly decode them.

Like it or not, we're living in the era of the "Bizarro Review." The term takes its name from the Bizarro

World, a time-warp zone in the Superman comic books where everything is bass-ackwards: Bizarro dogs meow while Bizarro cats bark,

Bizarro rain falls upward, and Roberto Benigni wins the Academy Award for Best Actor. "Me am so happy!" a s a d - f a c e d denizen of the

Bizarro World will pout, displaying not only the opposite meaning of many high-end reviews these days but also their unique prose style.

I mean, it's gotten to the point where I read certain reviewers raving

about a product and I know automatically that if *they* love it, it's got to suck. And if they're *not* so hot on it, nine times out of ten I'll listen to the same piece of gear and it'll be drop-dead fantastic. (I have to admit it's taken some of the fun out of truffle-pigging the good gear each month.) The fad for single-ended triode tube amps helped flush a lot of these guys out of the woods for me. Anyone dumb enough to fall for such aggressively colored and distorted sound and then go on the record as fawning over it as somehow being more "real" and "soulful" than the sound of a good modern amp, whether solid-state or tube-based, is a guy who really knows what he am talking about.

I bring all this up because there is no brand of hi-fi gear that audiophile reviewers so consistently go Bizarro over than Canada's Bryston, Ltd. The company's amps are so utterly clean, neutral, and ridiculously better-sounding than 90% of what passes for high-end these days that, as with the speakers of its like-minded compatriot Paradigm, it's no wonder the *Life Am Beautiful* crowd just doesn't get this stuff. Reviewers in the high-end mags almost always seem to go out of their way to temper a Bryston amp's outstanding measurement graphs and their reluctant admission of its excellent overall sound with half-assed gotchas. Such as: "A very capable performer with lots of muscle but, regrettably,

a shade less of that elusive see-through transparency I enjoy from my reference single-ended triode amp that am so musical and soulful."

**EVERY TIME I HEAR
A BRYSTON AMP
POWERING SPEAKERS, I
KNOW I'M HEARING THEM
AT THEIR VERY BEST.**

As for me, I know that every time I've heard a Bryston amp powering a set of speakers, I know I'm hearing those speakers at their very best. I've always come away incredibly impressed by how clean and neutral

Company Address: 677 Neal Dr., Peterborough, Ont. K9J 7Y4, Canada; 705/742-5325; www.bryston.ca.

Photo: Michael Groen

these amps sound. They take the audio signal and amplify it, and they don't seem to do anything else to it at all. And that's really *all* you should ask a great amp to do. I know some audiophiles look for an amp to add "life" or "bloom" to the sound, much in the way that MSG does to food, oak does to wine, and Viagra does to overtenderized meat. But the smart boys know better, which is why so many pro studios, mastering houses, and film soundtrack mixers rely on Bryston amps to get the clearest possible picture of what they're doing with the sound you eventually get served up at home.

Which brings me to Bryston's latest amp, the \$3,695 Model 9B-ST. The five-channel, 120-watt 9B-ST is the company's entry in a popular new category: the expensive, five-channel finesse amp meant for the highest-quality multichannel playback. Lots of mid-priced five-channel amps hit the market before such brands as Proceed and Krell got into the game, but the necessary compromises made to shoehorn five amps into a conventional-sized chassis meant a noticeably lower level of sound quality. Then Proceed and Krell came along and said, "You people really want five channels of true audiophile-grade amplification in one box? Okay, but it's gonna *cost* you." To the tune of five painful grand, yes, though these high-dollar finesse amps really do deliver five honest channels of high-powered, audiophile-grade sound, something you're just not going to get from even the best "100W" A/V receiver and mid-priced five-channel amps. Krell's KAV-500, in particular, is such a solid, clean-sounding brute that I've made it the anchor of my reference rig for the past several years.

Now comes Bryston, with an amp that, at 65 pounds, is lighter than Proceed's \$4,995, 119-pound AMP 5 and slightly heavier than Krell's \$5,000, 47-pound KAV-500. It's rated for comparable power, 120 watts per channel versus the Proceed at 125 watts and the Krell at an even 100. Except the Bryston's only \$3,695, and a hundred bucks more gets you the THX version, which is exactly the same amp but with a nifty 12-volt auto-on trigger you can rig to your surround preamp for remote turn-on and with a slightly higher than normal input sensitivity (per Lucasfilm's increasingly irrelevant specs for home theater).

I've long since given up on trying to correlate the model number of a Bryston amp with the number of channels it has. The company's 3B-ST, for example, is a stereo amp, but so's the 4B-ST, while the 5B-ST is a three-channel amp, the 7B-ST is a monoblock, and the 8B-ST is a four-channel number! A Canadian (or a Klingon) would say that this scheme of naming each new amp one number higher than the last, regardless of channel count, is perfectly logical, and certainly Spinal Tap's Nigel Tufnel would approve, as the 9B-ST is "one higher, innit?" An American reviewer might wish for a more literal naming scheme but only to have something, however tiny and niggling, to bitch about when faced with critiquing a product like the 9B-ST.

**LIKE OTHER BRYSTONS,
THE 9B-ST ACTS AND
SOUNDS LIKE
A MUCH BIGGER AMP.**



Unlike nearly every other multichannel amp on the market, the 9B-ST is actually five completely separate 120-watt mono amps housed in a single chassis (that's 19 inches wide, 5¼ inches high, and 16 inches deep; a 17-inch-wide version is available). The only thing the five channels share is a split feed off the incoming AC. Each amp channel is on a separate plug-in card that fits snugly into a slot inside the chassis. While virtually all five-channel amps (including the Krell KAV-500 but not the Proceed AMP 5) run all their channels off the same power supply, Bryston fits each of the 9B-ST's amps with its own compact but still quite beefy toroidal transformer and power-supply circuit right on the card. Krell

maintains that it's better to run all channels off of a single, larger power supply so that channels running into the red (the front channels) can "steal" some juice from those that coast most of the time (the surrounds); Bryston obviously feels differently, explaining that interchannel crosstalk and other dynamic interaction among the five channels is greatly reduced, if not eliminated entirely, by giving each amp its own power supply. A side benefit of this design is that if, say, one channel goes out (something that happens to Bryston amps about as often as the Knicks take a kid named Greenberg in the first round of the draft), you can pop the card out and have it repaired without taking the whole amp down.

The 9B-ST's spare front panel sports only a pushbutton power switch and five l'il LED status indicators, one per channel. Turn the amp on, and the lights go green. But push it past 120 watts for any of the channels, and its corresponding LED flashes red for overload. When I first got the Bryston I thought this was kind of a cheesy feature, but the more I lived with it, the more I appreciated it. The Krell KAV-500 lacks these overload indicators, so you've got to actually *listen* to tell if it's puking. What am I, a golden ears here? Give me the LEDs.

The very heavy-duty speaker outputs (though plastic-barreled and smooth-sided to boot, to prevent the use of such overkill as a socket wrench) hew to the European regulations, which mandate that these connectors prevent your using spade-lug-terminated speaker cables. Remember, people: Guns don't kill people, spade lugs do. Anyway, if you want to party with the 9B-ST, you'll need to tip off your cables with banana plugs or, better, leave the ends bare, insert them into the holes underneath the posts, and screw 'em down tight, for maximum contact integrity.

Owing to Bryston's longstanding presence in pro studios, the 9B-ST has not only unbalanced RCA and balanced XLR inputs for each channel but also balanced (TRS, a.k.a. "tip-ring-sleeve") quarter-inch phone jacks wired in parallel with the XLRs. Audiophiles might find the Bryston's phone inputs a bit odd, because you don't really find too many phone plugs in home hi-fi except on the end of a headphone cord. But if you want to have some fun with the Brys-

ton's inputs, plug a pair of headphones into one of the channels, scream your @%#\$ head off into one of the cups, and you'll have a kind of hillbilly microphone. The key here is that since the Bryston really wants to see a line-level input signal and you're only giving it a few millivolts, at best, you really need to cough up some serious lung to get any kind of sound at all out of your speakers. With practice and lots of whiskey sours, you'll be hitting those Bon Scott high notes in no time, to the delight of your family and friends.

I auditioned the Bryston 9B-ST in my main reference system, which handles everything from two-channel music to 5.1-channel DVD movies to real-time RealAudio rhythm and blues on the Net (courtesy of the mighty WWOZ-FM, New Orleans, at www.WWOZ.com). Swapping out my usual Krell KAV-500 for the Bryston at regular intervals, I fed both with a system centered around Theta Digital's Casablanca surround preamp, which handled Dolby Digital processing from a Toshiba SD3107 DVD player and performed 20-bit D/A conversion for Theta's Data III CD/laserdisc transport. A quartet of NHT 3.3s served as the main and surround speakers (each of these has its own 12-inch subwoofer, so I set the Casablanca to run the 3.3s full-range all around), while NHT's matching AudioCenter-1 sat atop my Pioneer big-screen. All electronics were plugged into API Power Pack AC-line filters, with Canare line-level and digital cables and Kimber 8TC speaker cables hitching everything together.

My listening setup is a good torture test for five-channel amps, mainly because I drive a roomful of moderately sensitive full-range speakers very, very loud in a large open loft. It's no wonder, then, that I went through a long list of mid-priced five-channel amps looking to find one that could give me the power and finesse I needed, with only a sad little pile of blown fuses and the acrid smell of burnt transistors hanging in the air to show for it. It wasn't till I finally got hold of the excellent Krell KAV-500 that I could live with a single amp driving the whole shebang. Call me crazy, but I like the KAV-500 better than Krell's bigger and more sophisticated two-channel "marquee" amps. It's more neutral-sounding, and it plays my NHTs louder than its 100-watt/channel rating would seem to imply.

The Bryston 9B-ST sounds quite different from the Krell. Though the KAV-500 has been my first choice in a five-channel amp for several years now, when I listened to both amps in a matched-level comparison, it was immediately obvious that this new Bryston surpassed the Krell very nearly



**EVEN WHEN THE 9B-ST'S
CHANNEL INDICATORS
FLASHED RED ON PEAKS,
THE SOUND
DIDN'T HARDEN.**

across the board. Living with the excellent Krell had taken my system's sound to a new height, but the Bryston raises the bar significantly in all of the areas that I believe are most important to an amplifier's sound (or, rather, its lack of one).

The most obvious improvement was in the bass. Although Krell amps have long had a deserved rep for the tightest tush, the Bryston's low end was tighter, more powerfully controlled, and far more cleanly articulated. Whether I was listening to Radiohead's bottom-heavy Brit techno on *OK Computer* (the band's only even halfway-decent record) or Willie Weeks' classic Fender jazz bass mastery all over *Donny Hathaway Live*, the 9B-ST locked the quartet of 12-inch woofers all around me in a much more manly grip than the KAV-500, pulsing the music along at what almost seemed like a quicker, more energetic tempo. If I had to draw an analogy, I'd say the Bryston's low end sounds like a really tight sealed woofer and the Krell's like a good ported one—still very meaty, just not nearly as tight and well defined.

The Bryston also scored in the areas of image focus and treble purity. If I had to

pinpoint one nagging fault of the Krell, it would be its high end, which tends to harden audibly as you push it harder. Of course, all amps, whether solid-state or tube, do this when pushed to their brink, but the Krell's ramp-up toward hardness seems to happen a bit sooner in the treble than in the rest of the spectrum. I've also found the combination of the Krell and the NHTs can, if the source material isn't smooth-sounding to begin with, get a bit too forward over the long haul. Not so with the Bryston. The more I listened to the system with the 9B-ST in the chain—and the louder I listened—the more I wanted to keep playing music. Even when the amp's channel indicators flashed red on peaks, the sound didn't harden. In fact, I had to crank the volume up till the red lights stayed on for the sound to audibly distort, and at that level it was way too loud even for me. This has been my experience with other amps in the Bryston stable. The 9B-ST may be rated for a "mere" 120 watts per channel into 8 ohms (200 watts into 4 ohms), but like other Brystons it acts and sounds like a much bigger amp.

Overall, the sense I got from the Bryston was that it's a more neutral and powerful amplifier than the Krell KAV-500, which itself is more neutral and powerful than just about any other five-channel amp you're going to find at any price. Either would be a major step up from most other multichannel amps on the market. But to my ears, the Bryston is the better-sounding, more character-free amplifier. That the THX version costs \$1,200 less than the Krell is the kind of gravy I like best.

Once again, Bryston delivers a power amplifier that's so good it almost works against its standing as a high-end audio product. If you're looking for an amp with "life" or "soul" or "warmth" to bring zest to your system, the 9B-ST won't do it for you. But if, like me, you're seeking a serious five-channel amp that offers a powerful yet crystal-clear view of whatever audio signal you feed it, I don't know of any other that will fit the bill better. I look forward to the months ahead as I begin to use the Bryston as my new reference amp, because my system has never sounded nearly as good as when the 9B-ST has been in the driver's seat. Even at \$3,795, this amp is a steal. Highly recommended. A

SONIC NIRVANA



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AURICLE

ANTHONY H. CORDESMAN

CONRAD-JOHNSON PREMIER 12 MONO AMP AND PREMIER 16LS PREAMP



Photo: Michael Groen

The last few years have been great ones for stereo. Improvements have taken place in digital front ends, preamplifiers, amplifiers, and loudspeakers at virtually every level. And this has been as true for tube electronics as much as for the most advanced solid-state gear. Today's best tube equipment is cleaner, quieter, and more transparent than ever before, with tighter and more extended bass reproduction. The highest octaves are also better defined, yet the smooth, sweet upper midrange that tube gear is famous for is retained. More soundstage detail is revealed, depth is extended, imaging is more three-dimensional, and image size and center fill are better defined.

The Conrad-Johnson Premier 16LS preamplifier and Premier 12 mono power amplifiers exemplify these developments. I have been reviewing Conrad-Johnson equipment for nearly two decades, and I have never auditioned anything from the company that did not provide at least very good sound quality and value for money. In fact, Conrad-Johnson has consistently been one of the handful of manufacturers whose best products have defined the state of the art in tube electronics.

The Premier 16LS preamp is based on technology that Conrad-Johnson developed for its massive, dual monaural Anniversary Reference Triode (ART) preamp, which sells for nearly \$15,000. The 16LS is a smaller unit that sells for \$7,995—just a little more than half of the ART's price. The 12 is a 140-watt monaural power amplifier that sells for \$6,990 a stereo pair. As with the 16LS, no one will accuse the 12 of being inexpensive, but Conrad-Johnson's top-of-the-line mono Premier Eight-A sells for \$16,990 per pair.

Company Address: 2733 Merrilee Dr., Fairfax, Va. 22031; 703/698-8581; www.conradjohnson.com.

The Premier 16LS is particularly striking. It looks a bit like the top half of the ART, breaking cleanly from the box-with-knobs style of most tube preamps. Its champagne gold front panel is a rather pleasant departure from the norm as well.

And its low-profile chassis—which measures only 3½ inches high, 19

inches wide, and 15¾ inches deep—should make it fairly easy to place in most cabinets or on most shelves.

**WITH BOTH AMP
AND PREAMP,
CONRAD-JOHNSON GOT ALL
THE BASIC ELEMENTS
RIGHT.**

pushbuttons. These include muting, volume, balance, a choice of five

The Premier 16LS is very easy to use. The remote can perform most control functions, although many of them are duplicated via front-panel

high-level inputs, and a choice of two external processor loops for tape decks, signal processors, etc. The back panel is straightforward: RCA jacks for all inputs and loops, plus a pair of main outputs. There are no balanced inputs or outputs. The 16LS inverts polarity, by the way, so if your amplifier does not, you will have to reverse the polarity of the speaker leads to preserve absolute phase (or as close to it as the recording, speaker, and so forth will allow).

Behind the Premier 16LS's functional simplicity lies a very sophisticated design. Input selection and volume adjustment are handled by microprocessor relays. Balance can be adjusted in 0.7-dB steps, set by precision, low-noise resistors. One nice aspect of this particular control is a pair of front-panel LED indicators, with readouts from 0 to 100, for each channel's level setting. This makes it possible to quickly and accurately reset levels and balance and to do so in steps small enough to allow precise tailoring for each recording.

The gain circuitry in the 16LS is both innovative and classically simple. Although it consists of a single triode stage, it's made up of six paralleled sections of 6922 high-transconductance triodes. This creates, says conrad-johnson, a composite triode that has six times the transconductance of a single tube and one-sixth the output impedance. Gain is specified as 25 dB and rated output impedance at a low 750 ohms. This eliminates the need for a cathode follower and reduces the number of active stages to the absolute minimum: one. There is no negative feedback used. Thus, the 16LS has about as pure a circuit as is possible, and less circuitry often means better sound.

The preamp's tubes are housed in an enclosure that makes changing tubes a snap and that seems designed to damp out any microphonics. The tubes come with rubber rings that fit around them to further minimize microphonics. Critical audio circuitry is mounted on an isolated subchassis. The microprocessor-controlled relays are right at the inputs, to keep the signal path short and minimize crosstalk. DC voltage is supplied from cascaded discrete voltage regulators to isolate the audio circuit from the power line and maintain a near-zero impedance at all audio frequencies. The manufacturer rates noise at better than 96 dB

below 1 volt and total harmonic distortion at less than 0.1%.

Traditionally, conrad-johnson has emphasized selecting components based on extensive listening sessions, which may have as much to do with the Premier 16LS's su-



**BEHIND THE PREAMP'S
FUNCTIONAL SIMPLICITY
LIES A VERY
SOPHISTICATED DESIGN.**

perior sound quality as its circuit design. Precision metal-foil resistors and polystyrene capacitors are used throughout the audio circuitry. The tubes are hand-selected for minimum noise and microphonics, and the switching relays are sealed and have gold-plated silver contacts. Input and output jacks are of high quality, and the circuit board is exceptionally clean and well manufactured.

The Premier 12 mono amplifier shares much of the circuitry of conrad-johnson's top-of-the-line Premier Eight-A amp and the same approach to component selection as the Premier 16LS preamp. The audio circuit has three stages. The input is amplified by paralleled sections of a 5751 twin triode, for improved bandwidth, and then passed to two 6FQ7s in a cathode-coupled, high-current, triode phase inverter. This stage drives the output circuit, which uses two pairs of 6550s to produce 140 watts. The output tubes are operated in an Ultra-Linear configuration that is said to provide high power, low distortion, and low output impedance. Large output transformers help ensure extended bandwidth and phase linearity. The Premier 12 uses about 12 dB of

negative feedback to reduce distortion and to provide enough damping for good operation with reactive speaker loads. (A special version can be ordered using EL34 output tubes wired for triode operation; it delivers 70 watts.)

No electrolytics are used in any of this amp's power supplies. DC power for the input and phase-inverter stages is supplied by separate low-impedance, discrete-component regulators. Power for the output tubes is filtered by a bank of custom polypropylene capacitors. Setting bias for each of these tubes is easy, as the front panel has LED indicators and a screwdriver is included.

The Premier 12's styling is classic tube amplifier, and its unusual champagne gold finish matches the Premier 16LS's. You can use it with or without a tube cover, but I expect most audiophiles will go for the glow and leave the cover off. The amp measures 7¼ inches high, 17½ inches wide, and 15¼ inches deep and weighs 51 pounds.

The Premier 12 normally comes wired for a 4-ohm speaker; 8- and 16-ohm connections are available. Rated input impedance is 100 kilohms, and the amp is said to take a 0.9-volt input to produce its rated power of 140 watts. Hum and noise are specified at 98 dB below rated power, with total harmonic distortion at no more than 1% from 30 Hz to 15 kHz at rated output.

The result is stunning sound quality. With both amp and preamp, conrad-johnson has got all the basic elements right. Frequency response is smooth and extended, from the deep bass to the highest frequencies. The overall timbre is intensely musical and natural, with just a touch of warmth that does nothing to mask upper-octave detail. Soundstage, dynamics, and transparency are all excellent. And though this is equipment designed to extract every bit of musical information, not soften the sound to make it euphonic, there is never a touch of hardness. I was particularly impressed with reproduction of complex choral passages and mixes of male and female voice, especially on *Gloria! Music of Praise and Inspiration*, with Robert Shaw, the Atlanta Symphony Orchestra, and vocal ensembles (Telarc CD-80519).

Like other conrad-johnson components, the Premier 16LS and Premier 12 seem to

have been designed with a particular sensitivity to the natural sound of strings and woodwinds and to the need to balance soundstage width and depth. I have rarely heard electronics this good at reproducing the nuances of the best string recordings or that do this well with clarinet and flute. The Premier 16LS and Premier 12 provided the most musically natural reproduction of the details of choral music, massed strings, and complex orchestral passages I have yet heard from any conrad-johnson equipment. The combo's musically natural separation of voices and instruments was always fine but particularly striking at low to middle levels. Sibilants, especially from soprano voice, and the sound of applause were very lifelike and natural.

I'd characterize this amp's and preamp's timbre, dynamics, and soundstage as mid-hall, and they offer an outstanding feeling of space. By comparison, the voicing of Audio Research and Krell equipment is a bit more forward, has slightly more upper-octave energy, and is a tad more live. The voicing of the Premier 16LS and Premier 12 is closer to that of Pass Laboratories Aleph electronics.

The Premier 16LS and Premier 12 do sound much less tube-like than early conrad-johnson designs. Like other examples of today's best tube equipment, their noise is so low as to be comparable with that of the best solid-state equipment. I encountered no tube noise or

amplifiers I use as two of my references. In its defense, the Premier 12 provides a slightly smoother transition from the deepest bass to the lower midrange, with just a touch more natural warmth than the Classé or Krell. And it does have enough power to eliminate most of the problems in the mid and deep bass that crop up when a speaker needs lots of control from an amplifier.

I don't think that the Premier 12's slightly warmer bass character can be ascribed to tubes alone or to damping factor. The Pass Aleph 1.2 has similar bass timbre, dynamics, and definition, even though it's a single-ended, Class-A transistor amp and has a much higher damping factor.

The conrad-johnson Premier 16LS, Krell KRC-HR, and Pass Labs Aleph P preamps

These are *nuances*, however; the sound will be shaped much more by the recording than the preamp.

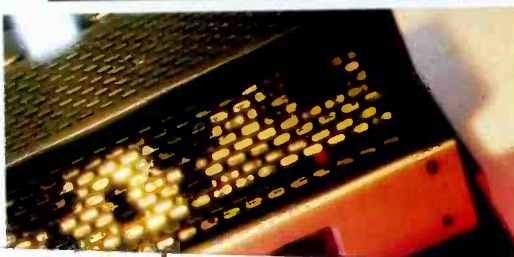
These distinctions apply to the conrad-johnson Premier 12, Krell 300S, and Pass Labs Aleph 1.2 amplifiers. The differences in low-frequency performance often dominated on music that contained lots of bass. The conrad-johnson had a bit more dynamic life than the Krell and Pass power amps in the middle and upper bass. The Krell had slightly more dynamic life in the upper midrange. The Pass was the softest and sweetest of the three.

As might be expected, the amplifiers were more sensitive to interactions with other equipment than the preamps were; a great deal depended on the speaker. These differences were more apparent with Thiel CS7.2 and Hales Transcendence Eight speakers than with Dunlavy SC-Vs and B&W 801s, perhaps because the Thiel and Hales systems present more complex loads. The differences were more noticeable with Kimber Select than Wireworld or Discovery Cable products, although the degree of the difference seemed to depend more on the speaker. (These kinds of system interactions

underscore how important it is to work closely with your dealer.)

The sonic character of the Premier 16LS will also be affected by the interconnects and the other components you use but to a much lesser extent. The Premier 16LS worked as smoothly with Pass, Classé, and Krell amplifiers as it

**THE OVERALL TIMBRE
IS INTENSELY MUSICAL
AND NATURAL,
WITH JUST
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MARK LEVINSON NO. 360S D/A CONVERTER



The proliferation of disparate digital formats—CD, DAT, DVD, DTS, DVD-Audio, Super Audio CD, and MPEG—is causing a tremendous amount of confusion among manufacturers, dealers, and consumers. Who wants to get stuck with several thousand dollars' worth of equipment that's soon obsolete? And why should we upgrade our systems when the software designs of many of the proposed new formats are incomplete or when there's uncertain-

ty about future encryption and copy-protection codes? Indeed, we can't be sure that today's hottest DVD player will read all of next month's DVD and CD formats. Exciting as the new technologies are, the audio industry has gone from shooting itself in the foot to shooting itself in the kneecap, and it seems to be setting its sights higher.

Nevertheless, there are three ways you can circumvent the format wars:

1. Take the "anchor" approach. Maintain CD as the core of your system, knowing that you already have a

large disc library and that the format will survive for years. This way, you still get outstanding music reproduction in the area where it matters most (i.e., stereo) while you wait for the new formats to shake out. And to make sure you have the best of both worlds, you can always play around with the new formats by buying components that are *not* top-of-the-line.

2. Build a "crossover" system. You assemble the best possible system for both stereo and surround sound, knowing you face a future of upgrading transports, D/A converters, and preamps (and everything else if the high end moves to eight-channel surround sound). This option compromises the stereo performance somewhat, but it can still be a lot of fun. (Much as I love experimenting with surround sound, I am constantly reminded of how immature it is, how truly bad most surround music tracks still are, and how difficult it is to marry a speaker layout that's ideal for stereo with one that's optimal for surround sound. I think many audiophiles are going to stick with a dedicated stereo system and listening room for years to come. Even those who savor surround sound will probably maintain a high-end stereo/surround "crossover" system in a separate room.)

3. Buy Madrigal's Mark Levinson No. 360S D/A converter, which provides superb

reproduction of CDs and 96-kHz/24-bit recordings and has been designed to handle new digital stereo formats no matter how

drastically the technology and the software may change.

The Mark Levinson No. 360S is the best protection against the format wars that I've encountered and is also the best Levinson D/A converter I've ever heard. Although it sells for \$6,995, it outperforms the older Levinson No. 30.5—which

**THE LEVINSON 360S
IS A TRIUMPH
OF SOUND QUALITY
AND ENGINEERING
FOR THE FUTURE.**

Company Address: Madrigal Audio Laboratories, P.O. Box 781, Middletown, Conn. 06457; 860/346-0896; www.madrigal.com.

Photo: Michael Green

sold for nearly \$16,000. This clearly illustrates how the sound quality of a company's flagship component can trickle down to somewhat more affordable units, even improving in the process.

Incidentally, the Mark Levinson No. 360 offers much of the same technology, sound quality, and upgradability for \$4,495. And if you currently own a No. 36 or No. 36S D/A converter, you can have it upgraded to the 360S for \$3,500 or \$2,500, respectively.

Every high-end manufacturer I know of now understands that expensive (i.e., more than \$2,000) D/A converters that can't be upgraded are becoming obsolete. Manufacturers are increasingly introducing products that can be upgraded in many ways, although their approaches do vary. Madrigal, for instance, has chosen a

new digital architecture and a new approach to software-based design. It has gone beyond digital filtering by using a proprietary digital interface receiver (DIR) and digital filter/decoder, all fully programmable via an RS-232 port.

The No. 360S uses dual-differential 24-bit DACs, a DSP-based digital filter with eight-times oversampling and 24-bit throughput, and a Bessel linear-phase output filter. The 360S can handle any standard sampling rate and word length up to 96-kHz/24-bit. And its design ensures that it can be programmed to decode 192-kHz signals—and any other proposed format, such as Meridian Lossless Packing (MLP) or Sony/Philips Direct Stream Digital (DSD).

The core of this capability, however, is at a deeper level than the RS-232 port or the usual capacity to incorporate improvements via replaceable circuit boards or chips. Separate low-voltage digital receivers provided for each input improve the impedance match to each source and increase the isolation between inputs. And all input paths employ high-quality connectors and wide-bandwidth pulse transformers to enhance performance.

The digital interface receiver, the first "smart" component in the signal path, parses the incoming signal, sending each segment to its correct destination (display,

digital filter, etc.). It has wide enough bandwidth that the No. 360S (and the 360) can accept very high-speed signals, exceeding the maximum data rate from any current DVD-based sources. In other words, the DIR can be programmed to handle anything a CD or DVD player might hand it. Some D/A converters are not forward-compatible in this way.

Following the DIR, and at the heart of the No. 360S's digital architecture, are four Analog Devices SHARC (Super Harvard Architecture) 32-bit digital signal processors. These provide proprietary digital filtering, decode such processing algorithms as HDCD, and will be able to decode any DVD-based "super audio" formats that arise in the future. (By the way, the No. 360 uses two SHARC DSP chips, which gives it less processing power for some applications than the 360S. Nevertheless, it should be upgradable to handle any of the new formats.)

The superior processing power in the 360S may also prove to have virtues beyond the bounds of straight D/A conversion. The multiple SHARCs not only give it greater ability to deal with existing compression/decompression algorithms—such as Dolby Digital, DTS, and MPEG—but also endow it with the potential for DSP control of volume and equalization. The 360S I reviewed did not have these software features because Madrigal is still evaluating them, but the hardware is there. (Eliminating the preamp and the extra interconnects really does make a difference in improving the sound quality of high-resolution systems. Such features are certain to become more important as studios push the noise floors of their recordings down.)

The No. 360S also makes major technical improvements that affect the sound of ordinary CDs. It uses a second-generation version of the company's Intelligent FIFO (first-in, first-out) jitter-reduction system to buffer and reclock digital audio signals. (FIFO first appeared in the 36 and 36S.) And the 360 and 360S use low-voltage differential signal (LVDS) drivers to transmit balanced digital signals from the digital

processing board (center section) to the audio boards for conversion, a technique pioneered in the 36S. Madrigal says these enhancements yield better resolution and smoother, more detailed high-frequency reproduction.

Both the 360S and the 360 use true 24-bit multibit DACs (Burr-Brown PCM 1704s), two matched devices per channel, to convert the balanced digital signal to analog. The 360S uses the same DACs as the 360 but hand-trimmed, bulk-metal foil resistors to match gain. (In the 360, gain is set with a hand-trimmed Vishay pot.) Both models make extensive use of balanced circuitry to reduce noise and distortion as much as possible. The 360S retains the four-layer, cyanate-ester circuit boards used in the 36S. Madrigal believes these boards allow outstanding power-, ground-, and signal-path routing and provide an ultra-low dielectric constant.

The layouts of the Levinson 360S and 360 show great attention to analog sound quality as well as to digital processing. Digital processing occurs on the main board, in the center of the chassis; it is carefully shielded to prevent noise contamination of the analog signals. Digital-to-analog conversion and output circuitry are on separate boards located on the left and right sides of the chassis. Each board has its own power-supply regulation.

The master power supply is shielded by a steel sub-enclosure (to contain and ground low-frequency electromagnetic noise). The 360 and 360S use two power transformers to increase the isolation between digital and analog circuits, and they improve channel separation by having separate secondary windings from the analog power-supply transformer. The AC power cord plugs in from the underside, to minimize 60-Hz noise. This is a bit annoying ergonomically, but as Benedetto Croce has pointed out, a minor flaw is essential to define even the best work of art as human.

The 360S's circuitry is superbly assembled, using excellent parts in an outstanding layout. It has a logical and coherent flow, from digital input to analog output. It may not have the flashy look of a Rolls, but it has great build quality where it counts—rather like the original Shelby Cobras.

The No. 360S's external styling is so reserved as to be almost soporific. You could

THE 360S'S CIRCUITRY USES EXCELLENT PARTS IN AN OUTSTANDING LAYOUT.

call it “understated” or “black box with boredom.” However, it is nice that you can easily identify the large controls and read the displays from a distance. Clearly, this is one case where inner beauty compensates for a lack of surface charm.

As for inputs, the 360S lacks only the analog type—not exactly a common feature on a D/A converter. The six digital inputs have a variety of connector types: two XLR (AES/EBU balanced), one RCA coaxial, one BNC coaxial, one ST-type optical, and one EIAJ-type (Toslink) optical. There’s also a mini-jack for an infrared repeater, an RJ-45 communications port (PHASTLink), and an RS-232 communications port on an RJ-11 connector.

Outputs include a pair each of analog XLRs (balanced) and RCAs, a digital XLR, and separate RJ-45 communications ports for PHASTLink and Mark Levinson Linking Master connections. It’s going to be very interesting to see how all of this converter’s digital upgrade and control features work once new software formats become available.

The basic specifications are clear. Total harmonic distortion (THD) is rated at a vanishingly low 0.0035% (1 kHz, 0 dBFS, A-weighted). Frequency response is specified as 10 Hz to 20 kHz, +0, -0.2 dB, with intermodulation distortion (SMPTE IM) at less than 0.005%. Other key specifications include better than 100 dB dynamic range, better than 105 dB signal-to-noise, and better than 110 dB channel separation. Low-level linearity is rated as having unmeasurable deviation to below -80 dBFS and being no greater than 1 dB below -90 dBFS.

Because the No. 360S’s output impedance is specified as less than 6 ohms, you should be able to use long lengths of virtually any cable. Nonetheless, you will profit from using the best possible digital and analog interconnects. I use Kimber Select digital interconnects and the same brand for my analog cables. Madrigal, however, has some superb new cables of its own. (I also had excellent results using AudioQuest, Discovery, Dunlavy, and Wireworld cables.)

I have found some benefit using the AES/EBU digital connection (where this is possible) and that it is less interconnect-sensitive than the S/P DIF coaxial input. It also is cleaner-sounding than the optical input. The RCA version of the Kimber Select

digital cable, however, performed particularly well relative to an AES/EBU XLR cable. And if you have a true balanced preamp and amp, use balanced cables. You can hear the improvement in signal-to-noise ratio.

The fact that the 360 series is so upgradeable and has superb 96-kHz/24-bit reproduction capability doesn’t mean that there are many transports of similar caliber. This is no problem with CD, but beware of DVD players. Let’s ignore the fact that virtually all DVD players claiming to have 96-kHz/24-bit DACs make *everything* flowing from their analog outputs sound much worse than a good CD player, such as the Adcom 750 or the Marantz CD-67SE. Plus, most current DVD players do not have a true 96-kHz/24-bit digital output (and for some reason the Levinson No. 360S was not compatible with my Theta transports, which do). Fortunately, you can derive excellent 96-kHz/24-bit signal quality from the digital output jacks of most Pioneer DVD players—the DV-505 and DV-606D are notable in this respect, although they are scarcely reference-quality transports.

You can adjust power-line voltage to 100, 120, 220, 230, or 240 volts; it is factory-set for the destination country, as is the line frequency (50 or 60 Hz). And if you want top-notch performance, make sure you have high-quality AC. I am currently using the Cinepro PowerPro 20 (reviewed in the January issue); it cleans up the sound enough to make a case for hooking up a first-class AC line conditioner.

At 15¾ x 3¾ x 14 inches and weighing 35 pounds, the No. 360S is easy to live with. You can choose which of the six inputs you make active and select what each input will be called in the display. There are controls for phase (polarity) and tape output. The phase control can help with some program material, but I could hear no difference when I turned the tape input and output on and off.

And sound quality? As with most reference-quality equipment today, nuances are getting harder to describe. In broad terms, the Mark Levinson No. 360S provides a level of transparency, musical information, and neutrality that is as good as I have ever heard from a D/A converter.

The 360S has extraordinarily *natural* musical dynamics and bass detail. It delivers enough extra low-level detail to make decent CDs sound a bit sweeter in the upper midrange and yield more musically natural harmonics. And there is also better reproduction of soundstage detail, especially of acoustic performances by solo instruments.

The 360S’s dynamics challenge any recording I know of and test the limits of my high-power Krell and Pass amplifiers and my Thiel CS7.2 and Dunlavy SC-V speakers. With the very best CDs, and particularly the 96-kHz/24-bit DVD recordings from Classic Records and Chesky, there is greater resolution of low-level detail than on any analog recording I have encountered. Indeed, in this respect the No. 360S rivals the far more expensive dCS Elgar D/A converter. In terms of transparency, transient response, and crisp dynamics, it slightly betters my

upgraded Theta DS Pro Generation V. Its low-level resolution—albeit of a different sonic character—equals anything I can get from my reference VPI TNT turntable, VPI and Wheaton tonearms, and an assortment of cartridges.

The Levinson’s soundstage is truly excellent. I have always favored rock-solid center fill combined with imaging spread over a wide soundstage. And I have gradually increased the distance between my speakers as they and my associated components have improved. The 360S clearly reveals there is more soundstage data in many recordings than I heretofore believed.



THE LEVINSON NO. 360S HAS TRULY NATURAL MUSICAL DYNAMICS AND BASS DETAIL.

The 360S provides the best reproduction of harpsichord, massed strings and woodwinds, and chorus I have heard, and it splendidly replicates the subtle timbral cues that characterize a particular make and generation of musical instrument. It yields the most musically natural reproduction of HDCD, demonstrating that the finest HDCD-encoded Reference Recordings discs are even better than I previously thought. Furthermore, the 360S shares the ability of the Mark Levinson No. 30 series to extract the best from old and poor-quality CDs. If you're frustrated with much of your CD collection, the 360S might help.

Of course, short of an A/B comparison with the 96-kHz/24-bit master tapes, I have

no way of knowing how close the 360S's reproduction of Chesky and Classic recordings comes to the originals. But I do believe that the No. 360S demonstrates that the best of these recordings *audibly* outperform the best CDs. There is tighter and more natural bass, better low-level and harmonic resolution, and a more realistic soundstage.

If you doubt this, visit a dealer and audition the Mark Levinson No. 360S with some 96-kHz/24-bit recordings, such as Dave's True Story's *Sex Without Bodies* (Chesky CHDVD174), the John Basile Quartet's *The Desmond Project* (Chesky CHDVD178), Livingston Taylor's *Ink* (Chesky CHDVD179), David Chesky's *Three Psalms for String Orchestra* (Chesky CHDVD181), Leonard Slatkin and the St. Louis Symphony Orchestra performing Gershwin's orchestral works (Classic Records DAD 1018), Muddy Waters' *Folk Singer* (Classic Records DAD 1020), or the New Music Consort's *Pulse* (Classic Records DAD 1002). Because this is a new recording technology, the industry unquestionably still has a lot to learn about how best to exploit the improved resolution that higher sampling frequencies and bit depths can provide. Still, the currently available titles show that even these early recording efforts really pay off. So if you want to hear the future, forget theoretical arguments and go listen.

**THE MARK LEVINSON
360S D/A CONVERTER
SUPERBLY REPRODUCES
96-kHz/24-BIT
RECORDINGS.**

The No. 360S is the most up-to-date and advanced D/A converter I have reviewed so far, yet I know that dCS, Krell, Meridian, and Theta have upgrades or new models in development. This makes it difficult to put the Levinson in perspective. And it would be unwise to imply that preeminent models from other manufacturers are not competitive in CD sound quality or that nuances of the Levinson 360S's sound are "right" and those of other top converters are "wrong." Theta's D/A converters, for example, have more lifelike high-level dynamics and a slightly warmer upper midrange. Krell converters have slightly deeper and more powerful bass and a slightly warmer upper midrange. And Meridian's converters prove a

rival in many aspects of transparency. Each resolves imaging and soundstage detail in a slightly different way.

I have also found that the results of A/B tests between leading D/A converters can be unsettling no mat-

ter how well you adjust for level. The timbre of one recording can sound slightly better on one converter, but another recording with a somewhat different timbre can produce the opposite result. The same can also occur with imaging, center fill, and the realism of low-level detail. Because recordings vary so much, the interaction between them and the D/A converter is a bit of a crapsheet. Which converter is right? Well, which concert hall is right? Which symphony orchestra or conductor is right?

In essence, I simply don't know of anything that sounds better than the Mark Levinson No. 360S. It is a triumph of sound quality and engineering for the future. True, it has rivals, but such is life in the high end. And it's a winner in the format wars. Of course, some CD players are so good that they remain valuable and competitive options despite their limited upgradability. There are *no* conditions, however, under which I would pay a dime for a stand-alone, expensive D/A converter that wasn't competitive in terms of upgradability. The Compact Disc is no more likely to die than the LP, but new high-priced, high-end D/A converters that can't compete in the format wars are dead, dead, dead.

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MYRYAD T-40 INTEGRATED AMP



America's airwaves are filled with AM and FM stations. Outside of central London, Britain's are not. So the British tend to buy integrated amps of about 50 watts per channel when their American counterparts (first-timers, students, or seasoned audiophiles buying something to keep their kids away from the high-end gear) opt for receivers. In the United Kingdom and elsewhere, sales

of integrated amplifiers (and of matching under-\$1,000 components) are large enough to attract the Japanese majors as well as brands with audiophile credibility such as Myriad, Arcam, and Creek. Cleverly, or perhaps bravely, the British underdogs proceed on the assumption that audiophiles will always prefer something from a specialist brand over a product from an industrial giant.

Ironically, the new-wave British integrations (and their accompany-

ing components) succeed precisely because they don't look British. Myriad's T-40 integrated amp, for example, could easily be mistaken for something Scandinavian, American, or even Japanese. You can stack the T-40 with, say, a Denon cassette deck or a Toshiba DVD player, and the look will not be jarring. (It helps that the amp is a few millimeters narrower than many "17-inch-wide" components and a few millimeters wider than the rest.)

The T-40's faceplate, sculpted of solid aluminum anodized in silver or satin black, exudes luxury. On the front panel are a power switch, push-button selectors for five line inputs and a phono input (moving-magnet or high-output moving-coil), a balance knob, a motor-driven volume control, and a headphone jack. (The speaker output mutes when a headphone is plugged in.)

The rear panel has a few nice touches. For one thing, you can use the phono input as a sixth line input by going through the two extra jacks that bypass the RIAA preamp; a tonearm grounding post is just above the RIAA input jacks. Also provided is a pair of preamp-level output jacks to drive a second amplifier (for biamping or to feed a sound system in another room). There are two buffered tape loops, with provisions for dubbing from one to the other. Gold plating covers all of the RCA jacks as well as the multiway speaker binding posts.

**THE T-40'S SOUND
IS SURPRISINGLY GOOD,
WITH ENOUGH GRUNT
TO DRIVE
MOST SPEAKERS.**

Through slots in the T-40's vibration-damped cover, you can see a massive toroidal transformer, which feeds seven regulated power supplies, each used for a different part of the amp. The power-supply circuitry, by the way, has 20,000-microfarad capacitors. There's a slight delay (accompanied by a blinking green LED) while the T-40 monitors

Company Address: c/o Artech
Electronics, P.O. Box 1980,
Champlain, N.Y. 12919; 800/
631-6448;
www.artech-electronics.com.



Myryad's T-10 CD player (top) and T-40 amp with system remote (near amp) and CD remote (foreground)

conditions before settling down; I found it reassuring. This amp has triple emitter-follower outputs and is rated at 50 watts per channel. Myryad promises high current to drive all speaker loads; in my testing, the T-40 had no problems at all with a variety of box-type two-way speakers, including B&W's Nautilus 805, Diapason's Karis, and Apogee's late, lamented Ribbon Monitor.

British hi-fi makers have finally learned to accept that "remote control" is not a four-letter word. Myryad supplies a system remote with the T-40 that controls volume and source selection on the company's pre-amps and integrated amps and controls other functions, including display dimming, on its tuners and CD players.

I happened to use one of Myryad's CD players, the T-10 (which comes with its own dedicated remote), with the T-40. The T-10 has a Sony transport mechanism, 20-bit delta-sigma DACs, and low-jitter master clocks. It also has a capacitor-coupled analog output with only one cap in the signal path, seven regulated power supplies (with 1,000-microfarad reservoir capacitors on the analog supplies), a high-quality FET op-amp in its analog output filter, and a coaxial digital output. The T-10's control microprocessors are shielded to prevent interference with the audio circuits. The player was smooth, if not luxurious, in operation.

With the various speakers mentioned above, Discovery interconnects, and A.R.T. speaker cable, the Myryad amp and CD player served as an object lesson in how little we now need to pay for a decent return: Myryad's elegant, well-made T-40 and T-10 will set you back only about \$1,600 (\$795 each), which should strike lovers of British audio as exceptionally economical. Despite convenience, styling, and finish that are up to Asian standards, the T-40 showed its British heritage through surprisingly good sound. It had more than enough grunt to drive speakers of modest sensitivity (87 to 90 dB) with ease, although the sort of speakers it's likely to drive—say, under \$1,500 per pair—tend not to require vast amounts of juice anyway.

Close listening revealed just enough warmth to disguise any potential transistor nasties, and the T-40's dynamics surpassed those of many similar British amps. Most fetching was its large soundstage; ample in all dimensions (and particularly impressive in its depth), it enabled small monitors to flourish. Even with the dinky Diapasons, which are no larger than loaves of bread, the wall of sound was convincing.

Yet however smooth and listenable the Myryad T-40 is (you really have to work to make it sound bad), the Creek 4330 SE and Musical Fidelity X-A1 amps (or any of the amps in Marantz's SE series, not sold in the U.S.) exhibit greater refinement. It's not that the T-40 is coarse; it's just that this amp sounds more "hi-fi" than the others, favoring excitement over sheer realism. A slight glare in the T-40's treble contrasts with its very warm, BBC-ish midband and solid, slightly dry bass, though you can ameliorate this through speaker choice. (Those who fall for the Myryad's looks and convenience are directed to speakers like Tannoy's R-1. And I would have loved to try the Myryad with the smallest Magnepan planar magnetics if I'd had a pair handy.) That "hi-finess" is certainly not as debilitating as some of the quirks that taint many of the biggest-selling budget integrations. It's so minor a consideration, in fact, that I feel churlish about mentioning it. But it will be noticed by precisely those people who should have the Myryad on their short lists: hi-fi buyers with high-end tastes and restricted budgets.

The problem for Myryad is that the natural competitors I've mentioned are so exceptional. What they don't have, however, is the Myryad T-40's perceived value, its combination of luxurious styling, convenience, features—take your pick. Factor in these non-sonic attributes (which I realize is heresy in most audiophile circles),

MYRYAD RECOGNIZES THAT "REMOTE CONTROL" IS NO LONGER A FOUR-LETTER WORD.

and Myryad's least-expensive integrated amplifier emerges as a sane, sensible, and wholly logical alternative for those torn between the undeniable competence and value of Japanese components and the musicality and rather crude construction of traditional British hardware. Despite strict European standards for hi-fi equipment, too many British components still seem to have been made in the garden shed. But that's not the case with the T-40; Myryad has created what I can only describe as a near-perfect marriage of Japanese and British virtues. Which is precisely what Mazda did with the Miata, and we all know how that baby took off.

CLASSICAL RECORDINGS

Mussorgsky: Boris Godounov (original versions of 1869 and 1872)

Various vocalists; Kirov Opera and Orchestra, Valery Gergiev
PHILIPS 462 230

Five CDs, DDD, 5:06:10
Sound: A-, Performance: A

Today, when we hear the original versions of Modest Mussorgsky's *Boris Godounov*—one from 1869 and the other from 1872—we are not in the least bothered by

other reorchestrations, more faithful to the 1872 version, were made by Karol Rathaus, Dmitri Shostakovich, and Igor Buketoff.

In this very first recording of the 1869 and 1872 original versions, you can hear decided differences between the two as well as whole sections that remain the same. The earlier score moves quite inexorably toward its conclusion in a documentary-like style; it is shorter and less operatic in the conventional sense, with scenes

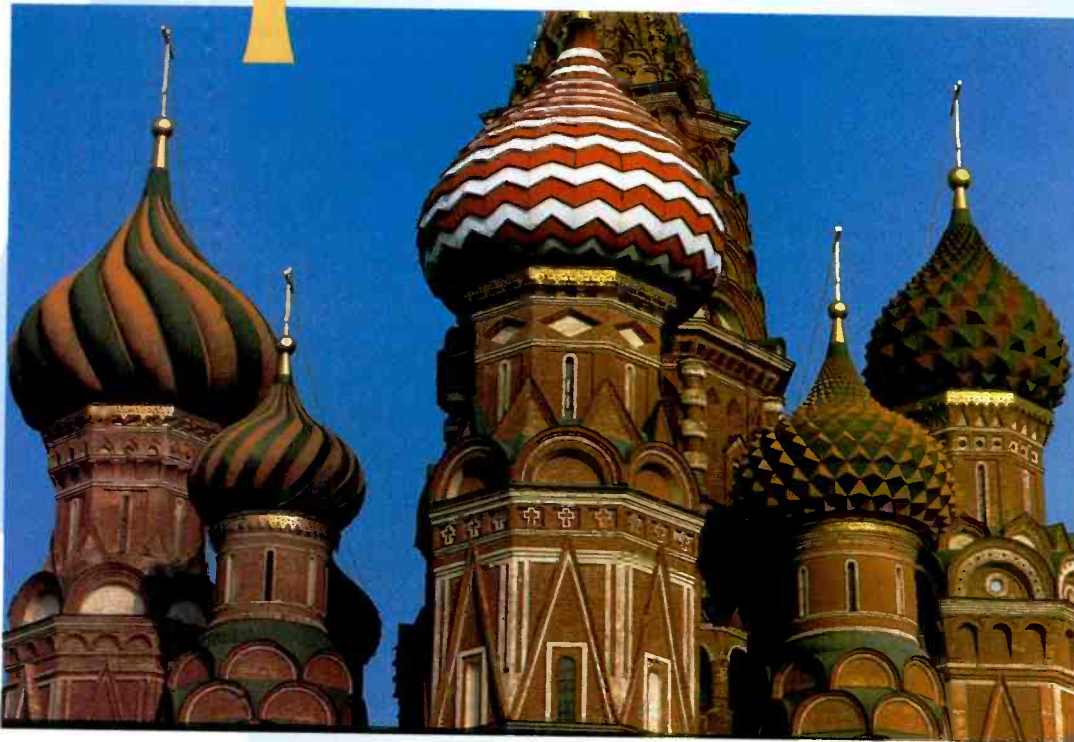
the explosive commencement to the later version's revolution scene. I found this performance dramatically electrifying.

The love-interest leads of the 1872 version are the set's vocal standouts. The rich-voiced mezzo-soprano Olga Borodina, as Marina, penetratingly captures the character of the politically opportunistic Polish princess. The 1869 Grigory of Viktor Lutsuk is perfectly competent. However, his 1872 counterpart, Vladimir Galusin, has such an outstanding voice, with its ringing high A's and virile demeanor, that he might make an ideal Siegfried. His scenes with Pimen in the monastery and at an inn on the Lithuanian border are thrilling, as is his victorious entrance in the revolution scene.

Most of the other roles are also sung with passionate drama, exemplary diction, and fine characterizations. Of the two Boris Godounovs, the 1872 Vladimir Vaneev is perhaps the more histrionic interpreter and a truer bass. Still, one wishes that both he and Nikolai Putilin, the Boris of the 1869, had more color in their relatively dry upper registers and less waver on sustained notes.

The recording boasts excellent orchestral balance, a particularly full and rich instrumental sound (one especially notices the vividness of the brass), a wide stereo soundstage, and first-rate imaging. Only in the matter of vocal reproduction could there be slight cause for complaint. There's an edge to several male singers' voices and an occlusion in the reproduction of the most massive choral sections, which, unlike the loudest orchestral moments, lack transparency.

Tracks are assigned for access to all the important sections, except for Boris's hallucination scene, which



the crudities that musicians such as Nikolai Rimsky-Korsakov objected to a century ago. It was Rimsky-Korsakov's version, a reorchestration and whole harmonic and melodic rearrangement, that made this work palatable to the opera houses and the public of the time. Although the impact of the originals is far greater than Rimsky-Korsakov might ever have envisaged, for a number of years Mussorgsky's abilities as an orchestrator were called into question. And as interest in authentic practices grew after the Second World War,

concluding almost as cinematic fades to black.

The drawing out of characters is different—more marked in one case, less so in another. Both versions need to be heard for full impact, and the impact is quite extraordinary. That this is mainly due to Valery Gergiev I have no doubt. His direction can be described only as stunning, as can much of the production itself, including such effects as the tolling bells of the coronation scene (present in both versions) and



Photograph: ©Bruce Grandini/The Stock Solution

could have used its own track number. A full libretto in four languages is included. The helpful annotations provide details on the various versions of this opera.

If five discs sounds a bit extravagant, fear not: Philips is offering the full set for the price of three CDs. For a magnificent performance of the greatest Russian opera in its two original versions, this is a bargain. *Igor Kipnis*

Dream Catchers

Gisela Méndez, piano;

North Texas Wind Symphony, Eugene Corporon
KLAVER KCD-11089, DDD, 71:05

Sound: A, Performance: A

In this addition to the Klavier Wind Recording Project, five American composers and one German have written pieces about the dream and spiritual worlds in a singular, personal manner. Walter Mays's "Dreamcatcher," based on an Ojibwa tribal tune, depicts the good and bad dreams that float over a man as he sleeps. While he's dreaming, a magic hoop above him lets the good dreams through and



filters out the bad ones, which are then destroyed by the light of day. David Gillingham's "Waking Angels" puts "Softly and Tenderly, Jesus Is Calling," Will

L. Thompson's old hymn, through a degenerative process illustrating the deadly progression of AIDS throughout society. Rolf Rudin's "The Dream of Oenghus" is based on an Irish legend in which a prince is driven mad by a recurring dream of a beautiful, unattainable girl.

The performances are expert, and the sound—which ranges from single wind instrument solos to a full band replete with thundering timpani and a bass drum that can be felt through a subwoofer—is as good as it gets. There's a remarkable combination of presence and stage depth. *Dream Catchers* is an important and enjoyable recording of very recent music. *Rad Bennett*

Tovey: Piano Concerto in A Major, Op. 15; Mackenzie: Scottish Concerto, Op. 55

Steven Osborne, piano; BBC Scottish Symphony Orchestra, Martyn Brabbins
HYPERION CDA67023, DDD, 61:40

Sound: A, Performance: A

Should you be a bit weary from well-worn late Romantic piano concertos by Tchaikovsky, Rachmaninoff, or Saint-Saëns, this disc of first recordings might prove intriguing. Both composers, Donald Francis Tovey (1875-1940) and Alexander Campbell Mackenzie (1847-

1935), have strong Scottish connections. The Eton-born Tovey taught at Edinburgh University and is better known for his *Essays in Musical Analysis* than for his compositions. Mackenzie, Scottish born and German trained, was head of London's Royal Academy of Music. His 1885 Violin Concerto



(Hyperion CDA66975) is an interesting alternative to Max Bruch's "Scottish" Fantasy.

Each work on this disc is distinctive. Notable in Mackenzie's 1897 concerto are its bagpipe tunes, "The Reel of Tulloch," "The Waulking of the Fauld," and "Green Grow the Rashes O." If the well-made Tovey concerto of 1903 has less melodic and rhythmic interest than the more brilliantly conceived Mackenzie, it nonetheless offers plenty of grandly heroic gestures through its use of Brahmsian harmonic language. Both works, however, are most effectively performed and recorded, an ideal presentation by all. *Igor Kipnis*

Schubert-Liszt: Die Forelle and Schwanengesang

Frederic Chiu, piano

HARMONIA MUNDI FRANCE

HMU 907239, DDD, 62:59

Sound: A, Performance: A

Franz Schubert's last published song set, the 14-part *Schwanengesang* (Swan Song), was the only Schubert cycle that Franz Liszt transcribed for keyboard in its entirety. Just before Liszt ended his performing career, he also adapted a dozen lieder from *Winterreise*, a half dozen from *Die Schöne Müllerin*, plus quite a few other isolated pieces. These helped bring Schubert's name to a wider audience. The majority of the transcriptions were far less flamboyant technically—in the sense of showing off—than one might have expected. For example, Liszt faithfully adhered to the originals in his piano adaptations of the gloomily introspective *Schwanengesang*. Perhaps that's why the American pianist



Frederic Chiu prefaced this less-often-played cycle with the popular and lighthearted "Die Forelle" ("The Trout").

All the music is performed quite stunningly and without a hint of sentimentality. One could imagine a few of the less serious songs, including "The Trout," as wanting a bit more charm, but Chiu's more intellectual approach is nowhere less than sensitive to the music and to the original texts. The piano is bright and full-bodied, with bass that is almost startling in a piece like "Die Stadt." *Igor Kipnis*

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Summer Teeth

Wilco

REPRISE 47828 AB, 56:12
Sound: C+, Performance: A+



Wilco's 1997 CD, *Being There*, affirmed the drawling purveyors of Byrdsian lo-fi tunes and self-conscious sentimentality as standard-bearers in country-rock revivalism. Well, somewhere along the road, the band got hit by a tractor-trailer of inspiration. Far from *Being There*'s melancholy corn pone, *Summer Teeth* is a natural, marvelously melodic songwriting experiment. This is one of the year's best albums, and it establishes Wilco as one of America's greatest bands.

Wilco has adapted the sonic colors of The Beach Boys' *Pet Sounds* and

The Beatles' *Magical Mystery Tour* to its country-rock palette. The band has also grown lyrically, giving Jeff Tweedy's weary vocals a free-falling relationship to sing about. Though this theme is standard pop fare, Wilco creates something altogether new with ingenious orchestral arrangements and irresistible, heart-sick melodies. From the opening R&B of "Can't Stand It" to the disquieting guitars and Mellotrons in "In a Future Age," *Summer Teeth* is an oddball, sumptuous treat.

"She's a Jar" unfolds mournfully, adorned in oboes and steaming Mellotron, whereas the booming tympani and macabre, sliding strings of "A Shot in the Arm" conjure up Phil Spector producing a frazzled Kurt Cobain. Brian Wilson meets George

Jones on "Pieholden Suite," with Wilco reveling in frothy vocals, bouncy banjos, and full horns. "How To Fight Loneliness" is the album's barren emotional core, a Mexicali-tinged song that offers no answers to isolation. Ending with a squirming backwards tape loop and the refrain

THE BLACK CROWES

By Your Side

COLUMBIA CK 6936, 44:56
Sound: A, Performance: E+

By Your Side, the fifth album from the Atlanta-based Black Crowes, yields little evidence of the band's desire to expand beyond a narrow set of influences. Guitarist Rich Robinson continues his adoration of the Keith Richards suspended chord, and older brother Chris remains possessed by the evil ghost of the late Small Faces/Humble Pie singer Steve Marriott.

Nonetheless, *By Your Side* is fueled more by songwriting strength and pure, kinetic rock 'n' roll passion than by derivation. After several wayward albums that found The Black Crowes precariously holding on for dear life, the band returns to the Memphis/Muscle Shoals/U.K. conduit of *Shake Your Money Maker*, its 1990 debut album. The Hammond organ swirls with a Sunday morning fervor while guitarist Robinson and drummer Steve Gorman are as rhythmically inextricable as well. The Stones' Keith and Charlie. The Stax/Volt-like horns—courtesy of The Dirty Dozen Brass Band—and gospel-esque background vocals make *By Your Side* something much more ambitious than, but just as rollicking as, the

classic five-piece rock outfit. Several songs do fall flat, however. A clarinet honks away at times, dismantling the propulsive vibe of the current single "Kickin' My Heart Around." But as much

as one's tempted to find fault with the overt borrowing, credit The Black Crowes for keeping rock's flame alive at a time when it feels almost dead.

Mike Bisber



"just smile all the time," this song cuts as deeply as a guillotine blade. Wilco also rocks out valiantly on *Summer Teeth*, but you are ultimately left with the sound of introspection, woozy Mellotrons, and those fragile voices and bittersweet, engaging melodies.

As if reinforcing the album's theme of romantic and impassioned destruction, *Summer Teeth* sounds oddly hollow. Tweedy's vocals are clear and crisp and the varied instruments naturally recorded, but the total effect is an unsettling, one-dimensional soundstage mirroring the album's mixed emotions and bleak moods.

Wilco? 10-4, good buddy. *Ken Micallef*

Can You Still Feel?

Jason Falkner

ELEKTRA 62205, 46:25

Sound: B+, Performance: A

After bouncing around several bands (most notably Jellyfish), Jason Falkner set out on his own in 1996 with *Jason Falkner Presents Author Unknown*. Self-produced and self-performed, it had so many memorable tunes that it had to be a one-shot wonder—didn't it? But with the release of his second solo effort, *Can You Still Feel*, he proves he's no fluke.

The music shows flashes of The Beatles, Elvis Costello, and XTC, but the finished product is purely Falkner. And though he plays nearly every instrument on *Can You Still Feel*, his consummate guitar work dominates the album. Couple that with clever, hook-laden melodies and lyrics posing some interesting questions, and you've got songs that grab you and won't let go. One listen to the hypnotic, Byrds-like "Revelation," for instance, and you may be repeating the haunting chorus, "So why am I down when there is life all around?" well into the 21st century.



Falkner serves up this ear-catching pop in a variety of ways: as bouncy power tunes ("My Lucky Day" and "Honey"); lush, layered anthems ("Eloquence" and "The Plan"); and ethereally acoustic numbers ("See You Again" and the soft closing number, "Goodnight Sweet Night"). He also delivers the unexpected, such as the Zeppelinesque guitar barrages on "I Already Know" and "All God's Creatures."

Falkner and Nigel Godrich (producer of Radiohead's *OK Computer*) have made a record that's full of '60s exuberance yet maintains a thoroughly modern sound. My only complaint is that Falkner's voice is not particularly strong; at times it gets lost amid the soaring guitars. Then again, that's not such a bad thing to be lost in. *Scott Van Camp*

Apple Venus, Vol. 1

XTC

TVT RECORDS TVT 3250, 50:06

Sound: A, Performance: A

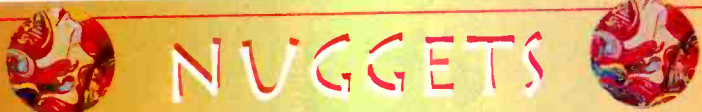
There aren't many pop bands that would take seven years off and return with a recording unlike anything it had ever done before. But then XTC—now simply Andy Partridge and Colin Moulding—isn't just any pop band. *Apple Venus, Vol. 1*, a beautiful and ambitious work billed as an "orchestral" album, uncovers an extraordinary new aspect of a group that's already revealed more than its fair share of exceptional qualities.

Beginning with the plunking of water droplets and the fleet plinking of violins, "River of Orchids" grows from a trickle to a fully

flowing stream, winding through horn charts, lovely harmonies, and exclamations of violin and cello. "Easter Theatre," which has a lush string intro and slowly adds squealing guitar and slick rhythms, recalls material from XTC's excellent *Skylarking*. One cut that disrupts the album's placid tone is "Your Dictionary." This scathing critique of unscrupulous friends, unfaithful family, and disreputable business associates is the equal of any of Partridge's more scabrous tunes.



Apple Venus, Vol. 1 is another in a long line of thoughtful, often brilliant, XTC recordings—"orchestral" or not. *Bob Gulla*



NUGGETS

**Original Artyfacts from the First
Psychedelic Era, 1965-1968**

Various artists

RHINO R2 75466, four CDs, 5:10 41

Sound: A, Performance: Varies

The original double-LP version of *Nuggets*, which was assembled by rock scribe Lenny Kaye, appeared in 1972 and was a pioneering retrospective of landmark psychedelic hits of the Top 40 radio era. It opened the door to scholarly examination and annotation of rock music. The material from that collection makes up the first disc of this set; the three other discs were compiled by Kaye and Rhino honcho Gary Stewart. Though the 118 selections cover an awful lot of territory, this set is by no means exhaustive (The Chambers Brothers' "Time Has Come Today" springs to mind as a glaring omission).

Some of the set's parameters are clear. For one, it is entirely American (unlike Rhino's three previous *Nuggets* CDs), so there is no Jimi Hendrix (whose backing bandmates were British), Cream, Easbeats, or early Bee Gees. Also, nearly every track appeared as a 7-inch, 45-rpm single, reflecting the last great flowering of Top 40 AM radio before FM displaced it.

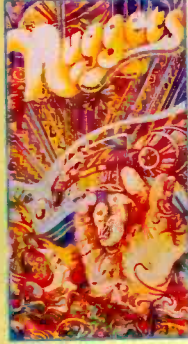
On this *Nuggets* compilation, the selections' stylistic and qualitative variety mirror the times, for Top 40 was a true melting pot back then. Psychedelia

flourished side by side with Motown, Stax/Volt, and Atlantic R&B; middle-of-the-road smashes by Sinatra (both Frank and Nancy) and Tony Bennett; the odd instrumental, such as Paul Mauriat's "Love Is Blue"; and occasional country crossovers, like The Statler Brothers' "Flowers on the Wall" and Roger Miller's string of hits. Tiny independent labels were breaking big hits all the time, which they have not been able to do since; the consolidation of the record business into a handful of marketing giants had only barely begun.

Some of the songs on the latest *Nuggets* mix are unabashedly trash, but the spirit is vibrant and exhilarating throughout. There are hits by The Electric Prunes, The Mojo Men, The Music Machine, The Swingin' Medallions, The Amboy Dukes, The Sir Douglas Quintet (great to see the original "She's About a Mover" making its CD debut here), and lots more. If I have a gripe, it's with how obscure many of the songs are; a number were regional hits.

The annotation in the 100-page booklet is spectacular. The profuse illustrations include both artist pictures and, well, "artyfacts" of the period. The essays are wonderful.

The middle '60s was a wide open time, when nearly anything could, and did, happen. And Rhino's *Nuggets* really captures the psychedelic side of that go-for-broke era. *Michael Tearson*



JAZZ & BLUES

r e c o r d i n g s

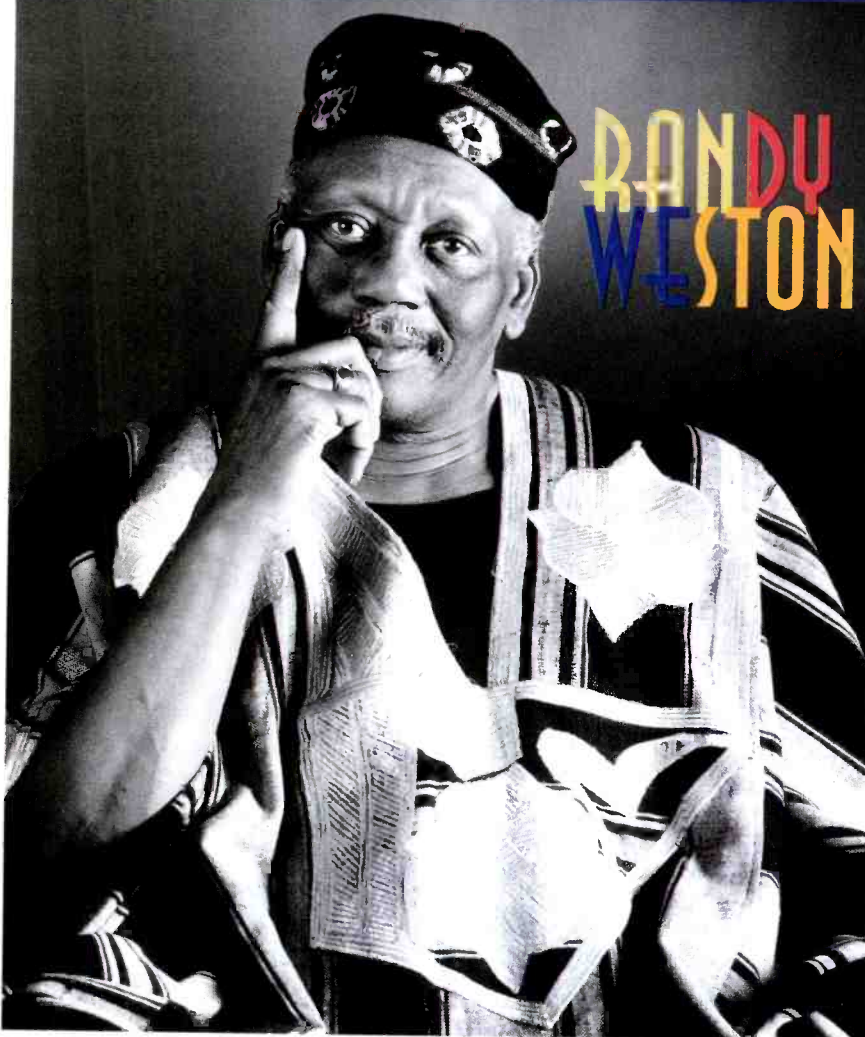


Photo: ©Cheung Ching Ming

Khepera

Randy Weston

VERVE 314 557 821, 68:21

Sound: A, Performance: A

The rhythms and tonal colors of jazz's African roots have always been an important force in this uniquely American genre. They are something felt and heard in subtle and explicit ways, in the music of Art Tatum, Duke Ellington, Chano Pozo, and the great Afro-Cuban bands through and beyond John Coltrane's and Pharoah Sanders' Arabian caterwauls and spiritual identification with the motherland. Nowhere is the African influence more pervasive, however, than

when its indigenous musical voices—talking drums, djimbés, Ashikos, koras, and chanting, for example—combine with the Western instruments that have helped shape jazz and propel it further.

Pianist/composer Randy Weston has explored this marriage for decades, embracing it not just musically, but with a personal and philosophical immersion in Africa. Throughout his career, the Brooklyn-born Weston has bridged the styles of early stride piano, Thelonious Monk (an early friend and mentor), and Ellington and has even brought in R&B influences. On his latest recording, *Khepera*, the septuagenarian



transcends Afro-centrism and attempts to forge a musical and spiritual link between African and Chinese cultures. He uses a creation-based theme, played by an ensemble that includes Talib Kibwe on alto sax and flute, trombonist Benny Powell, and tenorist/sopranist Sanders plus African instrumentation and Min Xiao Fen's pipa (a Chinese string instrument). Though the concept is lost halfway through, Weston's

BOBBY HUTCHERSON

Skyline

VERVE 314 559 616, 56:43

Sound: B, Performance: B-

Released scant months after Blue Note reissued *Medina*, Bobby Hutcherson's 1965 album, *Skyline* shows just how much jazz has changed in the last three decades. *Medina* flew high and wild in the experimentalism and genre-stretching that typified late-'60s jazz. By contrast, *Skyline* is a fine, swinging, breezy album, with excellent support from pianist Geri Allen, drummer Al Foster, alto sax titan Kenny Garrett, and bassist Christian McBride. But *Skyline* is also emblematic of many of today's jazz recordings from major labels: expertly played, choicely selected compositions that are as pleasant as a summer's drive with the top down, out there where the L.A. air is rarefied.

Hutcherson, one of the few modern masters of vibraphone, is flawless throughout *Skyline's* nine tracks. This disc is as misty with remembrances as an old scrapbook. "I Only Have Eyes for You," "Love Theme from *Superman*," and "Chan's Song" are cuddly and warm ballads swung with expert finesse and finery. "Pomponio" kicks hard, with hot Afro-Cuban rhythms and wailing solos by Hutcherson and Foster. With rhythms geared for twilight time, "Tres Palabras" continues the smoky Latin feel. "The Coaster" blasts the mellow air away, leaping off the disc like a hurtling jet ski. But even with its occasional flights of fury, *Skyline* delivers more of a lull than a wallop, coasting easy with the foot off the gas pedal.

Ken Micallef



cinematic compositions and the performances make for a rewarding experience.

Kepera's opening track, the aptly titled "Creation," launches the proceedings with a big bang reenactment. Cymbals crash explosively, and the entire ensemble depicts life emerging from the smoldering ground and developing into civilization. It's followed by "Anu Anu," where Weston exposes his Ellington influences: a familiar "Jungle Band" vamp and dark-hued tones from the piano's bass keys, with percussion and horn voices (handled, not surprisingly, by frequent Weston collaborator and arranger Melba Liston) creating a noir-like image. Here, Sanders honks, wails, growls, and whispers his calling-card, instantaneous dynamic shifts. But it's not until after "The Shrine"—a vamping, exotic groove in 6/8 meter with flutes and horn lines that flood the mind with images of a desert caravan—that Weston crosses continents and begins to forge the African-Asian link. "The Shang" introduces the China connection, in which Min Xiao Fen's solo pipa performance ultimately merges with Weston's unaccompanied, Spartan piano colors. But it's a short-lived affair. Although the Asian theme (courtesy of Xiao Fen and the pipa) resurfaces in "Portrait of Cheikh Anta Diop," it's a myopic vision that's left unfulfilled, obscured by African drums and several pieces that swing more toward the West and jazz's African-American branches.

Kepera nonetheless is an engaging album, benefiting from its compositions and performances and the impressions of the project's leader. In continuing to tie varied musi-

cal worlds together, Weston proves that whatever genres and idioms amount to semantically, Western and Eastern combine into a greater entity known simply as music. *Mike Bieber*

Fingertip Ship

Richard Leo Johnson
METRO BLUE 96901, 52:30
Sound: A-, Performance: A



Before you play *Fingertip Ship*, Richard Leo Johnson's major-label debut, prepare yourself for something special. This self-taught guitar virtuoso works by instinct, shaping alternative tunings and coaxing fresh textures out of his instrument. Johnson is a very physical player; some might even find him relentlessly kinetic. He shies away from effects boxes yet sticks a pencil between the strings and the neck to create a koto-like effect on "Empitsu No Uta" and works up a sweat, slappin' and wackin' his axe, on "Get Funked." Johnson's music is a strange amalgam of jazz, folk, rock, and World Music; you'll also hear traces of Leo Kottke, Larry Coryell, and John McLaughlin in it.

Fingertip Ship's one hell of a dense CD! It's so thick, in fact, that you might not even notice Johnson is the only player. But don't get the wrong idea, for Johnson's talent isn't just about spellbinding fretwork. He's more organically inclined, releasing music that satisfies the soul.

Steve Guttenberg

The Complete Bitches Brew Sessions

Miles Davis
COLUMBIA/LEGACY C4K 65570
Four CDs, 4:25:21
Sound: A, Performance: A+

When *Bitches Brew* was released 30 years ago, it was nothing short of revolutionary. It was fueled by everything Miles Davis had absorbed during the turbulent '60s: Jimi Hendrix and the potency of the electric guitar, psychedelia, free jazz, the Black Panthers, and inner-city turmoil. For better or worse, this breakthrough album heralded the arrival of jazz/rock fusion.

The original 90-minute *Bitches Brew* LP was culled from more than four hours' worth of material, most of which was recorded in 1969. Some of the leftover



tracks were used for other albums, and some of them remained unreleased—until now. The 20-bit remixes in *The Complete Bitches Brew Sessions* include everything producer Teo Macero captured on multi-track tape during these proceedings.

For these sessions, Davis expanded his quintet of Chick Corea, Jack DeJohnette, Wayne Shorter, and Dave Holland by adding guitarist John McLaughlin and organist Larry Young as well as a bevy of noteworthies (Joe Zawinul, Bennie Maupin) and a sitar player. These are the players who created the beautiful noise that turned the jazz world on its butt.

Excellent annotation includes session notes and essays from reissue producer Bob Belden, musician Carlos Santana, and Miles Davis biographer Quincy Troupe. *Mike Bieber*

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DVD REVIEWS

MORE TALES OF THE CITY

Armistead Maupin's More Tales of the City 1998; no rating; two one-sided, dual-layer discs (1.33:1 aspect ratio); Dolby Digital two-channel matrix surround; includes author/actor commentary, cut scenes, rehearsal sequences, still-frame archives, cast and production bios, Q & A video with actors, and Web link. DVD INTERNATIONAL DVDI-0717, two discs, 4 hours and 50 minutes of miniseries episodes plus 45 minutes for extras, \$49.95
Picture: A, Sound: A, Content: B+

Armistead Maupin and I both attended the University of North Carolina in the early '70s; he wrote somewhat conservative articles for *The Daily Tar Heel* in Chapel Hill, whereas I was a very liberal music student. We never met, but I vaguely remember referring to him as "that &!\$!\$#@ opinionated writer."

Moving to San Francisco liberated and liberalized Maupin. He became famous for his series of stories in *The San Francisco Chronicle*, "Tales from the City," which were later collected in a book of the same name. In these stories, Maupin ingeniously described the daily lives of a group of young eccentrics boarding at 28 Barbary

Lane in the late 1970s. The group comprised gay, straight, and possibly bisexual men and women. The overall tone was one of tolerance and compassion, reinforcing the idea that regardless of our individual quirks and kinks, we all have a lot in common. The cardinal sin in a Maupin story is to lie; all of the villains in *Tales* are people who have portrayed themselves falsely.

After a successful television miniseries based on the first book, the second book, *More Tales of the City*, was produced by Britain's liberal Channel Four (and carried in the United States on Showtime). In this entertaining, superbly acted series, humor and suspense are mixed in a Hitchcockian manner. As various mysteries unravel and

actions are explained, the viewer is shocked and delighted simultaneously.

Be forewarned: There are many scenes in which characters are seen smoking pot; this was the 1970s, and that's simply the way things were. There's also brief female and male nudity and some frank dialog, though it's entirely natural and unobtrusive.

The DVD edition is quite thorough, with simple indexing to the six episodes and intricate accessing of the numerous chapters (145 on the first disc alone!). In one of the extras, author Maupin is joined by actresses Olympia Dukakis (who brilliantly plays landlady Anna Madrigal), Laura Linney (Mary Ann Singleton), and Barbara Garrick (DeDe Ramsey) in a discussion about the characters of 28 Barbary Lane and the filming of the miniseries. Also in-

cluded are several scenes that were originally cut, with commentary from Maupin, as well as rehearsals of key scenes. After you play a rehearsal sequence, the disc automatically jumps to the corresponding scene in the episodes. The booklet gives a complete

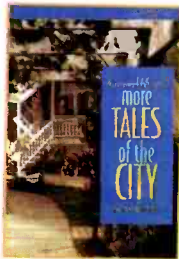


Photo: ©Eric Liebowitz/Showtime/Kobal

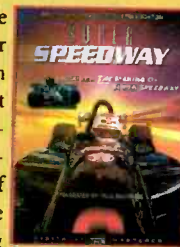
SUPER SPEEDWAY

Super Speedway 1997; no rating; one-sided (1.33:1 aspect ratio); THX certified; English, French Canadian, Mandarin, and American Spanish Dolby Digital 5.1; English, French, Mandarin, and Spanish subtitles; includes "making-of" documentary. OPENWHEELS/IMAGE ID4622OWDVD, 100 minutes (50 minutes each for feature and documentary), \$24.98

Picture: A, Sound: A, Content: A

A tribute to driver Mario Andretti and the excitement of championship race-car events, *Super Speedway* was originally shown in IMAX theaters. Everyone should find it fascinating. Even if you don't ordinarily appreciate the thrill of vehicles traveling in excess of 230 mph, this DVD contains a lot of interesting background material about the past and present of designing and building race cars. The main feature's been transferred to DVD with a very high degree of ac-

curacy. There are lots of pulse-pounding scenes seemingly shot right from the cockpit and scenes filmed trackside. Clarity is on par with a 35mm slide's; only two or three motion shots that contain tiny artifacts keep me from giving this DVD an A+ for quality. The DVD's sound has real you-are-there presence; its 5.1 mix puts you right into the action. Shots from the driver's perspective are enhanced by engine sound, which comes from behind and around you, while road



bumps and tire sounds hit you from the front. It's very realistic.

The "making-of" featurette shows how everything was done. A parallel chapter-selection menu enables you to rapidly call up a scene from the finished movie or its corresponding section in the documentary.

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list of chapters and indicates who speaks on the commentary for each.

The state-of-the-art video does full justice to the bright Flower Power colors of the '70s. Overall, this set is very impressive, and I would have graded its content A were it not for two important omissions. Since one of the series' key messages is compassion for different lifestyles, it seems unconscionable that segments of the population will be shut off from these DVDs. Yet there are no subtitles, in any language, and no closed-captioning for the hearing impaired. To fully appreciate this tale of tolerance, you must know English and be a hearing person.

Rad Bennett

Beethoven: Symphony No. 9 in D Minor ("Choral") 1983; no rating; one-sided (1.33:1 aspect ratio); Dolby Digital 5.1 and PCM stereo; English, German, and French subtitles. SONY CLASSICAL SVD 46364, 66 minutes, \$24.98

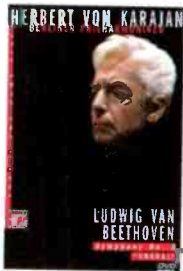
Picture: A, Sound: A, Content: A

There's been precious little in the way of classical music releases on DVD, but things are looking better this year, with several operas from Pioneer Artists and this title, from Herbert von Karajan's Telemondial series. The thrilling, old-line performance was shot from the stage rather than the house. There is not one single image of the whole chorus and Berlin Philharmonic. Instead, we get close-ups of a line of players or choristers in profile; rarely is anyone shown head-on. Some will appreciate this extreme intimacy and welcome the opportunity to see things the average concertgoer is denied; others will find it a bit claustrophobic, lacking in grandeur and space.

All will likely agree, however, that the quality of the video is quite good and that the sound is excellent. Though apparently shot at a live concert, applause has been edited out. Ignoring the video and experiencing this disc as an audio-only recording reveals the instruments as having wonderful aural presence, especially in the Dolby Digital 5.1 remix, which has a much wider stage than the PCM option. The all-important cellos and basses in the fourth movement seem quite tangible even during spell-binding pianissimo passages that will likely be nearly drowned out by the sounds of a refrigerator or the heating system in an average home.

Easy-to-read subtitles in English, German, or French are provided for the text of the last movement. These may be displayed, or not, by using the appropriate controls on your DVD player's remote.

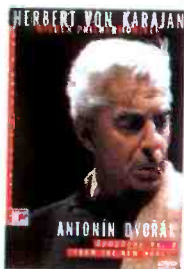
R.B.



Dvorak: Symphony No. 9 in E Minor ("From the New World") 1985; no rating; one-sided (1.33:1 aspect ratio); Dolby Digital 5.1 and PCM stereo; program notes in English, German, and French. SONY CLASSICAL SVD 48421, 43½ minutes, \$24.98

Picture: A-, Sound: A-, Content: B

For my money, a lot of opportunities have been missed in classical music DVDs so far; record labels have only begun to explore the medium's possibilities (with alternate language tracks for the skimpy program notes, for instance). It would be possible, say, to offer a complete score either as a video overlay or in its own right, with or without superimposed graphics (arrows or colors) that trace the melody or highlight the participation of particular instruments. Another extra could be a pair of alternative audio tracks describing the work or discussing the conductor's technique in achieving his particular interpretation.



Considering the capability of the DVD medium, the possibilities are limited only by lack of imagination or funding.

Like the Beethoven Ninth Symphony reviewed here, this disc never shows the whole Vienna Philharmonic, concentrating instead on extreme close-ups of individual players, sections of the orchestra, and the all-important conductor.

A straight-out presentation such as this one, which could have been accomplished on laserdisc, may have limited appeal at the current asking price. The video and audio are very good indeed, but Austrian conductor Herbert von Karajan's studied, ultra-controlled performance is one that ultimately elicits more admiration than love.

R.B.

Casablanca 1943; PG rating; one-sided, dual-layer (1.33:1 aspect ratio); black-and-white; English and French Dolby Digital two-channel mono; English and French subtitles; closed-captioned; includes movie trailer, eight additional trailers for other Humphrey Bogart features, and a documentary ("You Must Remember This"). MGM 906261, 103 minutes, \$24.98

Picture: A, Sound: A, Content: A

As time goes by (every pun intended), *Casablanca* gets better and better. It is the ultimate love story. There is something for everyone: romance, adventure, intrigue, suspense, heroism, and noble sacrifice. All are present in abundance and are tied together by director Michael Curtiz, with brilliant photography and a masterful Max Steiner score, into a cohesive, well-crafted whole. This movie was

even voted number two, edged out by *Citizen Kane*, on the list of 100 greatest movies compiled last year by the American Film Institute.

In releasing this Warner Brothers classic on DVD, MGM has done right by it. The video transfer is breathtaking, with images so clear and so well contrasted that it's like watching a brand-new movie in a state-of-the-art movie theater. There's not a trace of grain or video noise to get in the way of the sharply etched details that unfold in scene after scene. Scenes involving a lot of people, such as bustling street panoramas and long-range shots inside Rick's famous nightclub, are particularly stimulating. The soundtrack is also solid, with Steiner's effective score sounding rich and lush.

Extras include a documentary hosted by Lauren Bacall and a series of trailers for other Warner Brothers movies starring Humphrey Bogart—classics like *The Big Sleep*, *The Maltese Falcon*, *Key Largo*, and *To Have and Have Not*. If you can buy only one DVD this month, make sure this is it.

R.B.



The Doors: The Doors Are Open 1998; no rating; black-and-white; one-sided; Dolby Digital 5.1. PIONEER ARTISTS 98-593-D, 56 minutes, \$24.98

Picture: B, Sound: B, Content: A

This fascinating disc features performances of The Doors filmed at The Roundhouse in London's Chalk Farm in September 1968, interspersed with footage of the era's political luminaries (including Lyndon B. Johnson, Richard Nixon, and Ronald Reagan) and various campus riots. There are also relatively irreverent interview quips from band members as well as a few philosophical tidbits from an obviously stoned Jim Morrison.

I'd rather have had the DVD show the concert uninterrupted, without any distractions. Still, the performances are so mesmerizing, compelling, and hypnotic that it's worth putting up with the various breaks to see them. "When the Music's Over" and "Unknown Soldier" are downright riveting.

Don't let yourself be too bummed out by the relatively low grades I've given this disc's video and audio. The video quality is really quite good, at least for on-location concert footage taken during the era, and the 5.1 soundtrack created from the original two-track mix is mercifully discreet.

R.B.



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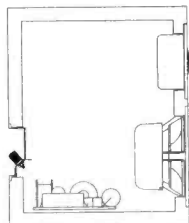
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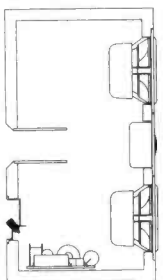


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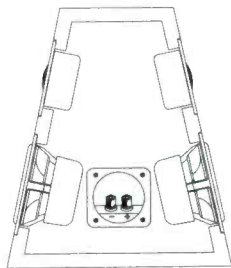


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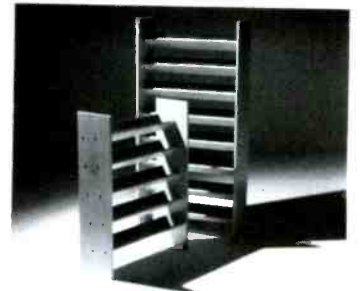
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PlayBack

PHILIPS PRONTO REMOTE CONTROL

The great thing about universal remote controls is that they consolidate the functions of many remotes into a single unit. But they tend to have so many tiny buttons that they're often very hard to use. When I first saw an LCD touchscreen remote, I thought it pointed to the road out of the jungle. Alas, it didn't; touchscreen remotes were very expensive or too inflexible to take full advantage of the technology's potential. But with the latest generation, that's starting to change. Take the \$399 Philips Pronto, which fits comfortably in the hand. At the head end is an infrared emitter; at the tail is an infrared eye for learning codes from other remotes. Most of its face is taken up by the LCD touchscreen, but there are seven conventional buttons as well. The five down the right side are fixed-function—for muting, channel up/down, and volume up/down—though they can be programmed to operate the same component or different ones. The two pads at the bottom are fully customizable, and their functions, which you can see on the LCD, change according to the device being controlled.

The rest of the action is all on the LCD, which is highly configurable. It opens with an array of buttons for selecting the device to be controlled. Tapping one of them brings up the first of what may be several screens of buttons dedicated to that component. In addition, there are always buttons for returning to the "home" screen and for activating a drop-down menu of device-selection buttons, so you can go directly from component to component without passing through the home screen.

The best thing about Pronto, however, is that while it has preset screens for common components, you can add, delete, rename, and rearrange them and the buttons within them. So you wind up with correctly labeled controls for the functions you need—and just those. You can also create (and edit) multicommand macros.

There are limits to the amount of customization you can do (though those should be overcome to some degree by the new Pronto Edit software, which enables you to do setup on a PC and transfer the results to the remote via a serial port). And sometimes there can be as many as three screens to control a single component, necessitating a lot of scrolling up and down. Overall, however, this is a great remote.

The Pronto works on AA batteries or from a supplied rechargeable battery pack. The charging cradle costs \$80. (Philips Digital Entertainment Group: 1070 Arastradero Rd., Palo Alto, Cal. 94304; 888/486-6272; www.pronto.philips.com.)

Michael Riggs



the Classics' bigger woofers, ribbon tweeter, and rear tweeter for ambience were more apparent.

The Studios have become my favorite small speakers. If you want to check them out, you must go to one of Legacy's 11 audition sites because the company sells only by mail. (Legacy Audio: 3023 East Sangamon Ave., Springfield, Ill. 62702; 800/283-6444; www.legacy-audio.com.)

John Gatski

Monster Cable M1000sv S-Video Interconnect

Consider this: If a new cable makes things better, it's because your old cable made something go wrong. When I first set up my home theater, I used the S-video cables supplied with my equipment. And they worked fine—for a few weeks. Then, with increasing frequency, I got black and white from my color DVDs and videocassettes. The reason? My shallow shelf forced me to jam my A/V receiver up against the wall, and the cables' flimsy plugs couldn't take the strain. It's now been months since I replaced the original S-video cables with 1-meter Monster M1000sv interconnects (\$60, lengths from 0.5 meter to 200 feet available), and they're holding up fine. I'm not sure the Monsters' silver-content solder, double shielding, silver-coated conductors, and low-capacitance design have improved the picture, but I do know the picture's fine. (Monster Cable: 455 Valley Dr., Brisbane, Cal. 94005; 415/840-2000; www.monster-cable.com.)

Ivan Berger





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